

Group H.1

RADIO AND RADAR SUPPLIES

(CODE RT, TR and IF)

◀ (Revised to include Mods. 1309, 1371 and 1376) ▶

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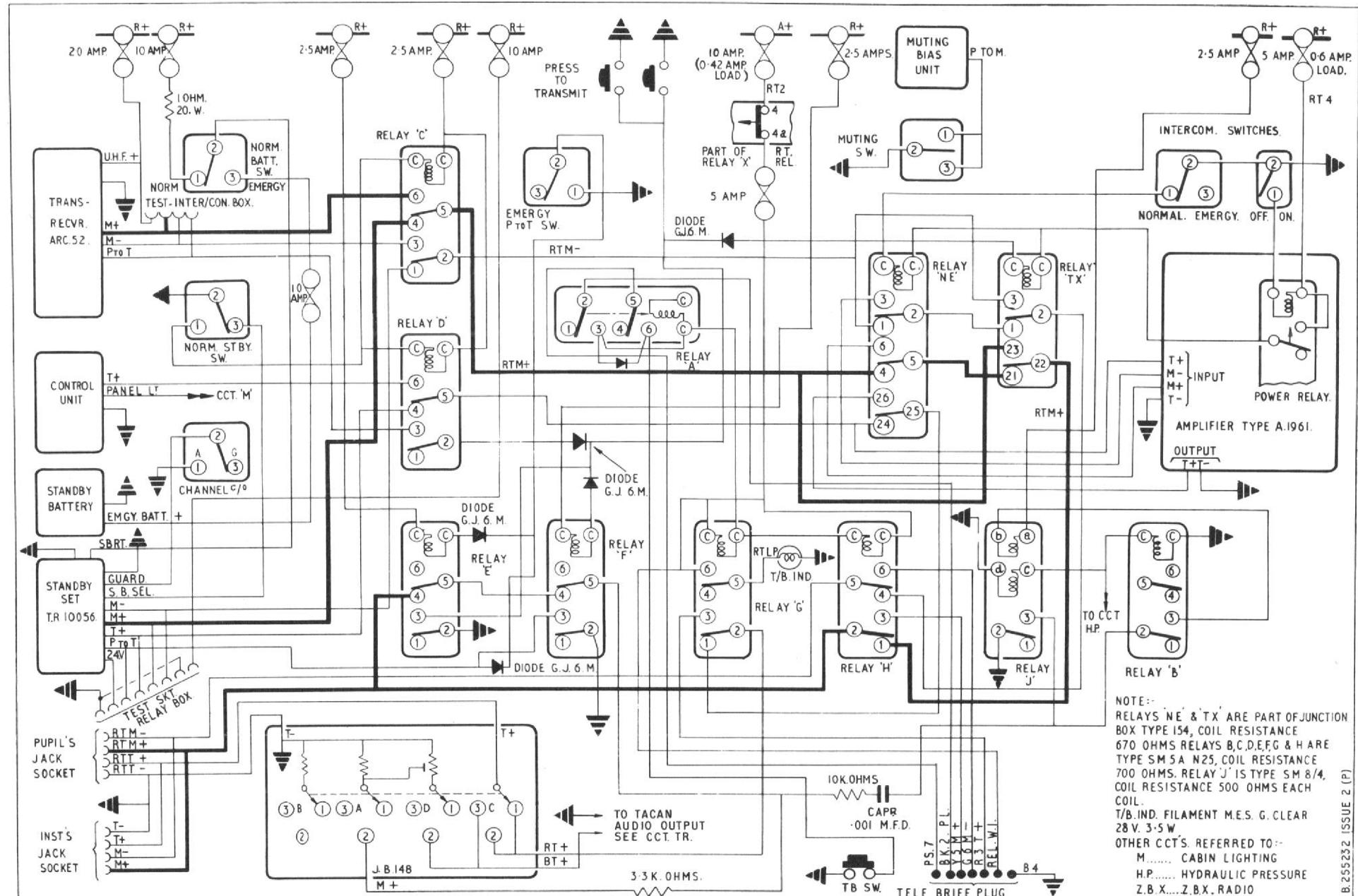


Fig. 1 UHF, telebriefing, intercomm. and tacan (theoretical)

Introduction

1. This group contains a description of the power supplies to the radio and radar installations and includes theoretical and routeing diagrams and a brief description of the installations and their operation. A full description of the installations is given in Sect.6, Chap.1 and Chap.2 together with component location diagrams. The major components employed in the supply circuits are listed in Table 1 below, together

with the Air Publication in which detailed descriptive and servicing information is given.

DESCRIPTION**Radio installation***General*

2. The power supplies for the U.H.F. radio sets and their associated equipment are taken from the supply panel (*Group A.1*) in

TABLE 1
Equipment type and Air Publication reference

Equipment Type	Air Publication
ARI 18124/1 and 23057 - UHF Main and Standby	
Control relays, Type SM.5A-N25 and S.M.8/4 A.P.113D-1309-1
Press-to-transmit switches	
(part of throttle twist grips)
Aerial selector, Set selector, Normal/Battery and Channel	
selector switches, C.W.C. Type XD.778 A.P.113D-1100 series
Press-to-mute switch, C.W.C. TypemXD.787
Emergency press-to-transmit switch, C.W.C. XD.781 A.P.113C-0307-1
Battery, Voltabloc Type 19-VO-7
ARI 18012 - Telebriefing	
Tele-briefing push switch, Type 1290 A.P.113D-1100 series
Tele-briefing indicator lamp, Type A A.P.113F-0600 series
A 1961 - Intercommunication	
Intercommunication control switches,	
C.W.C. Type XD.779... A.P.113D-1100 series
ARI 18107/1 - Tacan	
Junction box, Type 148 ARI 116B-0304-1
ARI 23134/3 IFF/SSR 1520	
Inverter, static Ekco, Type E182B	
Mounting rack, Type M2281A A.P.113D-0306-13A
Aerial test switch
Failure warning lamp/switch, Ref.5CW/9743 A.P. 113D-1100 series
Control unit lamps switch, Ref.5CW/9327...
Control relay, Type 20B, No.3 A.P.113D-1309-1

the radio bay, and are protected by two circuit breakers mounted below the panel, and marked respectively RADIO SUPPLIES, and A.R.C.52. The RADIO SUPPLIES circuit breaker feeds the A.R.C.52 circuit breaker, and also supplies the fuse busbars in the relay box. A 24 volt, Voltabloc type battery, carried on the lower platform of the radio mounting structure, provides an emergency supply for the U.H.F. standby set.

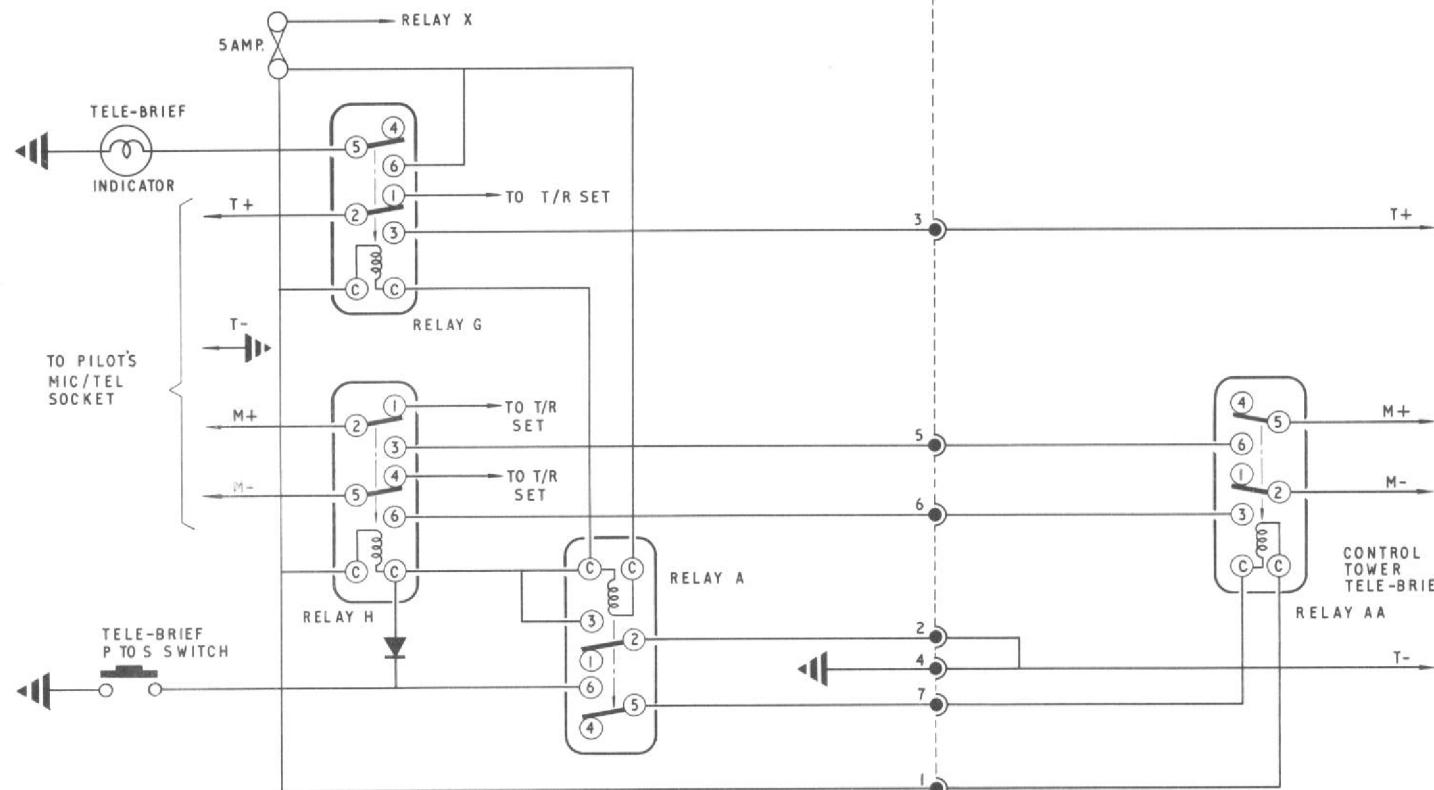
Radio relay box

3. The radio relay box is attached to the aft face to frame 15, in the radio bay. It contains most of the radio supply fuses, and the relays that integrate the circuits associated with the U.H.F. installations, as illustrated diagrammatically in fig.1. All the fuses except No.1 and No.2 are fed from the RADIO SUPPLIES circuit breaker. No.1 fuse is supplied from the emergency battery; No.2 fuse receives a supply from the essential load line via fuse No.26 on the supply panel, and the contacts of relay X in the fire warning and extinguisher circuit, (*Group C.2*). No.2 fuse is wired to the coils of relays A, G and H, whose energization circuits are completed when the telebriefing connection is made (*para.11*).

4. Relays C, D, E, F, and J derive energizing supplies from the radio supply fuses in the relay box, but relay J, which has two operating coils, also derives a supply (*in common with relay B*) from the hydraulic pressure failure warning circuit (*Sect.5, Chap.2, Group 5.A*) when this circuit operates. Relay J is a high speed type, whose coil a-b opposes the pull of coil c-d; in conjunction with relay B and a resistor-capacitor element; it provides an audio warning (*para.18*). The resistor and

A/C INSTALLATION

GROUND INSTALLATION



SK 40508 (P)

Fig. 2 Simplified telebriefing circuit (theoretical)

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capacitor, and also the diode rectifiers that protect the press-to-transmit circuits, are all contained in the radio relay box, which is also equipped with a test socket, one pin of which is wired to fuse No.4.

ARI 18124/1 – UHF Main

5. The supply from the A.R.C.52 circuit breaker to the main U.H.F. transmitter-receiver is routed via a plug and socket connection and an interconnecting box, both located in the radio bay. In the transmitter-receiver, the power supply is connected to a power supply relay. The coil of this relay is wired to the U.H.F. control unit, on which a function switch, when placed to either of its ON positions, operates to energize the power relay, which switches the power supply to the equipment in the set. When switched ON, the equipment is in the "receive" condition. It can be switched to the "transmit" condition by use of either of the two press-to-transmit switches which are incorporated respectively in each of the throttle twist grips.

6. The installation is provided with a blade type aerial which projects upwards from the hood fairing above the radio bay. Audio signals from the Tacan installation (para.12) are fed to the crew's telephones via a Type 148 junction box: this is mounted adjacent to Frame 10, on the port side of the cabin.

ARI 23057 – UHF Standby

7. The standby transmitter-receiver

normally operates on a supply derived from the RADIO SUPPLIES circuit breaker via fuse No.9 in the radio relay box. A plug-in resistor, located in the radio bay, reduces the supply to 24 volts. The supply is wired to a change over switch marked NORMAL and EMERGENCY BATTERY, which in the NORMAL position connects the aircraft supply to the set, and in the EMERGENCY BATTERY position connects the battery supply to the set, via fuse No.1 in the radio relay box.

8. A switch labelled NORMAL, and STANDBY is used to bring the transmitter-receiver into operation. In the STANDBY position, the switch completes the earth return for the coil of a relay in the set which switches the power to the equipment. When switched on, the set is in the "receive" condition. It can be switched to the "transmit" condition by operation of either of the press-to-transmit switches in the throttle twist grips, or – in the event of these proving ineffective – by use of the emergency press-to-transmit switch. Operation of these switches completes an earth return for a switching relay within the set. The NORMAL/EMERGENCY BATTERY switch, the NORMAL/STANDBY switch, and the emergency press-to-transmit switch, are mounted, with the channel change-over switch on the bracket attached to the port windscreens platform. The standby UHF operates through a rod type aerial protruding from the lower port side of the aircraft at frame 14.

Intercommunication amplifier

9. The A.1961 intercom. amplifier is supplied from fuse No.5 in the radio relay box, and the supply is wired to a relay within the unit, which is controlled by an ON/OFF switch, and a Normal/Emergency switch; both of which are mounted on a small shelf above the cabin starboard shelf. The ON/OFF switch, in the ON position completes the earth return for the power relay, thus switching the amplifier on, and also supplying the coil of a relay, NE, and making the supply available to the coil of a second relay, TX. These relays are contained in a Type 154 junction box, which is mounted adjacent to the amplifier, in the radio bay.

10. The earth return circuit for the coil of relay NE is completed via the Normal/Emergency switch when this is to NORMAL; the earth return for the coil of relay TX is completed only when either of the press-to-transmit switches is operated. When relay NE is energized, its contacts connect the crew's microphone circuit to the amplifier input, and the telephone circuit to the amplifier output, via contacts on relay TX. When relay TX is energized, its contacts transfer the crew's microphone circuit to the transmitter-receiver in use; the telephone line remaining connected to the amplifier output.

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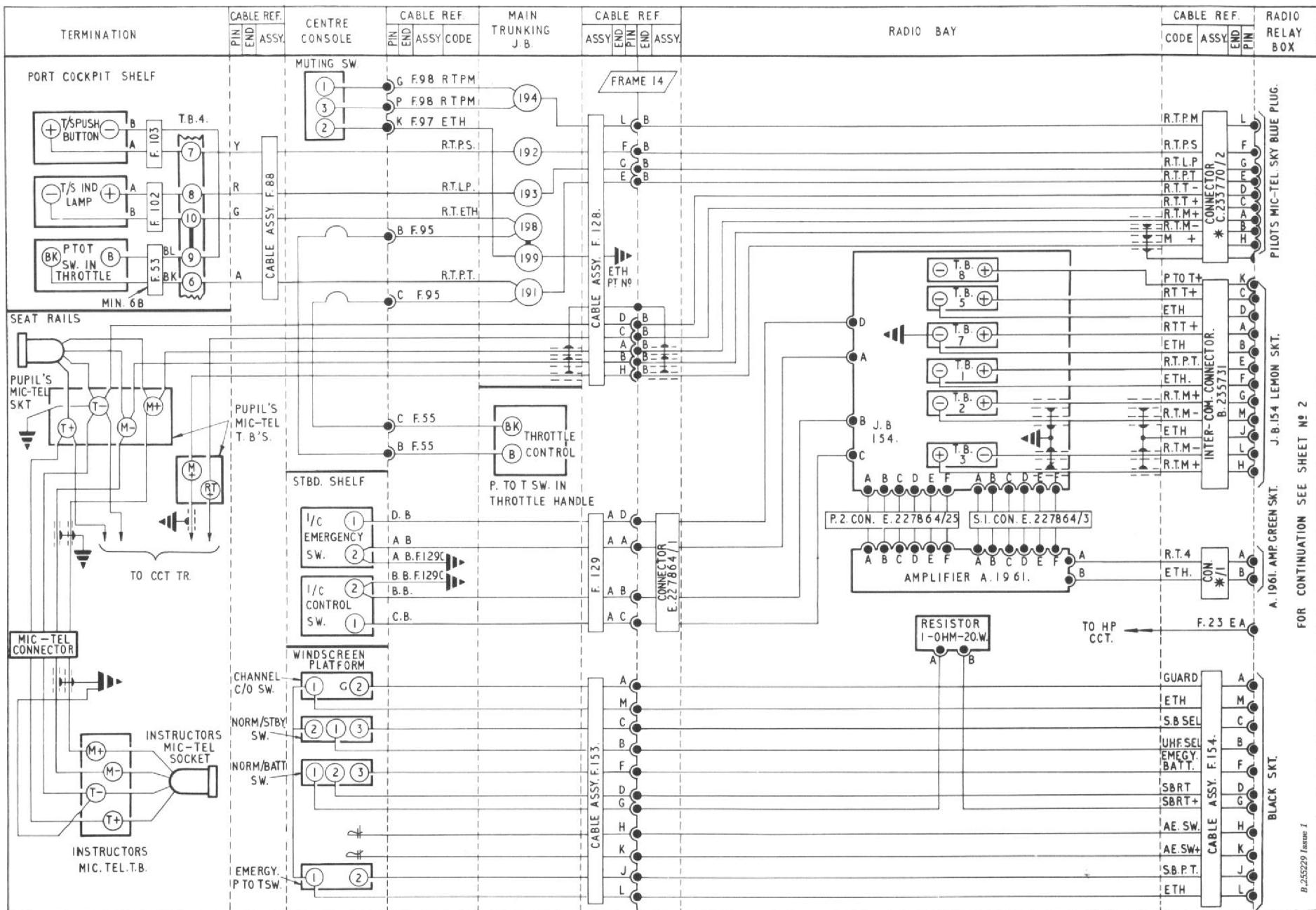


Fig. 3 UHF, telebriefing, intercomm. and tacan (routeing – sheet 1)

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FOR CONTINUATION SEE SHEET NO 1

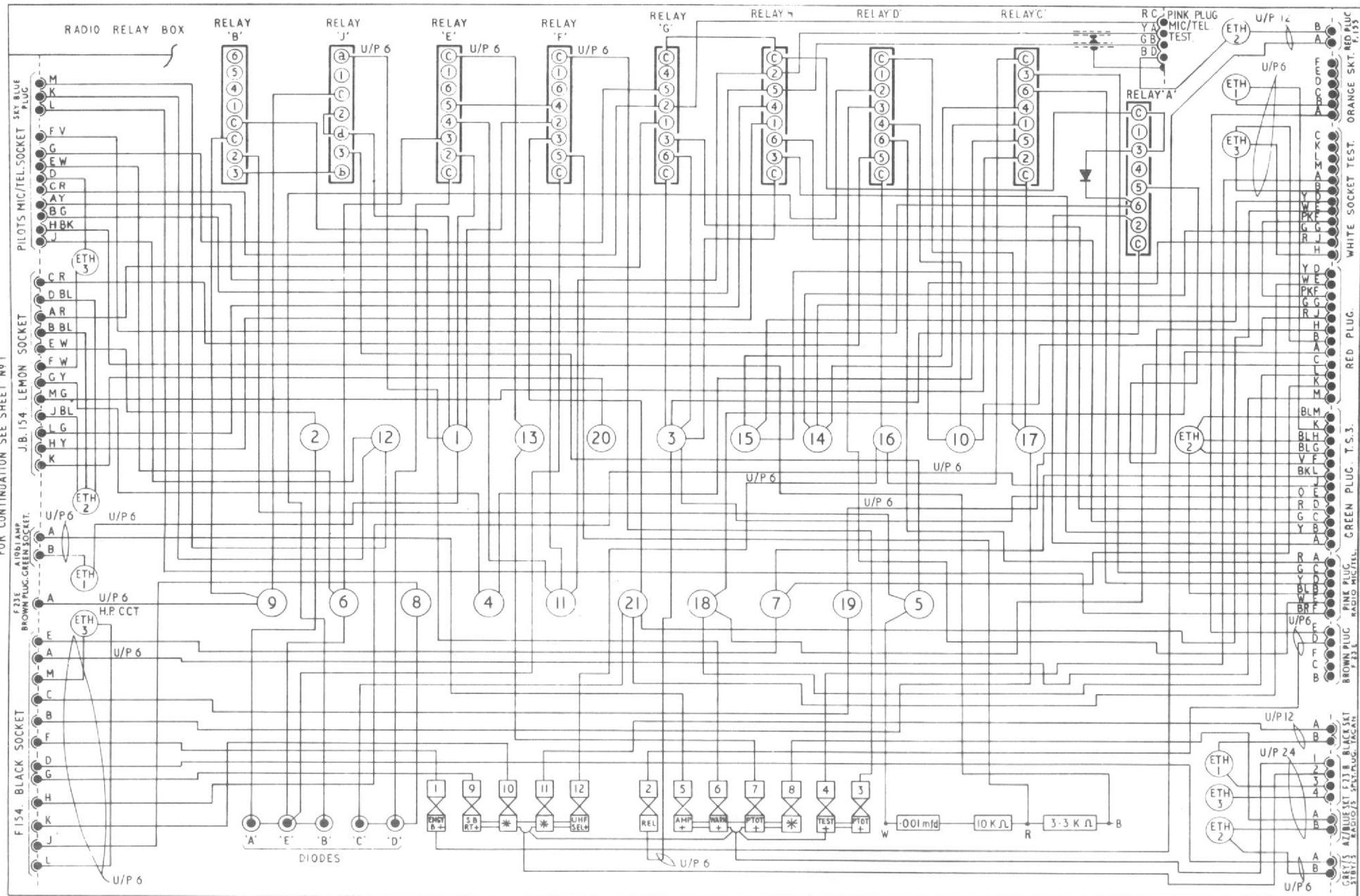


Fig. 4 UHF, telebriefing, intercomm. and tacan (routeing – sheet 2)

ARI 18012 - Tele-briefing

11. The initial requirement for placing this equipment into service is the coupling of the tele-briefing land line to the tele-briefing plug on the underside of the rear fuselage between frames 53 and 54. A tele-briefing push button switch and indicator lamp are mounted at the forward end of the cabin port shelf. To transfer from radio communication to tele-briefing it is necessary to momentarily depress the switch before the tele-briefing relays are energized. Once the energized relays remain locked on and the indicator lamp remains alight after release of the switch. Tele-briefing voice reception requires no further selection by the pilot, but to talk to the control tower he must hold the tele-briefing push button switch depressed as this energizes the microphone relay in the control tower and completes the mic. circuit.

Radar installations*ARI 18107/1 - Tacan*

12. The Tacan equipment in this aircraft comprises a transmitter-receiver, a coupling unit, and a control unit, and uses a Type 100B aerial. The installation is a navigation aid which, when tuned to a ground or surface beacon, provides outputs of distance and bearing information; these outputs are fed to the navigation display system (*Group 3.A*). Identification signals transmitted from the beacon are fed via the Type 148 junction box to the telephones in the U.H.F. radio installation.

13. The transmitter-receiver and the coupling unit are located in the nose wheel bay. They are supplied with a.c. and d.c. power via a.c. junction box No.2 (*also situated in the nose wheel bay*) from fuses in a.c. junction box No.1 which is mounted between frames 11 and 12 in the cabin. In the junction box, fuses No.11 and

14 pass 115 volt, single phase supplies from the a.c. supplies circuits (*Group E.1*), and fuse No.7 passes 28 volt d.c. These supplies are routed to the transmitter-receiver via a.c. junction box No.2 in which, from No.1 terminal a supply from No.11 fuse is taken to the coupling unit. On the transmitter-receiver mounting tray, power relays, controlled by a power supply switch on the control unit, are used to switch the power supplies to the transmitter receiver equipment.

14. On the control unit, the power supply switch is a two-position toggle switch marked ON and OFF. A further two-position switch, marked BRG, and DIST.BRG. is used to select the mode of operation. In the position BRG. the equipment is switched to "receive" only; in the DIST.BRG. position the mode is changed to transmit and receive for distance information. Interior illumination lamps in the control unit are supplied with 28 volt d.c. from the cabin lighting circuit (*Group F.1*).

ARI 23134/3 - IFF/SSR 1520

15. The IFF/SSR (Identification Friend or Foe/Secondary Surveillance Radar) installation forms the airborne part of the IFF/SSR system the purpose of which is to enable an aircraft to self identify rapidly and automatically when challenged by appropriately equipped ground installations. When interrogated by the ground station the airborne equipment responds by transmitting the appropriate reply signal.

16. The control unit, failure warning lamp and control unit lighting switch are installed on a common mounting between the instructor's knees on the starboard side of the cabin. The two Type 100B aerials are fuselage mounted,

one on the spine fairing between frames 27-28 and the other on the lower port side of the fuselage between frames 20-21. The remaining equipment of the IFF/SSR installation is mounted on two platforms on the starboard side of the nose bay. One platform, the inverter panel, between frames 1C and 2 holds the Type 182B inverter, its associated capacitor and the Type 20B control relay, the second platform between frames 4 and 6 holds the transmitter/receiver (transponder), the aerial switching unit, the aerial test switch and the test set supply socket. The two terminal blocks TB3663/1 and TB3663/2 are mounted on the aft face of frame 3.

17. Supply to the IFF/SSR circuits is from six fuses, four in the supply panel and two in the main fuse box. Interconnection of supply to the units on the inverter panel in the nose bay is taken to a single multi-pin connector mounted at the rear end of the panel from where it is taken to the individual units on the panel. The connections to the Type 182B inverter, mounted longitudinally on the outboard side of the inverter panel, are to two terminals at the forward end of the unit. The 5000 mfd. 50 v.w. smoothing capacitor mounted alongside the inverter is connected across the input to the inverter at the same points. Connection from the multi-pin plug to the control relay mounted crosswise on the panel aft of the capacitor is by screwed down terminal connections.

18. On the platform between frames 4 and 6 the transponder is mounted transversely at the rear on a shock mounting tray with the multi-pin supply plug at the outboard end of the unit and the co-axial connection to the aerial switching unit at the inboard end. The aerial

switching unit, bolted to a bracket forward of the transponder has a co-axial connector to each of the aerials and one to the transponder. The unit supply connector to the control relay and aerial test switch is of the multi-pin type. In-board of the aerial switching unit the aerial test switch and test set supply socket are mounted on a common bracket. The aerial test switch is three position, namely UPPER, FLIGHT and LOWER and controls the switching of the aerial switching unit. It is normally locked in the FLIGHT position by the switch guard but may be selected to UPPER or LOWER when servicing or testing the installation. The test set supply socket is used as a 28v d.c. supply source for the installation test set. The socket is supplied from fuse 22 in the main fuse box.

19. Supply connection to the installation control unit in the cabin is by a single multi-pin connector in the back of the unit. The IFF FAIL lamp and control unit lights switch mounted beside the control unit have separate terminal connections. A 75 ohm resistor fitted in the DIM circuit of the three-position BRIGHT/OFF/DIM lights switch is mounted on the aft face of frame 3 beside terminal blocks T3363/1 and T3363/2. Illumination of the control unit is by internal lighting two red lamps for the facia and eight white lamps for the switch rockers.

OPERATION

Radio installations

General

20. Fig. 1 illustrates the condition of the radio circuits when the battery master switch is OFF. When the battery master switch is ON, the power supply is available, via the RADIO SUPPLIES and ARC.52 circuit breakers,

at the power relay in the main transmitter-receiver, and also, via the RADIO SUPPLIES circuit breaker, at the fuses in the radio relay box. Supplies are thus available at the power relays in the standby transmitter-receiver and the intercom. amplifier.

U.H.F. - Main

21. When the Normal/Standby set selector switch is at NORMAL, it completes the earth return for the coils of relays C and D, which energize, and their contacts connect the crew's telephone, microphone, and press-to-transmit lines to the transmitter-receiver; the telephone positive line being routed via the Type 148 J.B. microphone lines via relays H,TX,NE and C.

22. By putting the control unit function switch to position TR, the power relay in the transmitter-receiver is energized, and the supply passes to the transmitter-receiver equipment, which then warms up ready for operation. When the control unit channel selector switch is set to a channel position, any signals on that channel will be received, and can be heard in the telephones.

23. In the event of failure of hydraulic pressure, a supply from the hydraulic failure warning circuit energizes the coil of relay B and coil c-d relay J (Para.4). Relay B's contacts connect the resistor-capacitor element in series with relay J's coil a-b and the microphone circuit; relay J's contacts (*initially closed by the pull of c-d*) are now opened by coil a-b, thereby de-energizing a-b and earthing the resistor-capacitor. This cycle of operations, repeated at high speed, produces a warning signal in the telephones until hydraulic pressure is restored, and relay B's coil and relay J's coil c-d are de-energized;

24. Operation of either of the main press-to-transmit switches completes the earth return for the switching relay in the transmitter-receiver via contacts 2-3 of relay D. Thus, the switching relay is energized, switching the transmitter-receiver to the 'transmit' condition. At the same time, operation of the press-to-transmit switch energizes relay F, whose contacts 5-4 open, disconnecting the audio warning element from the microphone circuit. In the event of the main press-to-transmit switches proving ineffective, operation of the emergency press-to-transmit switch energizes relay E, whose contacts 2-3 complete an alternative earth return circuit for the switching relay.

U.H.F. - Standby

25. The standby transmitter-receiver is brought into use by putting the NORMAL/STANDBY set selector switch to STANDBY, thereby disconnecting the earth return from the coils of relays C and D, and connecting it to the coil of the power relay in the standby transmitter receiver. This relay energizes, passing a supply to the transmitter-receiver equipment, which warms up ready for operation. At the same time, the contacts of the de-energized relays C and D connect the telephone, microphone, and press-to-transmit lines to the standby transmitter-receiver; these lines being routed as described in paragraph 20. With the set in the "receive" condition, signals on the guard or the alternative channel (*according to the position of the channel change-over switch*) will be received, and can be heard in the telephones.

26. Switching from the "receive" to the "transmit" condition is effected in a similar manner to that described in paragraph 24. To operate the set from the emergency battery,

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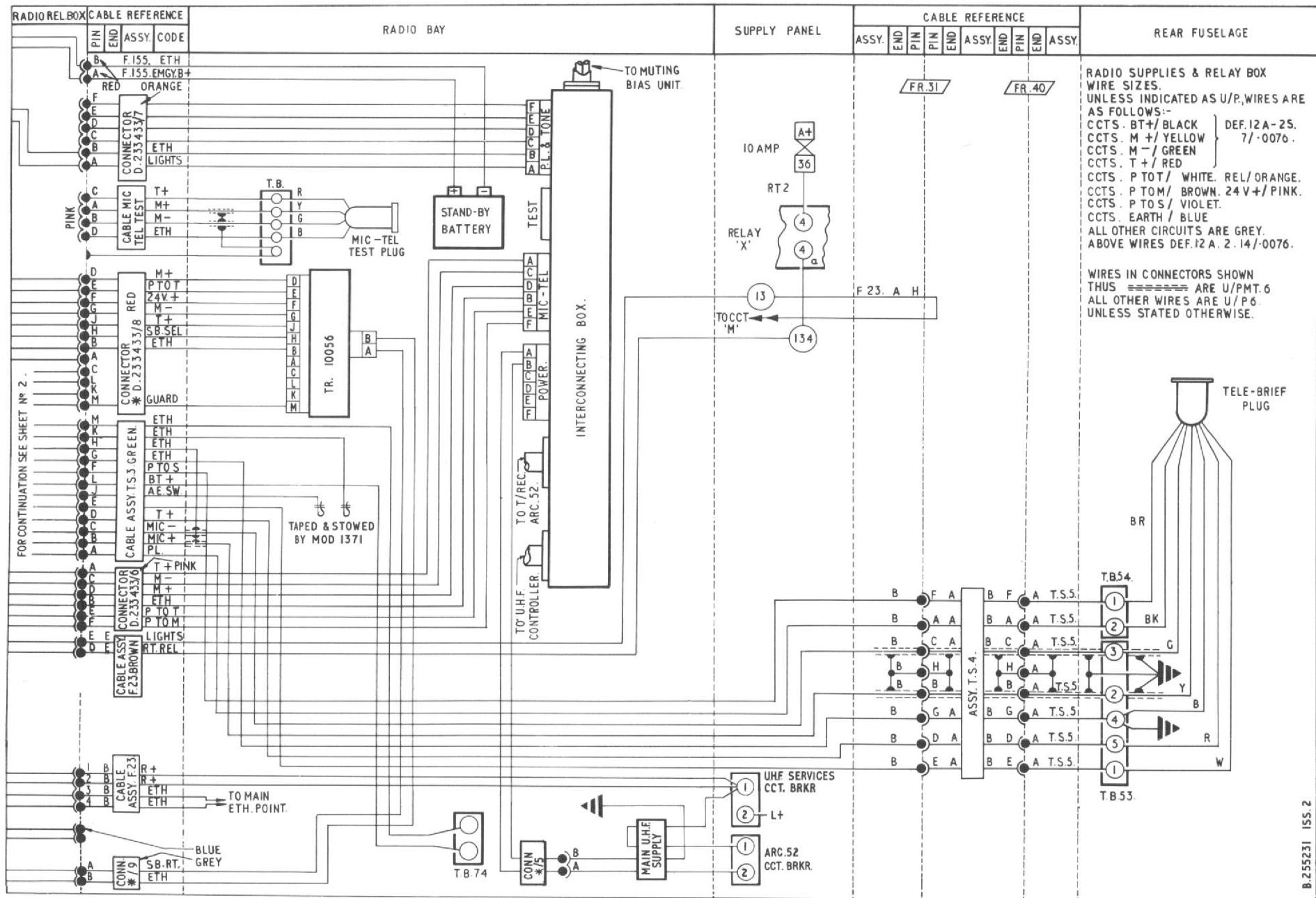


Fig. 5 UHF, telebriefing, intercomm. and tacan (routeing – sheet 3)

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the radio power switch is put to the EMERGENCY BATTERY position. A supply then passes from the battery via fuse No.1 in the radio relay box to the transmitter-receiver.

Inter-communication amplifier

27. With the amplifier ON/OFF switch to ON, and the NORMAL/EMERGENCY switch to NORMAL, an earth return circuit for the coil of the amplifier power relay and relay NE is complete. Thus, by a supply from fuse No.5, the power relay is energized, supplying the amplifier equipment and also energizing relay NE, thereby connecting the crew's microphone and telephone lines to the amplifier; the telephone line being routed via the Type 148 junction box, and relays G and NE; the microphone lines via relays H, TX and NE. The telephone line from the transmitter-receiver is connected to the amplifier input, hence the crew can communicate with each other, and also hear any received signals.

28. When the amplifier is on, operation of either of the press-to-transmit switches completes the earth return for the coils of relays TX and F, and the transmitter-receiver switching relay. The contacts of relay TX transfer the crew's microphone lines from the amplifier to the transmitter-receiver the telephone line remaining connected as before. On release of the press-to-transmit switch, relay TX is de-energized, and its contacts re-connect the crew's microphone lines to the amplifier.

29. In the event of a failure of the amplifier, the NORMAL/EMERGENCY switch is put to EMERGENCY, thereby de-energizing relay NE, whose contacts open, disconnecting the crew's telephone and microphone lines from the amplifier and connecting them to the transmitter-

receiver. The crew can then communicate via the transmitter-receiver audio-frequency stages.

Tele-briefing

30. Supply to energize the tele-briefing relays G,H and A is taken from fuse 2 in the radio relay box. This circuit is completed by the initial depressing of the tele-briefing P to S push button switch on the cabin port shelf after the tele-briefing land line has been coupled to the aircraft tele-briefing plug between frames 53 and 54 on the undersurface of the rear fuselage. A hold-on circuit for the relays on release of the P to S switch is provided across contacts 3-2 of energized relay A and pins 2 and 4 of the tele-briefing socket via the land line connection. This ensures the pilot's head-set microphone positive and negative remain connected to the tele-briefing land line by the closed contacts 2-3 and 5-6 of relay H, and the telephone positive by closed contacts 2-3 of relay G. Telephone negative is an unswitched earth return. A supply to the tele-briefing indicator lamp filament on the port shelf of the cabin is maintained by the closed contacts 6-5 of relay G.

31. From the simplified tele-briefing diagram it can be seen that the supply to energize relay AA in the control tower and complete the pilot's microphone circuit is from fuse 2 in the radio relay box via pin 1 of the land line to relay AA and back to earth via pin 7, the closed contacts 5-6 of energized relay A and the tele-brief P to S switch, which must be held depressed. The diode prevents the possibility of de-energizing the tele-briefing relays through feed-back when operating the P to S switch.

Radar installations

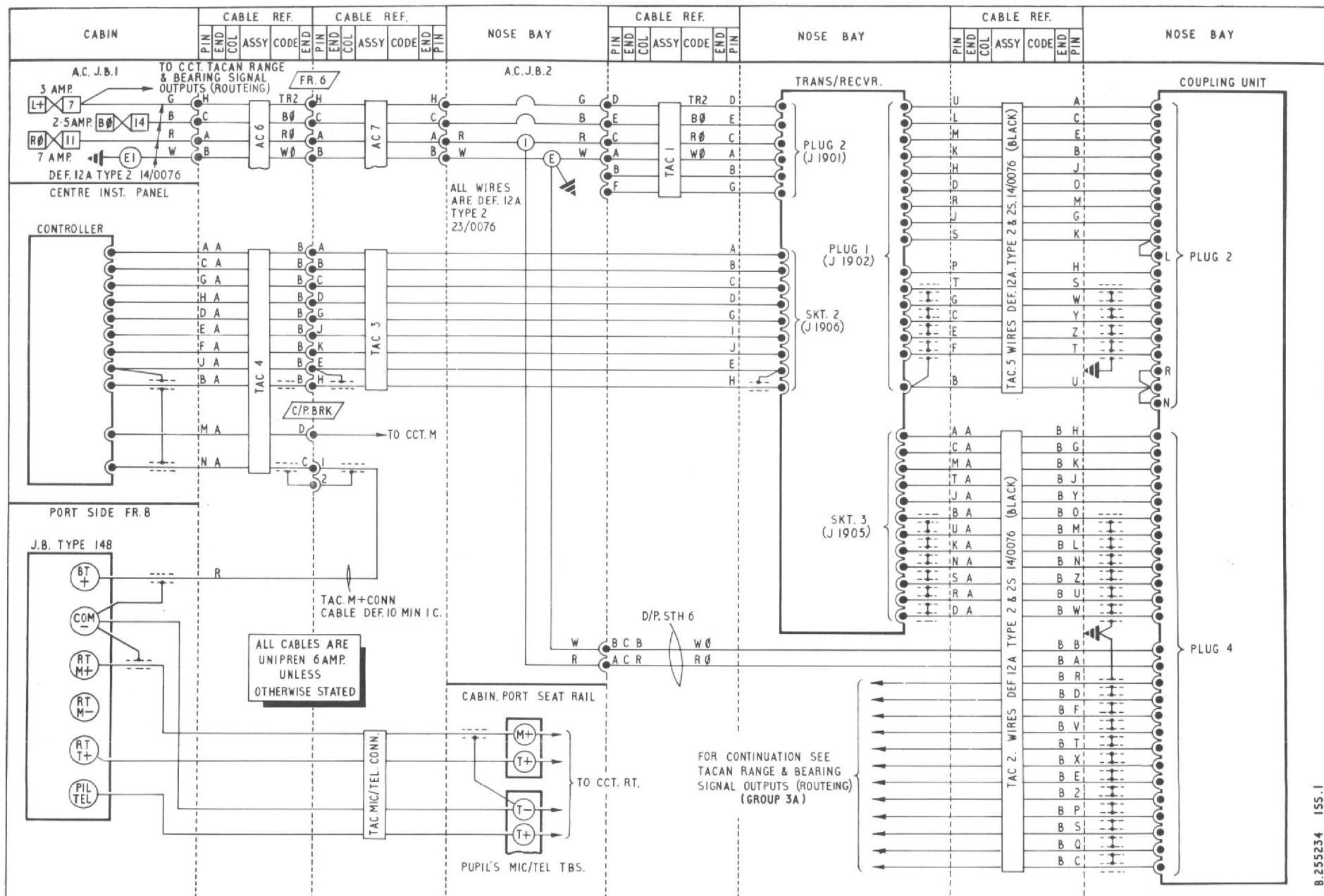
Tacan

32. When the aircraft's electrical supply services are operating the a.c and d.c. supplies required by the Tacan installation are available, via the fuses in a.c. junction box No.1 (para.14) at the power relays on the transmitter-receiver mounting, and at the coupling unit. The equipment is switched into operation when the power switch on the control unit is put to the ON position, and will operate as determined by the position of the mode selector switch. If this switch is put to the DIST.BRG. position, the transmitter-receiver power relays will switch on the whole of the equipment, so that both bearing and distance information is indicated; if the switch is in the position BRG., the equipment is switched on so that bearing information only is indicated and transmitted to the navigation display system.

IFF/SSR 1520

33. With 28v d.c. supply to the busbar and the IFF/SSR control unit function switch OFF, both the amber IFF FAIL lamp and green TEST lamp in the cabin will glow. The circuit for the FAIL lamp is from fuse 29 to pin 96 of the transponder through the failure circuits of the transponder to pin 44 then to earth through the FAIL lamp filament. The circuit for the green TEST lamp on the control unit is from fuse 29 to pin 96 of the transponder, through the failure warning circuits to pin 43, then to pin Z of the control unit and through the green filament to earth via pin t. Selection of the function switch to STDBY provides a circuit to energize the coil of the control relay Type 20B from fuse 30 in the supply panel to pin v of the control panel and through the arm of the switch to earth via pin t. With the control relay energized a circuit

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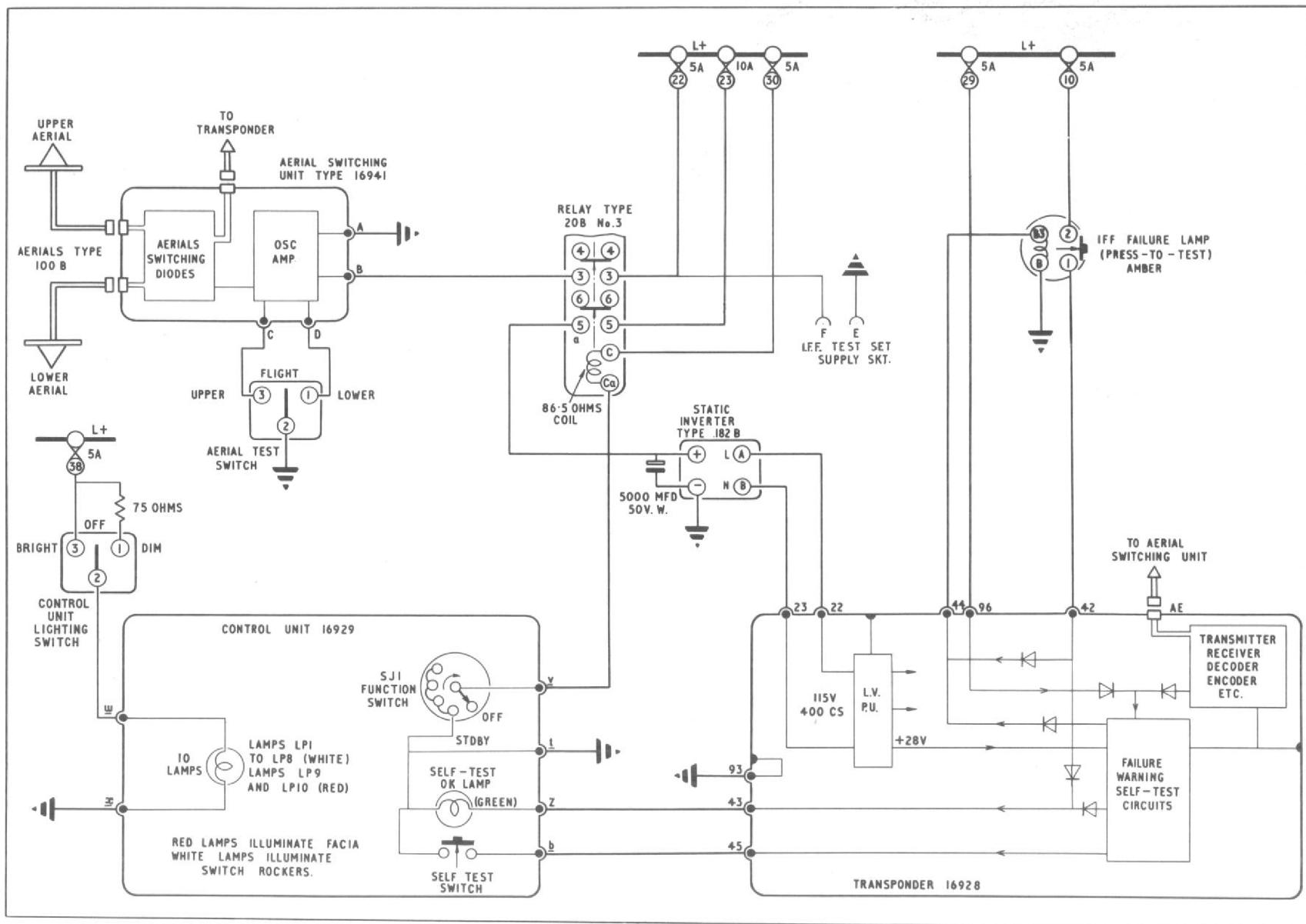


Fig. 7 IFF/SSR 1520 supplies (theoretical)

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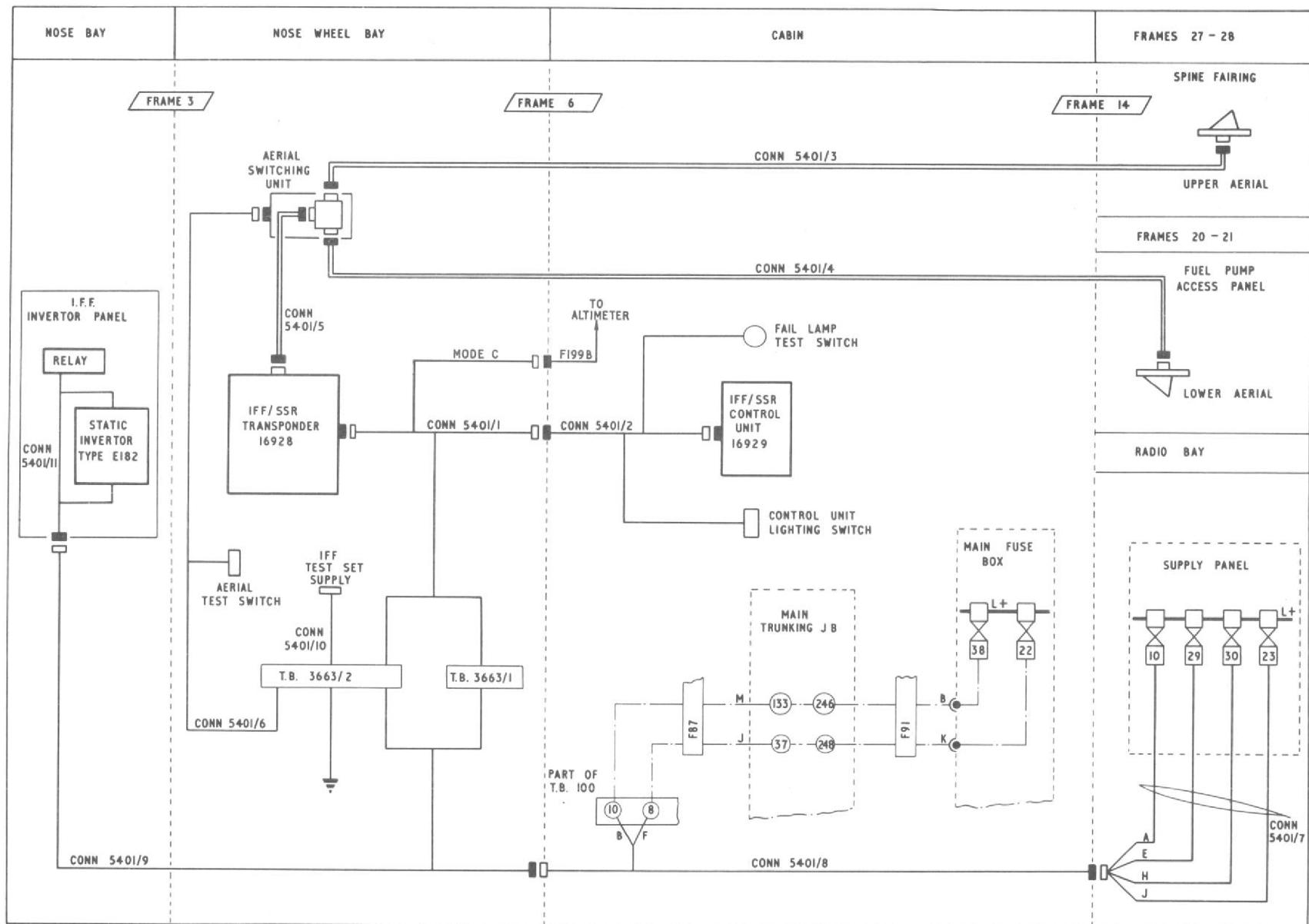


Fig. 8 IFF/SSR 1520 supplies (routeing)

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to operate the aerial switching unit is completed from fuse 22 in the main fuse box, across closed contacts 3-3a of the control relay to pin B of the aerial switching unit. The circuit is completed to earth via pin A. A circuit is also completed to the input side of the Type 182B inverter from fuse 23 in the supply panel across closed contacts 5-5A to the inverter which will commence to operate and supply single phase 115v 400Hz. a.c. to the low voltage power unit of the transponder via pin 22. Neutral between the inverter and transponder is completed at pin 23 of the transponder.

34. Once the installation is switched to STD-BY and warmed up the amber IFF FAIL lamp

and green TEST lamp will extinguish but the filaments can be checked for serviceability by depressing the body of the IFF FAIL lamp. The test circuit for the amber filament is from fuse 10 in the supply panel across contacts 1-2 of the lamp/switch to pin 42 of the transponder returning via pin 44 and through the lamp filament to earth. For the green TEST lamp the circuit is similarly to pin 42 of the transponder then from pin 43 to pin z of the control unit and through the green filament to earth via pin t of the control unit. Illumination of the IFF FAIL lamp when the installation is operating indicates failure of the installation. The green TEST lamp is used to check the self test circuits as outlined in the functional checks in Sect.6., Chap.2, and has a press to test facility for this purpose.

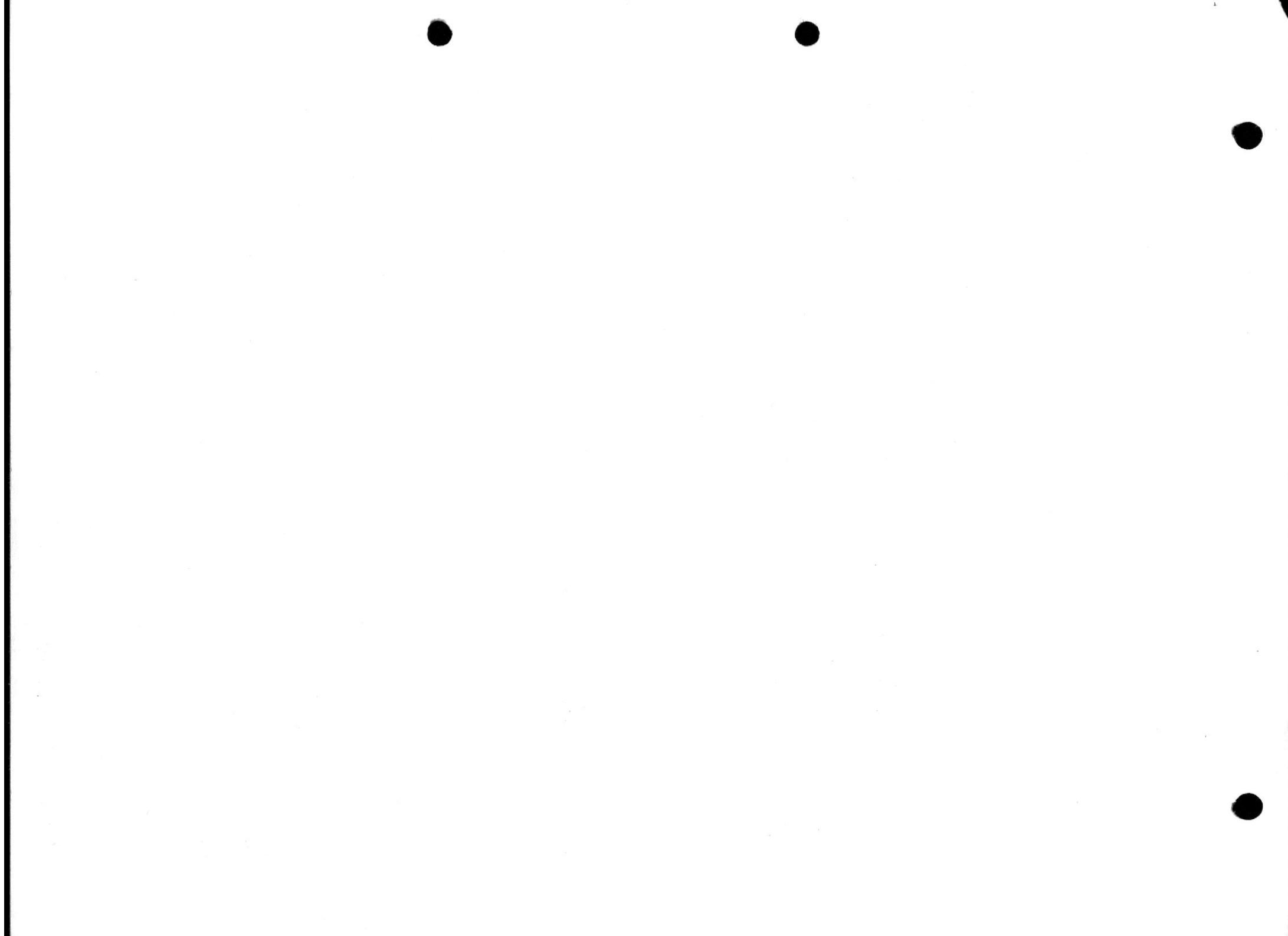
SERVICING

General

35. Standard routine tests for security and serviceability should be carried out as described in the appropriate Air Publications listed in Table 1. When a fault is reported in the radio or radar supply circuits these should first be checked to ensure that the fault is not in these circuits. Ensure also that all connectors are correctly mated and test the voltage both on and off load. General servicing of the aircraft electrical system is described in Group A.1.

REMOVAL AND ASSEMBLY

36. Removal and assembly of all items in the radio and radar supply circuits is self evident. Removal of the radio and radar installation components is detailed in Sect.6, Chap 1 and Chap.2.



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