A.P. 101B-0417-1B,Supplement
A.L.68, Nov.85

SECTION 6

ELECTRICAL INSTALLATION

LIST OF CHAPTERS OVERLEAF

SECTION 6

ELECTRICAL INSTALLATION

LIST OF CHAPTERS

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Chapter 1 GENERAL INFORMATION

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LIST OF ILLUSTRATIONS

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Introduction

1. This section contains information relating to the electrical system. It is divided into a number of self-contained chapters consisting of descriptive and servicing matter, illustrations, and tables appropriate to the chapter heading. The General Information chapter covers the complete installation and describes the wiring system and location of equipment. The illustrations locate the main components. Tables listing the fuses and lamp filaments can be found in A.P.101B-0417-10 (Servicing Diagrams Manual) Supplement.

DESCRIPTION

Power supplies

2. Two engine-driven Type P3 generators, operating in parallel, supply power at 28-volt d.c. for the main aircraft electrical system and also charge the 12-volt, 40 Ah batteries connected in series parallel. The special equipment, the wireless and radar installations and certain flight instruments operate from a.c. supplies obtained from two 30 kVA, 3-phase, 400 Hz, 200V turbine-driven alternators. In the event of failure of both alternators, two 115V, 3-phase, 400 Hz a.c. inverters provide a stand-by source of supply for operating the flight instruments. A third inverter provides 115 volts a.c. to the A.R.I. 23314 system.

Wiring system

3. The Plessey system of wiring, using cables and conduits with multi-pole plugs and sockets, is mainly used for making connections between equipment although in some instances, the Hellerman type of multi-pole plugs and sockets are used. In addition, certain cable assemblies pass through the pressure bulkhead by means of Helvin pressure bungs. Circuit distribution to the equipment is by the use of junction and distribution boxes dispersed throughout the aircraft. Each junction box is referenced by a number such as J.B.1, J.B.2, etc., which is marked on the box cover. Cable connections to the terminals and fuse blocks in the junction and distribution boxes are made by quick-release tags or ferrules.

Cable assemblies and junction boxes

4. All terminals in junction boxes and panel assemblies have identification tabs marked with their appropriate circuit reference. Conduits and cable assemblies are identified by a letter and number printed on rubber sleeves fitted at each end of the assemblies. Where a cable terminates in tails, each lead is fitted with a marker bearing the circuit reference of the terminal to which it is connected. Conduits or cables with the initial letters N, F, C or T, are usually installed in the nose, front, centre or rear fuselage respectively. Cables feeding into a junction box are referenced as above but when leaving a junction box for an item of equipment the initial reference is changed to that of the box; for example, cables leaving J.B.3 and J.B.4 are shown as 3A, 3B, 4A, 4B and so on.

5. Each lead in a cable fitted with multi-pole plugs or sockets is identified by a rubber marker bearing the number or letter reference of the pin to which it should be connected. On the routeing diagrams, a cable referenced as N45-1 or N45-A would be identified as cable N45-pin 1 or N45-pin A, the contact pins being represented by heavy dots shown at the termination or inter-section of a lead with a bulkhead plug, panel assembly, or other item of equipment. Where Type S relays are illustrated on the diagrams, the letter 'a' shown near the solenoid coil denotes the side of the relay which carries the contacts marked Ca (the solenoid connection) and 1A, 2A, etc.

Plessey wiring system

6. Both standard and miniature types of Plessey plugs and sockets are employed for making connections between items of equipment. The standard type is more widely used for the general electrical services whilst the miniature types are retained for interconnection between the instruments, wireless and radar units, and some items of intercomm. equipment. The joints between plug pins, socket inserts, and conductors in all miniature plugs and sockets and in all standard sockets of and above 37 amp size are soldered. Those in standard type plugs and sockets of less than 37 amp sizes are crimped. The Plessey system of wiring together with the standard plugs and sockets is described in A.P. 113D-1825-1 while the miniature plugs and sockets are dealt with in Chap. 8. General information concerning aircraft wiring systems will be found in A.P. 4343, Vol. 1, Sect. 12, Chap. 5.

WARNING

Where earth connections from various equipments are taken to a common earth terminal group, the disconnecting of the main airframe earth connection from such terminal groups, whilst the electrical system is live, could cause back feeding to the live supply via other equipments to another connected airframe earth. This could result in explosive circuits being inadvertently discharged, or sensitive equipments having higher than normal or reversed voltage on them.

It is therefore essential, before disconnecting any grouped earth connections, that both the main and emergency batteries be disconnected at the battery terminals and that all electrical supplies be disconnected from the aircraft.

7. The crimping process is a solderless method of making electrical joints between cable conductors and plug pins, socket inserts, terminal tags, or ferrules. The contact pin or tag, after the insertion of the bared conductor, is swaged by a crimping tool. This operation imparts sufficient pressure to contract the pin or tag body round the conductor to make a sound mechanical and electrical joint. The crimping tool carries a detachable die which can be changed to accommodate the various sizes of plug pins, socket inserts, tags or ferrules. There is available a special crimping tool kit No. 3 *(Ref. No. 5X/3186)* which comprises a hand tool and a range of dies suitable for crimping 4, 7 and 19 amp plug pins, socket inserts, and tags, etc.

8. To make a stronger joint when crimping the smaller size of cable, such as vin, cel, rubber 2.5 or Pren 4, the bared conductor should be doubled over before inserting it in the bore of the plug pin, insert or tag. After crimping the excess strands of wire should be carefully cut off before fitting a rubber sleeve over the joint.

9. In the standard type of Plessey socket, the contact inserts are secured in the moulding by spring clips which must be pressed down before the insert can be withdrawn. Special extractor tools for removing the inserts are available under the following Reference Numbers:-

Insert size	Ref. No.
7 amp	5X/2237
19 amp	5X/2238
37 amp	5X/2239
64 amp	5X/2240

10. The fitting of rubber sleeves, either as markers or for the protection of joints between cable conductors and plug pins or socket inserts, requires the use of a special stretching tool. Two sizes of Hellerman 3-prong stretching tools are available, the Type A (ref. No. 1C/5862) which is suitable for sleeves of sizes 0-4 and the Type B (Ref. No. 1C/5863) for sizes 5-10.

11. Servicing of Plessey plugs and sockets calls for special care during dismantling and reassembly. With the standard type, the socket coupling nut must always be slackened off first to allow the socket shell to be unscrewed independently of the inner moulding and cable leads. Pliers must never be used to unscrew tight socket shells - an adjustable strap wrench (Ref.No. 5X/1564) is available for this purpose. Before mating up multi-pole plugs and sockets it is essential to examine all contacts for the presence of metal swarf or other foreign matter which could cause shorting. The plug and socket threads must be kept clean and lightly lubricated with an approved low-temperature grease such as XG-287.

Pilot's station

12. All switches and instruments employed in the control of the aircraft are grouped on panels arranged round the cabin. The panels facing the pilot comprise three assemblies designated the main instrument panel; engine instrument panel, and starboard panel. Above these is a coaming panel on which are carried an E2B compass, certain wireless controls, an accelerometer and a number of cabin lamps and dimmer switches. Below the main instrument panel is the starter panel on which are the engine starting switches and the GM compass COMP-D/GYRO switch.

Pilot's console

13. The console structure at the port side of the pilot's seat carries on a detachable panel, switches associated with the control of all external lighting such as the navigation, taxying, landing, identification and anti-collision lamps. Also housed on this panel are switches which control the flying control trim circuits, the wing-tip tank/pod jettison circuits and certain cabin lighting lamps. At the aft end of the console under a detachable cover fitted with quick-release fasteners, are the fuses pro-

tecting the external lighting circuits. Spare fuses are carried in clips attached to the underside of the cover. Two 12-volt lead-acid batteries are housed behind the map stowage in the lower section of the console structure; these are provided for the emergency operation of the canopy and hatch jettison circuits and the turn-and-slip indicator. Connections to the equipment on the console are made by Plessey plugs and sockets on the underside of the detachable panel.

Take-off panel

14. Services which essentially must be in operation during take-off are controlled by switches grouped on a panel above and to port of the pilot's seat. These switches are associated with the control of battery isolation, canopy and hatch jettison, canopy demisting, fuel cocks, heating, alighting gear and No. 1 and No. 2 generator circuits.

Throttle box

15. The engine throttle box installed forward of the console panel carries the engine fuel pump isolation switches and, embodied in the handles of the H.P. fuel cock levers, the engine relight switches. Inside the box assembly is a microswitch which is connected into the alighting-gear circuit and operated when either throttle lever is less than one third open. Slow-speed running stops are fitted to the throttle quadrants to prevent under-frequency conditions occurring when running the a.c. generators on the ground.

Alighting-gear panel

16. This panel is located between the throttle box and the flight instrument panel. It carries the alighting-gear master switch, selector switch and position indicator together with the flaps control switch and indicator.

Flight instrument panel

17. The flight instrument panel, situated directly forward of the pilot's seat, embodies the flight instruments, navigational aid indicators, flying control trim indicators and instruments associated with ancillary services.

Engine instrument panel

18. This panel, positioned to starboard of the flight instrument panel, carries all engine instruments, fuel contents gauges and fuel pump switches. It also houses the d.c. generator failure warning lamps.

Starboard instrument panel

19. The starboard instrument panel is fitted diagonally at the starboard side of the cabin between the engine instrument panel and frame 3. It carries the miscellaneous instruments, oxygen indicators, cooling fan switches, cabin air and fire extinguisher controls, a Tacan indicator and the pilot's U.H.F. control unit and U.H.F. installation control switches.

Starter panel

20. On this panel are mounted the engine MASTER STARTING and IGNITION switches START push-switch, and the GM COMPASS COMP-D/GYRO switch used in the GM4B compass circuit.

Control column

21. The right handgrip of the pilot's control column carries the tail plane control cut-in and trim switches and, in the crook of the handle, the V.H.F. radio press-to-transmit switch.

Electrical control panel (E.C.P.)

22. The E.C.P. is installed slightly aft and to starboard of the pilot's seat. Fitted to the forward face of the panel are the fuel pump test switches and ammeter socket, panel internal lighting switch, and No. 1 and No. 2 generator field circuit breakers. On the starboard side of the panel, under a cover secured with quick-release fasteners, is a further hinged panel on which is mounted the main assembly of fuses. This panel may be hinged down to give access to the heavy current fuses and relays inside the assembly. Two lamps, controlled by the switch on the forward face, provide illumination for servicing the fuse panel.

A.E.O.'s station

23. The equipment at the A.E.O.'s station mainly consists of the controls necessary to the operation of the special equipment. Also fitted at this station are wireless and radar controls, a pack bay fire warning lamp, a control switch and two indicator lamps associated with the pack-bay air inlet scoops circuit, a hatch jettison switch, J.B.14, the GM4B compass control panel and amplifier, and the 400 Hz fusebox. The Davall recorder interface control unit is mounted at the A.E.O.'s station.

Navigator's station

24. The majority of the equipment at the navigator's station is fitted on the port wall and mounted on panels situated above the chart table.

The equipment on the port wall consists of a hatch jettison switch and alternator control box. Panels above the chart table house wireless and radar controls and indicators, navigation and flying instruments, lighting services and control switches. Other controls and services mounted in panels at the starboard side of the chart table are, essentially, associated with the control of the special equipment and are considered as part of the A.E.O.'s station.

Pressure bulkhead

25. The pressurized and unpressurized sections of the aircraft are divided by the pressure bulkhead at the rear of the cabin. Two methods are employed to take the circuits through the bulkhead; in one of these the cable runs are broken by plugs and sockets and in the other the cables pass directly through it by way of Helvin rubber bungs. During servicing that involves the removal or refitting of equipment on the bulkhead it is essential that adequate sealing is ensured at the attachment points to prevent loss of pressure from the cabin.

Upper equipment compartment

26. This compartment, located above the nose-wheel well and aft of the pressure bulkhead, houses the No. 2 distribution and relay box, the cabin pressure control valve, the instrument a.c. supplies step-down transformer and undervoltage and phase-sequence unit and the detonator resistor boxes for the hatch jettison circuit. Access to the equipment is gained through the roof of the compartment after the opening of a hinged panel.

Port equipment compartment

27. Situated on the port side of the nose-wheel bay, between the pressure bulkhead and frame 12, this compartment houses the contents and pressure gauges, and reducing valves for the nitrogen system, the contents gauge for the hydraulic wheel-brake system, the pack bay fire detector control unit, and the port inertia switch. Access to the equipment is by a hinged hatch forward of the battery bay.

Starboard equipment compartment

28. Situated at the starboard side of the nose-wheel bay, between the pressure bulkhead and frame 12, this compartment houses the main electrical panel assemblies, a.c. power supply inverters No. 1 and No. 2, the starboard inertia switch, mounted below the inverters on the fuselage structure, and the ground services earth point. Access to the equipment is through a hinged door in the starboard side of the fuselage. Illumination of the equipment is provided by a floodlamp fitted above the access door.

Main electrical panel (M.E.P.)

29. Three sub-assemblies designated the forward, aft and busbar panels comprise the M.E.P. The forward and aft panels are installed on the starboard wall of the nose-wheel bay, whilst the busbar panel is mounted in an inverted position on the underside of the upper equipment compartment floor. The panel assemblies carry the generator control and test equipment, battery isolation relay, external power plugs, crash relays, and heavy current H.R.C. fuses used in the d.c. distribution.

Armament safety-break panel

30. This panel is situated just aft of the starboard equipment compartment access door. Removal of its detachable cover exposes the safety-break, comprised of a multi-pin fixed socket and free plug attached to a red warning pennant. Below the safety break is an armament test switch in which must be fitted a ground test key (Ref. No. 1E/5245) to permit ground functioning of the armament system.

Pack bay

31. Among the many items of equipment installed in the pack bay are the electrically-driven fuel pumps and cocks, J.B.1, 2, 3 and 5, and the electrically-operated hydraulic valves which control the alighting gear, air scoops, flaps and air brakes. On the forward and aft bulkhead is fitted a fire extinguisher to protect the special equipment mounted in the bay. A Firewire sensing element is positioned on either side of the roof down the entire length of the bay and operates in conjunction with a control unit to provide a fire warning. Three inlet scoops and two outlet ducts are provided for equipment cooling. Operation of the scoops is controlled by an hydraulic valve. Microswitches, positioned adjacent to the scoop at frame 21, provide an indicator circuit. No. 1 distribution box, a contactor panel and a busbar switching logic unit are mounted on the roof of the bay and provide the control and distribution of the supplies from the alternators for the special equipment. Access to the equipment in the bay is obtained through the eight access panels positioned four on either side of the bay lower centre member.

Rear fuselage

32. The main items of electrical equipment installed in the rear fuselage are the fire extinguisher on frame 27A, J.B.6, rudder trim actuator, navigation lamps, the tail-plane actuator with its associated isolating relay and limit microswitches and the anti-collision lamps and flasher unit. Access to the rear fuselage is through a hinged hatch door on the underside of the structure, just aft of the pack bay.

Earth bonding data

33. There are three main earth bonding data.

(a) the generator earth terminal in the port and starboard wheel wells.

(b) the battery negative in the fuselage.

9000 series switches

34. Some of the 9000 series switches fitted on the aircraft, may incorporate a lever lock at the centre position only, or at the operated position, or at the operated positions and centre position. To operate any of these switches, the switch toggle must be pulled to unlock the toggle, before the next selection can be made.

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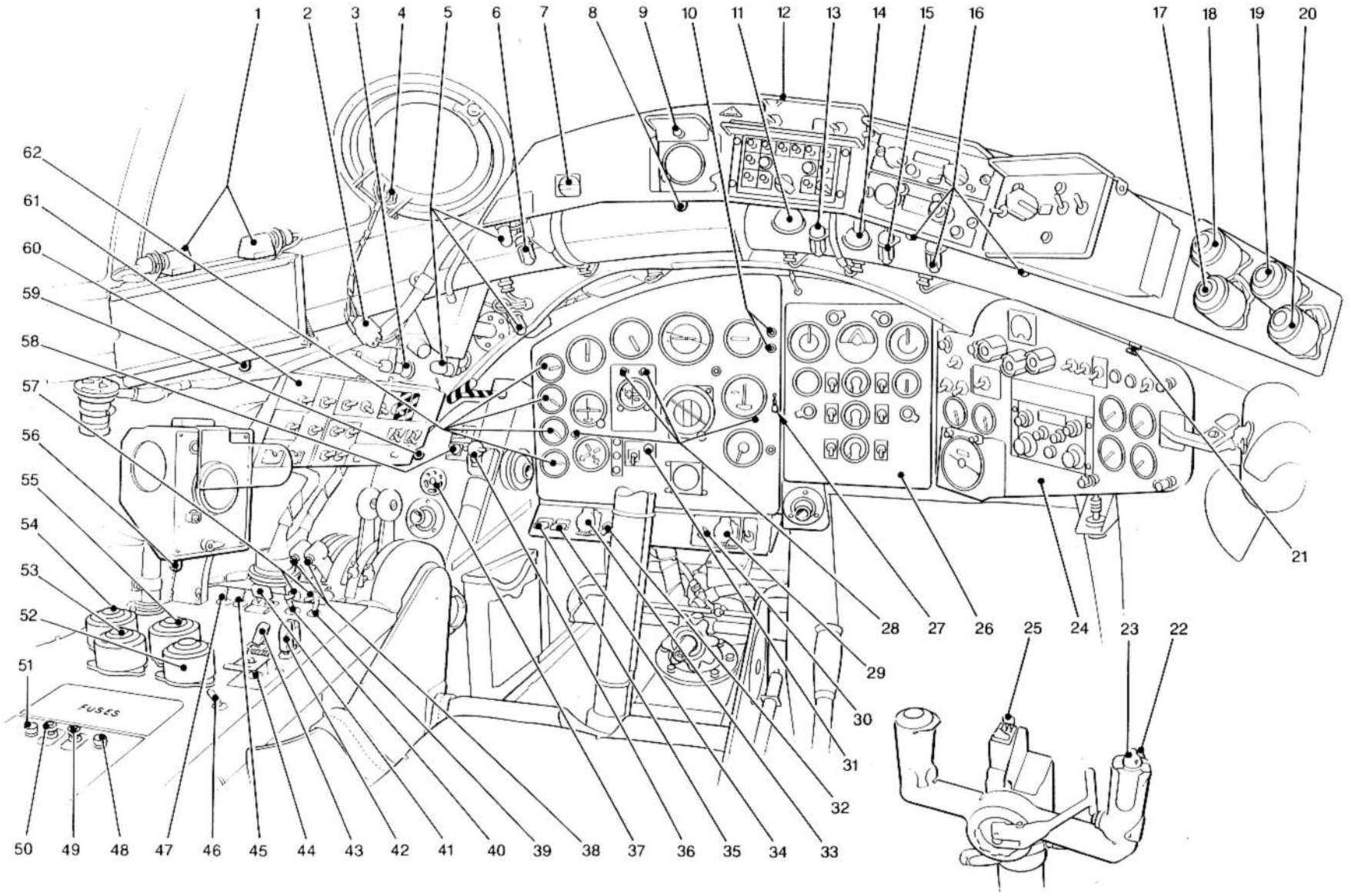

FIG. 1. ELECTRICAL INSTALLATION - PILOT'S STATION

◄ COAMING AMENDED ►

KEY TO FIG. 1 (PILOT'S STATION)

1 DEVIATION CARD LAMPS
2 D.V. WINDOW HEATER PLUGS AND SOCKETS
3 U/V LAMP (PORT)
4 D.V. WINDOW HEATER
5 PORT RED FLOODLAMPS (3)
6 EMERGENCY RED FLOODLAMP (PORT)
7 E2B COMPASS LAMP (INTEGRAL WITH COMPASS)
8 PORT RED FLOODLAMP
9 ACCELEROMETER LAMP
10 INSTRUMENT EMERGENCY A.C. SUPPLY INDICATORS (No. 1 AND No. 2 INVERTORS)
11 PORT U/V LAMP
12 EMERGENCY LIGHTS SWITCH
13 STARBOARD RED FLOODLAMP
14 STARBOARD U/V LAMPS (2)
15 EMERGENCY RED FLOODLAMP (STARBOARD)
16 STARBOARD RED FLOODLAMPS (3)
17 STARBOARD U/V LAMPS DIMMER SWITCH
18 RADIO CONTROL PANEL LAMPS DIMMER SWITCH
19 INTERCOMM. STATION BOX LAMPS DIMMER SWITCH
20 STARBOARD RED FLOODLAMPS DIMMER SWITCH
21 CANOPY DETONATORS
22 TAIL-PLANE TRIM CUT-IN SWITCH
23 TAIL-PLANE TRIM SWITCH
24 STARBOARD INSTRUMENT PANEL - REFER TO DETAIL C, FIG. 1A
25 AIR-BRAKES CONTROL SWITCH
26 ENGINE INSTRUMENT PANEL - REFER TO DETAIL B, FIG. 1A
27 TURN-AND-SLIP INDICATOR SUPPLIES SWITCH
28 ALTIMETER, I.L.S. INDICATOR AND RADIO COMPASS LAMPS
29 No. 2 ENGINE START PUSH-BUTTON
30 No. 2 ENGINE IGNITION SWITCH
31 INSTRUMENT A.C. SUPPLY SELECTOR SWITCH
32 No. 1 ENGINE IGNITION SWITCH
33 No. 1 ENGINE START PUSH-BUTTON
34 No. 2 ENGINE MASTER STARTING SWITCH
35 No. 1 ENGINE MASTER STARTING SWITCH
36 FLAP SELECTOR
37 ALIGHTING GEAR POSITION INDICATOR
38 No. 1 AND No. 2 ENGINE RELIGHT BUTTONS
39 EXTERNAL LIGHTS MASTER SWITCH
40 IDENTIFICATION LAMPS SWITCH
41 LANDING LAMPS SWITCH
42 RUDDER TRIM SWITCH
43 AILERON TRIM SWITCH
44 WING-TIP PODS/TANKS JETTISON SWITCH
45 TAXYING LAMPS SWITCH
46 ANTI-COLLISION LAMPS SWITCH
47 NAVIGATION LAMPS SWITCH
48 CANOPY JETTISON RELAY TEST FUSE
49 CANOPY JETTISON RELAY TEST SWITCH
50 HATCH JETTISON RELAY TEST SWITCH
51 HATCH JETTISON RELAY TEST FUSE
52 PORT RED FLOODLAMPS DIMMER SWITCH
53 CONSOLE RED FLOODLAMPS DIMMER SWITCH
54 DEVIATION CARD HOLDER LAMPS DIMMER SWITCH
55 PORT U/V LAMPS DIMMER SWITCH
56 CONSOLE RED FLOODLAMP
57 FUEL PUMP ISOLATING SWITCHES
58 ALIGHTING GEAR SELECTOR SWITCH
59 CONSOLE RED FLOODLAMP
60 OXYGEN REGULATOR RED FLOODLAMP
61 TAKE-OFF PANEL - REFER TO DETAIL A, FIG. 1A
62 CONTROL SURFACE POSITION INDICATORS

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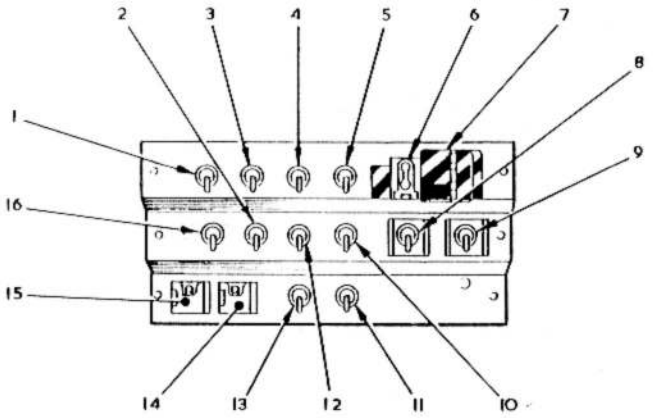
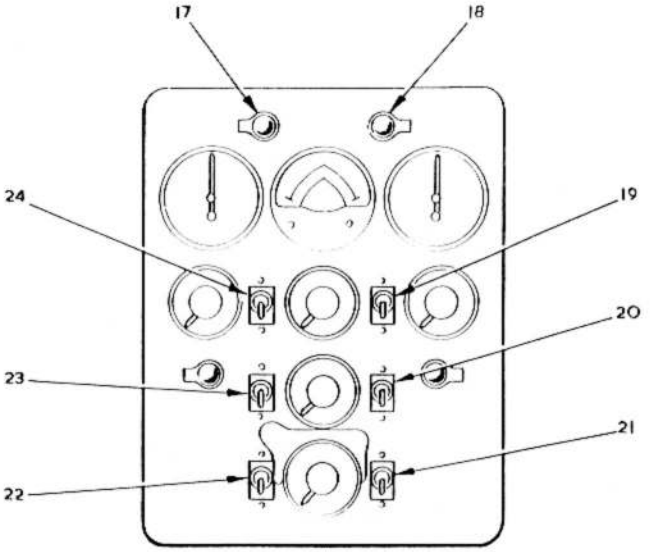


DETAIL 'A'



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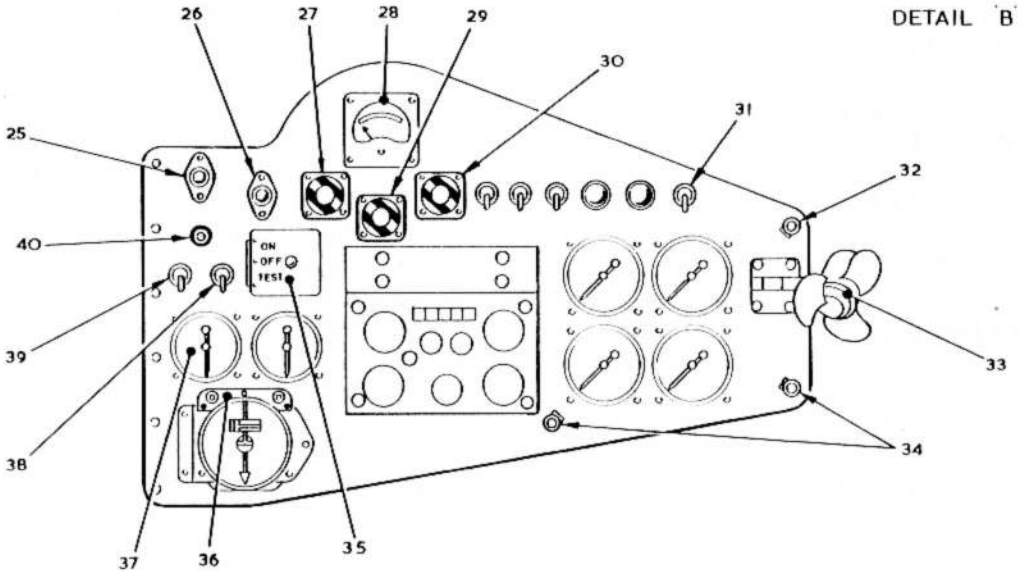

DETAIL 'C'

FIG. 1A. ELECTRICAL INSTALLATION - PILOT'S PANEL DETAILS

KEY TO FIG. 1A (PILOT'S PANEL DETAILS)

1 NO.1 TANK, PORT COCK SWITCH
2 NO.2 TANK, STARBOARD COCK SWITCH
3 NO.1 TANK, STARBOARD COCK SWITCH
4 ALIGHTING-GEAR MASTER SWITCH
5 BATTERY SWITCH
6 CANOPY/SNATCH MASTER SWITCH
7 CANOPY JETTISON SWITCH
8 NO.1 PORT GENERATOR SWITCH
9 NO.2 STARBOARD GENERATOR SWITCH
10 D.V. WINDOW HEATER SWITCH
11 VENT VALVE HEATER SWITCH
12 PRESSURE HEAD HEATER SWITCH
13 CANOPY DE-MIST SWITCH
14 NO.3 TANK, STARBOARD COCK SWITCH
15 NO.3 TANK, PORT COCK SWITCH
16 NO.2 TANK, PORT COCK SWITCH
17 NO.1 GENERATOR FAILURE WARNING LAMP
18 NO.2 GENERATOR FAILURE WARNING LAMP
19 NO.1 TANK, STARBOARD PUMP SWITCH
20 NO.2 TANK, STARBOARD PUMP SWITCH
21 NO.3 TANK, STARBOARD PUMP SWITCH
22 NO.3 TANK, PORT PUMP SWITCH
23 NO.2 TANK, PORT PUMP SWITCH
24 NO.1 TANK, PORT PUMP SWITCH
25 PACK BAY FIRE WARNING TEST SWITCH
26 ENGINE FIRE WARNING LAMPS TEST SWITCH
27 NO.1 ENGINE COMBINED PUSH-SWITCH AND FIRE WARNING LAMP
28 D.C. VOLTMETER
29 PACK BAY FIRE COMBINED PUSH-SWITCH AND FIRE WARNING LAMP
30 NO.2 ENGINE COMBINED PUSH-SWITCH AND FIRE WARNING LAMP
31 FAN SWITCH
32 OXYGEN CONTENTS GAUGE PILLAR LAMP
33 FAN
34 HYDRAULIC GAUGES PILLAR LAMPS
35 CABIN PRESSURE WARNING HORN SWITCH
36 TACAN INDICATOR BRIDGE LAMP
37 CABIN HEAT INDICATOR
38 NO.2 ENGINE, AIR-TO-CABIN VALVE SWITCH
39 NO.1 ENGINE, AIR-TO-CABIN VALVE SWITCH
40 CABIN AIR TEMPERATURE CONTROL SWITCH

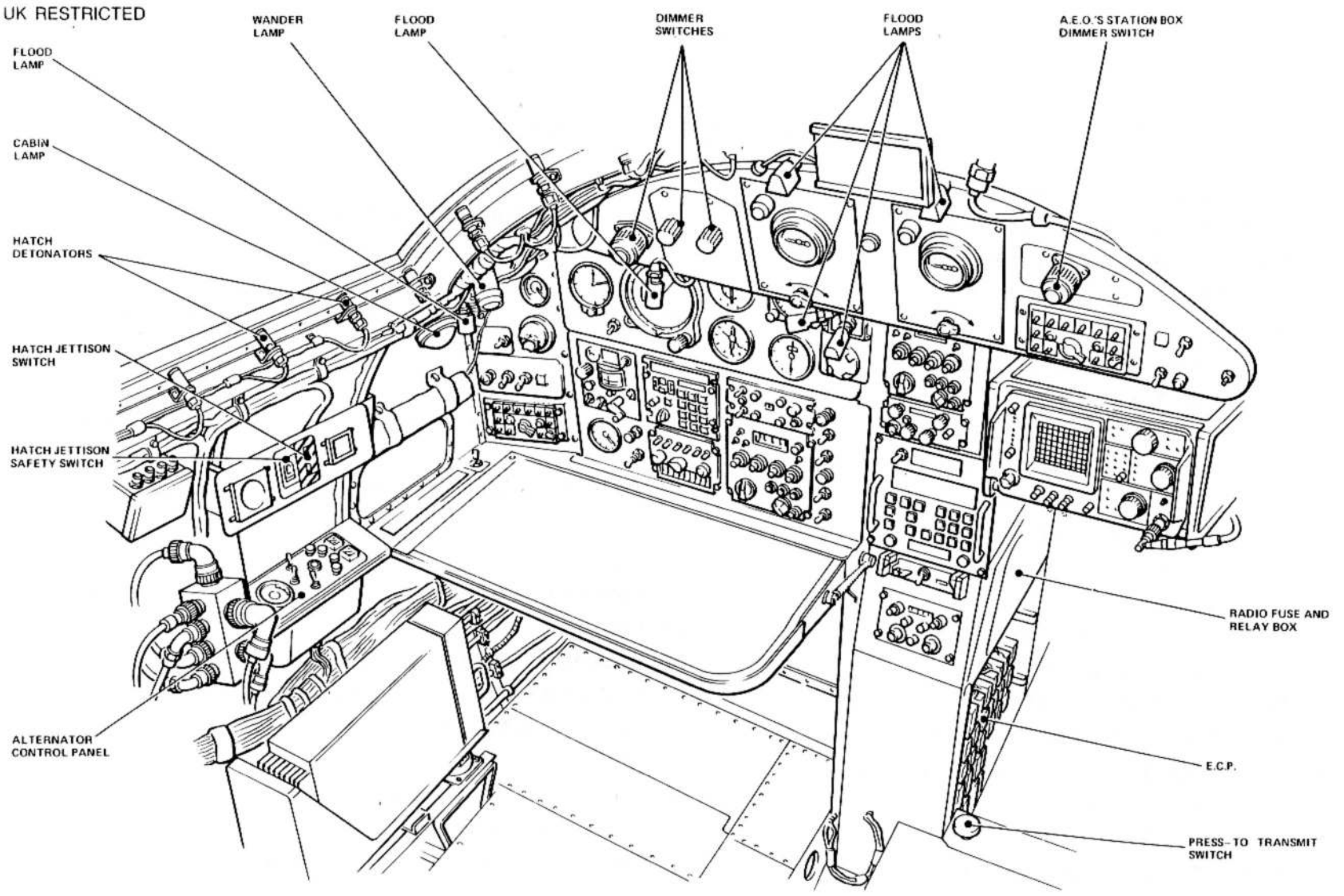

FIG. 2. ELECTRICAL INSTALLATION - NAVIGATOR'S STATION

◀ NAVIGATOR'S STATION AMENDED ▶

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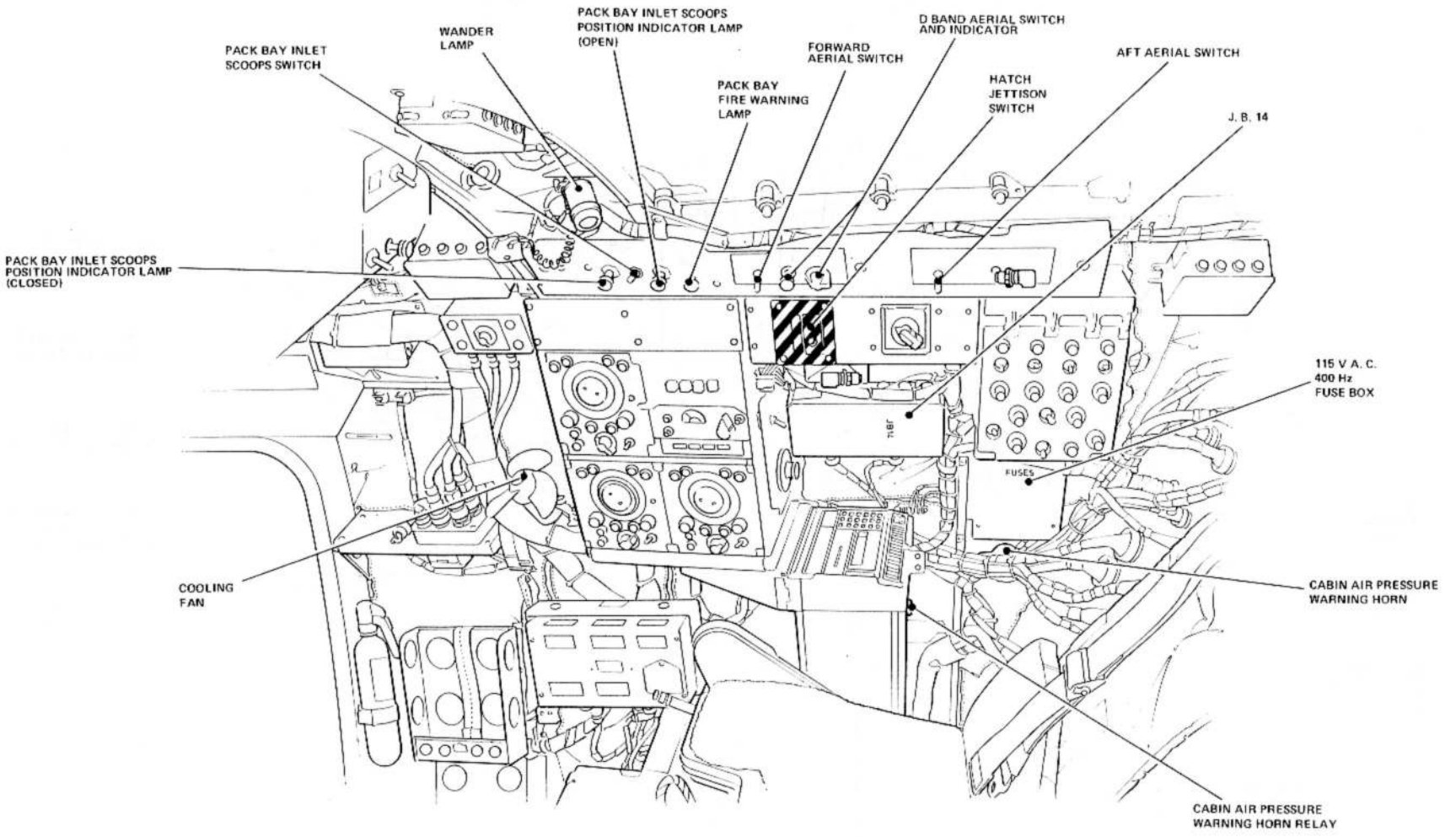

FIG. 3. ELECTRICAL INSTALLATION - A.E.O's. STATION

◄ LIGHTING AMENDED ►

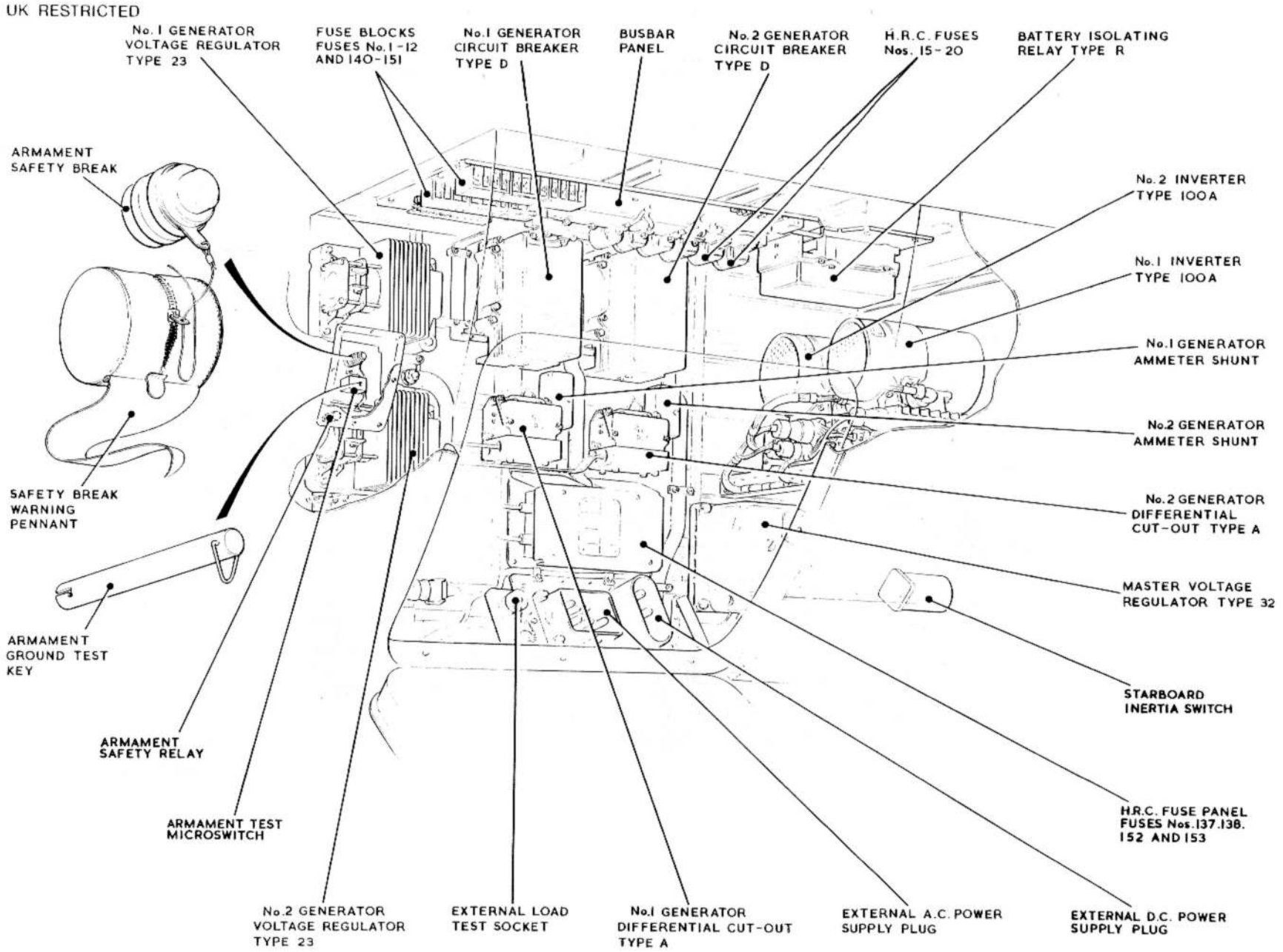

FIG. 4. ELECTRICAL INSTALLATION - STARBOARD EQUIPMENT COMPARTMENT

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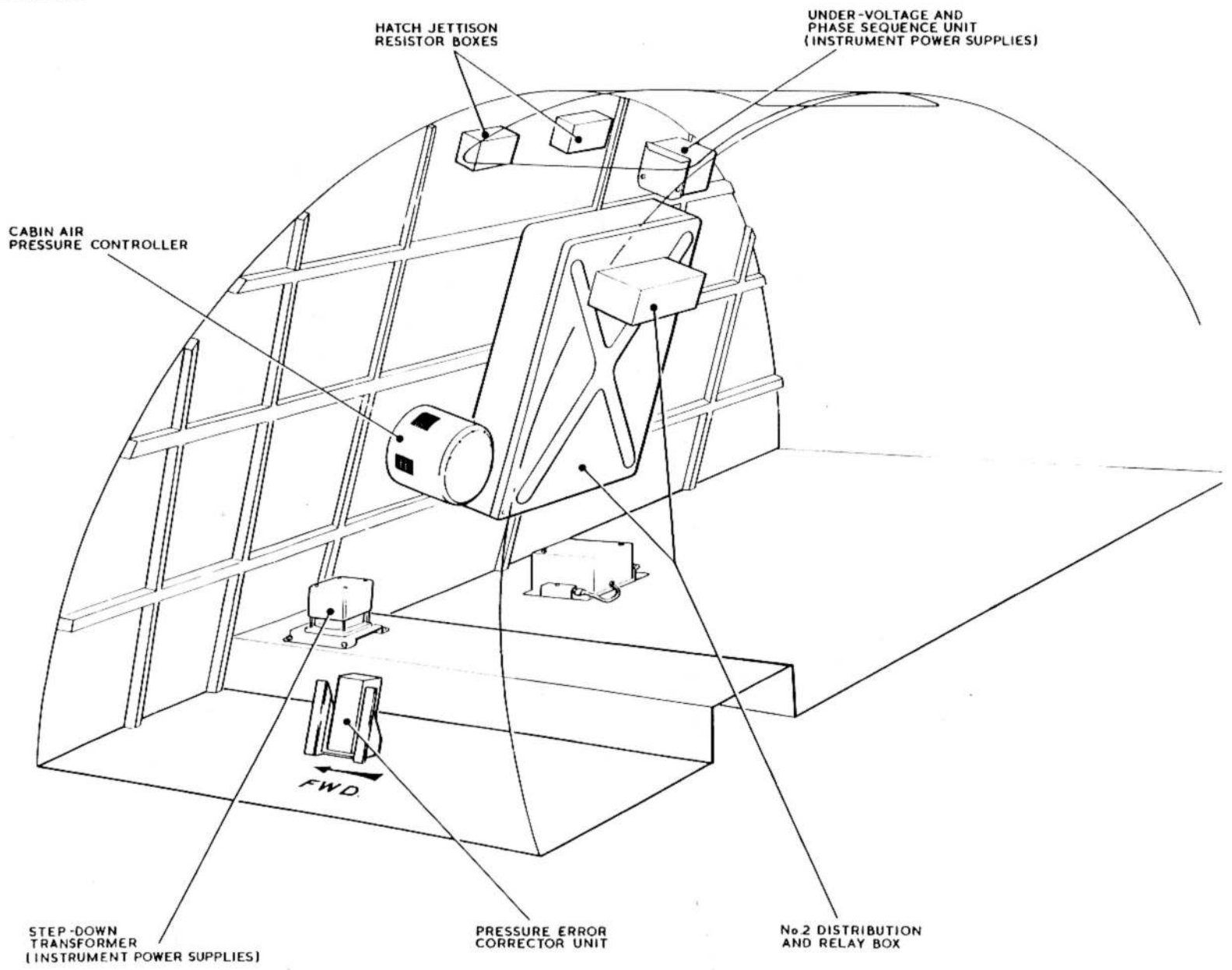

FIG. 5. ELECTRICAL INSTALLATION - UPPER EQUIPMENT COMPARTMENT

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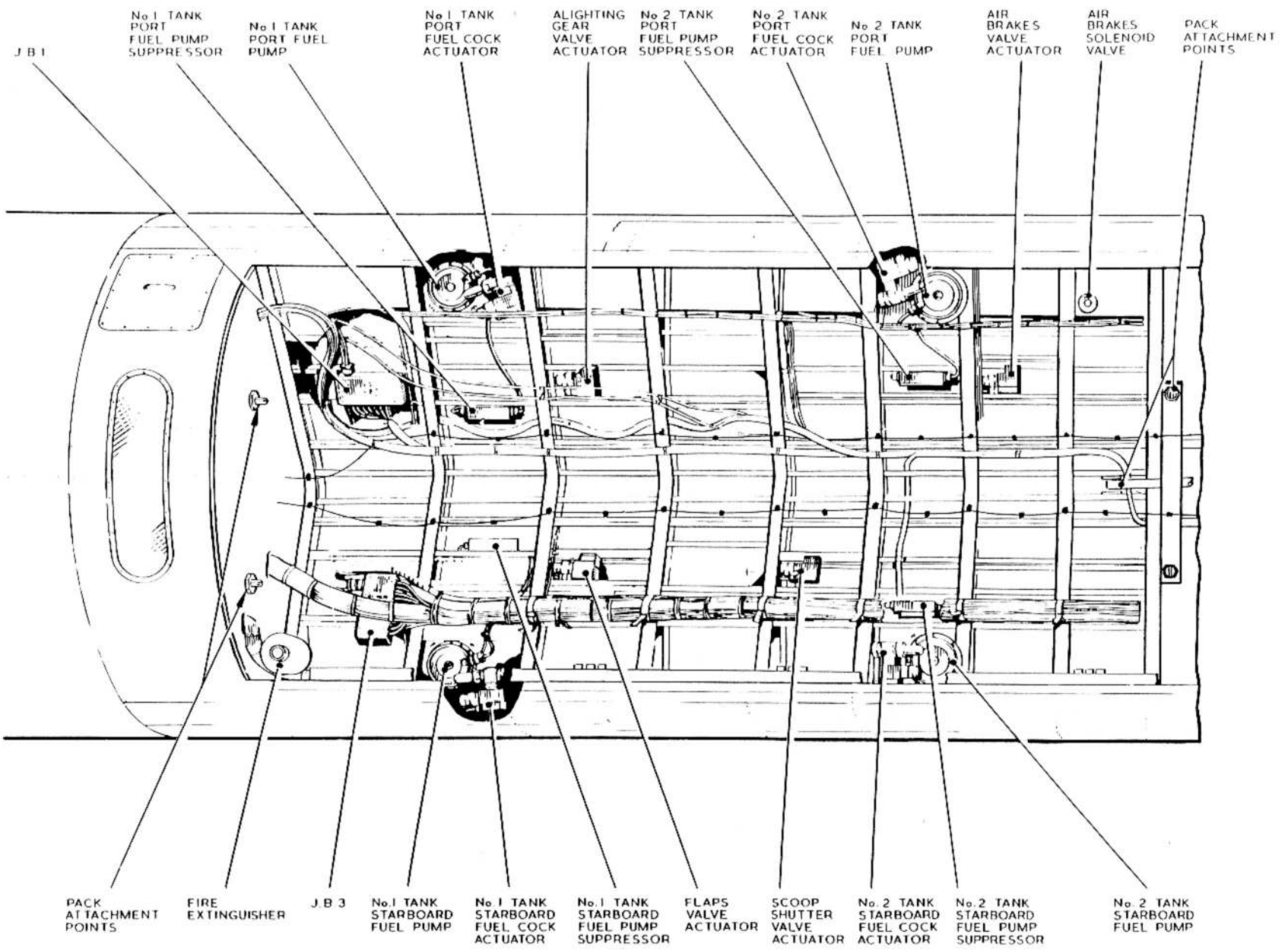

FIG. 6. ELECTRICAL INSTALLATION – PACK BAY

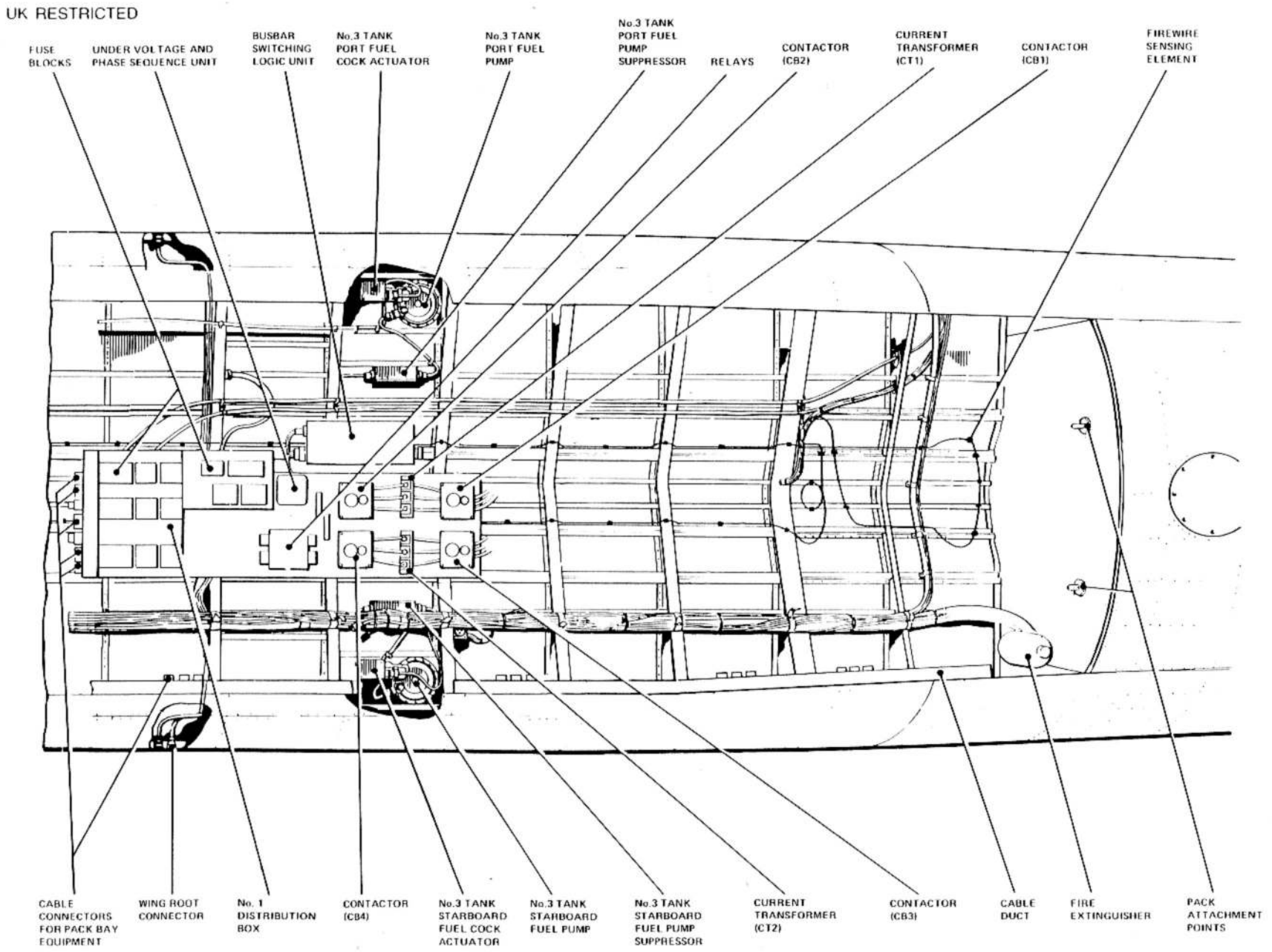

FIG. 6A. ELECTRICAL INSTALLATION–PACK BAY

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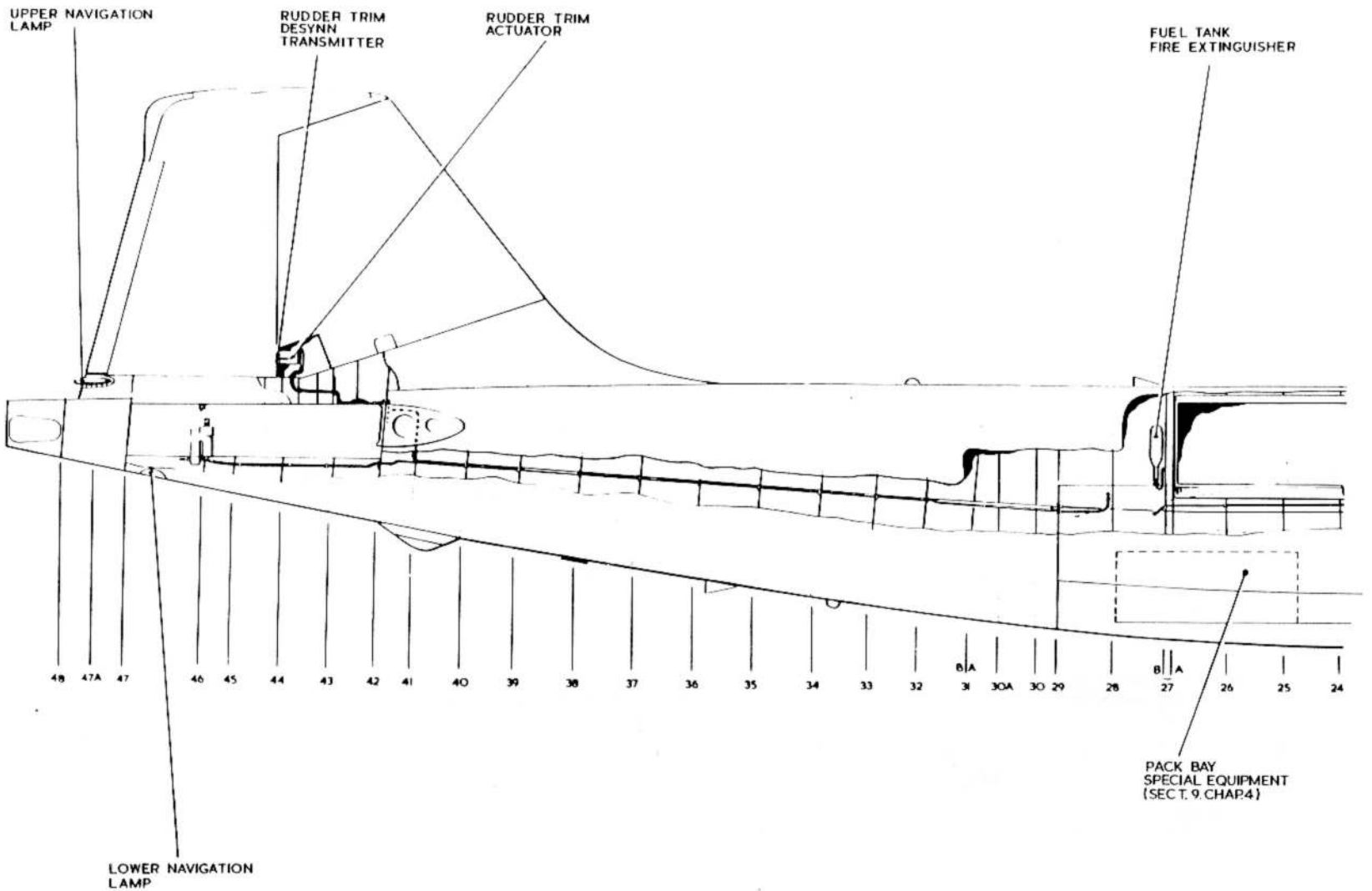

FIG. 7. ELECTRICAL INSTALLATION - PORT FUSELAGE

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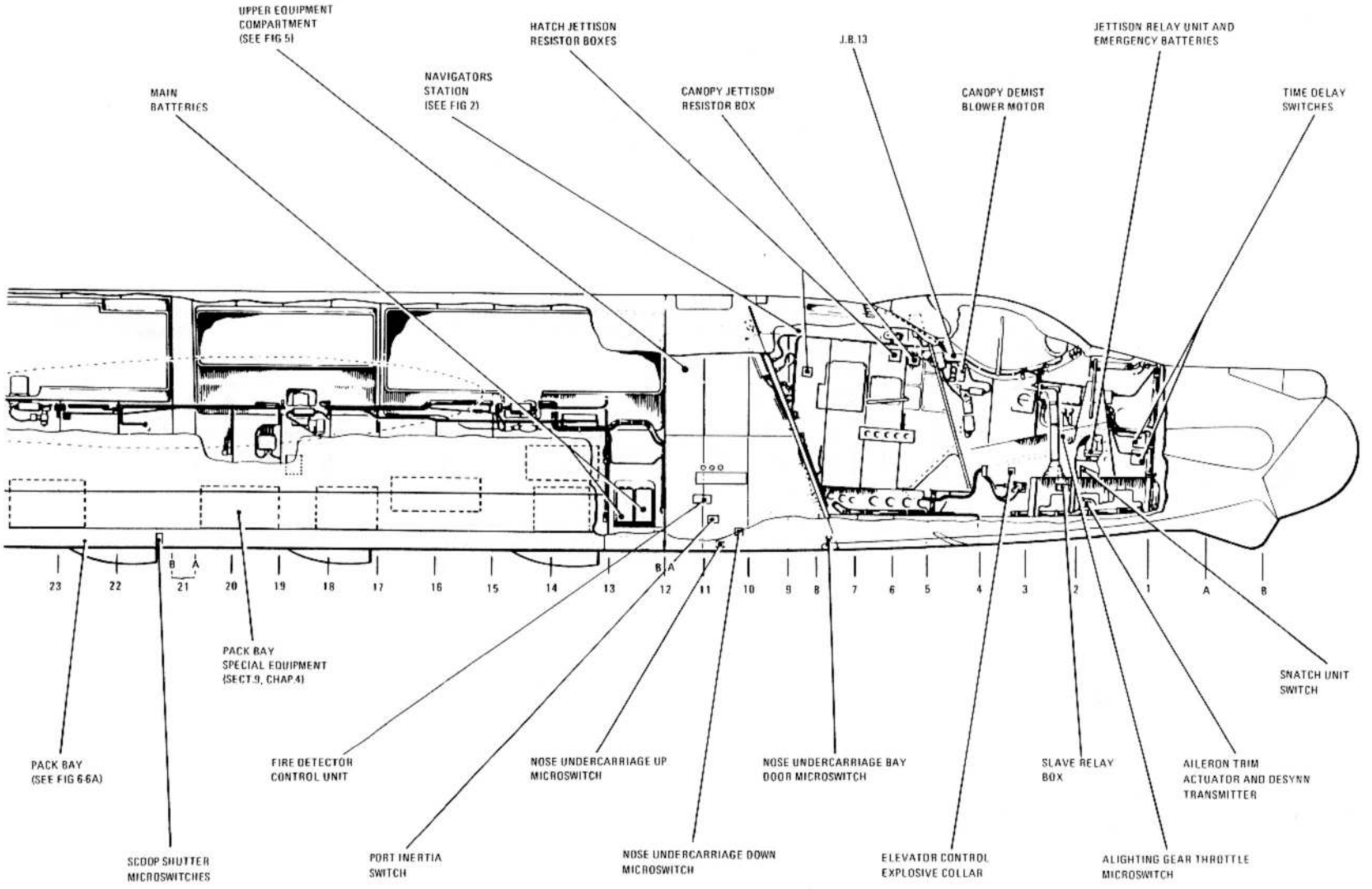

FIG. 7A. ELECTRICAL INSTALLATION – PORT FUSELAGE

◄ SPECIAL EQUIPMENT AMENDED ►

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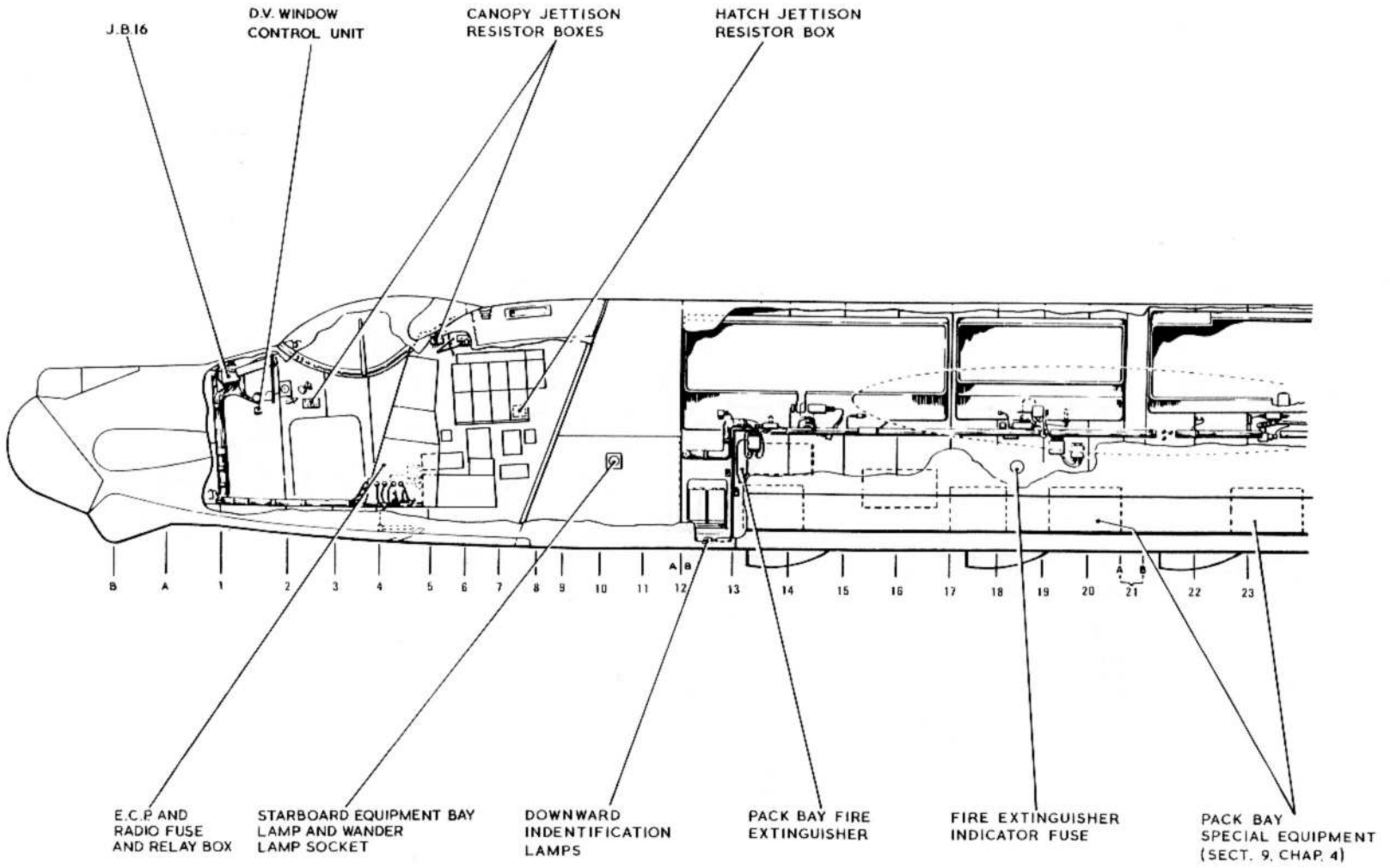

FIG. 8. ELECTRICAL INSTALLATION – STARBOARD FUSELAGE

◄ SPECIAL EQUIPMENT AMENDED ►

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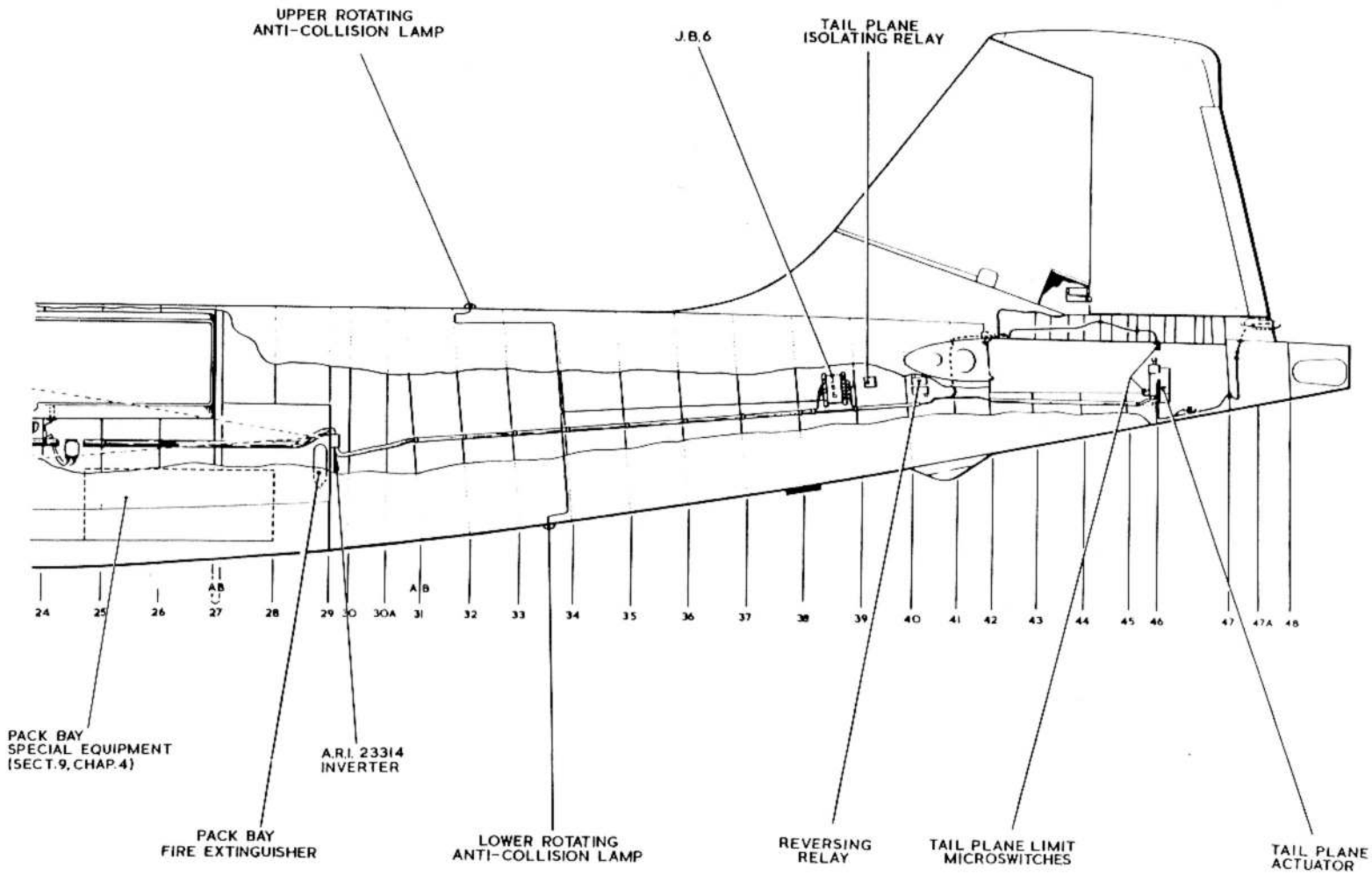

FIG. 8A. ELECTRICAL INSTALLATION – STARBOARD FUSELAGE

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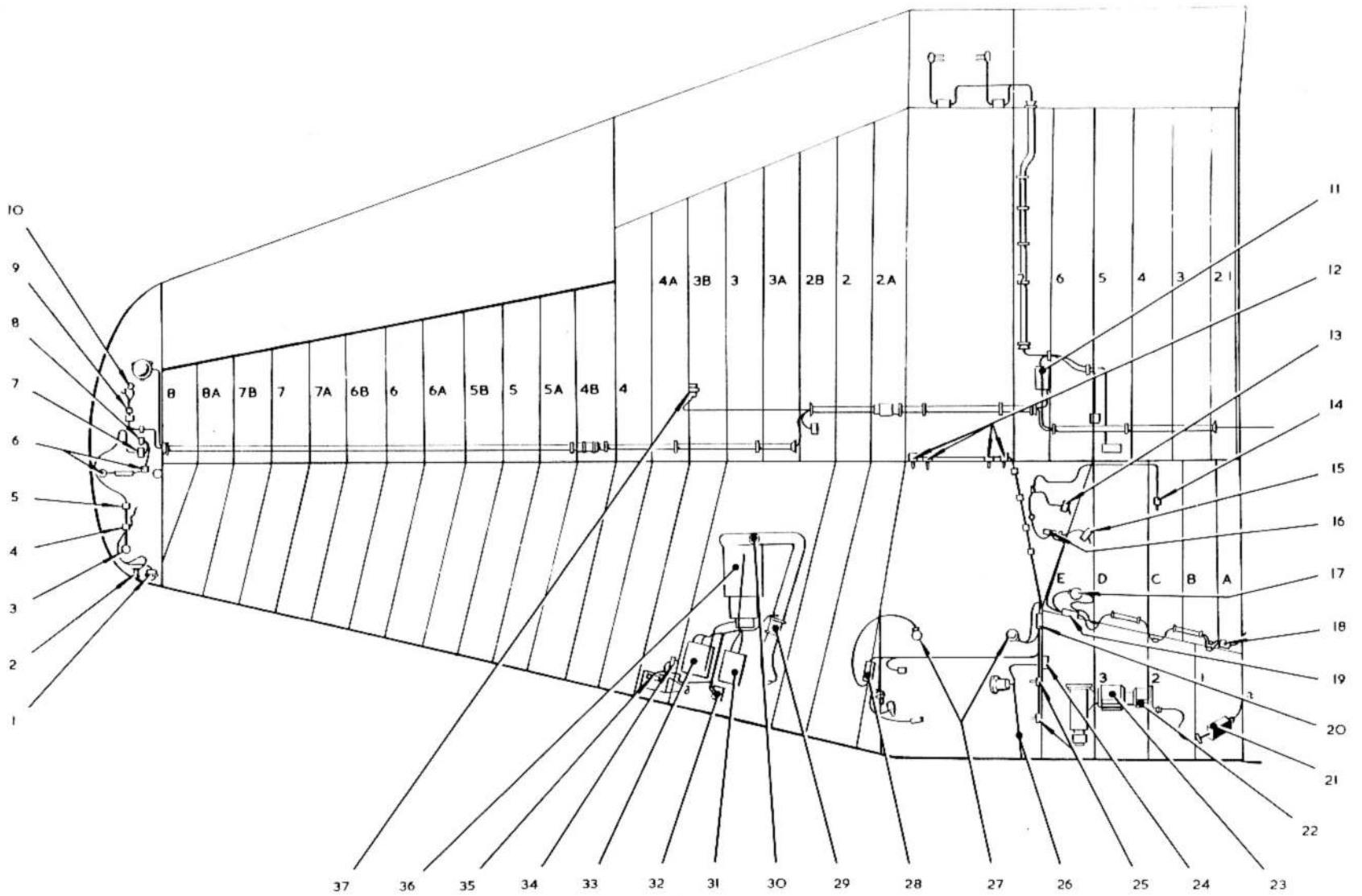

FIG. 9. ELECTRICAL INSTALLATION - STARBOARD MAIN PLANE

KEY TO FIG. 9 (STARBOARD MAIN PLANE)

1 TAXYING LAMP
2 NAVIGATION LAMP
3 DETONATORS
4 5-WAY TERMINAL BLOCK
5 DETONATOR RESISTORS
6 DETONATORS
7 2-WAY TERMINAL BLOCK
8 WING POD NAVIGATION LAMP CONTACT BLOCK
9 TERMINAL BLOCK
10 DETONATOR RESISTORS
11 J.B.10 AND E10
12 RESETTING FIRE DETECTORS
13 ALIGHTING GEAR 'UP' MICROSWITCH
14 ALIGHTING GEAR 'DOWN' MICROSWITCH
15 OLEO LEG MICROSWITCH
16 ALIGHTING GEAR TERMINAL BLOCK
17 FIRE EXTINGUISHER
18 J.B.8 AND E8
19 H.E. IGNITION UNIT (INBOARD)
20 J.B.12 AND E12
21 GENERATOR SUPPRESSOR
22 GENERATOR
23 TWO-SPEED GEARBOX
24 CABIN AIR VALVE ACTUATOR
25 RESETTING FIRE DETECTORS
26 CABLE TO STARTER CARTRIDGE
27 IGNITION PLUGS
28 H.E. IGNITION UNIT (OUTBOARD)
29 AIR SHUT-OFF VALVE
30 OVERSPEED TRIP VALVE AND RESET ACTUATOR
31 FREQUENCY CONTROL UNIT
32 ALTERNATOR TEST SOCKET
33 CONTROL AND PROTECTION UNIT
34 COOLING FAN THERMOSTAT
35 COOLING FAN
36 ALTERNATOR
37 AIR-BRAKE MICROSWITCHES

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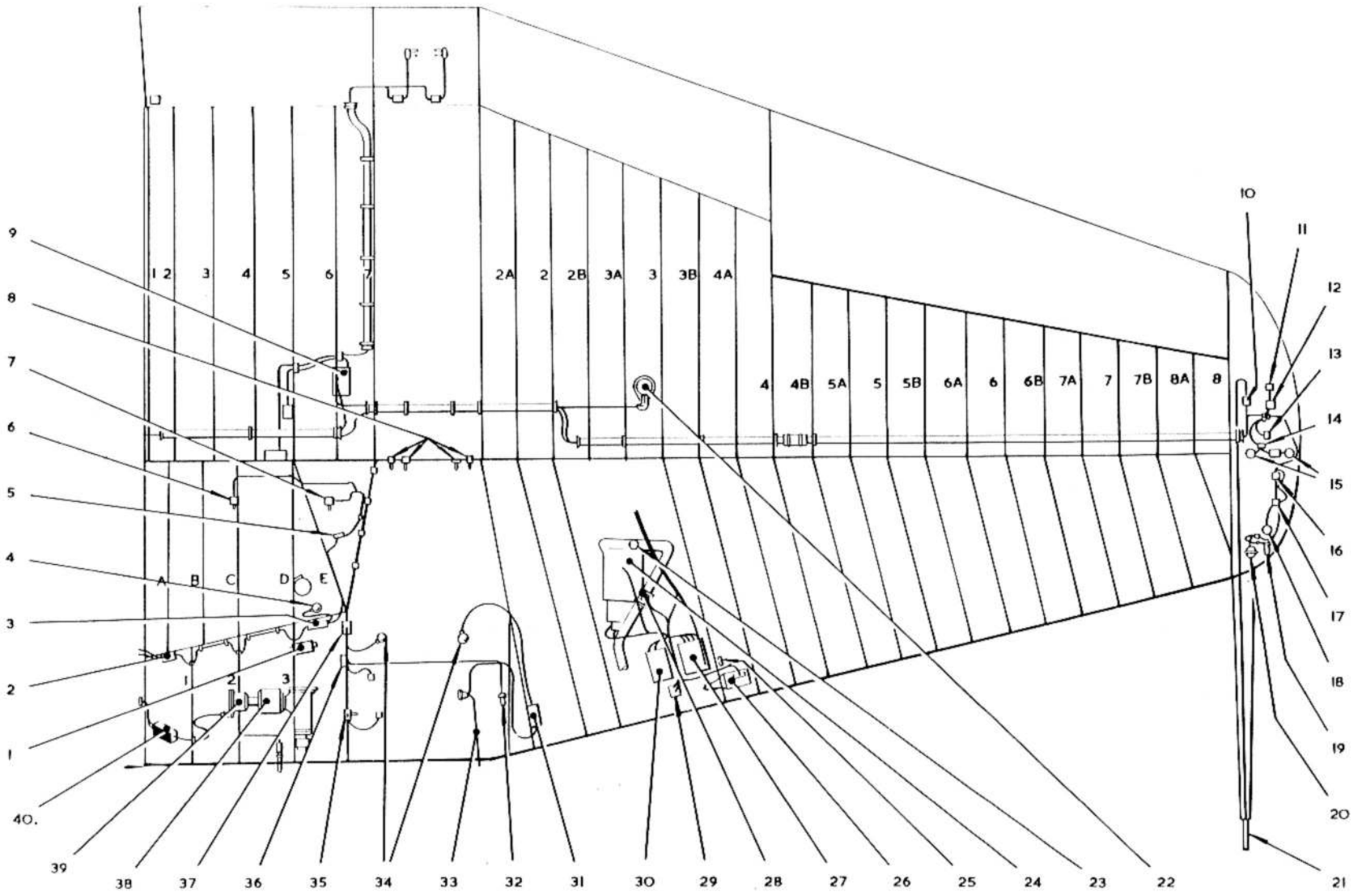

FIG. 10. ELECTRICAL INSTALLATION - PORT MAIN PLANE

KEY TO FIG. 10 (PORT MAIN PLANE)

1 MIXING VALVE ACTUATOR AND DESYNN TRANSMITTER
2 J.B. 7 AND E7
3 H.E. IGNITION UNIT (INBOARD)
4 FIRE EXTINGUISHER
5 ALIGHTING GEAR TERMINAL BLOCK
6 ALIGHTING GEAR 'DOWN' MICROSWITCH
7 ALIGHTING GEAR 'UP' MICROSWITCH
8 RESETTING FIRE DETECTORS
9 J.B. 9 AND E9
10 PRESSURE HEAD HEATER TERMINAL BLOCK
11 DETONATOR RESISTORS
12 TERMINAL BLOCK
13 WING TIP POD/TANK NAVIGATION LAMP CONTACT BLOCK
14 2-WAY TERMINAL BLOCK
15 DETONATORS
16 DETONATOR RESISTORS
17 5-WAY TERMINAL BLOCK
18 DETONATORS
19 NAVIGATION LAMP
20 TAXYING LAMP
21 PRESSURE HEAD HEATER
22 LANDING LAMP
23 OVERSPEED TRIP VALVE AND RESET ACTUATOR
24 ALTERNATOR
25 COOLING FAN THERMOSTAT
26 COOLING FAN
27 CONTROL AND PROTECTION UNIT
28 AIR SHUT-OFF VALVE
29 ALTERNATOR TEST SOCKET
30 FREQUENCY CONTROL UNIT
31 H.E. IGNITION UNIT (OUTBOARD)
32 RESETTING FIRE DETECTORS
33 CABLE TO STARTER CARTRIDGE
34 IGNITION PLUGS
35 RESETTING FIRE DETECTORS
36 CABIN AIR VALVE ACTUATOR
37 J.B. 11 AND E11
38 TWO-SPEED GEARBOX
39 GENERATOR TYPE P3
40 GENERATOR SUPPRESSOR

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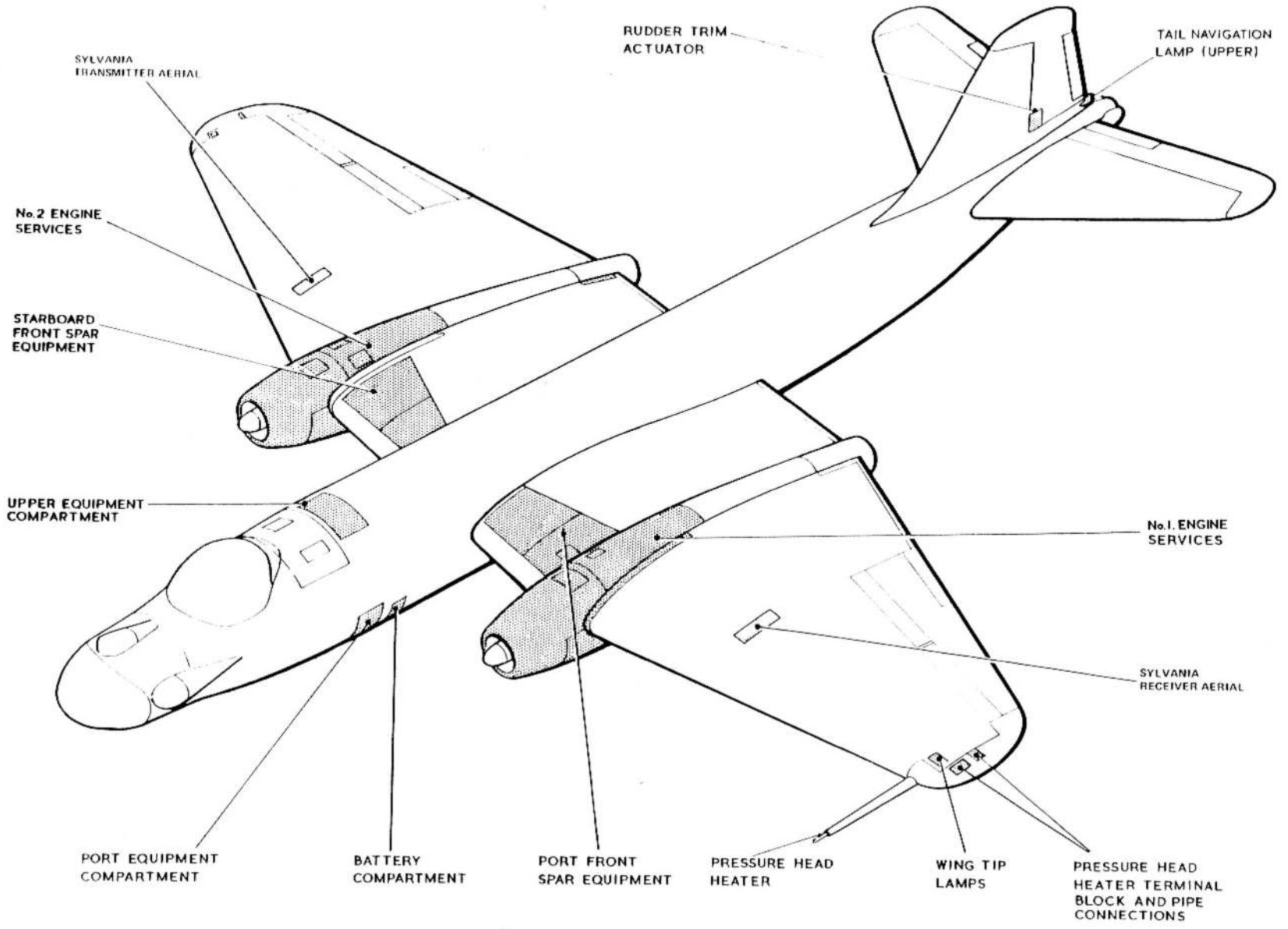

FIG. 11. ACCESS PANELS-UPPER SURFACE AND PORT SIDE

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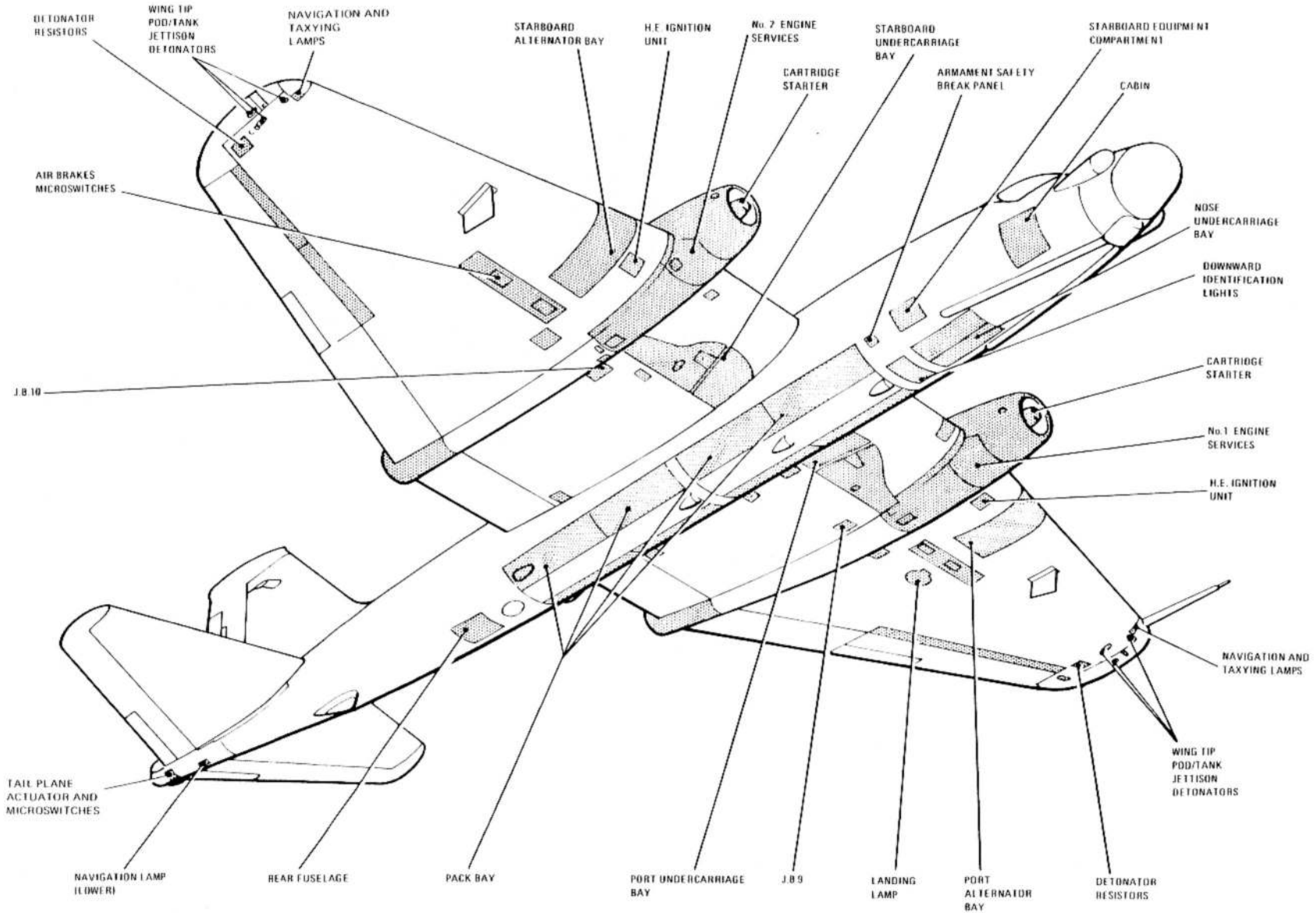

FIG. 12. ACCESS PANELS - LOWER SURFACE AND STARBOARD SIDE

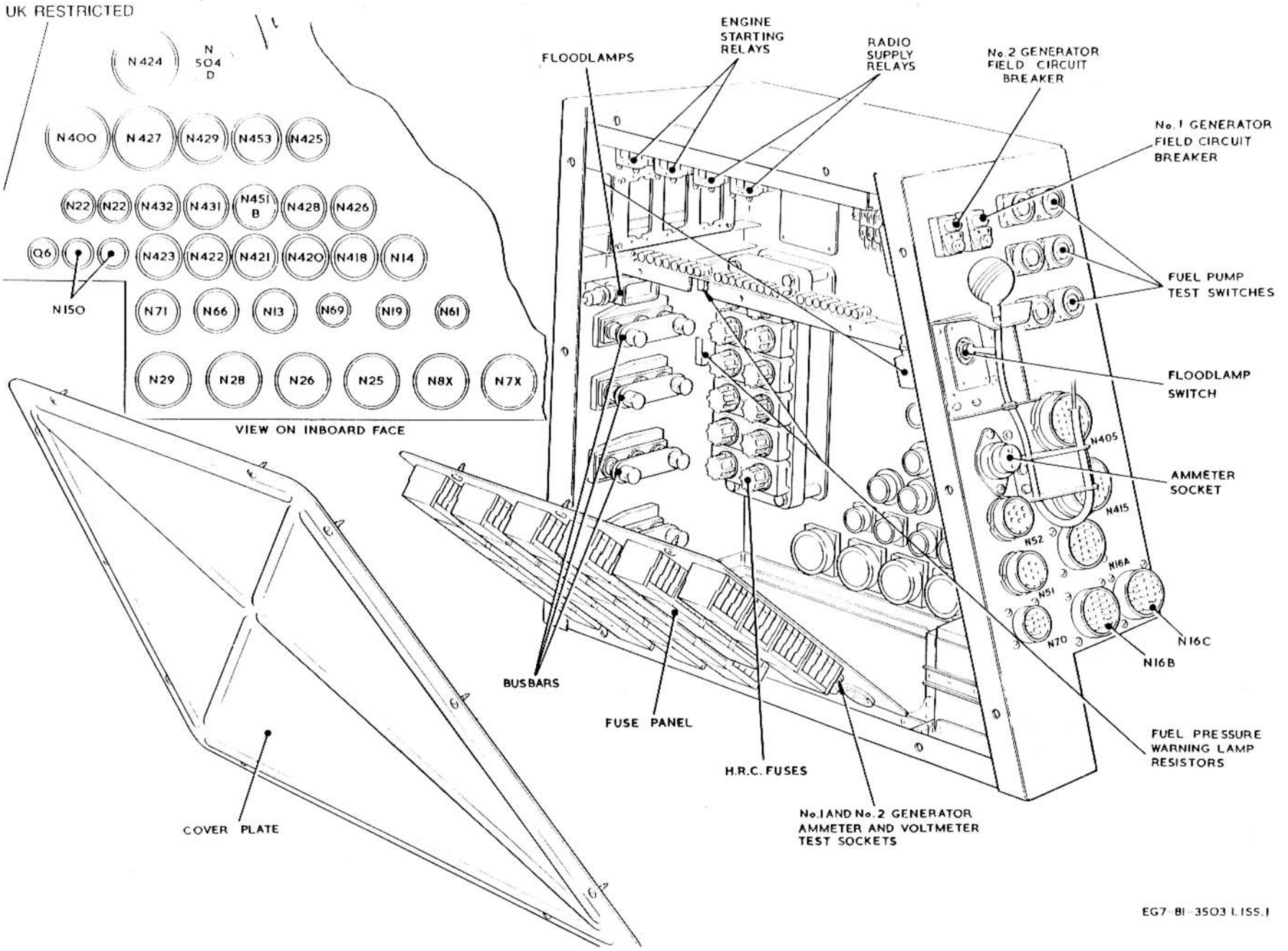

FIG. 13. ELECTRICAL CONTROL PANEL (E.C.P.)

Chapter 2 ARMAMENT

General

Owing to the complexity of the window system and in order to present the information in a readily understandable form, this chapter has been divided into a number of sub-chapters. Each of the sub-chapters is complete in itself, dealing with one particular aspect of the window system. Descriptive text, location diagrams, circuit and routeing charts, servicing information and removal and assembly instructions, are all given in the associated sub-chapter. The various sub-chapters described are:-

2A - General information
2B - Window launcher installation
2C - Not used

Chapter 2A GENERAL INFORMATION

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LIST OF ILLUSTRATIONS

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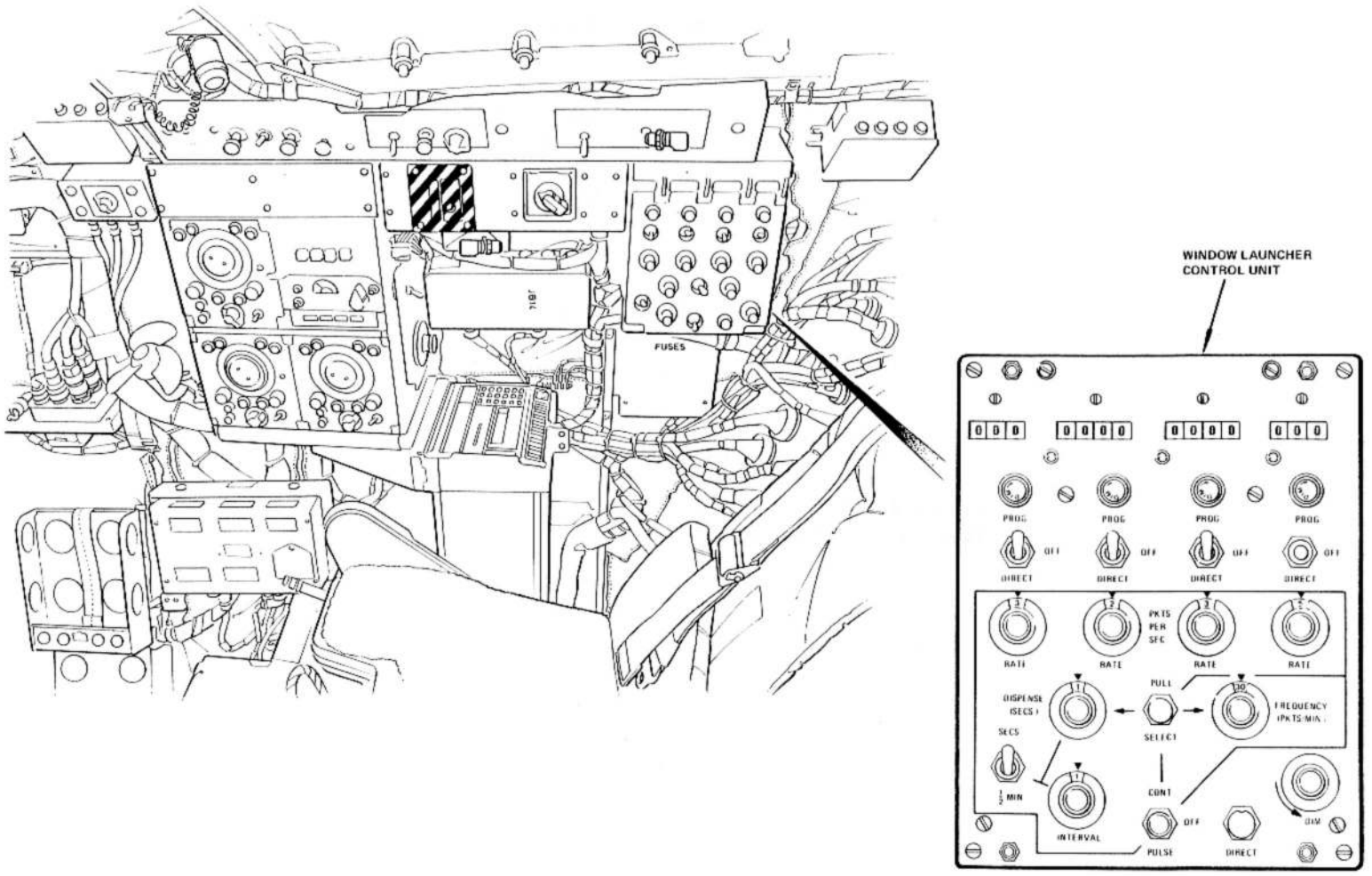

FIG. 1. CONTROL PANELS – A.E.O.'s STATION

◄ LIGHTING AMENDED ►

DESCRIPTION

General

1. The window dispensing installation comprises two individual systems; the window launcher and the cartridge discharger. The window launcher installation comprises a control unit and stripper units, located at the forward end of each of the port and starboard wing-tip pods. The control unit is located on the starboard wall, outboard of the A.E.O.'s seat; alternative control of the window launcher is achieved by a pair of switches mounted on the navigator's control panel, starboard end. The cartridge discharger installation is rendered inoperative by the removal of the control unit, which was located at the navigator's station, the wiring to the pressure bulkhead and the fitting of dummy fuses. Aft of the pressure bulkhead, and in the port and starboard wing-tip pods, the equipment, including the safety devices and wiring, are retained.

Power supplies

2. The supplies for window launcher installation are taken from the 28 volt d.c. busbars PP1 and P10 and are routed to the control unit and each wing-tip pod respectively.

Safety devices

General

3. The wiring to the ground arming link and the armament safety relay is retained in the aircraft but is inoperative due to the fitment of dummy fuses in the cartridge discharger installation supply lines.

Arming levers

4. As a further safety device, three arming levers are located on the inboard side of each wing-tip pod and are described in Chap. 2C and Sect. 5, Chap. 6.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

5. General information on the equipment used in the window installation can be found in A.P. 113F-1104-12 and in A.P. 101B-0417-1A, Sect. 5. In addition to a full description of the equipment used, the publications include operation, servicing and loading instructions.

TABLE 1

Equipment details

Equipment	Location	Access	Air.Pub.
Window control unit ▶◀	A.E.O.'s station	Cabin	A.P. 113F-1104-12
Stripper unit and magazine	Wing-tip pods (forward)	Hinged nose section	A.P. 113F-1104-12
Cartridge discharger (inoperative)	Wing-tip pods (rear)	Access panel (outboard)	
Arming levers	Wing-tip pods (inboard)		A.P. 101B-0417-1A, Sect. 5, Chap. 1

Chapter 4 INSTRUMENT POWER SUPPLIES

LIST OF CONTENTS

Note . . . *Combined theoretical/routeing diagrams for this installation are contained in A.P. 101B-0417-1O (Servicing Diagrams Manual).*

DESCRIPTION

General

1. Power supplies of 28-volts d.c. and 115-volts, 400 Hz three-phase a.c. are required to operate the flight instruments. The a.c. supplies are normally provided by two engine driven turbo-alternators (Chap. 13, Supplement). The output from the turbo-alternators is fed to the three-phase instrument supply busbars TR11 and TB11. The TR11 and TB11 supply is fed via fuses, a transformer and the closed contacts 5-5a and 7-7a of relays No.4 and No.8. Standby a.c. supplies are provided by two Type 100A inverters located in the starboard equipment compartment. Power factor capacitors are provided to offset the low power factor caused by the highly inductive windings of the oil pressure gauge transformers. The capacitors are installed in the No.2 distribution box. A 28-volt d.c. supply, taken from the normal aircraft d.c. distribution system, is required by the G4B compass amplifier and the turn and slip indicator. Provision is also made for alternative supplies for the turn and slip indicator should be primary source of power fail.

Normal operation

2. During the normal procedure of starting the port (No. 1) engine first, No. 2 inverter starts and supplies the instruments with a. c. power until the starboard (No. 2) engine is started, when supplies are normally taken from No. 1 inverter.

3. With the No. 1 ENGINE MASTER STARTING switch at ON the following events occur simultaneously:-

(1) A 28-volt d. c. supply from busbar PP1 is connected to the operating coil of the Type 9B No. 2 relay on the engine starting panel, via fuse 23, M8, M81, fuse 60 and F4. The operation of the Type 9B, No. 2 relay connects a parallel supply from F4 to the turn and slip indicator via relay contacts 5-6, the TURN & SLIP SUPPLY EMERGENCY switch, mounted on the main instrument panel, and F42.

(2) Both the relay No. 7 in the No. 2 distribution box and the EMER. INST. SUPPLY No. 2 INV magnetic indicator on the main instrument panel are energized from busbar PP1 via fuse 23, M8, the closed contacts of the No. 1 ENGINE MASTER STARTING switch, M81, the closed contacts 4 and 4a of relay No. 8 and M83.

(3) A 28-volt d. c. supply is connected from busbar PP1, via M2, closed contacts 3 and 3a of relay No. 7 and M21 to a control panel Type 12, causing the No. 2 inverter to start up.

(4) The 115-volt, 400 Hz, three-phase output from inverter No. 2 is connected to the instrument supply busbars TB11 via TB2 and TR11 via TR2 and closed contacts 6-6a and 8-8a of relay No. 8.

4. With the No. 2 ENGINE MASTER STARTING switch at ON the following events occur simultaneously:-

(1) A d. c. supply from busbar PP2 is connected to the open contact 3 of Type 9B, No. 2 relay via fuse 90, M71, fuse 57 and F5.

(2) A d. c. supply is connected to a suppressor Type P, and subsequently to the GM4B compass amplifier. This supply is routed from busbar PP2 via fuse 90, M71, closed contacts 2-2a of relay No. 8 and M65.

5. With the INSTRUMENT A. C. SELECTOR switch held in the No. 1 INV position the following events occur simultaneously:-

(1) A d. c. supply from busbar PP2 is connected to contact 6 of an under voltage and phase sequence unit (U.V.P.S.U.) relay via fuse 163, M6, contacts 1 and 2 of the INSTRUMENT A.C. SELECTOR switch and M61.

(2) A parallel d. c. supply is taken from M61 to energize and close relay No. 8 causing:-

(a) The d. c. supply to suppressor Type P to be disconnected.

(b) The d. c. supply to No. 2 inverter to be disconnected.

(c) The energization of the EMER. INST. SUPPLY No. 1 INV magnetic indicator.

(d) No. 2 relay to be energized and a d. c. supply to be applied to No. 1 inverter via its associated control panel Type 12.

(e) Output TB1 from inverter No.1 to be connected to the U.V.P.S.U. and TB11. The connection to the U.V.P.S.U. is via closed contacts D2-D3 and 6-6a of relays No.10 and No.4 respectively. The connection to TB11 is routed through the same contacts of relays No.10 and No.4 as above and also through the closed contacts 5-5a of relays No.8.

(f) Output TR1 from inverter No.1 to be connected to the U.V.P.S.U. and TR11. The connection to the U.V.P.S.U. is via closed contacts C2-C3 and 8-8a of relays No.10 and No.4 respectively. The connection to TR11 is routed through the same contacts of relays No.10 and No.4 as above and also through the closed contacts 7-7a of relay No.8.

6. As soon as the U.V.P.S.U. senses that the No. 1 inverter output voltage and phase sequence are correct the INSTRUMENT A. C. SELECTOR switch can be released to the neutral position. In this condition the relay in the U.V.P.S.U. is energized and contacts 6-7 close, providing a parallel connection between fuse 163 and No. 8 relay coil which completes a holding circuit for No. 8 relay. The suppressor Type P is then supplied from busbar PP2 via fuse 163, contacts 5 and 6 of the INSTRUMENT A. C. SELECTOR switch, M63, contacts 1-1a of relay No. 8 and M65.

7. When either of the a. c. generators *(Chap. 13, Supplement)* is on line, the instruments may be supplied from the main a. c. busbars via a 200/115V 1kVA transformer. With the INSTRUMENT A. C. SELECTOR switch held in the MAIN SUPPLY position a supply from busbar PP2 is connected to the coil of relay No. 4 via fuse 163, M6, contacts 2 and 3 of the INSTRUMENT A. C. SELECTOR switch and M62. With relay No. 4 in the closed condition the following events occur simultaneously:-

(1) The energizing supply to relay No.2 is broken at the now open ▶ contacts 4-4a of relay No.4 and the d.c. input to No.1 inverter is disconnected. ◀

(2) The output from the 1kVA transformer is connected to the instrument supply busbars via contacts 7-7a and 5-5a of both No. 4 and No. 8 relays.

(3) The U.V.P.S.U. samples the output from the 1kVA transformer and the relay, which is an integral part of the U.V.P.S.U., remains closed whilst the voltage and phase sequence of the transformer output are within limits.

(4) A parallel supply is connected from busbar PP2 to the operating coil of No. 4 relay via fuse 163, contacts 5 and 6 of the INSTRUMENT A. C. SELECTOR switch, M63, contacts 1-1a of relay No. 4, M64, closed contacts 2 and 1 of the U.V.P.S.U. relay and M62.

8. When the INSTRUMENT A. C. SELECTOR switch is released to the neutral position No. 8 relay remains energized under circumstances similar to those described in para. 6, No. 4 relay remains energized as described in para. 7 (4).

Alternator supply failure

9. Failure of the a. c. supply from the alternators causes the U.V.P.S.U. relay to de-energize and open resulting in No. 4 and No. 8 relays de-energizing and opening. In this condition No. 2 inverter commences to run, under the conditions described in para. 3.

10. It is possible to select No. 1 inverter for use as an alternative to the alternators. Should the No. 1 inverter fail No. 2 inverter automatically cuts in and supplies the instruments. If No. 1 inverter fails, the U.V.P.S.U. relay is de-energized and the holding supply for No. 8 relay coil is disconnected. No. 2 inverter then commences to run as described in para. 3.

Turn and slip indicator

General

11. This instrument is provided with three alternative sources of power supply, two from the main batteries and one from the emergency batteries.

Operation

12. The power supplies are initially controlled by a switch labelled TURN

& SLIP SUPPLY/EMERGENCY mounted on the pilot's main instrument panel. Normally the switch allows operation of the indicator from the main batteries via the engine master starting switches and the Type 9B, No. 2 relay on the engine starting panel. Setting the No. 1 engine master switch to ON, connects a supply from fuse 23 to the turn and slip indicator as described in para. 3 (1). If the supply from fuse 23 fails the relay is de-energized and the supply to the indicator is transferred to fuse 90, refer to para. 4 (1). If both normal supplies become unserviceable the indicator will continue to function from the emergency batteries after setting the TURN & SLIP SUPPLY/EMERGENCY switch to EMERGENCY.

Fatigue meter

13. This instrument takes a 28-volt supply from the alighting gear circuit FF1 *(Chap. 5, Supplement)*, via the armament safety relay which is energized only when the alighting gear is retracted.

Periscopic sextant

14. The 28-volt d. c. supply required for heating and lighting this instrument is fed from fuse 54 in the E.C.P. via the periscope mounting. The sextant, which has an integral switch, is placed in the mounting when required for use.

Automatic height encoding

15. The height encoding equipment is supplied with d. c. from busbar PP2 via fuse 204. Single-phase 115-volt 400 Hz a. c. is supplied from the output of the turbo-alternators via busbar 1XC and fuse 311. An a. c. and a d. c. test socket, located on the I.F.F. equipment tray, are supplied from fuse 321 (a. c.) and fuse 206 (d. c.). A further d. c. test supply is available on terminal FF3 in the E.C.P., via fuse 205 from busbar PP2.

Oil pressure gauge step-down transformers

16. The 26-volt a. c. supply required to operate the gauges is obtained from the instrument supply busbars by two step-down transformers in the No. 2 distribution box. For power factor correction two 0.25 μF capacitors are connected between the input side of the transformers and earth.

Artificial horizon

17. The three-phase 115-volt, 400 Hz a. c. supplies required for the operation of the artificial horizon are taken from the instrument supply busbars TB11, TR11 and EW.

G4B compass amplifier

18. The three-phase a.c. supplies required by the amplifier are also taken from the instrument supply busbars. The amplifier derives its d.c. supply as described in para. 4(2).

◀ **Altimeter vibrator**

19. This instrument takes an a.c. supply from the three-phase 115-volt, 400 Hz a.c. busbar TR11. The supply is fed via fuse 112. The busbar and fuse are situated in the 400 Hz fuse box.

Radio supplies

20. A 26V a. c. supply is taken from the instrument supply busbars via a step-down transformer and connected to the radio compass system and the V.O.R./I.L.S. system.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Inverters

21. General information on the servicing of the inverters will be found in A.P. 113D-0104-16.

REMOVAL AND ASSEMBLY

Inverters

22. Access to the inverters is through the upper equipment compartment hatch. The inverters can be removed after disconnecting the input and output plugs and sockets and undoing the bolts securing the inverter assembly to its mounting. ▶

Chapter 5 ALIGHTING GEAR

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LIST OF ILLUSTRATIONS

NOTE... *Combined theoretical/routeing diagrams for this installation are contained in A.P.101B-0417-10 (Servicing Diagrams Manual).*

LIST OF TABLES

DESCRIPTION

General

1. The alighting gear is hydraulically-operated and electrically-controlled. A Type C5182Y alighting-gear selector switch unit controls a Type 204 rotary actuator and hydraulic valve installed in the roof of the pack bay. A master switch is incorporated in the control circuit to prevent inadvertent retraction on the ground.

2. The alighting gear UP circuit U12, is used to energize the coil of the armament safety relay, via the armament test microswitch and U12B, and to control the operation of the circuits to the fatigue meter *(Sect. 7, Chap. 2)*.

Selector switch unit

3. The selector switch unit *(A.P. 113D-1130-1)* is fitted on a sloping panel forward of the throttle levers. The UP and DOWN selector buttons are spring-loaded, pressure on one releasing the other. To prevent accidental operation of the UP button on the ground, a solenoid in the unit prevents the buttons being operated while the main wheel legs are compressed. When the legs extend, on the aircraft becoming airborne or being jacked up, a microswitch fitted on the starboard leg torque link, closes and completes the circuit to the solenoid locking coil, this releases a mechanical lock to allow UP to be selected.

Emergency UP selection

4. The UP mechanical lock can be overridden in an emergency, or if required during servicing, by turning the knobbed ring which encircles the UP button clockwise through 60 degrees (or 90 degrees according to type) and then depressing the button in the normal manner. If UP selection is made in this way the mechanical lock will remain inoperative until reset. To reset, lightly depress the DOWN selector button and hold depressed. Insert into the small hole in the face of the UP selector button a resetting tool (See Table 1). Exert a steady pressure on the resetting tool to overcome internal spring tension until the UP button rises and the knobbed ring rotates counter-clockwise to its normal position (the knob horizontal to the switch body) under its own internal spring pressure. Ensure UP button cannot be depressed using normal finger pressure.

WARNING

Under no circumstances must the knobbed ring be turned past the 60 deg (or 90 deg) stop as such action will damage the switch, and may result in inadvertent retraction of the alighting gear, similarly it is important that returning the UP selector button to the normal mode be carried out as detailed. Any attempt to reset it by any other method, or by using a different tool will cause damage to the switch mechanism.

Master switch

5. The master switch fitted on the take-off panel prevents inadvertent retraction of the alighting gear by operation of the UP button while its mechanical lock is overridden. The switch is connected in series with the power supply and the UP selector, and has two positions, LIVE and SAFE. On the ground the switch must be at SAFE at all times except when retraction tests are being made with the aircraft jacked up.

Position indicator and microswitches

6. A Type C1224Y alighting gear indicator *(A.P. 113F-0607-1)* is mounted alongside the selector switch unit and is operated by microswitches installed in the nose and main wheel bays. The microswitches are shown in fig. 2 and 2A, with their adjustment. The microswitch shown forward of the nose wheel leg is actuated by the nose wheel door and connected in parallel with the nose wheel UP switch. Door-operated microswitches are not installed in the main wheel bays but in some aircraft it may be found that a spare cable for use with a door switch is fitted and taped up in each bay. This cable is referenced 7A4 (port). Another microswitch, fitted in the throttle box, brings on the nose wheel red light if the throttle lever of either engine is closed past its fast idling stop with the alighting gear retracted. Cams on the throttle lever shafts are arranged to close the microswitch contacts when the levers are less than one third open. Microswitch actuation is adjusted by varying the switch position in relation to the cam by utilizing the elongated holes in the attachment bracket. Adjustment and location details for all the microswitches in the position indicator circuit are given in fig. 1, 2 and 2A.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

Circuit checks

Indicator circuit

7. The alighting gear indicator circuits are not switched but fed direct from busbar PP1 which is controlled by the BATTERY isolation switch. The functioning of the circuits may be checked as follows:-

(1) Set the throttle levers fully open.

(2) Switch on the BATTERY ISOLATION switch and check that all three green DOWN lights are on.

(3) Break each DOWN switch in turn; the respective green light should go out and the red light come on.

(4) At each main wheel in turn, break the UP switch while keeping the DOWN switch broken; the red light should go out each time.

(5) With the nose wheel DOWN switch broken and the red light on, break both the UP switch and the door switch; the red light should go out.

(6) With both the UP and DOWN switches broken in either main wheel circuit and no lights on, move the throttle levers, in turn, to less than one third open; the nose wheel red light should come on each time.

Control circuit

8. Due to the safety precautions necessary when the aircraft is on the ground *(para. 3)* an electrical functioning check on this circuit can only take place with the weight of the aircraft removed from its main wheels, this allows the safety lock microswitch to operate and energize the locking coil in the selector switch unit and release the mechanical lock. An extra core is taken from the oleo microswitch to the operating coil of relay No. 1. The relay coil becomes energised when the aircraft is on the ground, i.e. the oleo is compressed. In the energised condition a core from the Omega receiver/processor unit is earthed, via closed contacts 3a and 3 of the relay, and the Omega flight/ground test switch (Sect. 8, Chap. 8, Supplement). Also, in the energised condition, the power supply direct to the (ground cooling connector) microswitch is opened, contacts 6a and 6 of the relay being opened. The power supply to the coolanol pump is now only via the coolanol coolant switch and the microswitch (part of the ground cooling connector). The coolanol pump can now only be powered with the coolanol coolant switch in the GRD TEST position and the microswitch closed (i.e. ground cooling connector attached). In this condition the operating coil of the three phase coolanol pump contactor is energised.

Actuator

9. Servicing of the actuator will normally be confined to checking the length of the brushes and removing carbon dust, two operations which require the removal of the motor end cover. Further information on servicing the actuator will be found in A.P. 4343D, Vol. 1, Sect. 16.

REMOVAL AND ASSEMBLY

Actuator

Removal

10. To remove the actuator:-

(1) Disconnect the electrical plug and socket at the motor.

(2) Unscrew the bolts attaching the actuator to the selector valve, and separate the two units.

(3) Remove the actuator.

Assembly

11. To assemble the actuator:-

(1) Ensure that the actuator and the selector valve are both at the same selection setting.

(2) Fit the actuator to the selector valve, and secure the attachment bolts.

(3) Reconnect the electrical plug and socket at the motor.

(4) Carry out a retraction test, A.P. 101B-0417-1A, Sect. 3, Chap. 6.

TABLE 1

Equipment details

Ref. No.	Equipment	Quantity	Relevant A.P.
5CW/4664472	Selector switch unit	1	113D-1130-1
5CX/4330226	Alighting gear position indicator	1	113F-0607-13A
5W/4511895	Hydraulic valve actuator	1	113E-0248-1
5CW/4408108	Master switch	1	
5CW/4400883	Microswitches		
	Nose wheel	3	
	Main wheel (port)	2	
	Main wheel (starboard)	3	
	Throttle	1	
27Q/5120-99-4674381	Dowty resetting tool Part No. ST1657 or	1	
	Locally manufactured resetting tool		113D-1130-1 Chapter 1 Figure 3

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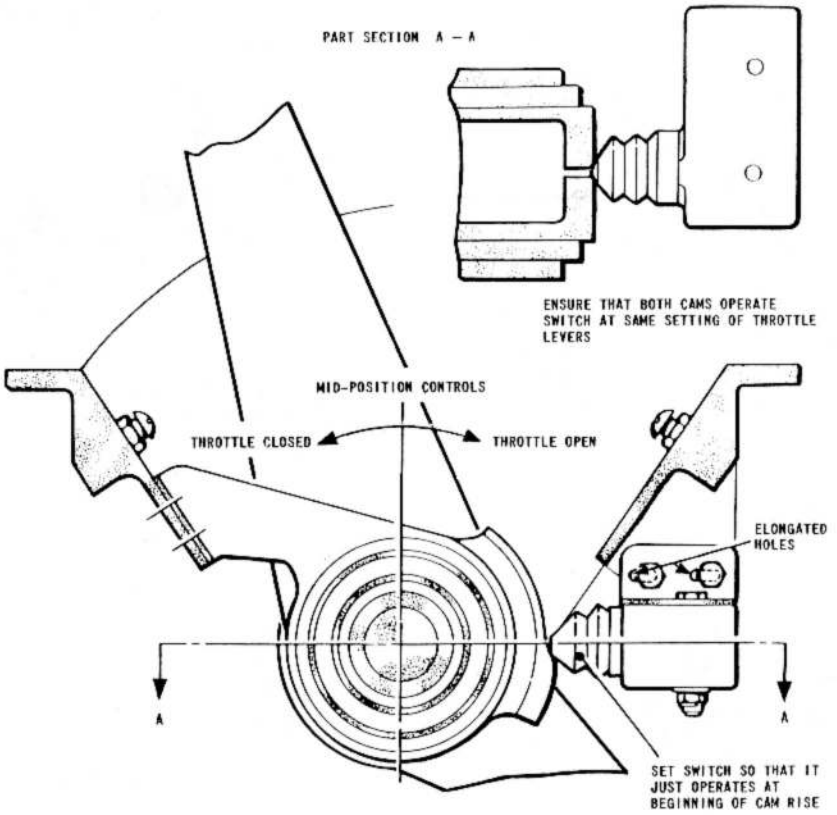

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FIG. 1. MICROSWITCH ADJUSTMENT - THROTTLE BOX

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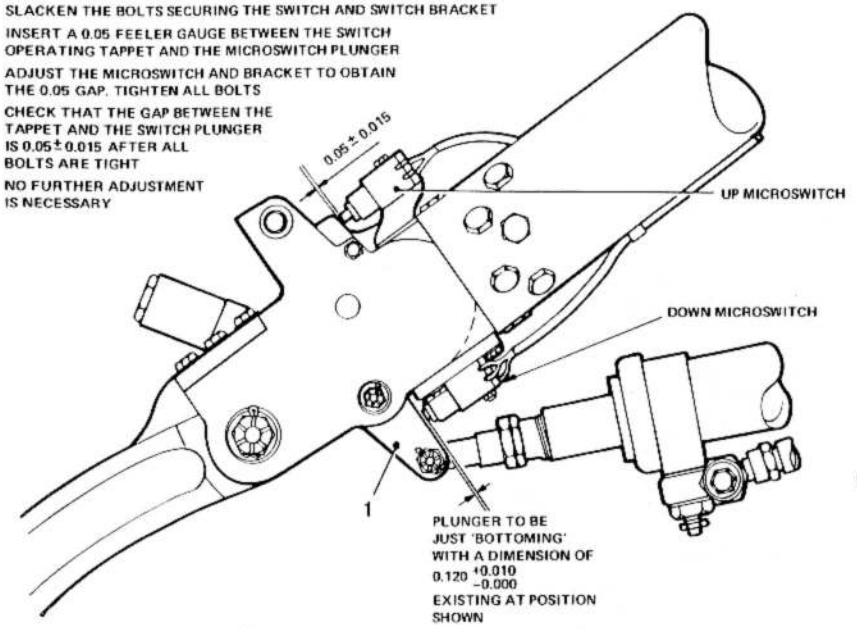
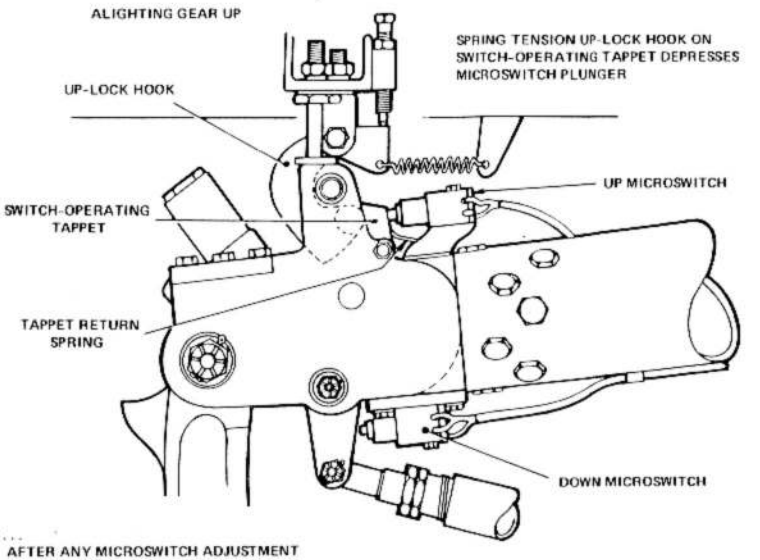
UP MICROSWITCH ADJUSTMENT WITH U/C IN THE DOWN POSITION

1. SLACKEN THE BOLTS SECURING THE SWITCH AND SWITCH BRACKET
2. INSERT A 0.05 FEELER GAUGE BETWEEN THE SWITCH OPERATING TAPPET AND THE MICROSWITCH PLUNGER
3. ADJUST THE MICROSWITCH AND BRACKET TO OBTAIN THE 0.05 GAP. TIGHTEN ALL BOLTS
4. CHECK THAT THE GAP BETWEEN THE TAPPET AND THE SWITCH PLUNGER IS 0.05 ± 0.015 AFTER ALL BOLTS ARE TIGHT
5. NO FURTHER ADJUSTMENT IS NECESSARY



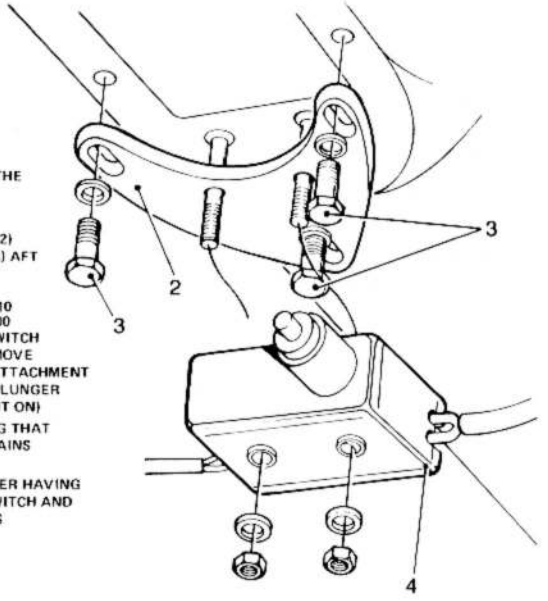


NOTES ...

1. AFTER ANY MICROSWITCH ADJUSTMENT AN UNDERCARRIAGE RETRACTION TEST MUST BE MADE AND THE WARNING LIGHTS CHECKED
2. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE STATED

DOWN MICROSWITCH ADJUSTMENT
U/C IN DOWN POSITION

1. CONNECT A 24 VOLT SUPPLY TO THE EXTERNAL SUPPLY SOCKET
2. SLACKEN THE BOLTS (3)
3. MOVE THE ATTACHMENT PLATE (2) COMPLETE WITH MICROSWITCH (4) AFT TO THE LIMIT OF ITS TRAVEL (GREEN LIGHT OFF)
4. WITH A DIMENSION OF $0.120\ ^{+0.010}_{-0.000}$ EXISTING BETWEEN THE MICROSWITCH PLUNGER AND LOCK LEVER (1), MOVE THE MICROSWITCH (4) AND THE ATTACHMENT PLATE (2) FORWARD UNTIL THE PLUNGER IS JUST BOTTOMING (GREEN LIGHT ON)
5. TIGHTEN THE BOLTS (3) ENSURING THAT SOME PLUNGER MOVE MENT REMAINS WHEN ADJUSTMENT IS FINALISED
6. RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING BOLTS



DOOR MICROSWITCH ADJUSTMENT

1. JACK THE NOSE (SECT.2,CHAP.4)
2. CONNECT A 24 VOLT SUPPLY TO THE EXTERNAL SUPPLY SOCKET
3. DISCONNECT THE PORT DOOR ACTUATING LINK (FIG.1) AT IT'S LOWER END
4. UNLOCK AND SELECT THE NOSE UNDERCARRIAGE UP/FLIGHT SELECTOR TO UP. USING THE HAND PUMP, FULLY RAISE THE NOSE WHEEL, ENSURING THAT THE DISCONNECTED LINK IS HELD CLEAR
5. SLACKEN THE TAPPET LOCKNUT (6)
6. SCREW TAPPET (6) AWAY FROM THE MICROSWITCH (7) (RED LIGHT ON)
7. SCREW TAPPET (5) TOWARDS THE MICROSWITCH (7) UNTIL A DEFINITE CLICK IS HEARD (RED LIGHT OFF) AND GIVE A FURTHER TWO COMPLETE TURNS
8. TIGHTEN THE LOCKNUT (6) AND ENSURE THAT SOME PLUNGER MOVEMENT STILL REMAINS
9. SELECT THE NOSE UNDERCARRIAGE UP/FLIGHT SELECTOR TO FLIGHT. USING THE HAND PUMP, FULLY LOWER THE NOSE WHEEL, ENSURING THAT THE DISCONNECTED DOOR LINK IS HELD CLEAR. WIRE LOCK THE UP/FLIGHT SELECTOR IN THE FLIGHT POSITION
10. RECONNECT THE PORT DOOR ACTUATING LINK

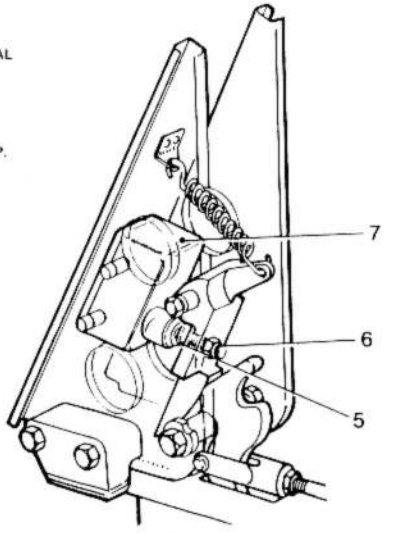
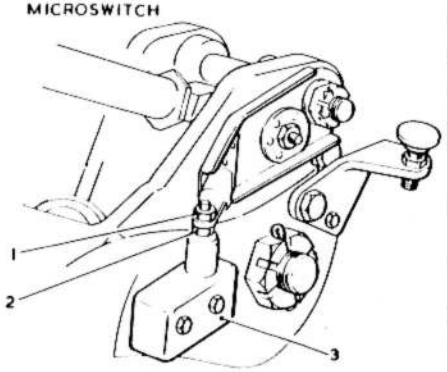


FIG. 2. MICROSWITCH ADJUSTMENT - NOSE UNDERCARRIAGE

UK RESTRICTED

DOWN MICROSWITCH

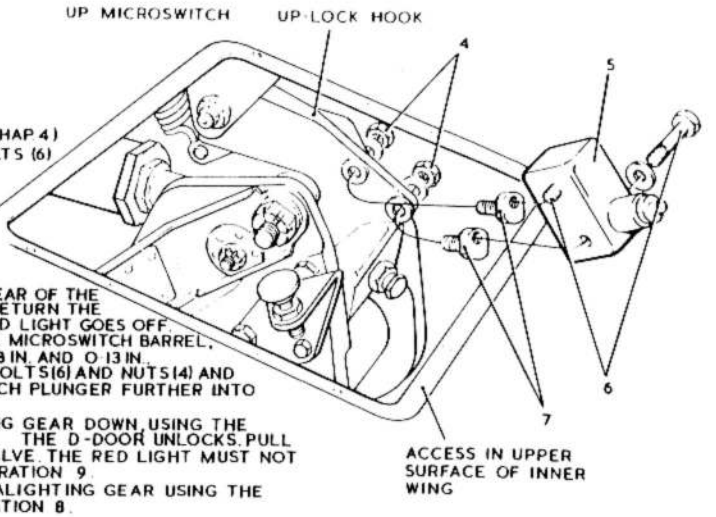


DOWN MICROSWITCH ADJUSTMENT

1 CONNECT A 24-VOLT POWER SUPPLY TO THE EXTERNAL SUPPLY SOCKET
2 SLACKEN LOCKNUT (1)
3 SCREW STRIKER BOLT (2) AWAY FROM MICROSWITCH (3) (GREEN LIGHT OFF)
4 SCREW STRIKER BOLT (2) TOWARDS MICROSWITCH (3) UNTIL A DEFINITE CLICK IS HEARD (GREEN LIGHT ON) AND THEN GIVE A FURTHER TWO COMPLETE TURNS
5 TIGHTEN LOCKNUT (1) AND ENSURE THAT SOME PLUNGER MOVEMENT REMAINS

UP MICROSWITCH ADJUSTMENT

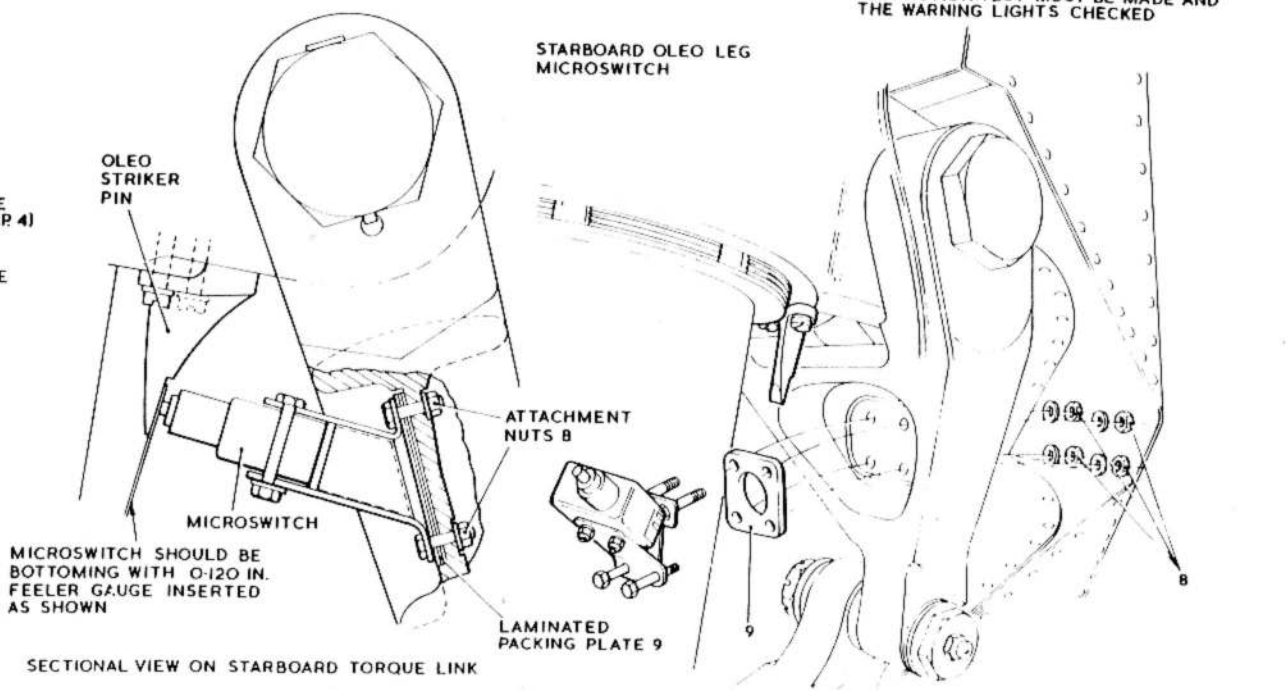
1 JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (SECT. 2, CHAP 4)
2 CONNECT A 24-VOLT POWER SUPPLY TO THE EXTERNAL SUPPLY SOCKET. GREEN LIGHT ON
3 REMOVE THE APPROPRIATE ACCESS PANEL FROM THE UPPER SURFACE OF THE MAIN PLANE INNER WING (SECT. 2, CHAP 4)
4 SLACKEN THE NUTS (4) AND MICROSWITCH ATTACHMENT BOLTS (6)
5 TURN THE HEADS OF THE ECCENTRIC BOLTS (7) SO THAT THE MICROSWITCH ATTACHMENT TAPPED HOLES ARE AT THE FURTHEST POINT OF ADJUSTMENT AWAY FROM THE HOOK. TIGHTEN THE ATTACHMENT BOLTS (6) AND NUTS (4)
6 RETRACT THE ALIGHTING GEAR, USING THE HAND PUMP, APPLYING FULL JACK PRESSURE. CHECK THAT THE RED LIGHT COMES ON DURING OPERATION, AND GOES OFF WHEN THE UP-LOCK HOOK IS FULLY ENGAGED.
7 THROUGH THE ACCESS PANEL, LIFT THE UP-LOCK HOOK CLEAR OF THE LATCH PIN, AND ENSURE THAT THE RED LIGHT COMES ON. RETURN THE UP-LOCK HOOK TO THE ENGAGED POSITION AND ENSURE RED LIGHT GOES OFF.
8 USING FEELER GAUGES, CHECK THAT THE GAP BETWEEN THE MICROSWITCH BARREL AND OPERATING FACE OF THE SIDE STAY IS BETWEEN 0·08 IN. AND 0·13 IN.
9 IF THE GAP IS IN EXCESS OF 0·13 IN., SLACKEN ATTACHING BOLTS (6) AND NUTS (4) AND ROTATE ECCENTRIC BOLT (7) TO DEPRESS THE MICROSWITCH PLUNGER FURTHER INTO OVERTRAVEL
10 EXHAUST THE JACK PRESSURE AND SELECT THE ALIGHTING GEAR DOWN, USING THE HAND PUMP. SLOWLY LOWER THE ALIGHTING GEAR UNTIL THE D-DOOR UNLOCKS. PULL THE DOOR OPEN AND OPERATE THE DOWN SEQUENCE VALVE. THE RED LIGHT MUST NOT COME ON. IF THE RED LIGHT DOES COME ON REPEAT OPERATION 9.
11 SELECT THE ALIGHTING GEAR UP, FULLY RETRACT THE ALIGHTING GEAR USING THE HAND PUMP, AND RECHECK THE PLUNGER GAP AS IN OPERATION 8.



AFTER ADJUSTMENT OF THE UP OR DOWN MICROSWITCHES, AN ALIGHTING GEAR RETRACTION TEST MUST BE MADE AND THE WARNING LIGHTS CHECKED

STARBOARD OLEO LEG MICROSWITCH ADJUSTMENT

1 JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (SECT. 2, CHAP 4)
2 INSERT A 0·120 IN. FEELER GAUGE BETWEEN THE MICROSWITCH PLUNGER AND THE OLEO STRIKER PIN. THE PLUNGER SHOULD JUST BE BOTTOMING
3 IF THE ADJUSTMENT (OPERATION 2) IS INCORRECT PROCEED AS FOLLOWS:-
(A) REMOVE THE MICROSWITCH ATTACHMENT NUTS (8) AND WASHERS, AND WITHDRAW THE MICROSWITCH TOGETHER WITH LAMINATED PACKING PLATE (9)
(B) BY PEELING A NEW LAMINATED PACKING PLATE REF. No. 26FZ/706 ADJUST THE MICROSWITCH TO OBTAIN THE CONDITION DESCRIBED IN OPERATION 2
4 RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING NUTS

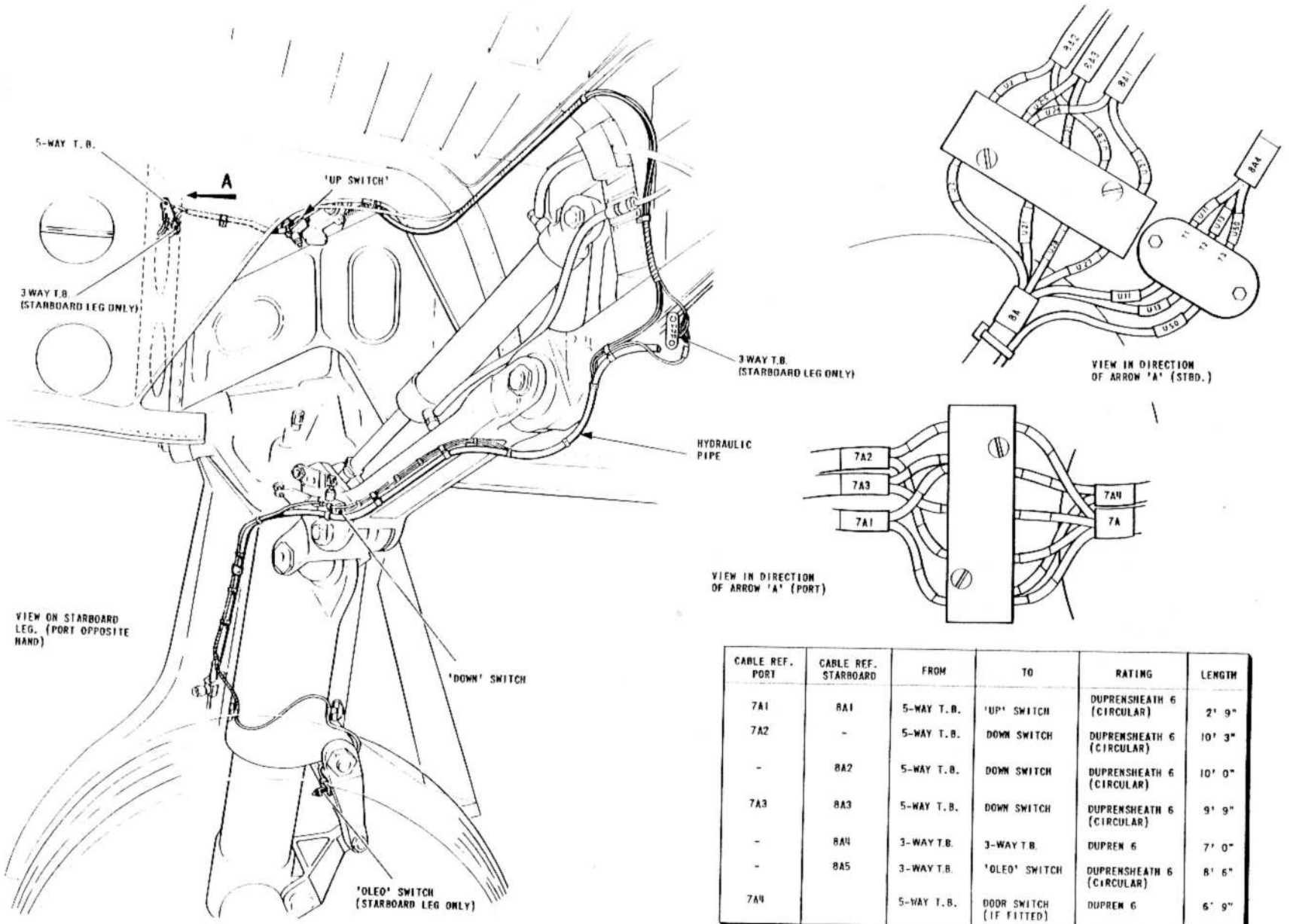


SECTIONAL VIEW ON STARBOARD TORQUE LINK

EA3 40 237 4
EA3 40 253 4

FIG. 2A. MICROSWITCH ADJUSTMENT – MAIN UNDERCARRIAGE

UK RESTRICTED



CABLE REF. PORT	CABLE REF. STARBOARD	FROM	TO	RATING	LENGTH
7A1	8A1	5-WAY T.B.	'UP' SWITCH	DUPRENSHEATH 6 (CIRCULAR)	2' 9"
7A2	-	5-WAY T.B.	DOWN SWITCH	DUPRENSHEATH 6 (CIRCULAR)	10' 3"
-	8A2	5-WAY T.B.	DOWN SWITCH	DUPRENSHEATH 6 (CIRCULAR)	10' 0"
7A3	8A3	5-WAY T.B.	DOWN SWITCH	DUPRENSHEATH 6 (CIRCULAR)	9' 9"
-	8A4	3-WAY T.B.	3-WAY T.B.	DUPREN 6	7' 0"
-	8A5	3-WAY T.B.	'OLEO' SWITCH	DUPRENSHEATH 6 (CIRCULAR)	8' 6"
7A4		5-WAY T.B.	DOOR SWITCH (IF FITTED)	DUPREN 6	6' 9"

FIG. 3. MAIN WHEELS - WIRING INSTALLATION

7718
EGJ 81 5333 Sht.1 ISS 2

UK RESTRICTED

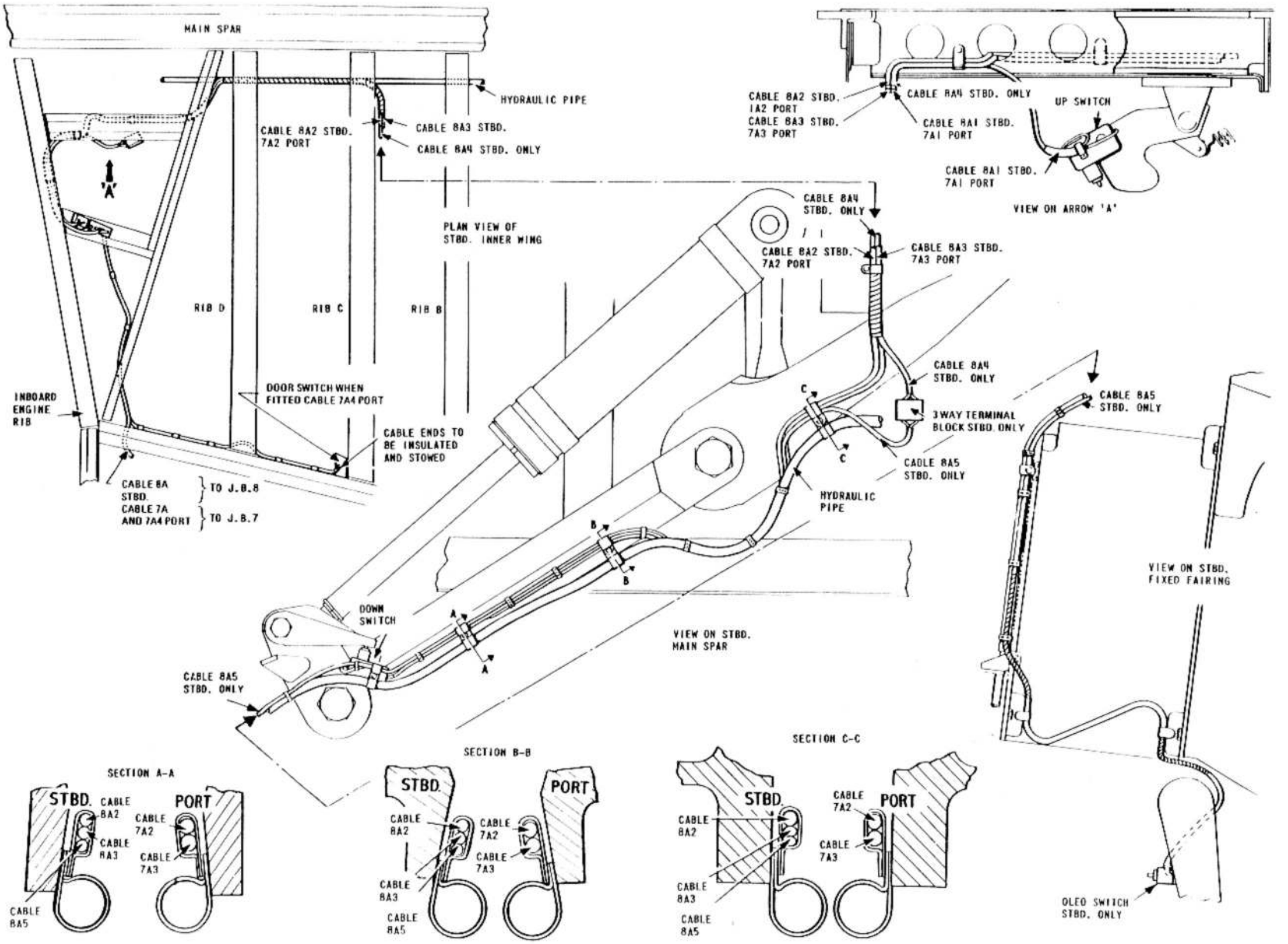


FIG. 3A. MAIN WHEELS - WIRING INSTALLATION

FA1 81 23/4 20/13
FB2 81 1307/8 26/16
7719
FG2 81 5333 SH1 1 155 2

UK RESTRICTED

NOTE...

IF THE ALIGHTING GEAR WIRING INSTALLATION IS DISTURBED OR REWIRED THE FOLLOWING MUST BE OBSERVED.

ON COMPLETION OF WIRING AND BEFORE FINAL TIGHTENING OF THE CABLE SECURING CLIPS:-

1 JACK AND TRESTLE THE AIRCRAFT (SECT.2, CHAP.4).

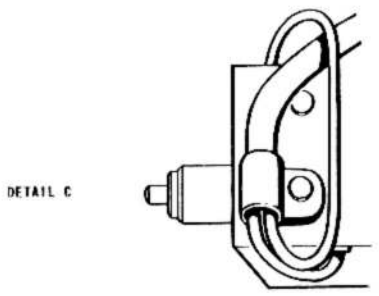
2 PREPARE THE ALIGHTING GEAR FOR HAND PUMP OPERATION (SECT.3, CHAP.6).

3 MANUALLY OPERATE THE ALIGHTING GEAR TO ITS FULL EXTENT UP AND DOWN.

4 ENSURE THAT AT ALL POINTS OF TRAVEL, AND WITH THE ALIGHTING GEAR LOCKED UP AND DOWN, THAT ALL CABLES ARE SAFELY ROUTED, DO NOT CHAFE AND ARE NOT TRAPPED OR STRETCHED.

5 TIGHTEN ALL SECURING CLIPS.

6 POWER OPERATE THE ALIGHTING GEAR AND ENSURE THAT IT IS LOCKED DOWN; REMOVE THE JACKS AND TRESTLES (SECT.3, CHAP.5).



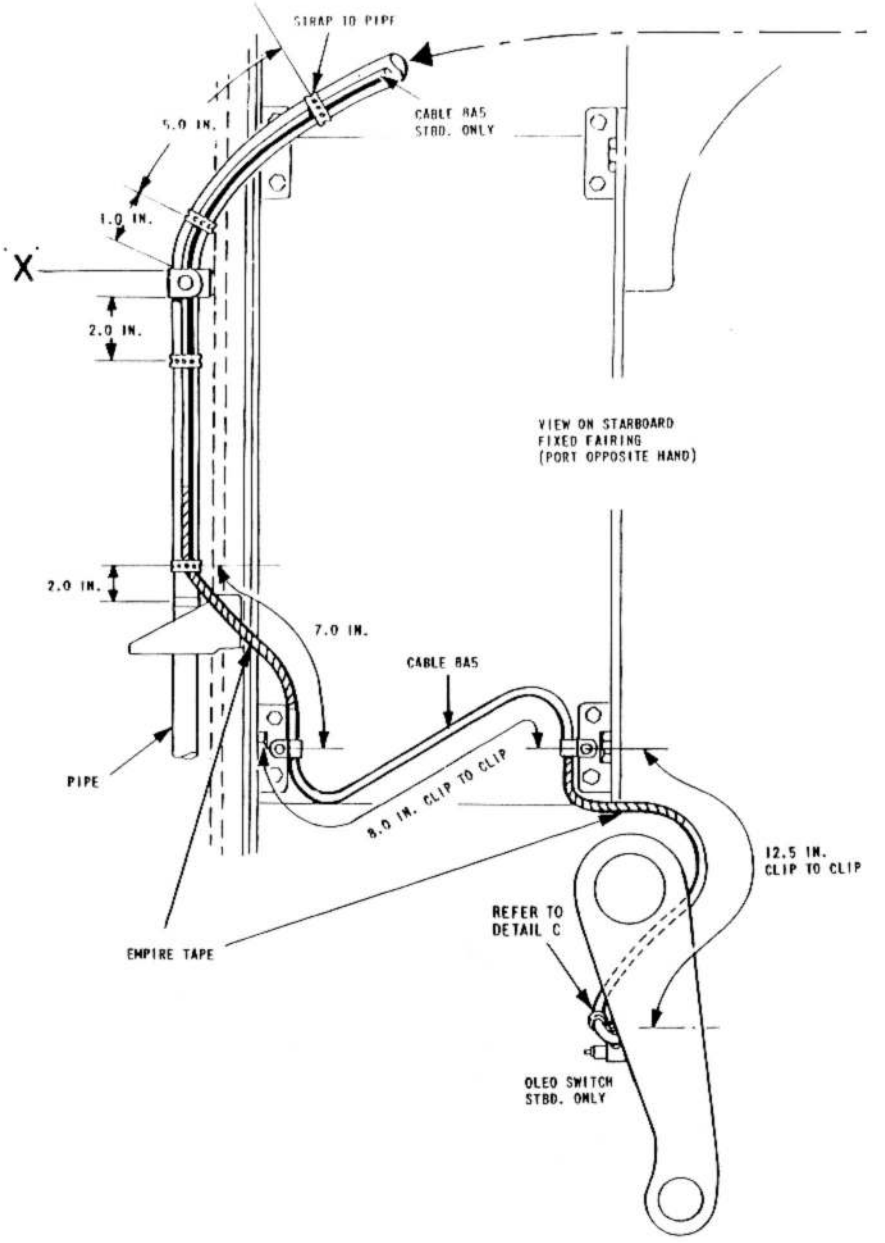


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FIG. 3B. MAIN WHEELS - WIRING INSTALLATION

UK RESTRICTED

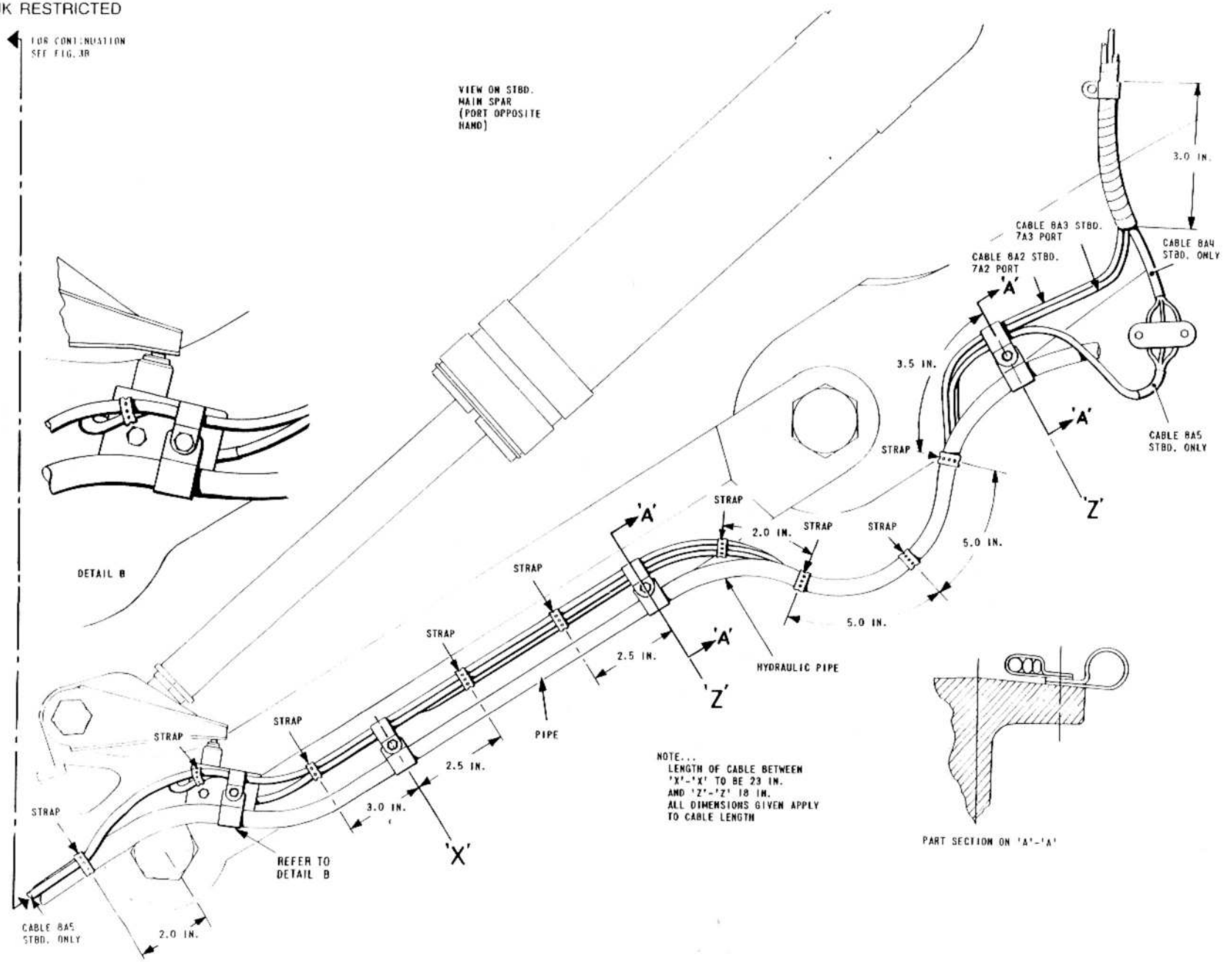
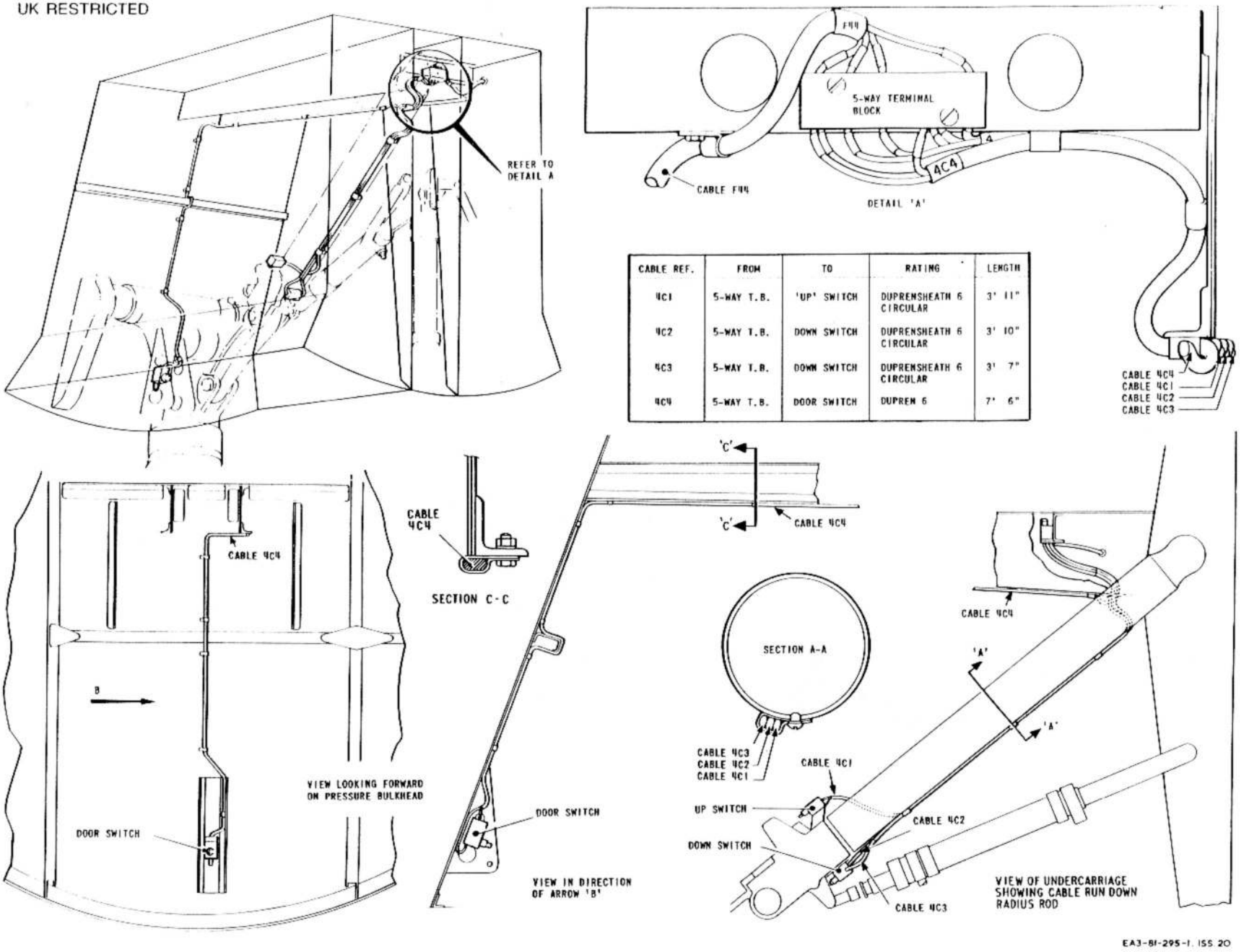


FIG. 3C. MAIN WHEELS - WIRING INSTALLATION

EAI-81-2304-20/13
EB7-81-13077/8-26/16
7721

UK RESTRICTED



CABLE REF.	FROM	TO	RATING	LENGTH
4C1	5-WAY T.B.	'UP' SWITCH	DUPRENSHEATH 6 CIRCULAR	3' 11"
4C2	5-WAY T.B.	DOWN SWITCH	DUPRENSHEATH 6 CIRCULAR	3' 10"
4C3	5-WAY T.B.	DOWN SWITCH	DUPRENSHEATH 6 CIRCULAR	3' 7"
4C4	5-WAY T.B.	DOOR SWITCH	DUPREN 6	7' 6"

EA3-81-295-1. ISS 20

FIG. 4. NOSE WHEEL - WIRING INSTALLATION

Chapter 6 HEATING AND AIR CONDITIONING

LIST OF CONTENTS

Note...*Combined theoretical/routeing diagrams for this installation are contained in A.P. 101B-0417-10 (Servicing Diagrams Manual).*

DESCRIPTION

CABIN AIR SYSTEM

General

1. A complete installation is provided for the maintenance of pressurized hot or cold air in the cabin. The hot air originates from the engine compressor and passes through a mixing valve in the port inner wing leading edge. The mixing valve is operated by a rotary actuator Type 233, and is controlled by a centre-off switch labelled CABIN AIR HOT/COLD fitted on the miscellaneous instrument panel. On this panel is also mounted a mixing valve indicator graduated from HOT to COLD. It is a Desynn-type indicator operated by a transmitter unit linked to the mixing valve mechanism. Pressure in the cabin is maintained by a Normalair pressure controller fitted on the pressure bulkhead. A warning circuit is provided to ensure that the crew receive audible warning should the pressure fall to a dangerous level. Further information on the air conditioning and pressurization will be found in A.P. 101B-0417-1A, Sect. 3, Chap. 8A.

Gate valves

2. The hot air from the engine compressor is controlled by two gate valves, one to each engine. These gate valves are operated by Type 234 rotary actuators controlled from the miscellaneous instrument panel by switches labelled ENGINE AIR TO CABIN No. 1 and No. 2. Switch No. 1 operates the port engine gate valve and switch No. 2 the starboard engine valve.

Low pressure warning

3. A switch incorporated in the pressure controller operates a warning device whenever there is a serious loss of pressure. The closing of the switch contacts is arranged to energize a Type 9B2A relay, which in turn closes and provides a supply to a warning horn. Both the relay and the horn are mounted on brackets at the starboard side of the navigator's station. The pilot may override the warning horn by a switch, labelled CABIN PRESSURE WRNG. HORN ON/OFF/TEST located on the miscellaneous instrument panel.

Pressure controller

4. A Normalair pressure controller is mounted on the forward face of the pressure bulkhead. It has a connection to the pitot system and contains a bellows to which is attached the warning circuit contacts. Full information covering this unit will be found in A.P. 107B-1415-1.

Cooling fans

5. To increase the circulation of cooling air in the pressure cabin, two cooling fans are fitted, one at the pilot's station and one in the rear of the cabin. The fan at the pilot's station is located, together with its control switch on the miscellaneous instrument panel, whilst that at the rear of the cabin is located at the lower left side of the A.E.O.'s control panel with the control switch on the coaming. Both fans are fed from fuse 48 in the E.C.P.

HEATERS

Direct vision window

6. The pilot's 'D.V.' window panel is electrically heated by an almost invisible gold-film heating element sandwiched between the glass laminations. Also incorporated in the panel is a sensing control element which operates in conjunction with a Plessey controller Type 34 – situated on the engine-start panel structure. Power supplies to the heater are controlled by a switch, labelled WINDSCREEN, on the take-off panel. Connections to the elements are made by non-interchangeable 2-pin plugs and sockets below the canopy coaming.

Control unit

7. A Plessey controller, Type 34, and a Diamond 'H' Type BS relay control the electrical supply to the heater element in the D.V. window panel by energizing and de-energizing the coil of the Diamond 'H' relay. Transductors in the controller provide the necessary output current to operate an incorporated slave-relay which energizes the coil of the Diamond 'H' relay. The operation of the transductors is dependent upon the resistance of the temperature-sensing element incorporated in the windscreen and, since the resistance varies with the temperature, complete control is obtainable. The controller is fully described in A.P. 107C-0404-16.

Pressure head heater

8. To prevent the formation of ice in the pitot system, a heater element

is provided in the pressure head. The supply to the element, fed from busbar PP1 through a fuse in the E.C.P., is controlled by a switch labelled PRESS HEAD mounted on the take-off panel.

Fuel tank vent valve heater

9. Provision is made for fitting a vent valve with an integral heater element at the aft end of the No. 3 fuel tank. The heater circuit is controlled by a switch, labelled VENT VALVES, mounted, on the take-off panel and protected by a fuse in the console fuse panel. If the vent valve is not fitted the heater supply cable is coiled and stowed, and the fuse removed.

DE-MISTING

General

10. Misting of the canopy sandwich is prevented by circulating dry air through the interspace between its inner surfaces. A motor-driven blower provided for this purpose is mounted forward of the navigator's table on a bracket attached to the table structure. The power supply to the motor is fed through a suppressor and controlled by the CANOPY DE-MIST switch on the take-off panel. The air is blown through a chemical dryer before it enters the canopy interspace. The complete de-misting installation is fully described in A.P. 101B-0417-1A, Sect. 3, Chap. 8C.

EQUIPMENT COOLING

Pack bay

11. Air scoops are provided to facilitate the cooling of the equipment in the pack bay. The scoops are operated by an actuator Type 206 which is controlled by the switch labelled INLET SCOOPS OPEN/CLOSED fitted on the A.E.O.'s starboard wall panel. Two lamps labelled OPEN and CLOSED and coloured green and amber respectively, are positioned one on either side of the switch to provide an indication of the setting of the scoops. Microswitches operated by the rear shutter mechanism in the open and closed positions provide the switching of the supplies to the relevant indicator lamp. A cooling system is installed in the forward pack bay for cooling the A.R.I. 23362 equipment, the cooling system is described in Sect. 9, Chap. 4, para. 8.

Alternator bay

12. Two fans are provided, one in each alternator bay, to assist the cooling of the alternator bay equipment when the speed of the aircraft is such that ram air cooling is inadequate. The supplies to the fans are drawn from the 200-volt, 3-phase, 400 Hz a.c. busbars via relays on the contactor panel. The relay coils are supplied from the 28-volt d.c. busbars and are controlled by a thermostatic switch mounted in the respective alternator bay.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

CABIN AIR SYSTEM

Valve actuators

13. Normal servicing of the valve actuators is confined to checking brush length, examination of the commutator, and removal of any accumulated carbon dust, which can be accomplished by removing the motor end cover. Access to both mixing and gate valve actuators is through the upper leading – edge panels inboard of each engine.

Desynn indicator and transmitter unit

14. Faulty indicators or unserviceable transmitter units should be removed and replaced by new items.

Low pressure warning

15. The warning circuit should be tested by removing the terminal cover of the pressure controller and short-circuiting the two terminals and, provided that the warning horn switch is set to ON, the horn will function. A further test may be carried out by operating the override switch to the TEST position. The warning horn should function.

Note . . .

The above test circuit by-passes the pressure controller contacts and

therefore only provides a confidence check on the power supply, relay and horn operation.

HEATER CIRCUITS

D.V. window checks

16. At normal ground level the resistance of the control element should be 30 ± 0.5 ohms at 20 deg C. The heater element may be considered to be serviceable if, with 24 volts across its terminals, it will pass a current not more than 3 amp and not less than 2.5 amp. This check can be made by connecting a suitable ammeter into the plug and socket connection near the window assembly.

Note . . .

During the above test the current applied to the heater must not flow continuously for more than 15 seconds unless a temperature control unit is used.

Replacement windows

17. It is advisable to carry out a bench test on any replacement window that has been in store. As the internal connections in the window rely on intimate contact between the elements and the window busbars the panel should be first heated to a temperature not exceeding 40 deg C and allowed to cool off before applying the test current.

Control unit check

18. Remove fuses 53 and 116, and disconnect plugs and sockets (N74) at the window. Connect a decade box, set at 28 ohms, in place of the sensing control element and a 28-volt test lamp in place of the heater element; check and refit fuses 53 and 116. Switch on the instruments 400 Hz supply and the control switch; the test lamp should light. Increase the decade resistance setting until the test lamp is extinguished, note the resistance which should be between 30.0 to 30.5 ohms. Decrease the decade resistance setting until the test lamp lights, note the resistance which should be 0.3 to 0.8 below the previously noted value at which the lamp was extinguished. Switch off the 400 Hz supply and the control switch and reconnect the plugs and sockets (N74) at the window. Check that the heater functions by switching on the 400 Hz supply and the control switch and note that the window heats up.

Note . . .

If the ambient temperature (above 20 deg C) prevents the heater switching on, connect a decade box set at 400 ohms across terminals A1 and A2 of the Plessey controller. Do not leave connected for more than 15 seconds and do not disturb the sensing control element connections.

Pressure head heater

19. Minimum maintenance is required on the pressure head. In the event of unserviceability a new head should be fitted.

DE-MISTING

Blower motor

20. Servicing of the blower motor is confined to checking brushes, inspecting the commutator, and the removal of carbon dust. Access to the brushes is accomplished by the removal of the end cover from the motor.

EQUIPMENT COOLING

Scoop actuator and alternator bay fans

21. Normal servicing of the actuator and fans is confined to checking the brushes, examination of the commutator, and removal of any accumulated carbon dust, which can be accomplished by removing the motor end cover of the actuator, or the conical fairing of the fans. The impeller blades of the fans must be examined for damage to the leading and trailing edges and the impeller boss checked for security and damage. The clearance between the blade tips and outer casing must be checked to ensure that the impeller can rotate freely.

REMOVAL AND ASSEMBLY

CABIN AIR SYSTEM

General

22. The removal of any actuator, the Desynn transmitter, or the pressure

controller is described in Sect. 3, Chap. 8A.

HEATER CIRCUITS

Direct vision window

23. Care must be taken on the removal of the window to ensure that the fragile connecting wires of the two elements are not damaged. Only the heating panel part of the window need be removed by taking out the bolt which acts as a hinge pin.

Pressure head heater

Removal

24. To remove the pressure head:-

(1) Disconnect the electrical supply at the terminal block in the port wing-tip adjacent to the pressure head boom.

(2) Unscrew the pitot/static gland nuts at the rear end of the boom and remove the nuts and sealing grommets from the pipes.

(3) Remove the countersunk screws securing the pressure head to the forward end of the boom.

(4) Withdraw the pressure head sufficiently to allow the unions at the rear of the head to be disconnected.

(5) Fully withdraw the pressure head and electrical cable.

Assembly

25. Assembly of the unit is the reverse of the removal procedure. After the unit has been installed a pitot/static system check must be carried out *(Sect. 7, Chap. 4).*

Note . . .

During assembly replace all gland nuts and sealing grommets that have been disturbed and ensure that the drain hole in the pressure head is positioned downwards.

Chapter 8 LIGHTING

LIST OF CONTENTS

Note . . . *Combined theoretical/routeing diagrams for this installation are contained in A.P. 101B-0417-10 (Servicing Diagrams Manual)*

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

EXTERNAL LIGHTING

General

1. All external lighting circuits are controlled from the pilot's console by individual switches and an 'EXTERNAL LIGHTS MASTER SWITCH'. The lamp circuits are protected by a 40-amp fuse in the E.C.P. which connects the supply busbar, PP2, to the external lights busbar PP3. A complete list of the lamp filaments used is included in Table 2 in the General Information Chapter at the beginning of the supplement.

Navigation lamps

2. Four navigation lamps, one on each wing tip and two at the tail, are installed in the aircraft. One tail lamp is mounted below the rudder and the other fitted behind a transparent window under the tail structure.

Wing tip fuel tank or pod lamps

3. As the normal wing tip lamps are obscured when jettisonable fuel tanks, or wing-tip pods are carried, the nose of each unit is fitted with an extra navigation lamp which is connected into the normal lamp circuit by means of a spring contact block. If the units have to be jettisoned at night the extra lamps are lost and the wing tip lamps, then being visible, assume their normal function.

Identification lamp

4. A downward identification lamp, Type C, fitted with a domed front is installed on the underside of the fuselage just forward of the pack bay. The lamp is controlled from a switch on the console labelled IDENT LAMP, ON/OFF.

Landing lamp

5. A retractable landing lamp Type J is installed on the underside of the port wing. The supply to the lamp motor is not controlled by the master switch but is drawn direct from busbar PP3 via a 5-amp fuse. The lamp is controlled from the console by a 3-position switch labelled 'OFF LOW-HIGH'. Setting the switch to 'LOW' operates the lamp to the half-extended position, at which point the filament is automatically switched on. When set to 'HIGH' the lamp moves to the fully extended position. Further information is contained in A.P. 4343D, Vol. 1, Sect. 16, and in A.P. 4343E, Vol. 1, Sect. 7. Further information is contained in A.P. 113E-0278-1 and in A.P. 4343E, Vol. 1, Sect. 7, Chap. 56.

Taxying lamps

6. Taxying lamps fitted near the navigation lamp in each wing tip are jointly controlled by a 2-position switch on the console.

Anti-collision lamps

7. Two rotating anti-collision lamps, Type G8400A-8-24 are fitted one above and one below the rear fuselage between frames 32 and 34, and are controlled by a switch annotated ANTI-COLLISION, ON/OFF, mounted on the console. Detailed information on the rotating lamps is given in A.P. 113F-0203-1.

INTERNAL LIGHTING

Navigator's station

8. General lighting in the cabin is provided by a Mk. 1A dome lamp on a bracket at the port side, above the chart table. A wanderlamp is installed above the navigator's instrument panel and controlled by an integral dimmer switch. Five flood lamps illuminate the instruments, these being supplied from the LLL21 circuit and controlled by the navigator's instrument panel lamps dimmer switch. Circuit, LLL11 controlled by a dimmer switch at the navigator's station, supplies integral lighting in the Tacan, I.F.F. and A.R.I. 23363 (rear) control units, the navigator's station box and the navigator's intercomm. override lamp. Integral lighting in the Omega control unit is brilliance controlled by a dimmer switch at the navigator's station. The starboard floods dimmer switch at the navigator's station controls the LL72 circuit, which supplies the lamps for the radio and chaff dispenser switches, starboard instruments and part of the A.E.O.'s station lighting. Integral lighting in the A.R.I. 23362 controller, A.R.I. 23363 (front), No. 2 U.H.F. and H.F. control units are supplied from circuit LL73 which is controlled by the starboard instruments dimmer switch. This dimmer switch also controls the A.E.O.'s station

box lighting and the A.E.O.'s intercomm. override lamp.

Cabin lighting

Instrument panels

9. Illumination of the pilot's instrument panels is provided by four ultraviolet lamps, eight red flood lamps, five pillar lamps, a bridge lamp, an accelerometer lamp and a lamp integral with the E2B compass. These lamps are controlled by dimmer switches labelled either U/V or RED mounted on the dimmer switch panels, which are located on the port console and starboard coaming panel, and control the port and starboard lamps respectively. Additional control of the brilliance of the bridge lamps which illuminate the pilot's altimeter, and the two pillar lamps, which illuminate the radio compass and the I.L.S. indicator, is effected by a 50-ohm dimmer switch preset to 40-ohm. The brilliance of the accelerometer lamp is also effected by a 15-ohm resistor which is fitted behind the port coaming panel at frame 2 and is connected in series with the lamp supply. A feed from the RED dimmer switch feeds the oxygen contents and hydraulic press No. 1 and No. 2 pillar lamps.

Coaming panel

10. The radio altimeter, VHF and VOR/ILS control units, which are fitted on the coaming panel, and the No. 1 UHF control unit, which is fitted in the miscellaneous instrument panel, are illuminated by integral lamps which are controlled by the dimmer switch on the starboard dimmer panel; this switch also controls the brilliance of the Tacan indicator bridge lighting on the miscellaneous instruments panel. The remaining dimmer switch on the panel controls the integral lighting of the pilot's station box (which is also fitted on the coaming panel) and the pilot's intercomm. override lamp.

Pilot's emergency lighting

11. In addition to the normal lighting system for the main instrument panel, two red flood lamps, one on each side of the cabin, are installed for emergency use. The lamps are controlled by the emergency lamps switch, fitted on the coaming panel. Under normal operating conditions the E2B compass lamp is supplied and controlled by the starboard red flood lamps dimmer switch via the OFF contacts of the emergency lamps switch. When the switch is selected to ON a supply to the emergency flood lamps and the E2B compass is drawn from busbar X7 which is connected to the emergency battery. To enable the switch to be readily located and identified in the dark, it is positioned so that the toggle of the switch protrudes above the top of the starboard coaming panel. For identification purposes a plate, which incorporates a fluorescent dot, is attached to the face of the panel directly in front of the switch position.

Console lighting

12. In addition to the cabin lighting described above, five lamps are installed for illuminating the pilot's console and the deviation card holder. These lamps are controlled by dimmers on the port dimmer panel.

A.E.O.'s station

13. The lamps integral with the A.E.O.'s station box and the A.E.O.'s intercomm. override lamp are supplied from the LL73 circuit dimmer switch in the navigator's station. The LL72 circuit dimmer switch, in the navigator's station, controls the two A.E.O.'s panel lamps. A wanderlamp is installed, above the GM4B compass control panel and controlled by an integral dimmer switch. The special equipment panel integral lighting for the A.R.I.23166 control indicators aft, stbd. and port and A.R.I.23167 control unit is supplied from busbar PP2 via fuse 161.

Pack bay

14. An integral lamp is fitted in the pack bay roof. This is controlled by a switch mounted in the pack bay. The supply for this lamp is from busbar P10 via fuse 12 in the M.E.P.

SERVICING LAMPS

Starboard equipment compartment

15. A Mk. 1A lamp, for use when servicing the generator control equipment etc. is fitted above the access door, and a socket for use with an inspection lamp and extension lead is mounted on the M.E.P. Both items of equipment are supplied with 28-volt d. c. from P10 via fuses on the M.E.P. busbar panel.

Inspection lamp

16. An inspection lamp and extension lead, stowed in two canvas bags below the control equipment at the A.E.O.'s station at the starboard side of the cabin, are intended for use during servicing operations.

Chapter 11 RADIO AND RADAR POWER SUPPLIES

LIST OF CONTENTS

Note . . . *Combined theoretical/routeing diagrams for this installation are contained in A.P. 101B-0417-10 (Servicing Diagrams Manual).*

DESCRIPTION

General

1. Both a. c. and d. c. power supplies are required to operate the radio and radar systems which comprise:- Intercomm., H.F., V.H.F., U.H.F., radio compass, V.O.R./I.L.S., I.F.F./S.S.R., Tacan, Spectrum analyser, omega and special equipment. The a. c. supplies are provided by two turbine-driven 200-volt 400 Hz, 3-phase alternators *(Chap. 13, Supplement)*, the 28-volt d. c. supplies are taken from the aircraft normal supplies *(Chap. 9, Main Section)*.

Intercomm.

2. The intercomm. system operates on 28-volt d.c. from busbar PP8; fuse 174 in the E.C.P. supplies (a) the intercomm. distribution box (PL.15 pin A) via the I/COMM MASTER switch and (b) the intercomm. distribution box (PL.7 pin D) via the I/COMM MASTER and the GROUND CREW AMPL'R switch, on the pilot's starboard coaming panel. Fuse 176 in the E.C.P. supplies the 28-volt d.c. required to energize the ground crew isolating relay, the supply being controlled by the GROUND CREW I/C ISOLATING switch on the pilot's starboard coaming panel. Fuse 177 in the E.C.P. supplies the intercomm. distribution box (pin C).

H.F.

3. Two d. c. supplies and one a. c. supply are required for the operation of the H.F. system, the supplies being fed into the H.F. distribution box. The d. c. supplies are routed from busbar PP7 via fuses 169 and 219 in the E.C.P., whilst the a. c. supply from busbar 1XC2 is routed via fuse 227 in the radio fuse and relay box. The supplies are controlled by system switches.

U.H.F.

4. The d. c. supply required to operate the No. 1 U.H.F. installation is taken from busbar PP7 and routed via fuse 218 in the E.C.P. to the ◀ No. 1 U.H.F. transmitter/receiver, where it is controlled by the No.1 ▶ U.H.F. control unit function switch on the starboard instrument panel. The supply to operate the No. 2 U.H.F. installation is taken from busbar P10 and routed via fuse 13 on the M.E.P. and fuse 251 in the upper ◀ equipment compartment to the No. 2 U.H.F. transmitter/receiver where ▶ it is controlled by the No. 2 U.H.F. control unit on the rear face of the radio fuse and relay panel. A separate d. c. supply to energise the aerial change-over relay is taken from busbar PP7 via fuse 168 in the E.C.P. and the U.H.F. AERIALS change-over switch on the starboard instrument panel.

V.H.F.

5. The d. c. supplies required for operation of the V.H.F. system are taken from busbar PP8 and routed via fuses 172 and 173 in the E.C.P. Fuse 172 supplies the V.H.F. interconnecting box through contacts 5-5a of relay No. 3 in the E.C.P. Fuse 173 is connected to interconnecting box via the energizing coil and contacts 1-1a and 3-3a of relay No. 3. The relay is controlled by the power control ON switch on the V.H.F. control unit on the pilot's coaming panel.

V.O.R./I.L.S.

6. The V.O.R./I.L.S. installation requires 28-volt d. c. and 26-volt a. c. for operation. The d. c. supply is taken from busbar PP7 to (a) the V.O.R./I.L.S. interconnecting box via fuse 167 in the E.C.P., the energizing coil and contacts 1-1a, 3-3a and 5-5a of relay No. 4 in the E.C.P., and (b) the V.O.R./I.L.S. marker interconnecting box via fuse 167 and the MARKER switch, situated on the pilot's coaming panel. 26-volt a. c. is fed from busbar TR61 to the V.O.R./I.L.S. interconnecting box via fuse 225 in the radio fuse and relay box and contacts 7-7a of relay No. 4. Relay No. 4 is controlled by the OFF/VOL switch on the Type 7430M controller, mounted on the pilot's coaming panel.

Radio altimeter

7. The radio altimeter installation is connected to a 115-volt single-phase a. c. supply via fuse 295 in No. 1 distribution box and a 28-volt d. c. supply via fuse 250 also in No. 1 distribution box. Both the a. c. supply, which is derived from busbar 1XB, and the d. c. supply, which is derived from busbar PP4, are connected directly to the transmitter/receiver and to the radio altimeter J.B. The power supplies are controlled by the LIMIT SELR. switch in the control unit mounted on the pilot's coaming panel.

Radio compass

8. A 28-volt d. c. supply from busbar PP8 is taken via fuse 175 in the E.C.P. to the radio compass control unit on the navigator's lower panel, where integral switching controls the power distribution. A 26-volt a. c. supply from busbar TR61 is used by the RMI's and the master in-

dicator for synchronization purposes.

Davall recorder

9. A 28-volt d. c. supply is required to operate the recorder and interface unit. The supply is taken from busbar PP7 via fuse 171.

I.F.F.

10. The I.F.F. equipment is supplied from the normal 28 volt d. c. system and from the output of No. 1 alternator. When the function switch (navigator's panel) is moved from the OFF position, it completes the circuit which energizes a relay in the distribution panel. With the relay energized an a. c. supply from No. 1 alternator is routed to the trans/rec unit and a d. c. supply is connected to the aerial switch unit. D. C. supplies are also fed direct to the transponder and via a LAMP CHECK switch, which enables the operator to carry out a confidence check on the fault light (navigator's panel) and OK light (controller) filaments. Also mounted on the navigator's port side panel is the aerial changeover switch (AERIAL C/O), this is marked UPPER, LOWER and FLIGHT: in the FLIGHT position the aerial switch unit is caused to oscillate at a rate of 40 Hz so that it alternately connects the upper and lower aerials to the transponder. In the other two positions the aerial switch unit is made to connect the transponder to the appropriate aerial.

Automatic height encoding

11. Power supplies to the automatic height encoding equipment are fully described in Chapter 4, Main Section.

Tacan

12. A. C. (single-phase) and d. c. supplies are required to operate the Tacan system. The a. c. supply is derived from circuit 1XA1 and fed to both the transmitter/receiver and the coupling unit via fuse 108 and contacts A2-A1 of relay No. 6 in the No. 2 distribution box. The d. c. supply from busbar PP7 to the transmitter/receiver is taken via fuse 165 in the E.C.P.

Omega

◀ **13.** A.C. and d.c. supplies are required to operate the Omega installation. The a.c. supply is 115V a.c. from an inverter, mounted between frames 9 and 11. The inverter is supplied with 28V d.c. from busbar P10, via fuse 143 and the inverter control box. Fuse 143 is situated in the main electrical panel and the inverter control box situated between frames 9 and 10. In the inverter control box the d.c. supply to the inverter is connected via a relay. To connect the d.c. supply to the inverter the relay must be energized. This is achieved by a 28V d.c. supply from busbar PP7 fed by fuse 166, in the electrical control panel, and the closed contacts 2 and 3 of the Omega on/off switch. The 115V a.c. is then fed from the inverter, via paralled fuses 106 and 105, in the No.2 distribution box to fuses 133 and 135 in the Omega junction box. Here the 115V a.c. is fed to the receiver/processor unit (R.P.U.), R.P.U cooling fan, true airspeed unit and a 115/26V a.c. step-down transformer. The 26V a.c. output from the latter is fed to the receiver/processor unit, the compass master indicator and the rectifier/circuit relay. The rectifier/circuit relay incorporates its own rectifier to provide d.c. to energize its operating coil. When 26V a.c. is available the rectifier/circuit relay operates to connect a 28V d.c. valid signal from fuse 166 via the Omega on/off switch to the receiver/processor unit. The d.c. supply is fed from fuse 166, via the Omega on/off switch and the Omega junction box, to the receiver/processor unit. A 28V d.c. compass DG mode signal is routed from fuse 166 to the Omega on/off switch and the COMPASS-D-GYRO switch to the receiver/processor unit when the COMPASS-D-GYRO switch is set to D-GYRO. ▶

Special equipment

14. 115-volt, 400Hz a. c. supplies are required to operate this installation. The computer/controller and spectrum analyser are both fed from fuse 235, which is supplied from busbar 1XB2. The busbar and fuse are located in the radio fuse and relay box. Fuse 235 is in turn fed from busbar 1XB, via fuse 287. Busbar 1XB and fuse 287 are located in the No. 1 distribution box.

15. A. C. (three-phase) and d. c. supplies are required by the A.R.I. 23363 installation. 28-volt d. c. is fed to the main unit (front) and (rear) by fuses 150 and 151 respectively, in the main electrical panel. Fuses, in the No. 1 distribution box, supply three-phase a. c. to the main unit (front) and (rear); fuses 265, 290 and 315 supply the (front) and fuses 266, 291 and 316 the (rear). 28-volt d. c. is fed to the front and rear waveguide switches; fuse 186 supplies the front switches, via the AERIAL SELECTOR switch (FWD) and fuse 202 the rear switches, via the AERIAL SELECTOR switch (AFT). Fuses 186 and 202 are in the E.C.P.

16. A.R.I. 23362 installation requires a. c. (three-phase) and d. c. supplies. Three-phase a. c. power is fed to the R. F. power amplifier via circuit breaker No. 1, and to the processor and L. V. power supply unit via circuit breaker No. 2. These circuit breakers are in the No. 1 distribution box. 28-volt d. c. is supplied to the R. F. power amplifer, the processor, L. V. power supply unit, the exciter and control unit from busbar P10, in the main electrical panel, via fuse 149 and T. B. 'B'.

17. A.R.I. 23166 installation requires a. c. (three-phase) and d. c. supplies. Three-phase a. c. power is fed to the cooler (starboard), via fuses 267, 292 and 317; to the cooler (aft), via fuses 277, 302 and 327; ◀ cooler (port), via fuses 264, 289 and 314. All these fuses are in the ▶ No. 1 distribution box. 28-volt d. c. is fed to the cooler (starboard), (aft) and (port), via fuses 241, 246 and 242 respectively. These fuses are in the No. 1 distribution box. The power supply for the A.R.I. 23167 installation is transferred from the A.R.I. 23166 cooler (port) when required.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

18. Faults in the power supplies should be investigated with the aid of the relevant combined routeing and theoretical diagrams in A.P. 101B-0417-10, Supplement (Servicing Diagrams Manual) and the relevant equipment Air Publication.

Chapter 13 A.C. POWER SUPPLIES

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LIST OF ILLUSTRATIONS

NOTE... *Combined theoretical/routeing diagrams for this installation are contained in A.P.101B-0417-10 (Servicing Diagrams Manual).*

DESCRIPTION

General

1. The main a. c. supplies for the special equipment *(Sect. 9, Chap. 4)*, the radio and radar equipment *(Chap. 11)* and certain instruments *(Chap. 4)* are obtained from two 30kVA, 3-phase, 400 Hz, 200V turbine-driven alternators controlled from a switch panel at the navigator's station. Control equipment within the alternator bay maintains the power supply within the specified limits and a busbar switching logic unit and contactors in the pack bay ensure correct distribution. The aircraft a. c. load is split between both alternators and each alternator supplies its part of the load through its associated busbar. A voltage or frequency discrepancy occurring in one channel causes the busbar switching logic unit to disconnect the busbar from the faulty alternator and connect it to the busbar of the serviceable channel via the busbar-tie-contactor (B.T.C.).

Frequency control

2. The turbo-alternator output frequency is controlled by a closed-loop servo system which consists of the following components:-

Frequency control unit, Type C.P.S.3, Mk. 4.

Torque motor.

Hydraulic servo.

Feedback potentiometers.

Flow control system.

The system controls the turbine speed and, in consequence, the output frequency at 400Hz ± 2 per cent.

3. The frequency control unit is installed in a flexible mounting in the main-plane leading edge, forward of each alternator, between rib 2 and 3. The unit is self-contained and operates in conjunction with the torque motor and two feedback potentiometers both of which are components of the hydraulic servo system. A change-over switch, jack socket, and frequency and balance trimmers are accessible through a panel in the leading-edge skin. Descriptive, servicing, adjusting and testing details are given in A.P. 4343B, Vol. 1, Book 2, Sect. 8, Chap. 18.

Operation

4. When the alternator is running at the design frequency of 400 Hz, any change in load or in the airflow at the turbine inlet will cause a deviation from that frequency and the frequency selective circuit will provide a differential voltage signal which is proportional to the frequency deviation. This signal is amplified and, depending on whether the frequency is above or below normal is transmitted through one of the two coils of the torque motor. Thus an increase in current passes through one coil of the torque motor, and a decrease in current through the other, the effective difference causing proportional rotation of the motor spindle. The torque motor has linear characteristics, i.e. the movement of the motor armature is proportional to the input current applied.

5. Movement of the arm mounted on the armature spindle actuates a hydraulic servo pilot valve, which directs oil pressure to one side or the other of a servo piston incorporating a toothed rack and operating a pinioned shaft. The shaft controls the position of the air mass flow valve which opens or closes, depending on whether the deviation is below or above the design frequency. Simultaneously with movement of the piston, the wiper arms on the feedback potentiometers move to send out a differential voltage signal which is fed back into the frequency control unit. The polarity of the feedback signal is in opposition to the signal from the frequency controller, consequently the primary signal is progressively cancelled out as movement of the hydraulic servo continues. The frequency control system thus returns to a state of equilibrium at the new conditions of load and air flow. The feedback, therefore, prevents overcorrection which would cause hunting of the whole system.

Overspeed

6. Turbine overspeed conditions which could be caused by a failure in the frequency control system, are prevented by the inclusion of an overspeed shut-off valve incorporated in the throttle valve body. The overspeed valve is mechanically linked to a centrifugally-operated overspeed trip driven from the main reducing gears. The overspeed trip can be reset by selecting the turbo-alternator ON-OFF/RESET switch to OFF/RESET.

Voltage control

7. The output voltage of the alternator is maintained within the design

limits by a voltage control and protection unit, Type U. 7703 *(A.P. 113D-0724-16)*, mounted in the main-plane leading edge adjacent to the frequency control unit. The unit incorporates transducers and transformer rectifier units for field current control, over and under voltage control, and also provides a control over the external loads circuits. A Merz-Price protection system is included to provide protection in case of line-to-line or earth-to-line faults.

Control panel

8. The turbo-alternator control panel is mounted on the navigator's port wall directly below the hatch jettison switch panel *(fig. 1)*. The control panel houses the following controls and warning indicators:-

PORT/STBD. TURBINE AIR VALVE position indicator.

No. 1 ALT. FAIL and No. 2 ALT. FAIL warning lamps.

O/S TRIP - PORT/STBD. warning lamps.

Turbo-alternator ON-OFF/RESET switch - PORT/STBD.

Contactor panel

9. The contactor panel, situated between frame 22 and frame 25 in the roof of the pack bay houses the main circuit breakers, relays and fuses.

Busbar switching logic unit

10. A busbar switching logic unit, situated beside the contactor panel, provides automatic control of the contactors, ensuring that the a. c. supplies cannot connect to the aircraft busbars unless their phasing and voltage are correct.

D.C. supplies

11. 28-volt d.c. supplies for contactor control, alternator field initial excitation, and actuator operation are obtained from the aircraft busbars. The control fuses are contained within the Main Electrical Panel.

A.C. supplies

12. The output from the turbo-alternators is fed via the control and protection unit, frequency control unit, main actuator, Merz-Price current transformer to the distribution panel in the roof of the pack bay.

Ground supply plug

13. A ground supply plug is located on the main electrical panel in the starboard lower equipment compartment.

Test sockets

14. Test sockets for alternator and system checking are located in each alternator bay.

SERVICING

WARNING

The relevant safety precautions detailed on the LETHAL WARNING marker card must always be observed before entering the cabin or performing any operations upon the aircraft.

General

15. All equipment cables and connectors associated with the a.c. system should be examined periodically for signs of damage, insecurity and overheating. Functional testing of the system is covered in A.P. 101B-0417-5. Details of the busbar logic switching unit test set and the fault simulator test set used during functional testing are to be found in Appendix 1A and Appendix 1B of Sect.6, Chap.13 of the main section of this A.P.

FAULT DIAGNOSIS

General

16. As the turbine speed control uses the alternator output frequency as an indication of turbine speed, any fault which deprives the frequency controller of its a.c. supply, or occurs within the controller or governor system will result in turbine overspeed shut-down. The faults which deprive the frequency controller of its a.c. supply include:-

Overvoltage.

Short circuit on main feeders (line to line or line to neutral).

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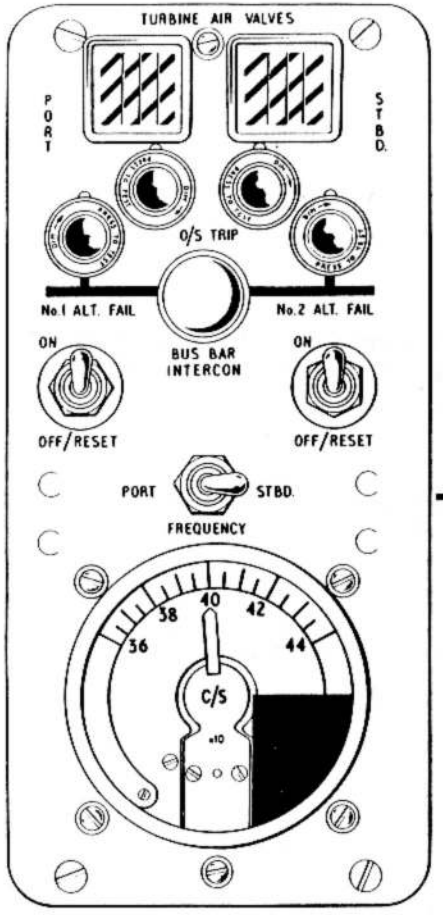

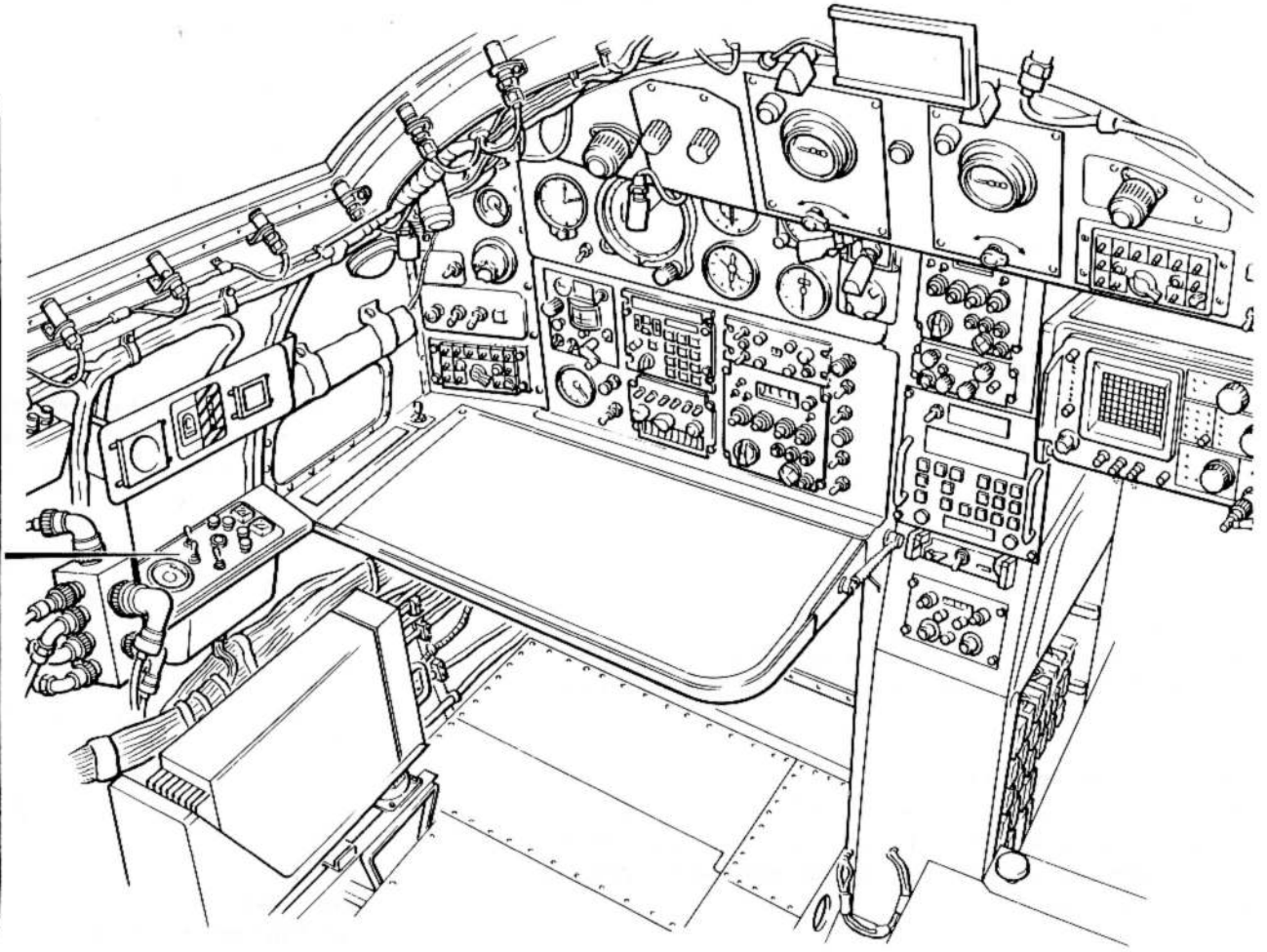

FIG. 1. CONTROL PANEL

◄ NAVIGATOR'S STATION AMENDED ►

A signal from inertia switch circuit.

Loss of alternator field excitation.

The first three faults cause the alternator field to be short circuited, and therefore effectively de-excited. As the alternator field is short circuited when the system is at rest, the fault causing the shut-down cannot be readily diagnosed and so the following fault finding procedure should be carried out.

Preparation

17. Connect a voltmeter (0-150V) and a frequency meter in parallel to a Mk. 4 plug and insert the plug into the alternator test socket. Select turbine control switch to ON. Start appropriate engine and run at slow idle.

Note . . .

Ground running instructions are provided in A.P. 101B-0417-1A, Sect. 2, Chap. 2 and also given in the Ground Handling Notes (A.P. 101B-0417-12).

Diagnosis

18. By slowly increasing the throttle opening and observing the indications on the meters, the diagnosis will be as follows:-

(1) If the voltage does not rise as the turbine runs up, this would indicate the presence of a signal from the inertia switch circuit, the absence of excitation current, a failure of the field shorting relay or its associated wiring, or a symmetrical 3-phase short circuit.

(2) If the voltage increases to some value less than 200 volts and then falls to zero, the fault would be either a short circuit or an incorrect setting of the overvoltage relay.

(3) If the voltage rises to approximately 220 volts and then drops to zero, the cause would be a failure of the voltage regulator.

(4) If the voltage build up and control is correct, but the frequency progressively increases with throttle setting, the apparent fault would be speed control failure.

These tests are to be repeated with the voltmeter connected between each pair of lines, the voltmeter connections being interchanged at the Mk. 4 plug, this is to ensure that no two lines are short circuited, i.e. the voltmeter should not read zero.

REMOVAL AND ASSEMBLY

Turbo alternators

19. For removal and assembly information refer to A.P. 101B-0417-1A, Sect. 4, Chap. 1.