CHAPTER 1

GENERAL INFORMATION

(Completely revised)

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V.2.1B. 1743

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Bomb fuzing release
Special bombing
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Circuit function letter 'B'

Not applicable

Circuit function letter 'C'

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Autopilot Mk.10

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Outside and cabin air temperature
Bomb bay temperature

Circuit function letter 'E'

Engine speed governor
Engine tachometers
Jet pipe temperature
Oil pressure indicators
Fuel flow meters
Jet pipe temperature limiters
Engine isolation cocks

Circuit function letter 'F'

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De-icing - fin
De-icing - refuelling probe
Bomb bay heating
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Pressurisation - abandon aircraft and decompression
Pressurisation - cabin air lamp and control valve indication

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Pressurisation - ram air valve actuator
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Lighting - navigation panel
Lighting - pilots' pillar
Lighting - cabin servicing and inspection sockets.
Lighting - high intensity anti-dazzle
Lighting - ground service
Lighting - red flood
Lighting - crew's red fluorescent
Lighting - console white fluorescent
Lighting - ultra-violet
Lighting - ultra-violet oxygen panels
Lighting - combined landing and taxying
Lighting - navigation
Lighting - downward identification
Lighting - E2B compass standby

Circuit function letter 'M'

Windscreen wipers

Circuit function letter 'P'

28v. d.c. control and supply - port
28v. d.c. control and supply - starboard
28v. d.c. distribution forward of R.P.B.
28v. d.c. distribution aft of R.P.B.
28v. d.c. ground supplies

Circuit function letter 'Q'

Low pressure fuel cocks
Cross-feed fuel cocks

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TABLE 1 (cont'd.)

Circuit function letter 'Q' (continued)

Fuel pressure warning
Fuel system - No.1 group tank selection and contents
Fuel system - No.2 group tank selection and contents
Fuel system - No.3 group tank selection and contents
Fuel system - No.4 group tank selection and contents
Fuel system - No.1 group refuelling
Fuel system - No.2 group refuelling
Fuel system - No.3 group refuelling
Fuel system - No.4 group refuelling
Fuel system - negative distribution
Fuel system - No.1 group fuel pumps
Fuel system - No.2 group fuel pumps
Fuel system - No.3 group fuel pumps
Fuel system - No.4 group fuel pumps
Fuel system - port transfer fuel pumps
Fuel system - starboard transfer fuel pumps
Fuel system - flight refuelling - port
Fuel system - flight refuelling - starboard
Fuel system - flight refuelling indication
Fuel system - flight refuelling centre of gravity
Fuel system - flight refuelling - nitrogen purge

Circuit function letter 'R'

Supplies for radio alt., i/c, H.F., I.L.S. and V.H.F., U.H.F.

Circuit function letter 'S'

Radio and radar supplies (unscreened)
Radio and radar supplies (screened)
I.F.F. supplies
Window launching
H2S air valve

Circuit function letters 'V' and 'X'

No.1 alternator controls
No.2 alternator controls
No.3 alternator controls
No.4 alternator controls
Alternator paralleling system
A.C. distribution - 200v 3 - ph. 400 c.p.s. supply

Circuit function letters 'V' and 'X' (continued)

A.C. distribution - 115v 3 - ph. 400 c.p.s. supply
Control of 115v 3 - ph. 400 c.p.s. supply
200v 3 - ph. 400 c.p.s. ground supply
A.A.P.P. start and control
A.A.P.P. engine services
A.A.P.P., R.A.T. and G.P.U. operation
Alternator power failure indication
Frequency changers 400/1600 c.p.s.
Ram air turbine
A.P.U. load shedding

Circuit function letter 'W'

Canopy and entrance door indication
Engine fire warning system
Engine fire extinguishers
No.1 and 2 tank bay fire extinguishers
Port wing tanks fire extinguishers
Starboard wing tanks fire extinguishers
Leading edge fire extinguishers
Oxygen regulators
Fuel tank pressurisation
Explosion suppression - tank wiring
Explosion suppression - power supplies

V.2.1B. 1745

WARNING . . .

Voltages in excess of 100 volts either a.c. or d.c. can be dangerous under certain circumstances. Personnel should therefore ensure that the electrical system is electrically safe before any servicing is attempted. Where it is essential that tests or adjustments be made with the electrical power switched on, the greatest care must be exercised.

Introduction

1. This Section contains descriptive and servicing information for the electrical system, and is divided into Chapters according to the mandatory code letter of each group of circuits, except in those cases where to segregate circuits bearing different code letters would involve unnecessary duplication. Where possible, the use is made of Post Office symbols in theoretical circuit diagrams, around which the text for the circuit operation is written.

2. Detailed information for standard items of equipment will not be given in this Section. The text will refer the reader to the appropriate Air Publication whenever this is necessary. A general list of Air Publications will be found at the front of this Book.

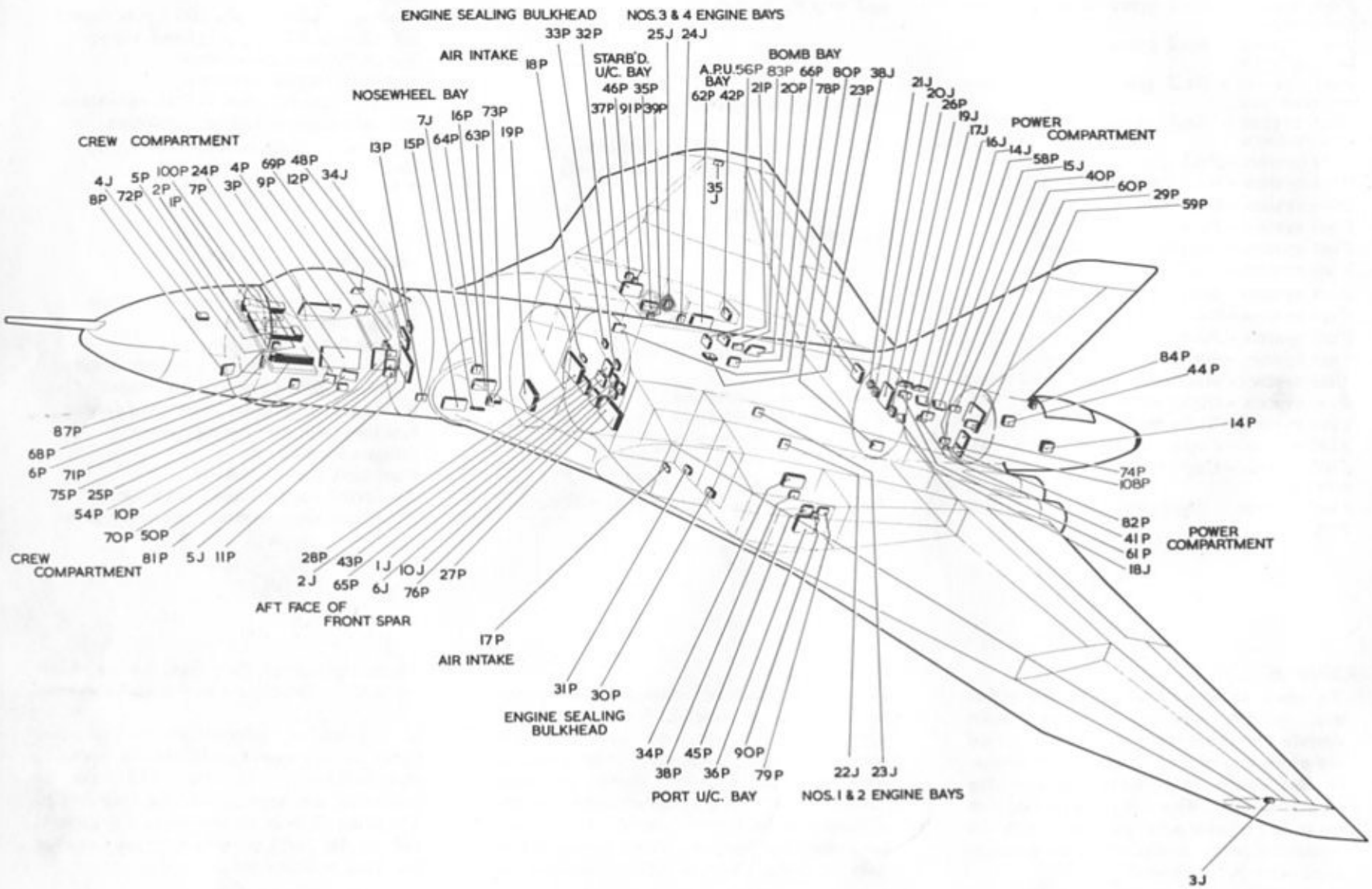

Fig.1 Location of panels and junction boxes

TABLE 2

Panels and Junction Boxes

Panels

1P Pilots' instrument panel
2P Fuel contents panel
3P Port fuse and relay panel
4P Starboard fuse and relay panel
5P Retractable centre console
6P Port console
7P Starboard console
8P Prone bombing panel
9P Bombing contol panel
10P Alternator control panel
11P Radio and radar supplies panel
12P Radio switch panel
13P Nosewheel bay terminal block panel
14P E.C.M. fuse panel
15P 28 volt d.c. power panel
16P 28 volt d.c. distribution panel
17P Port wing de-icing panel
18P Starboard wing de-icing panel
19P Vital supplies panel
20P Bomb gear distribution panel
21P Bomb bay T.B. panel
22P Not allocated
23P Fin de-icing panel – bomb bay
24P No.1 115 volt 3-phase dist. panel
25P No.2 115 volt 3-phase dist. panel
26P Rear spar distribution panel
27P Port 200/115 volt distribution panel
28P Starboard 200/115 volt dist. panel
29P G.P.U./A.P.U. fuse panel
30P No.1 engine T.B. panel
31P No.2 engine T.B. panel
32P No.3 engine T.B. panel
33P No.4 engine T.B. panel
34P Port fire extinguisher panel
35P Starboard fire extinguisher panel
36P Port ground refuelling panel
37P Starboard ground refuelling panel
38P Port undercarriage T.B. panel
39P Starboard undercarriage T.B. panel
40P Port P.F.C. and fuel pump relay panel
41P Stbd. P.F.C. and fuel pump relay panel
42P A.A.P.P. fuse panel
43P Bomb bay heating panel
44P E.C.M. relay panel
45P Port flight refuelling panel
46P Starboard flight refuelling panel
47P Not allocated
48P 28 volt d.c. sub-distribution panel
49P Not allocated
50P Secondary supplies switch panel
51P, 52P, 53P – Not allocated
54P Intercomm. panel
55P Not allocated
56P R.A.T.O. relay panel
57P Not allocated
58P No.1 power panel
59P No.2 power panel
60P No.3 power panel
61P No.4 power panel
62P A.A.P.P. fuse panel
63P Port nosewheel bay dist. panel
64P Stbd. nosewheel bay dist. panel
65P Bomb gear distribution panel
66P Artificial feel warning relay panel
67P Not allocated
68P Failure warning distribution panel
69P Pressure suit fuse panel
70P A.A.P.P. control switch panel
71P Military flight system power panel – port
72P Military flight system power panel – stbd.
73P Engine starting panel
74P Extra supplies relay panel
75P 200 volt sub-distribution panel
76P Explosion protection relay panel
77P Not allocated
78P Bomb bay fuel tanks panel
79P Bomb bay fuel tanks panel
80P Bomb bay fuel tanks panel
81P E.C.M. switch panel
82P A.A.P.P. voltmeter/transformer panel
83P Track and Glide panel
84P Parachute relay and indicator panel
85P Reserved for special store
86P Reserved for special store
87P Gold film windscreen panel
88P Not allocated
89P Bomb bay fuel tank contents
90P Not allocated
91P Refuelling time delay controls
92P Reserved for special store
93P Reserved for special store
94P Reserved for special store
95P Reserved for special store
96P Reserved for special store
97P Reserved for special store
98P Reserved for special store
99P Telemetry switch panel
100P Not allocated
101P A.R.I.5951 switch panel
102P Not allocated
103P Not allocated
104P Not allocated
105P Not allocated
106P Not allocated
107P Not allocated
108P I.R.D./R.B.W. fuse panel

Junction boxes

1J Port bomb bay junction box
2J Starboard bomb bay junction box
3J Port wing junction box
4J Nose junction box
5J Intercomm. relay and junction box
6J A.R.I.18051 junction box
7J Fuel flowmeter junction box
8J, 9J – Not allocated
10J Auto-stabilizer junction box
11J, 12J, 13J – Not allocated
14J No.1 load share junction box
15J No.2 load share junction box
16J No.3 load share junction box
17J No.4 load share junction box
18J No.1 alternator junction box
19J No.2 alternator junction box
20J No.3 alternator junction box
21J No.4 alternator junction box
22J No.1 Merz-Price box
23J No.2 Merz-Price box
24J No.3 Merz-Price box
25J No.4 Merz-Price box
26J Bomb sight
27J Not allocated
28J, 29J, 30J, 31J, 32J, 33J, – Not allocated
34J Military flight system junction box
35J Starboard wing junction box
36J, 37J – Not allocated
38J Bomb gear junction box
39J, 40J – Not allocated

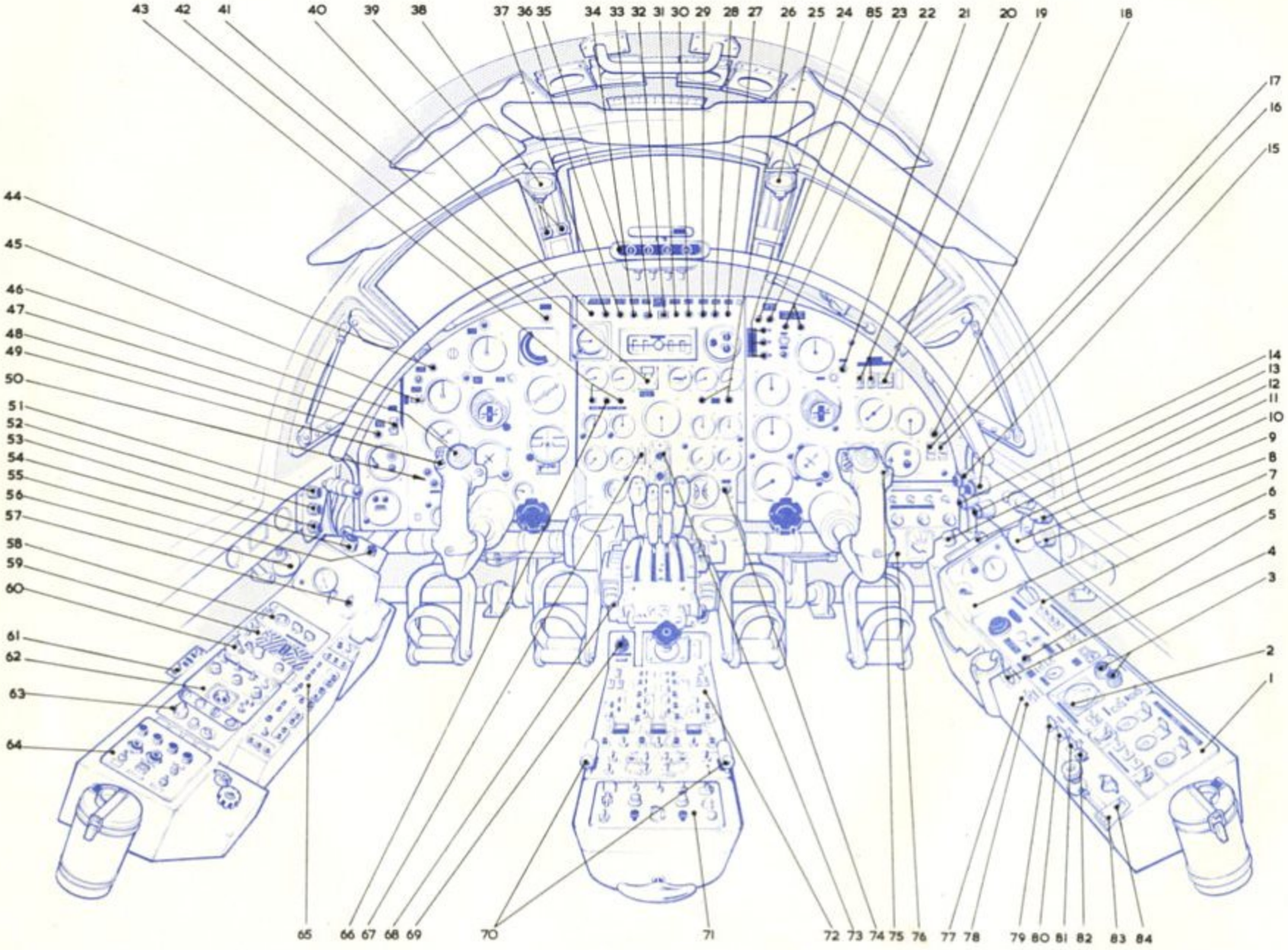

Fig. 2 Electrical components at pilots' station

► *Mod. 2455* ◄

KEY TO FIG.2
ELECTRICAL CONTROLS AT PILOTS' STATION

1 DE-ICING CONTROL PANEL
2 FLIGHT REFUELLING RECEIVER PANEL
3 FLIGHT REFUELLING PROBE LIGHT DIMMER SWITCHES
4 PRESSURE HEADS HEATER MASTER SWITCH
5 U/V LAMP DIMMER SWITCH
6 HEATING AND VENTILATION PANEL
7 2ND PILOT'S OXYGEN REGULATOR
8 E2B COMPASS LAMP DIMMER SWITCH
9 OXYGEN REGULATOR U/V LAMP
10 2ND PILOT'S KNEE PAD LAMP DIMMER SWITCH
11 THROTTLE DETENT TEST SWITCH
12 OXYGEN REGULATOR U/V LAMP DIMMER SWITCH
13 CONSOLE RED FLOOD LAMPS DIMMER SWITCH
14 COAMING RED FLOOD LAMPS DIMMER SWITCH
15 CENTRE CONSOLE RED FLOOD LAMPS DIMMER SWITCHES
16 WHITE FLOOD LAMP ON/OFF SWITCH
17 FUEL FLOW RESET SWITCH
18 2ND PILOT'S OXYGEN INDICATOR
19 WINDSCREEN WIPER CONTROL SWITCH
20 WINDSCREEN DE-ICE/DEMIST SWITCHES
21 WINDSCREEN OVERHEAT INDICATOR
▶ 22 TANKS FIRE WARNING INDICATORS – PRE MOD.2455
PORT AND STBD FUEL TANKS FIRE EXTINGUISHER PUSH SWITCHES – POST MOD.2455 ◀
23 I.L.S. MARKER INDICATOR
24 A.V.F. INDICATORS
25 E2B COMPASS AND LAMP
26 FUEL LOW PRESSURE INDICATORS
27 MAIN WARNING INDICATOR
28 PRESSURE HEAD HEATER SWITCH INDICATOR
29 ENTRANCE DOOR UNLOCKED INDICATOR
30 CANOPY UNLOCKED INDICATOR
31 ALTERNATOR FAILURE INDICATOR
32 BOMB DOORS AND FIN POSITION INDICATOR
33 AIR BRAKE INDICATOR
34 AUTOSTABILISER INDICATOR
35 ENGINE FIRE WARNING AND EXTINGUISHER SWITCHES
36 ARTIFICIAL FEED INDICATOR
37 P.F.C. UNITS INDICATOR
38 E2B COMPASS AND LAMP
39 TAIL TO GROUND WARNING INDICATORS
40 MAIN WARNING INDICATOR
41 BRAKE PARACHUTE CONTROL SWITCHES
42 I.L.S. MARKER INDICATOR
43 FUEL LOW PRESSURE INDICATORS
44 AUTO-THROTTLE INDICATOR
45 WINDSCREEN WIPER CONTROL SWITCH
46 AILERON/ELEVATOR SENSE NORMAL TRIM
47 WHITE FLOOD LAMP ON/OFF SWITCH
48 1ST PILOT'S OXYGEN INDICATOR
49 AILERON/ELEVATOR SENSE ARTIFICIAL FEEL RELIEF
50 REAR CREW ESCAPE INDICATORS
51 PILLAR LAMPS DIMMER SWITCH
52 E2B COMPASS LAMP DIMMER SWITCH
53 1ST PILOT'S KNEE PAD LAMP DIMMER SWITCH
54 U/V LAMP DIMMER SWITCH
55 U/V LAMP DIMMER SWITCH
56 OXYGEN REGULATOR U/V LAMP
57 1ST PILOT'S OXYGEN REGULATOR
58 BOMB DOORS CONTROL AND JETTISON SWITCH PANEL
59 ABANDON AIRCRAFT SWITCH PANEL
60 T.F.R. CONTROL UNIT
61 AUDIO WARNING AND RT/1 TONE SWITCHES
62 1ST PILOT'S I/C CONTROL UNIT
63 V.H.F. CONTROL UNIT
64 RAPID ENGINE START PANEL
65 P.F.C. CONTROL AND INDICATOR PANEL
66 ENGINE CONTROL INDICATOR
67 HYDRAULIC POWER PACK STOP/START SWITCH
68 1ST PILOT'S BOMB FIRING SWITCH
69 AUTOPILOT CONTROLLER
70 RED FLOOD LAMPS
71 AUTOPILOT CONTROL PANEL
72 FUEL SYSTEM CONTROL PANEL
73 ALIGHTING GEAR SELECTOR SWITCH
74 FUEL C.G. CHECK SWITCH
75 I/C PRESS-TO-TRANSMIT SWITCH
76 2ND PILOT'S I/C CONTROL UNIT
77 EXTERNAL LIGHTS MASTER SWITCH
78 DOWNWARD IDENTIFICATION LAMP SWITCH
79 LANDING LAMP SWITCH (PORT)
80 LANDING LAMP SWITCH (STARBOARD)
81 NAVIGATION LAMPS STEADY/FLASH SWITCH
82 MONITOR/ALARM SWITCH
83 WINDSCREEN OVERHEAT INDICATOR PANEL
84 VENTILATED SUITS MASTER SWITCH
▶ 85 BOMB BAY FUEL TANK FIRE WARNING INDICATOR – POST MOD.2455 ◀

DESCRIPTION

OUTLINE OF THE SYSTEM

3. The Vulcan B, Mk.2 utilises alternating current as a main source of electrical power. This is generated by four 40 kVA a.c. generators, driven by the aircraft engines, via constant speed drives to give an output at 200 volts 3-phase 400 Hz. The main consumer devices are all supplied from this source.

4. D.C. power for the secondary or low current consuming devices is supplied by transformer-rectifier units at 112 and 28 volts. Static transformers are used to obtain a.c. at 115 volts 3-phase 400 Hz, and frequency changers to give a.c. at 115 volt single-phase 1,600 Hz, for the radar, instrument and auto-control systems.

5. A battery is supplied for the 28-volt d.c. system only. This is of the S.A.F.T. 40 ampere-hour type, intended to supply certain vital services in an emergency. For the main generation system, two emergency services are provided; a ram air turbine driving a suitable alternator serves as a standby in the event of a power failure at high altitudes, and an auxiliary power unit, comprising an alternator driven by a gas turbine engine is provided for failure at lower altitudes.

6. A 3-pole wiring installation is employed for the 200-volt 3-phase 400 Hz, system, the three lines, usually Pren or Nyvin cables, being twisted together. The 115-volt single-phase and the d.c. systems employ a single-pole wiring installation with earth return. Care has been taken however to segregate a.c. and d.c. earth points.

7. Protective devices such as circuit-breakers and fuses are installed as close to the source of supply as possible, and disposed in groups to minimise vulnerability. Individual circuits are protected by fuses. In the case of the 3-phase installation, a fuse is included in each line. The three fuses to a particular load bear the same number followed by the suffix R, Y or B, indicating respectively red phase, yellow phase or blue phase.

8. Distribution feeders between main and sub-distribution panels on the 200-volt 3-phase 400 Hz, installation are triplicated; these triple-feeders are fused in each phase and at each end of the feeder, thus affording full protection in the event of fuse failures or open circuits. A similar triple feeder system is provided in the 28-volt d.c. system between the main and sub-distribution panels.

9. Two external supply plugs, one for the 200-volt and the other for the 28-volt system, are provided for ground testing and servicing purposes, a ground supply truck providing the a.c. and d.c. supplies. A further 28-volt d.c. ground supply plug is fitted for ground refuelling purposes only.

WIRING INSTALLATION

10. An AVRO wiring installation is employed, in which AVRO connector blocks provide most of the junction points. Plessey plugs and sockets of the standard and pressure-proof patterns are used at all transport joints. Where cables pass through the pressure bulkheads, pressure-proof cable bungs are used, with 'in-line' connectors providing the cable break point. An AVRO identification scheme, coupled with the S.B.A.C. circuit function letter, is used throughout.

PANELS AND JUNCTION BOXES

11. Each panel is an assembly of components such as fuses, circuit-breakers, busbars, instruments, relays etc., with or without connector blocks and plugs and sockets. Junction boxes are enclosed assemblies of connector blocks with or without plugs and sockets. The inlets or outlets of all panels and junction boxes are numbered clockwise. The designation of all panels and junction boxes is given in Table 2, their location is shown in fig.1.

CONNECTOR BLOCKS

12. Except in a few insolated cases, where standard S.B.A.C. are used, all circuits up to 150 amp. use the AVRO range of connector blocks. Each connector block is given the prefix T.B., and a number which is engraved on a plate or label forming part of the connector block assembly group.

13. The AVRO connector blocks have been designed to suit the new range of cable sizes, and are provided in the following sizes and ratings:-

(1) Lightweight connector block 5-way Ref. 5X/6591 for cables up to 12 amp.

(2) Lightweight connector block 3-way Ref. 5X/7504 for 18 and 24 amp. cables

(3) Medium duty connector block 2-way Ref. 5CZ/5381 Standard stud type (¼ in. dia.) accommodates up to 150 amp. terminal lugs.

Earthing blocks

14. In addition to the connector blocks listed in para.12, two sizes of earthing blocks are used at multiple earth points as follows:-

(1) Earthing block 12-way Ref.5X/7498 for cables up to 12 amp.

(2) Earthing block 8-way Ref.5X/7501 for 18 and 24 amp. cables.

The AVRO earthing blocks are made in one piece from electro-tinned light alloy; each block is equipped with mounting lugs for attachment to the panel or aircraft structure. Where the earthing blocks are fitted in panels, a separate earth cable link is brought out from the attachment lugs to the nearest main earth bolt.

15. Connector blocks in the S.B.A.C. range are dealt with in A.P.4343C, Vol.1, Sect.5, Chap.2. The full range of AVRO connector blocks is given in fig.9, crimping details are given in fig.10.

PLUGS AND SOCKETS

16. Single or double-ended plugs and sockets of the Plessey standard type are employed for transport joints and bulkhead break points. A number of panels are equipped with single-ended plugs and sockets where space provisions preclude the use of connector blocks or where a panel can be used as a transport break point. Pressure-proof plugs designed to withstand a differential pressure of 15-lb. sq.in., are used for low voltage services passing through the cabin pressure bulkheads.

17. Mk.4 miniature sockets are used for multi-core cables which connect to components equipped with plugs of the corresponding type. These units are pressure-proof, thus enabling instruments and electronic equipment to be sealed against changes in atmospheric pressure.

18. In some special cases (e.g., the integrated wiring for the bomb fuzing and release circuits), A.N. type plugs and sockets are employed. These are of the one-piece pressure-proof pattern, as used in American aircraft.

19. Descriptive and servicing details for the Plessey series of plugs and sockets are contained in A.P.113D–1824–1. Mk.4 miniature sockets and plugs are dealt with in the same publication.

CABLES

20. Cable assemblies are groups of single or multicore cables bunched together for convenience of installation. The extremities may consist of a plug or socket, a terminal lug or open tails. Cable looms are made up of single or multi-core cables for attachment to the terminals of components on a panel or in a junction box. The extremities of each loom may terminate as tails, terminal lugs or as plugs and sockets.

21. The Pren range of cables are normally used for all a.c. and d.c. circuits up to 200 amp., but in some cases the Nyvin range of cables will replace the Pren. Tersil and Efglas cables are used on all circuits where possible contamination with Ester based lubricants may occur, and cables connecting to the engine fire detector thermocouples are of the Unifiredet series. Cables used in the jet pipe temperature systems consist of Uniefglas for extra heat protection and Chromel Alumel. Cables connecting to the retractable centre console panel are Prenflex to allow for extension and retraction of the console.

22. On the 200 volt 3-phase 400 c.p.s. system, standard Pren or Nyvin cables, twisted into 3-core spirals have been introduced to replace the metal braided screened cables previously used. This method of wiring results in an appreciable saving in the weight of cables. A full description of all the cables used including precautions in preparation, and also the colour coding for core identification and new A.N. ratings will be found in A.P.4343C, Vol.1, Sect.6.

23. Cable assemblies and looms for the 200 volt 3-phase system and the 28 volt d.c. system are run separately as far as conditions allow. At distribution points, the 200 and 115 volt a.c. sections are separated from the d.c. sections and each group is clearly marked with the appropriate voltage.

CABLE END FITTINGS

24. Standard ferrules and adapters are used for the S.B.A.C. range of connector blocks. Three sizes of ferrules are employed for the AVRO connector blocks. In every instance the ferrules are crimped to the cable core. For special terminations Hellerman type crimped terminal lugs up to 35 amp. are used. Heavy duty terminal lugs of the hexagonal pattern are fitted where necessary to cables above the 35 amp. range. Crimping instructions for all cable ferrules and lugs will be found in A.P.4343S, Vol.1, Sect.15, Chap.10.

IDENTIFICATION SCHEME

25. The AVRO identification scheme provides complete and simple instructions for installation purposes, and constitutes

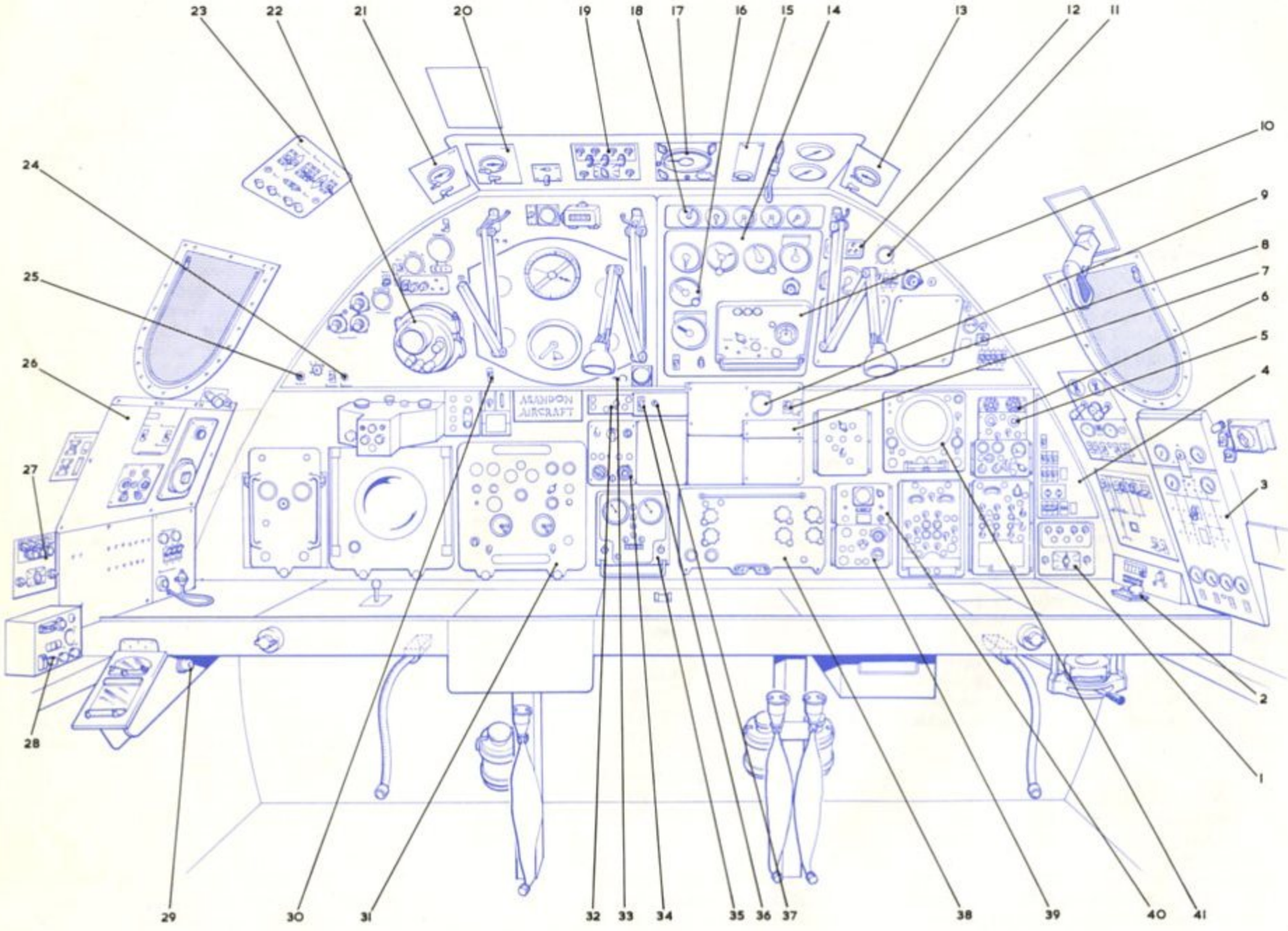

Fig.3 Electrical controls at crew's station - pre Blue Steel

KEY TO FIG.3

ELECTRICAL CONTROLS AT CREWS' STATION (PRE BLUE STEEL)

1 A.E.O.'S I/C CONTROL UNIT
2 MORSE KEY
3 ALTERNATOR CONTROL PANEL, 10P
4 RADIO SWITCH PANEL
5 A.R.I. 5848 CONTROL UNIT
6 A.R.I. 5848 CODER CONTROL UNIT
7 A.R.I. 18107/13 CONTROL UNIT PANEL
8 A.R.I. 18107/13 INTERROGATION SELECTOR SWITCH
9 A.R.I. 18107/13 DISTANCE AND BEARING INDICATOR
10 N.B.S. TRACK CONTROL UNIT
11 E.C.M. COOLANT TEMPERATURE GAUGE
12 A.R.I. 23063 CONTROL UNIT
13 A.E.O.'S OXYGEN REGULATOR
14 NAV./PLOTTERS INSTRUMENT PANEL
15 A.R.I. 23023 LOOP CONTROL UNIT
16 COMPASS REPEATER
17 A.R.I. 23023 CONTROL UNIT
18 BEARING AND TUNING INDICATOR
19 NAV./PLOTTERS I/C CONTROL UNIT
20 NAV./PLOTTERS OXYGEN REGULATOR
21 NAV./AIR BOMBER'S OXYGEN REGULATOR
22 MK.6A RADIO ALTIMETER INDICATOR
23 RADIO CONTROL PANEL, 12P
24 SCANNER ROTATION SWITCH
25 SCANNER STABILISATION SWITCH
26 BOMB PANEL, 9P
27 NAV./AIR BOMBER'S I/C CONTROL UNIT
28 CAMERA CONTROL UNIT
29 H2S CONTROL UNIT PILLAR LAMPS DIMMER SWITCH
30 BOMB DOORS OPEN/CLOSE SWITCH
31 H2S CONTROL UNIT
32 GROUND SPEED SELECTOR UNIT
33 NAV./PLOTTERS' OXYGEN FLOW INDICATOR
34 H.R.S. CONTROL UNIT
35 A.R.I. 5951 INDICATOR DRIFT ANGLE - GROUND SPEED
36 A.R.I. 5951 SUPPLY SWITCH
37 A.R.I. 5959 REDUNDANT CIRCUIT FAIL INDICATOR
38 G.P.I. MK.6
39 A.R.I. 5874 REMOTE CONTROL UNIT
40 A.R.I. 5874 AERIAL CONTROL UNIT
41 A.R.I. 5919 INDICATOR UNIT

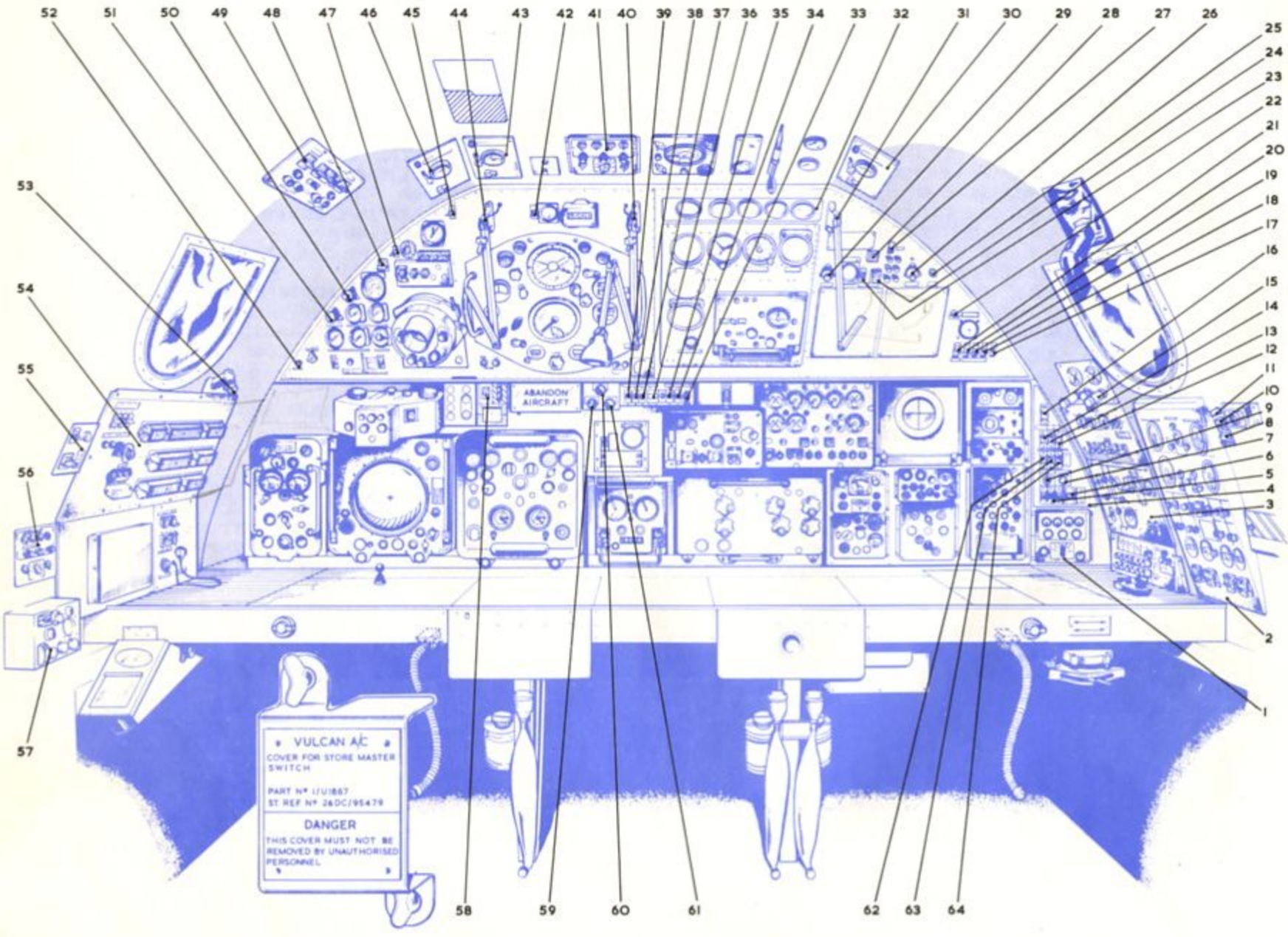

Fig.4 Electrical controls at crew's station - post Blue Steel

KEY TO FIG.4

ELECTRICAL CONTROLS AT CREW'S STATION (POST BLUE STEEL)

1 A.E.O.S' I/C CONTROL UNIT
2 ALTERNATOR CONTROL PANEL 10P
3 SECONDARY SUPPLIES CONTROL PANEL, 50P
4 RADIO SWITCH PANEL
5 EXTERNAL I/C SWITCHES
6 I/C SELECTION SWITCH
7 A.R.I. 5919 INDICATOR LAMPS DIMMER SWITCH
8 AUTO THROTTLE SUPPLY SWITCH
9 AIRBORNE WARNING INDICATOR LAMPS DIMMER SWITCH
10 A.R.I. 18011 SUPPLY SWITCH
11 PILLAR LAMP
12 A.R.I. 23023 SUPPLY SWITCH
13 A.R.I. 5874 HIGH-LOW SELECTOR SWITCH
14 A.R.I.5874 SUPPLY SWITCH
15 COCKPIT LAMPS AND DIMMER SWITCH
16 A.R.I. 5848 SUPPLY SWITCH
17 PERISCOPE HEATER SWITCH
18 LAMP UNDER NAV. TABLE, ON/OFF SWITCH
19 MAIN CABIN LAMP ON/OFF SWITCH
20 PORT FLUORESCENT LAMP ON/OFF SWITCH
21 STARBOARD FLUORESCENT LAMP ON/OFF SWITCH
22 A.E.O.S' OXYGEN FLOW INDICATOR
23 FIN GAP DOORS CONTROL SWITCH
24 FIN GAP DOORS EMERGENCY SWITCH
25 LOSS OF CABIN PRESSURE INDICATOR
26 A.E.O.S' CHARTBOARD LAMP DIMMER SWITCH
27 REFRIGERATION HEATERS SUPPLY SWITCH
28 FIN GAP DOORS INDICATOR
29 T.C.U. AND AUTO LAND INSTRUMENT LAMPS DIMMER SWITCH
30 A.E.O'S OXYGEN REGULATOR
31 A.E.O'S CHARTBOARD LAMP
32 NAV./PLOTTERS INSTRUMENT PANEL
33 EVENT MARKER PUSH SWITCH
34 V.G. RECORDER SUPPLY SWITCH
35 ROOF FLUORESCENT LAMP ON/OFF SWITCH
36 A.R.I. 5816 SUPPLY SWITCH
37 A.R.I. 5951 SUPPLY SWITCH
38 STARBOARD BEAM COMPASS SELECTOR SWITCH
39 PORT BEAM COMPASS SELECTOR SWITCH
40 NAV./PLOTTERS CHARTBOARD LAMP
41 NAV./PLOTTERS I/C CONTROL UNIT
42 H2S PRESSURISATION ON/OFF SWITCH
43 NAV./PLOTTERS OXYGEN REGULATOR
44 NAV./AIR BOMBERS CHARTBOARD LAMP
45 N.B.C. AIR SUPPLY ON/OFF SWITCH
46 NAV/AIR BOMBERS' OXYGEN REGULATOR
47 BOMB BAY MANUAL HEAT CONTROL SWITCH
48 BOMB BAY HEATING MAIN CONTROL SWITCH
49 RADIO CONTROL PANEL, 12P
50 TEMPERATURE GAUGE LAMPS DIMMER SWITCH
51 NAV./AIR BOMBERS CHARTBOARD LAMP DIMMER SWITCH
52 NAV./AIR BOMBERS OXYGEN FLOW INDICATOR
53 BOMB PANEL 9P LAMP AND DIMMER SWITCH
54 BOMB PANEL, 9P
55 SIMULATED BOMBING SWITCH PANEL
56 NAV./AIR BOMBER'S I/C CONTROL UNIT
57 CAMERA CONTROL UNIT
58 ANTI-DAZZLE LAMPS ON/OFF SWITCH
59 NAV./PLOTTERS' INSTRUMENT LAMPS DIMMER SWITCH
60 NAV./PLOTTERS' CHARTBOARD LAMP DIMMER SWITCH
61 DIFFUSED LIGHTING DIMMER SWITCH
62 PRESS-TO-TRANSMIT SWITCH
63 CONFERENCE I/C SWITCH
64 AIRBORNE WARNING MONITOR/ ALARM SWITCH

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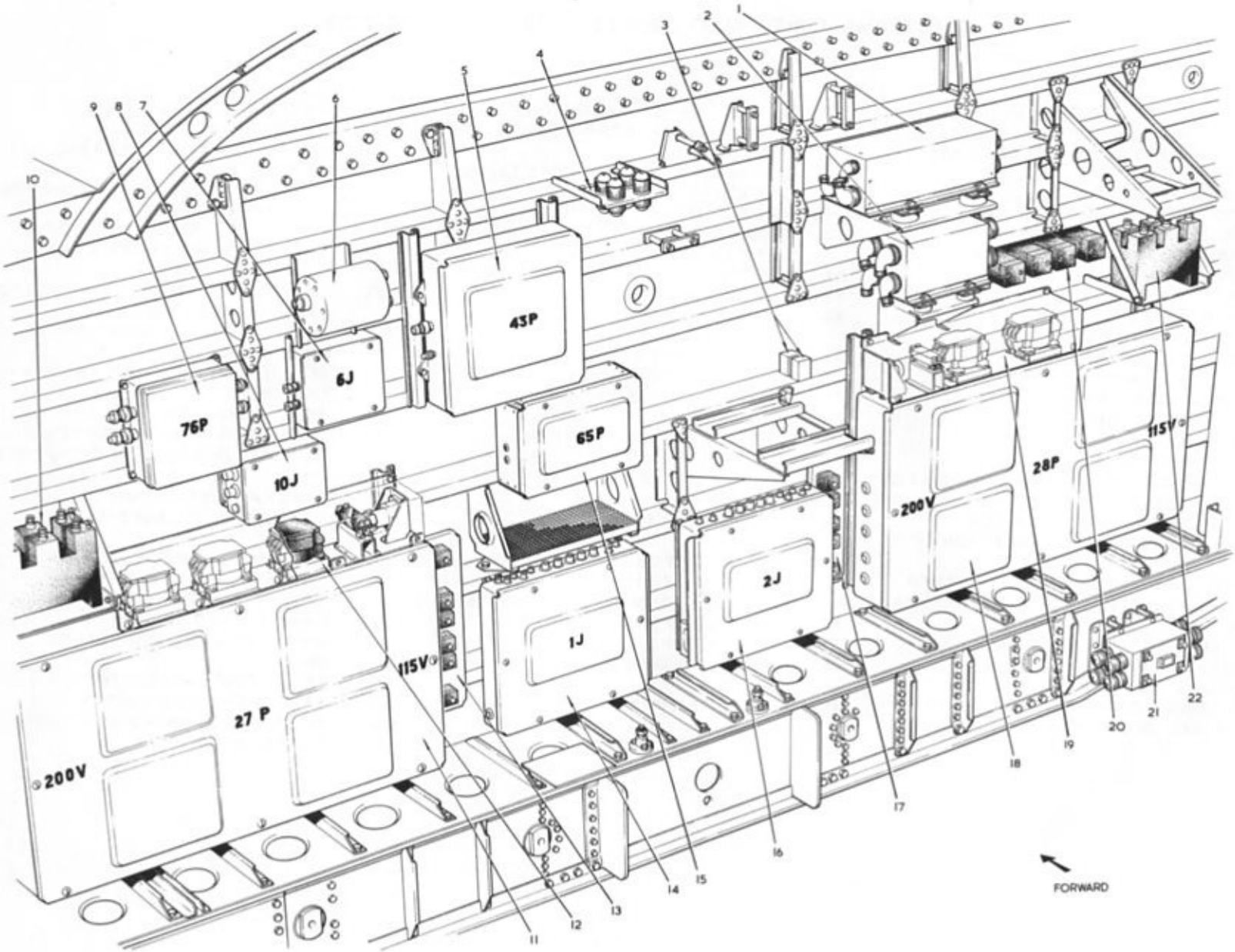

Fig.5 Distribution panels on aft face of front spar

KEY TO FIG.5

DISTRIBUTION PANELS ON AFT FACE OF FRONT SPAR

1 DISTRIBUTOR, TYPE 11
2 DISTRIBUTOR, TYPE 12
3 T.B.'S 89 AND 90
4 PLUG BRACKET
5 BOMB BAY HEATING PANEL - 43P
6 WING DE-ICING MAGNETIC AMPLIFIER
7 A.R.I. 18051 JUNCTION BOX - 6J
8 AUTOSTABILISER JUNCTION BOX - 10J
9 EXPLOSION SUPPRESSION RELAY PANEL - 76P
10 MAIN 3KVA TRANSFORMER - PORT
11 PORT 200/115 VOLT DISTRIBUTION PANEL - 27P
12 SECONDARY SUPPLY CONTROL RELAYS - PORT
13 T.B.'S 620 TO 625
14 PORT BOMB BAY JUNCTION BOX - 1J
15 BOMB GEAR DISTRIBUTION PANEL - 65P
16 STARBOARD BOMB BAY JUNCTION BOX - 2J
17 T.B.'S 630 TO 635
18 STARBOARD 200/115 VOLT DISTRIBUTION PANEL - 28P
19 SECONDARY SUPPLY CONTROL RELAYS - STARBOARD
20 FLIGHT REFUELLING CONTROL RELAYS NO'S 415 TO 419
21 PRE-SELECTOR, TYPE C
22 MAIN 3KVA TRANSFORMER - STARBOARD

an aid to fault location and general servicing. It is based on positional identification of cables and associated components, with the addition of a circuit function letter which is now a mandatory requirement (S.D.M's). The system of identification is concerned with the following sections of the wiring installation:-

(1) Panels and junction boxes.

(2) Cable assemblies and cable looms.

(3) Terminal or connector blocks.

(4) Plugs and sockets.

(5) Circuit protection devices such as circuit breakers and fuses.

Cables and cable assemblies

26. Each individual length of cable carries at each end a pink Helvyn sleeve bearing the appropriate circuit function letter. The extremities of each cable are equipped with a dual reference, i.e. the terminal or point of origin and destination.

27. In addition to the identification markings outlined in the previous paragraph, each cable bears two additional identification sleeves. One of these is a number, prefixed by the letter F (fuselage) P (port mainplane) S (starboard mainplane) which provides a ready reference to the position of the cable in the aircraft. The remaining sleeve bears the contractor's reference number. Note that cable assemblies for wireless and radar circuits bear the reference prefixes FR (fuselage) RF (port wing) SR (starboard wing).

Plugs and sockets

28. Cable assemblies with similar sockets at their extremities are wired without cross-overs, i.e. pin A is wired to pin A, B to B etc. When a large socket feeds into two or more smaller sockets, the larger of the latter follows this rule, and the smaller sockets divide the remainder in consecutive order. As an example, in a 26-way socket marked 1, 2 and A to Z (omitting letter I and O) the letters A to M would be allocated to A to M of a 12-way socket; N to U would be allocated to A to G in a 7-way socket, and V to Z to a 5-way socket. Pins 1 and 2 have not been used in this example. In those instances where sockets have numbered pins 1, 2, 3 etc., would connect to socket pins A, B, C etc.

EARTH ASSEMBLY POINTS

29. As stated in para.14, the majority of earth cables up to 24 amp. rating are connected to earthing terminal blocks. These blocks are separated for a.c. and d.c. circuits, and can be identified by their label assembly, which is coloured green for a.c. earths and blue for d.c. The earth blocks are again separately earthed by cables from their attachment lugs to the nearest aircraft earth bolt. These earth bolts are secured to accessible points of the aircraft metal structure. All earth bolts can be identified by their coating of blue oil base paint.

FUSES

30. High rupturing capacity (H.R.C.) cartridge fuses are employed for circuit protection on the complete electrical system. These fuses are designed to withstand a large percentage overload on circuits where high starting currents are produced, such as actuators, fuel pumps, etc. The fuse element is mechanically supported throughout its length by a filling medium inside the body. In addition it is hermetically sealed, thus oxydisation of the element is impossible. These fuses will be dealt with fully in A.P.4343C, Vol.1, Sect.5.

31. Three types of H.R.C. fuses are employed. For the 200 volt a.c. and d.c. low current circuits, a type identical in size to the glass bodied S type fuse is used. This type is available in current ratings from 2.5 to 25 amp., and the ratings can be identified by the colour of the fuse body as follows:-

Rating(amp.)		Body colour	Ref.
A.S.	2.5	Black/light blue	5CZ/5214
A.S.	5.0	White/black	5CZ/5215
A.S.	7.5	Black/orange	5CZ/5219
A.S.	10.0	Black/grey	5CZ/5216
A.S.	15.0	White/green	5CZ/5217
A.S.	20.0	Black/red	5CZ/5218

These fuses are all carried in S.B.A.C. fuseboxes, Type S.

32. For the 200 volt 3-phase a.c. medium current bus-bar fed consumer circuits, an 'end-on' pattern of fuse and fuse holder is employed. This type of fuse is slightly longer than the S type, and is available in the following ratings:-

Rating(amp.)	Ref.
1.0	Z590109
3.0	Z590111
5.0	Z590112
7.0	Z590113

These fuses are all carried in special 'end-on' carriers (Ref. 5CZ/5459). The fuse is secured within the cylindrical moulding by annular spring clips. When the top cap is screwed home, the fuse is held in position against the pressure of a

spring in the base of the carrier. A fuse is not correctly positioned in the holder until the top cap is screwed fully home.

33. For heavy current consuming devices, and distribution feeder protection etc., a horizontal bus-bar pattern fuse is employed. These fuses are of Brush manufacture, and available in the following ratings and sizes:-

Body Size	Rating (amp)	Ref.
2	10	10H/0590122
2	15	10H/0590123
2	20	10H/0590124
2	30	10H/0590125
2	40	10H/0120067
2	50	10H/0119127
3	125	10H/0119128
3	150	10H/0119129

These fuses are of the Admiralty pattern, and are bolted to the bus-bar in the various distribution panels. Fitted over the fuse is a P.V.C. shroud (Ref.5CZ/5628) which serves as an insulated cover and removal grip.

Fuse tables

34. A complete index of the distribution circuit breakers and fuses on the aircraft are given in the chapter dealing with power distribution, and they are tabulated for ease of reference. Each table deals with a particular supply voltage, and the circuit breakers and fuses are listed numerically. In addition to the rating and location, further information regarding the C.B. or fuse type, and their service category are provided. Circuit breaker and fuse types are shown as follows:-

Type in tables	Detail
C.B. Type L.G.A.	B.T.H. pattern
Fuse Type S	H.R.C. pattern, identical in size to S type (para.31 refers).
Fuse Type S1	H.R.C. pattern, special to artificial feel units only.
Fuse Type EO	H.R.C.'end on' pattern (para.32 refers).
Fuse Type H2	Horizontal pattern (para. 33 refers)
Fuse Type H3	Horizontal pattern (para. 33 refers)

Consumer service categories are referenced to as vital, essential or non-essential, and are shown in the fuse tables as:-

V - vital
E - essential
NE - non-essential (normal)

It should be noted that on the 200-volt 3-phase a.c. circuits, the three fuses bear the same number, but are distinguished by the suffix letter R, Y and B, indicating Red, Yellow and Blue phases respectively. On the 115-volt 3-phase a.c. circuits, the two fuses bear the same number but are distinguished by the suffix letters R and B, indicating Red and Blue phases respectively. The third phase in these circuits is connected to earth.

ROUTING CHARTS

35. Included in each chapter will be found the relevant routing charts for the circuits concerned. Each routing chart translates the standard S.I.S. or other approved basic diagram of connections for the particular circuit into a form which provides the following information:-

(1) The complete electrical circuit.

(2) The situation and terminal markings of each component.

(3) The situation in the aircraft of each section of wiring and its terminal markings.

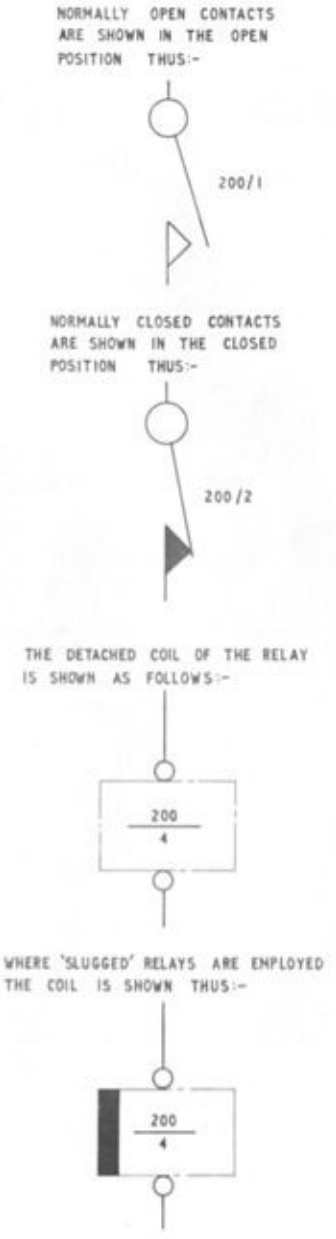

Fig.6 Relay symbols

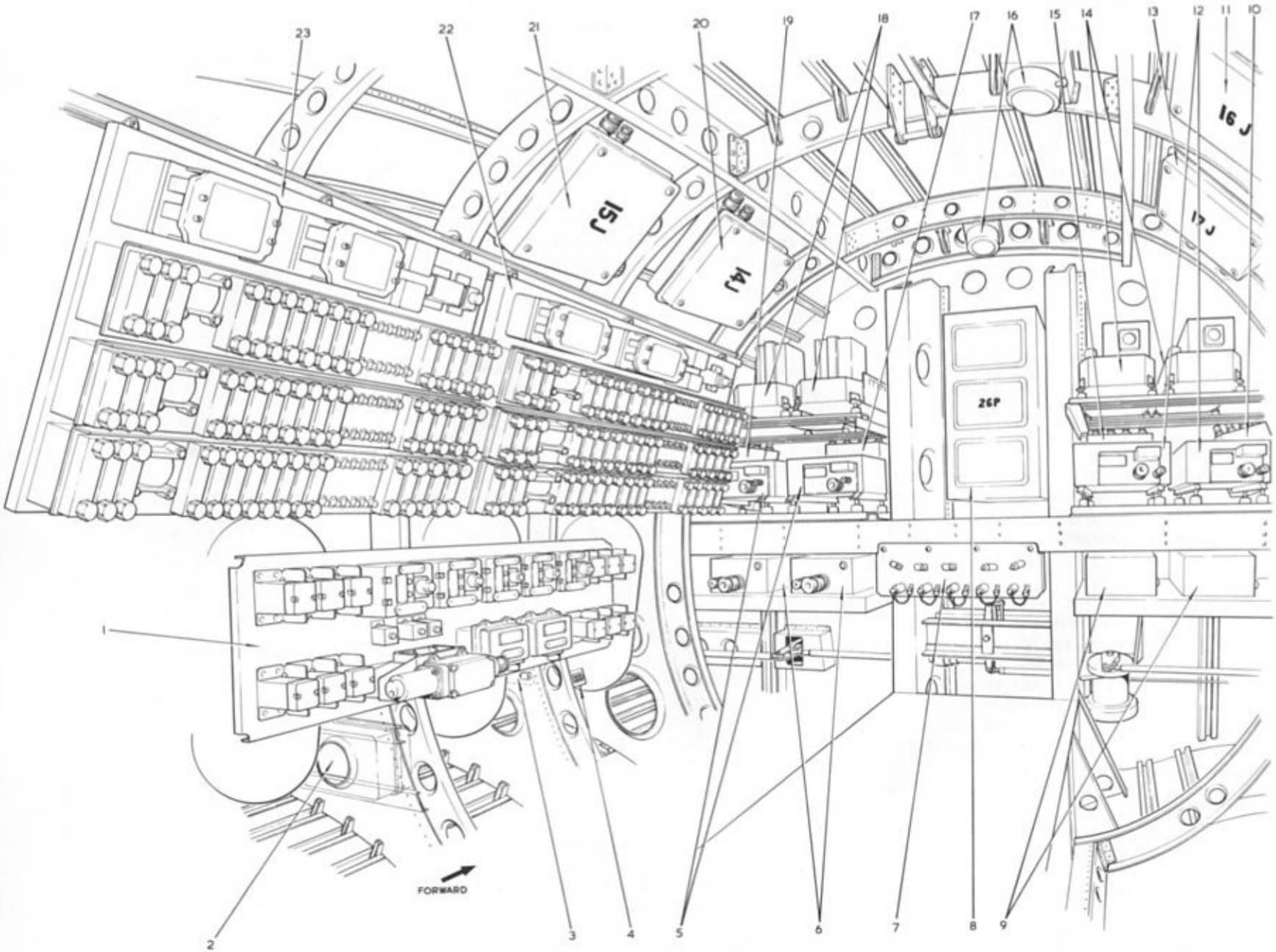

Fig.7 Equipment in power compartment - port

KEY TO FIG.7

EQUIPMENT IN POWER COMPARTMENT - PORT

1 PORT P.F.C. CONTACTOR AND FUEL PUMP PANEL - 40P
2 I.R.D./R.B.W. FUSE PANEL - 108P
3 I.R.D. R.B.W. RELAY AND FUSE PANEL
4 CIRCUIT BREAKERS C.B.109, 110 AND 111
5 NO.1 AND 2 ALTERNATOR FREQUENCY AND LOAD CONTROLLERS
6 NO.1 AND 2 ALTERNATOR CONTROL PANELS
7 ALTERNATOR VOLTAGE TRIM AND TEST PANEL
8 REAR SPAR DISTRIBUTION PANEL - 26P
9 NO.3 AND 4 ALTERNATOR CONTROL PANELS
10 NO.4 ALTERNATOR JUNCTION BOX - 21J
11 NO.3 LOAD SHARE JUNCTION BOX - 16J
12 NO.3 AND 4 ALTERNATOR FREQUENCY AND LOAD CONTROLLERS
13 NO.4 LOAD SHARE JUNCTION BOX - 17J
14 NO.3 AND 4 VOLTAGE REGULATORS
15 NO.3 ALTERNATOR JUNCTION BOX - 20J
16 COMPARTMENT LIGHTING
17 NO.2 ALTERNATOR JUNCTION BOX - 19J
18 NO.1 AND 2 VOLTAGE REGULATORS
19 NO.1 ALTERNATOR JUNCTION BOX - 18J
20 NO.1 LOAD SHARE JUNCTION BOX - 14J
21 NO.2 LOAD SHARE JUNCTION BOX - 15J
22 NO.1 POWER PANEL - 58P
23 NO.2 POWER PANEL - 59P

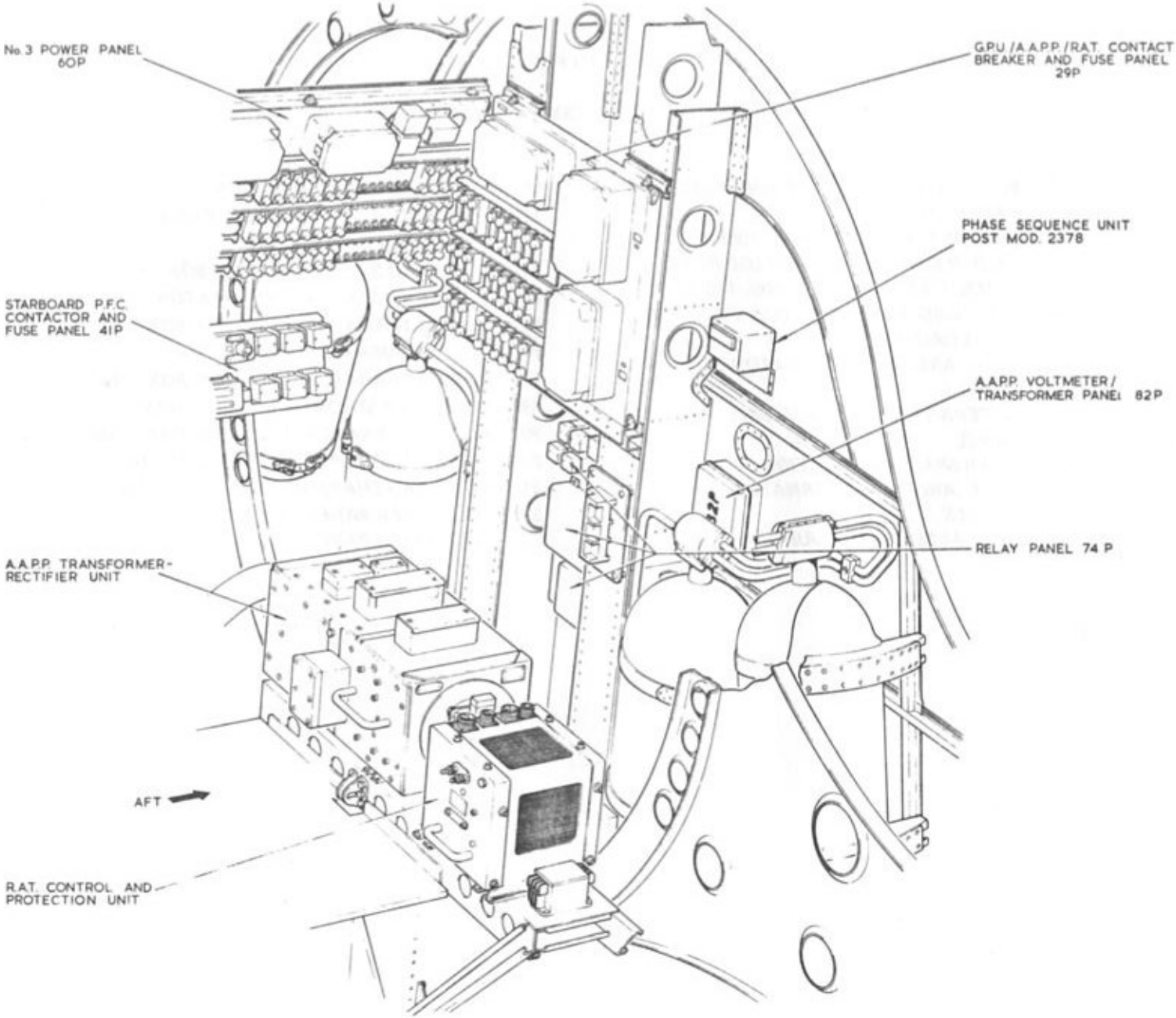

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Fig. 8 Equipment on aft face of power compartment

(Mod. 2378)

(4) The circuit function letter of the circuit.

(5) The type and capacity or size of each cable used.

36. These charts are in tabular form, with the vertical columns denoting the panel, junction box or item of equipment where the break points or connections occur in the circuit. It should be noted that although connection points are given for each circuit, it does not follow that cables shown diagrammatically as passing through a panel or similar column do so physically unless they have a junction or connection point in that column. Columns headed 'Con-Ref.' or 'Cable-Ref.' contain the cable assembly reference and/or plug and socket pin reference.

THEORETICAL CIRCUIT DIAGRAMS

37. Theoretical circuit diagrams are provided to assist the reader to understand the function of the more complex circuits. To simplify the arrangement of the circuit diagrams where relays are employed, the detached contact system is used (similar to the Post Office system). Under this system, a relay is designated by a fractional number, e.g., 200/4. The numerator identifies the relay, and the denominator shows the number of contacts used. The contacts are then indicated thus; 200/1, 200/2, 200/3, 200/4. Contact positions are shown in fig.6.

38. It should be noted that the theoretical circuit diagrams are provided only for circuit description. For fault finding and circuit testing, reference must be made to the routing charts contained in each Chapter.

SERVICING

GENERAL

39. Detailed servicing of cables, wiring and accessories is governed by the procedure laid down in A.P.4343, Vol.1, Sect. 12, Chap.5. Servicing notes of a more general nature, and a brief introduction to fault location methods are contained in the following paragraphs.

40. Strain on joints due to insufficient anchorage of cables, loose connections, tight cable clips and fairleads, abrasion and excessive pressure on the insulation of conductors are all possible causes of failure, and are points to be borne in mind and looked for during inspection periods. Should moisture be present in any item of equipment it must be thoroughly cleaned, dried out and treated in accordance with the instructions contained in A.P.4343, Vol.1, Sect.12, Chap.2.

41. All connector blocks in junction boxes, panels and on the aircraft structure should be examined at regular intervals for security of assembly and individual connections. This will reduce the development of high resistance conditions to a minimum. Junction boxes and panels should be checked to ensure that they do not contain any loose wires, swarf or other foreign matter likely to cause short circuits.

FAULT LOCATION

42. The first step to speedy fault location is to obtain from the routing chart a thorough knowledge of the nature of the defective circuit. The most common wiring faults fall under two headings, namely open circuits and earth faults. It cannot be over emphasized that the efficient inspection of connector blocks for cleanliness and security of connections should reduce open circuits and high resistance faults to a minimum.

43. When carrying out fault location tests, the following points should be observed:-

(1) Do not pull cables unnecessarily.

(2) Do not disconnect cables at connecting points without a definite object.

(3) When testing for open circuits, use an external supply and a low wattage test lamp.

WARNING . . .
If components are disconnected for any reason, the relevant routing chart should be consulted before any reconnecting is attempted. Many components are connected to two or even three different supply voltages.

FUSE TESTING

44. To facilitate fuse testing on the 28-volt d.c. side of the system during ground

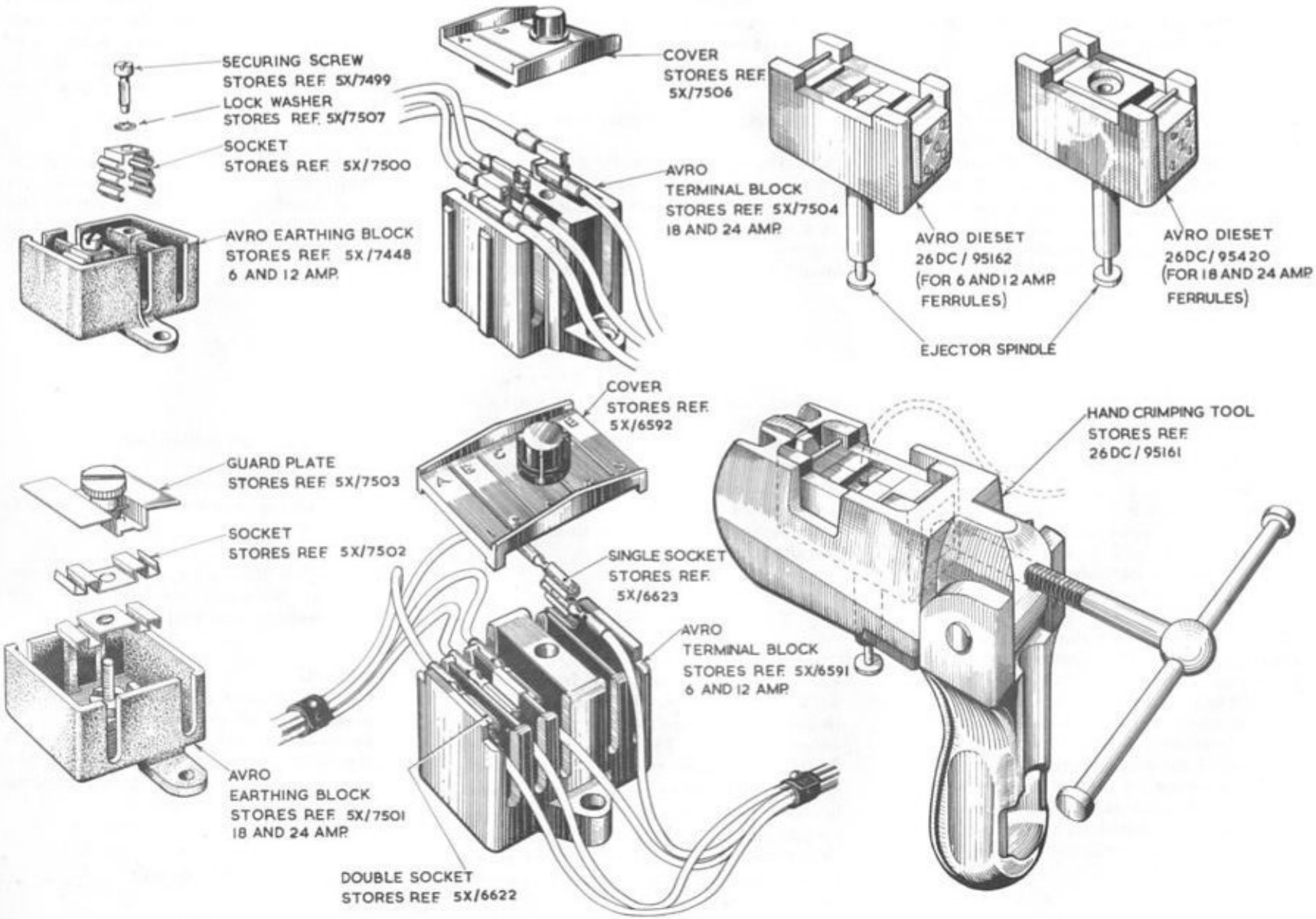

Fig.9 Avro terminal blocks and ferrule crimping

servicing periods, panels 3P and 4P in the crews compartment are each fitted with a test lamp and probe. One side of the test lamp is connected to earth, and the other to the test probe, using a suitable length of Pren cable. When the probe is not in use, it should be stowed in the clip provided at the top of the appropriate panel.

EARTH ASSEMBLY POINTS

45. It is essential that earth contacts of low resistance be maintained. All contact surfaces of connectors, washers and metal structure at earth assembly points must be thoroughly clean. When earth bolts are re-assembled, they must be scraped clean at the point of contact, and after the cables have been secured, the whole assembly is to be painted with blue oil-base paint Spec. D.T.D. 260B.

FERRULE CRIMPING

46. Crimping details for the S.B.A.C. range of ferrules and connectors are contained in A.P.4343C, Vol.1, Sect.25. Details for crimping of the AVRO range of ferrules are outlined in the following paragraphs.

47. Three sizes of AVRO ferrules are available specifically for use with the AVRO lightweight connector blocks namely:-

Ferrule 5X/6621 for 6 amp. cables (identified by a bevelled shoulder).

Ferrule 5X/6620 for 12 amp. cables (identified by a square shoulder).

Ferrule 5X/7509 for 18 - 24 amp. cables (identified by a bevelled shoulder).

Each ferrule is designed to form a close fit on the associated cable, the ferrule body being crimped to the cable conductor and the bucket to the cable insulation.

Crimping tools

48. Crimping of the ferrules to the cables is effected by AVRO dies (Ref.26DC/95162 for the 6 and 12 amp. ferrules, and 26DC/95420 for the 18 - 24 amp. ferrules), which are accommodated in a hand crimping tool (Ref.26DC/95161). Each die is equipped with an ejector spindle which is used to eject the ferrule and cable when the crimping operation is completed. The crimping tool is a modified version of the standard S.B.A.C. tool (Ref.5H/96). The modification takes the form of an enlargement of the slot in the base of the standard tool in order to accommodate the ejector spindle of the AVRO dies. The tool can be used for the crimping of both AVRO and S.B.A.C. ferrules provided that the appropriate die is fitted.

LUG CRIMPING

49. Standard tools of Plessey manufacture are available for the hexagonal crimping of copper and aluminium lugs to Pren and Prenal cables. A hand-crimping tool Ref. 5X/6462, which is supplied complete in a case with a set of dies and keys, is capable of crimping copper lugs up to 50 amp. size, and aluminium lugs up to 35 amp. size.

50. For lugs above the range of the hand tool, a hydraulic crimping press unit (Ref. 3A/3304) is used. This unit is portable and foot operated, thus leaving the hands free for manipulation of the cable and positioning of the lug. Full instructions for the crimping of hexagonal lugs, including certain precautions to be observed will be found in A.P.4343S, Vol. 1, Sect.15. The Plessey crimping tools are dealt with in the same section.

GENERAL

51. The electrical installation of the aircraft provides, as far as practicability allows, for easy and speedy removal of the various electrical panels, and equipment. Where equipment is situated within the structure, removeable access panels are fitted.

52. In order to prevent the occurrence of electrical fires, and possible damage to the aircraft due to live connections coming into contact with the metal structure, it is important that the following precautions be taken prior to the removal of equipment:-

REMOVAL AND ASSEMBLY

(1) Ensure that all power supplies are OFF, and that the fuse or circuit breaker controlling the item being removed has been rendered inoperative.

(2) Insulate and stow all disconnected cables and connectors.

53. Removal instructions for those items of electrical equipment which will require periodical servicing will be found in the respective Chapter for the equipment concerned; major items of equipment such as main panels and junction boxes will not normally require removal at inspection periods.

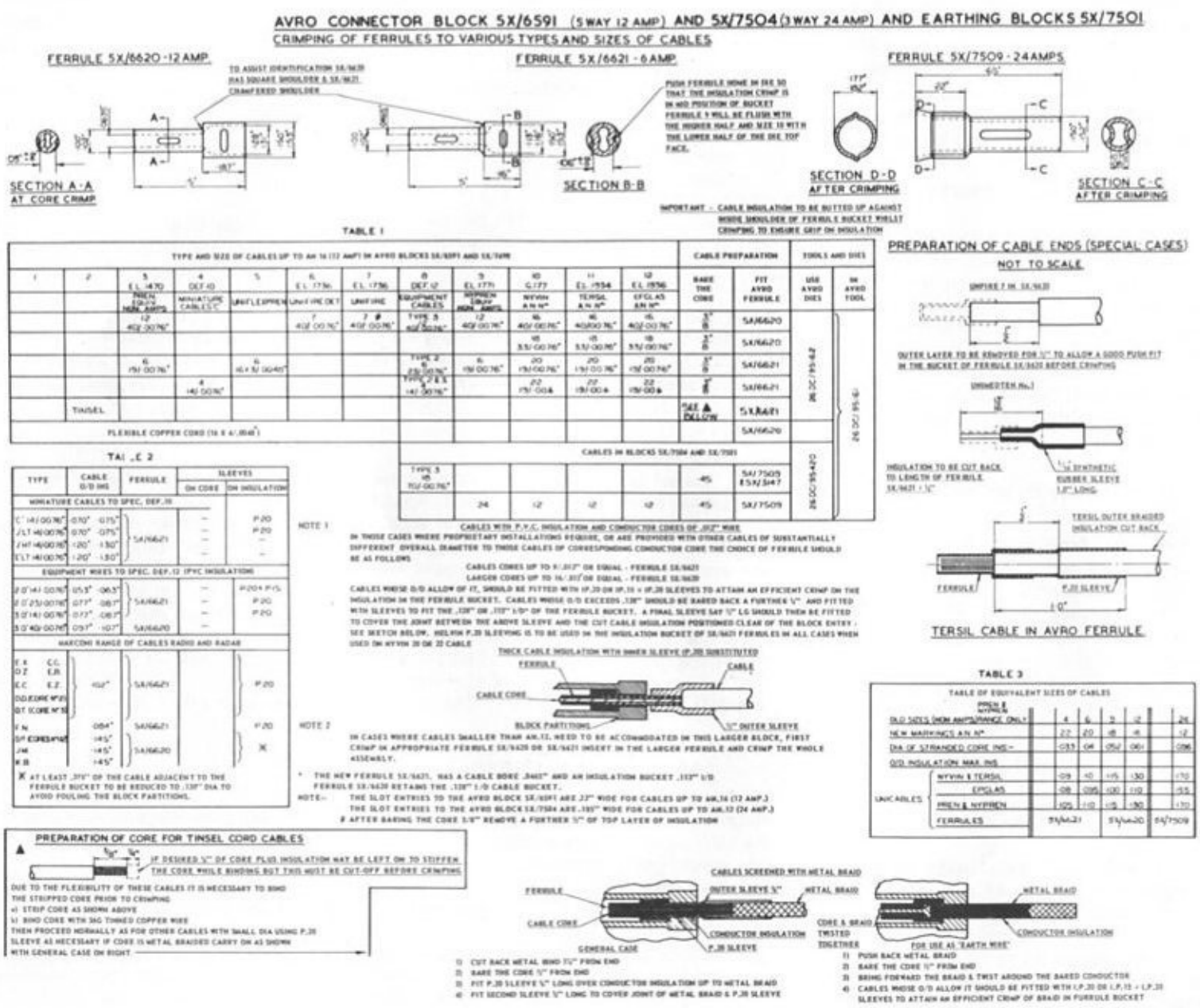

Fig. 10. Avro ferrules - crimping instructions

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