SECTION 5

ELECTRICAL SYSTEM AND INSTRUMENT INSTALLATION

LIST OF CHAPTERS

Note—*A list of contents appears at the beginning of each chapter*

1 Electrical system

2 Instrument installation

Chapter 1. ELECTRICAL INSTALLATION

(Completely revised)

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GENERAL INFORMATION

(Completely revised)

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Introduction

1. This chapter contains descriptive and servicing information relating to the electrical system. It is divided into a number of self-contained groups consisting of descriptive matter, together with illustrations and tables appropriate to the group headings. This group covers the complete installation and describes the wiring system, cable identification and location of equipment. The illustrations included show the location of the main components, each of which is numbered and annotated. The numbered items are listed in a master key, Table 1, which enables them to be easily located. Opposite each listed item is its item number and the figure number of the illustration on which it is shown, together with the group under which it is described and, where possible, the means of access. Also included are tables of fuses and lamp filaments. Theoretical and routeing charts are inserted near the descriptive matter in each group.

DESCRIPTION

Power supplies

2. The electrical installation operates on a 24/28 volt, voltage regulated, single-pole earth return system, d.c. power being supplied by two generators *(Group P)* operating in parallel in conjunction with two 24-volt 25 amp hr lead acid batteries *(pre Mod. 2539)* or two 24-volt 35 amp hr alkaline batteries *(post Mod.2539)*. By means of rotary inverters, power supplies of 400 c/s 3-phase a.c. and 1600 c/s single-phase a.c. are provided for operating the flight instruments and radar equipment respectively.

Wiring system

3. The Plessey system of wiring, using cables and conduits with multi-pole plugs and sockets, is used throughout the aircraft except for a number of cable assemblies which pass through the pressure bulkhead by means of Helvin pressure-tight bungs. Circuit distribution to the many items of equipment is by means 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.

Circuit identification

4. Each circuit has a code reference which is shown on the appropriate theoretical and routeing diagrams. The code consists of a basic alphabetical reference given to the circuit at the fuse or circuit breaker feed point and a suffix number which changes after each switch, relay, or other item of operative equipment in the circuit. These changes, where possible, consist of incremental alterations to the numerical component, i.e. F1 to F2, F11 to F12 etc. Earth returns from components carry similar identification as the earth points to which they are connected. Unipren and uninyvin cables of 6, 12 or 24 amp ratings and equipment wire *(DEF-12-B)*, Types 2, 3 and 4, are used for the general wiring in the aircraft and for internal wiring of distribution and junction boxes. Cable ratings are indicated on the routeing diagrams by a break in the cable line and the insertion of either 6, 12, 24, Q23, Q40 as the case may be. Coloured rubber sleeves fitted at cable terminations throughout the aircraft are used to denote circuit identification; yellow or pink indicate d.c.; green, 1600 c/s single-phase a.c.; red, blue and white, 400 c/s, three-phase a.c. In a.c. circuits the phase reference is the second letter of the circuit identification. For example, in a 1600 c/s circuit having the letter and number reference TG2, the letter 'G' denotes green and subsequently a 1600 c/s circuit. Similarly in the 400 c/s, 3-phase circuits, the second letter in references TR2, TB2, and EW, denotes the red, blue and white phases respectively.

Cable assemblies and junction boxes

5. 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 to be connected. Conduits or cables with the initial letters, N, F, C, or T, are usually installed, respectively, in either the nose, front fuselage, centre fuselage, or rear fuselage. 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, etc.

6. Each lead in a cable assembly fitted with multi-pole plugs or sockets is identified by a rubber sleeve 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 A, the contact pins being represented by heavy dots shown at the termination or intersection 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

General

7. 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 in the instrument, radio and armament systems.

8. 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. Joints in standard type plugs and sockets of less than 37-amp. size are crimped.

Servicing

WARNING

The disconnection of certain cable plugs and sockets results in the earthing circuits between some assemblies and items of equipment being broken. If disconnections are made while the electrical system is 'live' it is possible that backfeeding in the circuits can cause the fire extinguishers to be inadvertently discharged. It is therefore essential that before disconnecting any cables, the BATTERY ISOLATION switch is OFF, or the system otherwise made dead.

9. 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 means of 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 accomodate 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 10 amp. plug pins, socket inserts, and tags etc.

10. To make a stronger joint when crimping the smaller sizes 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 should be cut off before fitting a rubber sleeve over the joint.

11. The servicing of Plessey plugs and sockets calls for special care during dismantling and re-assembly. 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.

12. In the standard type of Plessey socket the contact inserts are secured in the moulding by spring lips 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

13. 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 to 4 and the Type B *(Ref.No.1C/5863)* for sizes 5 to 10.

14. Before mating up multi-pole plugs and sockets it is essential to examine all contacts for the presence of metal swarfe or other foreign matter which could cause shorting. The plug and socket threads must be kept clean and lightly lubricated with silicone compound MS.4 *(Ref.No.33C/9424829)*.

15. The Plessey wiring system is fully described in A.P.4343C, Vol.1, Sect.5, the standard types of plugs and sockets being covered in Chap.1 while the Mk.4 miniature types are dealt with in Chap.8. General information on the servicing of aircraft wiring systems is to be found in A.P.4343, Vol.1, Sect.12, Chap.5.

Cockpit

16. All switches and instruments employed in the control of the aircraft are grouped on panel assemblies arranged round the cockpit. The main items of equipment are carried by the flight, engine, and starboard instrument panels which extend across the cockpit. Above these panels is the coaming panel and below is the engine starter panel. The console, radio, and alighting gear panels, together with the throttle box, are situated at the port side of the pilot's seat, whilst the electrical control panel is fitted on the cabin floor at the starboard side of the pilot's seat.

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 system switches.

Starboard instrument panel

19. The starboard instrument panel is fitted diagonally at the starboard side of the cockpit between the engine instrument panel and frame 3. It carries the miscellaneous instruments, cabin air and fire extinguisher controls.

Coaming panel

20. This panel, mounted above the pilot's instrument panels, provides accommodation for the various dimmer switches, lamps, the emergency and anti-dazzle lamps switches, and the Type E2A emergency compass.

Starter panel

21. The starter panel is situated below the flight instrument panel and carries the engine master, ignition, and starting switches.

Radio panel *(pre Mod.3854)*

22. This panel, located above the console at the port side of the pilot's seat, carries various switches employed in the control of the radio and, on certain aircraft, radar systems.

Radio panel *(post Mod.3854)*

23. This modified panel carries various switches employed in the control of the radio systems and in addition two switches used in the generator control systems.

Throttle box

24. The throttle box, installed forward of the console, carries the engine re-light switches which are integral with the H.P. fuel cock levers.

Alighting gear panel

25. This panel, located between the throttle box and the flight instrument panel, carries the alighting gear master switch, selector switch, position indicator, fuel tank jettison switch, and the flaps control switch and indicator.

Console

26. The console is located to port of the pilot's seat. On the top of the console assembly is a removeable panel on which are mounted the control switches for external lighting, landing lamp, flare bay doors, camera doors, photoflash jettison, and flying control trimmers. Also on the panel are a number of fuses, situated below a small detachable panel.

Control column

27. The right handgrip of the pilot's control column incorporates the tail plane cut-in and trim switches and the V.H.F./U.H.F. PRESS-TO-TRANSMIT switch.

Electrical control panel *(E.C.P.)*

28. The E.C.P. is installed on the cabin floor slightly aft and to starboard of the pilot's seat. Mounted on its forward face are the circuit breakers protecting the fuel pump and cock circuits, while on the aft sloping face are the d.c. voltmeter, generator control switches and field circuit breakers, battery isolation switch, camera services circuit breaker, generator failure warning lights, inverter switches, and radar system control switches. On aircraft post Mod.1783 the generator control switches are not fitted. The aft vertical face of the panel is fitted with a number of circuit breakers which protect the inverter input circuits.

Navigator's station

29. Instruments at the navigator's station mainly comprise radio and radar indicators, and their associated control equipment. Control of the inverters and radar systems is effected from the navigator's switch panel which forms the aft sloping face of the E.C.P. Other items consist of a hatch jettison switch, lighting equipment and oxygen indicators.

Navigator's forward station

30. At this position is the equipment necessary to the navigator for use during the photographic day and night roles, and in addition lighting equipment.

Pressure bulkhead

31. 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 cables 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 the bulkhead by way of Helvin rubber bungs. During servicing that involves removal or re-fitting 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

32. This compartment is situated between

the pressure bulkhead and frame 12, the centre portion of its floor forming the roof of the nose wheel bay. Installed in the compartment are various inverters, 400 c/s distribution box, 1600 c/s distribution box, electronic voltage regulator, and numerous radio and radar components. Access to the compartment is through a hatch in the upper surface of the fuselage.

Starboard equipment compartment

33. 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 and associated equipment. Access to the compartment is through a hinged door in the starboard side of the fuselage.

Main electrical panel *(M.E.P.)*

34. Three sub-assemblies designated, forward, aft, and bus-bar panels comprise the M.E.P. which is located in the starboard equipment compartment. The forward and aft panels are installed on the starboard wall of the nose wheel bay, whilst the bus-bar panel is mounted in an inverted position on the underside of the upper equipment compartment floor. The panels carry the generator control equipment, external power supply plug, and a number of fuses used in the d.c. power supply distribution.

Port equipment compartment

35. This compartment, situated between the pressure bulkhead and frame 12 at the port side of the nose wheel bay, houses the main batteries. Access to the compartment is through a hinged door in the port side of the fuselage.

TABLE 1

Master key to location diagrams

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
D.C. POWER SUPPLY (pre Mod.3854)					
Port generator circuit					
Generator, Type P3	14	12		20	7
Suppressor, Type X3	14	13		20	7
Voltage regulator, Type 23	11	5		21	4
Differential cut-out, Type A	11	3		21	4
Ammeter shunt	11	13		21	4
Control switch	8	19		21	5
Circuit breaker, Type D	11	6		21	4
Power failure warning lamp	8	18		21	5
Test socket—amps	8	2		21	5
Test socket—volts	8	2		21	5
Starboard generator circuit					
Generator, Type P3	15	2		20	4
Suppressor, Type X3	15	1		20	4
Voltage regulator, Type 23	11	5		21	4
Differential cut-out, Type A	11	3	P	21	4
Ammeter shunt	11	13		21	4
Control switch	8	22		21	5
Circuit breaker, Type D	11	6		21	4
Power failure warning lamp	8	24		21	5
Test socket—amps	8	2		21	5
Test socket—volts	8	2		21	5
Battery isolation relay, Type R	11	9		21	4
External supply plug	11	16		21	4
Battery isolation switch	8	20		21	5
Busbar voltmeter	8	21		21	5
Master voltage regulator, Type 32	11	2		21	4
Main batteries	1A	5		20	10
Emergency battery	1A	11		21	5
Emergency lighting battery	1A	17		21	5
Busbar panel	11	7		21	4
M.E.P. fuse blocks	11	8		21	4
Pilot's services circuit breaker	8	26		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
No.1 generator field circuit breaker	8	25	P	21	5
No.2 generator field circuit breaker	8	25	P	21	5
Camera services circuit breaker	8	23	A & B	21	5
D.C. POWER SUPPLY (post Mod.3854)					
Port generator circuit					
Generator, Type 519	16	11		20	7
Voltage regulator	16	12		20	7
Voltage regulator trimmer	12	10		21	4
Field circuit breaker	12	7		21	4
Test socket – volts	12	8		21	4
Over-voltage relay	12	13		21	4
Generator test switch	12	9		21	4
Reverse current circuit breaker	12	19		21	4
Combined cut-out and contactor	12	14		21	4
Off-line switch	3	39		21	5
Generator failure warning lamp	9	17		21	5
Starboard generator circuit			P		
Generator, Type 519	17	2		20	4
Voltage regulator	17	30		20	4
Voltage regulator trimmer	12	2		21	4
Field circuit breaker	12	6		21	4
Test socket – volts	12	4		21	4
Over-voltage relay	12	11		21	4
Generator test switch	12	5		21	4
Reverse current circuit breaker	12	20		21	4
Combined cut-out and contactor	12	12		21	4
Off-line switch	3	39		21	5
Generator failure warning lamp	9	22		21	5
Battery isolation relay, Type R	12	26		21	4
External supply plug	12	28		21	4
Battery isolation switch	9	19		21	5
Busbar voltmeter	9	20		21	5
Main battery	1A	5		20	10
Emergency battery	1A	11		21	5
Emergency lighting battery	1A	17		21	5
Pilot's services circuit breaker	9	18		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
Camera services circuit breaker	9	21	A & B	21	5
Busbar panel	12	15	P	21	4
Heavy current fuses	12	18	P	21	4
M.E.P. fuse blocks	12	1	P	21	4
115-VOLTS, 400 C/S 3-PHASE A.C. POWER SUPPLIES					
No.2 inverter, Type 100B (instruments normal)	1A	13	D	21	5
	7	7	D	21	5
Protective circuit breaker	8	5	D	21	5
	9	7	D	21	5
No.3 inverter, Type RC.8A (instruments standby)	11	15	D	21	4
	12	25	D	21	4
Protective circuit breaker	8	6	D	21	5
	9	6	D	21	5
Emergency instruments supply indicator	3	51	D	21	5
Type 103A inverter (Green satin, post Mod.1025)	10	1	R & S	20	1
Relay, Type K	10	5	R & S	20	1
Magnetic starting switch	10	7	R & S	20	1
Control panel, Type 24	1A	3	R & S	21	7
Control panel, Type 15	1A	4	R & S	21	7
Type 103A inverter (Green satin, post Mod.2706/7)	10	1	R & S	20	1
Relay, Type T1	10	5	R & S	20	1
Magnetic starting switch	10	7	R & S	20	1
Control panel, Type 24	1A	3	R & S	21	7
Control panel, Type 15	1A	4	R & S	21	7
115-VOLTS, 1600 C/S SINGLE PHASE A.C. POWER SUPPLIES (post Mod.1025)					
No.4 inverter, Type 200 (standby)	10	4	R & S	20	1
Protective circuit breaker	9	5	R & S	21	5
Control switch	9	14	R & S	21	5
No.5 inverter, Type 201 (main)	12	23	R & S	21	4
Start switch	9	16	R & S	21	5
Stop switch	9	23	R & S	21	5
Circuit breaker, Type D2	12	27	R & S	21	4
Electronic regulator, Type 2B	10	12	R & S	20	1
No.4/No.5 inverter change-over switch	9	15	R & S	21	5
1600 c/s supply circuit breaker	9	9	R & S	21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
115-VOLTS, 1600 C/S SINGLE-PHASE A.C. POWER SUPPLIES (post Mod.2706/7)					
No.4 inverter, Type 200 (Rebecca)	10	4		20	1
Protective circuit breaker	8	7		21	5
Control switch	8	16		21	5
No.7 inverter, Type 200 (standby)	11	11		21	4
Protective circuit breaker	8	10		21	5
Control switch	8	15		21	5
No.8 inverter, Type 200 (I.F.F. Mk.10)	1A	2		21	7
Protective circuit breaker	8	8		21	5
Control switch	8	12		21	5
1600 c/s supply circuit breaker	8	9		21	5
RADIO AND RADAR SERVICES					
I/C relay panel	6	1		21	5
U.H.F./V.H.F. selector switch (post Mod.3524)	4	17		21	5
Relay, Type T1	11	4		21	4
Marconi radio compass – A.R.I.5877 (S.R.I.M.2263)			R & S		
Control unit, Type 8283	5	4		21	5
I.F.F. Mk.10 – A.R.I.5848					
Master switch	5	3		21	5
1600 c/s distribution box	10	10		20	1
J.B. and switch unit	1	8		21	15
Rear warning – A.R.I.5800 (post Mod.1025)					
Control switch	9	12		21	5
1600 c/s distribution box	10	10		20	1
Rebecca – A.R.I.5610 (post Mod.1025)					
Control switch	9	13		21	5
1600 c/s distribution box	10	10		20	1
Rebecca – A.R.I.5610 (post Mod.2706/7)					
Control switch	8	13		21	5
1600 c/s distribution box	10	10		20	1
Rebecca/I.F.F. Mk.10 change-over switch (post Mod.2706/7)	8	17		21	5
Green satin – A.R.I.5851 (post Mod.1025)					
Start switch	9	25		21	5
Relay, Type K	10	5		20	1
Magnetic start switch	10	7		20	1
Fuse block	10	2		20	1
Equipment switch	9	11		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
Green satin – A.R.I.5851 (post Mod.2706/7)					
Relay No.30, Type S4	11			21	4
Relay No.31, Type S4	11			21	4
Relay No.31/1, Type S4	11			21	4
Start switch	8	29	R & S	21	5
Relay, Type T1	10	5		20	1
Magnetic start switch	10	7		20	1
Equipment switch	8	11		21	5
Relay, Type S4 and fuse block	10	2		20	1
FUEL PUMPS AND COCKS (pre and post Mod.2713)					
No.5 tank (port)					
Fuel pump	13	7		21	19
Pump suppressor	13	7		21	19
Pump circuit breaker	8	40		21	5
	9	36		21	5
Cock actuator	13	7		21	19
Cock circuit breaker	8	39		21	5
	9	35		21	5
Pump and cock switch	3	75		21	5
No.5 tank (starboard)					
Fuel pump	13	11		21	19
Pump suppressor	13	11		21	19
Pump circuit breaker	8	35		21	5
	9	28	Q	21	5
Cock actuator	13	11		21	19
Cock circuit breaker	8	34		21	5
	9	29		21	5
Pump and cock switch	3	69		21	5
No.6 belly tank (port)					
Fuel pump	1A	25		21	13
Pump suppressor	1A	26		21	13
Pump circuit breaker	8	33		21	5
	9	32		21	5
Cock actuator	1A	26		21	13
Cock circuit breaker	8	38		21	5
	9	33		21	5
Pump and cock switch	3	74		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
No.6 belly tank (starboard)					
Fuel pump	2	6		21	13
Pump suppressor	2	5		21	13
Pump circuit breaker	8	32		21	5
	9	27		21	5
Cock actuator	2	5		21	13
Cock circuit breaker	8	31		21	5
	9	34		21	5
Pump and cock switch	3	64		21	5
Fuel transfer (top to No.6 belly tank)			Q		
Cock actuator	2	4		21	13
Cock circuit breaker	8	36		21	5
	9	30		21	5
Cock switch	3	73		21	5
Fuel pump test switches	8	4		21	5
	9	4		21	5
Fuel pump ammeter test socket	8	4		21	5
	9	4		21	5
ENGINE SERVICES					
Port engine					
H.E. ignition units	14	15		20	7
	16	14		20	7
Time delay switch unit	1A	12		21	5
Start switch	3	81		21	5
Ignition switch	3	80		21	5
Relight switch	3	33		21	5
Fuel pump isolation switch	3	5		21	5
Fuel pump isolation solenoid	14	4		21	8
	16	6		21	8
Fuel pressure warning resistor unit	8	37		21	5
	9	31	J & K	21	5
Starboard engine					
H.E. ignition units	15	32		20	4
	17	1		20	4
Time delay switch unit	1A	15		21	5
Start switch	3	78		21	5
Ignition switch	3	79		21	5
Relight switch	3	33		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
Fuel pump isolation switch	3	5	J & K	21	5
Fuel pump isolation solenoid	15	11		21	3
	17	10		21	3
Fuel pressure warning resistor unit	8	37		21	5
	9	31		21	5
Master starting switch (port)	3	83		21	5
Master starting switch (starboard)	3	82		21	5
FIRE EXTINGUISHER SYSTEM			W		
Fuselage circuit					
Port inertia switch	1A	24		20	10
Starboard inertia switch	11	1		21	4
Relay, Type S3	10	11		20	1
Fire extinguisher	1	4		21	15
Port engine circuit					
Resetting fire detectors	14	3,9,21		21	8
Fire extinguisher	14	16		21	11
Indicator lamp	4	14		21	5
Switch	4	13		21	5
Starboard engine circuit					
Resetting fire detectors	15	6,12,26		21	3
Fire extinguisher	15	31		21	14
Indicator lamp	4	16		21	5
Switch	4	15		21	5
FIRE EXTINGUISHER SYSTEM (post Mod.2340)					
Fuselage circuit					
Port inertia switch	1A	24		20	10
Starboard inertia switch	12	3		21	4
No.1 crash relay	12	22		21	4
No.2 crash relay	12	24		21	4
Fire extinguisher	1	4		21	15
Port engine circuit					
Resetting fire detectors	16	4,5,10,22		21	8
Fire extinguisher	16	17		21	11
Switch/indicator unit	4	6		21	5
Starboard engine circuit					
Resetting fire detectors	17	5,11,24		21	3

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
Fire extinguisher	17	29		21	14
Switch/indicator unit	4	8		21	5
Engine fire indicator test switch	4	5		21	5
EXPLOSION SUPPRESSION SYSTEM					
Forward crash trip element (port)	1A	20		21	5
Forward crash trip element (starboard)	2	9		21	5
Rear crash trip element (port)	1	6		21	15
Rear crash trip element (starboard)	2A	6		21	15
Crash trip relay box, Type C510	10	6		20	1
Relay, Type 20B. No.2	13	13		21	19
Press-to-test warning lamp	13	4		21	19
Safety ohmmeter test socket	13	2		21	19
FLIGHT-RESET-TEST switch	13	5		21	19
Indicator fuze	13	14		21	19
Suppression units and detonators	2	7		21	13
CANOPY AND HATCH JETTISON					
Canopy jettison					
Safety switch	3	28	W	21	5
Jettison switch	3	29		21	5
Jettison switch unit	1A	18		21	5
	3	32		21	5
Resistor boxes	5	9		21	5
	6	5		21	5
Explosive collar	1A	19		21	5
Hatch jettison					
Navigator's jettison switch	5	1		21	5
Master switch	5	1		21	5
Resistor boxes	5	2		21	5
	5	7		21	5
	6	2		21	5
	10	8		20	1
WING TIP FUEL TANK JETTISON					
Jettison switch	3	9		21	5
Detonators (port)	14	26,29		21	9
	16	28,31		21	9

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
Resistors (port)	14	23,27	W	21	9
	16	24,29		21	9
Detonators (starboard)	15	17,20		21	1
	17	15,18		21	1
Resistors (starboard)	15	19,24		21	1
	17	17,22		21	1
FLYING SERVICES					
Alighting gear control					
Master switch	3	1		21	5
Selector switch	3	42		21	5
Valve actuator	13	6		21	19
Position indicator	3	3		21	5
Throttle microswitch	1A	10		21	5
Port main wheel					
'UP' microswitch	14	19	G	21	11
	16	20		21	11
'DOWN' microswitch	14	17		21	11
	16	18		21	11
Starboard main wheel					
'UP' microswitch	15	28		21	14
	17	26		21	14
'DOWN' microswitch	15	29		21	14
	17	27		21	14
Nose wheel					
'UP' microswitch	1A	23		21	6
'DOWN' microswitch	1A	22		21	6
Door microswitch	1A	21		21	6
Tail plane control			C		
Cut-in switch	3	72		21	5
Trim switch	3	71		21	5
Tail plane actuator	1	9		21	18
Reversing relay	2A	9		21	15
Isolating relay	2A	3		21	15
Limit microswitches	2A	4		21	18
Rudder trim					
Control switch	3	4		21	5
Actuator	1	2		20	5

TABLE 1 – *continued*

Service	Location Fig.	Item	Group	Access Fig.	Item
Aileron trim					
Control switch	3	6		21	5
Actuator	1A	16		21	5
Flaps control					
Selector switch	3	2		21	5
Actuator	13	10		21	19
Air brakes			C		
Control switch	3	70		21	5
Actuator	13	8		21	19
Microswitches	15	25		21	2
	17	23		21	2
CABIN AIR SYSTEM					
Cabin air control (pre Mod.1005)					
Heating control switch	4	12		21	5
Mixing valve actuator	14	10		20	7
Cabin air control (post Mod.1005)					
Heating control switch	4	4		21	5
Mixing valve actuator	14	10		20	7
	16	15		20	7
Port engine air control switch	4	3		21	5
Starboard engine air control switch	4	2		21	5
Engine air gate valve actuator (port)	14	6		21	8
	16	15		21	8
Engine air gate valve actuator (starboard)	15	3		21	3
	17	3	H	21	3
Cabin air warning					
Override switch	4	1,11		21	5
Warning horn	6	9		21	5
HEATER CIRCUITS					
Pressure head heater	1A	14		21	5
Control switch	3	15		21	5
Vent valve heater (inoperative)					
Control switch	3	14		21	5
D.V. window					
Heater	3	38		21	5
Control switch	3	16		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
Canopy de-misting					
Blower motor	1A	8	H	21	5
Control switch	3	11	H	21	5
LIGHTING					
External lighting					
Master switch	3	25		21	5
Navigation lamps switch	3	24		21	5
Navigation lamp (port main plane)	14	30		20	9
	16	32		20	9
Navigation lamp (starboard main plane)	15	16		20	2
	17	14		20	2
Navigation lamp (upper tail)	1	1		20	6
Navigation lamp (lower tail)	2A	10		21	17
Taxying lamp (port main plane)	14	31		20	9
	16	33		20	9
Taxying lamp (starboard main plane)	15	15		20	2
	17	13		20	2
Taxying lamps switch	3	23		21	5
Downward identification lamp	1	7		21	16
Morse switch	3	19		21	5
Steady switch	3	21		21	5
Landing lamp	14	22		21	10
	16	23	L	21	10
Landing lamp switch	3	20		21	5
Anti-collision lamps switch	3	26		21	5
Anti-collision lamp (upper)	2A	2		21	15
Anti-collision lamp (lower)	1A	27		21	13
Internal lighting					
Pilot's station					
Console red lamps dimmer switch	3	31		21	5
Console red lamps	3	22,27,30,34		21	5
Red lamps dimmer switch (port)	3	35		21	5
Red lamps (port)	3	41,43,44,54		21	5
U/V lamps dimmer switch (port)	3	46		21	5
U/V lamps (port)	3	40,47		21	5
Red lamps dimmer switch (starboard)	3	56		21	5
Red lamps (starboard)	3	59,63,67		21	5
E2A compass lamp	3	55		21	5

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
U/V lamps dimmer switch (starboard)	3	58		21	5
U/V lamps (starboard)	3	57,66		21	5
Emergency lamps switch	3	36		21	5
Emergency lamp (port)	3	48		21	5
Emergency lamp (starboard)	3	61		21	5
Anti-dazzle lamps switch	3	50		21	5
Emergency lamps battery	1A	17		21	5
Red lamps dimmer switch (Mk.22D altimeter)	3	52		21	5
Anti-dazzle lamp (port)	3	45		21	5
Anti-dazzle lamp (starboard)	3	60		21	5
Pillar lamps (starboard instrument panel)	4	7,9,10,18		21	5
Navigator's rear station lighting					
Mk.1A flood lamp	5	6		21	5
Chartboard lamp (port)	5	8		21	5
Chartboard lamp dimmer switch (port)	5	5		21	5
Chartboard lamp (starboard)	6	3	L	21	5
Chartboard lamp dimmer switch (starboard)	6	4		21	5
Anti-dazzle lamps switch	5	10		21	5
Navigator's forward station lighting					
Mk.1A floodlamp	7	3		21	5
Chartboard lamp	7	2		21	5
Chartboard lamp dimmer switch	7	1		21	5
White lamp (port)	7	6		21	5
White lamp (starboard) (post Mod.3301)	7	4		21	5
White lamps dimmer switch	7	5		21	5
Servicing lamps					
Mk.1A floodlamp	11	10		21	4
	12	21		21	4
Mk.1A floodlamp	2	3		21	7
Mk.1A floodlamp	2A	1		21	15
MISCELLANEOUS EQUIPMENT					
Fatigue meter	13	18	D	21	19

TABLE 1 – *continued*

Service	Location Fig.	Location Item	Group	Access Fig.	Access Item
ARMAMENT AND PHOTOGRAPHIC					
Camera and photoflash control equipment – see Group A & B					
Flare doors installation					
Valve actuator	13	12		21	19
Control switch	3	8		21	5
Position indicators	3	7		21	5
Microswitches (open)	13	1,17	A & B	21	19
Microswitches (closed)	13	1, 17		21	19
Camera doors installation					
Valve actuator	13	9		21	19
Control switch	3	12		21	5
Position indicators	3	10		21	5
Photoflash jettison switch	3	18		21	5
JUNCTION BOXES					
J.B.1	1A	1		21	19
J.B.3	13	15		21	19
J.B.4	2	2		21	7
J.B.5	2A	5		21	15
J.B.6	2A	8		21	15
J.B.7	14	14		20	7
	16	13		20	7
J.B.8	15	33		20	4
	17	31		20	4
J.B.9	14	20		21	12
	16	21		21	12
J.B.10	15	27		21	20
	17	25		21	20
J.B.11	14	1		20	8
	16	1		20	8
J.B.12	15	5		20	3
	17	4		20	3
J.B.13	1A	9		21	5
J.B.14	6	8		21	5
DISTRIBUTION BOXES					
1600 c/s distribution box	10	10		20	1
400 c/s distribution box	10	11		20	1
400 c/s fuse box	6	6		21	5

TABLE 2

Fuse Numbers, Ratings and Location

Service	Fuse No.	Rating (amps.)	Circuit Ref.	Location
Main battery relay, Type R	1	◀ 10 ▶	P91	
Fire extinguishers	2	20	X1	
Photoflash jettison	3	20	B4	
Spare	4	—	—	
◀ No.1 generator volts test	5	5	P51	
No.1 generator amp. test	6	5	P71	
No.2 generator volts test	7	5	P61	
No.2 generator amp. test ▶	8	5	P81	
Voltmeter (bus-bar P10)	9	5	V +	
V.H.F. No.1	10	20	R1	
V.H.F. No.2	11	20	R2	M.E.P.
◀ Mk.1A equipment lamps	12	5	LL4	(pre Mod.3854)
No.5 inverter control (Inoperative post Mod.2707)	13	5	M58	
No.1 generator failure warning	14	5	W1	
No.2 generator failure warning	15	◀ 10	W2	
Explosion suppression (post Mod.2000)	16	10 ▶	XX94	
Canopy and hatch jettison (post Mod.450)	17	60	X5	
Canopy and hatch jettison (post Mod.450) ▶	18	60	X6	
Spare	19	—	—	
Spare	20	—	—	
No.1 crash relay	1	10	P91	
Fire extinguishers	2	20	X1	
Photoflash jettison	3	20	B4	
No.1 crash relay	4	10	X9	
Spare	5	—	—	M.E.P.
Spare	6	—	—	(post Mod.3854)
Spare	7	—	—	
Spare	8	—	—	
◀ Voltmeter (busbar P10) (post Mod.1783)	9	5	V +	
V.H.F. No.1 (post Mod.1783)	10	20	R1	
V.H.F. No.2 (post Mod.1783)	11	20	R2	
Mk.1A equipment lamps (post Mod.1783)	12	5	LL4	
No.5 inverter	13	◀ 5	M51 ▶	
No.1 generator failure warning	14	10	W1	
No.2 generator failure warning ▶	15	10	W2	
Spare	16	—	—	

TABLE 2 – *continued*

Service	Fuse No.	Rating (amps.)	Circuit Ref.	Location
◀ Canopy and hatch jettison	17	40	X5	M.E.P. (post Mod.3854
Canopy and hatch jettison ▶	18	40	X6	
E.C.P. supply	19	115	P10	
E.C.P. supply (pilot's services circuit breaker)	20	115	P10	
Tail plane control	21	5	CC7	E.C.P.
Navigator's periscope	22	5	H8	
Photoflash release	23	10	B1	
Flare door control	24	10	B3	
Tail plane control (post Mod.2159)	25	5	C2	
Tail plane control (post Mod.3872)	25	5	CC5	
Tail plane control – position indicator	26	5	C7	
Flap control	27	5	C3	
Flap control – position indicator	28	5	C4	
Rudder trim control	29	10	C5	
Rudder trim indicator	30	5	C6	
Air brakes control	31	10	C9	
Aileron trim control	32	10	CC1	
Aileron trim control – position indicator	33	5	CC2	
◀ Anti-dazzle lamps (post Mod.2359) ▶	34	5	L10	
External air thermometer	35	5	F2	
A.P.I. and A.M.U.	36	5	F7	
Cabin air control (pre Mod.1005)	37	5	H1	
Cabin heat control switch (post Mod.1005)	37	5	H1	
Cabin air control – position indicator	38	5	H2	
Cabin air warning	39	5	H3	
Cabin de-misting	40	5	H7	
Port engine starting	41	10	J1	
Port engine pump isolation valve	42	5	J3	
Port engine ignition	43	20	J5	
No.7 inverter (post Mod.2706/7)	44	5	MM73	
Starboard engine starting	45	10	J2	
Starboard engine pump isolation valve	46	5	J4	
Starboard engine ignition	47	20	J6	
◀ Flashes gone indicator (CM/MALTA/9)	48	5	M58 ▶	

TABLE 2 – *continued*

Service	Fuse No.	Rating (amps.)	Circuit Ref.	Location
Cabin air control – port engine (post Mod.1005)	49	5	HH1	E.C.P.
Cabin air control – starboard engine (post Mod.1005)	50	5	HH2	
Camera doors control	51	◀ 10 ▶	K3	
Camera doors indicator	52	5	K4	
Pilot's instrument lighting (Red)	53	5	L5	
Pilot's instrument lighting (U/V)	54	5	L6	
Nose and console lighting	55	5	L7	
Navigator's station lighting	56	5	L9	
Oxygen warning	57	◀ 5	W6	
Oxygen warning	58	5 ▶	W5	
Spare	59	–	–	
◀ Inverter No.103 control	60	5	MM6	
Exhaust gas thermometers	61	5	Q5	
Fuel contents gauges	62	5	Q7	
I/C supply	63	5	R3	
V.H.F. changeover No.1/No.2	64	5	R4	
I.F.F. Mk.10 (post Mod.1436)	65	5	S1	
P-to-T relay (post S.R.I.M.1436)	66	◀ 5	R5 ▶	
Alighting gear control	67	10	U1	
Alighting gear indicator (post Mod.3580)	68	◀ 7.5 ▶	U2	
Fuel pressure warning (port)	69	5	W3	
Fuel pressure warning (stbd)	70	5	W4	
Fire extinguisher (port engine)	71	5	X1P	
Fire extinguisher (stbd engine)	72	5	X1S	
Spare	73	–	–	
Fire warning (stbd engine)	74	5	X4	
Fire warning (port engine)	75	5	X3	
Fuel tank jettison	76	10	Y7	
Instrument supplies	77	10	M8	
Instrument supplies	78	10	M7	
◀ Inverters No.3/No.5 control (pre Mod.2706/7) ▶ ▶◀	79	◀ 5 ▶	M34	
		–	–	
Spare	80	–	–	
◀ Inverter No.4 control	81	5	M43	
Inverter No.8 control (post Mod.2706/7) ▶	82	5	MM8	
Turn-and-slip indicator	83	◀ 5	F4	
Turn-and-slip indicator	84	5 ▶	F5	

TABLE 2 – *continued*

Service	Fuse No.	Rating (amps.)	Circuit Ref.	Location
◀ Turn-and-slip indicator (emergency supply)	89	5	FX4	Console Jettison Unit
Spare	90			
Spare	91	–	–	
Spare	92	–	–	
Pressure head heater	93	10	H4	
Fuel vent valve heater (not used)	94	10	H5	
D/V window panel heater	95	10	H6	Console
Landing lamp control	96	5	L3	
Navigation lamps	97	5	L1	
Identification lamp	98	5	LL1	
Taxying lamps	99	10	L2	
Landing lamp	100	20	L4	
Oil pressure gauge (port)	101	5	Q3	
Spare	102	–	–	
Oil pressure gauge (stbd)	103	5	Q4	
Spare	104	–	–	
Electronic regulator blower (Inoperative post Mod.2707)	105	5	NB1	
Waveform generator blower (post Mod.1025)	106	5	SB5	
Rear warning (Inoperative post Mod.2707)	106	5	SB5	
Electronic regulator blower (Inoperative post Mod.2707)	107	5	NR1	
Waveform generator blower (post Mod.1025)	108	5	SR5	
Rear warning (Inoperative post Mod.2707)	108	5	SR5	400 c/s
G.M4B compass	109	5	FR3	Dist. box
Pilot's altimeter amplifier (post Mod.3898)	110	5	FR9	
Horizon gyro unit	111	5	FR6	
Phase failure indicator (post Mod.4316)	112	5	N86 (Red)	
G.M4B compass	113	5	FB3	
Nav's altimeter vibrator (post Mod.3954)	114	5	FB9	
Horizon gyro unit	115	5	FB6	
Phase failure indicator (post Mod.4316)	116	5	N86 (Yellow)	
Not used	117	–	–	
G.P.I. Mk.4A	118	5	F8	
Spare	119	–	–	
G.M4B compass	120	5	F3	
Photographic sight (post Mod.1406)	121	5	BR6	▶

TABLE 2 – *continued*

Service		Fuse No.	Rating (amps.)	Circuit Ref.	Location
◀ Spare		122	–	–	
Spare		123	–	–	
Not used		124	–	–	400 c/s
Photographic sight (post Mod.1406)		125	5	BB6	Dist. box
Spare		126	–	–	
Spare		127	–	–	
Not used		128	–	–	
Gee-H (Inoperative post Mod.2707)		129	5	S3	
Rebecca (Alternative to fuse 144)		130	5	S4	
Rear warning (Inoperative post Mod.2707)		131	5	S5	
Spare		132	–	–	
Gee-H (Inoperative post Mod.2707)		133	10	SG3	
Rebecca (Alternative to fuse 139)		134	5	SG4	1600 c/s
Rear warning (Inoperative post Mod.2707)		135	5	SG5	Dist. box
Spare		136	–	–	
I.F.F. Mk.10		137	5	SG1	
Tail plane control		138	60	C2	M.E.P.
Rebecca (Alternative to fuse 130)		144	5	S4	
Drift and tilt control		145	5	KS2	
F49		146	10	KS1	
Photoflash release		147	5	KN3	
FX89 camera (pre Mod.2172)		148	10	–	Camera
FX89 camera (pre Mod.2172)		149	10	–	Dist. panel
F52 camera control		150	5	KD7	
Photographic sight (post Mod.1406)		151	5	B6	
T4 sighting head control (post Mod.3301)		152	5	B7	
Spare		153	–	–	
Spare (post Mod.3854)		154	–	–	
Explosion suppression – No.6 belly tank (post Mod.3854)		155	5	XX94	
Spare	Applicable	156	–	–	
Spare	to two	157	–	–	M.E.P.
Spare (post Mod.3854)	aircraft only	158	–	–	
Spare		159	–	–	
Spare		160	–	–	
No.2 volts test socket (post Mod.3854)		161	5	P49	
No.2 over-voltage relay (post Mod.3854)		162	10	P21	
No.2 off line switch (post Mod.3854)		163	10	P25	
Spare (post Mod.3854)		164	–	–	▶

TABLE 2 – *continued*

Service		Fuse No.	Rating (amp.)	Circuit Ref.	Location
◀ No.1 volts test socket (post Mod.3854)	Applicable to two aircraft only	165	5	P32	M.E.P.
No.1 over-voltage relay (post Mod.3854)		166	10	P11	
No.1 off line switch (post Mod.3854)		167	10	P15	
Green satin inverter (post Mod.1783)		168	115	M6	
Spare (post Mod.1783)		169	–	–	
Tail trim (post Mod.1783)		170	60	C11	
Green Satin (post Mod.1025)		171	5	LM (Red)	
Green Satin (post Mod.1025)		172	5	LM (Blue)	
Tail trim (post Mod.1783)		173	60	C12	
Spare (post Mod.1783)		174	–	–	
U.H.F. D.C. supply (post Mod.3578)		175	40	R6	
Green Satin (post Mod.1025)		176	5	LN/A (Red)	
Green Satin (post Mod.1025)		177	5	LN/A (Yellow)	
Green Satin (post Mod.1025)		178	5	LN/A (Blue)	
Spare		179	–	–	
Spare (post Mod.3854)		180	–	–	
Spare		181	–	–	
Spare		182	–	–	
F89 camera, port (post Mod.2172)		183	5	KN7	Camera
F89 camera, stbd. (post Mod.2172)		184	5	KN6	
F89 control (post Mod.2172)		185	5	KN1	
F89 control (post Mod.2172)		186	5	KN2	
Green Satin ground start (post Mod.2706)		200	5	P94A	M.E.P.
No.6 inverter interlock (post Mod.2706)		201	5	MM69	
No.6 inverter interlock (post Mod.2706)		202	5	MM68	
Spare (post Mod.2706)		203	–	–	
Green Satin (post Mod.2310)		207	10	F50F (Red)	Equipment Bay
Green Satin (post Mod.2310)		208	10	F50F (Green)	
Fuel pumps and cocks (post Mod.2713)		213	5	Z11	E.C.P.
Fuel pumps and cocks (post Mod.2713)		214	5	Z21	
Fuel pumps and cocks (post Mod.2713)		215	5	Z31	
Fuel pumps and cocks (post Mod.2713)		216	5	Z41	
T3/T4 bombsight gyro control (post Mod.3301)		217	5	B38	
Fatigue meter (post Mod.3580)		218	5	U29	
T3/T4 bombsight collimator light (post Mod.3301)		221	5	LL5	
U.H.F. – D.C. control (post Mod.3524)		222	5	RR6	
Radio compass (post S.R.I.M. 2265)		223	5		
Flashing anti-collision lamps (post Mod.3353)		229	5	LL9	Pilot's console
U.H.F. supply (post Mod.3524)		230	40	R6	M.E.P. ▶

TABLE 3

Lamp filaments, reference and location

Service	Location	Ref.No.	No.off	Voltage	Watts
PILOT'S COCKPIT LIGHTING					
Red lamps	Cockpit coaming	5L/9951283	8	28	3.5
U/V lamps	Cockpit coaming	5L/9952261	4	12	7.0
E2A compass lamp	Cockpit coaming	5L/9959211	1	28	2.4
Anti-dazzle lamps	Cockpit coaming	5L/9951282	2	28	12.0
Altimeter red lamps	Main instrument panel	5L/9959118	2	28	0.04
Console lamps	Port cockpit	5L/9951283	4	28	3.5
Pillar lamps	Starboard instrument panel	5L/9959118	2	28	0.04
Emergency lamps (amber)	Cockpit coaming	5L/9951130	2	2.5	0.75
Alighting gear indicator	Port cockpit	5L/9951286	9	28	2.5
Power failure warning lamps	E.C.P.	5L/9951273	2	28	3.5
Fuel pressure warning lamps	Engine instrument panel	5L/9951110	2	6	0.24
Engine fire warning lamps	Starboard instrument panel	5L/9951284	2	28	3.5
NAVIGATOR'S STATION LIGHTING					
Chart-board lamp, Type E	Port of navigator's station	5L/9953273	1	28	18
Chart-board lamp, Type E	Starboard of navigator's station	5L/9953273	1	28	18
Cockpit lamp Mk.1A	Port of navigator's station	5L/9953271	1	28	7
NOSE STATION LIGHTING					
Chart-board lamp, Type E	Port nose roof	5L/9953273	1	28	18
Mk.1A lamp	Nose roof	5L/9953271	1	28	7
Cockpit lamp Mk.3	Camera control panel	5L/9953271	1	28	7
Cockpit lamp Mk.3	Starboard nose roof	5L/9953271	1	28	7
Camera control panel warning lamps	Camera control panel	5L/9951273	6	28	3.5
SERVICING LIGHTING					
Inspection lamp	Starboard of navigator's station	5L/9953271	1	28	7
Mk.1A lamp	Starboard equipment compartment	5L/9953271	1	28	7
Mk.1A lamp	Forward camera bay	5L/9953271	1	28	7
Mk.1A lamp	Flare bay	5L/9953271	2	28	7
Mk.1A lamp	Centre camera bay	5L/9953271	2	28	7
Mk.1A lamp	Rear camera bay	5L/9953271	1	28	7
NAVIGATION LIGHTING					
Wing-tip lamps	Wing-tips port and starboard	5L/9952431	2	28	24
Tail lamps	Above and below tail	5L/9952276	2	28	10
Identification lamps	Underside rear fuselage	5L/9952604	1	28	80
Taxying lamps	Wing-tips port and starboard	5L/9952511	2	28	60
Landing lamp	Underside port wing	5L/9954717	1	28	240
Anti-collision lamps	Above and below fuselage	5L/9952445	2	28	40

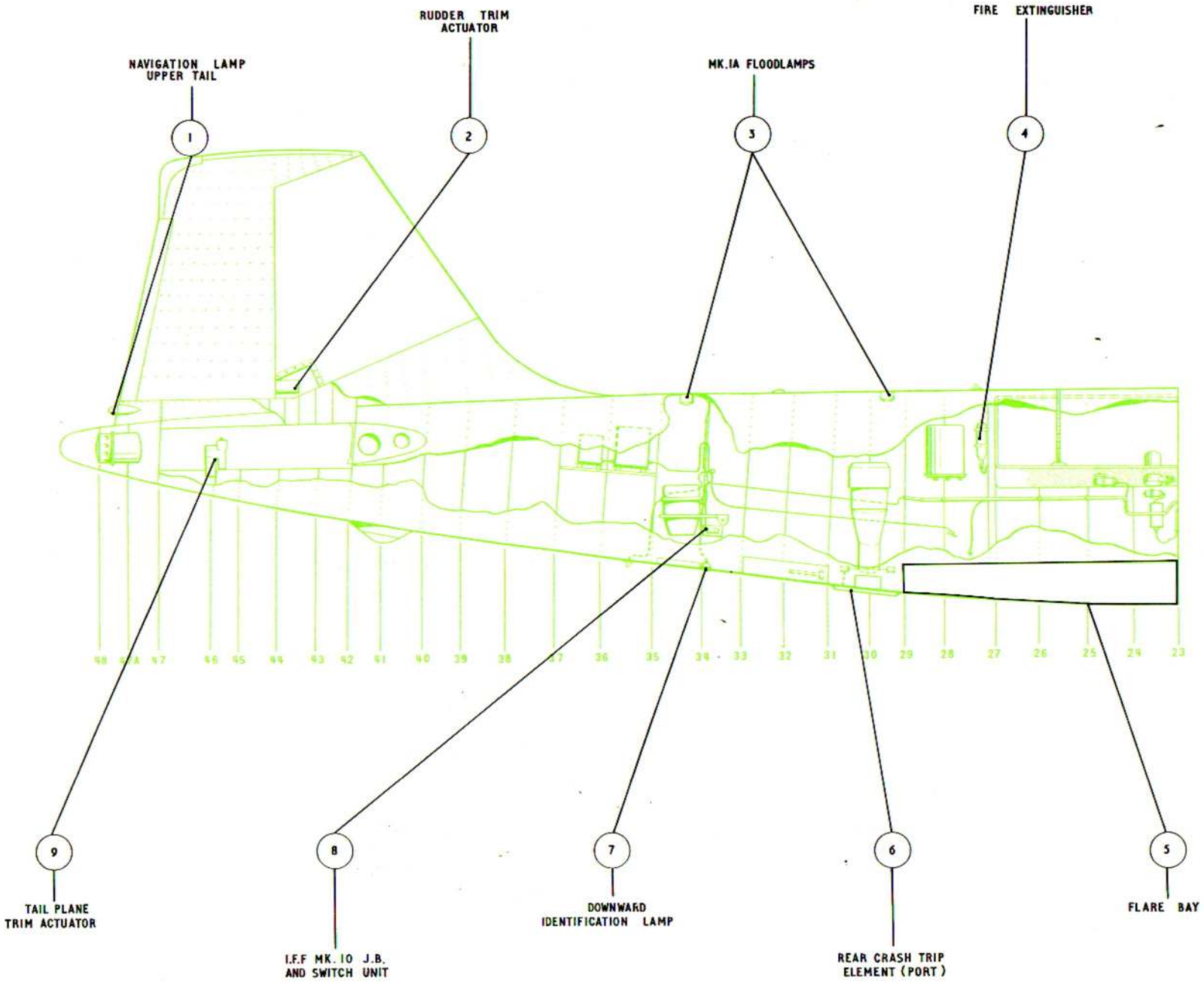


Fig.1. Electrical installation – port fuselage

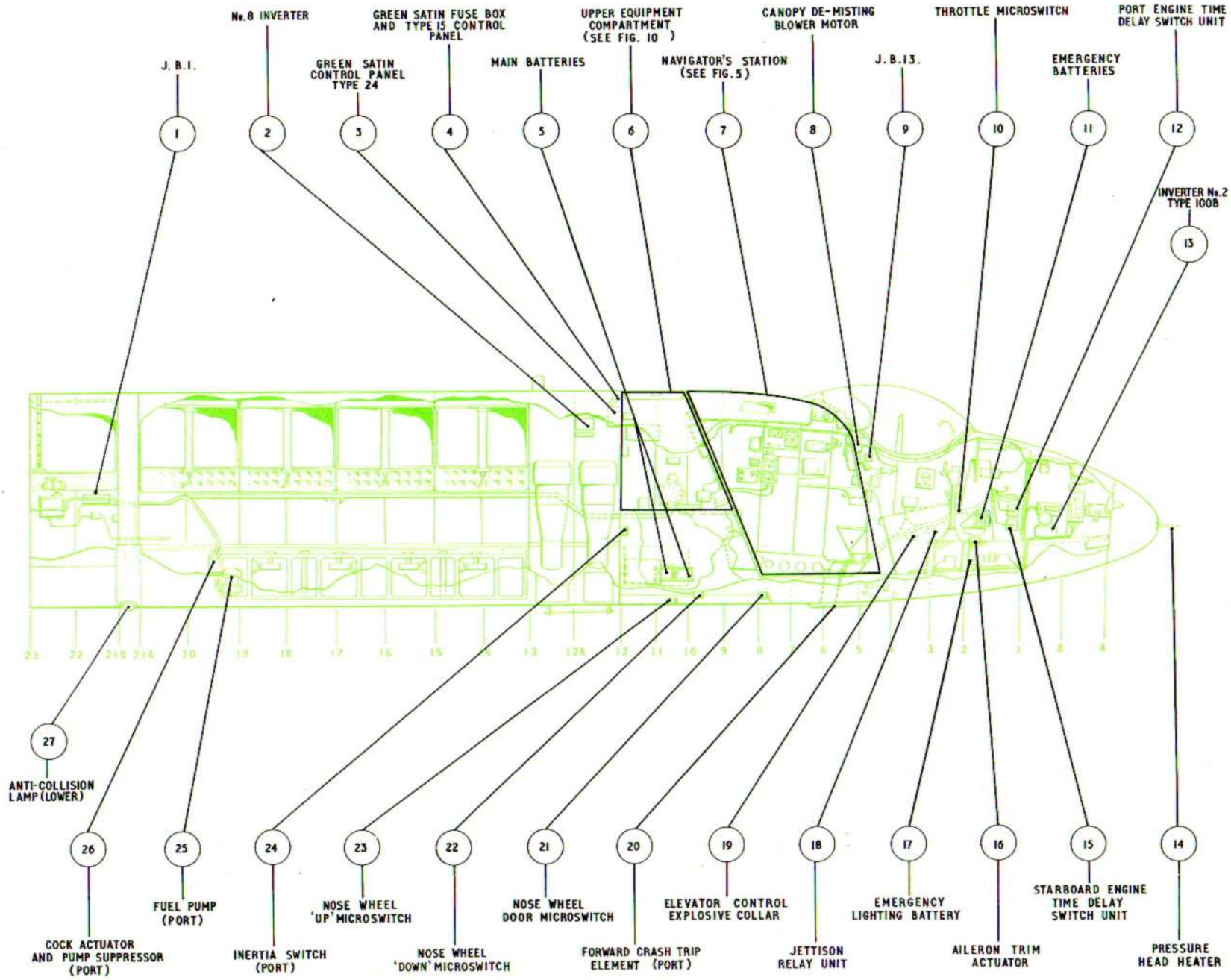


Fig.1A. Electrical installation – port fuselage

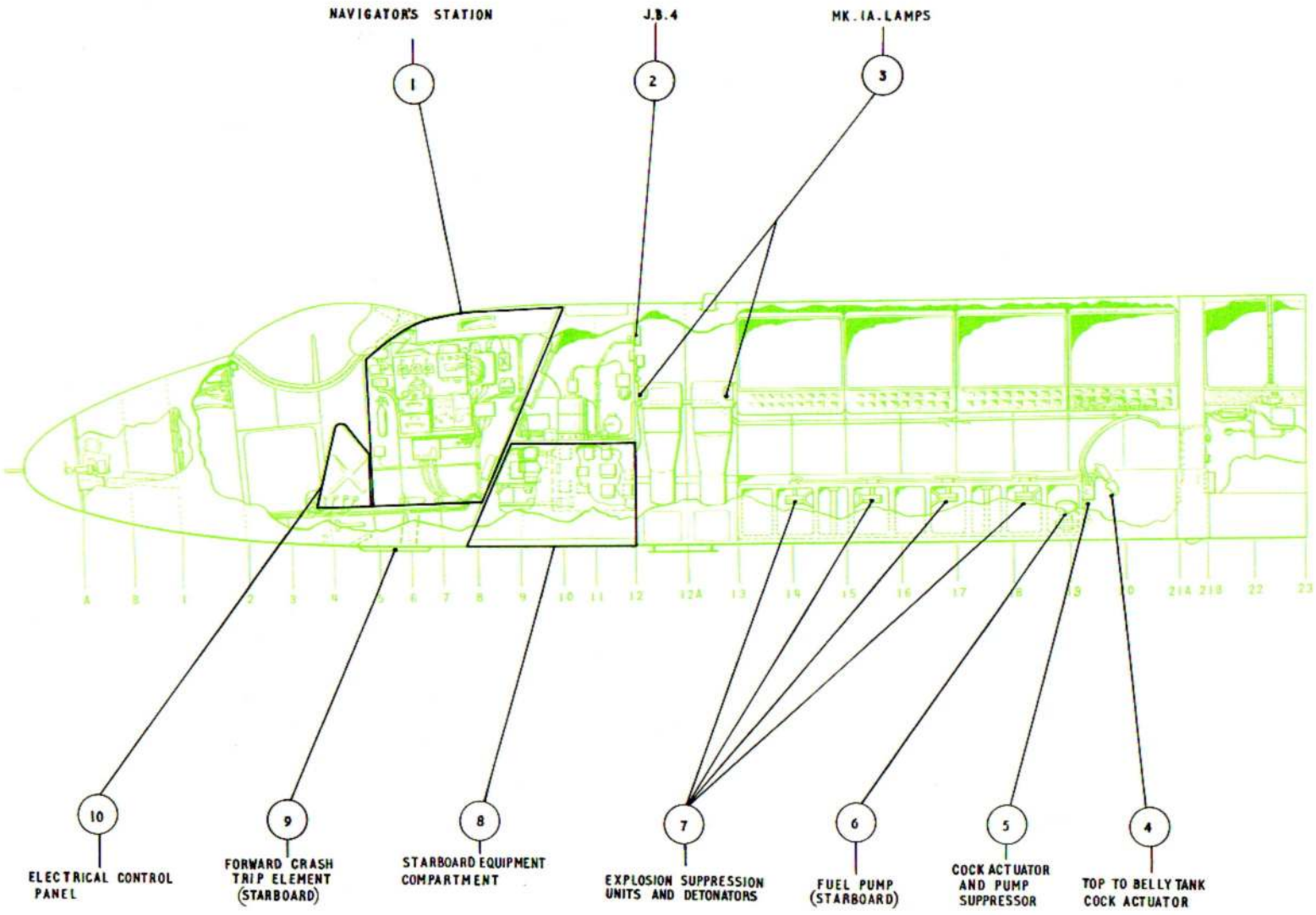


Fig.2. Electrical installation – starboard fuselage

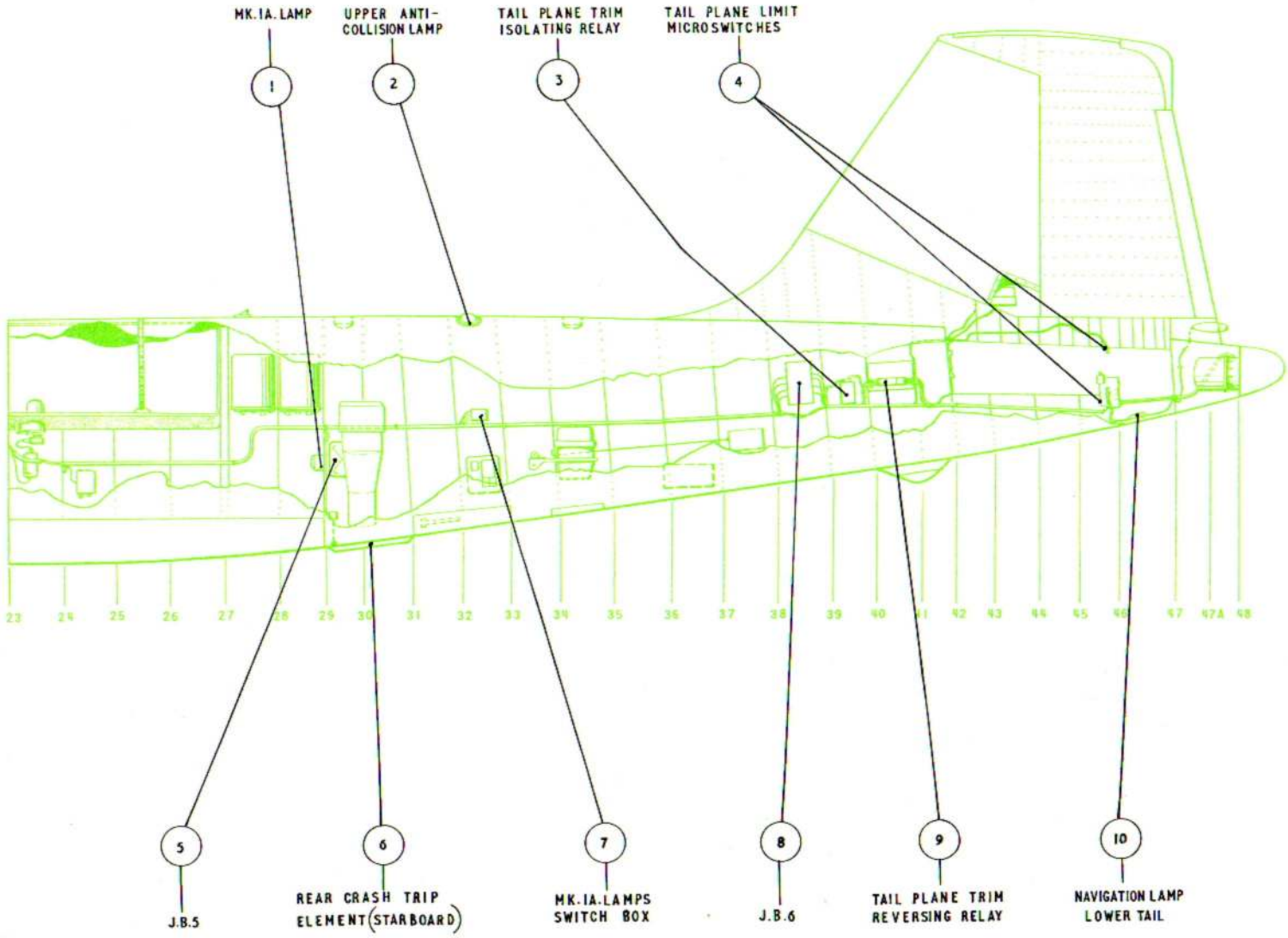


Fig.2A. Electrical installation – starboard fuselage

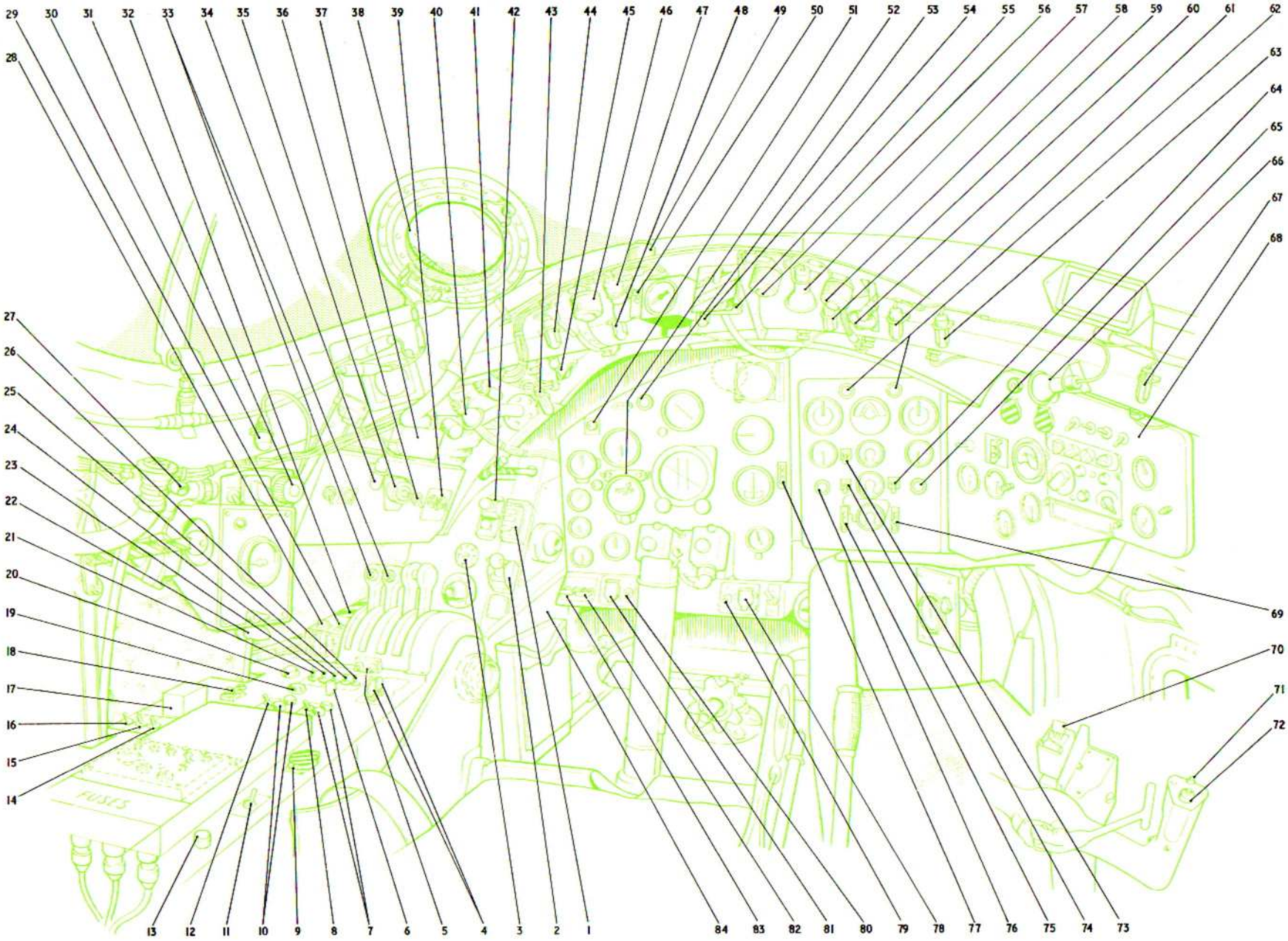
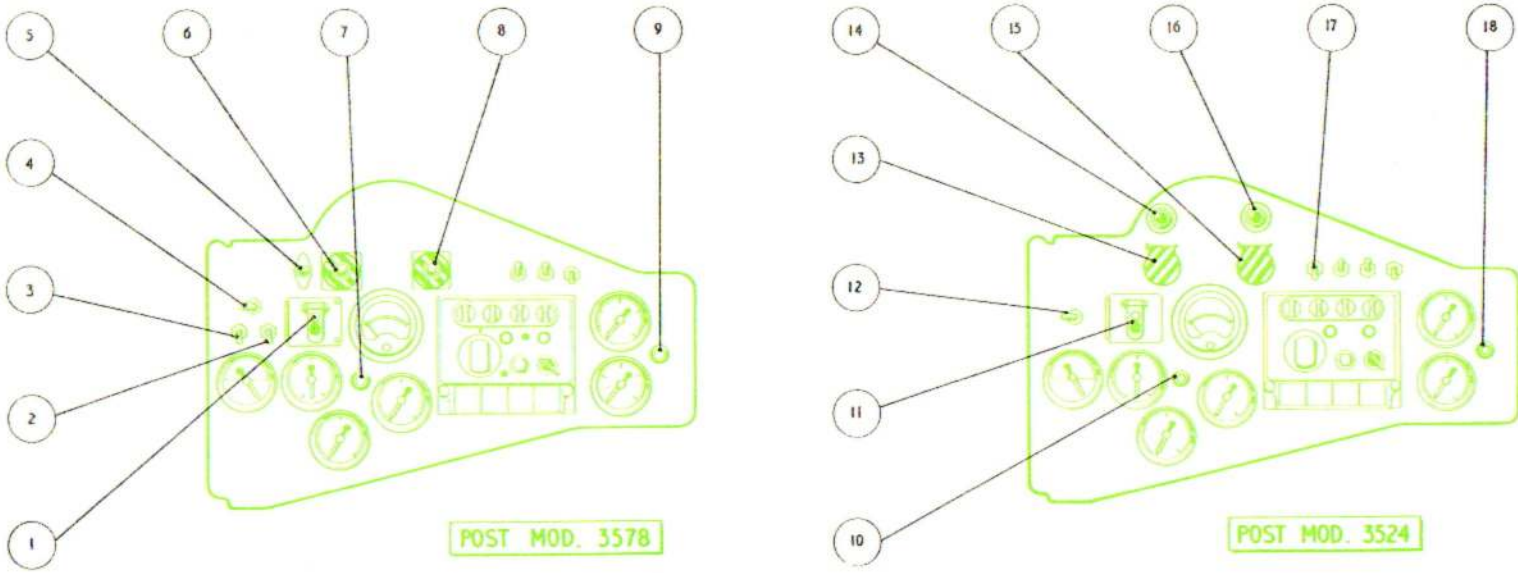


Fig.3. Electrical installation – cockpit

KEY TO FIG.3 (COCKPIT)

1 ALIGHTING GEAR MASTER SWITCH
2 FLAP SELECTOR SWITCH
3 ALIGHTING GEAR POSITION INDICATOR
4 RUDDER TRIM SWITCH
5 FUEL PUMP ISOLATION SWITCHES
6 AILERON TRIM SWITCH
7 FLARE BAY DOORS INDICATORS
8 FLARE BAY DOORS SWITCH
9 FUEL TANK JETTISON SWITCH
10 CAMERA DOORS INDICATORS
11 CANOPY DE-MISTING SWITCH
12 CAMERA DOORS SWITCH
13 ANTI-COLLISION LAMPS FUSE
14 VENT VALVE HEATER SWITCH
15 PRESSURE HEAD HEATER SWITCH
16 D.V. WINDOW HEATER SWITCH
17 PHOTOFLASH JETTISON RELAY
18 PHOTOFLASH JETTISON SWITCH
19 IDENTIFICATION LAMP SWITCH (MORSE)
20 LANDING LAMP SWITCH
21 IDENTIFICATION LAMP SWITCH (STEADY)
22 COCKPIT LAMP (RED)
23 TAXYING LAMPS SWITCH
24 NAVIGATION LAMPS SWITCH
25 EXTERNAL LIGHTS MASTER SWITCH
26 ANTI-COLLISION LAMPS SWITCH
27 COCKPIT LAMP (RED)
28 CANOPY JETTISON SAFETY SWITCH
29 CANOPY JETTISON SWITCH
30 COCKPIT LAMP (RED)
31 CONSOLE RED LAMPS DIMMER SWITCH
32 CANOPY JETTISON SWITCH UNIT
33 ENGINE RE-LIGHT SWITCHES
34 COCKPIT LAMP (RED)
35 PORT RED LAMPS DIMMER SWITCH
36 EMERGENCY LAMPS SWITCH
37 DETONATOR RESISTOR BOX (CANOPY JETTISON)
38 D.V. WINDOW HEATER
39 GENERATOR OFF-LINE SWITCHES (POST MOD.3854)
40 U/V LAMP
41 COCKPIT LAMP (RED)
42 ALIGHTING GEAR SELECTOR SWITCH
43 COCKPIT LAMP (RED)
44 COCKPIT LAMP (RED)
45 ANTI-DAZZLE LAMP
46 PORT U/V LAMPS DIMMER SWITCH
47 U/V LAMP
48 EMERGENCY LAMP (AMBER)
49 ALTIMETER RED LAMPS DIMMER SWITCH
50 ANTI-DAZZLE LAMPS SWITCH
51 EMERGENCY INSTRUMENTS SUPPLY INDICATOR
52 ALTIMETER RED LAMPS
53 PHOTOFLASH RELEASE INDICATOR
54 COCKPIT LAMP (RED)
55 E2A COMPASS LAMP
56 STBD. RED LAMPS DIMMER SWITCH
57 U/V LAMP
58 STBD. U/V LAMPS DIMMER SWITCH
59 COCKPIT LAMP (RED)
60 ANTI-DAZZLE LAMP
61 EMERGENCY LAMP (AMBER)
62 GENERATOR POWER FAILURE WARNING LAMPS (POST B.C.MOD.15)
63 COCKPIT LAMP (RED)
64 COCK AND PUMP SWITCH-No.6 BELLY TANK STBD
65 STARBOARD ENGINE FUEL PRESSURE WARNING LAMP
66 U/V LAMP
67 COCKPIT LAMP (RED)
68 STARBOARD INSTRUMENT PANEL (FIG.4).
69 COCK AND PUMP SWITCH-No.5 REAR TANK STBD
70 AIR BRAKES CONTROL SWITCH
71 TAIL PLANE CONTROL TRIM SWITCH
72 TAIL PLANE CONTROL CUT-IN SWITCH
73 FUEL TRANSFER COCK SWITCH
74 COCK AND PUMP SWITCH-No.6 BELLY TANK PORT
75 COCK AND PUMP SWITCH-No.5 REAR TANK PORT
76 PORT ENGINE FUEL PRESSURE WARNING LAMP
77 TURN-AND-SLIP INDICATOR EMERGENCY SWITCH
78 ENGINE START PUSH SWITCH (STBD)
79 IGNITION SWITCH (STBD)
80 IGNITION SWITCH (PORT)
81 ENGINE START PUSH SWITCH (PORT)
82 MASTER STARTING SWITCH (STBD)
83 MASTER STARTING SWITCH (PORT)
84 24-VOLT EMERGENCY BATTERY (BEHIND MAP STOWAGE PANEL)



1 CABIN AIR WARNING HORN OVERRIDE SWITCH
2 STBD ENGINE CABIN AIR CONTROL SWITCH
3 PORT ENGINE CABIN AIR CONTROL SWITCH
4 CABIN HEATING CONTROL SWITCH
5 ENGINE FIRE INDICATOR TEST SWITCH
6 PORT ENGINE FIRE EXTINGUISHER PUSH SWITCH/INDICATOR
7 PILLAR LAMP
8 STBD ENGINE FIRE EXTINGUISHER PUSH SWITCH/INDICATOR
9 PILLAR LAMP
10 PILLAR LAMP
11 CABIN AIR WARNING HORN OVERRIDE SWITCH
12 CABIN HEATING CONTROL SWITCH
13 PORT ENGINE FIRE EXTINGUISHER PUSH SWITCH
14 PORT ENGINE FIRE WARNING INDICATOR
15 STBD ENGINE FIRE EXTINGUISHER PUSH SWITCH
16 STBD ENGINE FIRE WARNING INDICATOR
17 U.H.F./V.H.F. SELECTOR SWITCH
18 PILLAR LAMP

Fig. 4. Starboard instrument panel details

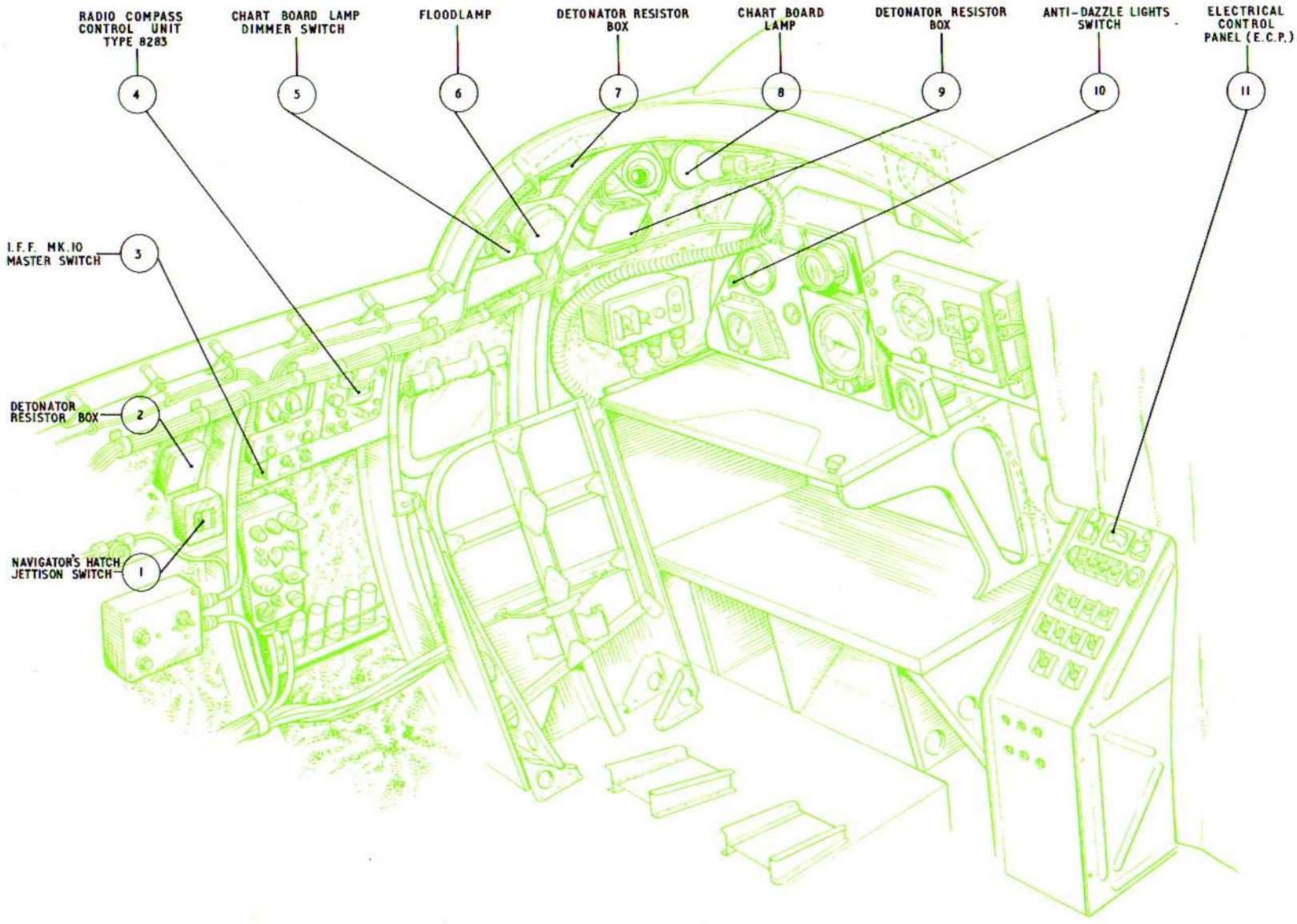


Fig.5. Electrical installation – navigator's rear station – port post Mod.1025 or 2706/7

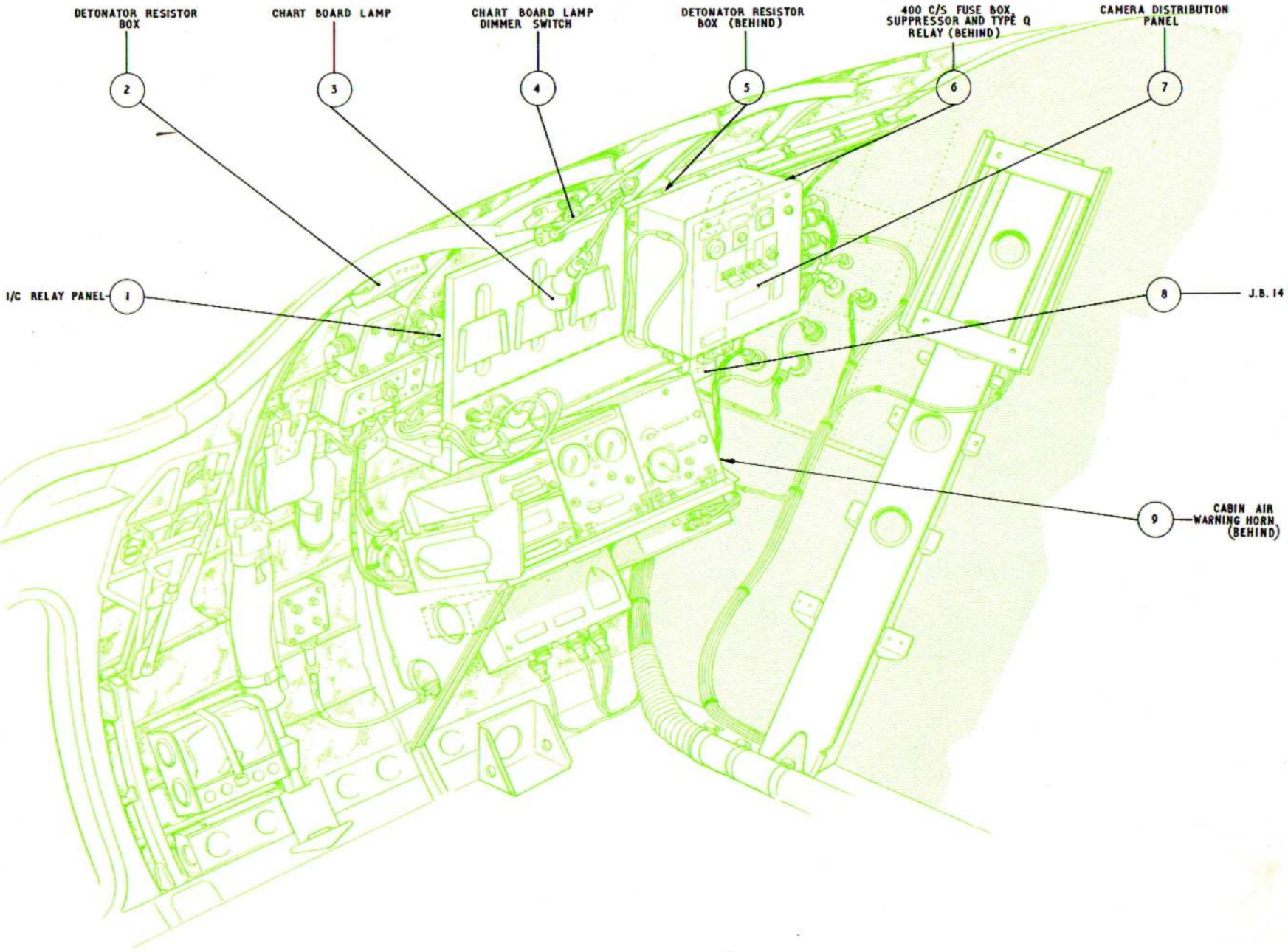


Fig.6. Electrical installation – navigator's rear station – starboard – aircraft post Mod.1025 or 2706/7

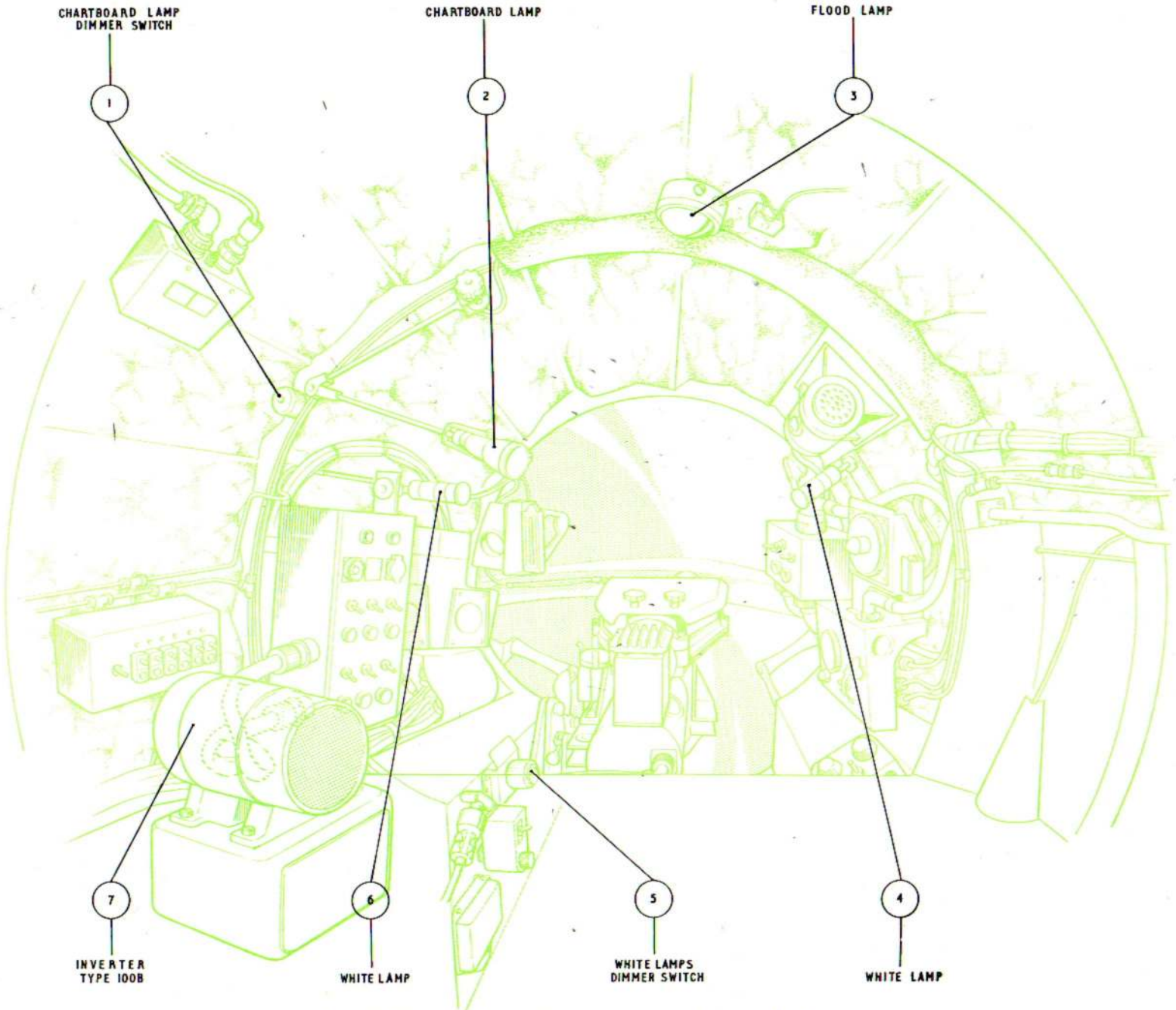


Fig.7. Electrical installation – navigator's forward station

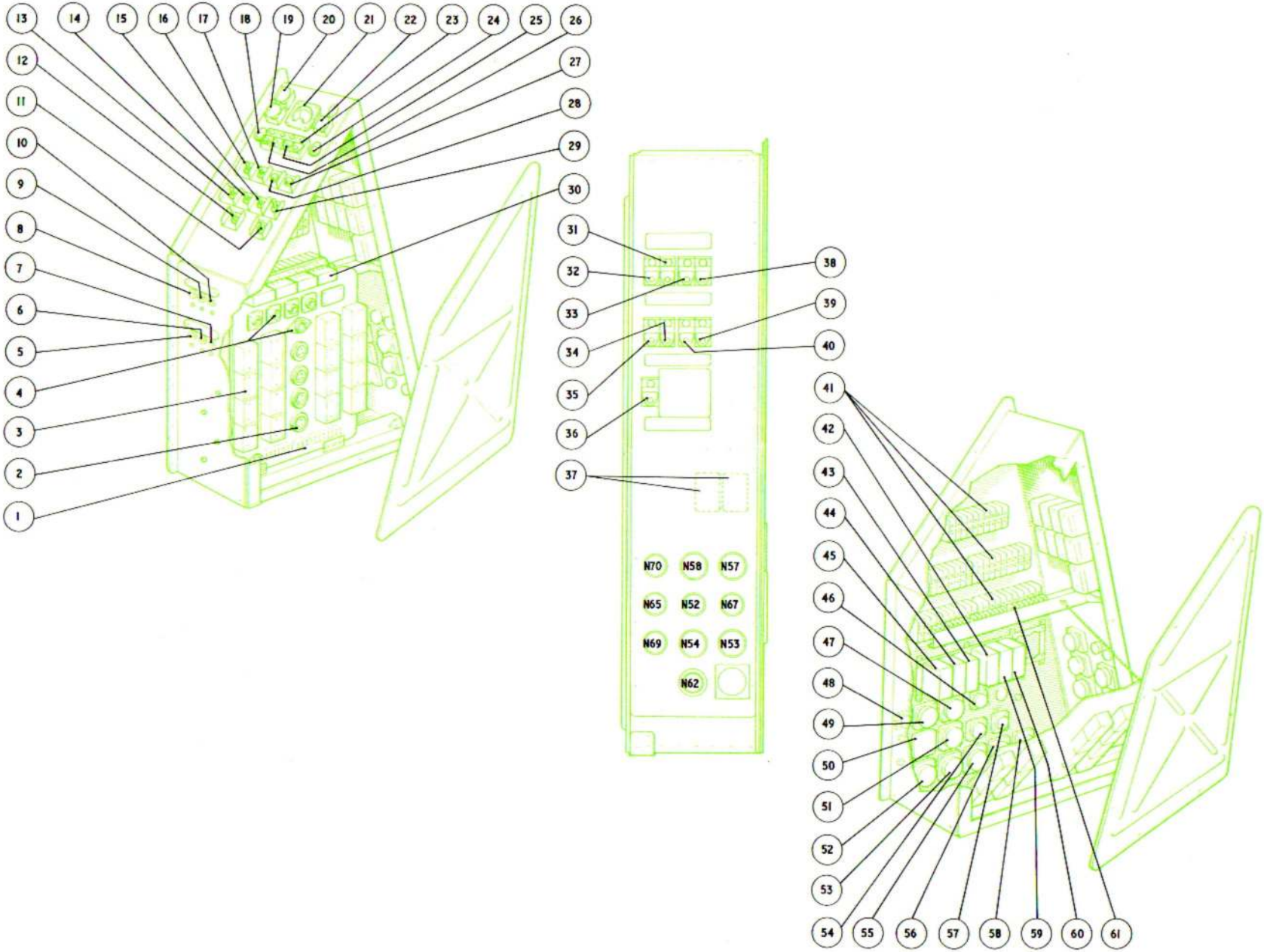


Fig.8. Electrical control panel (E.C.P.) – aircraft post Mod.2706/7

KEY TO FIG.8 ELECTRICAL CONTROL PANEL

1 HINGED FUSE PANEL
2 GENERATOR TEST SOCKETS
3 FUSE BLOCKS
4 FUEL PUMP TEST SOCKET AND PUSH SWITCHES
5 No.2 INVERTER CIRCUIT BREAKER
6 No.3 INVERTER CIRCUIT BREAKER
7 No.4 INVERTER CIRCUIT BREAKER (REBECCA)
8 No.8 INVERTER CIRCUIT BREAKER
9 1600 C/S SUPPLY CIRCUIT BREAKER
10 No.7 INVERTER CIRCUIT BREAKER
11 GREEN SATIN EQUIPMENT SWITCH
12 No.8 INVERTER CONTROL SWITCH
13 REBECCA CONTROL SWITCH
14 REAR WARNING CONTROL SWITCH (INOPERATIVE)
15 No.7 INVERTER CONTROL SWITCH
16 No.4 INVERTER (REBECCA) CONTROL SWITCH
17 REBECCA/I.F.F.Mk.10 CHANGE-OVER SWITCH
18 No.1 GENERATOR FAILURE WARNING LAMP
19 No.1 GENERATOR CONTROL SWITCH
20 BATTERY ISOLATION SWITCH
21 D.C. VOLTMETER
22 No.2 GENERATOR CONTROL SWITCH
23 CAMERA SERVICES CIRCUIT BREAKER
24 No.2 GENERATOR FAILURE WARNING LAMP
25 No.1 and No.2 GENERATOR FIELD CIRCUIT BREAKERS
26 PILOT'S SERVICES CIRCUIT BREAKER
27 No.5 INVERTER STOP SWITCH (INOPERATIVE)
28 No.5 INVERTER START SWITCH (INOPERATIVE)
29 GREEN SATIN START SWITCH
30 TERMINAL BLOCKS
31 FWD TANK STARBOARD FUEL COCK C.B.
32 FWD TANK STARBOARD FUEL PUMP C.B.
33 FWD TANK PORT FUEL PUMP C.B.
34 AFT TANK STARBOARD FUEL COCK C.B.
35 AFT TANK STARBOARD FUEL PUMP C.B.
36 FUEL TRANSFER COCK C.B.
37 RESISTOR UNITS, FUEL PRESSURE WARNING
38 FWD TANK PORT FUEL COCK C.B.
39 AFT TANK PORT FUEL COCK C.B.
40 AFT TANK PORT FUEL PUMP C.B.
41 TERMINAL BLOCKS
42 AFT STBD TANK-FUEL PUMP RELAY
43 FWD STBD TANK-FUEL PUMP RELAY
44 AFT PORT TANK-FUEL PUMP RELAY
45 FWD STBD TANK-FUEL PUMP RELAY
46 N14
47 N26
48 SPARE
49 N25
50 N27
51 N28
52 SPARE
53 N8X
54 N13
55 N29
56 N7X
57 N73
58 N71
59 No.1 ENGINE START RELAY
60 No.2 ENGINE START RELAY
61 SPARE FUSE STOWAGE

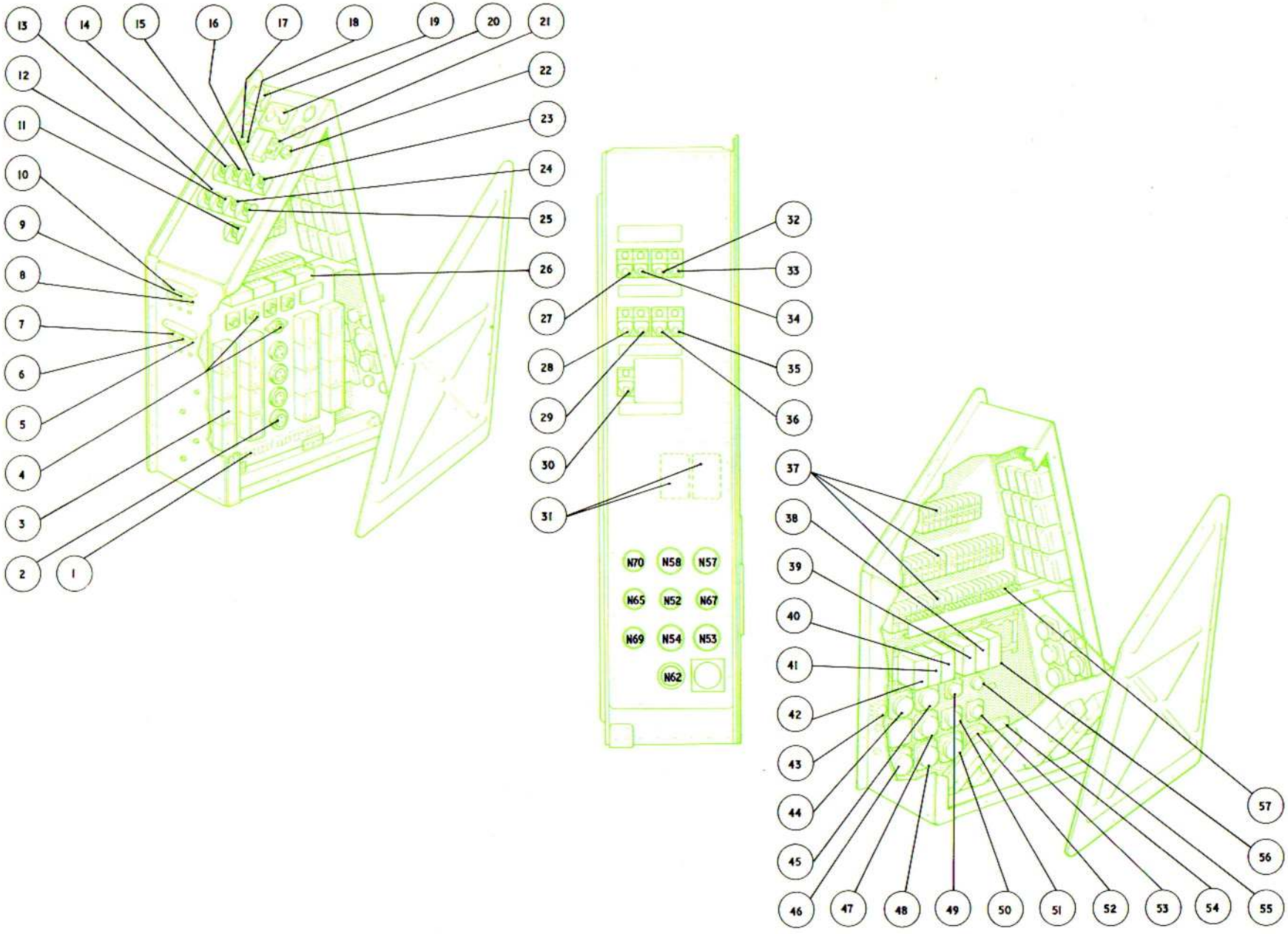


Fig.9. Electrical control panel (E.C.P.) – aircraft post Mod.1025 and 3854

KEY TO FIG.9 ELECTRICAL CONTROL PANEL

1 HINGED FUSE PANEL
2 GENERATOR TEST SOCKETS
3 FUSE BLOCKS
4 FUEL PUMP TEST SOCKET AND PUSH SWITCHES
5 No.4 INVERTER (STANDBY) CIRCUIT BREAKER
6 No.3 INVERTER CIRCUIT BREAKER
7 No.2 INVERTER CIRCUIT BREAKER
8 SPARE
9 1600 C/S POWER SUPPLY CIRCUIT BREAKER
10 SPARE
11 GREEN SATIN EQUIPMENT SWITCH
12 REAR WARNING CONTROL SWITCH
13 REBECCA CONTROL SWITCH
14 No.4 INVERTER (STANDBY) CONTROL SWITCH
15 No.4/No.5 INVERTER CHANGE-OVER SWITCH
16 No.5 INVERTER START SWITCH
17 No.1 GENERATOR FAILURE WARNING LAMP
18 PILOT'S SERVICES CIRCUIT BREAKER
19 BATTERY ISOLATION SWITCH
20 D.C. VOLTMETER
21 CAMERA SERVICES CIRCUIT BREAKER
22 No.2 GENERATOR FAILURE WARNING LAMP
23 No.5 INVERTER STOP SWITCH
24 GEE-H CONTROL SWITCH (INOPERATIVE)
25 GREEN SATIN START SWITCH
26 TERMINAL BLOCKS
27 FWD TANK STARBOARD FUEL PUMP C.B.
28 AFT TANK STARBOARD FUEL PUMP C.B.
29 AFT TANK STARBOARD FUEL COCK C.B.
30 FUEL TRANSFER COCK C.B.
31 RESISTOR UNITS FUEL PRESSURE WARNING
32 FWD TANK PORT FUEL PUMP C.B.
33 FWD TANK PORT FUEL COCK C.B.
34 FWD TANK STARBOARD FUEL COCK C.B.
35 AFT TANK PORT FUEL COCK C.B.
36 AFT TANK PORT FUEL PUMP C.B.
37 TERMINAL BLOCKS
38 No.1 ENGINE START RELAY
39 AFT TANK STARBOARD FUEL PUMP RELAY
40 FWD TANK STARBOARD FUEL PUMP RELAY
41 AFT TANK PORT FUEL PUMP RELAY
42 FWD TANK PORT FUEL PUMP RELAY
43 SPARE
44 N25
45 N26
46 SPARE
47 N28
48 N8X
49 N14
50 N29
51 N13
52 N7X
53 N73
54 N71
55 SPARE
56 No.2 ENGINE START RELAY
57 SPARE FUSE STOWAGE

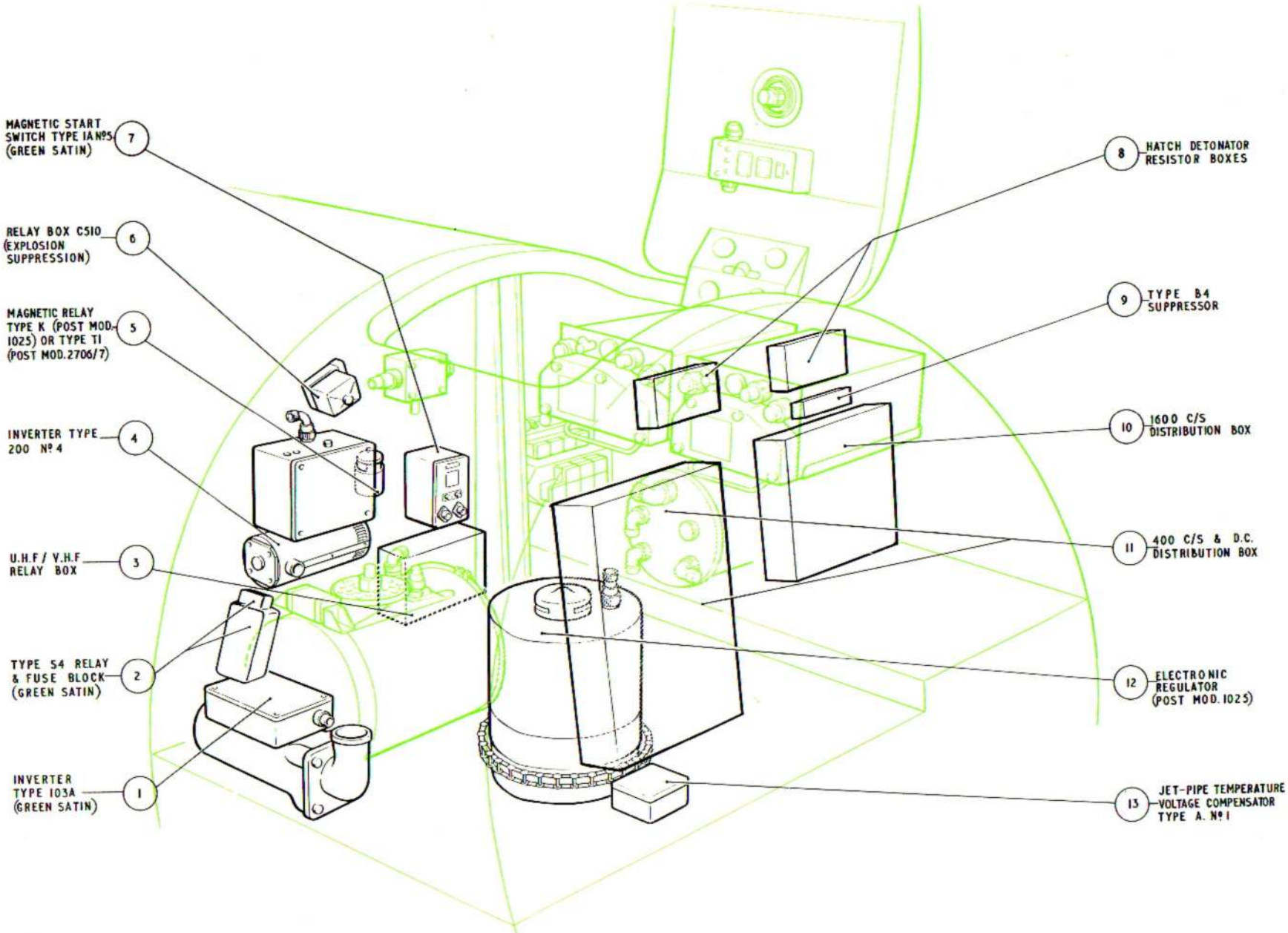


Fig. 10. Electrical installation – upper equipment compartment

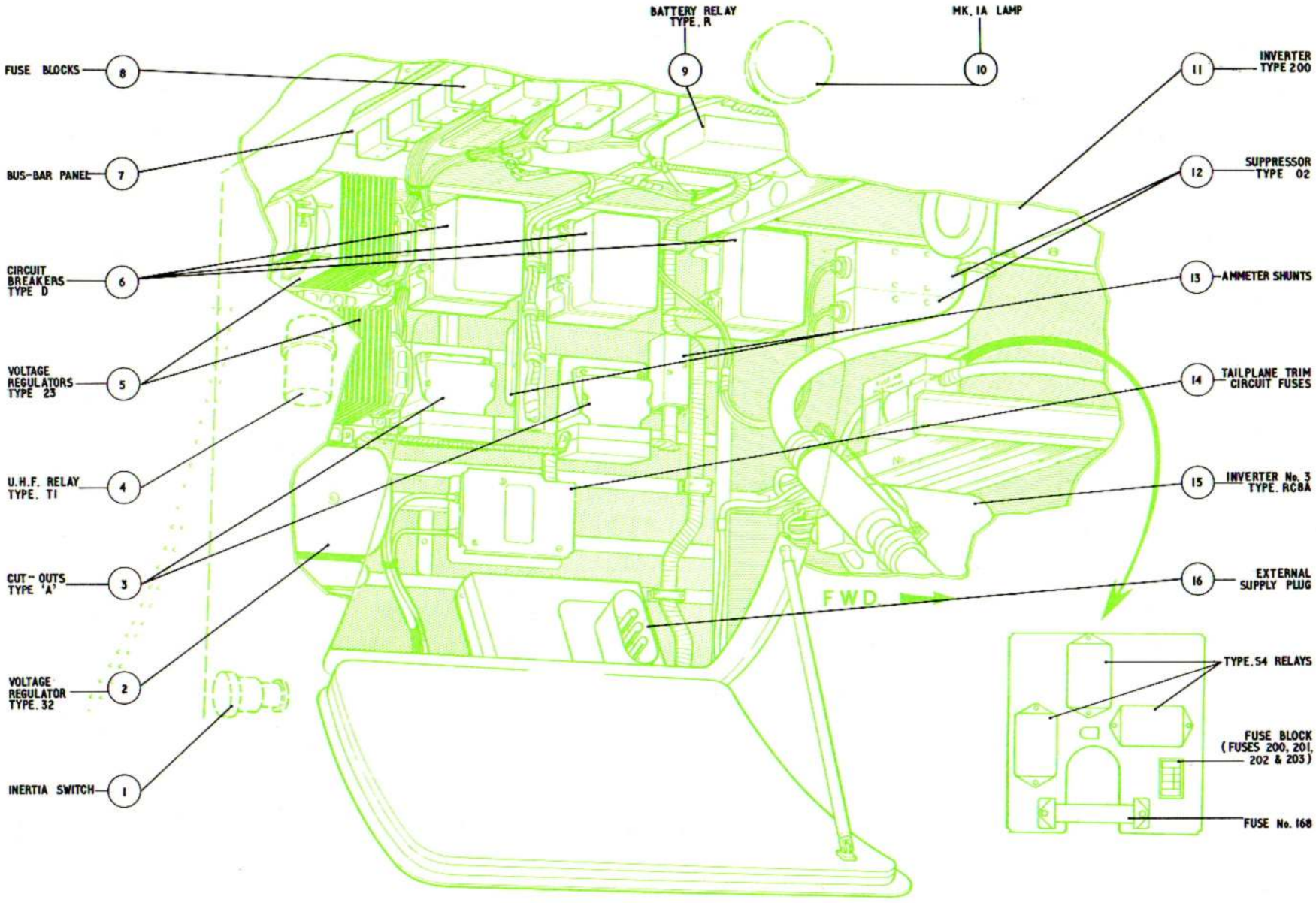


Fig.11. Electrical installation – starboard equipment compartment – aircraft post Mod.2706/7

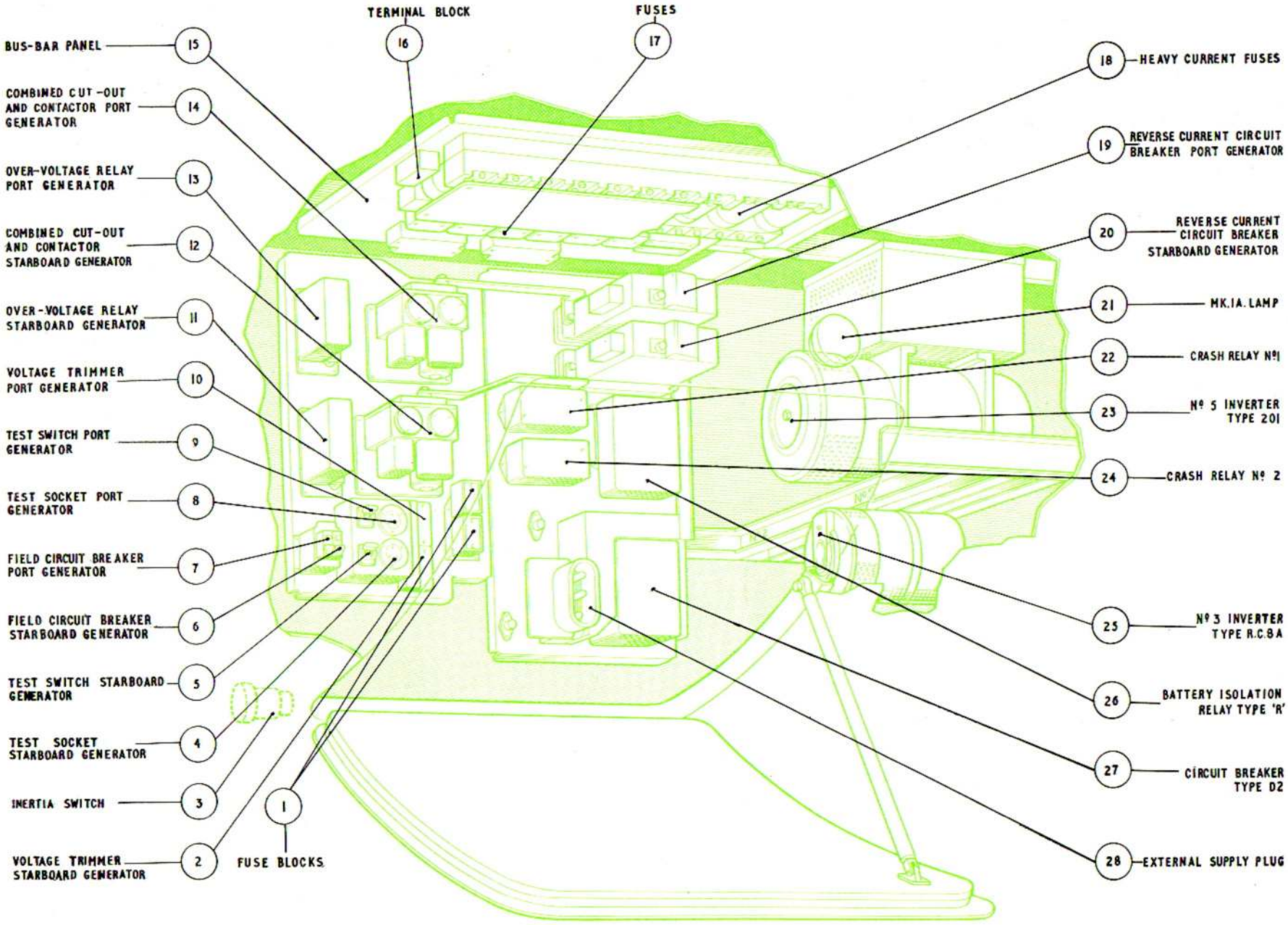


Fig.12. Electrical installation – starboard equipment compartment – aircraft post Mod.3854

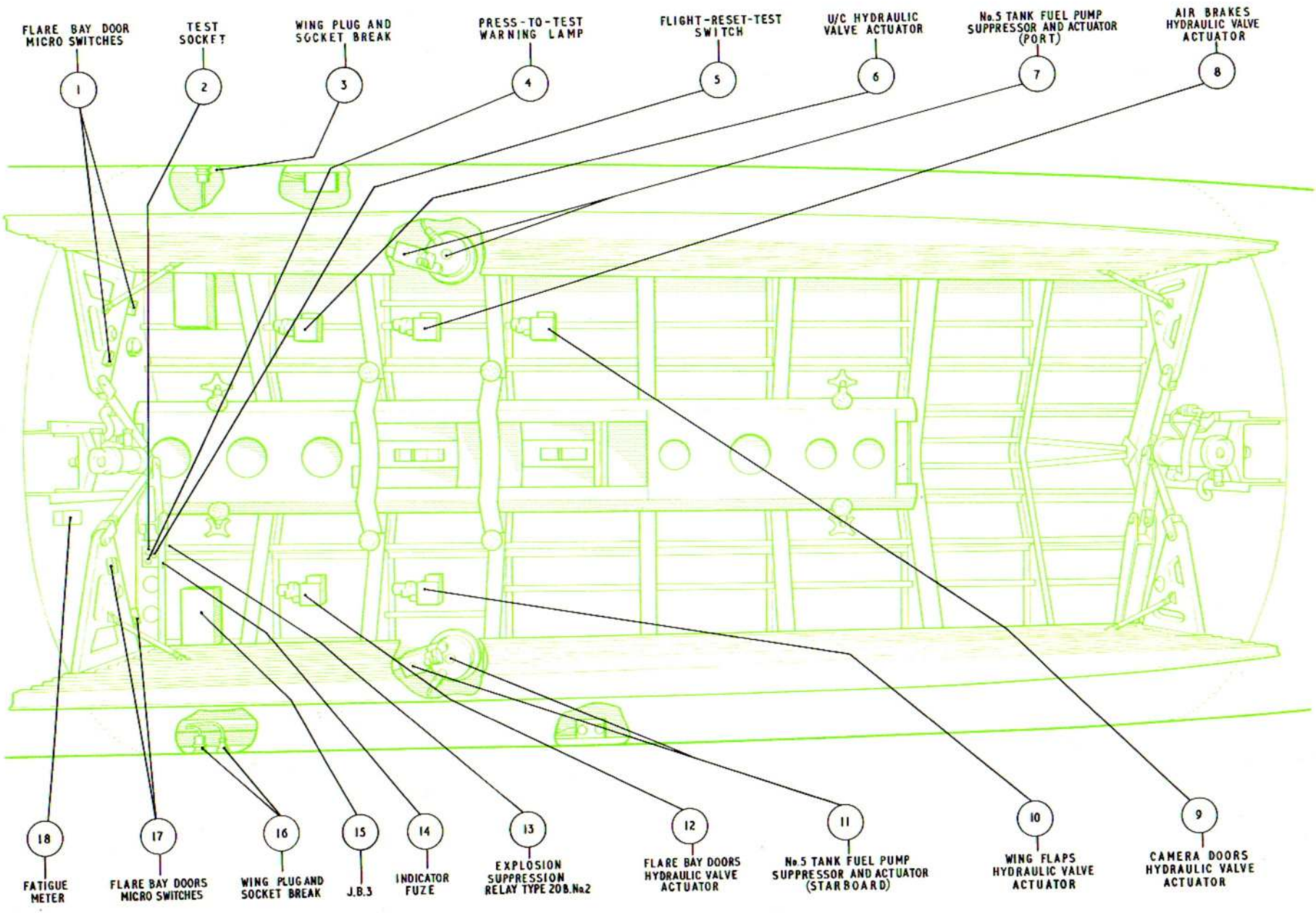
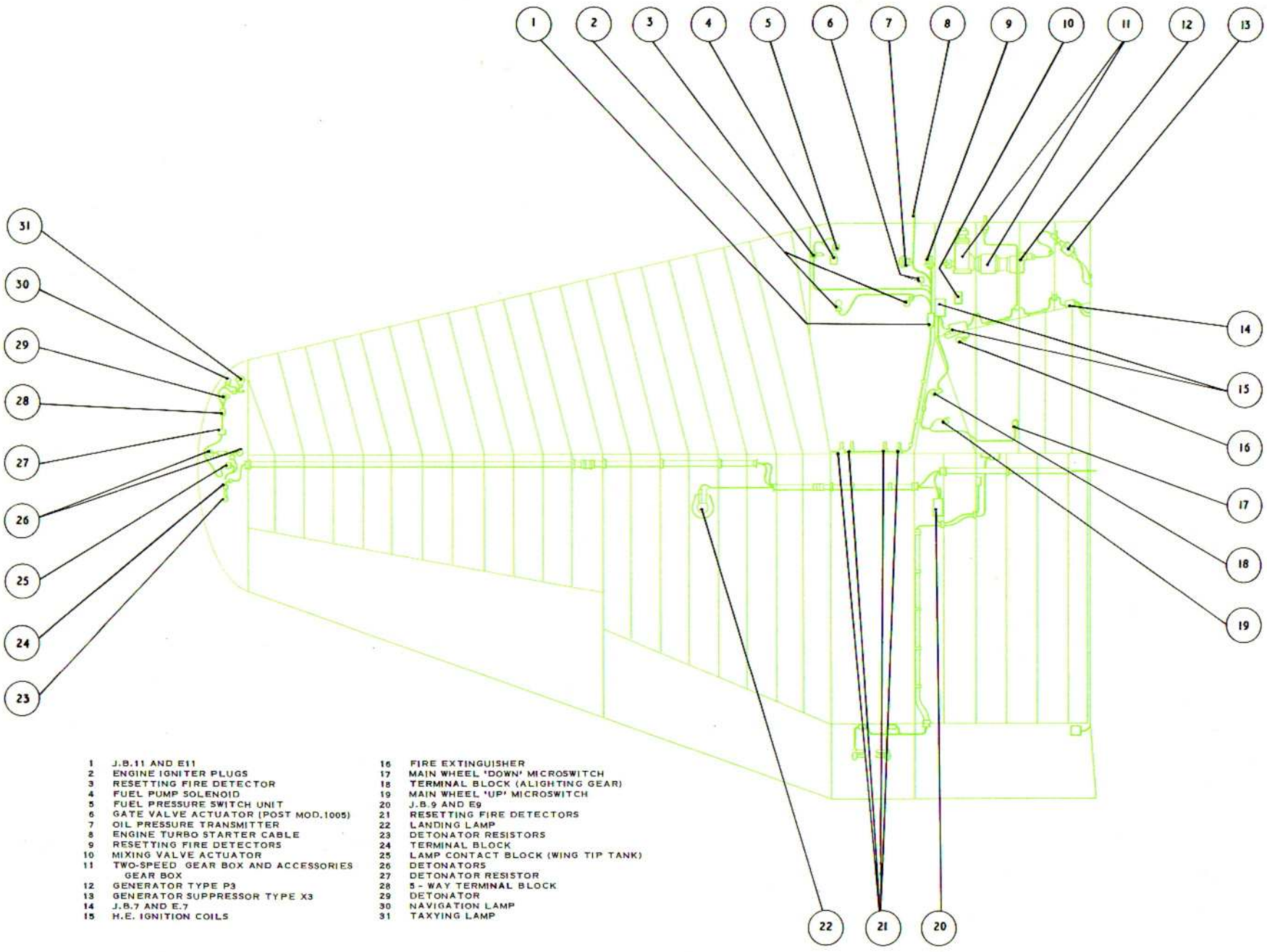


Fig.13. Electrical installation – flare bay



1 J.B.11 AND E11
2 ENGINE IGNITER PLUGS
3 RESETTING FIRE DETECTOR
4 FUEL PUMP SOLENOID
5 FUEL PRESSURE SWITCH UNIT
6 GATE VALVE ACTUATOR (POST MOD.1005)
7 OIL PRESSURE TRANSMITTER
8 ENGINE TURBO STARTER CABLE
9 RESETTING FIRE DETECTORS
10 MIXING VALVE ACTUATOR
11 TWO-SPEED GEAR BOX AND ACCESSORIES GEAR BOX
12 GENERATOR TYPE P3
13 GENERATOR SUPPRESSOR TYPE X3
14 J.B.7 AND E.7
15 H.E. IGNITION COILS
16 FIRE EXTINGUISHER
17 MAIN WHEEL 'DOWN' MICROSWITCH
18 TERMINAL BLOCK (ALIGHTING GEAR)
19 MAIN WHEEL 'UP' MICROSWITCH
20 J.B.9 AND E9
21 RESETTING FIRE DETECTORS
22 LANDING LAMP
23 DETONATOR RESISTORS
24 TERMINAL BLOCK
25 LAMP CONTACT BLOCK (WING TIP TANK)
26 DETONATORS
27 DETONATOR RESISTOR
28 5 - WAY TERMINAL BLOCK
29 DETONATOR
30 NAVIGATION LAMP
31 TAXYING LAMP

Fig.14. Electrical installation – port main plane pre Mod.1783

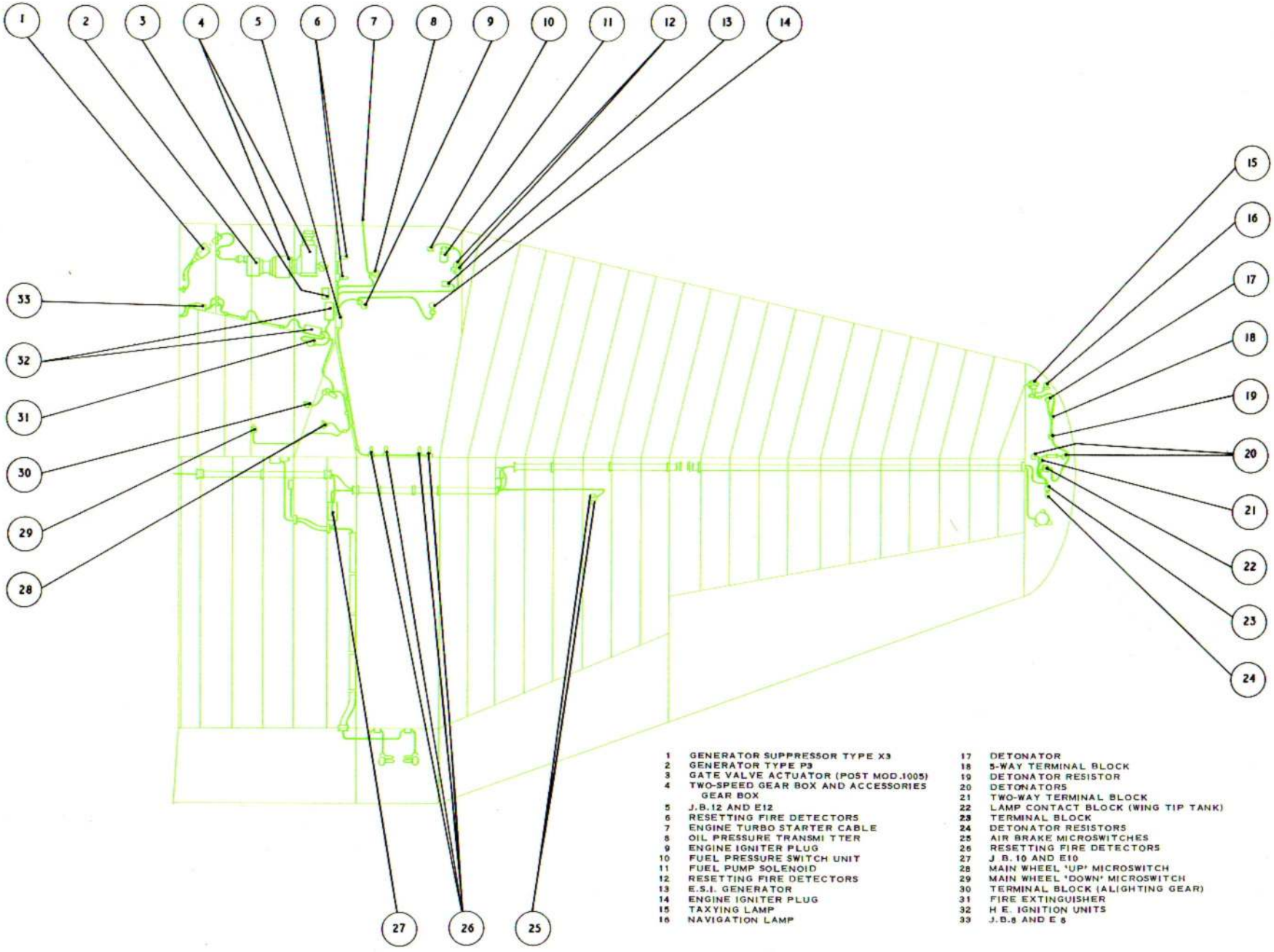


Fig.15. Electrical installation – starboard main plane pre Mod.1783

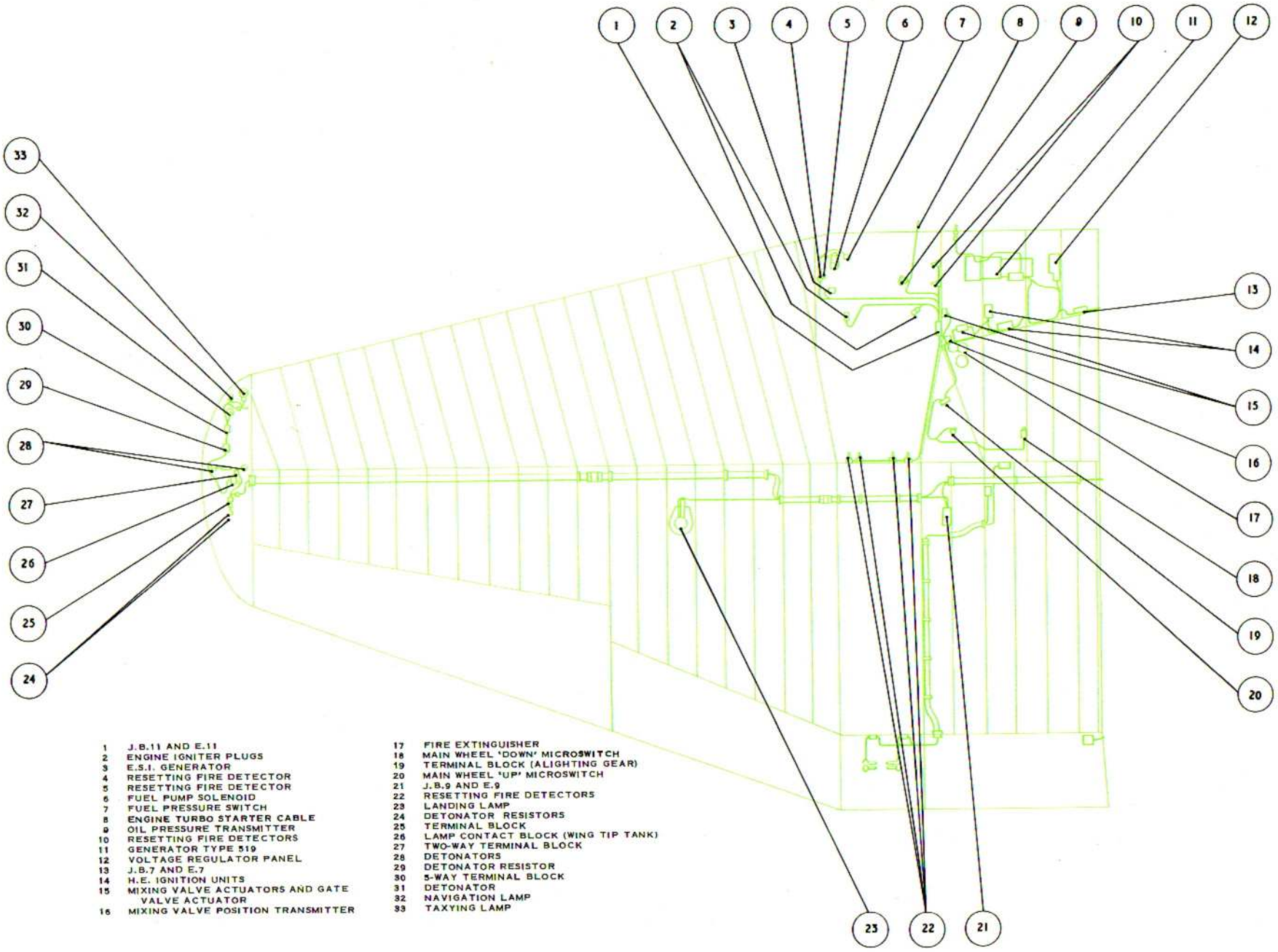


Fig. 16. Electrical installation – port main plane post Mod. 1783 and 3854

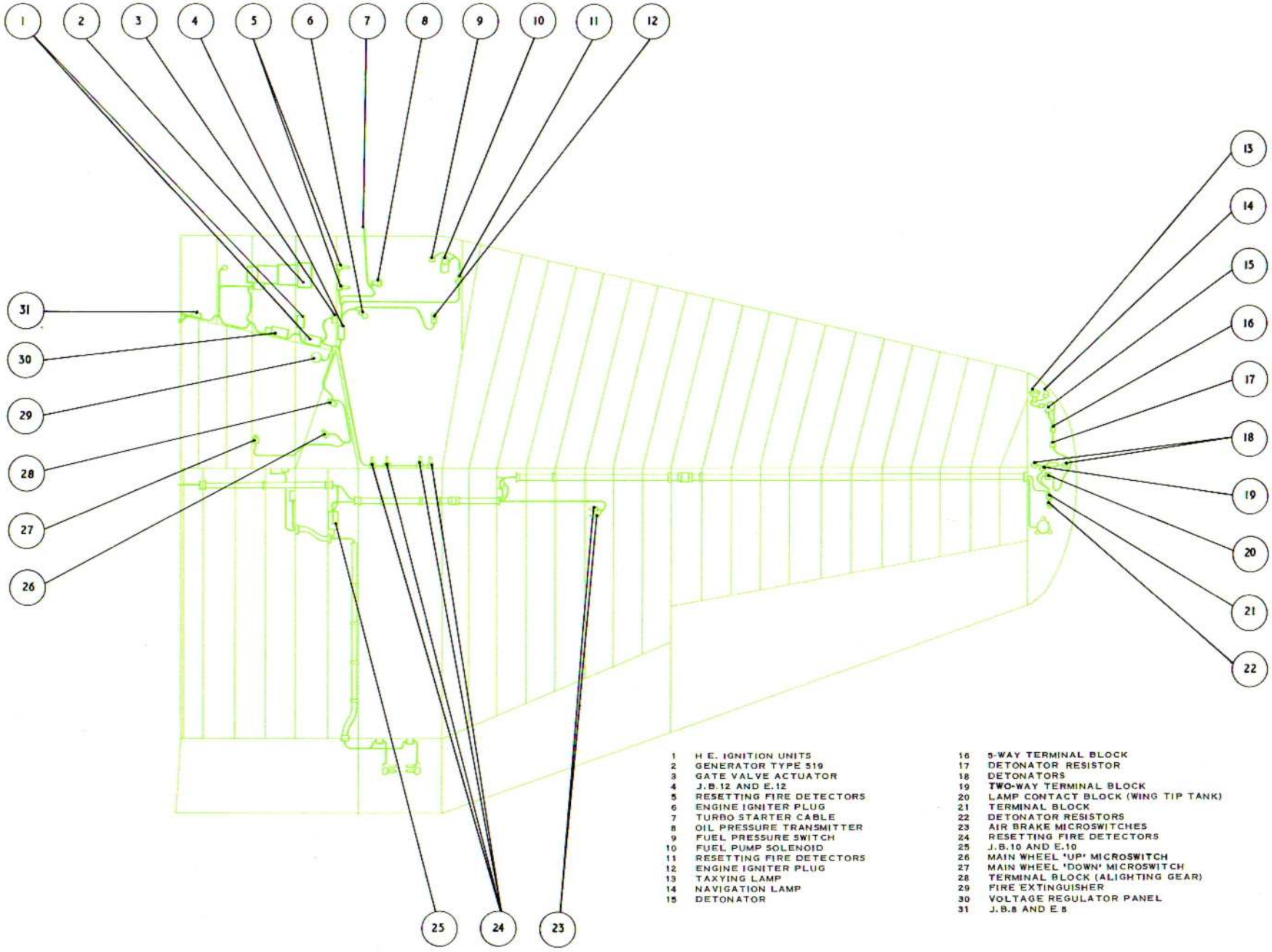


Fig.17. Electrical installation – starboard main plane post Mod.1783 and 3854

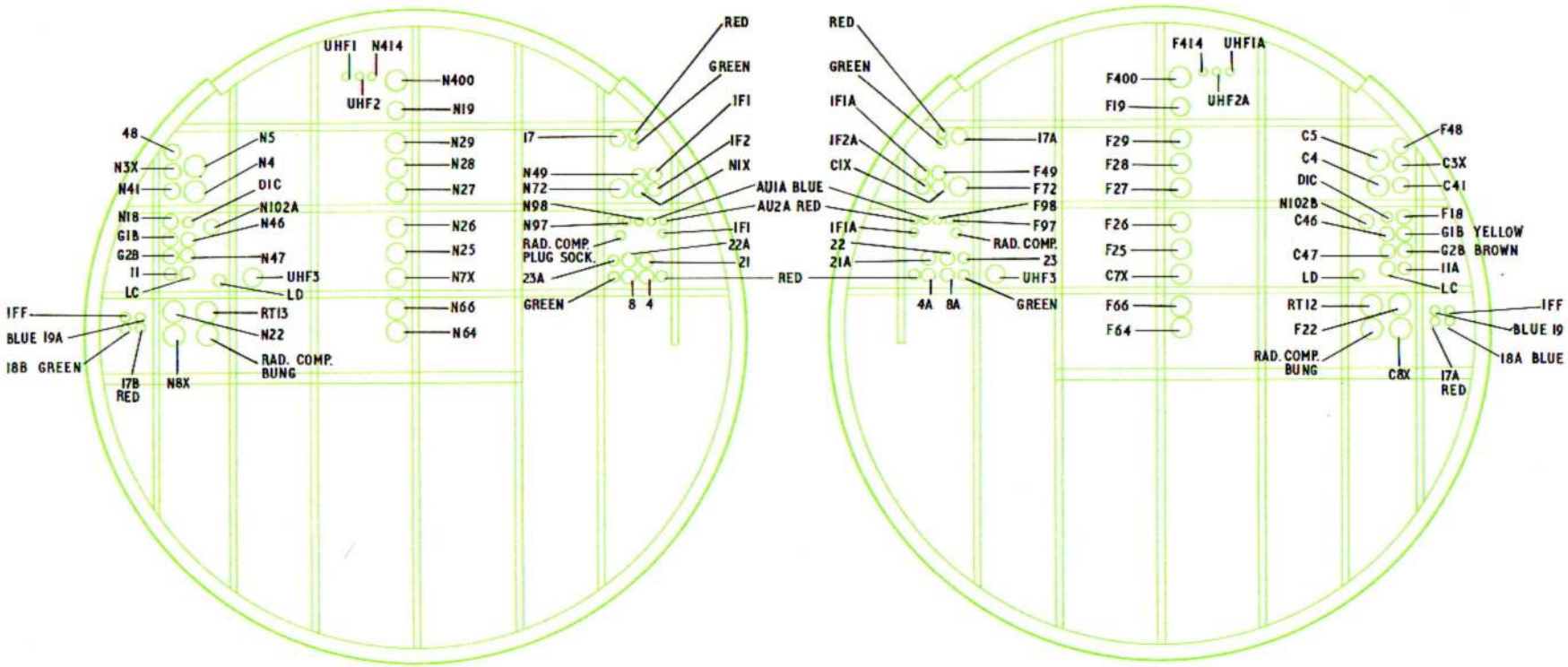


Fig. 18. Pressure bulkhead post Mod.2706/7

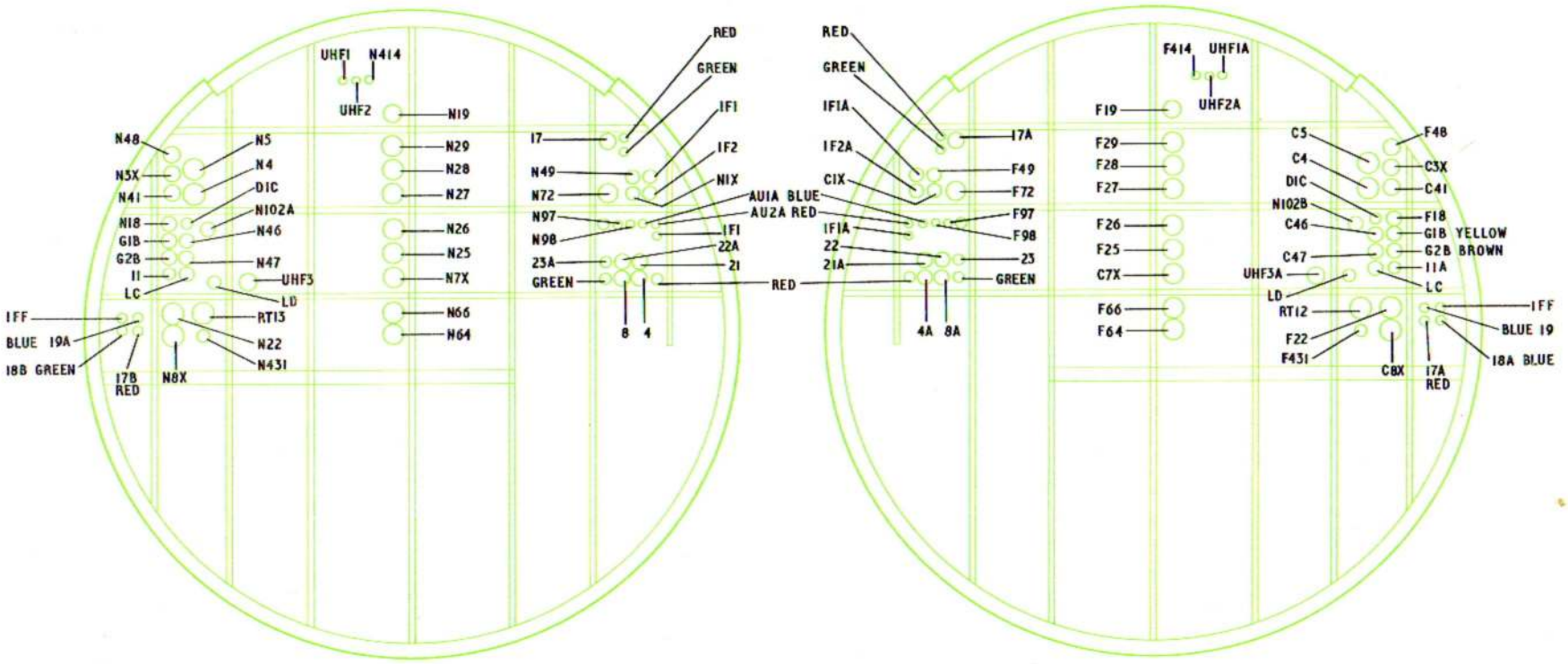


Fig.19. Pressure bulkhead post Mod.1025 and 3854

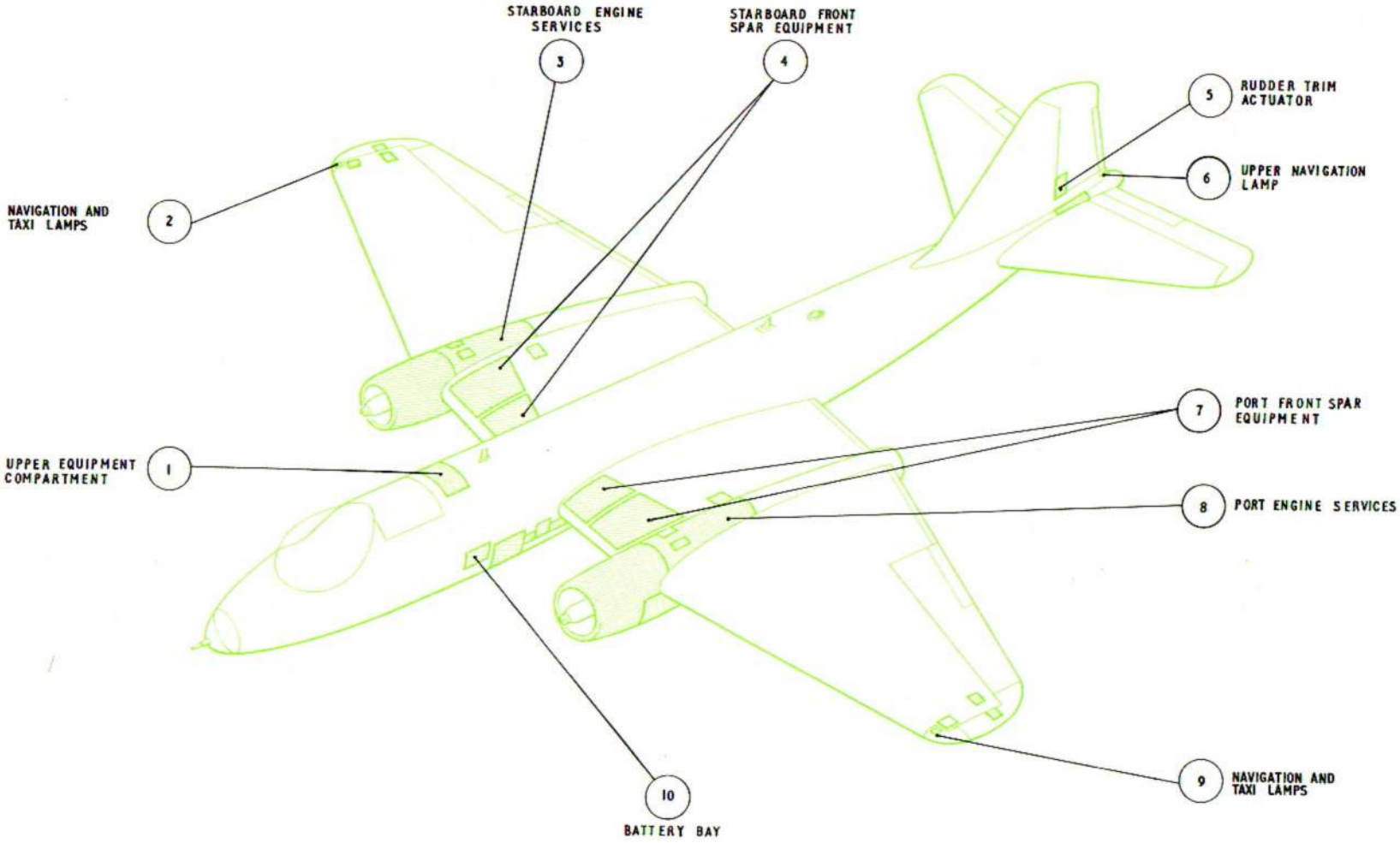


Fig.20. Access panels – upper surface and port side

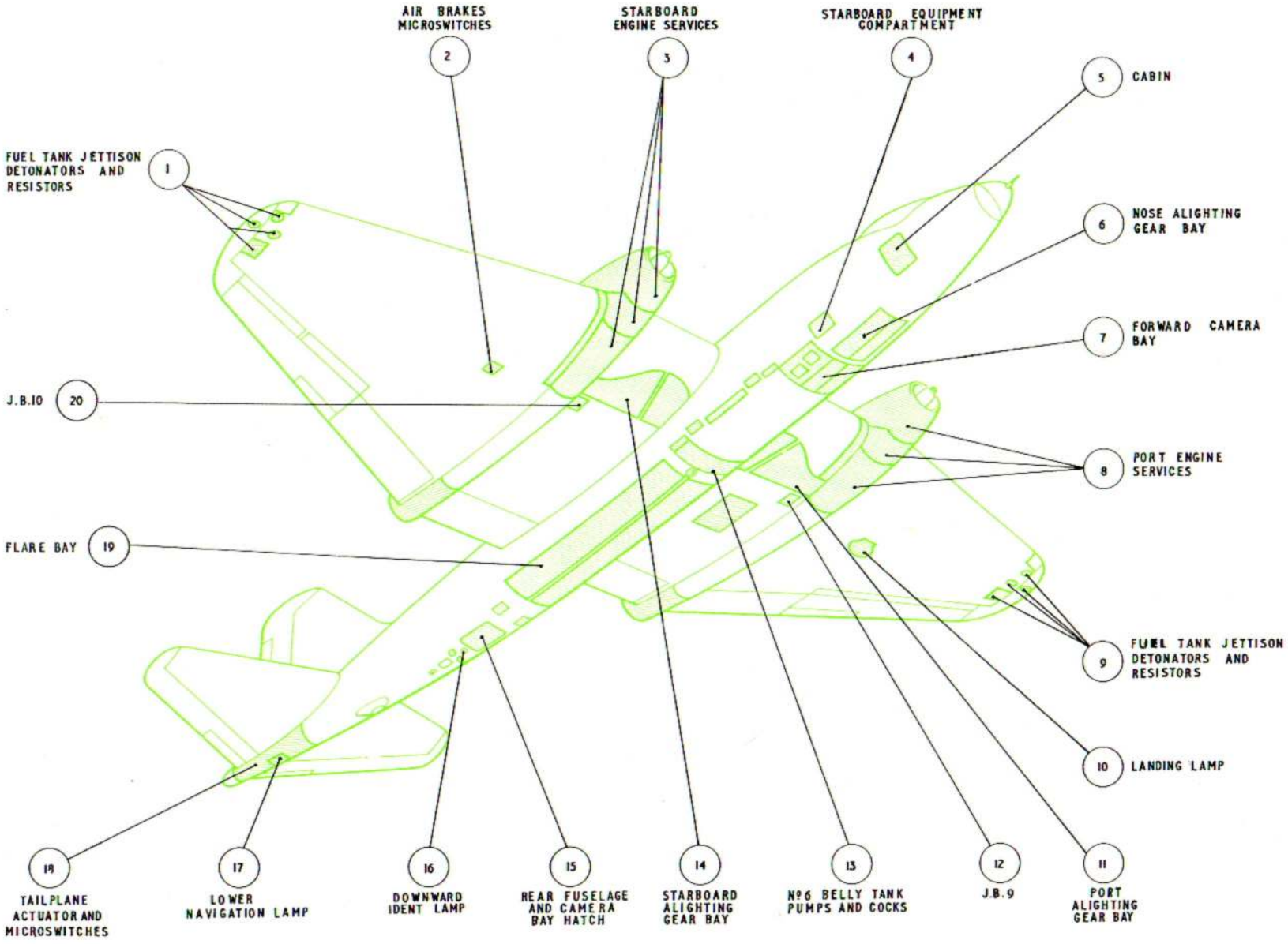


Fig.21. Access panels – lower surface and starboard side

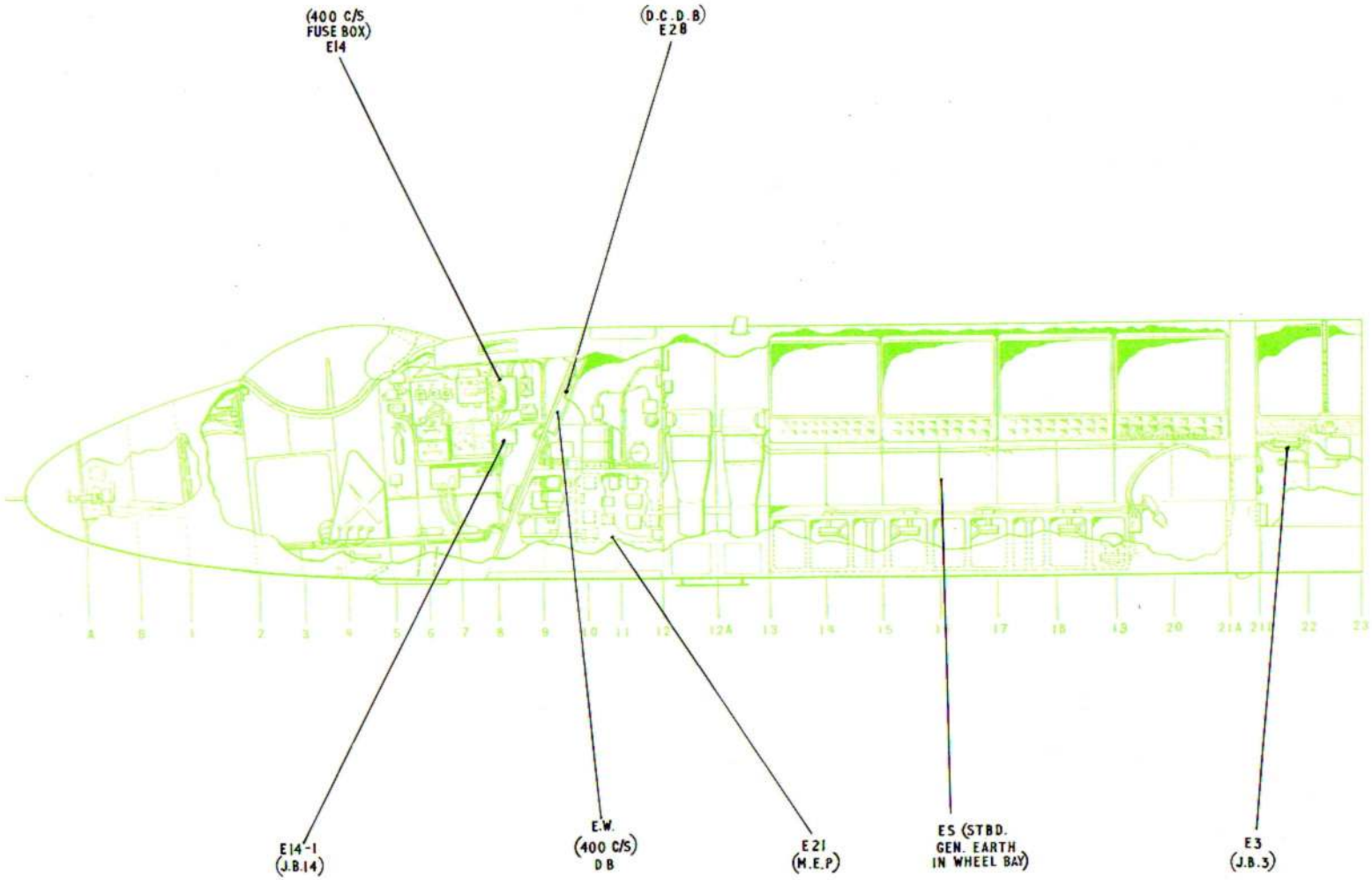


Fig.22. Earth points – starboard fuselage

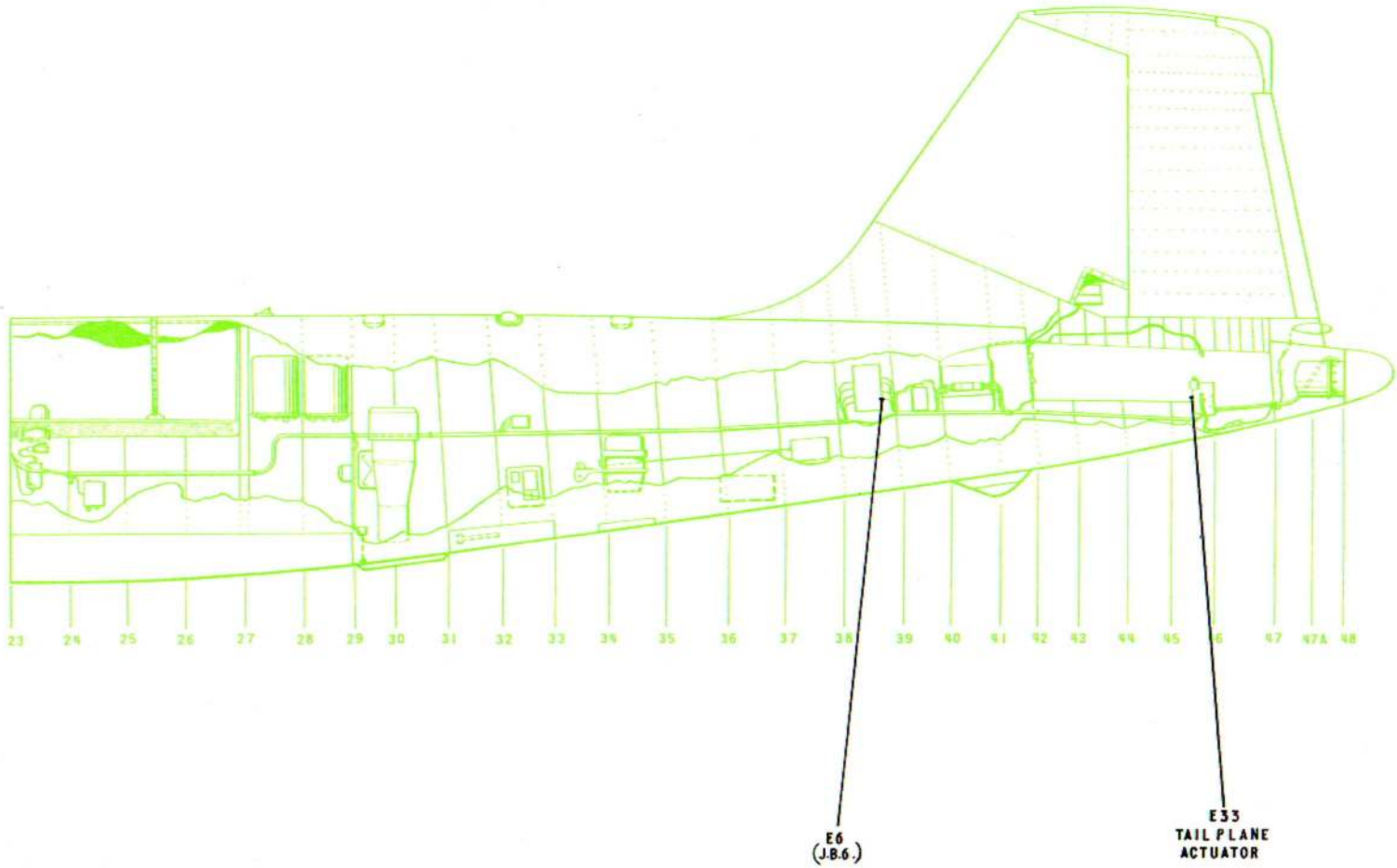


Fig.22A. Earth points – starboard fuselage

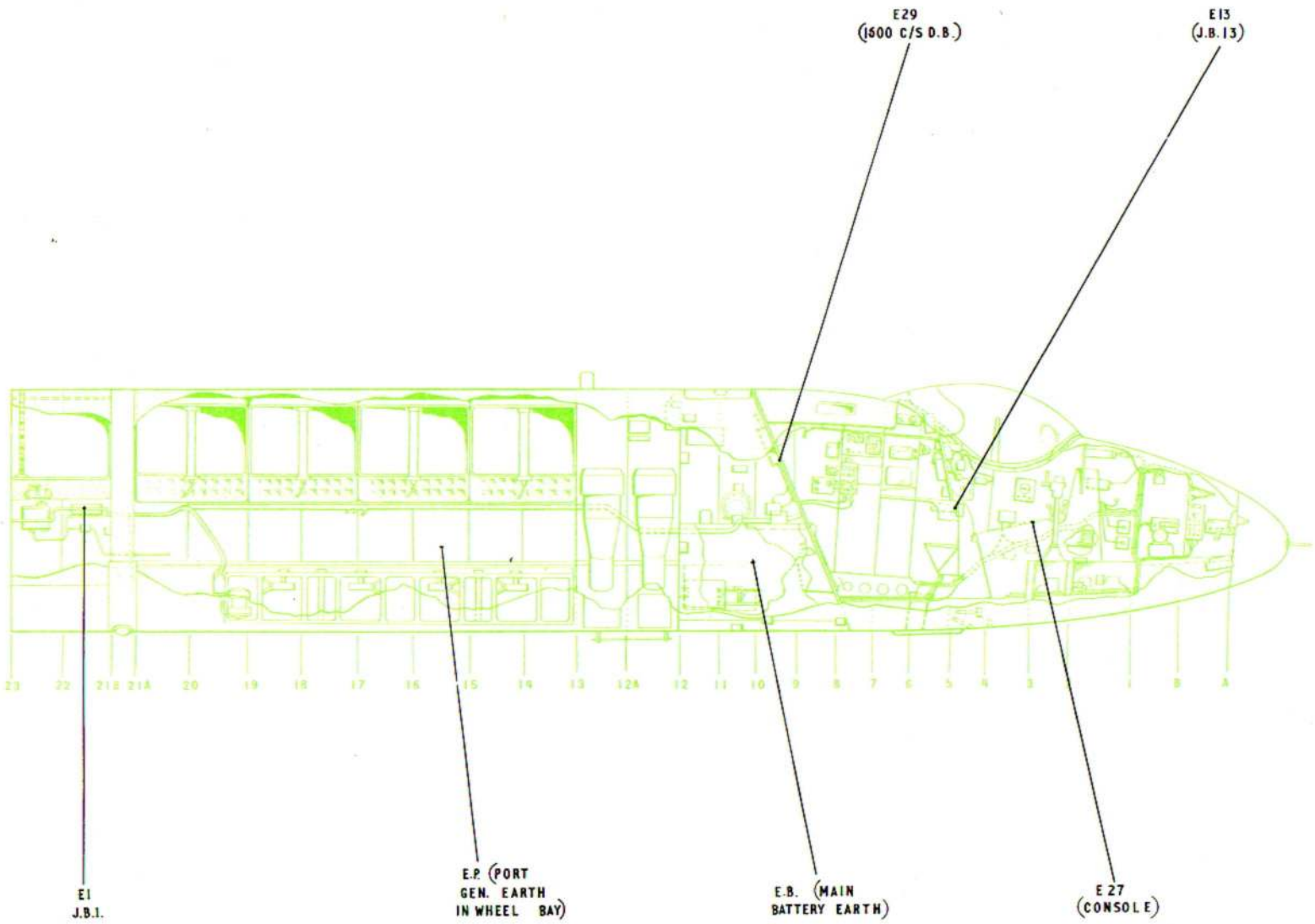


Fig.23. Earth points – port fuselage

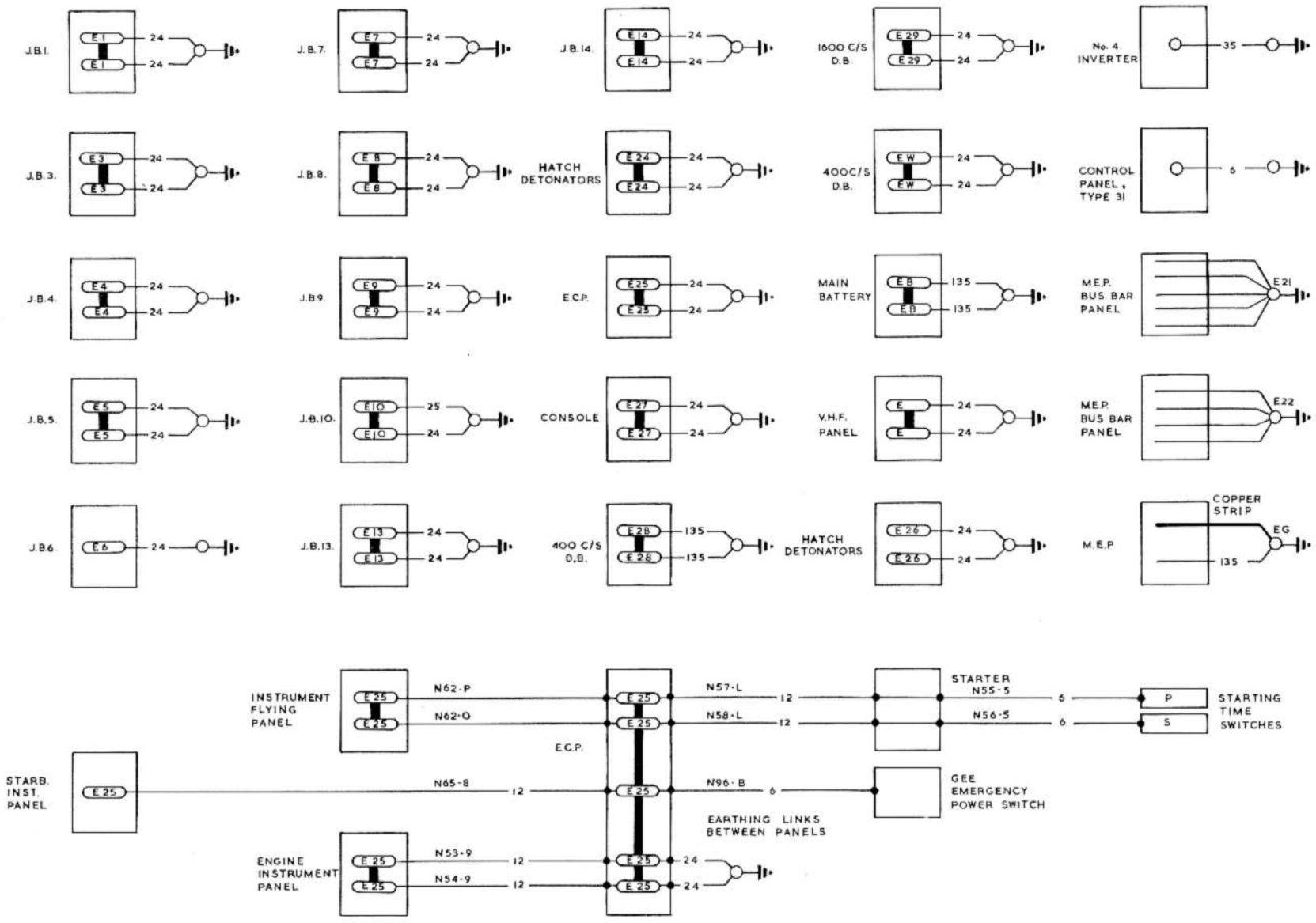


Fig.24. Circuit earthing details

ARMAMENT AND PHOTOGRAPHIC - GROUP A & B

(Completely revised)

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DESCRIPTION

Introduction

1. This group describes the operation of the photoflash and camera installations in the aircraft. Detailed information on the various camera roles and equipment used is given in Sect.5, Chap.2, Group A and B.

Camera distribution panel

General

2. Power supplies to the camera and photoflash circuits are distributed from this panel located at the starboard side of the navigator's station.

3. The panel houses a number of camera circuit fuses, camera circuit control switches, and two magnetic indicators; the latter when energized indicate that the camera doors and flare bay doors are open.

Two Type S3 relays, one of which is the camera doors interlock relay, a Type S1 relay, and a Type K3000 *(No.5)(photoflash gone relay)* are also housed. The F89 FLASH RELEASE/CAMERA START push-switch is connected to a short length of flexible lead and fitted in a stowage clip on the underside of the panel. Adjacent to the latter switch stowage is a Type Q relay *(camera master control)*. The front

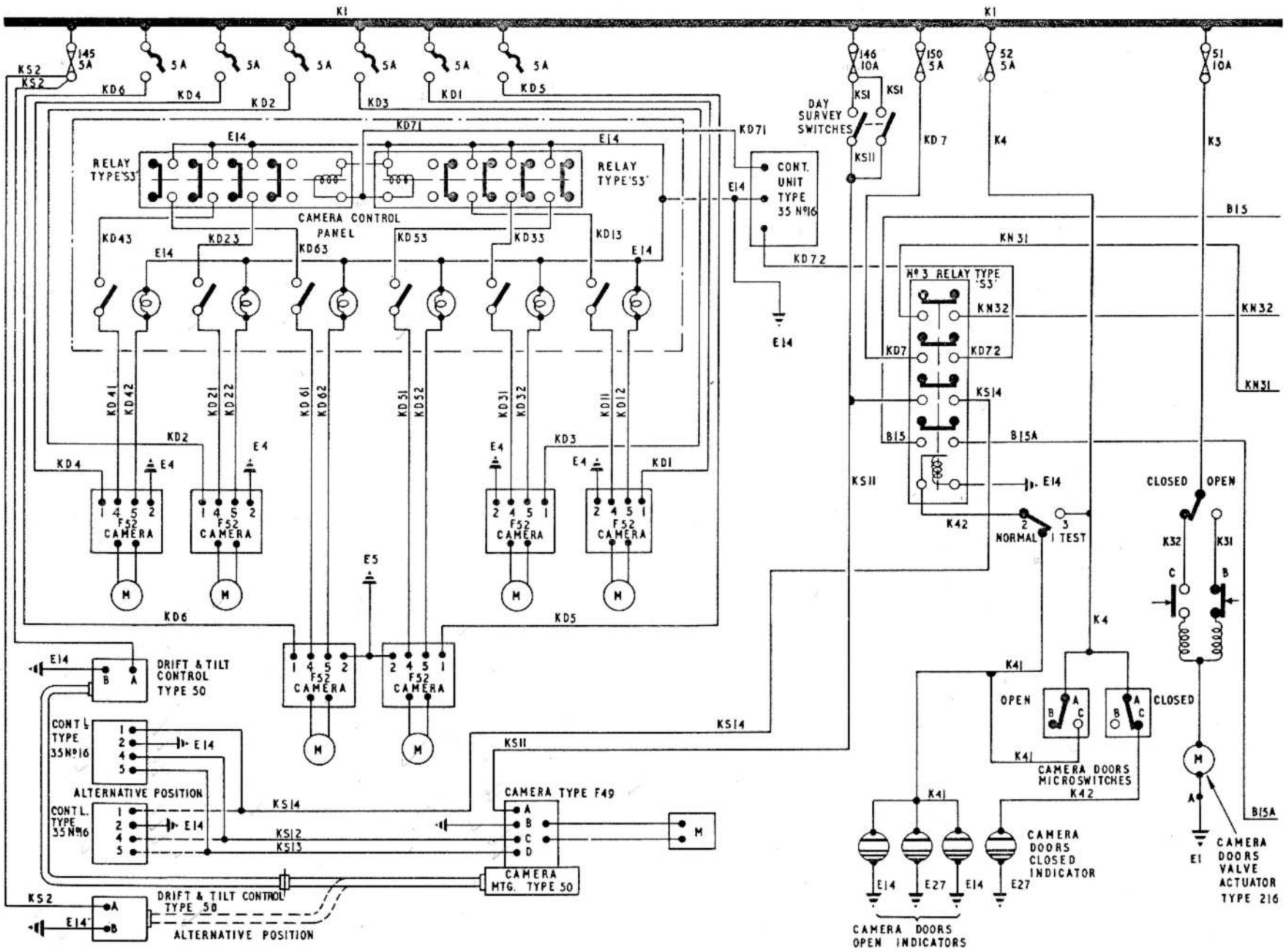

Fig. 1. Day cameras

panel embodies the following indicators and switches:—

CAMERA DOORS indicator
FLASH DOORS indicator
FLASH PULSE indicator
DAY SURVEY – ON/OFF switch
DAY CAMERAS – TEST/NORMAL switch
F89 CAMERAS – ON/OFF switch
F89 MASTER SELECTOR – PORT – STBD switch
F89 CAMERA STOP Push-switch
F89 PHOTOFLASH STOP push-switch

Camera control panel

4. The camera control panel is mounted on the port wall in the nose. From this panel, selection is made of the individual F52 camera circuits. Two Type S3 relays, one for the port cameras and one for the starboard cameras, are mounted on the underside of the panel and are energized from a Type 35, No.16 control unit. An F89 FLASH RELEASE/CAMERA START push-switch is connected to the panel by a short length of flexible lead, and is electrically connected in parallel with a similarly labelled push-switch, fitted in a stowage clip on the underside of the camera distribution panel. The switches and indicators mounted on the front of the panel are as follows:—

(F52) PORT CAMERAS – AFT – CTR – FWD switches
(F52) STBD CAMERAS – AFT – CTR – FWD switches
(F52) PORT CAMERAS – AFT – CTR – FWD indicator lamps
(F52) STBD CAMERAS – AFT – CTR – FWD indicator lamps
CAMERA DOORS indicator
FLASH DOORS indicator
F89 CAMERA STOP push-switch
F89 PHOTOFLASH STOP push-switch

Camera circuit breaker box

5. This box, mounted on the port wall in the nose aft of the camera control panel, houses six circuit breakers, one for each F52 camera, and an ON/OFF switch, labelled DAY SURVEY, for the F49 camera.

Flare bay doors operation

6. The flare bay doors are hydraulically operated and controlled by a Type 206 electrical actuator mounted in the roof of the flare bay. Normal operation of the doors is controlled by the PHOTO-FLASH DOORS switch mounted on the console which, when selected to OPEN, directly operates the Type 206 electrical actuator causing the doors to open. When the switch is selected to SHUT, the electrical actuator is fed via the normally-closed contacts of a Type S1, No.1 relay in the console.

Flare bay doors indicators

7. Indication that the flare bay doors are open is given by three magnetic indicators located one on the console, one on the camera distribution panel, and one on the camera control panel in the nose. The indicators are operated by two microswitches, mounted on the flare bay forward bulkhead, which close when the doors are fully open. A PHOTOFLASH DOORS CLOSED indicator, fitted on the console, is controlled by two further microswitches which operate when the doors are fully closed.

Camera doors operation

8. Sliding doors at each camera location are operated by hydraulic jacks and controlled by a Type 216 electrical actuator mounted in the roof of the flare bay, the electrical actuator being controlled by the CAMERA DOORS switch on the console.

Camera doors indicators

9. Indication that the camera doors are open is given by three magnetic indicators located, one on the console, one on the camera control panel, and one on the camera distribution panel. In addition a magnetic indicator, indicating when the doors are closed, is fitted on the console. The supply to these indicators is fed through two microswitches fitted adjacent to and operated by the centre camera bay doors. One microswitch serves for doors OPEN indication and the other for doors CLOSED.

Photoflash installation

General

10. When the aircraft is used for a night photographic role, the cameras are operated in conjunction with the discharge of photoflashes carried on a beam in the flare bay.

Flare beam

11. This beam is fitted with two release slips, numbered 1 and 2 from the forward end of the beam, which are used to carry either a Type 1, Mk.2 multi-store carrier at the No.1 position or a 252 x 1.75 inch photoflash container at the No.2 position, the latter role not being required on this aircraft. The two release slips are not electrically connected to the aircraft wiring and are used only as attachment points for the carriers. The manually-operated release mechanisms are operated by cables which run along the top of the beam and terminate in finger rings located under spring-loaded covers, labelled MANUAL RELEASE No.1 SLIP and MANUAL RELEASE No.2 SLIP, at the aft end of the beam. Cocking indicator sockets are provided at the aft end of the beam for checking that the release units are securely cocked. The beam is attached to the aircraft structure by 5/8 inch bolts at the

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AP4343X, Sect 24, Chap 3

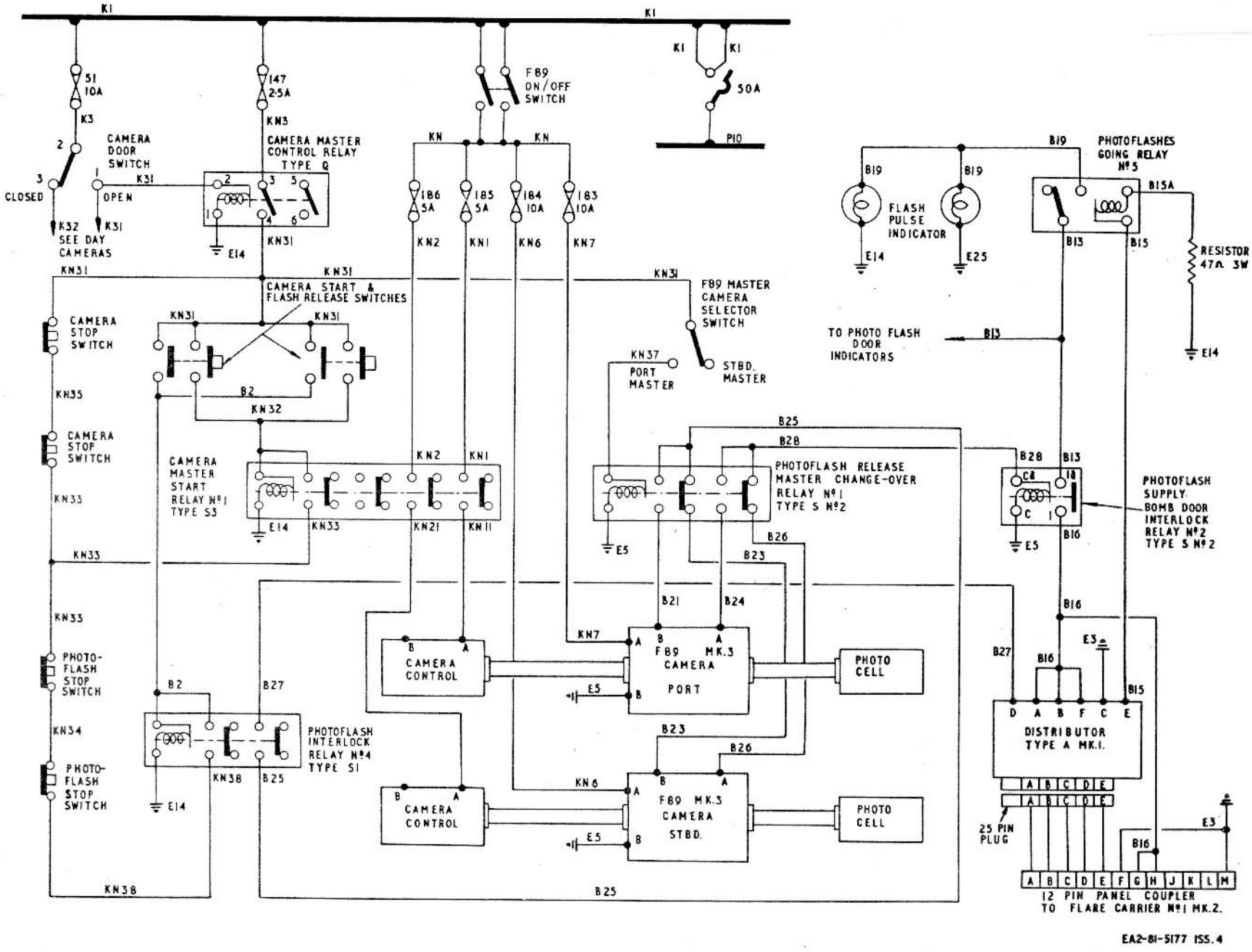


Fig. 2. F89 cameras and photoflash release

forward end and dowel pins at the aft end. Adjustable crutching bolts are attached to each side of the beam for stabilizing whichever carrier is fitted to it. Detailed information on the flare beam is contained in A.P.1664A, Vol.1, Book 2, Sect.3.

Photoflash release

12. Selecting the CAMERA DOORS switch to OPEN feeds a d.c. supply to energize and close the Type Q camera master control relay. On closing, the Type Q relay feeds a supply to the FLASH RELEASE/CAMERA START switches and the F89 MASTER CAMERA SELECTOR switch. When the latter is selected to STBD MASTER, the starboard F89 camera is the master controller for photoflash release, and when selected to PORT MASTER a Type S relay in the centre camera bay is energized with the result that the role of master is changed over from the starboard to the port camera. Pressing either FLASH RELEASE/CAMERA START switch energizes the camera master start relay and the photoflash interlock relay, the retaining circuit of the camera master start relay being completed through the CAMERA STOP switches. The CAMERA STOP switches control the retaining circuits of both relays, and the PHOTO-FLASH STOP switches the photo-flash interlock relay only. Film now passes through the cameras and electrical pulses from the master camera to the Type A distributor cause the release, at intervals, of photo-flashes. The release of each photo-flash energizes a PHOTO-FLASH GOING relay in the camera distribution panel. On closing, the relay energizes two flash pulse indicators fitted, one on the pilot's instrument panel and the other on the camera distribution panel.

Note...

Bomber Command Mod.No. 91 introduces 'flashes gone' indicators. These indicators are located on the top of the camera distribution panel and are duplicated on the camera control panel. With the photoflashes installed on the carrier, circuits B81, B82, B83, B84 and B85 are completed resulting in the indicators being energized to show white. As each store is released, its respective indicator circuit is de-energized and the indicator shows black.

Photoflash jettison

13. Emergency jettison of the 8-inch photoflashes is controlled by the PHOTO-FLASH JETTISON SAFE switch on the console. Selecting the switch to ON energizes a Type S1 No.1 relay in the console. On closing, the relay completes a d.c. supply from busbar P9 to the flare bay doors electrical actuator, causing the doors to open; at the same time a supply is fed from P9 via the relay to two series-connected microswitches on the flare bay forward bulkhead. When these switches close, due to the doors moving to the fully open position, a supply is fed via the 5-pole clipper socket on the flare beam to the carrier jettison circuits, resulting in the photoflashes being released SAFE.

Camera power supplies

F52 day cameras

14. These cameras operate from 28-volts d.c. fed from six 5 amp. circuit breakers in the camera circuit breaker box. The cameras are selected at the camera control panel by six switches in two banks of three, labelled PORT CAMERAS – AFT – CTR – FWD and STBD. CAMERAS – AFT – CTR – FWD; visual indication of the cameras operating is provided by six indicator lamps adjacent to their respective camera switches on the panel. The cameras are controlled to operate at predetermined intervals by a Type 35, No.16A camera control unit, positioned on a horizontal wedge plate at the port side of the photographic sight in the nose.

F49 day camera

15. This camera operates from 28-volts d.c. fed from fuse 146 through one of two switches, one on the camera distribution panel and the other on the camera circuit breaker box, labelled DAY SURVEY – ON/OFF. The operation of the camera is controlled by a Type 35, No.16A camera control unit mounted at the starboard side in the nose on a horizontal wedge plate. The camera is carried in a Type 50 mounting designed so that corrections for drift and tilt of the aircraft can be applied to the camera from a remote position; this facility is controlled by a Type 50 control unit, from which the corrections are made, mounted on a wedge plate in the nose. Two Desynn indicators, fitted to the control unit and operated by transmitters on the camera mounting, indicate the degree of correction applied. Alternative positions for the Type 50 control unit and the Type 35, No.16A camera control unit are provided at the navigator's rear station, both units being fitted on wedge plates adjacent to the camera distribution panel.

Day cameras test switch

16. A switch labelled DAY CAMERAS – TEST/NORMAL, mounted on the camera distribution panel, is provided to enable tests to be carried out with the camera doors closed.

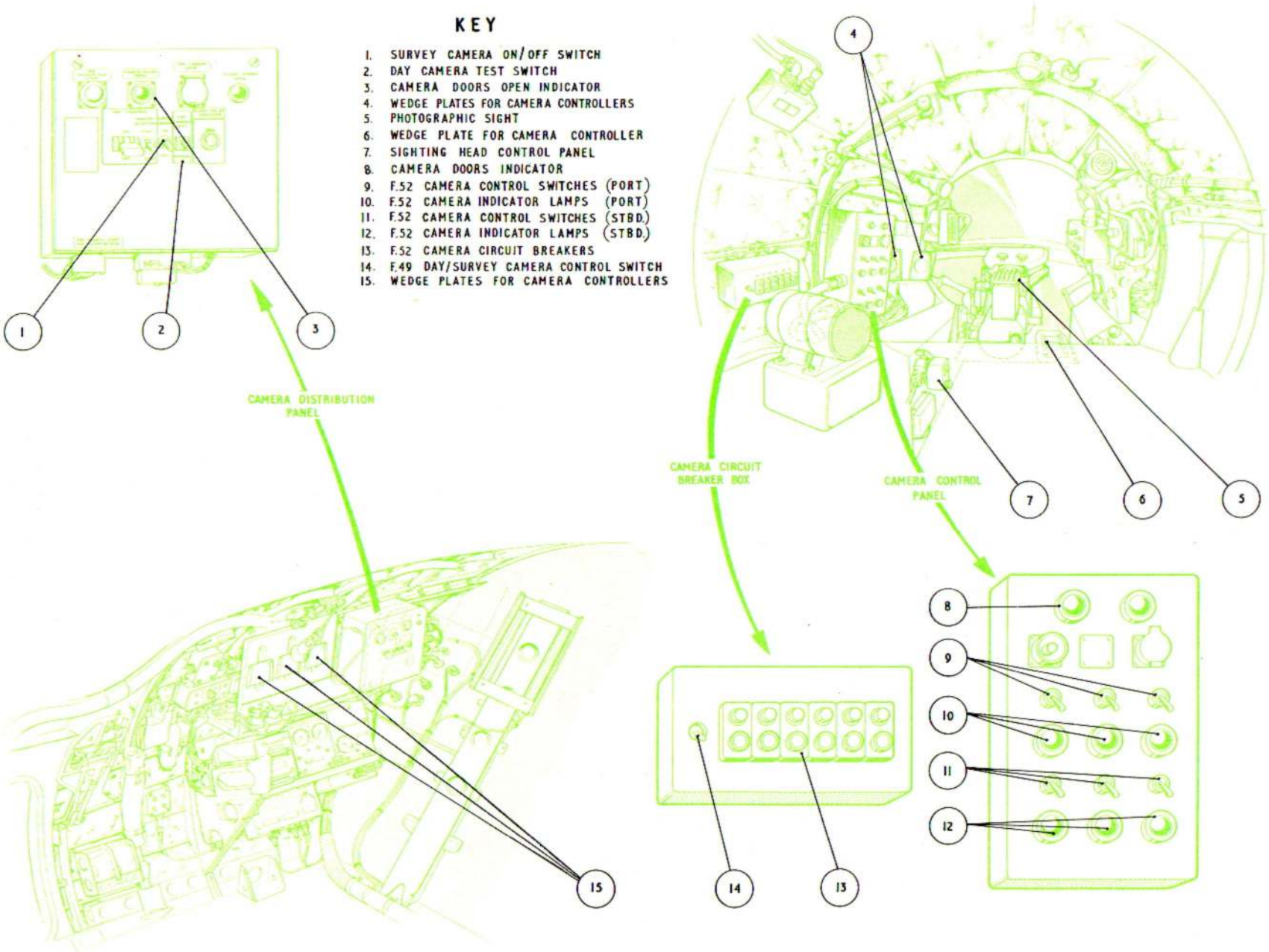


Fig. 3. Day camera control equipment

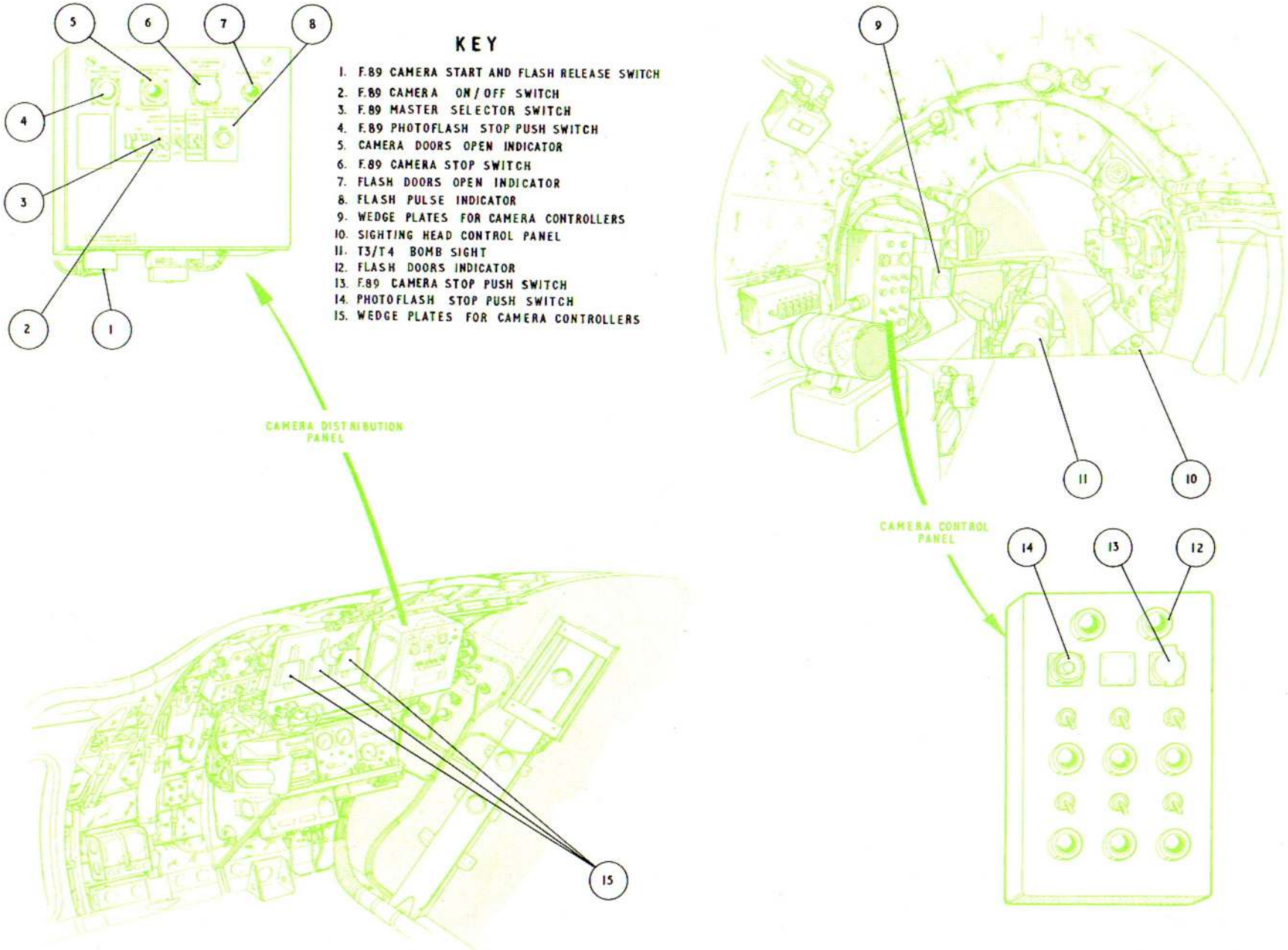


Fig. 4. Night camera control equipment

F89 Mk.3 cameras

17. The 28-volt d.c. power supply to these cameras is fed from fuses 183 and 184 via a double-pole switch, labelled F89 CAMERAS ON/OFF, on the camera distribution panel. In addition to controlling the power supply to the cameras, the F89 CAMERAS ON/OFF switch controls the power supply to the Type 89 camera control units, mounted on wedge plates adjacent to the camera distribution panel or alternatively on the wedge plates in the nose, via the normally-open contacts of the camera master start relay on the camera distribution panel. The Type S3, No.1 camera master start relay is controlled by either of the FLASH RELEASE/CAMERA START switches, providing the camera doors are open *(para.12)*. Pressing either FLASH RELEASE/CAMERA START switch energizes and closes the camera master start relay and the photoflash interlock relay *(para.12)*.

F89 Mk.3 camera stop switches

18. Two switches, one mounted on the camera distribution panel and the other on the camera control panel, are provided for stopping the cameras. Pressing either STOP switch results in the retaining circuit of the Type S3, No.1 camera master start relay being broken causing the relay to open and both cameras to stop.

Photographic sight Type 1 *(day role)*

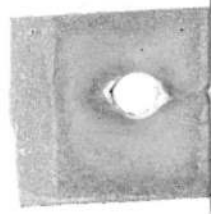
19. A Type 1 photographic sight is installed above the sighting window in the nose of the aircraft. It is a gyro-controlled instrument requiring power supplies of 28 volts *(nominal)* d.c. and 115 volts, 400 c/s, 3-phase a.c. *(see Group D)*, and functions in conjunction with a control panel adjacent to it.

Sighting head control panel

20. This panel *(Pt.No. 9/4533)*, mounted at the port side of the photographic sight, controls the d.c. supply to the sighting head collimator lamp. Housed in the panel is a dimmer resistor labelled COLLIMATOR LIGHT.

T3/T4 bomb sighting head *(Mod.3301)*

21. Mod.3301 introduces a Type T3 or T4 bomb sighting head, to assist in the dropping of photoflashes, as an alternative to the Type 1 photographic sighting head. The sighting head is a gyro-controlled instrument requiring power supplies of 28 volts *(nominal)* d.c. and 115 volts, 400 c/s, 3-phase a.c. *(see Group D)*. A gyro-control unit, mounted at the starboard side in the nose forward of the oxygen regulator, controls the gyro-unit in the bomb sighting head. When a Type T3 bomb sighting head is fitted a Type T3 gyro-control unit is used and similarly, if a Type T4 sighting head is fitted a Type T4 gyro-control unit is used, both types of gyro-control unit being interchangeable in the aircraft wiring.



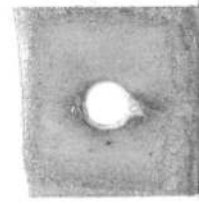
Sighting head control panel

22. This panel *(Pt.No. 109/82, or alternatively Pt.No. 9/4578)*, mounted at the starboard side of the sighting head, is used to control the d.c. supply to the sighting head collimator and drift scale lamps. The panel houses two dimmer resistors, one labelled DRIFT SCALE LIGHT and the other labelled COLLIMATOR LIGHT, and an ON/OFF switch which controls the power supply to the panel. When a Type T3 bomb sighting head is fitted, cable assembly N413 is connected between the bomb sight and the control panel *(Pt.No. 109/82)*, and cable assembly N407B-N407 is connected between the control panel and the camera distribution panel. If a Type T4 bomb sighting head is fitted, cable assembly N409 is connected between the bomb sight and the control panel *(Pt. No. 9/4578)*, and cable assembly N407A-N407 is connected between the control panel and the camera distribution panel. The cable assemblies not in use are stowed in a stowage bag at the port side of the bomb sighting head.

SERVICING

Flare doors and camera doors installation

23. The hydraulic valve actuator assemblies, Type 206 and Type 216, used respectively in the control of the flare bay doors and the camera doors, both incorporate a Type 200 electrical actuator for their operation. A full description of the actuator is contained in A.P.4343D, Vol.1, Book 5, Sect.16, Chap.11.



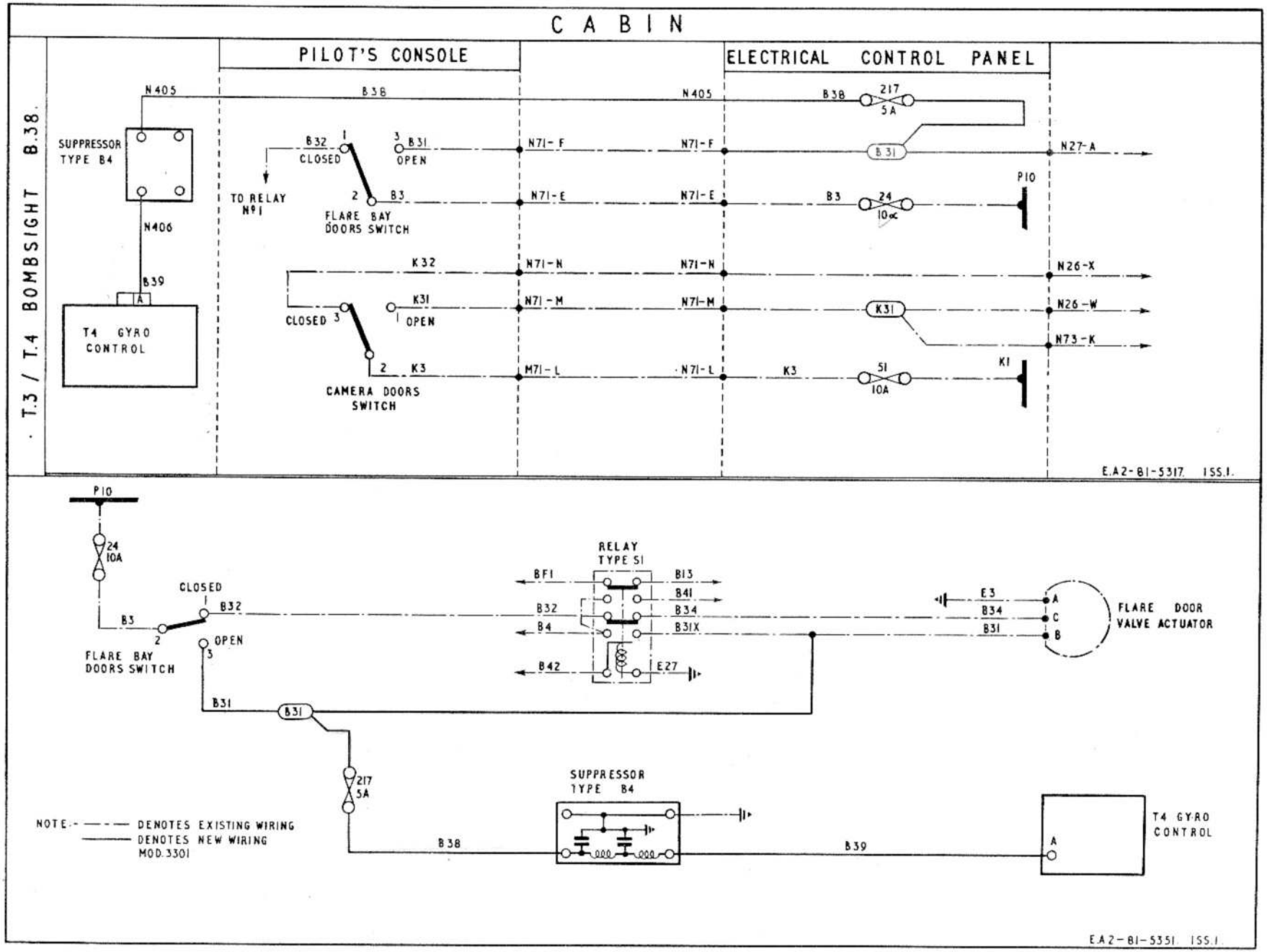


Fig. 5. Alterations to circuit and routeing diagrams on the introduction of Mod.3301

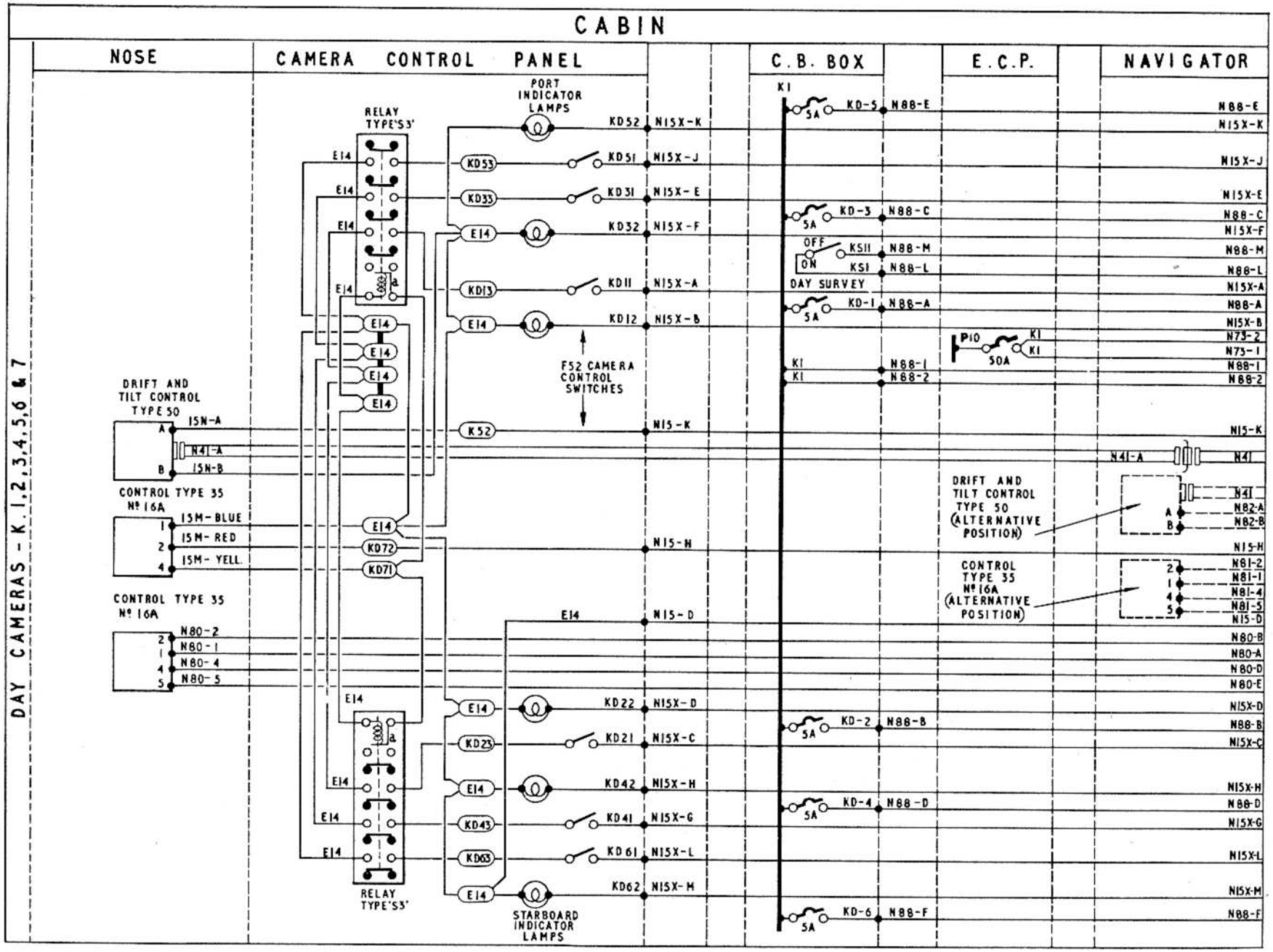


Fig. 6. Day cameras

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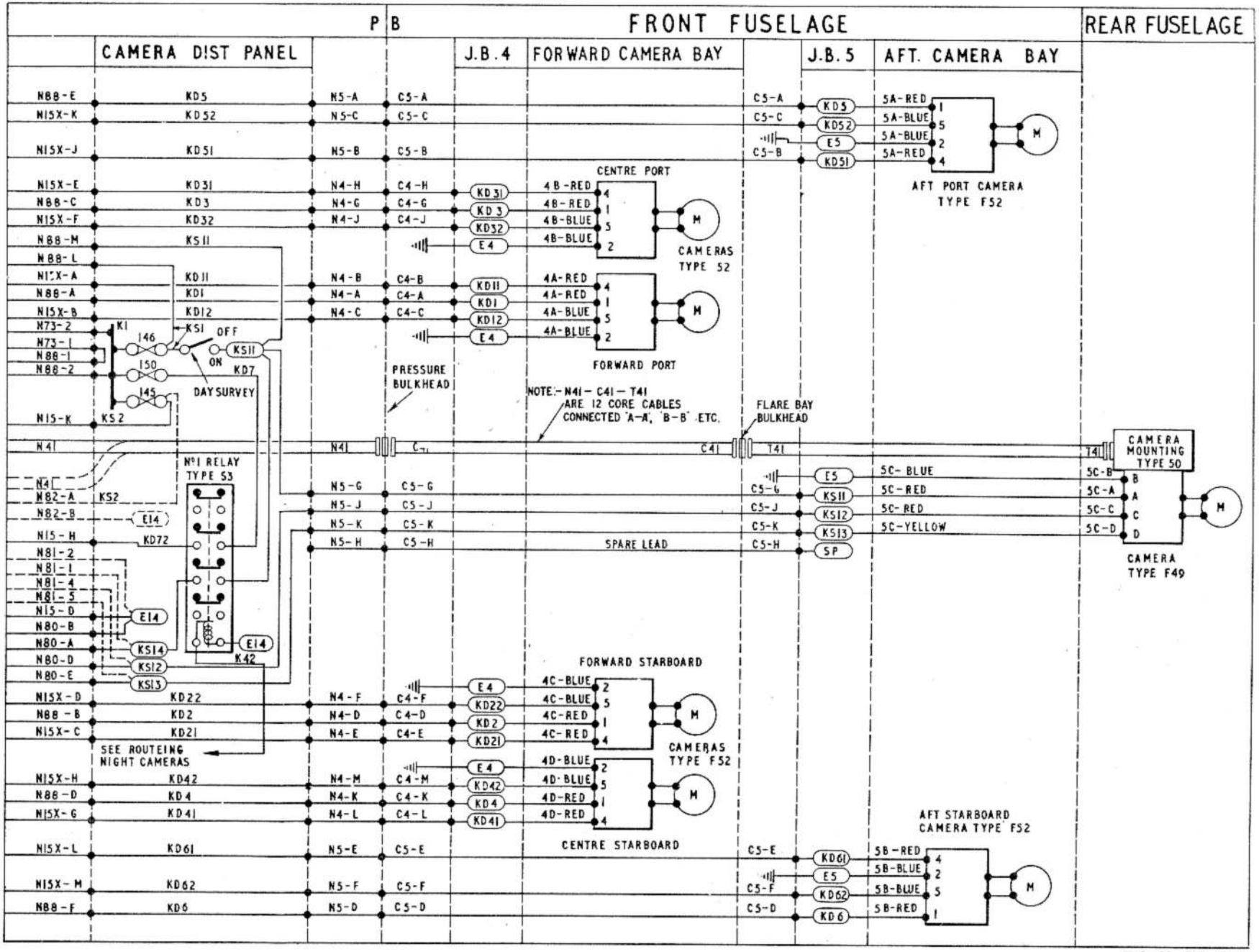

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Fig. 6A. Day cameras

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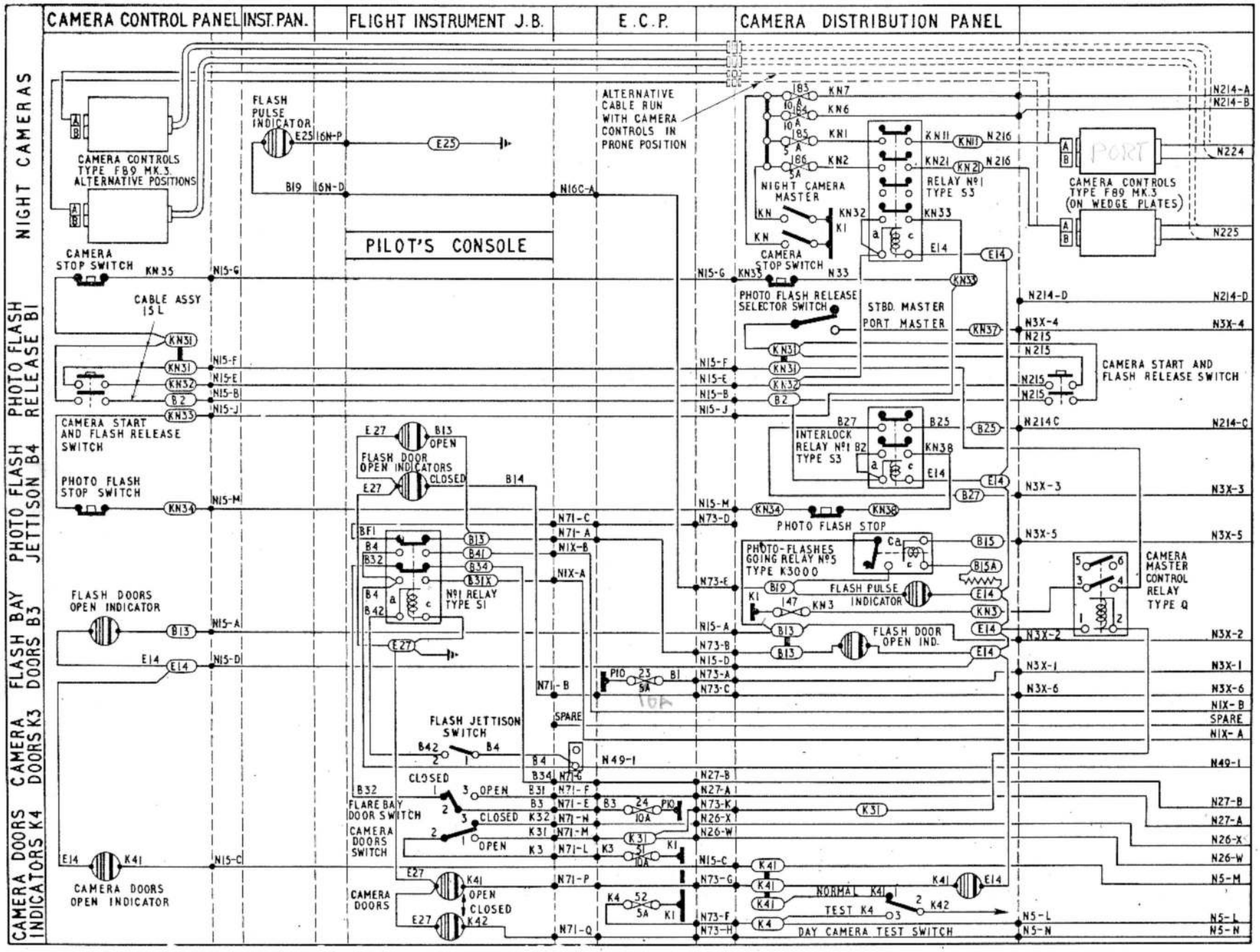

Fig. 7. Flare doors and camera doors control – photoflash jettison – night cameras – photoflash release (post Mod.2172)

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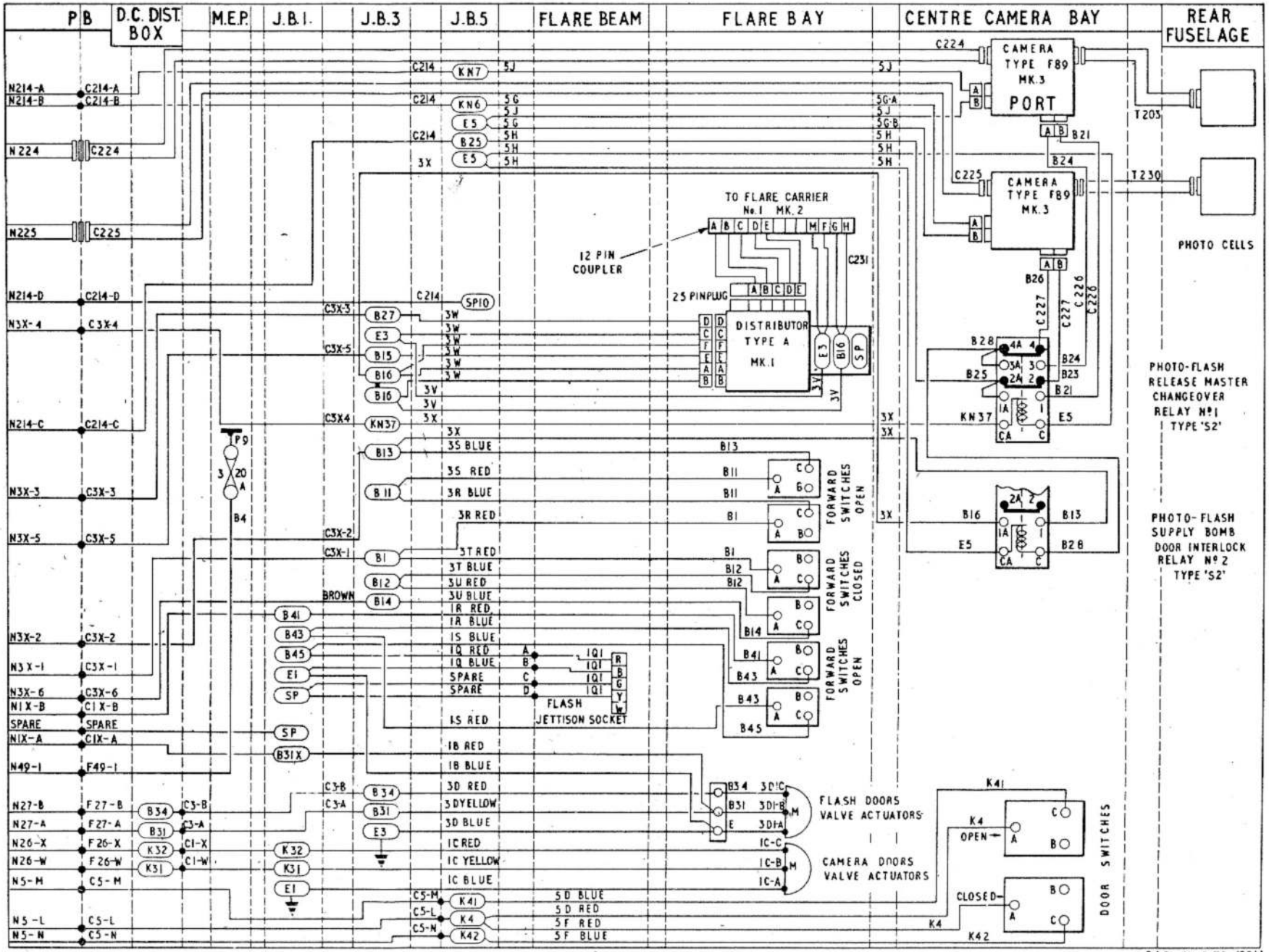

Fig. 7A. Flare doors and camera doors control – photoflash jettison – night cameras – photoflash release (post Mod.2172)

RESTRICTED

GROUP C – CONTROL SURFACES

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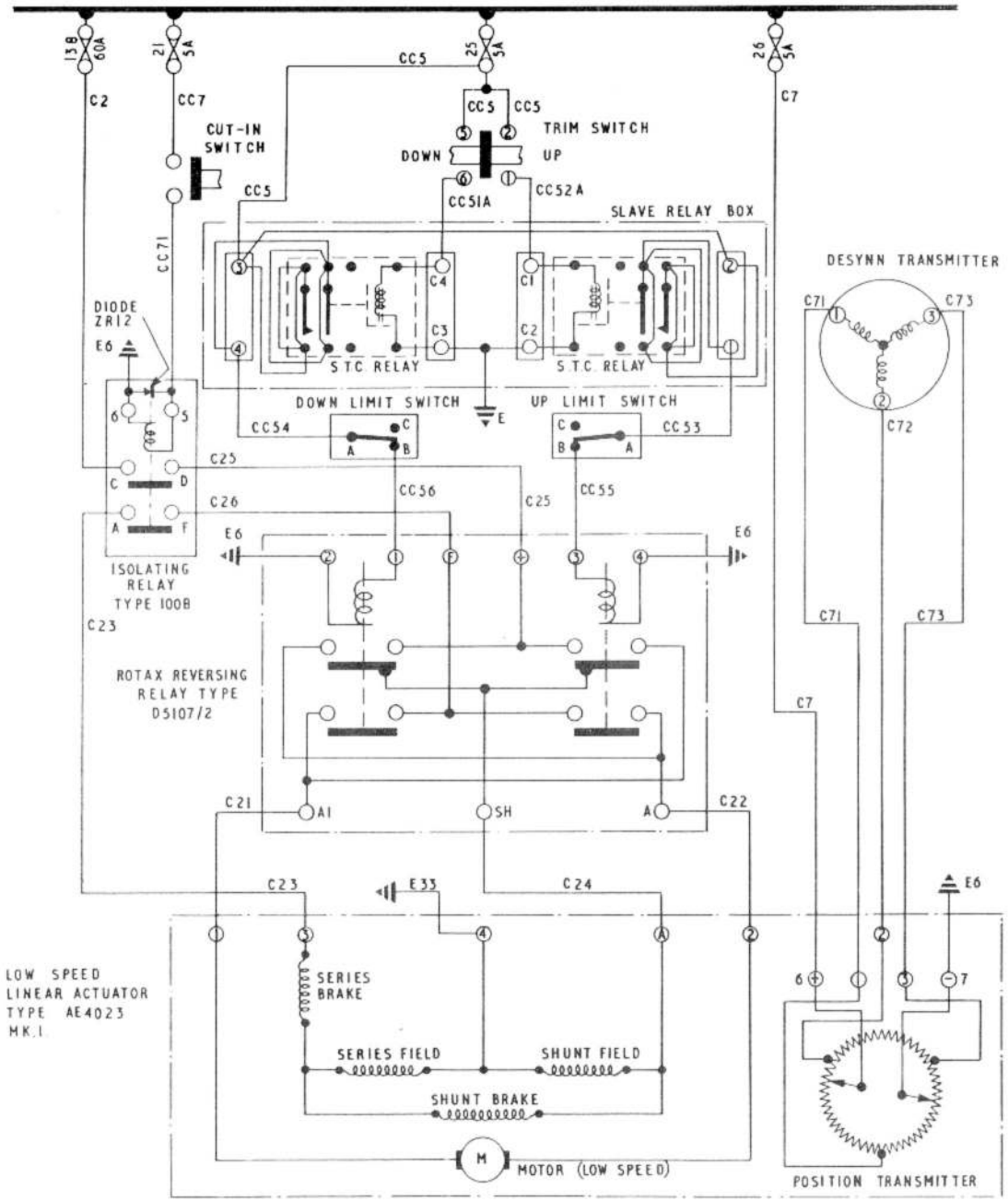

Fig.1. Tail plane incidence control (post Mod.2159)

(Mod.4107 embodied)

DESCRIPTION

TAIL PLANE CONTROL

General

1. Variation of tail plane incidence is controlled by an electrically-operated actuator which forms an extensible strut between the tail plane and the fuselage. Operation of the actuator is controlled by a cut-in switch and a trim switch fitted in the right hand grip of the control column. The switches operate in conjunction with an isolating relay, two S.T.C. relays, two limit switches, and a reversing relay. Visual indication of the tail plane setting is shown by a Desynn indicator, located on the pilot's main instrument panel, controlled by a transmitter embodied in the actuator.

Actuator, Type AE.4023, Mk.1 or Mk.2

2. This electrical actuator, located in the rear fuselage between frames 45 and 46, consists of a compound-wound 28-volt d.c. motor, fitted with a magnetic brake to ensure accurate positioning of any point during the stroke. Drive from the motor to the ram is provided by an arrangement of spur and epicyclic gear trains. The final spur gear is attached to a combined acme nut and ball screw which, through the mated thread on the ram, provides linear movement. The position of the ram is constantly indicated by a Desynn indicator *(para.8)*, which is connected to a potentiometer transmitter housed in the actuator.

Control switches

3. The cut-in and trim switches are fitted in a removable block embodied in the right handle of the control column, the cut-in switch being located forward of the trim switch and secured by a pin which engages

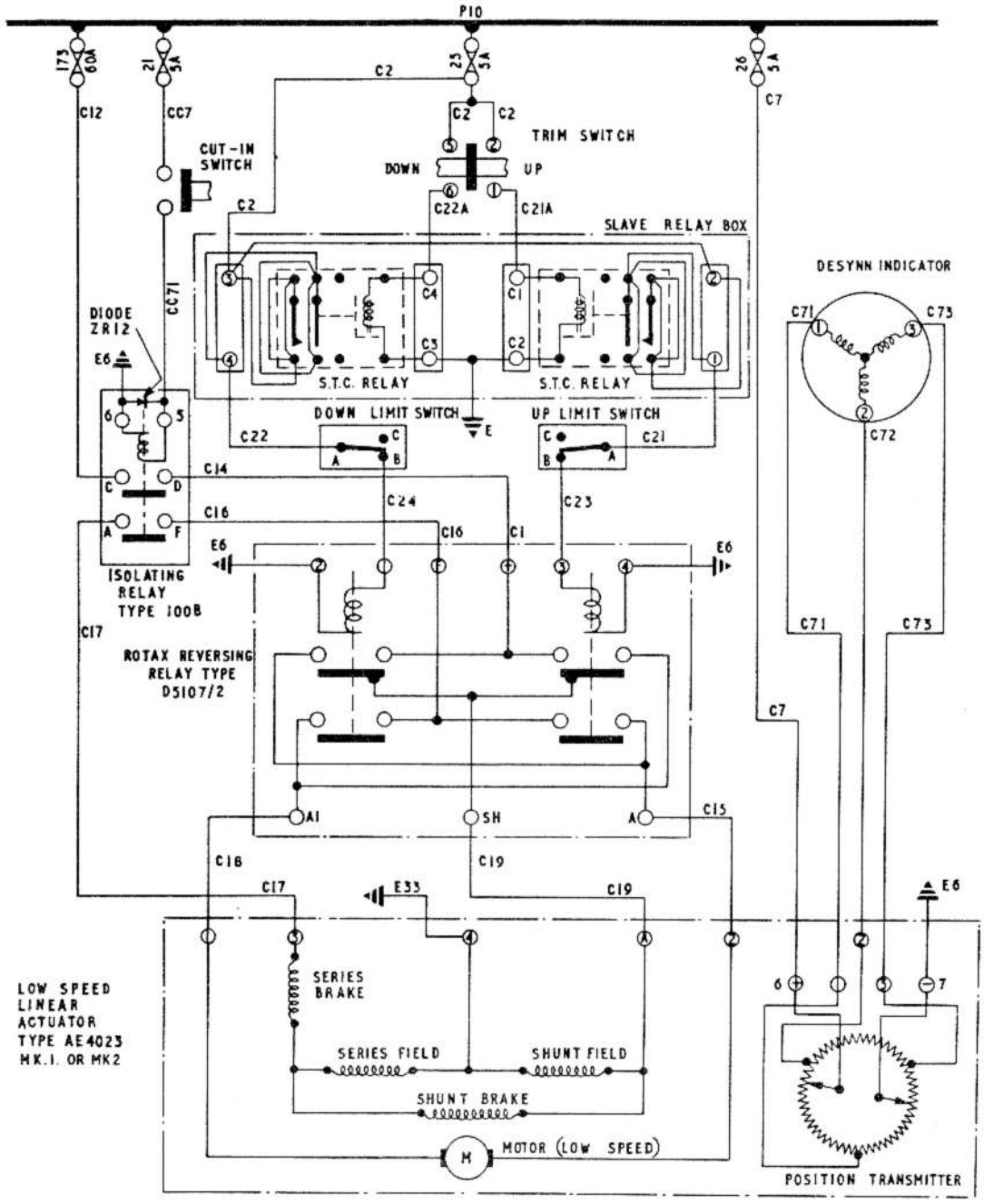

Fig. 2. Tail plane incidence control (post Mod.3872)

◀ *(Mod.4107 embodied)* ▶

tangentially with a circular groove in the switch body. The securing pin is accessible when the switch block is removed from the handle. The trim switch is secured by a wire circlip having a small locating lug and to ensure that the switch can only be operated in a fore and aft direction, the switch body has a small locating pip which slides in a key slot in the switch block. During fitting, the circlip is slid down the switch body with the lug opposite the key slot; when at the correct position the lug is turned by means of a narrow blade until it engages with a small horizontal slot cut into the switch block at right angles to the key slot. To prevent any pull being transmitted to the switch connections, the switch cables are secured by a split clamp inside the right handle of the control column. The two sections of the clamp are held together by two round-headed screws which are accessible from the underside of the handle.

Slave relay box

4. Two small Type SM5A-H19 S.T.C. relays, one wired in the NOSE UP circuit and the other in the NOSE DOWN circuit, are located in a box at the base of the control column below the pilot's floor. The relays are used as slaves between the trim switch and a reversing relay *(para.6)*.

Isolating relay, Type 100B

5. This relay is installed in the rear fuselage near J.B.6, and it is used to ensure that the tail plane actuator will only function when the cut-in and trim switches are operated simultaneously. Its operation controls the power supply to the actuator via a reversing relay. On the introduction of Mod.3701 a Type ZR12 diode is connected across the energizing and earth terminals of the relay to reduce arcing at the pilot's cut-in switch.

Reversing relay, Type D5017/2

6. This relay, mounted in the rear fuselage at the starboard side between frames 40 and 41, is a double-pole changeover relay and is used to reverse the direction of flow in the armature windings of the actuator motor, thereby reversing the direction of its rotation and subsequently the linear movement of the actuator.

Limit switches

7. Normal tail plane travel is limited by two microswitches installed one above and one below the tail plane. The switches are mounted on the fuselage and operate in conjunction with adjustable tappets fitted to the tail plane. Whenever the tail plane exceeds pre-determined limits of travel in either direction, one of the switches opens resulting in the actuator motor stopping. Setting of the limit switches is described in Sect.3, Chap.4.

Desynn indicator

8. This indicator, mounted on the pilot's main instrument panel, shows the position of the tail plane throughout its travel and operates in conjunction with a potentiometer transmitter housed in the electrical actuator.

Operation

9. Provided that the isolating relay is energized by operating the cut-in switch, selecting NOSE UP on the trim switch results in the NOSE UP S.T.C. relay closing and completing the power supply to energize the reversing relay via the UP limit switch. On closing, the reversing relay completes the power supply to operate the actuator in the NOSE UP direction. Similarly selecting NOSE DOWN on the trim switch results in the NOSE DOWN S.T.C. relay closing and completing the power supply to energize the other pole of the reversing relay. On closing, the reversing relay completes the power supply to operate the actuator in the NOSE DOWN direction. If tail plane trim is selected long enough for either limit switch to operate, the reversing relay will open and break the power supply to stop any further tail plane travel. To enable fine adjustment of tail plane travel to be made, the cut-in switch is operated and the trim switch is selected to the required direction of travel progressively until the setting is obtained.

RUDDER TRIM CONTROL

General

10. Rudder trim is effected by a Type 258 linear electrical actuator situated at the base of the rudder. The actuator is controlled by a double-pole 3-position switch on the console. The switch is so designed that each pole may be independently operated. The trim tab position is shown by a Desynn indicator, on the pilot's main instrument panel, which is controlled by a transmitter embodied in the actuator.

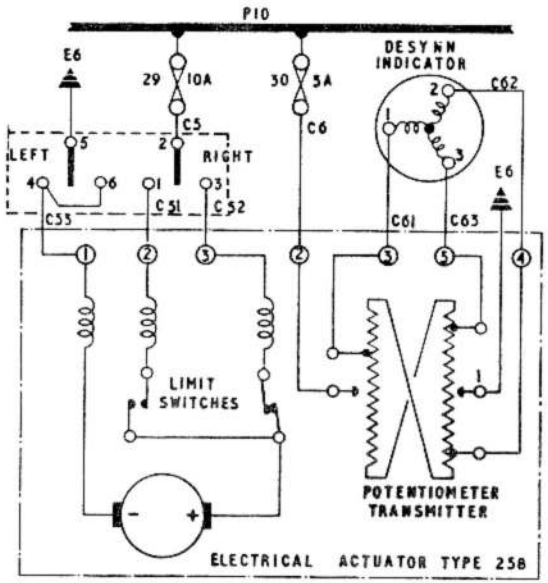

Fig. 3. Rudder trim control

(Mod.4229 embodied)

Actuator, Type 258

11. The actuator, located in the tail fin at the base of the rudder, consists of a 2-pole, split series field, 24-volt d.c. motor driving an actuating nut through the medium of a dog clutch and three-stage reduction spur gear train. The third reduction gear wheel rotates a steel screw which, in turn, drives the actuating nut. Snap-action limit switches, housed in the actuator, switch off the motor supply current when the actuating nut reaches its extreme positions of travel. In the event of failure of the limit switches, the actuating nut is brought to a standstill by coming into contact with a mechanical stop. The position of the actuating nut at any part of its stroke is constantly indicated by a Desynn indicator *(para.13)*, which is connected to a potentiometer transmitter housed in the actuator.

Control switch

12. The double-pole control switch, located on the console and labelled RUDDER TRIM Left/Right, is connected with one pole in the positive circuit and the other in the negative circuit of the actuator; both switch toggles must be selected before the circuit is operative.

Desynn indicator

13. This indicator, mounted on the pilot's main instrument panel, shows the position of the rudder trim tab throughout its travel and operates in conjunction with a potentiometer transmitter housed in the electrical actuator.

Operation

14. Selecting Right simultaneously with both RUDDER TRIM switch toggles results

◀ in the actuator moving the rudder trim tab to the right, and similarly selecting Left simultaneously with both switch toggles results in the actuator moving the rudder trim tab to the left. To enable fine adjustments to be made one of the switch toggles can be selected to the required direction of travel and the other toggle operated progressively until the setting is obtained. ▶

AILERON TRIM CONTROL

General

15. Aileron trim is effected by a Type 259 linear electrical actuator coupled to the aileron mechanism at the base of the control column below the pilot's floor. The actuator is controlled by a 3-position switch on the console. The amount of trim is shown by a Desynn indicator, on the pilot's main instrument panel, which is controlled by a transmitter embodied in the actuator.

Actuator, Type 259

16. The actuator, located at the base of the control column below the pilot's floor, consists of a 2-pole, split-series field, 28-volt d.c. motor driving an actuating nut through the medium of a dog clutch and 3-stage reduction spur gear train. The third reduction gear wheel rotates a steel screw which, in turn, drives the actuating nut. Snap-action limit switches, housed in the actuator, switch off the motor supply current when the actuating nut reaches its extreme positions of travel. In the event of failure of the limit switches, the actuating nut is brought to a standstill by coming into contact with a mechanical stop. The position of the actuating nut at any part of its travel is constantly indicated by a Desynn indicator *(para.18)*, which is connected to a potentiometer transmitter housed in the actuator.

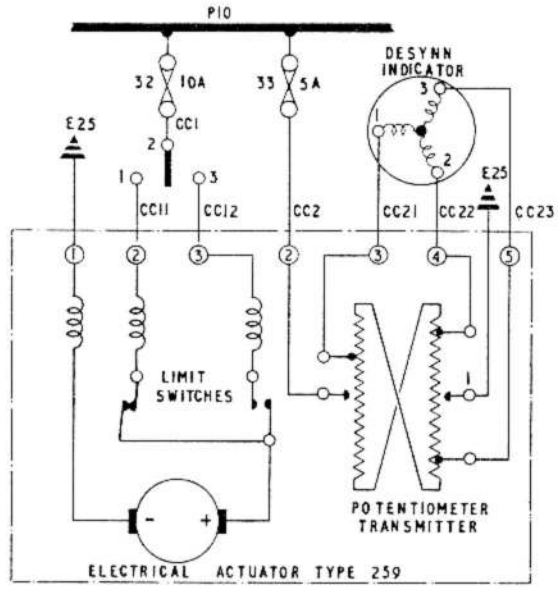

Fig.4. Aileron trim control

Control switch

17. The control switch, labelled AILERON TRIM Left/Right, is located on the console and controls the power supply to the actuator.

Desynn indicator

18. This indicator, mounted on the pilot's main instrument panel, shows the amount of trim applied and operates in conjunction with a potentiometer transmitter housed in the electrical actuator.

Operation

19. Selecting Left or Right with the AILERON TRIM switch results in the actuator applying trim in the appropriate direction.

FLAPS CONTROL

General

20. The flaps, installed on the trailing edge of each wing, are operated by hydraulic jacks controlled by a Type 205 rotary valve actuator situated in the roof of the flare bay, and a two-position switch on the alighting gear panel. The Type 205 rotary actuator is operated by a Type 200 electrical rotary actuator via a mechanical linkage. A Desynn indicator, mounted on the alighting gear panel, operated by a transmitter in the trailing edge of the port wing, shows the flap position.

Actuator, Type 200

21. The actuator, installed in the roof of the flare bay and mechanically linked to the Type 205 actuator, consists of a 2-pole, split-series field, 28-volt d.c. motor, driving

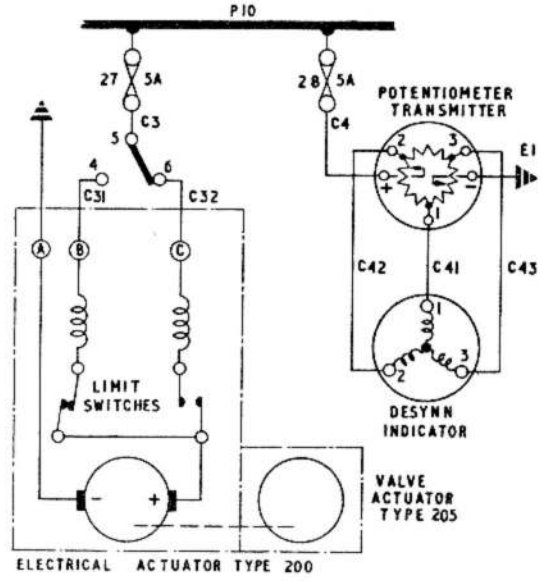

Fig.5. Flaps control

through a clutch, a two-stage epicyclic gear train, and a worm and wheel. Two limit switches are embodied in the actuator to switch off the motor supply at the extreme limit of a pre-determined angle of rotation, and mechanical stops are provided to prevent overrun of the output shaft.

Control switch

22. The control switch, labelled FLAPS — UP — DOWN, is located on the alighting gear panel and controls the power supply to the Type 200 electrical actuator.

Desynn indicator

23. This indicator, located adjacent to the control switch *(para.22)*, shows the position of the flaps and operates in conjunction with a potentiometer transmitter linked to the flap actuating mechanism in the inboard trailing edge of the port wing.

Operation

24. Selecting DOWN with the FLAPS switch causes the electrical actuator to operate the Type 205 actuator and extend the jacks in the wings, thereby lowering the flaps. Similarly selecting the FLAPS switch to UP causes the electrical actuator to operate the Type 205 actuator, in the reverse direction, and retract the jacks in the wings, thereby raising the flaps. The hydraulic system is fully described in Sect.3, Chap.6.

AIR BRAKES CONTROL

General

25. The air brakes system consists of a number of hydraulically-operated drag channels which are actuated by hydraulic jacks to project above and below the main planes when required. The hydraulic system is controlled by a Type 217 rotary valve actuator in the roof of the flare bay. The Type 217 rotary actuator is operated by a Type 200 electrical rotary actuator via a mechanical linkage, the electrical actuator being controlled by a switch on the control column. Two systems are in use; one *(pre Mod.709)* has two selections only, brakes in and brakes out, while the other *(post Mod.709)* provides for an extra mid position.

Air brakes control switch *(pre Mod.709)*

26. In this system the control column switch is labelled IN-OUT and its operation directly controls the electrical valve actuator in the flare bay.

Air brakes control switch *(post Mod.709)*

27. On the introduction of Mod.709 the system is initially controlled by a switch, on the control column, having three positions, IN-MID-OUT, which operates in conjunction with a Type S relay in the d.c. distribution box, a solenoid-operated hydraulic cock in the flare bay, and two microswitches mounted on the air brake jack assembly in the starboard wing.

Actuator, Type 200

28. The actuator, installed in the roof of the flare bay and mechanically linked to the Type 217 actuator, consists of a 2-pole, split series field, 28-volt d.c. motor, driving through a clutch, a two-stage epicyclic gear train, and a worm and wheel. Two limit switches are embodied in the actuator to switch off the motor supply at the extreme limit of a pre-determined angle of rotation, and mechanical stops are provided to prevent overrun of the output shaft.

Operation *(pre Mod.709)*

29. Selecting OUT with the AIR BRAKES switch causes the electrical actuator to operate the Type 217 actuator and retract the jacks in the wings, thereby moving the drag channels in the wings out. Similarly selecting the AIR BRAKES switch to IN causes the electrical actuator to operate the Type 217 actuator, in the reverse direction, and extend the jacks in the wings, thereby moving the drag channels in. The hydraulic system is fully described in Sect.3, Chap.6.

Operation *(post Mod.709)*

'Mid' selection

30. When the AIR BRAKES switch is selected to MID a supply is fed via the switch to energize and close the Type S relay. This action causes the electrical actuator to operate the Type 217 hydraulic actuator which retracts the jacks. When the starboard jack piston reaches the half-way position the short cam operates the No.1 microswitch so that the contacts A-B open and A-C close. This action de-energizes the Type S relay, causing the valve actuator to reverse, and at the same time energizes the solenoid-operated cock which closes the hydraulic circuit to lock the brakes in the MID position.

'Out' selection

31. On selecting OUT, a supply is fed to energize and close the Type S relay and at the same time the solenoid-operated cock is de-energized thus allowing the hydraulic fluid free passage. The energized relay completes the power supply to the electrical actuator which operates the Type 217 actuator, resulting in the jacks fully retracting and the drag channels moving to the OUT position.

'In' selection

32. When the switch is returned to the IN position the Type S relay is de-energized and opens causing the electrical actuator

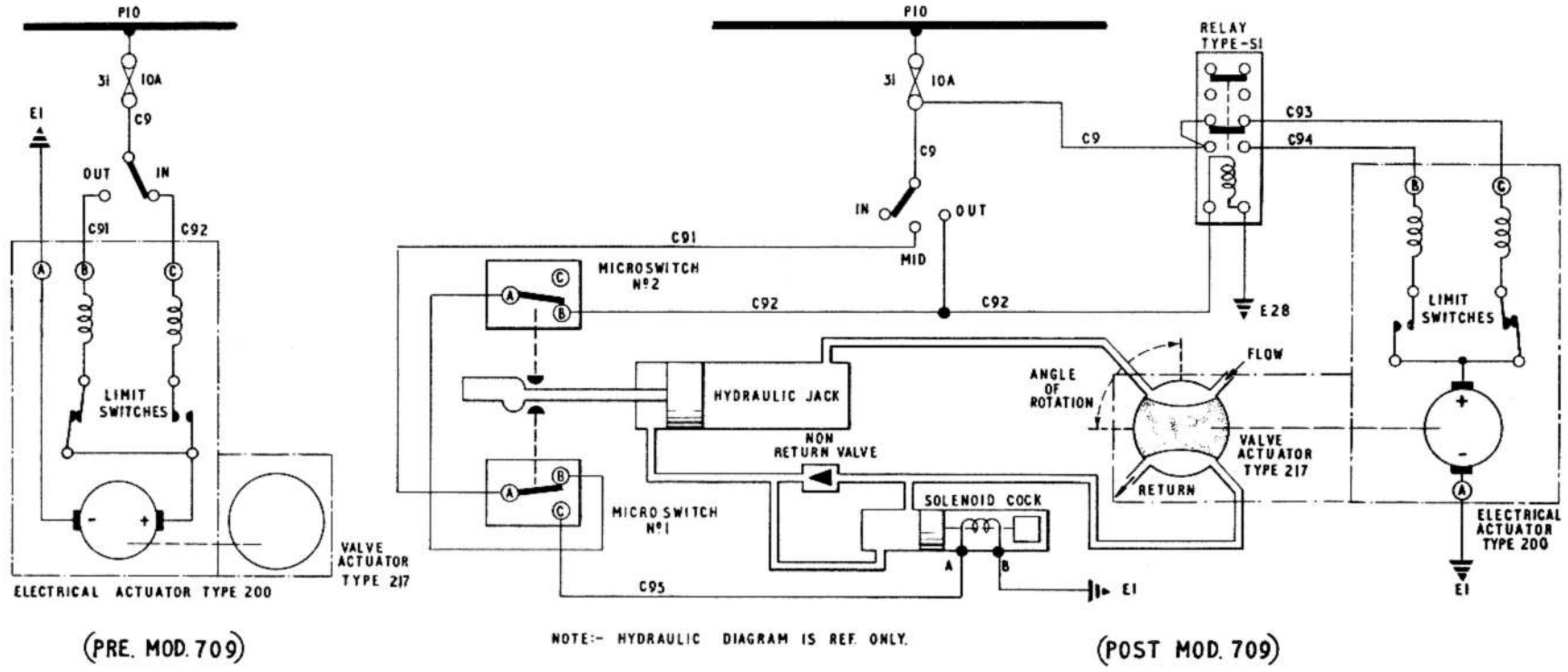

Fig.6. Air brakes control (pre and post Mod.709)

to operate the Type 217 actuator in the reverse direction, and extend the jacks, thereby moving the drag channels to the IN position. The hydraulic system is fully described in Sect.3, Chap.6.

SERVICING

Tail plane functional check

33. The functional check detailed below should be made prior to every flight and whenever the control circuit has been broken down in any way.

(1) Operate the trim switch only — the tail plane should remain stationary.

(2) Operate the cut-in switch only — the tail plane should remain stationary.

(3) Select NOSE UP by the trim switch and then operate the cut-in switch — the tail plane should move in the required direction.

(4) Repeat (3) but selecting NOSE DOWN.

(5) Repeat (3) and (4) but operating the trim switch in short 'blips'.

(6) The release of the cut-in switch at any time during checks (3), (4) and (5) should result in the immediate stopping of all tail plane movement.

Tail plane limit switches

34. Instructions for setting the tail plane limit switches are given in Sect.3, Chap.4.

Actuators

35. Descriptive and servicing information on the actuators Types 258, 259, 270 and AE.4023 is given in A.P.4343D, Vol.1, Book 3, Sect.14. The hydraulic valve assemblies, Types 205 and 217, used in the flaps and air brake systems, each incorporate a Type 200 electrical actuator which is fully described in Sect.16, Chap.11.

REMOVAL AND ASSEMBLY

Tail plane control switches *(fig.7)*

Removal

36. To remove the tail plane switches:—

(1) Disconnect the tail plane control cables at the base of the control column and remove the P.V.C. tubing carrying the cables down the column. Remove the lower half of the cable clamp fitted in the right arm of the control wheel.

(2) Remove the three countersunk screws (1) and the top plate (2) and withdraw the switch mounting block (3).

(3) Remove the trim switch (4) by inserting a narrow thin blade down the side of the switch and turning the circlip (6) until it aligns with the key slot (5).

(4) Remove the cut-in switch (7) by driving out the pin (8).

(5) Withdraw the switch cables from the P.V.C. tubing which was bound to the column.

Assembly

37. Assembly of the trim switches is the reverse of the removal procedure, but it is essential that the following precautions should be observed:—

(1) The switches must be a firm fit in the switch mounting block. If for this reason individual switches require packing, it is permissible to bind them with cellulose tape at the position shown. The tape must not cover the locating pip on the trim switch or the circular groove in the body of the cut-in switch.

(2) The switch mounting block must be a firm fit in the control handle and, before the switches are fitted, be cleared of any swarf or other foreign matter.

(3) As the large rubber sleeve which holds the trim switch cables together also serves the purpose of keeping the switch cover close to the switch body, it is important that the sleeve should be pushed as near as possible to the switch to retain the cover in position.

(4) It is essential at all times, either during storage or fitting, that swarf is not allowed ingress to the switch assemblies.

(5) After the switches have been reassembled in accordance with the foregoing precautions, they must be manually operated approximately 50 times before any electrical loading is applied to them.

(6) On the conclusion of the tests, the switch cables should be run through the P.V.C. tubing and then bound to the control column as shown. It is important that, when binding the cables, sufficient slack is left in them to allow a full 90 deg. each-way movement of the control wheel without causing any undue tightening at full travel. The P.V.C. tubing is normally marked with a white ring to denote the first binding point near the top of the column. If the marking is not visible, the tubing should be ringed at a point 20 in. from the switch mounting block in the control handle and the binding started at the position shown.

(7) In conjunction with the relevant routeing diagram connect the cables to the terminals at the base of the control column below the pilot's floor.

38. On completion of the above operations, the functioning tests detailed in para.18 should be carried out.

Actuators

39. Instructions for the removal and refitting of the flying control and trim actuators are given in Sect.3, Chap.4.

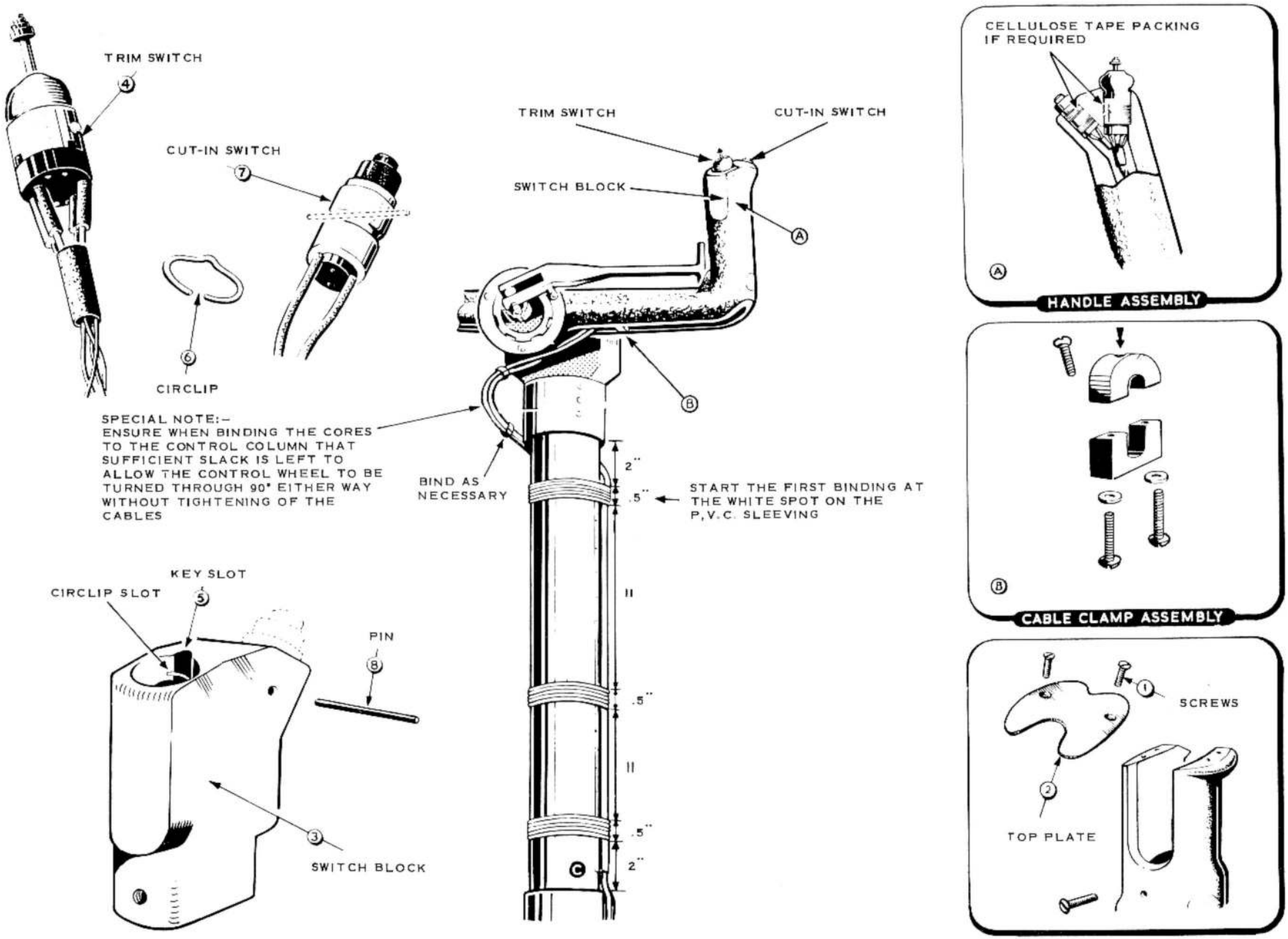

Fig.7. Control column tail plane switch assembly

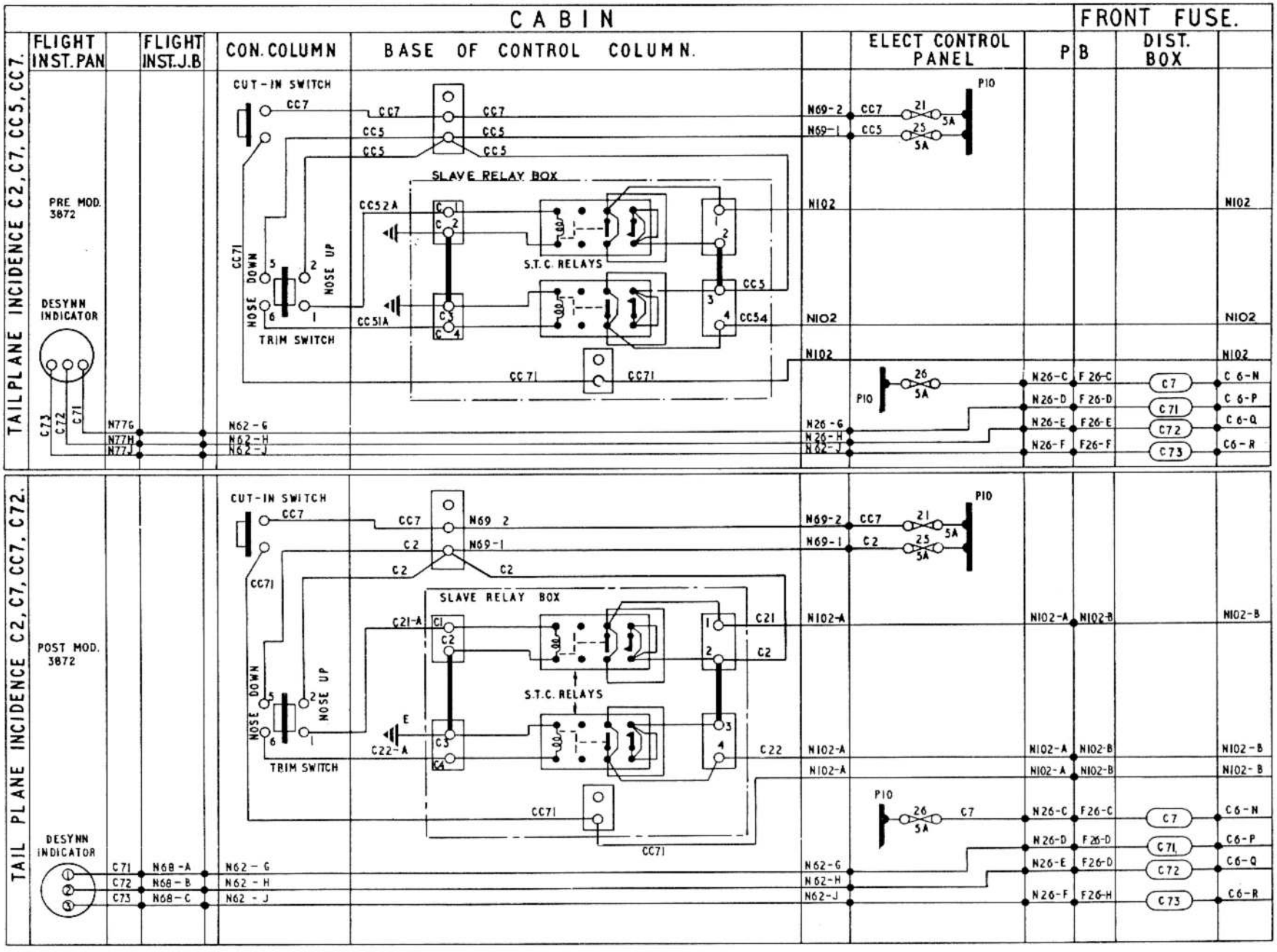

Fig.8. Tail plane control (pre and post mod.3872)

◀ *(Mod. 4288 incorporated)* ▶

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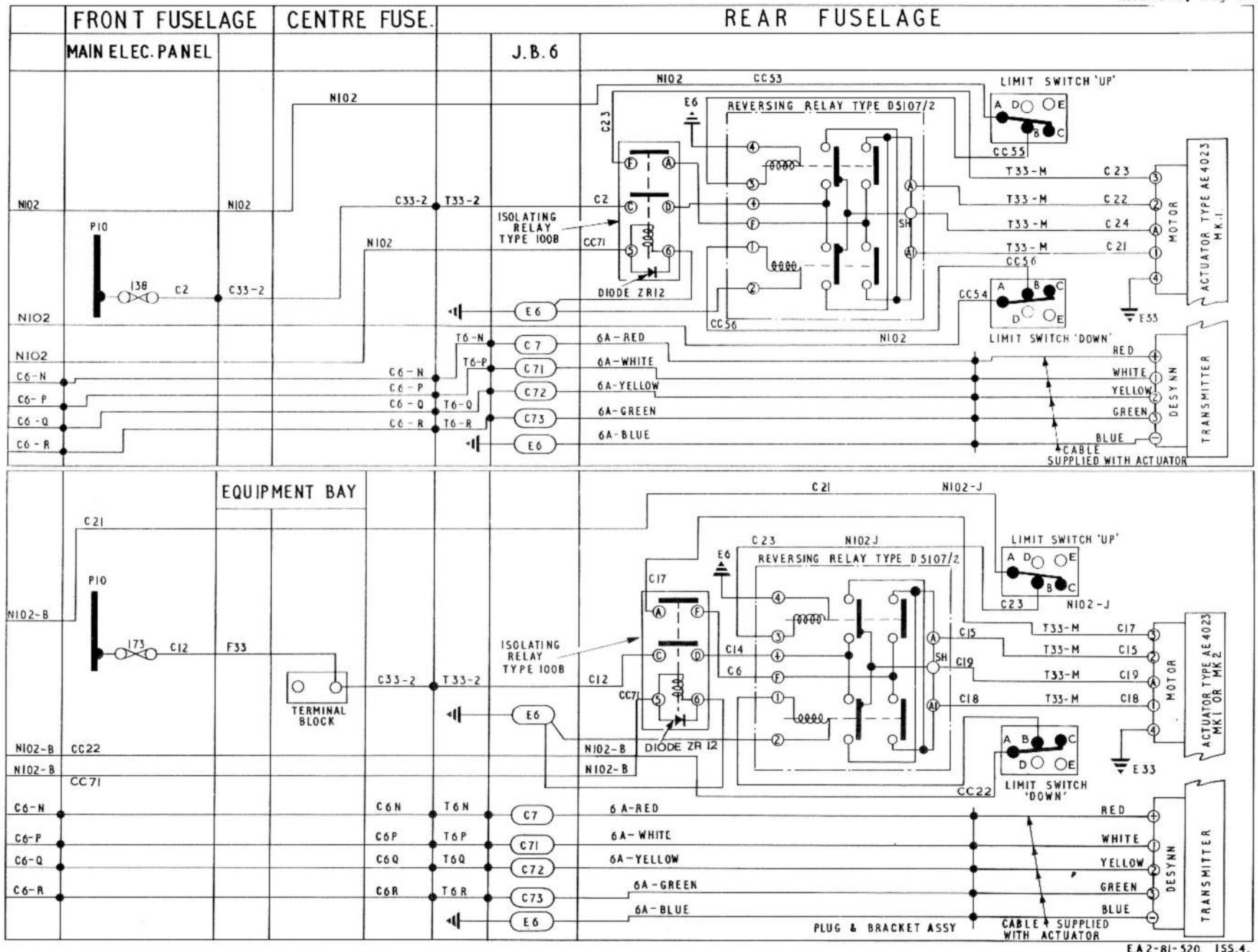

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FIG. 8A. TAIL PLANE CONTROL (PRE AND POST MOD. 3872)

◀MOD. 4107 INCORPORATED▶

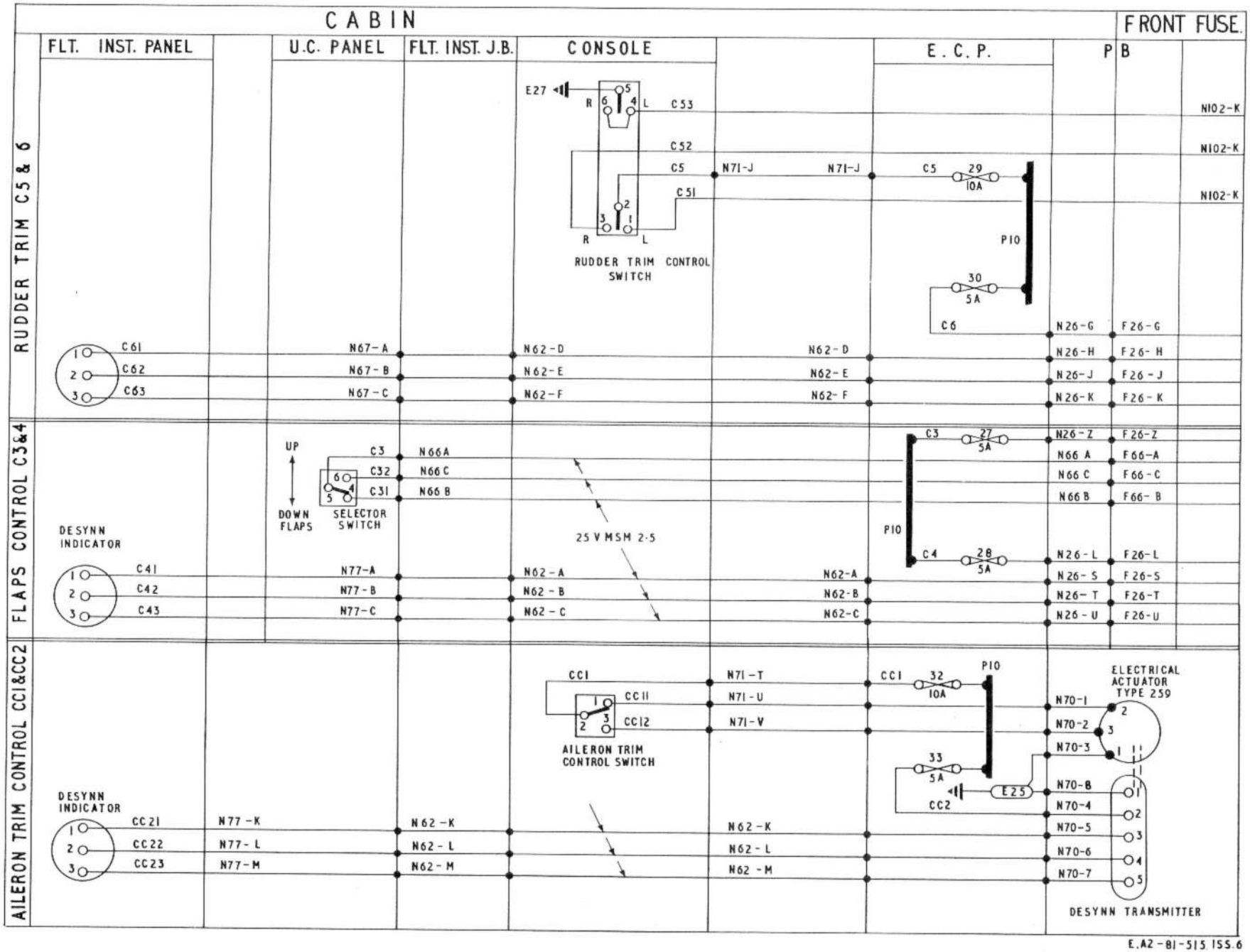

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FIG. 9. RUDDER TRIM—FLAPS CONTROL—AILERON TRIM

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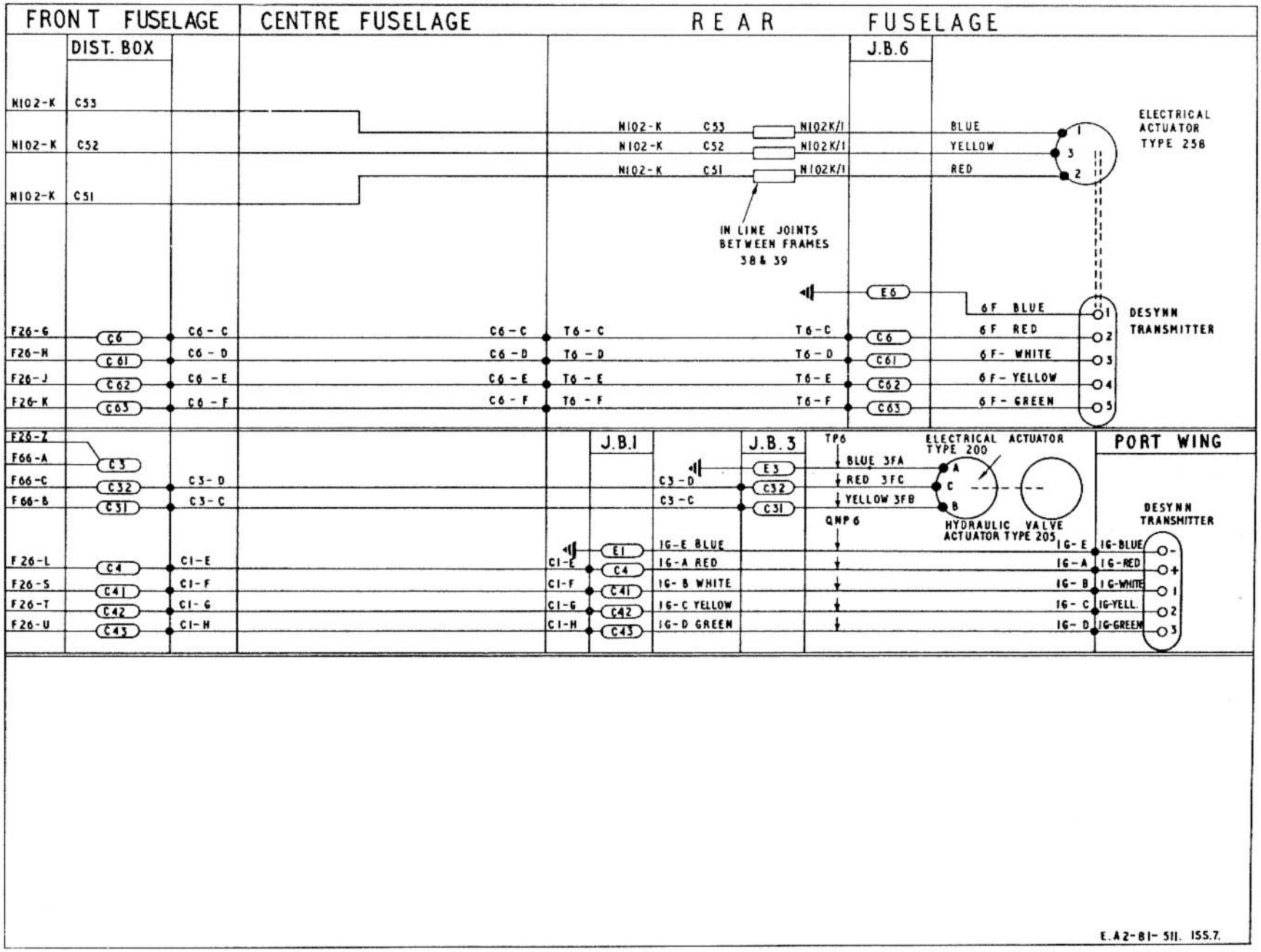

Fig. 9A. Rudder trim – flaps control – aileron trim

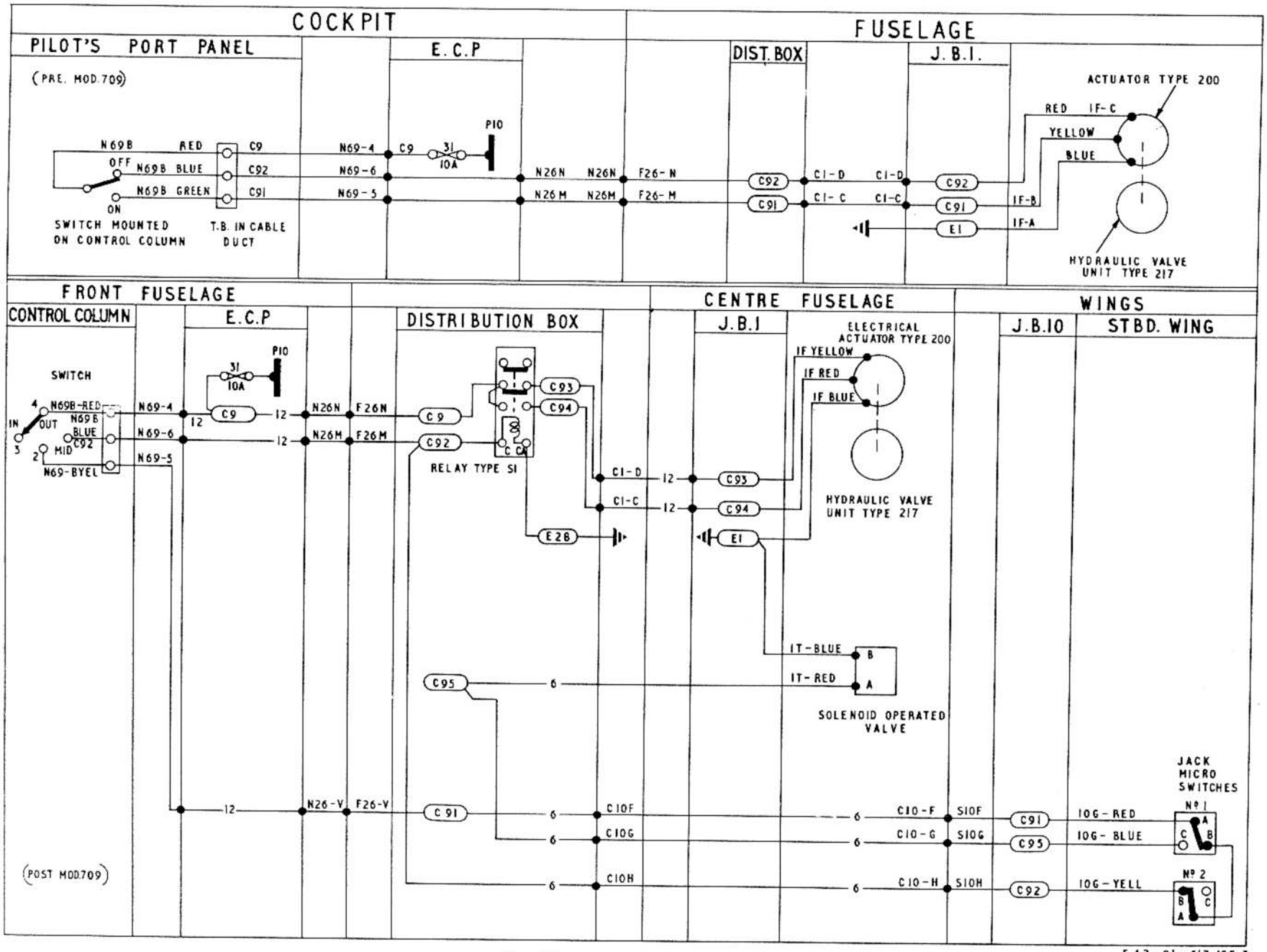

Fig. 10. Air brakes control

INSTRUMENT POWER SUPPLIES - GROUP D

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Introduction

1. Power supplies of 24/28 volts *(nominal)* d.c. and 115 volts, 400 c/s, 3-phase a.c., are required to operate the electrical instruments. On aircraft post Mod.1025 the a.c. supply is also used to operate the cooling blowers incorporated in the electronic regulator and units of the radar equipment. The a.c. supplies are provided by two rotary inverters, numbered 2 and 3. No.3 inverter is installed on a shelf in the starboard equipment compartment, whilst No.2 inverter is installed in the pressure cabin forward of the pilot's main instrument panel. A phase failure indicator *(post Mod. 4316)* is fitted to the starboard instrument panel, and is so connected to give an indication of the a.c. voltage from either inverter.

DESCRIPTION

2. The a.c. power to operate the G.M4B compass, artificial horizon, altimeter Mk. 22D, altimeter vibrator, and oil pressure gauges is normally taken from No.2 inverter, Type 100B, while No.3 inverter, Type RC8A, supplies the blowers used in the electronic regulator and the Rea· warning *(A.R.I.5800)* waveform generator and radar head. The inverters are controlled by switches coupled to the MASTER STARTING switches and protected by circuit breakers on the E.C.P. The switches operate in conjunction with Type S relays numbered 2, 3, 4, 7 and 8 in the d.c. section of the d.c. and 400 c/s distribution box and relay 17 in the a.c. section of the box. The d.c. input to No.3 inverter is fed

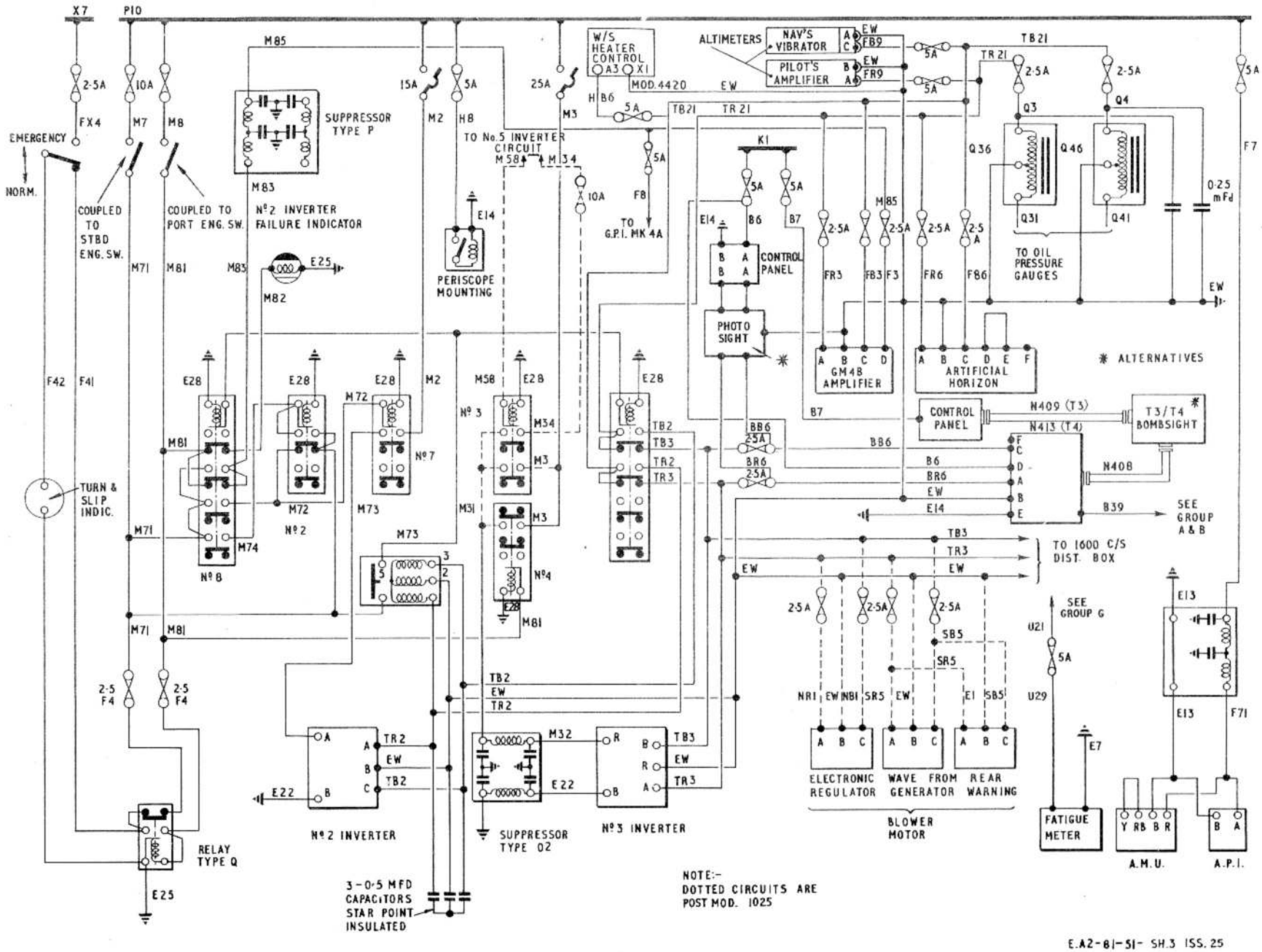

FIG. 1. INSTRUMENT POWER SUPPLIES

◀ MOD.4420 EMBODIED ▶

through a Type O2 suppressor adjacent to the inverter unit.

3. Provision is made for the automatic transfer of the flight instruments, phase failure indicator, and the oil pressure gauges to the No.3 inverter circuit if No.2 inverter becomes unserviceable. The changeover is primarily controlled by a Type B1 torque switch, installed above the 400 c/s distribution box in the upper equipment compartment, which operates in conjunction with the Type S relays in the d.c. and 400 c/s distribution box. Warning of the failure of No.2 inverter is given by a magnetic indicator on the instrument flying panel. When energized, the indicator shows either white or fluorescent, depending on the prevailing light.

No.3 inverter operation

4. Switching on the port MASTER STARTING switch completes circuit M8-M81 to energize No.4 relay, and also circuit M81-M82 via the contacts of No.8 relay, to energize the No.2 inverter failure indicator. Providing that the No.3 circuit breaker is ON, closing of No.4 relay completes circuit M3-M31-M32 via the Type O2 suppressor to start up No.3 inverter. On aircraft post Mod.1025, to ensure that the blower motors are running whenever No.5 inverter and the radar systems are operating, provision is made for No.3 inverter to start up automatically when No.5 inverter is switched on and the MASTER STARTING switches are OFF. Closing of the No.5 inverter circuit breaker completes circuit P10-M58 which closes No.3 relay and starts No.3 inverter. Operation of the No.5 inverter STOP switch opens the No.5 inverter circuit breaker which, in turn, breaks circuit P10-M58 to open No.3 relay and stop No.3 inverter.

No.2 inverter operation

5. Setting the starboard MASTER STARTING switch ON, completes circuit M7-M71 to the torque switch, and circuit M71-M72 via the contacts of No.2 relay, resulting in No.7 relay closing to start No.2 inverter. When the inverter output reaches approximately 98-volts, the torque switch closes and completes circuit M71-M73 to energize relays 8 and 17. The operation of No.8 relay breaks the failure indicator circuit so that the indicator shows a black, and completes circuit M71-M74 which gives a self-energizing feed to No.2 relay. The operation of No.17 relay changes the flight instruments and oil pressure gauges over from No.3 inverter to their normal supply circuit fed from No.2 inverter.

No.2 inverter failure

6. If the a.c. supply from No.2 inverter should fail, the torque switch and relays 2, 8 and 17 become de-energized and open, and the inverter closes down. Simultaneously, the flight instruments and oil pressure gauges are transferred to the No.3 inverter circuit.

No.3 inverter failure *(post Mod.1025)*

7. In the event of No.3 inverter failure there is no standby supply for the blower motors and the radar equipment must be switched off to prevent damage to the equipment by overheating.

Pilot's Mk.22D altimeter

Operation

8. This instrument operates on a 115v, 400 c/s, single-phase a.c. supply, and is fed via an amplifier Mk.1A, from fuse 110 in the 400 c/s fuse box. The 115-volts supply is normally taken from the No.2 inverter, or in an emergency from the No.3 inverter, as described in para.4, 5 and 6.

Navigator's Mk.19 altimeter vibrator

Operation

9. The altimeter vibrator fitted to the Mk.19 series altimeter at the navigator's station, operates on a 115v, 400 c/s, single-phase a.c. supply and is fed from fuse 114 in the 400 c/s fuse box. The a.c. supply is obtained from the same source as for the pilot's altimeter *(para.8)*.

Turn-and-slip indicator

General

10. This instrument operates on 24-volts *(nominal)* d.c. power supplies fed from busbar P10. Two alternative fused circuits are provided for normal operation, changeover from one to the other being controlled automatically by a Type Q relay mounted at the rear of the starter panel. A third power supply is available from a 24-volt emergency battery housed in the console, behind the pilot's map stowage. If both normal supplies should fail, the indicator will operate from the emergency battery after operating the NORMAL/EMERGENCY switch on the instrument flying panel.

Operation

11. Primary control of each normal fused circuit is by the switches coupled to the MASTER STARTING switches and used to control inverters No.2 and 3. The port switch controls circuit F5 *(fuse 83)* and the starboard switch, circuit F4 *(fuse 84)*. The Type Q relay is also energized and held closed by a feed from fuse 83 and the indicator operates from this fuse via the closed contacts of the relay. If fuse 83 should fail, the relay opens and the instrument then takes a supply from fuse 84.

Emergency operation

12. If both normal supplies fail, the indicator will continue to function from the

emergency battery after setting the NORMAL/EMERGENCY switch to EMERGENCY. The emergency circuit is protected by fuse 89 located at the forward end of the jettison relay unit below the emergency battery in the console.

Photographic sight

13. The photographic sight introduced by Mod.1406 operates from power supplies of 24-volts d.c. and 115-volts, 400 c/s, 3 phase a.c. The d.c. is fed from fuse 151 in the camera distribution panel, and the a.c. from No.3 inverter via fuses 121 and 125 in the 400 c/s fusebox.

Bombsight, Type T3/T4 *(Mod.3301)*

14. Mod.3301 introduces a Type T3 or T4 bombsight for the night photographic role as an alternative to the photographic sight for the day role. The bombsight is controlled by a sighting head control which operates from a power supply of 28-volts d.c., and a gyro control unit which operates from power supplies of 28-volts d.c. and 115-volts, 400 c/s, 3-phase a.c. The d.c. supplies to the sighting head control and the gyro control unit are fed from fuses 152 and 151 respectively. The a.c. supply for the gyro control unit is fed from fuses 121 and 125 in the 400 c/s fusebox. Separate cable assemblies are provided for the alternative roles, and stowage facilities are provided for stowing the cable assemblies not in use.

A.P.I. and A.M.U.

15. Both these instruments operate on d.c. fed from fuse 36 in the E.C.P. via a suppressor and junction box adjacent to the navigator's table.

G.P.I. Mk.4A

16. The G.P.I. Mk.4A indicator is fed by a d.c. supply from fuse 118 in the 400 c/s fusebox via a screened junction box adjacent to the navigator's table.

Phase failure indicator

17. This instrument gives indication of a 115-volt, 400 c/s, 3-phase a.c. supply and is fed from fuses 112 and 116 in the 400 c/s fusebox. The voltage indicated on the instrument relates to the output from No.2 inverter or in an emergency from No.3 inverter, as described in para.4, 5 and 6.

Engine instruments

Oil pressure gauges

18. These instruments operate from 26 volts a.c. stepped down from the 115-volts, 400 c/s supply by small transformers housed in the 400 c/s distribution box. The initial 115-volts supply is normally taken from No.2 inverter or in an emergency from No.3 inverter, as described in para.4, 5 and 6.

Tachometers

19. These instruments are operated by small a.c. generators mounted on and driven by their respective engines.

Exhaust gas thermometers

20. The d.c. supply to these instruments is not switched, but fed direct from fuse 61 in the E.C.P. The supply is stabilized by a voltage compensator installed on the floor in the upper equipment compartment.

Fuel pressure warning

21. The fuel pressure warning lamp circuits are fed from busbar P10 via fuses 69 and 70 in the E.C.P. The lamp filaments operate at 6 volts which is reduced from the 24-volts supply by two 400 ohm resistors in the E.C.P.

Fuel contents gauges

22. These gauges operate from a d.c. supply fed from fuse 62 in the E.C.P.

Miscellaneous instruments

External air thermometer

23. The 24-volts d.c. supply to operate the external air thermometer is not switched but fed direct from busbar P10 via fuse 35 in the E.C.P.

Oxygen system

24. The oxygen indicator circuits operate from d.c. fed from fuses 53 and 57 in the E.C.P.

Fatigue meter

25. The fatigue meter Mk.13 d.c. supply is fed from the alighting gear indicator circuit via fuse 218 in the E.C.P.

SERVICING

Inverters

26. General information on inverters is given in A.P.4343, Vol.1, Sect.8. Particular information on inverters will be found in A.P.4343B, Vol.1, Book 3.

REMOVAL AND ASSEMBLY

Inverters

27. Access to the inverters is gained through the starboard equipment hatch *(Type RC8A)* and the cabin door *(Type 100B)*. After disconnecting their input and output cables the inverters are readily removed after undoing the attachment bolts securing them to the mounting shelves.

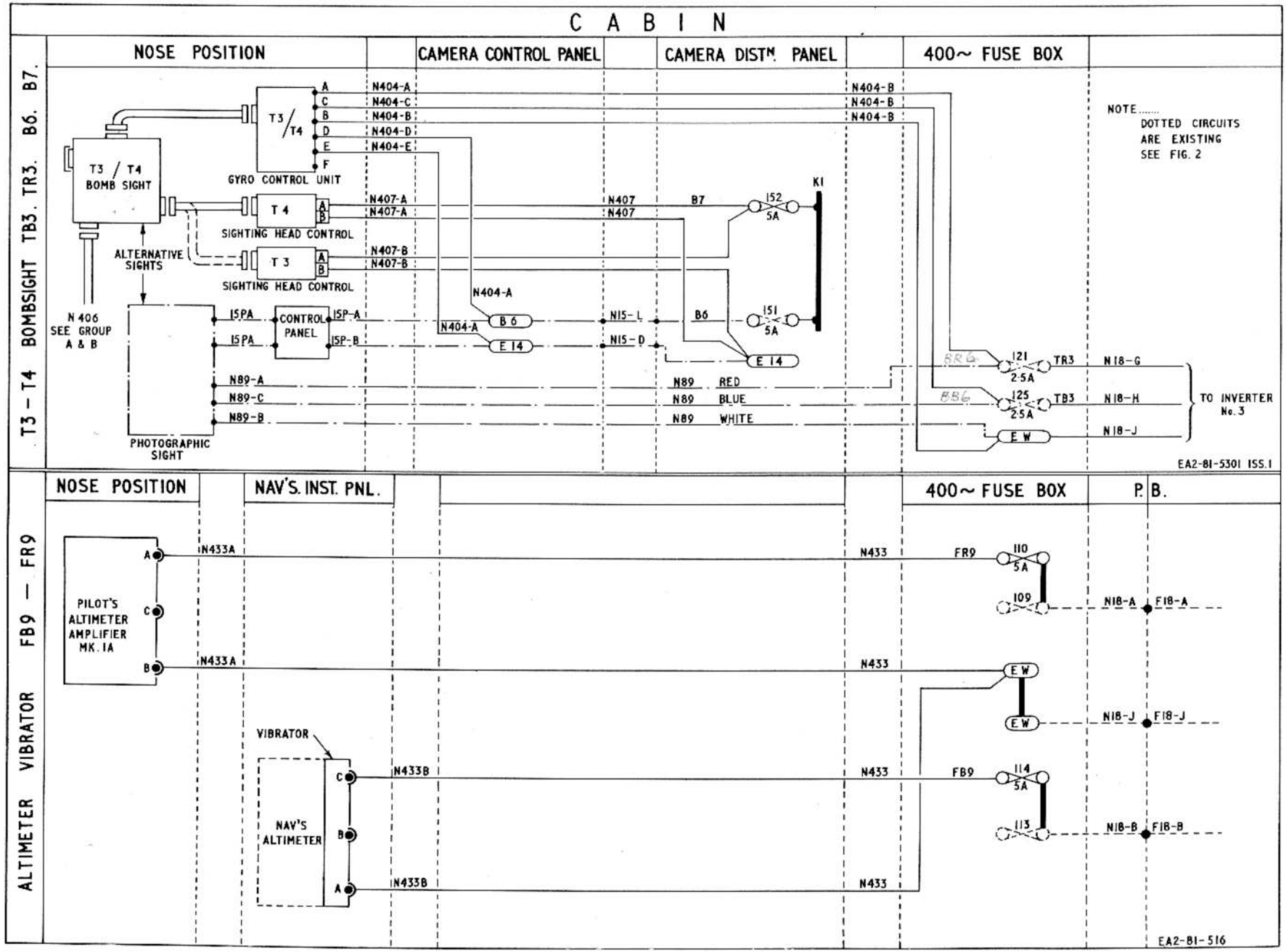

FIG.1A. T3/T4 BOMBSIGHT - ALTIMETER VIBRATOR POWER SUPPLIES

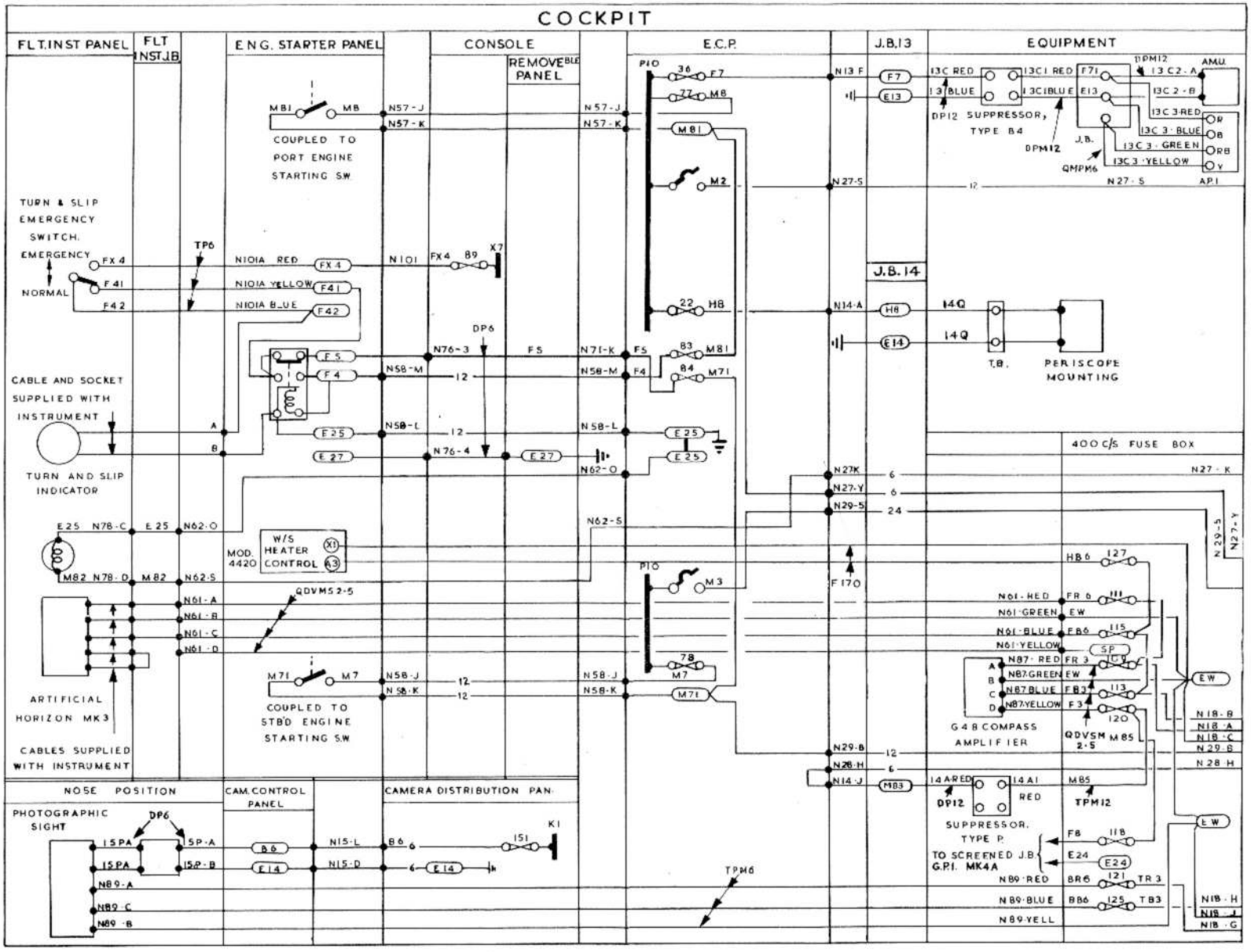

FIG. 2. INSTRUMENT POWER SUPPLIES

◀ MOD. 4420 EMBODIED ▶

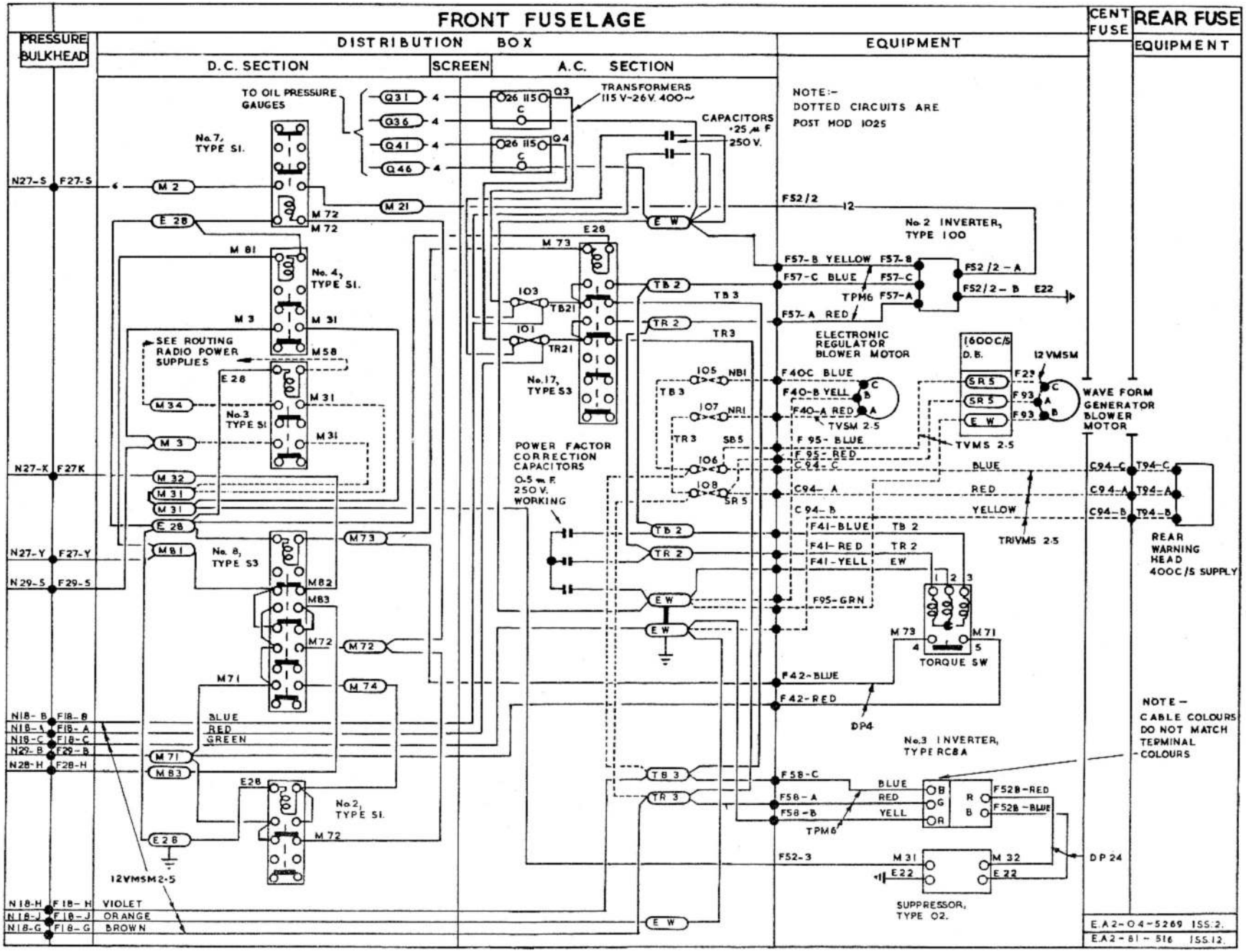

Fig. 2A. Instrument power supplies

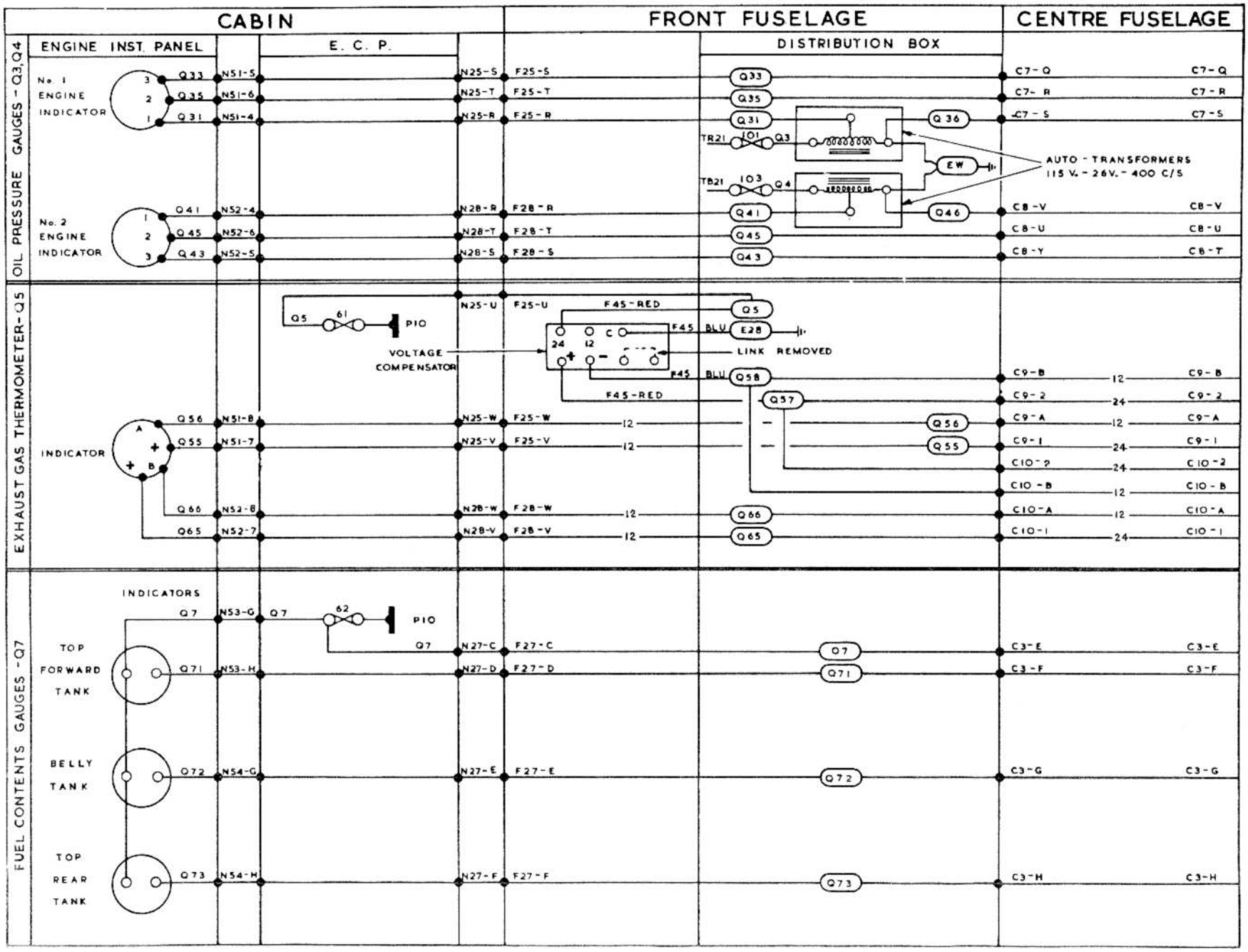

Fig. 3. Fuel contents gauges – exhaust gas thermos – oil pressure gauges

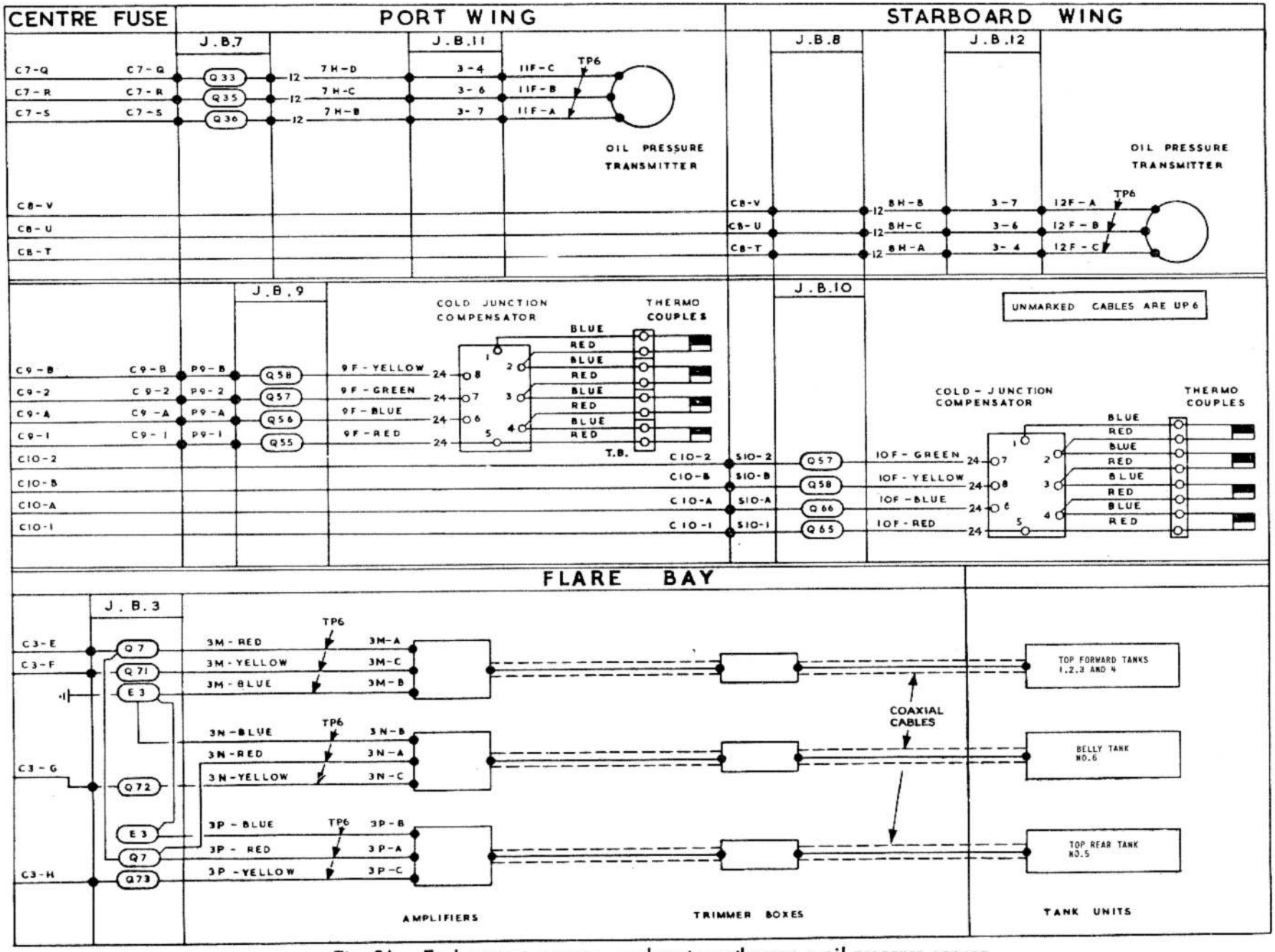

Fig. 3A. Fuel contents gauges – exhaust gas thermos – oil pressure gauges

◀*(Illustration amended)*▶

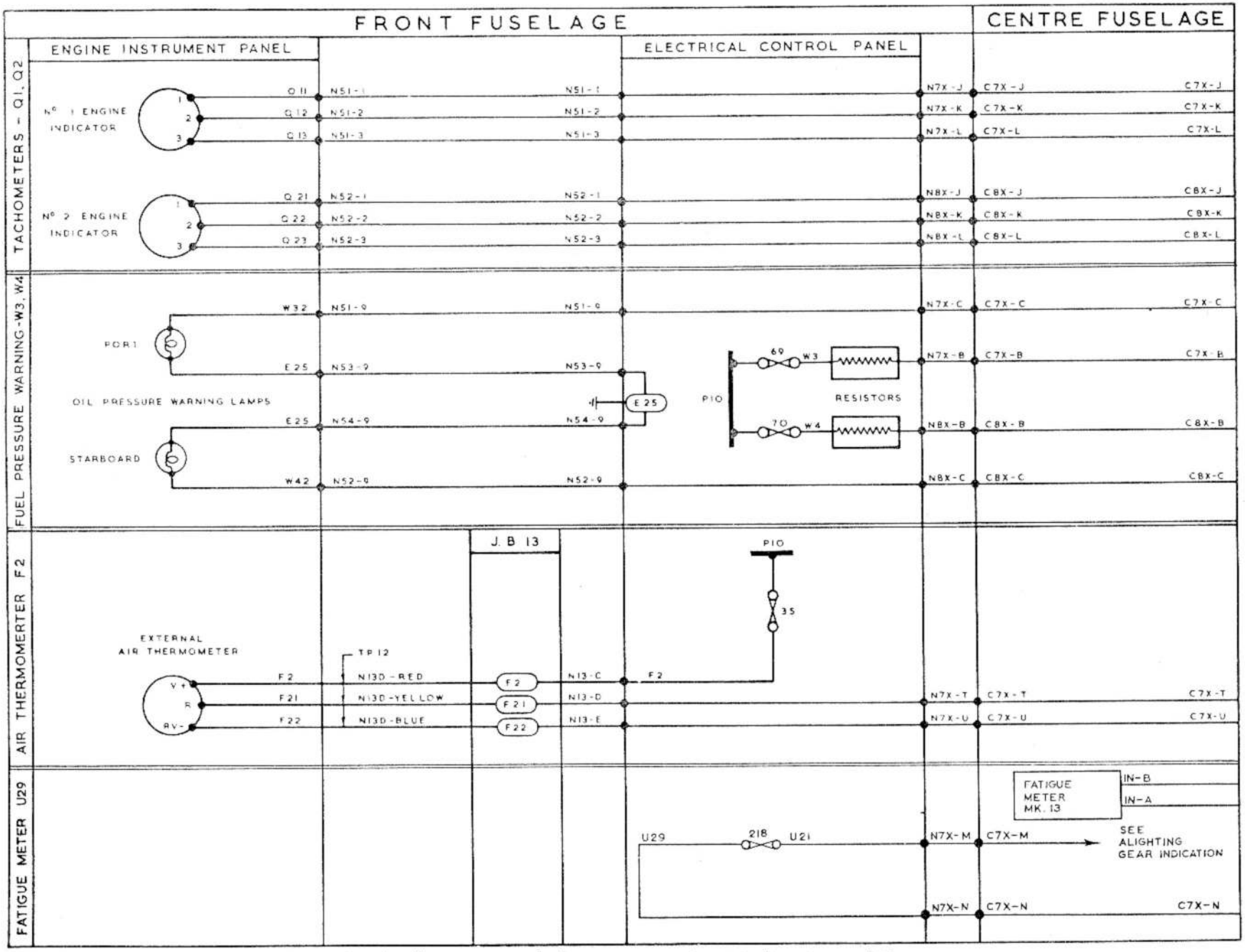

Fig. 4. Air thermometer – fuel pressure warning – tachometers – fatigue meter

(Mod. 3580 embodied)

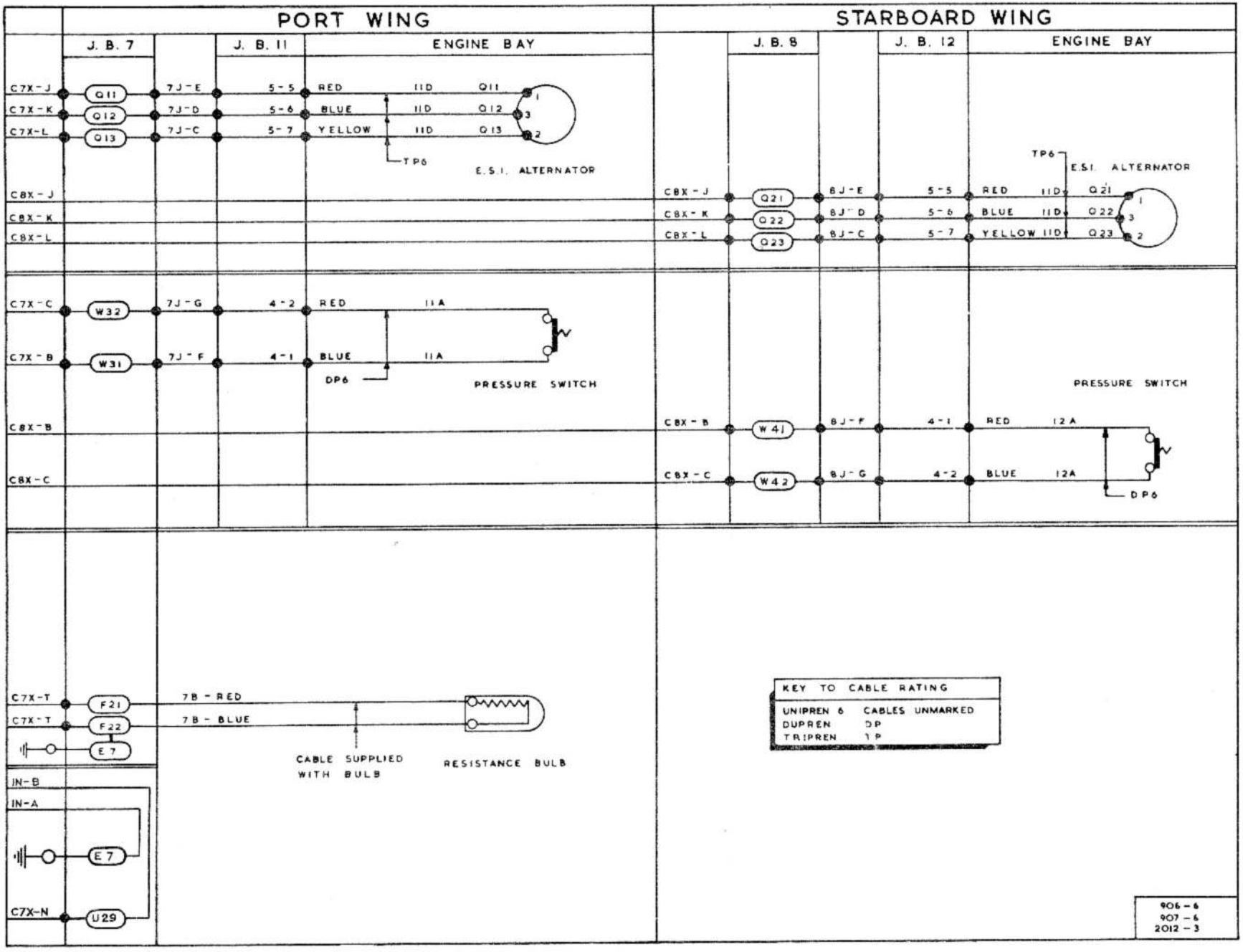

Fig. 4A. Air thermometer – fuel pressure warning – tachometers – fatigue meter

(Mod.3580 embodied)

ALIGHTING GEAR – GROUP G

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DESCRIPTION

General

1. The alighting gear is hydraulically-operated and electrically-controlled. A Type C2524Y alighting gear selector switch unit controls a Type 204 rotary actuator and hydraulic valve installed in the roof of the flare bay. A master safety switch is incorporated in the control circuit to prevent inadvertent retraction on the ground.

Selector switch unit

2. The selector switch unit *(A.P.4343C, Vol.1, Book 1, Sect.1, Chap.26)* 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 button 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 coil. This releases a mechanical lock to allow UP to be selected.

Emergency UP selection

3. The UP mechanical lock can be overridden in an emergency, or if required during servicing, by operating the knobbed ring which encircles the UP button. Turning the ring until the knobs are above and below the button allows UP to be selected in the normal manner. If the UP button is operated in this way it will be necessary to reset it, using a Dowty resetting tool, Part No. S.T.I. 1567. Inserting the tool in the small hole at the centre of the button and depressing the internal spring allows the lock ring to be returned to its normal position with its knobs at either side of the button.

Master safety switch

4. The master safety switch fitted adjacent to the selector switch unit prevents inadvertent retraction of the alighting gear by operation of the UP button while its mechanical lock is overridden. The switch

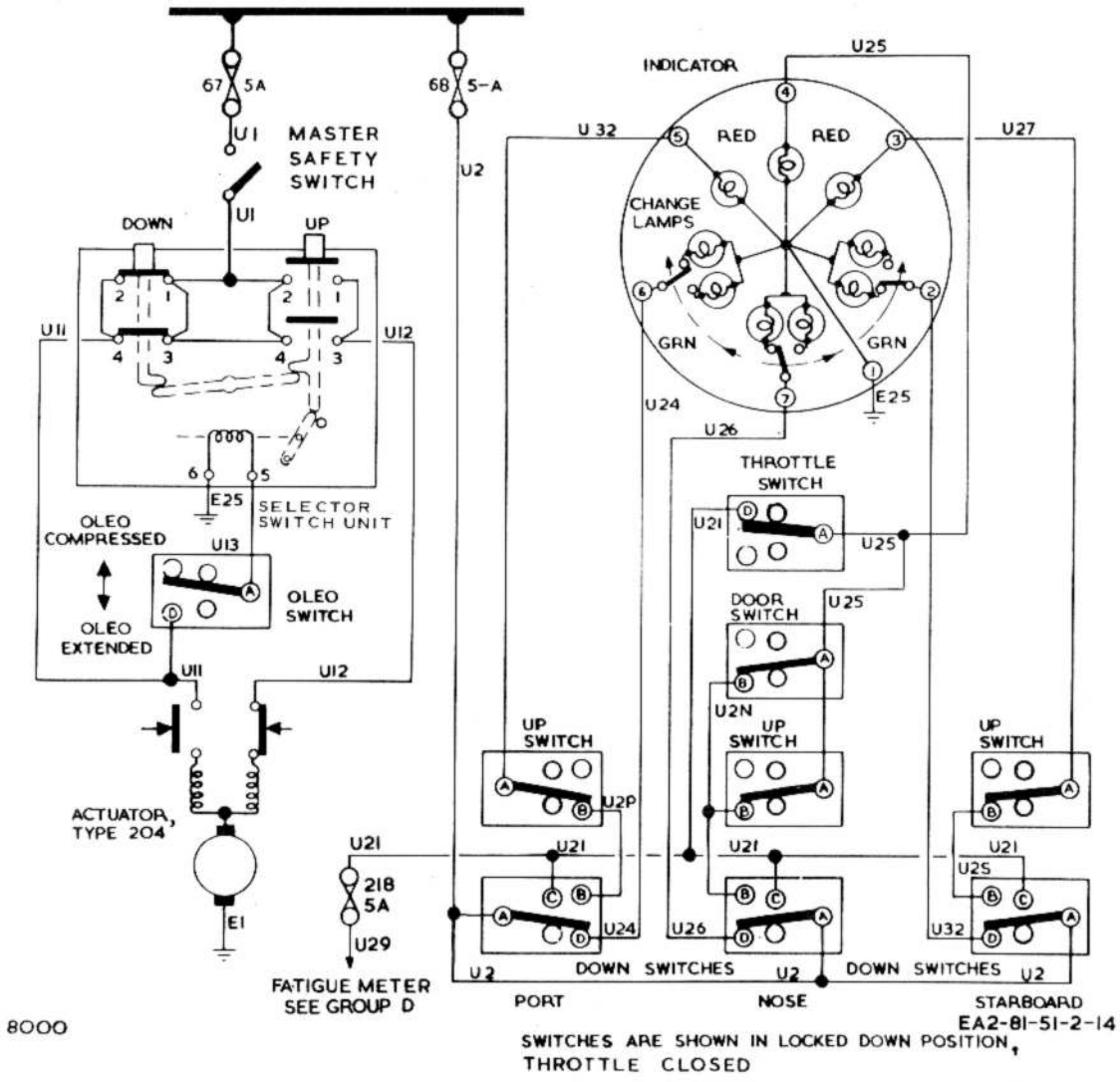


Fig. 1. Alighting gear control and indicator

is connected in series with the power supply and the control circuit 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

5. A Type D or D1 alighting gear indicator *(A.P.4343E, Vol.1, Sect.18, Chap.4 or 20)* is mounted alongside the selector switch unit and operated by microswitches installed in the nose and main wheel bays. A microswitch fitted 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 bay, 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. These cables are referenced 7A4 *(port)* and 8A6 *(starboard)*. Another microswitch, fitted in the throttle box, brings on the nose wheel red light if the throttle levers of either or both engines are set below a safe minimum 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 utilising the elongated holes in the attachment bracket. Adjustment and location details for all the microswitches in the position indicator circuit are given in fig.2, 3 and 3A.

6. On aircraft post Mod.3580 the alighting gear UP indicator circuit U21 is used for operating a fatigue meter via fuse 218 in the E.C.P.

SERVICING

Circuit checks

Indicator circuits

7. The alighting gear indicator circuits are not switched, but fed direct from busbar P10 which is controlled by the BATTERY ISOLATION switch on the E.C.P. 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 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 checks

8. Due to the safety precautions necessary when the aircraft is on the ground *(para.2)* 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.

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, Book 3, 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 *(Sect.3, Chap.6)*.

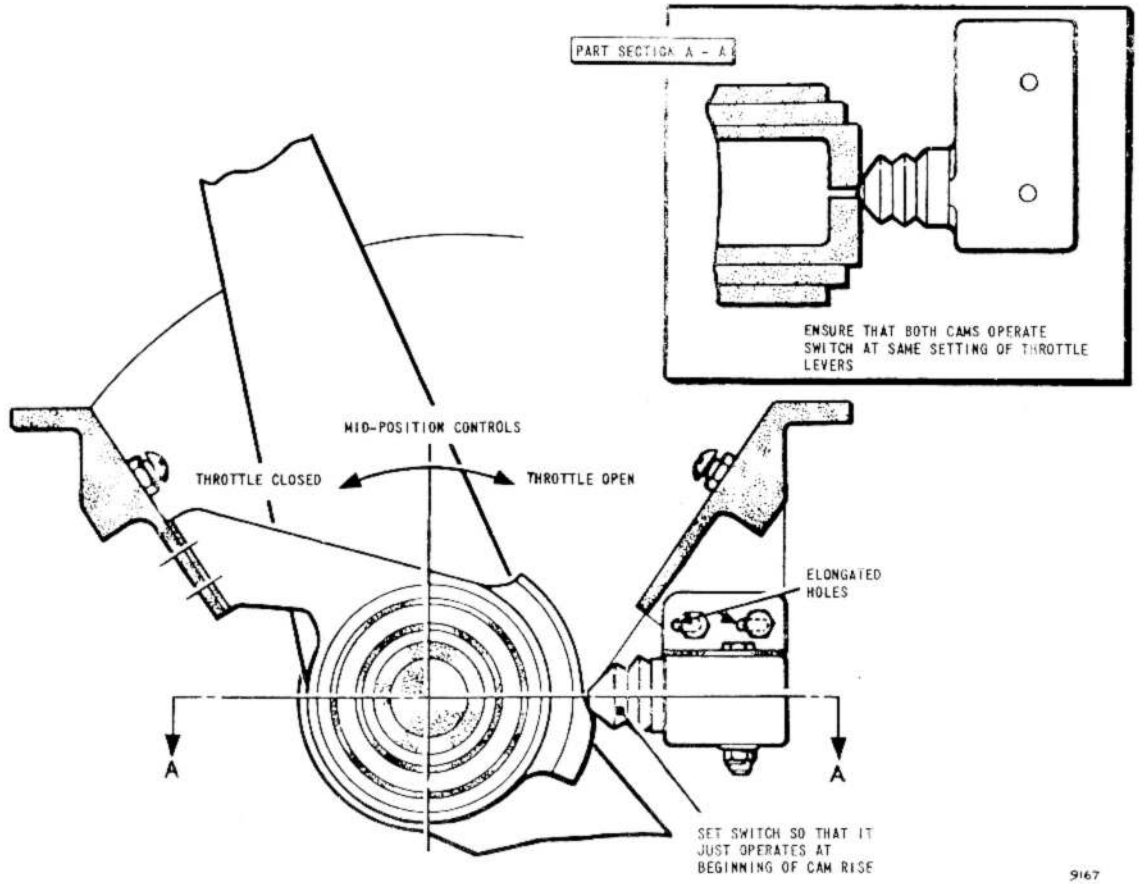


Fig. 2. Microswitch adjustment – throttle box

◀ ANNOTATIONS CORRECTED ▶

UP MICROSWITCH ADJUSTMENT WITH U/C IN THE DOWN POSITION.

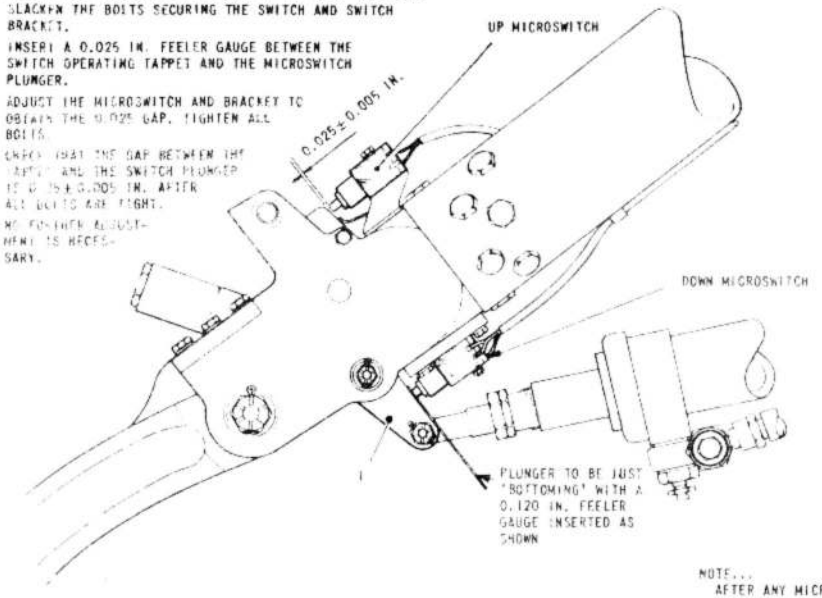
1 SLACKEN THE BOLTS SECURING THE SWITCH AND SWITCH BRACKET.

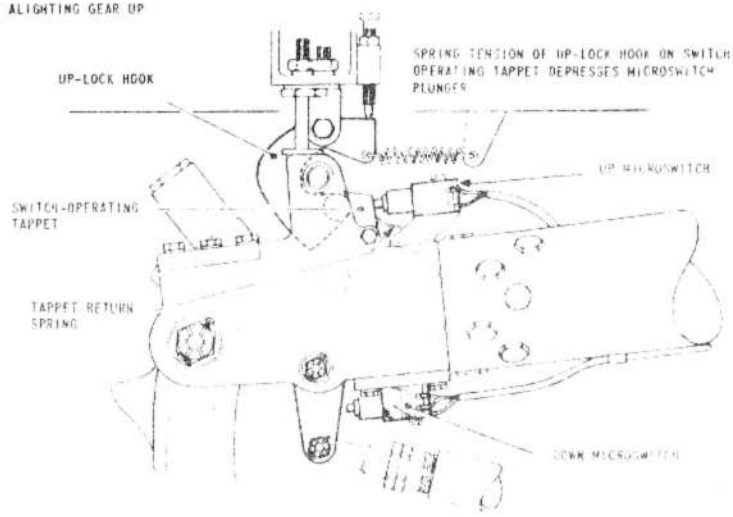
2 INSERT A 0.025 IN. FEELER GAUGE BETWEEN THE SWITCH OPERATING TAPPET AND THE MICROSWITCH PLUNGER.

3 ADJUST THE MICROSWITCH AND BRACKET TO OBTAIN THE 0.025 GAP. TIGHTEN ALL BOLTS.

4 CHECK THAT THE GAP BETWEEN THE TAPPET AND THE SWITCH PLUNGER IS 0.25±0.005 IN. AFTER ALL BOLTS ARE TIGHT.

5 NO FURTHER ADJUSTMENT IS NECESSARY.





NOTE...
AFTER ANY MICROSWITCH ADJUSTMENT AN UNDERCARRIAGE RETRACTION TEST MUST BE MADE AND THE WARNING LIGHTS CHECKED

DOWN MICROSWITCH ADJUSTMENT

1 CONNECT A 24-VOLT SUPPLY TO THE EXTERNAL SUPPLY SOCKET

2 SLACKEN THE BOLTS (3)

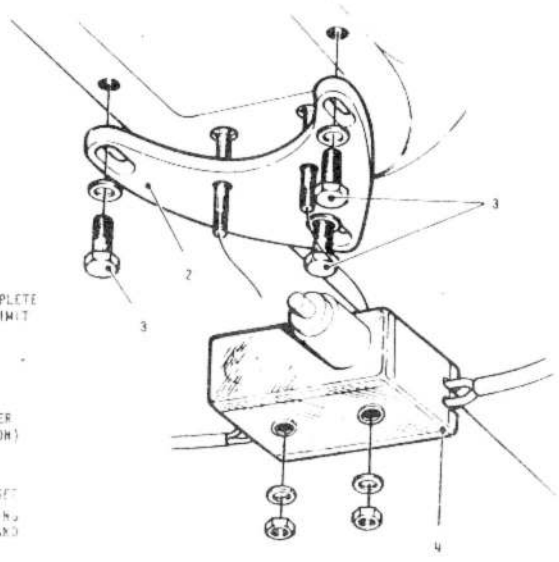
3 MOVE THE ATTACHMENT PLATE (2) COMPLETE WITH MICROSWITCH (4) AFT TO THE LIMIT OF ITS TRAVEL (GREEN LIGHT OFF)

4 INSERT A 0.120 IN. FEELER GAUGE BETWEEN THE MICROSWITCH PLUNGER AND LOCK LEVER (1) : MOVE THE MICROSWITCH (4) AND ATTACHMENT PLATE (2) FORWARD UNTIL THE PLUNGER IS JUST 'BOTTOMING' (GREEN LIGHT ON)

5 TIGHTEN THE BOLTS (3)

6 ENSURE THAT SOME PLUNGER MOVEMENT REMAINS WHEN ADJUSTMENT IS FINALISED

7 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 ROD (SECT.3, CHAP.5)

4 RAISE THE NOSE WHEEL (SECT.3, CHAP.6). TAKE CARE THAT DAMAGE IS NOT CAUSED BY THE DISCONNECTED ACTUATING ROD

5 SLACKEN THE TAPPET LOCKNUT (6)

6 SCREW TAPPET (5) AWAY FROM THE MICROSWITCH (7) (RED LIGHT ON)

7 SCREW TAPPET (5) TOWARDS THE MICROSWITCH (7) UNTIL A DEFINITE CLICK IS HEARD AND GIVE A FURTHER TWO COMPLETE TURNS (RED LIGHT OFF)

8 TIGHTEN THE LOCKNUT (6) AND ENSURE THAT SOME PLUNGER MOVEMENT STILL REMAINS

9 RECONNECT THE PORT DOOR ACTUATING ROD

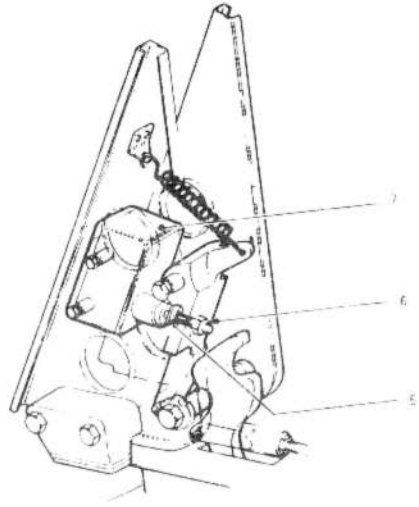
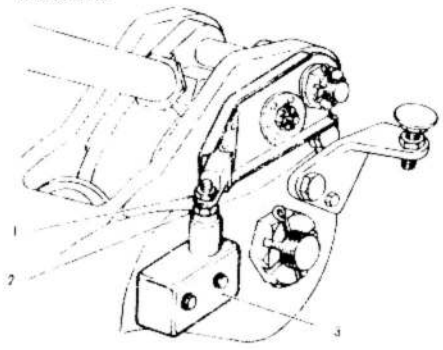


FIG. 3. MICROSWITCH ADJUSTMENT – NOSE UNDERCARRIAGE (POST MOD. 4449)

DOWN MICROSWITCH



DOWN MICROSWITCH ADJUSTMENT

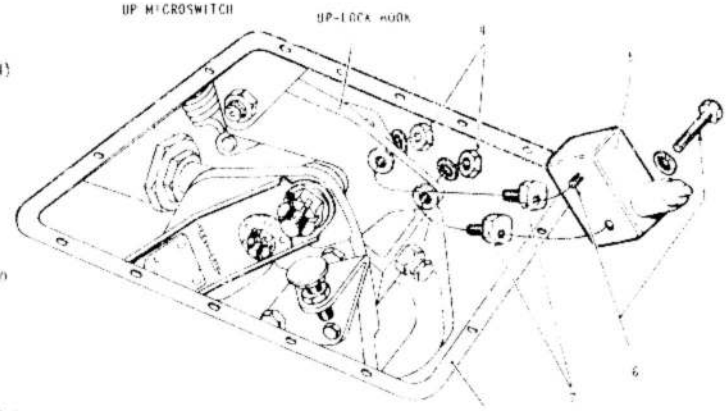
1 CONNECT A 24-VOLT POWER SUPPLY TO THE EXTERNAL SUPPLY SOCKET
2 SLACKEN LOCKNUT (1)
3 SCREW STRIKER BOLT (2) AWAY FROM MICRO-SWITCH (3) (GREEN LIGHT OFF)
4 SCREW STRIKER BOLT (2) TOWARDS MICROSWITCH (3) UNTIL A DEFINITE CLICK IS HEARD (GREEN LIGHT ON) AND THEN GIVE A FURTHER TWO COMPLETE TURNS
5 TIGHTEN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

UP MICROSWITCH ADJUSTMENT WITH U/C IN THE UP POSITION

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
3 REMOVE THE APPROPRIATE ACCESS PANEL FROM THE UPPER SURFACE OF THE MAIN PLANE INNER WING (SECT.2,CHAP.4)
4 RAISE THE ALIGHTING GEAR (SECT.3,CHAP.6)
5 SLACKEN THE NUTS (4) AND MICROSWITCH ATTACHMENT BOLTS (6)
6 TURN THE HEADS OF THE ECCENTRIC BOLTS (7) TOGETHER IN A COUNTER-CLOCKWISE DIRECTION UNTIL MICROSWITCH PLUNGER IS FULLY EXTENDED AND CLEAR OF STRIKING SURFACE (RED LIGHT WILL COME ON)
7 TURN THE HEADS OF THE ECCENTRIC BOLTS IN THE OPPOSITE DIRECTION UNTIL A DEFINITE CLICK IS HEARD (RED LIGHT OFF) TURN THE BOLTS A FURTHER 1/8 FULL TURN
8 DO NOT ALLOW THE MICROSWITCH TO MOVE AND TIGHTEN ITS ATTACHMENT BOLTS (6) AND NUTS (4)
9 ENSURE THAT SOME PLUNGER MOVEMENT STILL REMAINS

UP MICROSWITCH

UP-LOCK HOOK

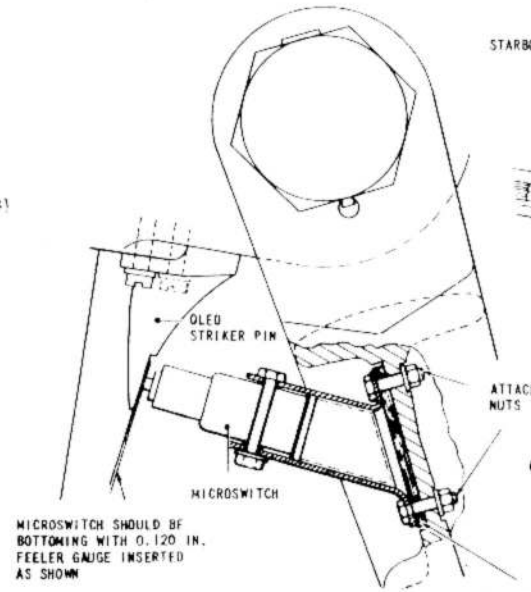


ACCESS IN UPPER SURFACE OF INNER WING

NOTE...
AFTER AN ADJUSTMENT OF THE UP OR DOWN MICROSWITCHES AN UNDERCARRIAGE 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.28FZ/706 ADJUST THE MICRO-SWITCH TO OBTAIN THE CONDITION DESCRIBED IN OPERATION 2
4 RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING NUTS



MICROSWITCH SHOULD BE BOTTOMING WITH 0.120 IN. FEELER GAUGE INSERTED AS SHOWN

SECTIONAL VIEW ON STARBOARD TORQUE LINK

STARBOARD OLEO LEG MICROSWITCH

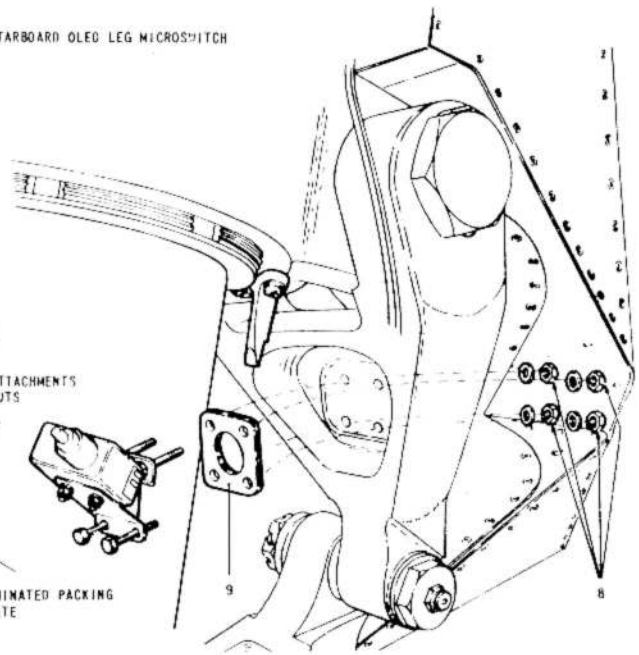
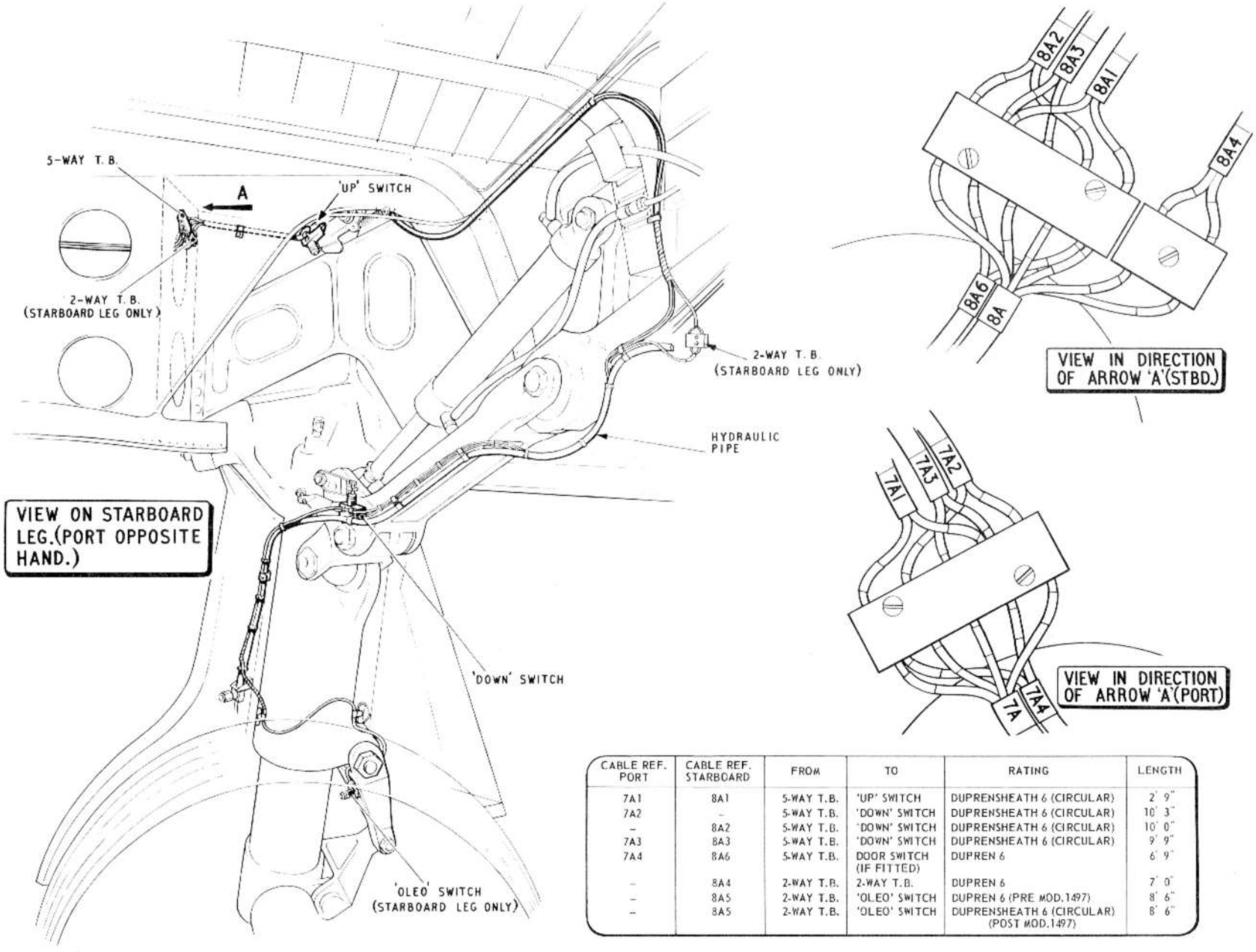


FIG.3A.MICROSWITCH ADJUSTMENT – MAIN UNDERCARRIAGE (POST MOD. 4449)



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"
7A4	8A6	5-WAY T.B.	DOOR SWITCH (IF FITTED)	DUPREN 6	6' 9"
–	8A4	2-WAY T.B.	2-WAY T.B.	DUPREN 6	7' 0"
–	8A5	2-WAY T.B.	'OLEO' SWITCH	DUPREN 6 (PRE MOD.1497)	8' 6"
–	8A5	2-WAY T.B.	'OLEO' SWITCH	DUPRENSHEATH 6 (CIRCULAR) (POST MOD.1497)	8' 6"

Fig. 4. Main wheels – wiring installation

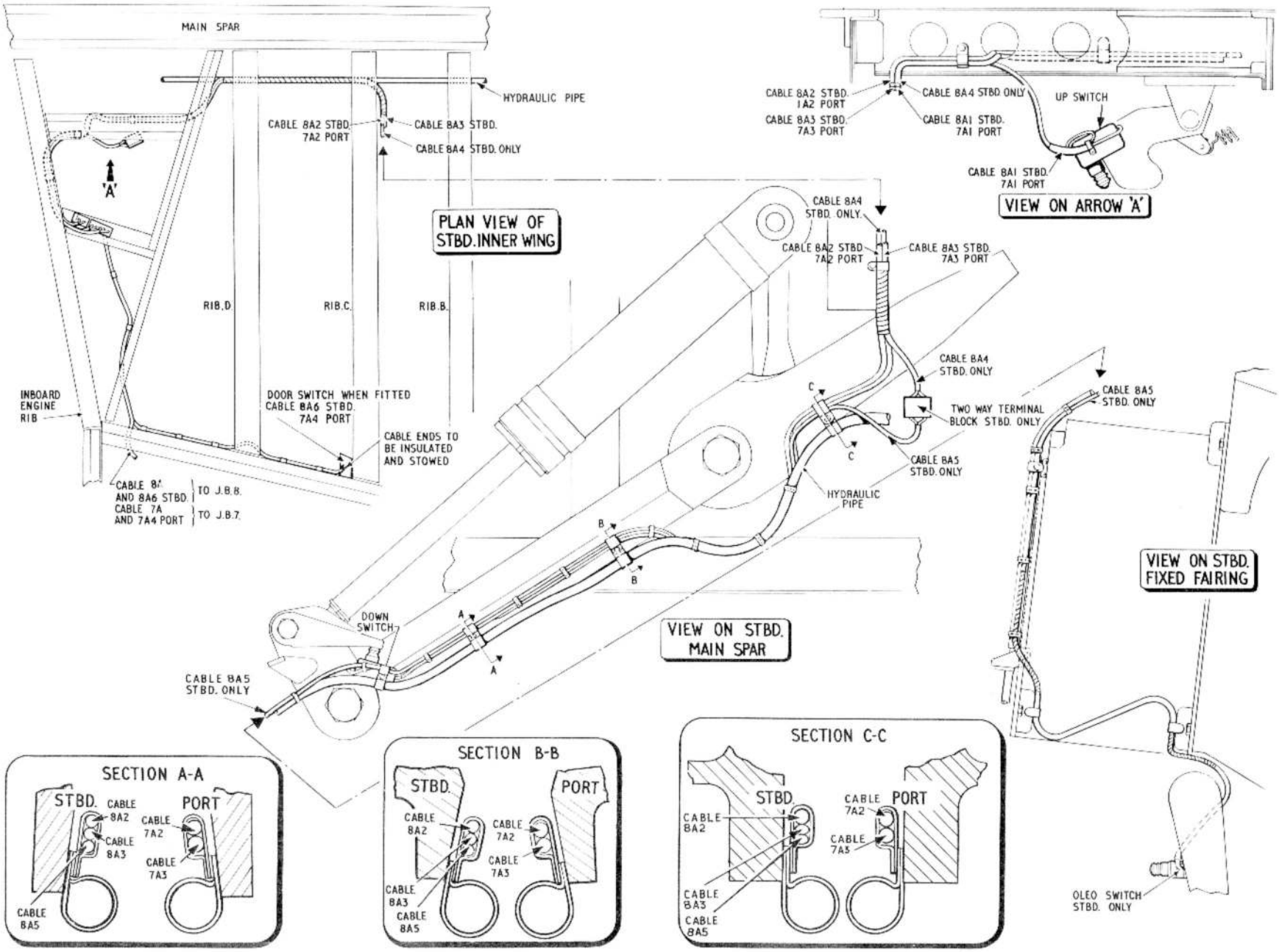


Fig. 4A. Main wheels – wiring installation

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◀ *(Wiring details corrected)* ▶

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).

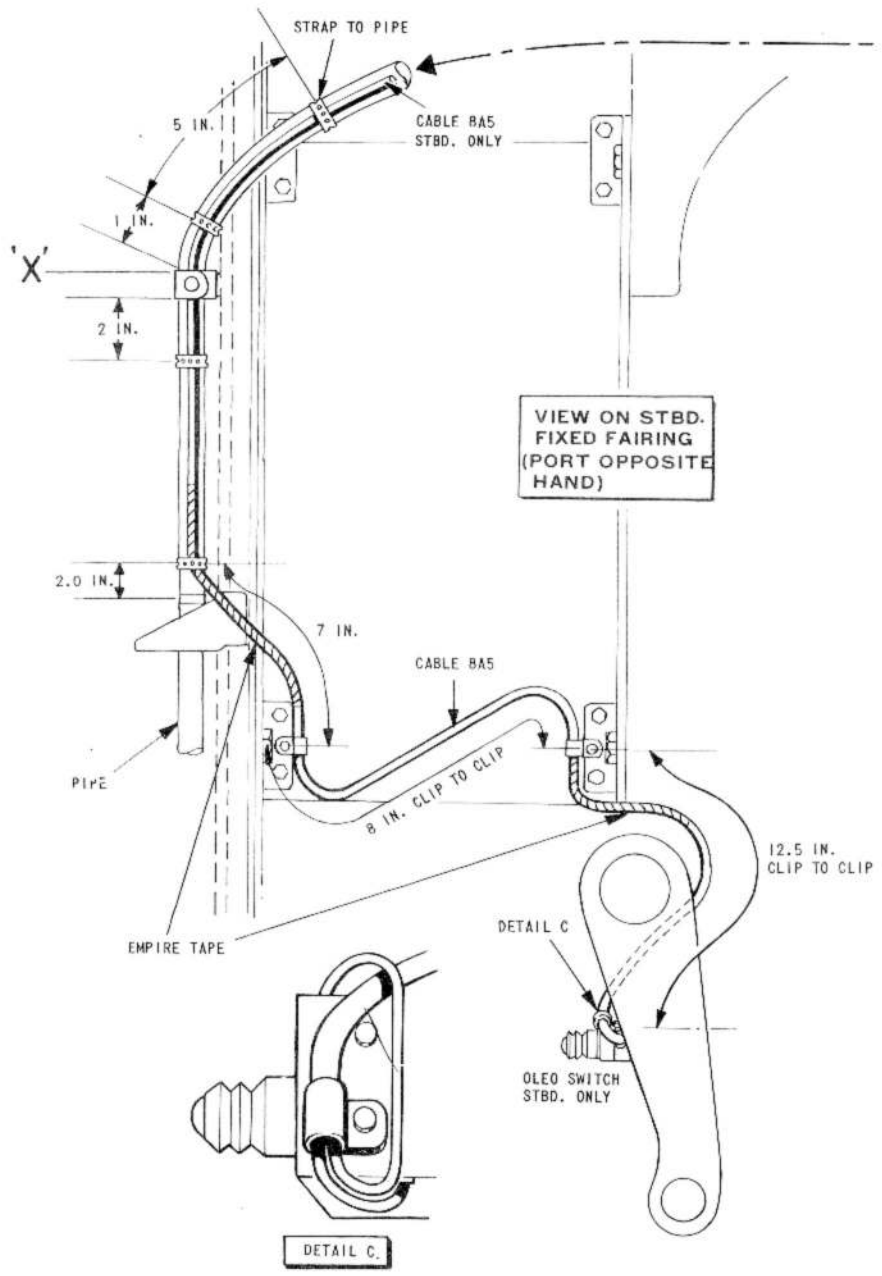


Fig. 4B. Main wheels – wiring installation

◀ *(Wiring details corrected)* ▶

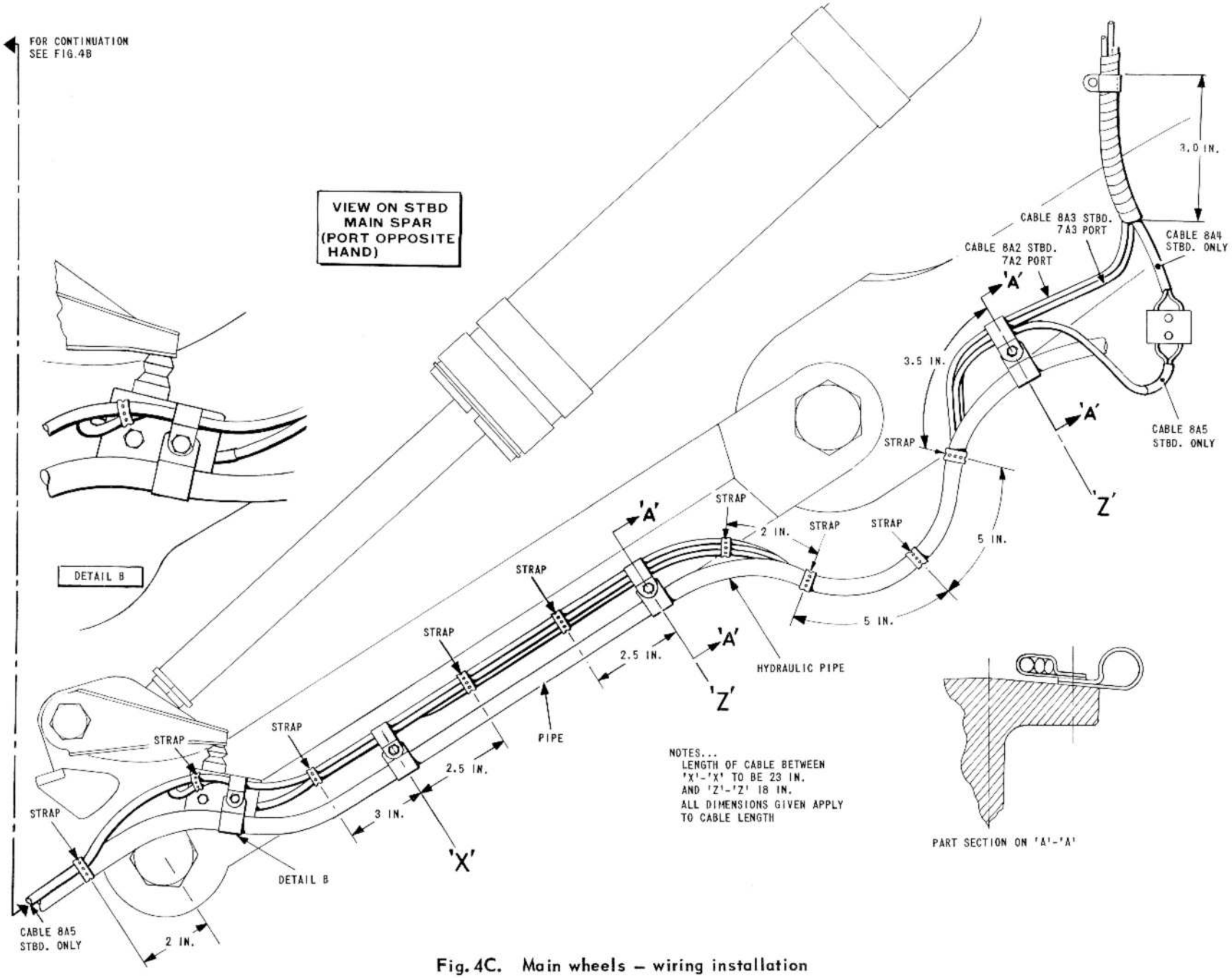
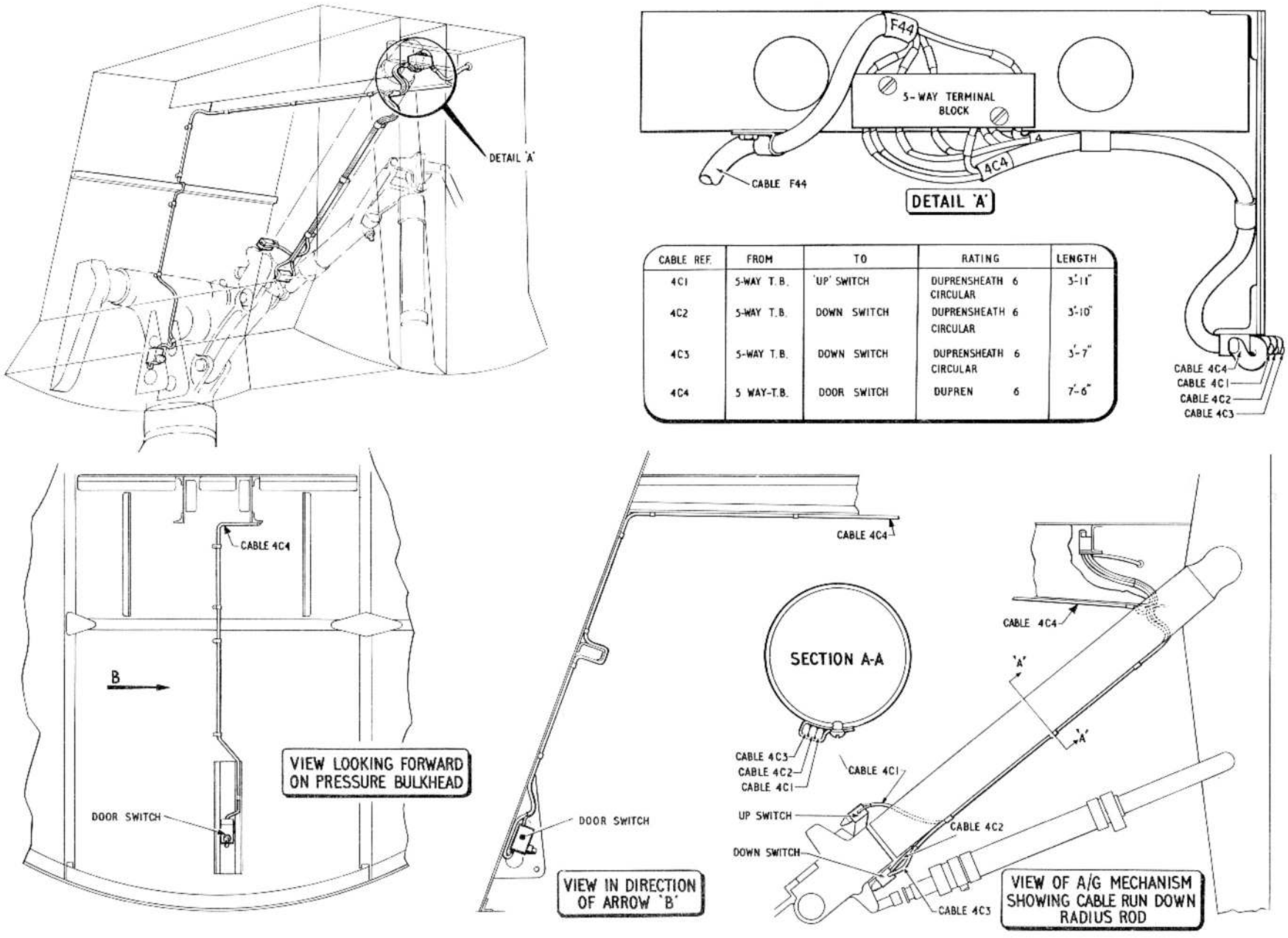


Fig. 4C. Main wheels – wiring installation

(Wiring details corrected)

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"

Fig. 5. Nose wheel – wiring installation

◀ *(Wiring details corrected)* ▶

RESTRICTED

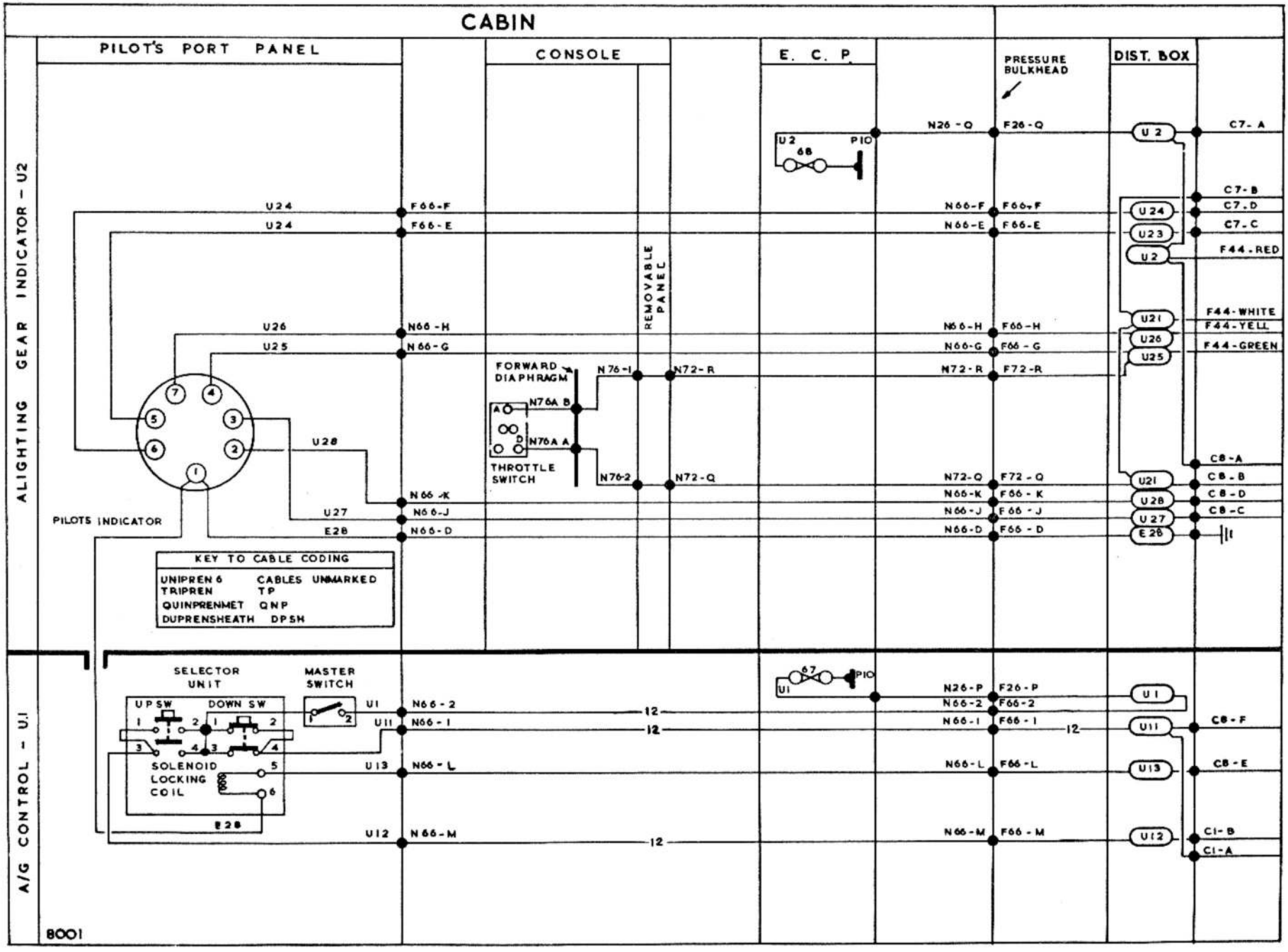


Fig. 6. Alighting gear control and indicator

(Mod. 4080 incorporated)

RESTRICTED

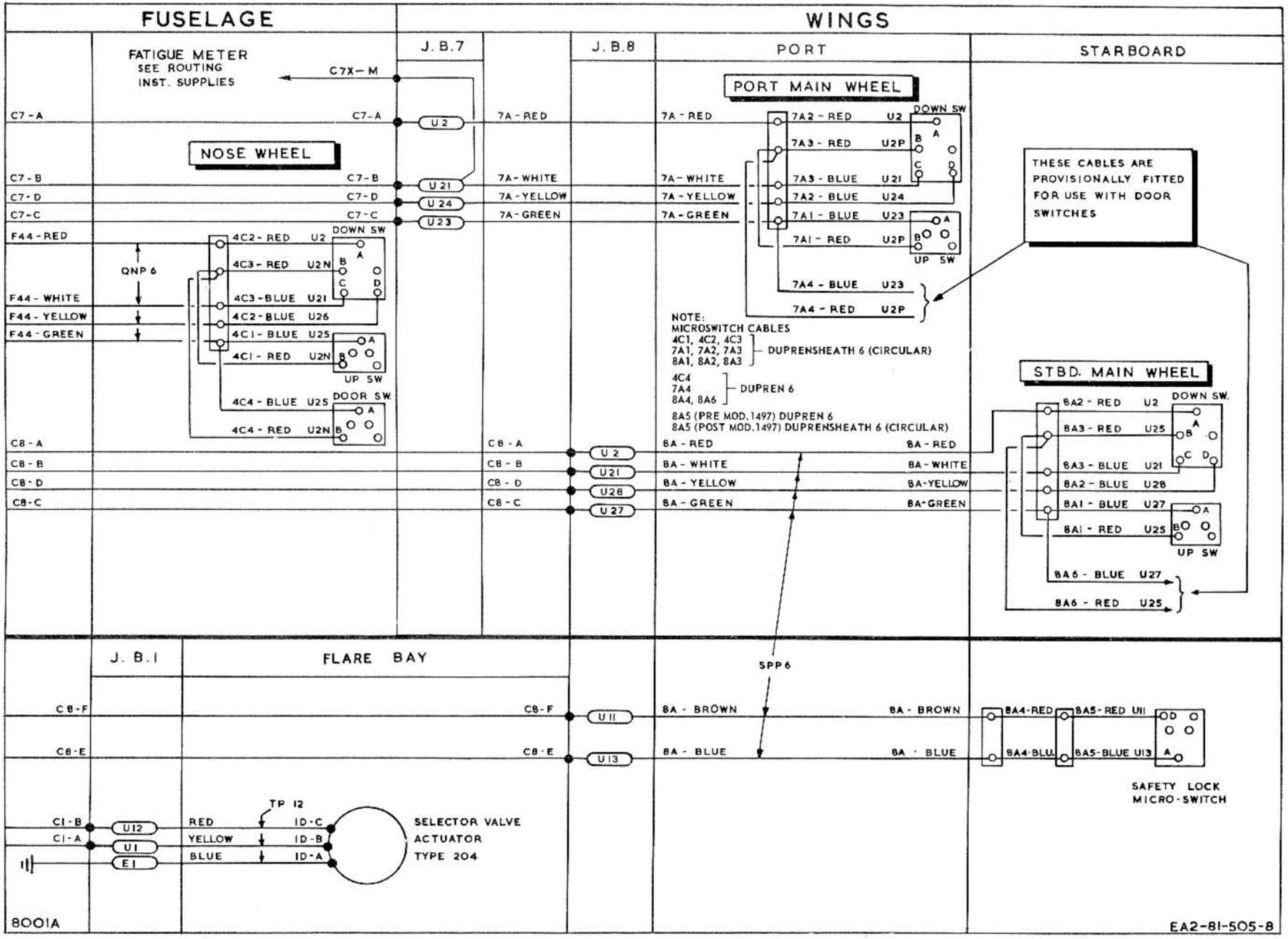


Fig. 6A. Alighting gear control and indicator

(Cable types corrected)

RESTRICTED

CABIN AIR SYSTEM, HEATERS, AND DE-MISTING - GROUP H

(completely revised)

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DESCRIPTION

CABIN AIR SYSTEM

General

1. The cabin pressurization system operates primarily from hot air tapped from the engine compressor stages. By means of a mixing valve, the hot air can be mixed with cold air to maintain any required temperature in the cabin. Pressure in the cabin is kept to a pre-determined level by a Normalair controller installed on the forward face of the pressure bulkhead. The hot air supply from the engines is also used for the camera heating systems. The cabin air system as a whole is described in Sect. 3, Chap. 8.

Mixing valve

2. This valve is installed in the port leading edge of the main plane and operated by a Type 203 actuator which is controlled by a switch, marked HOT and COLD, fitted on the miscellaneous instrument panel. The latter also carries a Desynn indicator which is operated by a transmitter coupled to the mixing valve mechanism.

Gate valves

3. On the introduction of Mod. 1005, two gate valves are used to control the hot air supply from the engines and are fitted, one port and one starboard, in the leading edge of the main plane. The valves are operated by Type 234 actuators which are controlled by switches, marked

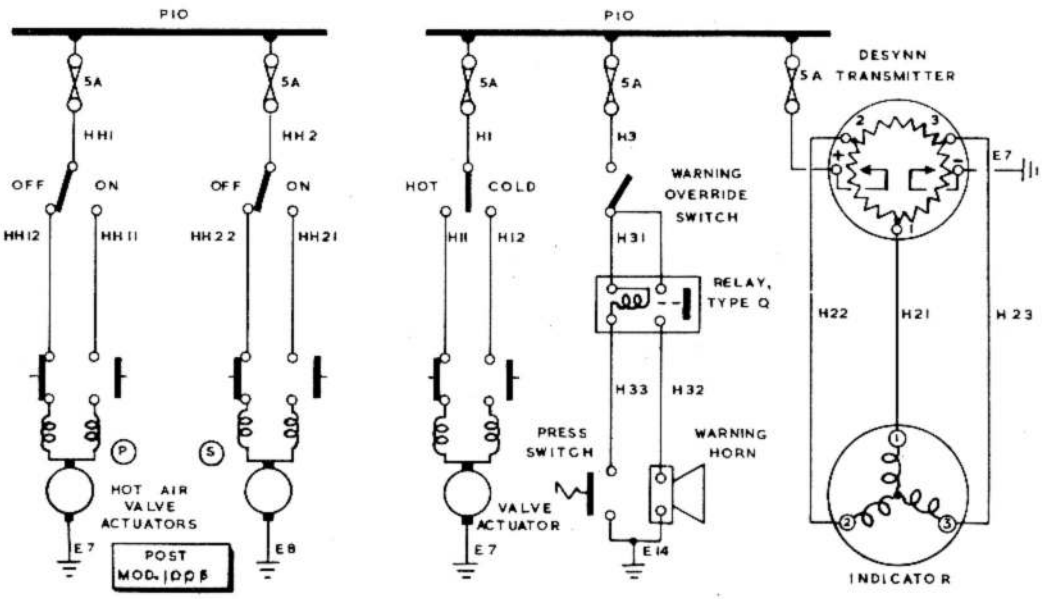

Fig. 1. Cabin air system

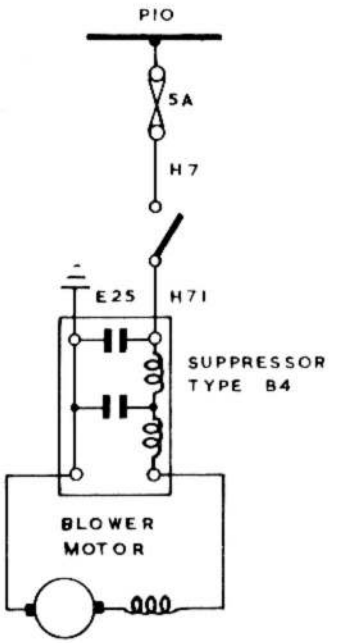

Fig. 2. Canopy de-misting

No. 1 and No. 2, fitted on the miscellaneous instrument panel. The modification also changes the mixing valve actuator to a Type 233.

Pressure controller

4. The pressure controller is connected to vents at the port and starboard sides of the nose by a pipeline separate from

that used for the flight instruments. The unit incorporates a pressure-operated switch which functions in a warning circuit comprising a Type Q relay, a warning horn, and a switch, labelled CABIN PRESS WARN OVERRIDE, mounted on the miscellaneous instrument panel. The relay is located near the 400 c/s fusebox at the starboard side of the cabin, while the warning horn is attached to the aft face of the mounting carrying the camera control panel. The controller pressure switch is preset to operate only above 10,000 ft. Above this height the switch contacts close to operate the warning horn if there is an excessive drop in cabin pressure. The pressure controller is fully described in A.P.1275A, Vol.1, Sect.20, Chap.2.

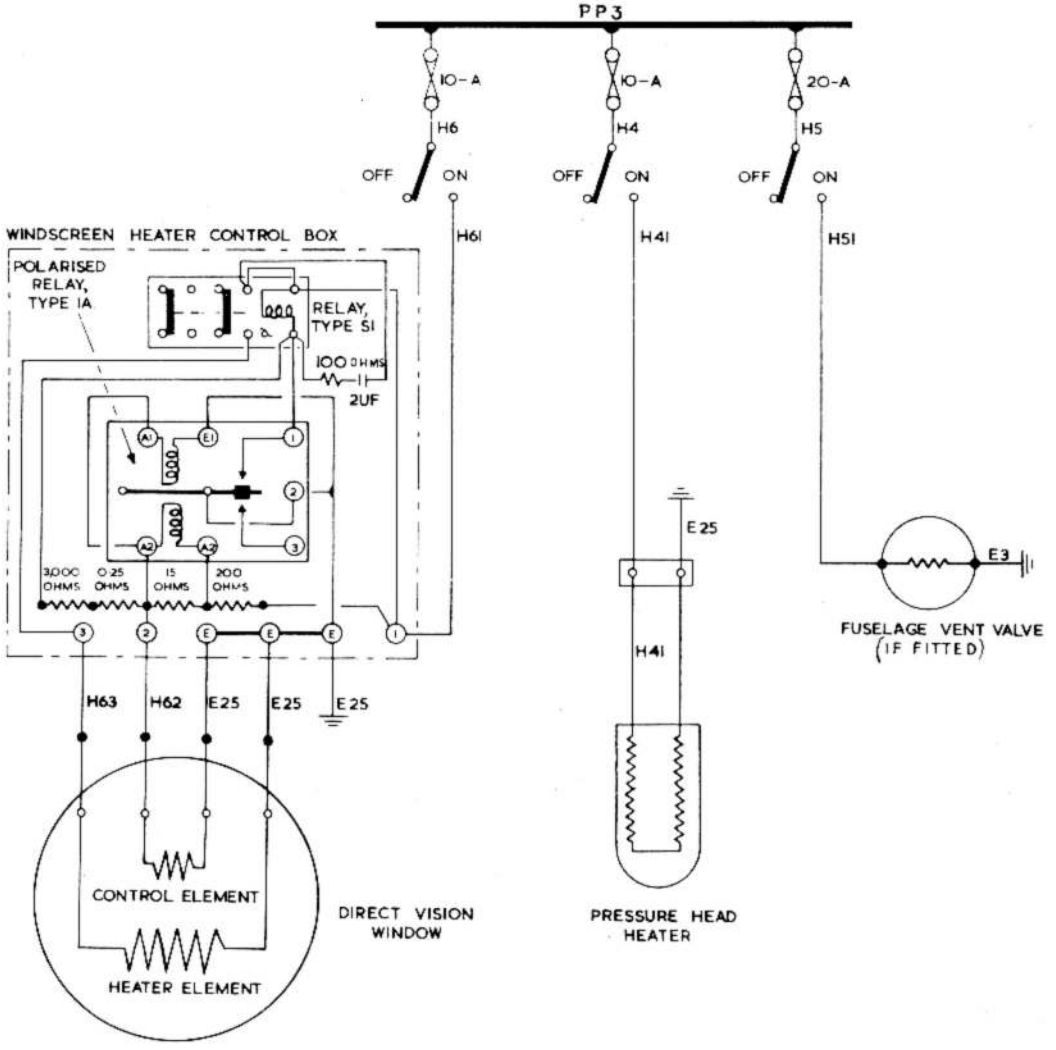

Fig.3. Heaters (pre Mod.4423)

CANOPY DE-MISTING

General

5. A motor-driven blower and an air drier are provided to circulate dry air between the inner surfaces of the Perspex skins forming the canopy structure. The blower is installed forward of the navigator's table and adjacent to it is a Type B4 suppressor which is connected in the power supply to the blower motor. The blower is controlled by the CANOPY DE-MIST switch on the console. The demisting systems are described in Sect.3, Chap.8.

HEATER CIRCUITS

Direct vision window

6. The pilot's D.V. window panel is electrically heated by an almost invisible nichrome-wire heating element sandwiched between the glass laminations; post Mod.4333 the panel is heated by a gold-film heating element. Also incorporated in the panel is a sensing control element which operates in conjunction with a control unit - windscreen heater box (pre Mod.4420) or Plessey controller Type 4, Mk.1 (post

Mod. 4420) - situated on the engine start panel structure. Power supplies to the heater are controlled by a switch, labelled WINDSCREEN, on the console top panel. Connections to the elements are made by non-interchangeable 2-pin plugs and sockets below the canopy coaming.

Control unit, windscreen heater box, pre Mod. 4420

7. The control unit incorporates a Type S relay, a miniature polarized relay, and four series-connected resistors, one of which is variable. When a drop in window temperature causes the resistance of the control element to fall below a pre-determined value, the polarized relay will close and operate the Type S relay. The operation of the Type S relay completes the supply to the heater element. As the temperature of the window rises the resistance of the control element increases. When its resistance reaches a pre-determined value the polarized and Type S relays open, breaking the supply to the heater elements.

Control unit, Plessey Type 4, Mk. 1, post Mod. 4420

8. On aircraft post Mod. 4420, the windscreen heater boxes are replaced by Plessey controllers Type 4, Mk. 1 and Diamond H Type B.S. relays. Control of the electrical supply to the heater element in the D.V. panel is achieved by energizing and de-energizing the coil of the Diamond H relays. Transductors in the controllers provide the necessary output current to operate incorporated slave relays which energize the coil of the Diamond H relays. The operation of the transductors is dependent upon the resistance of the temperature-sensing element incorporated in the window and, since the resistance varies with the temperature, complete control is obtainable. The controller is fully described in A.P. 4343E, Sect. 21.

Pressure head

9. The instruments pressure head installed on the nose fairing is fitted with a heating element to prevent icing. The heater power supply is controlled by the PRESS HEAD switch on the console.

Vent valve heater

10. In some aircraft, wiring provision is made for the installation of a heater in a vent valve assembly aft of No. 5 fuel tank. The provisional items include a cable, referenced 3A, installed and stowed in the tank bay, and a switch, labelled VENT VALVE, fitted on the console. While the heater is not fitted, the switch is inoperative and fuse 94 must be removed and replaced by a dummy fuse.

SERVICING

CABIN AIR SYSTEM

Valve actuators

11. Normal servicing of the mixing valve actuator and the gate valve actuators, if fitted, is confined to checking brush length, examination of the commutator, and the removal of carbon dust. The actuators are accessible after removing the top detachable wing panels inboard of each engine.

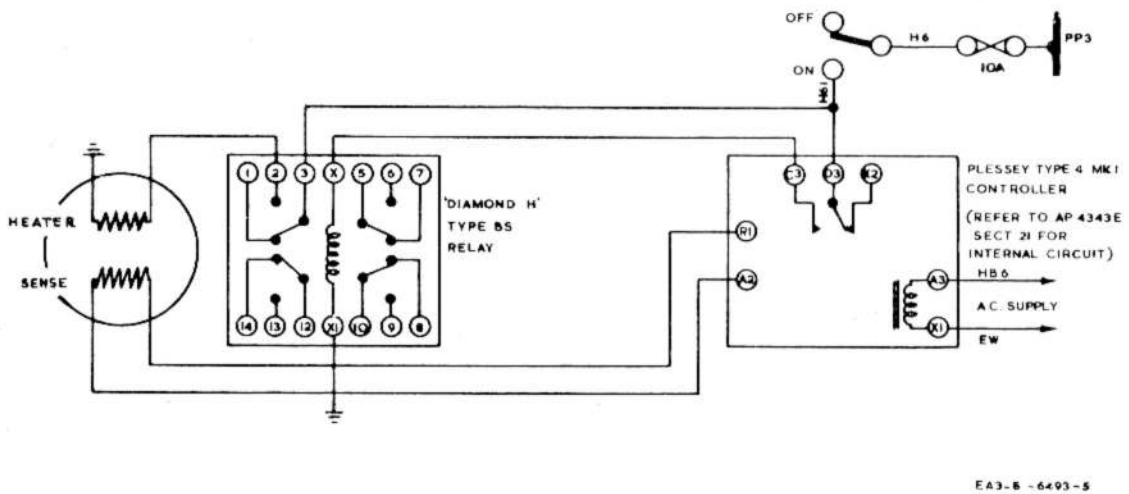

Fig. 4. D.V. window heater (post Mod. 4420)

Warning circuit check

12. The following procedure can be used to check the warning circuit:-

(1) Ensure that the BATTERY ISOLATION and CABIN PRESS WARN OVERRIDE switches are ON and remove the cap nut from the upper contact adjuster on the pressure controller *(fig.5)*.

(2) Insert a 3/32 in. diameter rod or stiff wire into the central hole in the adjuster and depress the plunger to close the switch contacts. The warning horn should operate.

WARNING

To avoid damage to the contact mechanism, the plunger must be depressed GENTLY. The required movement is approximately only 0.05 in.

(3) If the circuit functions correctly, replace and wire-lock the cap nut. If the circuit is suspect refer to A.P. 1275A, Vol.1, Sect.20, Chap.2, and the diagrams in this group.

HEATER CIRCUITS

D.V. window checks

13. 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, (pre Mod.4333) not more than 6 amp and not less than 4.2 amp, or (post Mod.4333) 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.

Window replacement

14. When replacing a faulty window with one that has been in store for some time, it is recommended that a bench check be made on the replacement before fitting. As the internal connections in the window rely on the intimate contact of the fine wire elements and busbars sandwiched between the window glasses, it has been found advisable to heat the window panel to approximately 40 deg C and allow it to partially cool off before applying test current during a pre-installation check.

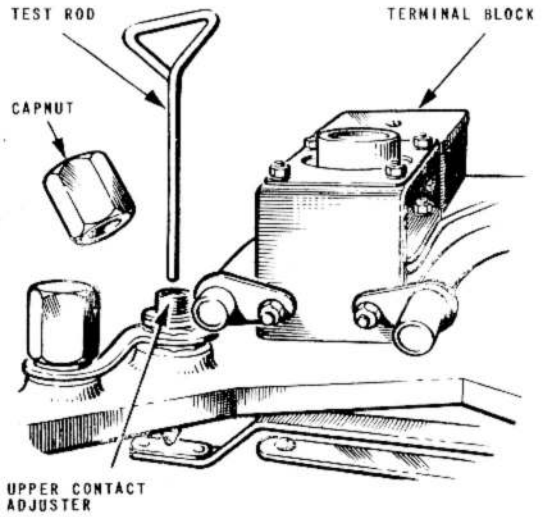

Fig.5. Pressure controller switch check

Control unit check (pre Mod.4420)

15. The correct functioning of the control unit may be checked by substituting a variable resistance for the control element and a test lamp for the heater element. This can be done at the plug and socket connections below the canopy coaming. Operate the variable resistor until the unit cuts in and the test lamp lights. Disconnect the variable resistor and measure its resistance with a suitable ohmmeter; it should be between 29 and 29.5 ohms. Reconnect the resistor and operate until the unit cuts out and the test lamp is extinguished. Disconnect the resistor again and measure its resistance; it should be between 30 and 30.5 ohms. The difference between cut-in and cut-out readings must not be less than 0.7 ohms.

Control unit check (post Mod.4420)

16. Remove fuses 95 and 127, 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 95 and 127. Switch on instruments 400 c/s supply and the control switch; the test-lamp should illuminate. Increase the decade resistance setting until the test-lamp extinguishes, note the resistance which should be between 30.0 to 30.5 ohms. Decrease the decade resistance setting until the test-lamp illuminates, 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 c/s 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 c/s 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 heat heater

17. Very little servicing is necessary for the pressure head. If its heater element should become unserviceable the head must be renewed.

Canopy de-misting

18. Servicing of the Type 1 blower motor is confined to checking brush length, examination of the commutator, and the removal of carbon dust.

REMOVAL AND ASSEMBLY

Cabin air system

19. The removal of the actuators, mixing valve and Desynn transmitter is covered in Sect. 3, Chap. 8.

D.V. window

20. During the removal of the window care must be taken not to damage the connections to the control and heater elements. The moveable window panel can be removed after taking out the hinge bolt.

Pressure head heater

Removal

21. To remove the pressure head:-

(1) Disconnect the head cable at the 2-way terminal block adjacent to it.

(2) Unscrew the pitot pipe union at the rear of the head and remove the pipe.

(3) Remove the fixing nut and sealing washer from the rear of the head then take out the head complete with sealing washer.

Assembly

22. Assembly of the head is the reverse of the removal procedure. After its installation a complete check should be made on the pitot system as described in Sect. 5, Chap. 2.

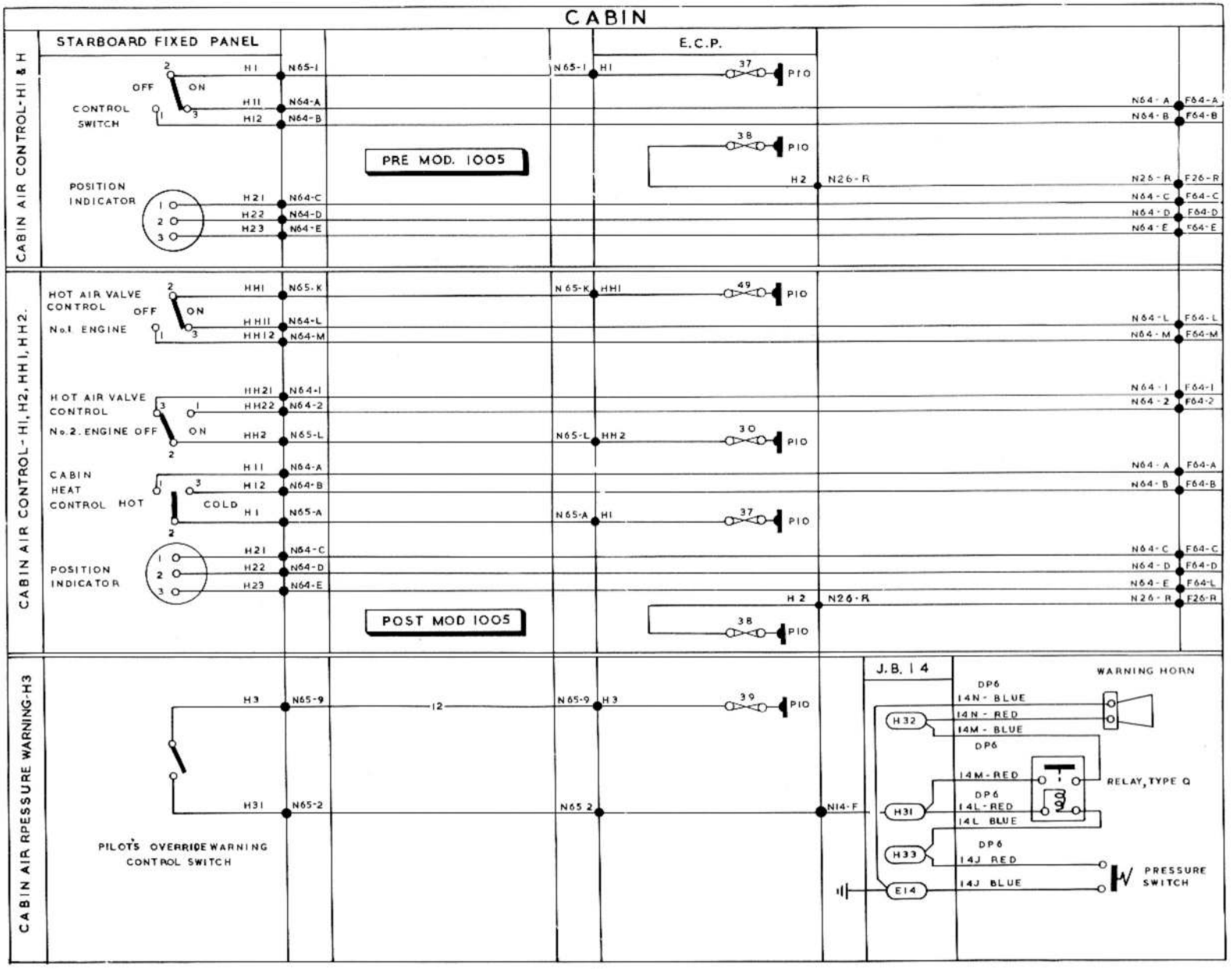

FIG. 6. CABIN AIR CONTROL - CABIN PRESSURE WARNING

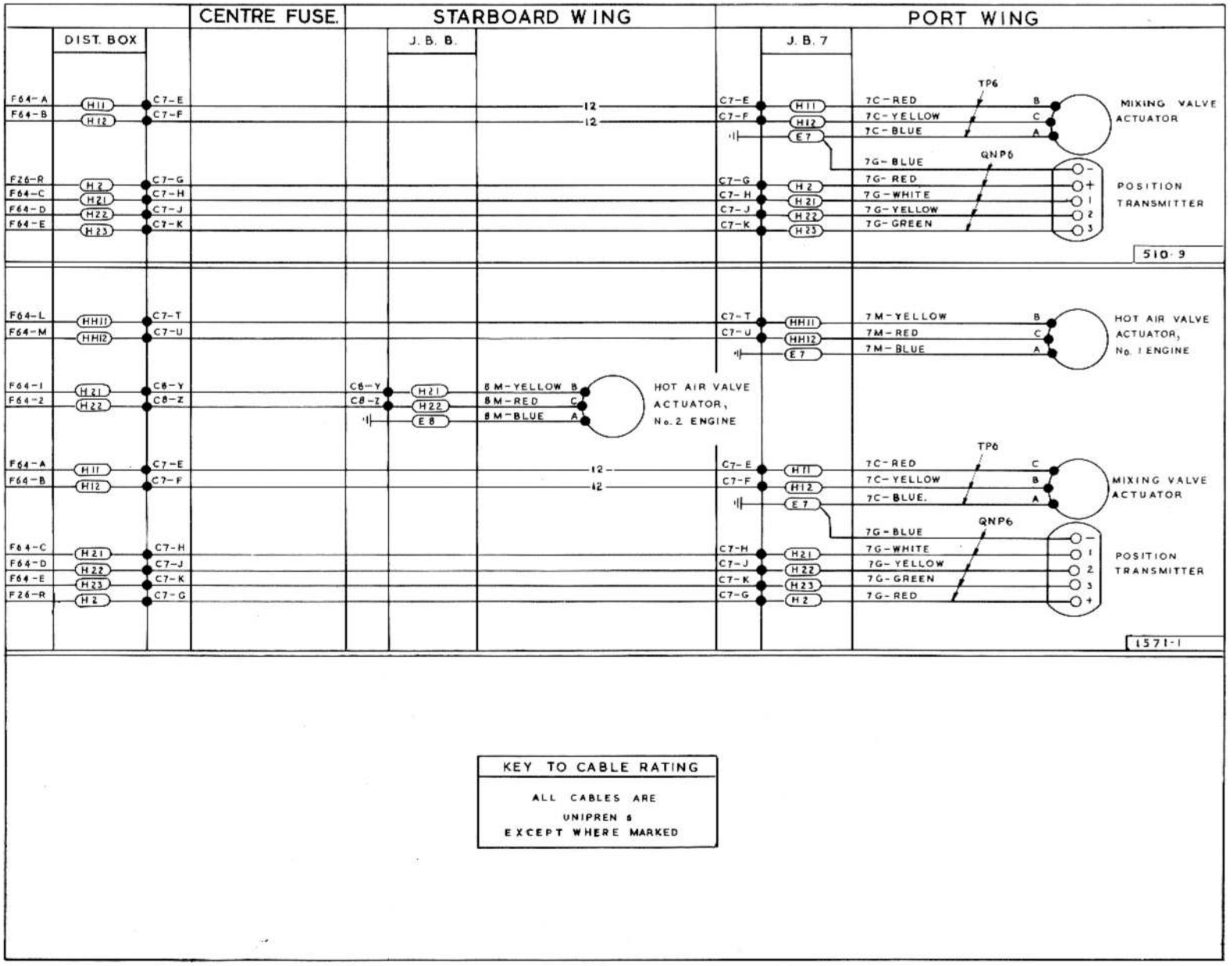

FIG. 6A. CABIN AIR CONTROL - CABIN PRESSURE WARNING

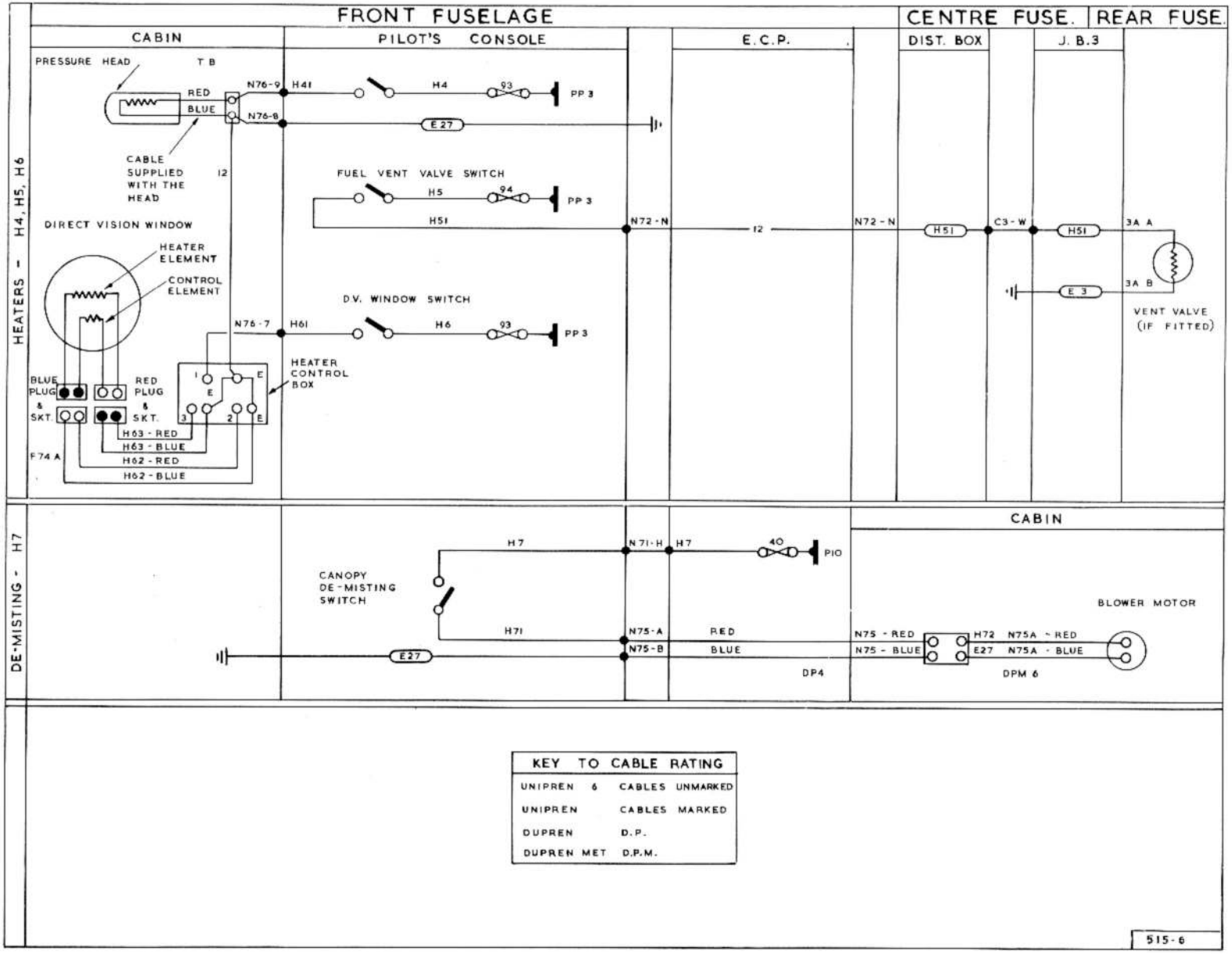

FIG. 7. HEATERS - DE-MISTING (PRE MOD.4420)

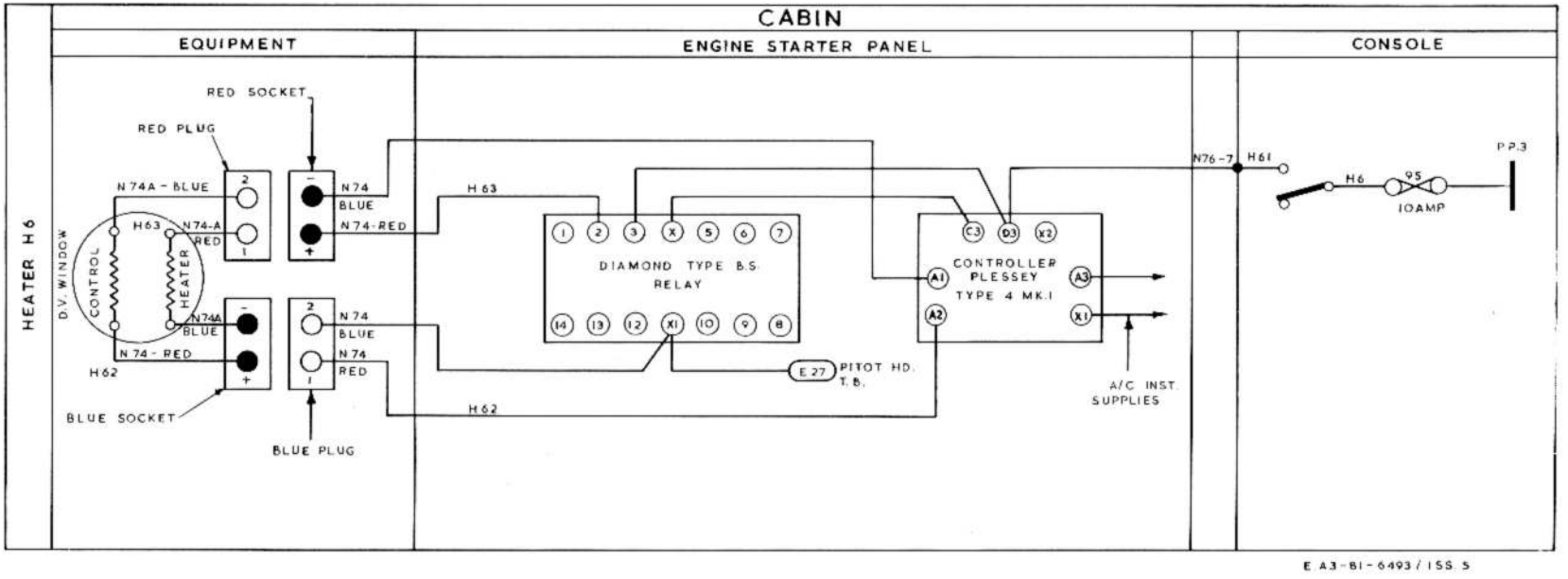

FIG. 7A. D.V. WINDOW HEATER (POST MOD. 4420)

GROUP J & K – ENGINE SERVICES

(Completely revised)

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Introduction

1. This group contains a description of the engine starting system, the appropriate theoretical and routeing diagrams, and information on servicing. The location of the main items of equipment is covered in the General Information group at the beginning of this chapter.

DESCRIPTION

General

2. Engine starting is effected by single-breech turbo-starters using Avon starting cartridges, high-energy ignition units and sparking plugs. The system is controlled by two master starting switches and two push switches, mounted on the starter panel, in conjunction with two time delay switches, Type F.H.M./A/25, located at the port side in the nose, forward of the rudder pedals. Also used in the starting circuits are two ignition switches mounted on the starter panel, two engine pump isolation switches mounted aft of the levers on the throttle box and two Type S1 relays in the E.C.P.

Time-delay switch

3. The time-delay switch is incorporated in the starting circuit to provide automatic control of the starting cycle. It is fitted with a magnetic clutch and a motor-driven switch mechanism designed to open and close a series of contacts, referenced A, B, C and D, in a set sequence.

High-energy ignition units

4. Two H.E. ignition units are used in each starting circuit and located inboard of the engine in the leading edge of the wing. The units are accessible after removing the wing top panels.

Operation

5. The starting operation is initiated by the START push switch and the subsequent functioning of the time-delay switch as follows:–

(1) The magnetic clutch is energized and contacts 'A' close.

(2) Contacts 'C' closed at start, open 5^{+2}_{-0} secs later.

(3) Contacts 'B' closed at start, open 29 ± 2 secs later.

(4) The overrun contacts 'D', closed at start, open 1.0 second *(minimum)* after contacts 'B' open.

6. Providing that the IGNITION switch is ON, the above cycle of operations will result in the following action:—

(1) The cartridge is fired.

(2) The Type S1 relay in the E.C.P. is energized and closes to actuate the high-energy ignition units.

(3) The engine starts up.

Engine relighting

7. Under suitable conditions, an engine can be relighted in flight by operating the relight switch embodied in its H.P. fuel cock lever forward of the console. Reference to the theoretical diagram will show that the operation of the relight switch by-passes the time-delay switch to energize the Type S1 relay which then closes and completes the supply to the ignition units.

SERVICING

WARNING

In certain circumstances, the energy stored in capacitors embodied in the H.E. ignition units may be of a lethal nature. As a safety precaution, it is essential that after disconnecting the Plessey plug and socket at least one minute should elapse before further handling of the unit.

General

8. Functioning tests using test lamps may be made on the starter circuits after the removal of any cartridges from the engine starter units and the disconnection of the H.E. ignition units.

Ignition circuit check

9. The ignition circuits can be checked by the following procedure:—

(1) Disconnect cables 7K and 7L from the port engine H.E. ignition units and cables 8K and 8L from the starboard engine ignition units

(2) Connect test lamps to pins A and B of the Plessey sockets on all four cables.

(3) Switch ON the MASTER STARTING and IGNITION switches.

(4) Press the port engine START switch button; the test lamps connected to cables 7K and 7L should light for a period of 29 ± 2 secs.

(5) Press the starboard engine START switch button; the test lamps connected to cables 8K and 8L should light for a period of 29 ± 2 secs.

(6) Press the port engine relight button, the test lamps connected to cables 7K and 7L should light and remain lit during the time the button is pressed.

(7) Press the starboard engine relight button, the test lamps connected to cables 8K and 8L should light and remain lit during the time the button is pressed.

(8) Remove the four test lamps, switch OFF the MASTER STARTING and IGNITION switches, remake the connections to the H.E. ignition units.

Starter cartridge circuit check

10. The cartridge circuit can be checked by the following procedure:—

(1) At the break point on the starboard side of each engine, disconnect cables 11K*(port)* and 12K *(starboard)* and connect a test lamp between the core of each cable and earth.

(2) Switch ON the MASTER STARTING switches.

(3) Press the port START switch button; the test lamp connected to cable 11K should light for a period of $5\ ^{+2}_{-0}$ secs.

(4) Press the starboard START switch button; the test lamp connected to cable 12K should light for a period of $5\ ^{+2}_{-0}$ secs.

(5) Switch OFF the MASTER STARTING switches, remove the two test lamps and reconnect the cables.

Fuel pump isolation valve check

11. These valves are solenoid-actuated and it is possible to hear them operate when the appropriate switches, fitted aft of the throttle levers are operated. If the valves cannot be heard functioning, the circuits should be checked as follows:—

(1) Disconnect cable 11B from the port engine solenoid valve and cable 12B from the starboard engine valve.

(2) Connect a test lamp to the socket of each disconnected cable.

(3) Operate, in turn, the port and starboard fuel pump isolation switches, the appropriate test lamp should light each time.

(4) Remove the test lamps and reconnect the cables to the valves.

12. Faults in the wiring should be investigated with the aid of the routeing diagram *(fig. 2-2A)*. Servicing of the engine starters, time-delay switches, and H.E. ignition units should be undertaken by authorized personnel only.

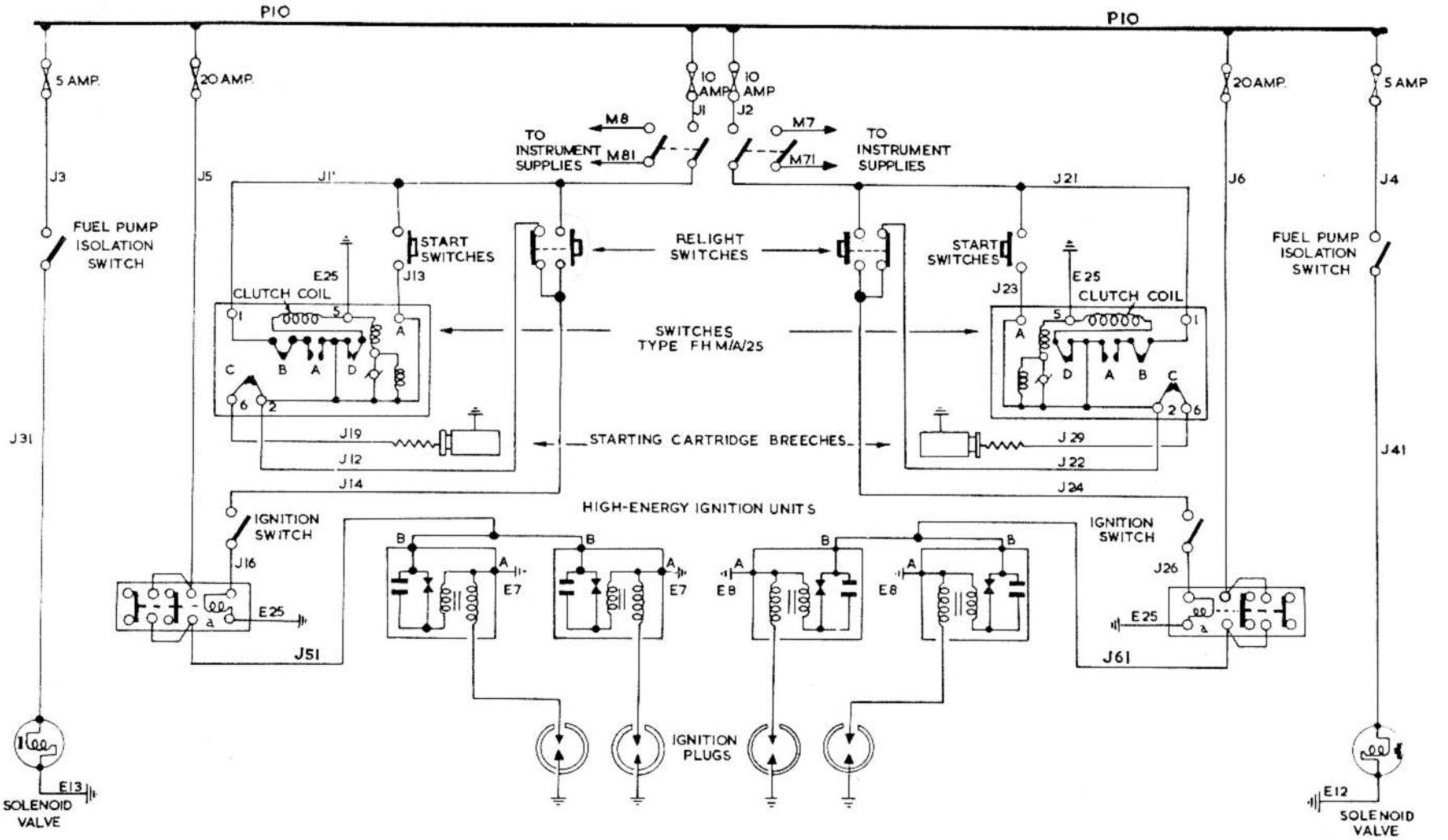

Fig. 1. Theoretical diagram – engine services

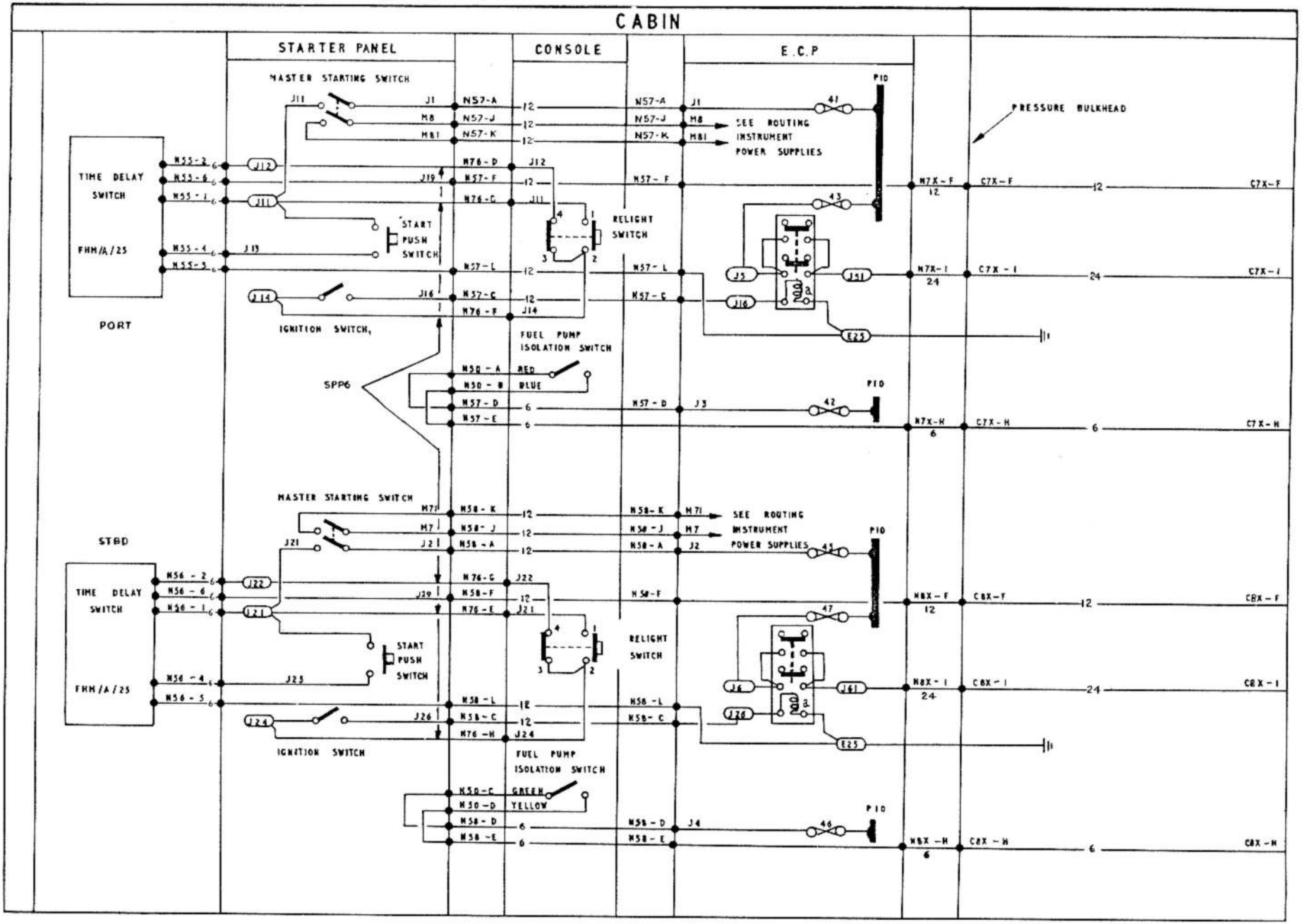

Fig. 2. Routeing diagram – engine services

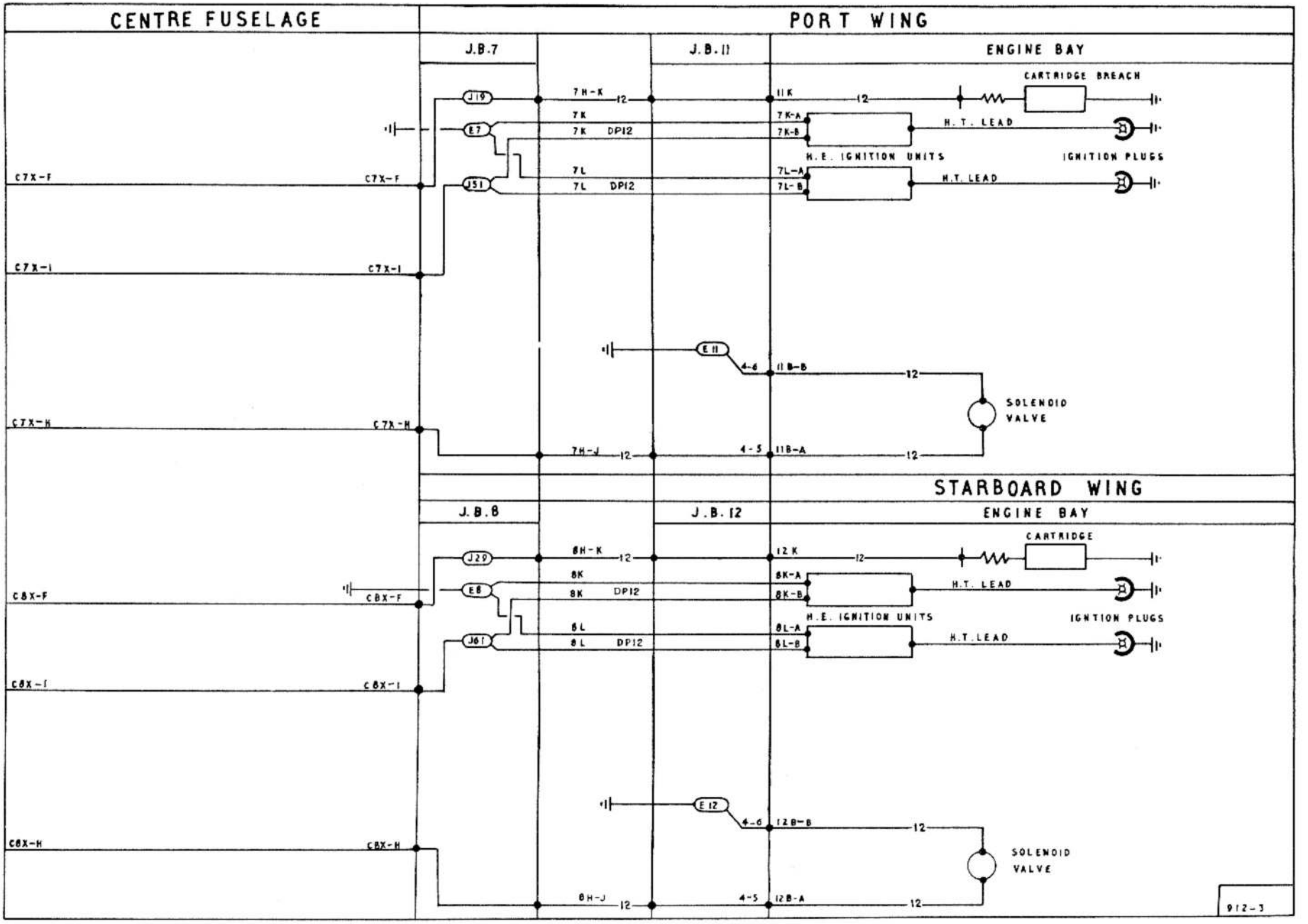

Fig. 2A. Routeing diagram – engine services

LIGHTING – GROUP L

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EXTERNAL LIGHTING

Description

1. All external lighting circuits are controlled from the console by individual switches and the EXTERNAL LIGHTS MASTER SWITCH. The power supply to the master switch is protected by the PILOT'S SERVICES circuit breaker on the E.C.P.

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 behind a transparent window under the tail structure.

Wing tip fuel tank lamps

3. As the normal wing tip lamps are obscured when jettisonable fuel tanks are carried, the nose of each tank is fitted with an extra navigation lamp which is connected into the normal lamp circuit by means of a spring contact block.

4. If the wing tip fuel tanks are jettisoned at night the extra lamps are lost and the normal lamps, then being visible, take over their usual function.

Identification lamp

5. A downward identification lamp, Type C, is installed on the underside of the fuselage aft of frame 34. The lamp is controlled by two switches on the console; one switch gives STEADY and OFF whilst the other, having a spring return-off action, is used for morse operation.

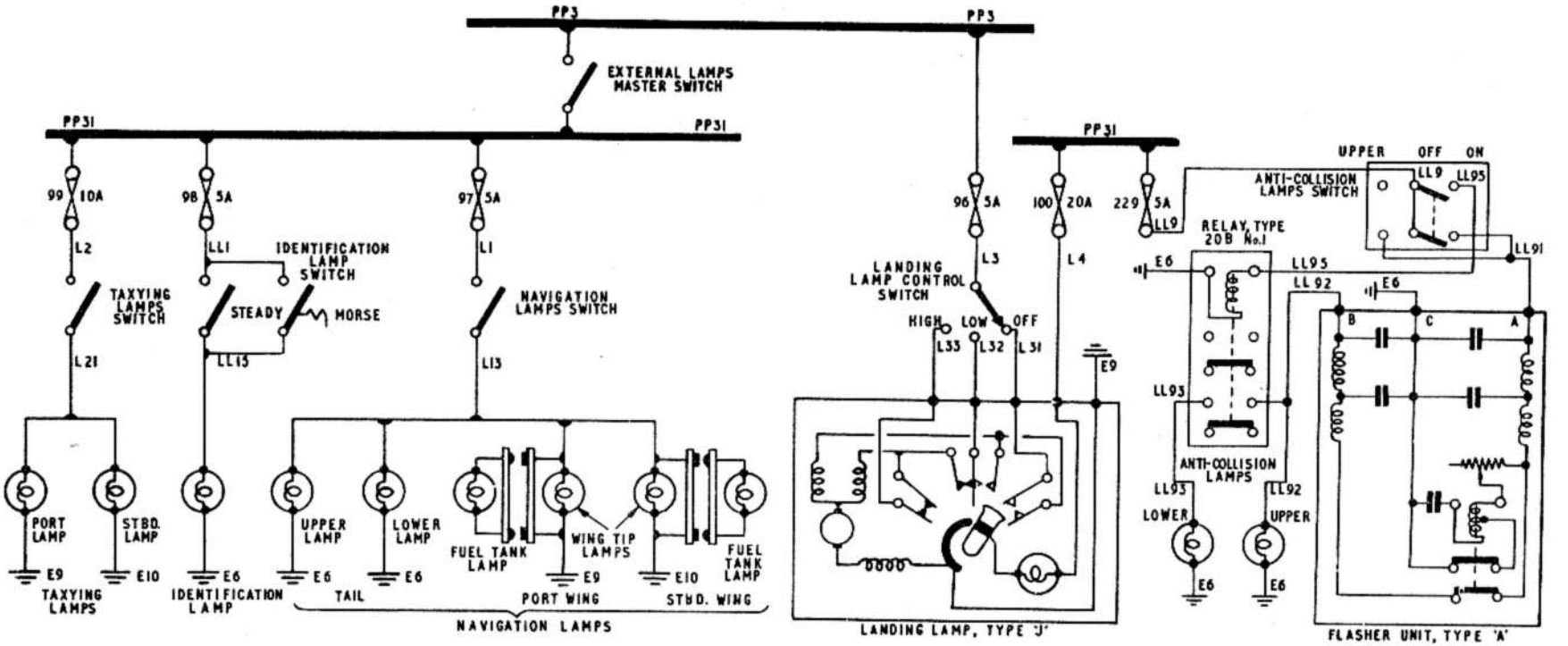

Fig. 1. External lighting

◀ *(Illustration amended Mod. 3353)* ▶

Landing lamp

6. A retractable Type J lamp is installed on the underside of the port wing. The lamp is controlled by a three-position switch, labelled OFF-LOW-HIGH, on the console. Selecting the switch to LOW operates the lamp to the half extended position at which point the filament is automatically switched on; when the switch is selected to HIGH the lamp moves to the fully extended position. Further information is contained in A.P.4343D, Vol.1, Book 3, Sect.16, Chap. 21 and A.P.4343E, Vol.1, Book 1, Sect.7, Chap.3.

Taxying lamps

7. A taxying lamp is fitted near the navigation lamp in each wing tip. Both lamps are jointly controlled by a two-position ON/OFF switch on the console.

◀ Anti-collision lamps *(post Mod. 3353)*

7A. On aircraft post Mod.3353 two anti-collision *(flashing)* lamps are fitted one above the rear fuselage, between frames 32 and 33, and one below the rear fuselage, between frames 21A and 21B. The lamps are controlled by a three-position switch on the console, labelled ANTI-COLLISION LAMPS ON-OFF-UPPER, in conjunction with a Type A flasher unit, located between frames 32 and 33 in the roof of the rear fuselage, and a Type 20B relay, located between frames 38 and 39 at the port side in the rear fuselage. Selecting the ANTI-COLLISION LAMPS switch to ON results in a pulsating supply being fed to both lamps; with the switch selected to UPPER a pulsating supply is fed to the upper lamp only. Should the pulsating supply fail, a direct supply is maintained and the lamp(s) will remain on. Detailed information on the Type A flasher unit is contained in A.P. 4343C, Vol.1, Book 2, Sect.3, Chap.86. ▶

INTERNAL LIGHTING

Nose station

8. General lighting at the prone position is provided by a Mk.1A lamp having an integral switch and a two-pin socket for use with an inspection lamp. A Mk.C chart-board lamp, controlled by an adjacent dimmer switch, is fitted on the aft face of frame A for illuminating the camera controls.

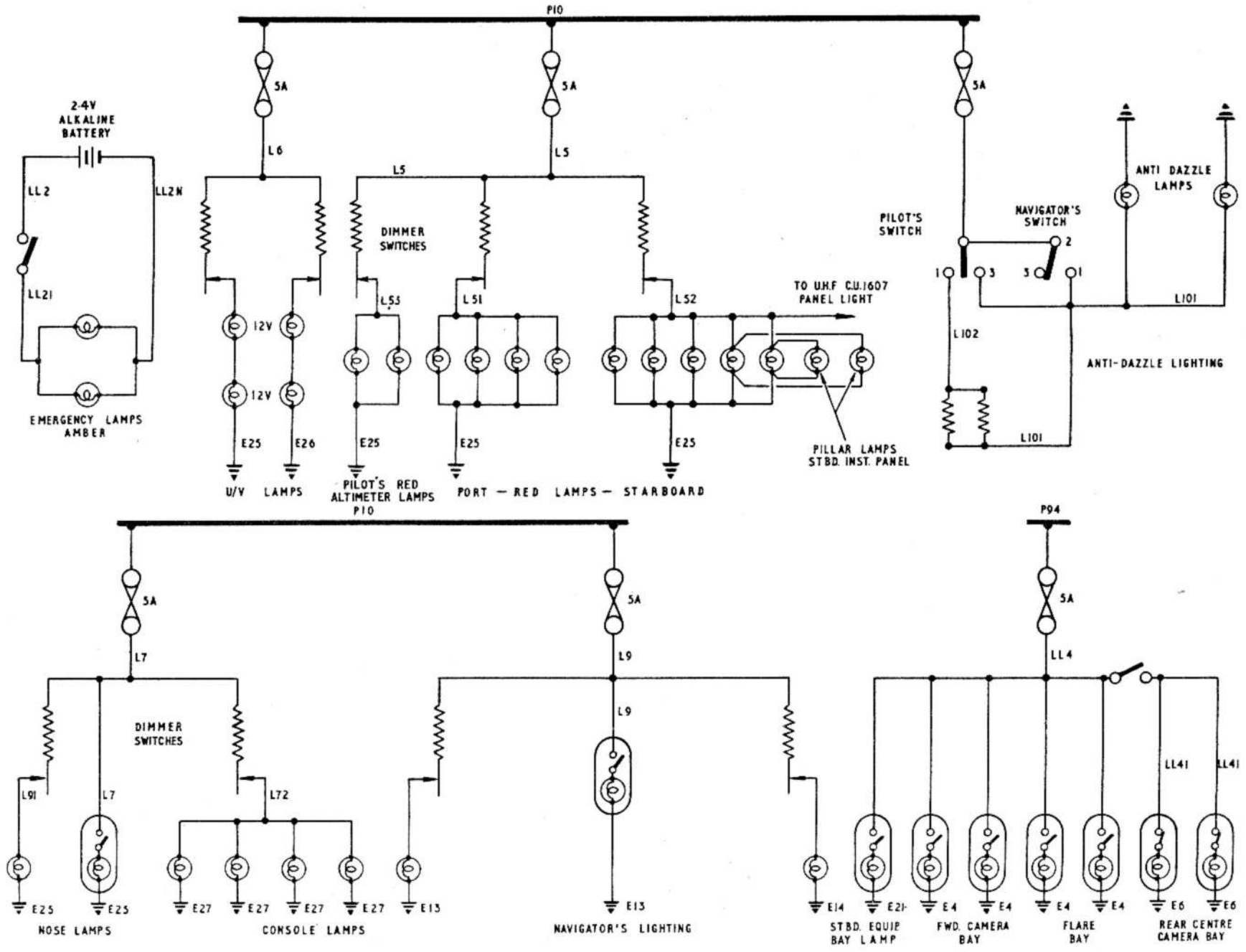

Fig. 2. Internal lighting

◀ *(Mod.3898 embodied)* ▶

RESTRICTED

Cockpit lighting

9. Illumination of the pilot's instrument panels is provided by four U/V and eight red floodlamps positioned below the canopy coaming. Two pillar lamps are fitted on the pilot's starboard instrument panel to illuminate the various instruments. The lamps are controlled by four dimmer switches, two of which, marked U/V, control the U/V lamps, and two of which marked RED, control the red lamps. A bridge lampholder, Type C, which comprises two pillar type lamps, is mounted on the pilot's main instrument panel and is secured by the upper attachment screws of the altimeter *(post Mod.3898)*. The lamps are controlled by a dimmer switch labelled ALTIMETER LIGHTS which is mounted on the upper surface of the canopy coaming cover plate. The starboard red lamps dimmer switch also controls the two pillar lamps on the starboard instrument panel, the E.2A compass lamp and two integral panel lamps fitted within the U.H.F. Type C1607/ARC.52 control unit *(Sect.6, Chap.1)*. The U/V lamps operate at 12 volts and are connected in series to suit the 28-volt supply.

Emergency lighting

10. Illumination of the pilot's instrument panels in an emergency is provided by two amber floodlamps positioned one at each side of the cockpit. The lamps are controlled by a switch mounted on the pilot's radio switch panel. The switch mounting plate has a luminous spot to facilitate its identification in the dark. Power for operating the lamps is supplied by a 2.4-volt alkaline battery, installed in the floor-well forward of the rudder pedals.

Anti-dazzle lighting (Mod.2359)

11. On the incorporation of Mod.2359, two high-intensity anti-dazzle lamps are installed one each side of the cockpit below the canopy coaming. The lamps are controlled by two switches, one a three-position switch labelled OFF-DIM-BRIGHT and fitted on the coaming panel, and the other, a two-position switch labelled OFF-BRIGHT, fitted on the navigator's instrument panel. Dimming of the lights is obtained by two parallel-connected resistor units, installed near frame 2 below the port coaming, which are in series with the lamps when the pilot's switch is selected to DIM. It should be noted that selecting BRIGHT by the navigator's switch overrides DIM selection by the pilot's switch.

Console lighting

12. In addition to the cockpit lighting, previously described *(para.9)*, four red floodlamps are installed, one above the console, two above the pilot's oxygen regulator, and one above the take-off panel. All four lamps are controlled by a dimmer switch above the oxygen regulator.

Cabin lighting

13. General lighting in the cabin is provided by a Mk.1A lamp, having an integral switch and a two-pin socket for use with an inspection lamp, positioned above the navigator's table. Two adjustable lamps are also installed, one above the camera control panel and the other above the navigator's instrument panel. Both lamps are controlled by dimmer switches adjacent to them.

Servicing lamps

14. A total of seven Mk.1A lamps are installed, for servicing use, in the fuselage aft of the pressure bulkhead. One lamp is mounted above the access hatch to the starboard equipment compartment and is used when servicing the generator control equipment. Two lamps are installed in the forward camera bay, two in the flare bay, and one each in the centre and rear camera bays respectively. The integral switches of the Mk.1A lamps in the centre and rear camera bays are left in the permanently ON position, the lamps being controlled by a switch mounted on the starboard wall of the fuselage above the rear camera bay hatch.

Servicing lamps power supply

15. As a precaution against the aircraft taking off with any servicing lamps alight, their supply is taken, via fuse 13 on the M.E.P. from circuit P94. This circuit is fed from the third *(small)* pin on the external power plug and is only alive when a ground supply socket is connected to it, the third *(small)* pin then being connected to the large positive pin.

Note...

If a plug/socket adapter, Ref.105G/11, is used to make connection between a two-pin ground supply plug and the aircraft three-pin external supply plug, it is essential to ensure before take-off that the adapter is not left in situ on the aircraft external supply plug.

Inspection lamp

16. An inspection lamp which can be plugged into any of the Mk.1A lamp sockets, is carried in a stowage bag located at the starboard side of the navigator's station. An extension lead for the inspection lamp is carried in another bag near the lamp stowage.

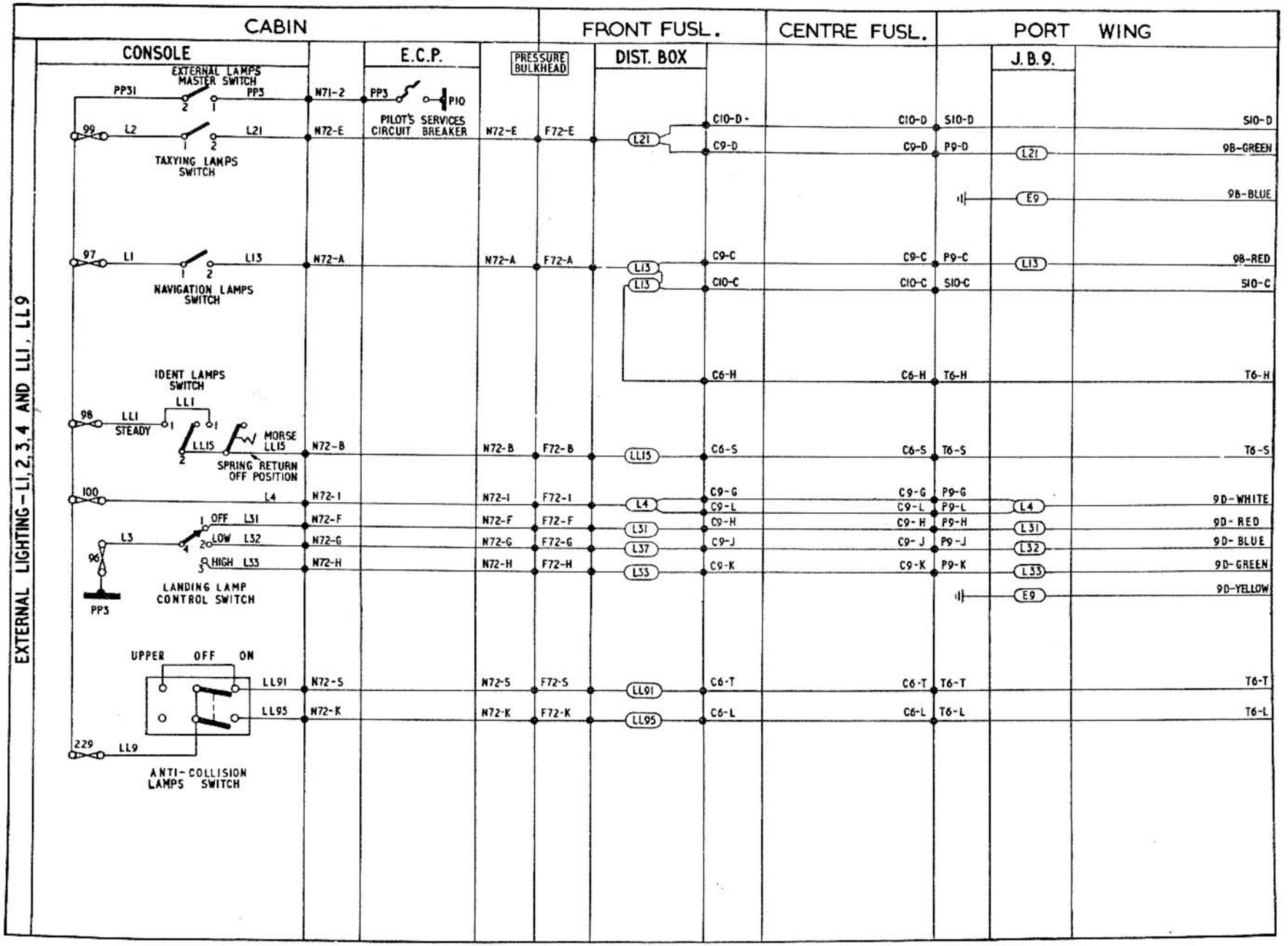

Fig. 3. External lighting

◀ *(Illustration amended Mod. 3353)* ▶

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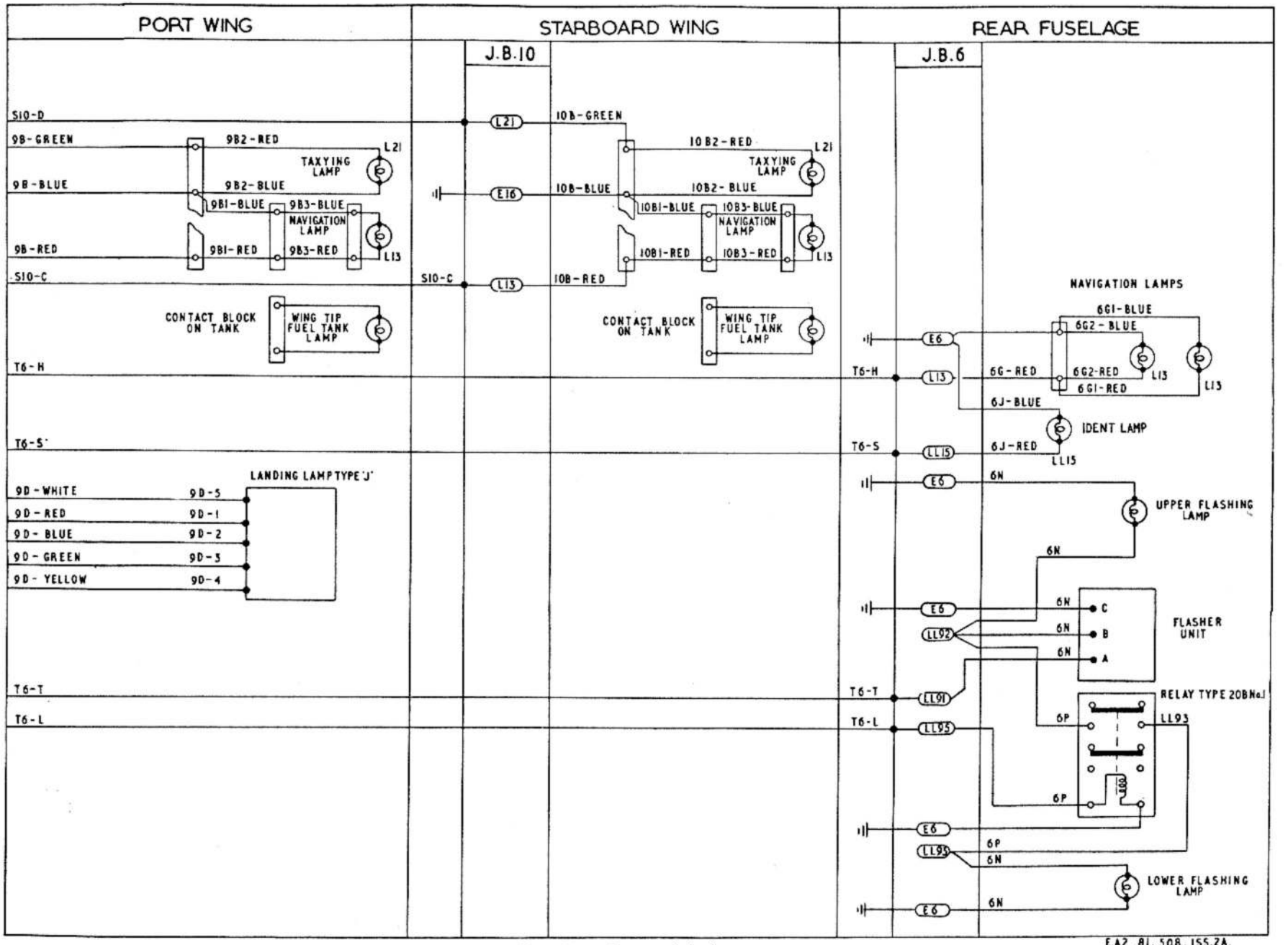

Fig. 3A. External lighting

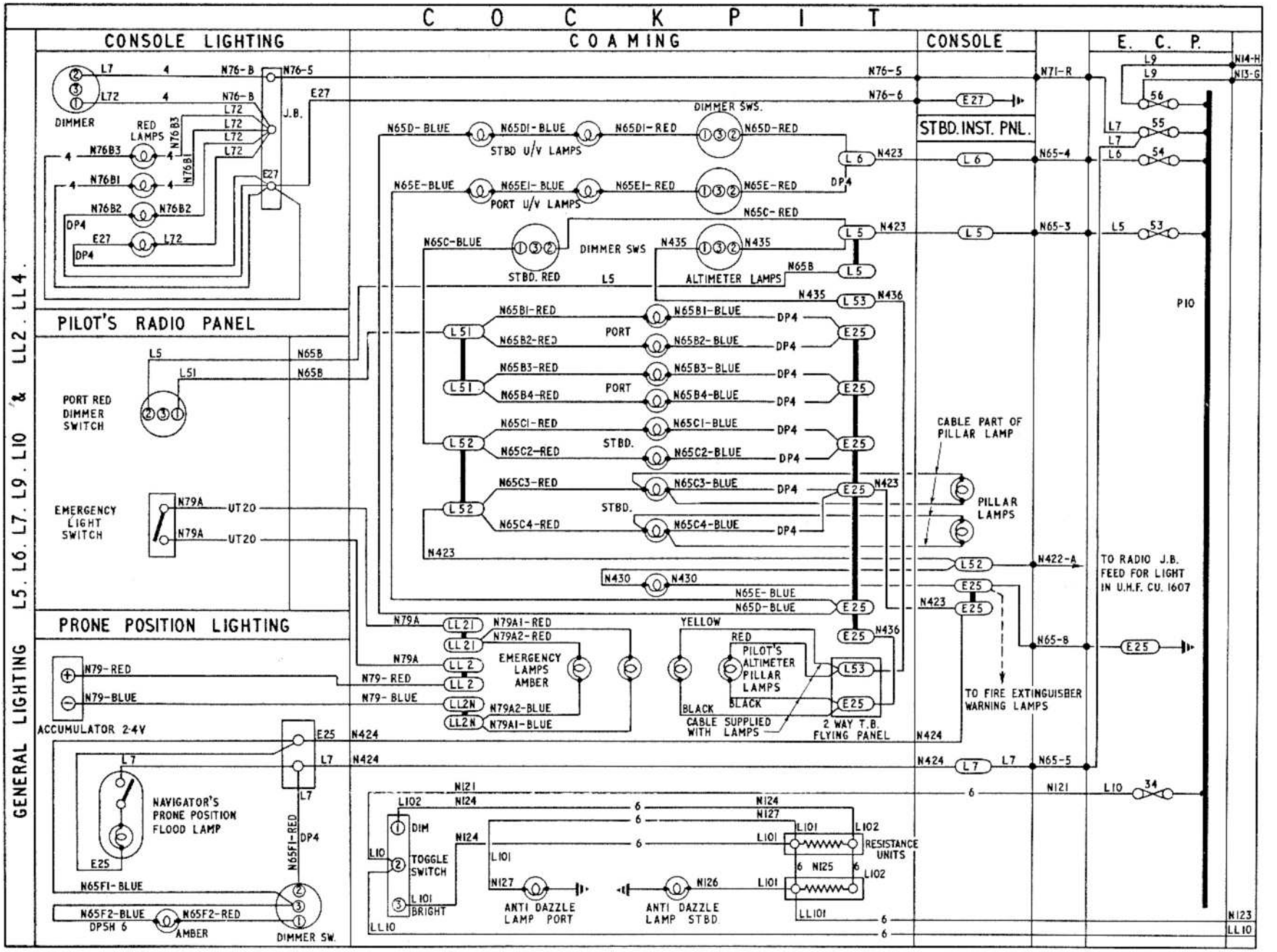

Fig. 4. Internal lighting

(Mods. 3898, 4158 embodied)

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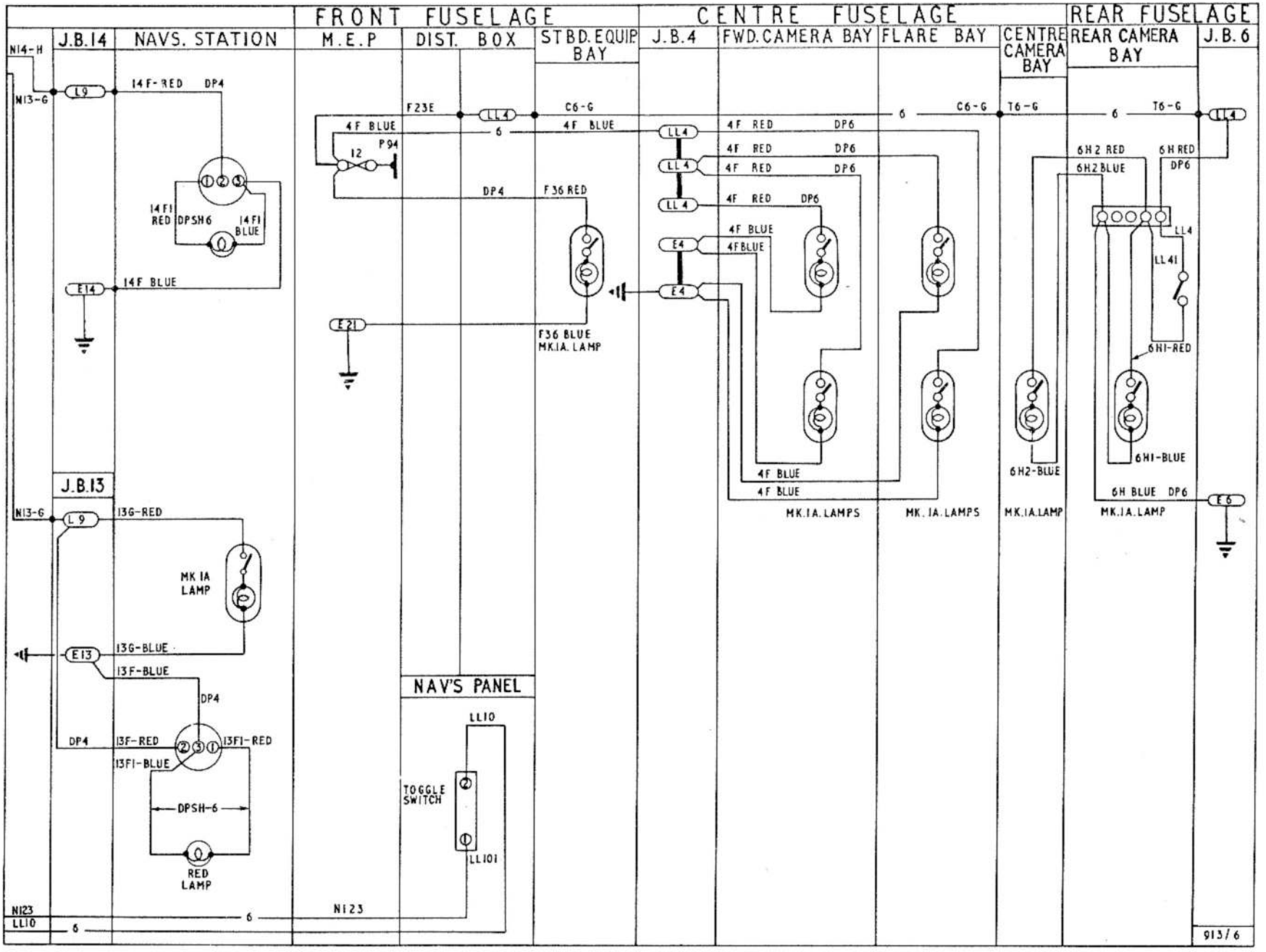

Fig. 4A. Internal lighting

◀ *(Mods.3898, 4158 embodied)* ▶

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D.C. POWER SUPPLIES — GROUP P

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DESCRIPTION

Introduction

1. This group contains a description of the d.c. power supplies and gives details of the location, operation and servicing of the generator and battery systems. Included in this group are circuit and routeing diagrams which cover the complete installation.

For information on the generator system post Mod.3854, fitted to aircraft embodying Mod.1783 and Mod.2355, reference should be made to Appendix 1 of this group.

General

2. Power for the electrical services and battery charging is provided by two Type P3 generators operating in parallel with an output voltage automatically controlled at 28-volts. Prior to the introduction of Mod. 714, each Type P3 generator is directly mounted on the accessories gearbox inboard of each engine in the leading edge of the main plane and driven at 0.64 engine speed. When Mod.714 is incorporated, each generator is driven through a two-speed gearbox, which in turn, is coupled to the accessories gearbox. The two-speed gearbox provides that a high output is available from a generator at low engine r.p.m. The gear change is automatic and controlled by a centrifugal clutch mechanism when this is subjected to a variation, within limits, of engine r.p.m. At low speeds the clutch is IN and high gear is engaged with the result that the generator is driven at 1.1072 times the engine speed. When engine r.p.m. rises to between 5930 and 6890 r.p.m., the high gear is automatically disengaged and the generator is driven at 0.64 engine speed. On a reduction of engine r.p.m. to between 5900 and 5150 r.p.m., high gear is re-engaged resulting in an increased generator output relative to engine speed. The Type P3 genator is fully described in A.P.4343A, Vol.1, Sect.3, Chap.8.

Generator control system

3. The equipment used to control each generator comprises a Type 23 voltage regulator, a Type A differential cut-out, and a Type D circuit breaker installed on the M.E.P., a generator switch and field circuit breaker on the E.C.P., and a Type X3 suppressor located in the inboard leading edge of the main plane. A Type 32 voltage regulator, also on the M.E.P., is used to balance the output from both generators and maintain it at a steady figure. Voltmeter and ammeter test sockets for checking generator operation are fitted on the M.E.P. and connected to shunts in series with the Type A cut-outs and the Type D circuit breakers. Generator failure is indicated by red warning lamps adjacent to the field circuit breakers on the E.C.P.

Operation

4. Each generator is initially controlled by its generator switch and field circuit breaker on the E.C.P. The paralleled output from both generators is connected to busbar P10 and fed to the battery busbar P9 via a Type R relay fitted on the busbar panel above the M.E.P.

Generator failure warning lamps

5. Indication of generator failure is given by two red warning lamps on the E.C.P. If the Type D2 circuit breaker in either generator circuit opens as a result of a fault in the generator or generator circuit, the relevant warning circuit is completed and the light comes on to indicate the failure.

Main relay, Type R

6. Connection between the battery busbar P9 and the generator busbar P10 is made via a Type R relay *(A.P.4343C, Vol.1, Book 2, Sect.3, Chap.7)*, fitted on the busbar panel in the M.E.P. The relay is normally controlled by the BATTERY ISOLATION switch on the E.C.P. During a crash landing the relay is automatically opened by operation of the inertia switch system, and the battery supply is isolated from all circuits except those for the fire extinguishers *(No.6 belly tank)* explosion suppression, canopy and hatch jettison, and photoflash jettison.

Inertia switch circuit *(pre and post Mod.1275)*

7. On aircraft pre Mod.1275, a single pendulum-type inertia switch is installed on frame 12 aft of the M.E.P. in the starboard equipment compartment. When Mod. 1275 is embodied, the single inertia switch is replaced by two piston-type inertia switches, fitted one port in the port equipment bay and one starboard on frame 12 in the M.E.P. bay, and a Type S relay in the d.c. distribution box in the upper equipment compartment. When the single pendulum inertia switch operates, some contacts close to operate the fire extinguishers and other contacts open to break the solenoid circuit of the Type R relay. The two piston-type inertia switches *(post Mod.1275)* are wired in series and operate in conjunction with a Type S relay in the d.c. distribution box. In the event of both inertia switches operating during a crash landing, the Type S relay is energized resulting in some of the relay contacts closing to operate the fire extinguishers and other contacts opening to break the solenoid circuit of the Type R relay *(para.6)*.

External power supply

8. A ground supply can be connected to busbar P10 via a 3-pole external power plug on the M.E.P. When the external power cable has a 2-pole connector, an adapter, *(Ref.No. 1056/11)*, should be used to make the connection. Connecting an adapter or the correct type of socket to the 3-pole plug, shorts the large positive pin *(P10)* to the small pin *(P94)* which is connected to fuse 12 and used as the supply for the servicing lamp in the starboard equipment bay and the lamps in the rear camera bay. This arrangement ensures that the lights can only be on while an external power supply is connected to the aircraft.

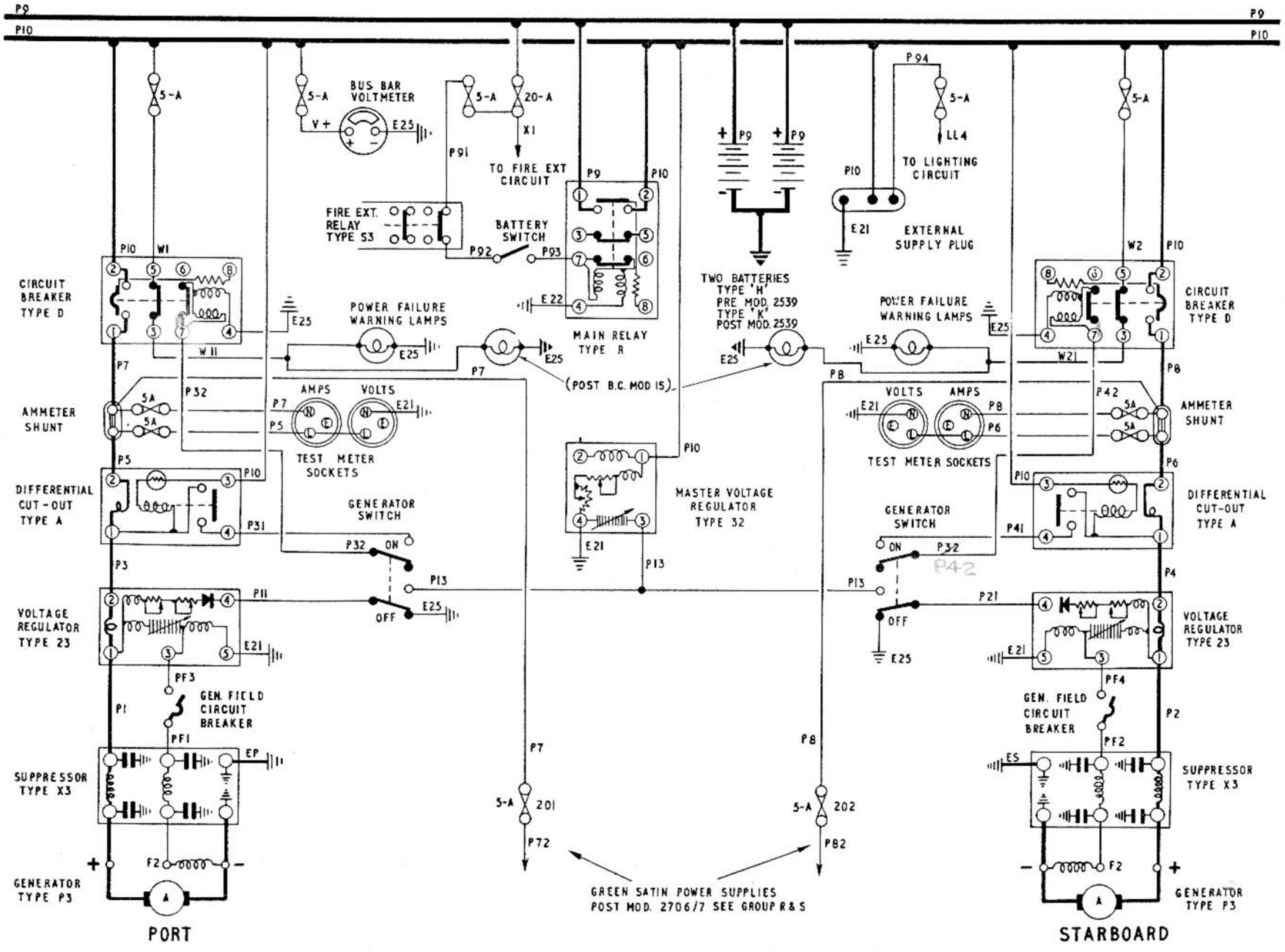

Fig. 1. D.C. power supplies

(B.C. 15 embodied)

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Batteries

Main batteries

9. In aircraft pre Mod.2539, two Type H, 24-volts, 25 amp hr , lead-acid batteries are installed in the port equipment compartment aft of the pressure bulkhead. When Mod.2539 is introduced, the Type H batteries are replaced by two Type K, 24 volt, 35 amp hr, nickel-cadmium batteries. The Type K battery has a built-in control unit and a thermal switch which breaks the charging current if the battery temperature becomes too high. The type of batteries installed affects the generator busbar voltage settings. In accordance with S.T.N./Electrical/82, the generator busbar voltage should be 27.5 volts with Type H batteries and 28 volts with Type K batteries.

24-volt emergency battery

10. Two lead-acid batteries rated at 12 volts, 4 amp hr each, are provided for the emergency operation of the turn-and-slip indicator, No.6 belly tank explosion suppression, and the canopy and hatch jettison circuits. The batteries are anchored by rubber bungees to a tray installed in the lower section of the console structure, and are accessible after removal of the pilot's map stowage panel. Two dummy terminals are fitted below the tray for stowing the battery cables when the batteries are removed for servicing.

Emergency lighting battery

11. A 2.4-volt alkaline battery for the emergency lighting of the pilot's instrument panels, is installed on the floor of the cabin forward of the rudder pedals.

SERVICING

General

12. The generators are accessible after the removal of the large detachable panel secured by screws to the upper surface of the main plane, inboard of each engine. The removal and assembly of the generators is described and illustrated in Sect.4, Chap.1. Suspected wiring faults should be investigated, using the theoretical and routeing diagrams included in this group and making point-to-point checks where necessary.

Charging circuit failure

13. On indication of a failure being given by a generator failure warning lamp, an examination should be made of the connections, etc., to the main components in the suspect system. If the failure indication be given during or after prolonged periods of high-altitude flying it is advisable to check the generator brushes as under these operating conditions abnormal brush wear can take place and cause a generator to quickly become unserviceable. The finding of worn brushes in one generator should lead to an examination of the other, although that unit may apparently be operating satisfactorily. Brushes should be renewed if found to be less than 0.42 in. in length or if their condition suggests that they will wear below that minimum before the next servicing examination is due. New brushes should be an easy sliding fit in their holders and bedded over their full thickness and at least 80 per cent of their axial length. Brush spring pressure should be maintained between 17 and 19 oz. After a visual examination of a suspected generator, its insulation should be tested to the figure given in A.P.4343A, Vol.1, Sect.3, Chap.8. If after test it is considered serviceable, it should be run to enable voltage regulator checks to be made in accordance with the instructions given in the following paragraphs.

Voltage regulator setting

14. The following procedure should be adopted when setting up the voltage regulators:–

(1) Switch OFF the BATTERY ISOLATION switch and both generator switches on the E.C.P.

(2) Close both field circuit breakers on the E.C.P.

(3) Connect a 24-volt ground supply to the external power plug.

(4) Connect a Type D testmeter *(set to the 30-volt d.c. range)* to No.1 voltmeter socket on the E.C.P.; this is accessible after removing the starboard detachable panel from the panel assembly.

(5) Start up No.1 *(port)* engine. When it reaches approximately 5000 rev./min. adjust the trimmer on the port Type 23 voltage regulator to give a meter reading of 24 volts. Vary the engine speed and verify that the reading remains steady at 24-volts ± 0.5 volt.

(6) Leaving No.1 engine idling, change over the testmeter connection to No.2 voltmeter socket.

(7) Start up No.2 engine and repeat the procedure (5) with the starboard voltage

regulator, again setting to 24 volts ± 0.5 volt.

(8) Switch ON both generator switches and run up both engines together to approximately 5000 rev./min. and adjust the trimmer of the Type 32 master voltage regulator until a steady reading is obtained. This reading should be 27.5 volts for aircraft with Type H batteries installed and 28 volts for those with Type K batteries *(see S.T.N./Electrical/82)*. Vary the engine speed either way to check that the voltage does not vary more than 0.5 volt either way. During this check the testmeter may be connected to either voltmeter socket.

Load balancing tests

15. Provided that the voltage regulators have been adjusted in the manner described in para.14, it should not be necessary to make load-balancing tests between the generator circuits.

Check for Type A differential cut-outs

16. These units can be checked by the following procedure:—

(1) Connect a testmeter Type D set to d.c. volts across terminal No.1 of the cut-out being checked and terminal No.2 of its associated Type D circuit breaker.

(2) Start the engine and slowly increase its speed until the differential cut-out contacts close. This should take place when the generator voltage is between 0.35-0.75 volts above the battery busbar voltage. *(No action need be taken if the differential voltage is slightly above the top limit of 0.75 volt).*

(3) With an ammeter connected to the appropriate test socket, slowly decrease the engine speed until sufficient current flows from the battery to the generator to open the differential cut-out contacts. This should occur at a reverse current of between 15 and 25 amp., but no action need be taken if the upper limit is slightly exceeded.

The Type A differential cut-out is fully described in A.P.4343B, Vol.1, Book 2, Sect.10, Chap.5.

Battery servicing

General

17. Batteries should be removed from the aircraft for servicing as called for in the current Servicing Schedule.

Type H main batteries

18. When these batteries are removed, their connecting cables should be stowed on the terminals provided for the purpose. The structure and equipment in the vicinity of the batteries must be kept clean and free from any trace of acid electrolyte which could cause corrosion.

Type K main batteries

19. These alkaline batteries do not normally require topping up, but should be kept clean with their terminals coated with protective PX-7. Servicing information on the batteries is to be found in A.P.4343A, Vol.1, Sect.12, Chap.5.

24-volt emergency battery

20. After the removal of the two 12-volt units which constitute this battery, their connecting cables should be stowed on the terminals provided below the battery tray. The latter must be kept clean and free from any trace of electrolyte.

Emergency lighting battery

21. If it is found necessary to top up this battery, distilled water only should be added; on no account is lead-acid battery electrolyte to be used. The terminals and top of the cells should be coated with protective PX-7 to prevent corrosion.

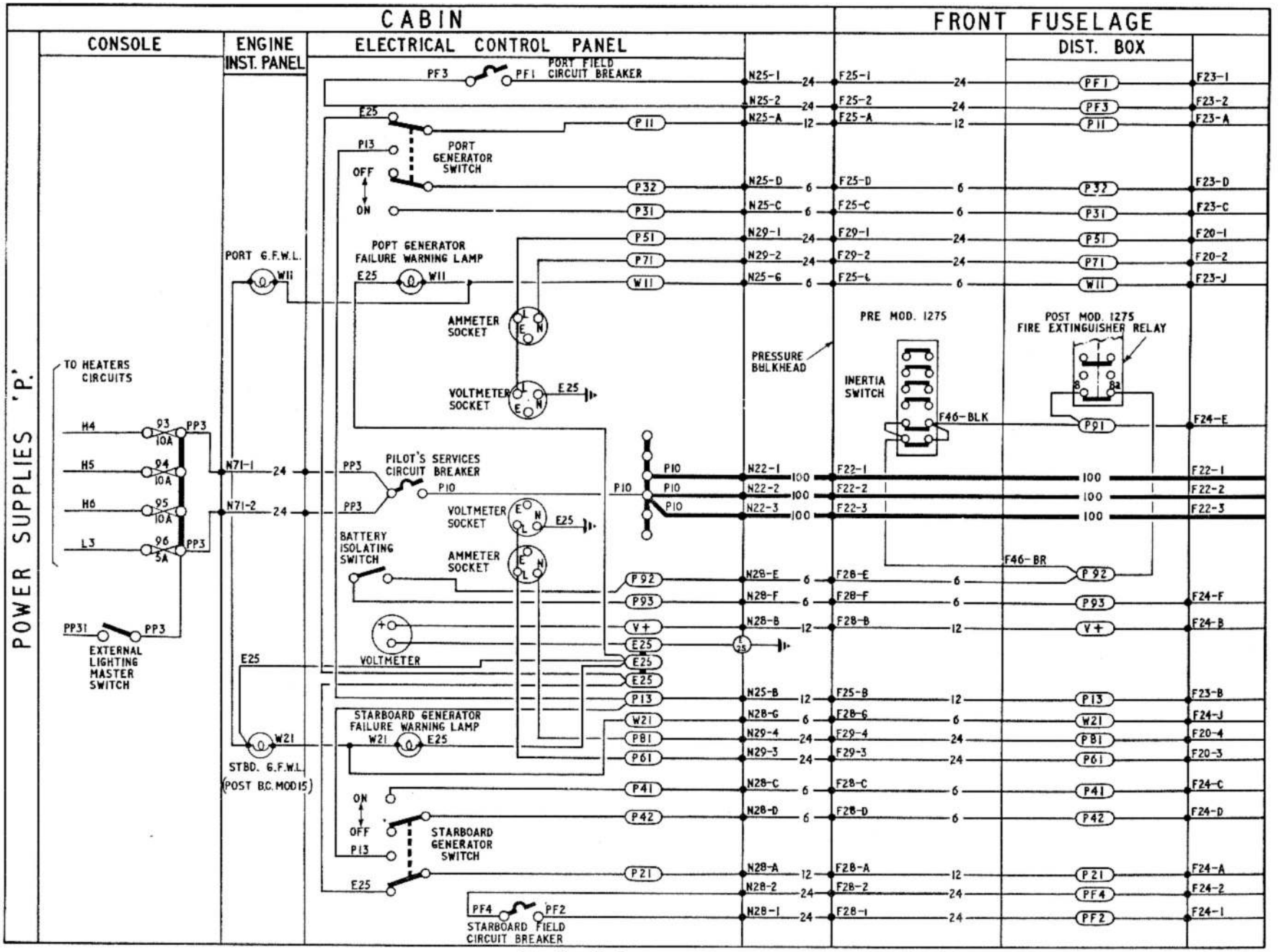

Fig. 2. D.C. power supplies

(B.C. 15 embodied)

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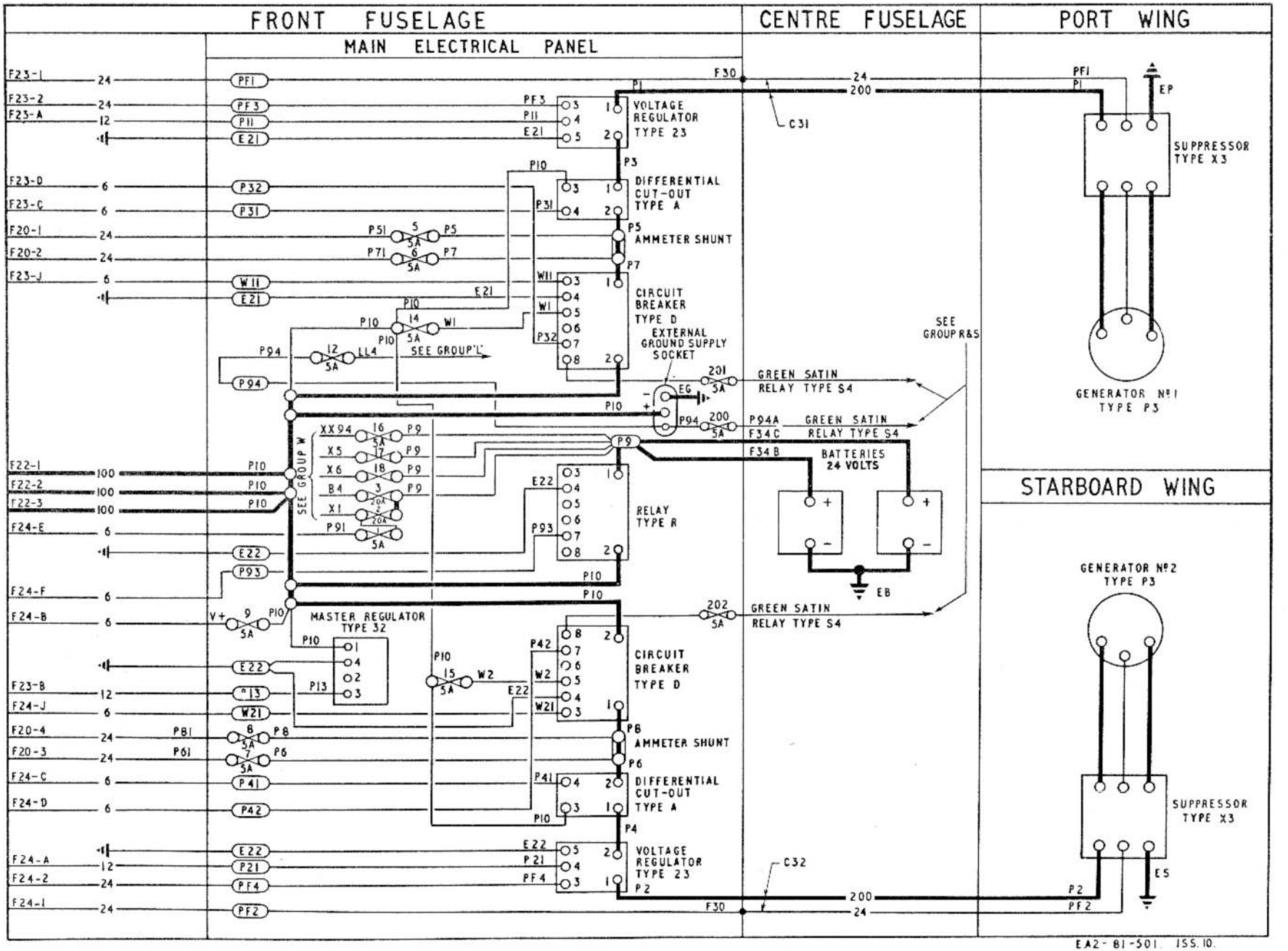

Fig. 2A. D.C. power supplies

◀ *(illustration amended)* ▶

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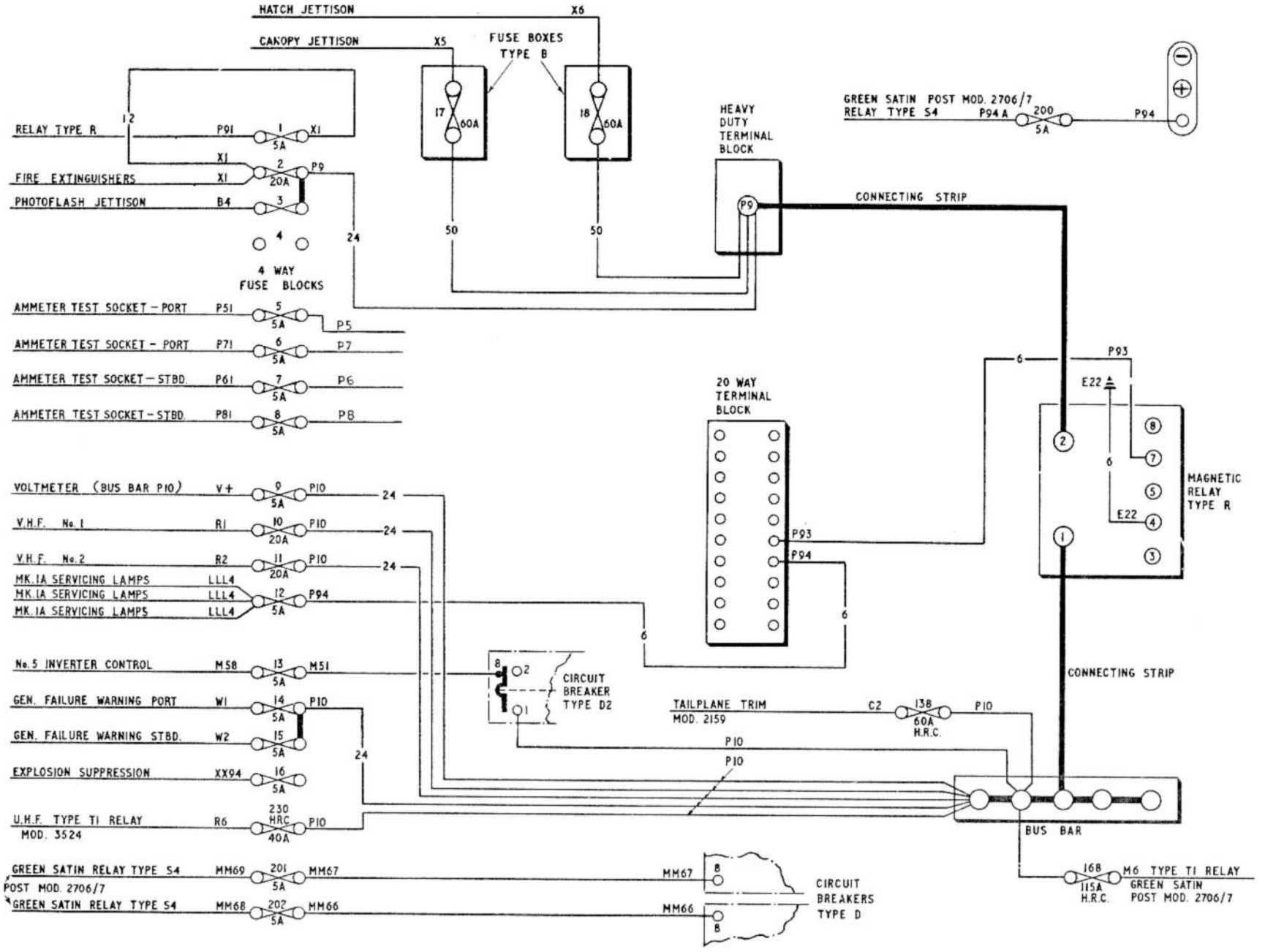

Fig. 3. D.C. power supply and distribution

(illustration amended)

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D.C. POWER SUPPLIES — GROUP P

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Introduction

1. This appendix contains a description of the d.c. power supplies post Mod.3854, fitted to aircraft embodying Mod.1783 and Mod.2355, and gives details of the location, operation, and servicing of the components of the generator system. Included in this appendix are circuit and routeing diagrams which cover the complete installation.

DESCRIPTION

General

2. Power for the electrical services and battery charging is provided by two Type 519, 300-amp generators operating in parallel with an output voltage automatically controlled at 28 volts. Each generator is installed in the leading edge of the main plane and driven from the accessories gearbox of its respective engine. The positive terminal of each generator is connected to busbar P10 via a Type 19B magnetic switch and a reverse-current circuit breaker, whilst the negative terminal connects to the main plane earth point. Also used in each generator circuit is a Type 18B overvoltage relay, Unipren 280 amp cable is used for the generator main cables and heavy duty terminals are provided at the wing breaks

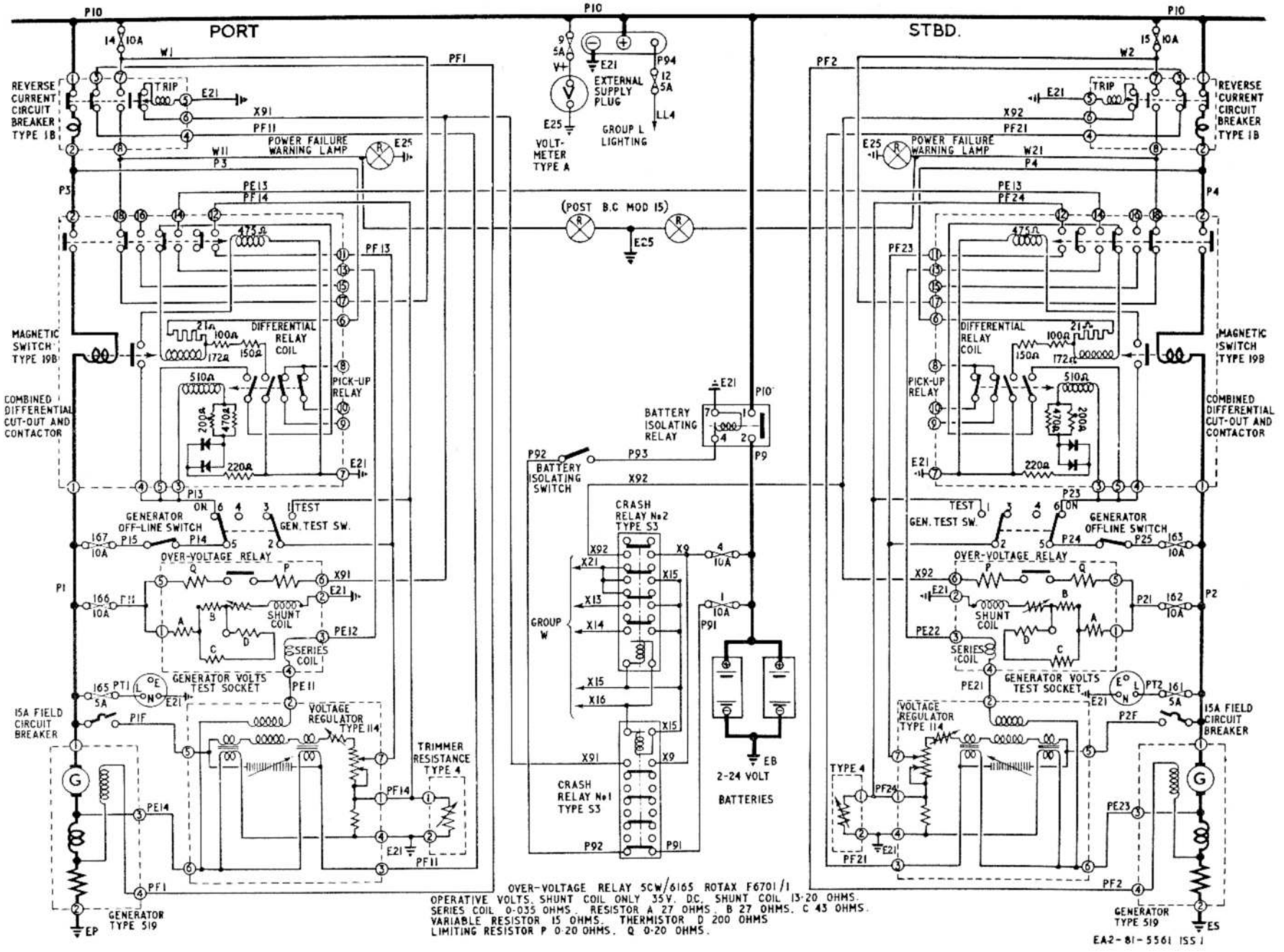

Fig. 1. D.C. power supplies (post Mod. 3854)

◀ (B.C.15 embodied) ▶

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for connecting the wing and fuselage sections of the main positive leads. The magnetic switches and the reverse-current circuit breakers are fitted on the main electrical panel *(M.E.P.)*, together with the overvoltage relays and other ancillary equipment.

Generator, Type 519

3. The Type 519 generator is a six pole, shunt-wound machine incorporating interpole and compensating windings. A resistance comprising two parallel-connected rings of resistance strip is connected in series with the compensating windings and earth; when the generator is developing its full output of 300-amp, a drop of 2 volts occurs between the negative terminal (2) and the negative brush terminal (3). This voltage is proportional to the output current of the generator and is used to maintain a balanced output from the two generators during parallel operation. Detailed information on the Type 519 generator will be found in A.P.4343A, Vol.1, Sect.3, Chap.21.

Voltage regulator, Type 114

4. Output of each generator is maintained at $28 \begin{smallmatrix} + 0.75 \\ - 0.5 \end{smallmatrix}$ volts throughout variations of generator speed and load by a Type 114 regulator which automatically controls the shunt field current. The regulator is mounted on a panel fitted adjacent to its respective generator.

Reverse-current circuit breaker, Type 1B, No.6

5. This unit is a high-rupturing-capacity switch capable of breaking a current of several thousand amperes. It is set manually and may be tripped either electrically or manually. In the event of a direct failure to earth at a point between the generator positive terminal and terminal 2 of the reverse-current circuit breaker, both the associated generator and the remainder of the system feed into the fault. The resulting surge of current immediately trips the circuit breaker, thus isolating the fault from the busbar system. At the same time, auxiliary contacts on the circuit breaker isolate the trip coil, complete the circuit of the generator warning lamp, and interrupt the shunt field circuit, rendering the generator inoperative. The reverse-current circuit breaker is described in A.P.4343B, Vol.1, Sect.10.

Switch magnetic, Type 19B

6. This unit is designed to connect a generator to the busbar when the generator voltage exceeds the busbar voltage by a predetermined value, and to disconnect the generator when its voltage is sufficiently reduced to cause a reverse current to flow.

7. When the generator output reaches 20 to 22 volts, a pick-up relay operates and closes two pairs of contacts, through one pair of which the generator voltage is applied to a polarized differential relay coil. When the generator voltage exceeds the battery voltage by 0.3 to 1.0 volt, the differential relay operates and closes contacts carried on an armature within the field of a permanent magnet. The influence of the magnet holds the armature stable to the side to which it was last operated. The contacts, when closed, connect the generator voltage to the operating coil of the contactor which, when energized, causes its main contacts to close, thus connecting the generator to the busbar via the reverse-current circuit breaker contacts. The contactor carries three pairs of auxiliary contacts. One set of contacts are not used, and when the contactor is energized the other two pairs of contacts close to complete the equalizing and voltage regulator circuits respectively.

8. A series-current coil fitted in the generator positive line is wound around the differential relay coil and assists the permanent magnet in holding the differential relay contacts closed. When the generator output falls below that of the battery, a reverse current flows from the busbar to the generator. When this current reaches a value of between 20 and 30 amps , it opposes the permanent magnet sufficiently to reverse the flux in the armature of the differential relay, thus opening the contacts and breaking the circuit to the contactor coil. The main contacts then open and the generator is disconnected from the busbar.

Overvoltage relay, Type 18B

9. In the event of excessive voltage being generated due to faulty voltage regulation, the overvoltage relay and its associated circuits will isolate the affected generator from the system.

10. The Type 18B relay is designed to operate when the generator voltage rises above 125 per cent of its normal value. When overvoltage is applied to a shunt coil the resulting rise in load-sharing current is applied to a series coil. The energization of both coils causes the contacts between two resistors, Q and P to close. Closure of the contacts connects the generator output to the trip coil of the reverse-current circuit breaker and results in disconnection of the generator from the busbar.

Supply voltmeter

11. Continuous indication of the supply voltage at busbar P10 is given by a voltmeter on the E.C.P. The voltmeter indicates

irrespective of whether the internal battery or an external supply is connected to busbar P10.

Generator failure warning lamps

12. Two generator failure warning lamps are fitted on the E.C.P., and two on the engine instrument panel *(post Mod.BC.15)*. The tripping of either generator circuit lights its respective red warning lamps.

Generator OFF-LINE switches

13. Port and starboard generator OFF-LINE switches for the pilot's use are fitted on the radio panel above the console. The switches, labelled NORMAL and EMERGENCY and normally set to the NORMAL position, are connected in series with the ON circuit of the generator test switches described in para.14.

Generator test panel

14. Each generator circuit includes a switch having a TEST position and a spring-loaded ON position, a test voltmeter socket, and a Type 4 voltage regulator trimmer resistance, all of which are mounted on the M.E.P. The TEST position is selected when it is necessary to isolate the generator from busbar P10 during ground servicing. With the switch at TEST, a section of the ballast resistance of the respective voltage regulator is short circuited to simulate the 'on load' condition while a voltage check is made. Voltage adjustment is effected by rotating the trimmer spindle in the appropriate direction with a screwdriver.

Field circuit breakers

15. Two shunt field circuit breakers are mounted on the M.E.P. and normally set to the 'closed' position.

Main relay, Type R

16. Connection between the main battery busbar P9 and the generator busbar P10 is made via a Type R relay on the M.E.P. The relay is normally controlled by the BATTERY ISOLATING switch on the E.C.P. In a crash landing the relay is automatically opened by the operation of the inertia switch system which isolates the battery supply from all services except the fire extinguisher, detonator, No.6 belly tank explosion suppression, and photoflash jettison circuits.

Inertia switch circuit

17. Two inertia switches are fitted on the forward face of frame 12, a starboard switch below the M.E.P. and a port switch in the port equipment compartment. The switches control the operation of two crash relays, numbered 1 and 2, mounted on the M.E.P. In the event of a crash landing, the No.1 relay de-energizes the Type R relay which opens to isolate the battery from the P10 busbar and simultaneously energizes the trip coil of the port generator reverse-current circuit breaker. Operation of the No.2 relay energizes the fire extinguisher circuits and the trip coil of the starboard generator reverse-current circuit breaker. Opening of the reverse-current circuit breakers isolates the generators from P10 busbar and breaks their shunt field circuits.

External power supply

18. An external supply of 24 volts may be connected to the aircraft via a three-pole plug on the M.E.P. To permit the use of a ground supply cable fitted with a two-pole plug, an adapter *(Ref. No. 105G/11)* is available. The third *(small)* pin on the aircraft plug receives a positive feed whenever an external supply socket or socket/plug adapter is connected to it. This feed, P94, after passing through fuse 12, becomes LL4 which is the supply to the Mk.1A lamp in the starboard equipment compartment and the Mk.1A lamps in the flare bay and camera bays. It is important that if a socket/plug adapter is used, it should be removed before flight.

Main batteries

19. Two Type K nickel-cadmium, 24-volt, 35 amp hr, batteries are installed in the port equipment compartment aft of the pressure bulkhead. The batteries incorporate a built-in control unit and a thermal switch which breaks the charging current if the battery temperature becomes too high. In accordance with S.T.N./Electrical/82, the generator busbar voltage should be 28-volts with this type of battery installed.

24-volt emergency battery

20. Two lead-acid batteries, rated at 12-volts, 4 amp hr each, are provided for the emergency operation of the turn-and-slip indicator, No.6 belly tank explosion suppression system, and the canopy and hatch jettison circuits. The batteries are anchored by rubber bungees to a tray installed in the lower section of the console structure, and are accessible after removing the pilot's map stowage panel. Two dummy terminals are fitted below the tray for stowing the battery cables when the batteries are removed for servicing.

Emergency lighting battery

21. A 2.4 volt-alkaline battery for the emergency lighting of the pilot's instrument panels is installed in the cabin floor forward of the rudder pedals.

SERVICING

General

22. Whilst the generator system continues to function satisfactorily, no attention is required in service other than ground running tests and routine examination of the components and connecting cables for security, cleanliness, and freedom from corrosion or damage. Information covering ground running tests and fault location will be found in A.P.4343, Vol.1, Sect.2, Chap.5.

Generator, Type 519

23. General information applicable to all types of generators is contained in A.P. 4343, Vol.1, Sect.2, Chap.1. Servicing of the Type 519 generator is covered in A.P. 4343A, Vol,1, Sect.3, Chap.21.

Voltage regulator, Type 114

24. Servicing information applicable to carbon pile regulators generally is given in A.P.4343, Vol.1, Sect.6, Chap.1. Descriptive and servicing information for the Type 114 voltage regulator will be found in A.P. 4343, Vol.1, Book 1, Sect.1, Chap.41.

Reverse-current circuit breaker

25. Whilst operating satisfactorily this unit requires no attention. When faulty it should be returned to a Maintenance Unit for repair.

Switch magnetic, Type 19B

26. Servicing information on this unit will be found in A.P.4343C, Vol.1, Book 2, Sect.3, Chap.123.

Overvoltage relay, Type 18B

27. Detailed information on the construction, operation and servicing of this unit will be found in A.P.4343C, Vol.1, Book 2, Sect.3, Chap.113.

Battery servicing

General

28. Batteries should be removed from the aircraft for servicing as called for in the current Servicing Schedule.

Main batteries

29. These alkaline batteries do not normally require topping up, but should be kept clean with their terminals coated with protective PX-7. Servicing information on the batteries is to be found in A.P.4343A, Vol. 1, Sect.12, Chap.5.

24-volt emergency battery

30. After removing the two 12-volt units which constitute this battery, their connecting cables should be stowed on the terminals provided below the battery tray. The latter must be kept clean and free from any trace of electrolyte.

Emergency lighting battery

31. If it is found necessary to top up this battery, distilled water only should be added; on no account is lead-acid battery electrolyte to be used. The terminals and top of the cells should be coated with protective PX-7 to prevent corrosion.

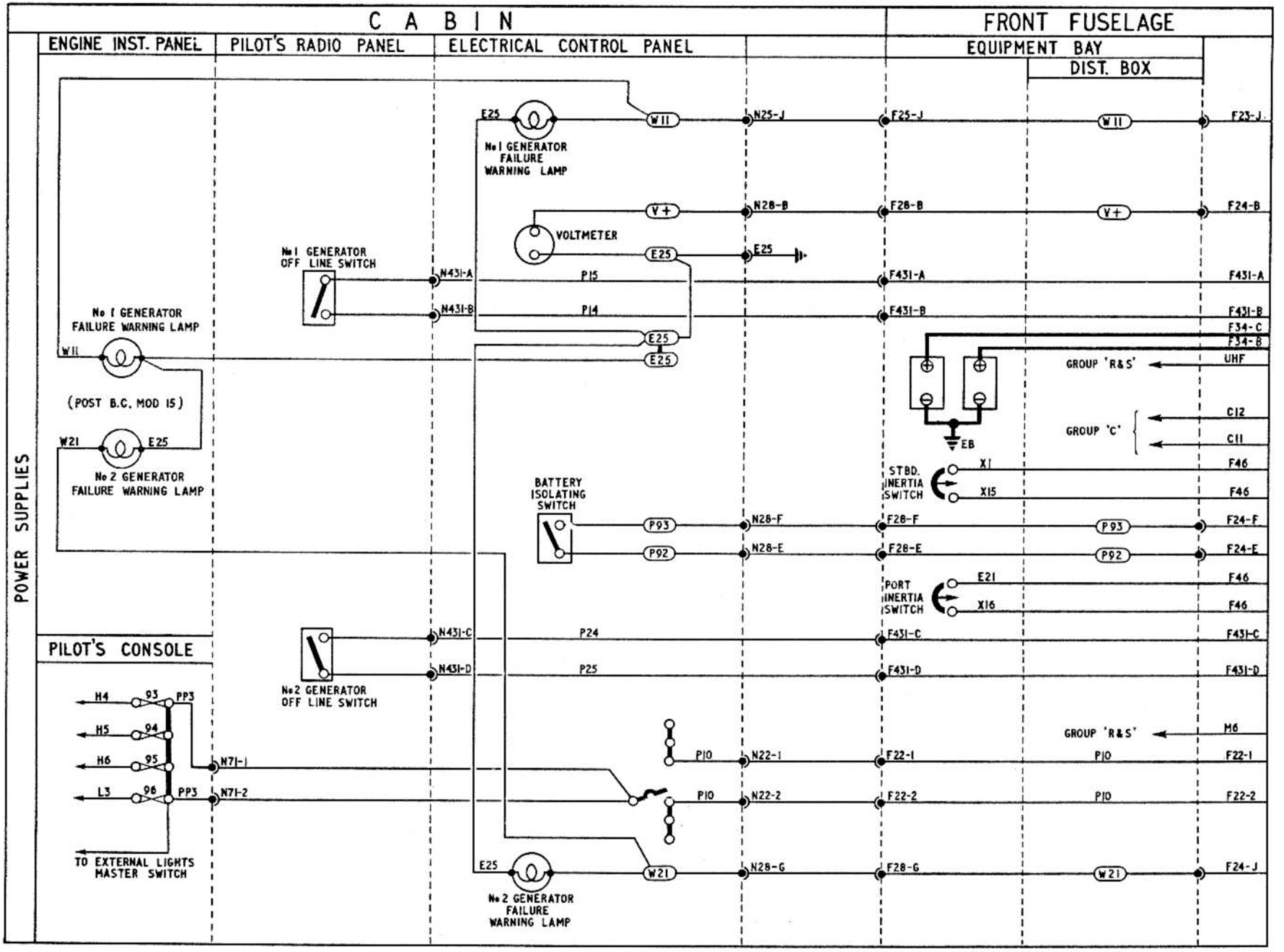

Fig. 2. D.C. power supplies (post Mod. 3854)

◀ *(B.C. 15 embodied)* ▶

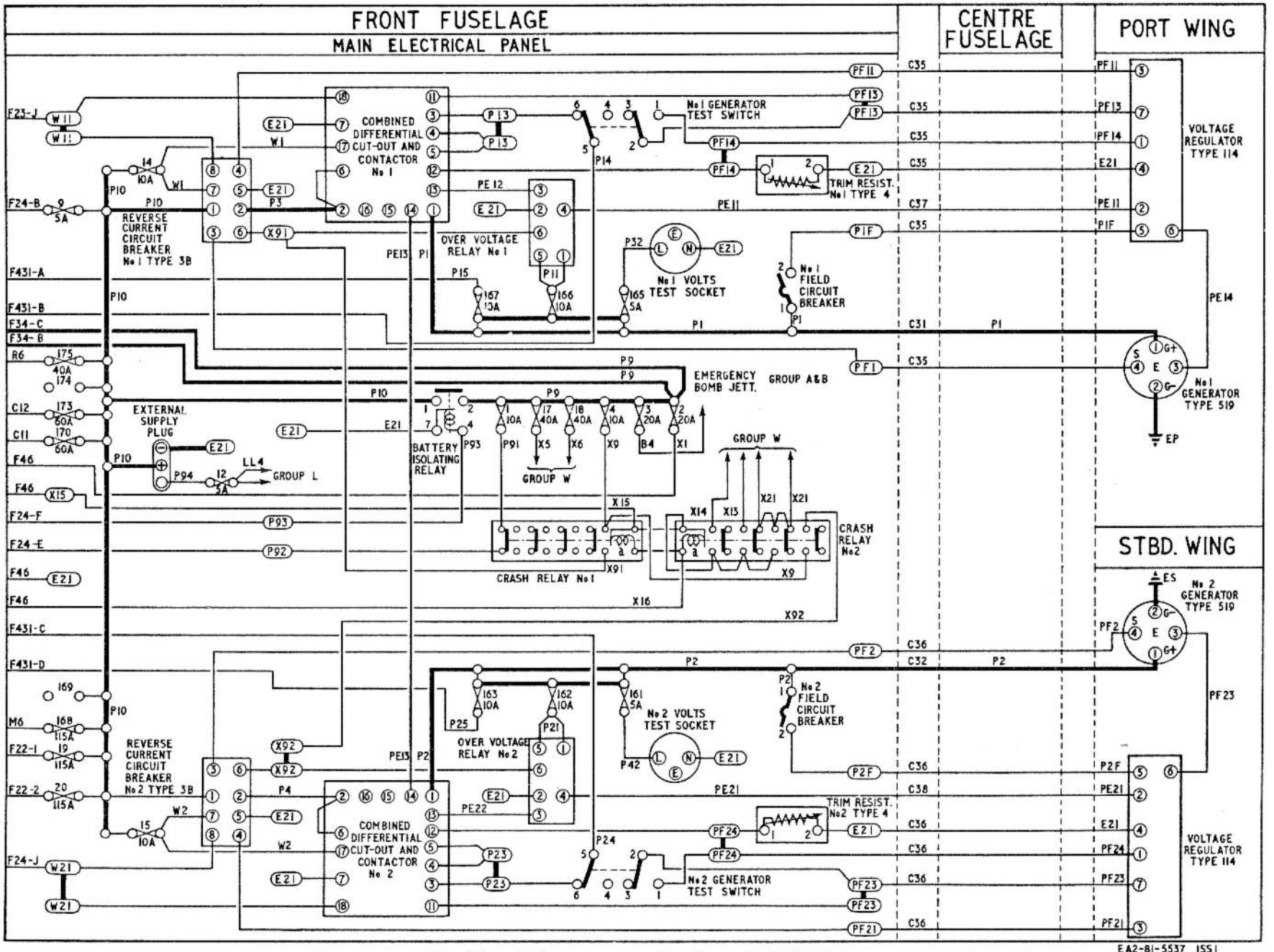

Fig. 2A. D.C. power supplies (post Mod. 3854)

◀ *(illustration amended)* ▶

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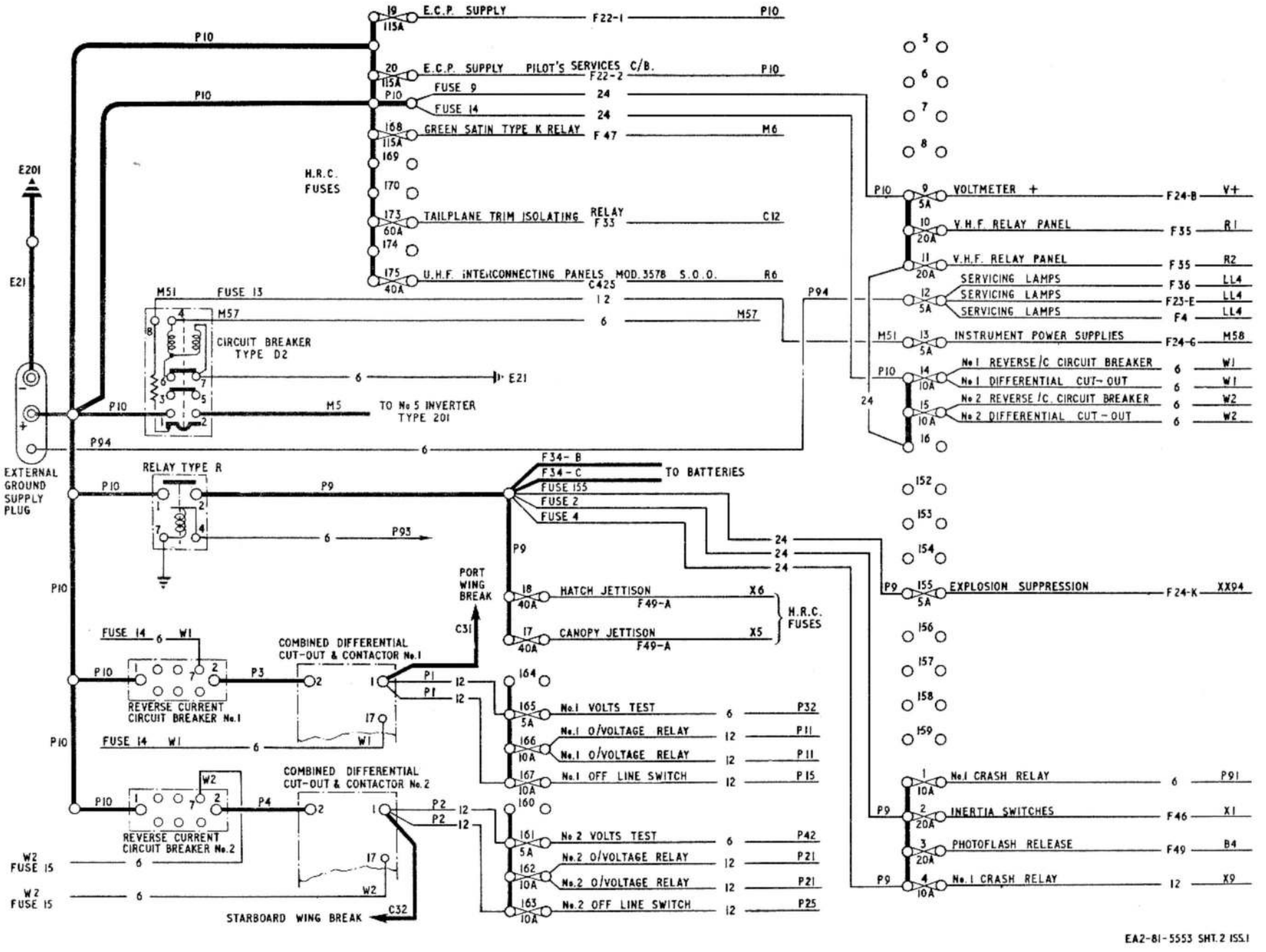

Fig. 3. D.C. power supply and distribution (post Mod. 3854)

FUEL PUMPS AND COCKS - GROUP Q

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DESCRIPTION

General

1. Six fuel tanks, consisting of top tanks, numbered 1 to 5, and a belly tank *(No.6)* are permanently installed in the fuselage. In addition, two jettisonable tanks may be carried, one below each wing tip, these tanks are without fuel pumps and cocks. The power supply to each pump circuit passes through a suppressor, located near its associated pump. The pumps and cocks are controlled by switches on the engine instrument panel and protected by circuit breakers on the E.C.P.

Forward top tanks *(No.1 to 4)*

2. The top tanks, numbered 1 to 4 have neither pumps or cocks and drain into the collector box at the aft end of the belly *(No.6)* tank. Fuel flow between these tanks and the collector box is controlled by a Type 222 electrically-actuated cock which in turn is controlled by a switch on the engine instrument panel.

Rear top tank *(No.5)*

3. The No.5 tank incorporates two pumps, ◀ which are Type SPE.1003 *(post Mod.727).* ▶ The pumps project into the bore of the tank through adapter plates in the roof of the flare bay, and are positioned port and starboard. Near to each pump is a fuel cock which is operated by a rotary actuator, Type 201.

Belly tank *(No.6)*

4. The section of this tank which comprises the collector box incorporates two Type PUL.907 pumps. The rear face of the collector box carries two Type 219 electrically-actuated cocks which control the delivery from the collector box pumps.

Control switches

5. Each pump and its associated cock circuit is jointly controlled by one of four switches on the engine instrument panel. Selecting any switch to ON directly operates its respective cock and also energizes a

Type S relay, housed in the E.C.P., which completes the power supply to the appropriate pump.

6. In aircraft embodying Bomber Command Mod. 32 *(1st part)*, the operation of the fuel pumps and cocks is changed whereby all the fuel cocks are electrically disconnected and permanently locked open. On the introduction of Bomber Command Mod.90(b) or Canberra Mod.2713, the two-position switches are replaced with three-position types permitting selective control of each cock with or without the operation of its associated pump. Selecting a switch to the top position provides COCK OPEN – PUMP ON, the mid-position COCK OPEN – PUMP OFF, and the bottom position COCK SHUT – PUMP OFF. These switches are fitted with spring-operated guard plates which have to be lifted clear of the switch to enable the COCK SHUT – PUMP OFF selection to be made. The isolating cock *(para.2)*, between the forward top tanks and the belly tank collector box, is controlled by a two-position switch on the engine instrument panel.

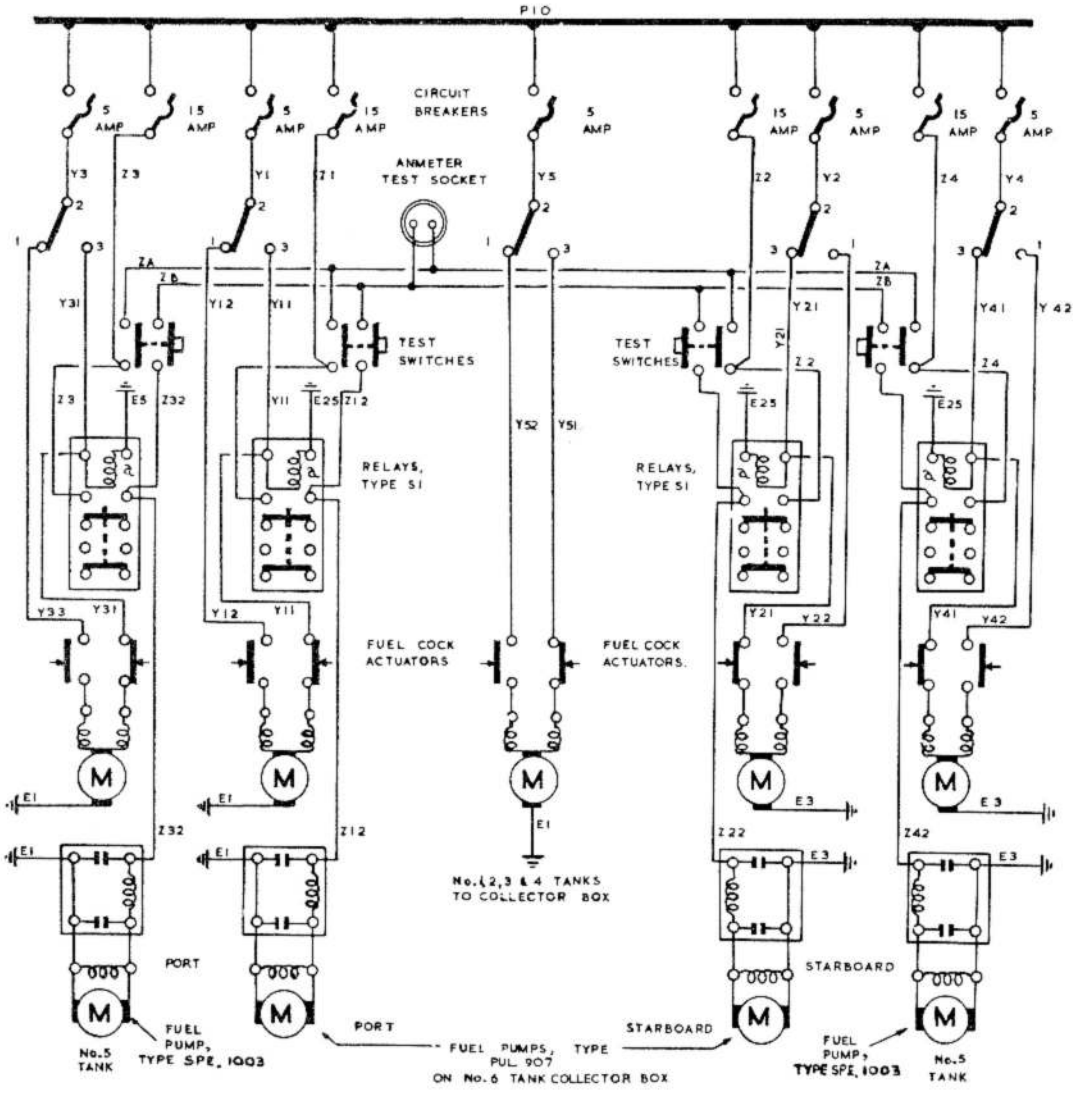

Fig.1. Fuel pumps and cocks – pre Mod.2713

Circuit protection

7. Each pump and cock circuit is protected by a circuit breaker mounted on the forward face of the E.C.P. The circuit breakers serving the pump circuits are rated at 15 amp and those for the cocks 5 amp. With Mod.2713 embodied a fuse is fitted in the energizing circuit to the Type S relay in each cock control circuit.

Fuel pump test panel

8. For checking the operation and current consumption of each pump, a set of four push-switches and a socket for a plug-in type ammeter are fitted inside the E.C.P., and are accessible after removing the detachable panel at the starboard side of the E.C.P.

SERVICING

General

9. All fuel pump tests should be made with the pumps immersed in fuel and operating under no-flow conditions with the appropriate cock closed.

Fuel pump test

10. The following describes the procedure for checking the operation and current con-

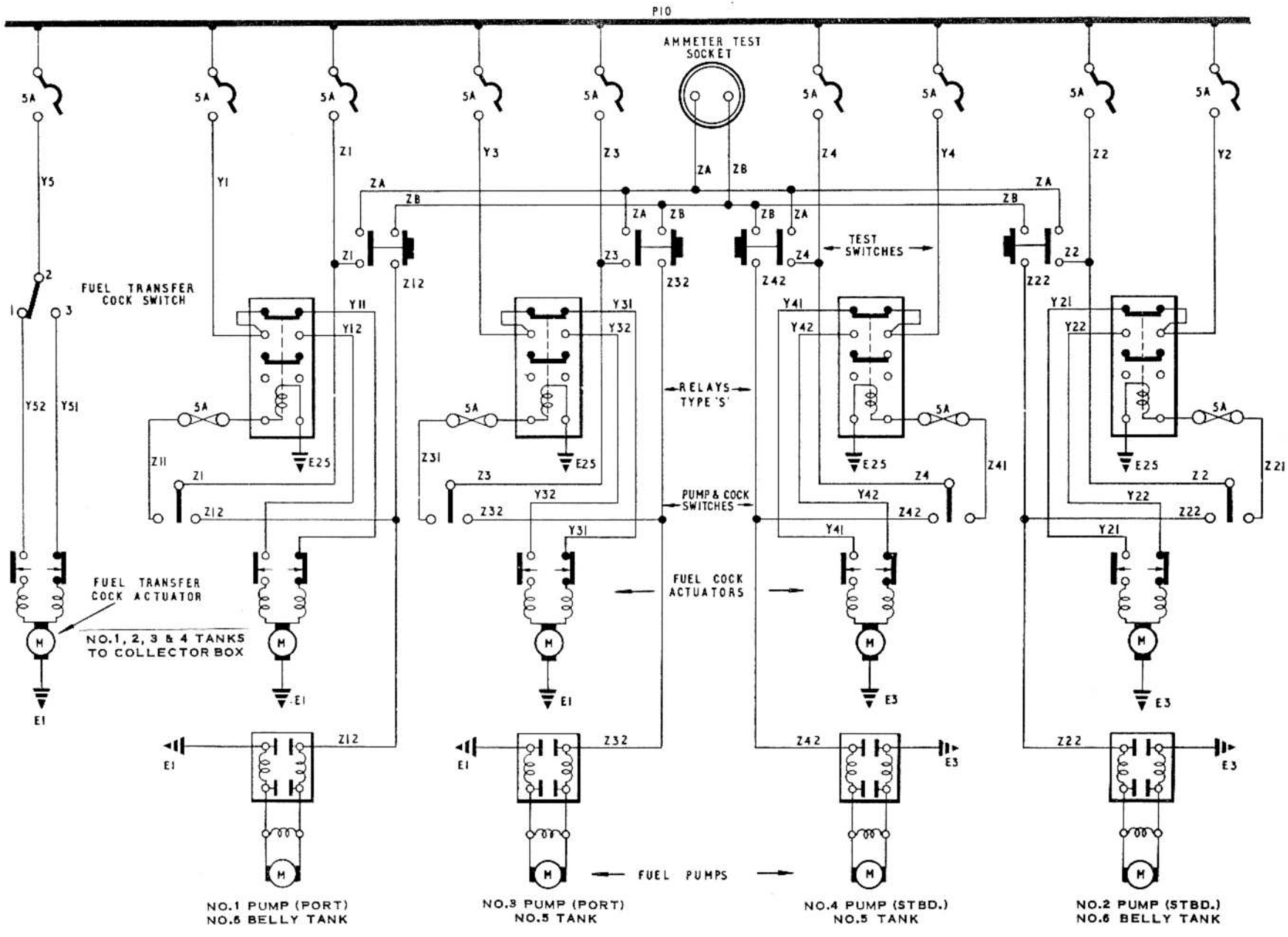

Fig.2. Fuel pumps and cocks – post Mod.2713

sumption of the fuel pumps:—

(1) Open the fuel cock circuit breakers and close the pump circuit breakers on the E.C.P.

Note . . .
On aircraft incorporating Bomber Command Mod.32 (1st part), the fuel cocks must be manually closed.

(2) Ensure that the pump and cock switches on the engine instrument panel are OFF *(pre.B.C.Mod.90(b) or pre.Can.Mod. 2713)* or in the mid-position *(post B.C.Mod. 90(b) or post Can.Mod.2713).*

(3) Connect a Type D testmeter, set to the 0-30 amp. range, or a suitable ammeter to the socket on the test panel in the E.C.P.

(4) Operate each pump test switch in turn, for at least 30 seconds.

11. When operating with 24-volts at its terminals, the Type BP.3 pump *(pre. Mod. 727)* should take a maximum current of 7.5 amp. when sustaining a no-flow pressure of 11.5 lb/in^2. The Type S.P.E. 1003 pump *(post Mod.727)* should take a maximum current of 11.5 amp. when sustaining a no-flow pressure of 16.5 lb/in^2. The Type PUL.907 should take a maximum current of 10.25 amp. when sustaining a no-flow pressure of 15.75 lb/in^2.

Interpretation of testmeter readings
12. (1) A steady reading not exceeding the current consumption figures given in para. 11 with their relevant test voltages will indicate that a pump is serviceable. Pumps showing appreciable higher current figures than these are suspect and should be replaced with new or reconditioned units.

(2) A fluctuating reading indicates either faulty brushes, commutator, or internal connections.

(3) A zero reading indicates an open circuit due to either a blown fuse, faulty wiring, or complete motor failure.

Voltage drop
13. The test voltage given in para.11 as 24 is that which should be available at the pump terminals and does not take into consideration the voltage drop between the busbar supply and the pump units when on load. The drop between the busbar and the pumps in No.5 and 6 tanks is approximately 2 volts. This voltage drop should be allowed for when making tests.

Cock actuators
14. The cock actuators Type 201, 219 and 222 incorporate Type 200 rotary actuators which are described in A.P.4343D, Vol.1, Normal servicing of the units is usually confined to checking brush length and removing carbon dust which can be done after the removal of the end cover from the motor.

REMOVAL AND ASSEMBLY

Fuel pumps
15. A fault on the pump motor necessitates the removal of the complete pump assembly. Instructions covering this procedure are given in Sect.4, Chap.2.

Actuators
Removal
16. (1) Disconnect the electrical plug and socket from the motor.

(2) Undo the bolts attaching the actuator to the body of the cock and separate the two units.

(3) Remove the actuator.

Assembly
17. (1) Ensure that the actuator and the cock are both at the same selection setting.

(2) Fit the actuator to the cock and secure the attachment bolts.

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

(4) Carry out a functioning test of the cock actuator.

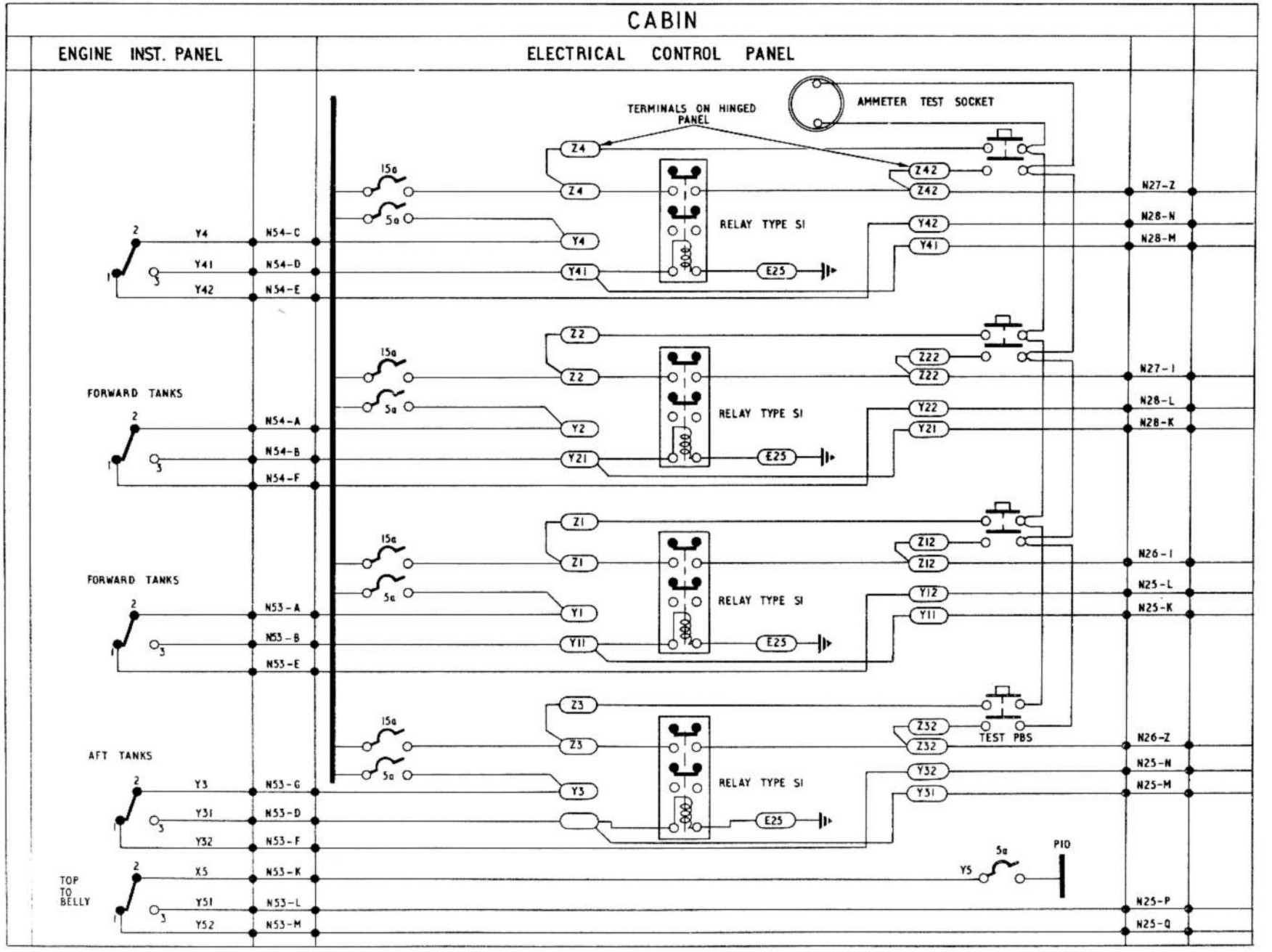

Fig.3. Fuel pumps and cocks – pre Mod.2713

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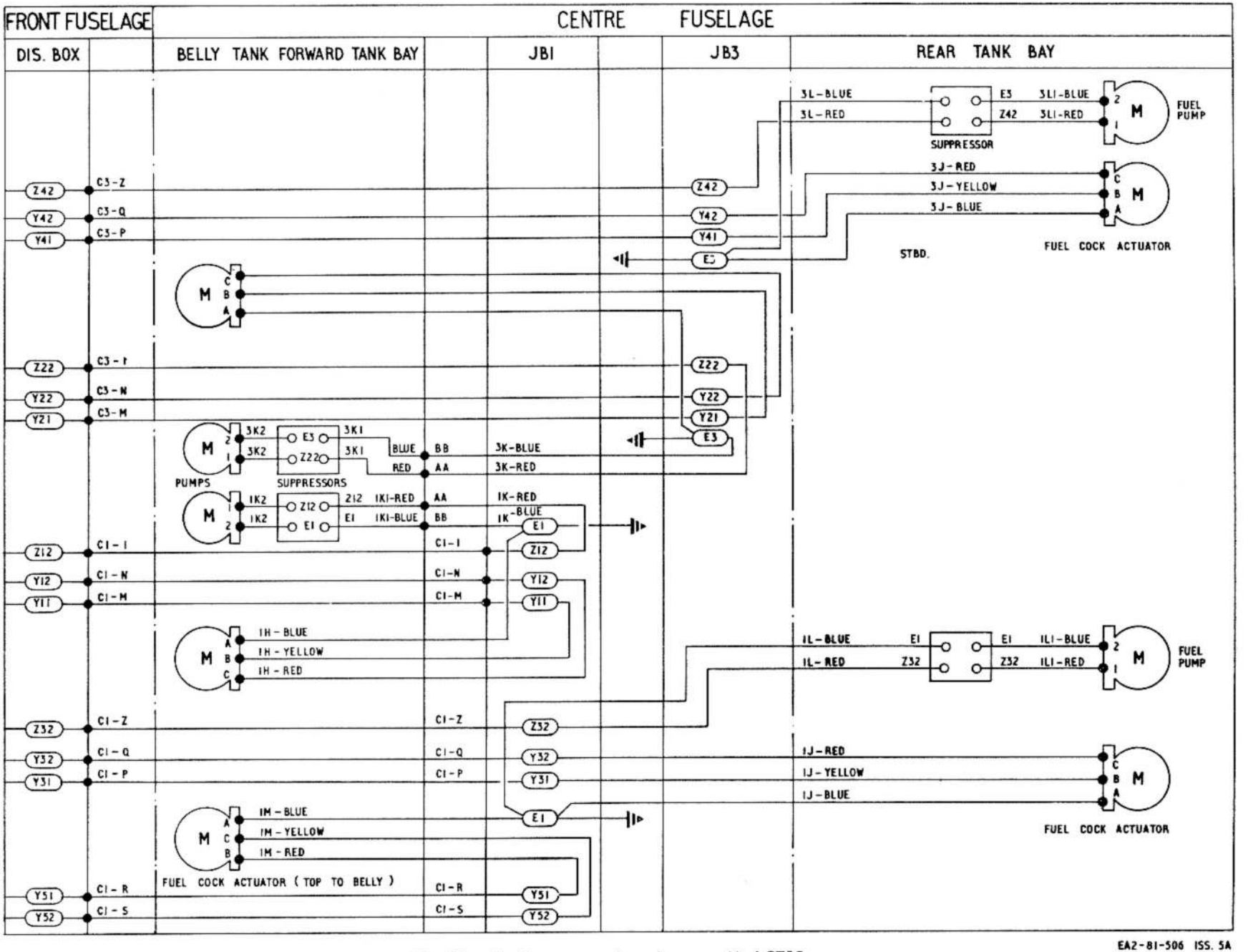

Fig.3A. Fuel pumps and cocks – pre Mod.2713

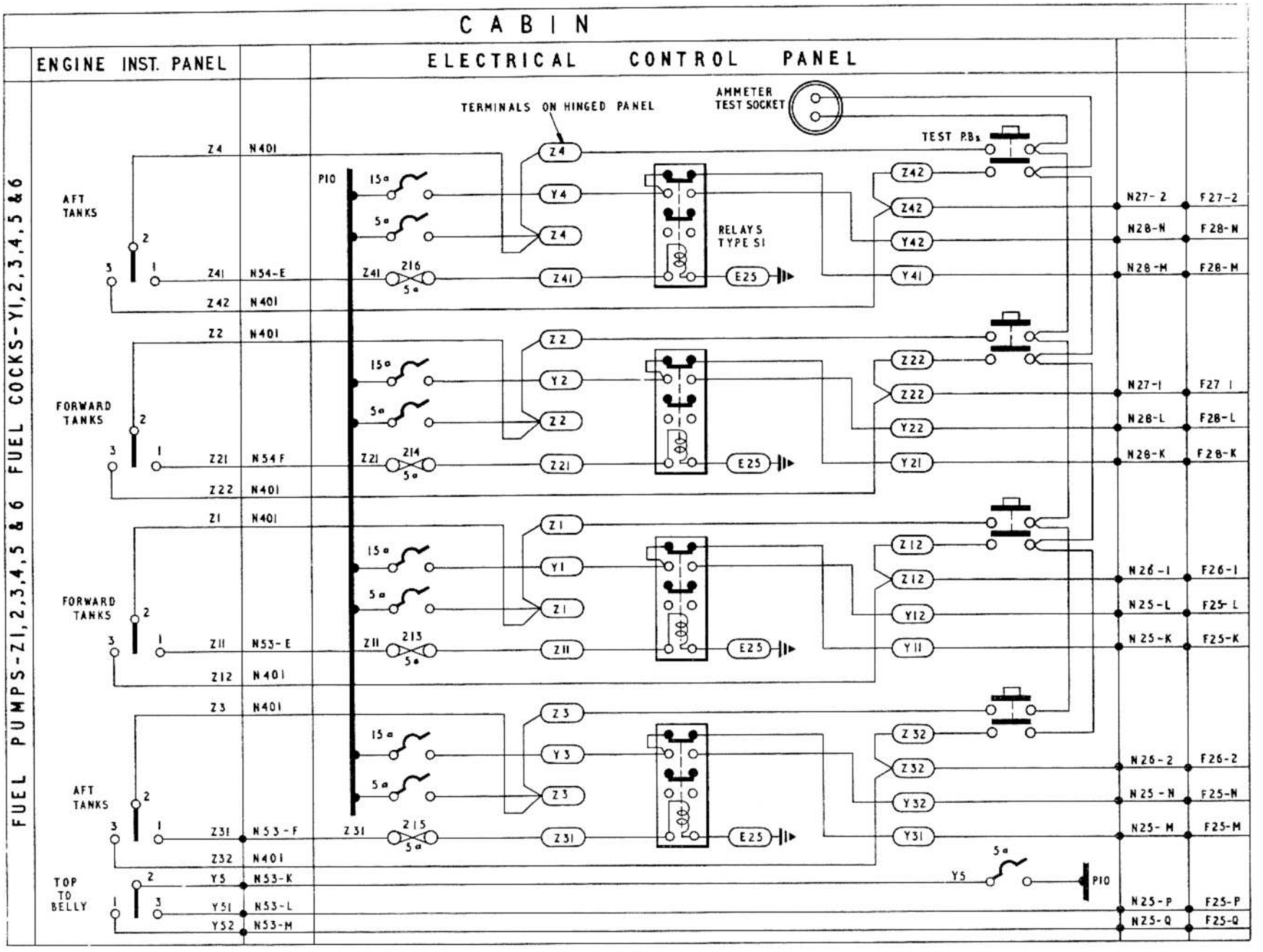

Fig.4. Fuel pumps and cocks – post Mod.2713

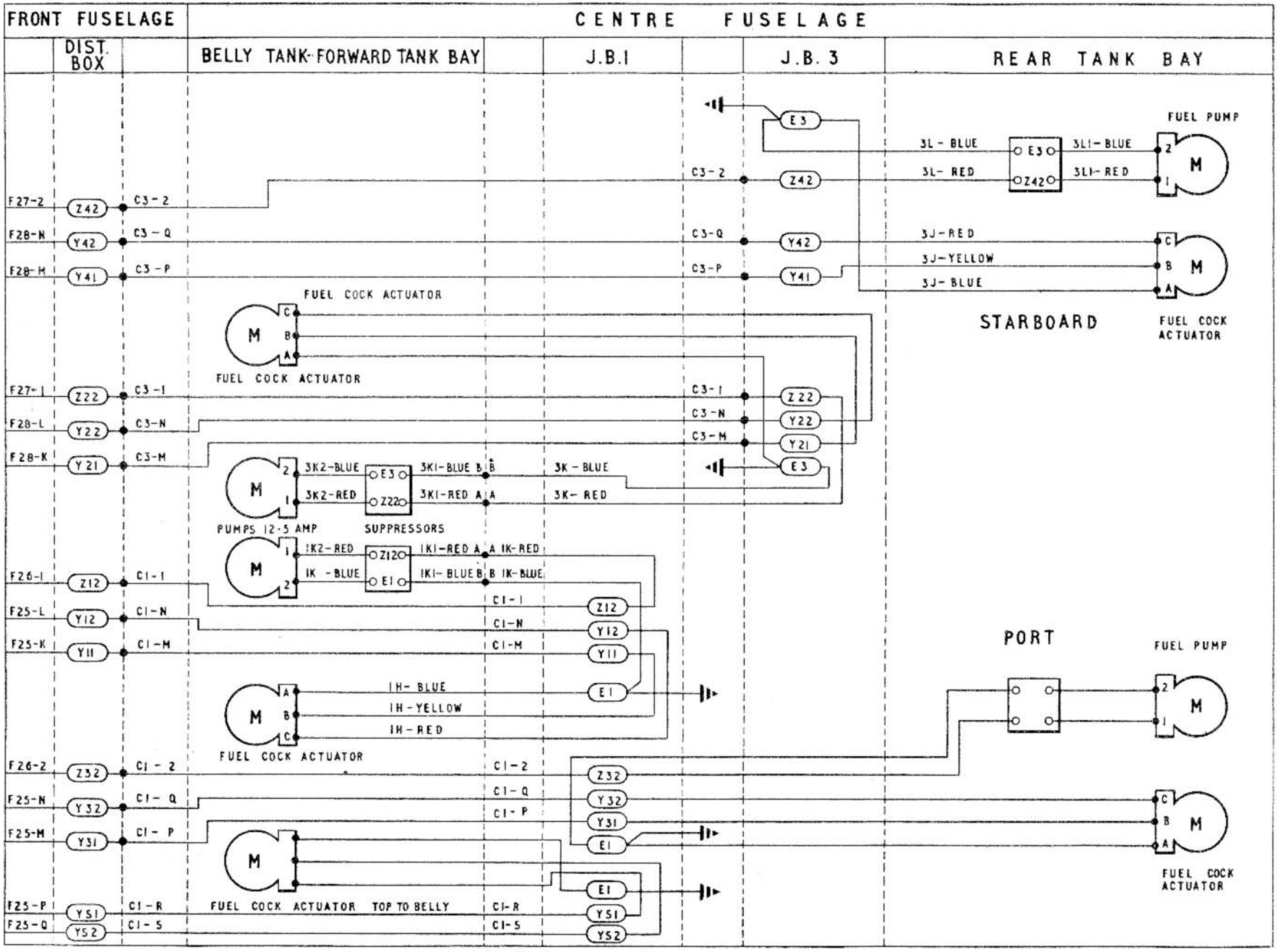

Fig.4A. Fuel pumps and cocks – post Mod.2713

(Illustration amended)

RADIO AND RADAR POWER SUPPLIES - GROUP R & S

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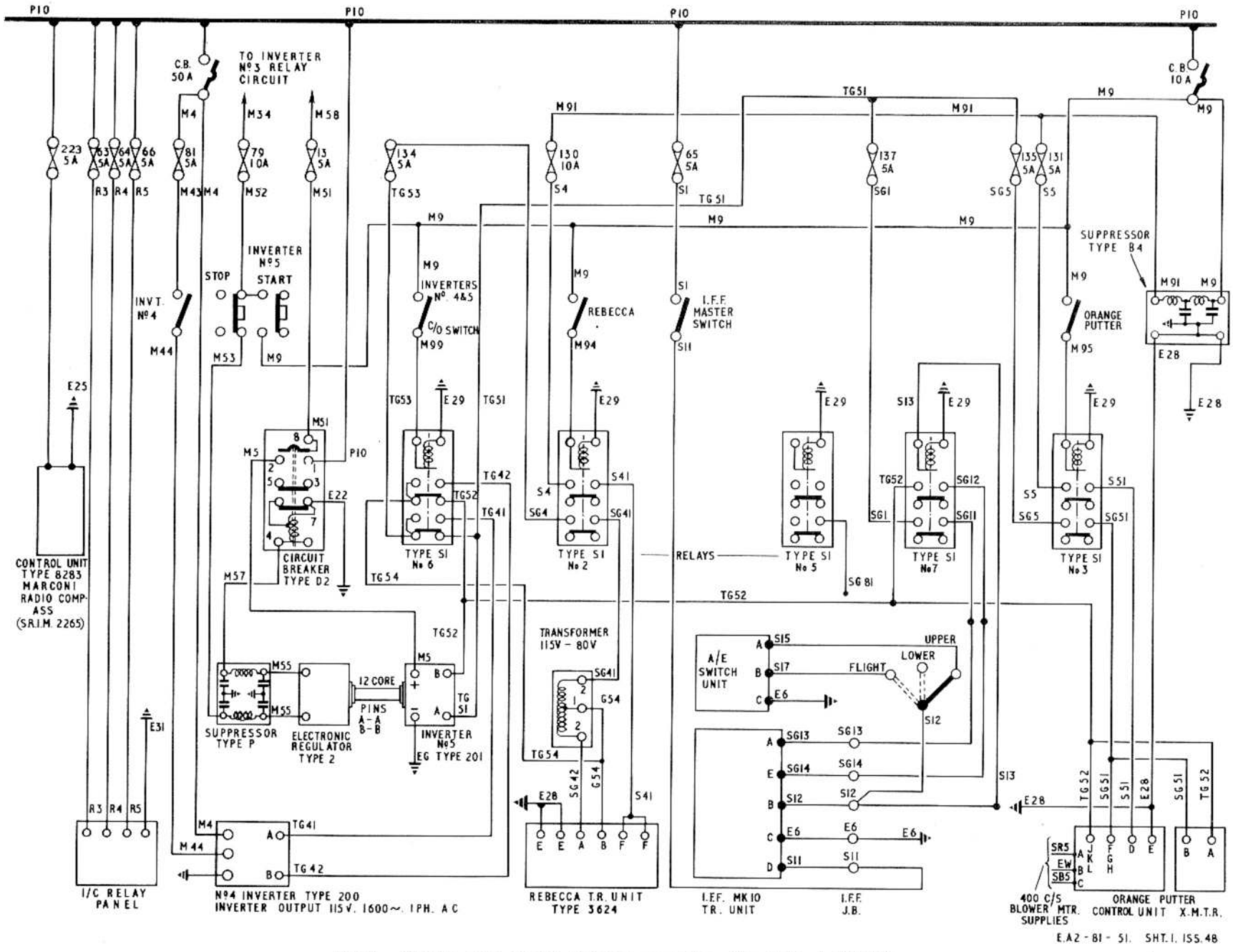

Fig.1. Radio and radar power supplies (Post Mod. 1025)

Introduction

1. Power supplies of 28-volts d.c.; 115 volts, 1600 c/s, single-phase a.c. and 115 volts, 400 c/s, 3-phase a.c. are used to operate the wireless and radar systems. On aircraft post Mod.1025 the 1600 c/s single-phase a.c. supplies are obtained from two inverters, a Type 200 *(standby)* and a Type 201 *(main)* numbered 4 and 5 respectively. No.5 inverter is mounted in the starboard equipment compartment forward of the M.E.P. and supplies a.c. power for the I.F.F. Mk.10, Rebecca and Rear warning systems. No.4 *(standby)* inverter is mounted at the starboard side on the rear wall in the upper equipment compartment and provides an a.c. supply of limited power, for the Rebecca system, should No.5 inverter fail. On aircraft post Mod. 2706 and 2707 the 1600 c/s single-phase a.c. supplies are obtained from the three Type 200 inverters numbered 4, 7 and 8. No.4 inverter, mounted at the starboard side on the rear wall in the upper equipment compartment, supplies a.c. power for the Rebecca system. No.8 inverter, mounted at the port side in the roof of the forward camera bay, supplies a.c. power for the I.F.F. Mk.10 system. No.7 *(standby)* inverter is mounted in the starboard equipment compartment forward of the M.E.P. and provides an a.c. supply for the Rebecca or I.F.F. Mk.10 systems, in the event of No.4 inverter or No.8 inverter failing. The 400 c/s, 3-phase a.c. power for the Green satin system *(post Mod.1025 or 2706/7)* is provided by a Type 103A inverter mounted on the floor in the upper equipment compartment.

DESCRIPTION

No.5 inverter *(aircraft post Mod.1025)*

2. No.5 inverter is initially controlled by two switches on the E.C.P., one labelled START and the other STOP. Provision is made in the circuit to ensure that No.5 inverter cannot be started up unless No.3 inverter *(see group D)* is running to operate the motor driven blowers that cool the electronic regulator and certain units of the radar installation. With a circuit breaker, labelled 1600 c/s CONTROL, on the E.C.P. closed, pressing the START switch feeds a supply from M9 to energize a Type D2 circuit breaker on the M.E.P. via the START and STOP switches, M52, M53, one leg of a Type P suppressor, a Type 2B electronic regulator in the upper equipment compartment, M56, the other leg of the Type P suppressor and M57. The Type D2 circuit breaker, upon closing, completes the input feed P10 and M5 to start up No.5 inverter. It also completes a self-energizing feed from P10, through its main contact, M51 fuse 13 on the M.E.P. and M58 to energize and close No.3 relay in the d.c. distribution box *(see group D)*, thereby completing the circuit for the 28-volt d.c. supply to the No.3 inverter. This action results in No.3 inverter automatically starting up *(see group D)*, providing it is not already running, thus ensuring that the blower motors are operating before the radar equipment is switched on. Pressing the STOP switch breaks the self-energizing feed to the Type D2 circuit breaker causing No.5 inverter to close down.

Electronic regulator, Type 2B
(aircraft post Mod.1025)
General

3. To ensure that the voltage and frequency of the output of No.5 inverter are maintained within predetermined limits, the inverter is designed to function in conjunction with a Type 2B electronic regulator, and for this reason the driving motor and alternator of the inverter are fitted with auxiliary high impedance windings. The combination of regulator and inverter ensures that the voltage and frequency of the inverter keeps to within ± 1 per cent under normal operating conditions. The voltage is variable over a small range about 115 volts and the frequency setting is infinitely variable over a range of 1472 to 1728 c/s the adjustments being made by externally accessible trimmers at the base of the regulator. A protective relay fitted in the unit is set to trip whenever the voltage or frequency rise in excess of 25 per cent above normal. The protective circuit is connected to pins A and B *(MM55-MM56)* of a 4-pin plug at the base of the unit. If the inverter voltage or frequency should vary sufficiently to operate the protective relay, the normally-closed circuits MM55-MM56 open to break the solenoid circuit of the Type D2 circuit breaker which opens and stops No.5 inverter.

Desiccator unit

4. Provision is made to absorb any moisture which may seep into the regulator interior by a desiccator containing silica gel crystals. The colour of the crystals, which should be blue when dry or pink when damp, can be inspected through a small window.

Pressure section

5. The lower section of the regulator unit operates under a pressure of approximately 5 lb/in², the pressure being maintained by the periodical use of a handpump which may be connected to a Schrader-type air valve on the base of the unit. The pressure in the section is maintained by internal sealing and a special roller chain, fitted externally to the base of the unit, which may be tightened or released by a single screw.

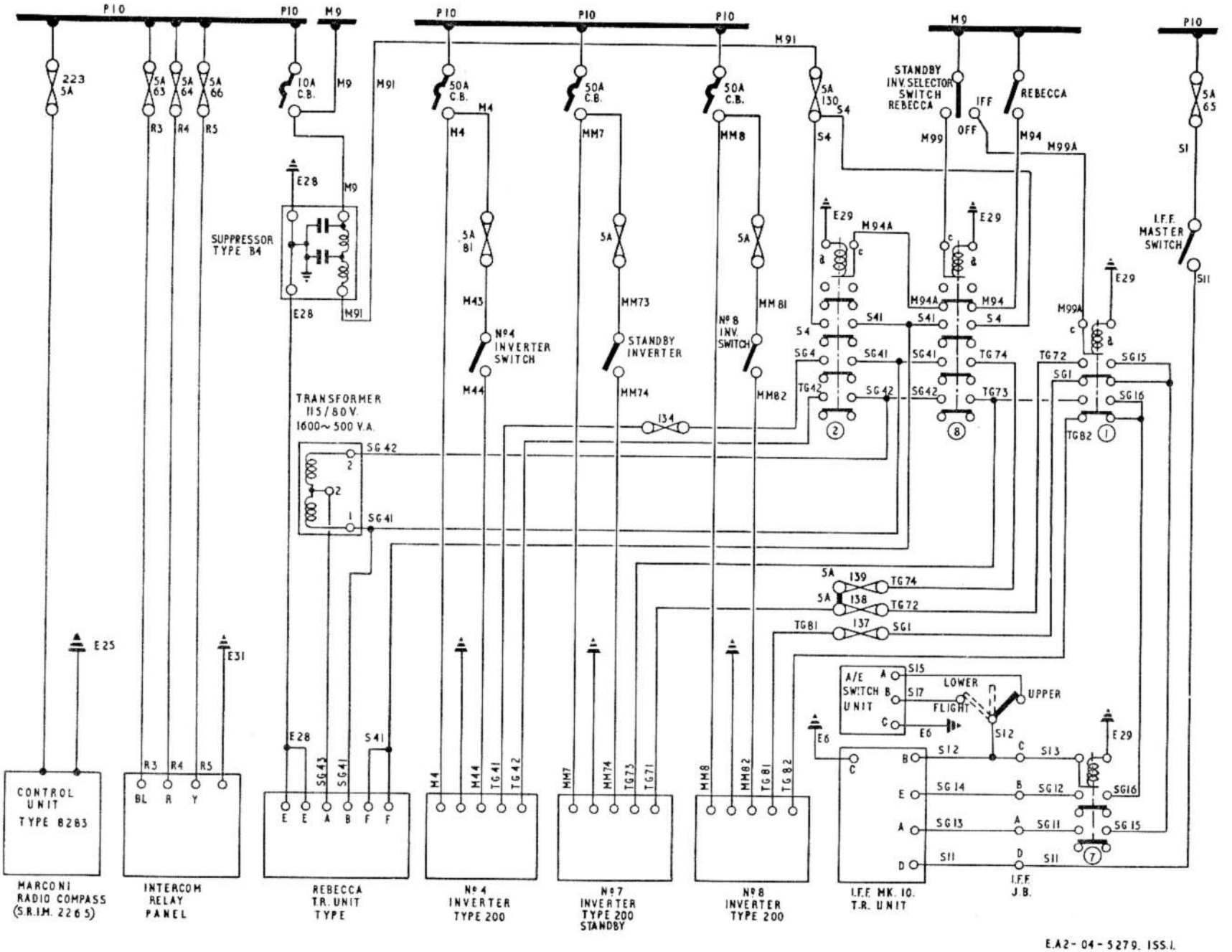

Fig.2. Radio and radar power supplies (Post Mod. 2706/7)

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◀ *(Fuse change)* ▶

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Cooling

6. For cooling purposes, a 400 c/s, a.c. operated blower motor is installed in the upper section of the regulator, the connection to it being made by a Plessey plug at the top of the cover.

No.4 inverter *(Rebecca standby – aircraft post Mod. 1025)*

7. If No.5 inverter becomes unserviceable, No.4 inverter may be brought into operation by closing the No.4 INVERTER circuit breaker, the No.4 INVERTER ON-OFF switch and selecting No.4 position on the No.4/No.5 inverter CHANGEOVER switch, all three switches being located on the E.C.P. The selection of No.4 at the No.4/No.5 CHANGEOVER switch, completes circuit M9-M99 to energize No.6 relay. Closing of No.6 relay changes over the output power supply from No.5 inverter circuit TG51-TG52 to No.4 inverter output power supply TG41-TG42. The power supply from No.4 inverter is provided to maintain the navigational facilities given by the use of the Rebecca system.

Rebecca supplies
(aircraft post Mod. 1025)

8. The Rebecca system operates from a 28-volt d.c. supply, and 80-volts a.c. obtained from the 115-volt, 1600 c/s supply via a step-down transformer in the upper equipment compartment. The transformer, rated at 500 V.A., supplies the Rebecca system. The supply is controlled by a switch on the E.C.P. Operating the switch energizes No.2 relay in the 1600 c/s distribution box, via M9-M94, which on closing completes the d.c. circuit S4-S41, fed from fuse 130 in the 1600 c/s distribution box, and the a.c. circuit SG4-SG41, fed from fuse 134 in the 1600 c/s distribution box.

I.F.F. Mk.10 supplies
(aircraft post Mod.1025)

9. Supplies of 28-volts d.c. and 115 volts 1600 c/s a.c. obtained from No.5 inverter, are required to operate the I.F.F. Mk.10 system. Operating the I.F.F. ON/OFF switch, mounted on a panel at the port side of the navigator's seat, energizes No.7 relay in the 1600 c/s distribution box via P10, fuse 65 in the E.C.P., S1-S11, the I.F.F. T/R unit, S12 and S13. On closing, the relay completes the a.c. circuits SG1-SG11-SG13, fed from fuse 137 in the 1600 c/s distribution box, and TG52-SG12-SG14, fed from the No.5 inverter via the 1600 c/s distribution box.

Rear warning supplies
(aircraft post Mod. 1025)

10. Supplies of 28-volts d.c. and 115 volts a.c. are required to operate the Rear warning system. Operating the A.R.I.5800 ORANGE PUTTER switch on the E.C.P. energizes No.3 relay in the 1600 c/s distribution box, via M9-M95, which on closing completes the d.c. circuit S5-S51, fed from fuse 131 in the 1600 c/s distribution box, and the a.c. circuit SG5-SG51, fed from fuse 135 in the 1600 c/s distribution box.

Green satin supplies
(aircraft post Mod. 1025)

11. The power supply of 115-volts, 400 c/s, 3-phase a.c. required to operate the Green Satin system, is provided by a Type 103A inverter in conjunction with a Type 24 control panel in the upper equipment compartment, and a Type 15 control panel on the aft face of frame 12 in the forward camera bay. The inverter operates from a 28-volt supply controlled by a switch, labelled GREEN SATIN ON/OFF, mounted on the E.C.P. A switch labelled GREEN SATIN EQUIPMENT PRESS-TO-START, located on the E.C.P. provides that the inverter can be started 'off load' and run to operational speed before the equipment is switched ON.

12. Selecting the GREEN SATIN switch to ON energizes the coil of a Type K relay, in the upper equipment compartment, via fuse 60 on the E.C.P., MM6, the GREEN SATIN switch and MM61; at the same time a d.c. supply is fed to the shunt field of the inverter. On closing, the relay completes the inverter input circuit from fuse 168 on the M.E.P., via M6, the Type K relay, M61, a Type 1A No.5 magnetic start switch, M62, a Type 24 control panel, and a Type 15 control panel.

13. Operating the GREEN SATIN EQUIPMENT PRESS-TO-START switch initially energizes a Type S4 relay, in the upper equipment compartment, which closes and completes the inverter output circuits to the GREEN SATIN T.R. unit via the Type 24 control panel and the Type 15 control panel. The Type S4 relay remains energized by a self-energizing feed, MM61-E34, through its own contacts after the GREEN SATIN EQUIPMENT switch has been released. This hold-in circuit is only broken when the GREEN SATIN – ON/OFF switch is selected to OFF.

Note...

(1) The Green satin inverter and the No.5 inverter must not be run simultaneously unless both generators are charging. The inverters must not be started simultaneously; having started one inverter a short period must be allowed before starting the other.

(2) The GREEN SATIN EQUIPMENT switch should not be operated until a

short period has elapsed from the closing of the GREEN SATIN – ON/OFF switch. This allows the speed of the inverter to build up to its operating rev/min. and prevents overloading.

No.4 inverter

(aircraft post Mod. 2706 and 2707)

14. No.4 inverter is initially controlled by a switch on the E.C.P. labelled No.4 INVERTER ON/OFF. With a circuit breaker, labelled No.4 INVERTER, on the E.C.P. closed, operating the No.4 INVERTER ON/OFF switch feeds a supply from P10 to No.4 inverter via M4, fuse 81 in the E.C.P., M43, the ON/OFF switch, and M44 to start up the No.4 inverter. At the same time a supply is fed from P10 to the shunt field of the inverter.

No.8 inverter

(aircraft post Mod. 2706 and 2707)

15. No.8 inverter is initially controlled by a switch on the E.C.P. labelled No.8 INVERTER ON/OFF. With a circuit breaker, labelled No.8 INVERTER, on the E.C.P. closed, operating the No.8 INVERTER ON/OFF switch feeds a supply from P10 to No.8 inverter via MM8, fuse 82, MM81, the ON/OFF switch, and MM82 to start up No.8 inverter. At the same time a supply is fed from P10 to the shunt field of the inverter.

No.7 inverter *(Rebecca and I.F.F. Mk.10 standby – aircraft post Mod.2706 and 2707)*

16. If No.4 inverter or No.8 inverter should become unserviceable, No.7 inverter may be brought into operation by closing the No.7 INVERTER circuit breaker, and the No.7 INVERTER ON/OFF switch, both located on the E.C.P. This action feeds a supply from P10 to No.7 inverter via MM7, fuse 44 in the E.C.P., MM73, the ON/OFF switch, and MM74 to start up No.7 inverter. At the same time a supply is fed from P10 to the shunt field of the No.7 inverter.

Rebecca supplies

(aircraft post Mod. 2706 and 2707)

17. The Rebecca system operates from 28 volts d.c., and 80 volts a.c. obtained from the 115-volt, 1600 c/s output supply of No.4 inverter, via a step down transformer in the upper equipment compartment. The supply is initially controlled by a switch, labelled REBECCA ON/OFF, on the E.C.P. Operating the REBECCA ON/OFF switch energizes relay No.2 in the 1600 c/s distribution box, via M9-M94, the normally-closed contacts of relay No.8 in the 1600 c/s distribution box, and M94A. No.2 relay on closing completes the d.c. circuit S4-S41 fed from fuse 130 in the 1600 c/s distribution box, and the a.c. circuits SG4-SG41, fed from fuse 134 in the 1600 c/s distribution box, and TG42-SG42, from No.4 inverter.

I.F.F. Mk.10 supplies

(aircraft post Mod.2706 and 2707)

18. Supplies of 28-volts d.c. and 115 volts, 1600 c/s a.c., obtained from No.8 inverter, are required to operate the I.F.F. Mk.10 system. Operating the I.F.F. ON/OFF switch, mounted on a panel at the port side of the navigator's seat, energizes No.7 relay in the 1600 c/s distribution box, via P10, fuse 65 in the E.C.P., S1-S11, the I.F.F. T.R. unit, S12 and S13. On closing, No.7 relay completes the a.c. circuits to the I.F.F. T.R. unit, via SG15-SG11, fed from fuse 137 in the 1600 c/s distribution box and the normally-closed contacts of relay No.1 in the 1600 c/s distribution box, and SG16-SG12, fed from No.8 inverter and the normally-closed contacts of relay No.1 in the 1600 c/s distribution box.

Rebecca and I.F.F. Mk.10 standby supplies

(aircraft post Mod. 2706 and 2707)

19. The standby supplies for the Rebecca and I.F.F. Mk.10 systems, obtained from No.7 inverter, are initially controlled by a three-position switch on the E.C.P., labelled REBECCA/I.F.F.10, the centre unlabelled position being off. Selecting the switch to REBECCA energizes No.8 relay in the 1600 c/s distribution box, via M9 and M99. No.8 relay on closing completes the d.c. circuit S4-S41, from fuse 130 in the 1600 c/s distribution box, and the a.c. circuits TG74-SG41, fed from No.7 inverter via fuse 139 in the 1600 c/s distribution box, and TG73-SG42, fed from No.7 inverter, to the Rebecca T.R. unit. At the same time the energizing feed, M94-M94A, to No.2 relay in the 1600 c/s distribution box is broken. This action results in No.2 relay falling out and isolating the a.c. output of No.4 inverter. Selecting the switch to I.F.F.10 energizes No.1 relay in the 1600 c/s distribution box, via M9-M99A, which on closing changes the a.c. supplies to the I.F.F. Mk.10 T.R. unit, from SG1-SG15, TG82-SG16, to TG72-SG15 and TG73-SG16, thereby isolating the a.c. output of No.8 inverter.

Note...

On aircraft embodying Mod. 2706 and 2707 the No.5 inverter circuit and the Rear Warning system are inoperative.

Green satin supplies

(aircraft post Mod. 2706 and 2707)

20. The power supply of 115-volts, 400 c/s, 3-phase a.c. required to operate the Green Satin system, is provided by a Type 103A inverter in conjunction with a Type

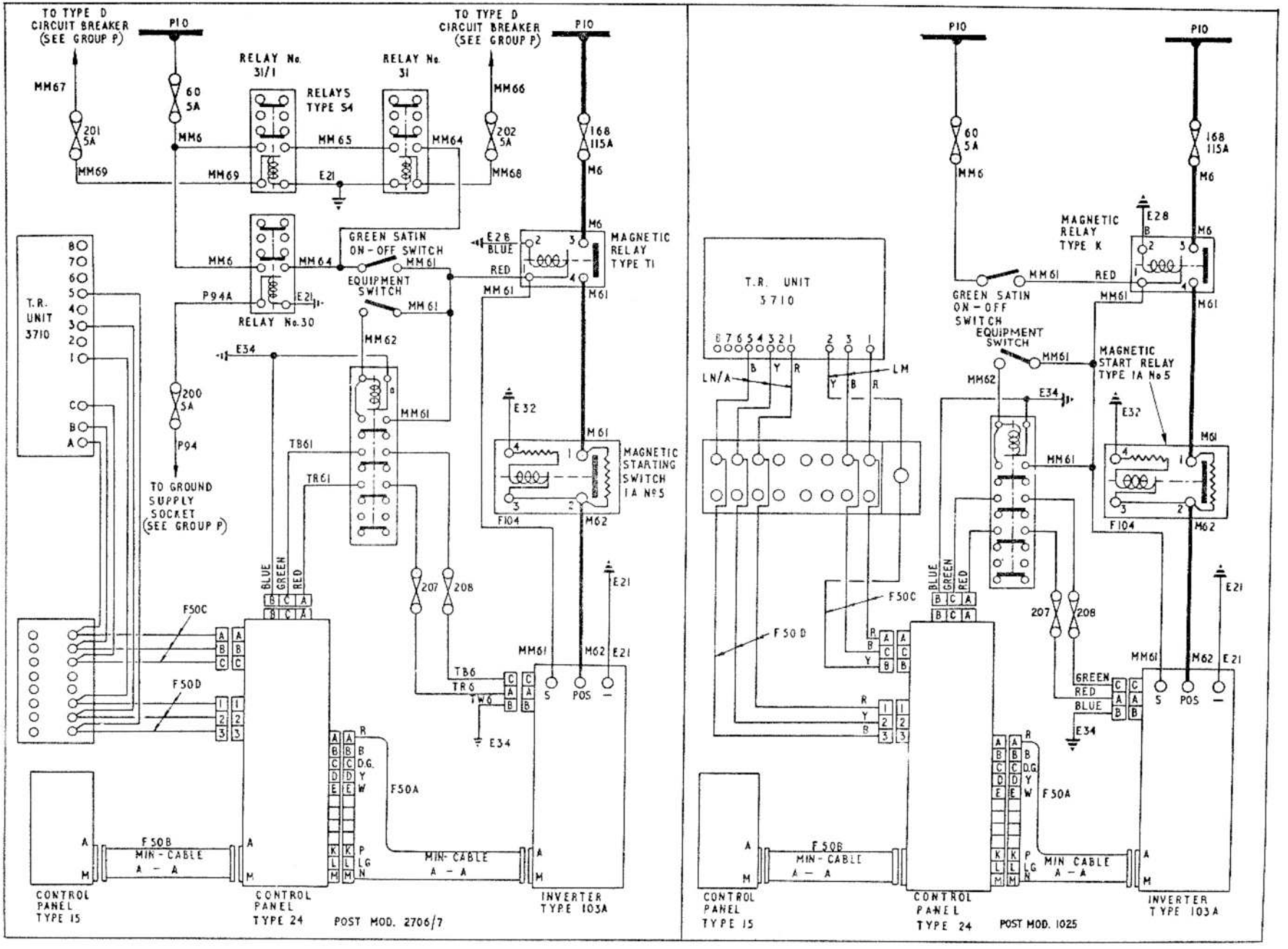

Fig. 3. Green satin power supplies (post Mod.1025 or 2706/7)

24 control panel in the upper equipment compartment and a Type 15 control panel on the aft face of frame 12 in the forward camera bay. The inverter operates from a 28-volt supply primarily controlled by a switch labelled A.R.I.5851 GREEN SATIN ON/OFF, on the E.C.P. A switch labelled GREEN SATIN EQUIPMENT PRESS-TO-START, located on the E.C.P., provides that the inverter can be started 'off load' and run to operational speed before the equipment is switched ON.

21. Providing both generators are running *(see group P)*, selecting the A.R.I.5851 GREEN SATIN ON/OFF switch to ON energizes the coil of a Type T1 relay in the upper equipment compartment, via P10, fuse 60 in the E.C.P., MM6, the normally-open contacts of relay No.31/1 in the starboard equipment compartment, MM65, the normally-open contacts of relay No.31 in the starboard equipment compartment, MM64, the ON/OFF switch and MM61. At the same time a d.c. supply is fed to the shunt field of the inverter, via MM61. On closing, the Type T1 relay completes the inverter input circuit from fuse 168 on the M.E.P., via P10, M6-M61, a Type 1A No.5 magnetic starting switch in the upper equipment compartment, M62, the Type 24 control panel, and the Type 15 control panel. When the equipment is being operated on the ground using an external supply, the energizing feed to the Type T1 relay is obtained via P10, fuse 60 in the E.C.P., MM6, the normally-open contacts of relay No.30 in the starboard equipment compartment, MM64, the ON/OFF switch and MM61.

22. Operating the GREEN SATIN EQUIPMENT PRESS-TO-START switch initially energizes a Type S4 relay, in the upper equipment compartment, which closes and completes the inverter output circuits to the Green Satin T.R. unit via the Type 24 control panel and the Type 15 control panel. The Type S4 relay remains energized by a self-energizing feed, MM61-E34, through its own contacts after the GREEN SATIN EQUIPMENT switch has been released. This hold-in circuit is only broken when the A.R.I.5851 GREEN SATIN – ON/OFF switch is selected to OFF.

Note...
The GREEN SATIN EQUIPMENT switch should not be operated until a short period has elapsed from the closing of A.R.I.5851 GREEN SATIN – ON/OFF switch. This allows the speed of the inverter to build up to its operating rev/min. and prevents overloading.

Marconi sub-miniature radio compass *(aircraft embodying S.R.I.M. 2265 or post Mod. 2706 and 2707)*

23. This system operates from 28-volts d.c. fed to the Type 8283 control unit, mounted at the port side of the navigator's seat, from a fuse in the E.C.P.

I/C supplies

24. The intercomm. system operates from 28-volts d.c. fed to the I/C relay panel at the starboard side in the cabin via fuses 63 and 64 in the E.C.P. A third supply, introduced by S.R.I.M.1436, is fed from the E.C.P. to the V.H.F. No.1/No.2 changeover switch via the I/C relay panel.

V.H.F. supplies
(aircraft pre and post Mod.3578)

25. The 28-volt d.c. power supplies required to operate the V.H.F. system are taken from fuses 10 and 11 in the M.E.P. to the V.H.F. relay panel in the port equipment bay.

U.H.F. supplies
(aircraft post Mod. 3578)

26. The U.H.F. system operates from 28-volts d.c. fed from fuse 175 on the M.E.P. to the Type A.R.C.52 interconnecting box in the rear fuselage.

U.H.F./V.H.F. changeover supply

27. A 28-volt d.c. supply is fed from fuse 222 in the E.C.P. to the radio junction box, installed at the starboard side in the cabin, via a switch labelled V.H.F./U.H.F. mounted on the starboard instrument panel. Selecting the switch to either V.H.F. or U.H.F. changes over from one system to the other, via relays in the radio junction box.

V.H.F. and U.H.F. supplies
(aircraft post Mod.3524)

28. To prevent overloading of the generators the V.H.F. and U.H.F. control circuits are combined and both systems are controlled by a three-position double-pole switch, mounted on the starboard instrument panel, labelled U.H.F. & V.H.F.2 – U.H.F. & V.H.F.1 – V.H.F.1 & 2. Selecting the switch to V.H.F.1 & 2 feeds a d.c. supply from P10 via fuse 222 in the E.C.P., RR6-RR62, to energize and close relays No.2, 3 and 4 in the U.H.F./V.H.F. relay box. At the same time a supply is fed from RR6 to energize and close relay No.2 in the radio junction box via a U.H.F./V.H.F. changeover switch, on the starboard instrument panel, selected to V.H.F. position, and RR65. On closing, relay No.2 in the U.H.F./V.H.F. relay box completes the d.c. supplies, P10, fuse 10, R1, the normally-open contacts of the relay and R12, and P10, fuse 11, R2, the normally-open contacts of the relay and R22, to the V.H.F. T.R. units. On relay No.2 in the radio junction box closing, the mic. tel.

circuits are transferred to the V.H.F. system *(Sect.6, Chap.1).*

29. With the U.H.F./V.H.F. changeover switch selected to U.H.F. and the three-position switch selected to U.H.F. & V.H.F.1, a d.c. supply is fed from P10 via fuse 222, RR6, the normally-closed contacts of relay No.3 in the U.H.F./V.H.F. relay box, RR63, the normally-closed contacts of relay No.4 in the U.H.F./V.H.F. relay box and RR64, to energize and close a Type T1 relay in the starboard equipment compartment and relay No.1 in the radio junction box. On closing, the Type T1 relay completes the d.c. power supply from P10 to the U.H.F. system via fuse 230, R6, the normally-open contacts of the relay and R61. On relay No.1 in the radio junction box closing, the mic. tel. circuits are transferred to the U.H.F. system *(Sect. 6, Chap.1).* Selecting the U.H.F./V.H.F. changeover switch to V.H.F. feeds a supply from RR6-RR65 to energize and close relay No.2 in the radio junction box. On closing, relay No.2 transfers the mic. tel. circuits to the V.H.F. T.R. unit No.1, which at the same time receives a d.c. supply from P10 via fuse 10, R1, the normally-closed contacts of relay No.1 in the U.H.F./V.H.F. relay box, R11, the normally-closed contacts of relay No.2 in the U.H.F./V.H.F. relay box and R12.

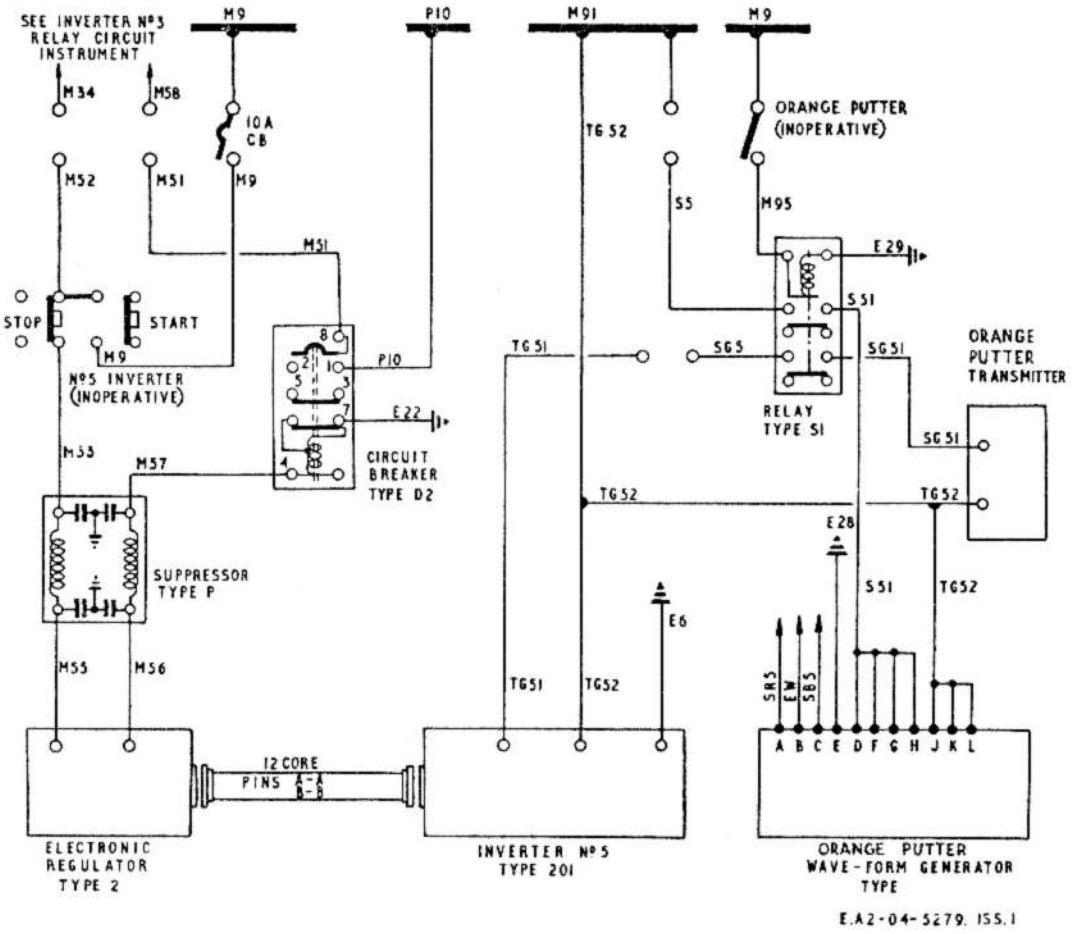

Fig. 4. Inoperative radar power supplies (post Mod.2706/7)

30. With the U.H.F./V.H.F. changeover switch selected to U.H.F. and the three-position switch selected to U.H.F. & V.H.F.2, a d.c. supply is fed from P10 via fuse 222, RR6, the normally-closed contacts of relay No.3 in the U.H.F./V.H.F. relay box, RR63, the normally-closed contacts of relay No.4 in the U.H.F./V.H.F. relay box and RR64, to energize and close a Type T1 relay in the starboard equipment compartment and relay No.1 in the radio junction box. At the same time a supply is fed from RR6-RR61 to energize and close relay No.1 in the U.H.F./V.H.F. relay box. On closing, the Type T1 relay completes the d.c. power supply from P10 to the U.H.F. system via fuse 230, R6, the normally-open contacts of the relay and R61. On relay No.1 in the radio junction box closing, the mic. tel. circuits are transferred to the U.H.F. system *(Sect.6, Chap.1).* Selecting the U.H.F./V.H.F. changeover switch to V.H.F., feeds a supply from RR6-RR65 to energize and close relay No.2 in the radio junction box. On closing, relay No.2 transfers the mic. tel. circuits to the V.H.F. T.R. unit No.2, which at the same time receives a d.c. supply from P10 via fuse 11, R2, the normally-open contacts of relay No.1 in the U.H.F./V.H.F. relay box, R21, the normally-closed contacts of relay No.2 in the U.H.F./V.H.F. relay box and R22.

SERVICING

General

31. Faults in the power supplies should be investigated with the aid of the relevant routeing and circuit diagrams together with the associated Air Publications covering any suspected equipment.

Inverters

32. Information on the servicing of inverters will be found in A.P.4343B, Vol.1, Book 3.

Magnetic starting switches

33. Details of the servicing of magnetic starting switches will be found in A.P. 4343B, Vol.1, Sect.11, Chap.9.

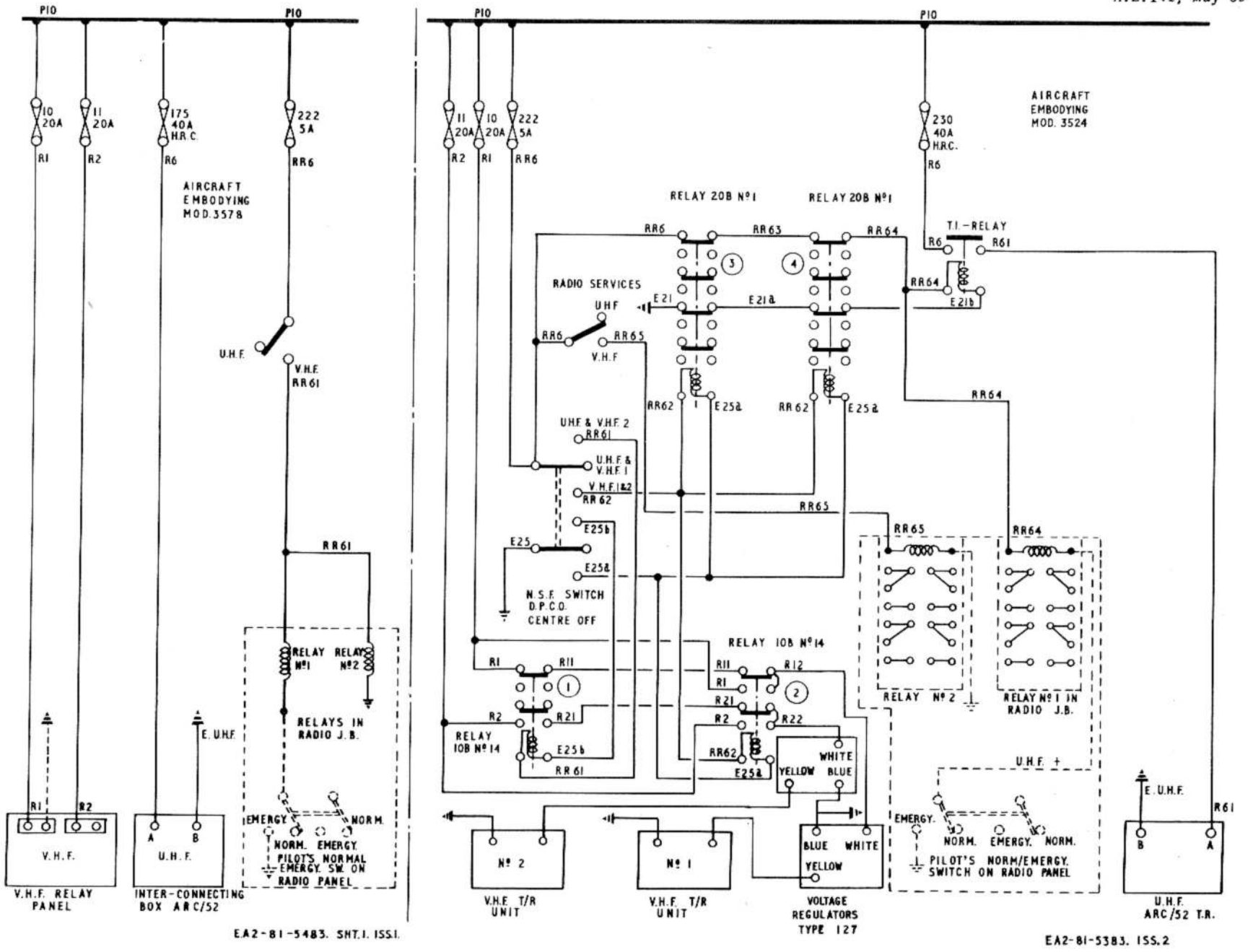

FIG. 5. D.C. RADIO SUPPLIES (POST MOD. 3524, 3578, 3876, AND 4299)

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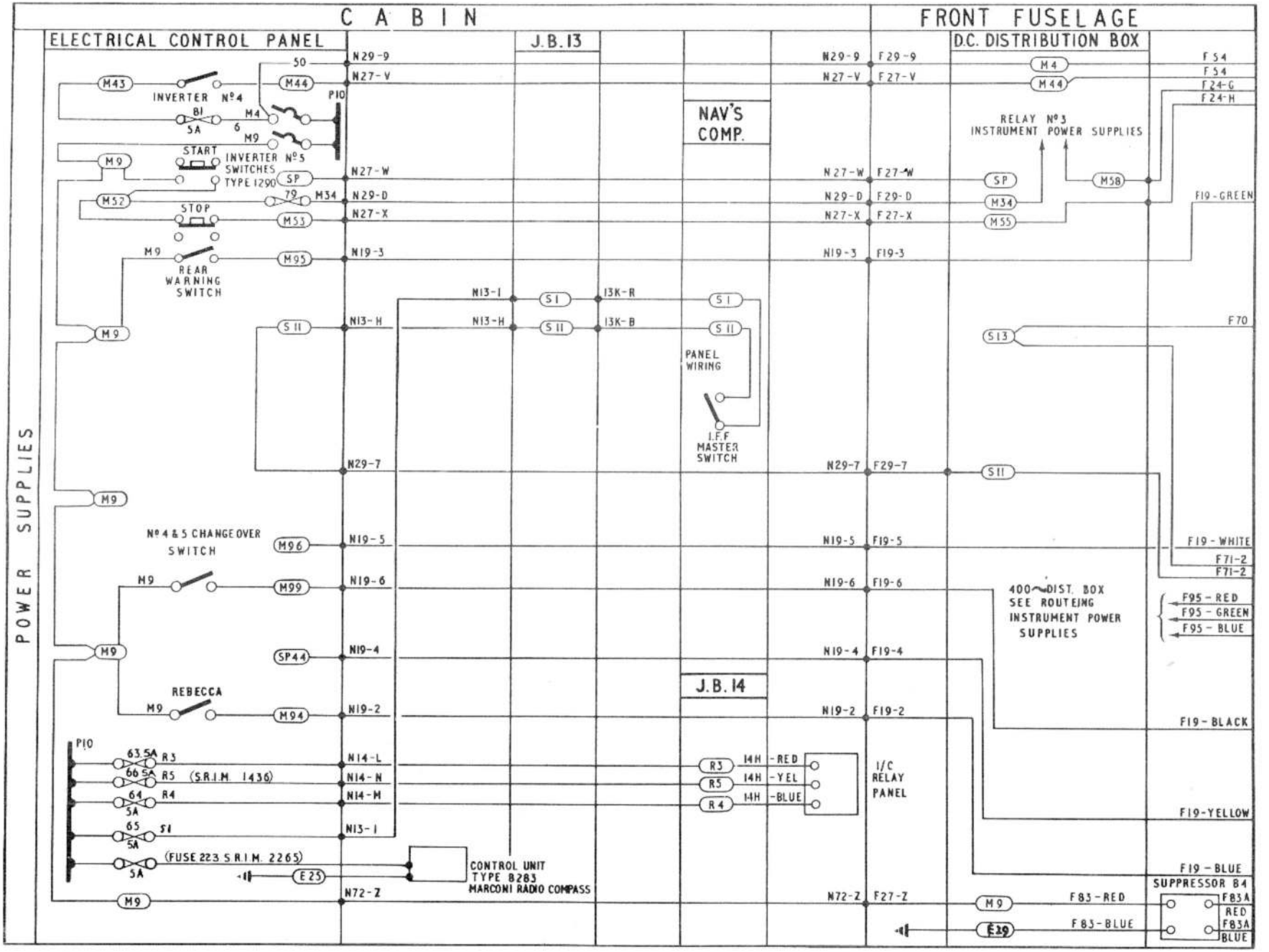

Fig.6. Radio and radar power supplies (Post Mod. 1025)

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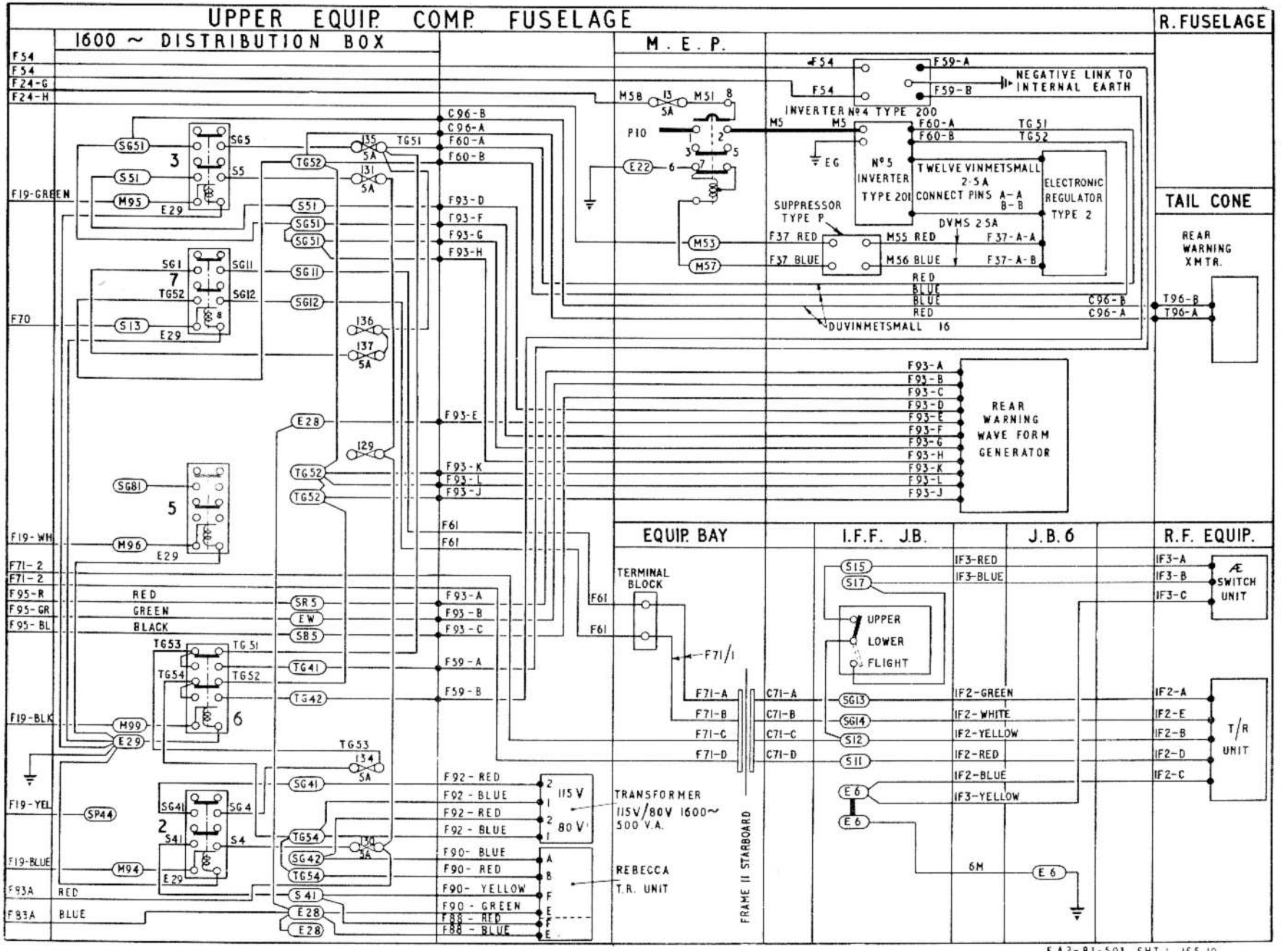

Fig. 6A. Radio and radar power supplies (post Mod.1025)

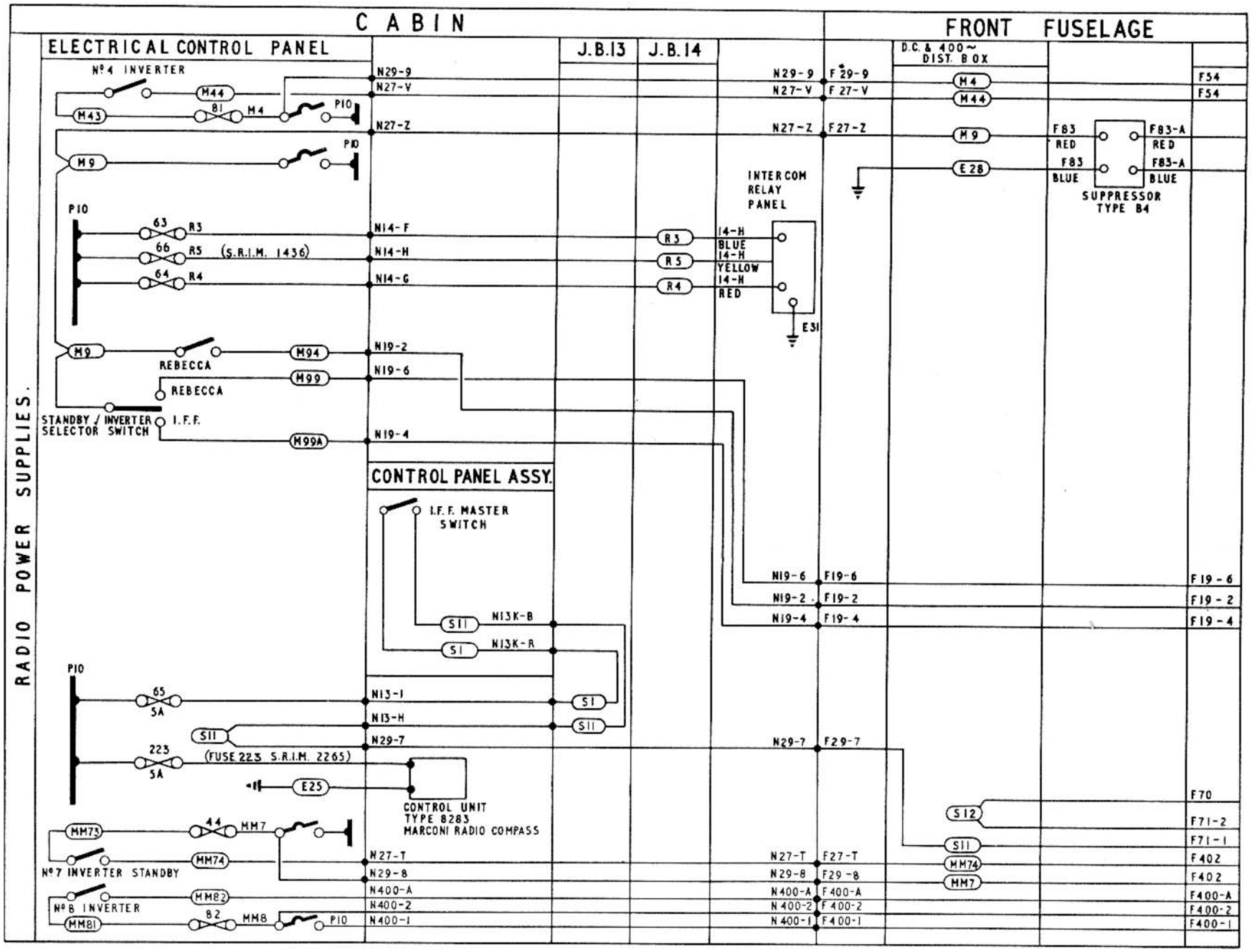

Fig.7. Radio and radar power supplies (Post Mod. 2706/7)

◀ *(Fuse change)* ▶

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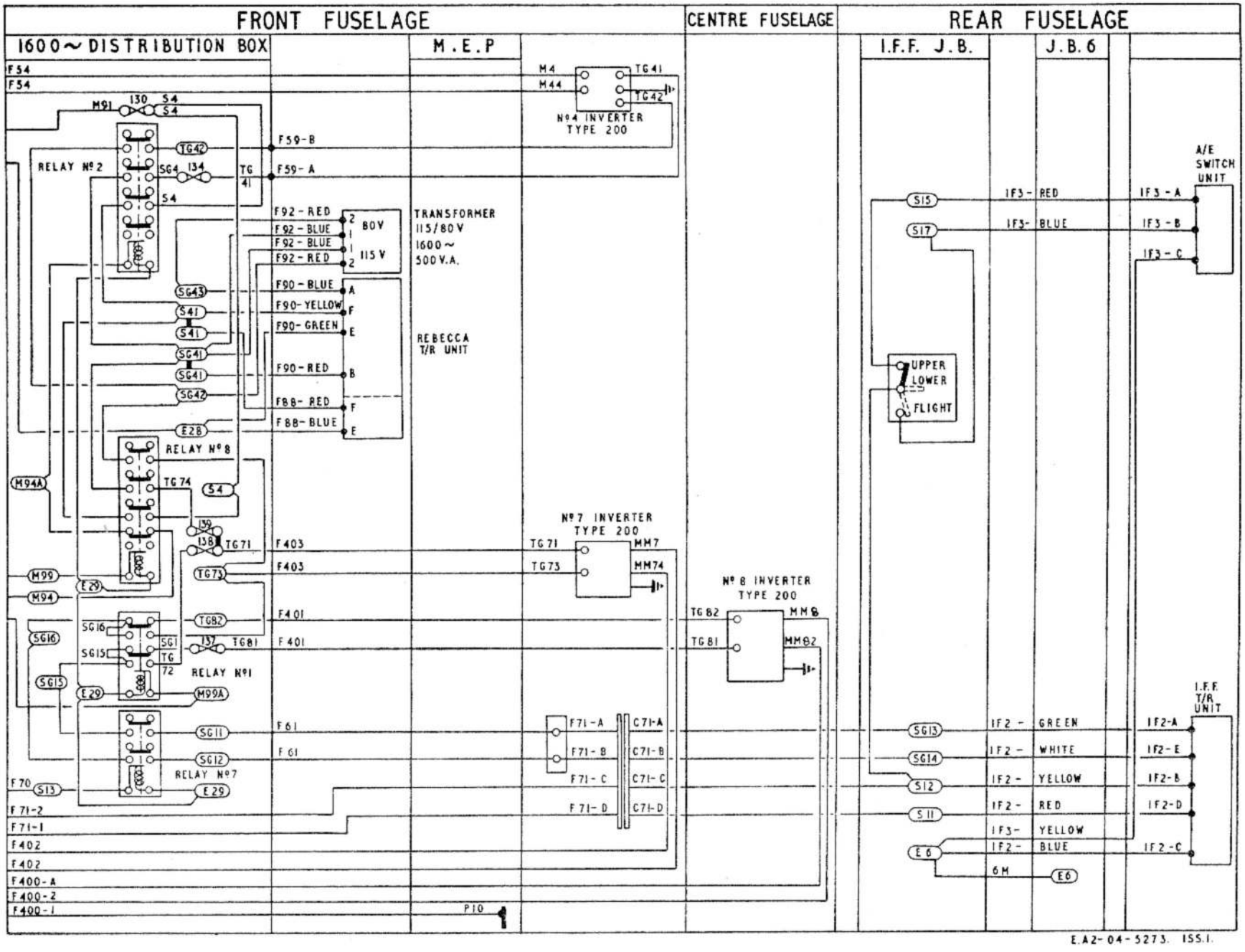

Fig.7A. Radio and radar power supplies (post Mod.2706/7)

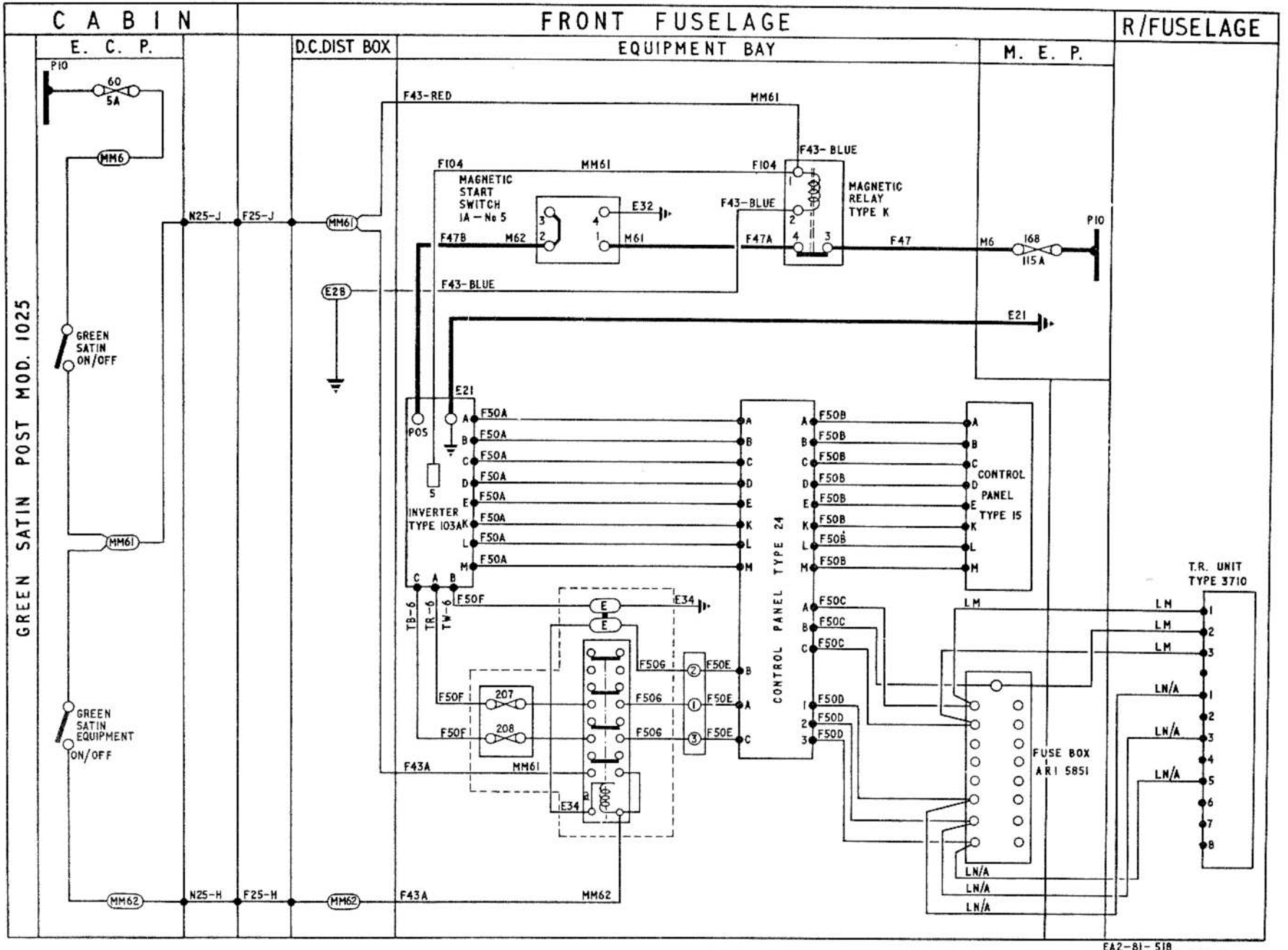

Fig. 8. Green satin power supplies (post Mod.1025)

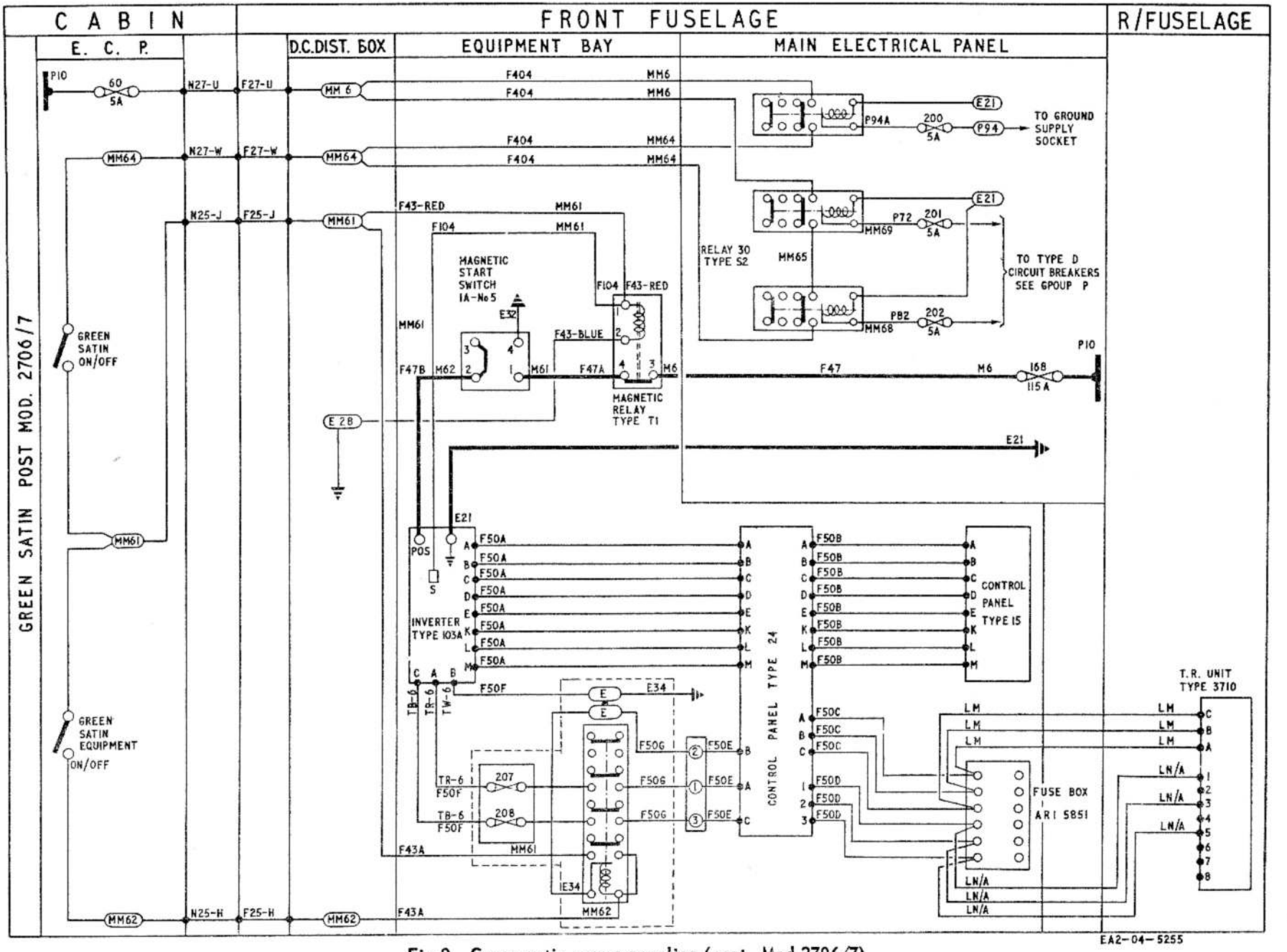

Fig.9. Green satin power supplies (post Mod.2706/7)

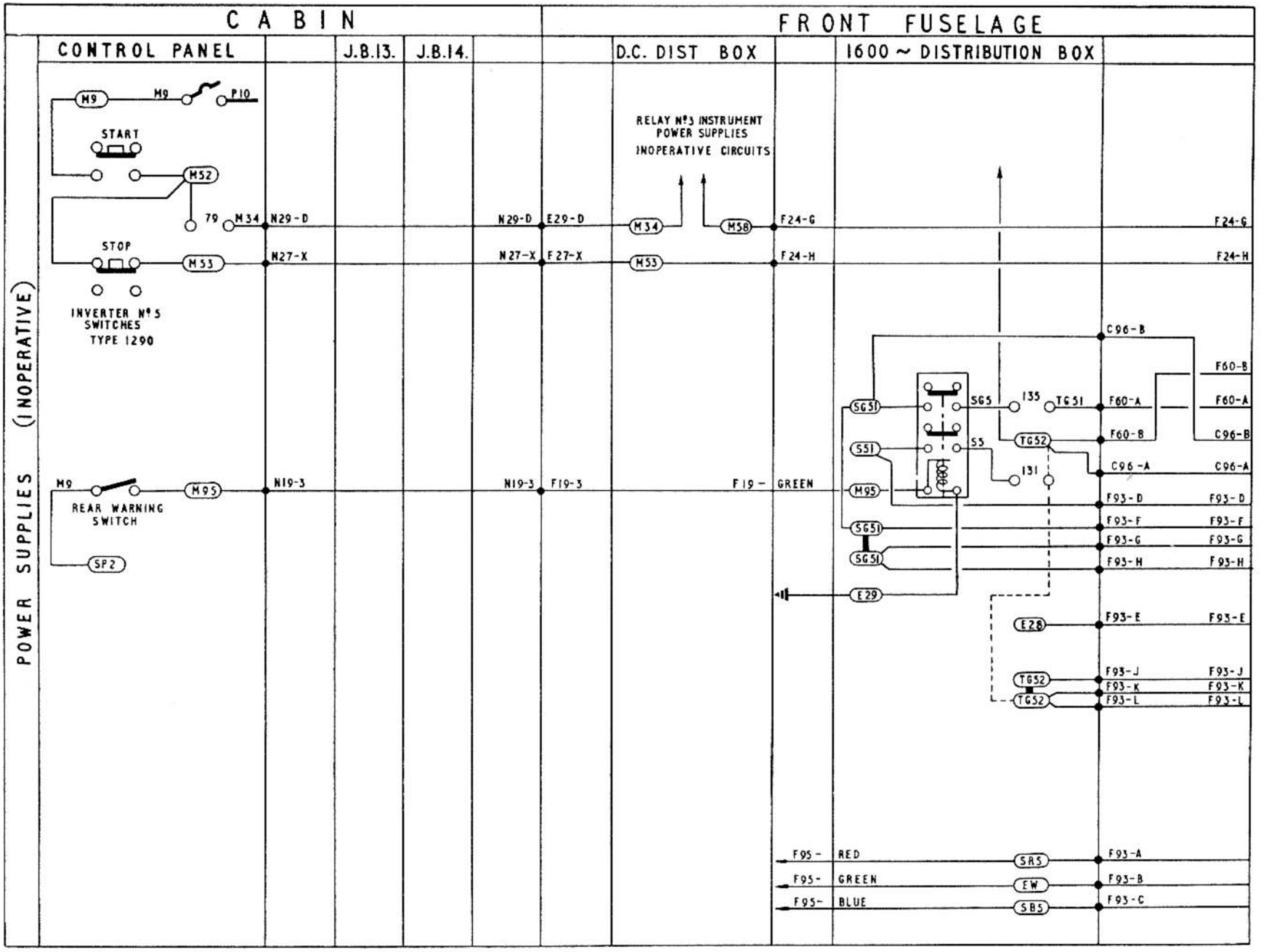

Fig.10. Inoperative radar power supplies (post Mod.2706/7)

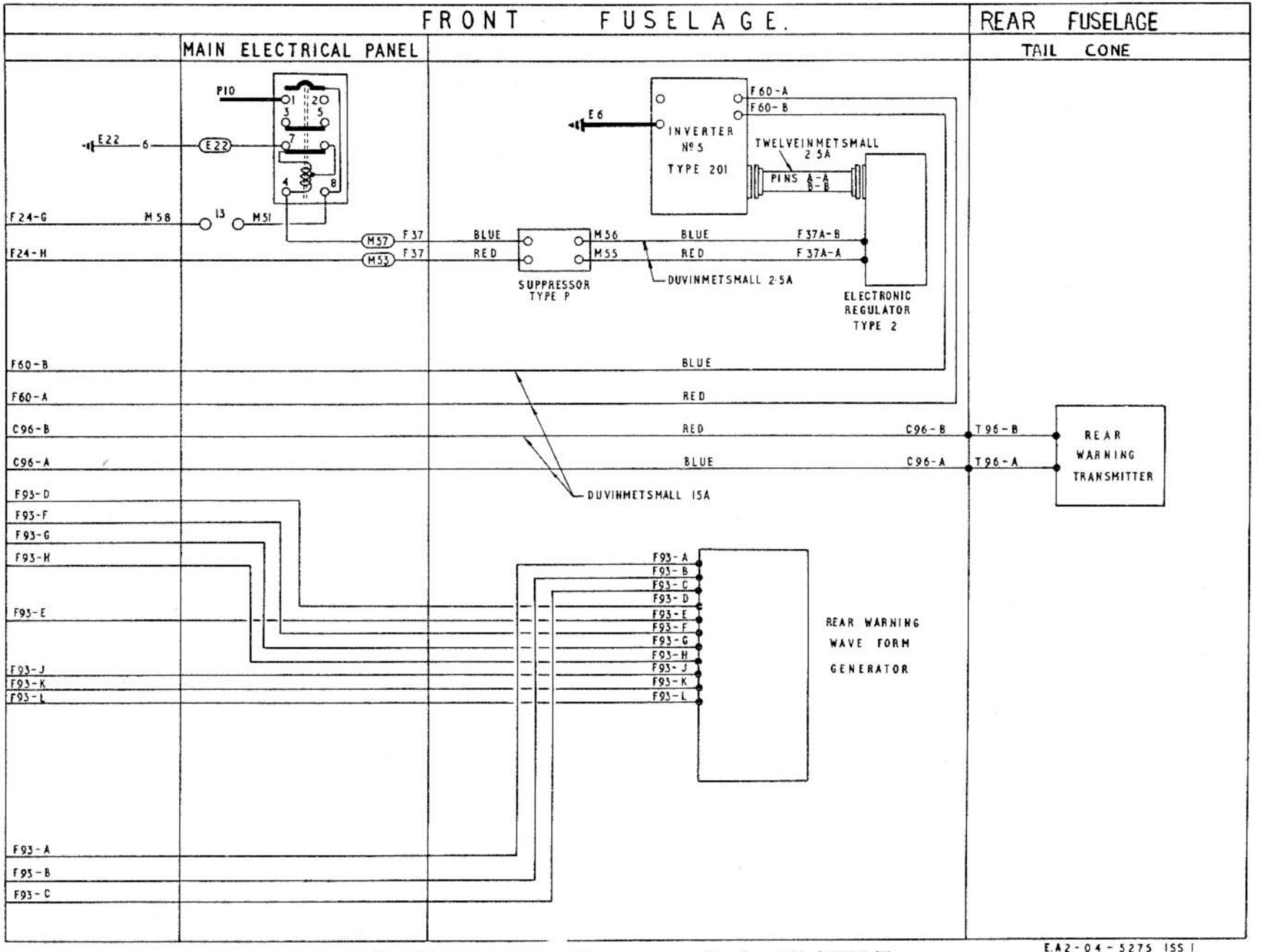

Fig.10A. Inoperative radar power supplies (post Mod.2706/7)

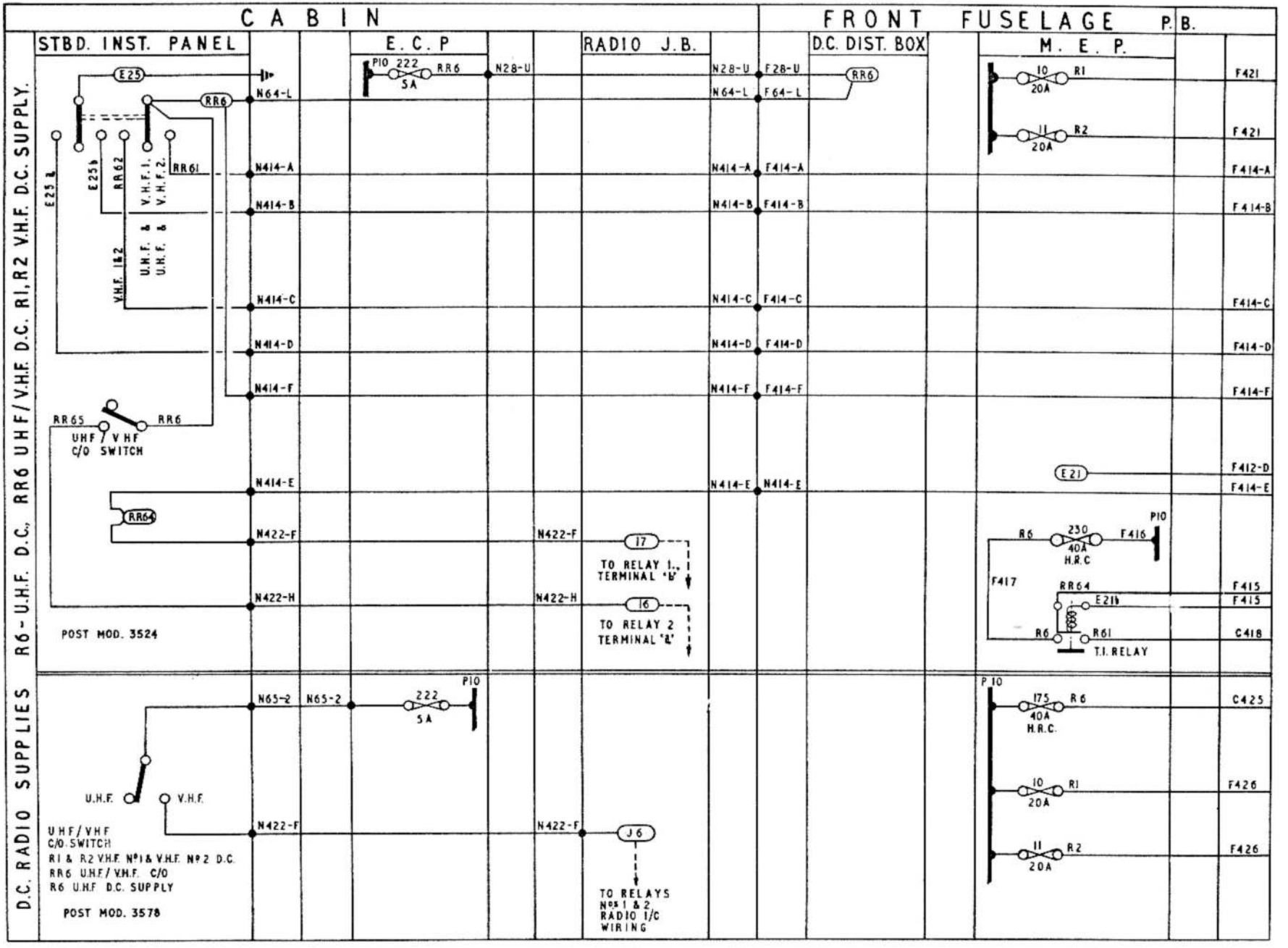

Fig.11. D.C. radio supplies (post Mod. 3524 and 3578)

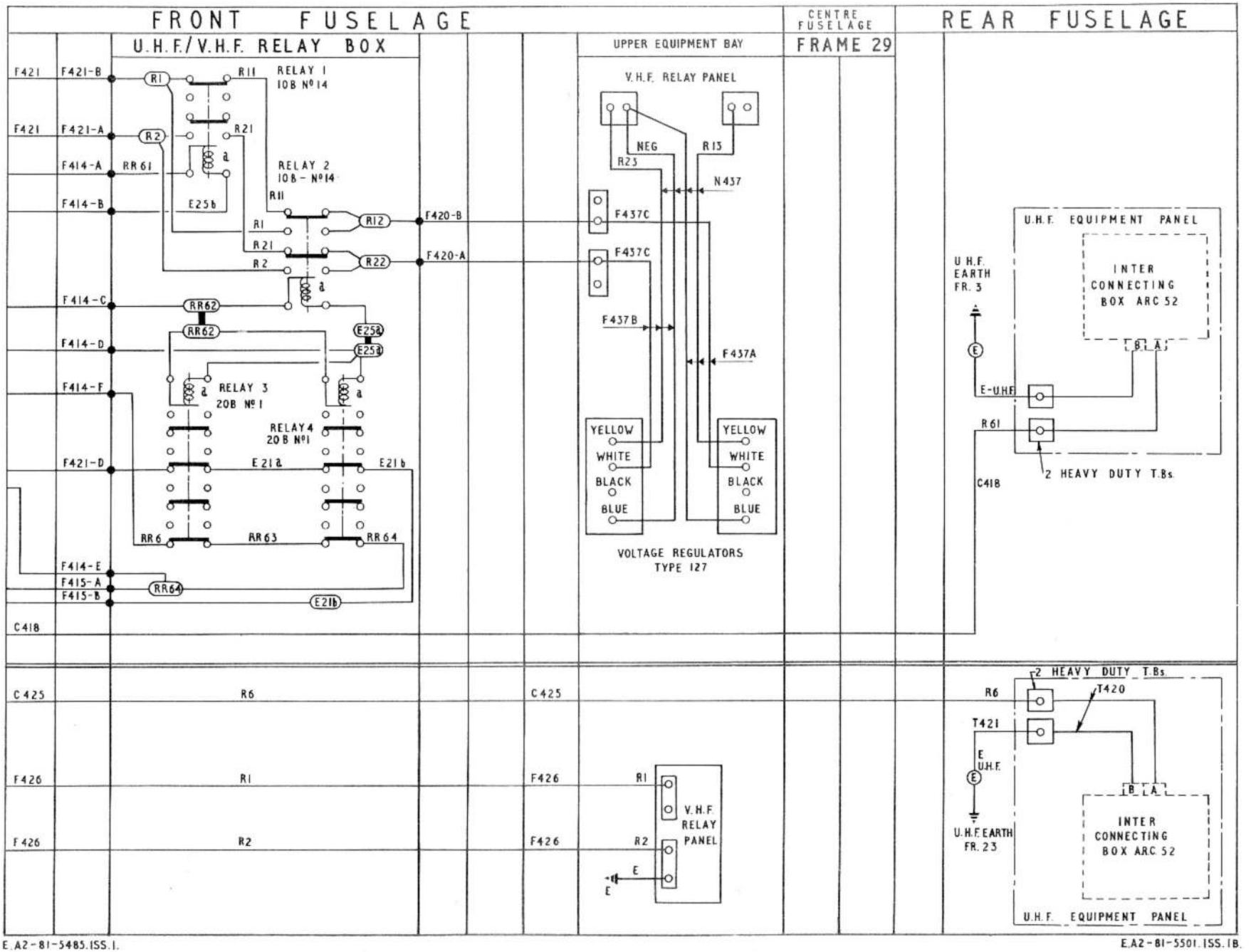

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FIG. 11A. D.C. RADIO SUPPLIES (POST MOD. 3524, 3578, 3876 AND 4299)

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WARNING AND EMERGENCY - GROUP W

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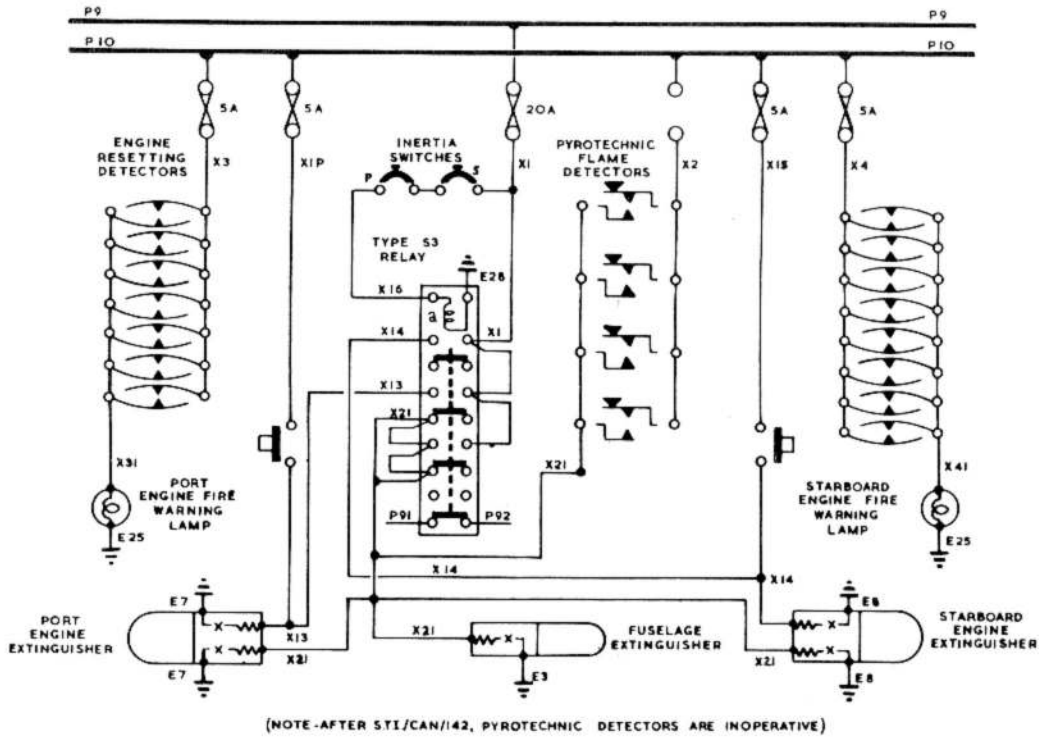
DESCRIPTION

FIRE EXTINGUISHER SYSTEM

General

1. A fire extinguisher system protects the engines and, in the event of a crash landing, the fuselage fuel tanks. Two Type 14A or 8AX extinguishers are installed one in each main wheel bay. These extinguishers are fitted with dual operating heads, one connecting to the engine spray-rings and the other to the fuselage fuel tank spray pipeline. On aircraft post Mod.3773, the operating head serving the fuselage fuel tank spray pipeline is operative only under crash landing conditions. A Type 12A or 4AX extinguisher, mounted on the aft face of frame 27A in the rear fuselage, protects the fuselage fuel tanks in a crash landing. The engine extinguishers operate in conjunction with a warning system consisting of warning lamps on the miscellaneous instrument panel and fire detectors installed in the engine bays. An inertia switch circuit discharges all extinguishers automatically in a crash landing.



(NOTE-AFTER STI/CAN/142, PYROTECHNIC DETECTORS ARE INOPERATIVE)

Fig. 1. Fire detectors and extinguishers

Fuselage fire protection

2. Prior to S.T.I./Canberra/142 the fuselage fuel tanks were protected by pyrotechnic detectors and the extinguisher on frame 27A. The S.T.I. disconnects the pyrotechnic capillaries from their switch units which are left in situ but inoperative, so that the extinguisher only operates after the inertia switches have tripped in a crash landing.

Engine fire protection

3. Fifteen Series 5 resetting-type detectors *(A.P.107E-0105-1)* are used for engine fire protection, seven being installed in the port engine bay and eight in the starboard bay, the detectors in each group being connected in parallel. The detector comprises a base housing a terminal block, and an alloy steel barrel in which is fitted a spring bow assembly carrying a pair of switch contacts, which are connected in the warning lamp circuits of the appropriate engine. When subjected to a temperature of 300 deg C or above, the barrel expands and causes the switch contacts to close and bring on the warning lamp. When the temperature falls and the barrel contracts, the switch contacts automatically re-open and extinguish the warning lamp.

Inertia switches

4. There are two Mk.2 piston-type inertia switches *(A.P.113D-1206-1)*. One is fitted on frame 12 aft of the M.E.P.

in the starboard equipment compartment while the other is fitted on frame 12 in the main battery compartment in the port side of the fuselage.

Engine fires operation

5. A fire in the port engine bay which results in the operation of one or more of the resetting detectors, completes circuit X3 (fuse 75) and X31, causing the port engine fire warning lamp to light. Similarly, the operation of any starboard detector will bring on the starboard warning lamp. Pressing the push switch adjacent to the warning lamp will discharge the appropriate extinguisher into the affected engine bay.

Inertia switch operation

6. The operation of both piston-type inertia switches completes the circuit X1-X16 to energize No.5 relay in the distribution box. The relay closes and completes the circuits X1-X21, X13 and X14, resulting in the fuselage extinguisher discharging into the tank bay, and the engine extinguishers discharging into the engine bays and the fuel bay in the fuselage (Mod.3773). The energizing of No.5 relay also breaks circuit P91-P92 and opens the Type R main relay. This results in the isolation of the power supplies to all electrical circuits except those for the fire extinguishers, canopy and hatch jettison, No.6 belly tank explosion suppression and photo-flash jettison.

Inertia switches (post Mod. 2340)

7. Two Mk.2 piston-type inertia switches *(A.P.113D-1206-1)* are embodied in the fire circuits; one is installed in the equipment compartment at the port side of the fuselage aft of the pressure-bulkhead and the other below the M.E.P. in the starboard equipment compartment. The switches are connected in series and are arranged to actuate two Type S relays, numbered 1 and 2, mounted on the M.E.P.

Test switch (post Mod. 2340)

8. A test switch, which when operated tests both warning lamps simultaneously, is fitted adjacent to the fire extinguisher buttons on the miscellaneous instrument panel.

Engine fires operation (post Mod. 2340)

9. The engine fire warning lamps embodied in the switch unit knobs light, if any of the resetting detectors in their associated circuits should operate. A fire in the port engine bay which results in operation of one or more of the resetting switches completes the circuit between X3 (fuse 75) and X31,

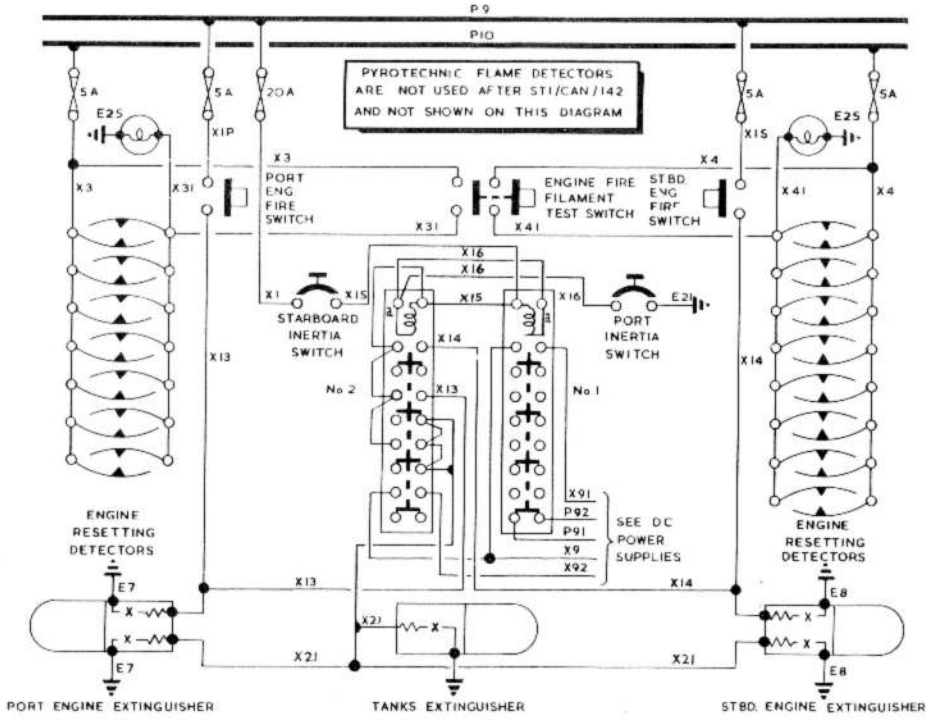


Fig. 2. Fire detectors and extinguishers (post Mod. 2340)

causing the port engine fire warning lamp to light. Similarly, if the starboard detector switches should operate, the circuit X4 (fuse 74) and X41 is completed, causing the starboard engine fire warning lamp to light. If indication of fire is given by the lamp in the port engine fire switch, pushing the switch knob IN will pass a supply from circuit X1P (fuse 71) to X13 and discharge the port Type 14A extinguisher into the port engine bay. On similar indication being given by the starboard engine fire warning lamp, the operation of the starboard switch knob completes the circuit X1S (fuse 72) and X14 to discharge the starboard Type 14A extinguisher into the starboard engine bay.

Inertia switch operation (post Mod. 2340)

10. If both inertia switches trip during a crash landing, a supply is fed from X1 (fuse 2) to X15 and X16 which energize the No.1 and No.2 crash relays. The closing of No.2 relay connects the circuit X1 and X15 to circuits X13, X14 and X21 resulting in, the Type 12A extinguisher at frame 27A discharging into the fuselage, one operating head of the Type 14A extinguishers, in the main wheel wells, discharging into the engine bays and the other discharging into the fuel bay in the fuselage. The closing of No.1 crash relay completes circuit X9 (fuse 4), X91 and X92 which closes down both generators, trips the reverse current circuit breakers, and breaks the circuit P91 (fuse 1) - P92 and P93 to open the battery isolation relay, Type R *(Group P, Appendix 1)*. This disconnects the main batteries from all aircraft circuits except those for photoflash jettison, canopy and

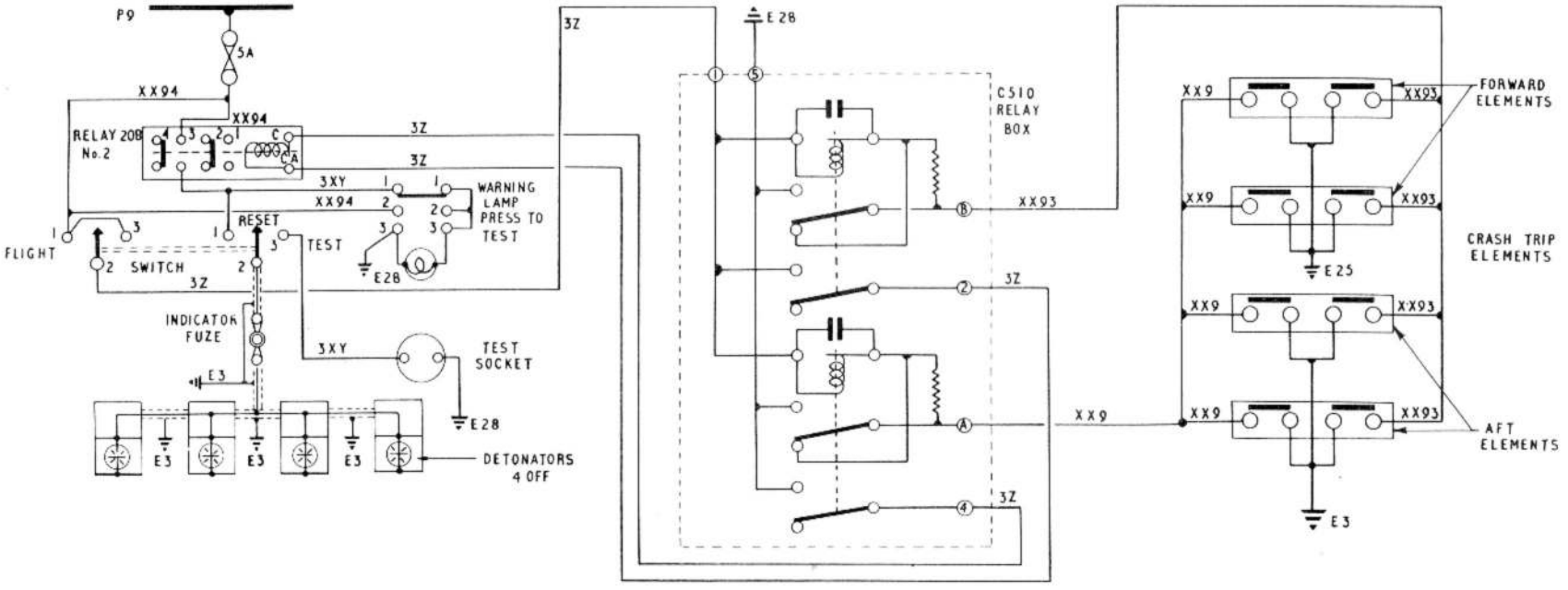


Fig. 3. No. 6 belly tank explosion suppression

hatch jettison, explosion suppression and the fire extinguishers.

NO.6 BELLY TANK EXPLOSION SUPPRESSION

Note...

Attention is drawn to the warning and safety precautions included under SERVICING.

General

11. Mods.2000 and 3302 introduce an explosion suppression system provided for the protection of the No.6 (belly) tank in the event of a crash landing. The system comprises four explosion suppression units complete with detonators mounted in the tank, and a crash trip installation which provides that the explosion suppression units are automatically discharged in a crash landing. The system is initially controlled by a double-pole switch, having three positions FLIGHT - RESET - TEST, which operates in conjunction with a Type 20B, No.2 relay, a warning lamp integral with a press-to-test switch and a test socket; the switch and its associated equipment being mounted in the flare bay on the aft face of frame 21B. Prior to flight the switch is set to the FLIGHT position, the RESET and TEST positions being used for servicing purposes only.

Crash trip elements, Type 12C

12. Four crash trip elements *(A.P.4343E, Vol.1, Sect.14, Chap.20)* are embodied in the explosion suppression system; the elements are mounted in pairs on the underside of the fuselage, two being installed forward of the nose wheel and two aft of the flare bay between frames 29 and 30. The elements are connected in parallel and are arranged to actuate a Type C510 relay box.

Graviner relay box, Type C510

13. This unit is mounted in the upper equipment compartment on the starboard side at frame 12 and incorporates two miniature relays, each in circuit with a capacitor and resistor.

Explosion suppression unit and detonator Type 116, Mk.1

14. The explosion suppression unit *(A.P.1661F, Vol.1, Sect.1, Chap.7)* consists of a cylindrical metal canister having a central detonator tube, in which a detonator *(A.P.1661F, Vol.1, Sect.5, Chap.6)* is located. A mixture of aircraft engine fuel and an extinguishing agent is contained within the canister, the wall being scored in such a manner that, when burst by the detonator, it opens like the petals of a flower. This gives an even distribution of suppressant into the fuel tank, and a minimum of loose particles from the canister.

Indicator fuze

15. An indicator fuze Ref.No.27N/177 *(A.P.1661F, Vol.1, Sect.5, Chap.8)*, mounted on the aft face at the starboard side of frame 21B, indicates when the explosion suppressors in the tank have been discharged. Also, by severing the electrical connection to the tank, the fuze obviates the possibility of an electrical spark occurring in the tank after suppression action.

Operation

16. In the event of a crash landing resulting in the crash trip elements closing, a supply is fed from a fuse in the M.E.P. via X94 through the FLIGHT - RESET TEST switch in the FLIGHT position, the capacitors on the coils in the Type C510 relay box and to complete the circuit momentarily via the closed crash trip elements; the capacitors are charged, the relays operate and are held on through the resistors and the operated contacts.

17. The energized Type C510 relay box completes the energizing circuit to the Type 20B, No.2 relay which closes and feeds a supply via the FLIGHT - RESET - TEST switch and an indicator fuze Ref. No.27N/177 to discharge the explosion suppression units into the tank.

DETONATOR CIRCUITS

General

18. The pilot's canopy, navigator's roof hatch, and wing tip fuel tanks may be jettisoned when necessary. The jettison system operates by exploding electrically-fired detonators housed in the attachment bolts of the jettisonable components. The canopy is secured by thirty-two and the roof by thirty-four of these bolts. The wing fuel tanks, when installed, are attached by three bolts each. Provision is also made, by means of an explosive charge fired by a detonator, to cut the elevator control tube at a point below the console.

Resistors

19. Each detonator is fed through a 15

ohm resistor, those used in the canopy and hatch circuits being housed in boxes holding a maximum of eight. Four boxes are used in the canopy circuits and positioned two at each side of the cockpit below the coaming tube. The hatch resistors are carried in five boxes, three of which are situated in the aft end of the cabin and the others in the upper equipment compartment aft of the pressure bulkhead. A resistor for the elevator control detonator is situated inside the console. Three resistors are permanently fitted in each wing tip ready for use with wing tip fuel tanks when these are to be installed.

Operation

Canopy jettisoning

20. Canopy jettisoning is controlled from the pilot's switch unit at the outboard side of the throttle levers. The switch unit consists of a box containing a Type S relay, a top panel on ◀ which is mounted a CANOPY/SNATCH MASTER ▶ switch and a CANOPY JETTISON switch, and two end panels each carrying two terminal blocks. The detonator in the elevator control severance unit is also ◀ controlled by the CANOPY/SNATCH MASTER switch together with a microswitch ▶ mounted on the snatch unit. The switch is operated by a gas-operated piston when the ejection seat face-screen or seat-pan firing handle is operated.

Hatch jettisoning

21. Provided that the SAFETY switch is in the ON position, selection of the JETTISON switch completes the circuit X61 through X62 to X63 to fire the hatch detonators. Operation of the ejection seat face-screen or seat-pan firing handle will cause the microswitches in the hatch jettison mechanism to be operated *(fig.4)* and, provided that the SAFETY switch is in the ON position *(Sect.3, Chap.11)*, completes the circuit X61 through X62 to X63 to fire the hatch detonators. Selection of the JETTISON switch will jettison the hatch without seat ejection *(Sect.3, Chap.11)*.

Snatch unit

22. The operation of the ejection seat face screen or seat pan firing handle closes the snatch unit switch to complete the circuit X53 and X55 which energizes the Type S1 relay in the pilot's jettison switch unit. The relay closes to complete the circuit X53 and X56, which fires the elevator control detonator. In addition to closing the snatch unit switch, operation of the ejection seat face screen or seat pan

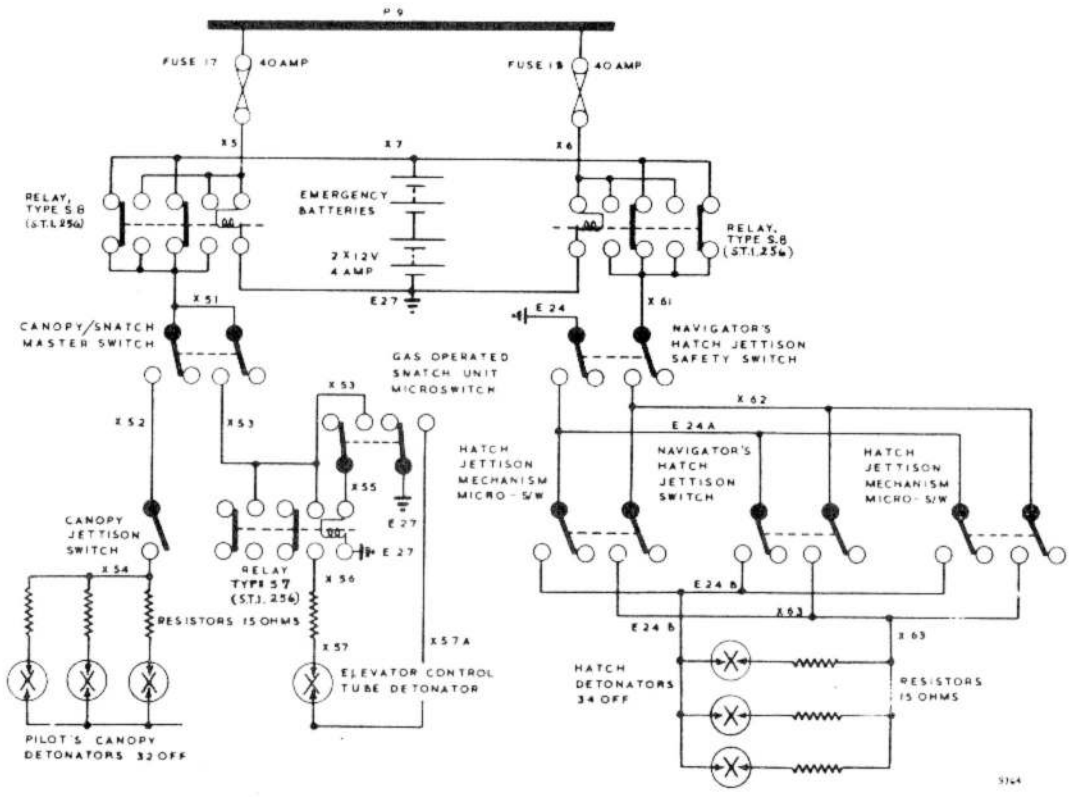


Fig. 4. Canopy and hatch jettison

◀ MOD. 4435 EMBODIED ▶

firing handle operates the snatch unit *(Sect.3, Chap.11)* which results in the control column being jerked forward against the instrument panel to give the pilot ejection clearance.

Power supplies

23. The normal power supply for operating the canopy, elevator snatch unit, and hatch detonator circuits is taken from the main battery busbar P9. In the event of failure of the normal supply, the detonator circuits are automatically transferred to the emergency battery circuit X7, the transfer being achieved by the functioning of two Type S relays positioned below the emergency batteries. During normal operation the change-over relays are held in the closed position by an energizing feed from circuit P9; if this feed is broken, the relays open and the circuit supply is transferred to busbar X7 via the contacts of the relays in the de-energized position.

Wing-tip fuel tank jettisoning

24. Fuel tanks carried at the wing tips can be jettisoned when necessary by operating the shielded TANK JETTISON switch, fitted on the console top panel, which completes the power supply from busbar P10 to the three detonators serving each tank. The tanks are not normally expendable and are only jettisoned in an emergency.

OXYGEN WARNING INDICATORS

General

25. The Mk.17D or 17E oxygen regulators are provided with electrical means for operating remote indicators. The latter are magnetically-operated, showing white by day and fluorescent at night, and blink in unison with the integral flow indicators in the regulator units. The pilot's indicator is on the instrument flying panel, while another for the navigator's use is near the roof at his aft station between frames 6 and 7 at the starboard side. The navigator's indicator is operated by the regulator fitted at his station in the nose and shows that the flow of oxygen is satisfactory before he takes his position there.

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.

FIRE EXTINGUISHER SYSTEM

Preparation for circuit tests

26. Before making functional tests on the fire extinguisher circuits, all extinguishers must be removed. Ensure that fuse 2 is fitted at the M.E.P. and fuses 71, 72, 74 and 75 are fitted in the E.C.P.

Engine fire detector circuits

27. Functional tests should be made periodically on the installed fire detectors using a battery-operated muff-type heater Ref.No.5G/566 which should be placed on the barrel of each detector in turn. When the temperature of the barrel reaches approximately 300 deg C the detector switch contacts should close and operate the appropriate warning lamp. If a heater unit is not available the following procedure can be followed, but it must be understood that this only checks the continuity of the cable run between the first and last switch in each circuit and does not test the functioning of the detector units.

(1) Remove the two attachment bolts of the lower centre detector fitted to each engine firewall and the top detector at each engine bay outboard rib. Remove the cover from the base of these detectors to gain access to their terminals.

(2) Connect together, in turn, the terminals of the partly dismantled detectors in each engine bay. The appropriate warning lamp should light each time.

(3) Replace all covers and refit detectors.

(4) Provided that they function satisfactorily when tested with a heater unit, no servicing is necessary with these detectors. They are adjusted during manufacture and no attempt should be made to alter the settings of their internal mechanism. Any detectors proved to be faulty should be renewed.

Extinguisher circuits

28. The following procedure can be used to check the extinguisher circuits:-

(1) Connect a test lamp to pins A and

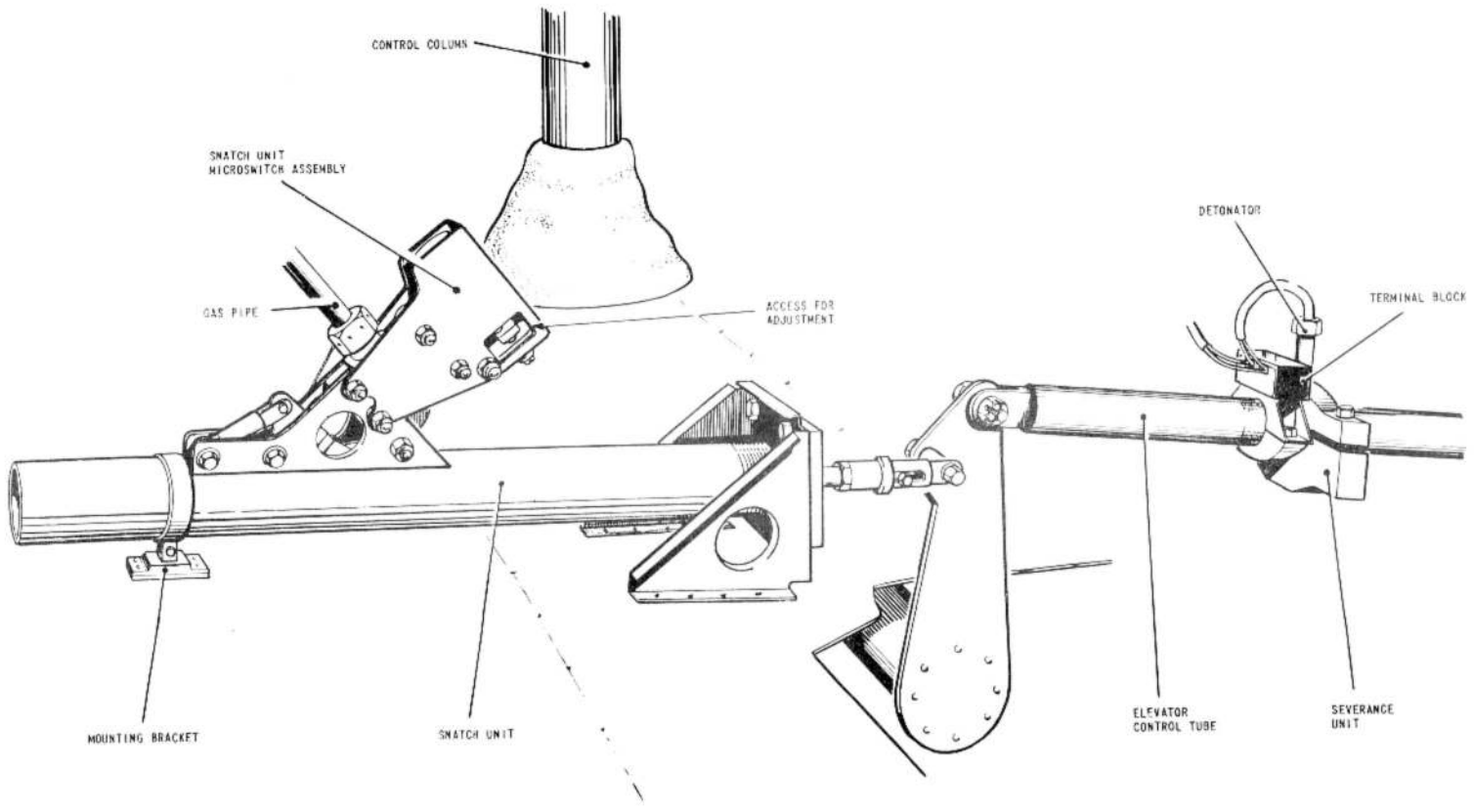


FIG. 5. SNATCH UNIT ASSEMBLY (POST MOD.4435)

B of the Plessey sockets on cable 7F in the port wheel bay, cable 8F in the starboard wheel bay, and cable 3B at frame 27A. On aircraft post Mod.3773, also connect test lamps to pins B and C on cables 7D and 8D in the port and starboard wheel wells respectively.

(2) Press the port and starboard engine fire push switches in turn. The appropriate test lamp should light each time.

(3) Test facilities are not embodied in the piston-type inertia switches, and circuit tests consist of checking the continuation of the cables connected to them. After removing the four screws which secure the covers on the two inertia switches, short together the terminals of each switch at the same time, No.5 relay in the distribution box should close, and all three test lamps should light (on aircraft post Mod.3773 two extra test lamps are used and therefore, five lamps should light).

On conclusion of the tests, remove the test lamps and replace the inertia switch covers.

Extinguisher circuits (post Mod.2340)

29. The following procedure can be used to check the extinguisher circuits:-

(1) Connect a test lamp to pins A and B of the two-pin Plessey socket on cables 7F and 8F in the port and starboard wheel wells respectively. (These cables connect to the Type 14A extinguisher heads directed to the engine bays).

(2) Press the port and starboard engine fire switches in turn. The appropriate test lamps should light each time.

Inertia switch circuit (post Mod.2340)

30. The circuit should be checked as follows:-

(1) Connect a test lamp to the Plessey socket of cable 3B which has been disconnected from the Type 13A extinguisher at frame 27A.

(2) Connect a test lamp to pins B and A of the Plessey sockets on cables 7F and 8F, in the port and starboard wheel wells respectively. On aircraft post Mod.3773, also connect test lamps to pins B and C on the Plessey sockets on cables 7D and 8D in the port and starboard wheel wells respectively.

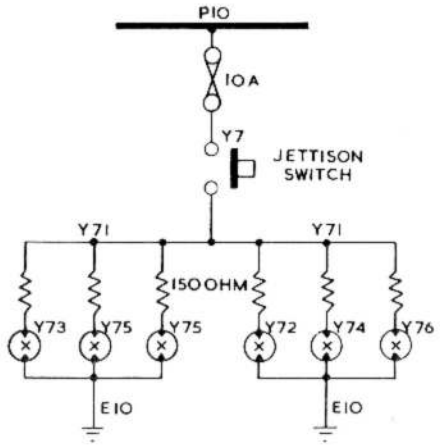


Fig.6. Wing-tip fuel tank jettison

(3) After removing the four screws which secure the covers on the two inertia switches, short together the terminals on each switch at the same time. This action energizes the two crash relays from X1 via X15 and X16 and results in a supply being fed from X1 via the now closed contacts of No.2 crash relay to X13, X14 and X21 to light all five test lamps.

Extinguisher fuze test

WARNING

During this test the extinguisher must be securely held in a fixed bracket with its nozzle so directed that its accidental discharge could not result in personal injury or damage to equipment.

◀ **31.** The resistance of the extinguisher head fuzes should be periodically checked using a Mk.5 or 6 safety ohmmeter in accordance with the instructions laid down in A.P.1661F, Vol.1, Sect.5, Chap.1. ▶

EXPLOSION SUPPRESSION SYSTEM

WARNING

The attention of all concerned is drawn to the risk of injury to personnel by the accidental firing of detonators whilst they are being installed or tested. The detonators appear to be innocuous, but they contain plastic explosive and should be handled with extreme care. Circuits should always be opened before columns of suppressors are fitted and only approved types of test equipment

should be used. The live detonators and indicator fuze are explosive stores and can constitute a lethal hazard to personnel. They should be handled and stored in accordance with the regulations contained in A.P. 2608A, 2nd Edn.

General

32. Before any functional tests on the explosion suppression system are commenced, ensure that fuse 16 or fuse 155 (post Mod.1783) is fitted at the M.E.P.

WARNING

1. Do not use a megger or lamp and battery on any lead of a completed system.

◀2. Only a safety ohmmeter Mk.5 Ref. No.5G/1006388 or Mk.6 Ref.No.5G/9018429 is to be used when checking resistance and continuity of the detonators and indicator fuze.▶

Detonators

33. The following procedure checks the detonators and indicator fuze in the explosion suppression system:-

Using a safety ohmmeter, connected to the test socket, select the FLIGHT-RESET-TEST switch to TEST, and check that the total resistance of the detonators plus the indicator fuze is within ± 0.2 ohms of the value recorded on the record card adjacent to the relay box in the upper equipment compartment. If the reading is found to be outside these limits, the system should be considered unserviceable.

Note...

If a new indicator fuze or detonators are fitted, the value on the record card must be corrected to suit the new resistance value obtained.

Explosion suppression circuit test

34. To test the explosion suppression system:-

WARNING

1. On no account should the FLIGHT-RESET-TEST switch be selected to the FLIGHT position when carrying out the following tests.

2. After carrying out the tests detailed in (3), (4), (5), (6) and (7), the FLIGHT-RESET-TEST switch must be maintained in the RESET position for a period of 8-10 seconds, thus allowing the relays in the Type C510 relay box time to de-energize.

Note...

If at any stage during the following test sequence any check is not satisfied, the fault must be rectified and the complete test sequence restarted. These tests must be carried out with the aircraft main batteries connected.

(1) Check that the system warning lamp is off. Operate the PRESS-TO-TEST button and check that the lamp comes on.

(2) Check the detonators and indicator fuze in accordance with the procedure as detailed in the previous para.

(3) Select the FLIGHT-RESET-TEST switch to TEST. Operate the front section of the port forward crash trip elements. Observe that the PRESS-TO-TEST lamp remains extinguished.

(4) Allow the FLIGHT-RESET-TEST switch to return to the RESET position. Observe that the PRESS-TO-TEST lamp remains extinguished.

(5) Repeat the procedure as detailed in (3) and (4) at the rear section of the port forward crash trip elements.

(6) Select the FLIGHT-RESET-TEST switch to TEST. Operate the front and rear sections of the port crash trip elements. Observe that the PRESS-TO-TEST lamp lights, this indicates that both relays in the Type C510 relay box and the Type 20B No.2 relay have been energized. Allow the FLIGHT-RESET-TEST switch to return to the RESET position, and observe that the PRESS-TO-TEST lamp is extinguished.

(7) Repeat the procedure as detailed in (3), (4), (5) and (6) at the forward starboard, and aft port and starboard crash trip elements.

(8) Select the FLIGHT-RESET-TEST switch to TEST and observe that the PRESS-TO-TEST lamp remains extinguished.

(9) Return the FLIGHT-RESET-TEST switch to the RESET position. Check the serviceability of the lamp filament with the PRESS-TO-TEST facility.

35. When the preceding tests have been satisfactorily completed and WARNING 2

in para.34 has been observed, the FLIGHT-RESET-TEST switch should be returned to the FLIGHT position.

DETONATOR CIRCUITS

WARNING

During servicing involving any interference with the detonator circuits, fuses 17 and 18 at the M.E.P. and fuse 76 in the E.C.P. must be removed. The service batteries, emergency batteries, and any external power supply, must be disconnected.

General

36. Electrical tests on the system consist of:-

(1) A circuit test to ensure that a ◂28/24 volt supply is available at all▸ points. Before commencing this test all detonators are to be removed.

(2) A resistance test to ensure continuity of supply through the detonator leads and fuzes. Before commencing this test ensure that all electrical power supplies are disconnected. The approved test instruments are the safety ohmmeter, photo-electric Mk.5, Ref.No.5G/1006388, or the safety ohmmeter Mk.6, Ref.No.5G/9018429, and these instruments only are to be used for this test.

Note...

Test (1) is necessary before initial installation and at all subsequent detonator changes.

Test (2) is necessary when detonators are first installed and at each replacement.

Preparation for circuit tests

37. Before any tests are made on the detonator circuits the system should be prepared as follows:-

(1) Remove fuses 17 and 18 at the M.E.P. and fuse 76 at the E.C.P. Disconnect the service batteries, emergency batteries and any external power supply. Set the cocking lever of the hatch jettison mechanism to the locked position.

(2) Disconnect the 32 canopy detonators at the four resistor boxes in the cockpit and then remove the detonators.

(3) Disconnect the 34 rear hatch detonators at the three resistor boxes in the cabin and the two boxes in the upper equipment compartment. Remove the detonators.

(4) Disconnect the single detonator at the terminal block fitted to the elevator control tube and remove the detonator from the elevator control tube severance unit.

(5) If fitted, disconnect and remove the three detonators in each wing tip. These are connected to Plessey 2 and 3-way terminal blocks which are accessible after removing small detachable panels on the top surface of the wings.

◂38. The following is a resume of the tests done by the Contractor. It is included for guidance during servicing and as an aid to fault diagnosis. When▸ the above preparations are completed proceed as follows:-

(1) Refit fuses 17 and 18 at the M.E.P. and fuse 76 in the E.C.P.

◂(2) Connect a 28V d.c. ground supply and close the battery isolation switch (this can be done by temporarily connecting P9 and P10 busbars).

(3) Reconnect the emergency battery.

(4) Switch on the CANOPY/SNATCH MASTER switch.

Note...

Before switching ON, ensure that all detonators have been removed.

Checking the canopy and elevator control tube detonator circuits

39.

Note...

To ensure that there is no cross connection between the canopy and hatch jettison circuits, it is required that a test lamp be fitted across the input terminals of a hatch jettison resistor box. It is important to ensure that this lamp does not light at any time during the following test procedure.

(1) Switch the CANOPY JETTISON switch to its ON position.

(2) Using a Type D testmeter, check the output currents at each pair of detonator terminals in the four canopy resistor boxes; the testmeter reading should be between 1.7 and 2.0 amp. ▸

◂(3) Switch OFF the CANOPY/SNATCH MASTER switch or the CANOPY JETTISON switch alternately and ensure that there is no reading with either switch OFF.

(4) Switch OFF the CANOPY/SNATCH MASTER switch and disconnect any pair of supply leads from a canopy resistor box.

(5) Return the CANOPY/SNATCH MASTER switch and the CANOPY JETTISON switch to the ON position and, using the Type D testmeter, check that the voltage across the disconnected leads is 28 volts. Check also across the points of disconnection and ensure that the testmeter again registers 28 volts.

(6) Remove fuse 17 and check that the testmeter now reads 24 volts at both positions. Repeat (3).

(7) Switch OFF the CANOPY/SNATCH MASTER switch and the CANOPY JETTISON switch, remove the testmeter and reconnect the resistor box supply cables.

(8) Manually operate the snatch unit microswitch.

(9) Connect the testmeter across the elevator control tube severance unit terminal block and, after switching ON the CANOPY/SNATCH MASTER switch, check that the output current is between 1.4 and 1.7 amp.

(10) Replace fuse 17 and check that the meter now reads between 1.7 and 2.0 amp. ▸

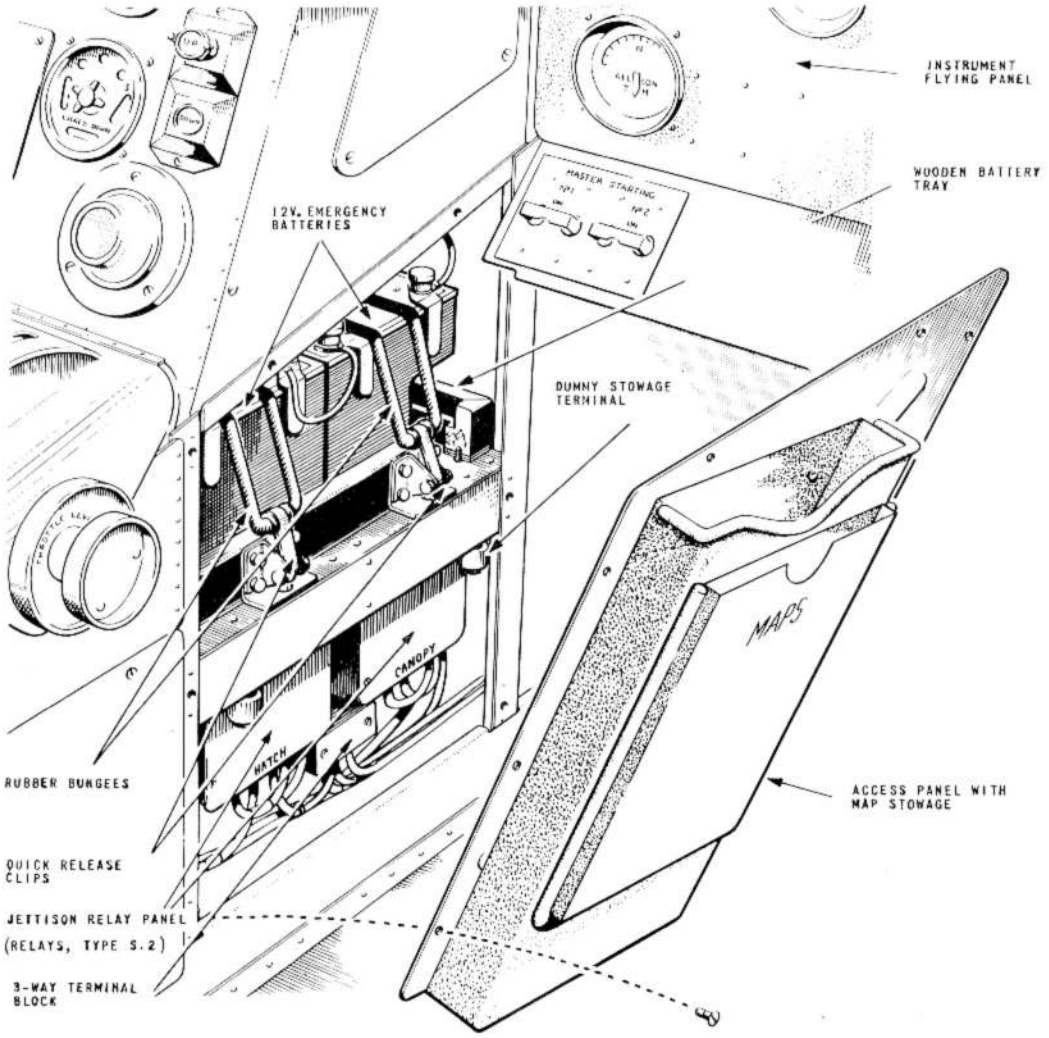


Fig. 7. Jettison relay panel

◂(11) Switch OFF the CANOPY/SNATCH MASTER switch and ensure that the testmeter now reads zero.

(12) Switch ON the CANOPY/SNATCH MASTER switch, return the snatch unit microswitch to the off position and ensure that the testmeter again returns to zero.

(13) Test the two poles of the snatch unit microswitch as follows:-

(a) Check the voltage at X57 to E.27 the meter should read No volts.

(b) Close the microswitch, the reading should be 28 volts.

(c) Open the microswitch, reading should be No volts.

(d) Ensure that all switches are OFF.

(e) Connect the ohmmeter to X57A and E.27 and close the microswitch, the meter should read approximately zero.

(f) Open the microswitch and the meter should read infinity.

40. On completion of the circuit tests, ensure that the microswitch clearance is as detailed in Sect.3, Chap.11, fig.1.

Checking the hatch detonator circuits

41.

Note...

To ensure that there is no cross connection between the canopy and hatch jettison circuits, it is required that a test lamp be fitted across the input terminals of a canopy jettison resistor box. It is important to ensure that this lamp does not light at any time during the following test procedure.

(1) At the navigator's position, switch ON the SAFETY switch and hold the JETTISON switch in the ON position. Connect the testmeter across each pair of terminals in the five resistor boxes serving the hatch detonator circuit; the reading must be 1.7 to 2.0 amp. With the testmeter connected to one pair of terminals, switch OFF the SAFETY switch and JETTISON switch alternately and ensure that there is no meter reading with either switch OFF. Switch OFF both switches.

(2) Disconnect any pair of supply leads from a hatch resistor box. ▸

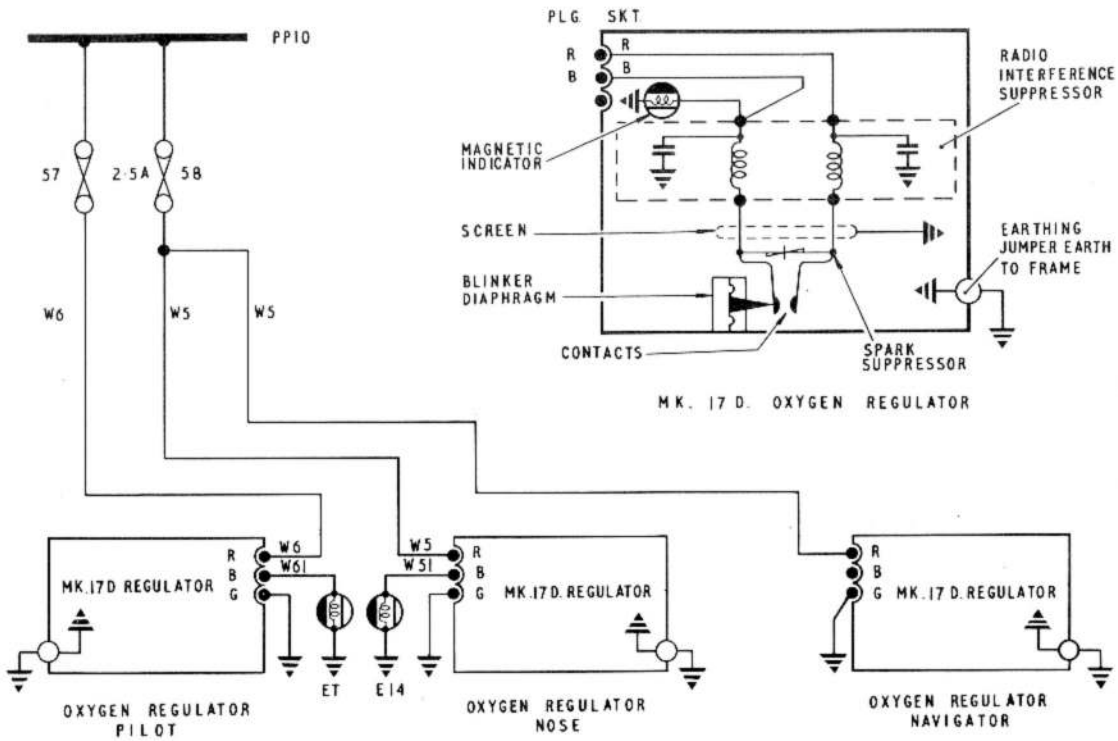


Fig. 8. Oxygen warning indicators (post Mod. 2318)

(3) Switch on the navigator's HATCH JETTISON and SAFETY switches and using a Type D testmeter, check that the voltage across the disconnected leads is 28 volts. Check also across the points of disconnection and ensure that the testmeter again registers 28 volts.

(4) Remove fuse 18 and check that the testmeter now reads 24 volts at both positions.

(5) Switch off the navigator's HATCH JETTISON and SAFETY switches, remove the testmeter and reconnect the resistor box supply cables.

42. In addition to the tests detailed in para.41, the single-lever system hatch jettison mechanism is to be tested as follows:-

Close the microswitches in the navigator's hatch jettison mechanism by operating the cocking lever and removing the sear. Switch ON the navigator's SAFETY switch and connect the testmeter across each pair of terminals in the five resistor boxes; the reading must be between 1.7 to 2.0 amp. With the testmeter connected to one pair of terminals, switch OFF the SAFETY switch and open the microswitches (by moving the cocking lever to the cocked position) alternately; ensure that there is no meter reading with either switch in the OFF position. Re-cock the mechanism and refit the sear. Ensure open end of the sear hook is to starboard.

43. Connect the emergency batteries and remove fuse 18 at the M.E.P. This action de-energizes the Type S2 relay on the jettison relay panel and switches the supply from busbar P9 to the emergency battery supply busbar X7. Repeat the tests detailed in para.41-42, at least one pair of terminals is to be checked at each operation. Replace fuse 18 and disconnect all sources of supply.

Wing-tip tank detonator circuit

44. Where applicable, test the circuit as follows:-

(1) Ensure that fuse 76 is refitted in the E.C.P. and switch ON power supply.

(2) Connect the testmeter, in turn, across each pair of terminals in the detonator terminal blocks in each wing tip *(fig.13)*. Operate the wing-tip tank jettison push-switch for each testmeter connection; the testmeter must read 1.7 to 2.0 amp. Each time the push-switch is released ensure that there is no reading on the testmeter.

45. Upon completion of the circuit tests, ensure that all circuit switches are in the OFF position and that the guards for the pilot's and navigator's jettison switches are wire-locked with 32 s.w.g. copper wire. Before installing the detonators, ensure that the WARNING preceding para.36 has been complied with.

Detonator circuits resistance test

Precautions

46. This test is effected with the detonators installed, therefore, before commencing the test on any of the detonator circuits, the following precautions must be observed.

(1) Ensure that the aircraft and emergency batteries together with any external power supply are disconnected.

(2) The batteries and external supply must remain disconnected whilst any part of a detonator circuit or its fitting is dismantled.

(3) The approved testmeters are the safety ohmmeter, photo-electric Mk.5, Ref.No.5G/1006388 and the safety ohmmeter Mk.6, Ref.No.5G/9018429. Before use the meters should be tested as detailed in A.P.4343J, Vol.1, Sect.4, Chap.3.

(4) Whilst the detonators are installed, no test method other than the following is to be employed.

Pilot's canopy and navigator's hatch circuits

47. Check the resistance at each pair of detonator terminals in the resistor boxes. The ohmmeter should read between 0.8 and 1.6 ohms.

Elevator control tube detonator circuit

48. Check the resistance across the terminals of the detonator terminal block. The ohmmeter should read 0.8 to 1.6 ohms.

Wing-tip tank detonator circuit

49.

(1) Check the resistance across the

terminals in the detonators terminal blocks in each wing tip. The ohmmeter should read between 0.8 and 1.6 ohms.

(2) Check the resistance between terminal Y71 in the d.c. distribution box and earth. The ohmmeter should read approximately 2.6 ohms.

Detonator renewal

WARNING

Do not handle the tube of the detonator. All operations must be done holding the electrical leads near to where they enter the plug of the detonator assembly. THIS IS MOST IMPORTANT.

50. Detonators are lifed and must be changed at the intervals laid down in the current Servicing Schedule for this class of explosive store.

51. A full description of the canopy, hatch and snatch unit installations is given in Sect.3, Chap.11. The installation of the wing tip tank detonators is described in Sect.4, Chap.2.

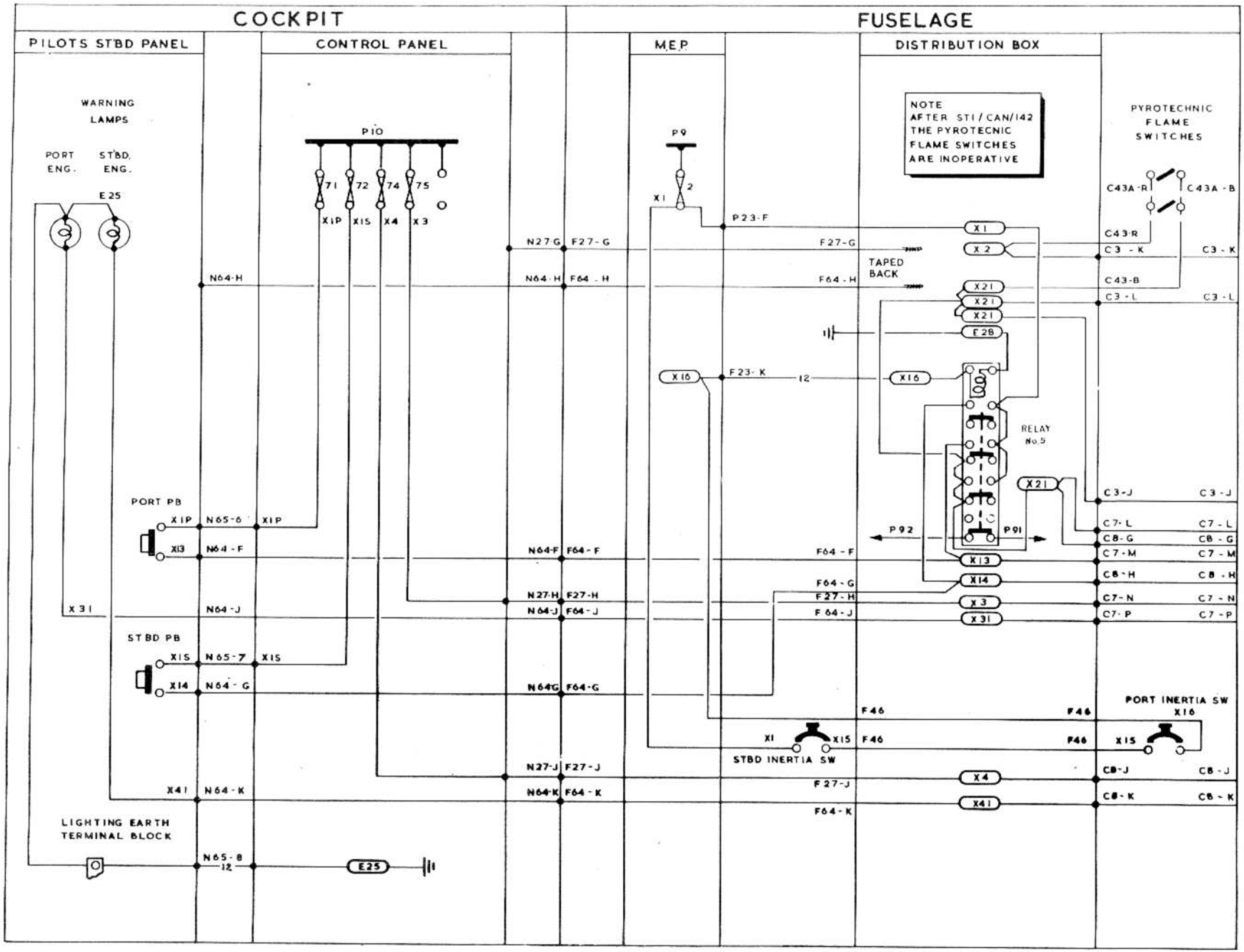


Fig. 9. Fire detectors and extinguishers

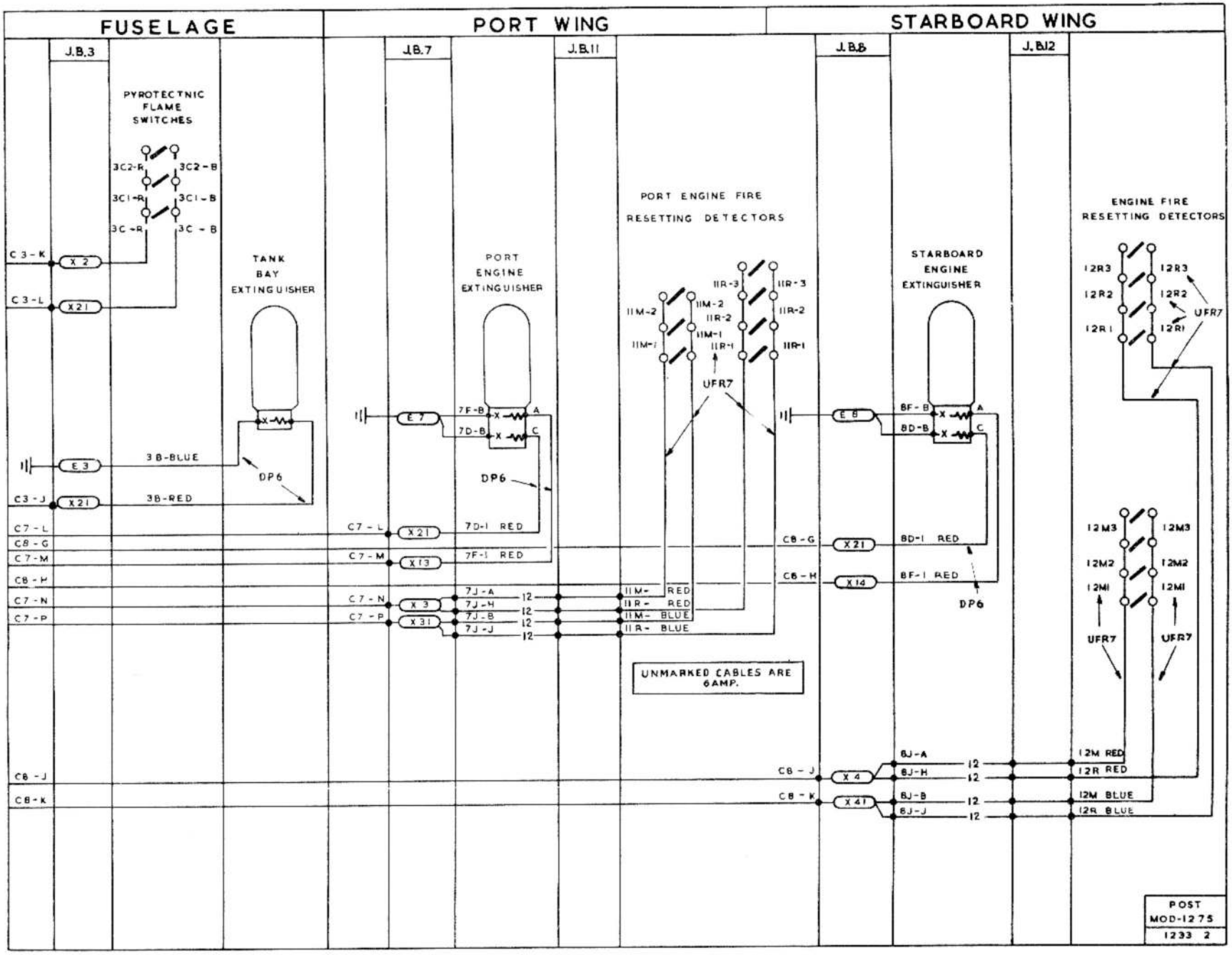


Fig. 9A. Fire detectors and extinguishers

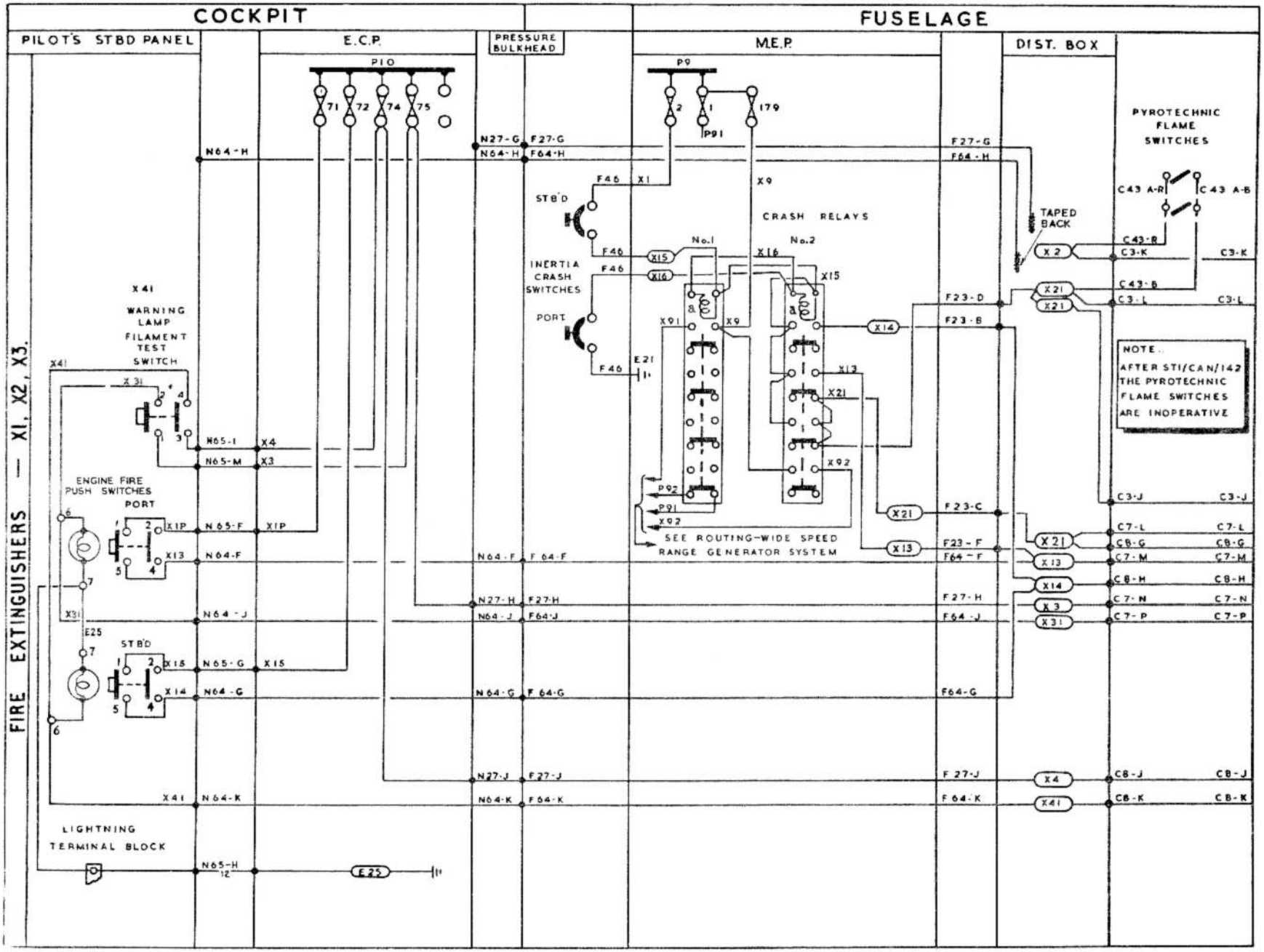


Fig. 10. Fire detectors and extinguishers (post Mod.2340)

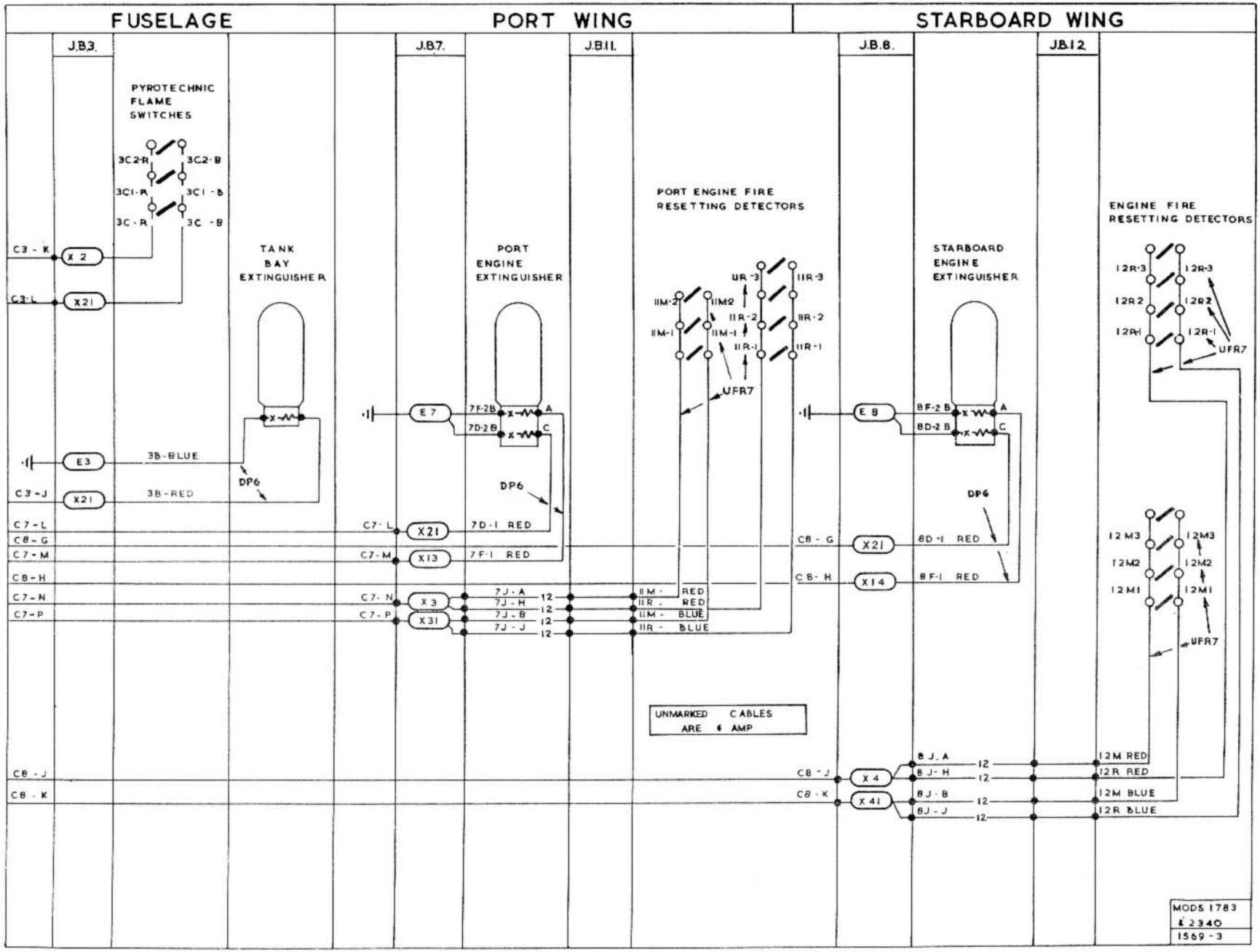


Fig. 10A. Fire detectors and extinguishers (post Mod.2340)

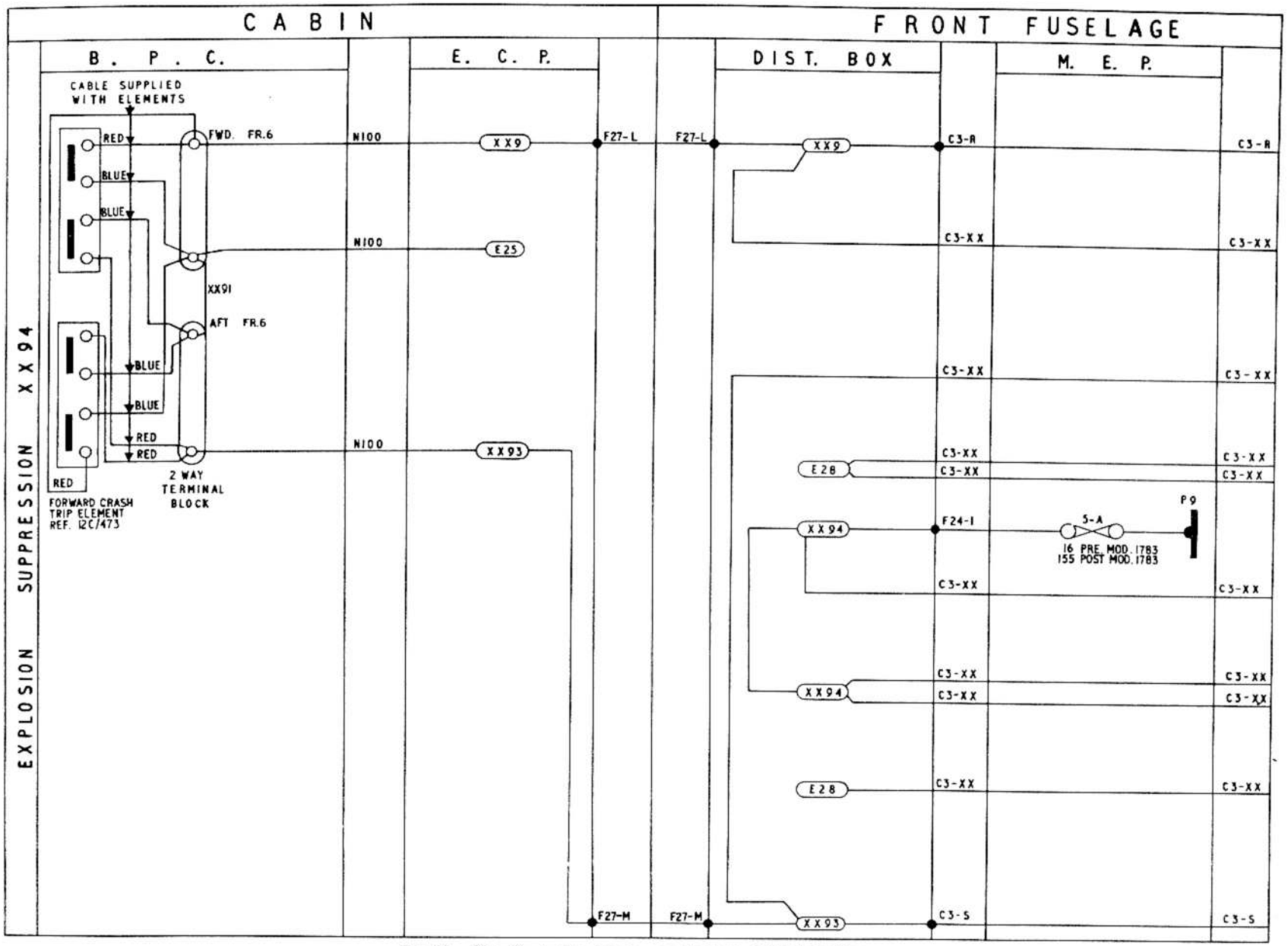


Fig.11. No. 6 belly tank explosion suppression

◀ *(Wiring of trip element revised)* ▶

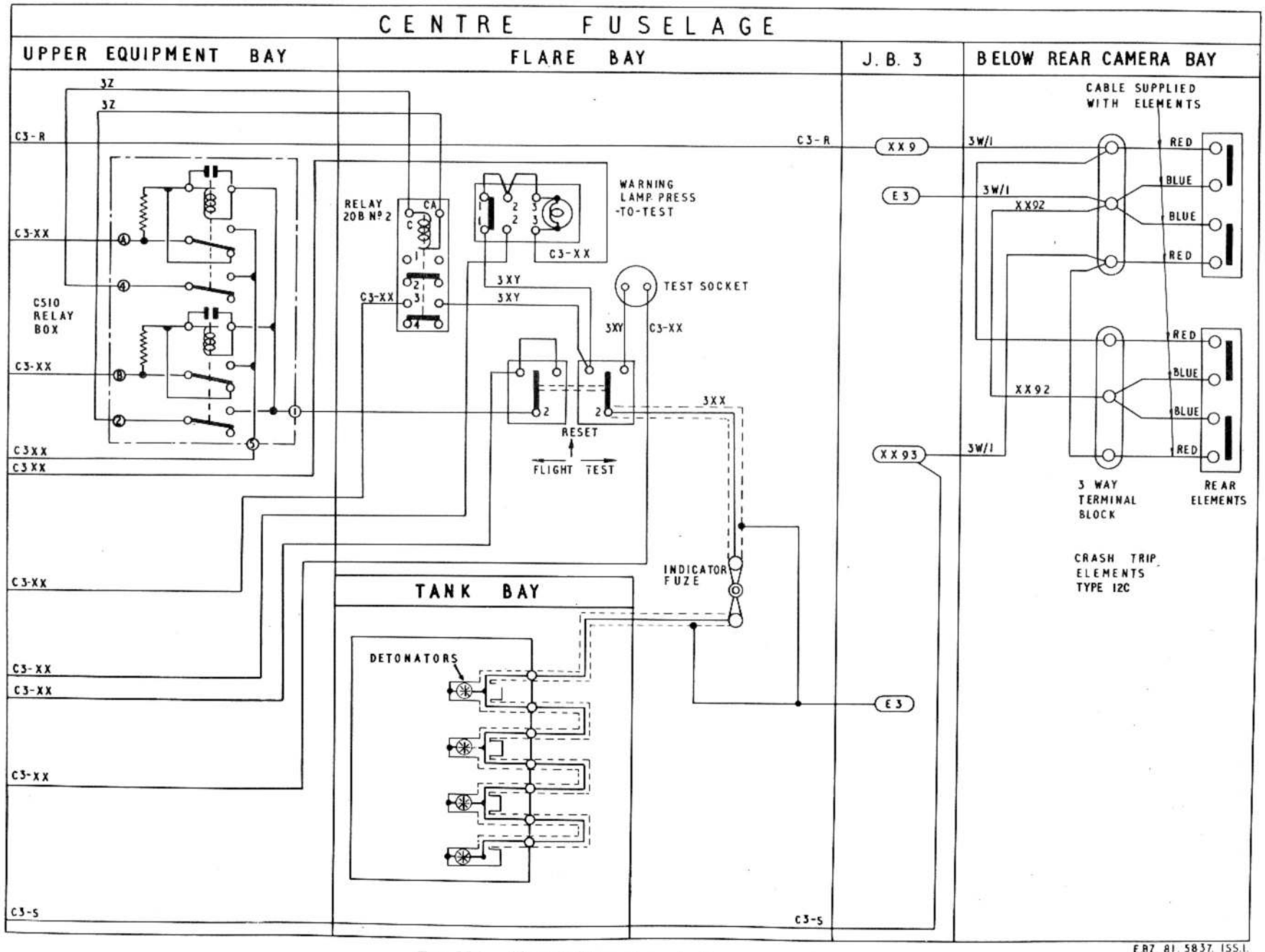


Fig. 11A. No.6 belly tank explosion suppression

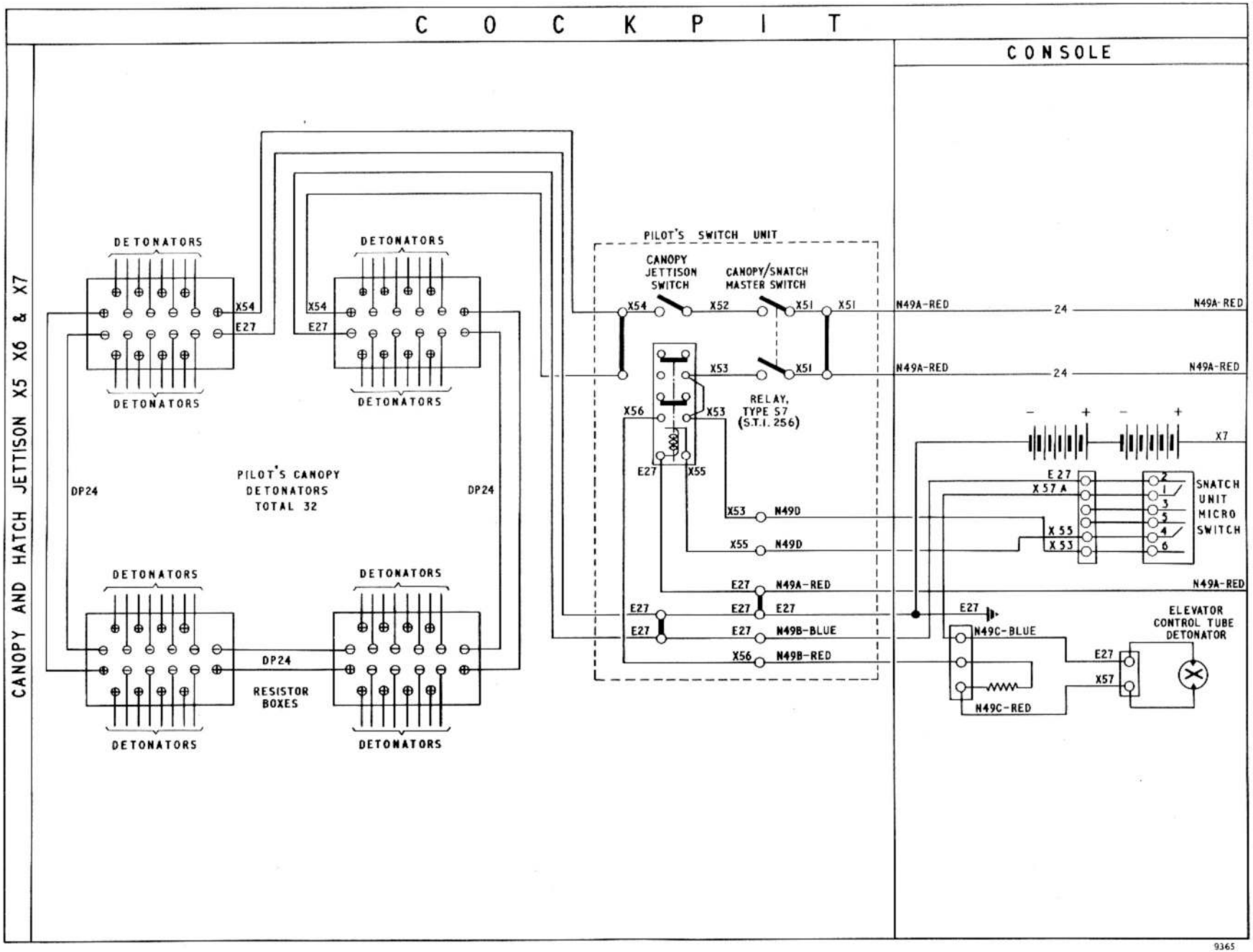


FIG. 12. CANOPY AND HATCH JETTISON

(MOD. 4435 EMBODIED)

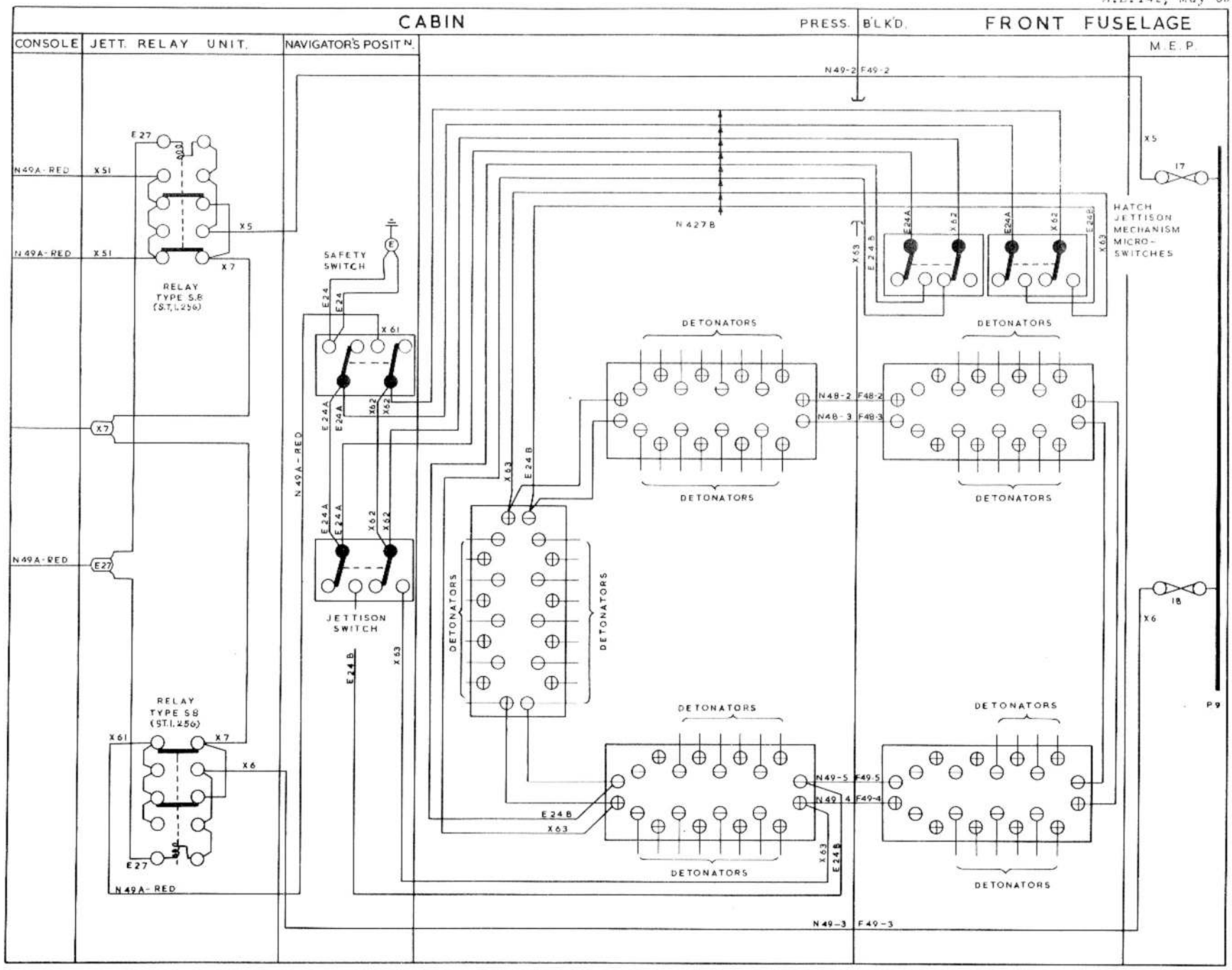


FIG. 12A. CANOPY AND HATCH JETTISON

◀ MOD. 3951 EMBODIED ▶

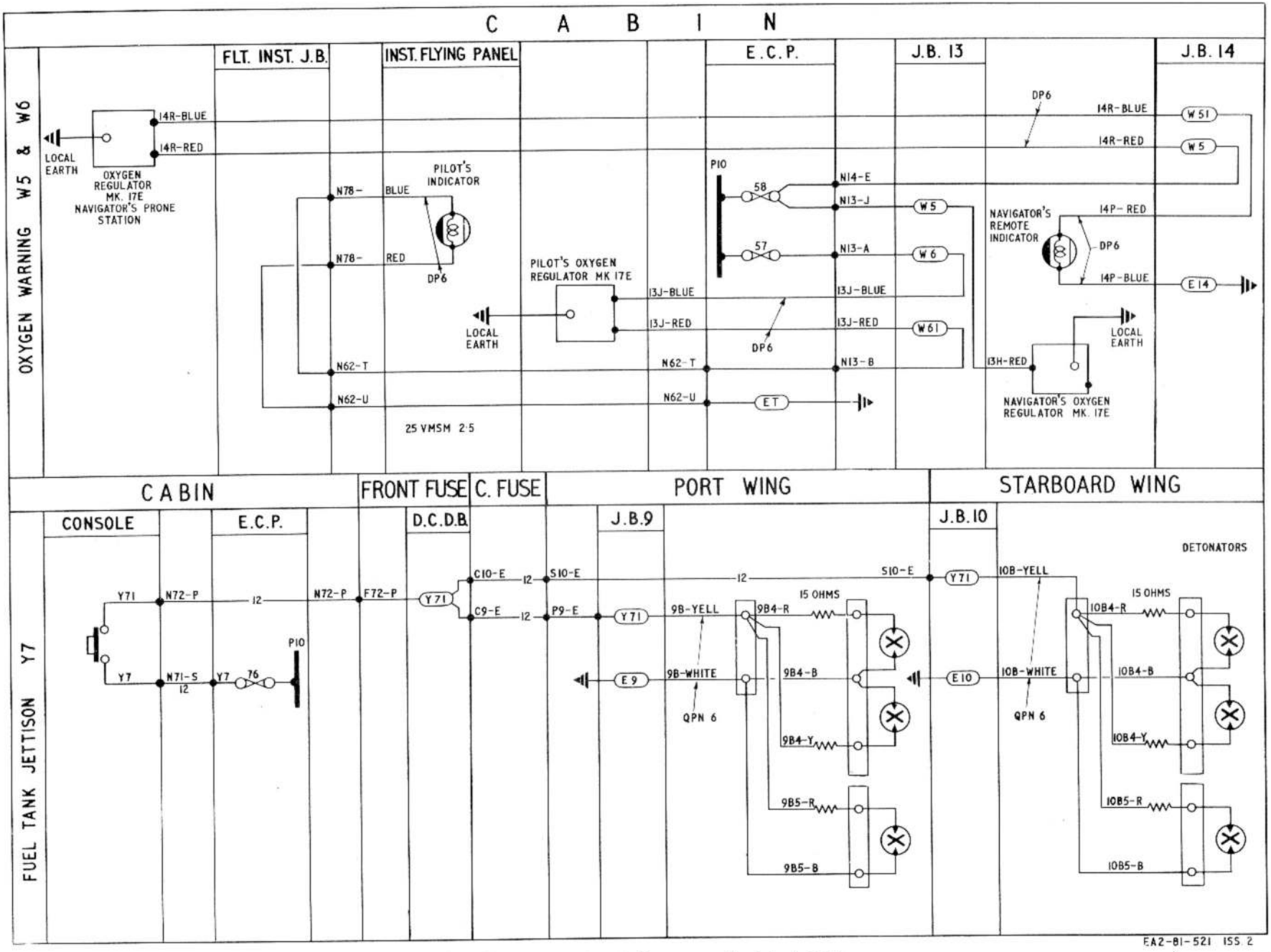


Fig. 13. Oxygen warning indicators – fuel tank jettison

Chapter 2 INSTRUMENT INSTALLATION

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ENGINE INSTRUMENTS.	E
FLIGHT INSTRUMENTS	F

Note – *A detailed list of contents will be found at the beginning of each group*

GENERAL INFORMATION

(Completely revised)

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General

1. This chapter contains descriptions of the instrument systems and gives information on their servicing. The chapter is divided into a number of groups in which the main items of equipment are described under their functional headings, and which contain theoretical diagrams near the appropriate text. Each group contains tables listing the main items of equipment and, wherever possible, the Air Publication in which they are described. There are no routeing charts in this chapter. All information concerning the aircraft electrical system is assembled in the appropriate Group in Chapter 1 – Electrical Installation.

Location of equipment

2. In the cockpit, the pilot's instruments are mounted on three panels, designated the instrument flying panel, the engine instrument panel, and the starboard panel. Below these panels is mounted the engine starter panel. At the navigator's station the instruments are mounted on a panel above the chart table. Table 1 gives a comprehensive list of all the main instruments, their item numbers on the location diagram, and wherever possible, the panel through which they are accessible.

TABLE 1

Key to location of equipment

Equipment	Location		Group	Access	
	Fig.	Item		Fig.	Item
ARMAMENT AND PHOTOGRAPHIC INSTRUMENTS	See Group A & B				
MISCELLANEOUS INSTRUMENTS					
Accelerometer	3	8		10	6
Cabin air altimeter	3	19		10	6
External air temperature indicator	4	4		10	6
Air temperature bulb	7	4		9	3
Fore-and-aft level	6	6		10	6
Phase failure indicator (post Mod.4316)	3	20		10	6
Clock	3	28		10	6
Hydraulic pressure gauge (main system)	3	22		10	6
Hydraulic pressure gauge (brakes)	3	23		10	6
Hydraulic pressure gauge (main accumulator)				10	4
Hydraulic pressure gauge (brakes accumulator)	1A	4	D		
Oxygen regulator, pilot's station	3	1		10	6
Oxygen regulator, navigator's station	4	6		10	6
Oxygen regulator, navigator's prone station	6	10		10	6
Oxygen contents gauge	3	21		10	6
Oxygen contents gauge	3	21		10	6
Remote magnetic indicator, pilot	3	34		10	6
Fatigue meter	2	4		10	9
ENGINE INSTRUMENTS					
Fuel contents gauges					
Top tanks (Nos. 1, 2, 3 and 4 tanks)	3	14		10	6
Rear tank (No. 5 tank)	3	26		10	6
Belly tank (No.6 tank)	3	25		10	6
Fuel contents amplifiers			E		
Top tanks	2	3		10	9
Rear tank	2A	3		10	9
Belly tank	1A	2		10	9
Fuel contents trimmers					

TABLE 1 *(continued)*

Key to location of equipment

Equipment	Location		Group	Access	
	Fig.	Item		Fig.	Item
Top tanks	2	1		10	9
Rear tank	2A	1		10	9
Belly tank	1A	12		10	9
Fuel contents tank units					
No.1 tank, No.2 tank, No.3 tank, No.4 tank (Top tanks)	1A	3		10	3
Rear tank	1-1A; 2-2A	2, 1; 2, 2		10	12
Belly tank	1A	11		10	3
Fuel pressure warning					
Indicator (port), Indicator (starboard)	3	17		10	6
Pressure switch (port)	7	3		10	5
Pressure switch (starboard)	8	2		10	5
Exhaust gas thermometer			E		
Indicator	3	13		10	6
Cold junction compensator (port)	7	7		10	8
Cold junction compensator (starboard)	8	7		10	15
Thermocouples (port)	7	9		10	10
Thermocouples (starboard)	8	6		10	14
Voltage compensator					
Oil pressure gauges					
Indicator (port)	3	11		10	6
Indicator (starboard)	3	16		10	6
Transmitter (port)	7	2		10	5
Transmitter (starboard)	8	1		10	5
Tachometers					
Indicator (port)	3	12		10	6
Indicator (starboard)	3	15		10	6
Generator (port)	7	1		10	5
Generator (starboard)	8	3		10	5

TABLE 1 *(continued)*

Key to location of equipment

Equipment	Location		Group	Access	
	Fig.	Item		Fig.	Item
FLIGHT INSTRUMENT EQUIPMENT					
Turn-and-slip indicator	3	10		10	6
Emergency instrument supply indicator	3	30		10	6
Rate-of-climb indicator	3	9		10	6
Artificial horizon	3	7		10	6
Air speed indicator, pilot	3	5		10	6
Air speed indicator, navigator	4	3		10	6
Machmeter	3	3		10	6
Altimeter, pilot	3	4		10	6
Altimeter amplifier, pilot	8	4	F	10	6
Altimeter, navigator	4	2		10	6
Aileron trim indicator	3	32		10	6
Aileron trim transmitter	1A	9		10	6
Rudder trim indicator	3	33		10	6
Rudder trim transmitter	1	1		9	2
Tail trim indicator	3	2		10	6
Tail trim transmitter	1	3		10	13
Pitot head	1A	8		10	6
NAVIGATION INSTRUMENT EQUIPMENT					
G.M.4B compass					
Master indicator	4	8		10	6
Gyro compass unit	3	6		10	6
Control panel	5	1		10	6
Amplifier	5	5		10	6
Detector	8	4		10	1
Junction box	8	5	F	10	2
Navigator's compass repeater	6	9		10	6
Compass/direct gyro switch	3	27		10	6
E.2A compass	3	29		10	6
A.D.R.I.S.					
A.M.U. Mk.4	5	4		10	6
A.M.U. control panel	4	1		10	6
A.P.I. indicator	4	7		10	6

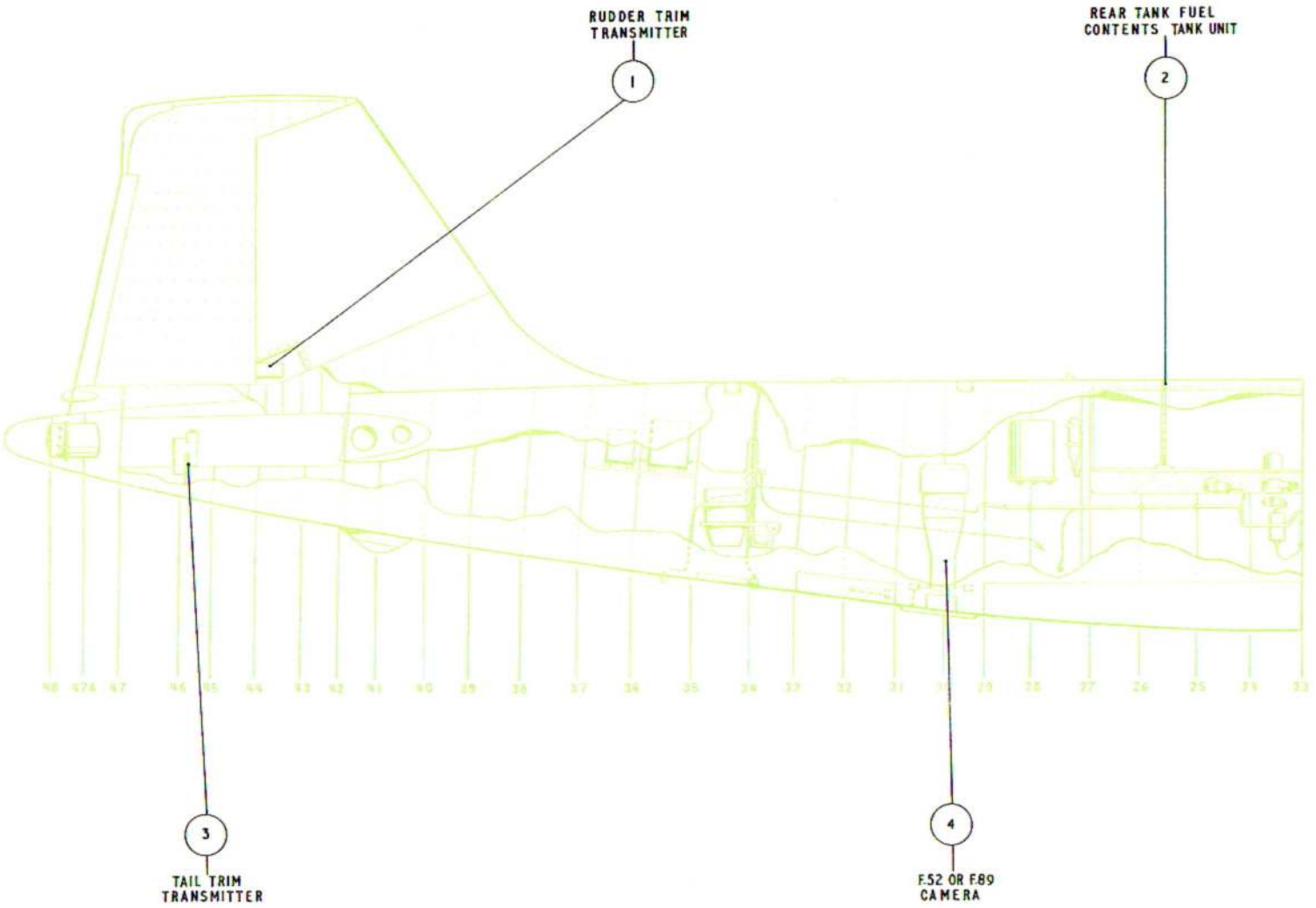

Fig. 1. Instrument installation – port fuselage

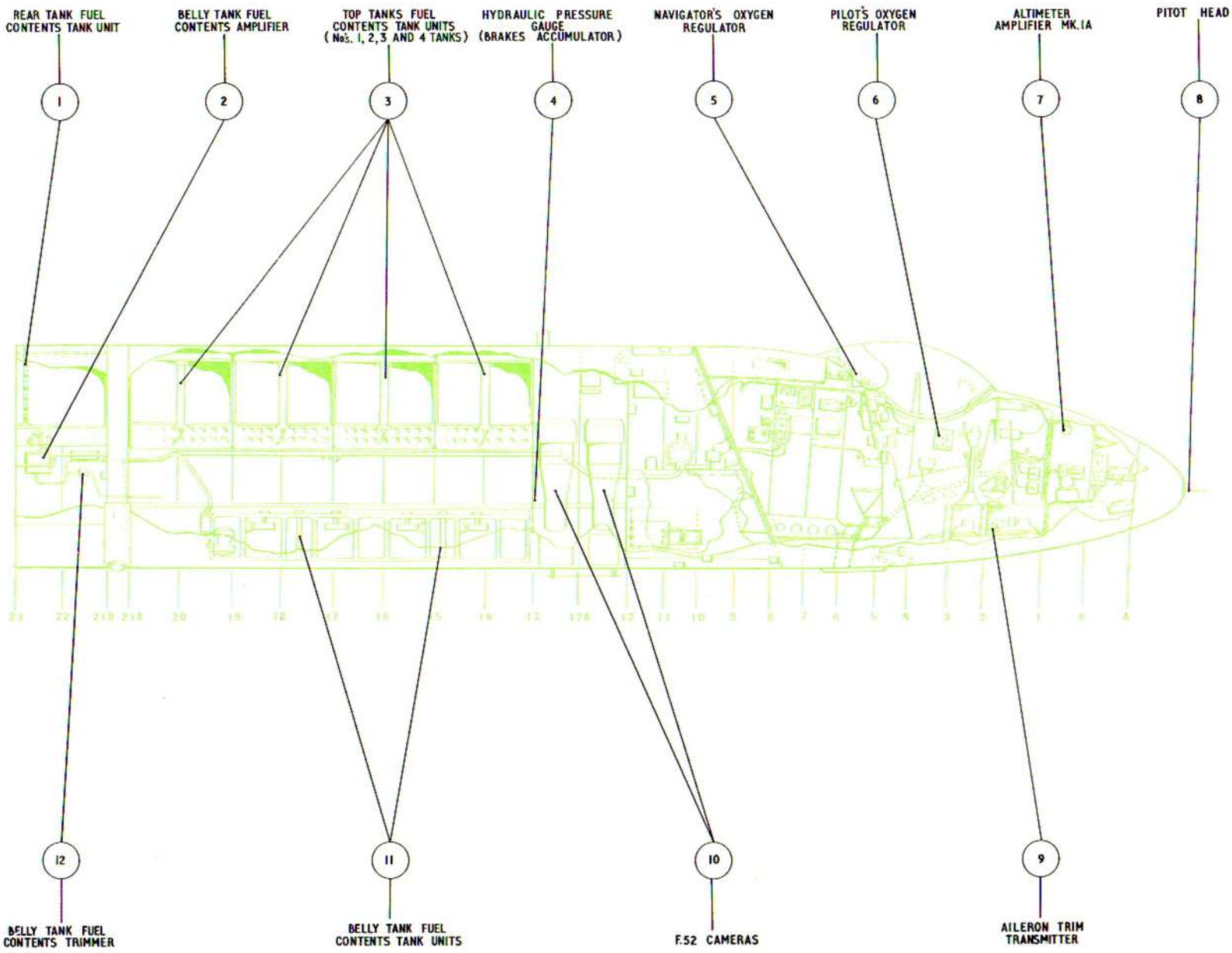

Fig. 1A. Instrument installation – port fuselage

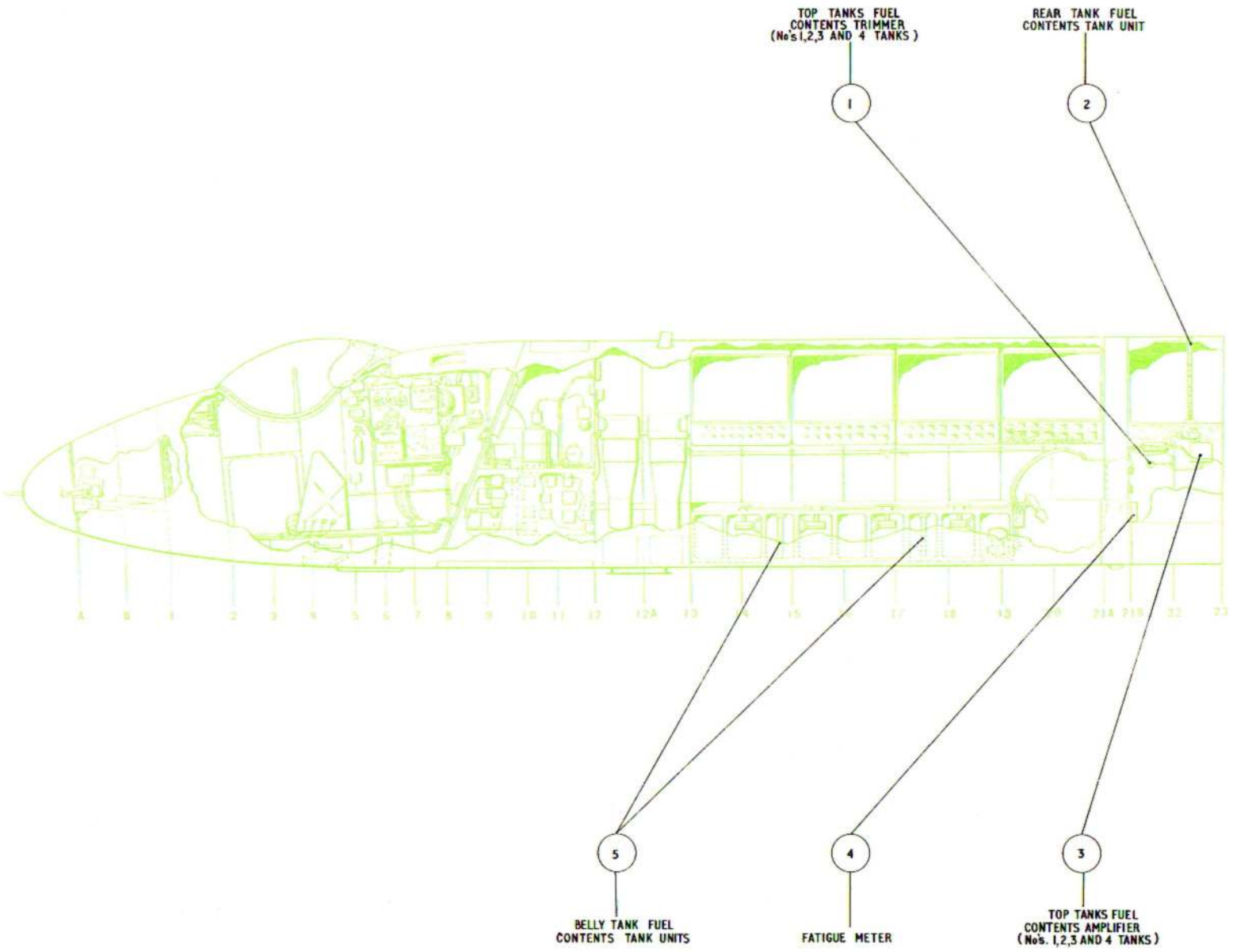

Fig. 2. Instrument installation – starboard fuselage

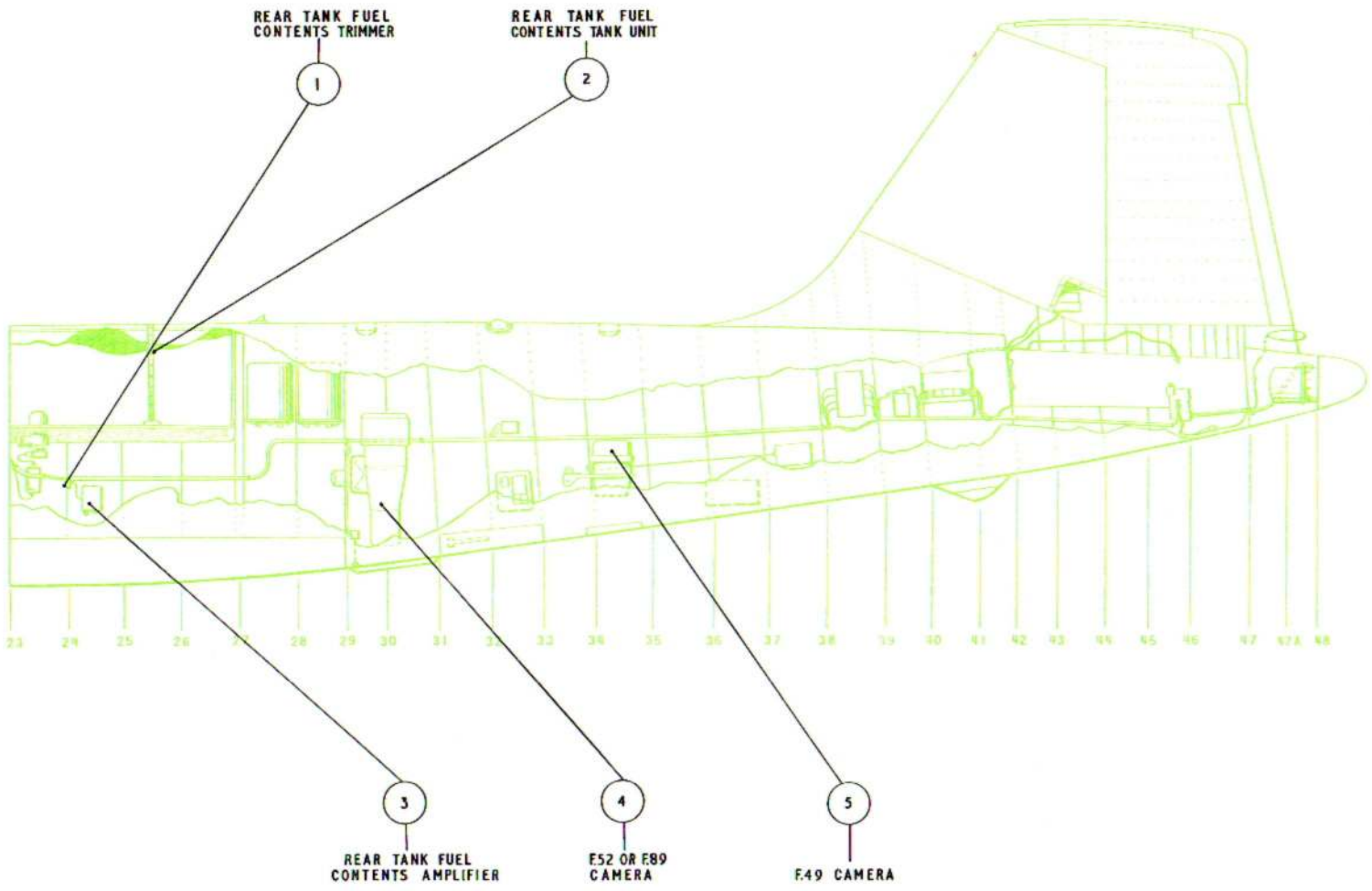

Fig. 2A. Instrument installation – starboard fuselage

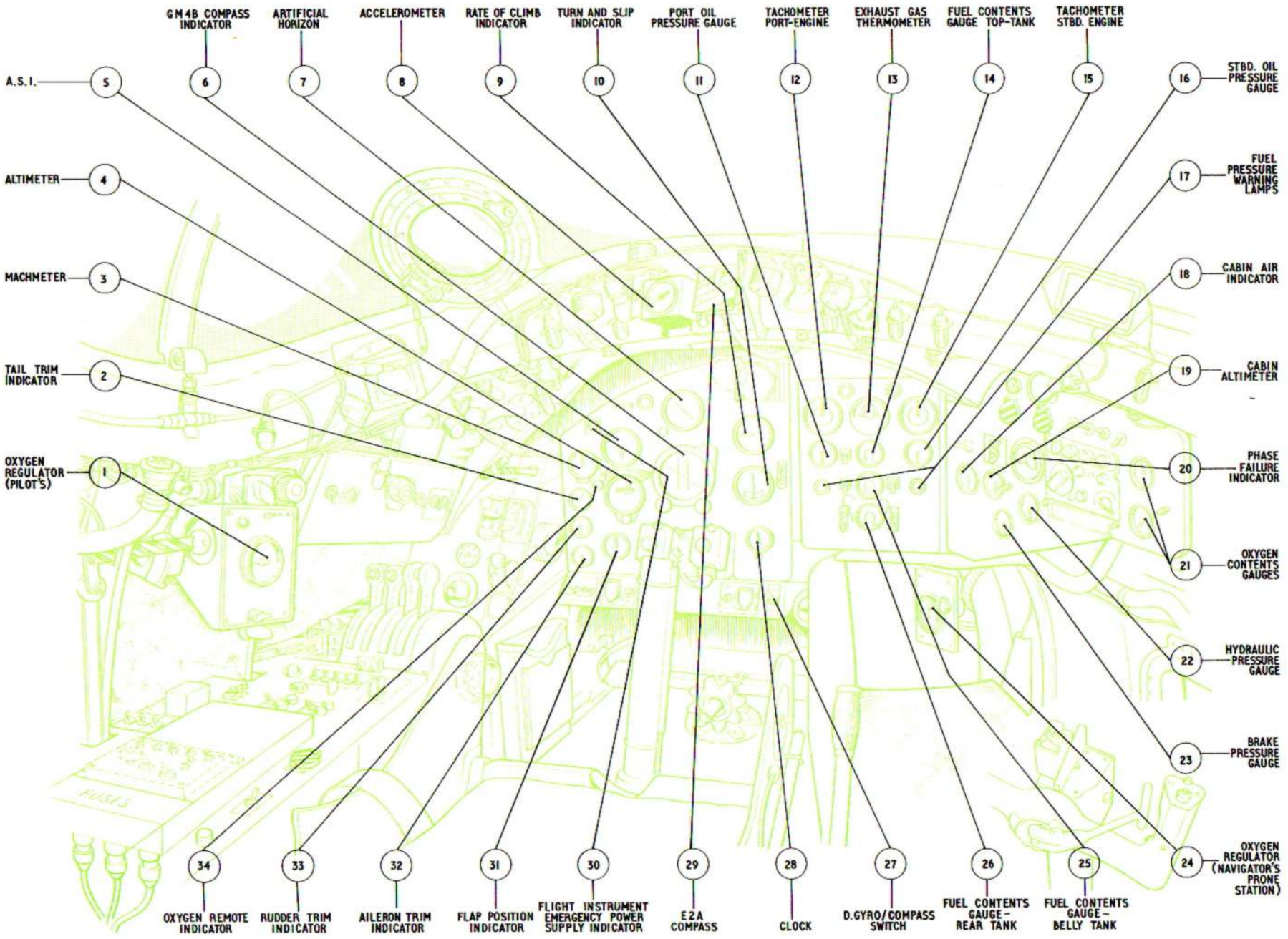

Fig. 3. Instrument installation – cockpit

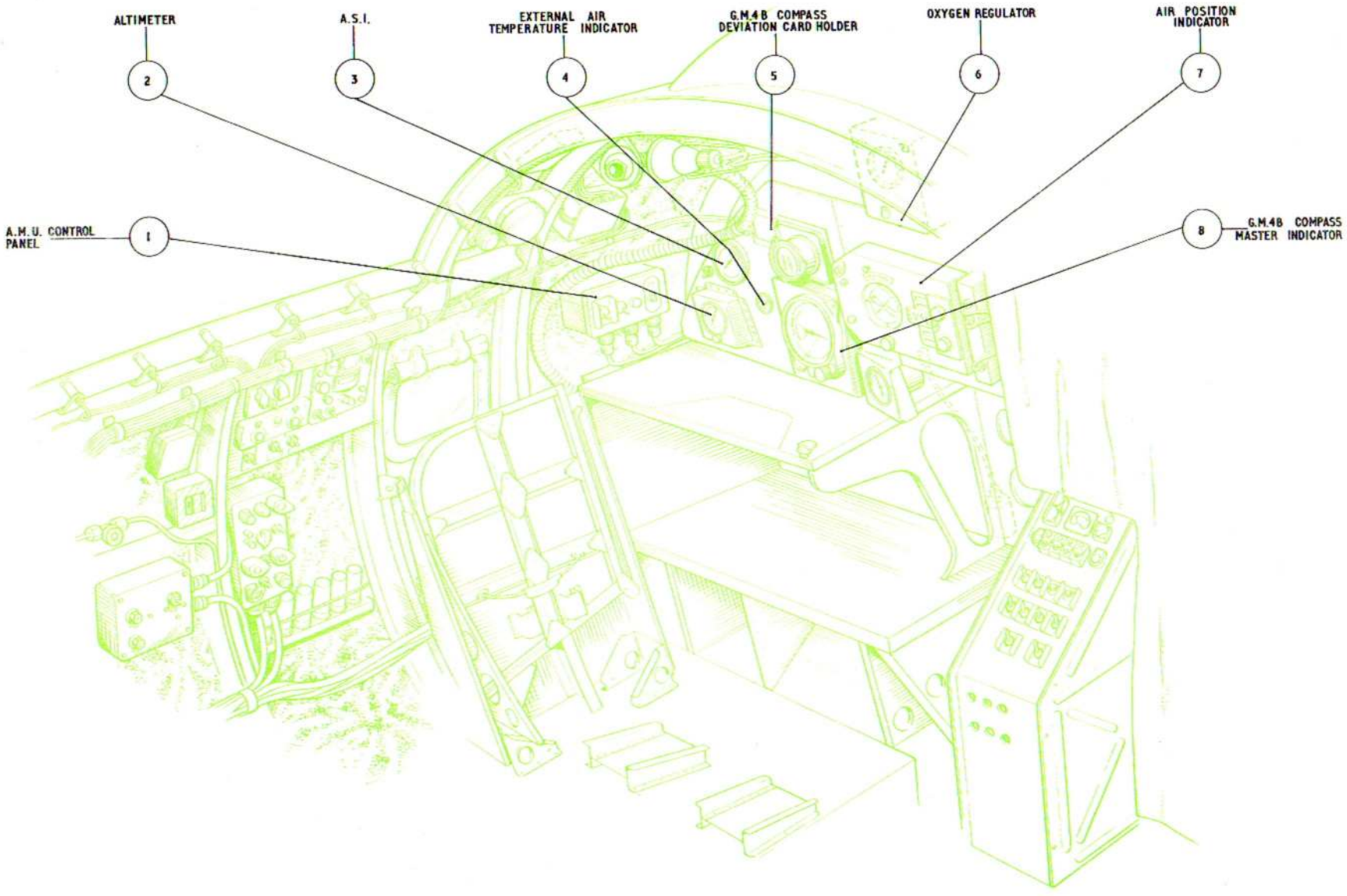

Fig. 4. Instrument installation – navigator's rear station (port)

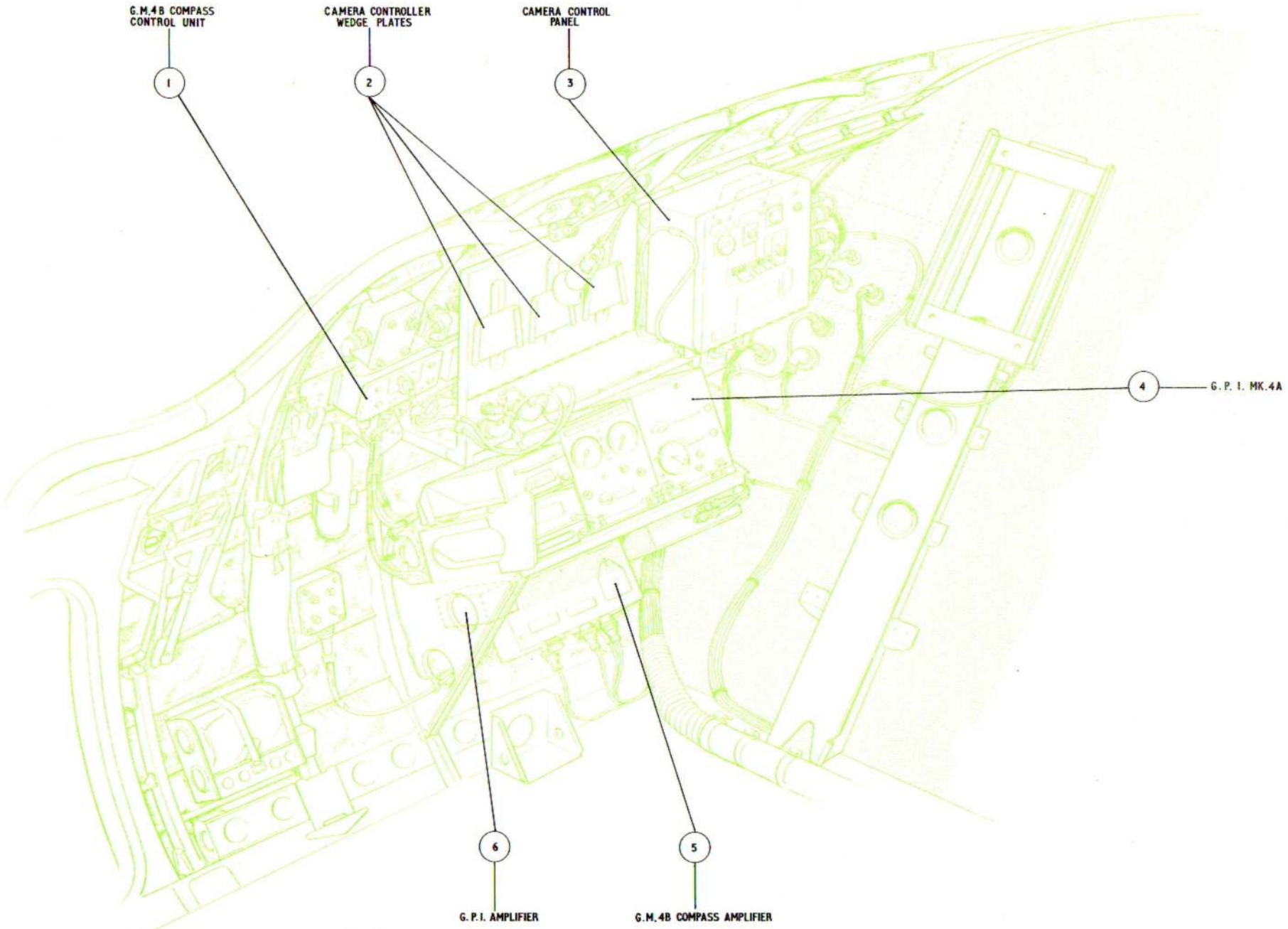

Fig. 5. Instrument installation – navigator's rear station (starboard)

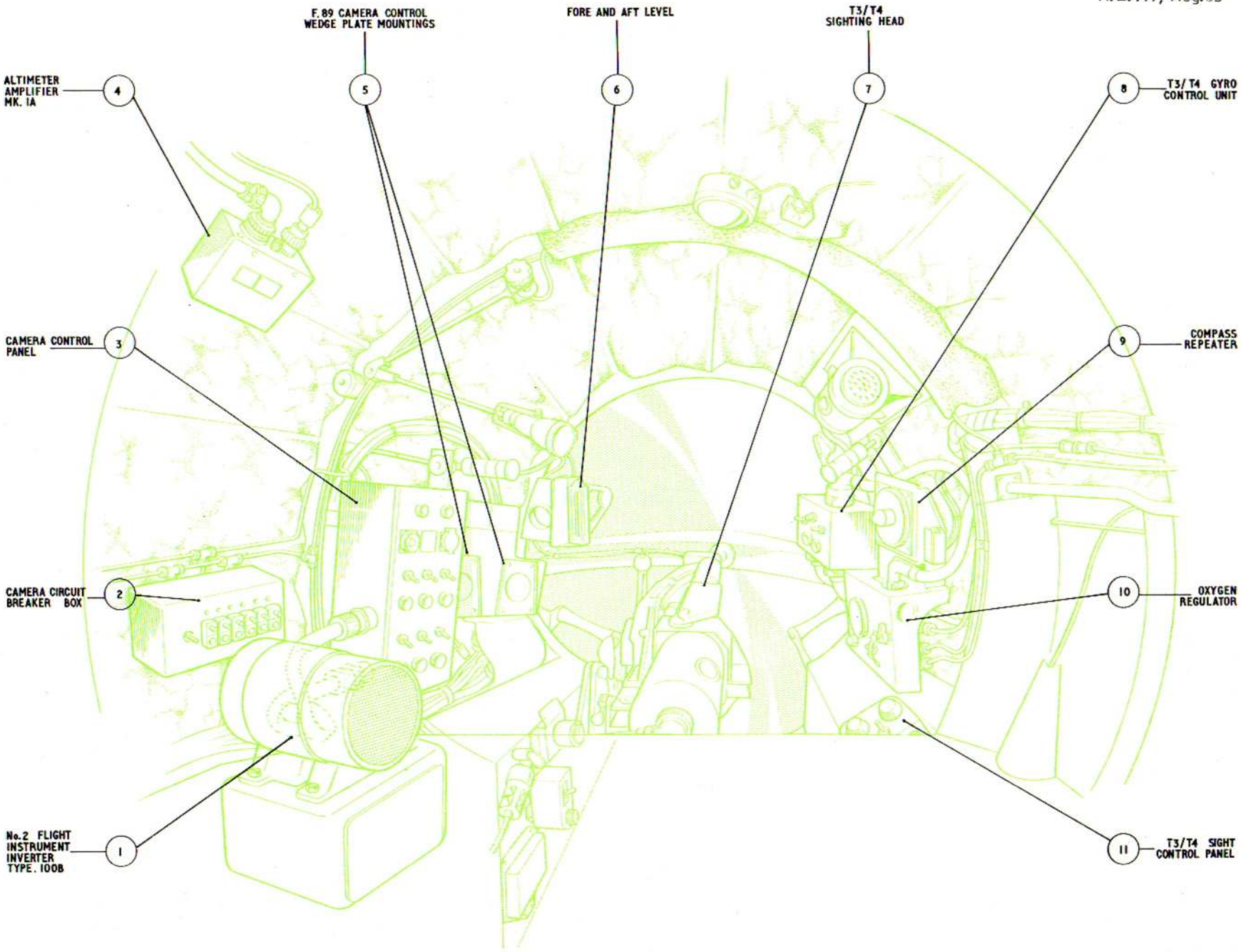

Fig. 6. Instrument installation – navigator's forward station

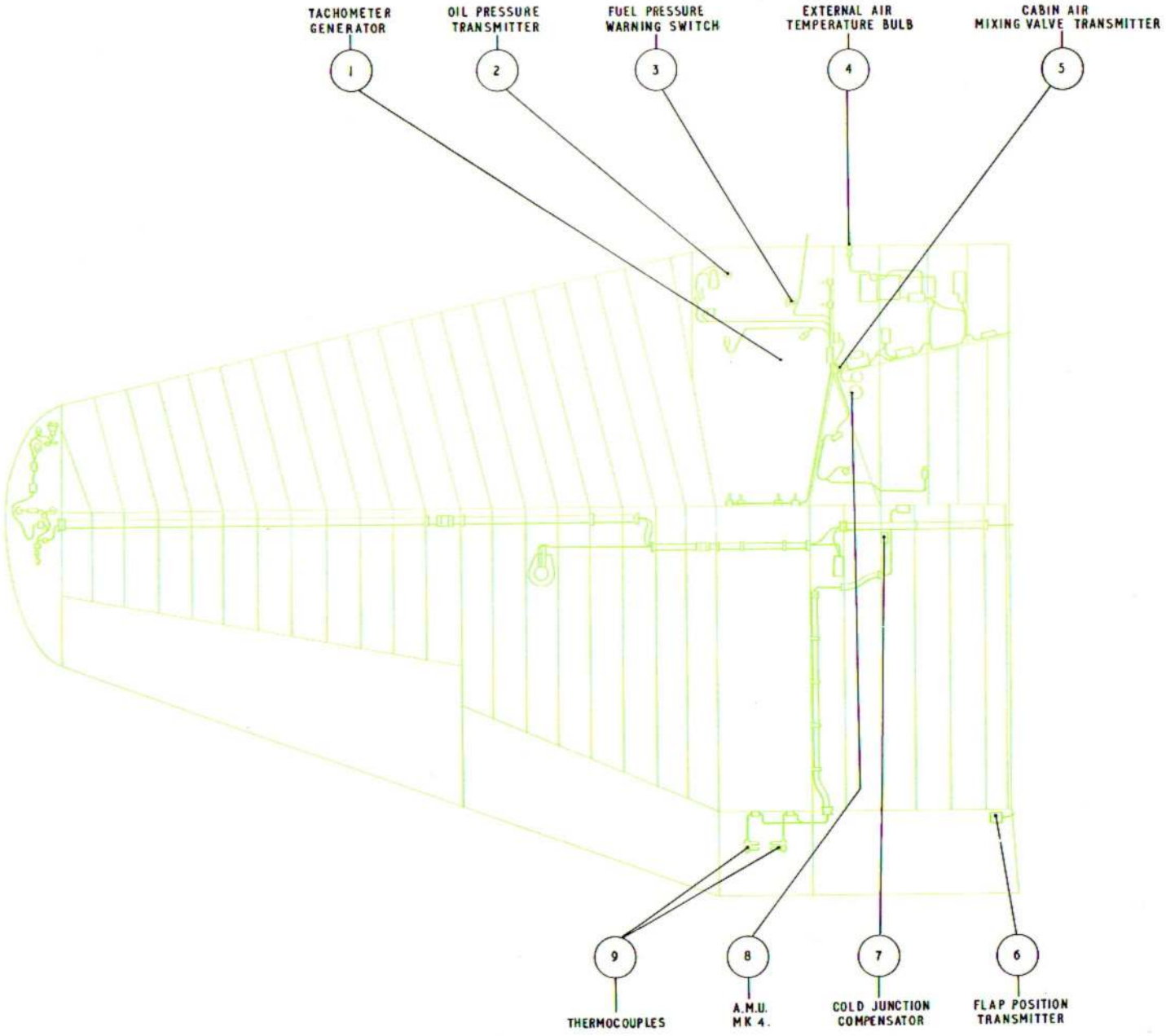

Fig. 7. Instrument installation – port main plane

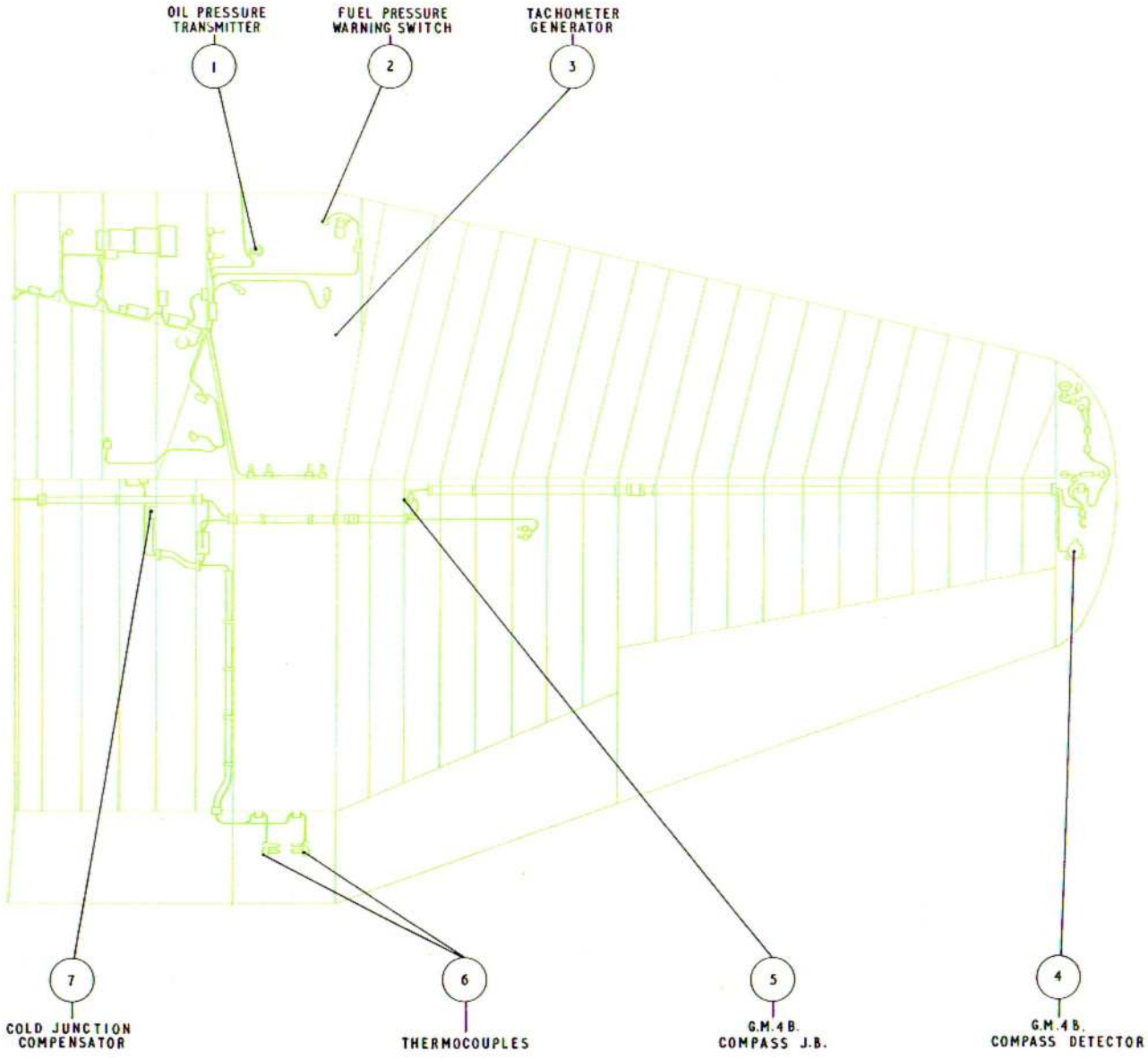

Fig. 8. Instrument installation – starboard main plane

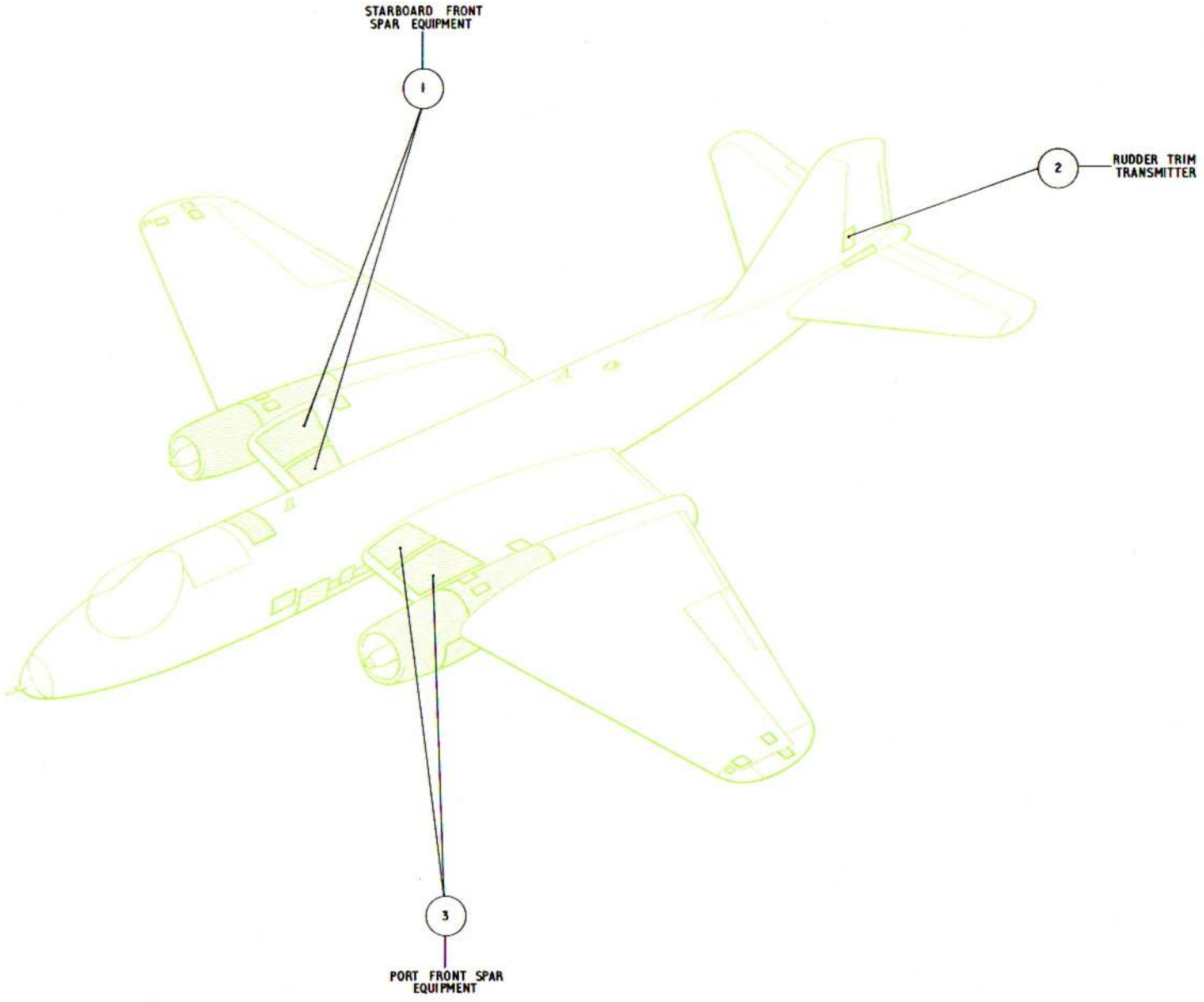

Fig. 9. Access panels – upper surface and port side

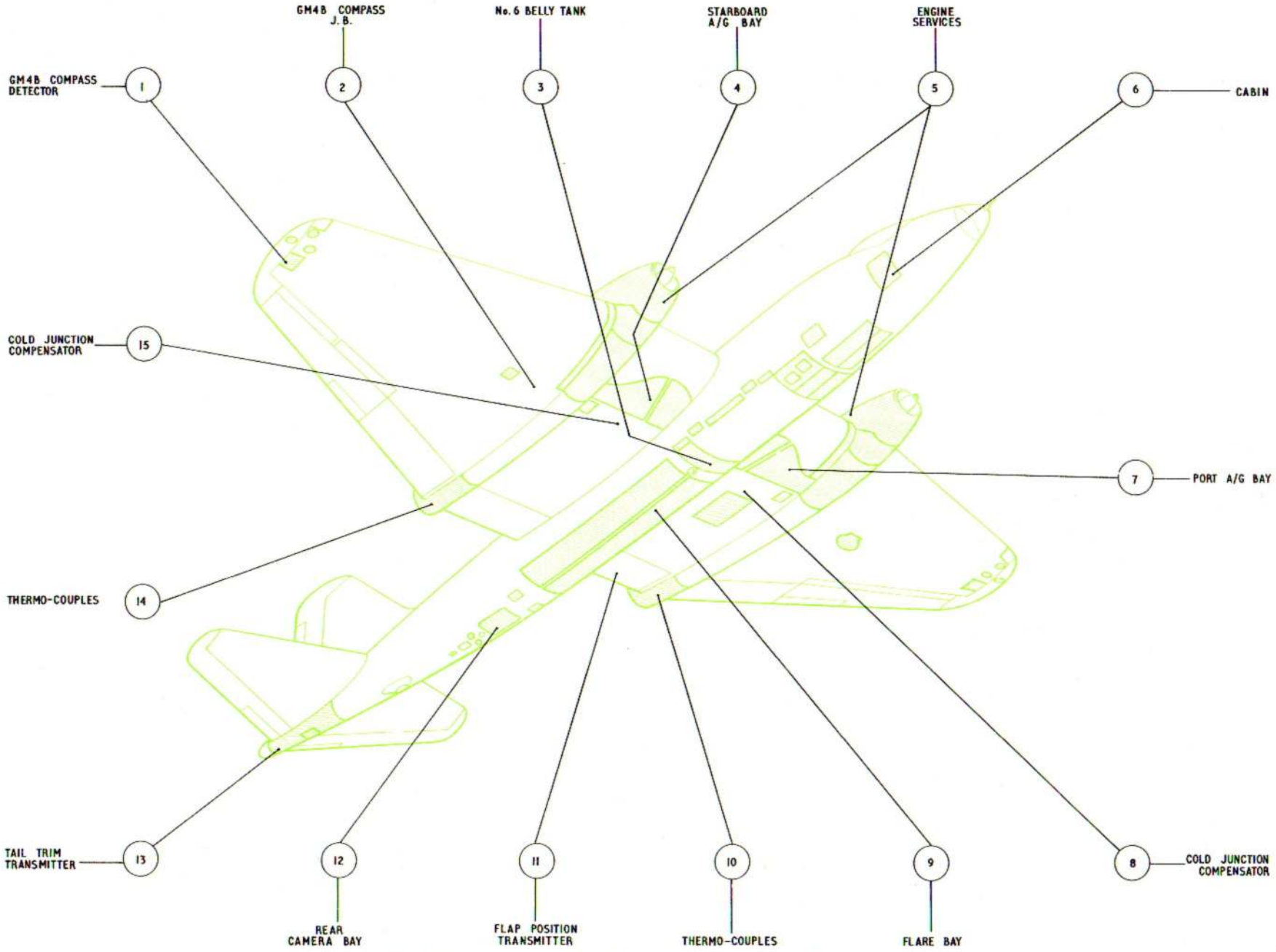

Fig. 10. Access panels – lower surface and starboard side

ARMAMENT AND PHOTOGRAPHIC - GROUP A & B

(Completely revised)

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Introduction

1. In this group a description is given of the camera installations used for various operational roles. Table 1 is a list of the cameras and associated equipment together with their reference numbers and the A.P. in which they are described. Detailed information on the camera power supplies is given in Sect.5, Chap.1, Group A and B.

DESCRIPTION

General

2. The camera installations are designed for four operational roles; these are the day role, the alternative day role, the day survey role, and the high-level night role. The basic camera installation employs F52 and F49 cameras in the day roles and F89, Mk.3 cameras at night. The number of cameras installed and the type of lens fitted to each camera will depend on the role for which the aircraft is required. A circuit breaker on the E.C.P. controls the power supplies for the various roles. The F49 and F89 cameras are fitted with built-in motor units but each F52 camera is driven by a flexible drive from a separate

motor. Timing of the exposures made by the F52 and F49 cameras is determined by the settings of two Type 35 controls. Type 89 camera controls are used with the F89 cameras which are arranged to operate automatically when the light of a photo-flash burst is sensed by two camera photo-cells.

Camera bays

3. The cameras are accommodated in three bays, the forward bay situated between frames 12 and 13, the centre bay between frames 29 and 31 and the rear bay between frames 34 and 35. Details of the camera bays are to be found in Sect.3, Chap.1.

4. The forward bay is equipped to take four F52 cameras, the centre bay either two F52 or two F89 cameras, and the rear bay one F49 camera and two photo-cells. In the rear bay the photo-cells installation is removable and is secured to the rear camera support structure and the airframe by pip-pins. Access to the equipment in each bay is by way of hatches in the underside of the fuselage. As a precaution against misting of the camera lenses, and windows, hot air fed from the cabin heating system is distributed by diffusers at the camera positions. Details of the heating system are to be found in Sect.3, Chap.8.

Camera roles

Day role (fig.1)

5. For day photography a total of six F52 cameras fitted with 36-inch lenses and one F49 camera fitted with either a 6-, 12-, or 24-inch lens are used. Four of the F52 cameras are installed in the forward bay and two in the centre bay. Each F52 camera is fitted in a No.5 adapter which is secured by four fixing bolts to the frame of a Type 46, Mk.2 mounting. The No.5 adapter enables the camera to be set to any one of four angles in relation to the vertical axis of the aircraft. The two F52 cameras in the centre bay are each carried together with a No.5 adapter and Type 46, Mk.2 mounting, in a further special adapter. The installation of the F49 camera in the rear bay is identical to that for the Day Survey role described in para.8. An adjustable adapter set to the 36-inch lens position, is fitted to the camera platform in the centre camera bay. The cameras are fitted in No.5 adapters and bolted to Type 46, Mk.3 mountings secured by clamps to the adjustable adapter.

Alternative day role (fig.2)

6. For this installation four F52 cameras with 20-inch lenses and one F49 camera with either a 6-, 12-, or 24-inch lens are installed in the aircraft. Two F52 cameras are installed in the forward position in the forward camera bay and two in the centre bay. These cameras are fitted in No.4 adapters which are secured to Type 46, Mk.2 mountings. The mounting of the F49 camera in the rear camera bay is described in para.8.

7. When Mod. 2172 is embodied, the adjustable F52 camera adapter, fitted to the camera platform in the centre camera bay should be set to the 20-inch lens position. The cameras are fitted in No.4 adapters bolted to Type 46, Mk.3 mountings which are secured by clamps to the adjustable adapter.

Day survey role (fig.3)

8. In this role a Type F49 camera, fitted with either a 6-, 12-, or 24-inch lens, is installed in the rear camera bay. When a 6-inch lens is used, the camera is fitted in a fixed mounting directly secured by eight pip-pins to four vertical members of the aircraft structure. For use with a 12- or 24-inch lens, the camera is fitted in a No.1 or a No.2 adapter respectively and then, complete with adapter, fitted to a Type 50 mounting. This mounting is bolted to four brackets which are secured by eight pip-pins to the four vertical members of the aircraft structure. The highest position on the vertical members is used when a 24-inch lens is fitted and the lowest position when a 6- or 12-inch lens is fitted. For this role the control unit for the Type 50 mounting and the Type 35, No.16A camera control are fitted on wedge plates adjacent to the camera distribution panel.

High level night role (fig.4)

9. For the high level night role, two F89 Mk.3 cameras are fitted with 36-inch lenses. With this installation, photoflash release is controlled by the cameras, one of which is selected as the master. The cameras in turn are controlled from two F89 camera control units fitted to the camera control wedge plates at the starboard side of the navigator's compartment or, alternatively, to the wedge plates in the nose. Each camera, fitted with a Type 123 mounting, is seated in a special adapter fitted to the camera platform in the centre camera bay. The adapter allows the camera to be tilted by one degree increments from 6 degrees forward to 9 degrees aft. The two photo-cells are fitted in a Type 25, Mk.2 mounting installed at the port photo-cell position in the rear camera bay.

Photographic sight *(day role)*

10. A Type 1 photographic reconnaissance sight is installed above the sighting window in the nose of the aircraft. It is a gyro-operated instrument and it functions in conjunction with a control panel adjacent to it.

TABLE 1

Photographic equipment

Ref. or Part No.	Equipment	Quantity	Ref. or Part No.	Equipment	Quantity
14A/2802	Camera, Type F52, 36-inch lens	6	14A/4014	Camera control, Type 35, No.16A	2
	Camera, Type F49, 24-inch lens	1	14A/3575	Camera control, Type 50	1
14A/4244	Camera, Type F52, 36-inch lens	6	14A/5530	Camera, Type F89, Mk.3, 36-inch lens	2
14A/988	Camera motor, Type B	6	14A/5528	Mounting, Type 123	2
14A/3568	Flexible drive, Type C	6	EA2.83.5079	Adapter, F89 camera	2
14A/4130	Adapter, No.5	6	14A/4589	Photo-cell	2
14A/4131	Mounting, Type 46, Mk.2	6	14A/404	Mounting, Type 25, Mk.2	1
EA2.83.5383	Adapter, F52 camera	1	14A/4643	Camera control, Type F89, Mk.3	2
14A/2787	Camera, F52, 20-inch lens	4	9/4532	Photographic sight	1
14A/4129	Adapter, No.4	4	9/4533	Control panel	1
14A/4133	Camera, Type F49, 6-inch lens	1	9/4552	T3 bomb sighting head	1
EA2.83.1355	Mounting, F49, 6-inch lens	1	9/4554	T3 gyro control unit	1
14A/5513	Camera, Type F49, 12-inch lens	1	109/82	Control panel, 28-volt	1
14A/4332	Adapter, No.1	1	9/4566	T4 bomb sighting head	1
14A/3574	Mounting, Type 50	1	9/4554	T4 gyro-control unit — Alternative fit to T3 bomb sight equipment	1
	Camera, Type F49, 24-inch lens	1	9/4578	Control panel, 28-volt — Alternative fit to T3 bomb sight equipment	1
14A/4333	Adapter, No.2	1			

Details of Aircraft Cameras, Camera Controls and Camera Mountings are found in A.P.1355C. Details of Aircraft Bomb Sights are found in A.P.1275D.

T3/T4 bombsight *(night role)*

11. Mod.3301 introduces a Type T3 or T4 bombsight, to assist in the dropping of photoflashes, as an alternative to the Type 1 photographic sight. It is a gyro-operated instrument and it functions in conjunction with a control panel adjacent to it and a gyro-control unit, mounted at the starboard side in the nose forward of the oxygen regulator.

SERVICING

Camera installation

Forward camera bay

12. Owing to the lack of space when servicing, no provision is made in the forward camera bay for the use of any lifting tackle or other mechanical means for handling the cameras. Before the cameras can be fitted in this bay, the detachable panel fitted between frames 12 and 13 on the underside of the fuselage must be removed. Prior to installation, the No.4 or No.5 adjustable adapters and the Type 46 mountings, should be assembled to the cameras, the film magazines removed, and suitable protective covers fitted to the camera register glasses. The complete units should be placed in position below the fuselage, then lifted on to their support rails and secured in position.

Centre and rear camera bays *(fig.5, 6 and 7)*

13. In the centre and rear camera bays provision is made for using a 'Minilift' hoist *(A.P.2817A, Vol.1)* when fitting or removing the cameras. The hoist is attached to a small trolley running in rails installed near the roof in the rear fuselage. By the use of the hoist and suitable slings, the cameras can be lifted through the bottom hatchway and transported within the fuselage to their appropriate positions ready for attachment. The trolley is fitted with four rollers which run within the two channels which form the rail assemblies. Two hooks which hang from the trolley are used as attachment points for the 'Minilift' hoist. The ends of the rails are cut away to enable the trolley, when tilted at a suitable angle, to slide into the rail channels. Stop blocks fitted at the ends of the rails ensure that the trolley cannot run out of the channels while in use.

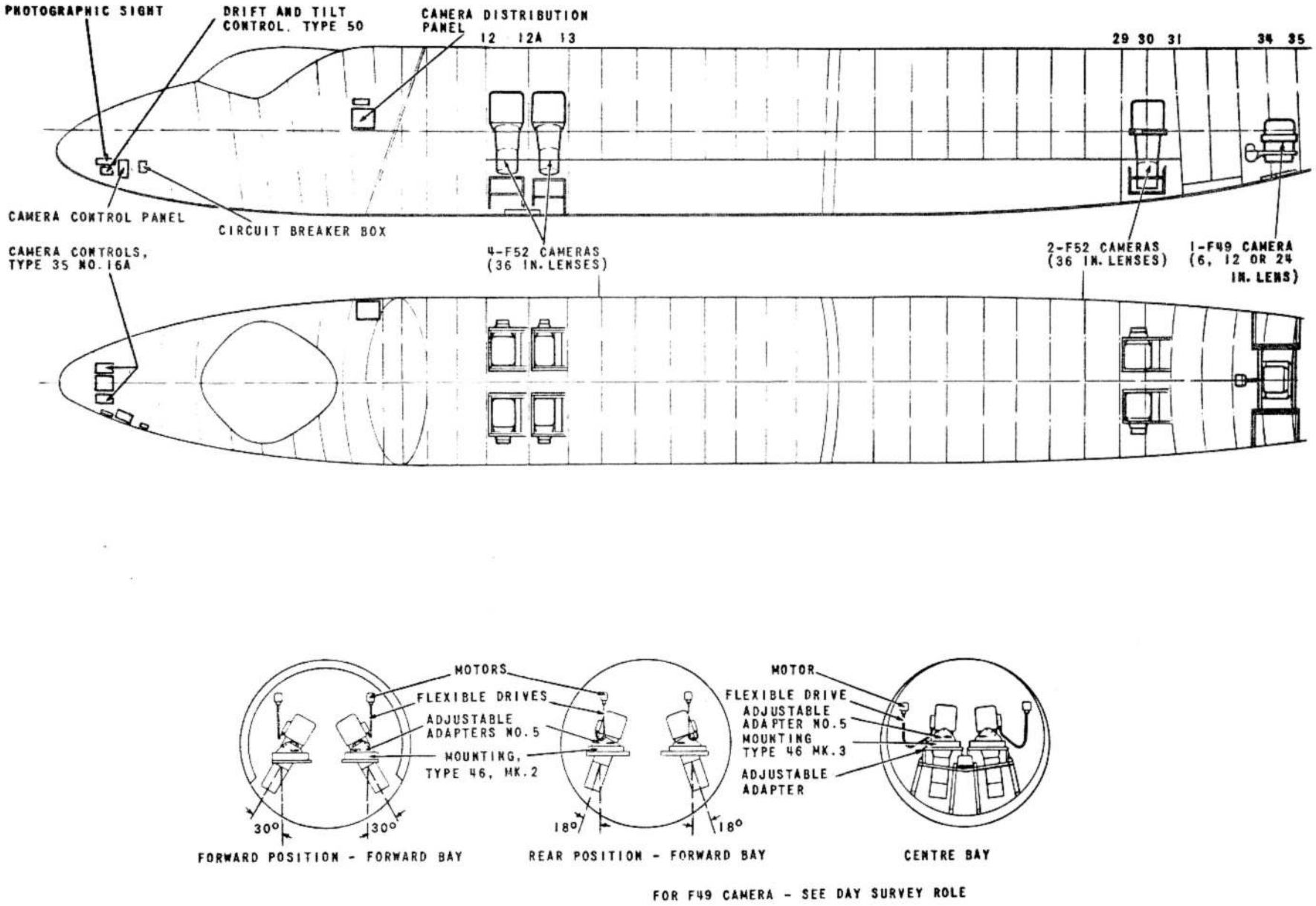
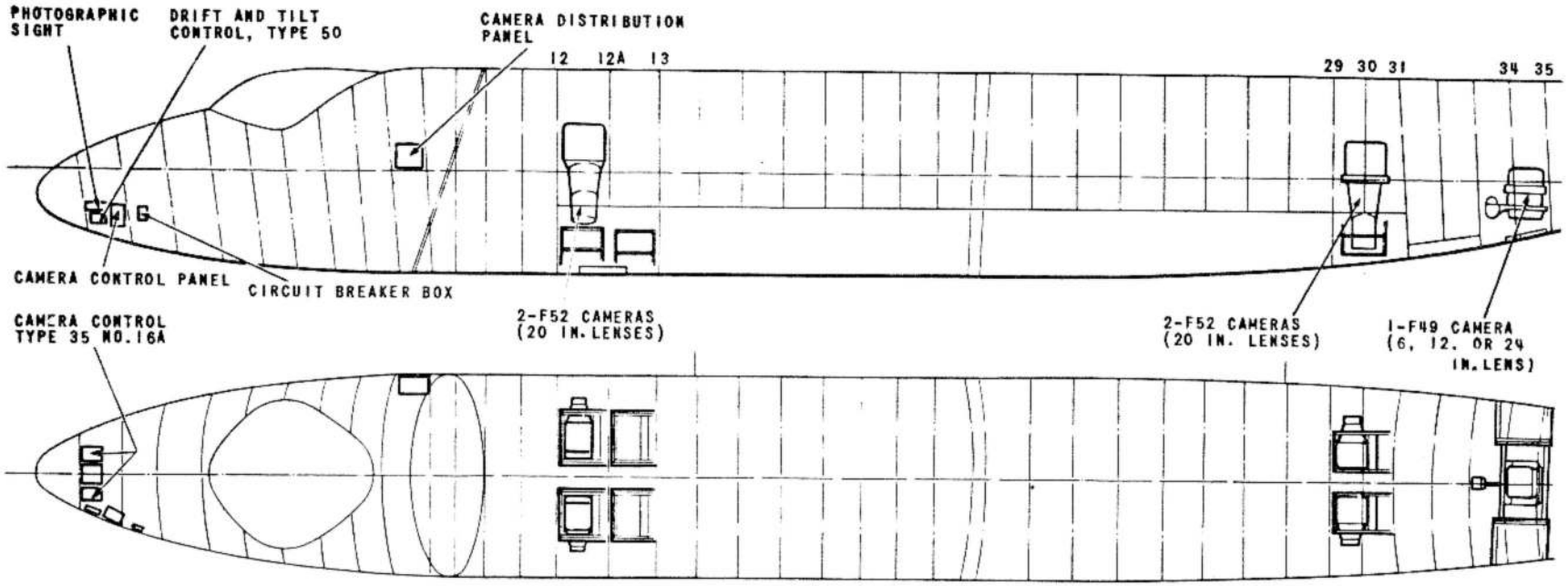
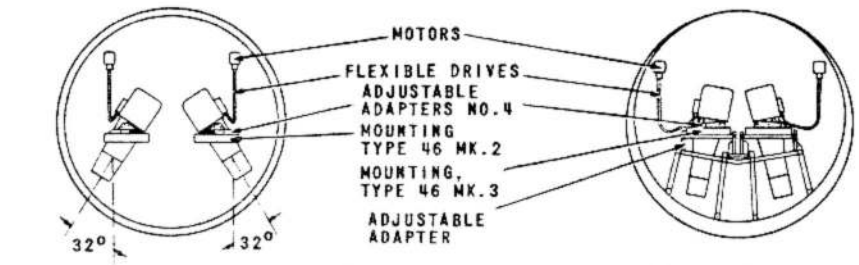


Fig. 1. Camera installation – day role





FOR F49 CAMERA - SEE DAY SURVEY ROLE

Fig. 2. Camera installation – alternative day role

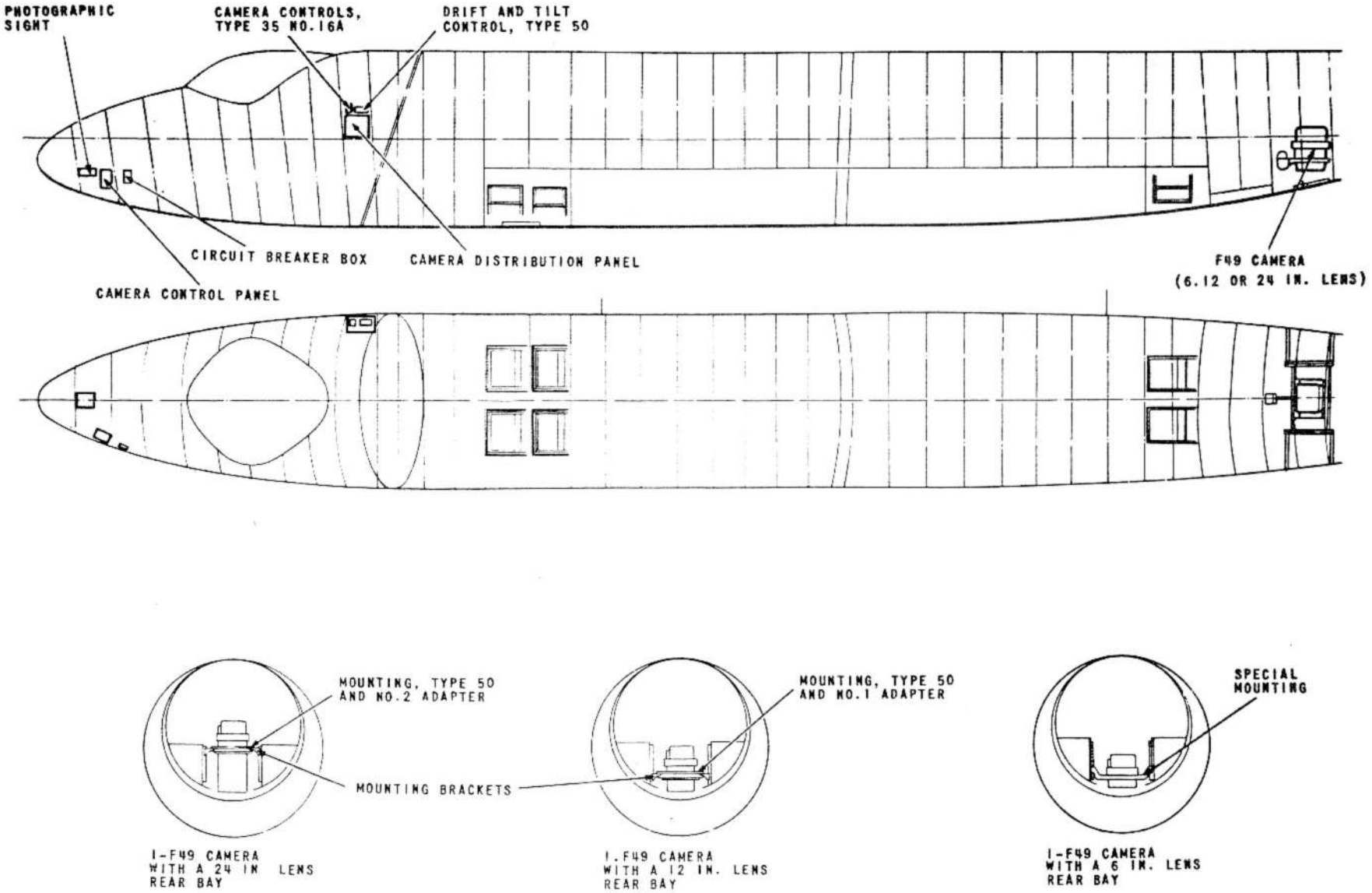


Fig. 3. Camera installation – day survey role

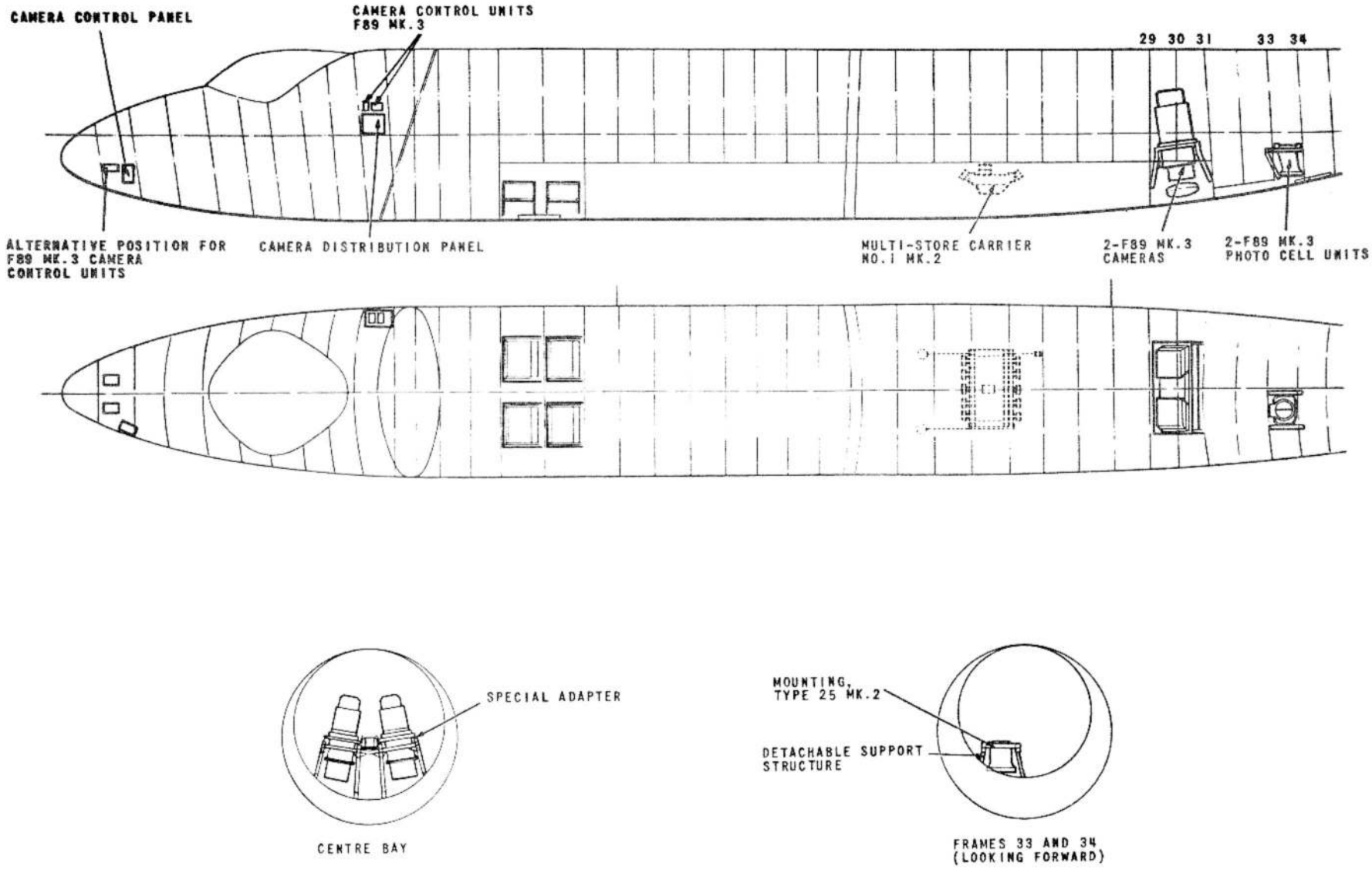


Fig. 4. Camera installation – high-level night role

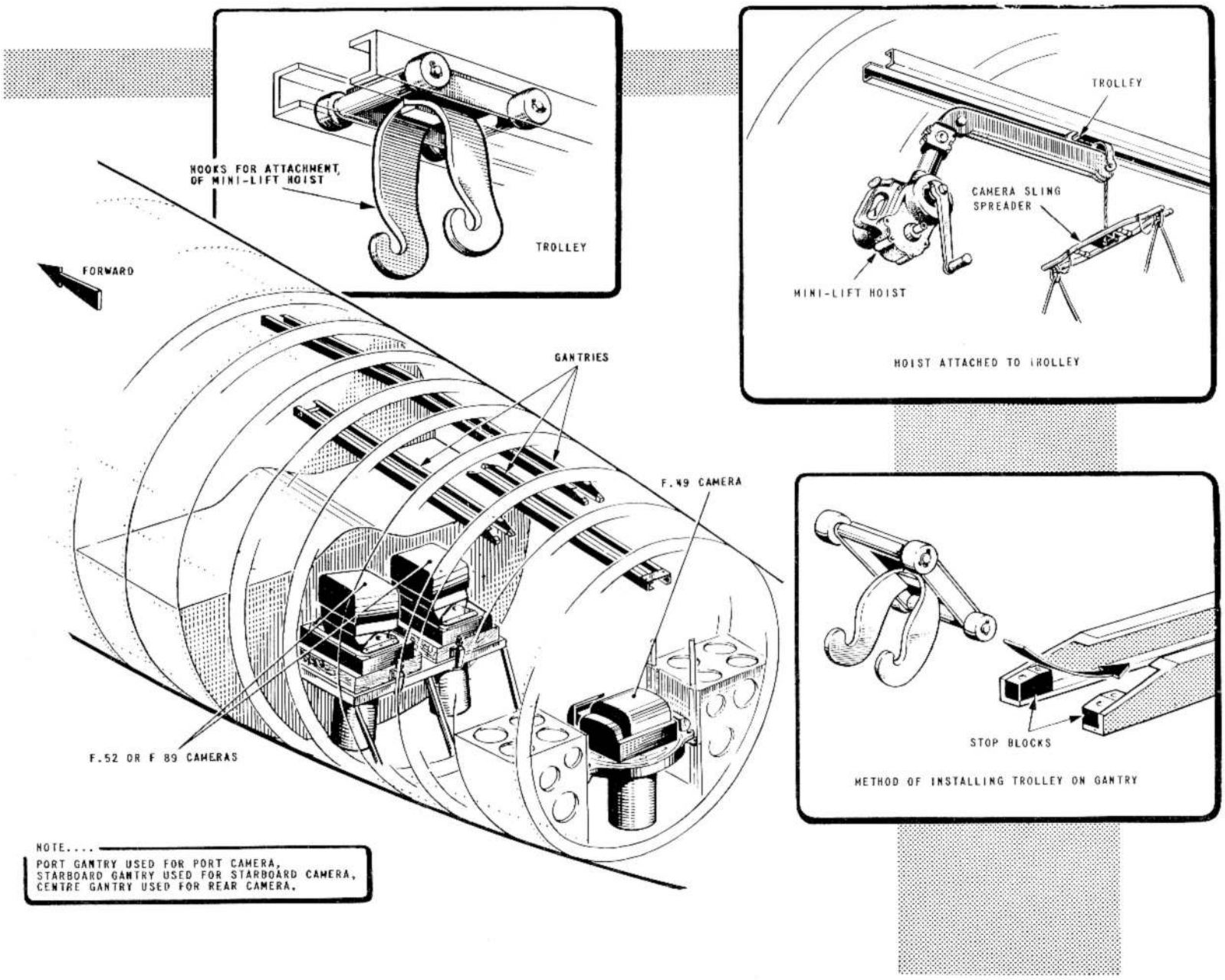
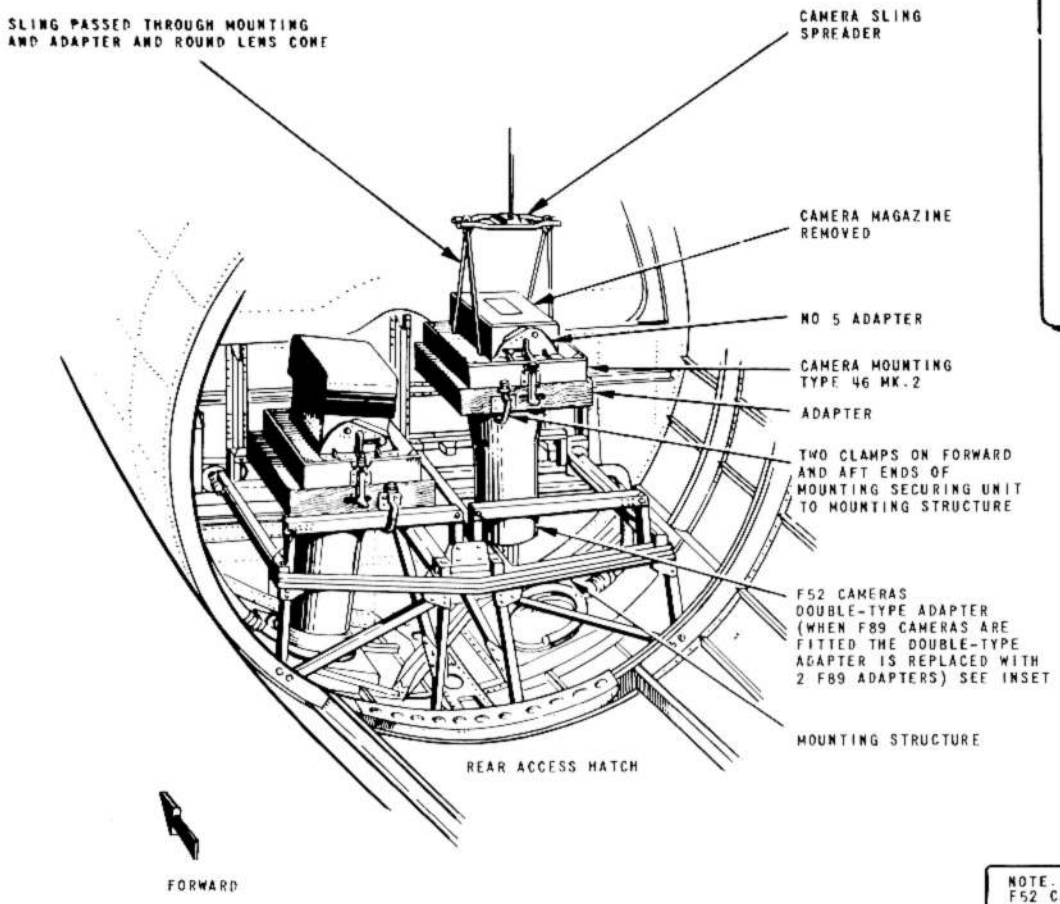


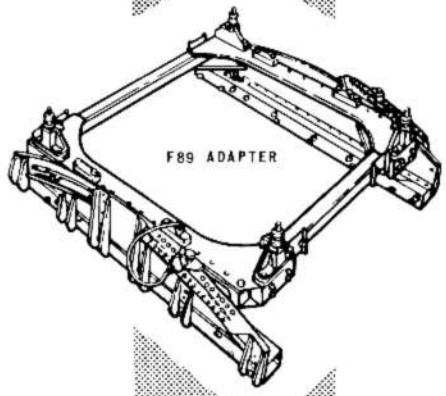
Fig. 5. Camera lifting equipment



INSTALLATION OF F52 AND F89 CAMERAS

1. PLACE PHOTO-CELL WINDOW COVERS IN POSITION
2. FIT TROLLEY TO APPROPRIATE RAILS
3. REMOVE CAMERA MAGAZINES AND PROTECT REGISTER GLASSES WITH COVERS (EXISTING EQUIPMENT)
4. SECURE CAMERA TO MOUNTING AND PLACE UNDER REAR HATCH
5. ATTACH SLINGS TO MOUNTING AS SHOWN AND SECURE FREE ENDS TO SEPARATE SNAP LINKS ON SPREADER SLING
6. ATTACH HOIST TO CENTRE BLOCK OF SLING SPREADER AND LIFT MOUNTING AND CAMERA THROUGH HATCH AS HIGH AS POSSIBLE
7. PUSH HOIST ALONG RAIL TO POINT DIRECTLY ABOVE CAMERA WINDOW
8. LOWER HOIST AND SEAT CAMERA AND MOUNTING IN POSITION
9. SECURE MOUNTING TO STRUCTURE WITH CLAMPS

THE REMOVAL OF THE CAMERAS IS THE REVERSE OF THE PROCEDURE OUTLINED ABOVE



NOTE...
F52 CAMERAS SHOWN.
REMOVAL AND INSTALLATION OF F89 MK.3 CAMERAS IS SIMILAR.

Fig. 6. Camera servicing in centre bay

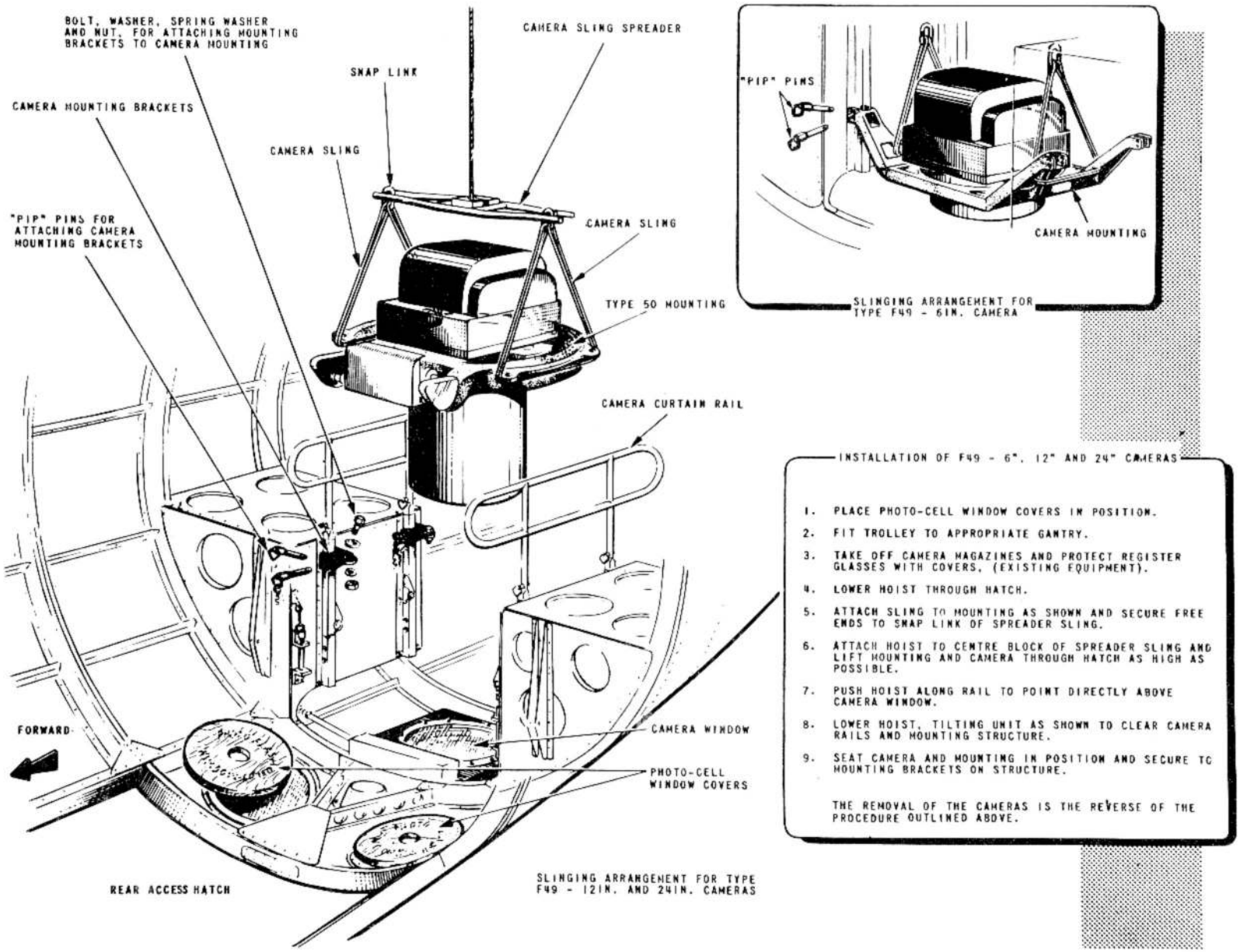


Fig. 7. Camera servicing in rear bay

MISCELLANEOUS INSTRUMENTS GROUP—D

(Completely revised)

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TABLE

	Table
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Introduction

1. This group describes the miscellaneous instruments and their location in the aircraft. Table 1 is a list of the instruments together with their reference numbers and the A.P. in which they are described. The oxygen system as a whole is described in Sect.3, Chap.10.

Accelerometer

2. An accelerometer Mk.2 *(post Mod. 4158)* is fitted in the centre of the coaming above the flight instrument panel at the pilot's station. The instrument accommodates a central locking device at the rear end and a resetting shaft at the front, and is designed to operate over the range −5g to + 10g.

Cabin air altimeter

3. A Mk.21 altimeter, having an operating range of 8000 to 50000 ft is fitted to the starboard instrument panel to indicate the apparent height in the cabin due to the operation of the cabin pressurization system. It is used by the crew so that they are aware of their oxygen requirements and can regulate accordingly.

Clock

4. A clock which may be one of three types, either a Mk.4, Mk.4B, or a Type 5ACA, is mounted on the starboard side of the instrument flying panel.

Phase failure indicator

5. A phase failure indicator fitted on the starboard instrument panel *(post Mod. 4316)*, is connected via a three-way cable to circuit TR21, TB21 and EW via fuses 112 and 116 in the 400 c/s a.c. fuse box. This ensures that the instrument indicates the output level of either No.2 or No.3 flight instrument inverter.

Fatigue meter

6. A Mk.13 fatigue meter *(post Mod. 3580)* is fitted to the rear face of frame 21B in the flare bay. It is connected by a 2-way cable, fitted with a Plessey plug at the meter end only, to J.B.7 in the port main plane. The cable connects to circuit terminals U.29 and E.7 *(Sect.5, Chap.1, Group D)* which ensures that the meter

will only operate when the aircraft is in flight with the alighting gear retracted.

Pressure gauges

7. Four Mk.14LL gauges, calibrated from 0-4000 lb/in², are installed to register the pressures in the main hydraulic system and the brakes system. Two of these gauges, one for each system, are mounted on the starboard instrument panel and indicate the hydraulic pressures in their respective systems. The air pressures in the main system accumulator and the brakes system accumulator are shown by two other gauges, one in the starboard wheel well for the main system accumulator and the other on the flare bay forward bulkhead for the brakes system accumulator.

Rear viewing periscope

8. This periscope, designed to provide an external field of view in the rearward direction to enable the navigator to observe condensation trails and the rear of the aircraft, is inserted into the tube of the sextant mounting located in the roof at the navigator's station. A 3-pole plug attached to the periscope may be mated with a plug on the periscope mounting which provides a 28-volt supply for heating the periscope window to prevent misting or icing. When not in use the periscope is stowed in a container located at the starboard side of the navigator's station below the Green Satin equipment structure.

Oxygen instruments

WARNING

The presence of oil or grease in contact with oxygen at high pressure is extremely dangerous, since it introduces a grave risk of explosion. Every precaution must be taken to avoid contamination of the installation with oil, grease or any other material that is subject to spontaneous combustion when in contact with oxygen.

General

9. Three Mk.17D or Mk.17E oxygen regulators are fitted, one located above the pilot's console, one above the navigator's instrument panel, and one on the starboard wall in the nose of the aircraft at the navigator's prone station. A brief description of the regulators is given in the following paragraphs; for further information refer to A.P.1275G, Vol.1, Sect.2.

Oxygen regulators, Mk.17D and E series

10. These regulators are designed to automatically mix oxygen with air in suitable ratios for high flying. The oxygen supply to the regulator is controlled by an ON/OFF knob at the bottom of the regulator faceplate. A diluter lever, marked NORMAL OXYGEN – 100% OXYGEN, is fitted at the top of the faceplate. With the lever at NORMAL OXYGEN, the regulator operates automatically and delivers a mixture of oxygen and air to the user's mask. When the diluter lever is changed over to 100% OXYGEN the regulator will deliver undiluted oxygen irrespective of altitude.

11. A pressure gauge and flow indicator are mounted on the face of the regulator. The pressure gauge is calibrated from 0 to 500 lb/in², and shows the pressure downstream of the reducing valve. It does NOT indicate the pressure in the oxygen cylinders. The flow indicator is electrically operated and consists of a dolls-eye type electro-magnet which blinks when oxygen is supplied to the associated mask. It should be noted that the blinker does not operate when the oxygen supply is off.

Remote magnetic indicators

12. Two remote magnetic indicators are fitted; one is mounted on the instrument flying panel and operated by the pilot's regulator while the other, which is operated by the navigator's prone position regulator, is located between frames 6 and 7 at the starboard side of the cabin adjacent to the coaming tube. The latter enables the navigator to check the oxygen flow from the prone position regulator whilst he is at his main station in the rear of the cabin. When energized, the indicators show a white disc by day and a fluorescent glow at night. The remote indicators are wired in parallel to those on the regulators.

Oxygen contents gauges

13. Two Mk.3 oxygen contents gauges, positioned above the cabin entrance door, indicate the amount of oxygen remaining in each bank of cylinders. The instrument dials are marked in fractions from 0 to full, the '1/8' sector being coloured red.

TABLE 1

Miscellaneous instruments

Ref.No.	Equipment	Quantity		Relevant A.P. Vol.1.
6A/3451	Accelerometer, Mk.2	1		A.P.1275A, Sect.12
6A/4245	Altimeter, Mk.21	1		A.P.1275A, Sect.22
5Q/170	Indicator, phase failure	1		
6A/6486	Fatigue meter, Mk.13	1		A.P.1275A, Sect.12
6D/1966	Oxygen regulator, Mk.17D	3	Alternatives	A.P.1275G, Sect.2
6D/2294	Oxygen regulator, Mk.17E	3		
6D/1615	Oxygen contents gauge, Mk.3	2	Alternatives	A.P.1275G, Sect.1
6D/2237	Oxygen contents gauge, Mk.4	2		
6B/2764	Periscope	1		A.P.1275B, Sect.17
6A/2693	Pressure gauge, Mk.14LL	4		A.P.1275A, Sect.15

ENGINE INSTRUMENTS – Group E

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Introduction

1. In this group descriptive and servicing information is given for the engine instruments. Table 1 lists the main components together with their relevant A.P.'s. The location of the main items of equipment can be found by referring to Table 1 and the location diagrams in General Information group at the beginning of this chapter.

TABLE 1

ENGINE INSTRUMENTS

Ref.No.	Equipment		Quantity	Relevant A.P.
	Smith Waymouth fuel gauges			
6A/3855	Indicator, A.G.25 (pre Mod.3391)	(Rear tank system)	1	A.P.1275A, Vol.1, Sect.18, Chap.9
6A/7516	Indicator, A.G.144 (post Mod.3391)	(Rear tank system)	1	
6A/3856	Indicator, A.G.30	(Top tank system)	1	
6A/3868	Indicator, A.G.29	(Belly tank system)	1	
6A/2762	Amplifier, F.A.A.	(All systems)	3	
6A/2765	Cable box, JLA/103/J (pre Mod.3391)	(Rear tank system)	1	
6A/7515	Cable box, JY/86 (post Mod.3391)	(Rear tank system)	1	
6A/2848	Cable box, JLA/103/41 Mod.01	(Top tank system)	1	
6A/2849	Cable box, JLA/103/111	(Belly tank system)	1	
6A/2804	Tank unit, TC17	(Rear tank)	2	
6A/2805	Tank unit, TC18	(Rear tank)	2	
6A/2812	Tank unit, TAB1.18	(Top tank No.1)	1	
6A/2844	Tank unit, TAB2.19	(Top tanks No.2, 3, 4)	3	
6A/2845	Tank unit, TAA1.77	(Belly tank)	1	
6A/2846	Tank unit, TAA2.78	(Belly tank)	3	
	Fuel pressure warning			A.P.1275A, Vol.1, Sect.24,
5CX/1553	Warning lamp		2	Sub.Sect.A, Chap.17
6A/1200	Resistance units		2	
6A/1912	Pressure switch unit		2	
	Tachometers			A.P.1275A, Vol.1, Sect.26, Chap.9
6A/2801	Indicator, Mk.10A		2	
6A/2237	Generator, Mk.8		2	
	Oil pressure gauges			A.P.1275A, Sect.16, Chap.5
6A/2714	Indicator, 0-40 lb/in ^{2}		2	
6A/2716	Transmitter		2	
6A/2715	Transformer		2	
	Exhaust gas thermometers			A.P.1275A, Sect.17, Chap.9
6A/1674	Indicator, Type B, No.1, Twin pointer		1	
6A/1677	Cold junction compensator		2	
6A/1678	Voltage compensator, Type A		1	
6A/1675	Thermocouples, Type B		8	
6A/1942	Extension leads		8	

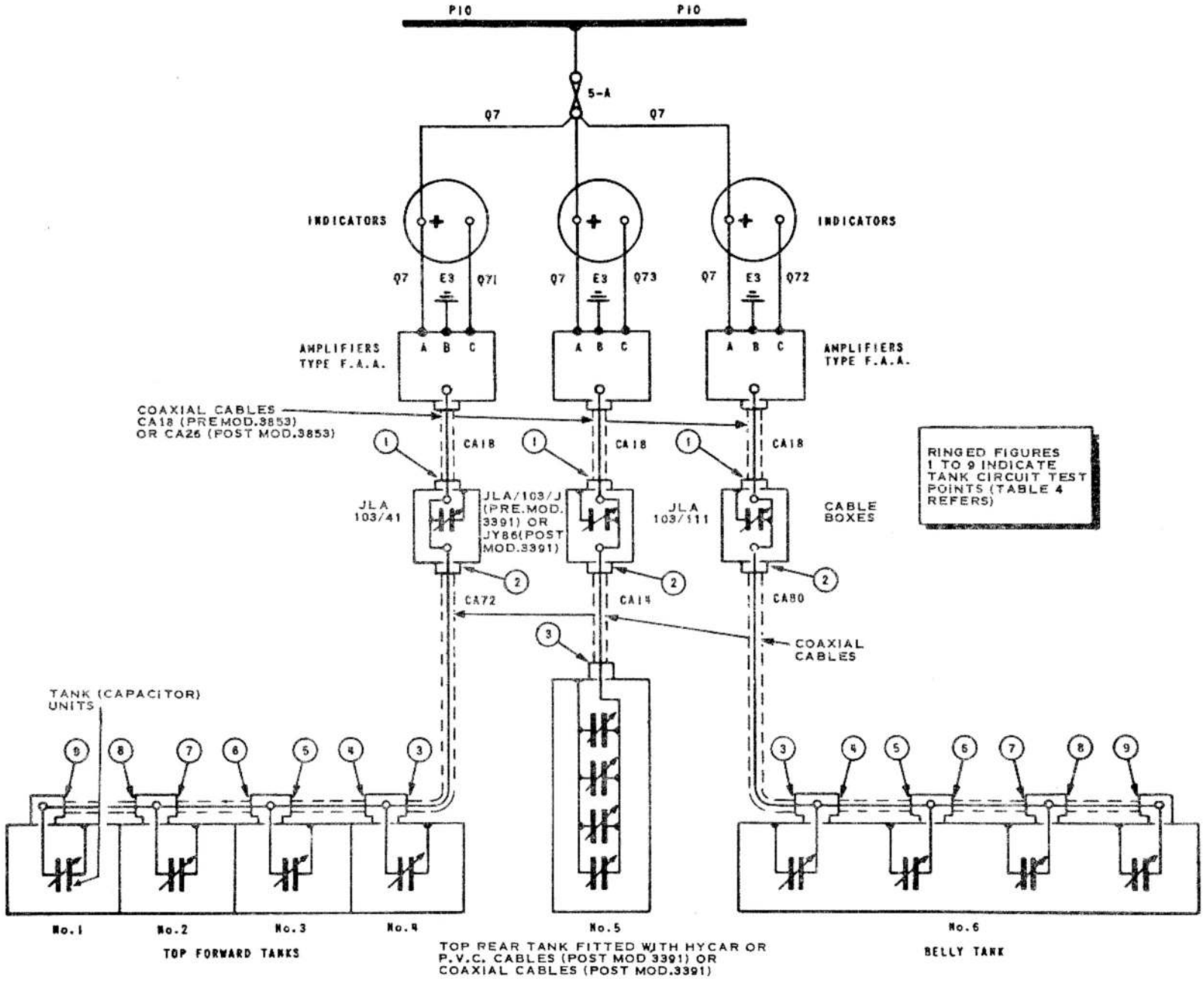

Fig.1. Fuel contents gauges

FUEL CONTENTS GAUGES

General

2. The fuselage tanks are fitted with Smith Waymouth type electrical fuel contents gauges. No gauges are fitted in the jettisonable wing tip tanks which may be fitted.

3. The installations operate from the 28-volt d.c. supply and comprise, in effect, three separate fuel gauge systems, each with its own tank *(capacitor)* units, cable box, amplifier and indicator. Coaxial cables are used to connect the capacitance-operated items in each circuit.

Tank units

Top (No.1, 2, 3 and 4) tank system

4. The top tank system consists of four tanks *(No. 1, 2, 3, and 4)*, each of which contains a flange mounted tubular tank unit bolted to the bottom skin of the tank and extended upwards. The tank units are externally connected in parallel with co-axial cables.

Rear (No.5) tank system

5. The rear top fuselage tank *(No.5)* contains four flexible type tank units connected in parallel by insulated copper wire *(pre Mod. 3391)* or coaxial cables *(post Mod. 3391)* to a coaxial terminal in the base of the tank.

Belly (No.6) tank system

6. The belly tank *(No. 6)* contains four flange mounted tubular tank units bolted to the top skin of the tank and extended downwards. The tank units are externally connected in parallel with co-axial cables.

Cables boxes

7. The connection between the tank gauge terminals and their respective amplifiers are made via cable boxes located in the vicinity of the tank terminal assemblies. Each cable box has a trimmer capacitor for calibration purposes. The trimmer can be adjusted with a screwdriver after removing the cable box cover.

Amplifiers

8. A total of three Type FAA amplifiers are employed in the system and are located two on the starboard and one on the port walls of the flare bay. The amplifier units comprise two 25L6 valves operating in conjunction with an oscillator and rectifier circuit and the variable capacitance of the tank units connected to them. The change induced in the input valve circuit by the variable capacitance is arranged, after rectification, to control the output valve circuit and, consequently, the indicator. The accuracy of the system is dependent on the supply voltage being maintained at the required value, and on the dielectric constant of the fuel.

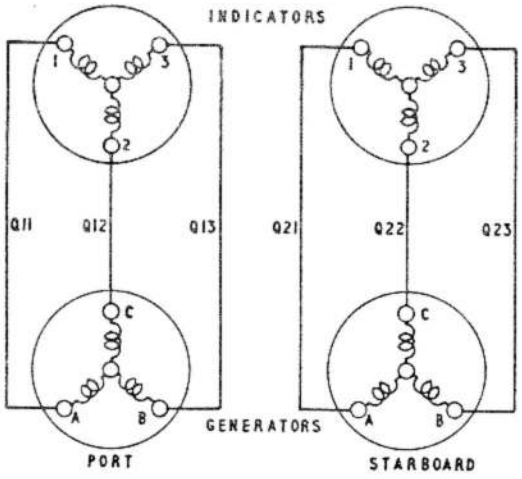

Fig.2. Tachometers

Indicators

9. Three Type AG indicators, one for each tank system, are installed on the engine instrument panel. The instruments differ only in their calibration markings.

TACHOMETERS

10. Engine speeds are indicated by two Type 10A tachometers mounted on the engine instrument panel. Each instrument has a range of 1200 to 12000 r.p.m. shown on two

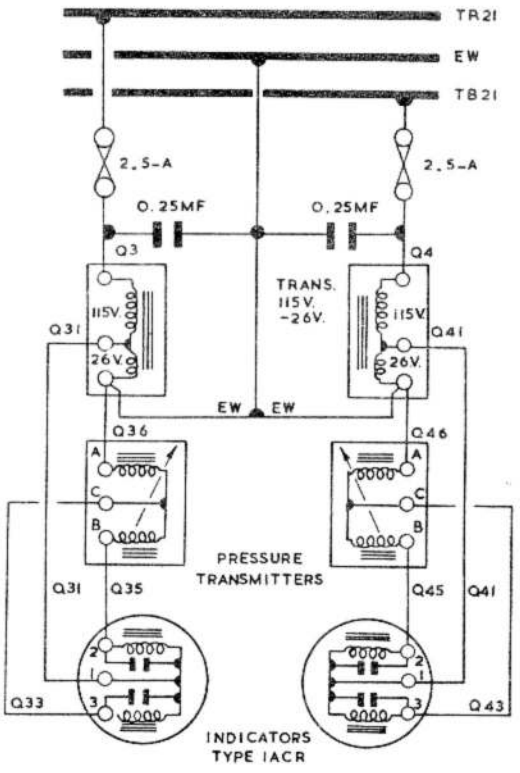

Fig.3. Oil pressure gauges

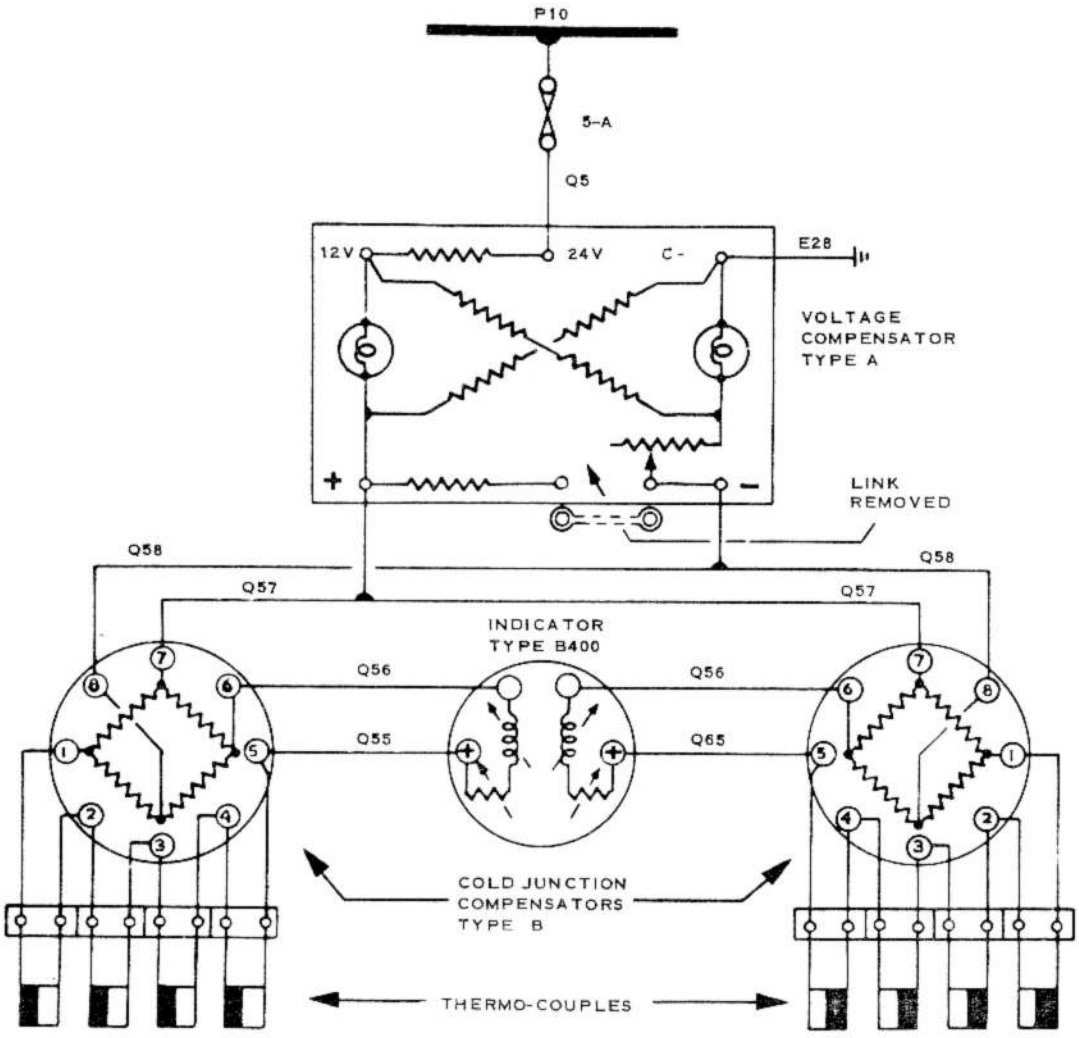

Fig.4. Exhaust gas thermometers

scales, an inner scale reading thousands of r.p.m. and an outer scale reading hundreds of r.p.m. Basically, each indicator is a 3-phase a.c. motor operating synchronously with a small generator fitted on, and driven by, its respective engine.

OIL PRESSURE GAUGES

11. Engine oil pressures are indicated by two gauges mounted on the engine instrument panel. The instruments operate on 26-volts a.c. fed from the 115-volt, 400 c/s, 3-phase supply by means of two small step-down transformers housed in the 400 c/s distribution box. Two 0.25 mF capacitors are connected between the input side of the transformers and earth for power factor correction purposes. The initial 115-volts a.c. supply is obtained from the normal flight instruments power supply described in Chap. 1, Group D, of this section.

EXHAUST GAS THERMOMETERS

12. The temperature of the engine exhaust gas is shown by a Type B twin-reading indicator, labelled JET PIPE TEMPERATURE fitted on the engine instrument panel. The thermometer is primarily operated by thermocouples, four of which project into each engine jet pipe, and are located at four predetermined positions *(fig.5)*. Ensure that when installing new or serviceable thermocouples the correct positioning is maintained.

13. Each group of thermocouples operates in conjunction with a cold junction compen-

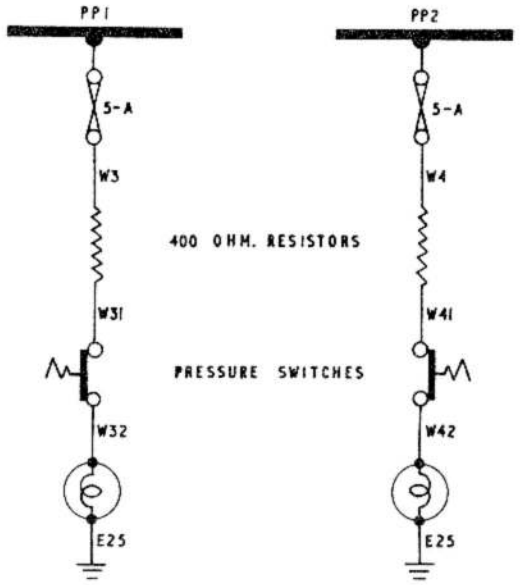

Fig.5. Fuel pressure warning

sator located on rib 5 aft of each wing main spar. As the operation of the thermometers depends on the operating voltage being maintained at a constant value, a Type A voltage compensator is embodied in the system and installed on a bracket attached to frame 12 in the upper equipment compartment.

14. The thermocouples are connected to terminal blocks positioned on the wing rear spar connector rings which carry the jet pipes. The terminal blocks are connected to the cold junction compensators by cables of fixed length and standard resistance and it may be found that excess cable is coiled up at the rear of the wing spar. This cable must not on any account be shortened as this would affect the functioning of the system.

FUEL PRESSURE WARNING

15. Warning of low pressure in the engine fuel supply lines is given by two red lamps mounted on the engine instrument panel. Each lamp is operated by the closing of a pressure-operated switch fitted at the starboard side of its respective engine unit. The switch contacts are set to close whenever the fuel pressure falls below $6\ ^{+\frac{1}{2}}_{-0}$ lb/in² *(post Mod.3911)*. The lamp filaments, rated at 6 volts, are fed from the aircraft 28-volt d.c. supply via 400-ohm resistors located in the E.C.P.

SERVICING

FUEL CONTENTS GAUGES

General

16. Apart from the normal examination of the installation for the security of components and obvious damage, the fuel gauge system requires no routine servicing other than functional tests. If a gauge should give erratic indications, its system should be checked in accordance with the instructions contained in the following paragraphs. For servicing and testing individual components reference should be made to A.P.1275A, Vol.1, Sect.18, Chap.9. Information on the use of the Smith Waymouth test set, Type QAA, is given in A.P.1275T, Vol.1, Sect.5, Chap.2.

17. A functional check should be made on the complete installation in accordance with the current Servicing Schedule, and on individual gauges whenever tanks are drained or major components of the fuel gauge system are changed.

18. Whenever the cable box trimmers are altered, a functional check is to be made immediately afterwards. The tanks contain the following quantities of fuel which cannot be used:—

Rear (No.5) tank	5 gallons
Belly (No.6) tank	30 gallons

19. Before the trimmers are adjusted to obtain a zero reading, 30 gallons of fuel should be put into the belly tank and 5 gallons into the rear tank and the booster pumps run until no more fuel is delivered.

Functional checks

20. With the BATTERY ISOLATION SWITCH set to the OFF position, connect a 28-volt supply to the external power plug. Allow at least five minutes for the amplifier to warm up and check that the indicator reads zero.

21. Should the indicator show an incorrect reading, remove the cover plate of the relevant cable box and carefully adjust the trimmer with a screwdriver to obtain the correct setting. If, due to a fault in the system, it is found impossible to obtain a zero reading on the indicator, the procedure referred to in para.22 should be followed.

Tanks 'empty' checks

22. The tanks empty checks are made in conjunction with Table 4 and the diagram, fig.1, which shows the interconnection between the tank gauge installation and amplifiers; the ringed numbers *(1 to 9)* indicate where the systems should be broken down so that the Smith Waymouth test set can be connected into the circuit. The figures shown against the test points 1 to 9 in Table 4 are the values of capacitance that should be fed into the system at these points in order to obtain a zero reading on the gauge being checked and a reading of approximately 2 mA on the test set meter.

TABLE 2

FUEL CONTENTS GAUGE CAPACITANCE VALUES

A – Cable box capacitance values

Code	Total capacitance value	
	Trimmer at Max. not more than	*Trimmer at MIN. not less than*
JLA/103/J or	110 pF	200 pF
JLA/103/J/MOD.01	75 pF	165 pF
JY/86 (post Mod.3391)	1374pF	1540pF

Code	'Tanks Empty' capacitance into box at input socket			
	Trimmer at MIN. not less than	*Box input Nominal value*	*Trimmer at MAX. not more than*	*'Tanks Empty' Capacitance out of Box*
JLA/103/41 MOD.01	1492 pF	1447 pF	1402 pF	1468 pF
JLA/103/111	1751 pF	1706 pF	1661 pF	1468 pF

B – Tank terminal capacitance values

Code	Capacitance
JCB.A.Mod.01	17 ±3 pF
JKB.Mod.01	17 ±3 pF

C – Coaxial cables capacitance values

Code	Length (in.)	Capacitance
CA14	14	26 ±3 pF
CA18 (pre Mod.3853)	18	32 ±3 pF
CA26 (post Mod. 3853)	26	47 ±3 pF
CA38	38	68 ±3 pF
CA40	40	72 ±3 pF
CA55	55	99 ±3 pF
CA72	72	129 ±3 pF
CA80	80	144 ±3 pF
PR30 (No.5 tank post Mod.3391)	30	44 ±5 pF
PS54 (No.5 tank post Mod.3391)	54	83 ±9 pF
PS73 (No.5 tank post Mod.3391)	73	115 ±12 pF

D – Tank units capacitance values

Unit code	Initial capacitance (pF)	Range (pF)	Tank Ref.
TAB.1.18	278 ±5	265 ±3	No.1 Top
TAB.2.19	278 ±5	265 ±3	Nos.2,3,& 4 Top
TAA.1.77	310 ±3	265 ±3	Belly (No.6)
TAA.2.78	310 ±3	265 ±3	Belly (No.6)
TC.17	230 ±5	246 ±3	Rear (No.5)
TC.18	230 ±5	246 ±3	Rear (No.5)

E – Capacitance values of complete tank with terminal

Tank	Capacitance empty and out of aircraft	Capacitance installed empty and dry	Capacitance installed wet	Unusable fuel
Top No.1,2,3 and 4	278 ±5 pF each tank	278 ±5 pF each tank	281 ±8 pF each tank	Nil
Rear (P.V.C.) (pre Mod. 3391)	1100 ±23 pF	1165 ±33 pF	1265 ±43 pF	5 gal
Rear (HYCAR) (pre Mod. 3391)	1135 ±23 pF	1207 ±33 pF	1307 ±43 pF	5 gal
Rear (post Mod.3391)	1377 ±70 pF	1400 ±70 pF	1432 ±80 pF	5 gal
Belly	1655 ±23 pF	1655 ±23 pF	1670 ±23 pF	30 gal

TABLE 3

FUEL CONTENTS GAUGE TEST VALUES

A – Insulation resistance tests

Component	Condition	Insulation resistance
Tank unit	New	Not less than 20 megohms
	In situ	Not less than 3 megohms
Coaxial cables	New or used	Not less than 20 megohms
Complete tank installation	Tank empty but wetted with fuel	Not less than 1 megohm
Cable boxes JLA/103.J JLA/103.J Mod.01 ◄ JY/86 (post Mod. 3391) ►	New or used	Not less than 20 megohms
JLA/103.41 Mod.01 JLA/103.111	New or used	As these boxes contain a coil connected to earth, they may be considered serviceable if they conform to the capacitance figures given in Table 2 – A.
Amplifiers	New or used	As the amplifiers contain items which may be damaged by the application of high voltage, insulation tests using a megger must not be made on these units
Indicators	New or used	Insulation test must not be made on these instruments. They may be considered serviceable if they conform to the figures given in their calibration tables.

B – Capacitance/indicator values

Amplifier – Code FAA

Power supply – Nominal 28 volts – Current 0.7 amp. approx.

Capacitance figures	
Initial (or 'tanks empty')	1500 pF
'Tanks full'	2500 pF
Range	1000 pF

The relationship between indicator current and capacitance with a power supply of 28 volts is given in the table below:–

Capacitance (pF)		*Indicator Current (mA)*
(pre Mod.03)	(post Mod.03 onwards)	
1500	1500	2.00 ±.03
1637	1646	3.00 ±.05
1801	1816	4.00 ±.05
2004	2010	5.00 ±.05
2242	2242	6.00 ±.05
2504	2500	7.00 ±.05

TABLE 4

TEST POINT CAPACITANCE VALUES

This table shows the capacitance value that must be fed into each marked test point on fig.1 to obtain a reading of approximately 2 mA on the test meter and zero contents on the indicator.

	USING QAA MOD.04 TEST SET			APPROXIMATE READING ON	
TEST POINT	TEST CAPACITANCE A (p F)	TEST CAPACITANCE B (p F)	ADAPTERS AND CABLES USED	AIRCRAFT INDICATOR	TEST SET METER
			Top tank system		
1	1468 ±3	1310 ±8	CE1, CC1	Zero contents	2mA
2	1457±34	1307 ±37	CE1	Zero contents	2mA
3	1328 ±29	1170 ±34	CE1, CC1	Zero contents	2mA
4	1047 ±24	897 ±27	CE1	Zero contents	2mA
5	957 ±21	821 ±26	CE1, CC1	Zero contents	2mA
6	698 ±16	548 ±19	CE1	Zero contents	2mA
7	630 ±13	472 ±18	CE1, CC1	Zero contents	2mA
8	349 ±8	199 ±11	CE1	Zero contents	2mA
9	281 ±5	241 ±10	* CA18, CC1	Zero contents	2mA
			Rear tank system wired with P.V.C. (pre Mod.3391)		
1	1468 ±3	1310 ±8	CE1, CC1	Zero contents	2mA
2	1291 ±46	1141 ±49	CE1	Zero contents	2mA
3	1265 ±43	1107 ±48	CE1, CC1	Zero contents	2mA
			Rear tank system wired with Hycar (pre Mod.3391)		
1	1468±3	1310 ±8	CE1, CC1	Zero contents	2mA
2	1333 ±46	1183 ±49	CE1,	Zero contents	2mA
3	1307 ±43	1149 ±48	CE1, CC1	Zero contents	2mA
			Rear tank system (post Mod.3391)		
1	1447 ±3	1289 ±8	CE1, CC1	Zero contents	2mA
2	1458 ±83	1308 ±86	CE1	Zero contents	2mA
3	1432 ±80	1274 ±85	CE1, CC1	Zero contents	2mA

* — A CA18, or similar low capacitance cable is used at this point since the test set will not read below 50 pF.

(continued)

TABLE 4 *(continued)*

The standard items of equipment supplied with the QAA Mod.04 Test Set are given below

Code	Description	Capacitance
CG144	6-cored cable with plug and socket	Not applicable
CE1	Coaxial cable with plugs	150 ±3pF
CC1	Pye-Waymouth adapter	8 ±2pF

No.5 tank special check *(pre Mod.3391 only)*

23. Two types of cable, one P.V.C. covered and the other Hycar covered, are used to connect the tank units in No.5 tank. There is an appreciable capacitance difference between these cables and it is essential to ascertain which type is installed in a particular tank before making capacitance checks on its gauge system. The cables can be identified by colour, Hycar being black. In tanks wired with P.V.C. covered cable, the cable between the tank units and the insulated coaxial terminal in the base of the tank is coloured red whilst the earth cable only is black. Providing the tank is empty of fuel, the colour of the connecting cable can normally be checked through the tank filler aperture by using a suitable lamp. If difficulty is experienced in identifying the cable by this method, the bolts which attach the coaxial terminal to the base of the tank *(these are accessible in the roof of the flare bay)* should be removed and the assembly pulled down so that the cable connected to its insulated terminal can be seen. To save future checking of the type of cable fitted to a tank before making capacitance checks on its gauge system, it is suggested that after verifying the type of cable the letters P.V.C. or the word Hycar, as applicable, should be stencilled on the coaxial terminal assembly in the flare bay. If the No.5 tank should be changed at some future date, the cable check should again be made before testing its gauge system, and the terminal box marked to suit.

Checks on fitting new tanks

24. After the installation of any new fuel tanks in the aircraft, special precautions should be taken before making any initial checks on their fuel gauge systems. As the tank units in a new tank are in a dry condition they will feed a lower capacitance into their associated amplifier than units that have previously been wetted with fuel. To obviate any discrepancies due to this cause, the units in a new tank should be sprayed with fuel and allowed to drain before making any functional checks.

25. In Tables 2, 3, 4 and 5 are given the capacitance values of the components comprising the fuel gauge system, test values, and indicator calibration current values.

Amplifier removal

26. During servicing involving the removal of the tank gauge amplifiers, the flare doors should not be fully open, as then the amplifiers are partly screened. After disconnecting the Plessey plug and socket and the coaxial cable, the amplifiers are instantly removable after undoing the single fastener at the top of the units, and lifting them out of the bottom slot of the brackets that carry them.

Changing tank units

▶◀

No.5 tank

27. Instructions for removal, installation, and folding for storage are given in Sect.4, Chap.2, where frequent warnings are given against the danger of damaging flexible tank units in the tanks. To counter possible damage resulting from storage conditions, No.5 tanks are supplied without their tank units fitted. Before installing tank units in a tank it is essential to check that their capacitance agrees with the figures given in Table 2 (D).

28. No.5 fuel tanks are manufactured both by the Marston Excelsior Company and the Fireproof Tank Company. Each make of tank can be recognised by its colour, the 'Marston' tanks being black whilst the 'Fireproof' tanks are green. Although the tanks are interchangeable, the method of fitting their tank units differs. In the 'Marston' tanks each unit is held in position by three rubber straps, with the ends of the units attached to the tank wall by 2 B.A. bolts vulcanised to the inner skin. The

units in the 'Fireproof' tank are housed in perforated rubber pockets the same length as the units whilst the ends of the units are secured by rubber studs vulcanised to the tank inner skin. Access to the forward tank units is through the pump apertures; access to the aft tank is through either the filler neck or through the float valve aperture. The Type T.C.17 units are installed at the forward end of the tank and the Type T.C.18 units at the filler neck or rear end.

29. The procedure for fitting or changing the tank units in No.5 tank is described under the tank installation *(Sect.4, Chap.2).*

EXHAUST GAS THERMOMETERS

30. Access to each cold junction compensator is obtained by removing a detachable panel on the underside of the wings, aft of each main wheel leg. The voltage compensator is accessible through the hatch of the upper equipment compartment. Servicing of the thermo-couples involves the removal of the engine rear cone fairings as described in Sect.4, Chap.1.

FUEL PRESSURE WARNING

31. Setting of the pressure switches is covered in A.P.1275A, Vol.1, Sect.24, Sub. Sect.A, Chap.17.

TABLE 5

INDICATOR CALIBRATION/CURRENT VALUES

Top Tank System		Rear Tank System				Belly Tank System	
Indicator – Code AG30		Indicator – Code AG25 (pre Mod.3391)		Indicator – Code AG144 (post Mod.3391)		Indicator – Code AG29	
Indication pounds	Current (mA)	Indication pounds	Current (mA)	Indication pounds	Current (mA)	Indication pounds	Current (mA)
0	2.00	0	2.00	0	2.00	0	2.00
500	2.68	250	2.91	250	2.40	250	2.20
1000	3.10	500	3.43	500	2.70	500	3.40
1500	3.52	750	3.75	750	2.95	750	3.99
2000	3.88	1000	3.99	1000	3.20	1000	4.44
2500	4.20	1250	4.24	1250	3.46	1250	4.86
3000	4.50	1500	4.49	1500	3.71	1500	5,21
3500	4.79	1750	4.72	1750	3.96	1750	5.52
4000	5.05	2000	4.94	2000	4.22	2000	5.82
4500	5.32	2250	5.20	2250	4.48	2250	6.11
5000	5.57	2500	5.42	2500	4.74	2500	6.41
5500	5.81	2750	5.64	2750	5.02	2750	6.67
6000	6.08	3000	5.88	3000	5.30	3000	6.93
6500	6.34	3250	6.15	3250	5.58	3155 FULL	7.11
7000	6.65	3500	6.47	3500	5.89		
7460 FULL	6.86	3750	6.75	3750	6.24		
		4000	7.07	4000	6.62		
		4290 FULL	7.20	4290 FULL	6.90		

Tolerance on all current values ±0.05 mA.

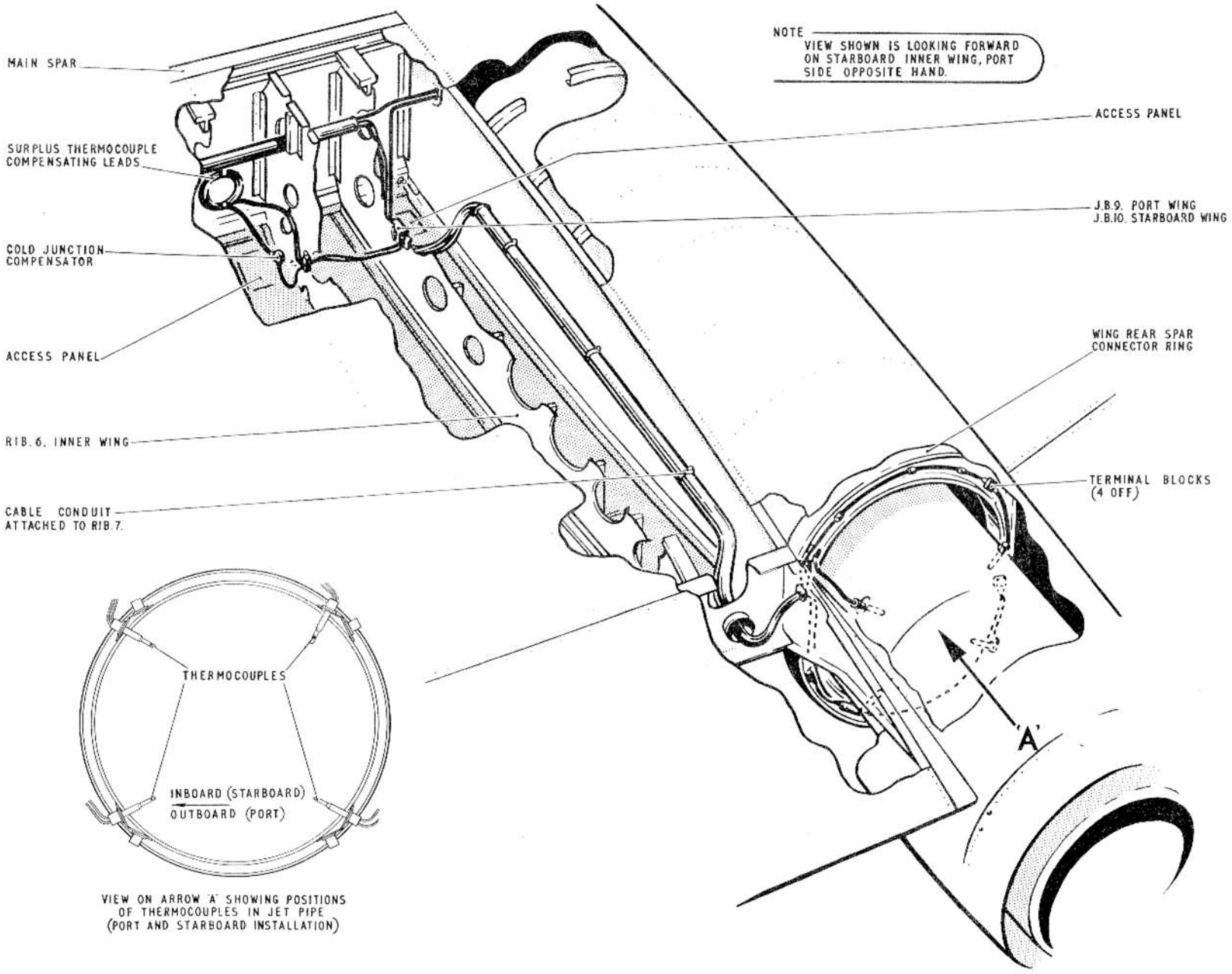

Fig.6. Thermocouple installation

FLIGHT INSTRUMENTS GROUP – F

(Completely revised)

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Introduction

1. In this group descriptive and servicing information is given for the pitot and static system and the flight instruments. Table 1 lists the main components together with their reference numbers and their relevant Air Publication. The location of the main items of equipment can be found by referring to the Table 1 and the location diagram in the General Information group at the beginning of this chapter.

PITOT AND STATIC SYSTEM

General

2. Instruments that depend on pitot and static pressure for their operation are connected to common pipelines. Static pressure is taken from two vents fitted one at each side of the nose while pitot pressures are fed from a Mk.8W pressure head installed on the plastic fairing which forms the foremost point of the fuselage. To prevent icing, a heater unit which is controlled by a switch mounted on the pilot's console panel, is embodied with the pressure head. The main instruments which depend on the pitot and static system for their operation are the A.S.I's, altimeters, machmeter, and the A.M.U. Provision is made near the A.M.U. in the port wing to connect a V.G. recorder when required.

Drain traps

3. Moisture in the pipelines is collected

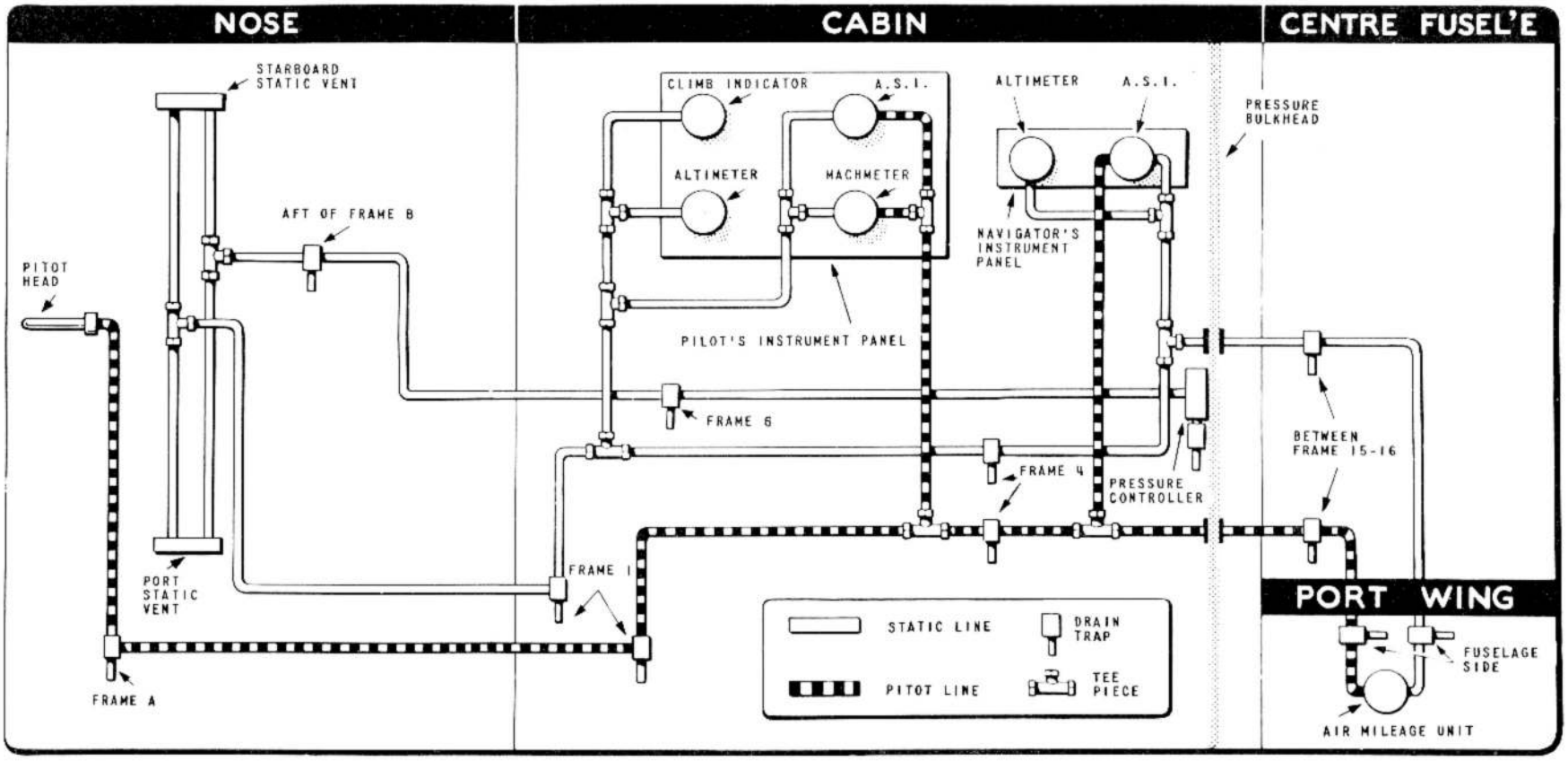

Fig. 1. Pitot and static system

by drain traps located at various points in the system. They are fitted in the nose, cabin, aft of the pressure bulkhead in the bomb bay, and near the wing root in the port wing. Each drain trap consists of a short length of tube, having a closed end, which is connected to the pipeline by a tee-piece.

Bonding

4. The pipelines are bonded to the aircraft structure by first scraping the pipes at the point of attachment and wrapping with wire gauze before fitting the clips. Flexible bonding leads are also used at various points to complete the earthing of the pipelines where the runs are broken by the fitting of unions and tee-pieces.

Servicing

5. As all instruments that function by pitot and static pressure operate from common pipelines, any faults in the lines will normally affect them all. Any single instrument giving suspect readings should be checked by reference to the relevant A.P. and renewed if necessary. The drain traps should be periodically removed and drained; after being refitted, the system must be tested for leaks and re-calibrated.

Leakage tests

6. The following tests are to be made on the pitot and static system in accordance with the aircraft Servicing Schedule and after any operation that involves disturbing joints or connections to the pipelines.

Test equipment

7. The leak test set *(Ref.No.6C/849)* described in A.P.1275T, Vol.1, Sect.3, Chap.4, is to be used when making tests on the pitot and static system.

Note...
The pump embodied in the tester must not be operated too vigorously as such action may cause damage to the instrument capsules.

Method of testing

8. The test procedure described in the following paragraphs has been summarised from A.P.1275A, Vol.2, Leaflet A9.

(1) Disconnect the pitot and static pipelines from the A.M.U. and seal them off. Seal one of the static vents with a Mk.2 protective plug *(Ref.No.6A/2679)*.

(2) Couple the pitot head, by means of the appropriate adapter, to the pitot connector on the tester and set the selector valve to 'Pressure to Pitot'. Apply pressure by using the pump until the test indicator reads just over 130 knots. Check the time taken for the indicator reading to fall to 125 knots; this must be greater than 3 minutes.

(3) Couple the static vent, by means of an adapter, to the static connector on the tester and set the selector to 'Suction to static'. Using the pump, apply suction until the tester indicator reads just over 130 knots and check the time taken for the indicator reading to fall to 125 knots. This should exceed 3 minutes.

(4) Connect the tester and an Air Reservoir of 100 in^3 capacity *(Ref.No.6C/1447)* to the pitot and static connections of the A.M.U. in turn. Apply pressure by the pump in each case and time the drop from 130 to 117 knots. The time must be greater than 50 secs for the pitot line and 20 secs for the static line.

(5) Reconnect the A.M.U. and repeat the tests detailed in (2) and (3) but with the 100 in^3 air reservoir tee-ed into the system. Check that the time taken for the pressure to drop from 130 to 117 knots is greater than 75 secs for the pitot line and 50 secs for the static line.

Drying out the system

9. When aircraft have been dispersed for any length of time under adverse weather conditions that have caused moisture to collect in the pitot and static system, it is necessary to empty all drain traps and dry the system out to prevent icing at high altitude. The procedure given in the following paragraphs is to be carried out at the following times:—

(1) Whenever the system is suspect.

(2) When called for in the relevant Servicing Schedule.

(3) When the aircraft has been out of service for more than 4 weeks.

10. The drying-out operation calls for the use of an instrument and auto-control testing trolley *(Ref.No.4F/1510)*, a pitot head test adapter *(Ref.No.4F/1502)*, and a static vent test adapter Mk.1 *(Ref.No.6C/499)*.

11. The procedure to be adopted is as follows:—

(1) Disconnect all instruments coupled to the pitot and static system at the point nearest each instrument.

(2) Connect the test trolley supply, by means of rubber hose and the pressure head adapter, to the pressure head and secure the clip.

(3) Start the motor of the trolley and allow the air supply, when completely warm, to circulate through the system for at least 5 minutes.

(4) Remove the trolley air supply hose from the pressure head and re-connect to one of the static vents by means of the Mk.1 static vent adapter. Repeat the previous sub-para.(3).

12. On the conclusion of the operation, remove the test trolley, re-connect all instruments and carry out the leak test detailed in para.6. If the aircraft is not for immediate use, fit and tape up a pressure head cover and refit the static vent plugs to prevent ingress of moisture into the system.

13. It is essential that during servicing which involves the removal and replacement of pipelines, bonding should be efficiently maintained by cleaning the pipelines and their clip attachment points and also that all bonding leads are refitted where necessary.

TURN AND SLIP INDICATOR

14. The Mk.2 turn and slip indicator, mounted on the instrument flying panel, is provided to indicate the lateral attitude of the aircraft in straight flight, the direction and rate of turn and the amount of sideslip, if any, during a turn. A power failure indicator is incorporated in the instrument and takes the form of a flag visible through an aperture in the dial; no indication is given when the power is on but the word 'OFF' appears when the speed of the gyro rotor is reduced to the extent when accurate turn indications are no longer provided. The instrument is basically an electrically-driven rate gyroscope which normally operates from one of two duplicated d.c. supplies controlled by the engine MASTER STARTING switches.

craft incorporating Mod.450 are also provided with a third power supply from an emergency battery. This supply is controlled by a NORMAL/EMERGENCY switch adjacent to the indicator. The power supplies to the instrument are fully described in Chap.1.

ARTIFICIAL HORIZON

15. Indication of the attitude of the aircraft in pitch and roll is given by a Mk.3C artificial horizon mounted on the pilot's instrument panel. The instrument is a gyroscopic unit operating from the 115-volts, 400 c/s, 3-phase a.c. power supplies described in Chap.1, Group D of this section.

AIR SPEED INDICATORS

16. Two Mk.9H*P air speed indicators, one mounted on the pilot's instrument panel and the other on the navigator's instrument panel, are installed in the aircraft. Both instruments are connected to the common pitot and static pipe lines.

ALTIMETERS

Pilot's altimeter system

17. The pilot's altimeter system *(post Mod.3898)* incorporates a Mk.22D altimeter, and a transistorized electronic amplifier Mk.1A. The altimeter is located on the instrument panel, and is connected by a multicore cable from a 12-way plug at the rear of the instrument to a 12-way socket on the amplifier mounted in the roof forward of frame 1.

Power supplies

18. The altimeter system operates from a 115 volt, 400 c/s, single-phase a.c. supply described in Chap.1, Group D. Indication of power supply failure to the system is indicated by a black and yellow striped flag appearing in a window on the instrument face.

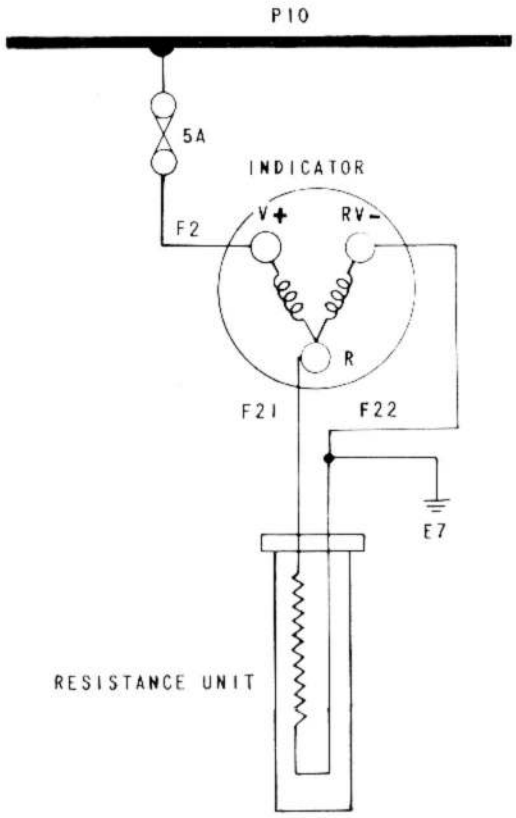

Fig. 2. External air thermometer

Navigator's altimeter

19. A Mk.19B, C or F Type altimeter is installed on the navigator's instrument panel, and is connected to the common static pipeline. With Mod.3954 embodied a vibrator unit is fitted to the rear of the altimeter. The unit operates from a 115 volt, 400 c/s, single-phase a.c. supply *(Chap.1, Group D).*

MACHMETER

20. A Mk.2 machmeter, fitted on the pilot's instrument panel, is operated from the pitot and static system.

RATE OF CLIMB INDICATOR

21. This instrument, which may be either a Mk.3P or Mk.3P*, is mounted on the pilot's instrument panel and connected into the static pipe line.

EXTERNAL AIR THERMOMETER

22. The temperature of the air outside the aircraft is shown by a thermometer on the navigator's instrument panel. The thermometer indicator functions in conjunction with a Type A resistance bulb which protrudes from the leading edge of the inboard end of the port main plane.

Servicing

23. Access to the resistance bulb is attained by removing the inboard detachable panel on the top side of the port main plane between the fuselage and the engine.

G.M.4B COMPASS

General

24. The Mk.4B gyro-magnetic compass combines the functions of a directional gyro and a magnetic compass and possesses the particular advantages of each. The indications shown by the compass are stabilized by means of a gyro and synchronized with the earth's magnetic field by a remote detector unit and a monitoring system. By means of a repeater system, compass heading is fed into a compass repeater in the nose and the A.P.I.

25. The installation consists of a detector unit, amplifier, control panel, gyro unit, and master indicator. The detector unit is fitted in the starboard wing tip, the amplifier and control panel at the starboard side of the navigator's station and the gyro unit and

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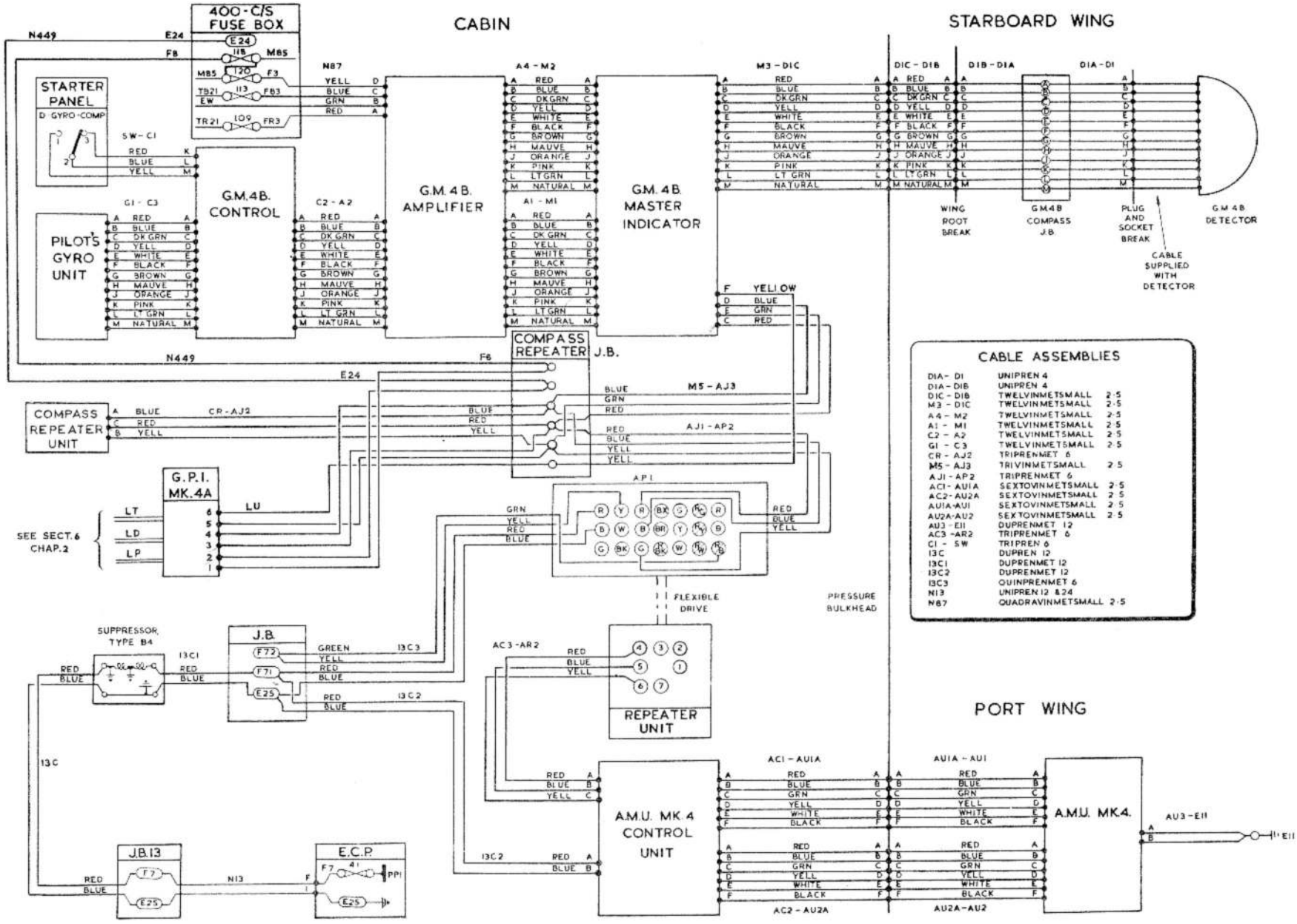

Fig.3. G.M.4B compass – G.P.I. Mk.4A – A.P.I. and A.M.U.

master indicator on the pilot's and navigator's instrument panels respectively. A switch, labelled COMP/D-GYRO and mounted on the starter panel, permits the pilot to operate the gyro unit as either a compass or directional gyro as required.

Power supplies

26. The compass system operates from the 28-volts d.c. and 115-volts, 400 c/s, 3-phase a.c. power supplies described in Chap. 1, Group D.

Servicing

27. The compass installation should be checked in accordance with the current Servicing Schedule. During a visual examination, particular attention should be paid to the security of the connector plugs and sockets and the amplifier mountings.

Servicing periods

28. These are laid down in A.P.3158, Vol. 2, Leaflet B11. Functioning tests and detailed routine servicing of the equipment is given in A.P.1275B, Vol.1, Sect.11.

Calibration

29. The compass system should be calibrated periodically using the procedure outlined in A.P.1275B, Vol.1, Sect.11, Chap.5, App. 3.

Functional test

30. To check the functioning of the compass:—

(1) Switch on the d.c. and a.c. power supplies to the compass by operating the starboard engine MASTER STARTING switch on the starter panel. Allow at least two minutes for the inverter to run up and check that the compensator lamps in the amplifier are alight; these are visible through small holes on the front of the amplifier case. Failure of either lamp will cause the value of the current flowing through the compensator coil to alter, thus introducing compass errors. Set the variation scale on the Master Indicator to read 'O'

(2) Turn the selector switch on the control panel to GYRO COMPASS and allow the precession amplifier to warm up. Verify that the dot (.) or the (x) is shown in the annunicator window of the gyro unit and that a similar indication is shown by the annunicator in the master indicator on the navigator's panel.

(3) Press in the synchronizing knob and turn it in the direction shown by the flag in the annunciator window *(i.e. clockwise when the dot (.) is showing and counter-clockwise when the cross (x) is showing).* When the indication in the annunciator window changes to the opposite sign, slowly turn the synchronizing knob back until the window is cleared, or a dot and cross appear alternately. The gyro unit is now synchronized. Check that the indications shown in the master indicator annunciator window are similar to those shown by the gyro unit. Note the compass card heading against the lubber line; this reading should agree approximately with the stand-by compass.

(4) Offset the compass card 5 deg. from the indicated heading by means of the synchronizing knob and note the time taken for it to return to the original heading within ±0.5 deg. The time taken should not exceed 3 minutes. Check that the master indicator follows the compass card and agrees within ±1 deg.

(5) Set the pilot's switch to D-GYRO and verify that D.G. is shown in the annunciator windows of the gyro unit and the master indicator.

(6) Alter the heading shown by the compass card by means of the synchronizing knob and check that the master indicator pointer follows the movement of the card and agrees within ±1 deg.

(7) Having synchronized the gyro, set ten degrees of westerly variation on the master indicator. Check that the new card indication after synchronizing is ten degrees less than the previous readings. Return the variation scale to zero.

MAGNETIC COMPASS, TYPE E2A

31. In addition to the G.M.4B compass system an emergency magnetic compass, Type E2A, is installed above the instrument flying panel. It is illuminated by a lamp which is controlled by the starboard 'red' lamp dimmer switch below the canopy coaming.

AIR POSITION INDICATOR (A.P.I.) AND AIR MILEAGE UNIT (A.M.U.)

General

32. The air mileage unit (A.M.U.) and the air position indicator (A.P.I.), together with the G.M.4B compass, are designed to maintain a continuous and accurate air plot in terms of latitude and longitude. The main components comprise the A.M.U., A.M.U. control panel, A.M.U. repeater unit, and the A.P.I.

TABLE 1

Flight instruments

Ref.No.	Equipment	Quantity	Relevant A.P. Vol.1.
6A/3953	Turn-and-slip indicator, Mk.2A	1	A.P.1275A, Vol.1, Sect.13
6A/5465	Amplifier, Mk.1A	1	A.P.1275A, Vol.1, Sect.22
6A/3489	Artificial horizon, Mk.3C	1	A.P.1275A, Vol.1, Sect.2 (Old series)
6A/3147	Air speed indicator, Mk.9H*P	2	A.P.1275A, Vol.1, Sect.21
or			
6A/4722	Air speed indicator, Mk.9M	2	A.P.1275A, Vol.1, Sect.21
6A/5040	Altimeter, Mk.19B	1	A.P.1275A, Vol.1, Sect.22
or			
6A/7018	Altimeter, Mk.19C (post Mod.3750)	1	A.P.1275A, Vol.1, Sect.22
or			
6A/8267/1	Altimeter, Mk.19F (post Mod.3971)	1	A.P.1275A, Vol.1, Sect.22
6A/7041	Altimeter vibrator unit (post Mod.3954)	1	A.P.1275A, Vol.1, Sect.22
6A/7762	Altimeter Mk.22D (post Mod.3898)	1	A.P.1275A, Vol.1, Sect.22
6A/3384	Machmeter, Mk.2	1	A.P.1275A, Vol.1, Sect,21
6A/2697	Rate-of-climb indicator, Mk.3P	1	A.P.1275A, Vol.1, Sect.22
or			
6A/5845	Rate-of-climb indicator Mk.3P*	1	A.P.1275A, Vol.1, Sect.22
6A/3820	Pressure head, Mk.8W	1	A.P.1275A, Vol.1, Sect.22
6A/3682	Air thermometer, Mk.4 (Type B)	1	A.P.1275A, Vol.1, Sect.17
6A/3684	Resistance bulb, Type A	1	A.P.1275A, Vol.1, Sect.17
	A.D.R.I.S. system		A.P.1275B, Vol.1, Sect.16
6B/554	Air mileage unit, Mk.4A	1	
6B/471	Control panel, A.M.U., Mk.4	1	
6B/314	Repeater unit	1	
6B/1158	Air position indicator	1	
6B/2649	G.P.I. Mk.4A	1	A.P.1275B, Vol.1, Sect.16
	G.M.4B compass system		A.P.1275B, Vol.1, Sect.11
6B/1993	Detector unit, Type A	1	
6B/634	Master indicator, Type B	1	
6B/561	Gyro unit, Type B	1	
6B/562	Amplifier, Type B	1	
6B/437	Mounting tray, Type A	1	
6B/408	Control panel, Type A	1	
6B/742	Repeater compass	1	
6B/405	Compass, Type E.2A	1	A.P.1275B, Vol.1, Sect.10

Air mileage unit

33. The Mk.4A A.M.U. is installed in the port wheel well and is mounted flush with the lower surface of the mainplane. The electrical connections to it are made by screened cables and Plessey miniature plugs and sockets. Also fitted on the unit are two unions for connecting the pitot and static pipelines.

A.M.U. control panel

34. The system is controlled from the A.M.U. control panel mounted near the fuselage skin above the navigator's table. The panel includes the A.M.U. MAIN ON/OFF switch, an ON/OFF switch which controls the electrical transmission from the A.M.U. to the A.M.U. repeater unit, and a ground test push-switch. An indicator lamp embodied below the face of the panel shows when the A.M.U. is operating satisfactorily and an adjustable screen, marked BRIGHT, DIM and OUT, fitted over the lamp, can be adjusted to control the illumination from it.

A.M.U. repeater unit

35. A.M.U. output is received as 'M' type electrical transmission by a motor in the A.M.U. repeater unit, a flexible drive from the repeater unit feeds this output into the A.P.I. The unit is mounted on a panel below and forward of the navigator's table and is accessible from the port side of the pilot's seat.

Air position indicator

36. This indicator, fitted to the navigator's instrument panel, shows the aircraft's position in latitude and longitude. It receives inputs from the A.M.U. repeater by flexible drive and from the G.M.4B master indicator by 'M' type electrical transmission. The cable run from the G.M.4B master indicator to the A.P.I. passes through a junction box mounted on a panel between frames 5 and 6.

Power supplies

37. Both the A.M.U. and A.P.I. operate from a common source of 28-volts d.c. fed from the E.C.P. via J.B.13 and a Type B4 suppressor, and a 3-entry junction box mounted on the same panel as the G.M.4B/A.P.I. junction box.

Servicing

Ground testing

38. The following procedure describes a brief check to test the A.M.U. on the ground. After setting the main and electrical transmission switches on the control panel to the ON position, wait for 30 seconds and then press the ground test switch. Allow a few seconds for the instrument to settle down and then check the following:—

(1) That the control panel indicator lamp is 'winking'. The rate of winking may be considerably greater than in normal flight conditions.

(2) Check that the A.P.I. counters are moving in the appropriate direction according to the heading indicated by the instrument.

Note...

The ground test speed of the A.M.U. may be anywhere between 70 and 270 knots.

Servicing of the items of equipment is only to be undertaken by qualified personnel. Faults in the power supplies should be traced by referring to Chap.1, Group D.

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