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SECTION 5

ELECTRICAL SYSTEMS AND INSTRUMENT INSTALLATION

LIST OF CHAPTERS OVERLEAF

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ELECTRICAL SYSTEMS AND INSTRUMENT INSTALLATION

LIST OF CHAPTERS

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

Chapter 1 ELECTRICAL INSTALLATION

LIST OF CONTENTS

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

MODIFICATIONS INCLUDED SUBSEQUENT TO STANDARD

Modification Number	Effect on Publication	Incorporated by A.L. Number
5204	Amends Sect.5 and 6	215
4868 4251 4263	Adds a Supplement after Sect.6, Chap.2, Part 2	216
5078		
5409	Amends Sect.5, Chap.1, General Information, Group P and Group R&S Amends Sec.6, Chap.1, General Information and Part 2	220
5209	Amends Leading Particulars	221
◀5510	Amends Sect.5, Chap.1, General Information and Group A & B	227▶

GENERAL INFORMATION

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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, and the access panels for servicing them. Also included are tables of fuses and earth point locations. Theoretical and routeing charts are inserted near the descriptive matter in each group.

DESCRIPTION

Power supplies

2. The electrical installation operates on a d.c. 24/28 volt, voltage regulated single-pole earth return system, power being supplied by two generators *(Group P)* operating in parallel in conjunction with four 12 volt, 40 amp hr batteries. By means of two rotary inverters and two static inverters, power supplies of 400 Hz 3-phase a.c. and 400 Hz single-phase a.c. are provided for operating the flight instruments and radar equipments.

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 the use of junction and distribution boxes dispersed throughout the aircraft. Each junction box is referenced by a number such as J.B.1, J.B.2 etc. which is marked on the box cover. Cable connections to the terminals and fuse blocks in the junction and distribution boxes are made by quick release tags or ferrules. In some instances Hellerman Deutsch connectors are used, should these types of plugs and sockets be encountered information on them can be found in A.P.113D-1822-1.

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. 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. Coloured rubber sleeves fitted at cable terminations throughout the aircraft are used to denote circuit identification; yellow or pink indicate d.c., green, 400 Hz single-phase a.c. and red, blue and white, 400 Hz three-phase a.c. In a.c. circuits the phase reference is the second letter of the circuit identification. For example, in a 400 Hz circuit having the letter and number reference TG2, the letter 'G' denotes green and subsequently a 400 Hz single-phase circuit. Similarly in the 400 Hz 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 are shown as 3A, 3B, etc.

6. Each lead in a cable assembly fitted with multi-pole plugs or sockets is identified by 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 items 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 radar 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

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

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

9. The crimping process is a solderless method of making electrical points 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 accommodate the various sizes of plug pins, socket inserts, tags or ferrules. There is available a special crimping tool kit 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 below 20 s.w.g. 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 reassembly. With the standard type, the socket coupling nut must always be slackened off first to allow the socket shell to be unscrewed independently of the inner moulding and cable leads. Pliers must never be used to unscrew tight socket shells – an adjustable strap wrench is available for this purpose.

12. In the original 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

In the modern standard type of Plessey socket, the contact inserts are retained in a moulded comb and are renewed on replacement.

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 tool 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 swarf or other foreign matter which could cause shorting. The plug and socket threads must be kept clean and lightly lubricated with grease XG-287, Ref.No.34B/2241793.

15. The Plessey wiring system and the standard type plugs and sockets are fully described in A.P.113D-1825-1 while the Mk.4 miniature plugs and sockets are described in A.P.113D-1824-1.

Pilot's station

16. All switches and instruments employed in the control of the aircraft are grouped on panel assemblies arranged round the pilot's station. The main items of equipment are carried by the flight, engine and miscellaneous instrument panels which extend across the station. Above the main panels is the blast shield and below them the starter panel. The console, port switch and port sloping panels, together with the throttle box, are situated at the port side of the pilot's seat, whilst the electrical control panel is fitted at the starboard side.

Flight instrument panel

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

Engine instrument panel

18. This panel positioned to starboard of the flight instrument panel, carries all engine instruments, fuel contents gauges and fuel pump switches. Also located on the panel are the fuel pressure warning and generator failure warning lamps.

Miscellaneous instrument panel

19. The miscellaneous instrument panel is fitted diagonally at the starboard side of the cockpit between the engine instrument panel and frame 3. Located on the panel are the hydraulic pressure, brake pressure and oxygen contents gauges, cabin air and altitude indicators, the cabin environment control switch(es), the cabin pressure warning horn switch, engine fire warning push switches and the engine fire warning lamps test switch. Further switches, ◀which are employed in the V/U.H.F. system and a V/U.H.F. control unit are also located on the panel.▶

Blast shield

20. This shield, which is mounted above the pilot's instrument panels, provides accommodation, on its underside, for various dimmer switches, red, U/V and emergency lamps, the frequency card holder and lamps and the emergency compass. Located on the top of the shield is the accelerometer.

Starter panel

21. The starter panel is situated below the flight instrument panel and carries the engine master ignition and starting switches, also the GM4B compass switch.

Port switch panel

22. The port switch panel is located on the port side of the pilot's seat above the console. Located on the panel are the console lamps dimmer switch, the emergency lamps switch, the intercomm. control switch stand-by U.H.F. supply selector switch and the 'A' guard switch. Also located on the panel are the switches associated with the target towing system which comprise the master switch, normal and emergency jettison switches and the cocking test lamp.

Throttle box

23. The throttle box which is installed forward of the console panel carries the engine relight switches, which are integral with the H.P. fuel cock levers, and the fuel pump isolation switches.

Port sloping panel

24. This panel is located between the throttle box and the flight instrument panel and carries the alighting gear master safety switch, selector switch, position indicator the flaps control switch and the tip-tank jettison push switch.

Console

25. The console is located to port of the pilot's seat. On its top is a removable panel on which are mounted the control switches associated with the external lights, anti-collision lamps, identification lamps, landing lamp, taxying lamps, navigation lamps, rudder trim and aileron trim. To port of the throttle box is the canopy/snatch jettison and safety switches. The switches for the D.V. window, pressure head and vent valve heaters, bomb doors and canopy de-mist are mounted to the rear of the console along with the bomb doors indicator, anti-collision lamps fuse and intercomm. control unit. Located at the extreme aft end of the console is a small detachable panel which forms the console fuse panel, forward of which, are located the canopy and hatch jettison test lamps and fuses.

Control column

26. The right handgrip of the pilot's control column incorporates the tail plane trim switches and the radio press-to-transmit switch. Fitted in the centre of the control column is the air brakes control switch.

Electrical control panel (E.C.P.)

27. The E.C.P. is installed in the cabin 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 and the pilot's heater clothing control switch and Burcostat. On the aft sloping face, which forms a switch panel, are mounted the pilot's services, No.2 and No.3 inverter and I.L.S. circuit breakers and the switch, field circuit breaker and failure warning lamp for No.1 and No.2 generators. Also located on the switch panel are the Tacan/I.F.F. control and battery isolation switches and two capped test supply sockets. On the starboard side of the panel, under a cover secured by quick-release fasteners, is a further hinged panel on which is mounted the main assembly of fuses, the fuel pump test switches and the ammeter socket and the No.1 and No.2 generator amps and volts test sockets. This panel may be hinged down to give access to the terminal blocks and the fuel pump/cock relays inside the assembly.

1st navigator's station

28. The navigator's equipment is grouped on panels above the chart table and mounted on the port cabin wall. The panel mounted controls comprise the navigational instruments, oxygen regulator, the radio and radar switches and controllers. Below the oxygen regulator is a banner target emergency jettison switch. The equipment mounted on the port wall consists of the hatch jettison and safety switches, a cockpit lamp, heated clothing control switch and Burcostat, radio compass and I.L.S. control switches, dimmer switches for the panel, control units and angle poise lamps and other equipment concerned with the navigational instruments. Further equipments, located below the table, are concerned with the radio and radar systems.

2nd navigator's station

29. At this station the equipment is mounted on the cabin wall and comprise the hatch jettison and safety switches, No.2 inverter, heated clothing control switch and Burcostat, cabin pressure warning horn and relay, hatch detonator resistor boxes, J.B.14 and the 400 Hz fuse box. Also located on the wall is the chartboard lamp and dimmer switch, an inspection lamp and extension lead and other equipment associated with the instrument and radio systems.

Forward station

30. At this station is located a cockpit lamp, a wander lamp and dimmer switch and an oxygen regulator.

Pressure bulkhead

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

Upper equipment compartment

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. Located in the compartment are inverters 'A' and 'B', No.1 and No.2 distribution boxes, both navigator's hatch jettison mechanism, hatch jettison resistor boxes, cabin pressure controller, torque switch and air brakes relay box. Further equipment associated with the instrument and radio systems are also located in the compartment. 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 (M.E.P.) assemblies, a.c. power supply inverter No.3 and the starboard inertia switch. Illumination of the equipment is provided by a cockpit lamp fitted above the access door. Access to the equipment is through a hinged door in the starboard side of the fuselage.

Main electrical panel (M.E.P.)

34. On this panel are the generator voltage regulators, circuit breakers, cut-outs, ammeter shunts, the external power plug and inverter A and B relays, and circuit breakers. The busbar panel, installed directly above the M.E.P., is the primary distribution point for the main d.c. power supplies. On it are mounted the Type R battery isolation relay, main terminal connector, and a number of fuses and terminal blocks.

Port equipment compartment

35. Situated at the port side of the nose wheel bay, between the pressure bulkhead and frame 12, this compartment houses the standby U.H.F. equipment which comprises the battery, dropper resistor, battery test switch, which is located on the junction box, and relay 3577/1.

Bomb bay

36. Among the items of equipment installed in the bomb bay are the electrically-operated fuel pumps and cocks, J.B.1, 2, 3 and 5, the electrically-operated valves which control the operation of the alighting gear, bomb-bay doors, and air brakes, and the fuel gauge amplifiers.

Rear fuselage

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

Cable ratings

38. The rating of the cables is marked in accordance with the American system which is indicative of the cross-sectional area of the cable. The rating number is printed in black and appears approximately every five inches along the braiding of the cable. Should details of this data be required, reference should be made to A.P.101B-0402-3A, Vol.3, Part 1, Book 2, Sect.R, Schedule of Cables which is the overriding authority.

Earth bonding

39. Before remaking the connections at an earth point which has been broken down, each terminal must be scraped clean. After reassembly the earth point must be painted with blue oil base paint D.T.D.2608 to exclude moisture.

9000 series switches

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

TABLE 1

Circuit identification scheme

Ident.	Circuit
B1	Bomb bay doors indicator
B3	Bomb bay doors control
C2	Tail trim control
C3	Flaps control
C4	Flaps indicator
C5	Rudder trim control
C6	Rudder trim indicator
C7	Tail plane trim indicator
C9	Air brakes
CC1	Aileron trim control
CC2	Aileron trim indicator
CC5	Tail trim control
CC7	Tail trim isolation
F2	External air thermometer
F3	GM4B compass
F4	Turn and slip indicator
F5	Turn and slip indicator
F6	Artificial horizon
F7	AMU/API
FF2	Automatic height encoding
FF3	Automatic height encoding
FF4	Automatic height encoding
FX4	Turn and slip indicator
H1	Cabin air control
H2	Cabin air indicator
H3	Cabin air pressure warning
H4	Pressure head heater
H5	Vent valve heaters
H6	D.V. window heater
H7	Canopy de-misting – pilot's heated clothing
H8	1st navigator's heated clothing
H9	2nd navigator's heated clothing
HH1	Cabin air control – No.1 engine gate valve (post Mod.5)
HH2	Cabin air control – No.2 engine gate valve (post Mod.5)
IFF	I.F.F./S.S.R.
J1	Engine starting – No.1 engine
J2	Engine starting – No.2 engine
J3	Fuel pump isolation – No.1 engine
J4	Fuel pump isolation – No.2 engine
J5	Ignition – No.1 engine
J6	Ignition – No.2 engine
L1	Navigation lamps
L2	Taxying lamps
L3	Landing lamp control
L4	Landing lamp
L5	Pilot's station red lamps
L6	Pilot's station U/V lamps
L7	Pilot's console and forward station lamps
L8	1st navigator's station panel lamps
L9	Navigator's cockpit and chartboard lamps
L10	Anti-collision lamps
LL1	Identification lamps
LL2	Pilot's station emergency lamps
LL4	Equipment bay lamp
M2	Inverter No.2
M3	Inverter No.3
M5	Inverter 'A'/'B' control
M7	Inverter No.2 control
M8	Inverter No.3 control
M9	Inverter 'A'/'B' changeover
P1	Generator No.1
P2	Generator No.2
P3	Generator No.1
P4	Generator No.2
P5	Generator No.1
P6	Generator No.2
P7	Generator No.1
P8	Generator No.2
P9	Battery positive
P10	Main busbar

continued . . .

TABLE 1 Circuit identification scheme – *continued*

Ident.	Circuit
PF1	Generator field (No.1)
PF2	Generator field (No.2)
PF3	Generator field (No.1)
PF4	Generator field (No.2)
PP3	Pilot's console fuse panel supply
Q1	No.1 engine tachometer
Q2	No.2 engine tachometer
Q3	No.1 oil pressure gauge
Q4	No.2 oil pressure gauge
Q5	No.1 exhaust gas thermometer
Q6	No.2 exhaust gas thermometer
Q7	Fuel contents
R3	Intercomm.
R5	Intercomm.
R8	Radio compass
RR1	V/U.H.F.
T2	Inverter No.2 output
T3	Inverter No.3 output
TF1	Inverter 'A' output
TF2	Inverter 'B' output

Ident.	Circuit
TAC	Tacan
U1	Undercarriage control
U2	Undercarriage indicator
V+	D.C. voltmeter
W1	No.1 generator failure warning lamp
W2	No.2 generator failure warning lamp
W3	Fuel pressure No.1 engine
W4	Fuel pressure No.2 engine
W5	Oxygen warning
W6	Oxygen warning
X1	Fire extinguishers (inertia switch)
X3	No.1 engine fire warning
X4	No.2 engine fire warning
X5	Canopy/snatch jettison
X6	Hatch jettison
X1P	No.1 engine fire warning push switch
X1S	No.2 engine fire warning push switch
X7	Canopy and hatch emergency jettison
Y1	Fuel cock No.1 port
Y2	Fuel cock No.1 stbd.

Ident.	Circuit
Y3	Fuel cock No.2 port
Y4	Fuel cock No.2 stbd.
Y5	Fuel cock No.3 port
Y6	Fuel cock No.3 stbd.
Y7	Wing tip tank jettison
Y9	Target towing
YS1	Overload tank – port fuel cock (post Mod.1490)
YS2	Overload tank – stbd. fuel cock (post Mod.1490)
YY9	Target towing emergency jettison
Z1	Fuel pump No.1 port
Z2	Fuel pump No.1 stbd.
Z3	Fuel pump No.2 port
Z4	Fuel pump No.2 stbd.
Z5	Fuel pump No.3 port
Z6	Fuel pump No.3 stbd.
ZS1	Overload tank – aft fuel pump (post Mod.1490)
ZS2	Overload tank – fwd. fuel pump (post Mod.1490

TABLE 2

Fuse numbers, ratings and location

Service	Fuse No.	Rating (amps)	Circuit Ref.	Location
Battery isolation	1	5	P91	
Fire extinguisher	2	20	X1	
Target towing emergency jettison	3	5	YY9	
Fatigue meter	4	2.5	U12A	
Ammeter test socket	5	5	P51	
Ammeter test socket	6	5	P71	
Ammeter test socket	7	5	P81	
Ammeter test socket	8	5	P61	
Voltmeter	9	5	V+	
Stand-by U.H.F. – normal	10	10	–	M.E.P.
Stand-by U.H.F. – emergency	11	10	–	
Equipment bay lamp	12	5	LL4	
Stand-by U.H.F. battery test	13	5	–	
No.1 generator failure warning lamp	14	5	W1	
No.2 generator failure warning lamp	15	5	W2	
Stand-by U.H.F. control	16	5	–	
Canopy jettison	17	50	X5	
Hatch jettison	18	50	X6	
U.H.F. system	19	40	–	
Tail-plane control	21	5	CC7	
Bomb bay door indicator	22	5	B1	
Mic. junction box	23	2.5	–	
Bomb bay door control	24	10	B3	
Tail-plane control	25	5	CC5	
Tail-plane indicator	26	5	C7	E.C.P.
Flaps control	27	10	C3	
Flaps indicator	28	5	C4	
Rudder-trim control	29	10	C5	
Rudder-trim indicator	30	5	C6	
Air brakes	31	10	C9	
Aileron-trim control	32	10	CC1	

continued . . .

TABLE 2 Fuse numbers, ratings and location – *continued*

Service	Fuse No.	Rating (amps)	Circuit Ref.	Location
Aileron-trim indicator	33	5	CC2	
Oxygen warning	34	2.5	W5	
External air thermometer	35	5	F2	
A.M.U. and A.P.I.	36	5	F7	
Cabin air control	37	5	H1	
Cabin air indicator	38	5	H2	
Cabin air warning	39	5	H3	
Cabin air control (post Mod.5)	40	5	HH1	
No.1 engine starting	41	10	J1	
No.1 engine pump isolating solenoid	42	5	J3	
No.1 engine ignition	43	20	J5	
A.H.E. 28V d.c. test supply	44	5	FF4	
No.2 engine starting	45	10	J2	
No.2 engine pump isolating solenoid	46	5	J4	
No.2 engine ignition	47	20	J6	
Target towing	48	5	Y9	E.C.P.
◀ Cabin air control (post Mod.5)	49	5	HH2	▶
Overload tank fuel cock, starboard (post Mod.1490)	50	5	YS2	
Overload tank fuel cock, port (post Mod.1490)	51	5	YS1	
Oxygen warning	52	2.5	W6	
Pilot's instrument panel lighting	53	5	L5	
Pilot's panel lighting (U/V)	54	5	L6	
Console and forward station lighting	55	5	L7	
Navigator's cockpit and chartboard lamps	56	5	L9	
Canopy de-misting	57	5	H7	
Fuel pump, overload tank, forward (post Mod.1490)	58	20	ZS2	
Fuel pump, overload tank, aft (post Mod.1490)	59	20	ZS1	
Spare	60	–	–	
Exhaust gas thermometers	61	5	Q5	

continued . . .

TABLE 2 Fuse numbers, ratings and location – *continued*

Service	Fuse No.	Rating	Circuit Ref.	Location
Fuel contents gauges	62	7.5	Q7	E.C.P.
Intercomm. supply	63	5	R3	
Intercomm. junction box	64	5	R4	
Spare	65	–	–	
Intercomm. isolation panel	66	5	R5	
Alighting-gear control	67	10	U1	
Alighting-gear indicator	68	5	U2	
Fuel pressure warning (No.1 engine)	69	5	W3	
Fuel pressure warning (No.2 engine)	70	5	W4	
No.1 engine fire warning	71	5	X3	
No.2 engine fire warning	72	5	X4	
Spare	73	–	–	
No.1 engine fire extinguisher push switch	74	5	X1P	
No.2 engine fire extinguisher push switch	75	5	X1S	
Wing tip fuel tank jettison	76	10	Y7	
Tacan d.c. supply	77	5	M34	
Radio compass	78	10	–	
Spare	79	–	–	
Instrument d.c. supplies	80	5	M8	
Instrument d.c. supplies	81	10	M7	
Turn and slip indicator	82	2.5	F5	
Turn and slip indicator	83	2.5	F4	
U.H.F. aerial change-over	84	5	RR2	
Turn and slip indicator (emergency)	89	2.5	FX4	Pilot's console
Emergency lighting	90	2.5	LL2	
Pressure head heater	93	10	H4	
Vent valve heater (if fitted)	94	10	H5	
D.V. window heater	95	10	H6	
Landing lamp control	96	5	L3	
Navigation lamps	97	5	L1	
Identification lamps	98	5	LL1	
Taxying lamps	99	10	L2	
Landing lamp filament	100	20	L4	

continued . . .

TABLE 2 Fuse numbers, ratings and location – *continued*

Service	Fuse No.	Rating	Circuit Ref.	Location
Oil pressure gauge (No.1 engine)	101	2.5	Q3	
Radio compass	102	5	–	
Oil pressure gauge (No.2 engine)	103	2.5	Q4	
Radio compass	104	5	–	
Tacan	105	5	TAC1	No.1 distribution box
Tacan	106	5	TAC3	
Spare	107	–	–	
Tacan	108	5	TAC4	
GM4B compass	109	2.5	FR3	
Spare	110	–	–	
Artifical horizon	111	2.5	FR6	
D.V. window heater	112	5	HR6	
GM4B compass	113	2.5	FB3	
Spare	114	–	–	
Artificial horizon	115	2.5	FB6	
Spare	116	–	–	
Spare	117	–	–	
Spare	118	–	–	
Spare	119	–	–	400 Hz fusebox
GM4B compass	120	2.5	F3	
Spare	121	–	–	
Spare	122	–	–	
Spare	123	–	–	
Spare	124	–	–	
Spare	125	–	–	
Spare	126	–	–	
Spare	127	–	–	
Spare	128	–	–	
Spare	129	–	–	
Spare	130	–	–	
A.H.E.	131	5	FFB2	
A.H.E. 115V a.c. test supply	132	5	FFB3	
Spare	133	–	–	No.2 distribution box
Spare	134	–	–	
Spare	135	–	–	
IFF/SSR	136	5	–	
Spare	137	–	–	

continued . . .

TABLE 2 Fuse numbers, ratings and location – *continued*

Service	Fuse No.	Rating	Circuit Ref.	Location
Tail-plane control	138	60	C2	M.E.P.
V/U.H.F. system (Mod. 5409)	139	10	RR11	Rear fuselage, FR.30-30A
No.1 port fuel cock	149	5	Z11	E.C.P.
No.2 port fuel cock	150	5	Z31	
No.3 port fuel cock	151	5	Z51	
No.1 starboard fuel cock	152	5	Z21	
No.2 starboard fuel cock	153	5	Z41	
No.3 starboard fuel cock	154	5	Z61	
A.H.E.	155	5	FF2	
A.H.E. 28 volt d.c. test supply	156	5	FF3	
IFF aerial switch unit	157	5	–	
IFF transponder	158	5	–	
IFF control	159	5	–	
IFF fail	160	5	–	
Tacan/IFF inverter control	161	5	M52	
D.C. test socket	162	10	–	
Navigator's instrument panel lamps	163	5	L8	
V/U.H.F. control unit	164	5	–	
Anti-collision lamps	165	5	L10	Pilot's console
HE ignition unit (inboard)	166	10	J51A	Port undercarriage bay
HE ignition unit (outboard)	167	10	J51B	
HE ignition unit (inboard)	168	10	J61A	Starboard undercarriage bay
HE ignition unit (outboard)	169	10	J61B	
Pilot's heated clothing	170	5	H7	
1st navigator's heated clothing	171	5	H8	
2nd navigator's heated clothing	172	5	H9	

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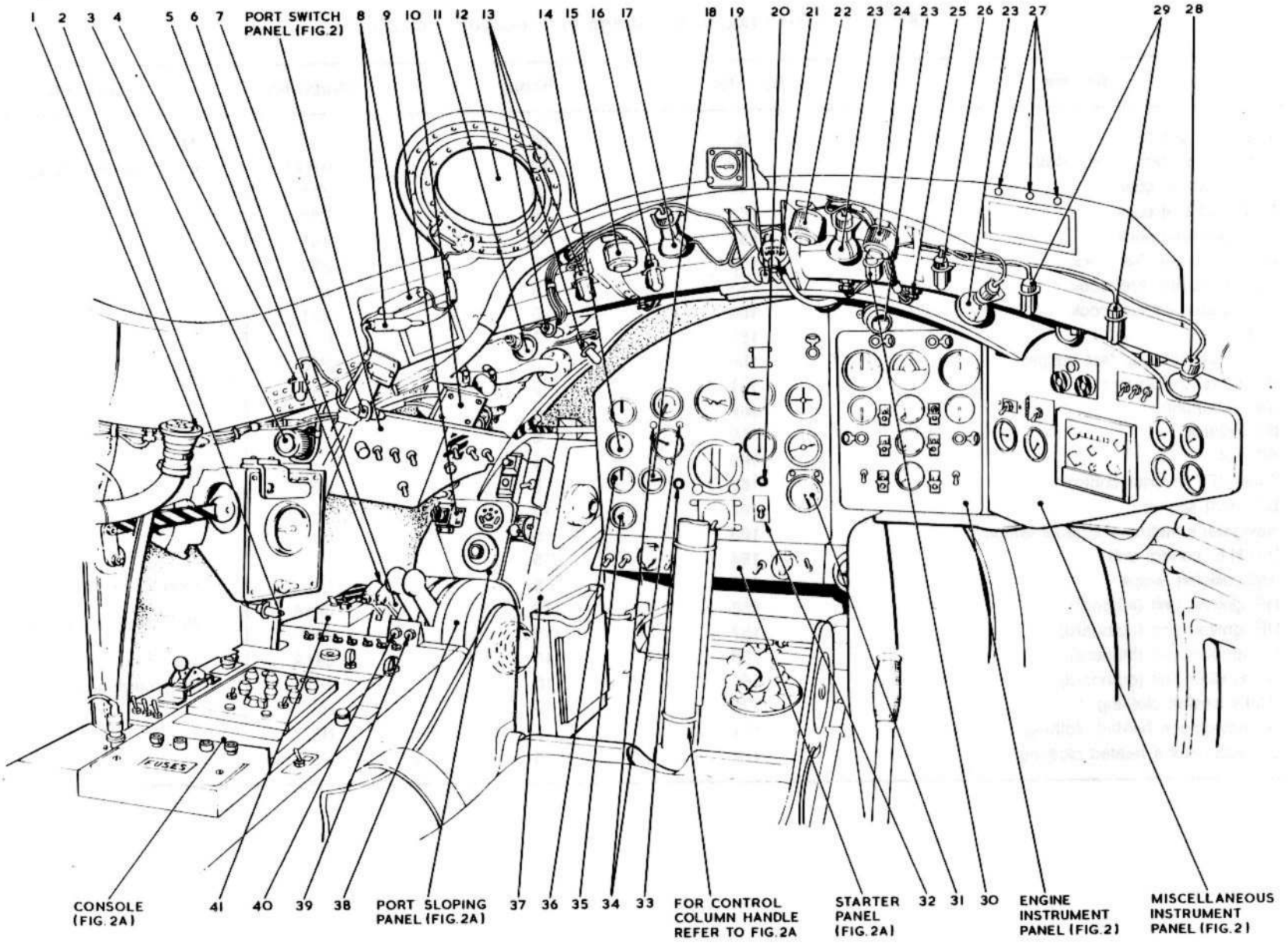


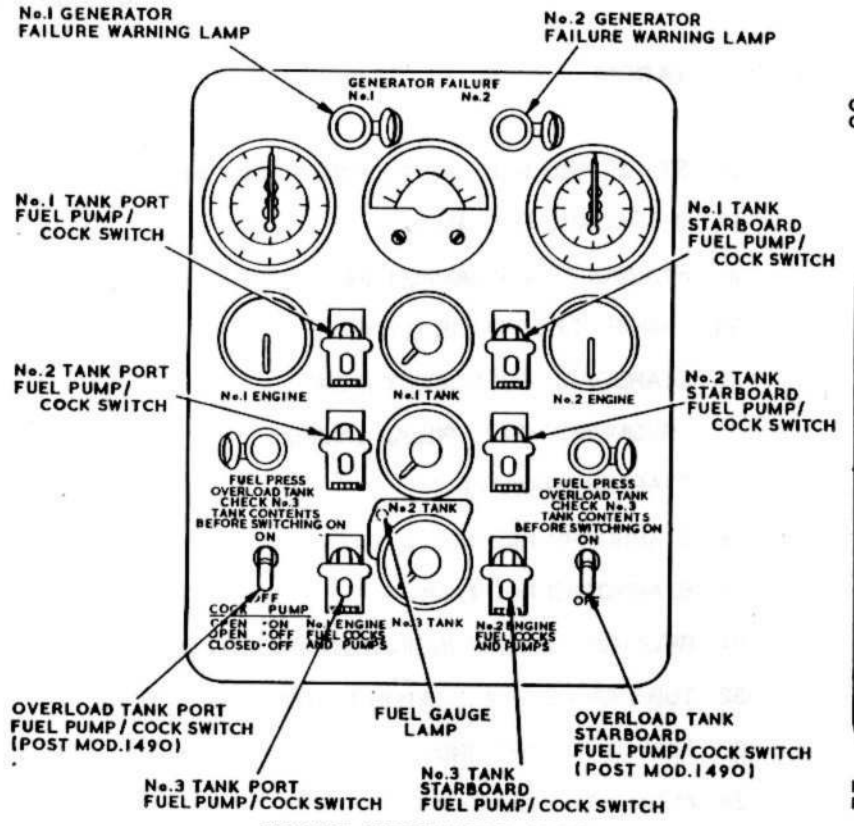
FIG. 1. ELECTRICAL INSTALLATION-PILOT'S STATION

◀ STI/CAN/586c INCORPORATED ▶

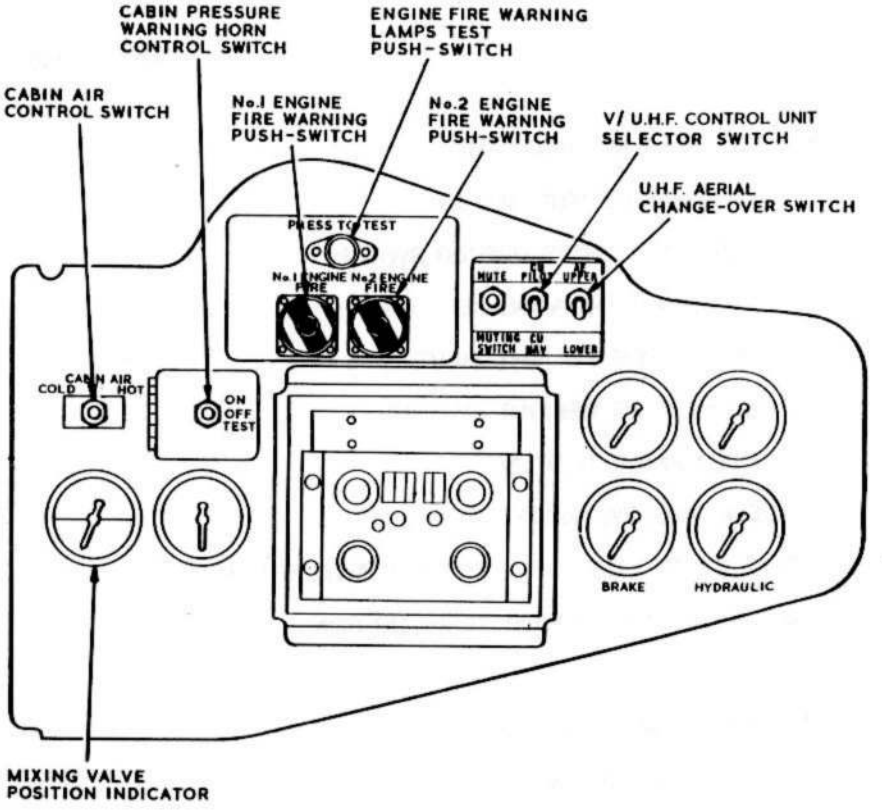
KEY TO FIG.1 (PILOT'S STATION)

1 CONSOLE AFT RED LAMP
2 CONSOLE CENTRE RED LAMP
3 PORT RED LAMPS DIMMER SWITCH
4 OXYGEN REGULATOR RED LAMP
5 No.1 ENGINE RELIGHT SWITCH
6 No.2 ENGINE RELIGHT SWITCH
7 PORT PANEL RED LAMP
8 D.V. WINDOW HEATER CONNECTORS
9 WING TIP FUEL TANK JETTISON SWITCH RED LAMP
10 CANOPY DETONATOR RESISTOR BOX
11 PORT U/V LAMP
12 D.V. WINDOW HEATER
13 PORT RED LAMPS
14 TAIL PLANE TRIM POSITION INDICATOR
15 PORT U/V LAMPS DIMMER SWITCH
16 PORT EMERGENCY LAMP
17 PORT U/V LAMP
18 FLAP POSITION INDICATOR
19 PORT RED LAMP
20 INSTRUMENT SUPPLIES MAGNETIC INDICATOR
21 EMERGENCY COMPASS LAMP
22 STARBOARD RED LAMPS DIMMER SWITCH
23 STARBOARD U/V LAMPS
24 STARBOARD U/V LAMPS DIMMER SWITCH
25 CANOPY DETONATOR (TYPICAL)
26 STARBOARD EMERGENCY LAMP
27 FREQUENCY CARD PILLAR LAMPS
28 STARBOARD U/V LAMP
29 STARBOARD RED LAMPS
30 STARBOARD RED LAMP
31 RELATIVE BEARING INDICATOR BRIDGE LAMP
32 TURN AND SLIP INDICATOR CONTROL SWITCH
33 REMOTE OXYGEN INDICATOR
34 ALTIMETER PILLAR LAMPS
35 AILERON TRIM POSITION INDICATOR
36 RUDDER TRIM POSITION INDICATOR
37 JETTISON RELAY UNIT AND EMERGENCY BATTERIES (BEHIND PANEL)
38 THROTTLE MICROSWITCH (INSIDE THROTTLE BOX)
39 No.2 ENGINE FUEL PUMP ISOLATION SWITCH
40 No.1 ENGINE FUEL PUMP ISOLATION SWITCH
41 CANOPY/SNATCH MASTER AND CANOPY JETTISON SWITCHES

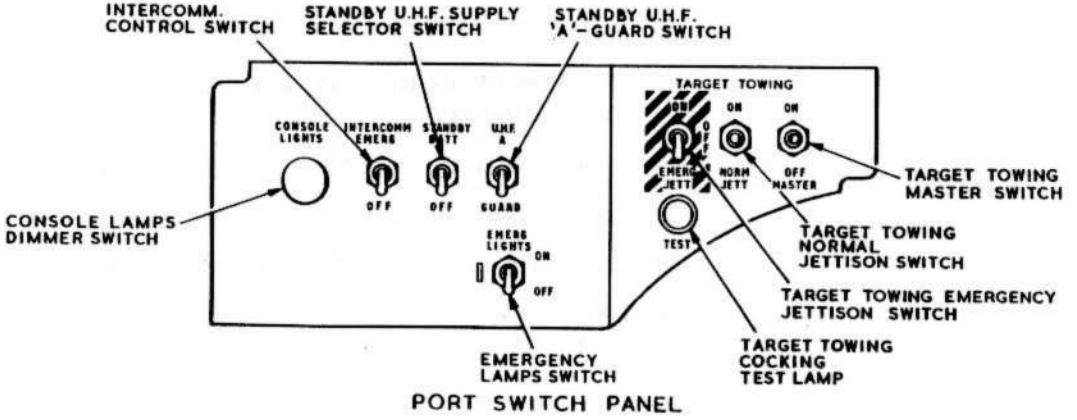
UK RESTRICTED



ENGINE INSTRUMENT PANEL



MISCELLANEOUS INSTRUMENT PANEL



PORT SWITCH PANEL

FIG.2. PANEL DETAILS

◀ STI/CAN/586c INCORPORATED ▶

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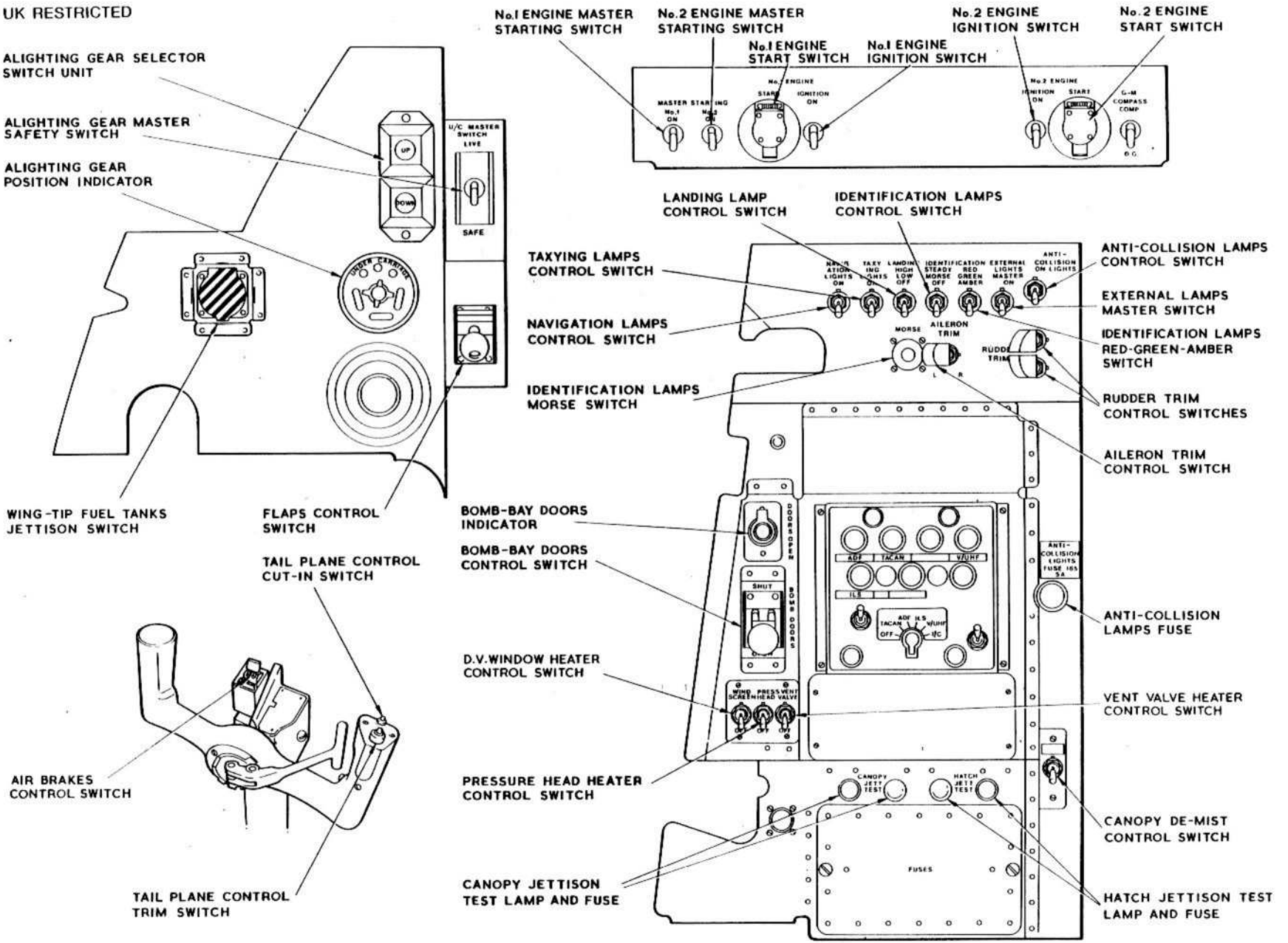

FIG. 2A. PANEL DETAILS

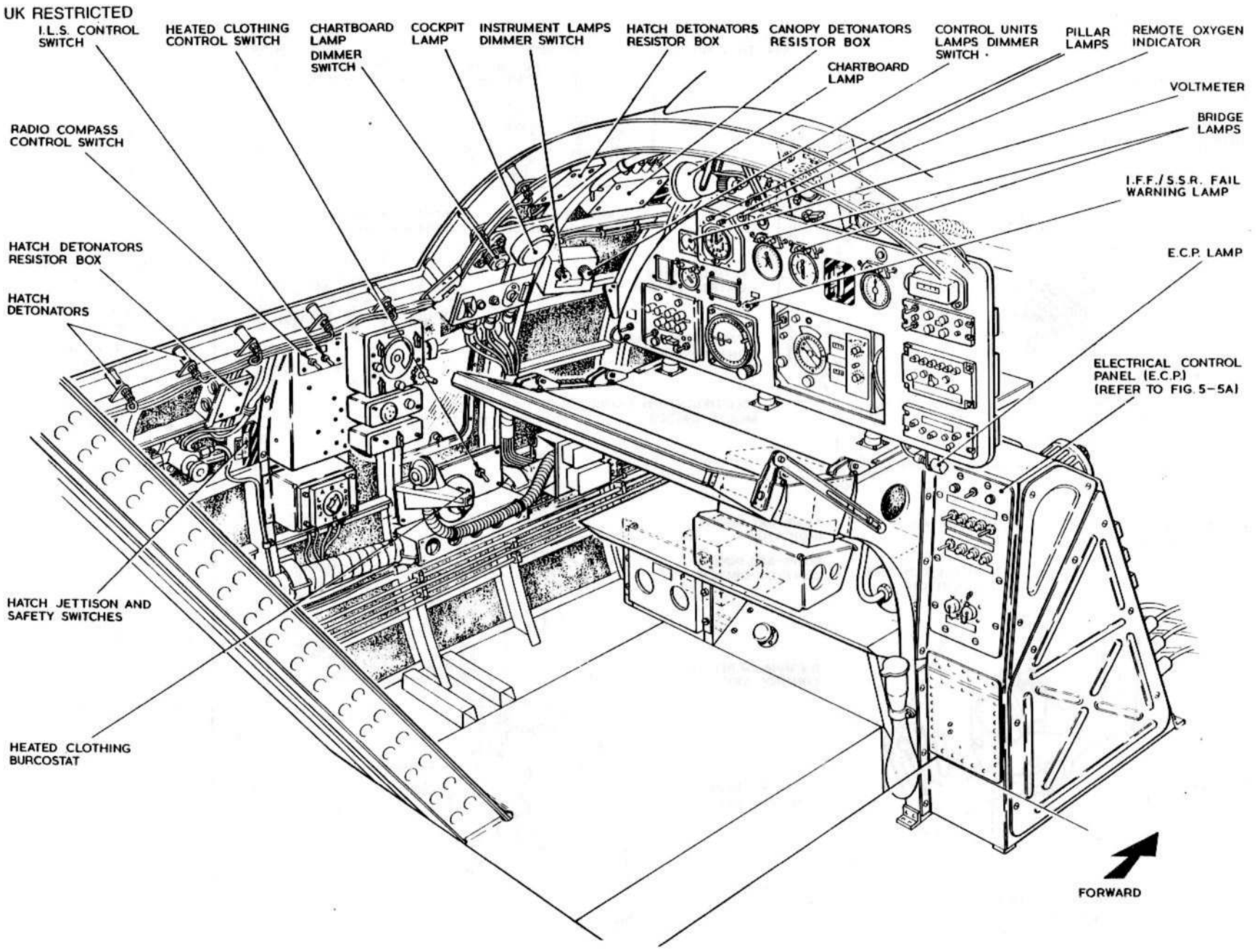

FIG. 3. ELECTRICAL INSTALLATION — 1st. NAVIGATOR'S STATION

◀STI/CAN/586c INCORPORATED▶

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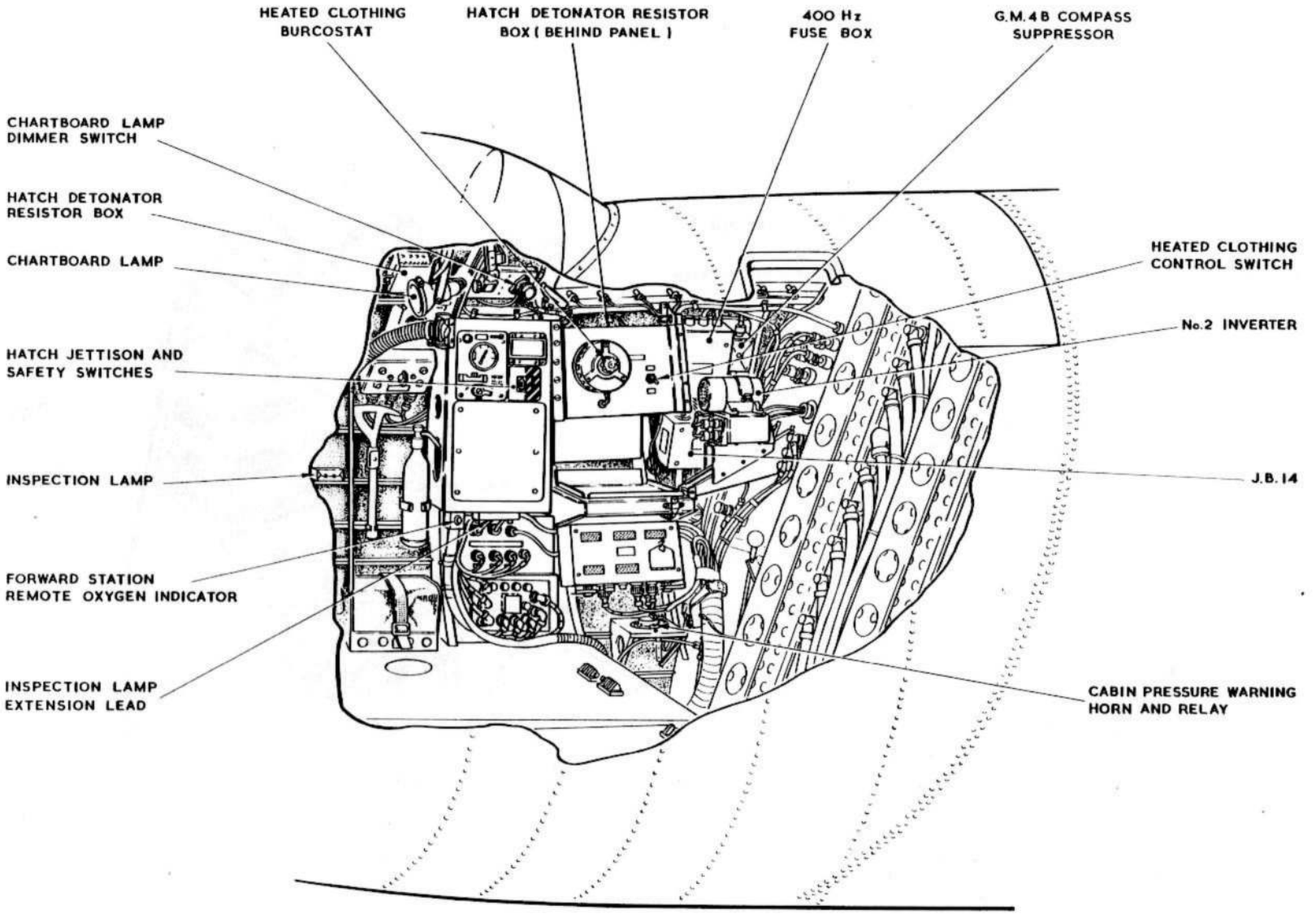


FIG. 4. ELECTRICAL INSTALLATION - 2nd. NAVIGATOR'S STATION

◀STI/CAN/586c INCORPORATED▶

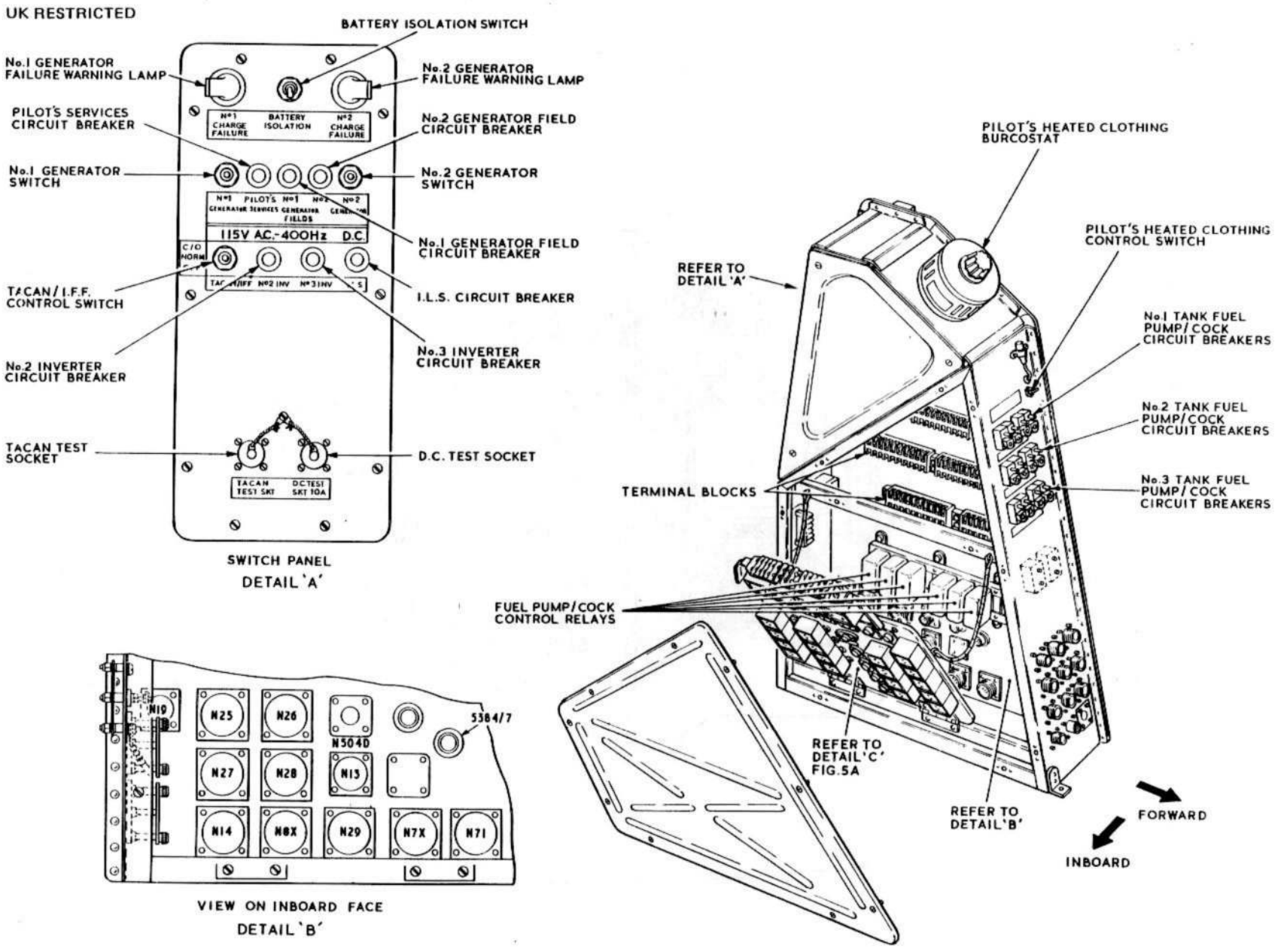
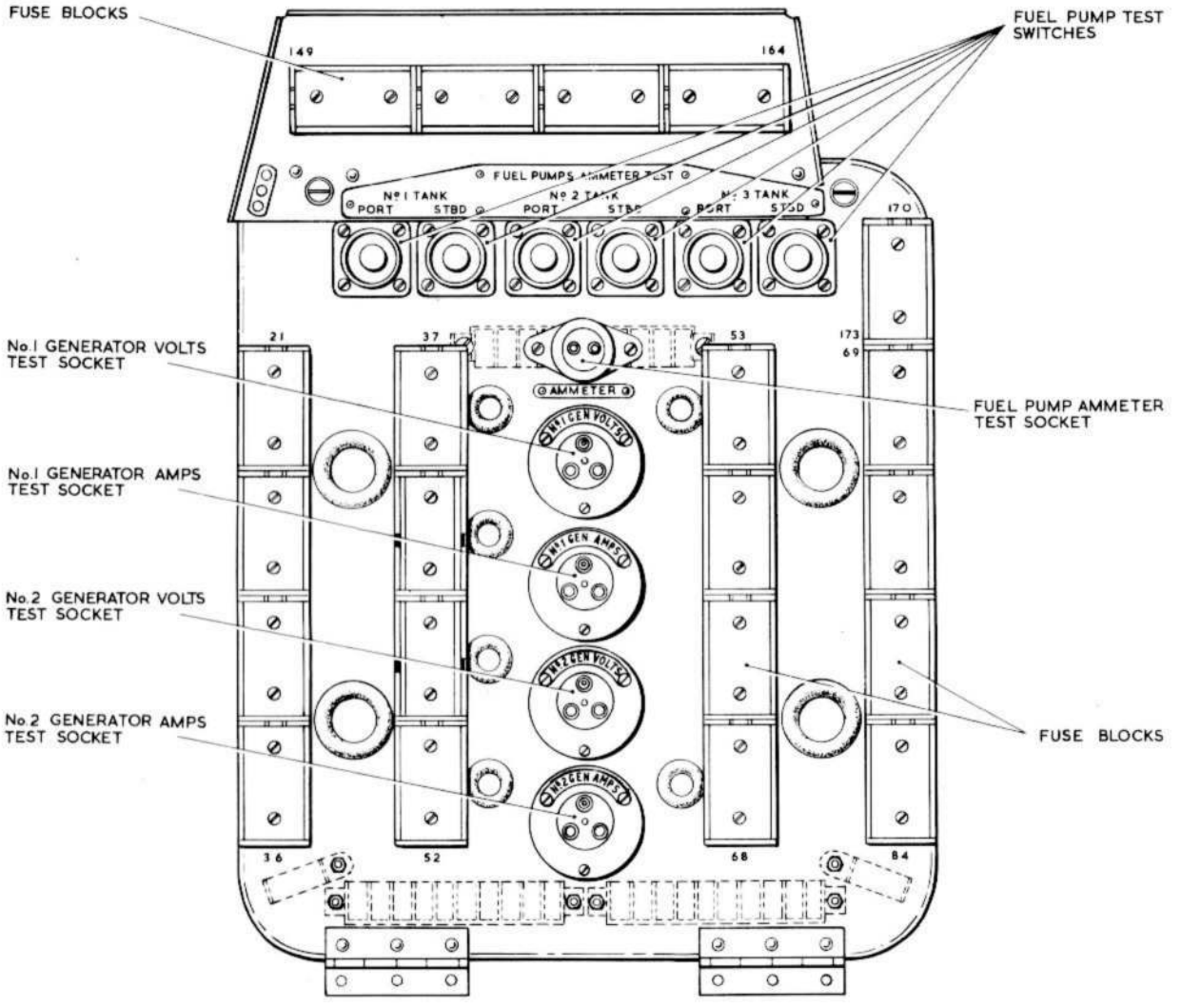


FIG.5. ELECTRICAL CONTROL PANEL (E.C.P.)



FUSE PANEL

DETAIL 'C'

FIG. 5A. ELECTRICAL CONTROL PANEL (E.C.P.)

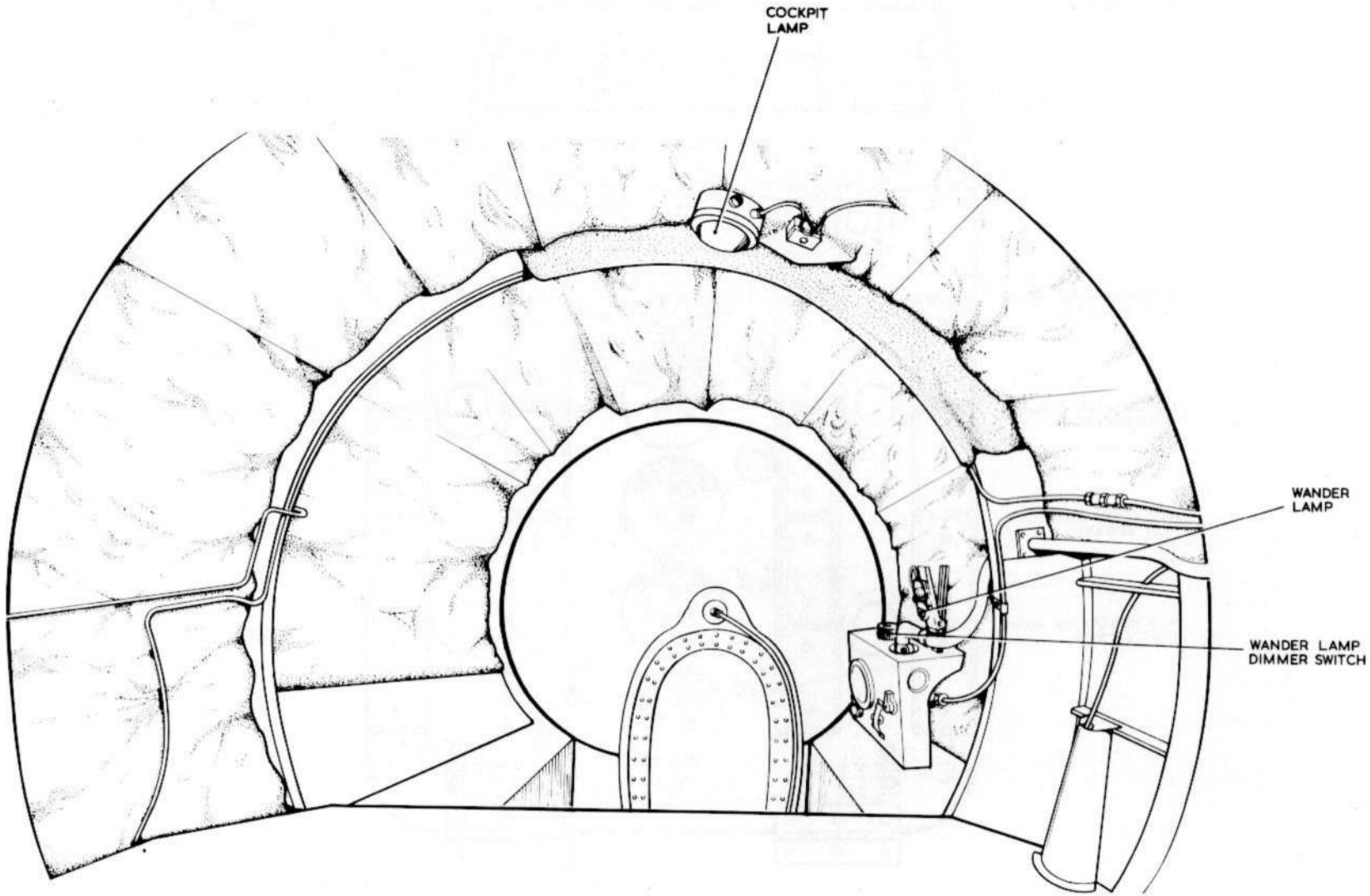


FIG. 6. ELECTRICAL INSTALLATION – FORWARD STATION

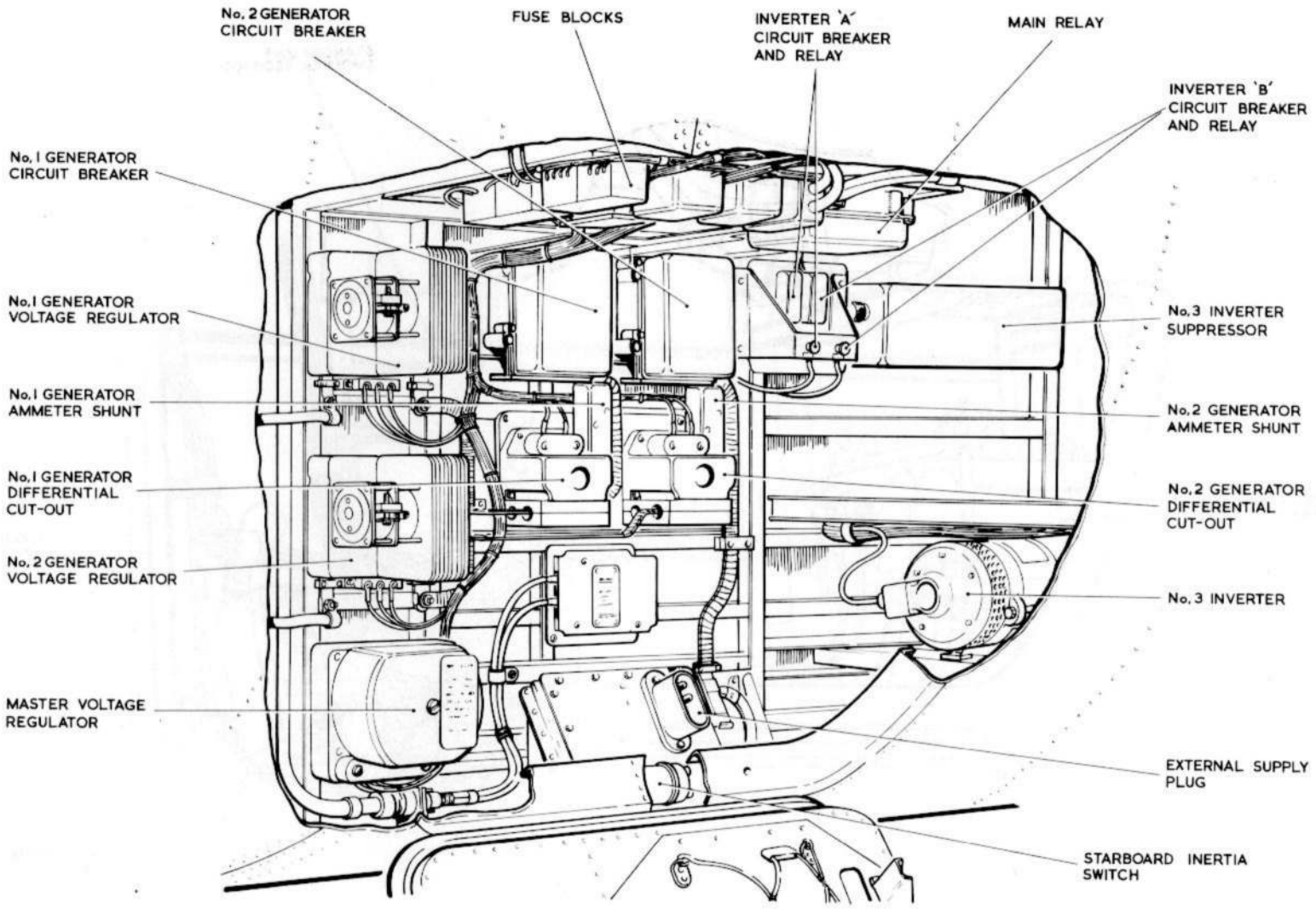


FIG.7. ELECTRICAL INSTALLATION-STARBOARD EQUIPMENT COMPARTMENT

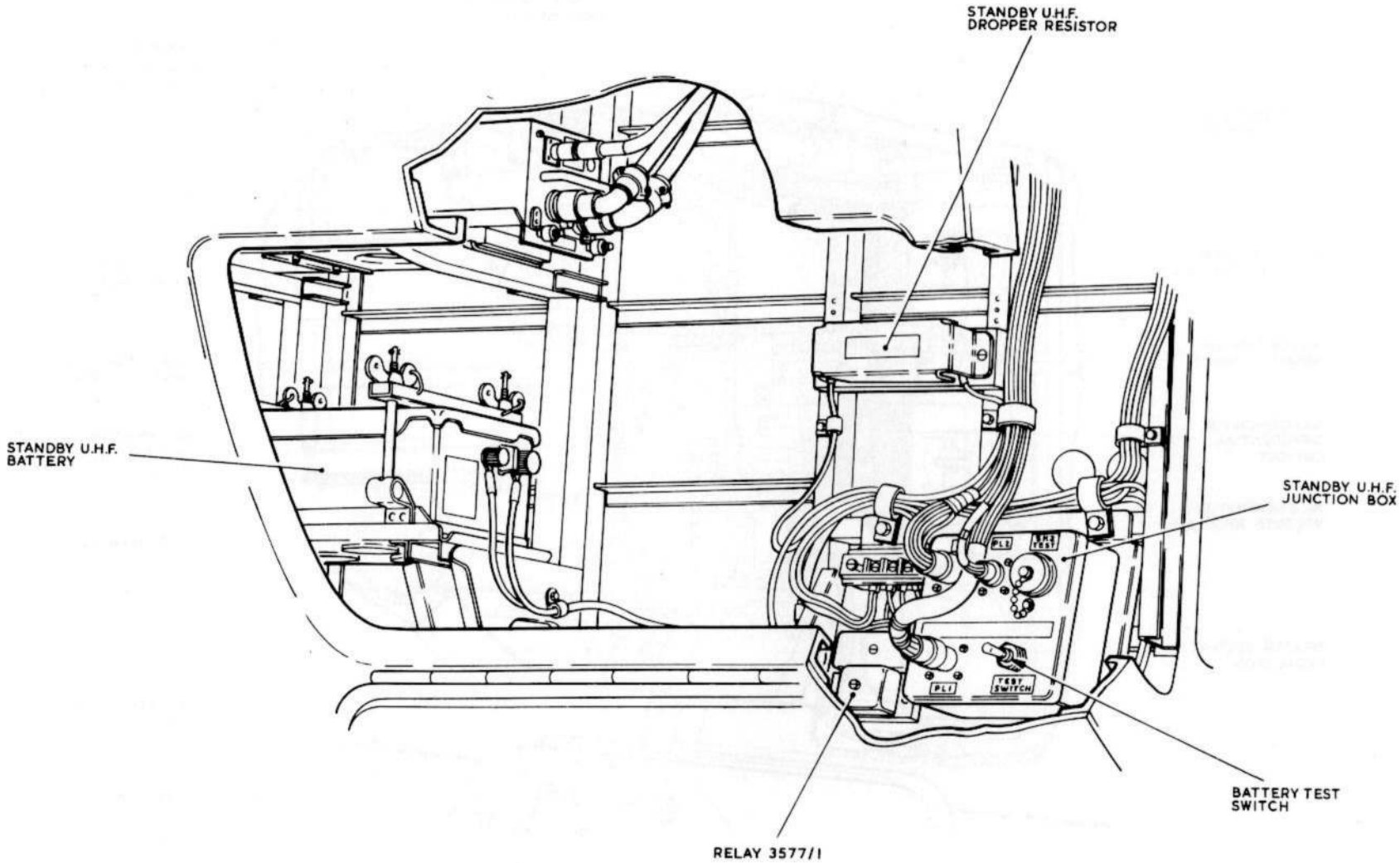


FIG.8. ELECTRICAL INSTALLATION – PORT EQUIPMENT COMPARTMENT

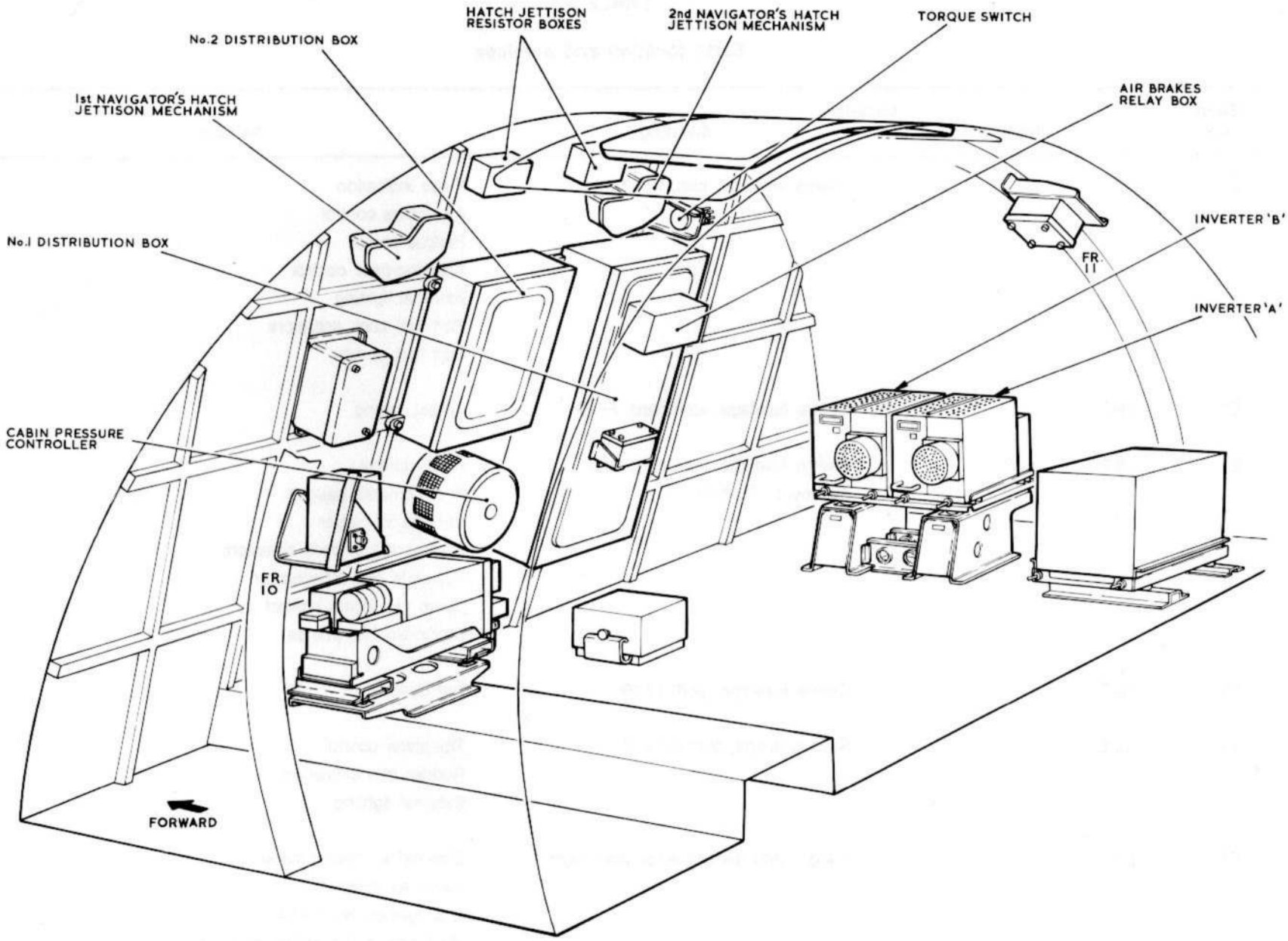


FIG.9. ELECTRICAL INSTALLATION - UPPER EQUIPMENT COMPARTMENT

TABLE 3

Earth location and services

Earth No.	Location Junction	Bonding	Service
E1	J.B.1	Centre fuselage, port, Fr.13-14	Flaps indication Air-brakes control Fatigue meter Alighting-gear control External lighting Port fuel cock actuators Port fuel pumps
E2	J.B.2	Centre fuselage, starboard, Fr.19	Target towing
E3	J.B.3	Centre fuselage, starboard floor members, Fr.13-14	Flaps control Fuel contents gauges Vent valve heater Starboard fuel cock actuators Fuselage fire extinguisher Bomb bay doors control Starboard fuel pumps
E5	J.B.5	Centre fuselage, port, Fr.19	Not used
E6	J.B.6	Rear fuselage, starboard, Fr.39	Tail-plane control Rudder trim indication External lighting
E7	J.B.7	Wing – port leading edge diaphragm	External air thermometer Cabin air control H.E. ignition No.1 engine No.1 engine fire extinguisher

continued . . .

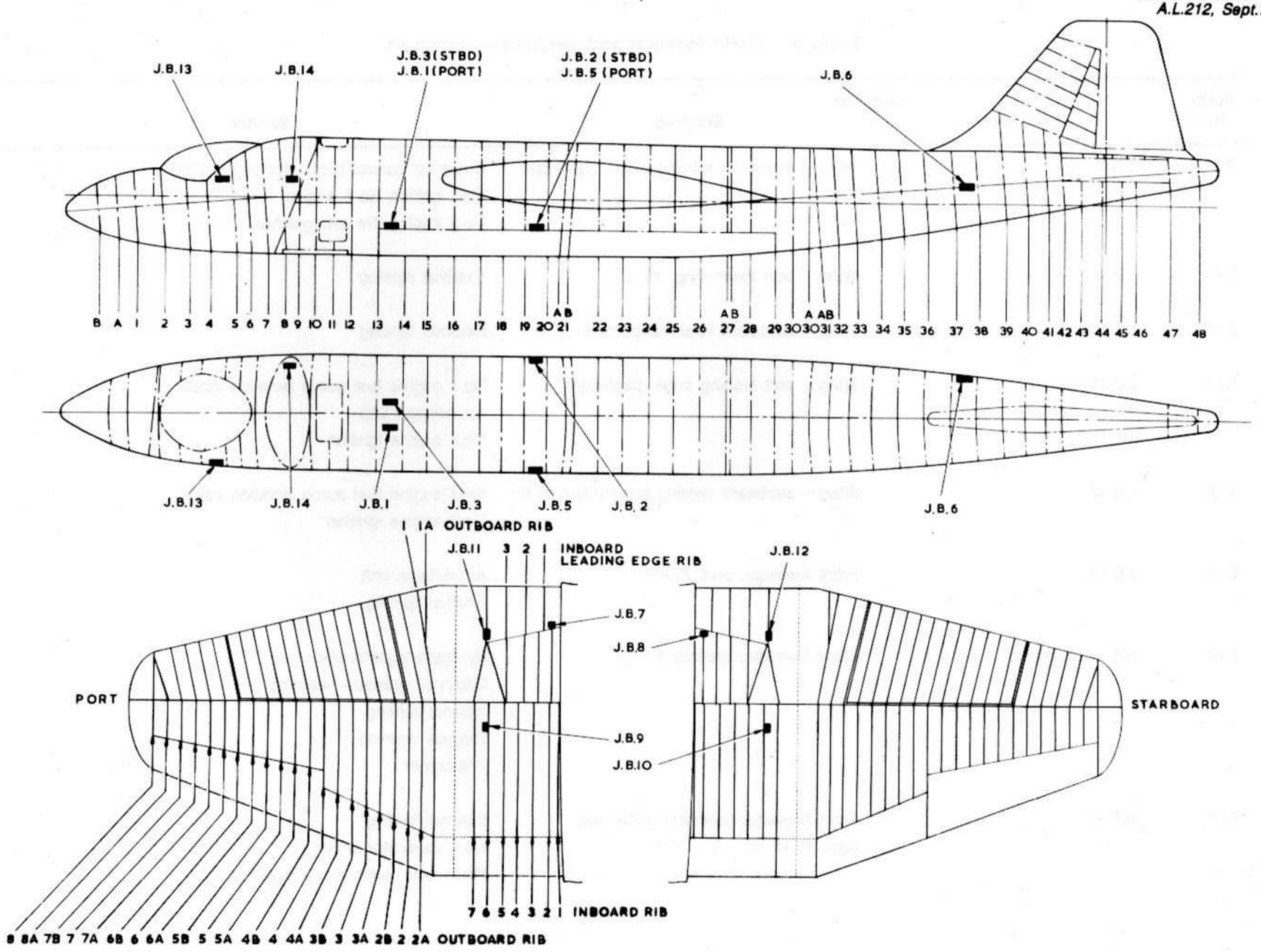


FIG. 10. JUNCTION BOX LOCATION DIAGRAM

Table 3 Earth location and services – *continued*

Earth No.	Junction	Location Bonding	Service
E8	J.B.8	Wing – starboard leading edge diaphragm	Cabin air control (post Mod.5, or 4939) H.E. ignition No.2 engine No.2 engine fire extinguisher
E9	J.B.9	Wing – port inner wing, rib 6	External lighting
E10	J.B.10	Wing – starboard inner wing, rib 6	External lighting
E11	J.B.11	Wing – port leading edge diaphragm	No.1 engine fuel pump isolation valve Air mileage unit No.1 engine ignition
E12	J.B.12	Wing – starboard leading edge diaphragm	No.2 engine fuel pump isolation valve No.2 engine ignition
E13	J.B.13	Front fuselage, port, Fr.4-5	Air mileage unit Internal lighting
E14	400 Hz fusebox	Front fuselage, starboard, Fr.8	Navigator's periscope Cabin air pressure warning Internal lighting Oxygen warning Intercomm.
E21	M.E.P.	Front fuselage starboard under rear floor, Fr.10-12	Internal lighting No.1 generator circuit Radio and radar power supplies

continued . . .

TABLE 3 Earth location and services – *continued*

Earth No.	Location: Junction	Location: Bonding	Service
E22	M.E.P.	Front fuselage, starboard, under rear floor, Fr.10-12	No.2 inverter No.3 inverter No.2 generator circuit Battery isolation relay No.1/No.2 generator master regulator
E24	Navigator's station	Front fuselage, port, Fr.8A	Hatch jettisoning
E25	E.C.P.	Front fuselage aft of E.C.P. on navigator's table structure	Aileron trim control and indication Turn and slip A.H.E. D.C. volts Target towing Fuel pressure warning Engine starting Internal lighting No.1/No.2 generator – voltmeter and test sockets Cabin air pressure warning Fuel pumps and cocks Instrument power supplies Radio compass D.C. test socket Heated clothing Engine fire warning Oxygen warning
E26	Navigator's station	Front fuselage, starboard, Fr.7A	Hatch jettisoning

continued . . .

TABLE 3 Earth location and services – *continued*

Earth No.	Location Junction	Bonding	Service
E27	Pilot's console	Front fuselage port – top of pilot's console	Rudder trim control D.V. window heating Canopy de-misting Internal lighting Canopy jettisoning Snatch unit Bomb bay doors indication Pressure head heater Stand-by U.H.F. No.1/No.2 generator failure warning
E28	No.1 distribution box	Front fuselage starboard on aft face of pressure bulkhead	Instrument power supplies Alighting gear position indicator I.F.F./S.S.R. Air-brakes control Crash relay Exhaust gas thermometer Pressure error corrector (P.E.C.) A.H.E.
E29	No.2 distribution box	Front fuselage port on aft face of pressure bulkhead	Radio and radar power supplies
E31	Port equipment compartment	Front fuselage, port, Fr.12A	Stand-by U.H.F. Stand-by U.H.F. battery
E33	Tail plane actuator	Rear fuselage starboard forward of actuator, Fr.45-46	Tail-plane control
EB	Battery compartment	Front fuselage, port, Fr.12A	Main batteries
E DET	Port wing tip	Port wing outboard, rib 8	Wing tip fuel tank jettison

continued . . .

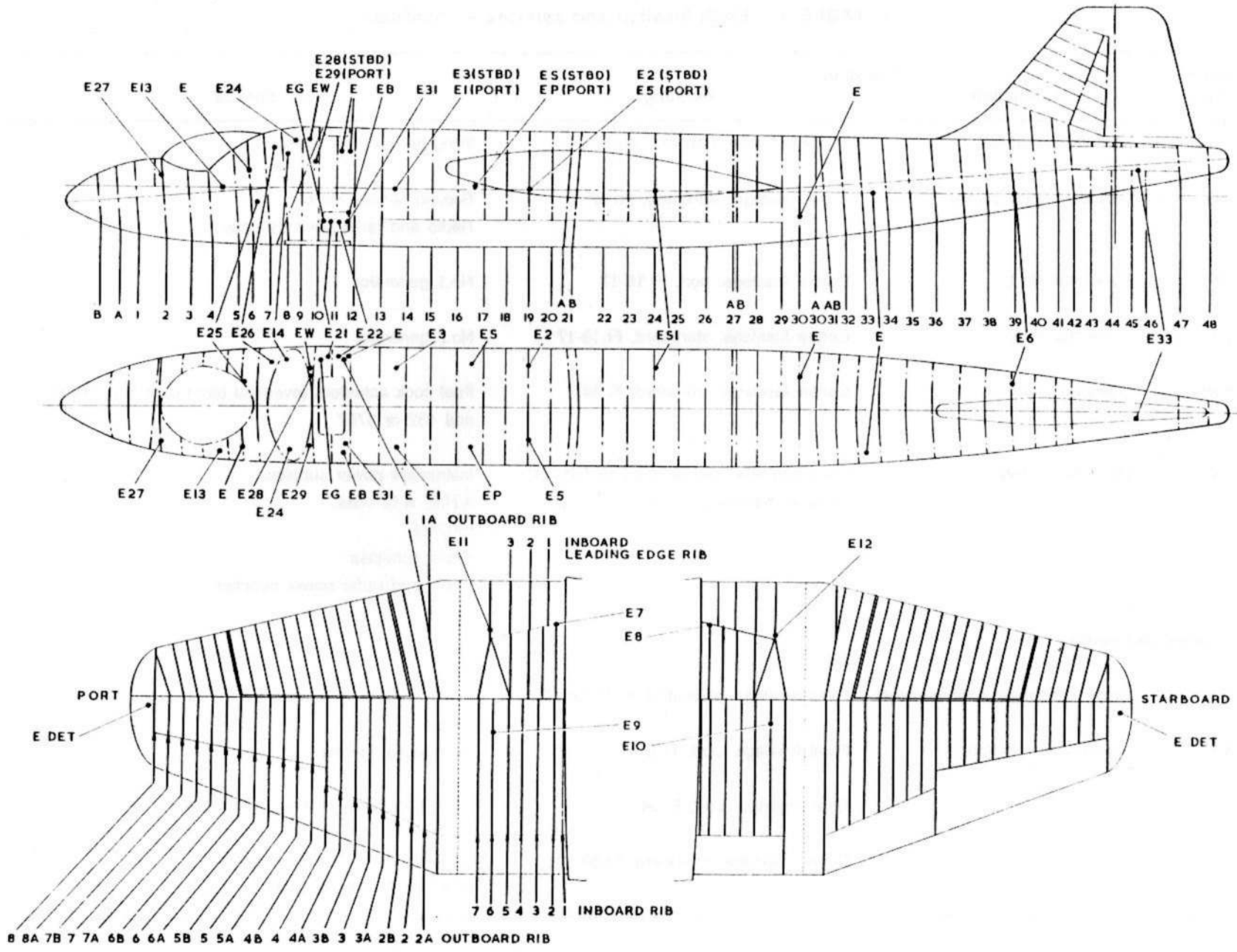


FIG. 11. EARTH POINT LOCATION DIAGRAM

TABLE 3 Earth location and services – *continued*

Earth No.	Location Junction	Bonding	Service
E DET	Starboard wing tip	Starboard wing outboard, rib 8	Wing tip fuel tank jettison
EG	External supply socket	Front fuselage, starboard, Fr.10	Ground service earth Radio and radar power supplies
EP	Generator No.1	Centre fuselage, port, Fr.16-17	No.1 generator
ES	Generator No.2	Centre fuselage, starboard, Fr.16-17	No.2 generator
ES1	Overload tank	Centre fuselage, starboard, Fr.24	Fuel cock actuators (overload tank) post Mod.1490, and 432 or 3757
EW	No.1 distribution box	Front fuselage starboard on aft face of pressure bulkhead	Instrument power supplies A.H.E. A.C. volts TACAN Radio compass Radio and radar power supplies
Unreferenced earths			
E	Upper equipment compartment	Front fuselage, starboard, Fr.12 (2 off)	I.L.S.
E	1st navigator station	Front fuselage, port, Fr.6	Navigator's lighting
E	–	Rear fuselage, port, Fr.34	◀ V/U.H.F. aerial change-over relay ▶
E	–	Centre fuselage, starboard, Fr.30	◀ V/U.H.F. interconnection box ▶ I.F.F./S.S.R. transponder

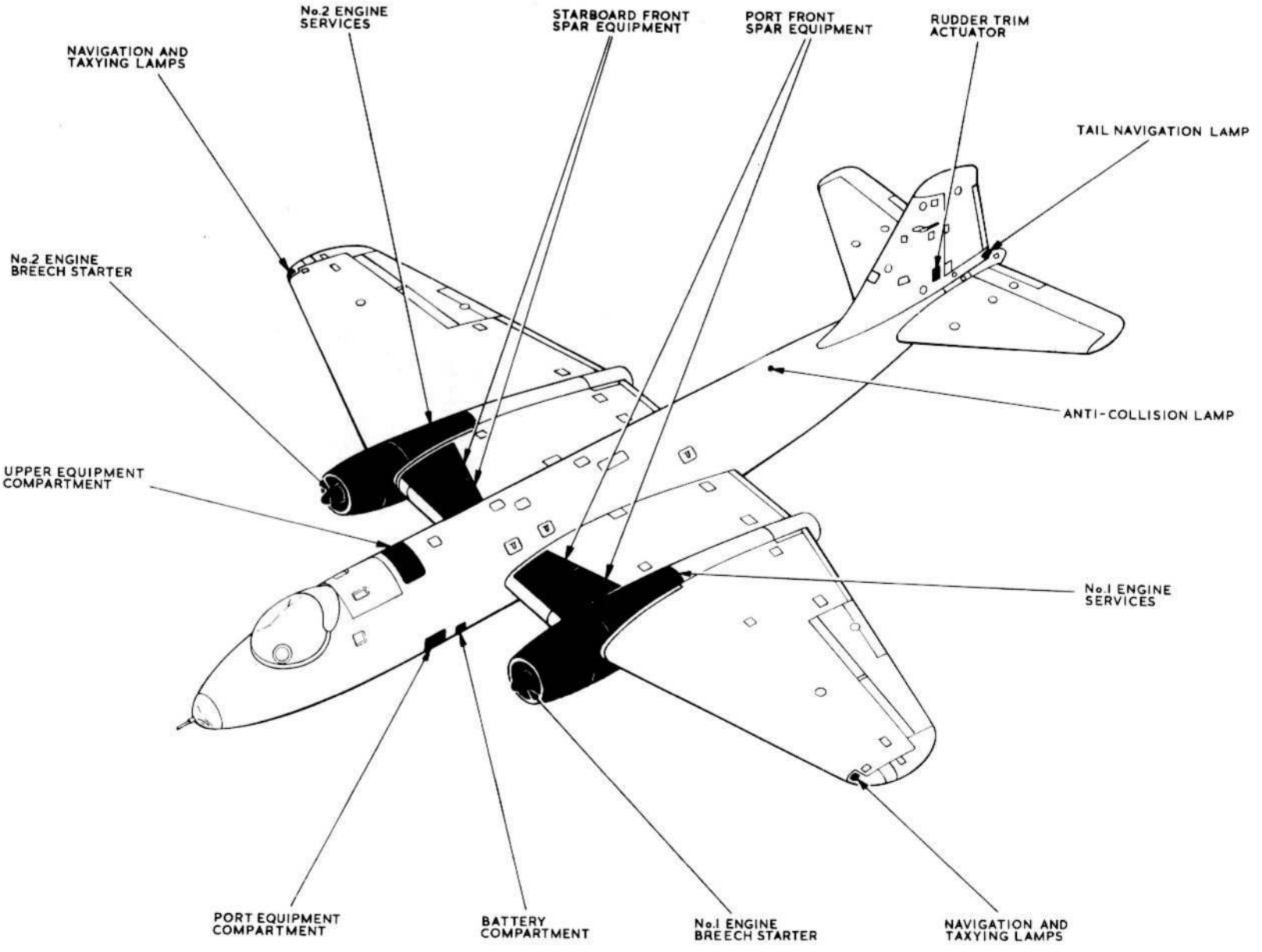


FIG.12. ACCESS PANELS — UPPER SURFACE AND PORT SIDE

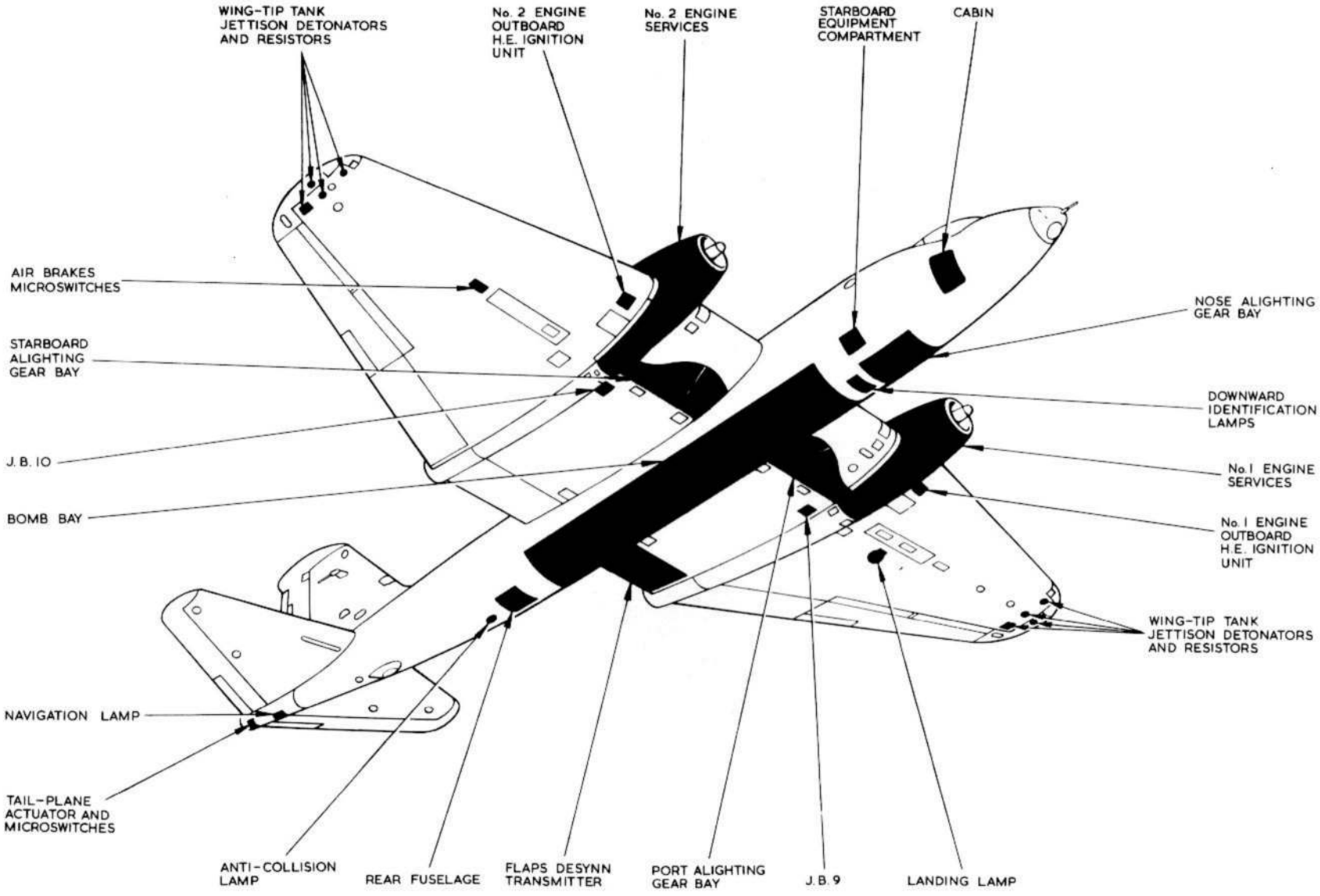


FIG. 13. ACCESS PANELS – LOWER SURFACE AND STARBOARD SIDE

BOMB BAY DOORS CONTROL AND INDICATION – TARGET TOWING – GROUP A & B

(completely revised)

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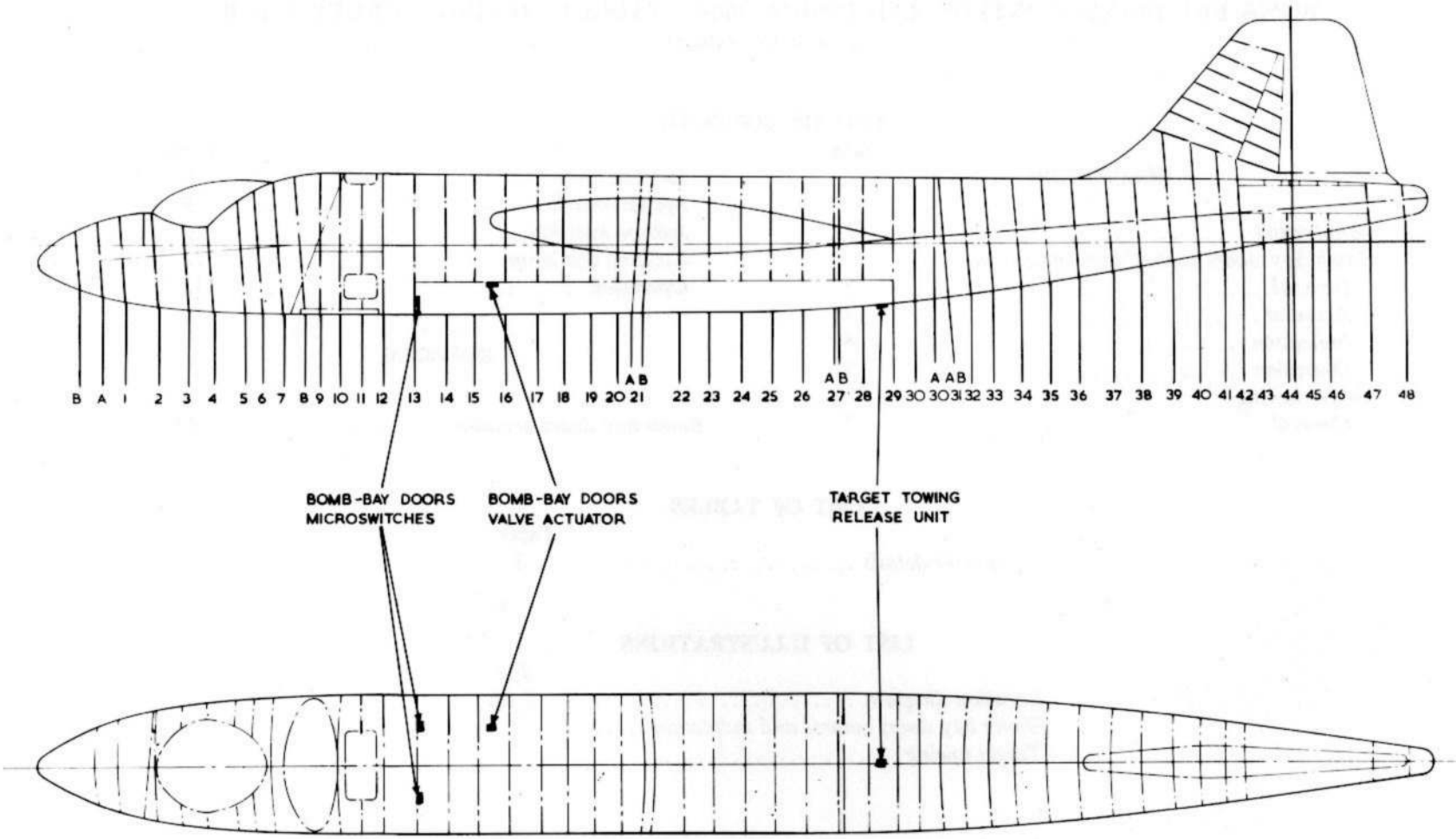

FIG.1. LOCATION DIAGRAM

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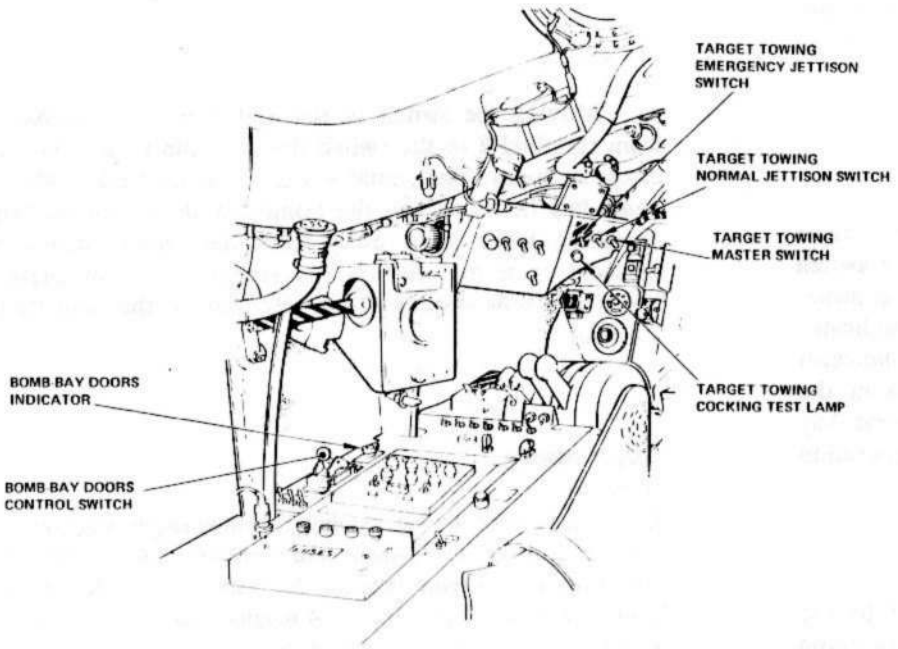
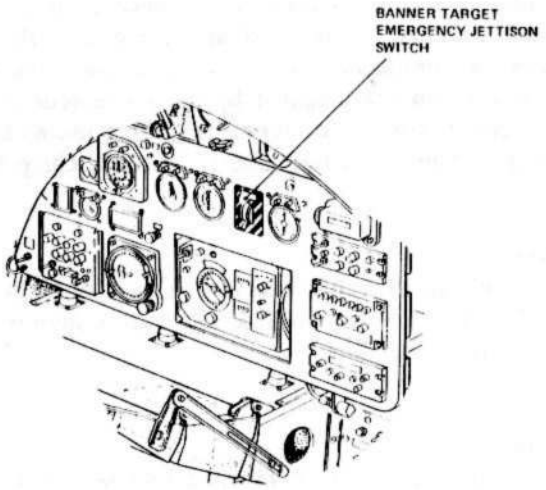


PILOT'S STATION



1st NAVIGATOR'S STATION

FIG. 1A. LOCATION DIAGRAM

◀STI/CAN/586c INCORPORATED▶

DESCRIPTION

Introduction

1. This group describes the electrical circuits associated with the bomb bay doors control and indication and the target towing facility. Table 1 provides a list of the main components, their reference/part numbers and, where possible, the A.P. in which they are described. Location of the components and switches are shown in fig.1-1A.

Bomb bay doors control and indication

General

2. The bomb bay doors are hydraulically operated via a valve actuator in the bomb bay. The actuator is controlled by a switch labelled bomb doors open-shut located on the pilot's console. Indication of the doors position is shown by a magnetic indicator mounted adjacent to the switch on the console. The indicator operates in conjunction with two microswitches located in the bomb bay which are actuated by the movement of the bomb bay doors jacks. Further information regarding the hydraulic operation can be found in A.P.101B-0402-1A, Sect.3, Chap.6.

Actuator

3. An electrical valve actuator is mechanically linked to the hydraulic selector valve which is selected to open or shut according to the desired selection.

Indication

4. A magnetic indicator, labelled DOORS OPEN, mounted on the pilot's console indicates the position of the bomb-bay doors. When the doors are shut the indicator displays black, when they are open, white.

Operation

5. A 28 volt d.c. supply from busbar P10 in the E.C.P. is routed via fuse 24 to terminal 2 of the BOMB DOORS control switch. The selection of the switch to the OPEN position passes the supply direct to pin B and the open winding of the actuator. The operation of the actuator selects the hydraulic valve to open the bomb-bay doors. On the doors reaching their fully open position two series connected microswitches, one port, one starboard, will be operated by the bomb bay doors operating jacks and bring into circuit the magnetic indicator on the console, which displays white, denoting to the pilot that the doors are open.

6. Moving the switch to the SHUT position, passes the supply from terminal 2 of the switch direct to pin C and the shut winding of the actuator. The actuator selects the hydraulic valve to shut the bomb-bay doors. When the bomb-bay doors are partially shut the operating jacks move away from the microswitches, the switch contacts open to interrupt the supply to the magnetic indicator, which will now display black, denoting to the pilot that the doors are shut.

Target towing

General

7. A facility for towing a standard banner target is provided by a release unit which protrudes through the bomb-bay doors at the aft end of the bay. Control and indication for the system is provided by switches and a lamp on the pilot's port panel. A banner target emergency jettison switch is also fitted on the panel above the 1st navigator's table. If the release unit is not fitted to the aircraft the release unit cable is stowed on a dummy plug located in the bomb-bay roof between frames 28 and 29.

Release unit

8. The release unit is located between two brackets which are attached to the bomb-bay rear bulkhead and protrudes through the bomb-bay doors at the centre-line of the aircraft. The unit embodies a hook lock mechanism which comprises the target towing hook and a lock which can be disengaged electrically, two hook lock release solenoids which are operated in the normal and emergency jettison modes respectively and an external cocking lever which actuates the cocking switch in the unit when the hook is fully engaged.

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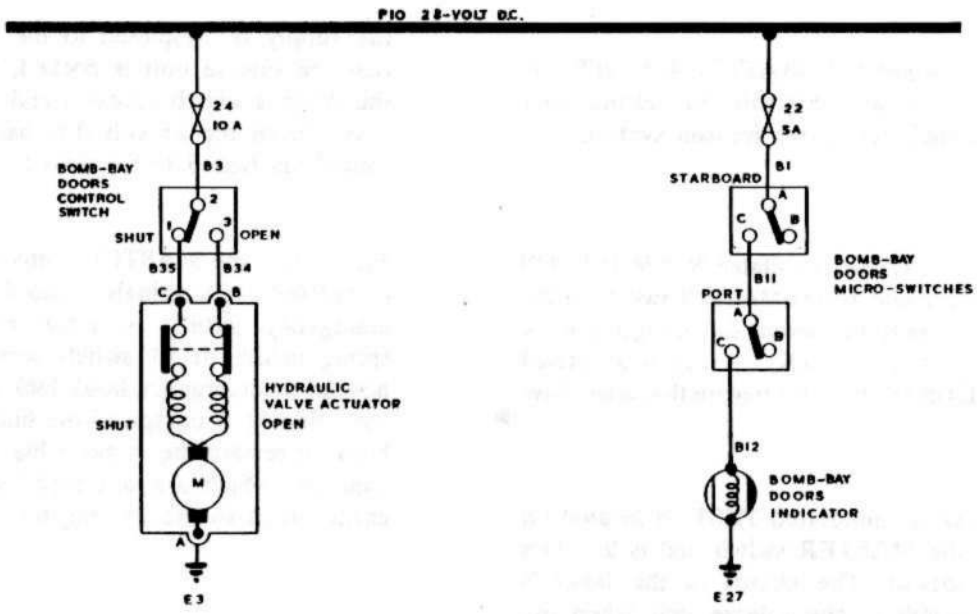

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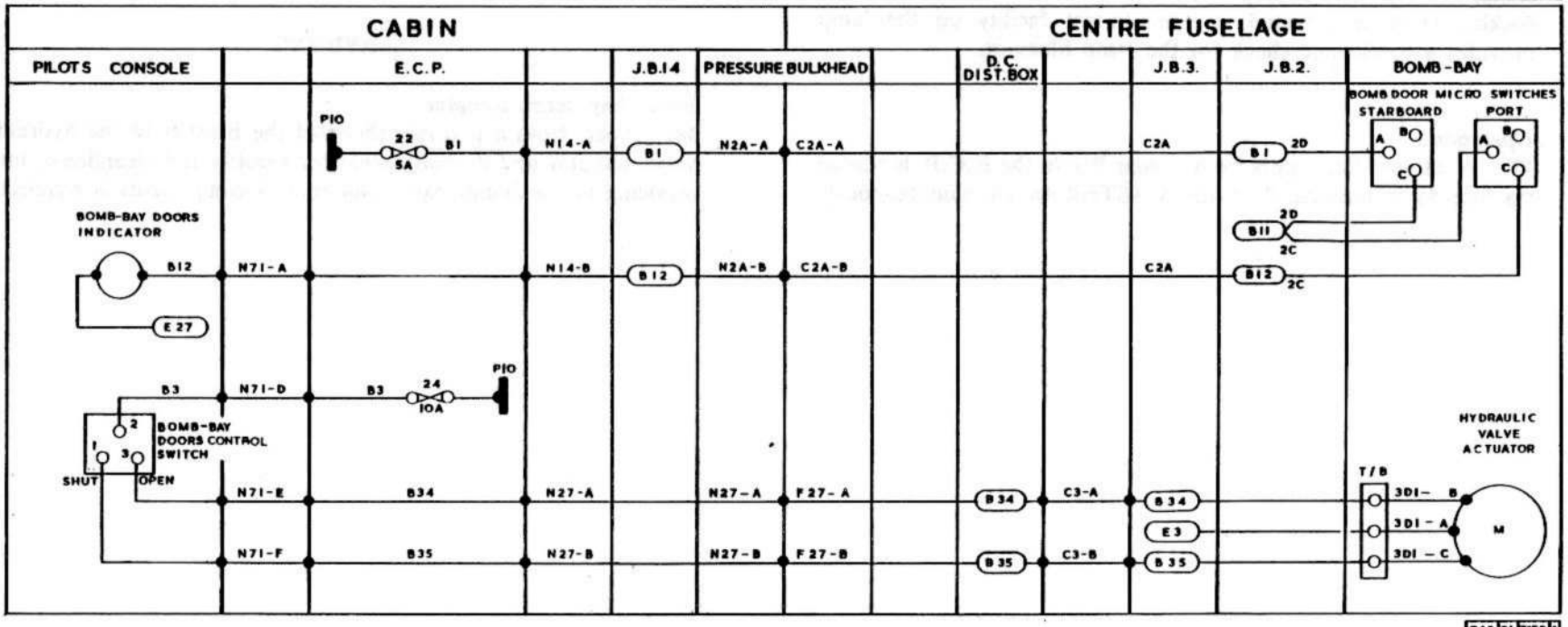

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FIG.2.BOMB BAY DOORS CONTROL AND INDICATION

Master switch

9. This switch, which is annotated MASTER-ON-OFF, is located on the pilot's port panel and controls the normal and emergency power supplies to their respective jettison switches.

Jettison switches

◀ **10.** Two spring-loaded, centre-off switches, annotated NORM JETT ON and EMERG JETT ON, located adjacent to the MASTER switch on the pilots port panel, control the supplies to the normal and emergency hook lock solenoids, in the release unit, respectively. A switch annotated BANNER EMERGENCY JETTISON-ON-OFF is fitted on the panel above the 1st navigator's table. ▶

Cocking test lamp

11. A press-to-test warning lamp, annotated TEST, is located on the pilot's port panel below the MASTER switch and is lit when the target towing hook is locked. The circuit to the lamp is completed via the cocking switch in the release unit when the cocking lever is actuated; a press-to-test facility on the lamp provides a confidence check for the lamp filament.

Operation

12. A 28 volt d.c. supply from busbar P10 in the E.C.P. is routed via fuse 48 to terminal 2 on the MASTER switch; simultaneously the supply is completed to the cocking test lamp and, providing that the release unit is cocked, the earth circuit is completed via the cocking switch contacts and the lamp lights. A second supply drawn from the 24 volt d.c. battery busbar, P9, in the E.C.P. is routed via fuse 3 to terminal 5 of the switch.

13. When the MASTER switch is selected to ON the supplies are completed via terminals 3 and 6 to terminal 2 on the normal and emergency jettison switches respectively. Operation of either spring loaded JETT switch completes the circuit to energize the normal or emergency hook lock solenoid in the release unit. When the solenoid is energized the hook lock is disengaged allowing the hook to release the target cable, simultaneously the cocking switch contacts, which are operated by the hook, open and break the earth circuit to the cocking test lamp which extinguishes.

SERVICING

Bomb bay doors actuator

14. Apart from a periodic check of the brushes in the hydraulic valve actuator and normal checks for security and cleanliness, little servicing of the bomb bay doors control components is required.

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
	Actuator Type 206 comprising:-		
5W/4511895	Actuator Type 200	1	A.P.113E-0248-1
5W/340	Adapter assembly	1	—
27Q/780	Valve assembly	1	—
5CZ/5003	Magnetic indicator Type A	1	A.P.113F-0615-1
9A/2138	Release unit	1	A.P.110G series

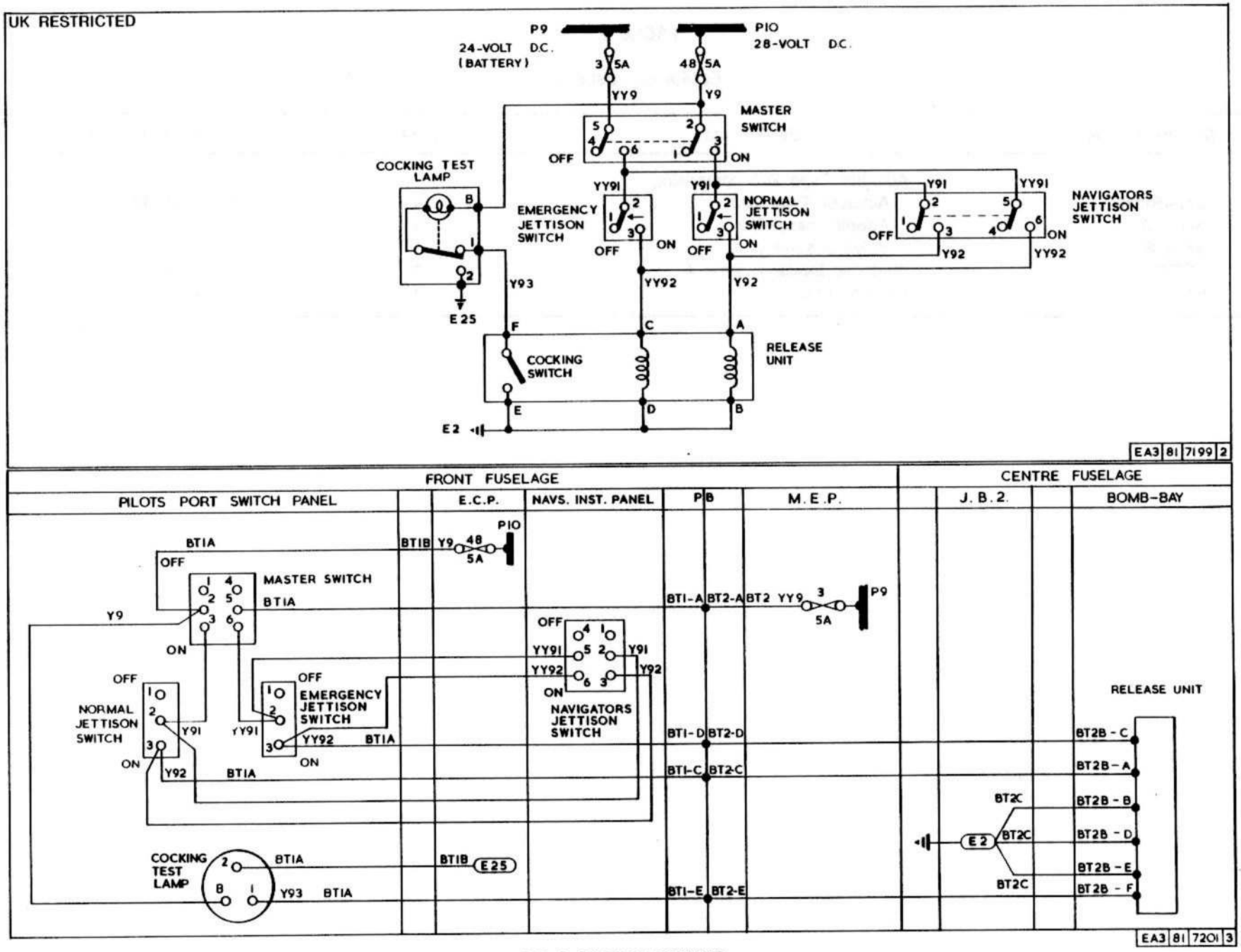

FIG.3. TARGET TOWING

◂MOD 5510 EMBODIED▸

CONTROL SURFACES – GROUP C

(completely revised)

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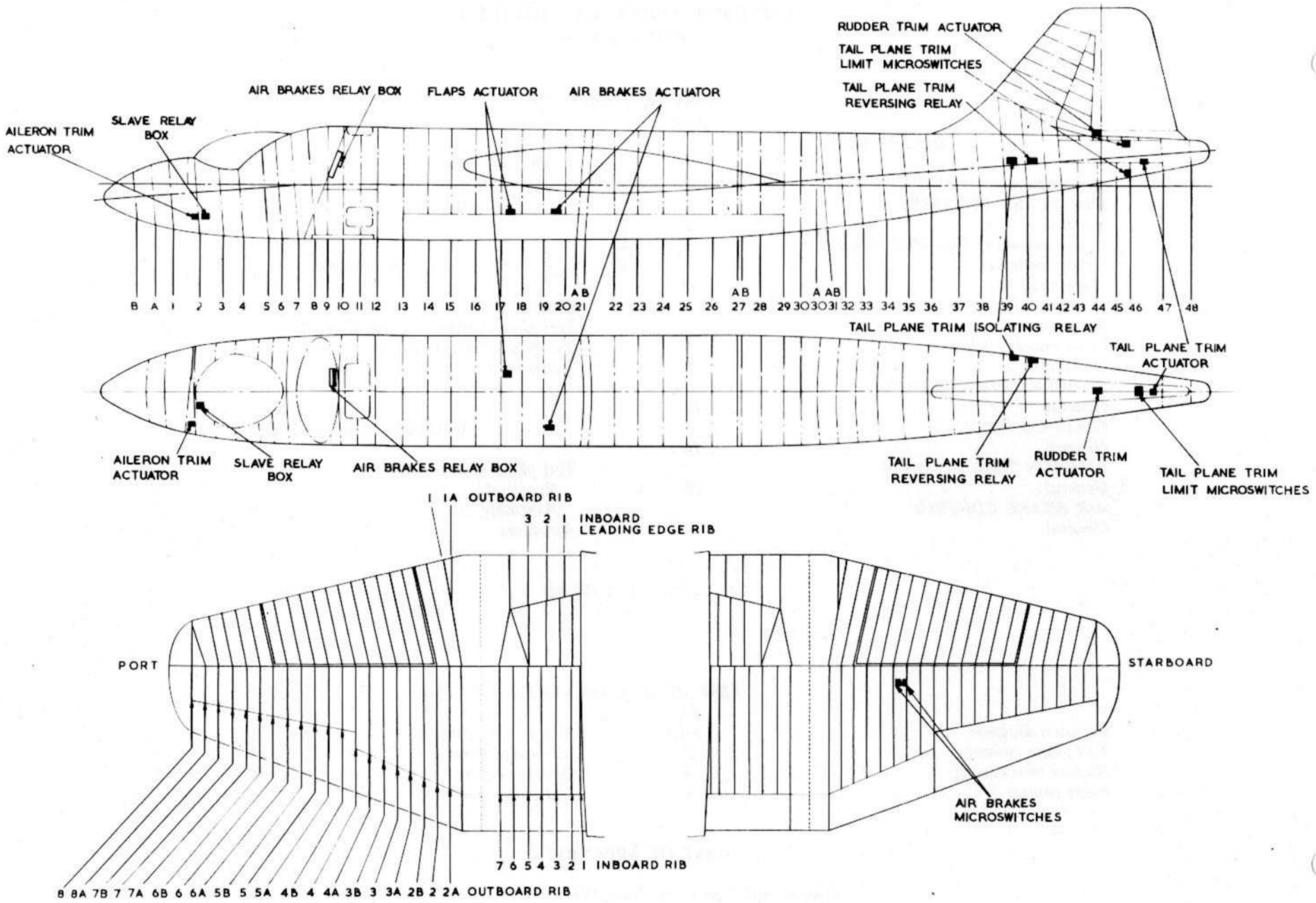
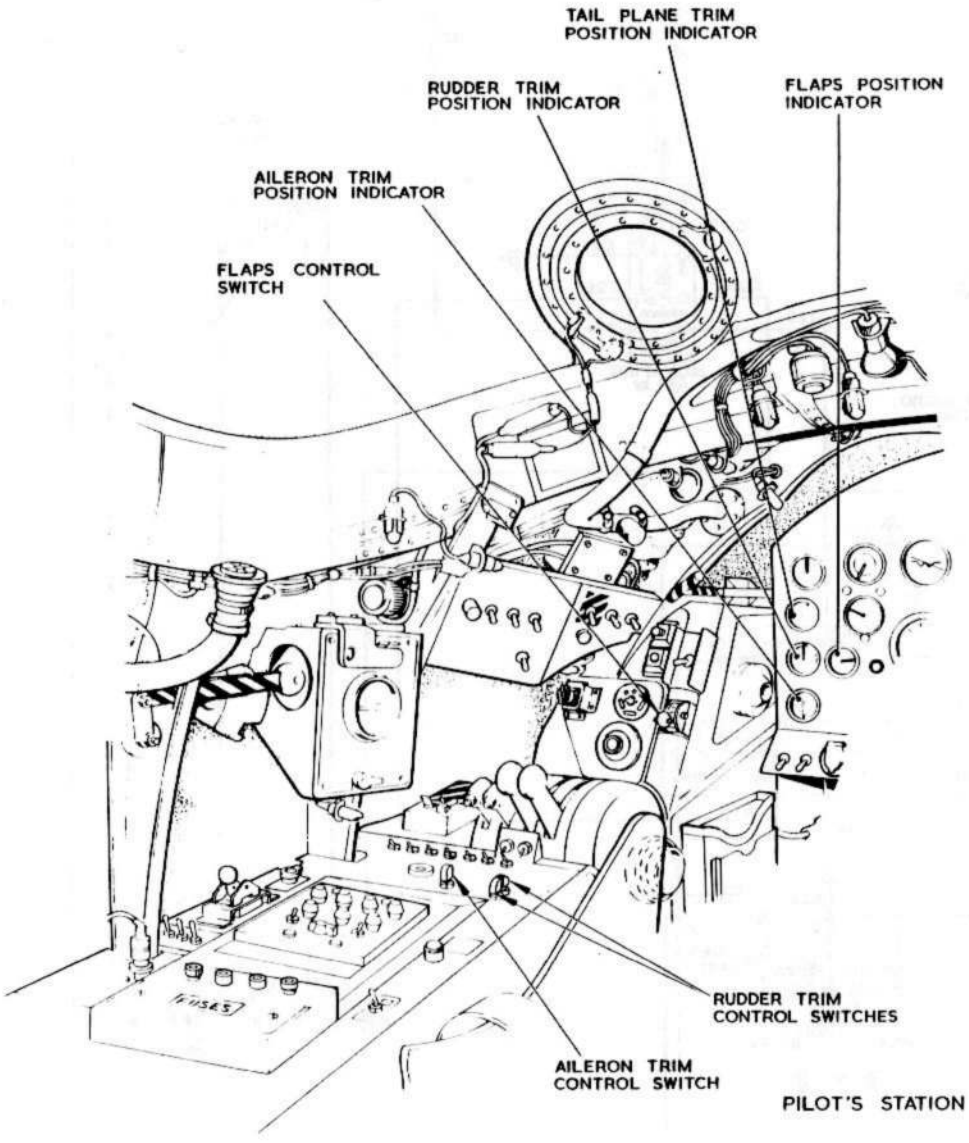


FIG.1. LOCATION DIAGRAM

UK RESTRICTED



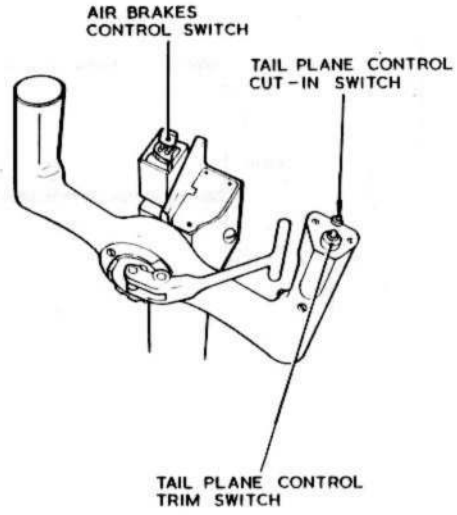


FIG.IA. LOCATION DIAGRAM

◀STI/CAN/586c INCORPORATED▶

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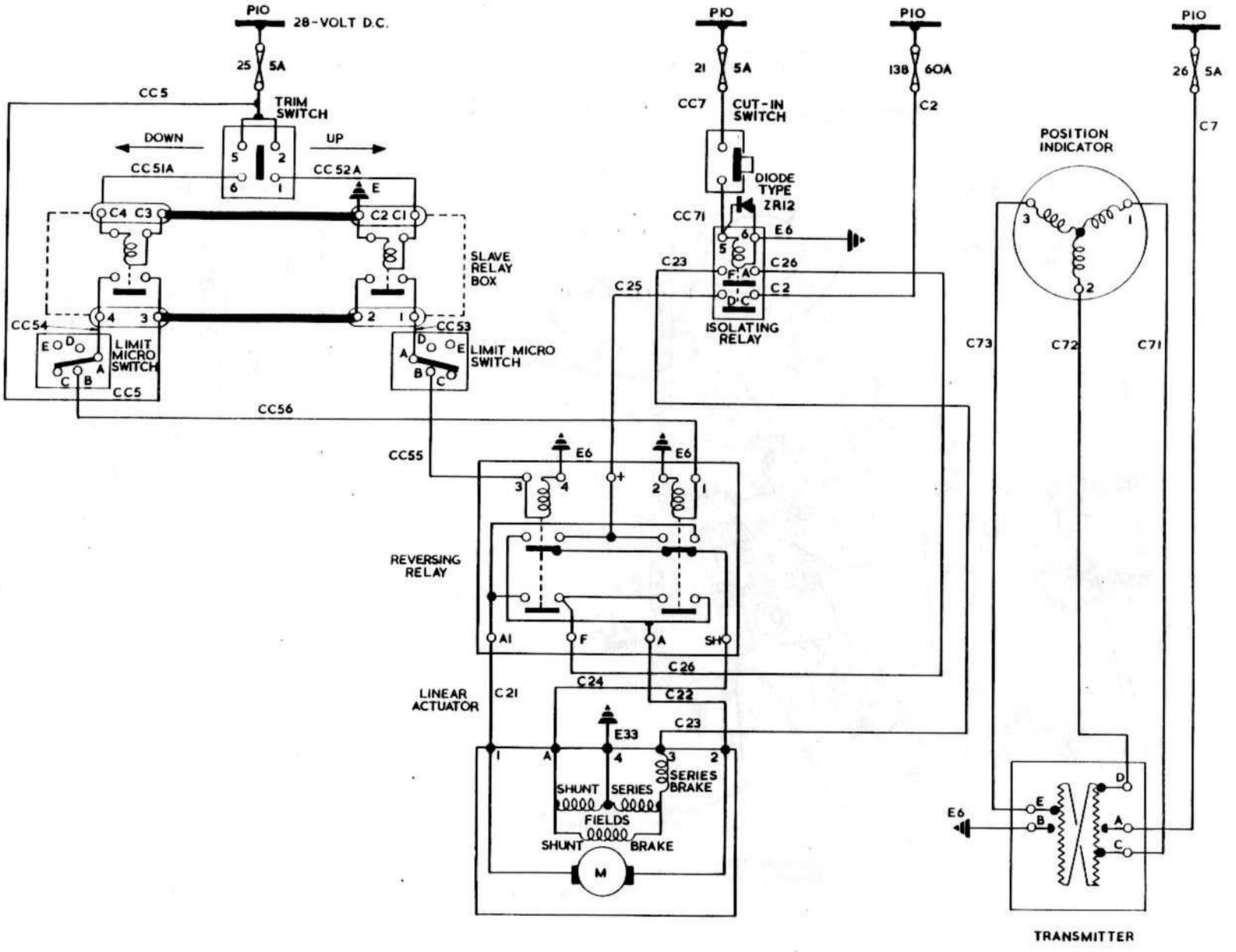

EA3	B1	7129	1

FIG.2.TAIL PLANE CONTROL

DESCRIPTION

Introduction

1. This group gives a description of, and provides circuit and routeing diagrams associated with the aircraft control surfaces, i.e. tail plane, rudder, flaps, aileron and air brakes. Location of components and control switches can be found on fig.1-1A while details of the equipment is given in Table 1 along with the relevant Air Publication reference.

TAIL PLANE CONTROL

General

2. Variation of tail plane incidence is controlled by an electrically-operated linear actuator which forms an extensible strut between the tail plane and fuselage. Operation of the actuator is controlled by a cut-in switch and a trim switch fitted to the control column. The switches operate in conjunction with an isolating relay, two relays, in the slave relay box, two limit switches, and a reversing relay. The tail plane setting is shown on the flight instrument panel by a Desynn indicator which is operated by a transmitter embodied in the actuator.

Linear actuator, Type 4023, Mk.1

3. This type of actuator consists of a gear-driven ram assembly which is driven by a low speed integral motor. In addition to the shunt and series field coils, the motor has an electro-mechanical brake to prevent rotation of the armature and consequent movement of the ram when no current is flowing in the motor circuit. The actuator also incorporates a slipping clutch which prevents damage to the units or airframe if for any reason the tail plane should 'run away'.

Control switches

4. 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 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 vertical 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 so that it engages 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 arm of the column control. The two sections of the clamp are held together with two round-headed screws which are accessible from the underside of the arm.

Slave relay box

5. Two-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 the reversing relay near J.B.6 in the rear fuselage.

Isolating relay

6. This relay is installed near J.B.6 and its use ensures that the tail plane actuator will only function while the cut-in switch is operated simultaneously with the trim switch. Its operation controls the power supply fed to the actuator through the reversing relay. A diode is connected across the coil terminals of the relay to prevent overloading of the cut-in switch.

Reversing relay

7. This relay is installed adjacent to the isolating relay and consists of two coils and associated contacts. Energization of the relay coils, which are controlled by the tail plane control limit microswitches, determines the direction of rotation of the tail plane actuator.

Limit microswitches

8. Normal tail plane travel is limited by two microswitches

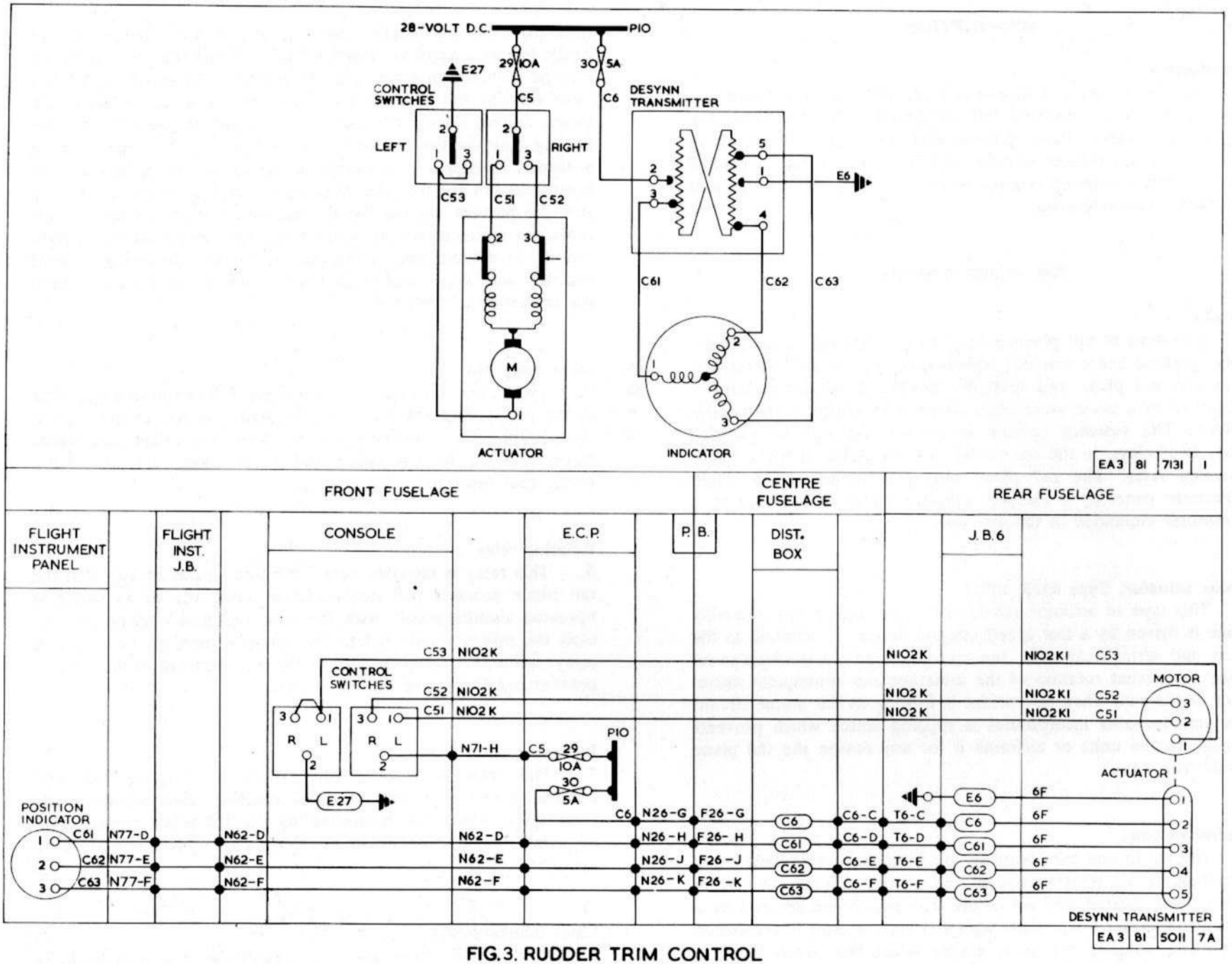

FIG. 3. RUDDER TRIM CONTROL

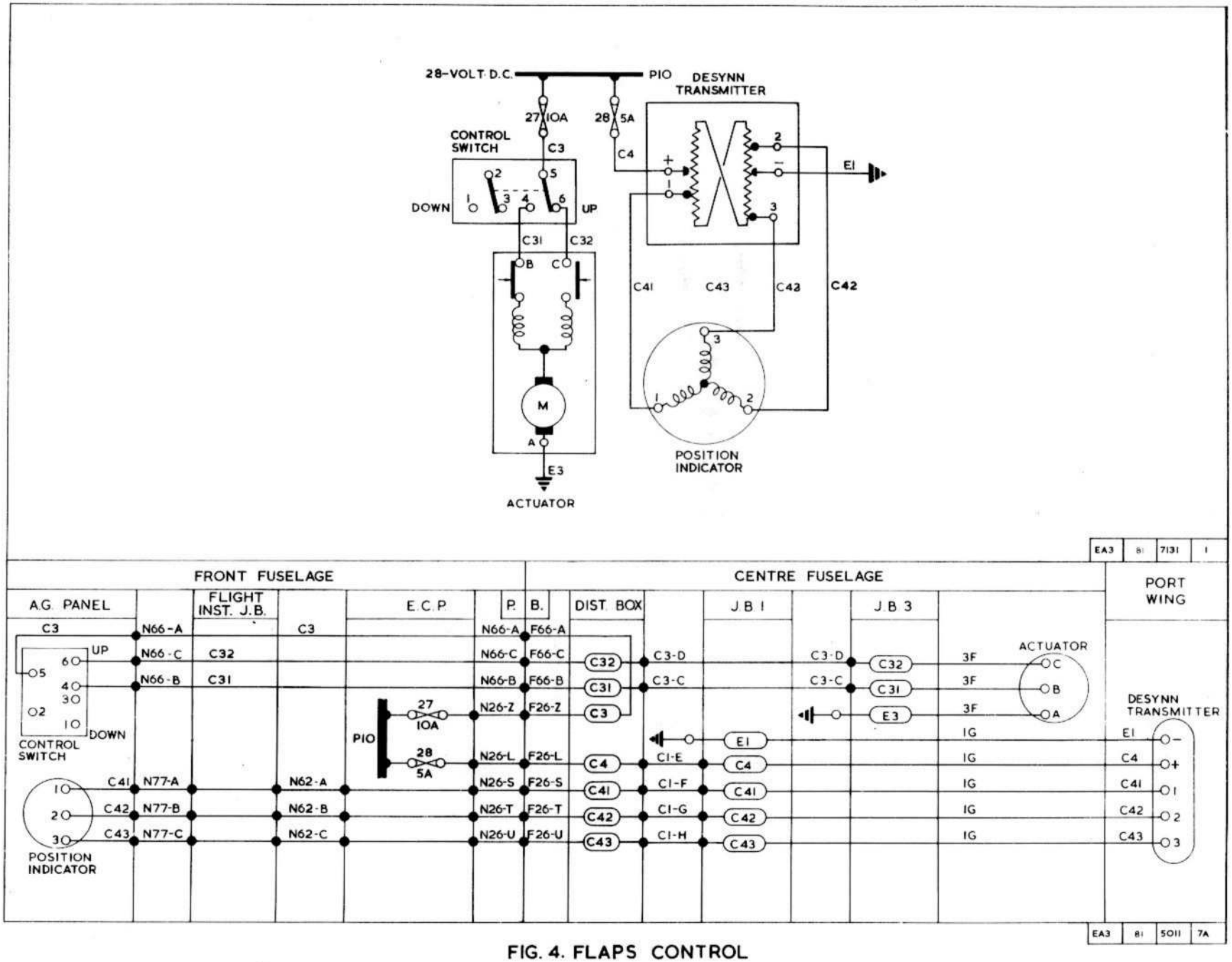

FIG. 4. FLAPS CONTROL

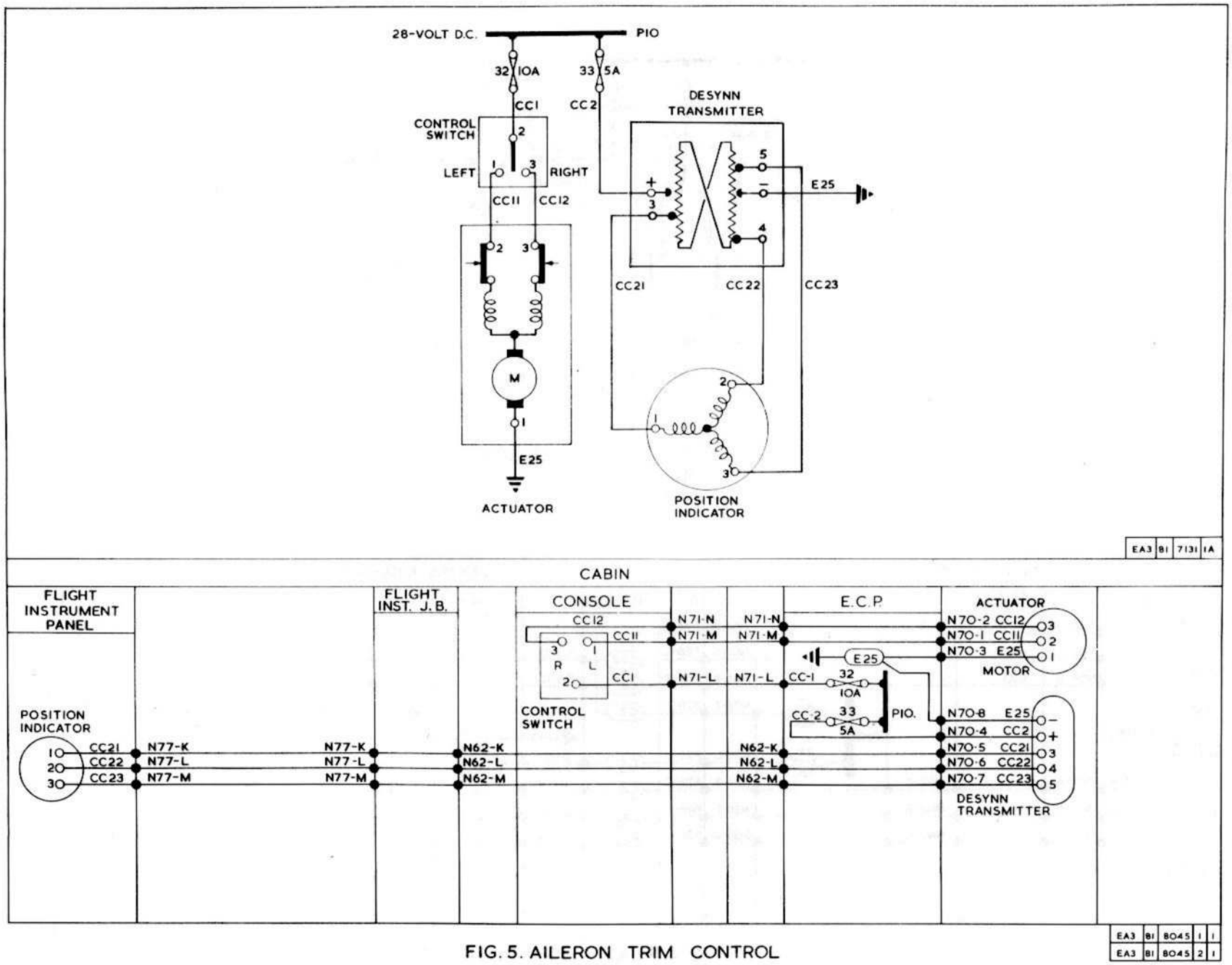

FIG. 5. AILERON TRIM CONTROL

◂MOD 5204 EMBODIED▸

installed one above and one below the tail plane.The switches are mounted on the fuselage and operated by adjustable tappets, fitted to the tail plane, whenever the latter exceeds predetermined limits of travel. Setting of the limit switches is described in A.P.101B-0402-1A, Sect.3, Chap.4.

Operation

9. Closing the cut-in switch completes a circuit from fuse 21 in the E.C.P. to energize the isolating relay; the latter closes to complete the circuit from fuse 138 (circuit C2) to the positive terminal (C25) of the reversing relay. The closing of the isolating relay also completes the circuit between terminal F (C26) of the reversing relay and terminal 3 (C23) of the actuator motor.

10. Selection of the trim switch to NOSE UP passes a supply from CC5 (fuse 25) and CC52A to energize the 'nose-up' relay in the slave relay box; the relay closes and completes the 'reversing' relay 'nose-up' solenoid circuit through CC5, CC53, the 'up' limit microswitch, CC55, and terminal 3 on the reversing relay. The 'nose-up' contacts in the reversing relay close to complete the circuits from C2 (fuse 138) C25 to start up the actuator motor resulting in the actuator moving the tail plane in the direction which gives 'nose-up' trim.

11. Selecting the trim switch to NOSE DOWN connects CC5 (fuse 25) and CC51A to energize the 'nose-down' relay which completes the reversing relay 'nose-down' solenoid circuit through CC5, CC54, the 'down' limit microswitch, CC56, and terminal 1 on the reversing relay. The 'nose-down' contacts of the reversing relay close, completing the circuits from C2 (fuse 138) C25 to start up the low speed motor to operate the actuator in the 'nose-down' trim direction.

12. If NOSE UP or NOSE DOWN is selected long enough for either of the limit microswitches to operate, the microswitch affected will break the solenoid circuit of the reversing relay which then opens to cut-off the power supply to the actuator motor and prevent any further tail plane movement.

RUDDER TRIM CONTROL

General

13. Rudder trim control is effected by an electrically operated linear actuator situated at the base of the rudder. The actuator is controlled by two independent single-pole, 3-position switches on the console. The trim tab position is shown by a Desynn indicator on the flight instrument panel. The indicator is operated by a transmitter embodied in the actuator assembly.

FLAPS CONTROL

General

14 The hydraulically-operated flaps are electrically controlled by a rotary valve actuator installed in the roof of the bomb bay. The actuator is controlled by a 2-position switch, labelled FLAPS-UP-DOWN, fitted on the alighting gear panel. A Desynn indicator showing the flaps position is mounted on the flight instrument panel and operated by a transmitter installed in the inboard trailing edge of the port wing. The transmitter is actuated by a linkage coupled to the flap control rod.

AILERON TRIM CONTROL

General

15. Aileron trim is electrically controlled by an actuator coupled to the aileron mechanism at the base of the control column, and a 3-position switch, labelled AILERON TRIM-L-R, fitted on the console. The amount of trim is shown on the flight instrument panel by a Desynn indicator operated by a transmitter embodied in the actuator.

AIR BRAKE CONTROL

General

16. The system is initially controlled by a switch, situated on the control column handle, having three positions, IN-MID-OUT, which operates in conjunction with a relay in the relay box. A solenoid-operated hydraulic cock and actuator, installed in the

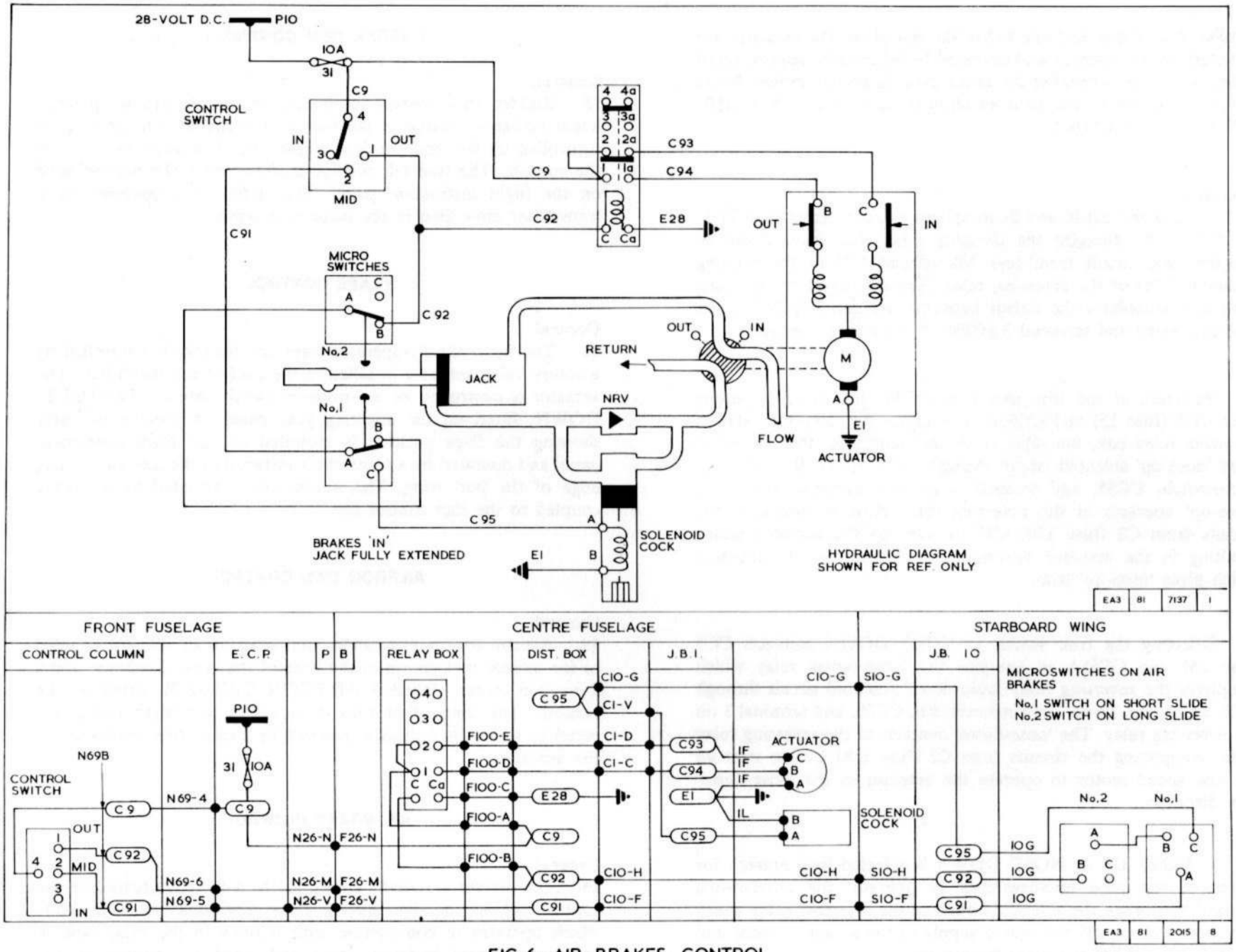

FIG. 6. AIR BRAKES CONTROL

bomb bay, and two microswitches mounted on the air brake jack assembly in the starboard wing complete the system. The microswitches, numbered 1 and 2 are actuated by cams attached to the moving piston rod of the air brake hydraulic jack, switch No.1 by a short cam and switch No.2 by a long cam.

Operation

'Mid' selection

17. When MID is selected from IN the supply C9 is fed via C91, both microswitches and C92, to energize the relay. This completes circuit C9-C94 to the actuator which operates the valve to retract the jack. When the jack piston reaches the halfway position the short cam operates the No.1 microswitch so that contacts AB open and AC close. This action de-energizes the 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

18. On selecting OUT, a supply is fed from C9 to C92 to energize the relay and complete circuit C9-C94 to the actuator, at the same time the solenoid-operated cock is de-energized. This results in the valve operating to retract the jack and fully extend the brakes.

'In' selection

19. If the selector switch is returned to IN the relay is de-energized, and the supply C9 is changed over to C93, causing the actuator to move the hydraulic valve to the IN position and retract the brakes.

SERVICING

WARNING

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

General

20. The functional check for the rudder trim, flaps, aileron trim and air brake control systems consist of operating the relevant switches, in each direction, and ensuring that the control surfaces operate in the appropriate manner. For the functional check of the tail plane control system refer to the following paragraph.

Tail plane control functional check

21. The functional check detailed below should be made when specified in the Servicing Schedule and whenever the control unit 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) Operate the cut-in switch then select NOSE UP by the trim 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 microswitches

22. Instructions for setting the tail plane limit microswitches are given in A.P.101B-0402-1A, Sect.3, Chap.4.

Actuators

23. Descriptive and servicing information on the actuators used in the tail plane, rudder trim and aileron trim control circuits is given in the relevant A.P. detailed in Table 1. The hydraulic valve assemblies used in the flaps and air brakes control systems, each incorporate a Type 200 electrical actuator which is also described in the relevant A.P. detailed in Table 1.

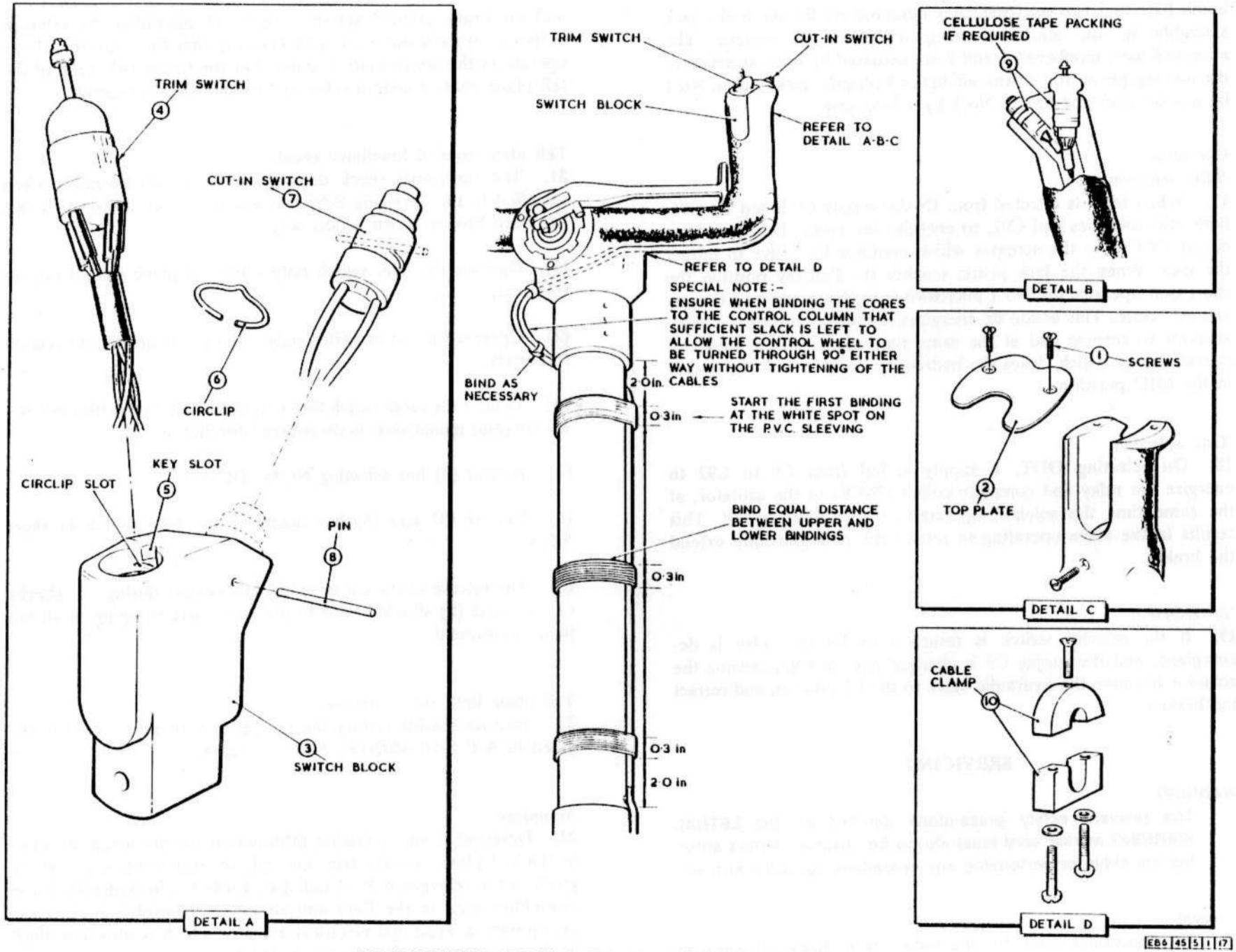

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FIG.7 CONTROL COLUMN TAIL PLANE SWITCH ASSEMBLY

bomb bay, and two microswitches mounted on the air brake jack assembly in the starboard wing complete the system. The microswitches, numbered 1 and 2 are actuated by cams attached to the moving piston rod of the air brake hydraulic jack, switch No.1 by a short cam and switch No.2 by a long cam.

Operation

'Mid' selection

17. When MID is selected from IN the supply C9 is fed via C91, both microswitches and C92, to energize the relay. This completes circuit C9-C94 to the actuator which operates the valve to retract the jack. When the jack piston reaches the halfway position the short cam operates the No.1 microswitch so that contacts AB open and AC close. This action de-energizes the 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

18. On selecting OUT, a supply is fed from C9 to C92 to energize the relay and complete circuit C9-C94 to the actuator, at the same time the solenoid-operated cock is de-energized. This results in the valve operating to retract the jack and fully extend the brakes.

'In' selection

19. If the selector switch is returned to IN the relay is de-energized, and the supply C9 is changed over to C93, causing the actuator to move the hydraulic valve to the IN position and retract the brakes.

SERVICING

WARNING

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

General

20. The functional check for the rudder trim, flaps, aileron trim and air brake control systems consist of operating the relevant switches, in each direction, and ensuring that the control surfaces operate in the appropriate manner. For the functional check of the tail plane control system refer to the following paragraph.

Tail plane control functional check

21. The functional check detailed below should be made when specified in the Servicing Schedule and whenever the control unit 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 microswitches

22. Instructions for setting the tail plane limit microswitches are given in A.P.101B-0402-1A, Sect.3, Chap.4.

Actuators

23. Descriptive and servicing information on the actuators used in the tail plane, rudder trim and aileron trim control circuits is given in the relevant A.P. detailed in Table 1. The hydraulic valve assemblies used in the flaps and air brakes control systems, each incorporate a Type 200 electrical actuator which is also described in the relevant A.P. detailed in Table 1.

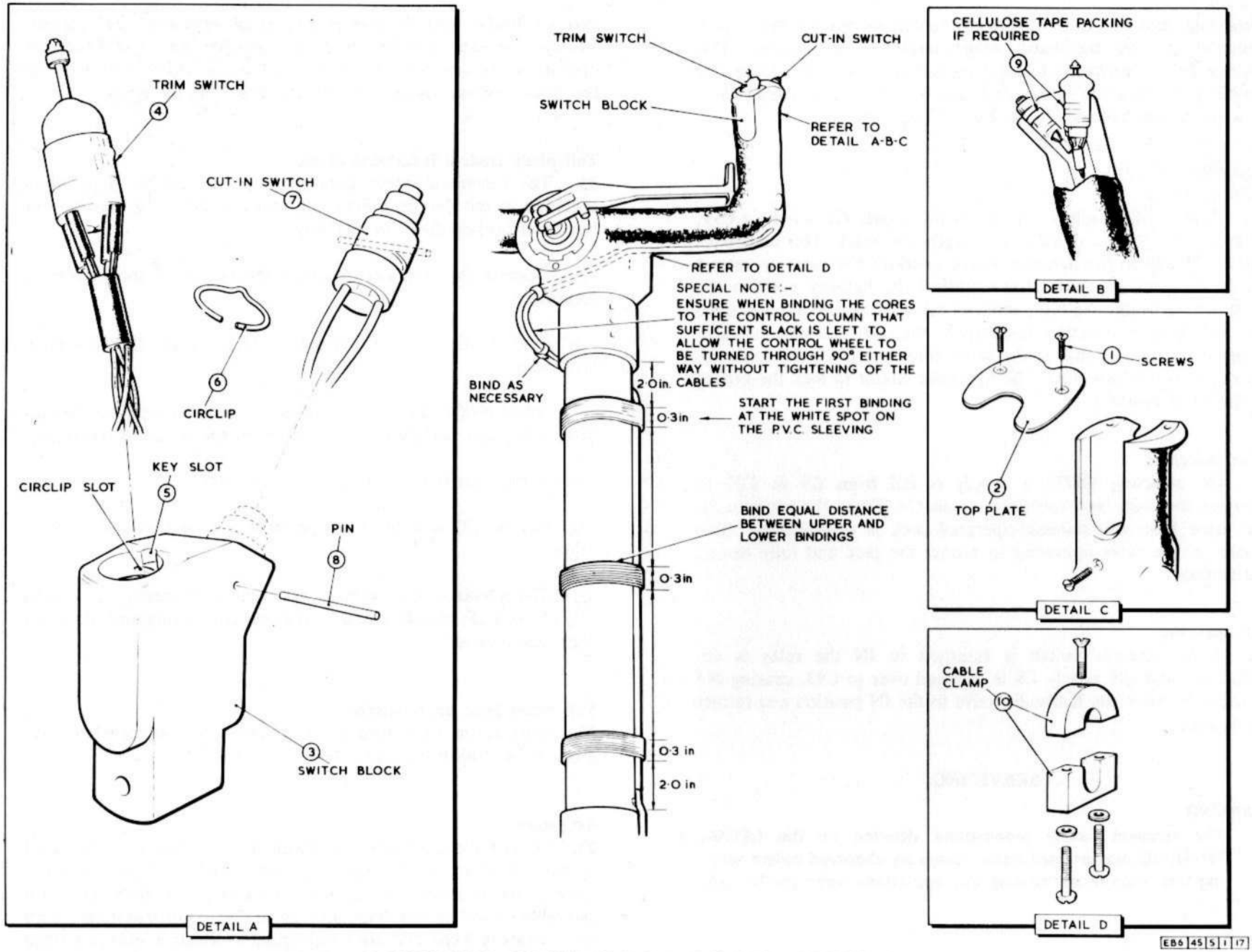

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FIG.7. CONTROL COLUMN TAIL PLANE SWITCH ASSEMBLY

REMOVAL AND ASSEMBLY

Tail plane control switches *(fig.7)*
Removal

Note. . .
To prevent the ingress of swarf or the scoring of control column inner tubes fitted with a vertical conduit channel, the channel must not be removed in situ, or its attachment rivets substituted by PK self-tapping screws.

24. 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 (10) 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 cales from the P.V.C. tubing which was bound to the column.

Assembly
25. 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 (9). 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 hold 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 switchs have been reassembled in accordance with the fore-going 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.

26. On completion of the above operations, the functioning tests detailed in para.21 should be carried out.

Actuators
27. Instructions for the removal and refitting of the flying control trim actuators are given in A.P.101B-0402-1A, Sect.3, Chap.4.

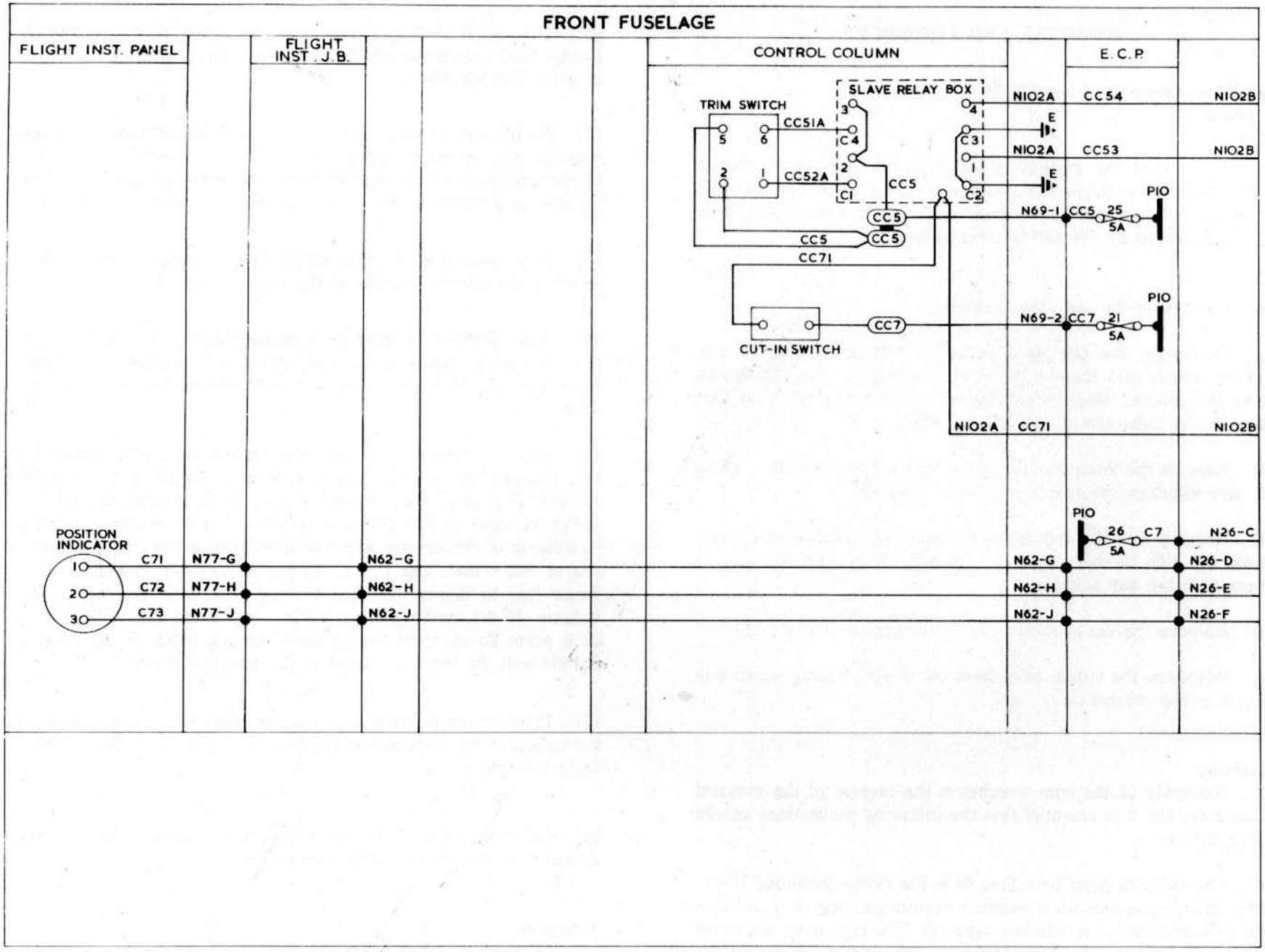

FIG. 8. TAIL PLANE CONTROL

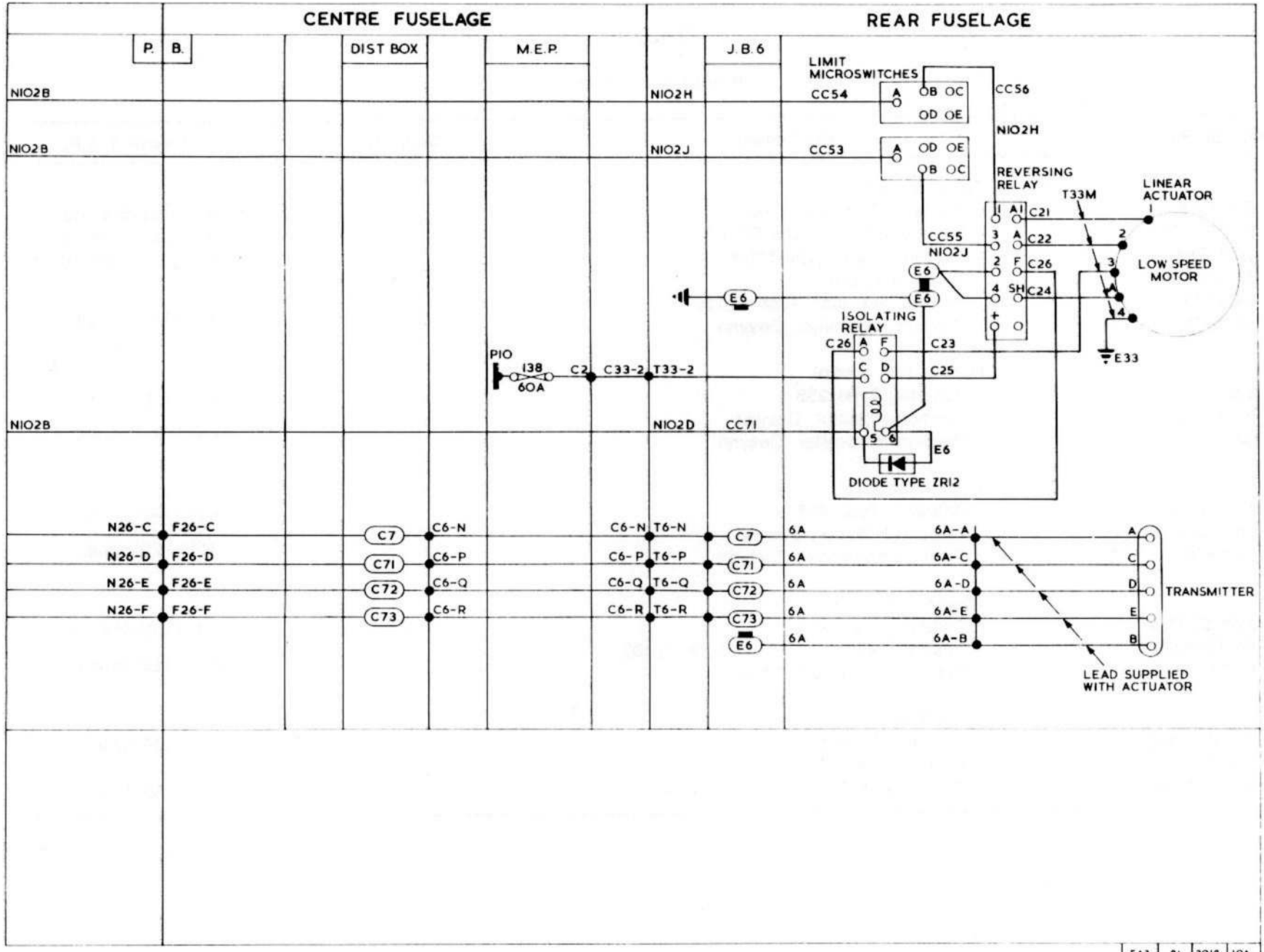

FIG.8A. TAIL PLANE CONTROL

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
	Tail plane control		
5W/2386	Actuator, Type 4023, Mk.1	1	A.P.113E-0141-16
5CW/9777	Reversing relay, Type D5107/2	1	A.P.113D-1374-16
5CW/5986	Isolating relay, Type 100B	1	A.P.113D-1397-16
EA3-81-2843	Slave relay box	1	—
6A/3660	Position indicator, Type FL496	1	A.P.112G series
6A/3576	Position transmitter, Desynn	1	
	Rudder trim control		
5W/55	Actuator, Type 258	1	A.P.113E-0143-16
6A/4333226	Position indicator, Desynn	1	A.P.112G series
6A/3576	Position transmitter, Desynn	1	
	Flaps control		
5W/4511895	Actuator, Type 205	1	A.P.113E-0248-1
6A/4333174	Position indicator, Desynn	1	A.P.112G series
6A/3576	Position transmitter, Desynn	1	
	Aileron trim control		
5W/4520730	Actuator, Type 259	1	A.P.113E-0143-16
6A/4333225	Position indicator, Desynn Type FL430	1	A.P.112G series
6A/3576	Position transmitter, Desynn	1	
	Air brakes control		
5W/4511895	Actuator, Type 217	1	A.P.113E-0248-1
27BM/22	Solenoid cock, Type 6330	1	—
5CW/9729122	Relay, Type S1	1	A.P.113D-1311-1

Appendix 1 RUDDER TRIM CONTROL (PRE MOD.4937)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. On aircraft pre Mod.4937 standard, the rudder trim installation may be pre or post Mod.3428, both circuit and routeing diagrams associated with the latter are given in this Appendix.

Rudder trim control

2. Rudder trim is controlled by a trimming tab, which is operated by an electrical actuator situated at the base of the rudder. In the pre Mod.3428 state the actuator is controlled by a single-pole, 3-position switch whereas in the post Mod.3428 state a double-pole, 3-position switch is utilized. Either switch is labelled RUDDER TRIM and is located on the pilot's console. The trim tab position is shown by a Desynn indicator on the flight instrument panel which is operated by a transmitter embodied in the actuator assembly.

3. Location of the main components and switches are as shown in the main chapter.

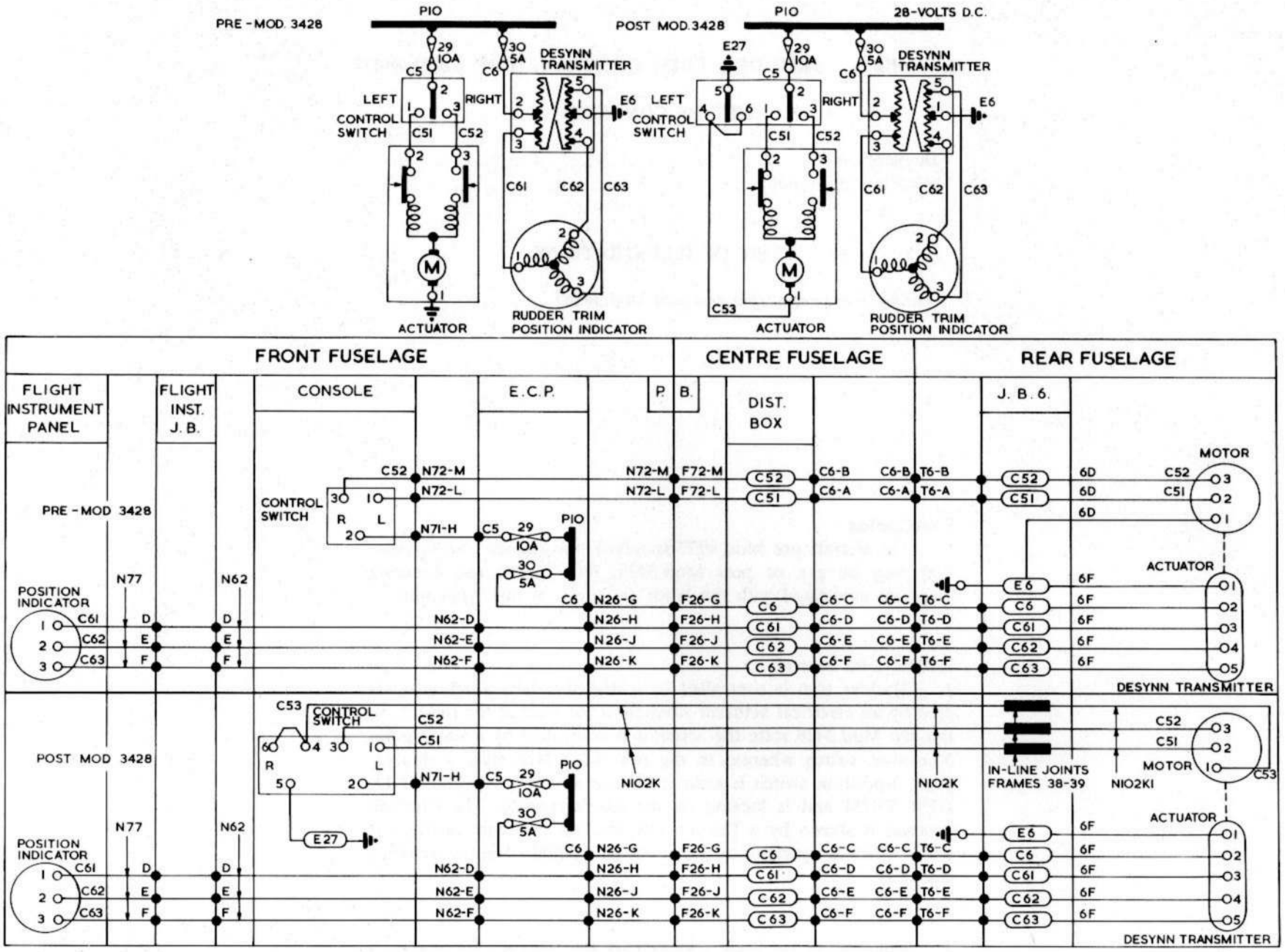

FIG.1. RUDDER TRIM CONTROL (PRE AND POST MOD. 3428)

INSTRUMENT POWER SUPPLIES – GROUP D

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LIST OF TABLES

LIST OF ILLUSTRATIONS

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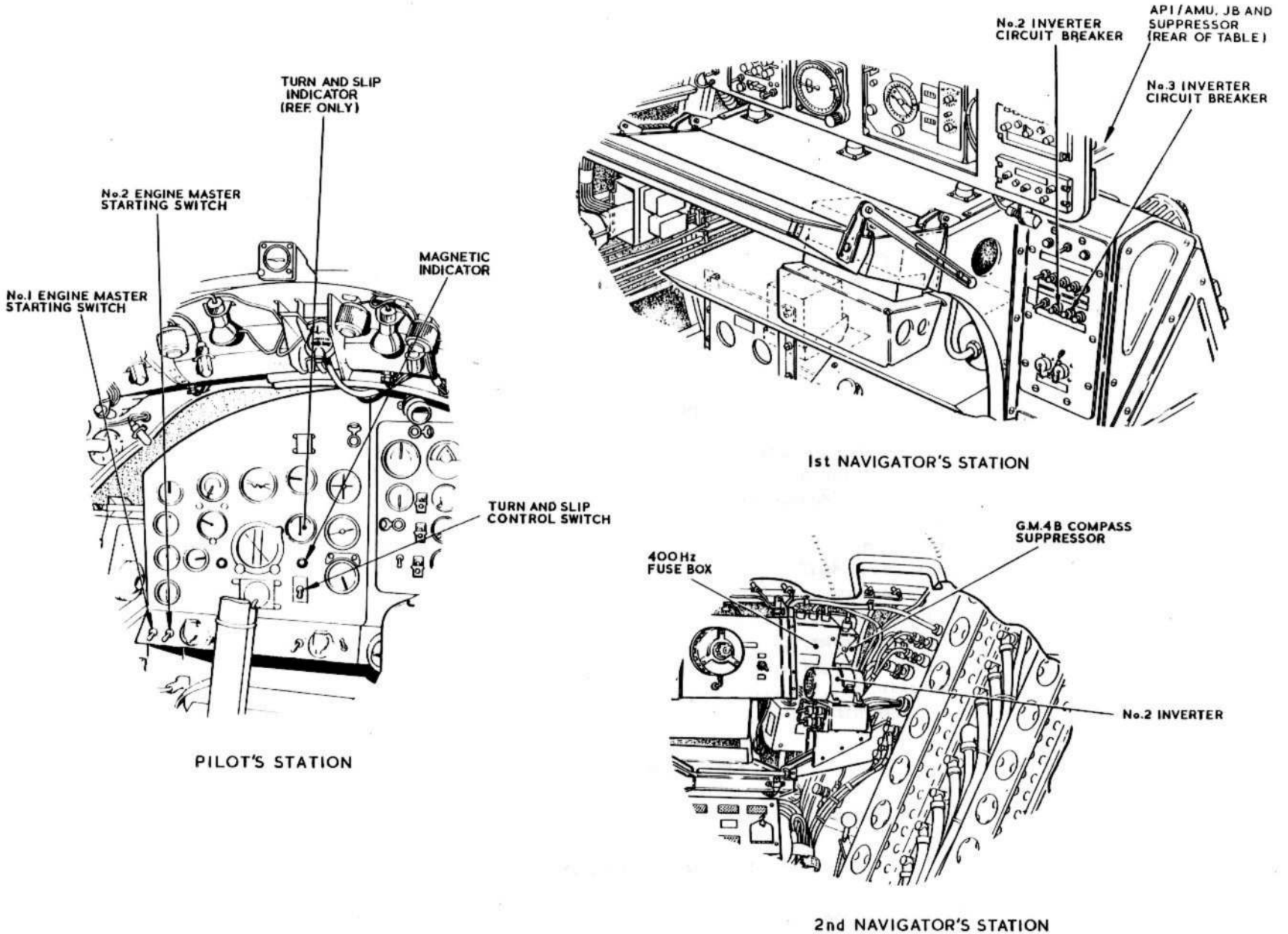
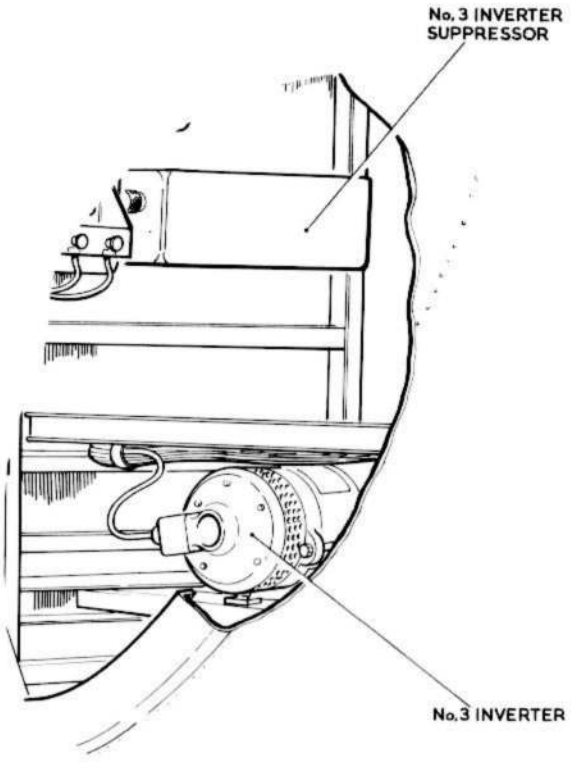
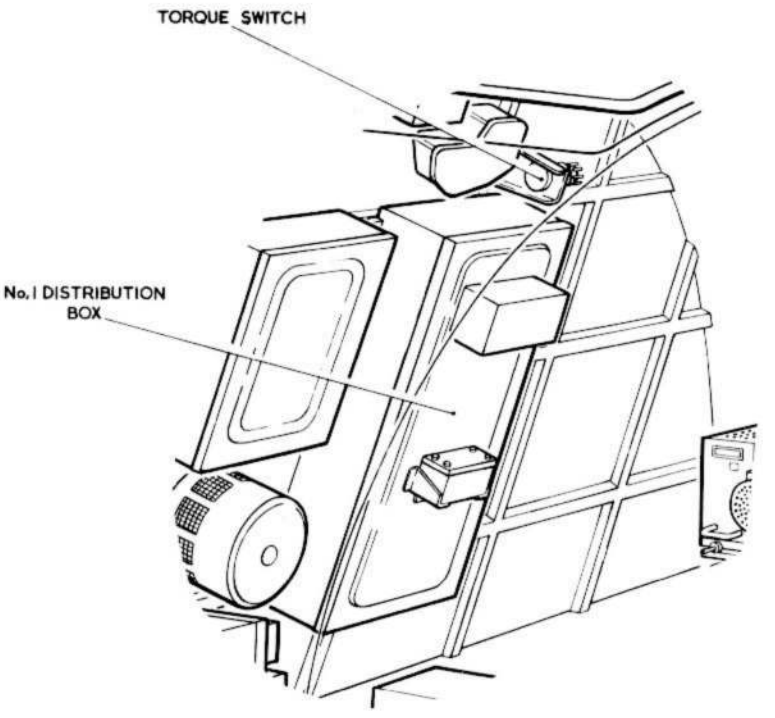


FIG.1. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶



STARBOARD EQUIPMENT COMPARTMENT



UPPER EQUIPMENT COMPARTMENT

FIG. 1A LOCATION DIAGRAM

Introduction

1. This group gives a description of, and provides the circuit and routeing diagrams for, the a.c. and d.c. power supplies required by the various engine, flight and navigation instruments and the radio compass. Table 1 provides a list of the main components, their reference/part numbers and where possible the Air Publication in which they are described. Location of the components and control switches are shown in fig.1-1A.

DESCRIPTION

A.C. supplies

2. The 115 volt, 400 Hz, 3-phase a.c. is supplied by the No.2 and No.3 inverters. No.2 inverter is located on the pressure bulkhead at the starboard side of the 2nd navigator's station whilst No.3 inverter is located in the starboard equipment compartment. The a.c. supplies to the instruments are normally provided by the No.2 inverter whilst provision is made by means of a torque switch and relays to automatically transfer the circuits to the No.3 inverter should the No.2 inverter fail. To offset the low power-factor caused by the highly inductive windings of the torque switch and oil pressure gauge transformers *(Chap.2, Group E)*, power-factor capacitors are provided and installed in the No.1 distribution box.

No.2 inverter

3. The 28 volt d.c. supply to the inverter is drawn from busbar P10 via the No.2 INV circuit breaker, on the E.C.P. switch panel, and the contacts of relay No.1 in the No.1 distribution box. The output from the inverter is routed to the instrument supplies busbar via the normally-open contacts of relay No.7.

Torque switch

4. A torque switch, located in the upper equipment compartment, ensures that No.2 inverter does not come on-line to supply the busbars until its output is of the correct voltage and phase sequence. It also operates in conjunction with relays No.6 and 7 during failure conditions to bring into circuit the No.3 inverter.

No.3 inverter

5. The 28 volt d.c. supply to the inverter is drawn from busbar P10 via the No.3 INV circuit breaker, on the E.C.P. switch panel, and the contacts of relay No.4 in the No.1 distribution box. The output from the inverter is routed to the instrument supplies busbars via the normally-closed contacts of relay No.7.

Magnetic indicator

6. A magnetic indicator, annotated EMERGENCY INSTRUMENT SUPPLY-ON, located on the flight instrument panel indicates which of the two inverters is in use. The indicator shows black when No.2 inverter is on line and white when No.3 inverter is on line.

D.C. supplies

7. The equipment requiring d.c. for its operation obtains a 28 volt d.c. supply from the aircraft busbars which are fed by the main generating system *(Group P)*. Should this system fail, the turn and slip indicator can be maintained from two 12 volt, 4 amp hour emergency batteries *(para.11)*.

OPERATION

No.2 and No.3 inverters

8. Switching ON the No.1 engine MASTER STARTING switch energizes relay No.4 allowing the main feed from the circuit breaker to pass along M3, through the relay contacts, via M31, a suppressor and M32 to start up No.3 inverter. The a.c. output from the inverter is fed via TR3 and TB3 and the contacts of the de-energized relay No.7 to the instrument supplies busbars. The No.6 relay which is also de-energized passes a d.c. feed from M81, through its contacts and M82 to the magnetic indicator which changes from black to white or fluorescent. Another set of contacts connects a d.c. supply to the GM4B compass amplifier via M81 and M83, a suppressor, circuit M84, fuse 120 and F3.

9. When the No.2 engine MASTER STARTING switch is set to ON, a feed is provided via circuit M71, through the contacts of the

de-energized relay No.2, via M72, to energize and close relay No.7. The main supply from the circuit breaker then passes from M2 through the relay contacts to start up No.2 inverter. When the output of the inverter reaches approximately 98 volts, the torque switch closes, and results in the supply feed M71 passing to M73 and energizes relay No.6 and 7. Relay No.6, on closing, breaks the circuit to the magnetic indicator which becomes de-energized and shows black. At the same time the d.c. supply circuit to the compass amplifier is transferred from M81 to M71; No.2 relay becomes energized via circuit M74 and, as this relay closes, its coil receives a paralleled supply from M71; relay No.1, initially energized from M71 via the contacts of relay No.2, is then held in by a supply from relay No.6. Operation of the change-over relay (No.7) connects the supply from No.2 inverter (circuits TR2 and TB2) to the instrument supplies busbars.

No.2 inverter failure

10. Failure of inverter No.2 will cause the torque switch to open, tripping relays No.6 and 7. This latter, in opening, transfers the supply to the instrument supplies busbar to the output lines of inverter No.3 (circuits TB3 and TR3). When relay No.6 opens, relay No.1 becomes de-energized and, on opening, shuts down No.2 inverter, the d.c. supply circuit for the compass amplifier is transferred from circuit M71 to M81, and the magnetic indicator is energized and shows white or fluorescent to indicate that change-over of the supplies has occurred. As relay No.2 remains energized and closed by a supply from M71 fed via its own contacts, relay No.1 cannot be reclosed by an energizing supply from M71-M72. The input circuit of No.2 inverter thus remains isolated.

Turn and slip indicator supplies

General

11. For operation of this indicator a supply of 28 volts d.c. is required, and three separate sources are provided. Two of the supplies have automatic change-over via a relay fitted behind the starter panel. The other supply originates from the emergency battery and is manually controlled by a guarded TURN & SLIP EMERGENCY SUPPLY switch fitted on the flight instrument panel.

Operation

12. When the No.1 engine MASTER STARTING switch is closed a supply is provided from the busbar P10 through fuse 80 and circuit M8-M81, via fuse 83 to F4 and the coil of the relay. The relay closes and, if the TURN & SLIP EMERGENCY SUPPLY switch is in the normal position, the supply passes to the indicator via F41 and M42. Should fuse 83 rupture, the relay opens and the supply is routed through the closed No.2 engine MASTER STARTING switch, N71 to fuse 82, then via F5, through the contacts of the open relay, to the switch and the indicator. If the normal aircraft supply becomes unserviceable, operation of the switch to the EMERGENCY position connects the emergency battery busbar X7 to the indicator via fuse 89.

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

13. The d.c. power requirements for operating these instruments (A.D.R.I.S. system) are fed from fuse 36 in the E.C.P. via a Type B4 suppressor. The circuit diagram for the system is shown in Chap.2, Group F.

GM4B compass

14. Power supplies of 115 volt, 400 Hz, 3-phase a.c. and 28 volt d.c. are required to operate the GM4B compass system. The a.c. supplies are drawn from the instrument supplies busbars, TR21, TB21 and are routed to the compass amplifier via fuse 109 and 113 in the 400 Hz fusebox. The d.c. supply is drawn from busbar P10 via relay No.6 and is described in para.8, 9 and 10. The circuit diagram for the system is shown in Chap.2, Group F.

Artificial horizon

15. Power supplies of 115 volt, 400 Hz, 3-phase a.c. are required to operate this instrument and are drawn from the instrument supplies busbars, TR21, TB21, via fuses 111 and 115 in the 400 Hz fusebox.

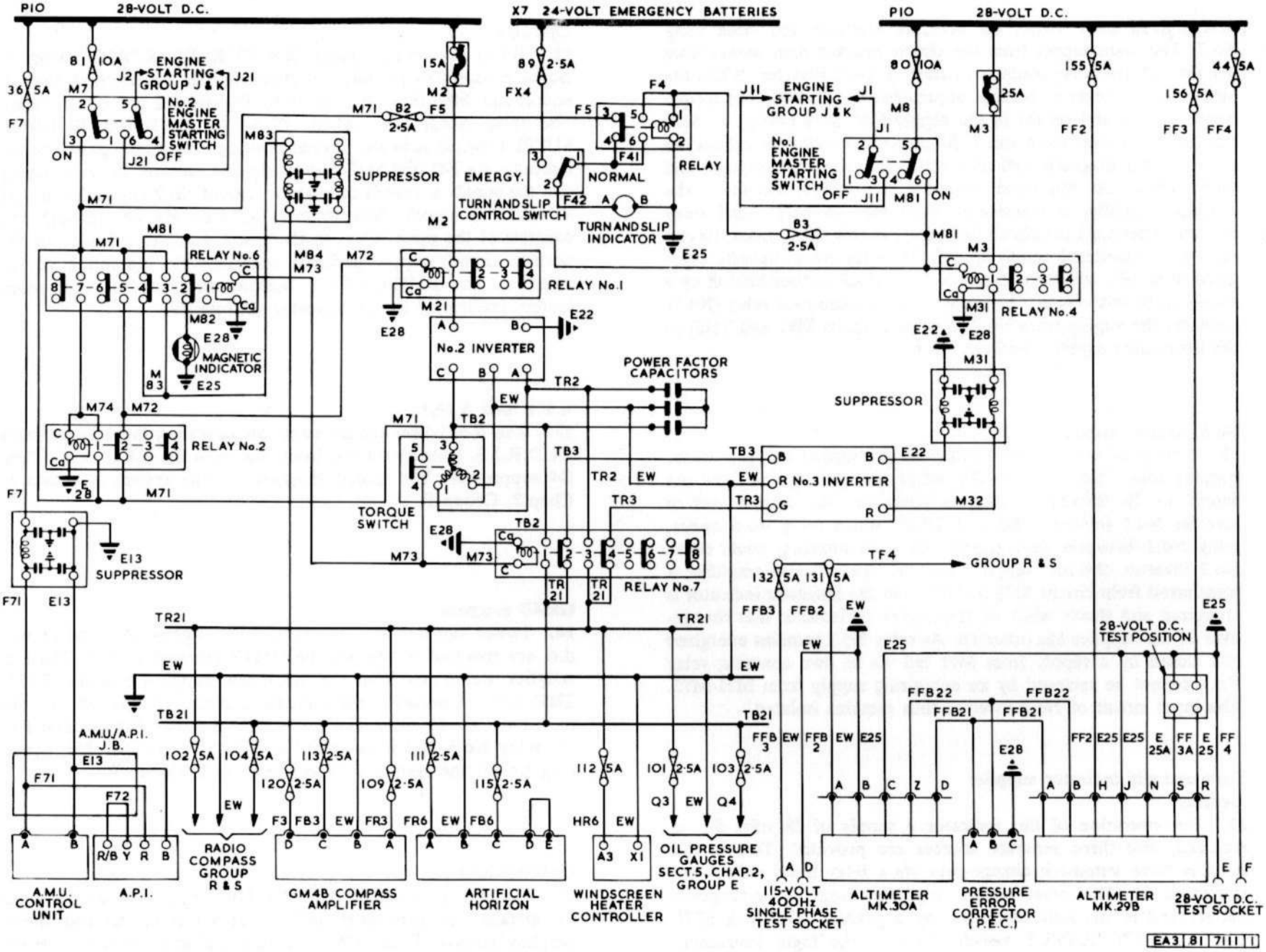


FIG.2. INSTRUMENT POWER SUPPLIES

Windscreen heater

16. Power supplies of 115 volt, 400 Hz, single-phase a.c. is required to operate this system and is drawn from the instrument supply busbar, TR21. The supply is routed to the windscreen heater controller via fuse 112 in the 400 Hz fusebox. The circuit diagram for the system is shown in Group H.

Oil pressure gauges

17. These instruments are operated by 26 volt a.c. stepped down from the 115 volt, 400 Hz, supply by two small transformers housed in the No.1 distribution box. The 115 volt supply is provided by the instrument supplies busbars, TR21, TB21, via fuses 101 and 103 also in the distribution box. The circuit diagram for the gauges is shown in Chap.2, Group E.

Altimeters

18. The power supplies to the pilot's and navigator's altimeters and the P.E.C., which form part of the height encoding system, and test supply sockets are described in Group R & S.

Radio compass

19. Power supplies of 115 volt, 400 Hz, 3-phase a.c. are required to operate this system and are drawn from the instrument supplies busbars, TR21, TB21, via fuses 102 and 104 in the No.1 distribution box. The radio compass supplies are further described in Group R & S.

TABLE 1

Equipment details

Ref./Part No.	Equipment	Quantity	Relevant A.P.
5UB/4935	Inverter, No.2, Type 100B	1	113D-0104-16
5UB/4342258	Inverter, No.3, Type RC8A	1	113D-0120-1
5CW/4400244	Torque switch, Type B1	1	113D-1384-1
5CY/7001363	Suppressor, Type. B4 (A.P.I./A.M.U.)	1	113D-1902-1
5CY/4376389	Suppressor, Type P (GM4B compass)	1	
5CY/4376390	Suppressor, Type 02 (No.3 inverter)	1	

FIG.3 INSTRUMENT POWER SUPPLIES
(illustration overleaf)

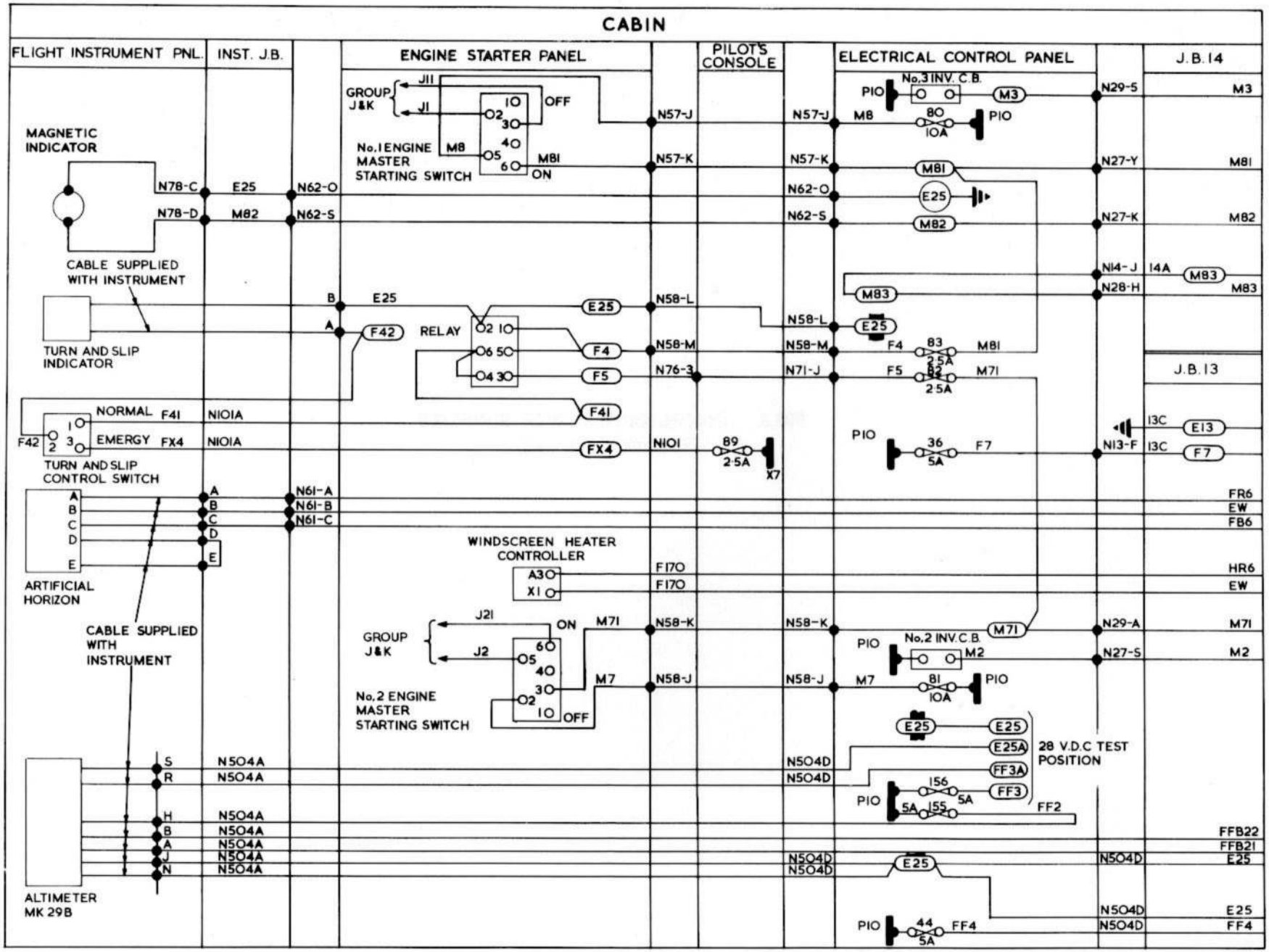


FIG. 3. INSTRUMENT POWER SUPPLIES

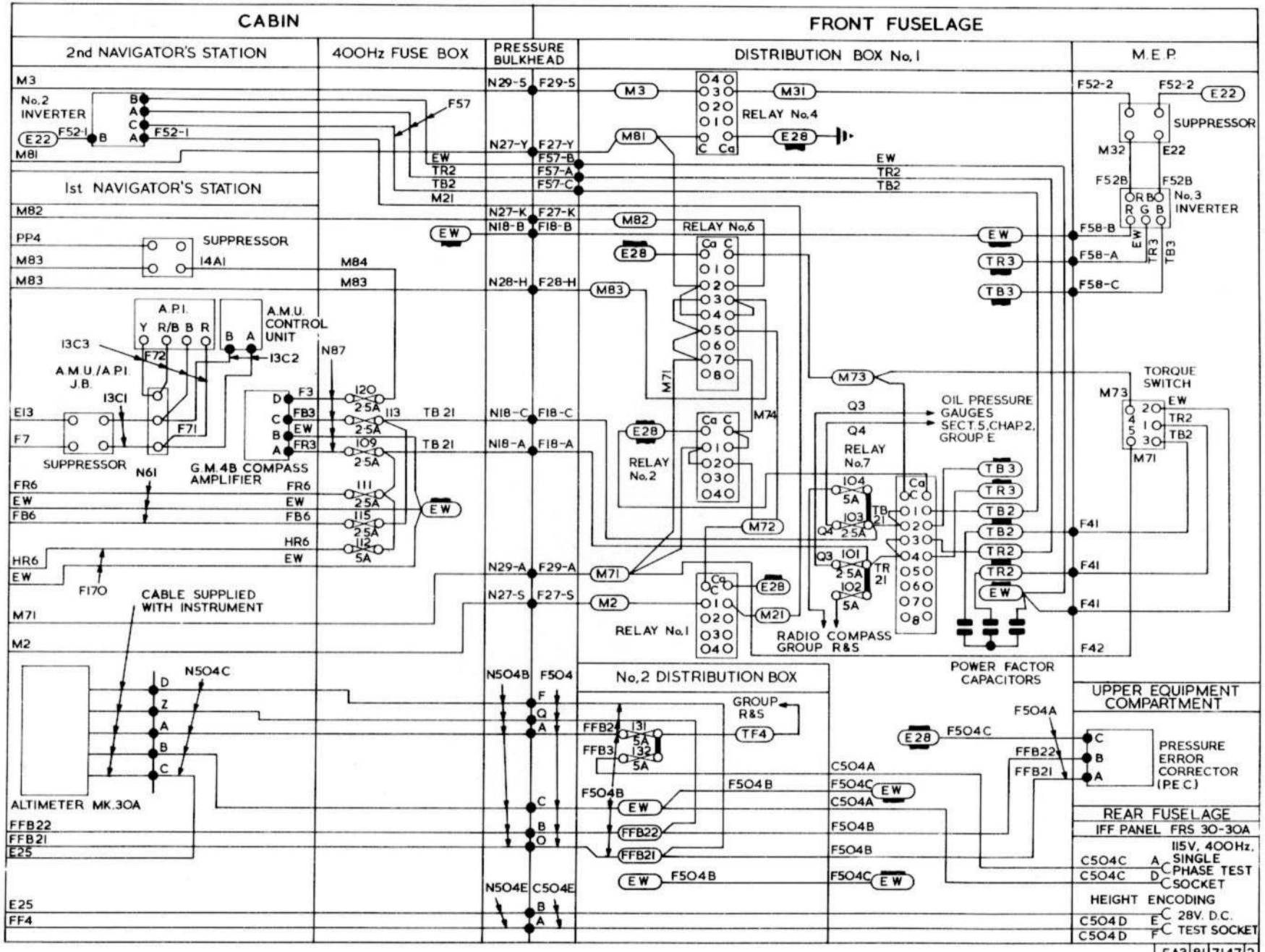


FIG.3A.INSTRUMENT POWER SUPPLIES

Appendix 1 AUTOMATIC HEIGHT ENCODING POWER SUPPLIES (POST MOD.4859)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. This appendix gives a description of, and provides a circuit and routeing diagram for the automatic height encoding (A.H.E.) a.c. and d.c. power supplies. A full description of the A.H.E. system and an interconnection diagram are given in Chap.2, Group F.

2. The A.H.E. system is only fitted to aircraft embodying certain S.R.I.M.'s, details of which are not included in this publication, but the following may be of assistance:-

(1) *1600 Hz distribution box*
On aircraft embodying S.R.I.M. 3577 or 3676, or 3479 and 3604 (Mod. 4924), internal details of the 1600 Hz distribution box should be read in conjunction with drawings 60MU/13505, 21812 and 31603.

(2) *Electrical control panel (E.C.P.)*
On aircraft embodying S.R.I.M. 3577 or 3676 the internal details of the E.C.P. should be read in conjunction with drawing 60MU/40935.

(3) *Navigator's plug break (Chap.2, Group F)*
The navigator's plug break is fitted to Fr.5 port, except on aircraft embodying S.R.I.M. 3479 when it is fitted to the table upper shelf.

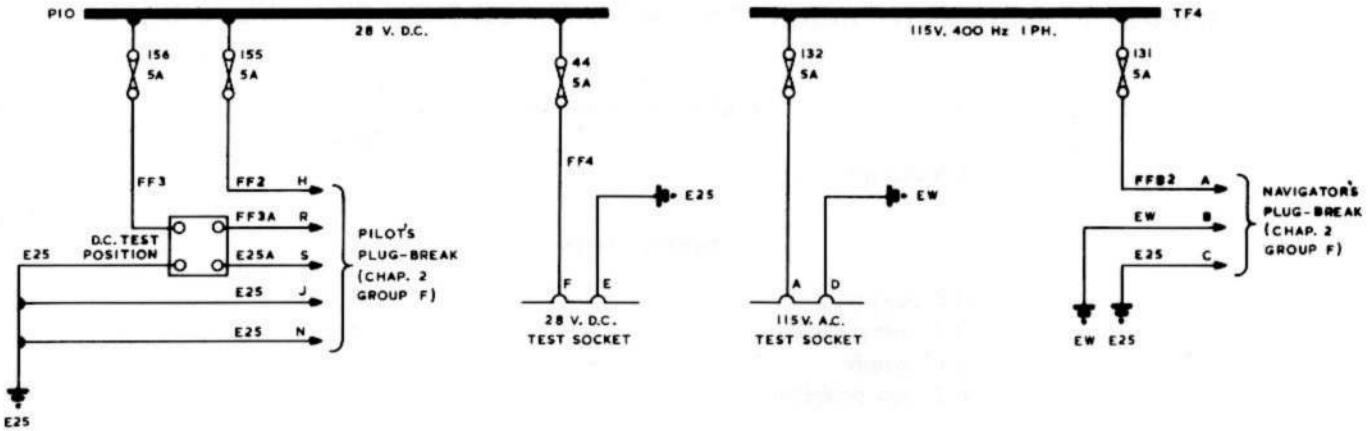
DESCRIPTION

A.C. supply

3. The 115-volt 400 Hz single-phase a.c. supply is derived from busbar TF4 (refer to para.2(1)), in the 1600 Hz distribution box. The supply is fed via fuse 131 and circuit FFB2 to the navigator's plug break and thence to the altimeter *(Chap.2, Group F)*.

Note . . .

The supply to busbar TF4 is derived from inverter No.5 or No.6 introduced by S.R.I.M. action. The selection and control switches for the inverters are situated on the aft face of the E.C.P. as modified by the S.R.I.M.



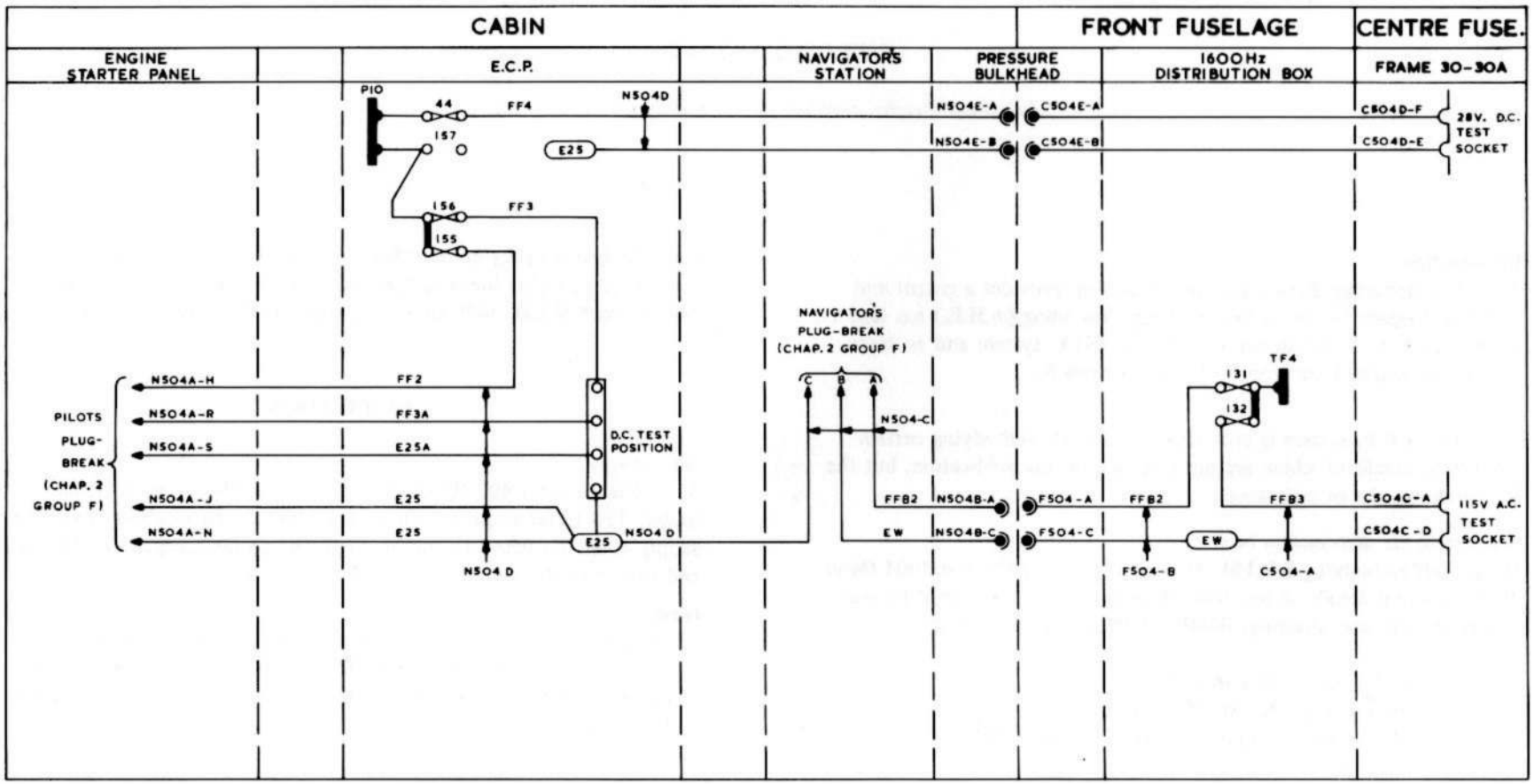


FIG. I. AUTOMATIC HEIGHT ENCODING POWER SUPPLIES

EA3-81-6681 ISS.1

A.C. test position

4. A test socket, located between frames 30 and 30A is connected through cable assembly C504 to EW and to the busbar TF4 via protective fuse 132.

D.C. supply

5. The 28V d.c. supplies are derived from busbar P10 in the E.C.P. feeding fuses 155 and 156. Circuit FF2 conects fuse 155 directly to the pilot's plug break behind the engine starter panel. Fuse 156 supplies the plug break via circuit FF3, the E.C.P. test position, and circuit FF3A.

D.C. test positions

6. A five-way terminal block is mounted on the rear inside face of the E.C.P. connected to circuits FF3, FF3A, E25 and E25A. One position on the block is not used. In the centre fuselage, between frames 30 and 30A, a test socket is provided, linked by cable assembly C504 to E25 and, via protective fuse 44, to busbar P10.

ALIGHTING GEAR – GROUP G

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

UK RESTRICTED

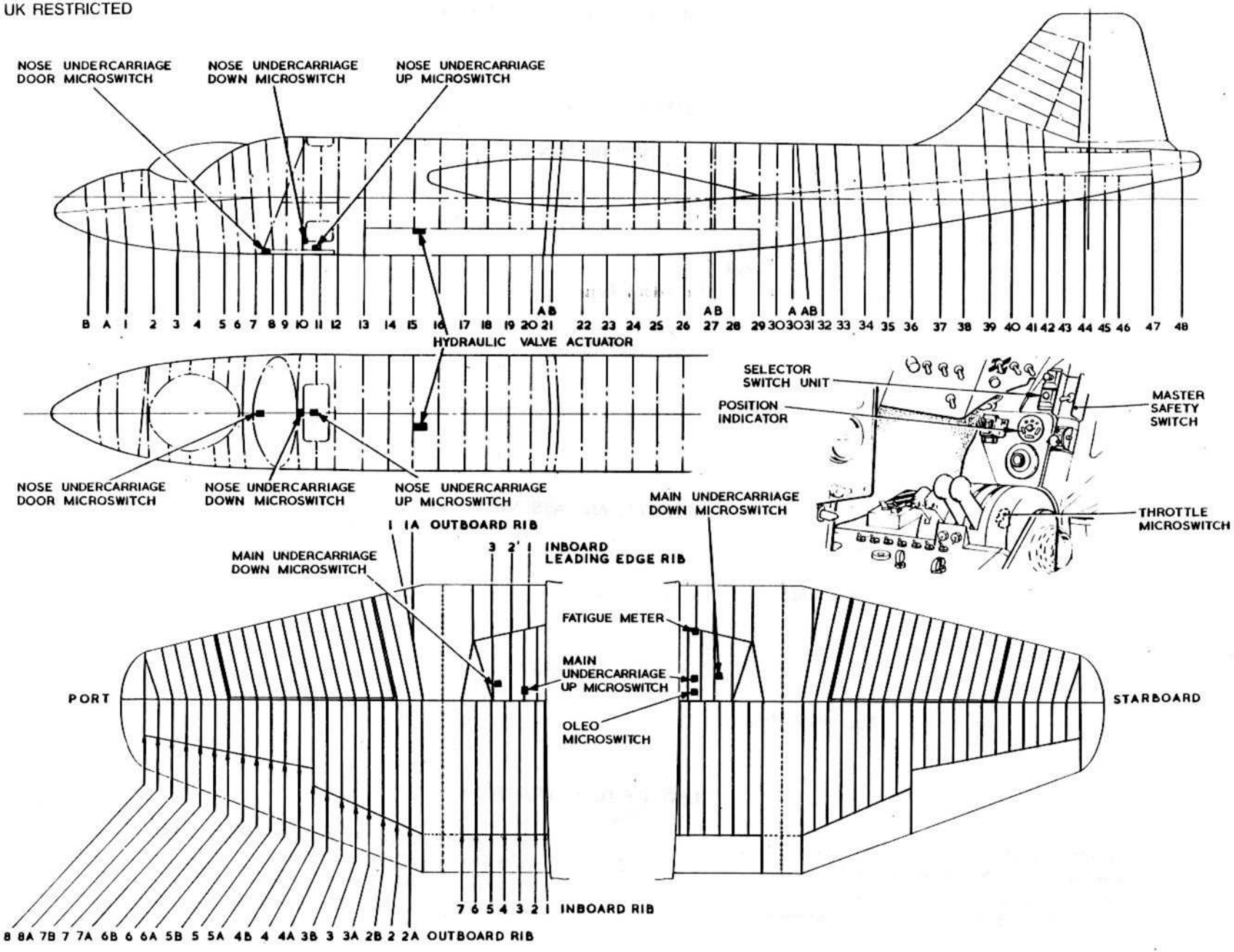


FIG.1 LOCATION DIAGRAM

◀MASTER SAFETY SWITCH RE-DRAWN▶

DESCRIPTION

General

1. This group gives a description of the circuit and routeing diagrams for, and the microswitch adjustments, on the alighting gear. Table 1 provides a list of the main components, their reference/part numbers and, where possible, the publication in which they are described. The location of the components and the circuit switches are shown in fig.1.

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

Selector switch unit

3. The selector switch unit 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.

4. With the alighting gear selected UP, the selector switch circuit U12 energizes the fatigue meter *(Chap.2, Group D)* via fuse 4 in the M.E.P. and circuit U12A.

Emergency UP selection

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

WARNING

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

Master safety switch

6. 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 is connected in series with the power supply and the UP selection 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 carried out with the aircraft jacked up.

Position indicator and microswitches

7. An alighting gear position indicator is mounted alongside the selector switch unit and is 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. Another microswitch, fitted in the throttle box, brings on the nose wheel red lamp 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 microswitch position in relation to the cam by utilizing the elongated holes in the attachment bracket. Adjustment and location details for all the microswitches in the position indicator circuit are given in fig.3, 4 and 5.

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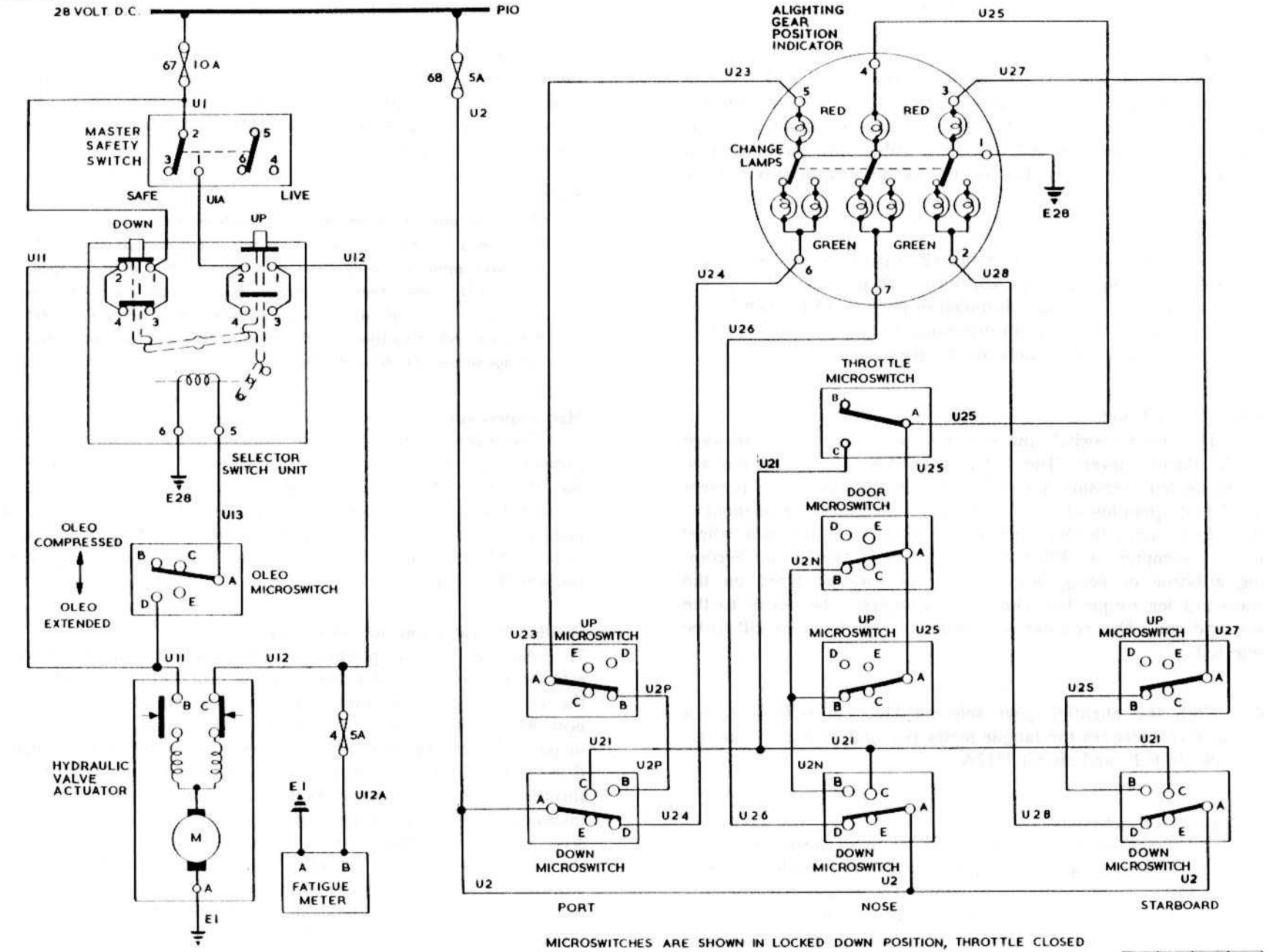


MICROSWITCHES ARE SHOWN IN LOCKED DOWN POSITION, THROTTLE CLOSED

EA3 | 81 | 7117 | 3

FIG. 2. ALIGHTING GEAR CONTROL AND INDICATION

◄MOD 5262 INCORPORATED►

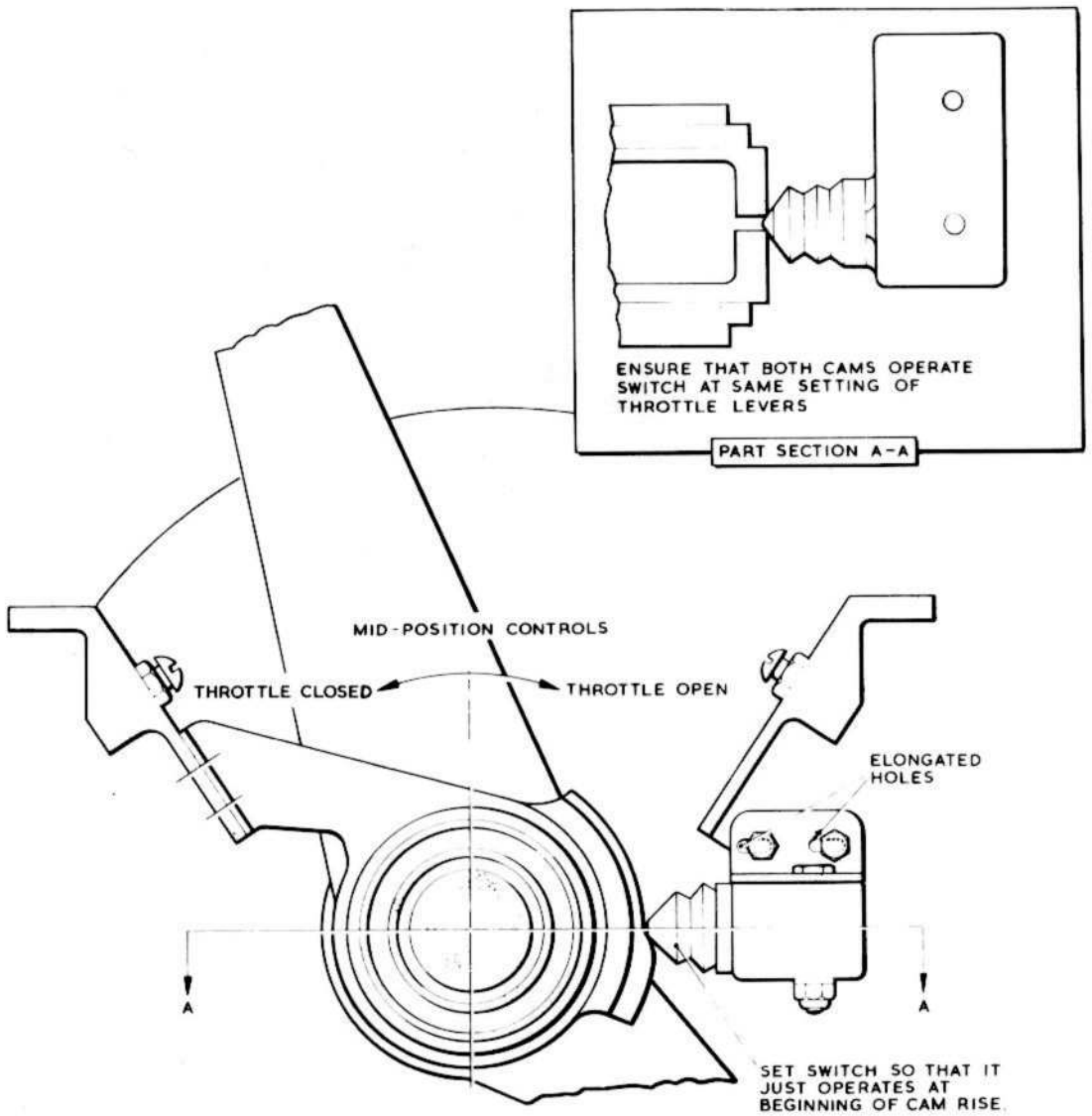
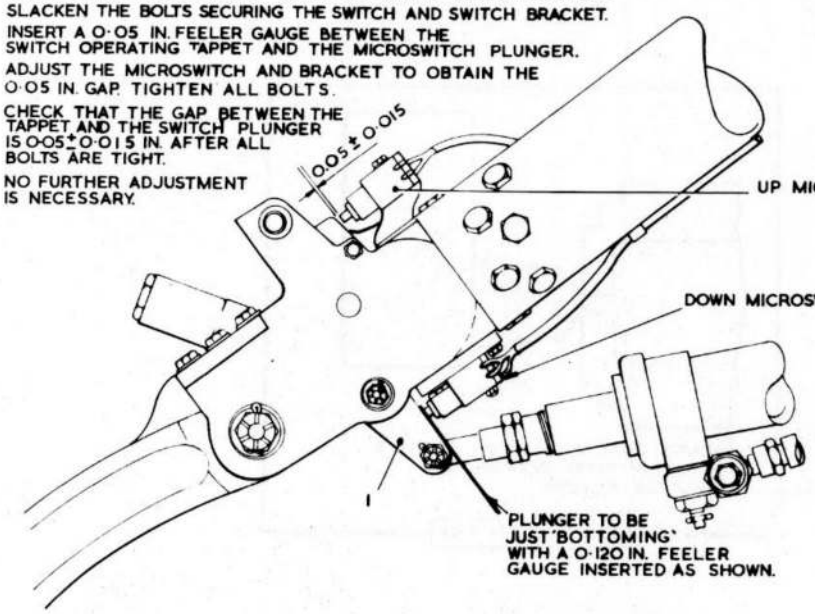
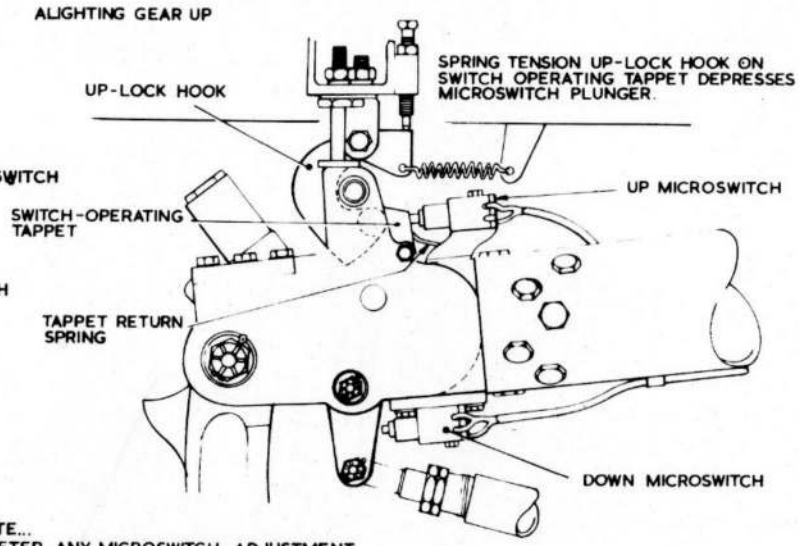


FIG. 3. MICROSWITCH ADJUSTMENT – THROTTLE BOX

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

1. SLACKEN THE BOLTS SECURING THE SWITCH AND SWITCH BRACKET.
2. INSERT A 0·05 IN. FEELER GAUGE BETWEEN THE SWITCH OPERATING TAPPET AND THE MICROSWITCH PLUNGER.
3. ADJUST THE MICROSWITCH AND BRACKET TO OBTAIN THE 0·05 IN. GAP. TIGHTEN ALL BOLTS.
4. CHECK THAT THE GAP BETWEEN THE TAPPET AND THE SWITCH PLUNGER IS 0·05 ± 0·015 IN. AFTER ALL BOLTS ARE TIGHT.
5. NO FURTHER ADJUSTMENT IS NECESSARY.

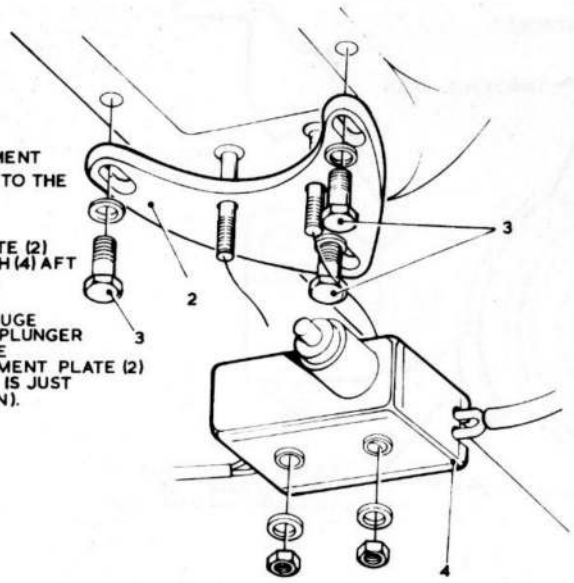




NOTE...
AFTER ANY MICROSWITCH ADJUSTMENT AN UNDERCARRIAGE RETRACTION TEST MUST BE MADE AND THE WARNING LIGHTS CHECKED.

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).



DOOR MICROSWITCH ADJUSTMENT

1. JACK THE NOSE (A.P. 101B-0402-1A, SECT.2, CHAP.4.)
2. CONNECT A 24 VOLT SUPPLY TO THE EXTERNAL SUPPLY SOCKET.
3. DISCONNECT THE PORT DOOR ACTUATING ROD (A.P. 101B-0402-1A, SECT. 3, CHAP. 5)
4. RAISE THE NOSE WHEEL (A.P. 101B-0402-1A, 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.

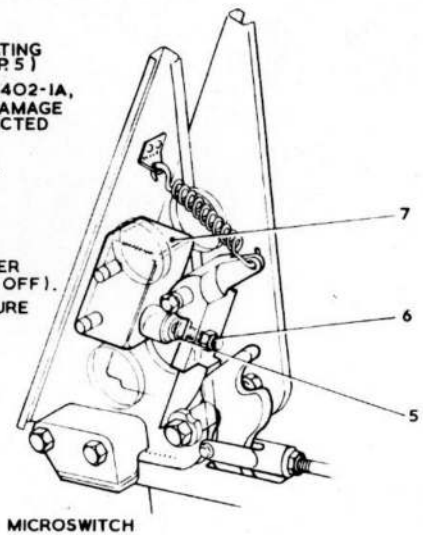
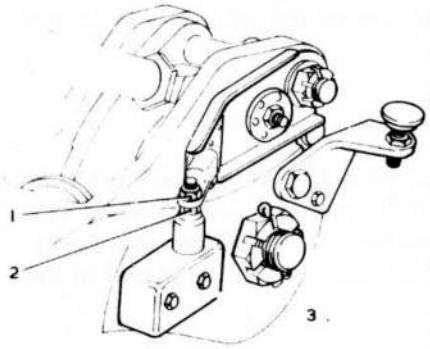


FIG. 4. MICROSWITCH ADJUSTMENT - NOSE UNDERCARRIAGE

EA3	40	1	11C
EA3	40	261	3

DOWN MICROSWITCH



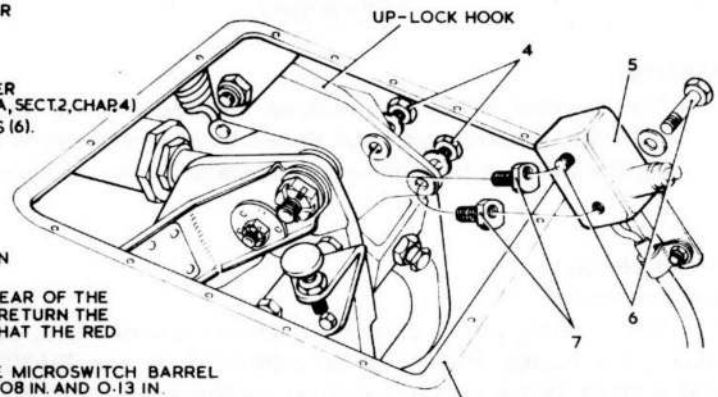
DOWN MICROSWITCH ADJUSTMENT

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

UP MICROSWITCH ADJUSTMENT

1. JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (A.P.101B-0402-1A, SECT.2, CHAP.4)
2. CONNECT A 24-VOLT POWER SUPPLY TO THE EXTERNAL SUPPLY SOCKET. GREEN LIGHT ON.
3. REMOVE THE APPROPRIATE ACCESS PANEL FROM THE UPPER SURFACE OF THE MAIN PLANE INNER WING (A.P.101B-0402-1A, SECT.2, CHAP.4)
4. SLACKEN THE NUTS (4) AND MICROSWITCH ATTACHMENT BOLTS (6).
5. TURN THE HEADS OF THE ECCENTRIC BOLTS (7) SO THAT THE MICROSWITCH ATTACHMENT TAPPED HOLES ARE AT THE FURTHEST POINT OF ADJUSTMENT AWAY FROM THE HOOK. TIGHTEN THE ATTACHMENT BOLTS (6) AND NUTS (4)
6. RETRACT THE ALIGHTING GEAR, USING THE HAND PUMP, APPLYING FULL JACK PRESSURE. CHECK THAT THE RED LIGHT COMES ON DURING OPERATION, AND GOES OFF WHEN THE UP-LOCK HOOK IS FULLY ENGAGED.
7. THROUGH THE ACCESS PANEL, LIFT THE UP-LOCK HOOK CLEAR OF THE LATCH PIN, AND ENSURE THAT THE RED LIGHT COMES ON. RETURN THE UP-LOCK HOOK TO THE ENGAGED POSITION AND ENSURE THAT THE RED LIGHT GOES OFF.
8. USING FEELER GAUGES, CHECK THAT THE GAP BETWEEN THE MICROSWITCH BARREL AND THE OPERATING FACE OF THE SIDE STAY IS BETWEEN 0·08 IN. AND 0·13 IN.
9. IF THE GAP IS IN EXCESS OF 0·13 IN., SLACKEN ATTACHING BOLTS (6) AND NUTS (4) AND ROTATE ECCENTRIC BOLT (7). TO DEPRESS THE MICROSWITCH PLUNGER FURTHER INTO OVERTRAVEL.
10. EXHAUST THE JACK PRESSURE AND SELECT THE ALIGHTING GEAR DOWN. USING THE HAND PUMP, SLOWLY LOWER THE ALIGHTING GEAR UNTIL THE D-DOOR UNLOCKS. PULL THE DOOR OPEN AND OPERATE THE DOWN SEQUENCE VALVE. THE RED LIGHT MUST NOT COME ON. IF THE RED LIGHT DOES COME ON REPEAT OPERATION 9.
11. SELECT THE ALIGHTING GEAR UP, FULLY RETRACT THE ALIGHTING GEAR USING THE HAND PUMP AND RECHECK THE PLUNGER GAP AS IN OPERATION 8.

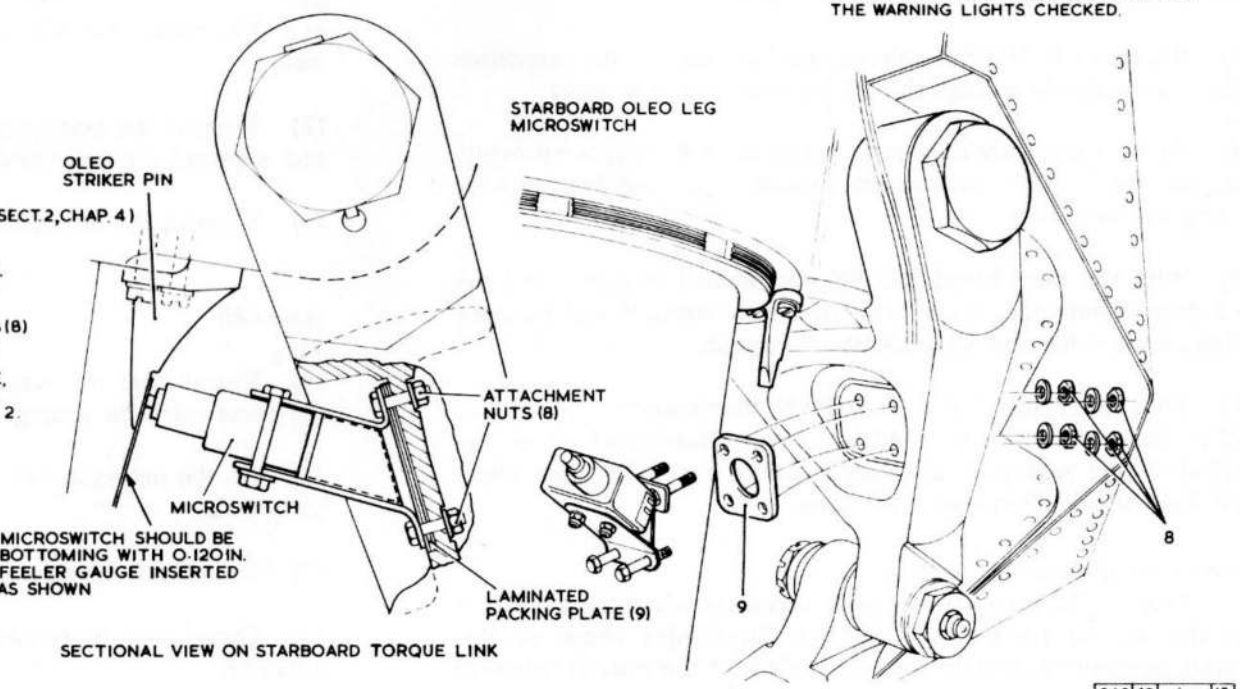
UP MICROSWITCH



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

STARBOARD OLEO LEG MICROSWITCH ADJUSTMENT

1. JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (A.P.101B-0402-1A, 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, PART NO. EAI-40-335 ADJUST THE MICROSWITCH TO OBTAIN THE CONDITION DESCRIBED IN OPERATION 2.
4. RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING NUTS



SECTIONAL VIEW ON STARBOARD TORQUE LINK

EA3	40	1	19
EA3	40	237	4

FIG. 5. MICROSWITCH ADJUSTMENT – MAIN UNDERCARRIAGE

SERVICING

WARNING

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

Circuit checks

Indicator circuits

8. The alighting gear indicator circuits are not switched, but fed direct from busbar P10 which is controlled by the BATTERY ISOLATION switch on the electrical control panel (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 lamps are illuminated.

(3) Break each DOWN microswitch in turn – the respective green lamp should extinguish and the red lamp illuminate.

(4) At each main wheel in turn, break the UP microswitch while keeping the DOWN microswitch broken – the red lamp should extinguish each time.

(5) With the nose wheel DOWN microswitch broken – and the red lamp illuminated, break both the UP microswitch and the door microswitch – the red lamp should extinguish.

(6) With both the UP and DOWN microswitches broken in either main wheel circuit and no lamps illuminated move the throttle levers in turn, to less than one-third open – the nose wheel red lamp should illuminate each time.

Control circuit checks

9. Due to the safety precautions necessary when the aircraft is on the ground *(para.3)* an electrical functioning check on this circuit can only take place with the weight of the aircraft removed from its main wheels. This allows the safety lock microswitch to operate and energize the locking coil in the selector switch unit and release the mechanical lock.

Actuator

10. 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 the relevant A.P. detailed in Table 1.

REMOVAL AND ASSEMBLY

Actuator

Removal

11.

(1) Disconnect the electrical plug and socket connection from the motor.

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

(3) Remove the actuator.

Assembly

12.

(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 to the motor.

(4) Carry out a retraction test *(A.P.101B-0402-1A, Sect.3, Chap.6).*

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5CW/12963	Selector switch unit	1	A.P.113D-1130-1
5CX/4204	Alighting gear position indicator	1	A.P.113F-0607-13A
5W/4511895	Hydraulic valve actuator	1	A.P.113E-0248-1
5CW/1047697	Master safety switch	1	
	Microswitches		
	Nose wheel	3	
◄ 5CW/13598	Main wheel (port)	2	
	Main wheel (starboard)	3	
5CW/9504373	Throttle	1	
27Q/5120-99-4674381	Dowty resetting tool Part No. ST1657 or Locally manufactured resetting tool	1	113D-1130-1 Chapter 1. Figure 3.

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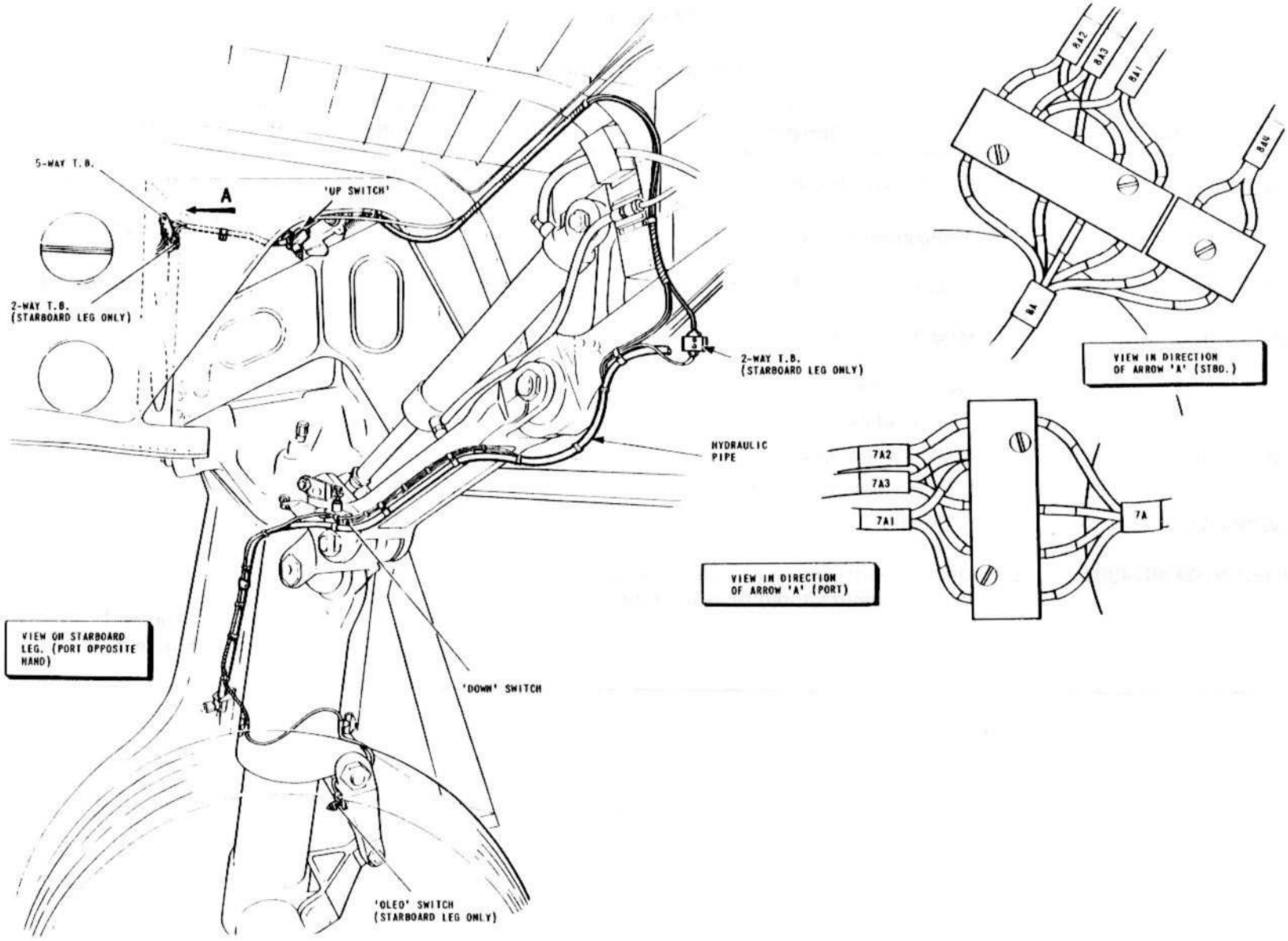

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FIG. 6. MAIN WHEELS - WIRING INSTALLATION

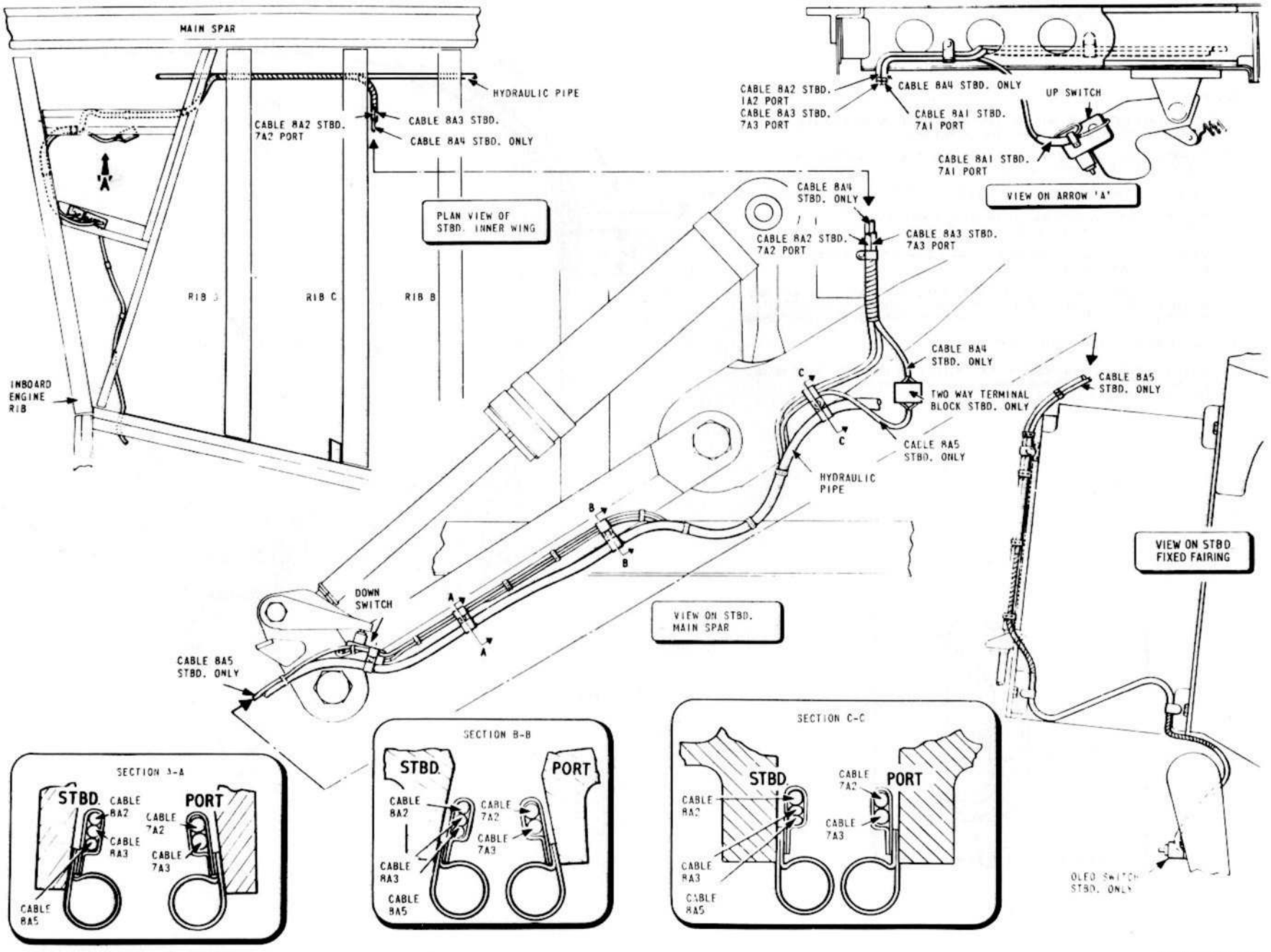

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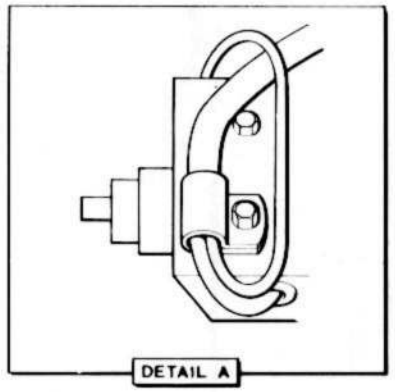
FIG. 6A. MAIN WHEELS - WIRING INSTALLATION

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 (A.P.101B-0402-1A, **SECT. 2,CHAP. 4**).
2. PREPARE THE ALIGHTING GEAR FOR HAND PUMP OPERATION (A.P.101B-0402-1A, 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 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 (A.P.101B-0402-1A, SECT. 3,CHAP. 5)



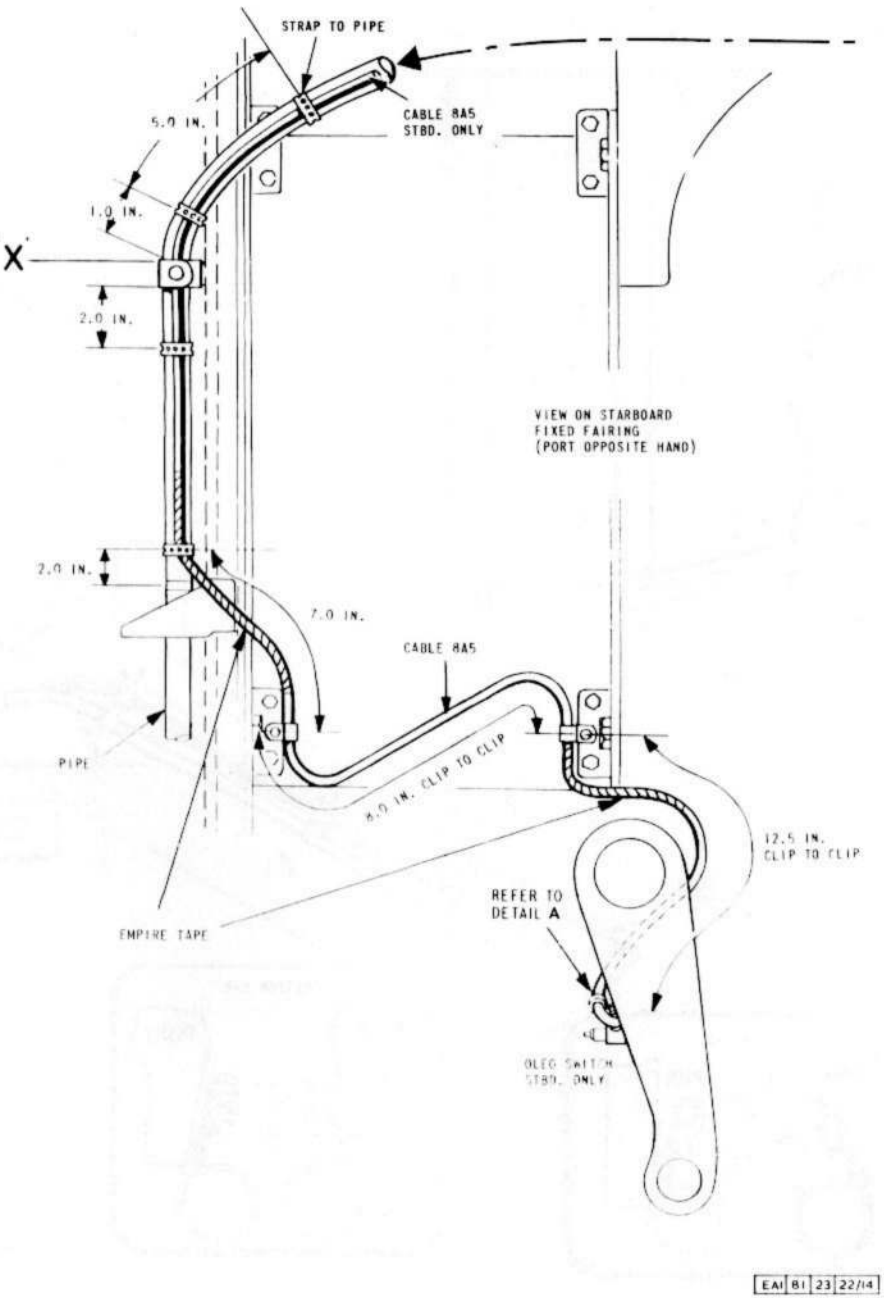


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FIG. 6B. MAIN WHEELS-WIRING INSTALLATION

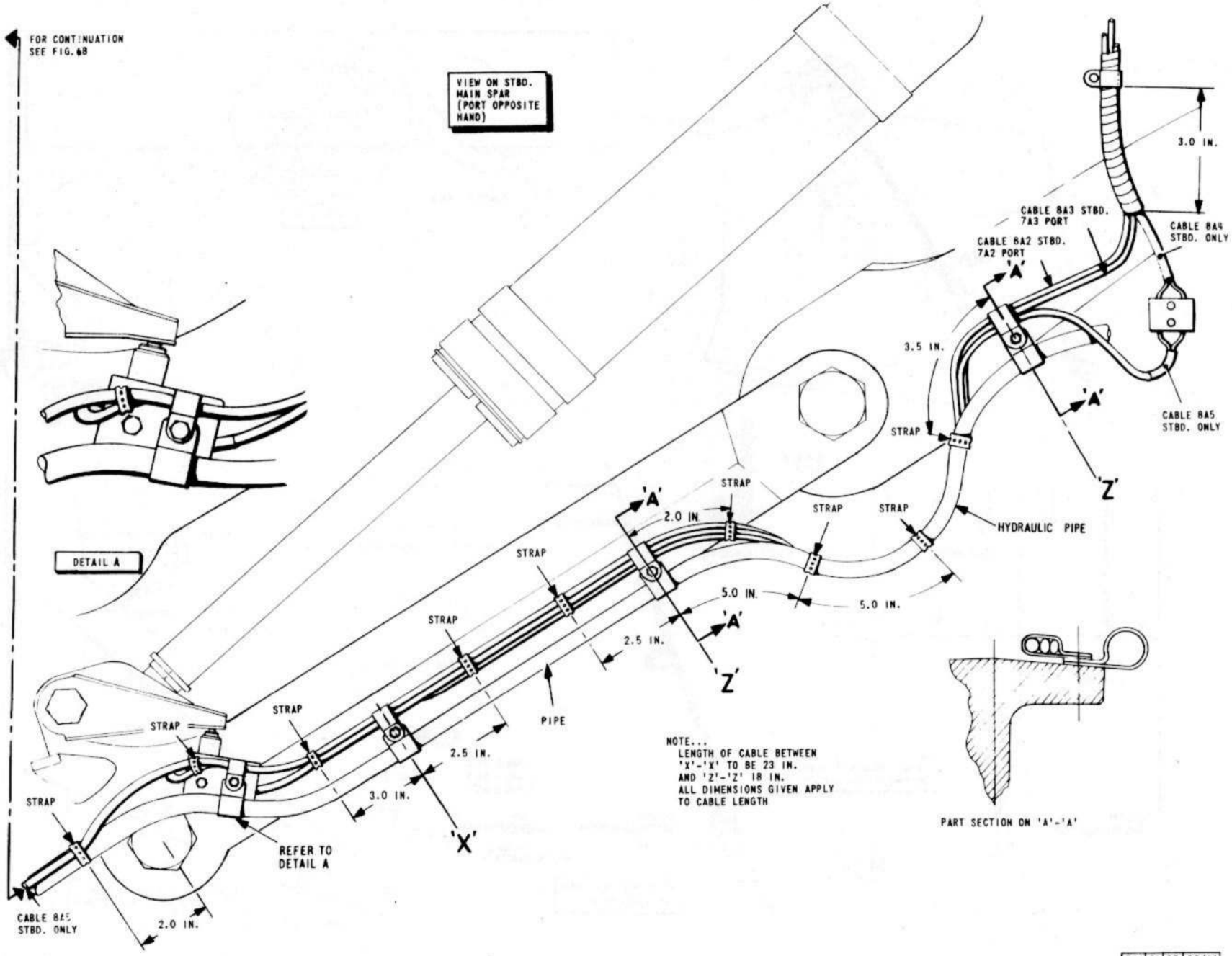

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FIG. 6C. MAIN WHEELS-WIRING INSTALLATION

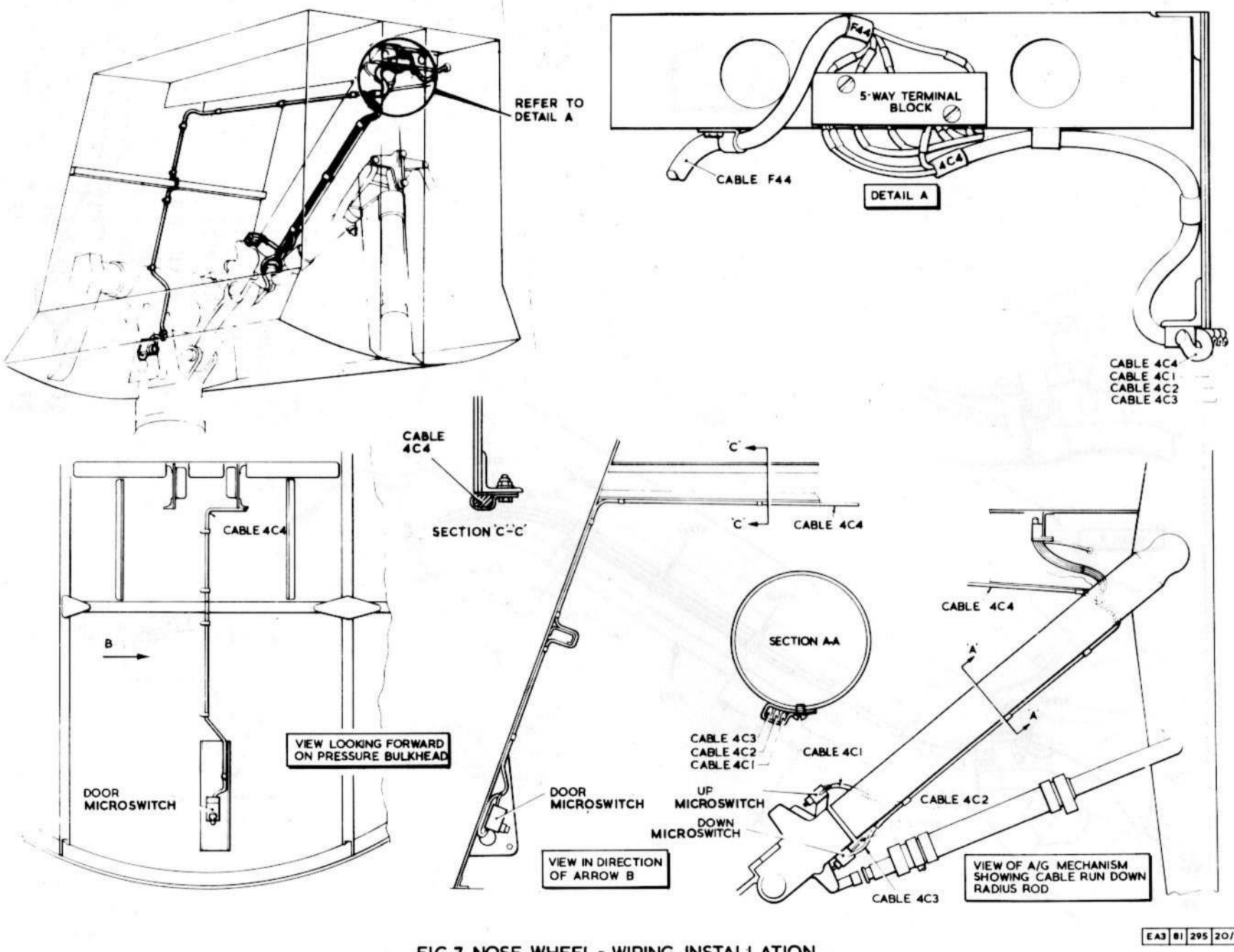

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FIG.7. NOSE WHEEL - WIRING INSTALLATION

FIG.8. ALIGHTING GEAR CONTROL AND INDICATION

(illustration overleaf)

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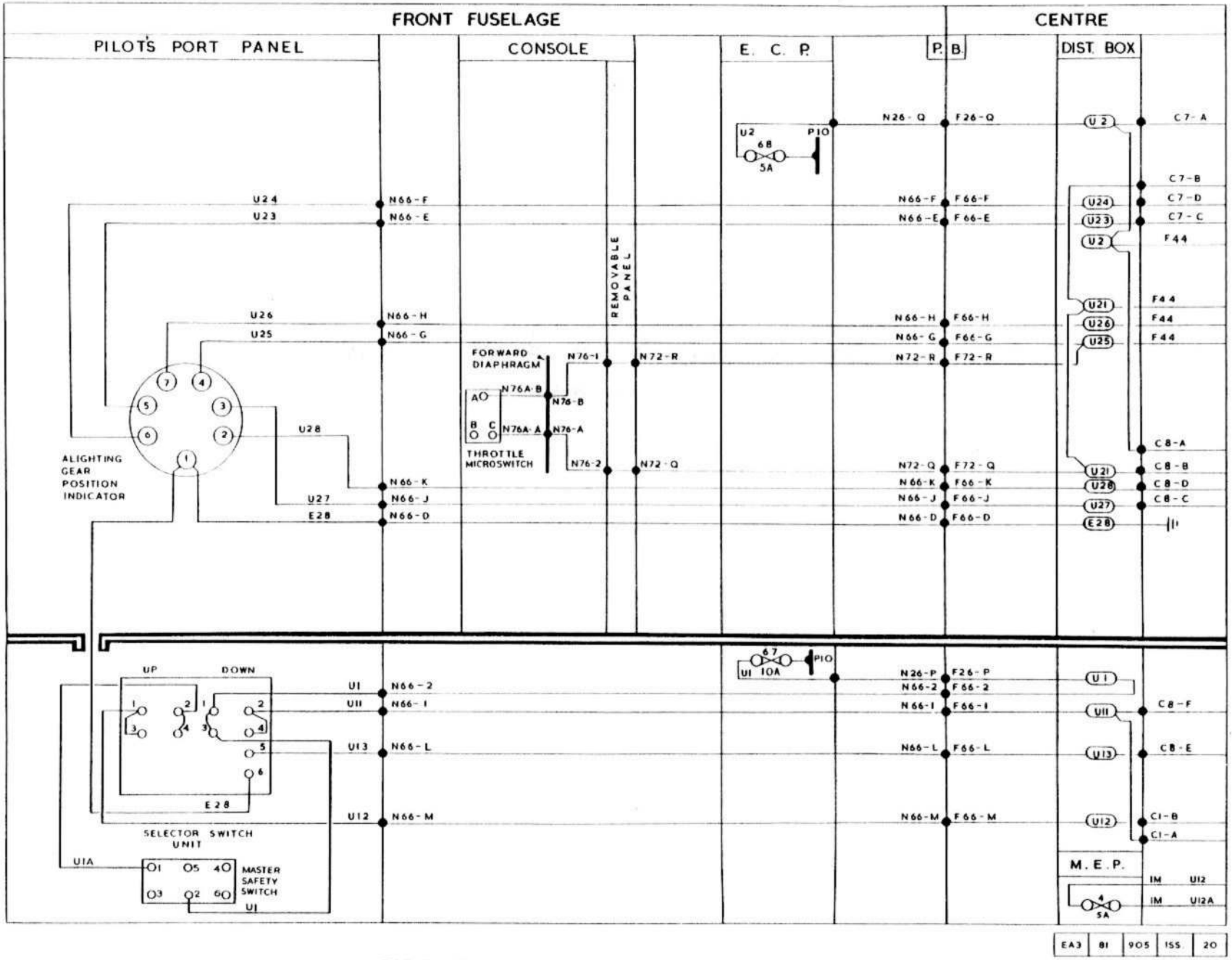

FIG. 8. ALIGHTING GEAR CONTROL AND INDICATION

◀MOD 5262 INCORPORATED▶

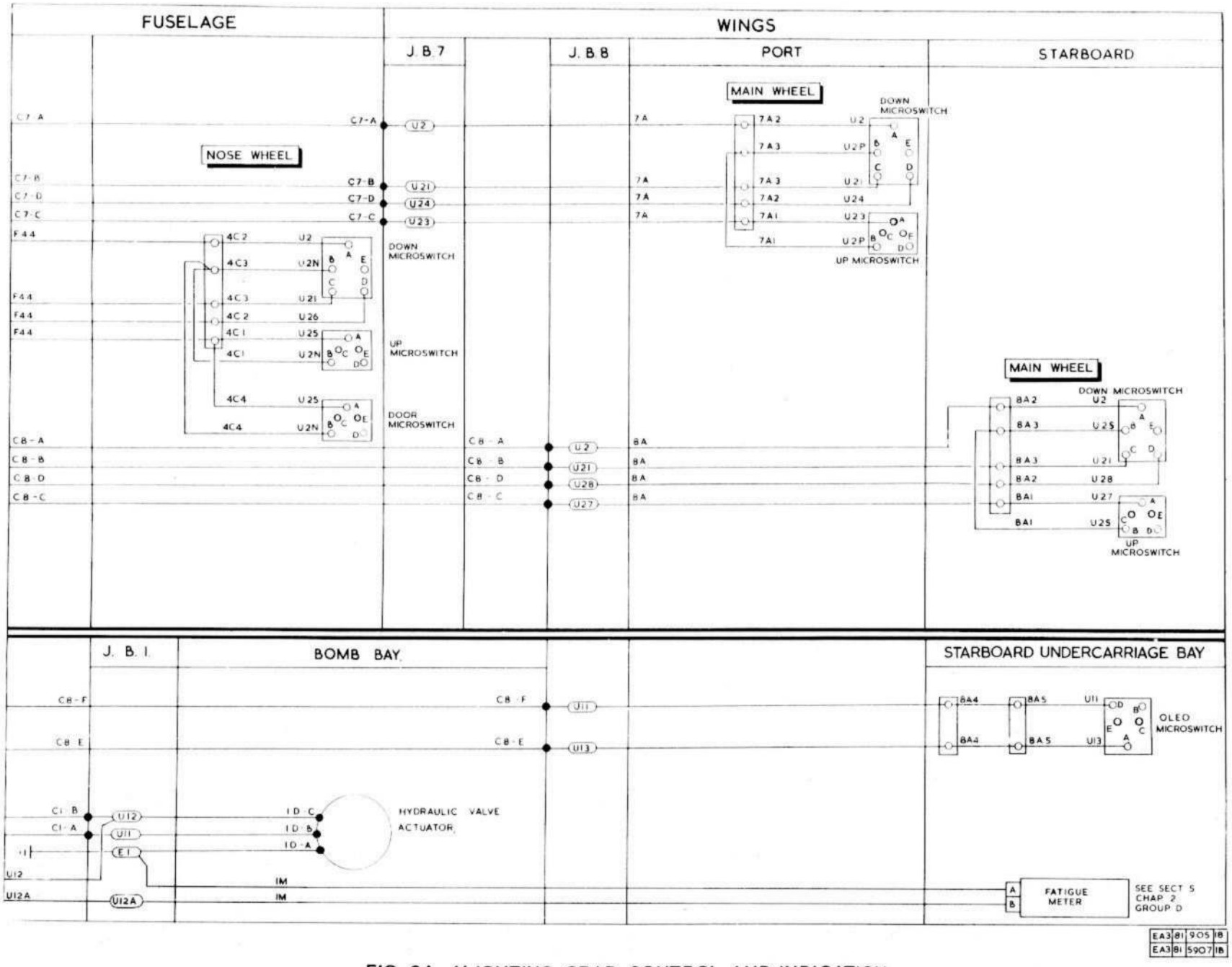

FIG. 8A. ALIGHTING GEAR CONTROL AND INDICATION

CABIN AIR SYSTEM, HEATERS, DE-MISTING AND ENGINE ANTI-ICING – GROUP H

(completely revised)

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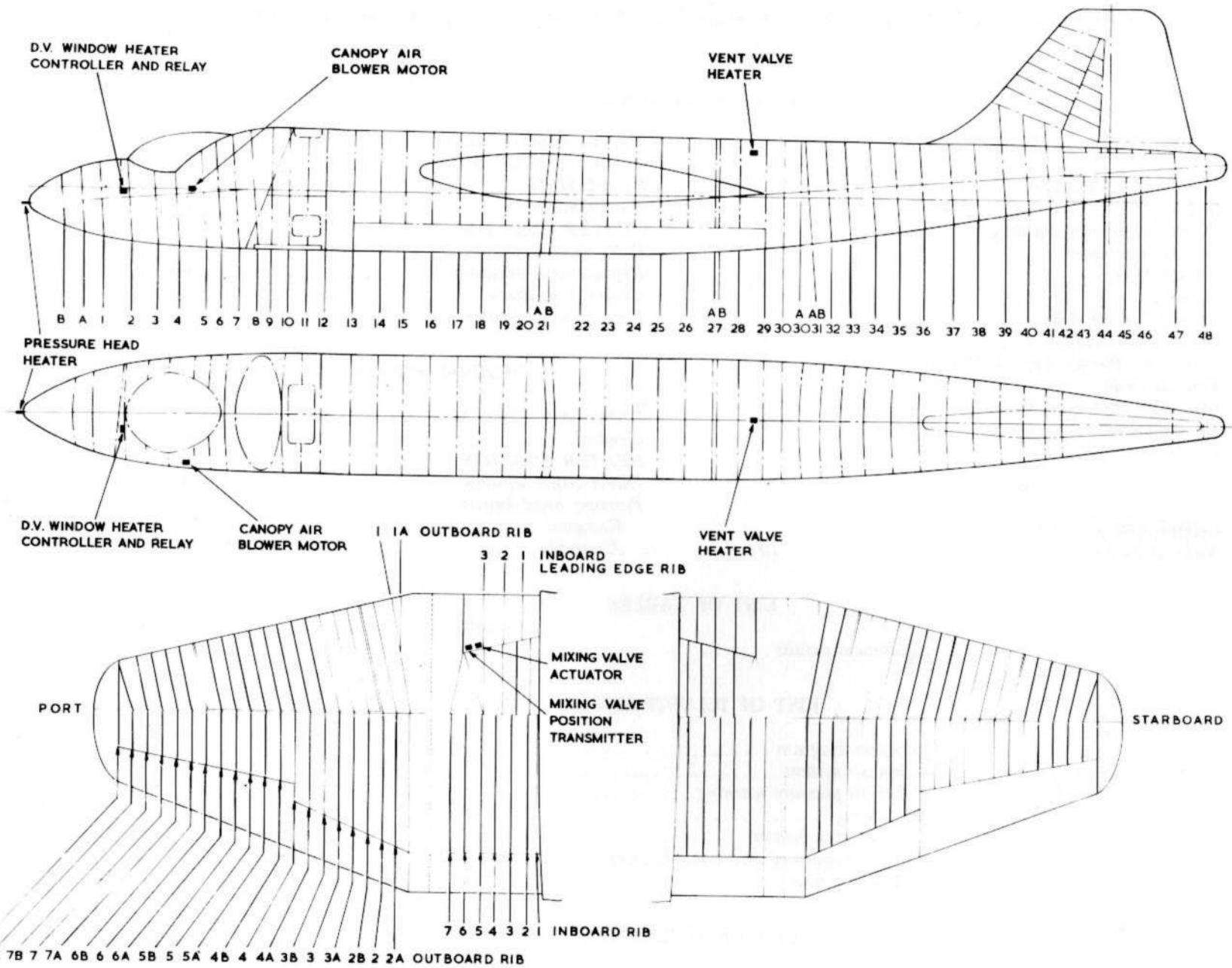

FIG. 1. LOCATION DIAGRAM

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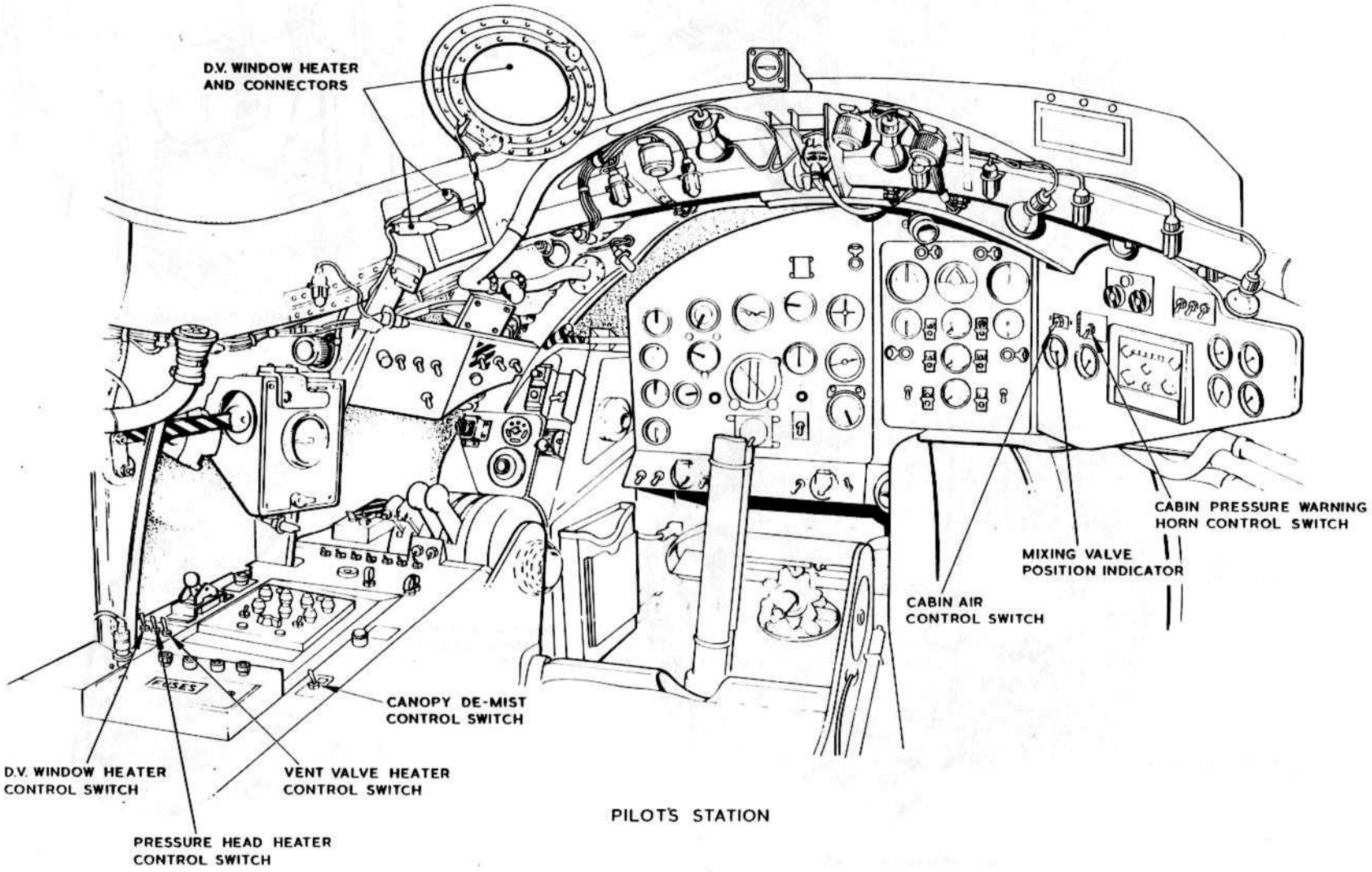

FIG. 1A LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

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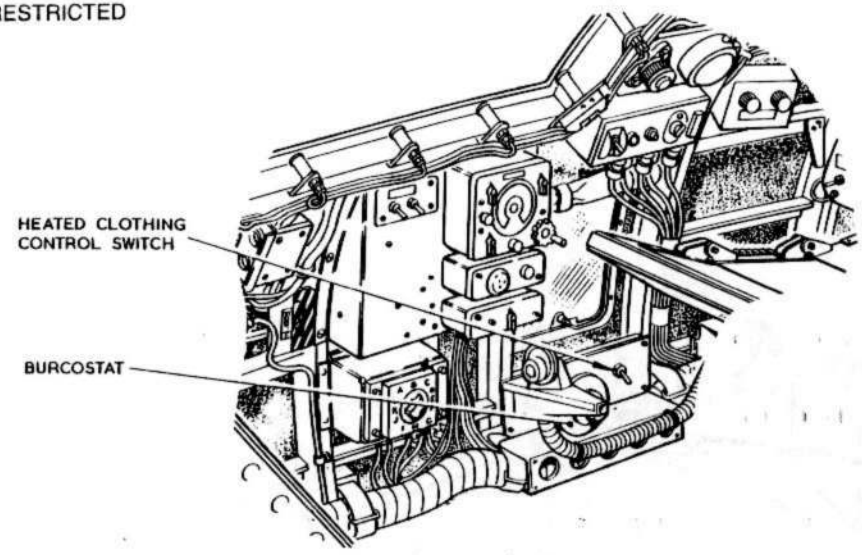
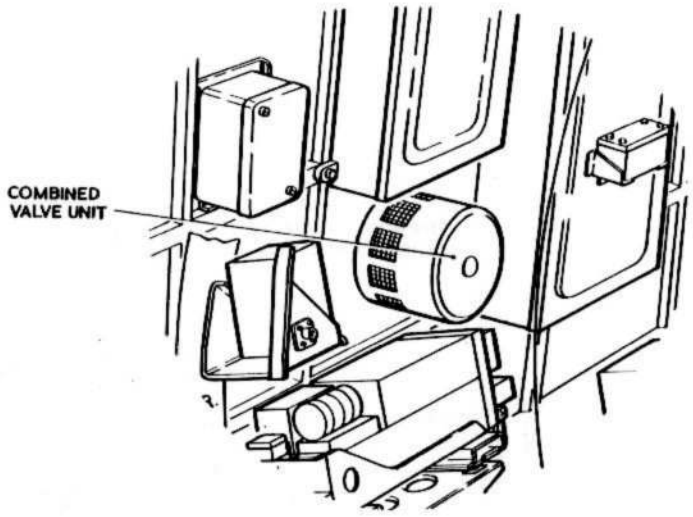
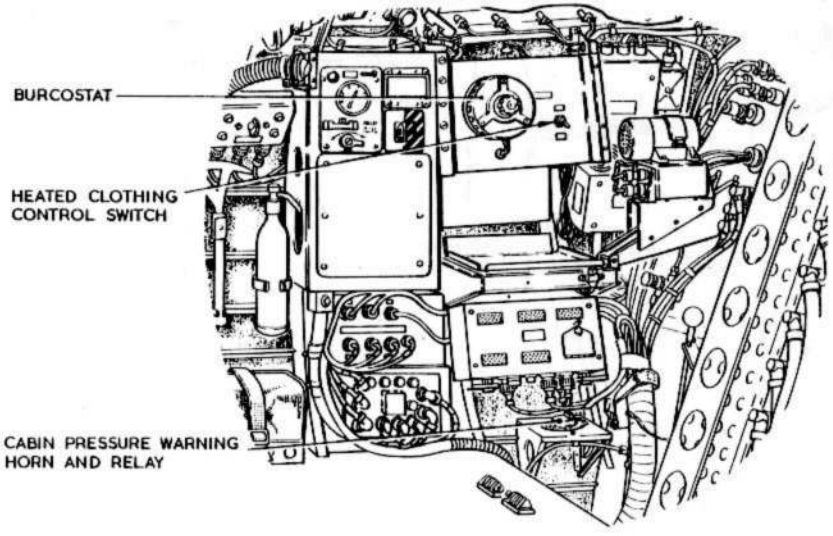


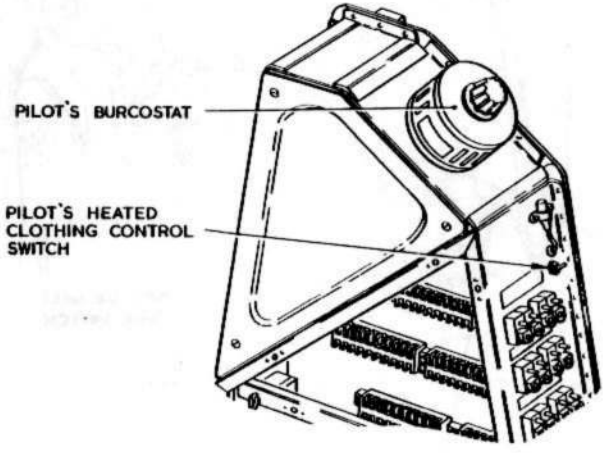
1st. NAVIGATOR'S STATION



UPPER EQUIPMENT COMPARTMENT



2nd. NAVIGATOR'S STATION



E.C.P.

FIG. 1B. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

DESCRIPTION

CABIN AIR SYSTEM

General

1. A complete installation is provided for the maintenance of pressurized hot or cold air in the cabin. The hot air originates from the engine compressor and passes through a mixing valve in the port inner wing leading edge. The mixing valve is operated by a Type 203 rotary actuator and controlled by a switch labelled CABIN AIR HOT-COLD fitted on the miscellaneous instrument panel. On this panel is also mounted a mixing valve position indicator graduated from HOT to COLD. It is a Desynn-type indicator operated by a transmitter unit linked to the miximg valve mechanism. Pressure in the cabin is maintained by a pressure controller fitted on the pressure bulkhead. A warning circuit is provided to ensure that the crew receive an audible warning should the pressure fall to a dangerous level. Further information on the air conditioning and air pressurization will be found in A.P.101B-0402-1A, Sect.3, Chap.8. The location of principal items relevant to this group are shown in fig.1-1A-1B whilst a list of equipment and relevant Air Publications are given in Table 1.

Cabin air pressure warning

2. The cabin air pressure switch, incorporated in the pressure controller, operates a warning device whenever there is a serious loss of pressure. The closing of the switch contacts is arranged to energize a relay which in turn closes and provides a supply to a warning horn. Both the relay and the horn are mounted on brackets at the starboard side of the 2nd navigator's station. The pilot may switch off the warning horn by a control switch, labelled CABIN PRESSURE WARNING HORN-ON/OFF/TEST, located on the miscellaneous instrument panel. With the switch in the TEST position a confidence check is provided for the relay and warning horn by by-passing the contacts of the pressure switch.

Pressure controller

3. A pressure controller is mounted in the upper equipment compartment on the rear face of the pressure bulkhead. It has a connection to the static system and contains a bellows to which is attached the warning circuit contacts. Further information on the controller can be found by referring to the relevant A.P. detailed in Table 1.

DE-MISTING

General

4. Misting of the canopy sandwich is prevented by circulating dry air through the interspace between its inner surfaces. A motor-driven blower provided for this purpose is mounted forward of the navigator's table on a bracket attached to the table structure. The power supply to the motor is fed through a suppressor and controlled by the CANOPY DEMIST ON switch on the console. The air is blown through a chemical dryer before it enters the canopy interspace. The complete de-misting installation is fully described in A.P.101B-0402-1A, Sect.3, Chap.8.

HEATER CIRCUITS

Direct vision window

5. The pilot's D.V. window panel is electrically heated by an almost invisible gold-film heating element sandwiched between the glass laminations. Also incorporated in the panel is a sensing control element which operates in conjunction with a Diamond H, Type BS relay and a Plessey controller Type 4, Mk.1 situated on the engine start panel structure. Power supplies to the heater are controlled by a switch, labelled WINDSCREEN, on the console. Connections to the elements are made by non-interchangeable 2-pin plugs and sockets below the canopy coaming.

Controller, Plessey Type 4, Mk.1

6. 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 relay. Transductors in the controller provide the necessary output current to operate incorporated slave relays which energize the coil of the Diamond H relay. The operation of the transductors is dependent upon the resistance of the temperature-

sensing element incorporated in the window and since the resistance varies with the temperature, complete control is obtainable. Further information on the control unit can be found by referring to the relevant A.P. detailed in Table 1.

Pressure head

7. A heating element is embodied in the pressure head to prevent icing. The supply to the element, fed from busbar PP3 through a fuse in the console is controlled by the PRESS HEAD switch on the console.

Fuel tank vent valve heater

8. Icing of the vent valve fitted at the aft end of No.3 tank is prevented by the use of a heater element built into the valve assembly. The heater is controlled by the VENT VALVE switch on the console and is protected by a fuse in the console fuse panel.

Heated clothing

9. Sockets are provided at each crew position for the connection of heated clothing. The power supply of 28 volt d.c. to each socket is fed from busbar P10 and a fuse in the E.C.P. via a control switch and a Burcostat at each crew position. The control switch, Burcostat and socket for each crew position are located as follows:- pilot, on the forward face of the E.C.P.; 1st navigator, on the port wall below the table; 2nd navigator, on the starboard wall adjacent to the oxygen regulator.

SERVICING

WARNING

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

CABIN AIR SYSTEM

Valve actuator

10. Normal servicing of the valve actuator is confined to checking brush length, examination of the commutator, and removal of the accumulated carbon dust, which can be accomplished by removing the motor cover. Access to the valve actuator is through the leading edge panels inboard of each engine.

Desynn indicator and transmitter unit

11. Faulty indicators or unserviceable transmitter units should be replaced by new items.

Cabin air pressure warning

12. The warning circuit should be tested by removing the terminal cover of the pressure controller and short-circuiting the two terminals and, provided that the control switch is set to ON, the warning horn should function.

13. A further test may be carried out by selecting the control switch to the TEST position, when the warning horn should function.

Note . . .

The above test circuit by-passes the pressure controller contacts and relay operation and therefore only provides a confidence check on the warning horn and power supply.

DE-MISTING

Blower motor

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

HEATER CIRCUITS

D.V. window checks

15. 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 of not more than 3 amp and not less than 2.5 amp. This check can be made by connecting a suitable ammeter into the plug and socket connection near the window assembly.

Note . . .

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

Replacement windows

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

Control unit check

17. Remove fuses 95 and 112, 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; examine and refit fuses 95 and 112. Switch on instruments 400 Hz 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 Hz supply and the control switch and reconnect the plugs and sockets (N74) at the window. Check that the heater functions by switching on the 400 Hz supply and the control switch and note that the window heats up.

Note . . .

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

Pressure head heater

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

REMOVAL AND ASSEMBLY

CABIN AIR SYSTEM

General

19. The removal of any actuator, the Desynn transmitter, or the pressure controller is described in A.P.101B-0402-1A, Sect.3, Chap.8.

HEATER CIRCUITS

Direct vision window

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

Pressure head heater

Removal

21. To remove the pressure head:-

(1) Disconnect the electrical supply at the terminal block adjacent to the pressure head.

(2) Unscrew the gland nut at the rear of the pressure head and remove the pitot pipe.

(3) Remove the fixing nut and sealing washer from the rear end of the head.

(4) Remove the pressure head complete with the outside sealing washer.

Assembly

22. Assembly of the unit is the reverse of the removal procedure. After the unit has been installed check that the heater operates correctly and carry out the pitot system tests detailed in Sect.5, Chap.2, Group F.

TABLE 1

Equipment details

Ref. No.	Equipment	Quantity	Relevant A.P.
5W/4520728	Actuator Type 203	1	A.P.113E-0249-1
5UD/3310	Air blower Type 1	1	A.P.113E-03104-1
5CY/7001363	Suppressor Type B4	1	A.P.113D-1902-1
27KD/2836	Cabin pressure controller	1	A.P.107B-1407-16
5CZ/1961	Warning horn Type C	1	A.P.113F series
5UC/8770	Controller, Plessey Type 4	1	A.P.107C-0404-16
6A/4333460	Pressure head Mk.8W	1	A.P.112G-0629-1
6A/4333500	Desynn indicator Type 505FL	1	
6A/2133	Desynn transmitter Type C	1	A.P.112G-0559-1
5CZ/4337466	Bercostats Type L100CD	3	A.P.113 series

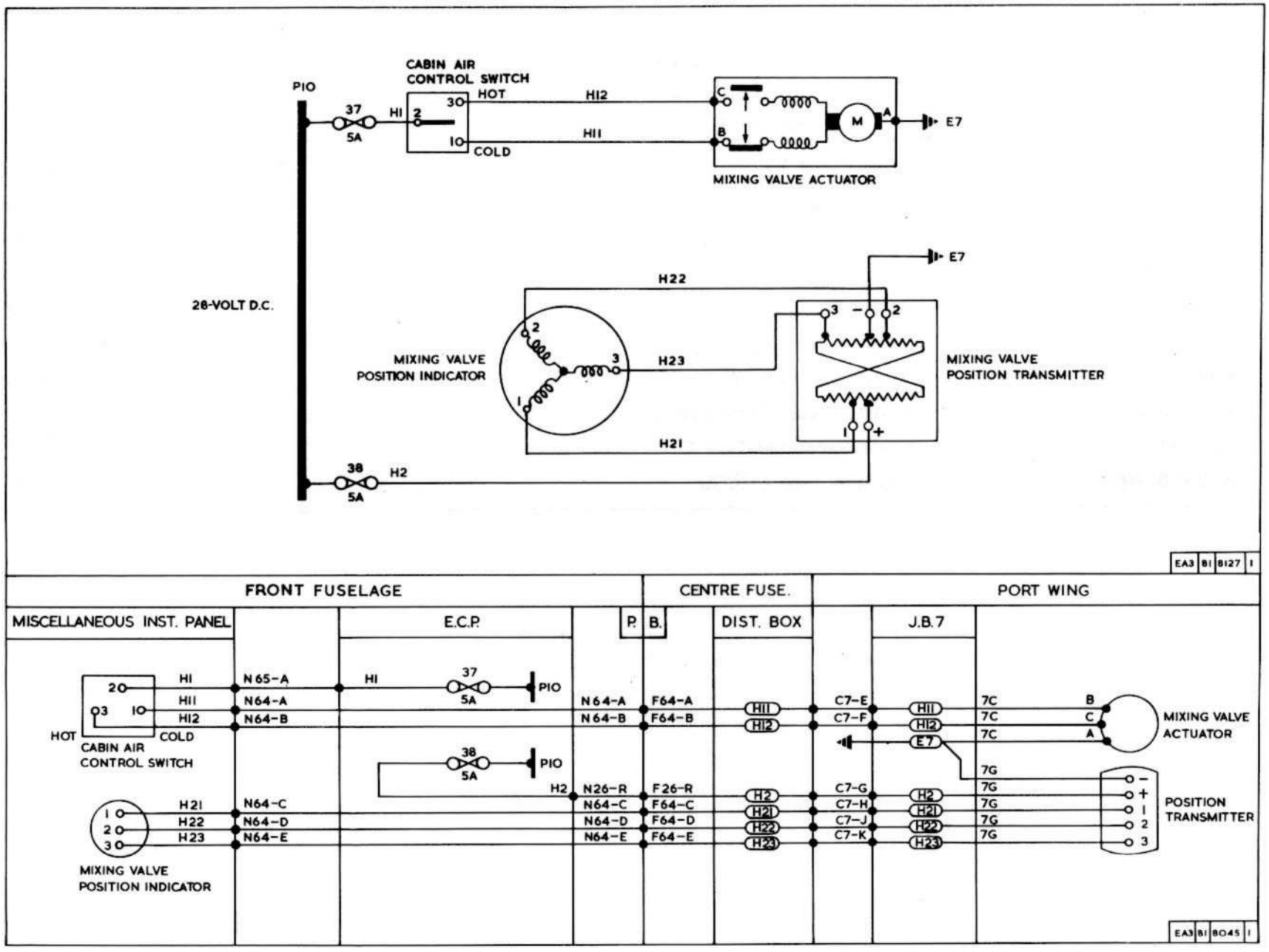


FIG. 2. CABIN AIR SYSTEM

◂MOD 5204 EMBODIED▸

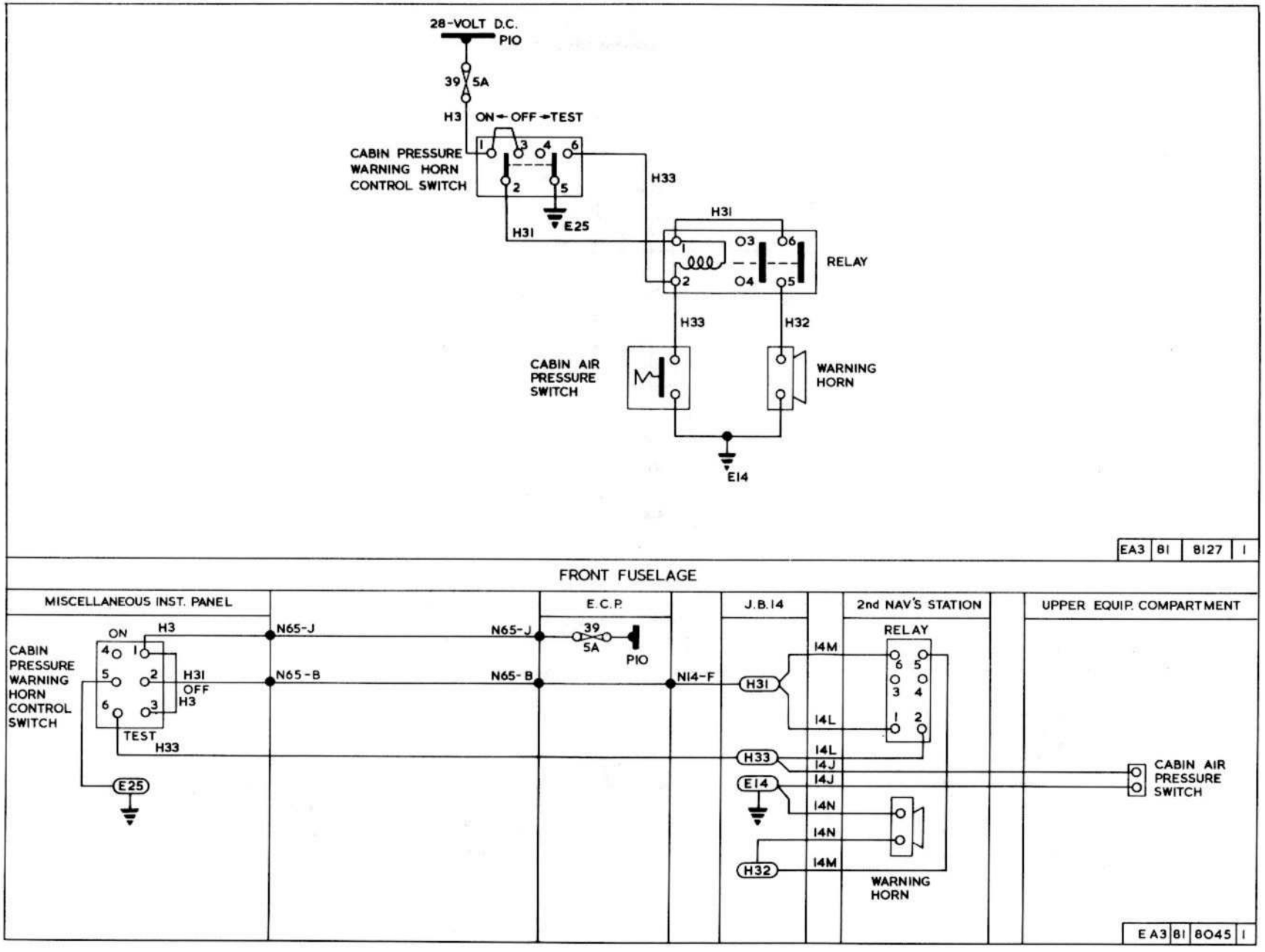


FIG.3. CABIN AIR PRESSURE WARNING

◂MOD 5204 EMBODIED▸

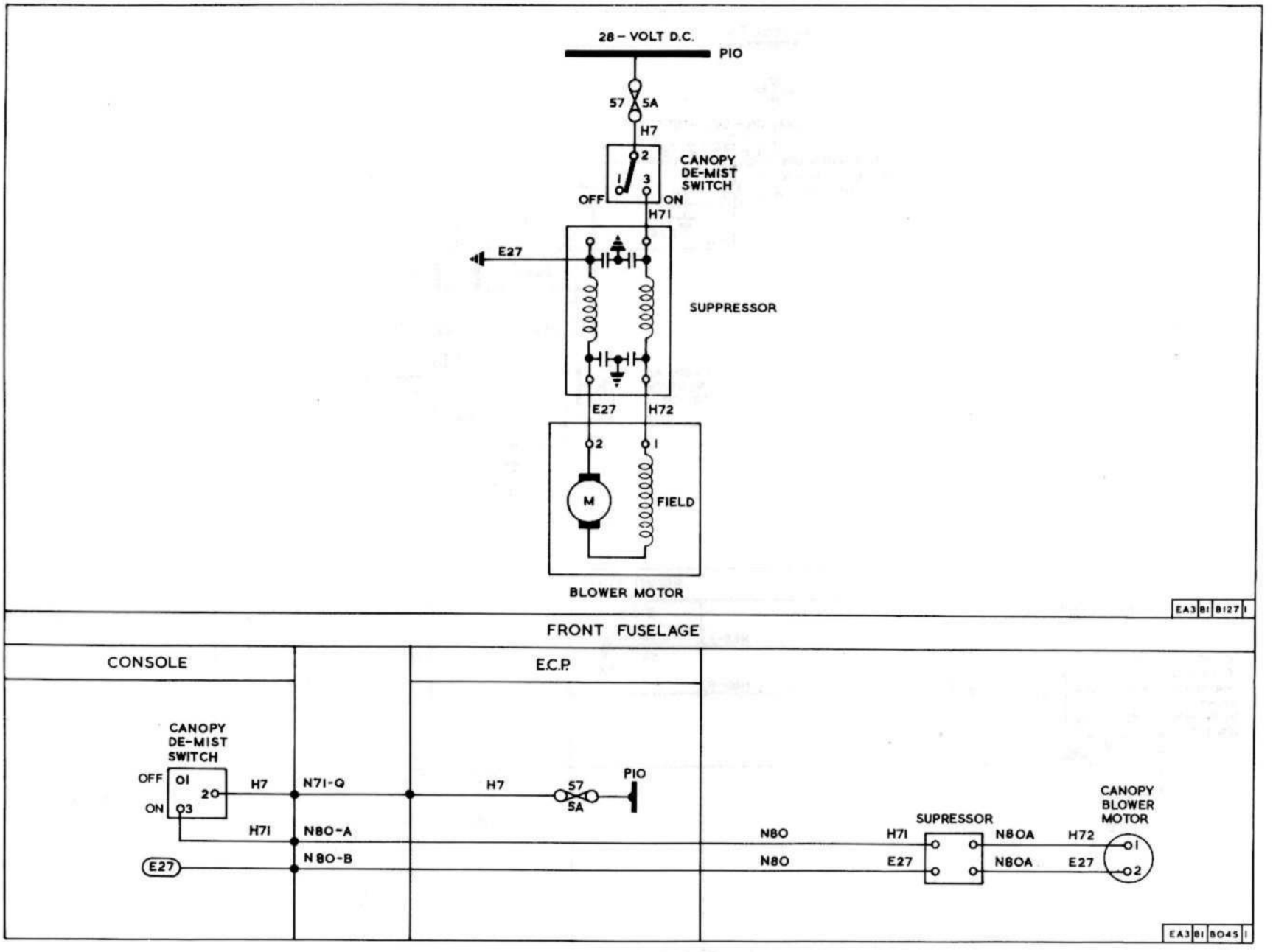


FIG. 4. DE-MISTING

◂MOD 5204 EMBODIED▸

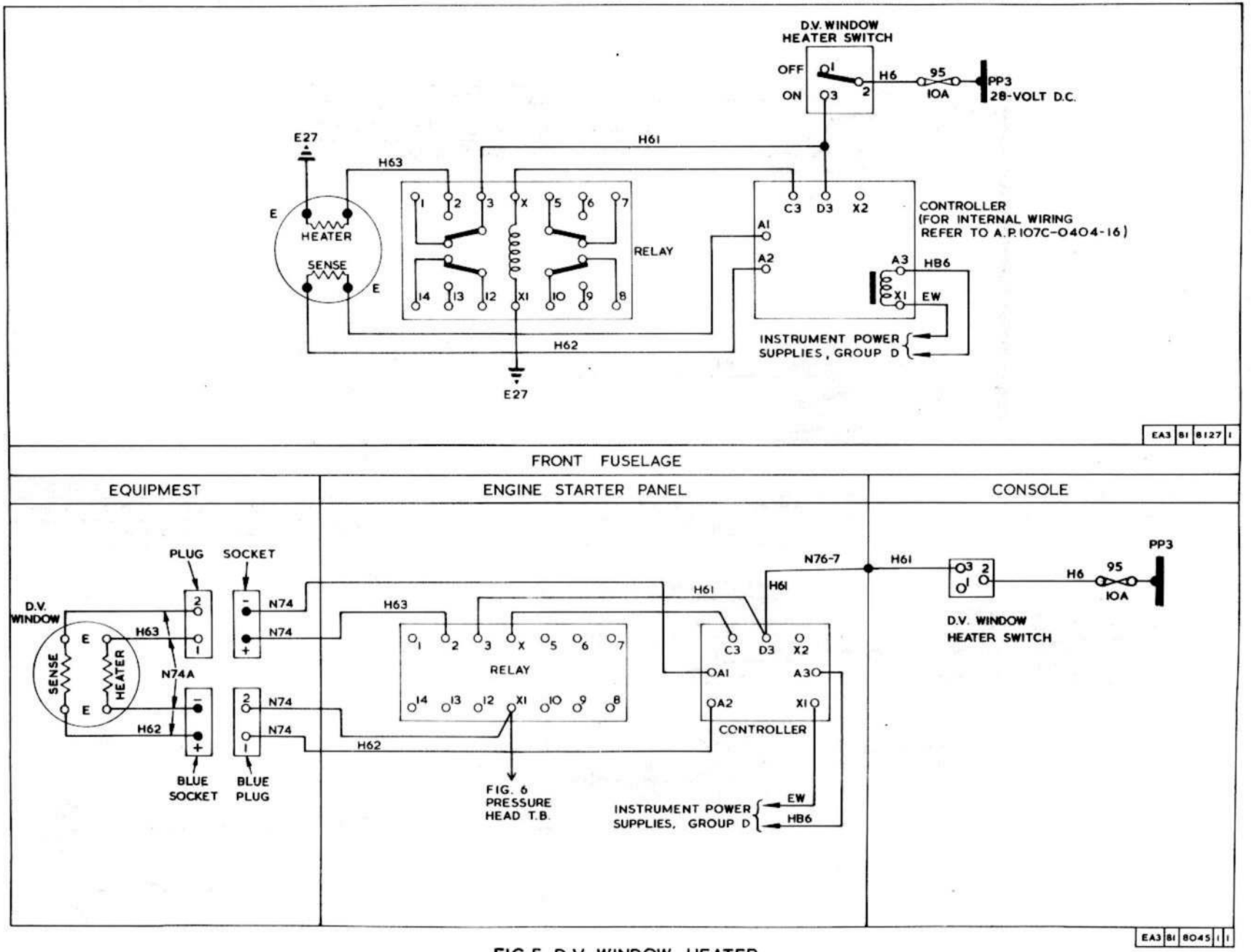


FIG.5. D.V. WINDOW HEATER

◂MOD 5204 EMBODIED▸

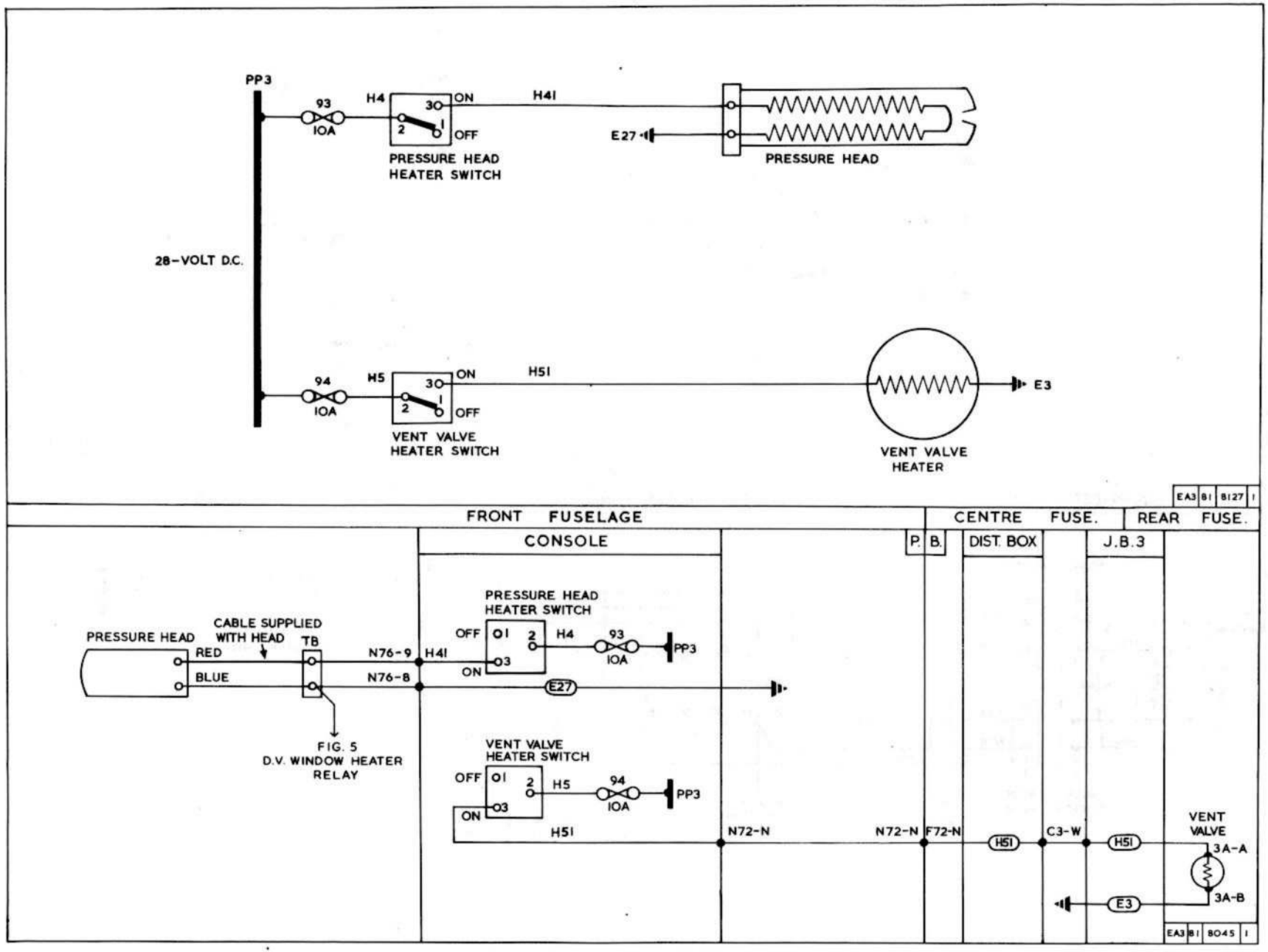


FIG. 6. PRESSURE HEAD AND VENT VALVE HEATERS

◂MOD 5204 EMBODIED▸

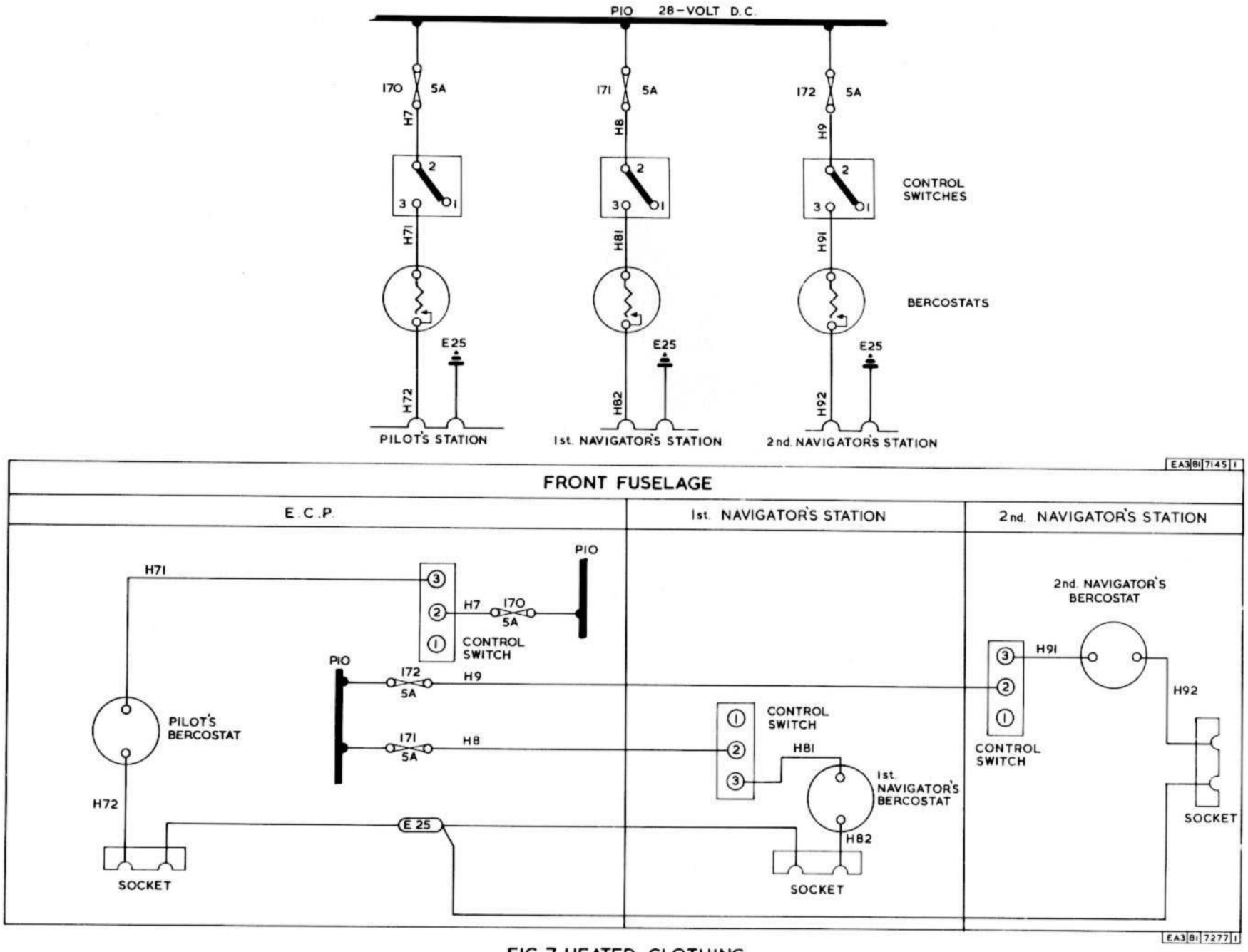


FIG.7. HEATED CLOTHING

Appendix 1 CABIN AIR SYSTEM – HEATERS (POST MOD.5, PRE MOD.4333 AND 4939)

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LIST OF ILLUSTRATIONS

DESCRIPTION

Introduction

1. This appendix describes the cabin air system and direct vision window post Mod.5, pre Mod.4939 and 4333. The location of the main components which differ from the main chapter are shown in fig.1 and where appropriate circuit and routeing diagrams and servicing information is included in this appendix.

CABIN AIR SYSTEM

General

2. On post Mod.5 aircraft the cabin air system is similar to that described in the main chapter with the exception that the mixing valve, and position transmitter, is operated by a Type 233 rotary actuator and is controlled by a switch labelled HOT-OFF-COLD on the miscellaneous instrument panel, and a gate valve is fitted in each engine to control the hot air supply from the compressor. A circuit and routeing diagram for the cabin air system is shown in fig. 2.

Gate valves

3. These gate valves are operated by Type 234 rotary actuators and are controlled from the miscellaneous instrument panel by two switches labelled No.1 and No.2 which operate the respective engine gate valve.

Cabin air pressure warning

4. On pre Mod.4939 aircraft the cabin air pressure warning is similar to that described in the main chapter with the exception that the cabin air control switch located on the miscellaneous instrument panel is labelled CABIN PRESSURE OVERRIDE ON-OFF. A circuit and routeing diagram for the cabin air pressure warning is shown in fig.3.

HEATERS

Direct vision window

5. On pre Mod.4333 aircraft the direct vision window heater is similar to that described in the main chapter with the exception that a nichrome-wire heater element is sandwiched between the glass lamination of the window panel. The circuit and routeing diagram for the heater is shown in the main chapter.

SERVICING

CABIN AIR SYSTEM

Cabin air pressure warning

6. The warning circuit should be tested by removing the terminal cover of the pressure controller and short-circuiting the two terminals and provided that the override switch is set to ON the warning horn should function.

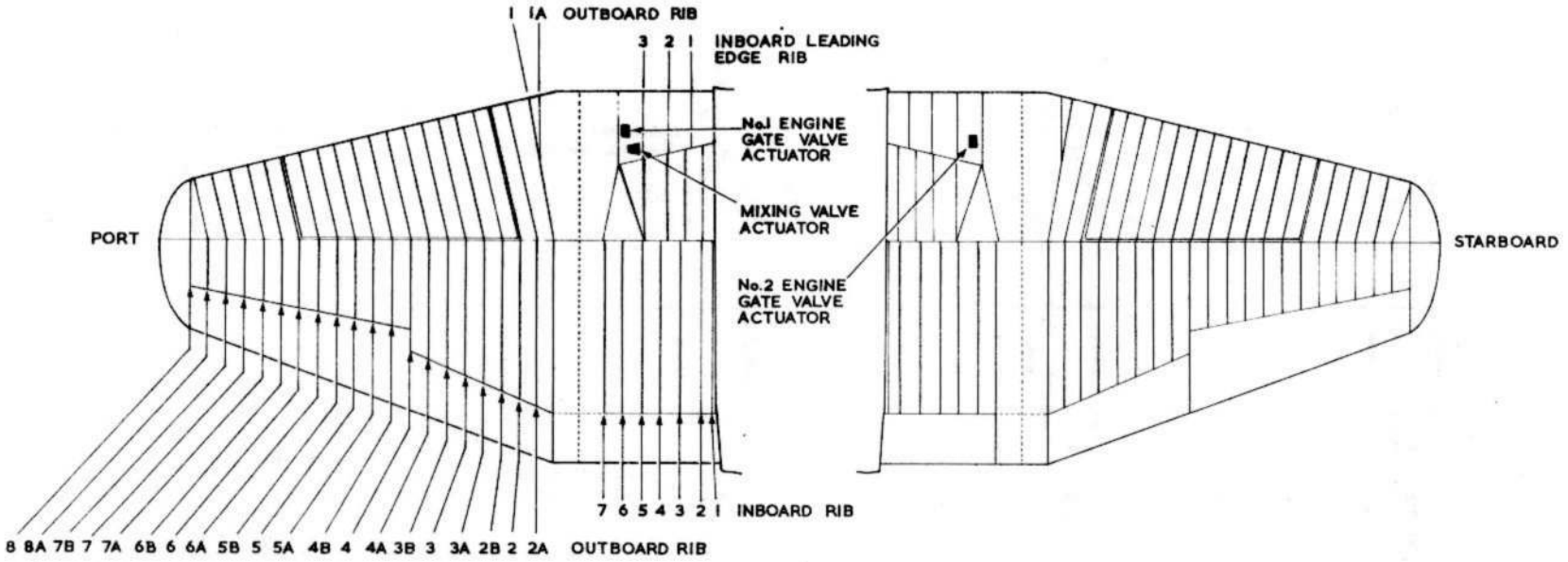
HEATERS

Direct vision window

7. 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 of 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.



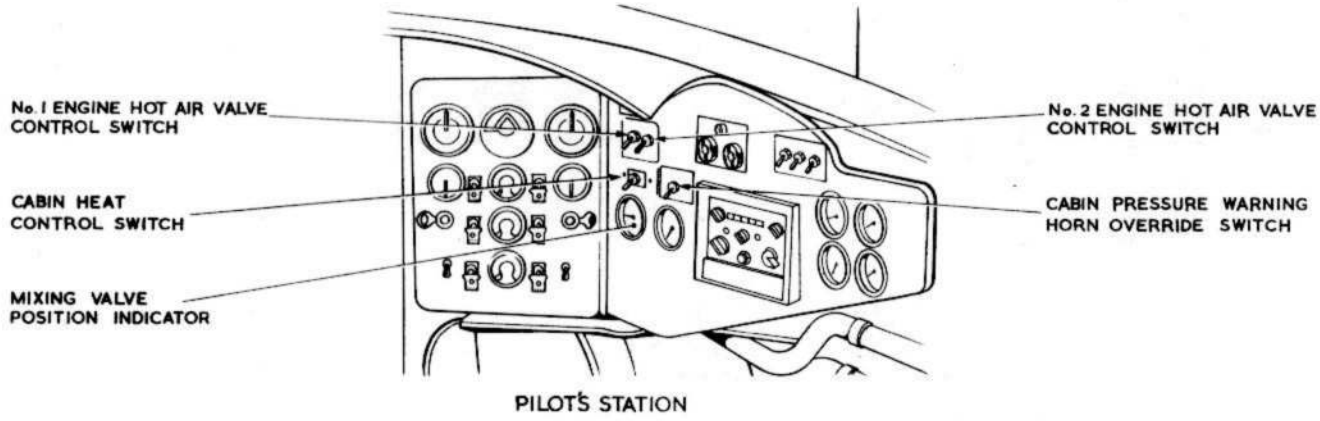


FIG. 1. LOCATION DIAGRAM (POST MOD 5, PRE MODS 4333 AND 4939)

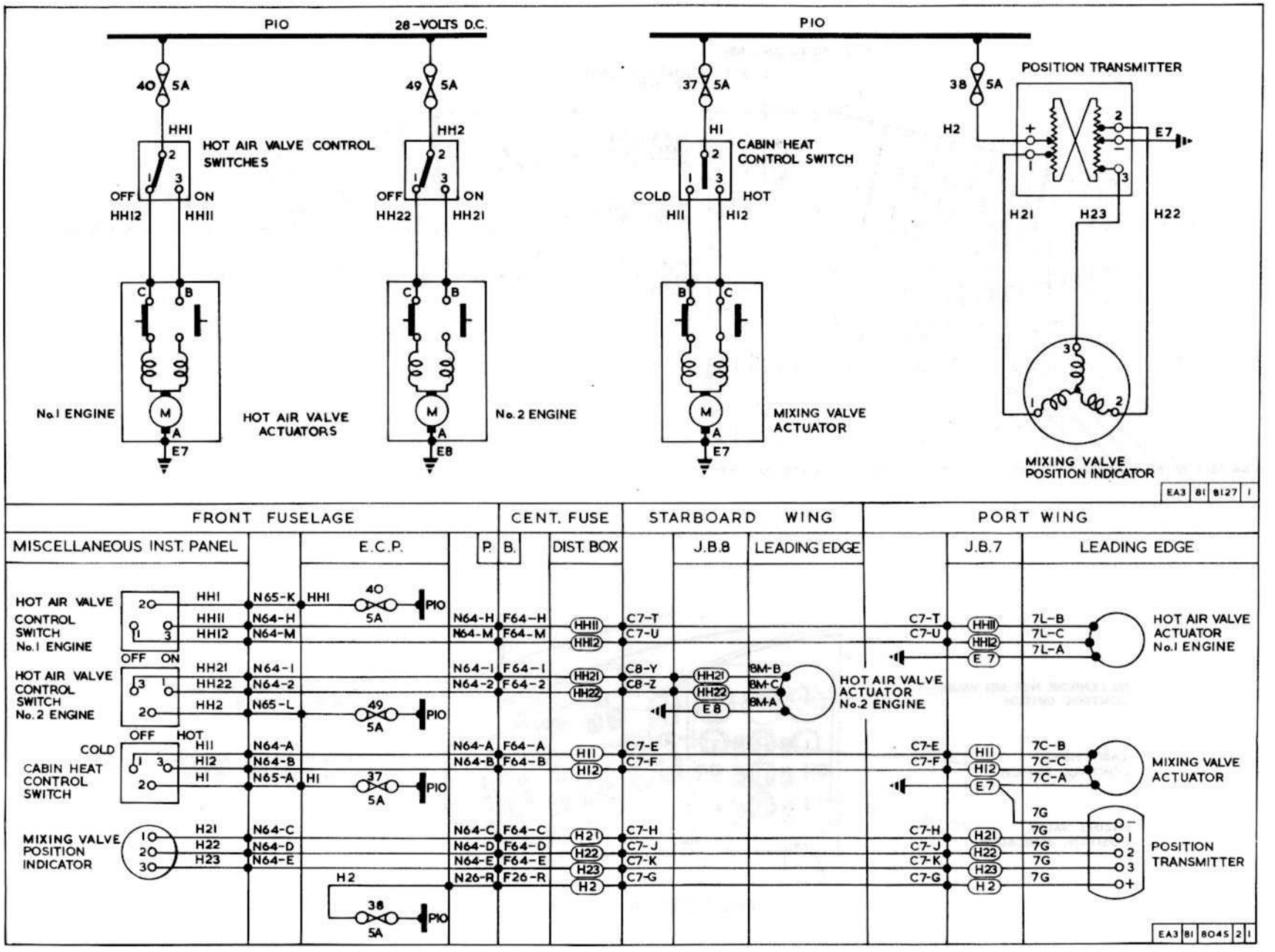


FIG. 2. CABIN AIR SYSTEM (POST MOD 5)

◂MOD 5204 EMBODIED▸

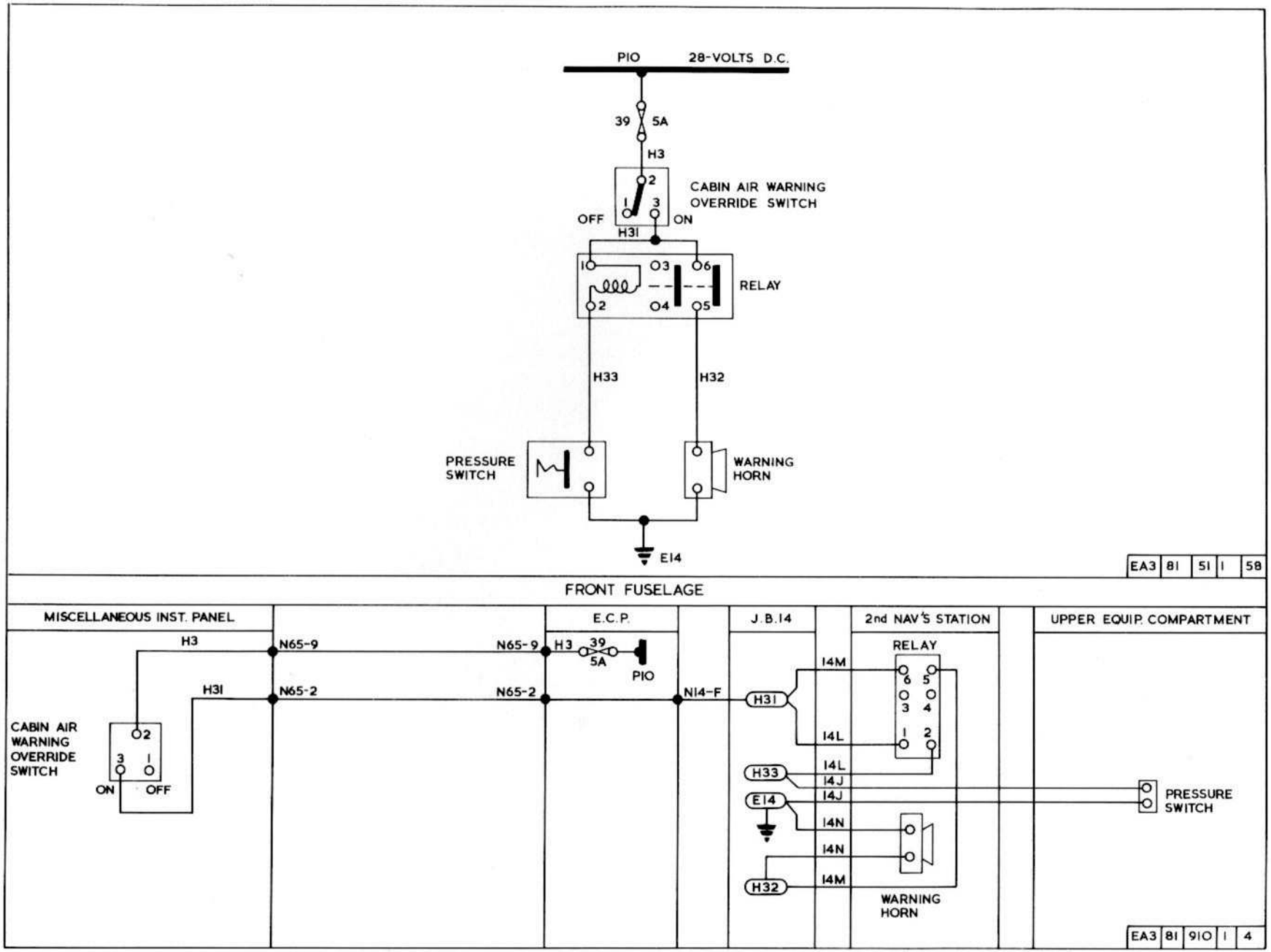


FIG. 3 CABIN AIR PRESSURE WARNING (PRE MOD. 4939)

ENGINE SERVICES GROUP J & K

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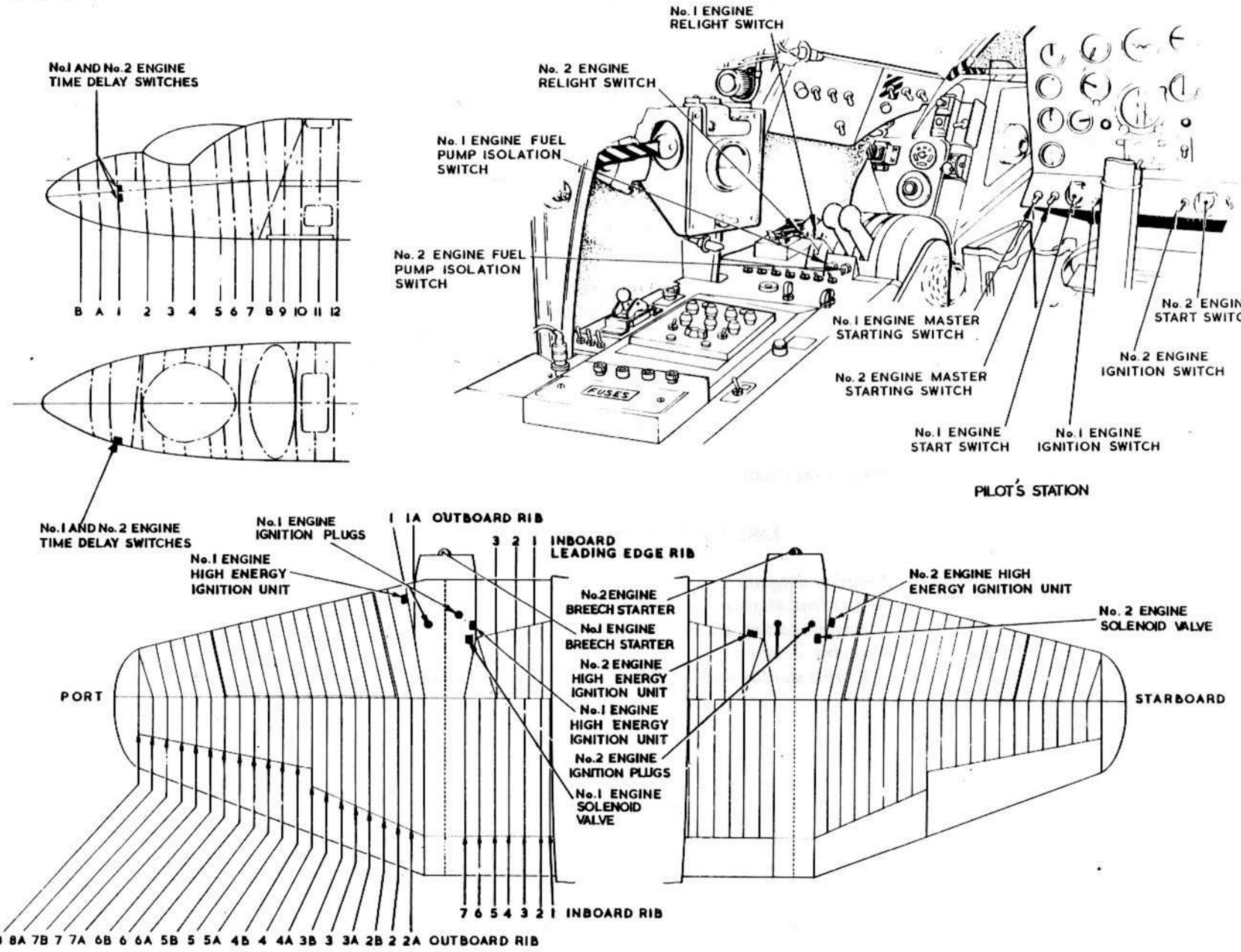

FIG.1 LOCATION DIAGRAM

◀STI/CAN/586c INCORPORATED▶

Introduction

1. This group gives a description of, and the circuit and routeing diagrams for, the engine starting and ignition system. Table 1 provides a list of the main components, their reference/part numbers and where possible the A.P. in which they are described. The location of the main components and the circuit switches are shown in fig.1.

DESCRIPTION

General

2. Each engine starting system comprises a single-breech starter mounted at the centre of the air intake, two high energy ignition units, and two igniter plugs which operate in conjunction with a MASTER STARTING, IGNITION and START switch on the starter panel, a time delay switch, a fuel pump isolation switch, and a relay in the E.C.P. The cartridge, when fired, releases gases which feed a small turbine in the single-breech starter, causing the turbine to rotate the engine long enough for light-up to occur.

3. A push-switch embodied in the high-pressure cock handle for each engine enables the engine to be relighted in flight.

Master starting switches

4. Two switches, annotated No.1 and No.2 MASTER STARTING-ON located on the starter panel, control the power supply to the starting, relight and ignition circuits of each engine. Further contacts on the switches control the power supplies to the instrument power supply inverters *(Group D)*, No.1 switch controlling No.3 inverter and No.2 switch controlling No.2 inverter.

Start switch

5. The START switch initiates the power supply to operate the magnetic clutch and motor in the time delay switch. After the initial operation of the START switch a parallel circuit, completed via contacts 'A' and 'B' of the time delay switch, is completed to energize the time switch clutch and motor until the functional sequence of the switch is completed.

Time-delay switches

6. The time-delay switch for each engine is installed at the port side of the nose fuselage forward of the rudder pedals. Each switch incorporates a magnetic clutch and a motor-driven switch mechanism designed to operate a series of contacts, referenced A, B, C and D, in a set sequence.

High energy ignition units

7. Two of these units are used in each engine circuit. The units are installed, one on the main plane front spar inboard of the engine and the other outboard of each engine nacelle and operate in conjunction with the ignition plugs on the engine.

Fuel pump isolation switches

8. These switches, labelled NORMAL and ISOL, are mounted aft of the levers on the throttle box. Each switch controls a solenoid-operated valve on its associated engine.

OPERATION

WARNING

Before entering the cabin the relevant instructions detailed on the LETHAL WARNING marker card must be observed.

Engine starting

9. With the associated MASTER STARTING switch at ON pressing the START switch initiates the functioning of the time-delay switch as follows:-

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

(2) Contact 'C', closed at start, open $5 \pm^{2}_{0}$ seconds later.

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

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

10. Providing that the associated IGNITION switch is ON and the fuel pump isolation switch is at NORMAL, the above cycle of operations will result in the following action:-

(1) The cartridge is fired.

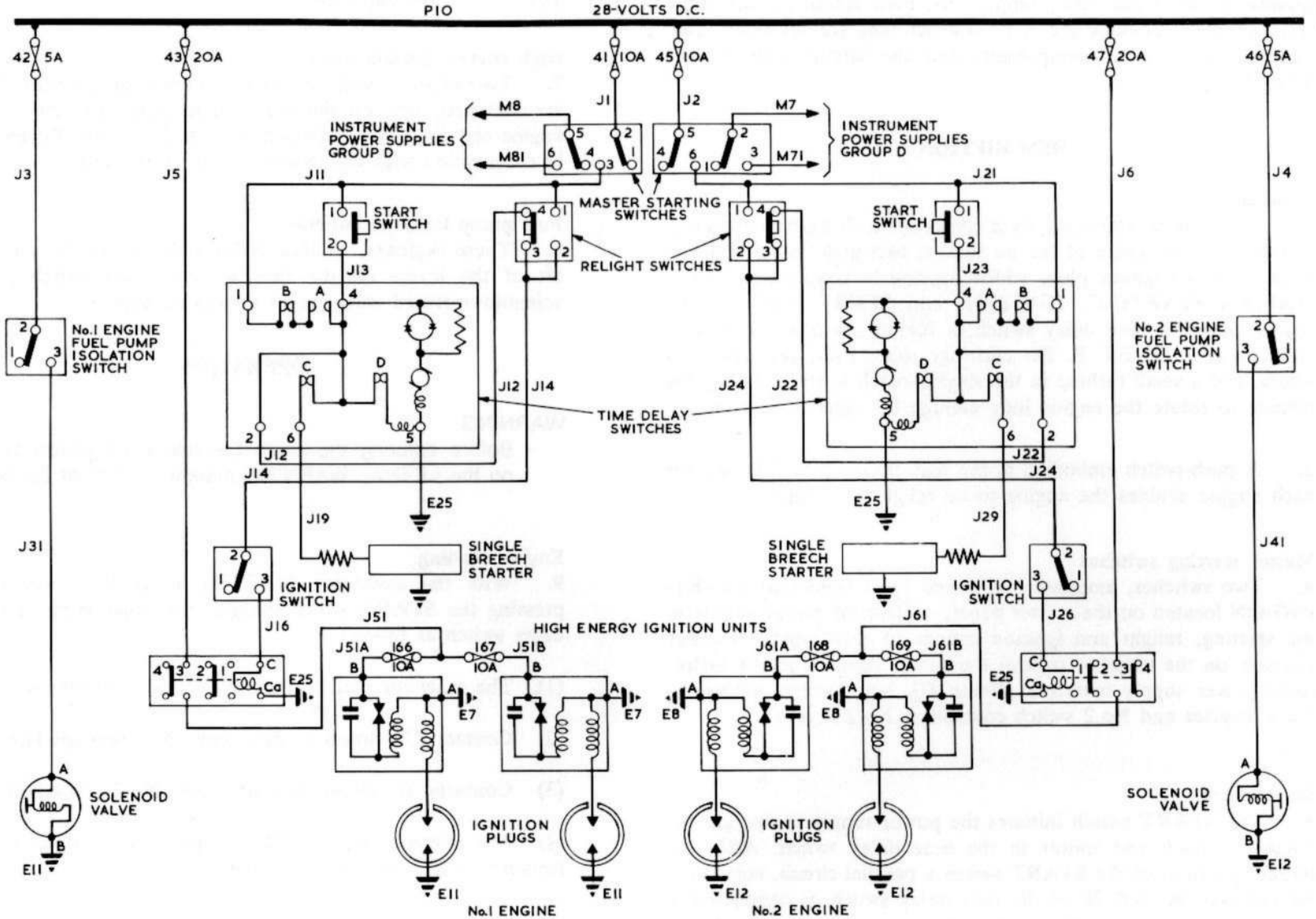

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FIG. 2. ENGINE STARTING AND IGNITION

(2) The relay closes to energize the H.E. ignition units.

(3) The engine should start up.

Engine relighting

11. Under suitable conditions, an engine can be relighted in flight by using the relight switch embodied in its H.P. fuel cock lever. Reference to fig.2 will show that the operation of the relight switches by-passes the time switches and feeds a direct supply, to energize and close the relay and operate the H.E. ignition units.

SERVICING

WARNING

Before entering the cabin the relevant instructions detailed on the LETHAL WARNING marker card must be observed.

General

12. After the cartridges have been removed from both starter units, and the H.E. ignition units have been disconnected, functioning tests, using test lamps, may be made on the installation.

WARNING

◀ The energy stored in the capacitors of high energy ignition units can be of a LETHAL NATURE. No servicing should be attempted until at least one minute has elapsed after disconnection of the low tension supply to the input plug. ▶

Ignition supply circuits

13. The operation of the ignition supply circuits can be checked by the following procedure:-

(1) Disconnect cables 7K and 7L (port) and 8K and 8L (starboard) from the H.E. ignition units and connect test lamps across pins A and B at each cable socket.

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

(3) Press the No.1 engine START button – the two port test lamps should light for a period of 29±2 seconds.

(4) Press the No.1 engine relight button – the port test lamps should light immediately.

(5) Repeat checks (3) and (4) with the No.2 engine switches and test lamps.

(6) Remove the test lamps and reconnect the H.E. ignition units.

Cartridge circuit check

14. The following procedure will check the cartridge circuit up to the engine break point:-

(1) Disconnect cables 11K (port) and 12K (starboard) at the break point at the starboard side of the engines and connect test lamps across each cable socket.

(2) Switch ON the MASTER STARTING switches.

(3) Press the No.1 engine START button – the port test lamp should light for approximately 5 seconds.

(4) Press the No.2 engine START button – the starboard test lamp should light for approximately 5 seconds.

(5) Remove the test lamps and reconnect the cables.

Fuel pump isolation valve check

15. It is sometimes possible to hear valves operate when the appropriate switch is operated. If they cannot be heard, the circuits may be checked as follows:-

(1) Disconnect cable 11B from the No.1 engine valve and cable 12B from the No.2 engine valve and connect test lamps across each cable socket.

(2) Operate, in turn the No.1 and No.2 engine fuel pump isolation switches – the appropriate test lamp should light each time.

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

TABLE 1

Equipment details

Ref. No.	Equipment	Quantity	Relevant A.P.
5CW/4402866	Time delay switch, Teddington Type FHM/A/25	2	113D-1404-16
37A/1790	H.E. ignition unit, BTH C10TS/3	4	113L series
37A/1401	H.E. ignition unit, Rotax NB 25/2 alternatives		
37F/11316	Single-breech starter, SBS 720, Mk.5	2	
12K/1220	Cartridge No.9, Mk.2	2	110N series

FIG.3. ENGINE STARTING AND IGNITION

(illustration overleaf)

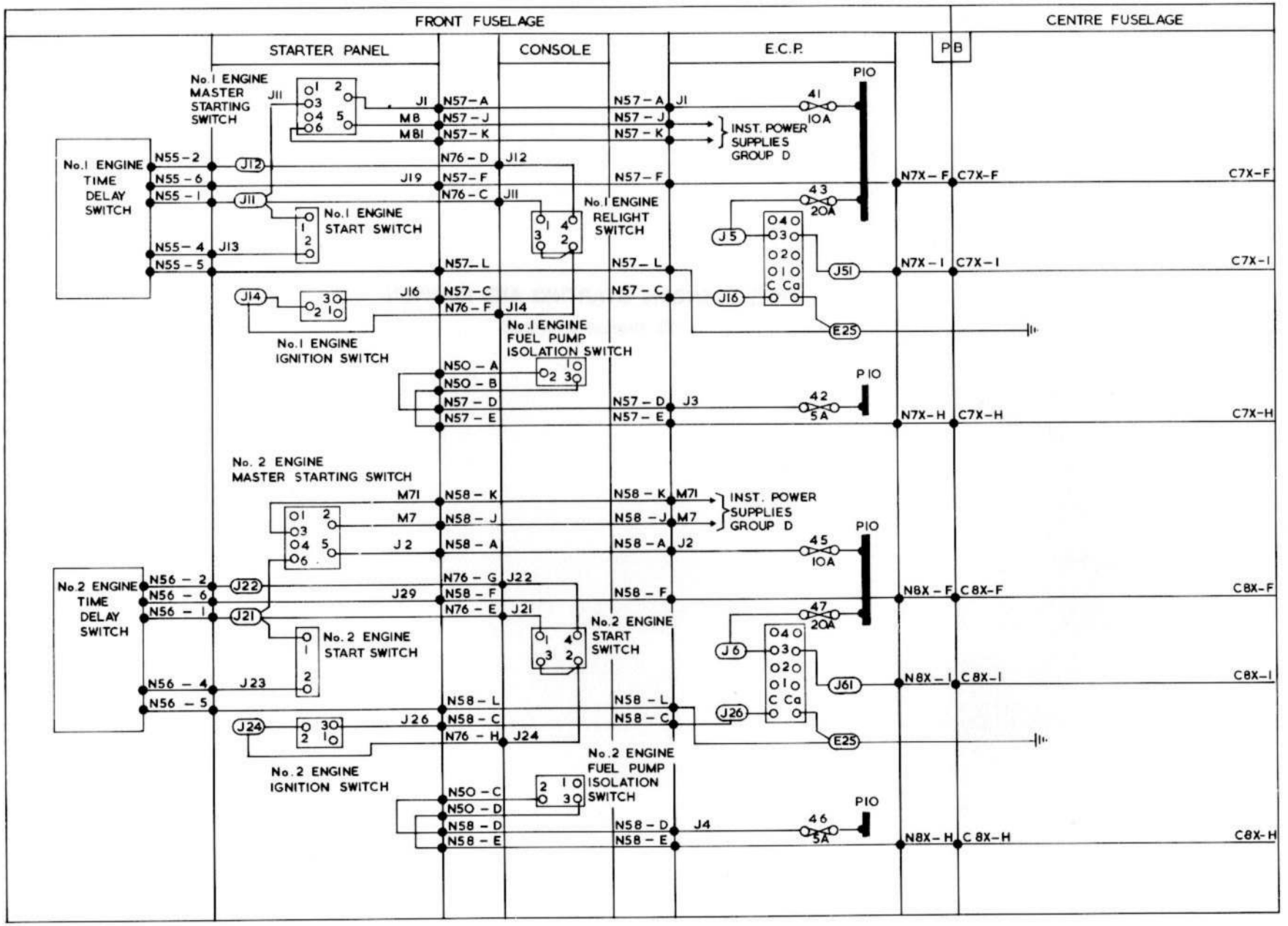

FIG.3, ENGINE STARTING AND IGNITION

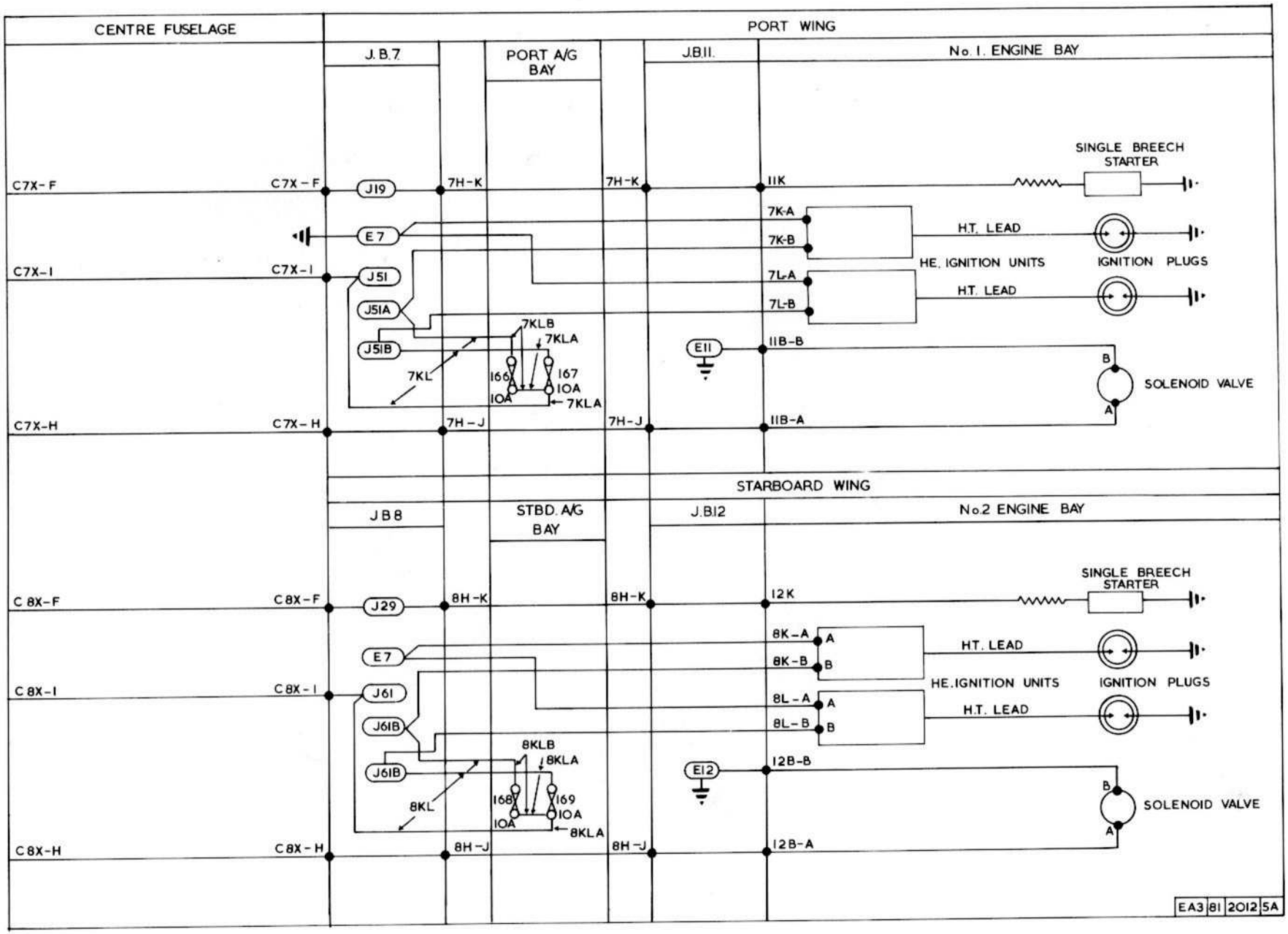

FIG.3A, ENGINE STARTING AND IGNITION

LIGHTING – GROUP L

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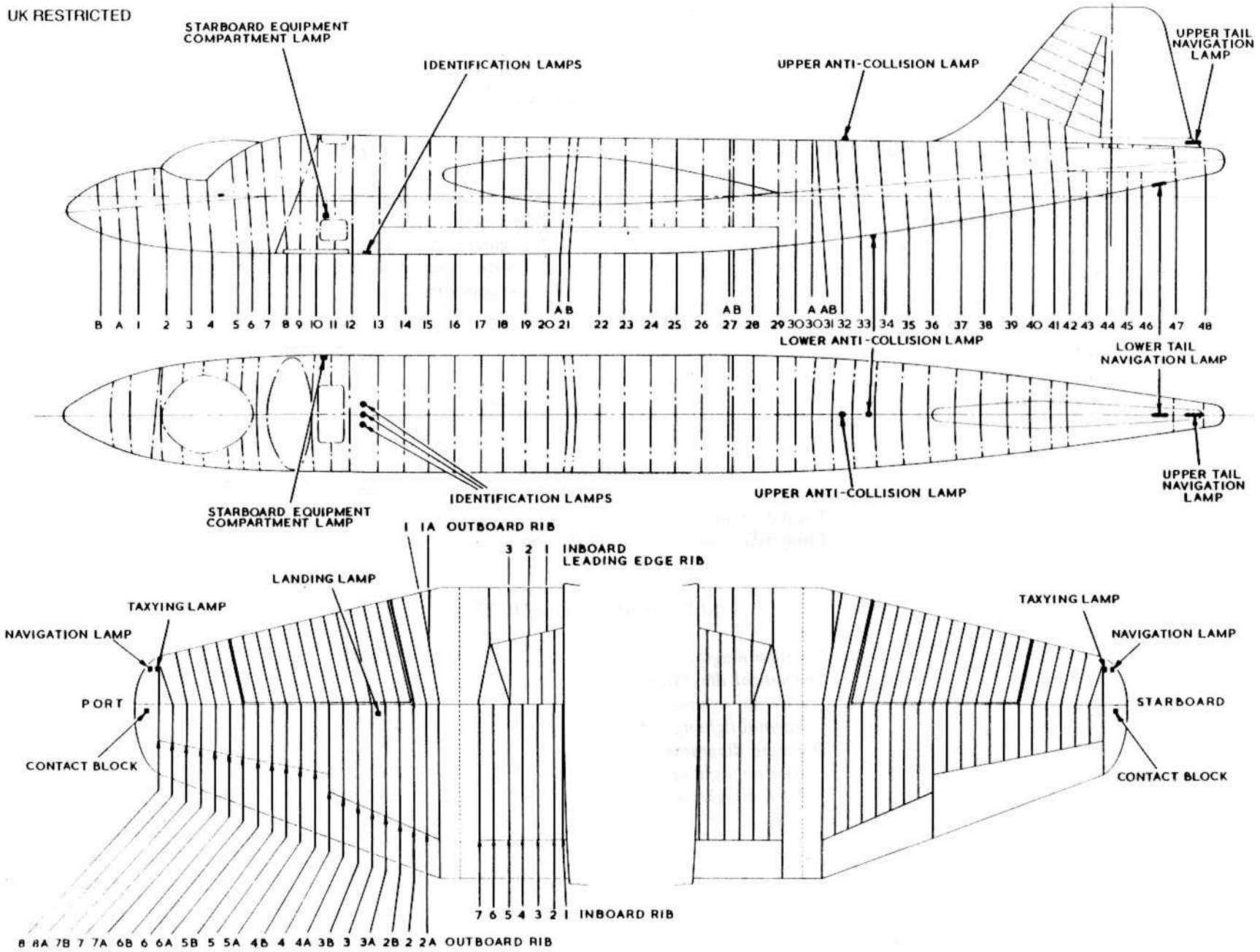

FIG.I. LOCATION DIAGRAM

◄SEM/CANBERRA/0128/STC INCORPORATED►

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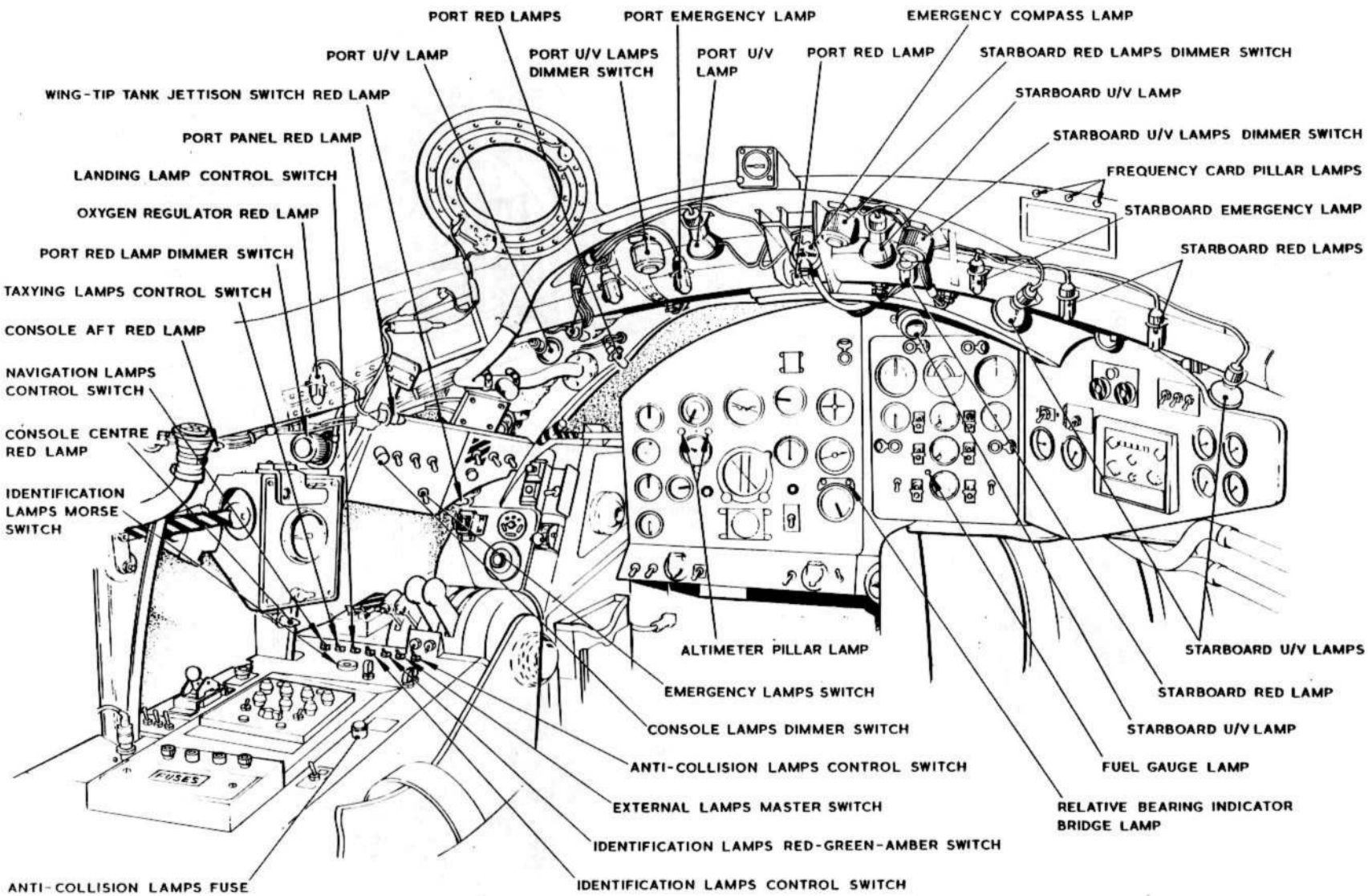

PILOT'S STATION

FIG. IA. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

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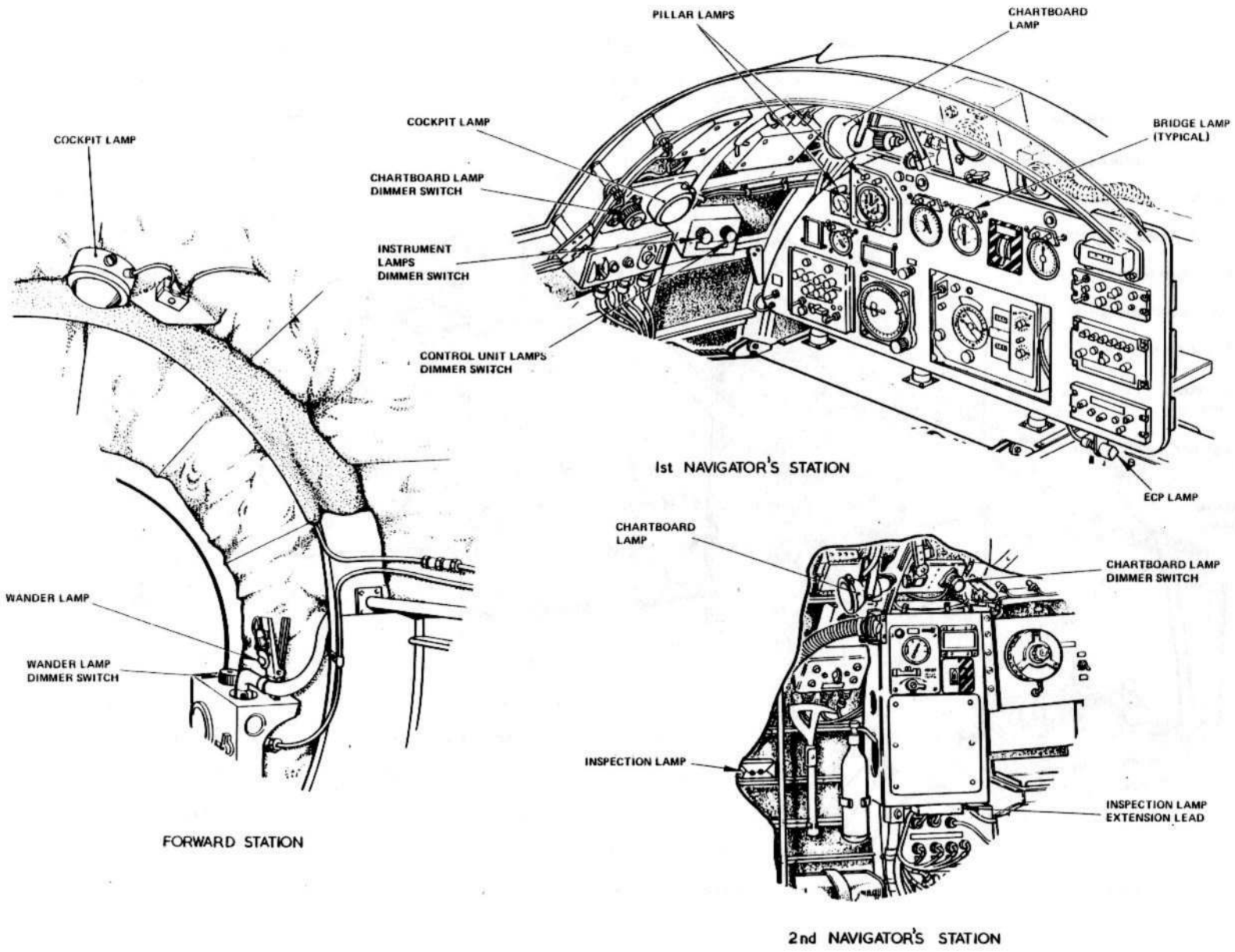

FIG.1B. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

DESCRIPTION

Introduction

1. This group describes the electrical circuits associated with the external and internal lighting. Table 1 provides a list of the main components, their reference/part numbers and where possible the Air Publication in which they are described, whilst Table 2 provides a list of the lamp filaments. Location of the components and switches are shown in fig.1-1A-1B.

EXTERNAL LIGHTING

General

2. Power supplies for external lighting are taken from the 28 volt d.c. busbar PP3. All circuits, except the landing lamp motor circuit, are controlled by an external lamps master switch idented EXTERNAL LIGHTS MASTER – ON, mounted on the pilot's console. The landing lamp motor is fed direct from busbar PP3, via its own switch. All switches associated with the external lighting system are grouped together on the pilot's console.

Navigation lamps

3. Four navigation lamps, one at each wing tip and two at the tail, are fitted. One tail lamp is positioned just below the rudder and the other behind a transparent window on the underside of the fuselage. The lamps are controlled by a switch, idented NAVIGATION LIGHTS – ON, mounted on the pilot's console.

Wing tip fuel tank lamps

4. When wing tip fuel tanks are fitted, the normal wing tip navigation lamps are obscured, so each tank is fitted with a lamp which derives its power supply via mating contact blocks on the underside of the wing tip and the tank.

Identification lamps

5. Three downward identification lamps, fitted with domed fronts and individually coloured red, green and amber are installed on the underside of the fuselage just forward of the bomb bay. The lamps are controlled from two 3-position switches on the console, one switch labelled 'IDENTIFICATION – AMBER – GREEN – RED' and the other 'IDENTIFICATION – OFF – MORSE – STEADY'. A push switch, labelled MORSE, allows the selected lamp to be flashed when the control switch is in the MORSE position.

Landing lamp

6. A retractable landing lamp is mounted in the underside of the port main plane. Power supply to the lamp motor is controlled by a switch idented LANDING OFF/LOW/HIGH, mounted on the pilot's console. When the switch is set to LOW, the lamp moves to a half-extended position and the power supply circuit from PP31/*L4* via fuse 100 is automatically completed and the lamp filament is illuminated. When the switch is set to HIGH, the lamp moves to its fully extended position. When the switch is set to OFF, the lamp is retracted into its housing and the circuit to the lamp filament is automatically broken.

Taxying lamps

7. Two taxying lamps are mounted in the main planes one on each wing tip, adjacent to the navigation lamps. The lamps are controlled by a switch, idented TAXYING LIGHT-ON, mounted on the pilot's console.

Anti-collision lamps

8. Two rotating anti-collision lamps are located; one on the upper fuselage, between frames 32 and 33 and one on the lower fuselage between frames 33 and 34. The lamps comprise two filaments which are mounted on a rotating gear plate which is driven by an electric motor; the whole being enclosed by a glass lens. Operation of the lamps is controlled by a switch, idented ANTI COLLISION LIGHTS-ON, mounted on the pilot's console. When the switch is set to ON, a supply is completed to the two filaments and, via an inbuilt suppressor, to the lamp motor.

INTERNAL LIGHTING

General

9. The internal lighting circuits are supplied from the aircraft 28 volt d.c. busbar P10. Normal illumination is provided by red, white and U/V lamps, an integral lamp in the emergency compass, bridge and pillar lamps on the instrument panel, chartboard lamps and cockpit lamps. The radio and radar control units are fitted with integral lamps. In the event of failure of the normal lighting two emergency floodlamps are supplied from a 2.4 volt emergency battery.

Forward station lighting

10. General lighting of the forward station is supplied by a cockpit lamp situated in the roof near frame 2. The lamp is controlled by an integral switch and has a 2-pin socket which is used as the supply point for an inspection lamp when required. Illumination of any equipment at the forward station is provided by a wander lamp fitted with a spring clip enabling it to be secured in any desired position. The lamp is controlled by a dimmer switch mounted on top of the oxygen regulator.

Pilot's station lighting

11. Illumination of the panels and instruments at the pilot's station is provided by:-

(1) Six U/V lamps fitted below the canopy coaming, two port and four starboard. Each group of lamps is controlled by a U/V dimmer switch mounted adjacent to its respective lamps.

(2) Six red floodlamps fitted below the canopy coaming to illuminate the flight, engine and miscellaneous instrument panels. The lamps are grouped into four port and two starboard, each group being controlled by a RED lamps dimmer switch.

(3) Five red floodlamps are fitted to illuminate the pilot's console (2 lamps), oxygen regulator, wing tip fuel tank jettison switch and the port panel (1 lamp each) and are controlled by the CONSOLE LIGHTS dimmer switch located on the port panel. This dimmer switch also controls the integral lamps in the pilot's intercomm. station box on the console.

(4) Three pillar lamps illuminate the frequency card holder on the starboard side of the blast shield; two pillar lamps illuminate the altimeter and a bridge lamp illuminates the radio compass relative bearing indicator, on the flight instrument panel. All these lamps are controlled by the port RED lamps dimmer switch *(para.(2))*.

(5) The emergency compass is illuminated by an integral lamp, the No.3 fuel tank contents gauge is illuminated by a lamp on the engine instrument panel and the V/UHF control unit, on the miscellaneous instrument panel, is illuminated by integral lamps. All these lamps are controlled by the starboard RED lamps dimmer switch *(para.(2))*.

◀ **12.** In addition to the normal lighting system, two amber emergency floodlamps, one each side of the pilot's panels, are fitted. The lamps are operated from two series-connected 12 volt 4 AH lead-acid batteries located in the lower section of the pilot's console. Access to the batteries is by removal of the pilot's map stowage panel. The lamps are controlled by an emergency lights switch mounted on the pilot's port switch panel. The switch has a fluorescent spot, and a fluorescent strip is located on the panel adjacent to it, to make it readily identifiable in the dark. ▶

Navigator's stations lighting

13. General lighting of the navigator's stations is provided by a cockpit lamp located on the port wall above the chart table. Two chartboard lamps, one located above the 1st navigator's instrument panel and one on a bracket at the 2nd navigator's station also provide general lighting. Both lamps are controlled by dimmer switches located adjacent to them.

14. Illumination of the instruments on the 1st navigator's instrument panel is provided by four bridge lamps and three pillar lamps which are controlled by the INST LIGHTS dimmers switch located on a panel at the port side of the 1st navigator's station above the chart table. A red floodlamp, which illuminates the E.C.P. switch panel, is also controlled by this dimmer switch.

15. Illumination of the IFF/SSR, TACAN and V/UHF control units and the intercomm. station box is provided by integral lamps which are controlled by the C.U. LIGHTS dimmer switch located on the panel adjacent to the INST. LIGHTS dimmer switch *(para.14)*.

Starboard equipment compartment lighting

16. A cockpit lamp for use when servicing the generator control equipment is located above the access door to the compartment.

Inspection lamp

17. An inspection lamp and extension lead stowed in two canvas bags at the 2nd navigator's station is for use during servicing operations. The lamp may be connected to the aircraft electrical system via the 2-pin socket on each cockpit lamp.

SERVICING

WARNING

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

General

18. All lighting circuits should be periodically examined and operated. Should any filament prove to be unserviceable it should immediately be replaced by one of the correct type in accordance with Table 2. During examination the condition of watertight seals in external lighting components should be noted. Should the presence of moisture be observed within any component the seal should be replaced after first ensuring the interior of the component, or component housing, is thoroughly dry.

TABLE 1

Equipment details

Ref./Part No.	Equipment	Quantity	Relevant A.P.
5CX/5330541	Lamp, anti-collision	2	113F-0203-13A
5CX/4330018	Lamp, navigation – port	1	113F-0227-1
5CX/4330446	Lamp, navigation – starboard	1	
5CX/1053800	Lamp, navigation – tail	2	113F-0229-1
5CX/1053245	Lamp, downward identification	3	
5CX/3465	Lens, downward identification – amber	1	113F-0002-1
5CX/4330088	Lens, downward identification – green	1	
5CX/4330089	Lens, downward identification – red	1	
5CX/4330093	Lamp – taxying	1	113F-0209-1
5CX/4330151	Lamp – landing	1	113F-0002-1
5CW/2453	Dimmer, Type R	1	
5CW/2531	Dimmer, Type R	1	
5CW/11499	Dimmer, Type 01-0010, Thorn	2	
5CW/11505	Dimmer, Type 01-0016, Thorn	1	113D-0016-6
5CW/4405514	Dimmer, Type R	2	
5CW/4405520	Dimmer, Type R	3	
5CX/433001	Lamp inspection	1	
5CX/3700	Lead extension	1	
5CX/4662065	Wander lamp	1	113F-0002-1
5CX/4330002	Lamp cockpit, Mk.1A	3	
5CX/1982602	Lamp chartboard	2	
5CX/1143869	Lamp pillar	8	113F-0223-1
5CX/5350	Lamp bridge	5	113F-0224-1
◀ 5CX/4330059	Lamp U/V	3	113F-0002-1
5CX/4330060	Lamp U/V	3	113F-0002-1
5CX/4058	Lamp, Type C2	13	▶

TABLE 2

Lamp filaments, ratings and location

Service	Location	Ref. No.	No. off	Voltage	Watts
External lighting					
Upper anti-collision lamp	Upper side fuselage	5L/2641	2	28	40
Lower anti-collision lamp	Underside rear fuselage	5L/2641	2	28	40
Downward identification	Underside of fuselage (frame 12)	5L/9952604	3	24	80
Navigation	Wing tips, port and starboard	5L/9952431	2	28	24
Navigation (when wing tip tanks are fitted)	Jettisonable fuel tanks	5L/9952431	2	28	24
Navigation	Tail, upper and lower	5L/9953294	2	28	12
Taxying	Wing tips, port and starboard	5L/9954609	2	28	100
Landing	Underside port wing	5L/9954717	1	26	240
Internal lighting					
Navigator's chartboard lamp	1st and 2nd navigators' stations	5L/9953278	2	28	18
Pilot's instrument lighting (U/V)	Port and starboard cockpit	5L/9952261	6	12	7
Pilot's instrument lighting (red)	Port and starboard cockpit	5L/9951263	7	24	2.8
Pilot's instrument lighting, emergency (amber)	Canopy coaming	◀ 5L/9951283	2	24	3.5 ▶
Console lighting (red)	Console	5L/9951263	5	24	2.8
Wander lamp	Forward station	5L/9953278	1	28	18
Emergency compass	Pilot's cockpit coaming	5L/9959121	1	28	0.04
No.3 fuel gauge lighting	Engine instrument panel	5L/9959211	1	24	2.4
Inspection lamp	2nd navigator's station	5L/9952257	1	24	6
Bridge lamps	Instrument panels	5L/9959182	10	28	2
Pillar lamps	Instrument panels	5L/9959182	8	28	2
Cockpit lamp	Forward station	5L/9953271	1	28	7
Cockpit lamp	1st navigator's station	5L/9953271	1	28	7
Cockpit lamp	Starboard equipment bay	5L/9953271	1	28	7

continued . . .

TABLE 2 Lamp filaments, ratings and location – *continued*

Service		Location	Ref. No.	No. off	Voltage	Watts
Miscellaneous	Refer to:-					
Fire warning	Chap.1, Group W	Miscellaneous instrument panel	5L/9951273	2	28	3.5
Bomb-bay doors	Chap.1, Group A & B	Console	5L/9951273	1	28	3.5
Position indicator						
Generator failure warning	Chap.1, Group P	E.C.P., Engine instrument panel	5L/9951273	4	28	3.5
Alighting gear indicator	Chap.1, Group G	Port sloping panel	5L/9951286	9	28	2.5
Fuel pressure warning	Chap.2, Group E	Engine instrument panel	5L/9951110	2	6	0.24

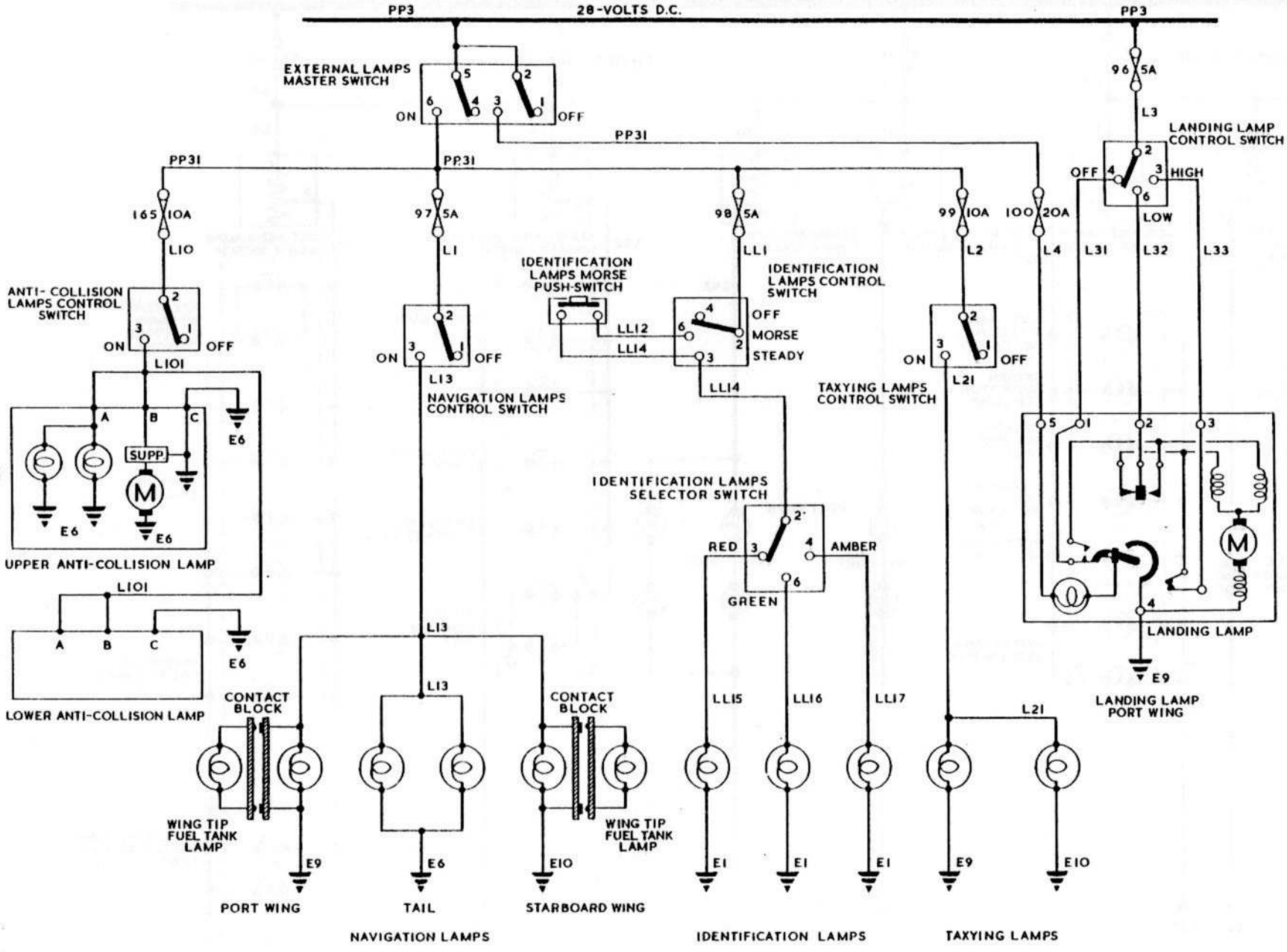

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FIG.2. EXTERNAL LIGHTING

◀ ANNOTATIONS AMENDED ▶

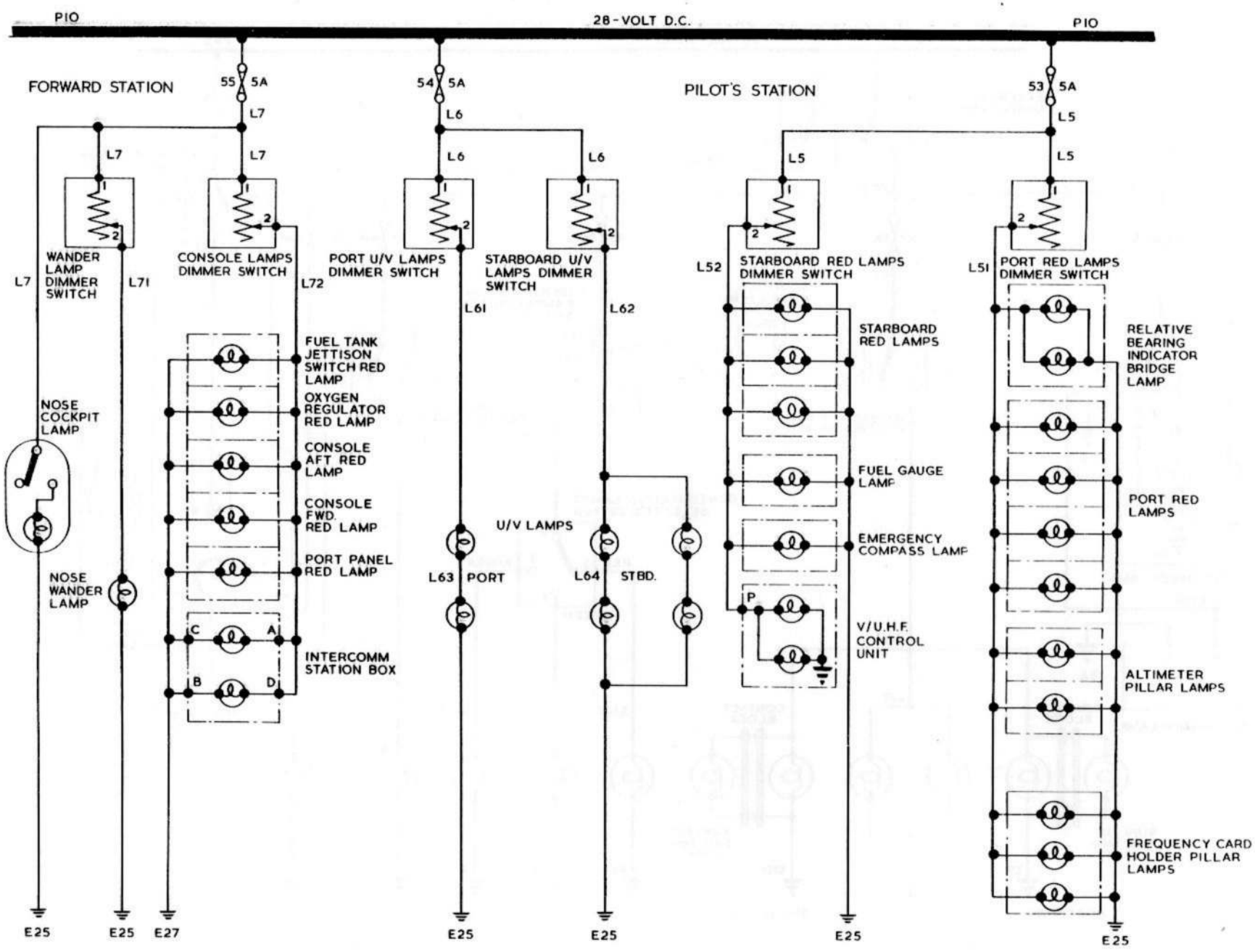

FIG.3. INTERNAL LIGHTING

◄ ANNOTATIONS AMENDED ►

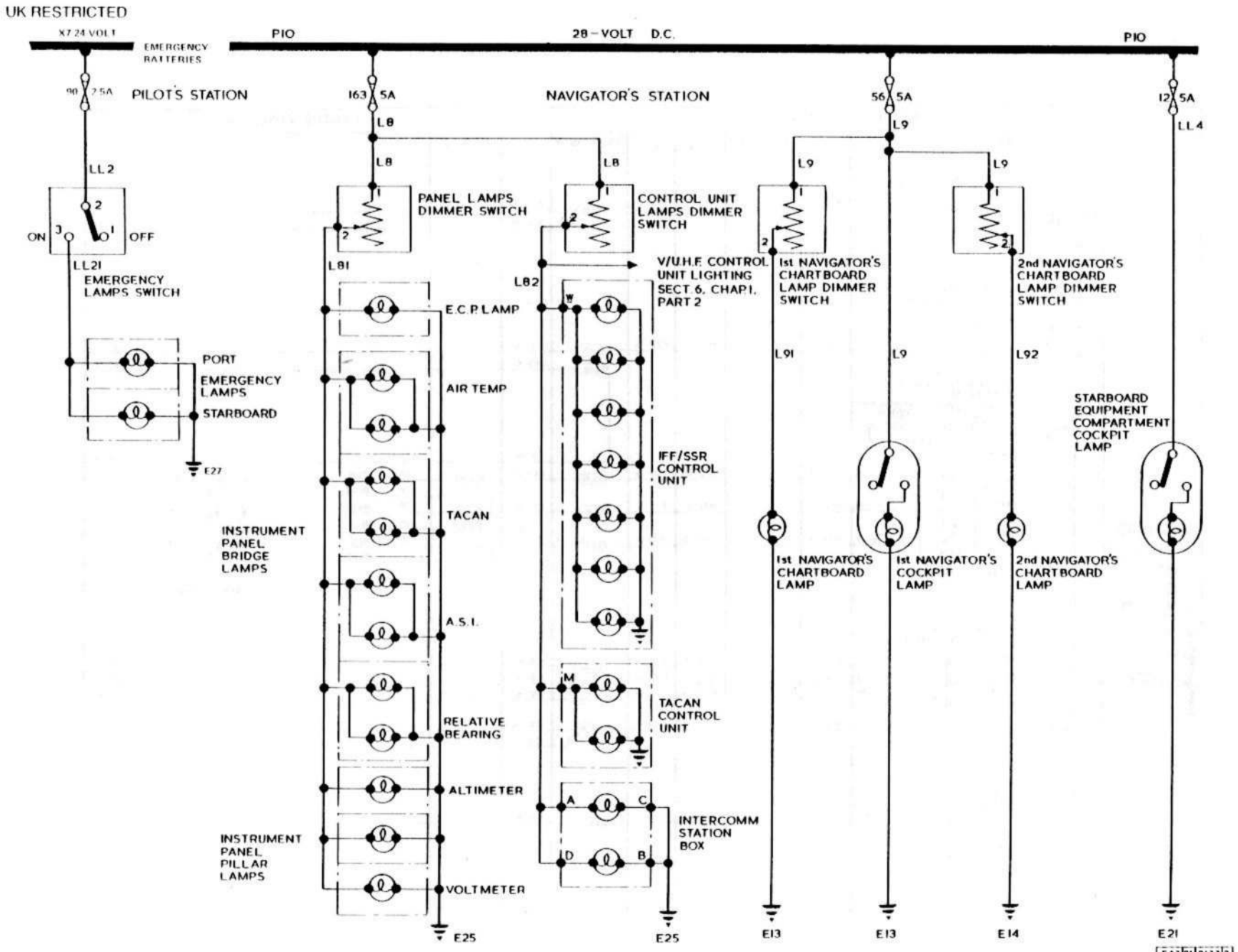

FIG.3A.INTERNAL LIGHTING

◀SEM/CANBERRA/0128/STC INCORPORATED▶

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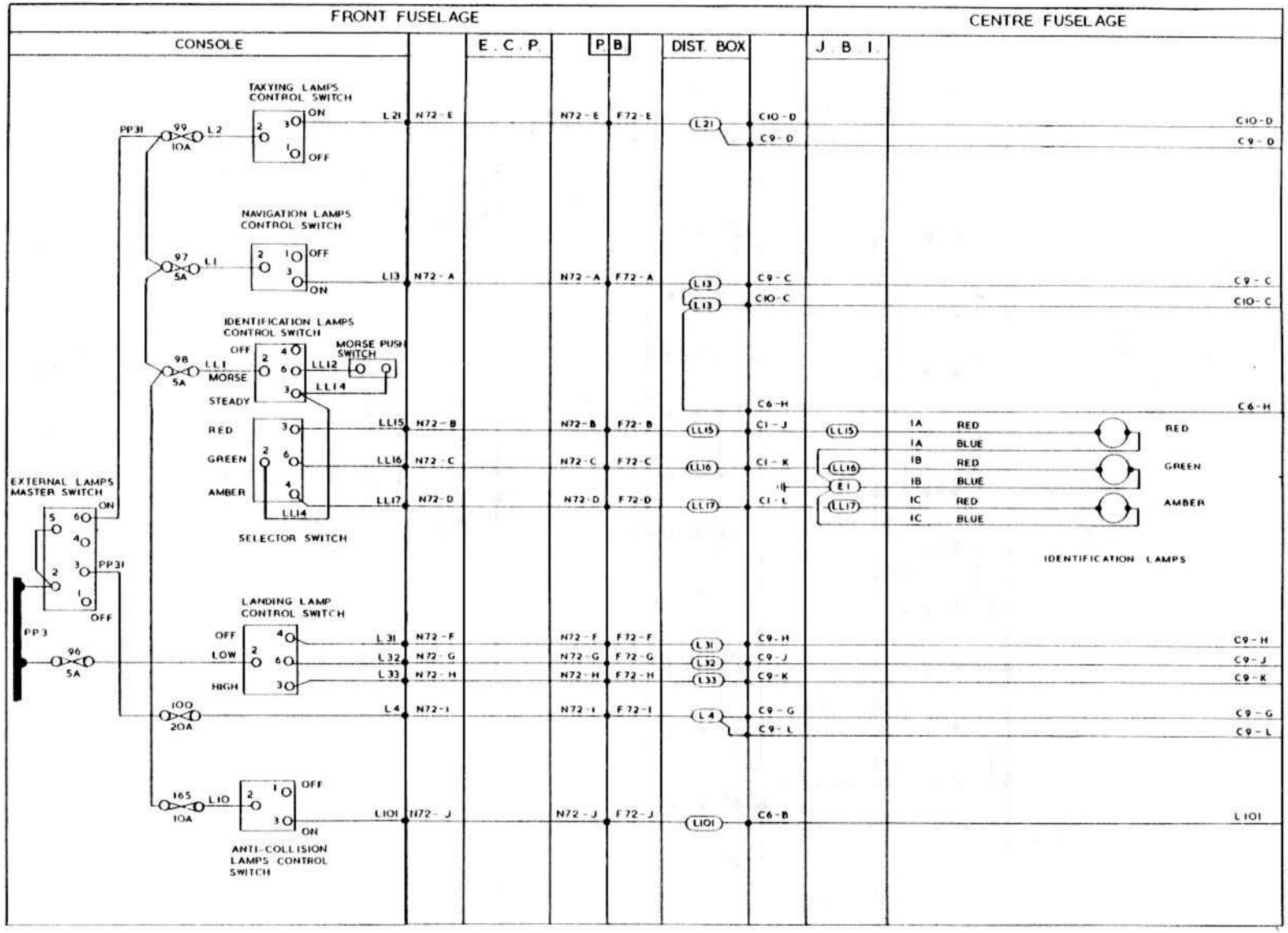

FIG. 4. EXTERNAL LIGHTING

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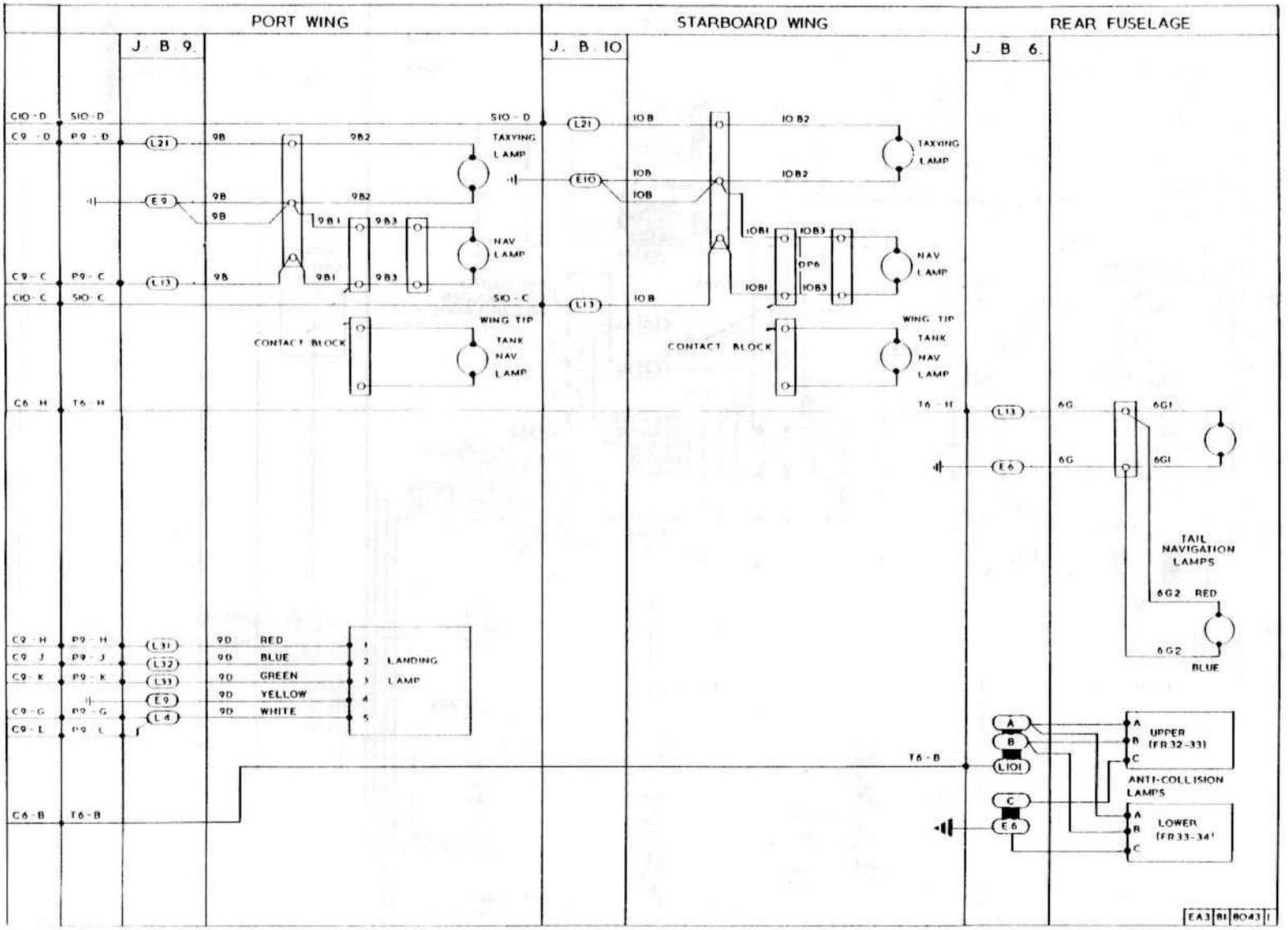

FIG. 4A. EXTERNAL LIGHTING

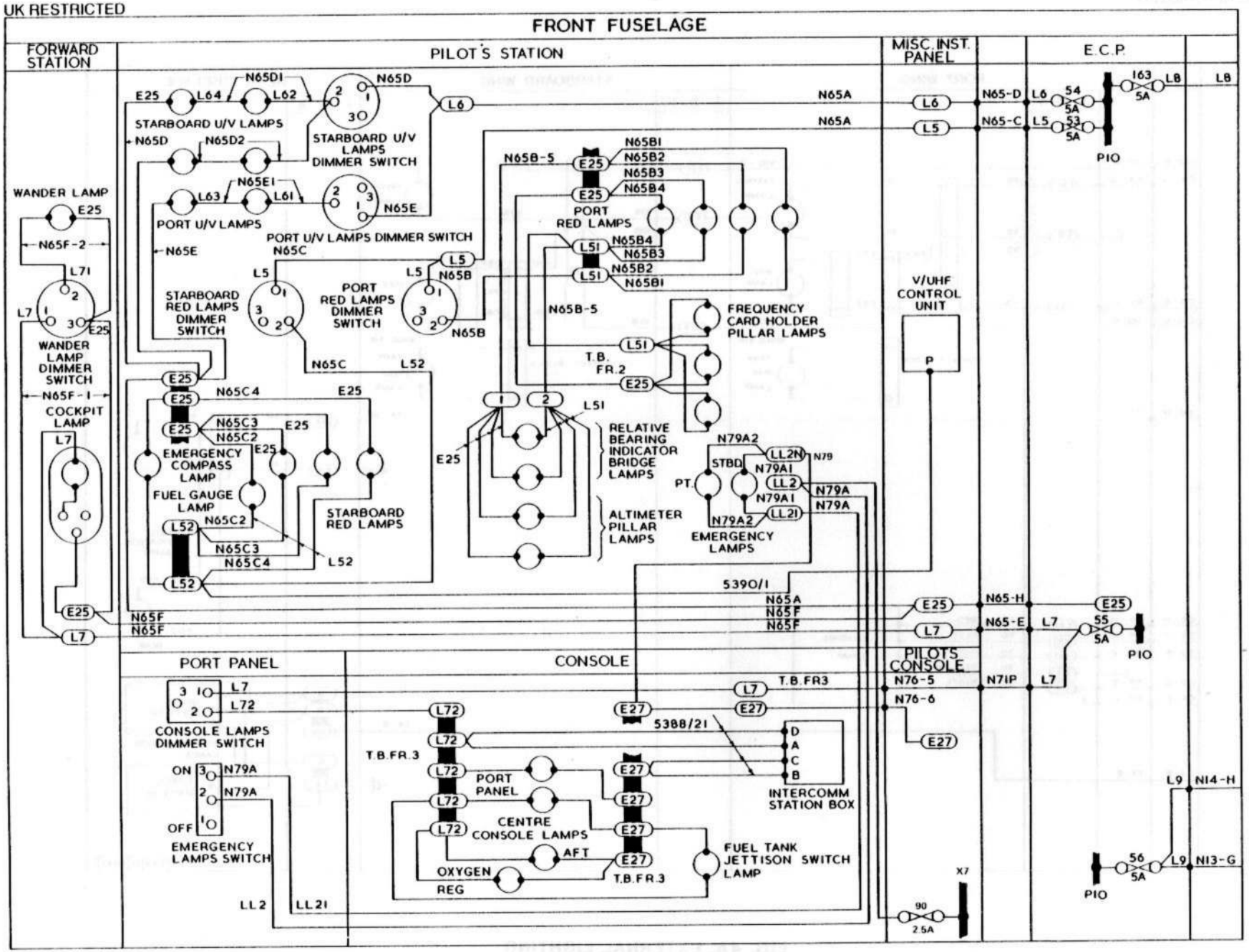

FIG. 5. INTERNAL LIGHTING

◀SEM/CANBERRA/0128/STC INCORPORATED▶

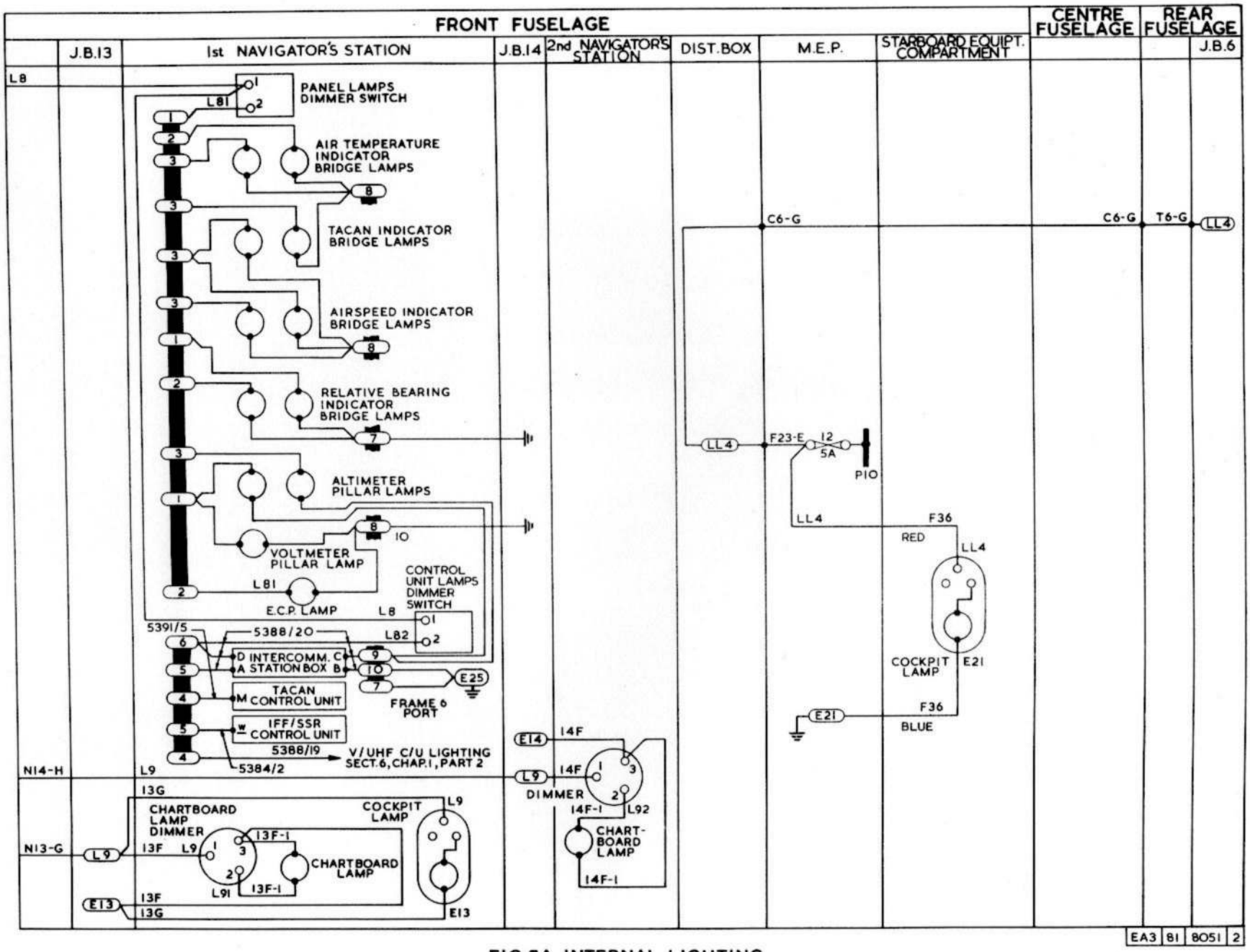

FIG.5A. INTERNAL LIGHTING

◂MOD 5204 EMBODIED▸

D.C. POWER SUPPLIES – GROUP P

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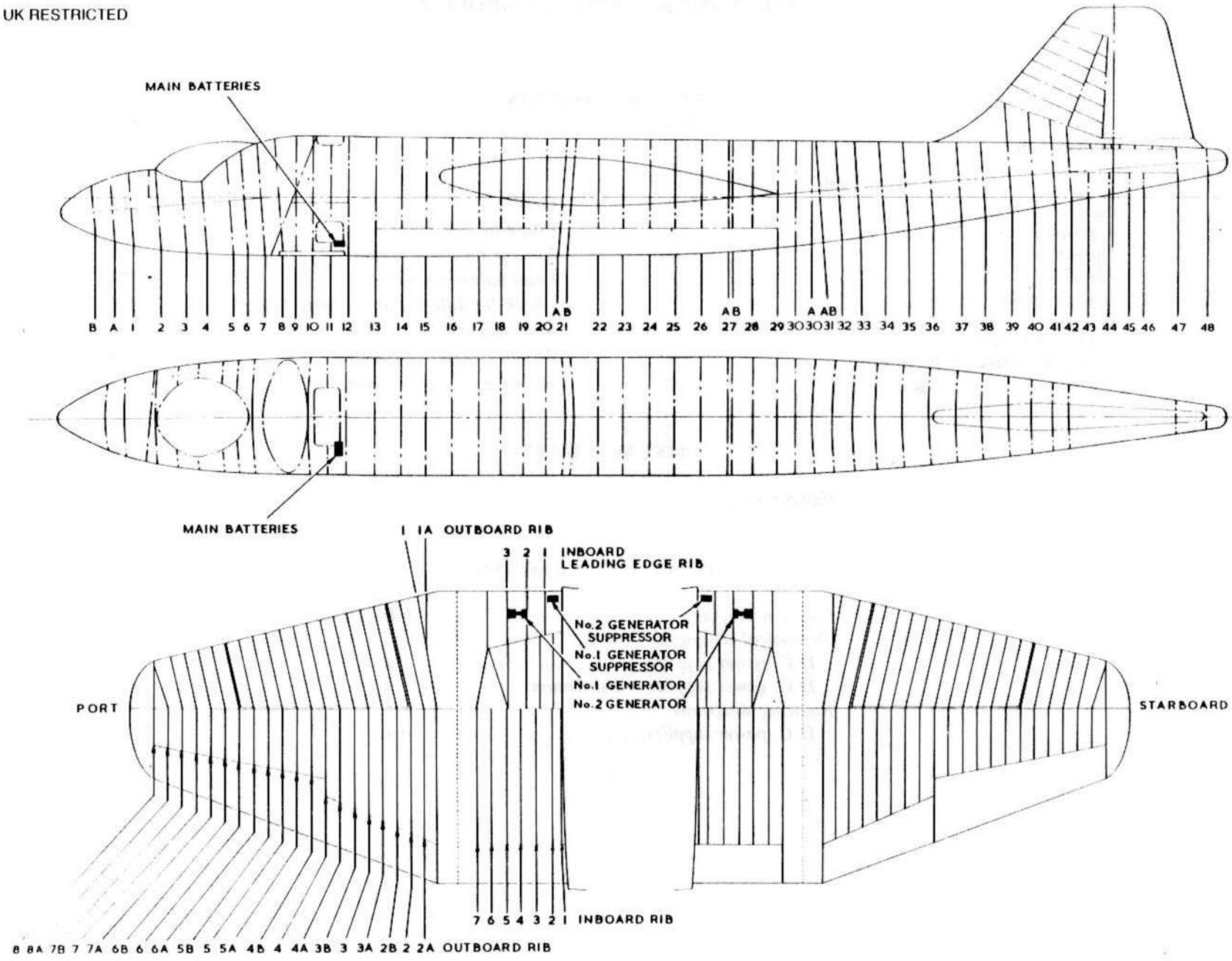

FIG. 1. LOCATION DIAGRAM

◀SEM/CANBERRA/0128/STC INCORPORATED▶

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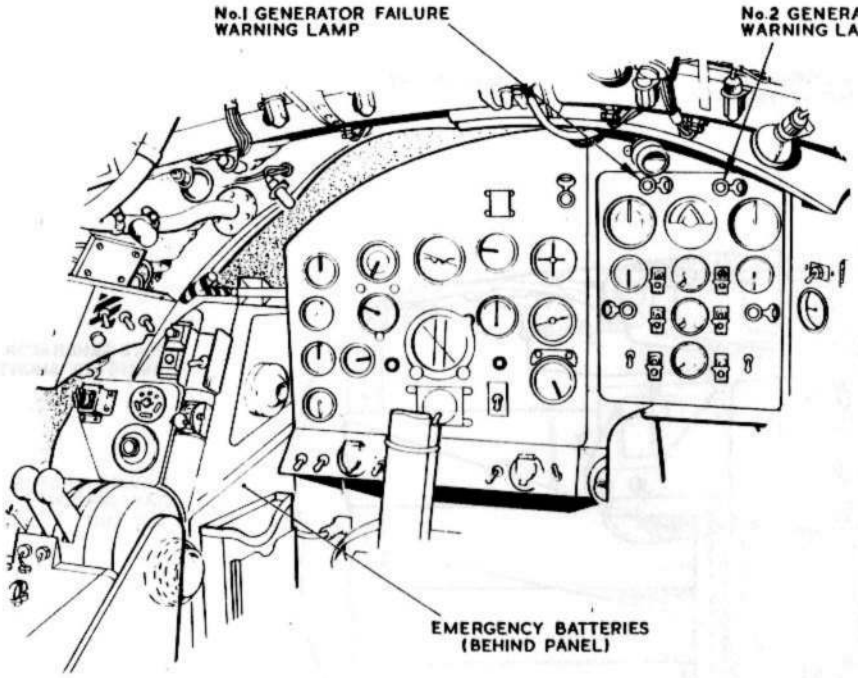
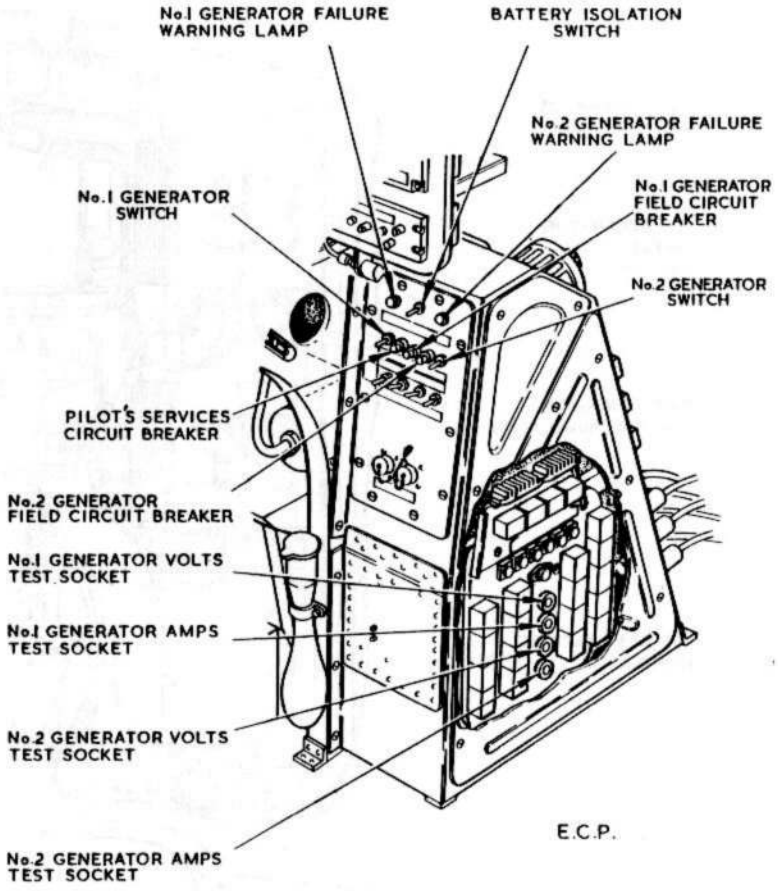


PILOT'S STATION



1st NAVIGATOR'S STATION

FIG.1A. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

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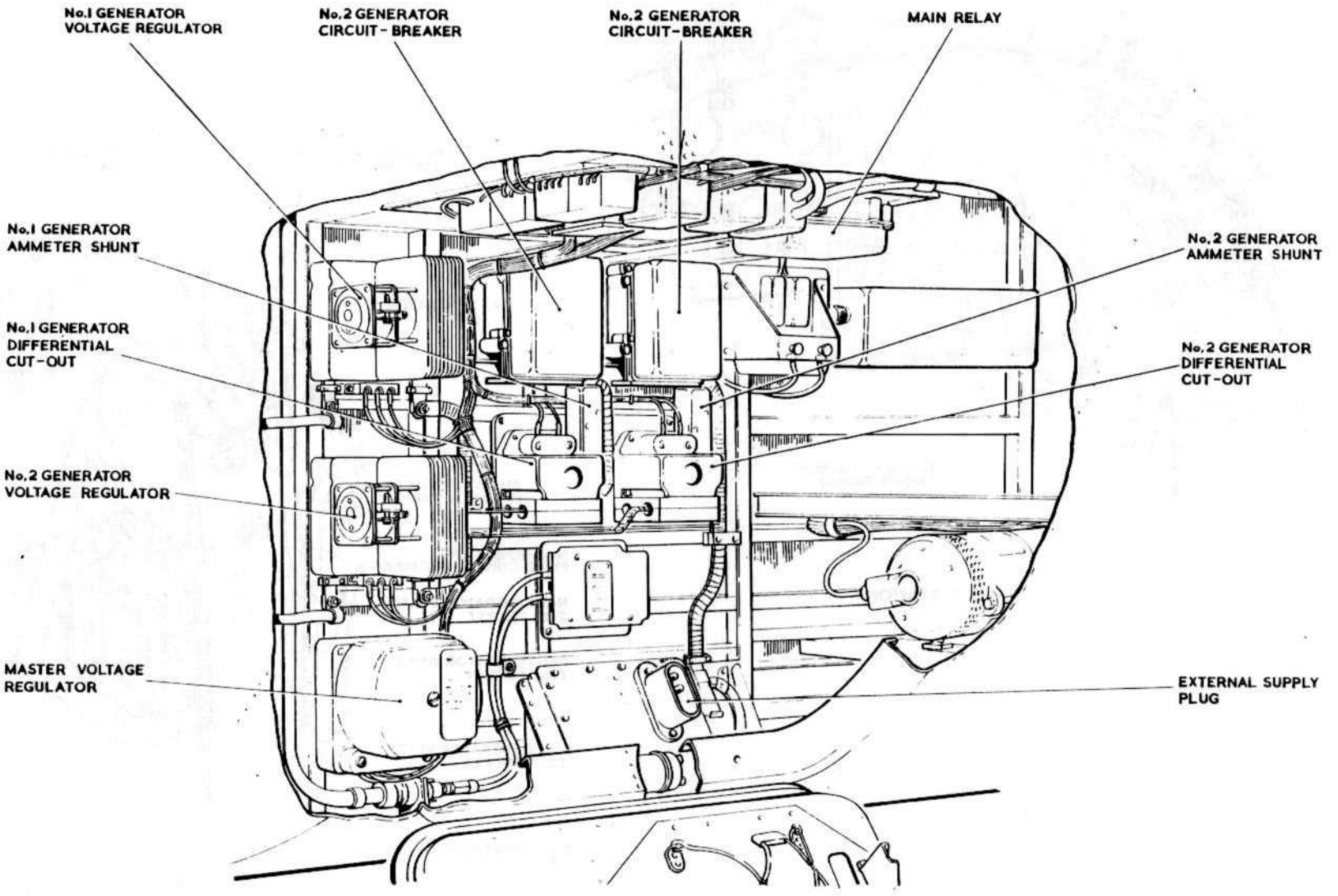

M.E.P.-STARBOARD EQUIPMENT COMPARTMENT

FIG.IB LOCATION DIAGRAM

Introduction

1. This group contains descriptive and servicing information appertaining to the d.c. generating system and the batteries. Included in the group are theoretical and routeing diagrams which cover the complete installation. Table 1 forms a list of the principal components of the system together with their reference/part numbers and the Air Publication in which they are described. The location of the components and the circuit switches are shown in fig.1-1A-1B.

DESCRIPTION

General

2. Power for the electrical services and for battery charging is provided by two generators operating in parallel with their output automatically controlled at 28 volts d.c. The generators are 6-pole, self-excited, shunt-wound machines rotating in a clockwise direction; they are cooled by ram air ducted from intakes in the leading edge of the main plane.

Generator drive

3. Each generator is driven through a 2-speed gearbox which, in turn, is coupled to the accessories gearbox. The 2-speed gearbox provides that a high output is available from a generator at low engine rev/min. The gear change is automatic and controlled by a centrifugal clutch mechanism when this is subjected to a variation, within limits, of engine rev/min. At low speeds the clutch is IN and high gear is engaged, with the result that the generator runs at 1.1072 times the engine speed. When the engine speed rises to between 5930 and 6890 rev/min the high gear is automatically disengaged and the generator is then driven at 0.64 engine speed. On the reduction of engine rev/min to between 5900 and 5150, high gear is re-engaged and generator output then increases relative to the engine speed.

Operation

4. The output from each generator, after passing through a suppressor located near the fuselage in the leading edge of the main plane, is controlled by a voltage regulator, a differential cut-out, and a circuit-breaker all of which are located on the M.E.P. in the starboard equipment compartment. Also on the M.E.P. is a master voltage regulator which balances and maintains the output of both generators at 28 volt. The generators are initially controlled by the No.1 GENERATOR and No.2 GENERATOR switches and their associated FIELD circuit breakers fitted on the switch panel of the E.C.P. Adjacent to each field circuit breaker is a red warning lamp which, if alight during flight, indicates generator failure. These warning lamps are also duplicated on the engine instrument panel. The outputs from the generators are connected to busbar P10 and fed to the battery busbar P9 via the main relay on the busbar panel.

Main relay

5. The function of the main relay is to isolate the services connected to busbar P10 from the battery busbar P9. It is normally controlled by the BATTERY ISOLATION switch on the E.C.P. switch panel but is also connected in the inertia crash switch circuit. If the inertia switches operate in a crash landing, crash relay No.5 opens and disconnects the power supply to all electrical circuits except those for the fire extinguishers, canopy and hatch jettison. For information on the inertia switches operation refer to Group W of this chapter.

External power supply

6. A 3-pole plug is fitted on the M.E.P. for the purpose of connecting an external power supply to the aircraft. To cater for an external supply cable having a 2-pole connector, an adapter Ref.No.105G/11 should be used.

Batteries

Main batteries

Note . .

Extra care must be taken when changing batteries due to the restricted access on embodiment of SEM/CAN/0136. ▶

7. Four lead-acid batteries are installed between frames 12 and 13 in the port side of the fuselage. Each battery is rated at 12 volts, 40 Ah and all four are connected in series parallel giving 24 volts, 80 Ah. The batteries are carried on a sliding tray mounted on rollers and are reached through an access door at the port side of the fuselage forward of the main plane. The access door hinges downwards and is used as a platform on to which the batteries and

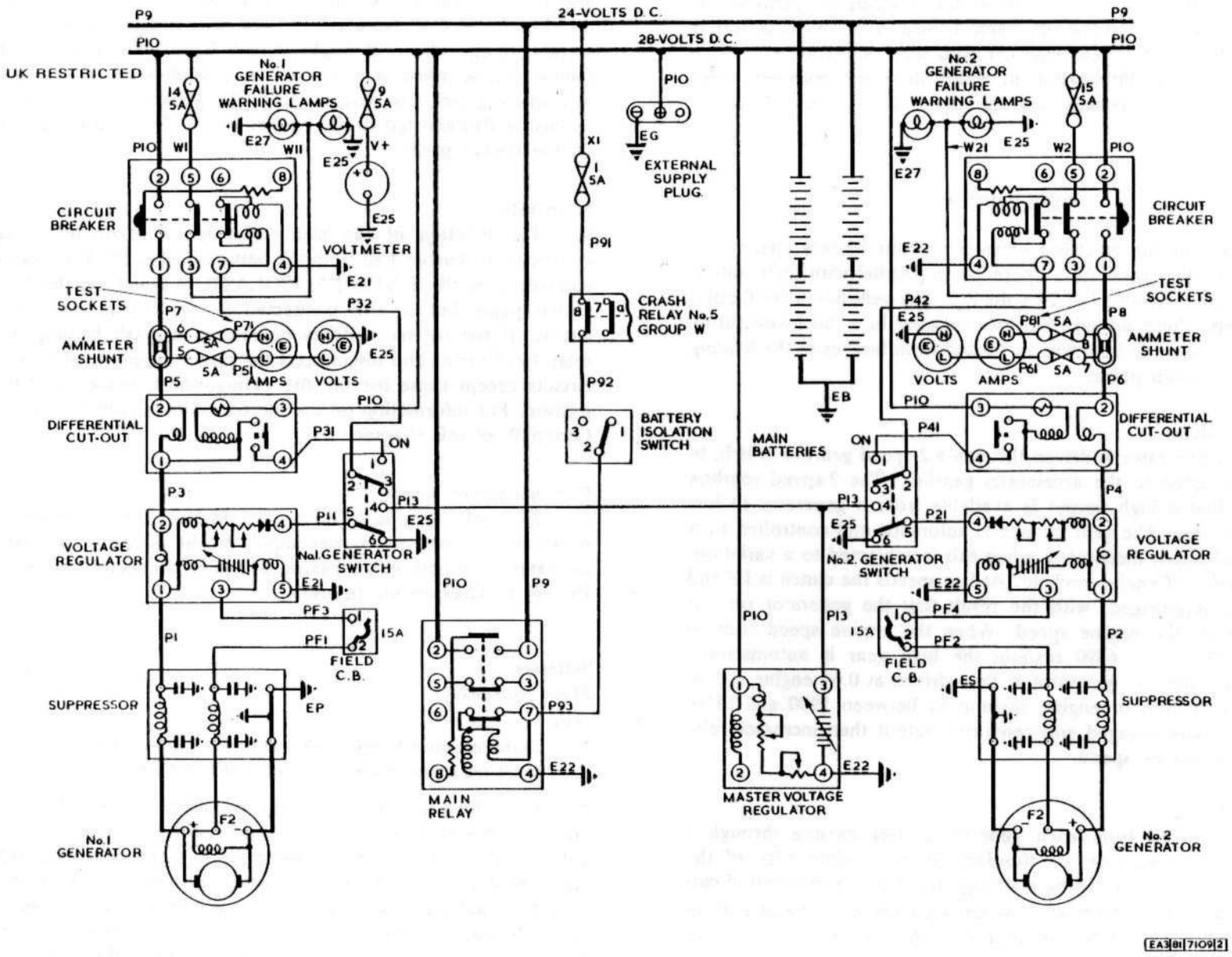

FIG. 2. D.C. POWER SUPPLIES

tray can be run. As a number of circuits are not controlled by switches but are directly connected to the main positive supply, to conserve battery current it is essential that while the aircraft is on the ground the BATTERY ISOLATION switch should be OFF. When a power supply is required for servicing purposes an external source should be used.

24 volt emergency batteries

◀ 8. Two lead-acid batteries rated at 12 volts 4 Ah each, are provided to supply emergency power for the detonator circuits, turn and slip indicator and instrument panel lighting. 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 connecting cables when the batteries are removed for servicing.

9. Not used. ▶

SERVICING

WARNING

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

General

10. The generators are accessible after the removal of large detachable panels 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 A.P.101B-0402-1A, 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

11. If indication of a generator fault is given by a generator warning light, the main components in the suspect system should be examined, particular attention being given to the connections at the circuit breaker, voltage regulator, and cut-out etc. in its circuit. If the aircraft has had recent prolonged periods of high-altitude flying it is advisable to check the generator brushes, as, under these flight conditions, abnormal brush wear can take place and quickly cause a generator to become unserviceable. The finding of worn brushes in one generator should lead to an examination of the brushes in the other, although that unit may apparently be operating satisfactorily. Brushes should be renewed if found to be less than 0.43 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 at 17 to 19 oz. After a visual examination of a suspected generator, its insulation should be tested to the figure given in its relevant A.P. 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

12. The following procedure should be adopted when setting up the voltage regulators:-

(1) Switch OFF the BATTERY ISOLATION switch on the E.C.P. switch panel.

(2) Connect a ground supply to the external power plug.

(3) Switch OFF both generator switches on the E.C.P. switch panel.

(4) Close both field circuit breakers on the E.C.P. switch panel.

(5) Connect a Type D testmeter (set to the 30 volt range) to No.1 voltmeter socket in the E.C.P.

UK RESTRICTED

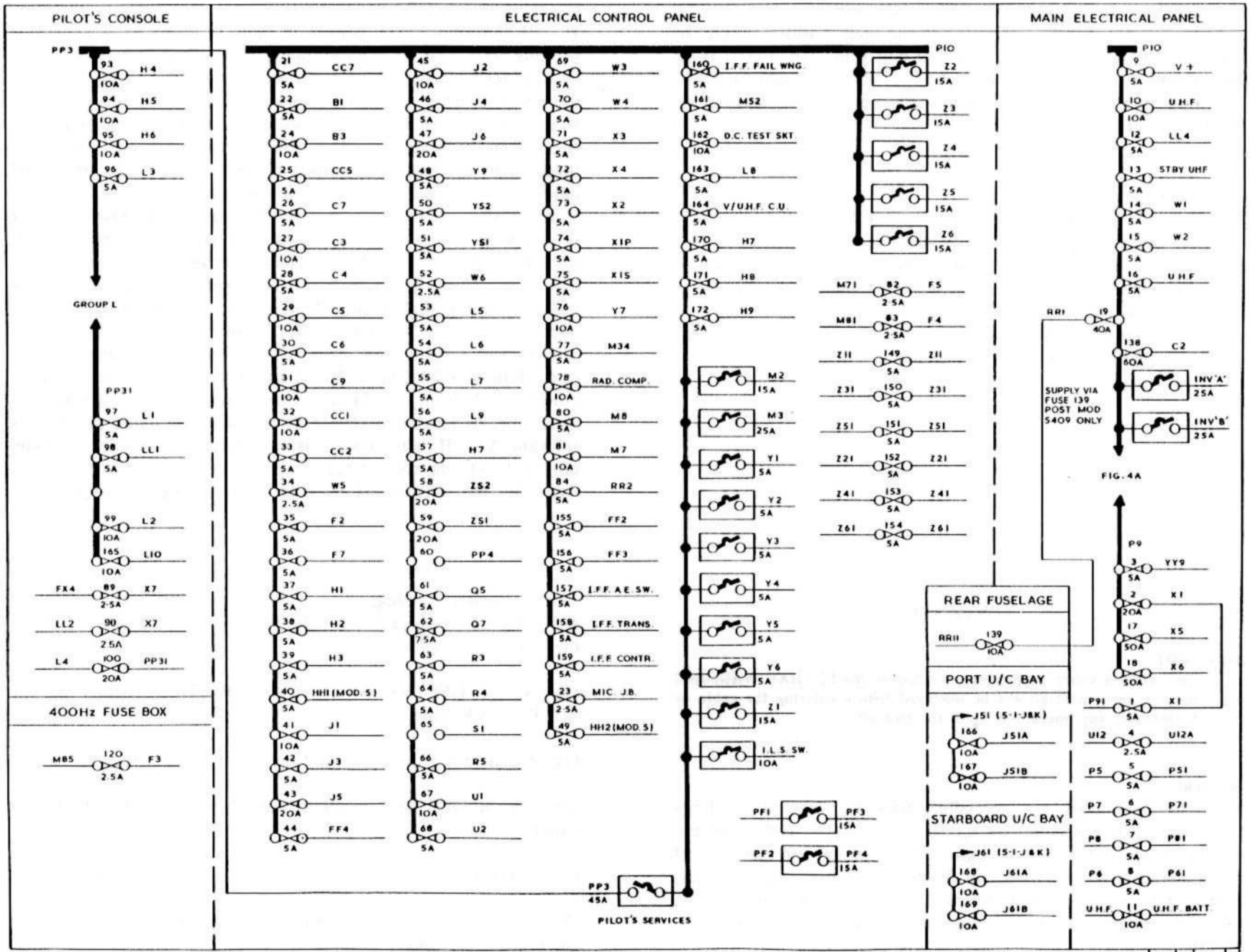

FIG. 3. D.C. POWER SUPPLIES - DISTRIBUTION

EA3 | 81 | 8105 | 1
EA3 | 81 | 8311 | 2 | 1

(6) Start up No.1 engine. When it reaches 3500 rev/min adjust the trimmer on the port 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.

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

(8) Start up No.2 engine and repeat the procedure (6) with the starboard voltage regulator, again setting to 24 volts ± 0.5 volt.

(9) Disconnect external power supply and switch off all internal loads.

(10) Switch ON both generator switches and run up both engines together to approximately 3500 rev/min. and adjust the trimmer of the master voltage regulator until a steady reading of 28 volts is obtained. Vary the engine speed over its normal range and check that the voltage does not vary more than 0.5 volt either way. During this check the testmeter may be connected to either meter socket.

Load balancing tests

13. Provided that the voltage regulators have been adjusted in the manner described in para.12, it should not be necessary to carry out load-balancing tests between the generator circuits.

Check for differential cut-outs, Type A

14. The cut-outs can be checked by following the procedure detailed below:-

(1) Connect a sensitive 0-3 voltmeter across terminal No.1 of the cut-out being checked and terminal No.2 of its associated 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) 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.

Main batteries

Note. . .

Extra care must be taken when changing batteries due to the restricted access on embodiment of SEM/CAN/0136.

15. The batteries must be removed from the aircraft and serviced in accordance with the Servicing Schedule. During removal or replacement the four batteries must not be placed on the access door simultaneously or damage to the door structure may result. Whenever the batteries are removed, the battery cables should be stowed on the terminals provided for the purpose. The structure and equipment adjacent to the batteries must be kept clean and free from any trace of electrolyte.

24 volt emergency batteries

16. In accordance with the aircraft Servicing Schedule, these batteries should be removed and charged at the rate shown on the battery label. The battery tray and adjacent structure must be kept clean and free from any trace of electrolyte which could cause corrosion.

◀ 17. Not used. ▶

TABLE 1

Equipment details

Ref./Part No.	Equipment	Quantity	Relevant A.P.
5UA/4360452	Generator, Type P3	2	113B-0217-1
5UC/4379035	Voltage regulator, Type 23	2	113D-0728-16
5UC/4379065	Differential cut-out, Type A	2	113D-0802-16
5CY/2853	Circuit breaker, Type D	2	113D-0908-13A
5UC/4379038	Master regulator, Type 32	1	113D-0729-1
5CW/6185	Main relay, Type R	1	113D-0908-1
5J/3253	Batteries, Type C	4	113C-0205-1
	▶◀		
5J/9101543	Batteries, lead-acid	2	113C-0207-1

FIG.4. D.C. POWER SUPPLIES

(illustration overleaf)

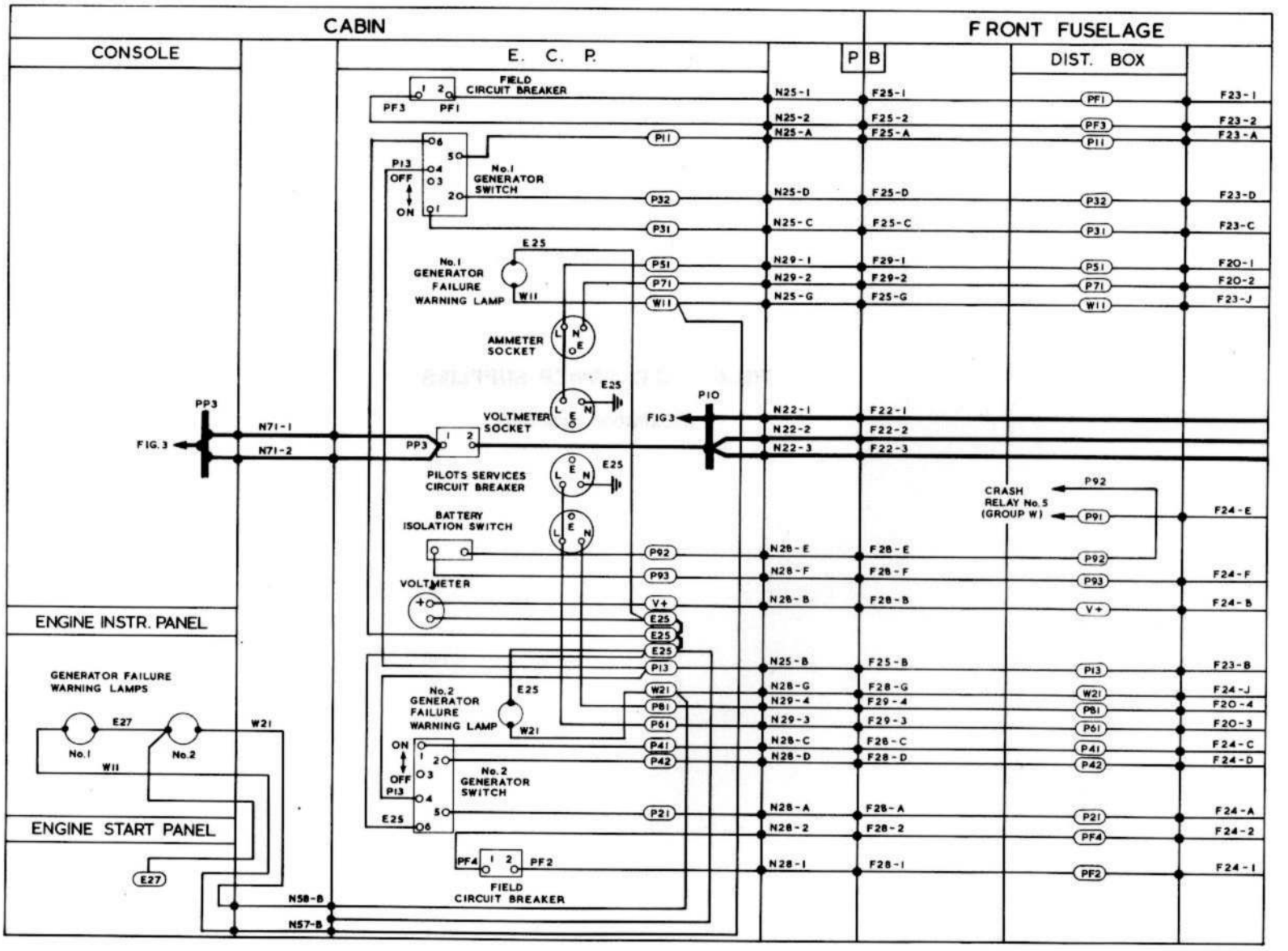

FIG.4. D.C. POWER SUPPLIES

◂ ROUTEING AMENDED ▸

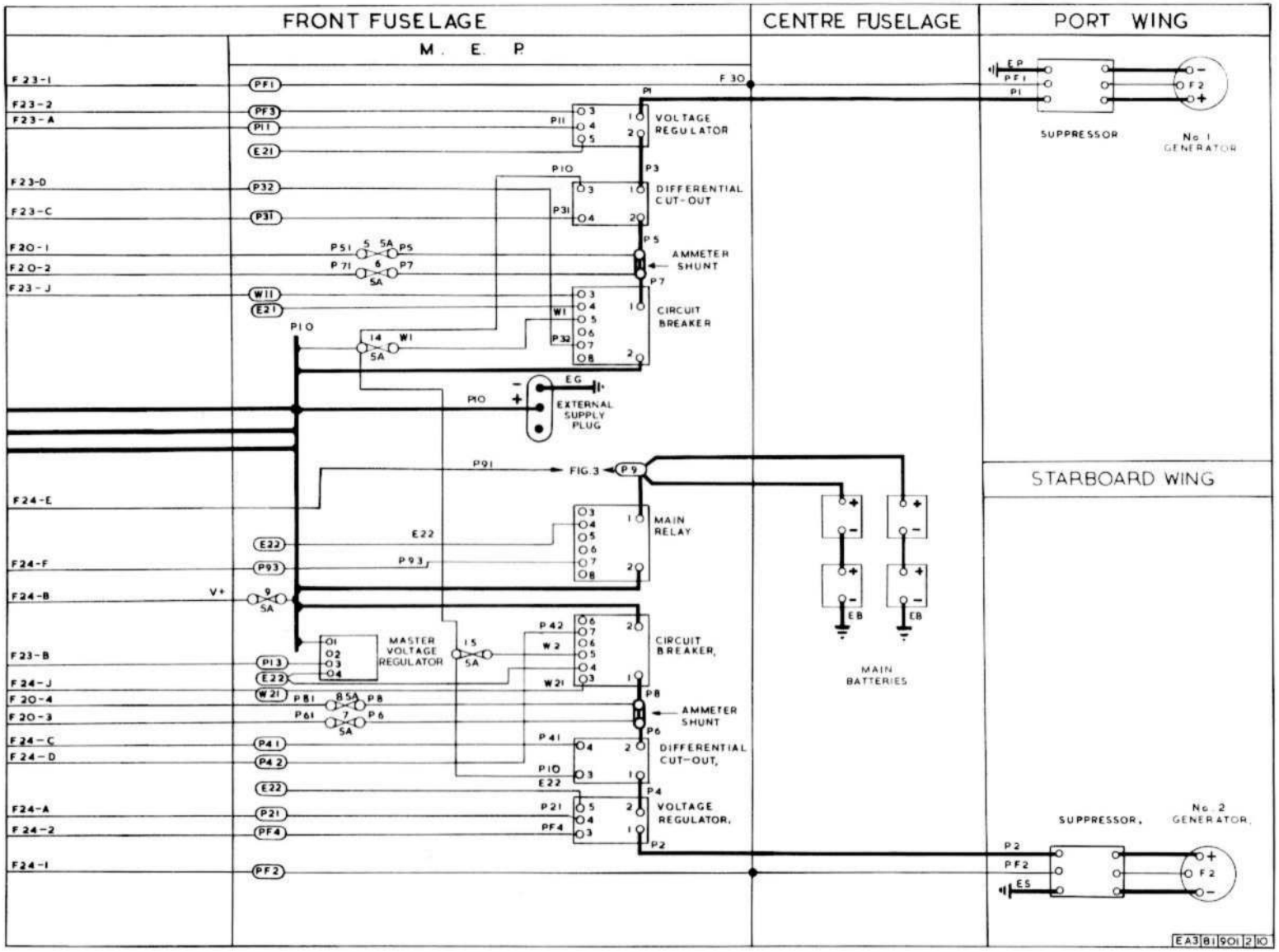

FIG.4A. D.C. POWER SUPPLIES

FUEL PUMPS AND COCKS - GROUP Q

(completely revised)

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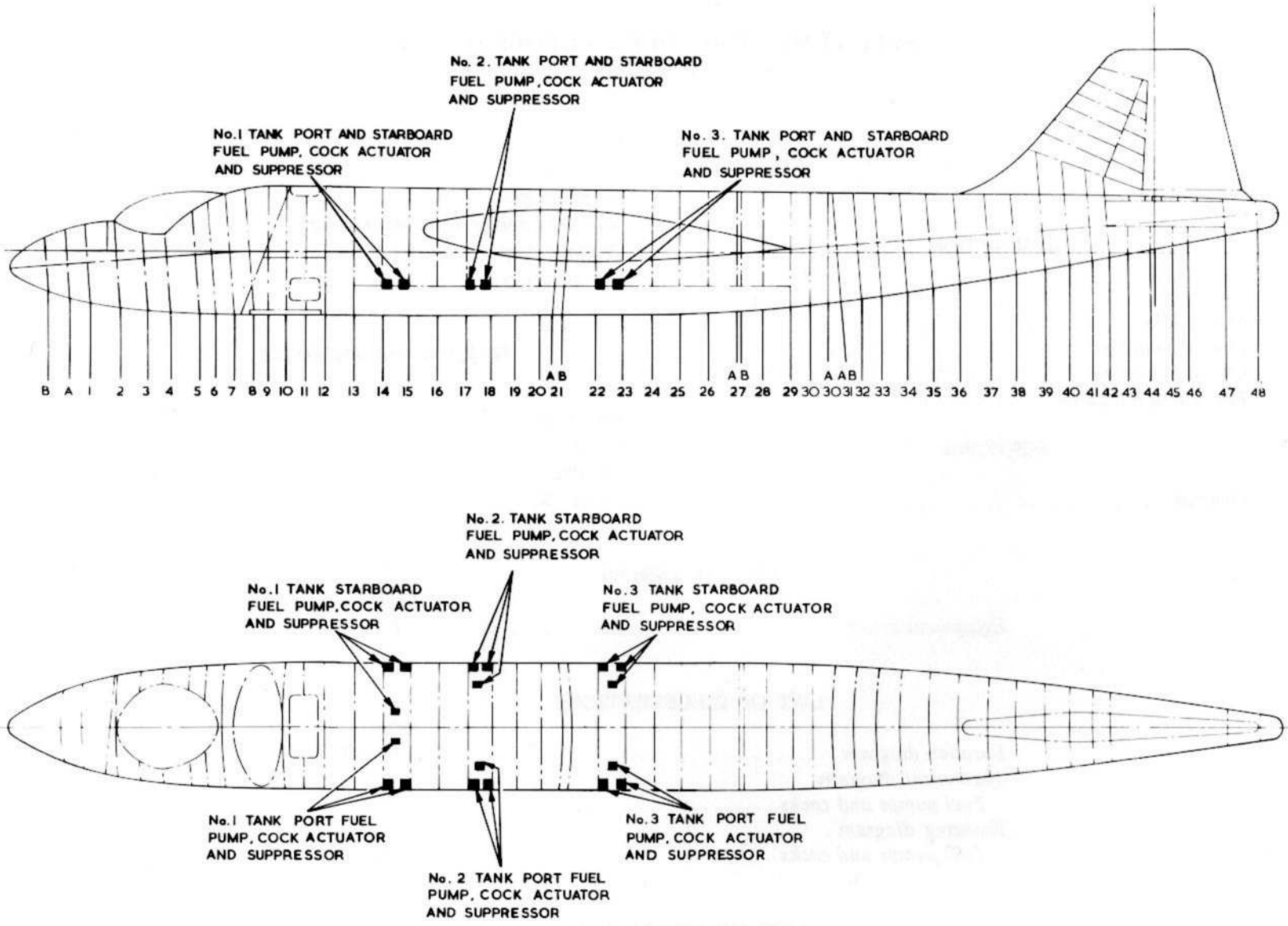
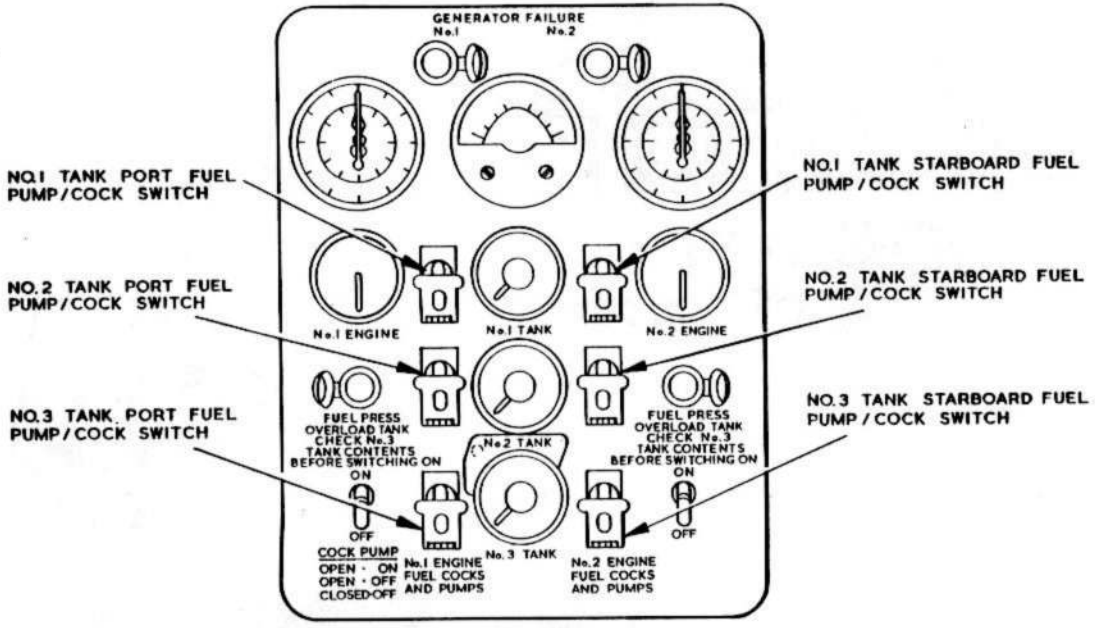


FIG. 1. LOCATION DIAGRAM

UK RESTRICTED



ENGINE INSTRUMENT PANEL
PILOT'S STATION

FIG.1A. LOCATION DIAGRAM

◀ PANEL AMENDED ▶

UK RESTRICTED

UK RESTRICTED

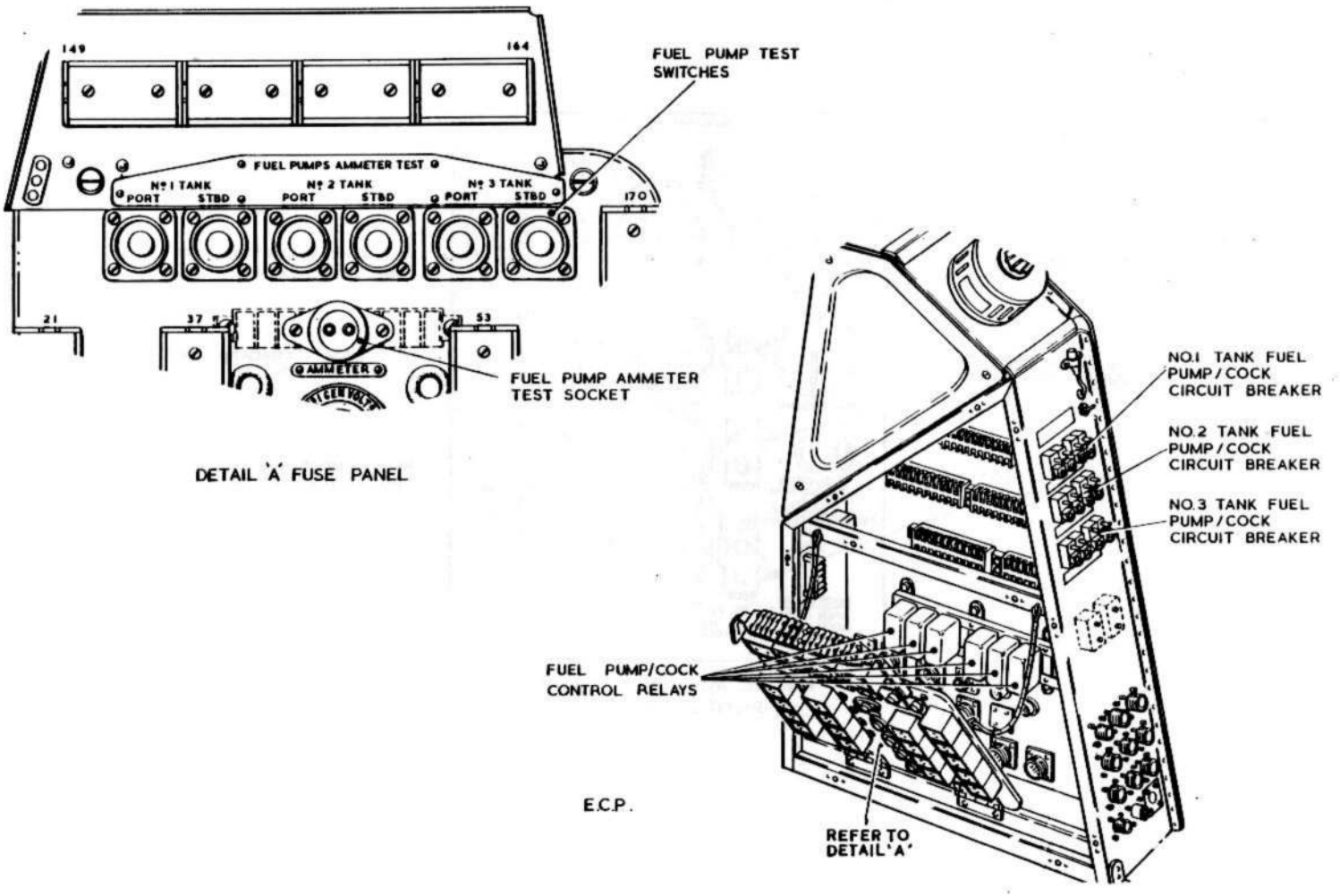


FIG. 1B . LOCATION DIAGRAM

Introduction

1. This group gives a description of, and the circuit and routeing diagrams for the fuel pumps and cocks. Table 1 provides a list of the main components, their reference/part numbers and where possible the A.P. in which they are described. The location of the main components and the circuit switches are shown in fig.1-1A-1B.

DESCRIPTION

General

2. Three fuel tanks are permanently installed in the aircraft in the compartment above the bomb bay. The tanks are fitted with electrically-driven immersed fuel pumps, the power supply to each passing through an interference suppressor. Fuel delivery from the pumps is controlled by electrically actuated cocks. Provision is also made to mount a jettisonable fuel tank below each wing tip but these tanks are without pumps or cocks.

Main tanks

3. The main tanks, numbered 1, 2 and 3 from the forward end of the aircraft, are each fitted with two fuel pumps which project into the base of the tank through adapter plates in the roof of the bomb bay. The pumps are positioned port and starboard and near to each is a fuel cock which is operated by a rotary actuator.

Control switches

4. Each pump and its associated cock circuit is jointly controlled by one of six switches on the engine instrument panel.

5. The three-position switches permit selective control of each cock with or without the operation of its associated pump. Selecting a switch to the top position gives pump on-cock open, the mid-position pump off-cock open, and the down position, pump off-cock closed. These switches are fitted with spring-operated guard plates which have to be lifted to select pumps off-cocks closed.

Circuit protection

6. Each pump and cock circuit is protected by a circuit breaker mounted on the forward face of the E.C.P. The circuit breakers servicing the pump circuits are rated at 15 amp and those for the cocks 5 amp. The relay in each cock control circuit is protected by a 5 amp fuse fitted in the E.C.P.

Fuel pump test panel

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

SERVICING

WARNING

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

General

8. 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

9. The following describes the procedure for checking the operation and current consumption of the fuel pumps.

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

(2) Ensure that the pump and cock switches on the engine instrument panel are in the mid position.

(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.

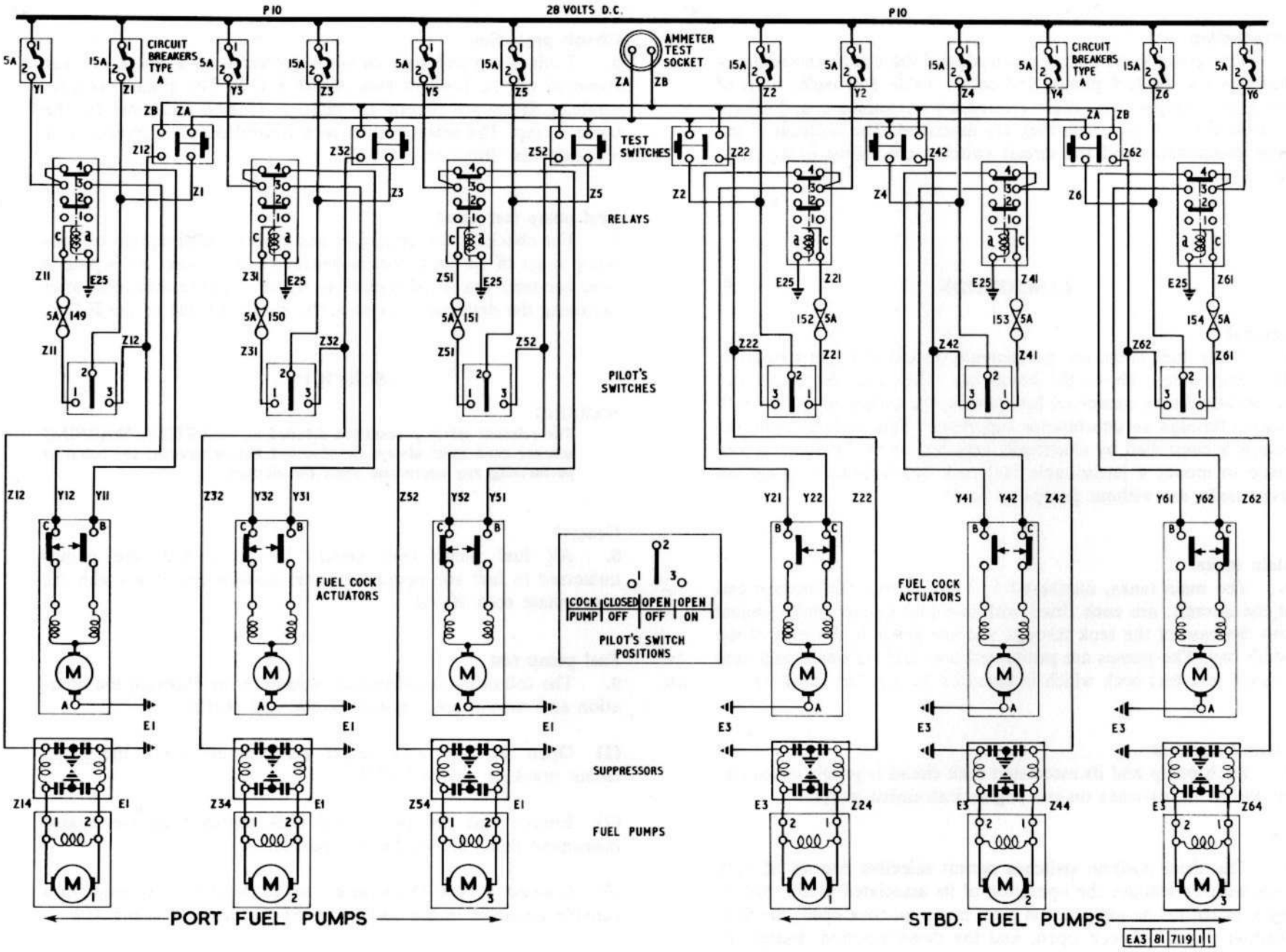


FIG.2.FUEL PUMPS AND COCKS

10. When operating with 24 volts at its terminals, the pump should take a maximum current of 11.5 amp when sustaining a no-flow pressure of 16.5 lb/in^2.

Interpretation of testmeter readings

11.

(1) A steady reading not exceeding the current consumption figures given in para.10 with their relevant test voltages will indicate that a pump is serviceable. Pumps showing appreciably higher current figures than these are suspect and should be replaced.

(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

12. The test voltage given in para.10 as 24 volts 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 the No.1, 2 and 3 fuselage tanks is approximately 1.25 volts, 1.75 volts and 2 volts respectively. This voltage drop should be allowed for when making tests.

Cock actuators

13. The cock assemblies incorporate Type 200 actuators. 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

14. A fault on the pump motor necessitates the removal of the complete pump assembly. Instructions covering this procedure are given in A.P.101B-0402-1A, Sect.4, Chap.2.

Actuators

Removal

15.

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

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

(3) Remove the actuator.

Assembly

16.

(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.

TABLE 1

Equipment details

Ref. No.	Equipment	Quantity	Relevant A.P.
	Cock actuator, Type 201, Mk.8 comprising:-	6	
5W/4511895	Actuator, Type 200, Mk.1	–	113E-0248-1
5W/337	Adapter assembly	–	
27FS/2206	Fuel cock	–	
5UE/9104	Pump, Type SPE 1003, Mk.4	6	113E-0438-1

FIG.3 FUELS PUMPS AND COCKS

(illustration overleaf)

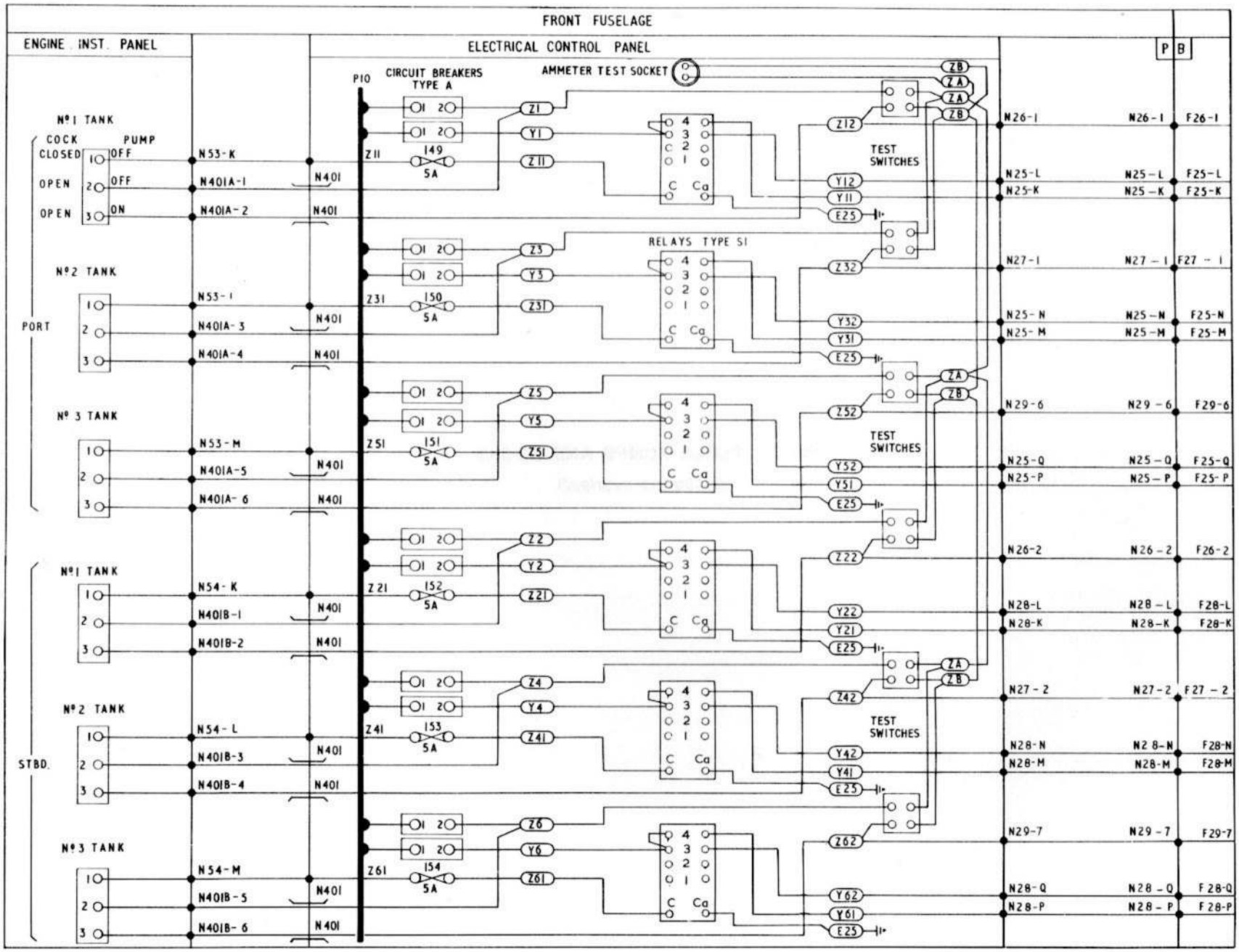


FIG.3. FUEL PUMPS AND COCKS

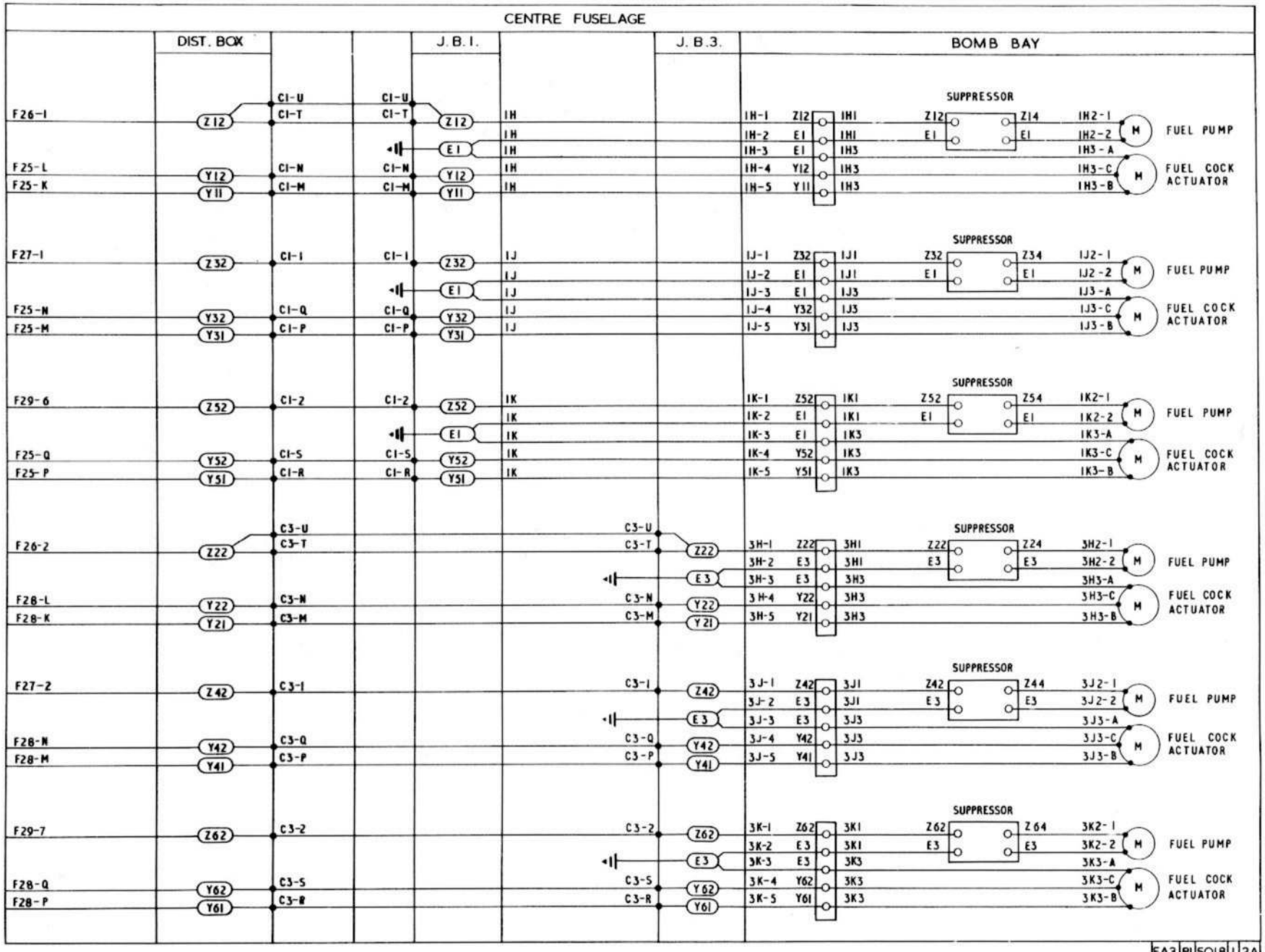


FIG. 3A. FUEL PUMPS AND COCKS

Appendix 1 FUEL PUMPS AND COCKS – OVERLOAD TANKS (post Mod.1490 and 432 or 3757)

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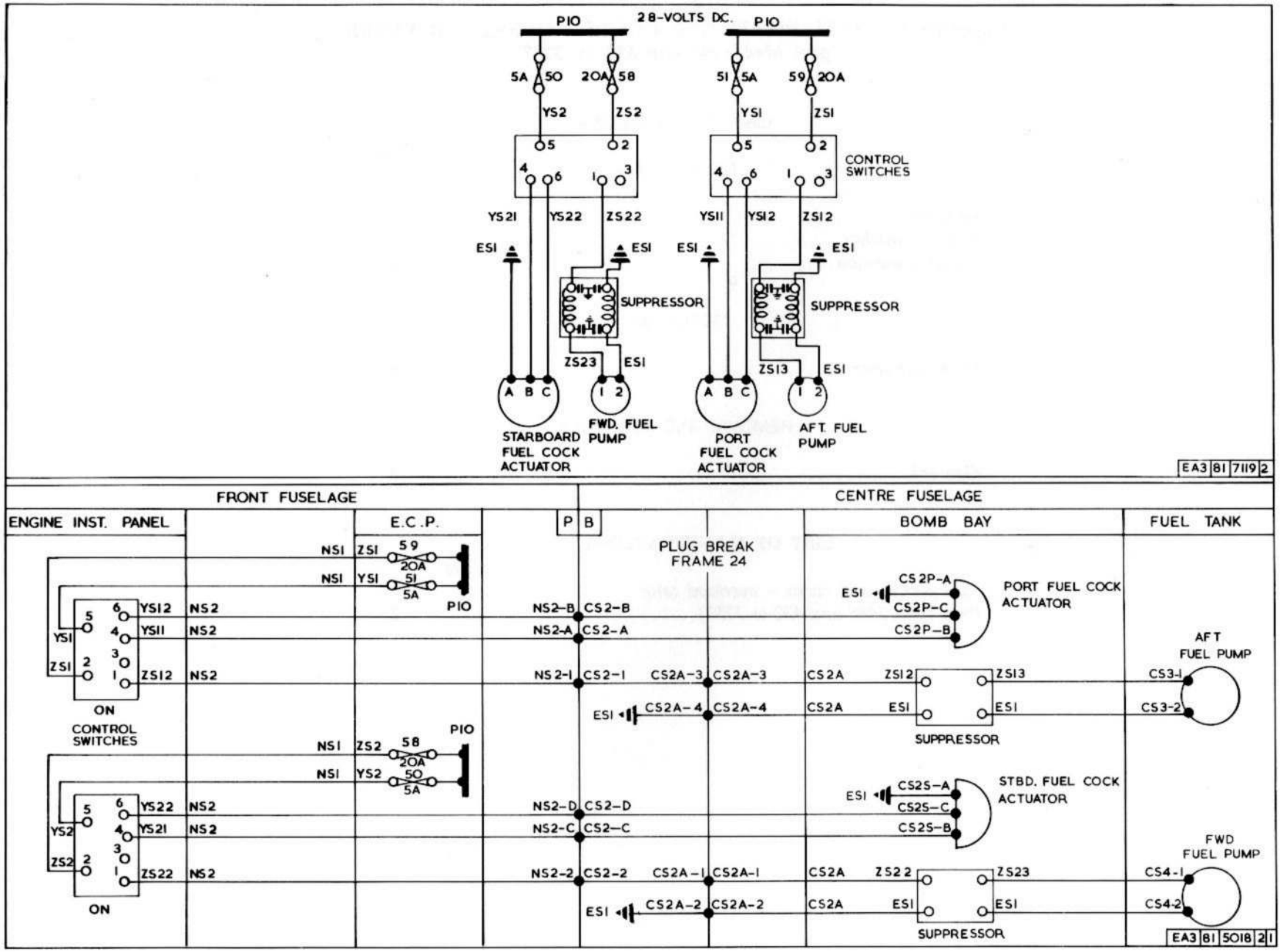

FIG. 1, FUEL PUMPS AND COCKS – OVERLOAD TANK (POST MOD 1490 AND 432 OR 3757)

DESCRIPTION

General

1. On aircraft Post Mod.1490 provision is made to install an auxiliary fuel tank *(Mod.432 or 3757)* in the bomb bay.

2. Two fuel pumps are fitted to the tank and two fuel cocks, operated by rotary actuators, control the fuel delivery from the pumps. The cocks, and the suppressors used in the pump control circuits, are permanent fixtures and are located at the port and starboard side of the bomb bay roof between frames 25 and 26.

3. The circuit and routeing diagram for the pumps and cocks is shown in fig.1.

Control switches

4. Two switches, labelled OVERLOAD TANK ON-OFF, located on the engine instrument panel adjacent to the No.3 tank port and starboard pump/cock switches *(main chapter)* control the overload tank fuel pumps and cocks. Each switch jointly controls the operation of its respective pump and associated cock actuator.

Circuit protection

5. The circuit to each individual pump and cock is protected by a fuse in the E.C.P.

SERVICING

Cock actuators

6. Servicing of the cock actuators is as detailed in the main chapter.

REMOVAL AND ASSEMBLY

General

7. Removal and assembly of the fuel pumps and cock actuators is as detailed in the main chapter.

RADIO AND RADAR POWER SUPPLIES – GROUP R & S

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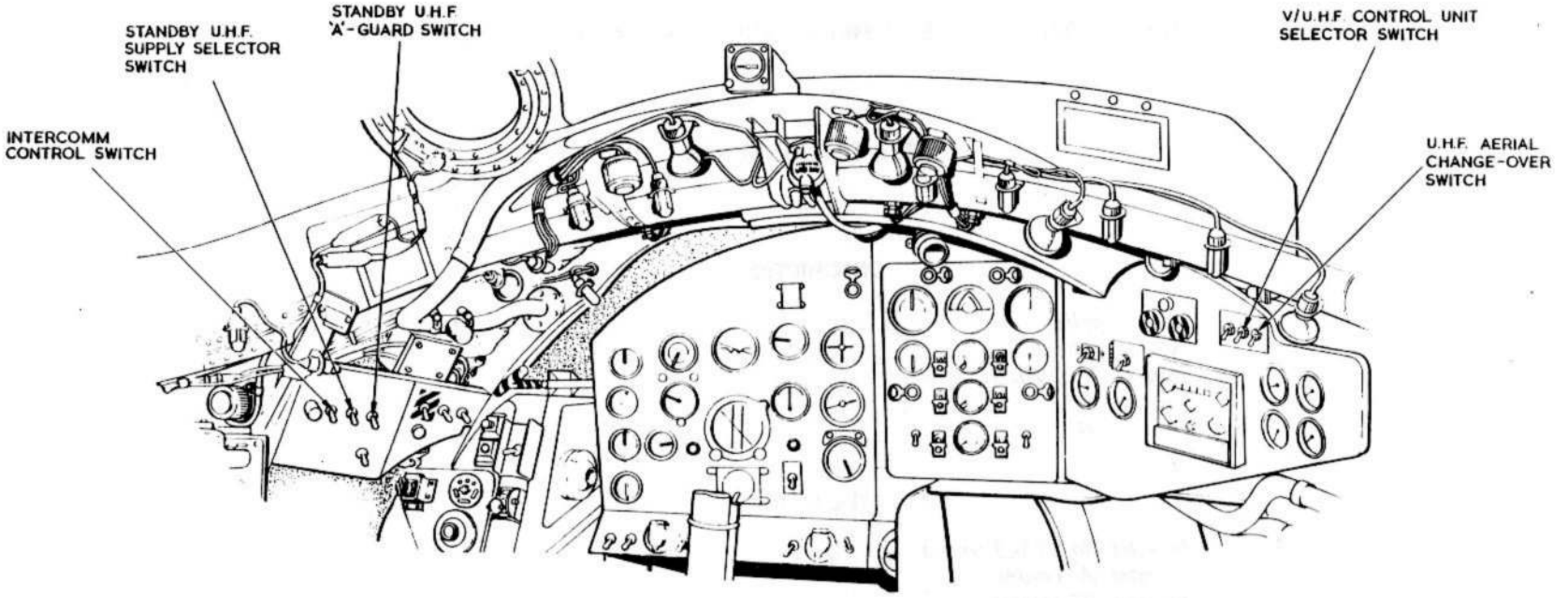
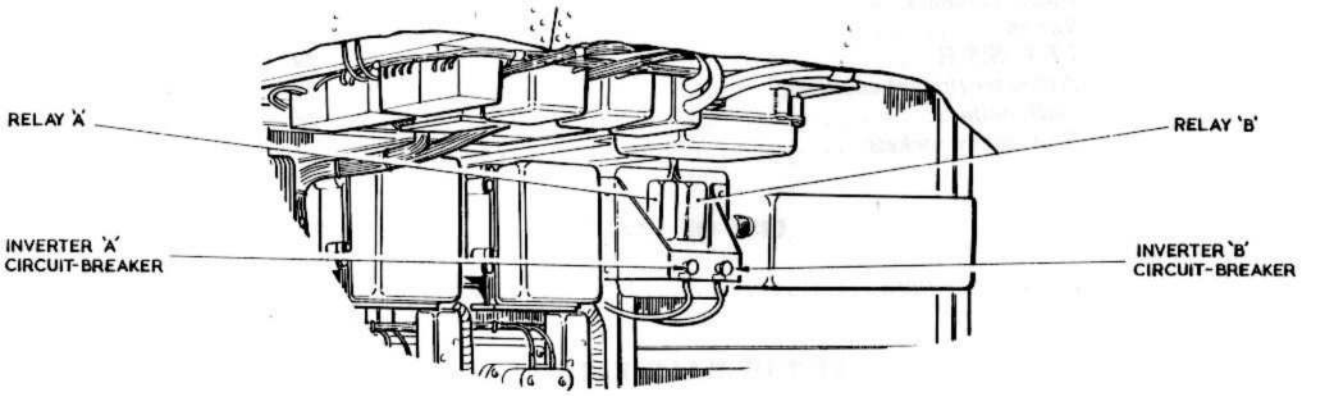


PILOT'S STATION



STARBOARD EQUIPMENT COMPARTMENT

FIG. I. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

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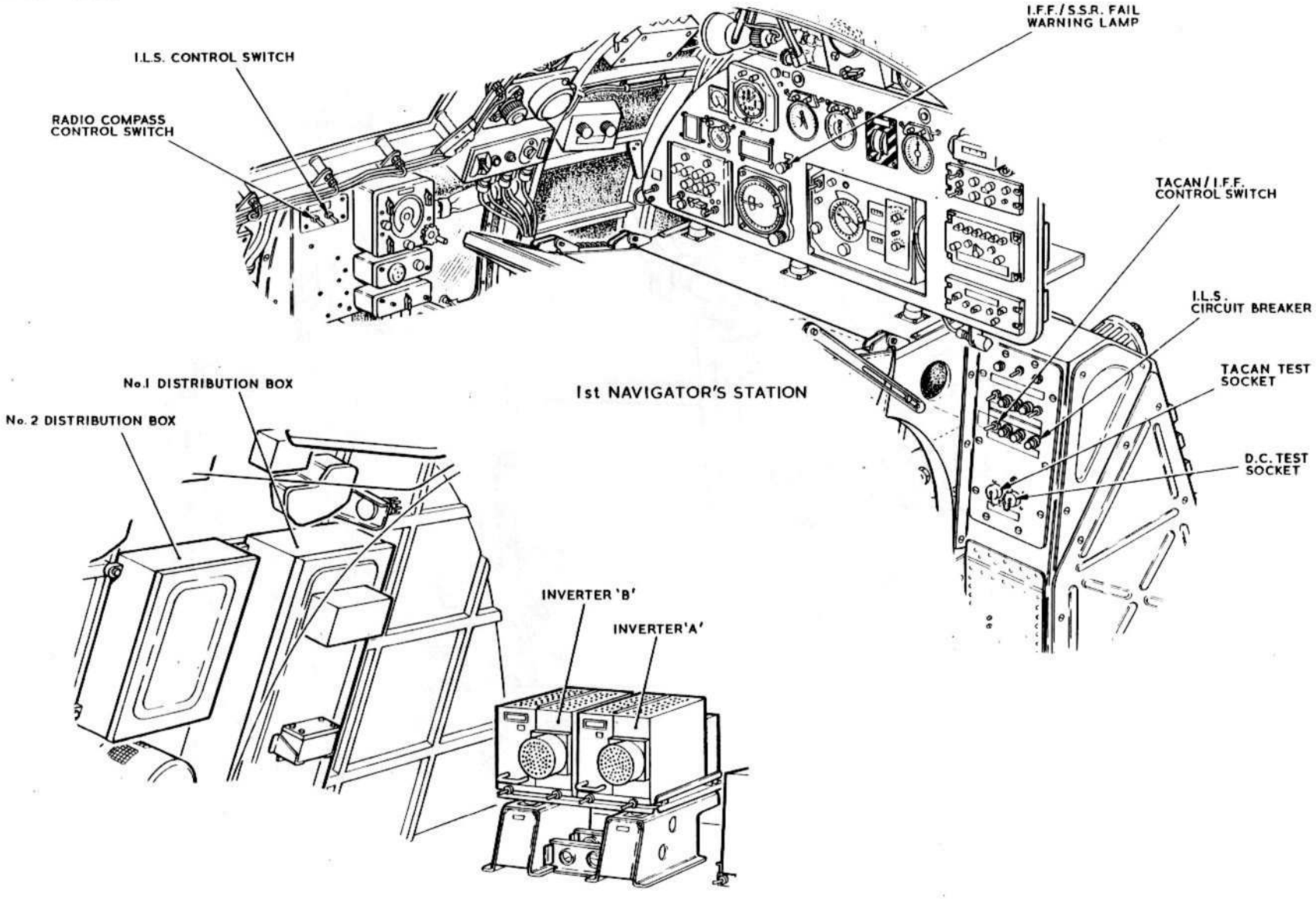
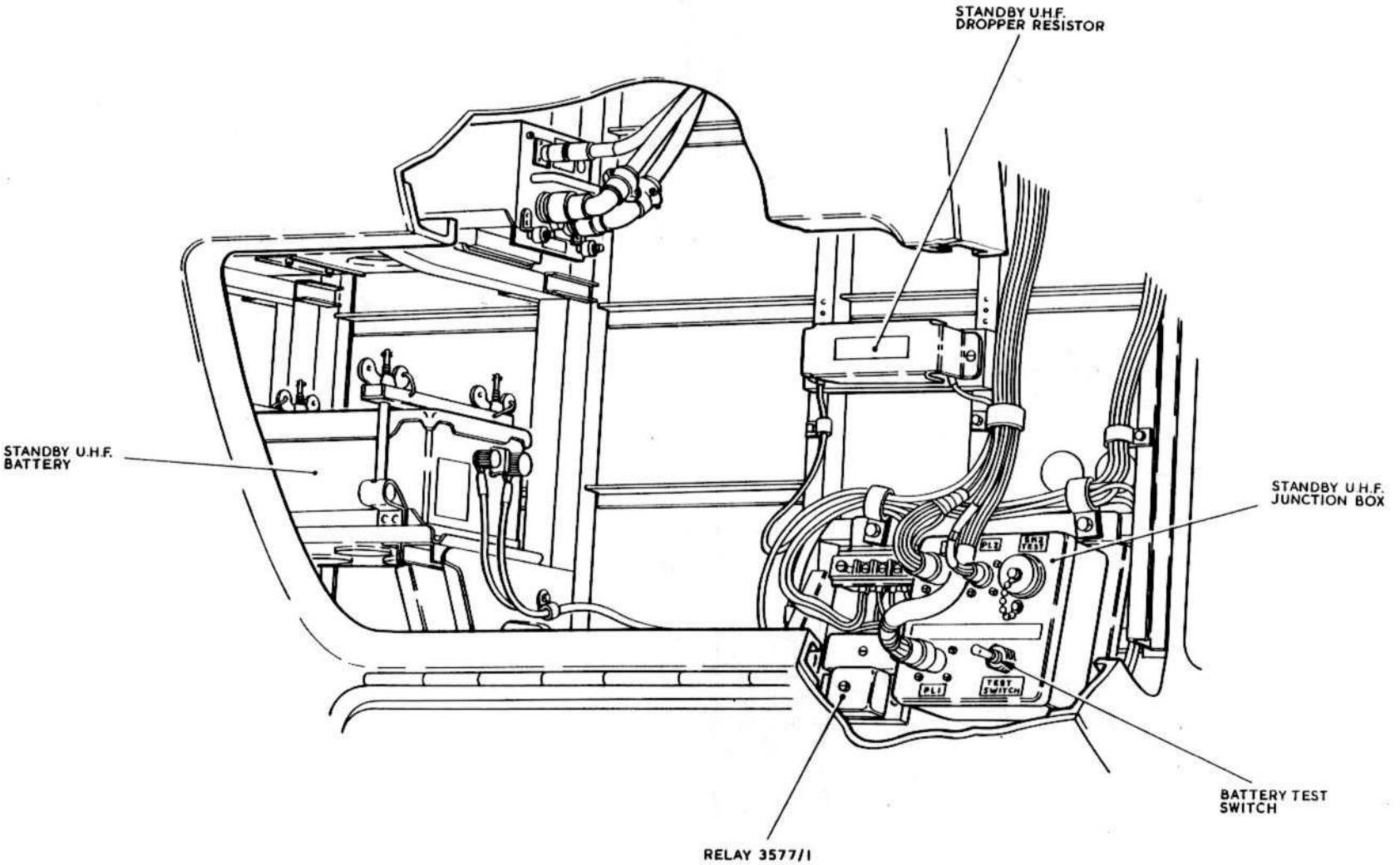


FIG.IA. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

UK RESTRICTED



PORT EQUIPMENT COMPARTMENT

FIG.1B. LOCATION DIAGRAM

Introduction

1. This group gives a description of, and provides the circuit and routeing diagrams for the 28 volt d.c. and 115 volt, 400 Hz, single and three-phase a.c. supplies required to operate the radio and radar systems. Table 1 provides a list of the main components, their reference/part numbers and where possible the Air Publication in which they are described. Location of the components and circuit switches are shown in fig.1-1A-1B.

DESCRIPTION

D.C. supplies

2. The 28 volt d.c. supplies required by the various systems are drawn from busbar P10 of the normal d.c. supplies system described in Group P.

A.C. supplies

3. The 115 volt, 400 Hz a.c. supplies are drawn from the No.2/No.3 inverter *(Group D)* or from two, Type 208, static inverters, designated 'A' and 'B', located in the upper equipment compartment.

Inverter No.2/No.3

4. The No.2 inverter provides the 115 volt, 400 Hz, three-phase a.c. power supply for the radio compass. In the event of No.2 inverter failure the power supplies are transferred to the No.3 inverter as described in Group D.

Inverter 'A'

5. Inverter 'A', which is controlled by a circuit breaker and relay on the M.E.P. and a control switch, annotated TACAN/IFF OFF-NORM-C/O on the E.C.P. switch panel, provides the 115 volt, 400 Hz, single-phase a.c. supplies for the TACAN system.

Inverter 'B'

6. Inverter 'B' which is also controlled by a circuit breaker and relay on the M.E.P. and the control switch, annotated TACAN/IFF OFF-NORM-C/O, on the E.C.P. switch panel, provides the 115 volt, 400 Hz, single-phase a.c. supplies for the I.F.F./S.S.R. system.

OPERATION

Inverter No.2/No.3 control

7. The operation of the No.2 and No.3 inverters and associated circuits are fully described in Group D.

Inverter 'A' control

8. When the INV 'A' circuit breaker on the M.E.P. is closed, a 28 volt d.c. supply from busbar P10 is completed to one contact of the inverter control relay, also on the M.E.P. Operation of the TACAN/IFF control switch, on the E.C.P. switch panel, to NORM completes a 28 volt d.c. supply from busbar P10 to energize the coil of the relay and its contacts close completing the input circuit to the inverter. The output from the inverter is routed via circuit TF1, the normally-closed contacts of relay No.6, in the No.2 distribution box, and TF3 to the TACAN system.

Inverter 'B' control

9. The operation of inverter 'B' is identical to that described in para.8 with the exception that the INV 'B' circuit breaker on the M.E.P. must be closed and the output from the inverter is routed via circuit TF2, the contacts of relay No.6 and TF4 to the height encoding system *(Group D)*, and via relay No.7 and TF5, to the IFF/SSR system.

Inverter change-over

10. As inverter 'A' normally provides the a.c. supplies for the TACAN system and inverter 'B' normally provides the a.c. supplies for the IFF/SSR system failure of one inverter will result in the loss of the associated system.

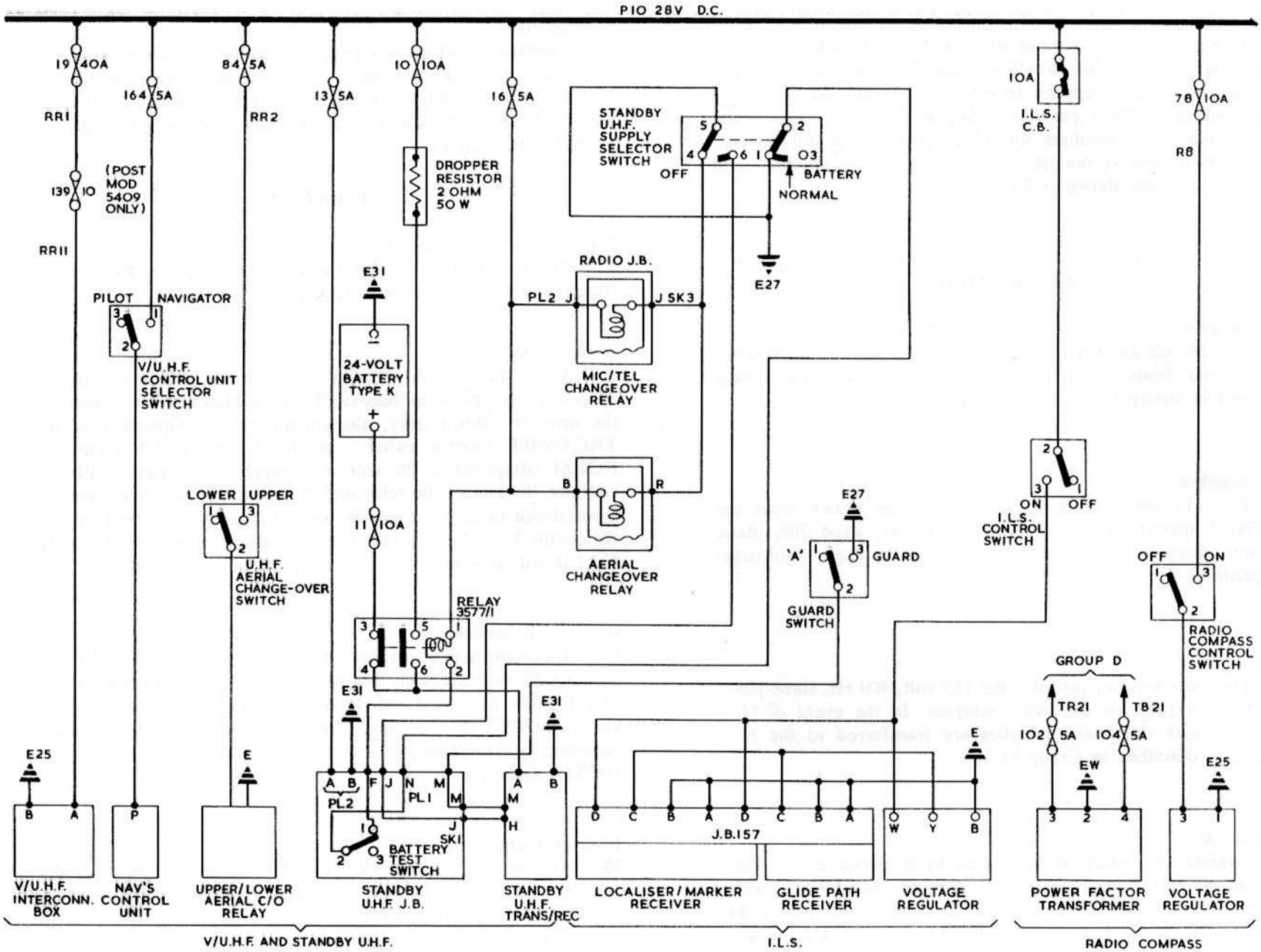


FIG.2. RADIO AND RADAR POWER SUPPLIES

◄ MOD. 5409 EMBODIED ►

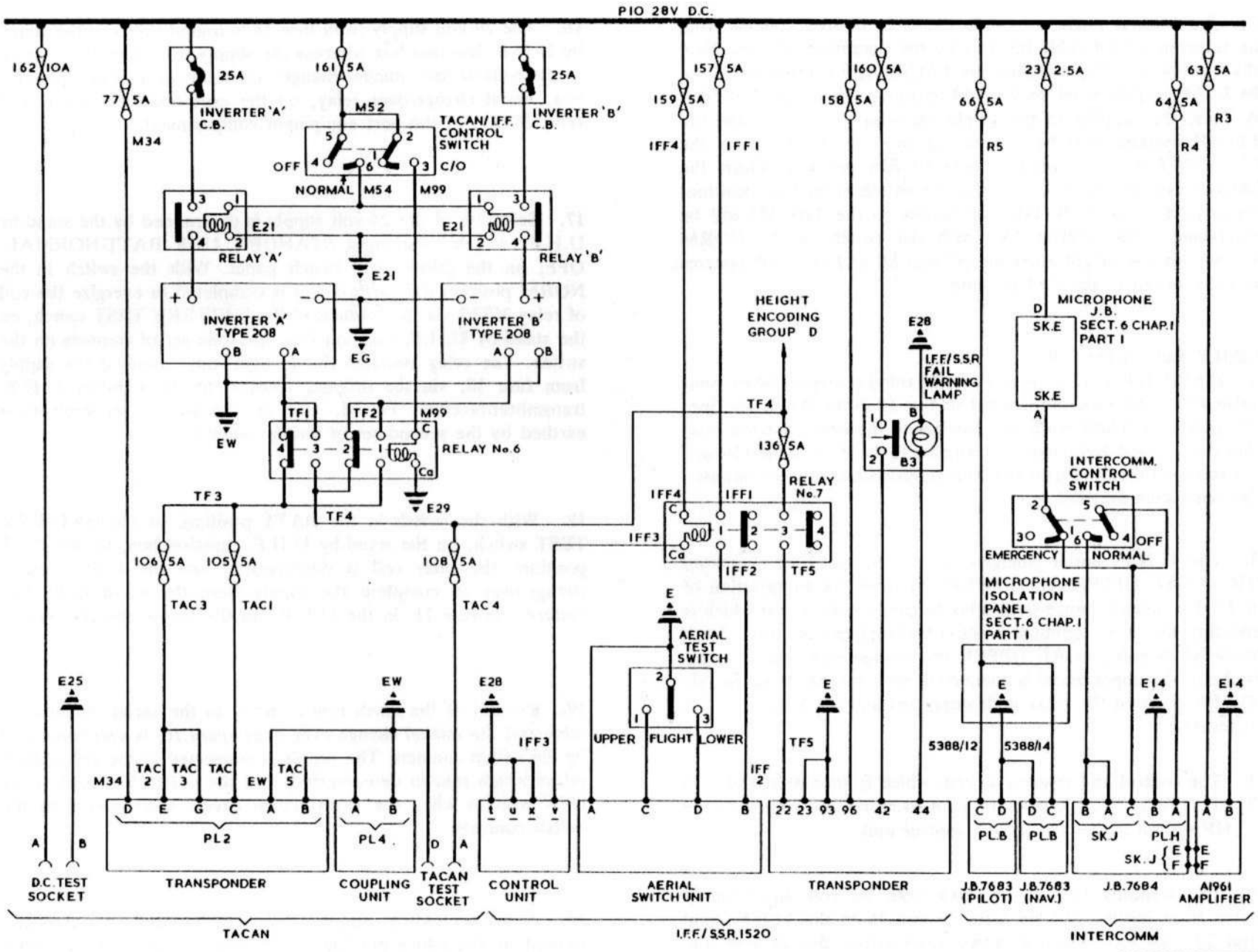


FIG.2A. RADIO AND RADAR POWER SUPPLIES

EA3	81	8113	2
EA3	81	8311	2 1

11. Provision is made to supply the most desired systems from the remaining serviceable inverter by the operation of relay No.6 which is energized by selecting the TACAN/IFF control switch, on the E.C.P. switch panel, to the C/O position. Therefore, if inverter 'A' fails, the supplies to the height encoding *(Group D)* and the IFF/SSR systems will be maintained by inverter 'B', with the TACAN/IFF control switch in the NORM position, whilst the TACAN can be supplied by placing the switch in the C/O position; similarly, if inverter 'B' fails the supply to the TACAN will be maintained from inverter 'A', with the switch in the NORM position, or the height encoding *(Group D)* and IFF/SSR systems with the switch in the C/O position.

◀ **V/U.H.F. and stand-by U.H.F.**

12. The V/U.H.F. system operates from 28 volt d.c. supplies taken from busbar P10. The main supply is fed via fuse 19 in the M.E.P. and fuse 139 (post mod. 5409) in the rear fuselage to the interconnecting box while fuses 84 and 164 provide the supplies to the U.H.F. aerial change-over and control unit selector switches respectively, located on the miscellaneous instrument panel.▶

13. The U.H.F. aerial change-over switch, which is annotated PTR 175 AE UPPER-AE LOWER, controls the energization of the U.H.F. aerial change-over relay to connect the aerial which is providing the ▶◀ optimum transmitter/receiver operation. With the switch selected to AE UPPER the change-over relay is energized and the upper aerial is connected; with the switch in the AE LOWER position the relay is de-energized and the lower aerial is connected.

14. The control unit selector switch, which is annotated PTR 175 CU PILOT-CU NAV, allows the pilot to switch the control of the V/UHF system to the navigator's control unit.

15. The stand-by U.H.F. operates from 28 volt d.c. supplies drawn from busbar P10 via fuses 13 and 16 in the M.E.P., and from 24 volt d.c. supplies drawn from either the 28 volt d.c. busbar, P10, via fuse 10, in the M.E.P. and a dropper resistor, or from the 24 volt stand-by U.H.F. battery.

16. The 28 volt supply from fuse 13 is routed direct to the stand-by U.H.F. junction box whereas the supply from fuse 16 is routed to the coils of the:- mic/tel change-over relay, in the radio junction box, aerial change-over relay, on the port bomb-bay door, and relay 3577/1, in the port equipment compartment.

17. Selection of the 24 volt supply is determined by the stand-by U.H.F. switch, annotated STANDBY UHF BATT-NORMAL-OFF, on the pilot's port switch panel. With the switch in the NORM position the earth circuit is completed to energize the coil of relay 3577/1 via the contacts of the BATTERY TEST switch, on the stand-by U.H.F. junction box, and one set of contacts on the switch. The relay contacts change-over and complete the supply from fuse 10, via the dropper resistor, to the stand-by U.H.F. transmitter/receiver. Pin H, also on the transmitter/receiver, is earthed by the second set of switch contacts.

18. With the switch in the BATT position, or the BATTERY TEST switch, on the stand-by U.H.F. junction box, in the TEST position, the relay coil is de-energized and the relay contacts change-over to complete the supply from the stand-by U.H.F. battery, via fuse 11, in the M.E.P., to the transmitter/receiver.

19. Control of the earth return circuit to the aerial change-over relay and the mic/tel change-over relay *(para.16)* is also controlled by the switch contacts. The supply is connected to the coil of both relays which remain de-energized until the switch is placed in the OFF position when the earth return circuit is completed by the switch contacts.

20. A further switch, annoted STANDBY UHF 'A' GUARD, located on the pilot's port panel, controls the earth return circuit from the alternative or guard circuits within the transmitter/receiver *(Sect.6, Chap.1, Part 2).*

I.L.S.

21. The I.L.S. system operates from a 28 volt d.c. supply drawn from busbar P10 via the I.L.S. circuit breaker, on the E.C.P. switch panel, and the I.L.S. ON-OFF control switch on the navigator's port panel.

Radio compass

22. The radio compass operates from 115 volt, 400 Hz, three-phase a.c. and 28 volt d.c. supplies. The a.c. supplies are drawn from the output of No.2/No.3 inverter *(Group D)*. The d.c. supply is drawn from busbar P10, via fuse 78, in the E.C.P., and the RADIO COMPASS ON-OFF switch, on the navigator's port panel.

Tacan

23. The Tacan operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply to the transponder is drawn from inverter 'A' via fuses 105 and 106 in the No.1 distribution box. The 28 volt d.c. supply to the transponder is drawn from busbar P10 via fuse 77 in the E.C.P.

I.F.F./S.S.R.

24. The I.F.F./S.S.R. operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply is drawn from inverter 'B' via fuse 136 and is routed to the normally-open contacts of relay No.7 in the No.2 distribution box. The 28 volt d.c. supplies, drawn from busbar P10 via fuses 159 and 157, in the E.C.P., are connected via the relay coil to the control unit and the second set of normally-open contacts on the relay respectively. When the control panel function switch is selected to any position other than OFF the earth circuit to the relay coil is completed and the relay contacts change over, completing the a.c. supply to the transponder and the d.c. supply to the aerial switching unit. The main d.c. supply to the transponder is drawn from busbar P10 via fuse 158 in the E.C.P. A further d.c. supply, drawn from busbar P10 via fuse 160 in the E.C.P., is connected to the IFF FAIL lamp on the navigator's instrument panel. When the lamp is pressed the supply is completed to illuminate the IFF FAIL lamp and the control panel TEST lamp filaments *(Sect.6, Chap.2, Part 1)*.

Altimeters (height encoding)

25. The pilot's and navigator's altimeters *(Group D)*, which form part of the height encoding system, operate from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply is drawn from inverter 'B' via fuse 131, in the No.2 distribution box, whilst the d.c. supplies are drawn from busbar P10 via fuses 155 and 156, in the E.C.P.

Intercomm.

26. The intercomm. system operates from 28 volt d.c. supplies drawn from busbar P10 via fuses 23, 63, 64 and 66, in the E.C.P. The earth return circuit from the system (J.B.7684) and the microphone junction box is controlled by the intercomm. control switch, annotated INTERCOMM OFF-NORM-EMERG, on the pilot's port panel, when in the NORM or EMERG positions.

Test supply sockets

27. The radio/radar systems test equipment can be connected to a 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. test supply sockets located on the aft face of the E.C.P. The a.c. test supply is drawn from inverter 'B' via fuse 108 in the No.1 distribution box and is routed to the socket annotated TACAN TEST SKT whilst the d.c. supply is drawn from busbar P10 via fuse 162 in the E.C.P. and is routed to the socket annotated D.C. TEST SKT.

28. The height encoding system *(Group D)* test equipment can be connected to a 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. test sockets located on the IFF panel in the rear fuselage. The a.c. test supply is drawn from inverter 'B' via fuse No.132 in the No.2 distribution box, whilst the d.c. test supply is drawn from busbar P10 via fuse 44, in the E.C.P.

TABLE 1

Equipment details

Ref./Part No.	Equipment	Quantity	Relevant A.P.
5UB/1959028	Inverter, Type 208	2	113D series
5UB/1959029	Mounting tray	2	
5CW/9994741	Relay, Type A (Plessey)	2	113D-1313-1
5CW/6453	Relay, Type 9B-2A	1	113D-1328-1
5CW/6717	Relay, Type S7	2	113D-1309-1
5J/1115903	Battery, nickel-cadmium, Type K	1	113C-0303-1

FIG.3 RADIO AND RADAR POWER SUPPLIES
(illustration overleaf)

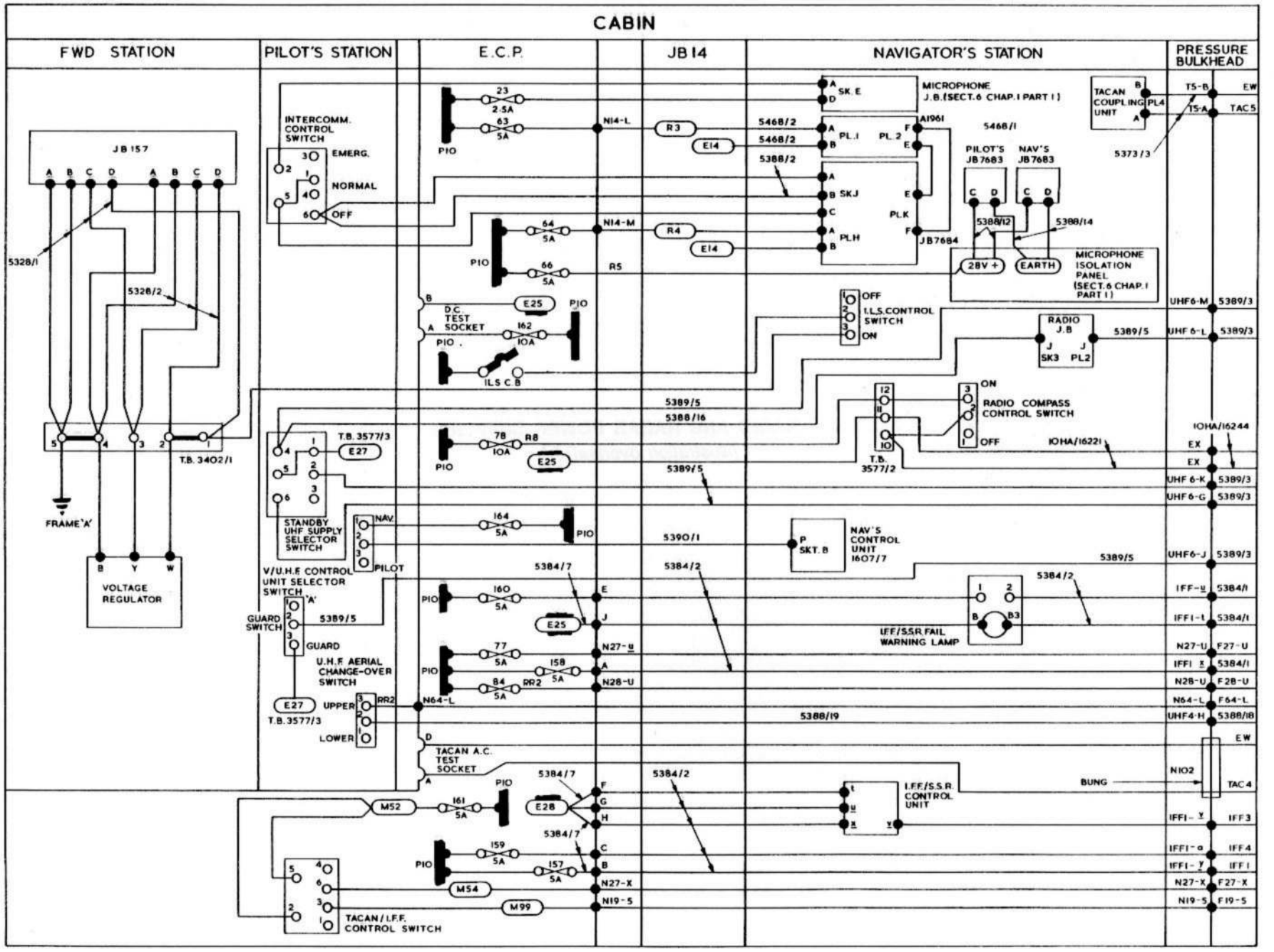


FIG.3.RADIO AND RADAR POWER SUPPLIES

◀ ANNOTATIONS AMENDED ▶

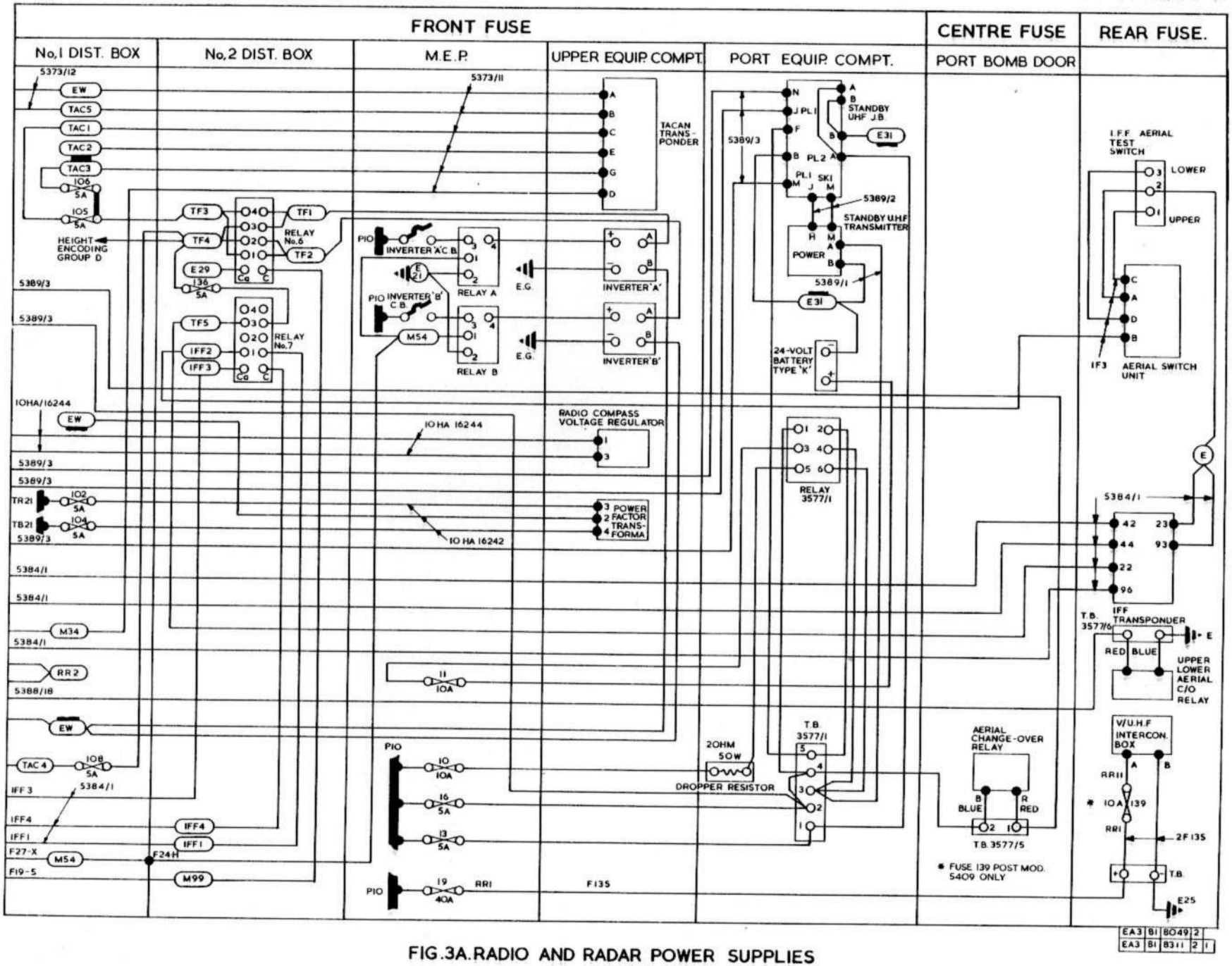


FIG.3A. RADIO AND RADAR POWER SUPPLIES

◄ MOD. 5409 EMBODIED ►

WARNING AND EMERGENCY – GROUP W

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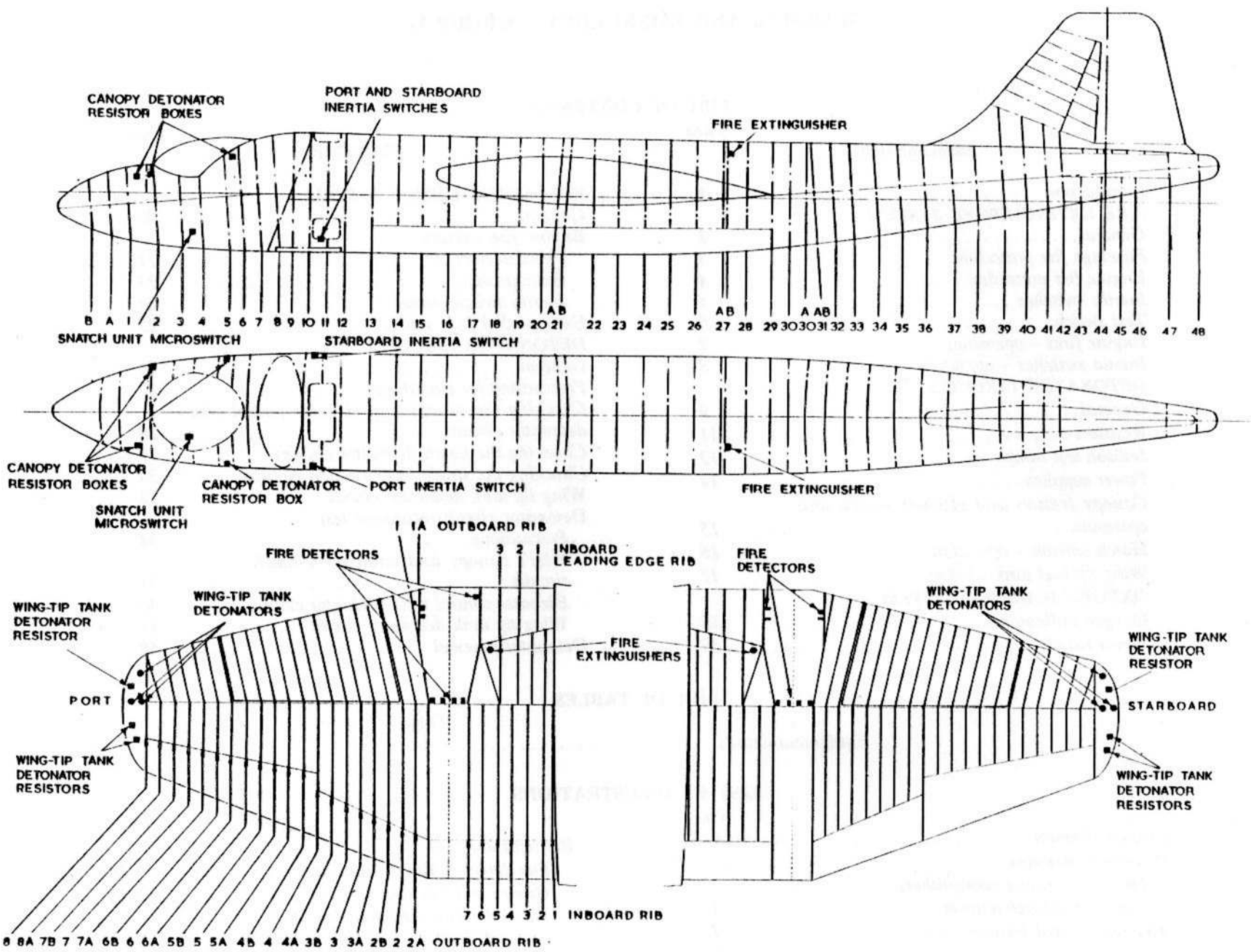

FIG. 1. LOCATION DIAGRAM

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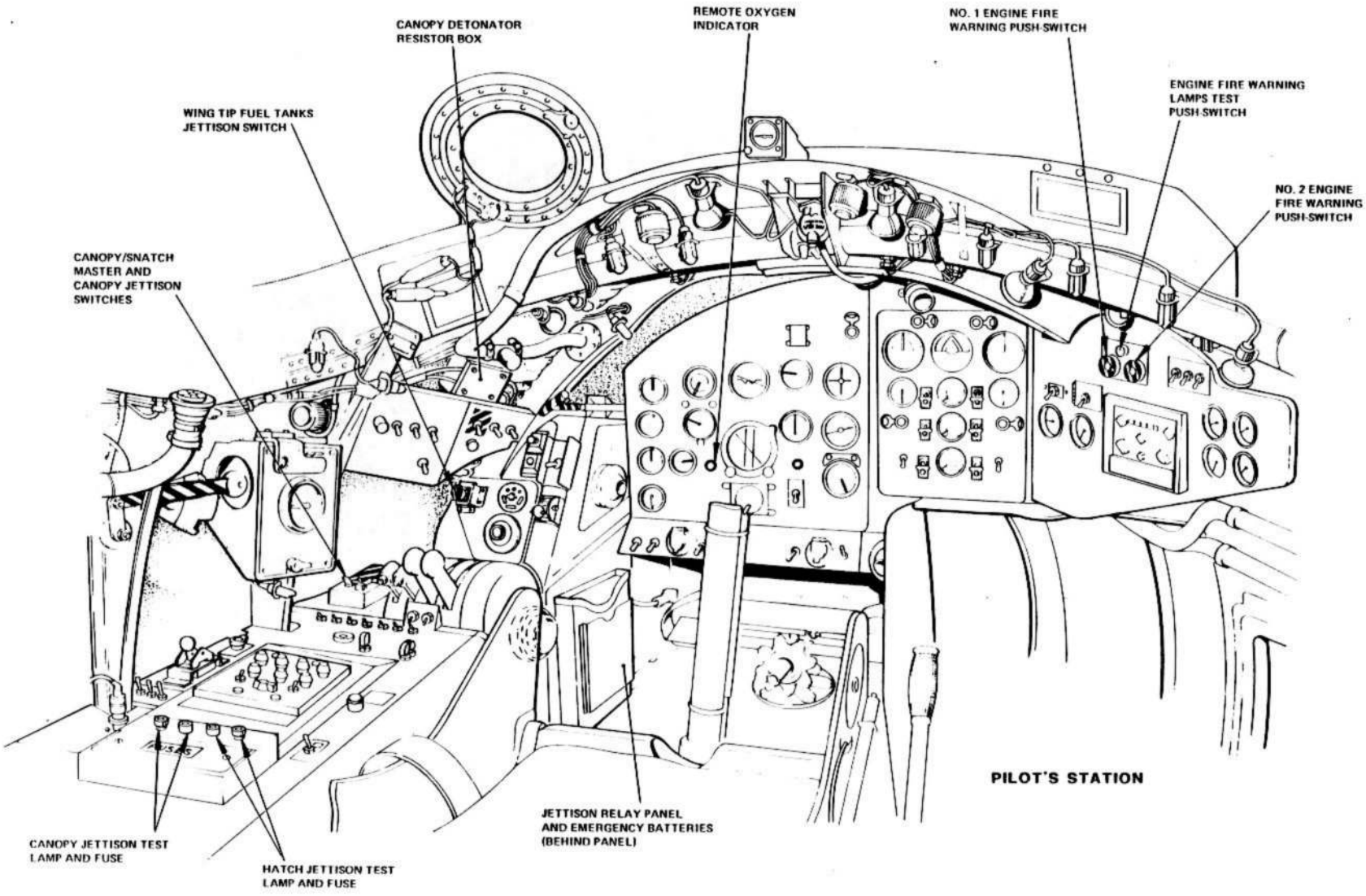

FIG. 1A. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

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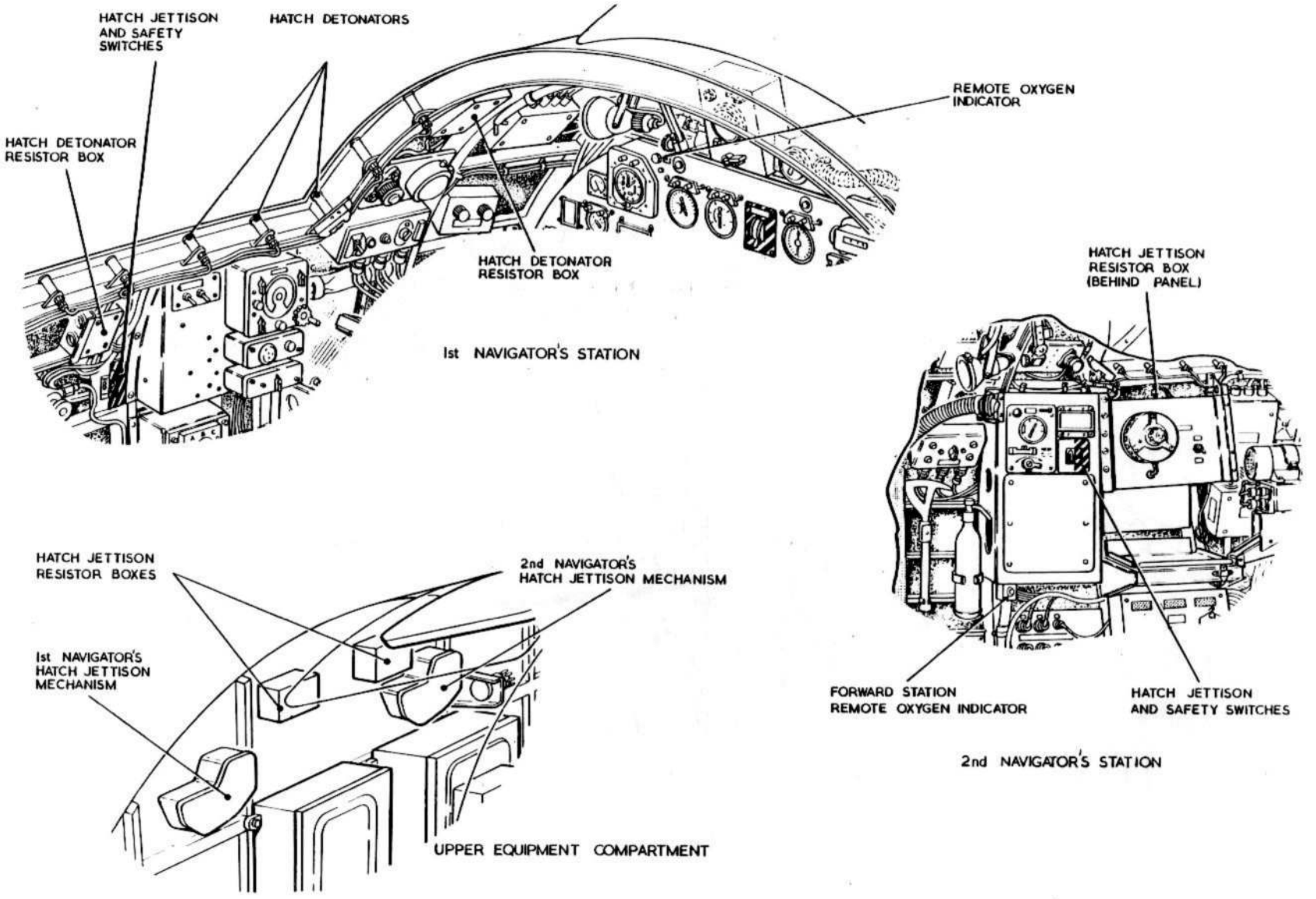

FIG.IB. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

DESCRIPTION

Introduction

1. This group gives a description of, and provides the circuit and routeing diagrams for the warning and emergency services in the aircraft. Table 1 forms a list of the principal components of the system together with their reference/part numbers and the A.P. in which they are described. The location of the components and the circuit switches are shown in fig.1-1A-1B. Further information on the fire extinguisher system can be found in A.P.101B-0402-1A, Sect.4, Chap.5.

FIRE EXTINGUISHER SYSTEM

General

2. A fire extinguisher system is provided for the protection of the engines and, in the event of a crash landing, also the fuselage fuel tanks. Two Type 14A (or Type 138A) extinguishers, are installed one in each main wheel well. 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. A Type 12A (or Type 89A) extinguisher, with a single operating head, is located on the aft face of frame 27A in the rear fuselage and is connected into the fuselage fuel tank spray pipeline. This extinguisher only operates after the inertia switches have operated during a crash landing. Indication of fire in the engine bays is given by warning lamps integral with extinguisher push button switches on the miscellaneous instrument panel. The warning lamps are operated by fire detectors fitted in the engine bays. An inertia switch circuit provides for the automatic discharge of all bottle in the event of a crash landing.

Fuselage fire protection

3. The fuselage fuel tanks are protected by one head of the engine dual head extinguishers and the extinguisher on frame 27A. The extinguishers only operate after the inertia switches have tripped in a crash landing.

Engine fire protection

4. Fifteen series 5 resetting-type detectors are used for engine fire protection, seven being installed in No.1 engine bay and eight in No.2 engine bay. The detectors in each group are connected in parallel. This type of detector comprises a base in which is fitted a terminal block, and an alloy-steel barrel housing a spring bow assembly carrying a pair of switch contacts connected in the warning lamp circuit 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 operate the warning lamp. When the temperature falls and the barrel contracts, the switch contacts automatically re-open and extinguish the warning light.

Inertia switches

5. Two Mk.1 piston-type inertia switches 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 the crash relay, No.5, in the No.1 distribution box.

Test switch

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

Engine fires – operation

7. 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 No.1 engine bay which results in operation of one or more of the resetting switches completes the circuit between X3 (fuse 71) and X31, causing the No.1 engine fire warning lamp to light. Similarly if the No.2 engine detector switches should operate, the circuit X4 (fuse 72) and X41 is completed, causing the No.2 engine fire warning lamp to light. If indication of fire is given by the lamp in the No.1 engine fire switch, pushing the switch knob will pass a supply from circuit X1P (fuse 74) to X13 to discharge one head of the port Type 14A

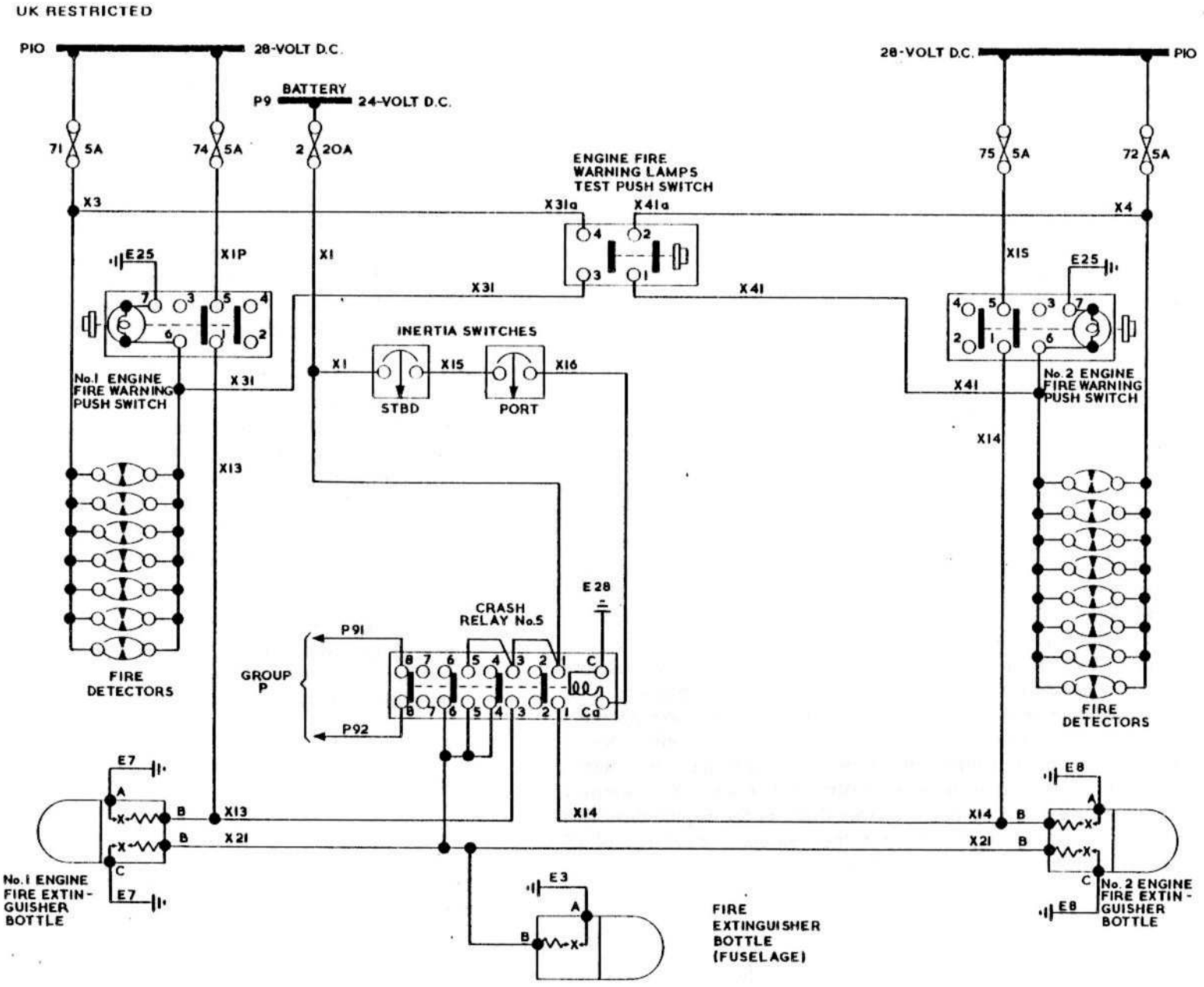

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FIG.2. FIRE DETECTORS AND EXTINGUISHERS

or Type 138A extinguisher into the No.1 engine bay. On a similar indication being given by the No.2 engine fire warning lamp, the operation of the No.2 switch knob completes the circuit X1S (fuse 75) and X14 to discharge one head of the starboard Type 14A or Type 138A extinguisher into the No.2 engine bay.

Inertia switches - operation

8. If both inertia switches trip during a crash landing, a supply is fed from X1 (fuse No.2) via the starboard inertia switch, X15, the port inertia switch and X16 to energize the crash relay, No.5, the circuit being completed to earth through E28. This action causes the following events to occur simultaneously:-

(1) The Type 12A or Type 89A extinguisher at frame 27A discharges into the fuselage.

(2) One operating head of the Type 14A or Type 138A extinguishers in the main wheel wells, discharges into the engine bays and the other discharges into the fuel bay in the fuselage.

(3) The crash relay, No.5 breaks circuit P91-P92-P93 to de-energize the battery isolation relay *(Group P)*. This disconnects the main battery from all aircraft circuits except those for canopy and hatch jettison and the fire extinguishers.

DETONATOR CIRCUITS

General

9. A complete system is installed in the aircraft for the emergency jettison of the pilot's canopy, the navigator's roof hatch and the two wing tip fuel tanks if these are fitted. The system operates by exploding electrically-fired detonators which are housed in the attachment bolts of the jettisonable components. The canopy is secured by 32 explosive bolts, the navigator's roof hatch by 34 similar bolts and the wing tip fuel tanks, when fitted, by 3 bolts each. Provision is also made, by means of an explosive charge, to cut the elevator control tube at a point near the aft end of the console.

10. Canopy jettisoning is controlled from the pilot's jettison switch unit at the outboard side of the throttle levers. The switch unit consists of a box containing a relay, a top panel on which is mounted a double-gated 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 microswitch is operated by a gas-operated piston when the ejection seat face-screen or seat-pan firing handle is operated. Hatch jettison is controlled by the No.1 navigator's HATCH SAFETY switch and either the No.1 or No.2 navigator's HATCH JETTISON switches. Each of the navigator's switches are mounted on a yellow/black-striped warning panel on the adjacent cabin wall. Additional microswitches accommodated in hatch jettison mechanisms located on the rear of the pressure bulkhead provide for automatic hatch jettisoning when the ejection seat firing cable is operated. With the HATCH SAFETY switch selected to ON, both JETTISON switches and hatch mechanism switches become operative.

Resistors

11. Each detonator circuit is fed through a 15 ohm resistor. Those serving the canopy and hatch are carried in boxes holding a maximum of eight. Four boxes used for the canopy circuits are situated two at each side of the cockpit below the coaming tube. Five boxes are used for the hatch circuits, three in the aft end of the cabin and two in the upper equipment compartment aft of the pressure bulkhead. A resistor in circuit with the elevator tube detonator is fitted on the jettison relay panel located in the console structure. Three resistors are permanently fitted in each wing tip for use with the explosive attachment bolts for the wing tip fuel tanks when these are installed.

Jettison test lamps

12. Two press-to-test lamps, one for the canopy/snatch jettison and one for the hatch jettison circuits, are located on the aft end of the pilot's console and are annotated CANOPY JETTISON TEST and HATCH JETTISON TEST respectively. A fuse, located in a holder adjacent to each lamp, protects the lamp circuits.

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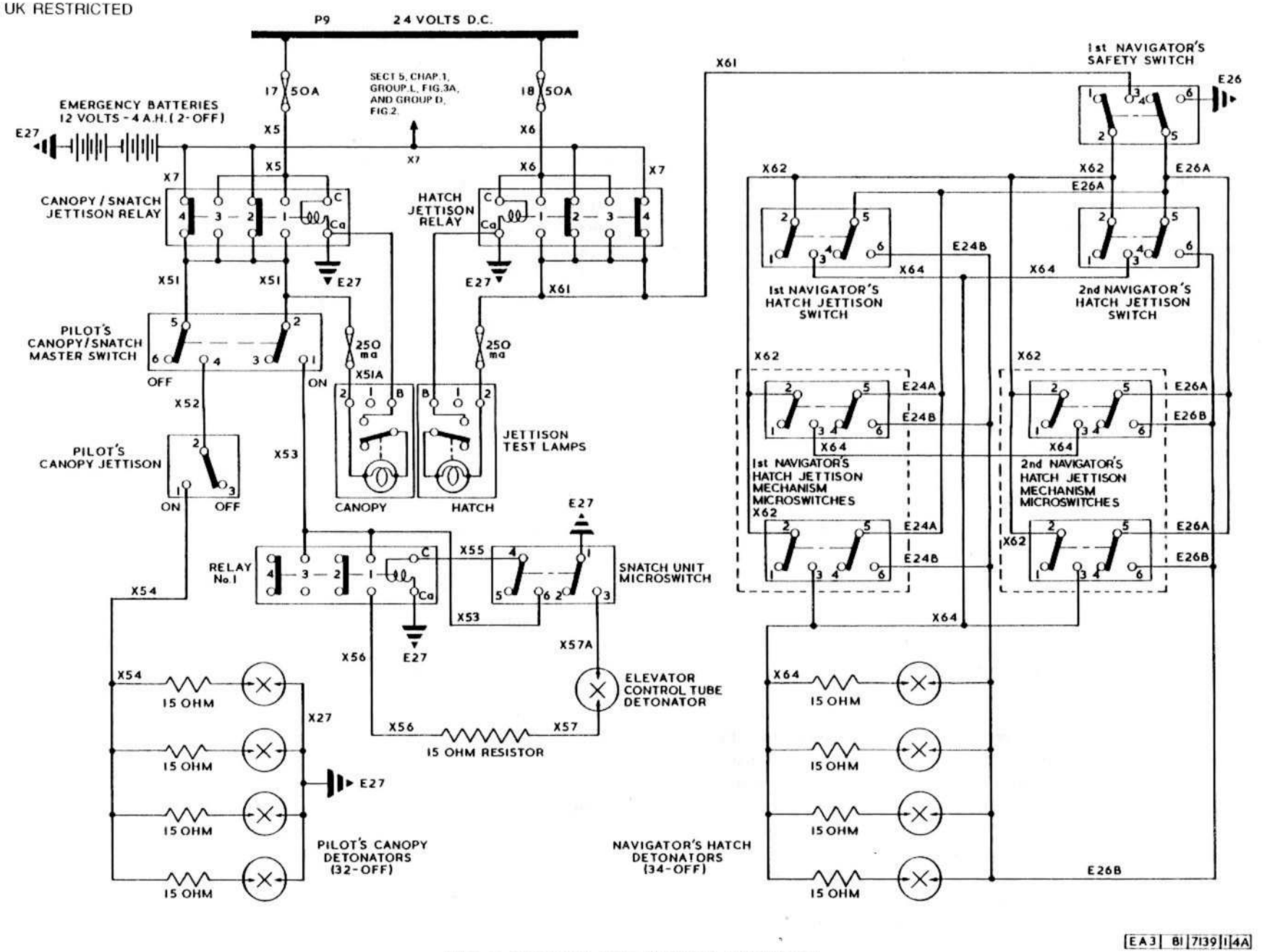

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FIG.3. CANOPY AND HATCH JETTISON

◄SEM/CANBERRA/0128/STC INCORPORATED►

13. When the lamp is pressed it provides a confidence check on the respective jettison supplies and the efficient operation of the jettison relay contacts. With a supply available from busbar P10 the canopy/snatch and hatch jettison relays are energized and the supplies to the lamps are completed via the 'normally open' contacts of the relays. With the relays de-energized the lamps are supplied from the emergency battery busbar, X7, via the 'normally closed' contacts of the relays.

Power supplies

14. 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 above detonator circuits are automatically transferred to the emergency battery circuit X7, the transfer being achieved by the functioning of two relays housed on the jettison relay panel located in the console. During normal operation the changeover relays are held in the closed position by an energizing feed from circuit P10; 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.

Canopy jettison and elevator snatch unit – operation

15. The 2-pole CANOPY/SNATCH MASTER switch controls both the normal and emergency power supplies to the canopy jettison and elevator snatch unit circuits. With the CANOPY/SNATCH MASTER switch ON, the closing of the CANOPY JETTISON switch completes the circuit X52 and X54 to fire the canopy detonators. 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 to energize the relay the contacts of which fire the elevator control tube detonator. In addition to closing the switch, operation of the ejection seat face-screen or seat-pan firing handle operates the snatch unit *(A.P.101B-0402-1A, Sect.3, Chap.11)* which results in the control column jerked forward against the instrument panel to give the pilot ejection clearance.

Hatch jettison – operation

◀16. Provided that the SAFETY switch is in the ON position, selection of either JETTISON switch completes the circuit X61 through X62 to X64 to fire the hatch detonators which jettisons the hatch without seat operation. Operation of either ejection seat face screen or seat-pan firing handle, will cause the microswitches in the appropriate hatch jettison mechanism to be operated and provided that the hatch SAFETY switch is selected ON it completes the circuit X61 through X62 to X64 to fire the hatch detonators.▶

Wing tip fuel tank jettison

17. These tanks, when carried at each wing tip, can be jettisoned by operating a shielded push switch, labelled FUEL TANK JETTISON, on the port sloping panel forward of the console. The tanks are not normally expendable and are only jettisoned in an emergency.

OXYGEN WARNING SYSTEM

Oxygen indicators

18. Four regulators are provided for use by the crew, one at the pilot's station, one each at the 1st and 2nd navigator's station and one at the forward station. The regulators are fitted with magnetic indicators which operate when oxygen is flowing through the regulators. The indicators are energized and de-energized by the movement of the diaphragm within the regulator making and breaking electrical contacts in series with the indicators. Because the regulators, with the exception of the 2nd navigator's, are positioned out of the normal line of sight, remote magnetic indicators are fitted to show when oxygen is flowing through the regulator to which they are connected. The remote indicators are connected in parallel with their respective oxygen regulator indicators and are located as follows:-

Pilot's indicators	– flight instrument panel
1st navigator's indicator	– navigator's instrument panel
2nd navigator's indicator	– no remote indicator
Forward station indicator	– 2nd navigator's station

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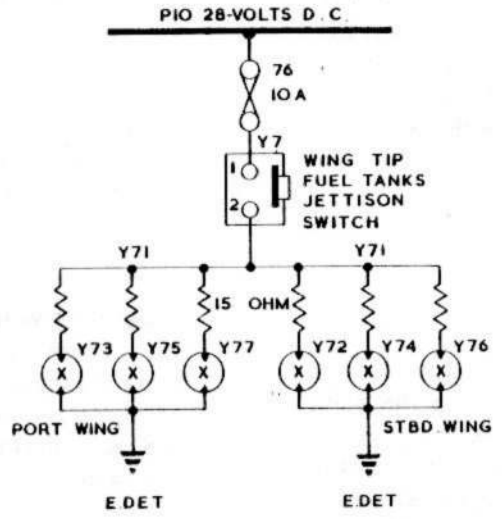

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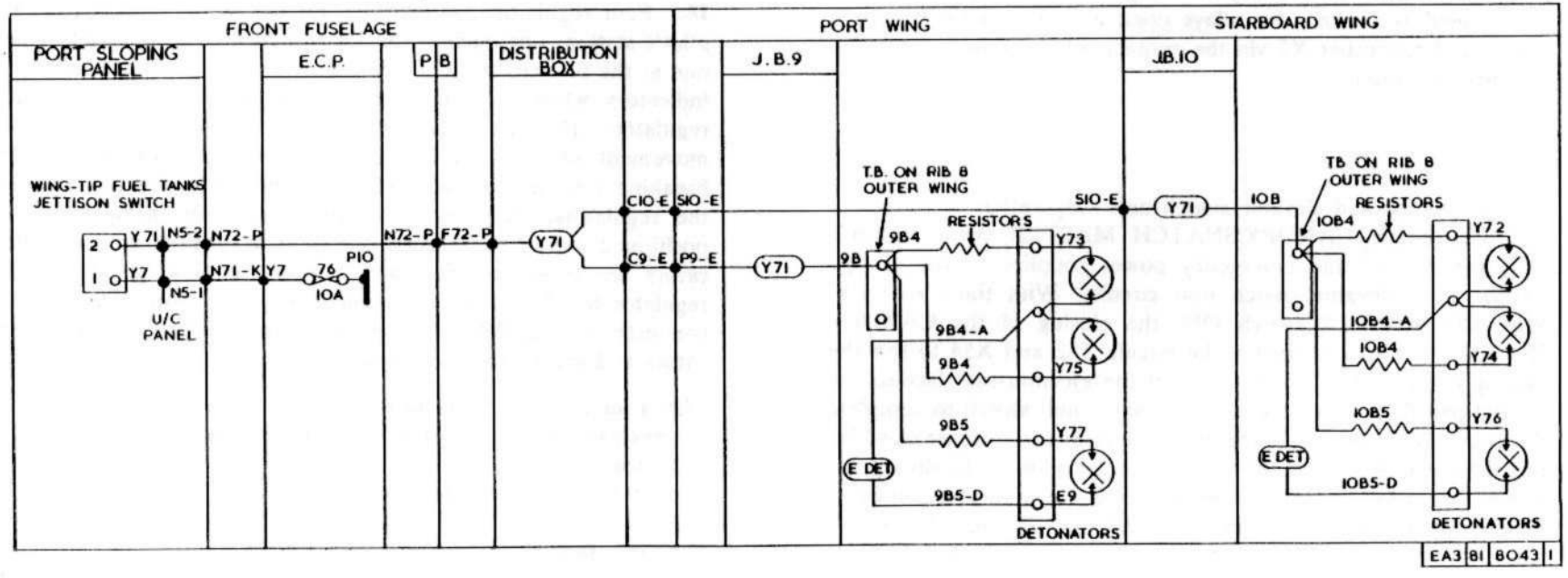

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FIG.4. WING-TIP FUEL TANK JETTISON

Power supply

19. The power supply for the system is not switched but fed direct from fuses 34 and 52 in the E.C.P. Fuse 34 protects both navigator's and the forward station regulators and fuse 52 the pilot's regulator.

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

General

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

Engine fire circuits

Fire detectors

◀**21.** Prior to installation of the detectors, or if the installed detectors are suspect, they must be Bay Serviced in accordance with A.P.107E-0105-1, Chap. 2/1.▶

Note . . .

The engine fire detectors are adjusted and set by the manufacturers and do not require any internal servicing.

◀22. The following procedure can be followed but it must be understood that this test only checks the continuity of the cable run between the first and last switch in each engine fire circuit and does not check the functioning of the detector units.▶

(1) Remove the attachment bolts of the lower centre detector fitted to each engine firewall, and the top switch at each engine bay outboard rib. Remove the cover plate from the base of each detector to gain access to its 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) To prevent spurious fire warnings, particular attention must be given to the connector assemblies at J.B.11 and J.B.12 for ingress of moisture. All connectors must be checked for adequate sealing and, if necessary, disconnected, stripped, cleaned, dried, resealed and reconnected.

Extinguishers

23. The following procedure checks the extinguisher circuits:-

(1) Connect a test lamp to pins A and B of the 2-pin Plessey socket on cables 7F and 8F in the port and starboard undercarriage bays respectively. (These cables connect to the extinguisher operating heads directed to the engine bays).

(2) Press the No.1 and No.2 engine fire push switches in turn; the appropriate test lamp should light each time.

Inertia switch circuit

24. Check this circuit as follows:-

(1) Connect test lamps as in para.23 (1) also connect test lamps to pins B and C on the Plessey sockets on cables 7D and 8D in the port and starboard undercarriage bays respectively and to pins A and B on the socket on cable 3B at frame 27A.

(2) 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 No.5 relay through circuit X1-X16. The closing of the relay will complete all crash circuits and all five test lamps should light. On the conclusion of the tests remove the test lamps and replace the inertia switch covers.

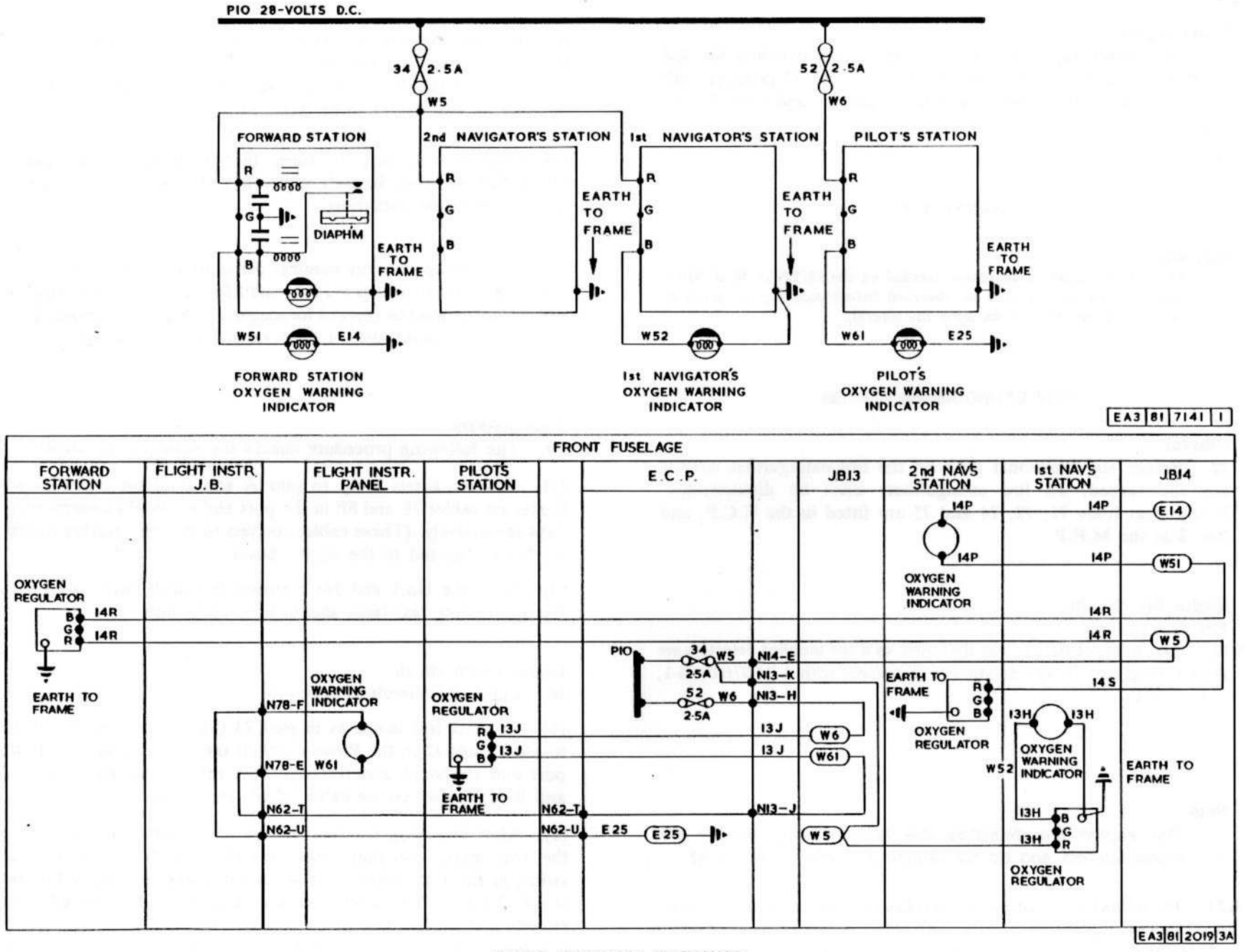


FIG.5. OXYGEN WARNING

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.

25. 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.110N-0703-1.

DETONATOR CIRCUITS

WARNING

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

General

26. 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 test

27. Before any tests are made on the detonators 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 levers of the two hatch jettison mechanisms 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.

When the above preparation 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.

(3) Reconnect the emergency batteries.

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

Note . . .

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

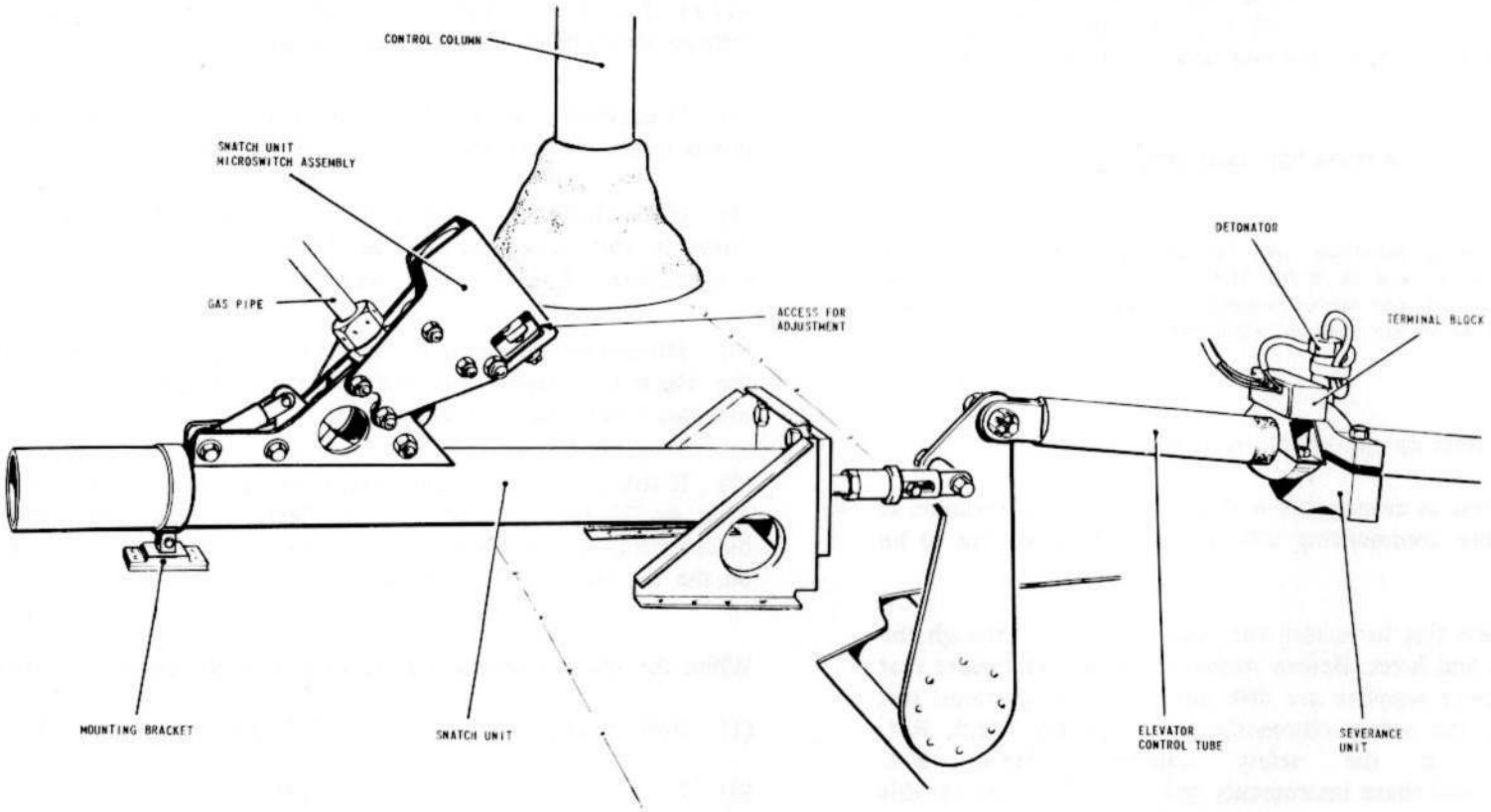


FIG. 6. SNATCH UNIT ASSEMBLY

ASSEMBLY NOTES

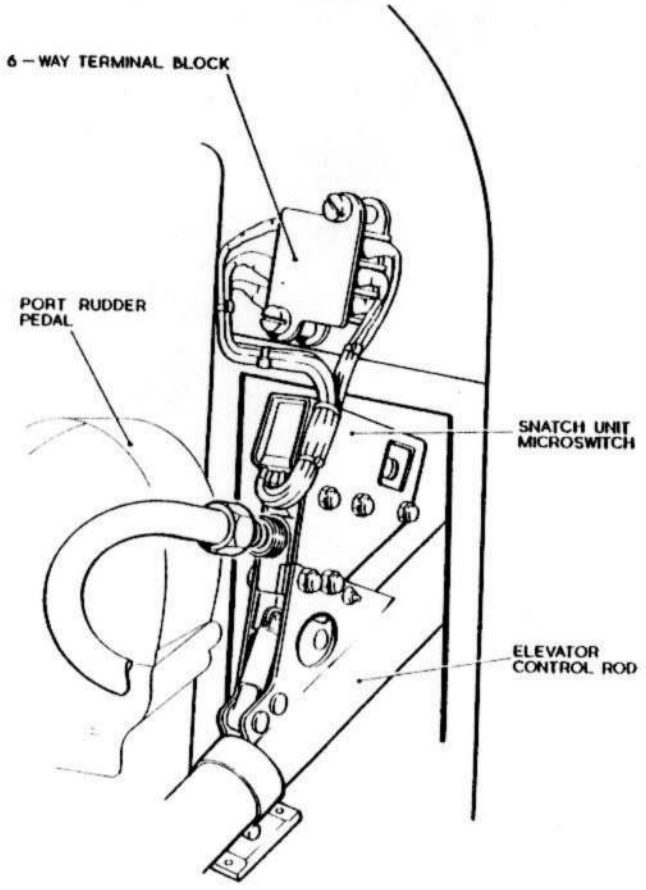
WHEN CONNECTING A SNATCH UNIT MICROSWITCH AND/OR ELEVATOR DETONATOR TO THE 6-WAY TERMINAL BLOCK PROCEED AS FOLLOWS:-

1. ROUTE CABLES OUTBOARD FROM THE MICROSWITCH TO THE TERMINAL BLOCK AS SHOWN.
2. CABLES ARE TO BE CUT TO THE MINIMUM LENGTH REQUIRED TO REACH THE TERMINAL BLOCK.
3. BIND CABLES TOGETHER AND WHERE POSSIBLE BIND TO ANY ADJACENT CABLES TO KEEP IN POSITION.
4. WHERE NECESSARY CRIMP NEW 4BA TAGS, HELLERMANN REF. HE.294 TO RELEVANT CABLES.

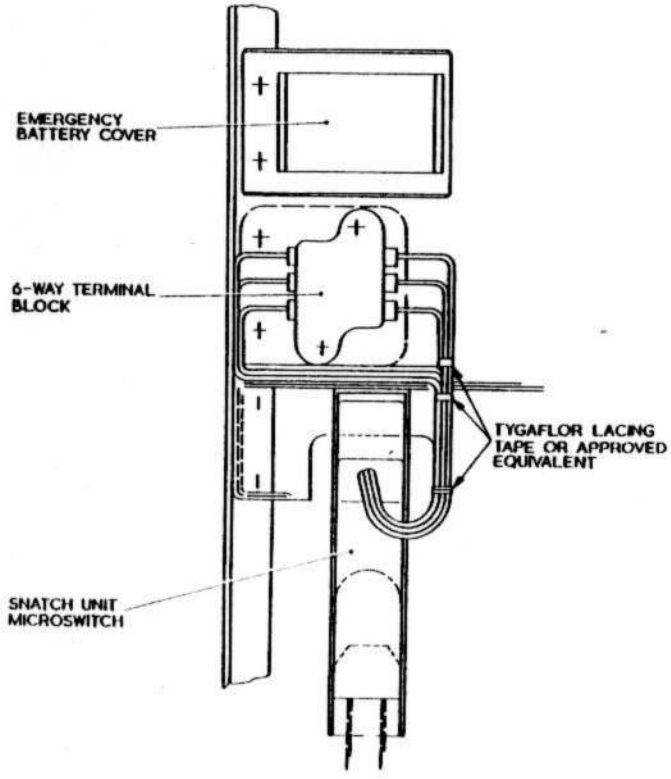
WARNING

ENSURE THAT THE CABLES ARE ROUTED AND SECURED SO THAT THEY CANNOT PROTRUDE INTO THE PILOT'S FOOTWELL BEYOND THE EMERGENCY BATTERY ACCESS PANEL.

WHEN INSTALLING A SNATCH UNIT ASSEMBLY PARTICULAR CARE MUST BE TAKEN TO ENSURE THAT THE CABLE ASSEMBLY WIRING IS ROUTED AND SECURED IN SUCH A MANNER THAT IT WILL NOT BE DAMAGED DURING RUDDER MOVEMENTS



ELEVATOR SNATCH UNIT MICROSWITCH WIRING
VIEW LOOKING AFT PORT SIDE



ROUTEING OF CABLES

FIG. 6A SNATCH UNIT - CABLE ROUTEING

◄ NEW ILLUSTRATION ►

Checking the canopy and elevator control tube detonator circuits
28.

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 meter 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) and replace fuse 17.

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

(8) Connect the testmeter to the detonator terminal block on the elevator control tube in the console and switch on the CANOPY/SNATCH MASTER switch.

(9) Manually close the microswitch on the snatch unit. The testmeter must read between 1.7 and 2.0 amp. Switch OFF the CANOPY/SNATCH MASTER switch. Open the microswitch alternately. Ensure that there is no meter reading with either switch OFF.

(10) When the microswitch is still switched to ON and the testmeter is reading between 1.7 and 2.0 amp, remove fuse 17 at the M.E.P. This action de-energizes the canopy relay on the jettison relay panel, causing it to open and switch the supply from the P10 busbar to the emergency battery X7 busbar. The reading must be 1.4 to 1.7 amp. Check that the emergency supply is available at the canopy resistor boxes by operating the canopy jettison switch.

(11) Manually return the microswitch to OFF. Refit fuse 17 and ensure supply does not exist at the detonator block on the elevator control tube.

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

(a) Check the voltage at X57 to E27 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 all switches are OFF.

(e) Connect the ohmmeter to X57A and E27 and close the microswitch, the meter should read approximately zero.

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

Checking the hatch detonator circuits

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.

29.
(1) At the 1st 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 or 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.

(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.

◀ (6) Repeat test (1) to (5) using the 1st navigator's hatch SAFETY switch and the 2nd navigator's hatch JETTISON switch. ▶

Checking the single lever ejection circuits
30. In addition to the tests detailed in para.29, the single-lever system hatch jettison mechanism is to be tested as follows:-

(1) Close the microswitches in the 1st 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 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. Recock the mechanism and refit the sear. Ensure that the open end of the hook is to starboard.

◀ (2) Repeat test (1) for the 2nd navigator's hatch jettison mechanism. ▶

31. Connect the emergency batteries and remove fuse 18 at the M.E.P. This action de-energizes the hatch relay on the jettison relay panel and switches the supply from busbar P10 to the emergency battery supply busbar X7. Repeat the tests detailed in para.29-30, 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
32. Where applicable, test the circuit as follows:-

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

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

33. Upon completion of the circuit tests, ensure that all circuit switches are in the OFF position and that all guards for the pilot's, 1st and 2nd navigator's jettison switches are wire-locked with 32 s.w.g. copper wire. Before installing the detonators, ensure that the WARNING preceding para.26 has been complied with.

Detonator circuits resistance test
Precautions
34. 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.8.

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

Pilot's canopy and navigator's hatch circuits

35. 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

36. Check the resistance across the terminals of the detonator terminal block. The ohmmeter should read between 0.8 and 1.6 ohms.

Wing tip tank detonator circuit

37.

(1) Check the resistance across the terminals in the detonator terminal blocks in each wing tip. The ohmmeter reading should be 0.8 to 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 by holding the electrical leads near to where they enter the plug of the detonator assembly. THIS IS MOST IMPORTANT.

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

39. A full description of the canopy, hatch and snatch unit installations is given in A.P.101B-0402-1A, Sect.3, Chap.11. The installation of the wing tip tank detonators is described in A.P.101B-0402-1A, Sect.4, Chap.2.

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5CW/9438526	Fire warning push switch	2	A.P.113D series
5CW/4405748	Fire warning test switch	1	A.P.113D series
27N/4526592	Fire detector	15	A.P.107E-0105-1
27N/4526464	Inertia switch	2	A.P.113D-1206-13A
27N/1119550	Fire extinguisher, Type 89A } alternatives	1	A.P.107E-0400-1A
27N/4526467	Fire extinguisher, Type 12A } alternatives		
12K/9635263	Cartridge No.1, Mk.3, Type A716-3	1	A.P.110N series
27N/7185521	Fire extinguisher, Type 138A } alternatives	2	A.P.107E-0400-1A
27N/4526468	Fire extinguisher, Type 14A } alternatives		
12K/9231213	Cartridge No.1, Mk.3, Type A717-3	2	A.P.110N series
12G/9635206	Detonator 108, Mk.3 } alternatives - canopy and hatch	66	A.P.110N series
12G/9635204	Detonator 108, Mk.4 } alternatives - canopy and hatch		
12G/9635205	Detonator 109, Mk.2 elevator tube severance	1	
12G/9635205	Detonator 109, Mk.2 wing tip fuel tank	6	
12G/9635203	Charge No.1, Mk.3 elevator explosive collar	1	
5CZ/5003	Magnetic indicator	3	A.P.113F-0615-1

FIG.7 FIRE DETECTORS AND EXTINGUISHERS

(illustration overleaf)

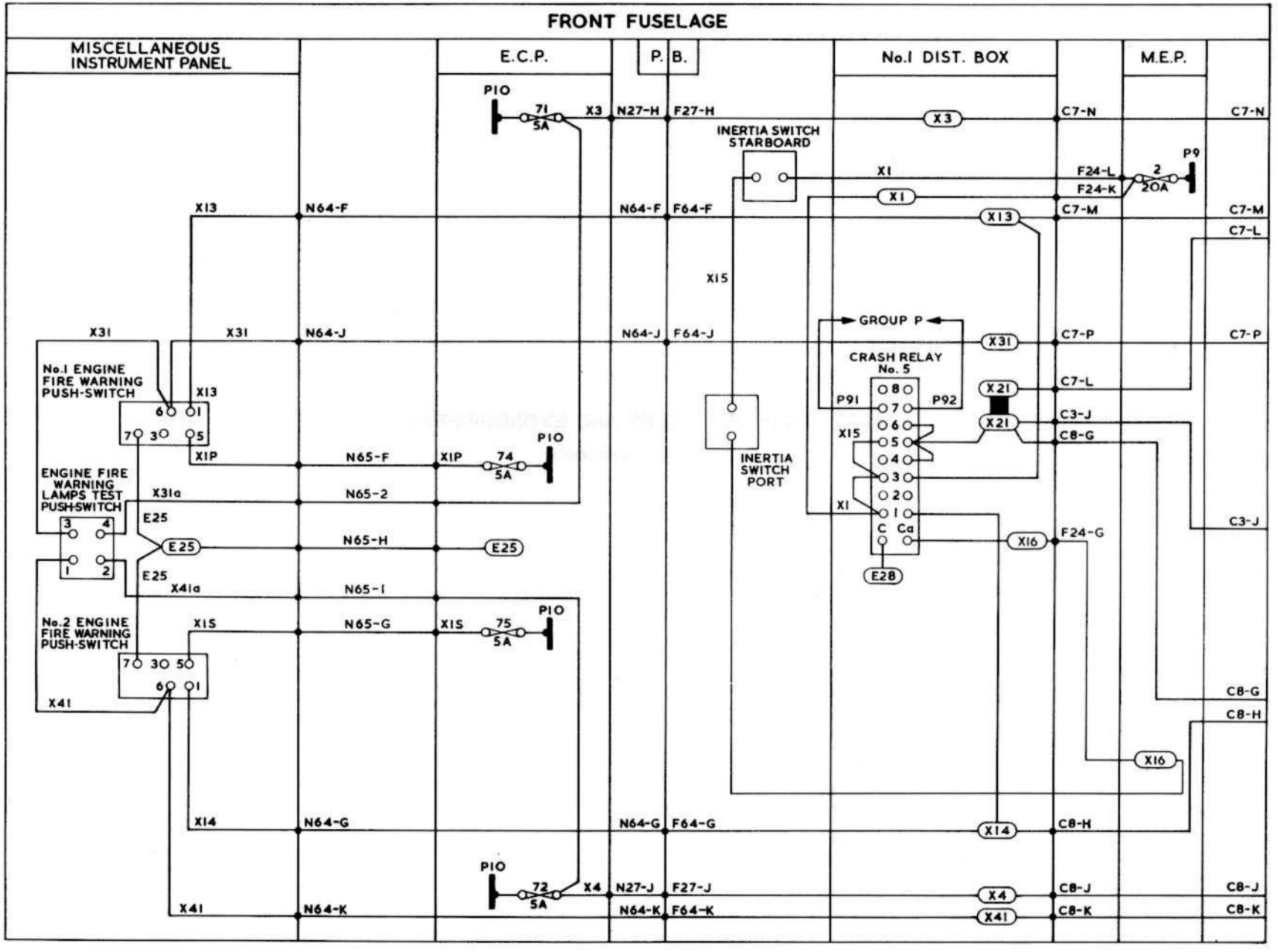


FIG.7. FIRE DETECTORS AND EXTINGUISHERS

◂MOD 5204 EMBODIED▸

UK RESTRICTED

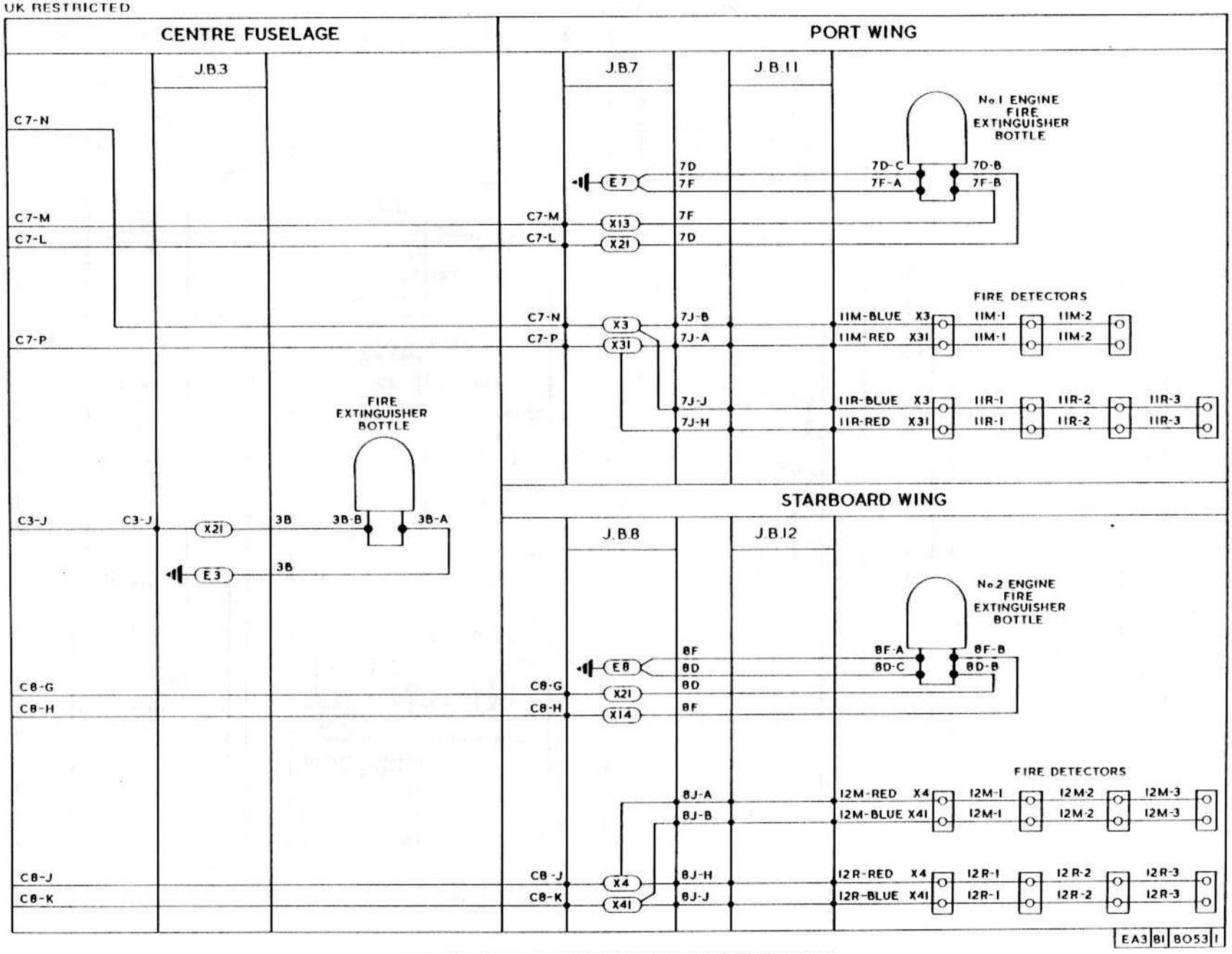


FIG.7A. FIRE DETECTORS AND EXTINGUISHERS

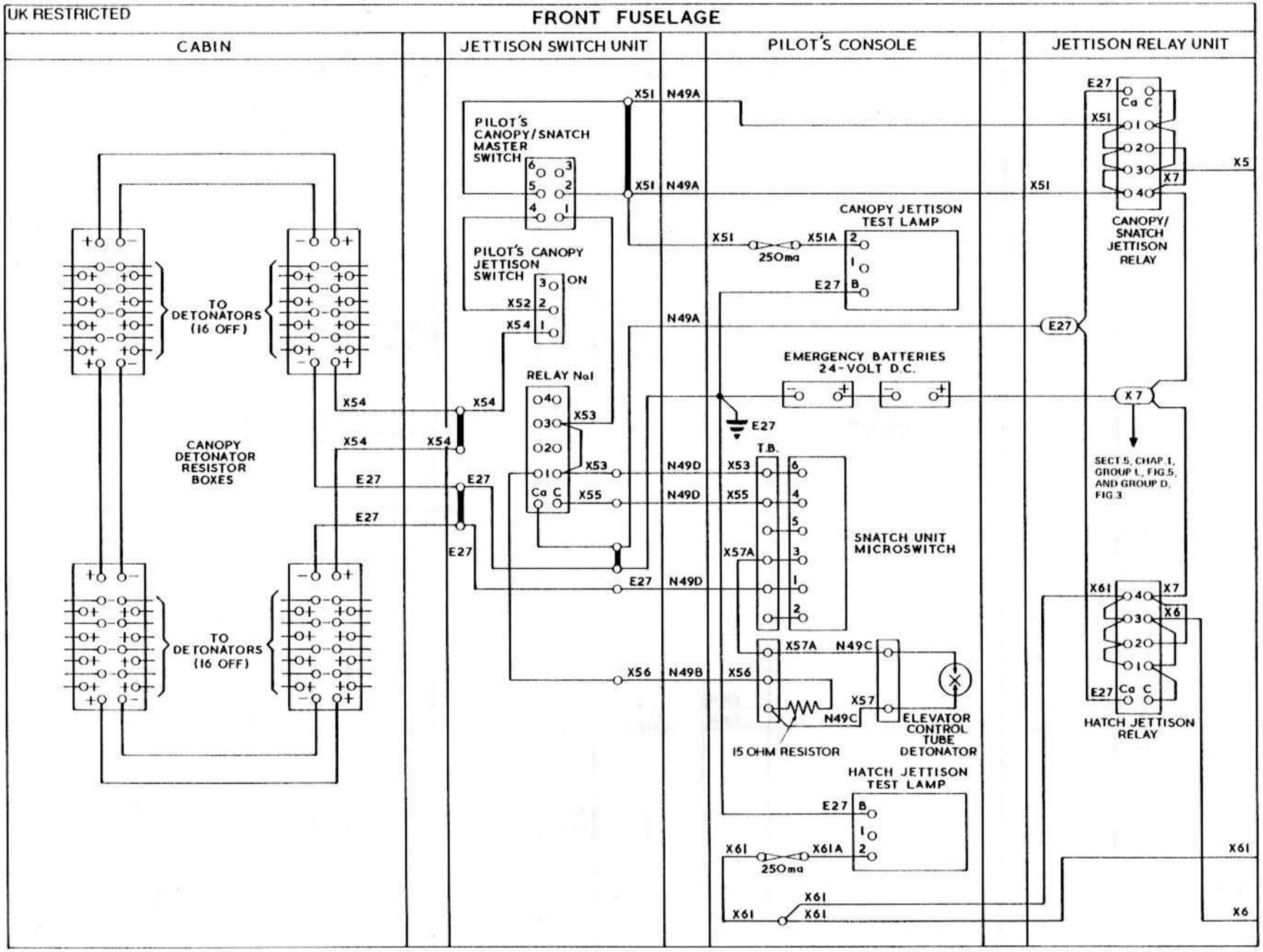


FIG.8. CANOPY AND HATCH JETTISON

◄SEM/CANBERRA/0128/STC INCORPORATED►

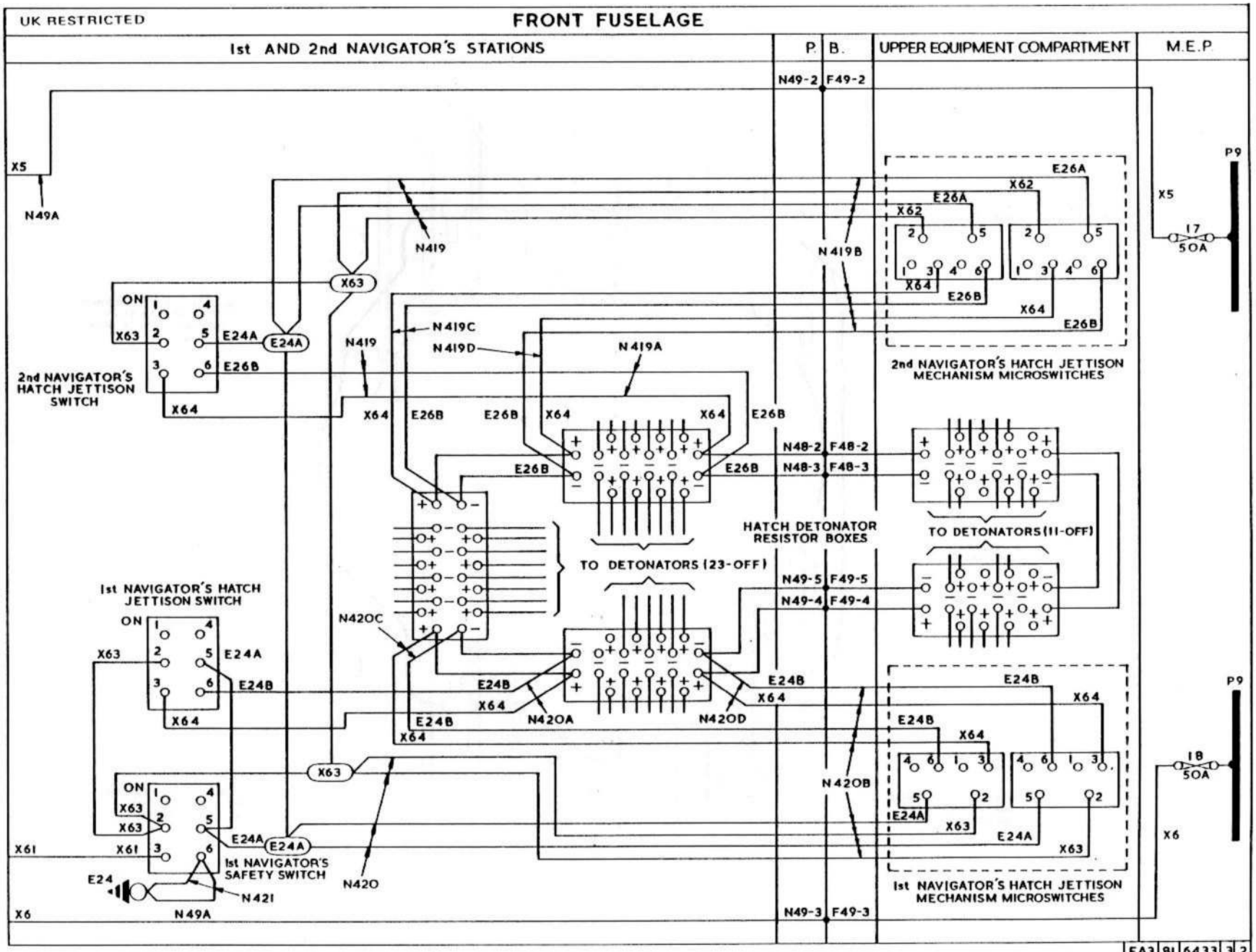


FIG.8A. CANOPY AND HATCH JETTISON

◄ 2ND NAVIGATOR'S SAFETY SWITCH AND ASSOCIATED WIRING DELETED ►

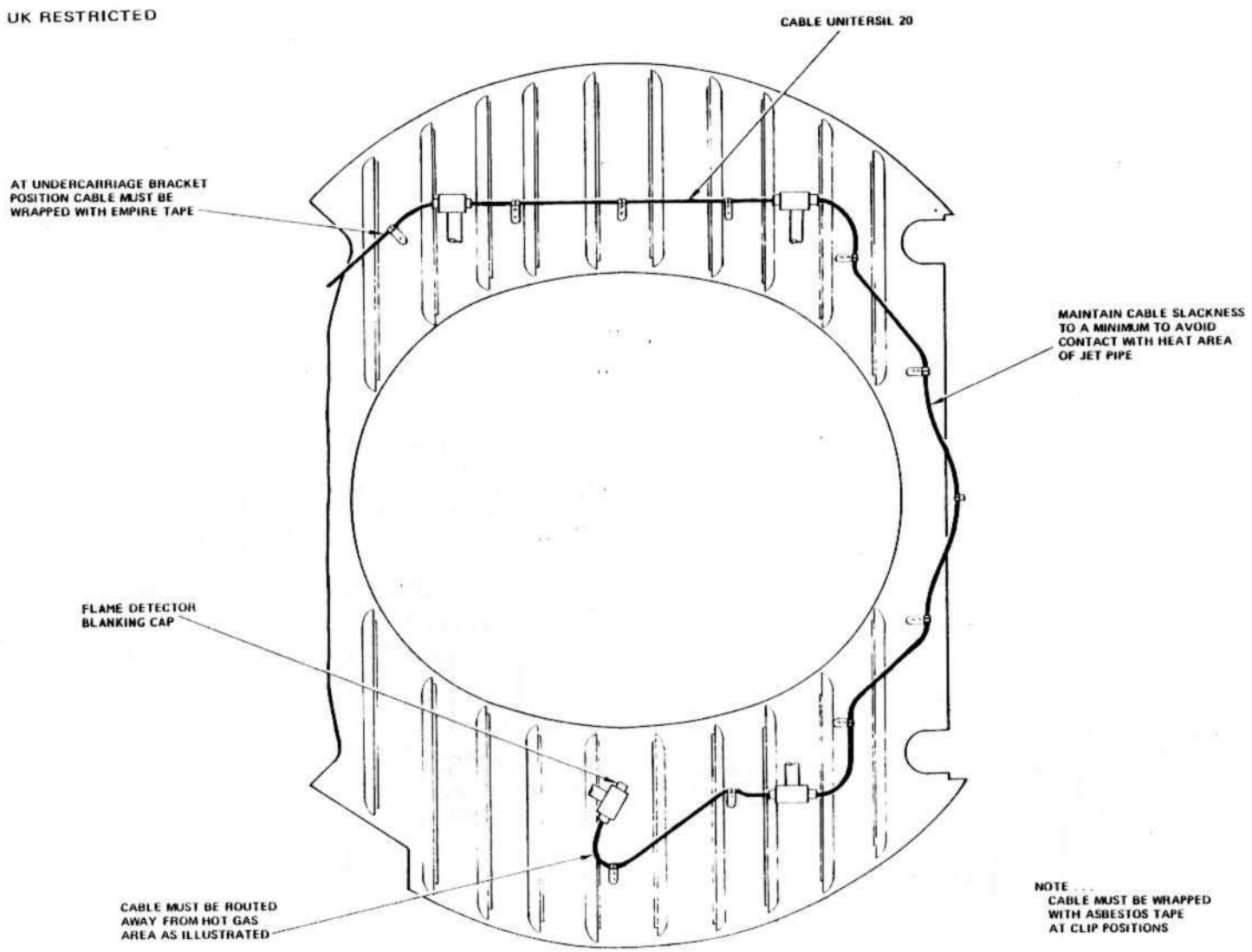


FIG. 9 FLAME DETECTOR CABLE ROUTEING- No. 1. ENGINE FIREWALL

EA 81 2335

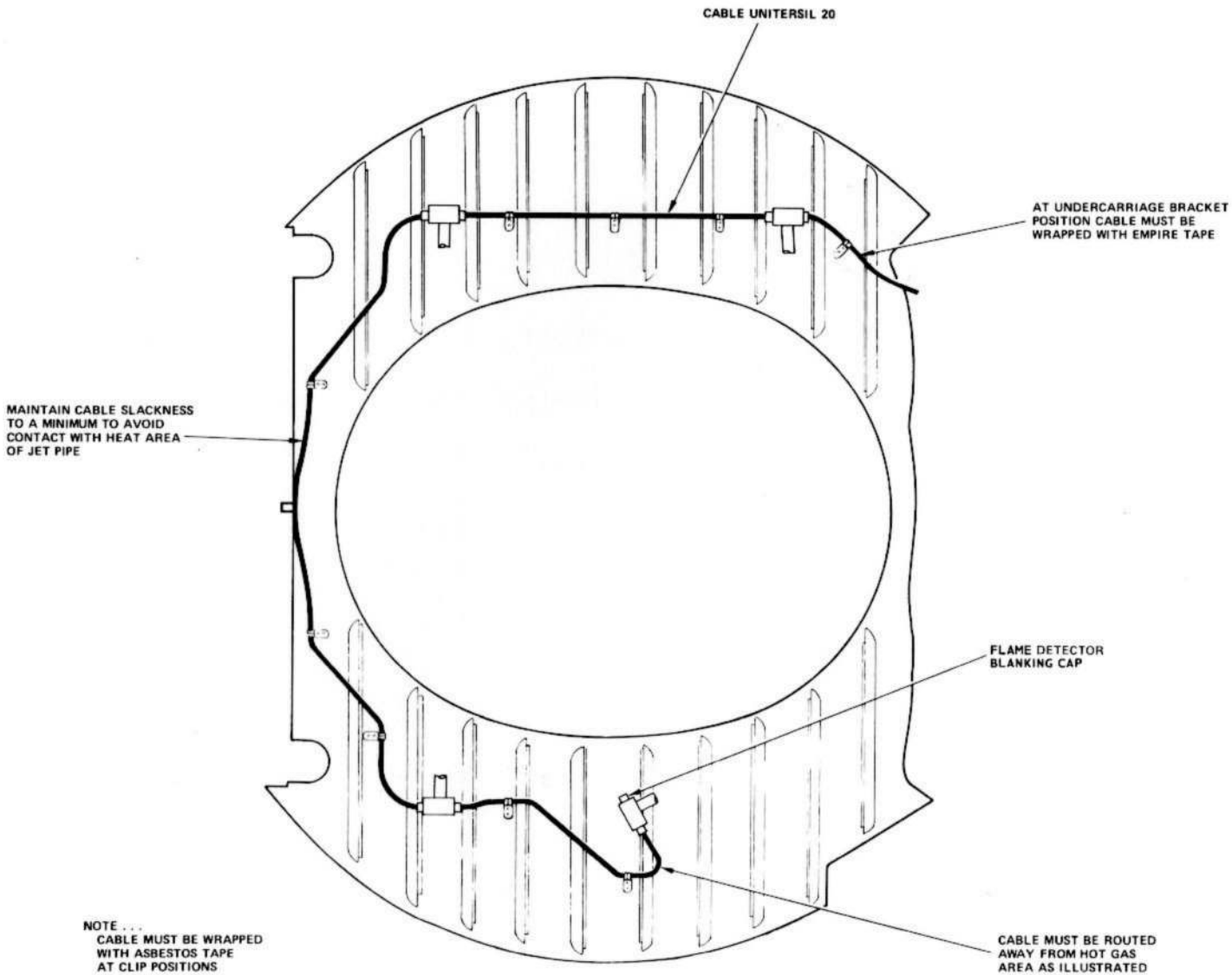


FIG. 10 FLAME DETECTOR CABLE ROUTEING - No. 2 ENGINE FIREWALL

EA3-81-2436

Chapter 2 INSTRUMENT INSTALLATION

LIST OF CONTENTS

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

GENERAL INFORMATION

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LIST OF ILLUSTRATIONS

General

1. This chapter contains a description of the instrument system and infotmation covering the servicing of the equipment. It is divided into self-contained groups in which the equipment is described under suitable functional headings.

2. Schematic wiring and routeing diagrams for the electrical instruments accompany the appropriate text.

3. A list of equipment included in each group details the References of the items and the Air Publication in which they are described.

Location of equipment

4. Location of the instruments and of the access panels for servicing them are shown in the location diagrams contained in this group.

9000 series switches

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

UK RESTRICTED

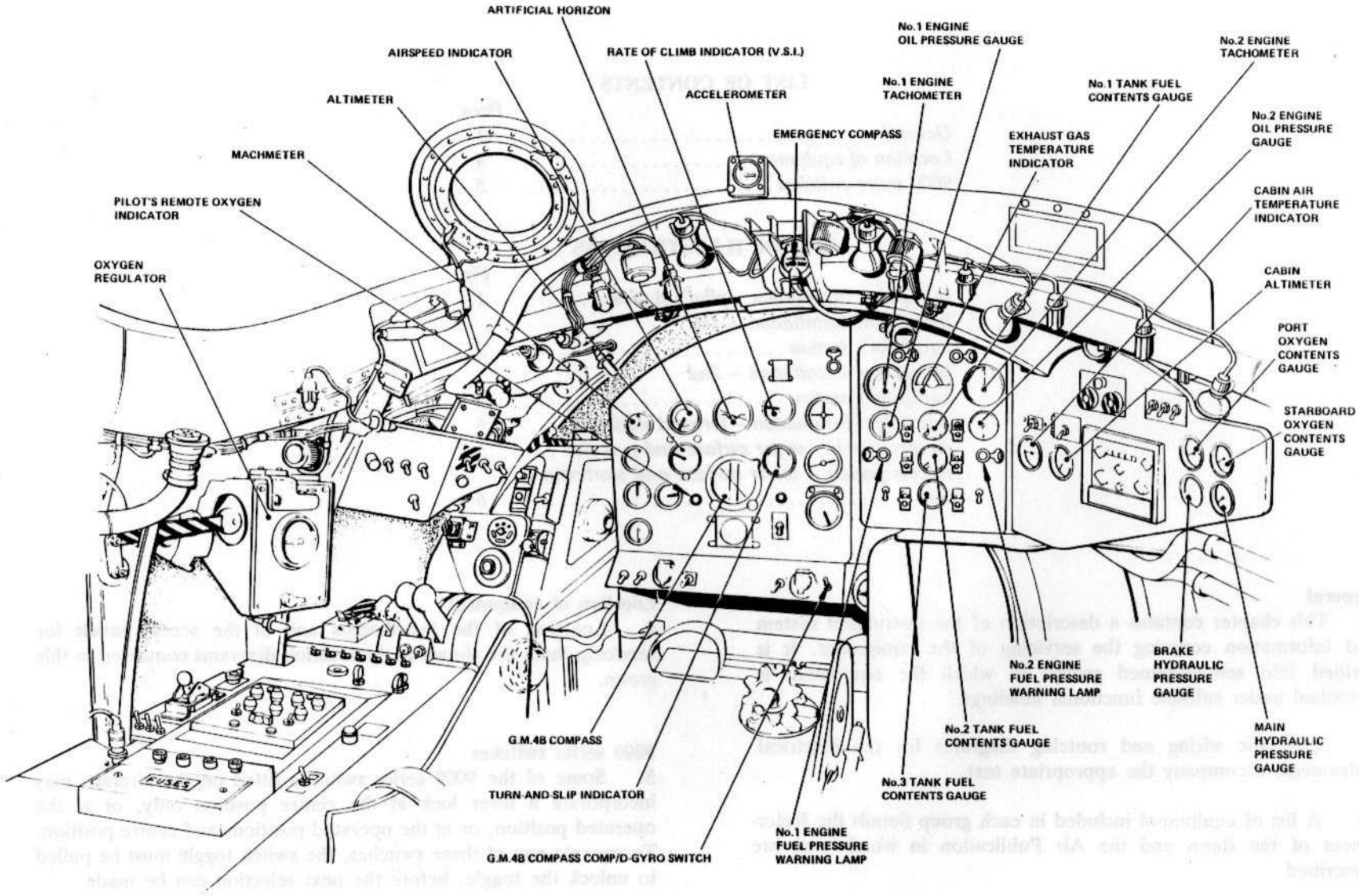

FIG. 1. INSTRUMENT INSTALLATION – PILOT'S STATION

◀ STI/CAN/586c INCORPORATED ▶

UK RESTRICTED

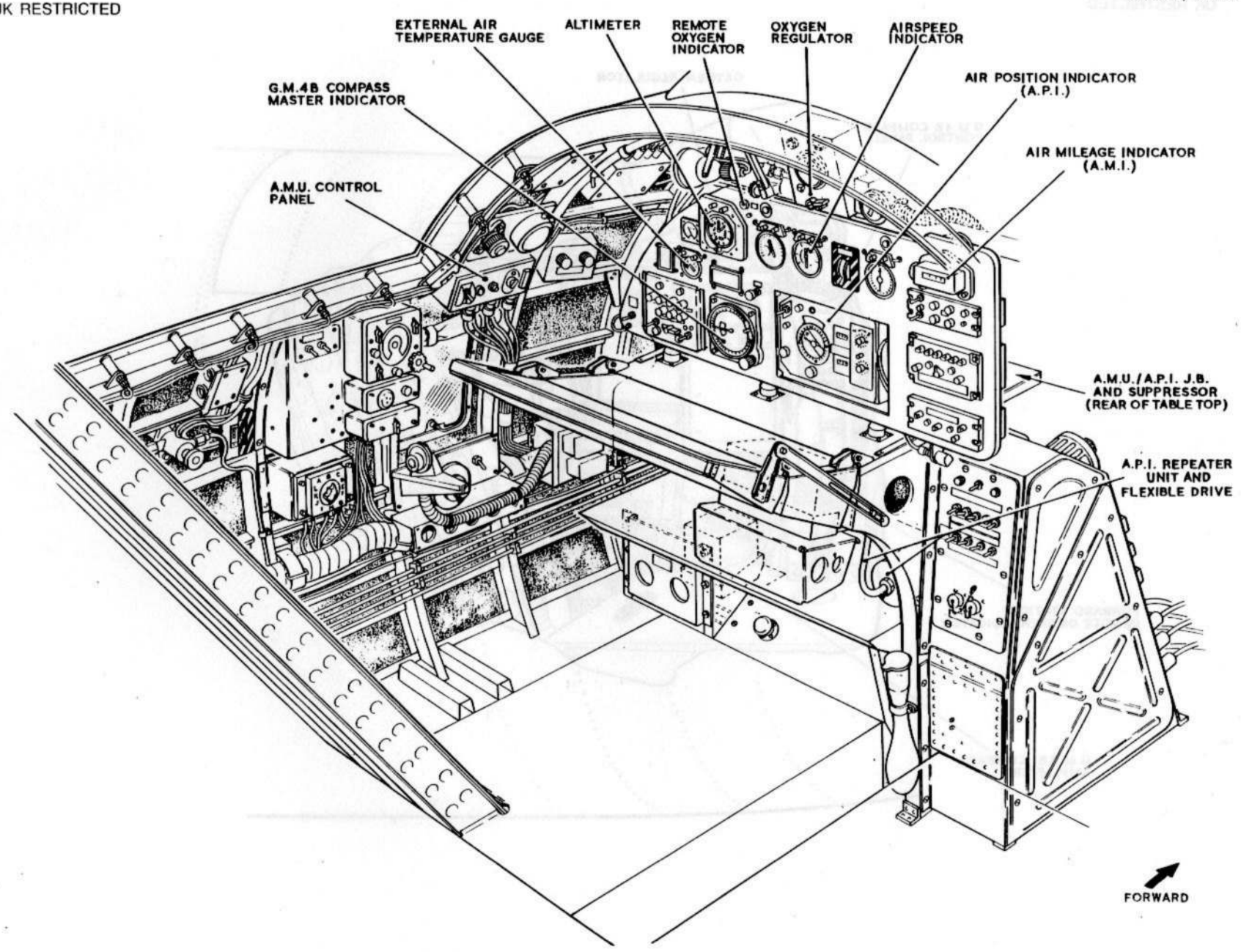

FIG.2. INSTRUMENT INSTALLATION — 1ST NAVIGATOR'S STATION

◀STI/CAN/586c INCORPORATED▶

UK RESTRICTED

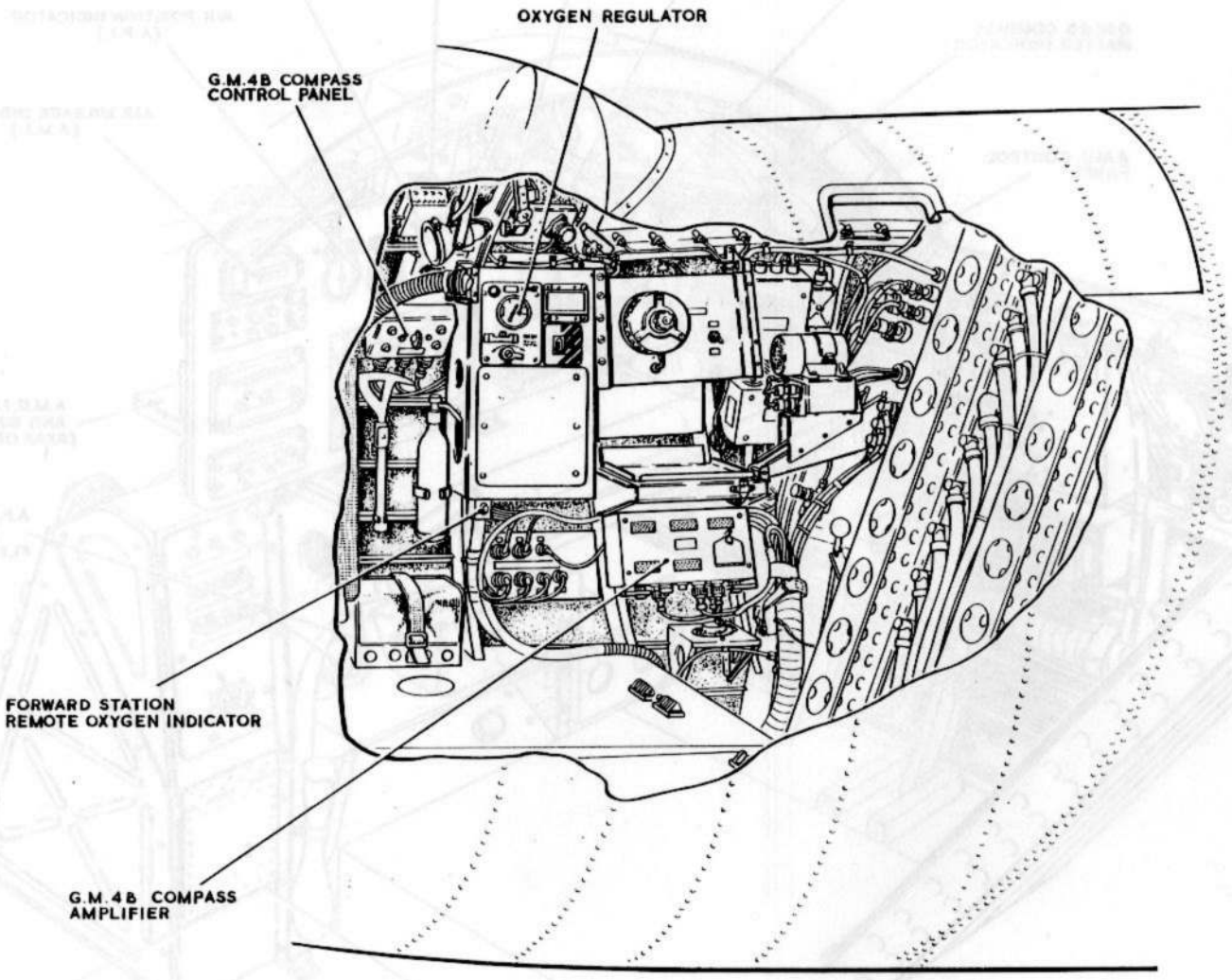

FIG.3. INSTRUMENT INSTALLATION– 2ND NAVIGATOR'S STATION

◀ STI/CAN/586c INCORPORATED ▶

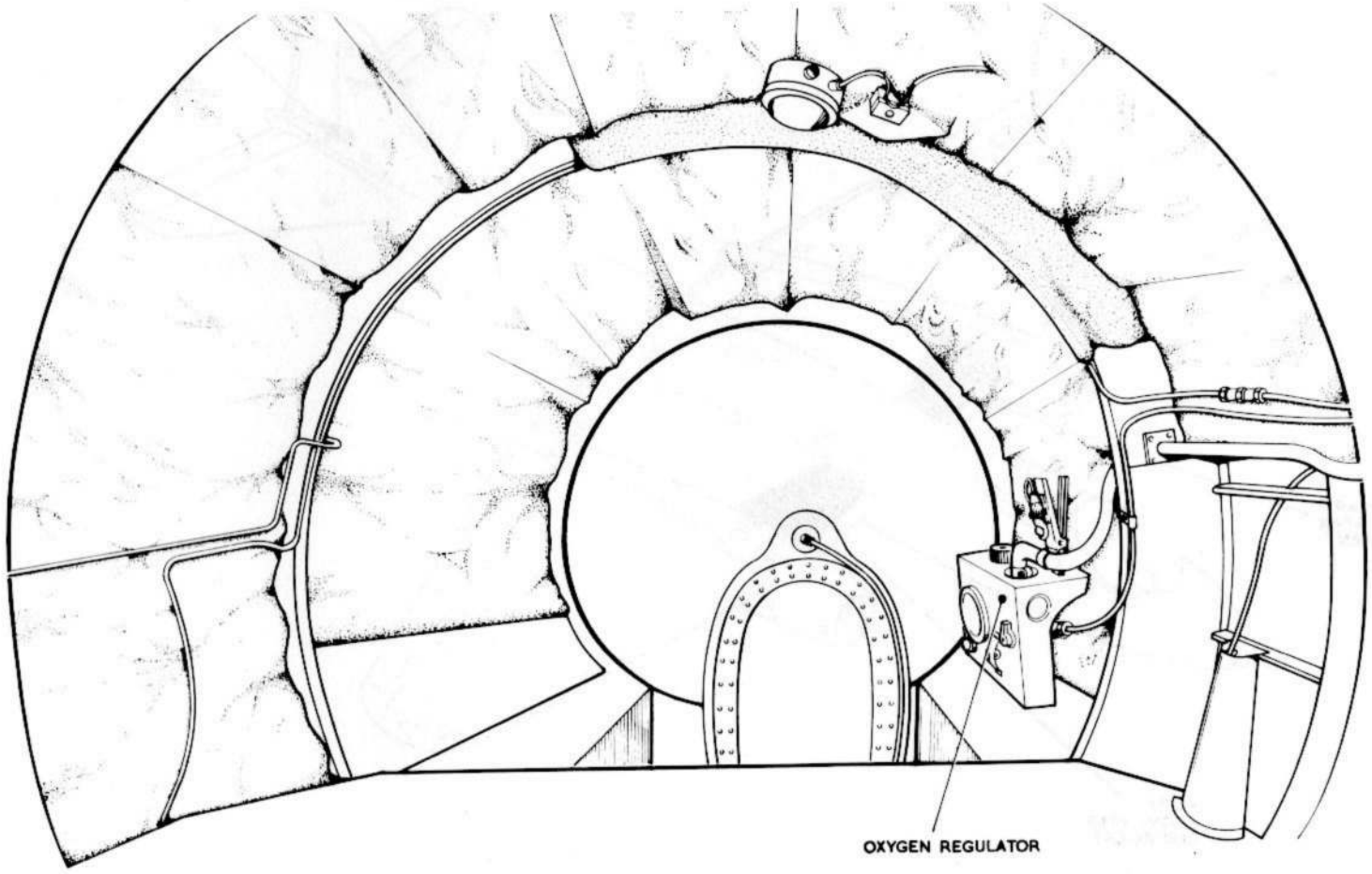

FIG. 4. INSTRUMENT INSTALLATION – FORWARD STATION

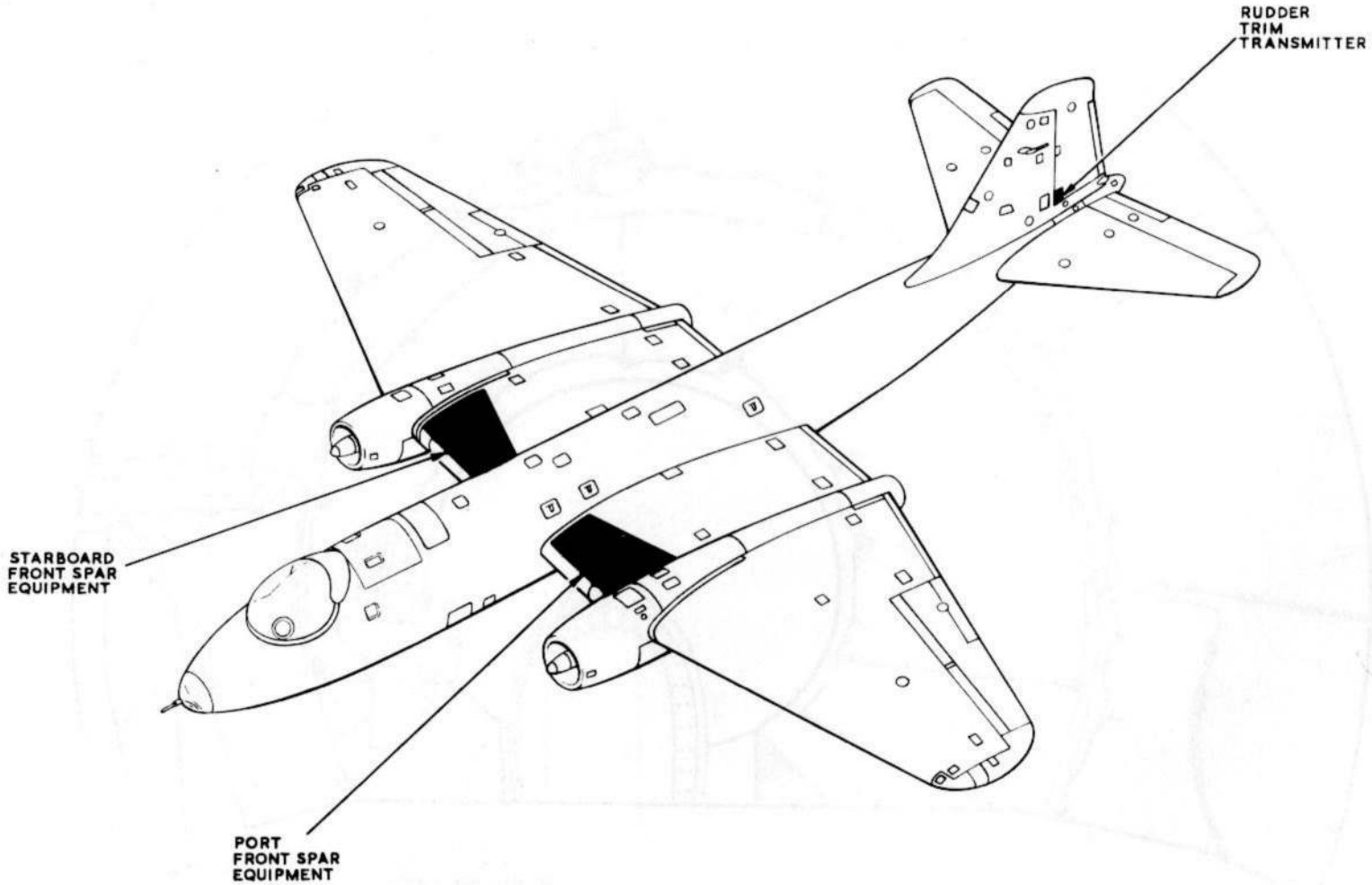

FIG. 5. ACCESS PANELS—UPPER SURFACE AND PORT SIDE

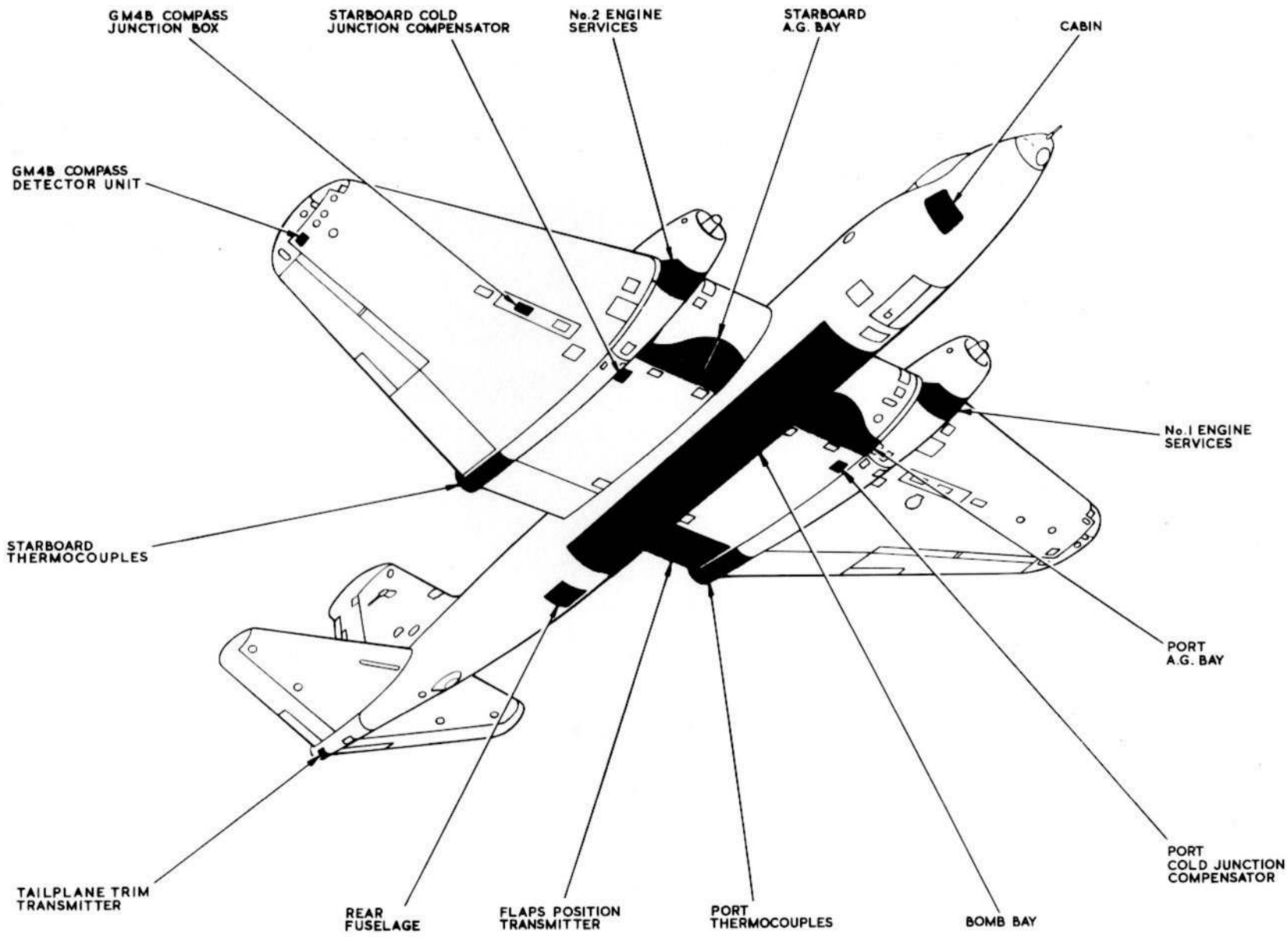

FIG.6. ACCESS PANELS—LOWER SURFACE AND STARBOARD SIDE

ARMAMENT AND PHOTOGRAPHIC INSTRUMENTS - GROUP A & B

LIST OF CONTENTS

LIST OF TABLES

Introduction

1. A description of the armament and photographic instruments is given in this group. The main items of equipment, together with their relevant A.P. references, are listed in Tables 1 and 2. Location of the equipment is covered in the General Information group at the beginning of the chapter.

ARMAMENT INSTRUMENTS

2. The armament instruments comprise a bomb sighting head and bombing computor which are listed in Table 1.

Bombing instruments

General

3. Visual bombing is controlled by a Type T2 computor and a Type T2 sighting head. In addition, a sighting head control panel is installed at the starboard side of the prone position in the nose.

Computor, Type T2

4. This unit is carried by four resilient mountings within a tubular structure which is secured by two attachment plates to a floor bracket at the port side of the prone position in the nose. The attachment plates are slotted to engage the two tubes of the structure and each is secured by two 2 B.A. bolts to the bracket. To obviate lateral movement of the computor and its mounting, a latch plate, attached to frame 1, is arranged to engage with one of the tubular frame members. During the removal of the computor the latch plate can be swung away after taking out a quick release pin.

5. The computor mechanism is operated by compressed air fed from the cabin pressurization system. The air is tapped from a union located between frames 15 and 16 in the roof of the bomb bay. From this point a pipe runs forward, via an air filter situated at frame 12A, to the pressure bulkhead and on to the bomb aimer's station in the nose. At the latter position the air supply is controlled by a manually-operated cock adjacent to the computor unit.

6. Other requirements for operation of the computor are pitot and static pressure supplies, an a.c. supply for running the gyros, 24-volts d.c. to operate the dial lamps, and a supply from the GM4B compass repeater circuit.

7. Pitot and static pressures are tapped from the common pipe lines which connect to all the pressure-operated instruments in the aircraft. The 115-volts, 3-phase supply, fed from No.3 inverter circuit, is connected by a Plessey plug and socket to the gyro at the rear of the instrument. Compass readings are obtained

from the compass repeater junction box located aft of the navigator's instrument panel and fed into the instrument by way of a 7-pin plug and socket at its forward end. A 2-pin plug also on the forward end of the unit is the connecting point for the supply to the dial lamp, which is controlled by a dimmer switch. Dummy unions and electrical plugs installed on a bracket near the computor unit are provided for stowing all supply pipes and connectors when the computor is removed from the aircraft.

Servicing

8. The position of the computor in relation to its mounting bracket is governed by two locating pegs fitted to the bracket assembly and two holes in the bottom tubes of the mounting. When a computor mounting is being installed for the first time, each bottom tube has to be drilled to mate with the pegs in the bracket. The two holes, Morse No. 10, *(0.1935")* should be positioned 8.2 in. aft of the centre line of the forward resilient mounting when the computor is in its approximate position in the aircraft.

9. After all pipes and electrical sockets have been disconnected and stowed, the computor can be removed by taking out the four 2 B.A. bolts that secure the slotted attachment plates and removing the quick-release pin which holds the top latch plate.

Sighting head, Type T2

10. This instrument is situated above the clear sighting panel fitted to the plastic nose fairing and is secured by a locking catch to the spigot of a mounting bracket. The latter is equipped with means of adjustment for altering the pitch attitude of the head in relation to the aircraft level. Two electrical plugs are fitted to the head; one is mounted on the gyro and carries the a.c. supply to that unit; the other is located on the underside and carries the d.c. to operate the drift scale and collimator lamps. The latter are controlled by two dimmer switches mounted on the sighting head control panel positioned at the starboard side of the fuselage near the sighting head. Sighting and drift angles are transmitted from the computor to the sighting head by two flexible drives.

Servicing

11. After disconnecting the electrical cables and flexible drives and stowing them at the positions provided, the head can be removed by operating the release catch and sliding the unit off the spigot. Any servicing which involves interference with the computor or sighting head should only be carried out by authorized personnel in conjunction with the relevant A.P. Faults in the power supplies should be traced by referring to Group D in Chap. 1 of this section.

TABLE 1

Armament Instruments

Stores Ref.	Equipment	Quantity	Relevant A.P.
9/4471	Computor, Type T2.....	1	A.P. 1275D, Vol. 1, Sect. 6
9/4472	Sighting head, Type T2.....	1	
9/3350	Mounting bracket.....	1	
109/82	Control panel.....	1	

PHOTOGRAPHIC INSTRUMENTS

12. The photographic instruments and ancillary equipment are listed in Table 2.

General

13. The main components are the F.24 camera which is carried by a Type 25 Mk.2 camera mounting, located between frame 29 bulkhead and frame 30, and a camera control Type 35, and the camera master switch fitted above the bomb distributor on the starboard side of the cabin. The camera is electrically-driven through a flexible drive by a camera motor, Type B, positioned on a wedge plate on frame 29. Electrical connection between camera and motor is made with a camera electrical lead No.4.

Lenses

14. Various operational requirements are met by fitting lenses of different focal lengths to the camera. The lenses available are listed in Table 2. As lenses of long focal length have correspondingly long lens cones, provision is made to vary the height of the camera to suit the lens in use.

15. The camera mounting is clamped on two rails, the height of which can be varied. The rails are arranged to slide in four channels which are part of a box structure attached to frame 29 bulkhead and two sub-frames forward of frame 30. The channels are drilled at suitable positions which permit the camera to be located at the height required for the lens in use. The mounting is provided with a spirit level and means of adjustment of camera angle and tilt. The camera rails are drilled to mate with holes in the channels and secured by four quick-release pip pins.

Operation

16. Provision is made for the camera to make single exposures or to function in conjunction with the bomb release circuits. Provided that the CAMERA MASTER switch and the integral switch on the camera control are ON, single exposures can be made by depressing the SINGLE EXPOSURE switch on the Type 35 control. When required to function with the bomb release circuits, the CAMERA MASTER switch should be set to ON. The camera will then begin to function whenever the pilot's or the bomb aimer's bomb release switch is operated. Either switch, when closed, energizes a Type Q relay situated near J.B.14 in the rear starboard cabin. The relay has two sets of contacts which close when the relay is energized. One set initiates camera operation via the Type 35 camera control, and the other set, bomb release via the bomb control circuits.

Camera heating

17. A hot air diffuser is installed near the camera window to prevent misting of the window and the camera lens. The hot air is tapped from the hot air supply for the cabin heating and pressurization system.

TABLE 2

Photographic Instruments

Stores Ref.	Equipment	Quantity	Relevant A.P.
14A/2602	Camera, Type F24, c/w 8 in. F2.9 lens.....	1	
14A/3147	Lens, 14 in. F5.6, No.2 or.....	1	
14A/3255	Lens, 14 in. F5.6, No.3 or.....	1	A.P.1355C, Vol.1, Sect.1
14A/4119	Lens, 20 in. F6.3, No.4.....	1	
14A/2615	Filter, No.4.....	1	
14A/2206 or 4013	Control, Type 35 No.8 or 8A.....	1	
14A/988	Camera motor, Type B.....	1	
14A/3568	Camera drive, Type C.....	1	A.P.1355C, Vol.1, Sect.3
14A/862	Camera lead, No.4.....	1	
14A/4004	Mounting, Type 25, Mk.2.....	1	A.P.1355C, Vol.1, Sect.4

MISCELLANEOUS INSTRUMENTS – GROUP D
(completely revised)

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LIST OF ILLUSTRATIONS

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 Air Publication in which they are described. The oxygen system as a whole is described in A.P.101B-0402-1A, Sect.3, Chap.10. The location of the relevant items of equipment in this group are shown in fig.1-1A.

DESCRIPTION

Accelerometer

2. An accelerometer is mounted on the centre of the coaming above the flight instrument panel at the pilot's station and provides a visual indication of the acceleration forces being imposed on the aircraft structure during flight. The instrument accommodates a central locking-device at the rear and a re-setting shaft at the front. It is designed to operate over the range −5g to +10g.

Cabin air altimeter

3. An altimeter, having an operating range of 8000 to 50,000 ft, is fitted to the miscellaneous instrument panel to indicate the apparent altitude in the cabin due to the operation of the cabin pressurization system.

Hydraulic pressure gauges

4. Four gauges, calibrated from 0-4000 lb/in^2, register the pressures in the main hydraulic system and the brakes system. Two of these gauges, one for each system, are mounted on the miscellaneous instrument panel and indicate the hydraulic pressures in their respective systems. The 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 bomb bay forward bulkhead for the brakes system accumulator.

Fatigue meter

5. A fatigue meter is fitted in the starboard undercarriage bay. It is connected by a 2-way cable, fitted with a connecting plug at the meter end only to J.B.7 in the leading edge of the port wing. The cable connects to circuit terminals U12 and E1 *(Sect.5, Chap.1, Group G)* which ensures that the meter will only operate when the aircraft is in flight with the alighting gear retracted.

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

6. The oxygen system, as a whole, is described in A.P.101B-0402-1A, Sect.3, Chap.10 and the electrical services for the regulators and their associated remote magnetic indicators in Sect.5, Chap.1, Group W. A brief description of the regulators and oxygen contents gauges is given in the following paragraphs; for further information reference should be made to the A.P.107D series.

Oxygen regulators

7. Four regulators are fitted in the cabin. One is mounted on the fuselage skin above the pilot's console, one above the 1st navigator's instrument panel, one on the fuselage skin at the starboard side of the 2nd navigator's station, and one at the forward station on the starboard side. A transparent guard is fitted over the blinker of the pilot's regulator.

8. The regulators are designed to automatically mix oxygen with air in suitable ratios for high altitude 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 per cent 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 per cent OXYGEN the regulator will deliver undiluted oxygen irrespective of altitude.

9. A pressure gauge and flow indicator are mounted on the face of each regulator. The pressure gauges are calibrated from 0 to 500 lb/in^2 and show the pressure down-stream of the reducing valves. They do NOT indicate the pressure in the oxygen cylinders. The flow indicators consist of doll's-eye-type electro-magnetic indicators which blink when oxygen is supplied to their associated masks.

Remote indicators

10 A remote magnetic indicator mounted on the flight instrument panel and the navigator's instrument panel provides the pilot and the 1st navigator respectively with a direct frontal indication that their oxygen regulators are operating correctly. A further remote indicator, located on the starboard wall at the 2nd navigator's station, provides a remote indication that the forward station oxygen regulator, when in use, is operating correctly. The remote indicators are electrically connected in parallel with the indicators on their associated regulators.

Oxygen contents gauges

11. Two oxygen contents gauges fitted on the miscellaneous instrument panel, indicate the amount of oxygen remaining in each bank of cylinders. The instrument dials are marked in fractions from 0 to full, the '⅛' sector being coloured red.

Rear viewing periscope

12. This instrument is designed to provide an external field of view in the rearward direction to enable the crew to observe condensation trails and examine the rear of the aircraft. When in use the periscope is inserted into the tube of the periscopic sextant mounting. A 3-pole plug attached to the periscope may be mated with a plug on the sextant mounting which carries a 28 volt supply for heating the window which is coated with a transparent conducting medium. When connected to the supply, the window is heated sufficiently to prevent icing or misting either of the window or of the index prism.

TABLE 1

Miscellaneous instruments

REF. No.	Equipment	Quantity	Relevant A.P.
6A/6556084 or 6A/2237916	Hydraulic pressure gauge, 10069	4	
6A/3451	Pressure gauge, Mk.14LL	4	A.P.112G-0400-1
6A/1037854	Accelerometer, Mk.2	1	A.P.112G-0208-1
6A/6486	Altimeter, Mk.21	1	A.P.112G-1005-1
6D/2671	Fatigue meter, Mk.13	1	A.P.112G-0203-1
6D/2237	Oxygen regulator, Mk.17F	4	A.P.107D series
6B/2764	Oxygen contents gauge, Mk.4	2	A.P.107D-0305-1
	Rear viewing periscope, Type KPG 0502	1	A.P.1275B, Sect.17

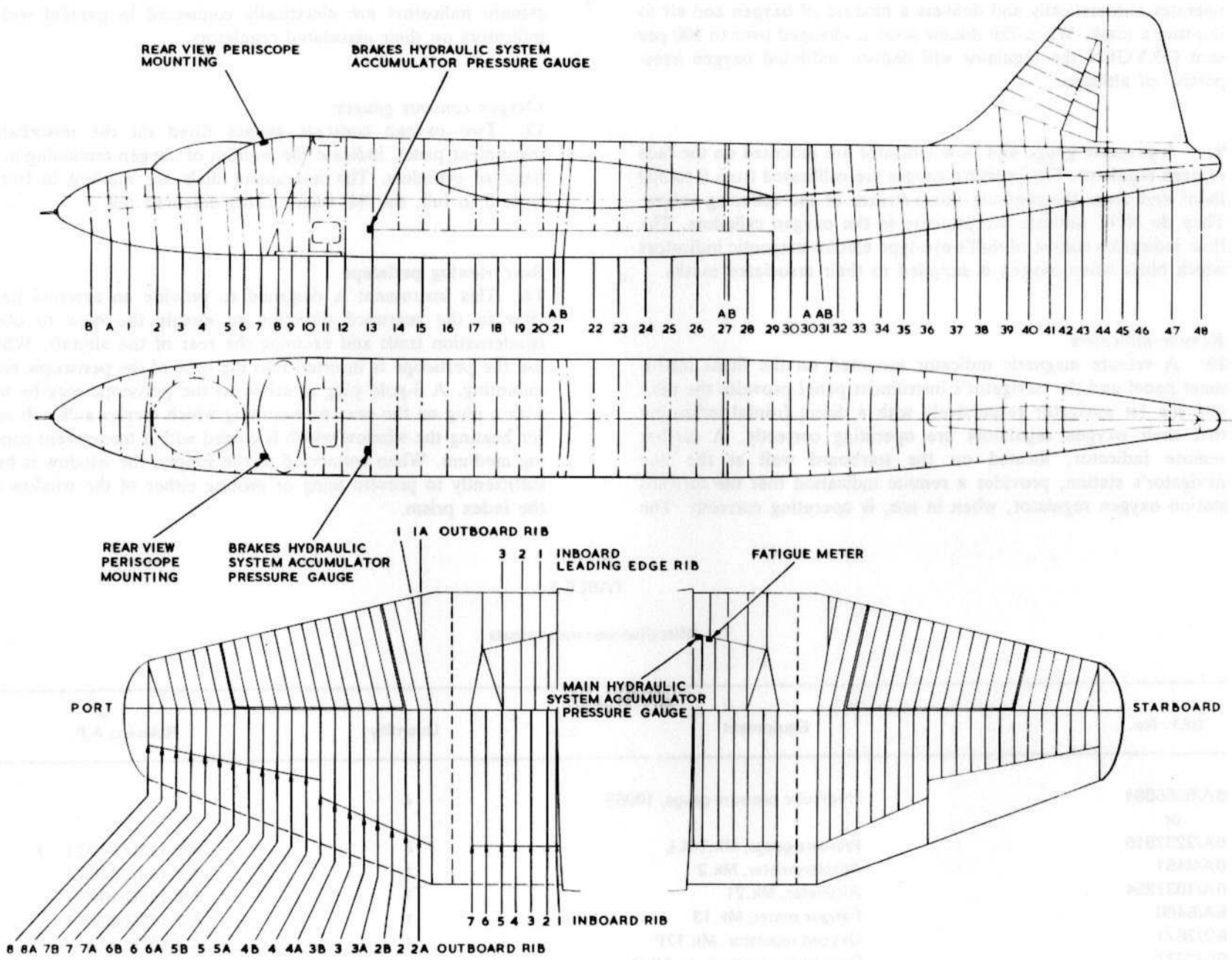
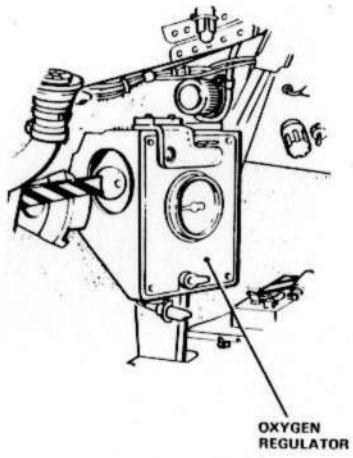
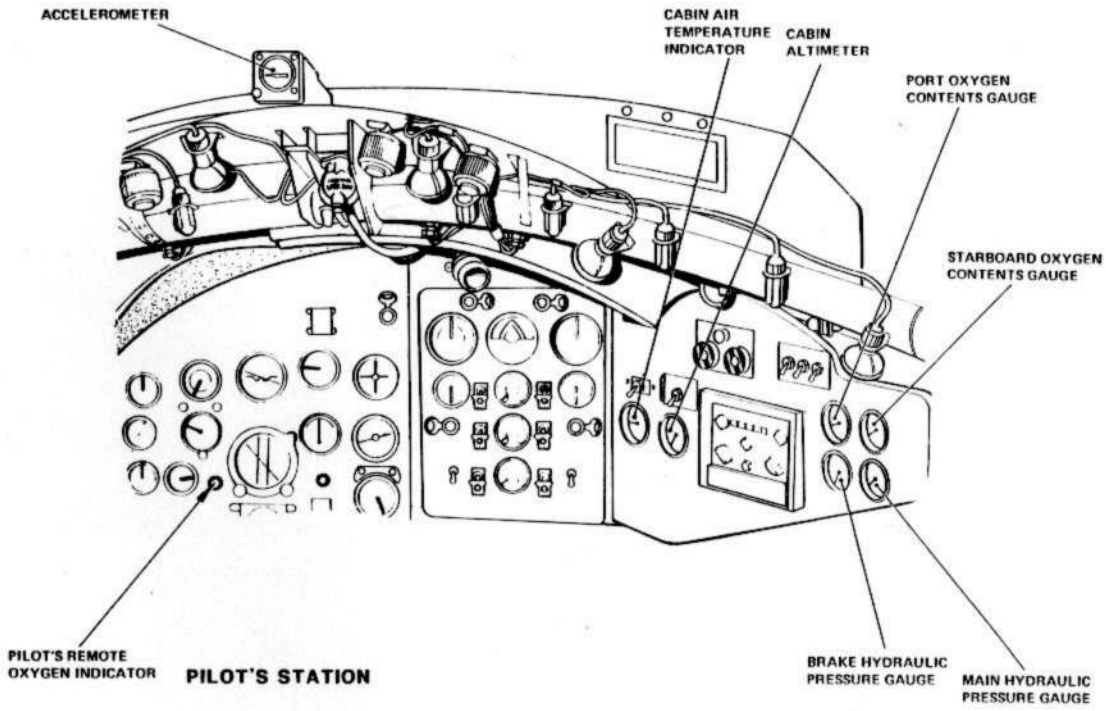


FIG. 1. LOCATION DIAGRAM

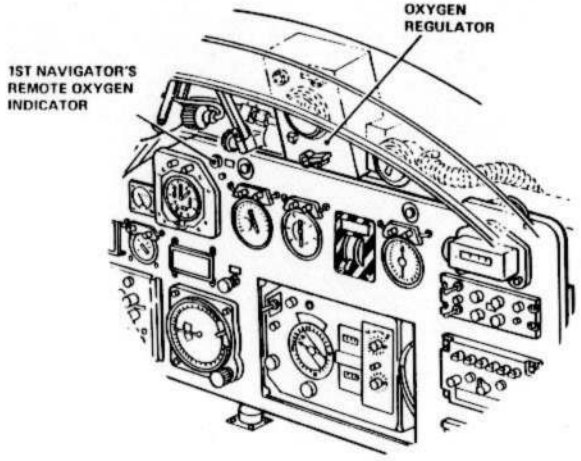
101B-0402-1B/223/8233608/7-83/BAe/1307

UK RESTRICTED

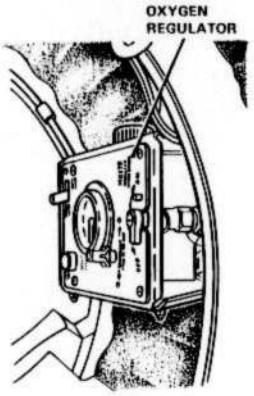




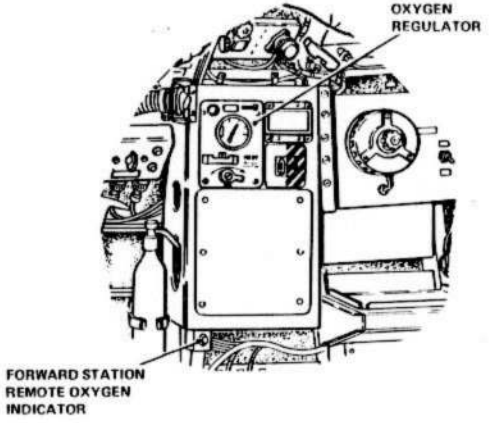
PILOT'S STATION



1ST NAVIGATOR'S STATION



FORWARD STATION



2ND NAVIGATOR'S STATION

FIG.1A. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

ENGINE INSTRUMENTS — GROUP E

(completely revised)

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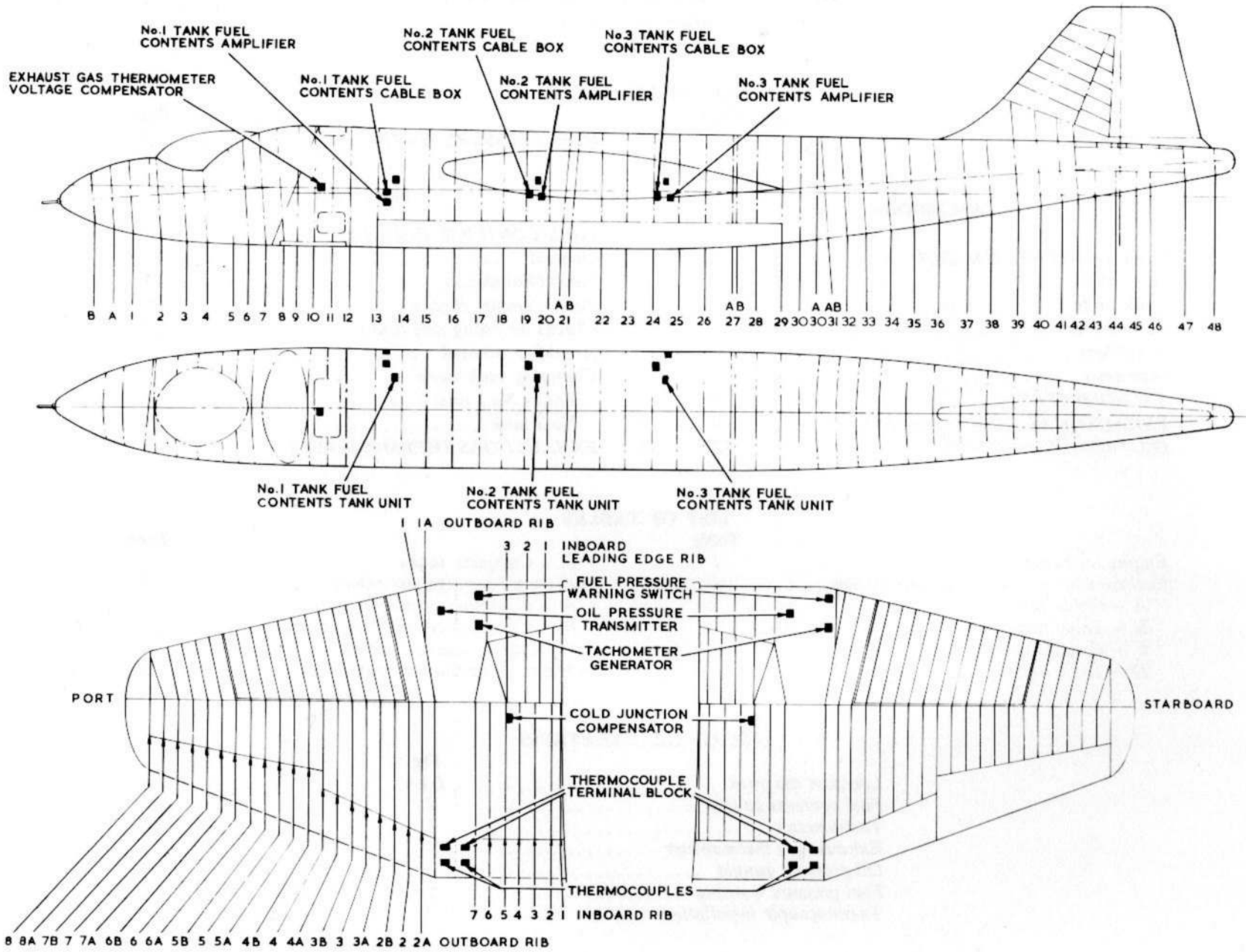

FIG.1. LOCATION DIAGRAM

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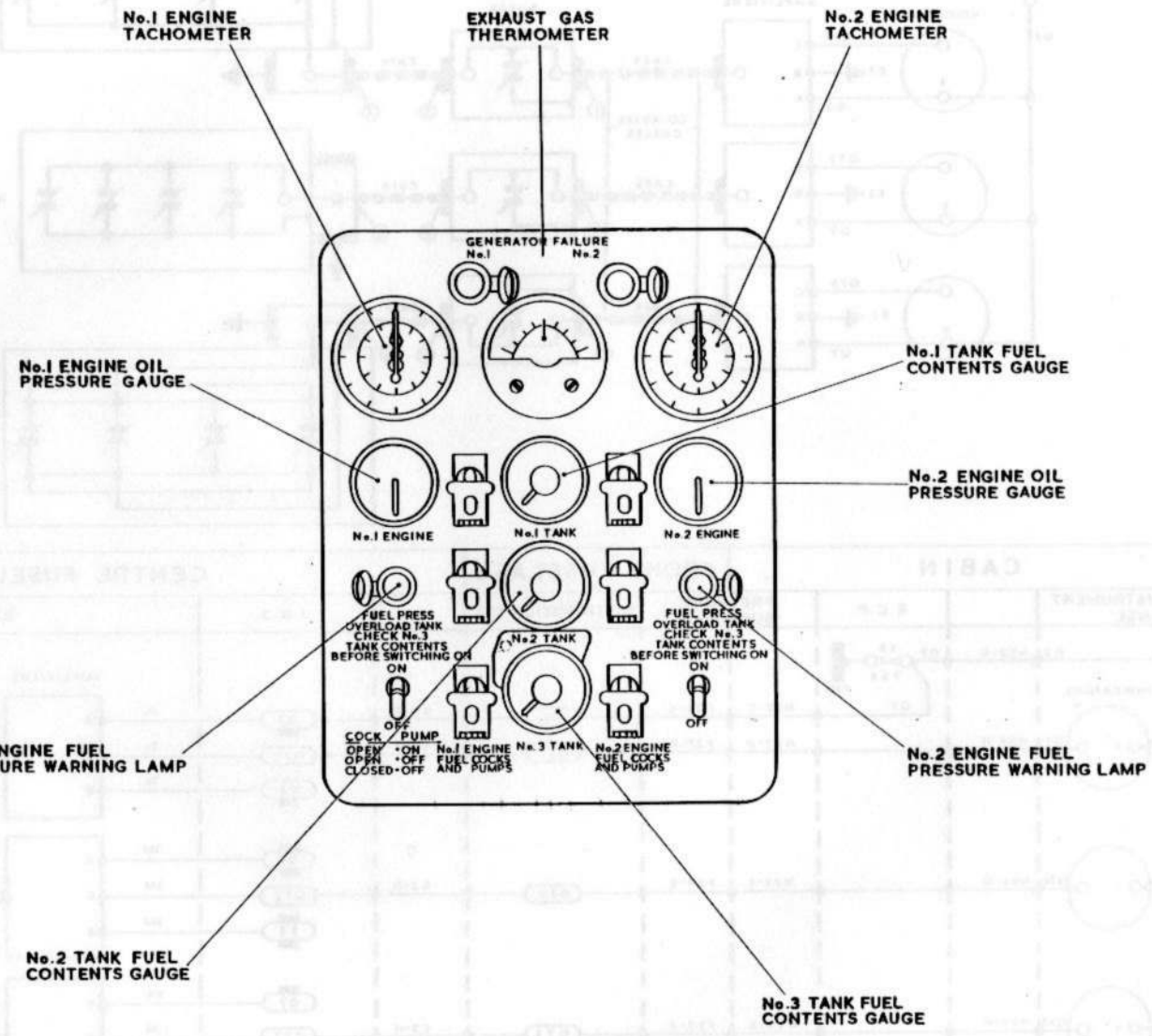

ENGINE INSTRUMENT PANEL — PILOT'S STATION

FIG.1A. LOCATION DIAGRAM

◀PANEL AMENDED▶

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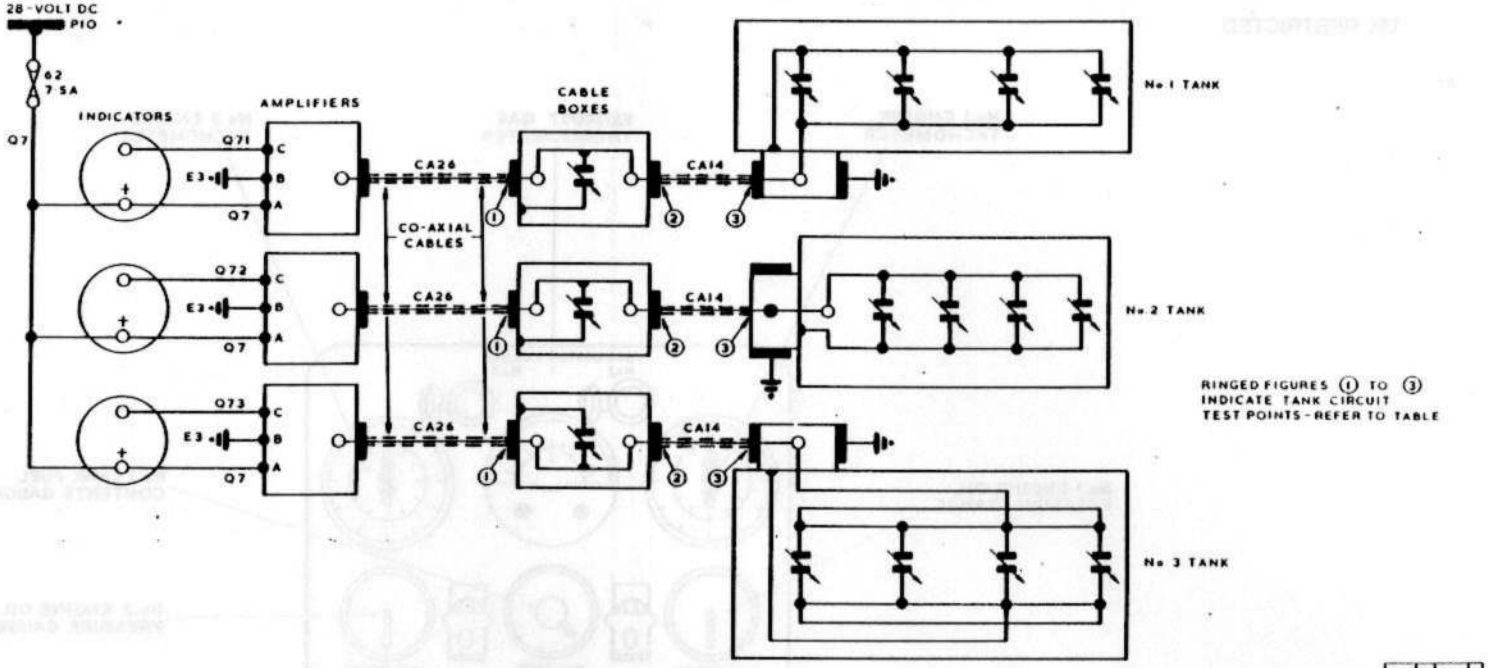


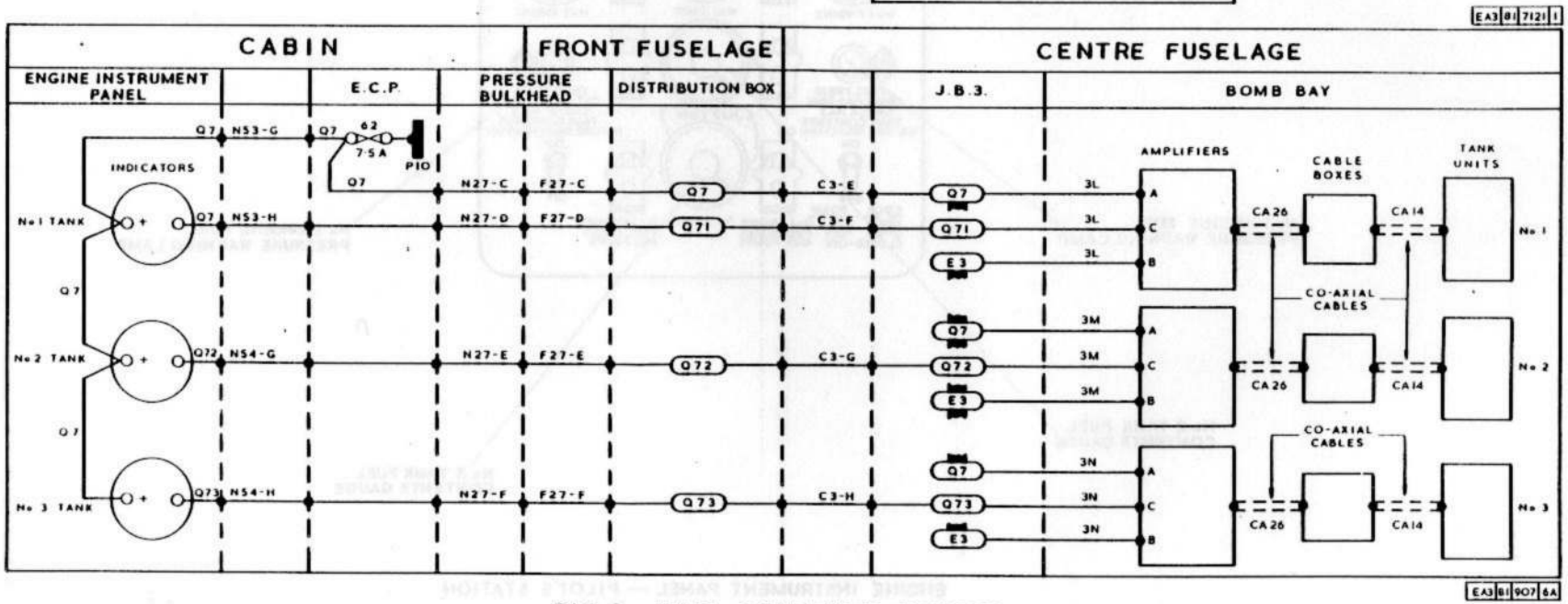


FIG. 2. FUEL CONTENTS GAUGES

UK RESTRICTED

Introduction

1. In this group, descriptive and servicing information is given for the engine instruments. Table 1 lists the main components together with their reference numbers and the Air Publication in which they are described. The location of the principle items of equipment relevant to this group are shown in fig.1-1A.

DESCRIPTION

FUEL CONTENTS GAUGES

General

2. The fuselage fuel tanks are fitted with Smith Waymouth type electrical fuel contents gauges. No gauges are fitted in the jettisonable wing tip tanks nor in any bomb bay overload or auxiliary 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

4. No.1 and No.2 tanks each have four channel-type units paralleled in ring circuits. The units in each tank are linked by insulated copper wire and connected to a coaxial terminal in the base of the tank. No.3 tank has four flexible-type units connected by coaxial cables.

Cables boxes

5. 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 trimmer cover plate.

Amplifiers

6. A total of three amplifiers are employed in the system and are located along the starboard wall of the bomb 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.

Indicators

7. Three indicators, one for each tank system, are mounted on the engine instrument panel. The instruments differ only in their calibration markings.

TACHOMETERS

8. Engine speeds are indicated by two tachometers mounted on the engine instrument panel. Each instrument has a range of 1200 to 12,000 r.p.m. shown on two 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. Two sockets, annotated RPM PORT-STBD, mounted on the forward face of the E.C.P. are connected in parallel with the indicator and generator and provide the facility to monitor the r.p.m. readings.

EXHAUST GAS THERMOMETERS

9. The temperature of the engine exhaust gas is shown by a twin-reading indicator, fitted on the engine instrument panel. The thermometer is primarily operated by thermocouples, four of which project into each engine jet pipe.

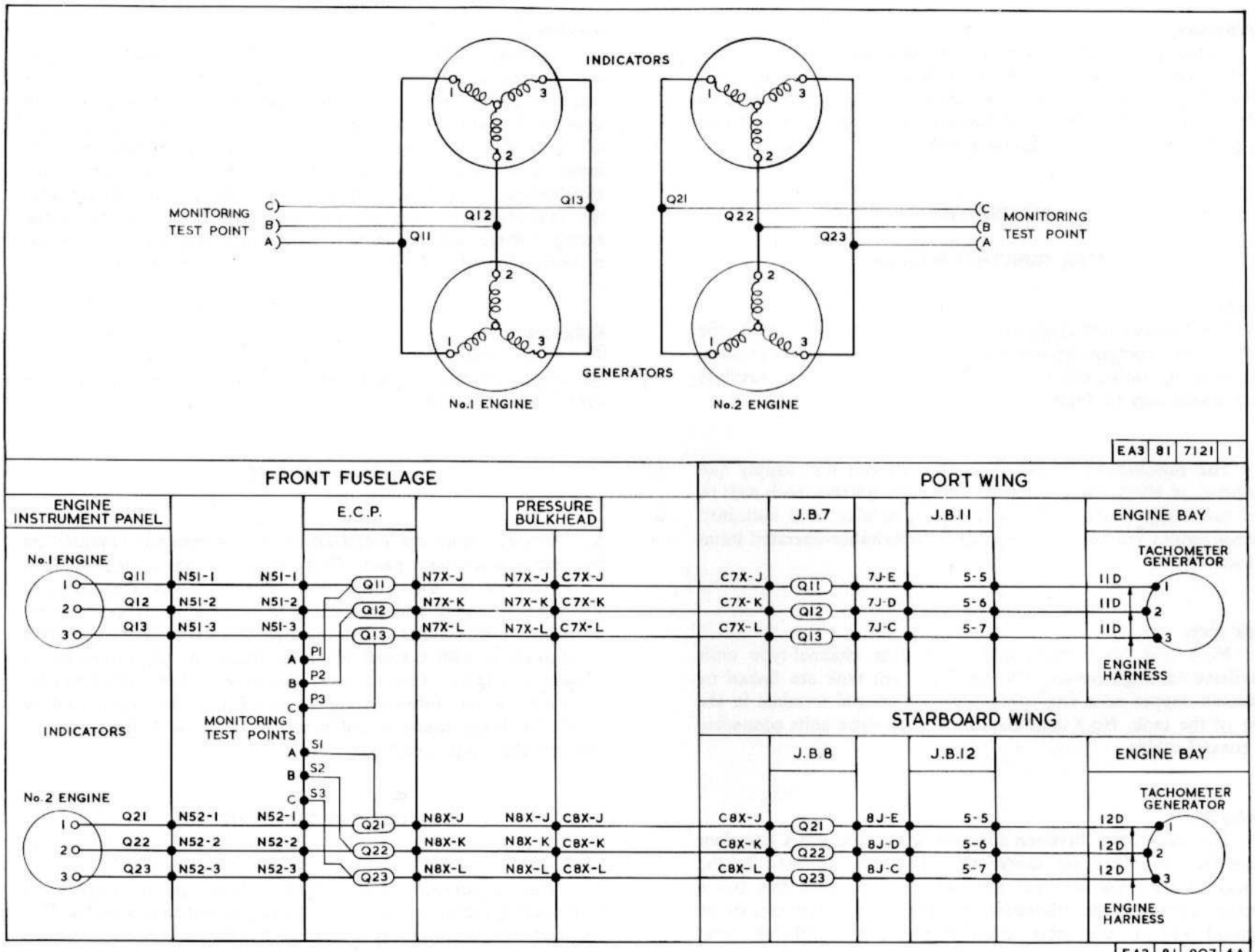


FIG.3. TACHOMETERS

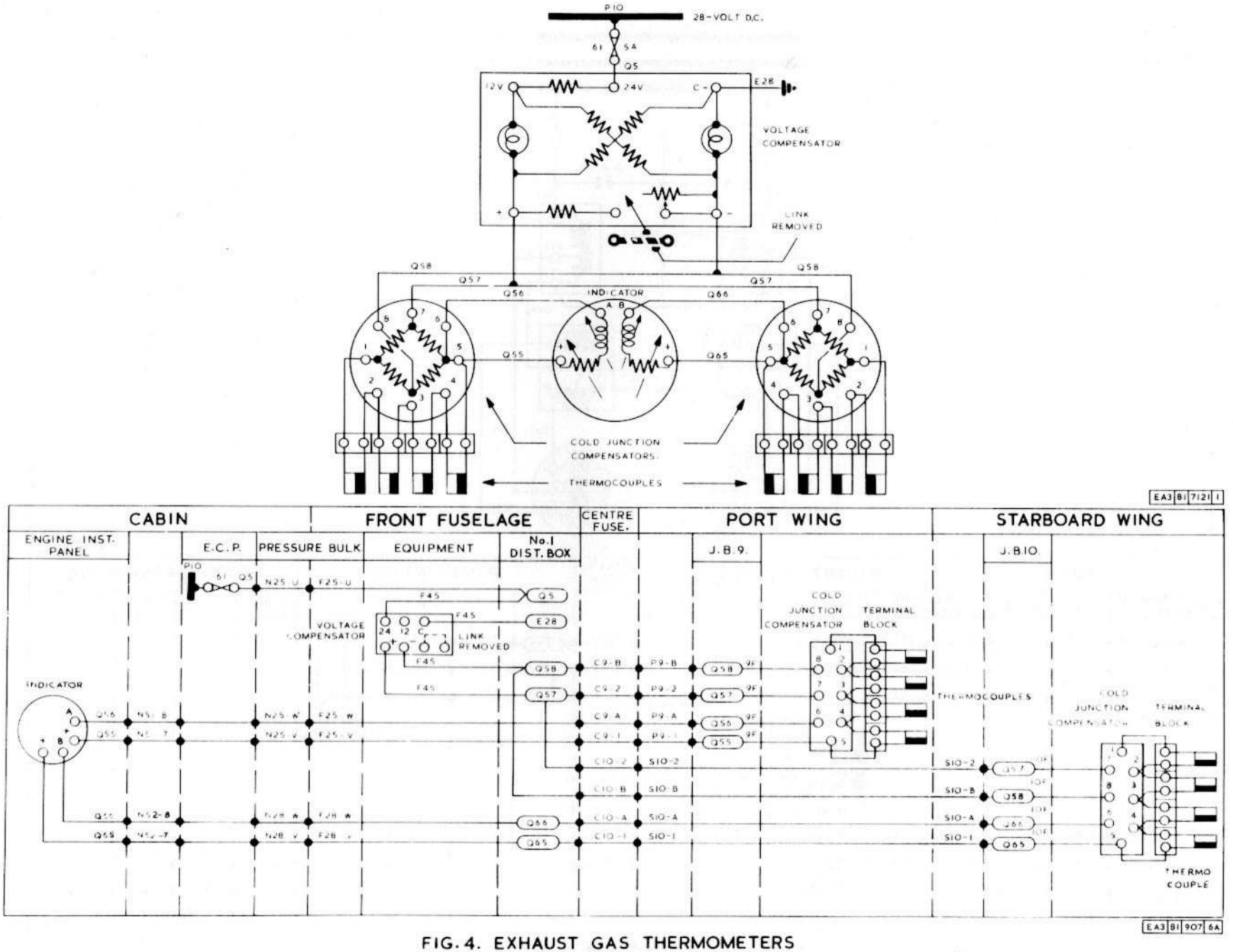


FIG. 4. EXHAUST GAS THERMOMETERS

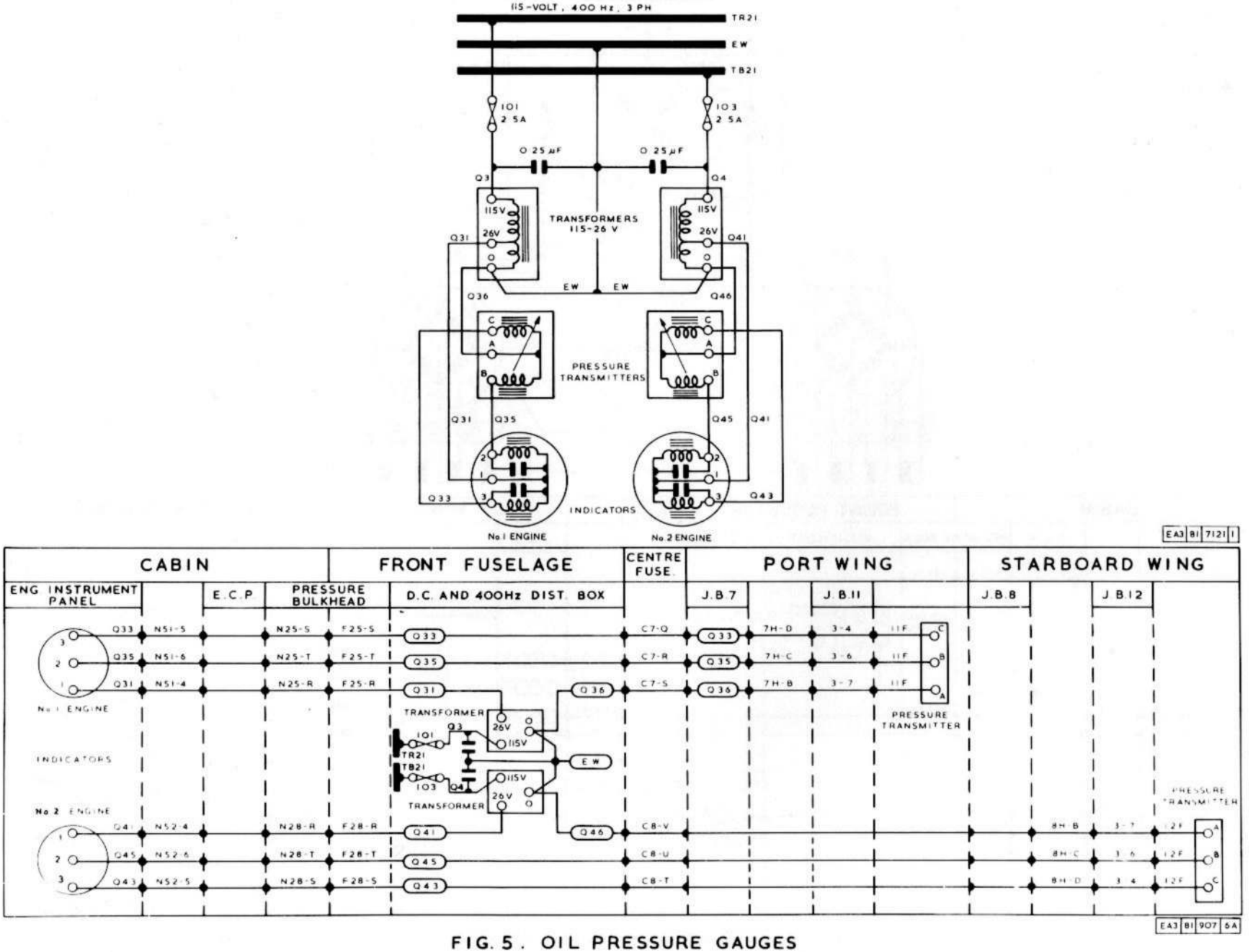


FIG. 5. OIL PRESSURE GAUGES

10. Each group of thermocouples operates in conjunction with a cold junction compensator 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 voltage compensator is embodied in the system and is installed on a bracket attached to frame 12 in the upper equipment compartment.

11. 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.

OIL PRESSURE GAUGES

12. 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 Hz, 3-phase supply by means of two small step-down transformers housed in the No.1 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 *(Chap.1, Group D).*

FUEL PRESSURE WARNING

13. Warning of low pressure in the engine fuel supply lines is given by two red lamps mounted on the engine instrument panel. The lamps are operated by the closing of a pressure switch fitted at the starboard side of the engine. The switch contacts are set to close whenever the fuel pressure falls below $6 \begin{smallmatrix}+\frac{1}{2}\\-0\end{smallmatrix}$ lb/in^2. The lamp filaments, rated at 6 volts,are fed from the aircraft d.c. supply via 400 ohm resistors located in the E.C.P.

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.

FUEL CONTENTS GAUGES

General

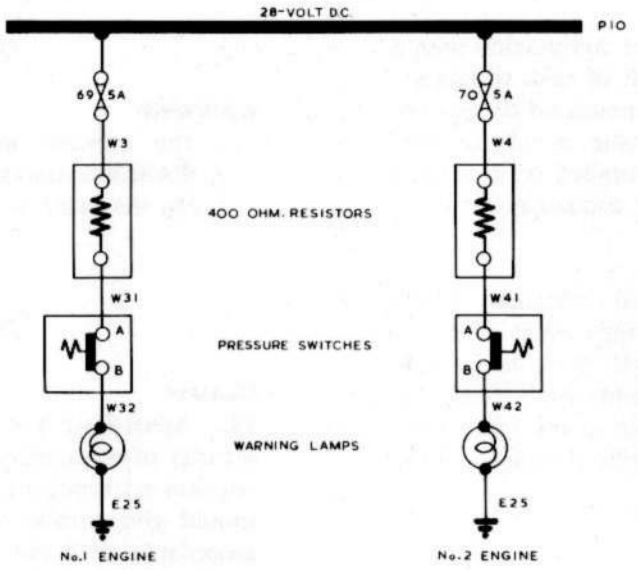
14. Apart from the normal examination of the installation for the security of components and obvious damage, the fuel gauge system requires no routine servicing other than functional tests. If a gauge should give erratic indications, its system should be checked in accordance with the instructions contained in the following paragraphs. For servicing and testing individual components reference should be made to the relevant Air Publication *(Table 1).* Information on the use of the Smith Waymouth test set, Type QAA, is given in A.P.112G-0753-1.

15. 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.

16. 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:-

No.1 tank	2 gallons
No.2 tank	4 gallons
No.3 tank	5 gallons

17. Before the trimmers are adjusted to obtain a zero reading, five gallons of fuel should be put into each tank and the booster pumps run until no more fuel is delivered.



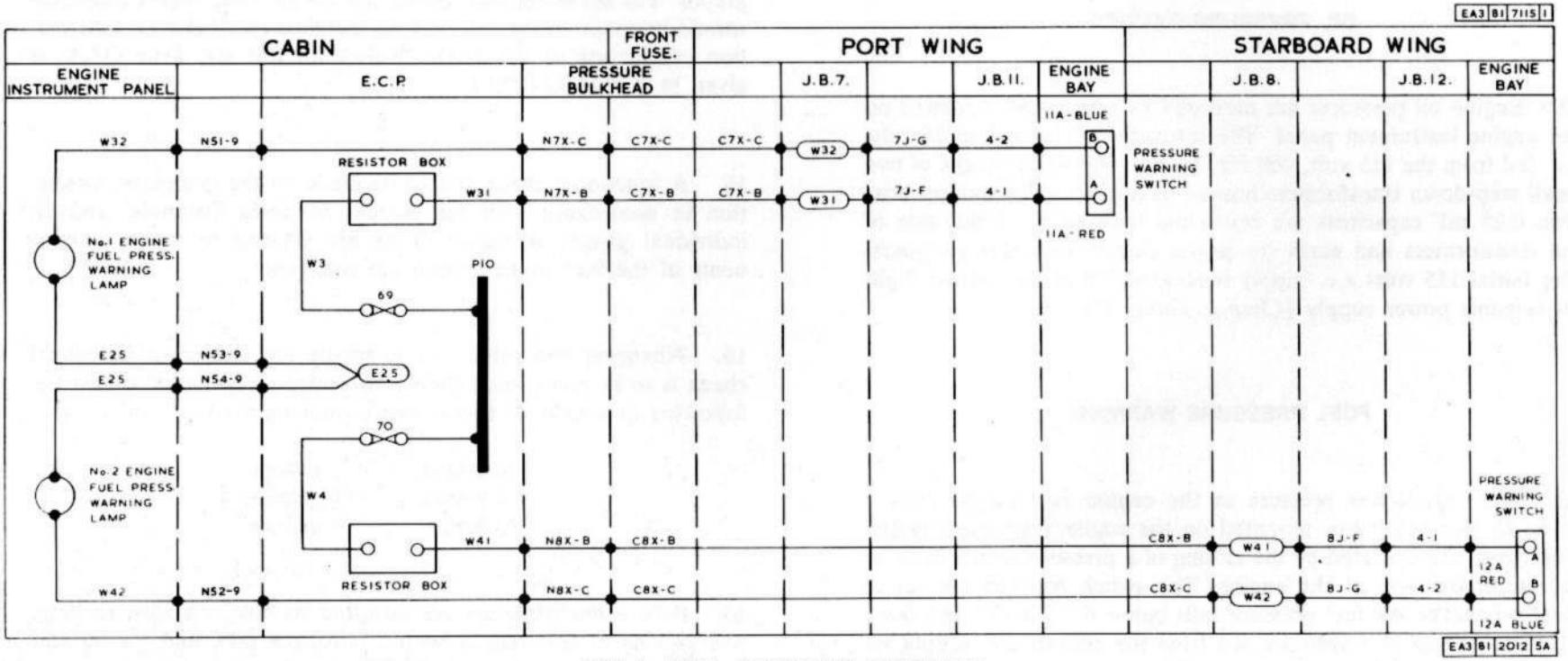


FIG.6. FUEL PRESSURE WARNING

Functional checks

18. With the BATTERY ISOLATION SWITCH set to the OFF position, connect a 28 volt supply to the external power plug. Allow at least 5 minutes for the amplifier to warm up and check that the indicator reads zero.

19. 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.20 should be followed.

Tanks 'empty' checks

20. The tanks empty checks are made in conjunction with Table 4 and the diagram, fig.2, which shows the interconnection between the tank gauge installation and amplifiers; the ringed numbers (1 to 3) 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 3 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 2mA on the test set meter.

Checks on fitting new tanks

21. 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.

22. 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

23. During servicing involving the removal of the tank gauge amplifiers, the bomb 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

Tanks No.1 and 2

24. If either No.1 or No.2 fuselage tanks have to be changed because of faulty tank units, they should be returned to the appropriate manufacturer for servicing.

No.3 tank

25. Instructions for removal, installation and folding for storage are given in A.P.101B-0402-1A, 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.3 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).

26. No.3 fuel tanks are manufactured both by the Marston Excelsior Company and the Fireproof Tank Company. Each make of tank can be recognized 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

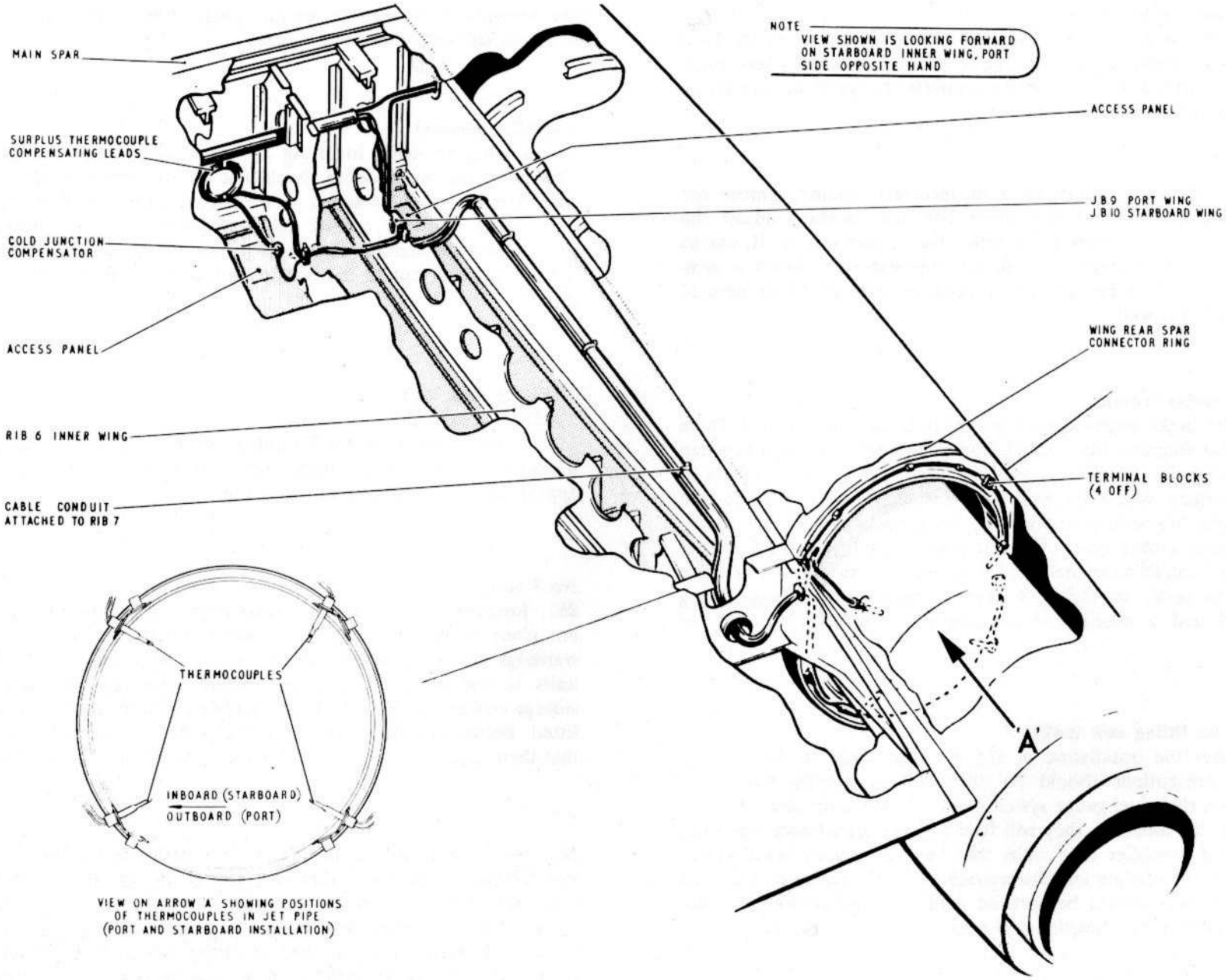


FIG. 7. THERMOCOUPLE INSTALLATION

2 B.A. bolts vulcanized to the tank 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 vulcanized to the tank inner skin. Access to the forward tank units is through the pump apertures; access to the aft tank units 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.

27. The procedure for fitting or changing the tank units in No.3 tank is described under the tank installation *(A.P.101B-0402-1A, Sect.4, Chap.2).*

EXHAUST GAS THERMOMETERS

28. 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 thermocouples involves the removal of the engine rear cone fairings as described in A.P.101B-0402-1A, Sect.4, Chap.1.

TABLE 1

Engine instruments

Ref.No.	Equipment		Quantity	Relevant A.P.
	Smith-Waymouth-type fuel contents gauges			
6A/4333472	Indicator, A.G.26	(No.1 tank)	1	A.P.112G-0725-1
6A/4333473	Indicator, A.G.27	(No.2 tank)	1	
6A/4339125	Indicator, A.G.144	(No.3 tank)	1	
6A/4333096	Amplifier, F.A.A.		3	
6A/4333097	Cable box, JLA/103/60	(No.1 tank)	1	
6A/4333098	Cable box, JLA/103/61	(No.2 tank)	1	
6A/4339124	Cable box, JY/86	(No.3 tank)	1	
6A/4333088	Tank unit, TB44A		1	
6A/4333089	Tank unit, TB45A	(No.1 tank)	1	
6A/4333090	Tank unit, TB46A		1	
6A/4333091	Tank unit, TB47A		1	
6A/2757	Tank unit, TB48A		1	
6A/4333093	Tank unit, TB49A	(No.2 tank)	1	
6A/4333094	Tank unit, TB50A		1	
6A/4333095	Tank unit, TB51A		1	
6A/4333112	Tank unit, TC17	(No.3 tank)	2	
6A/433313	Tank unit, TC18		2	
	Fuel pressure warning			
5L/1085815	Warning lamp		2	A.P.113F-0235-1
6A/1912	Switch unit		2	A.P.112G-1141-1
6A/1062426	Resistance units		2	
	Oil pressure gauges			
6A/4333074	Indicator 0-40 lb/in^2 Type S.63.4.364		2	A.P.112G-0517-16
or				
6A/2781	Indicator 0-40 lb/in^2 Type S.63.4.232		2	
6A/4333076	Transmitter		2	
6A/4333075	Transformer, Type 213MV		2	

continued . . .

TABLE 1 Engine instruments — *continued*

Ref. No.	Equipment	Quantity	Relevant A.P.
	Exhaust gas thermometers		
6A/1674	Indicator, Type B twin pointer	1	A.P.112G-0628-1
6A/4332834	Cold junction compensator	2	
6A/4332835	Voltage compensator, Type A	1	
6A/1942	Extension leads	8	
6A/1675	Thermocouples, Type B (Modified to E.E.A.Drg.EA3.81.1105)	8	
	Tachometers		
6A/2801	Indicator, Mk.10A	2	A.P.1275A, Vol.1, Sect.26, Chap.9
6A/4333280	Generator, Mk.8	2	A.P.112G-1224-1

TABLE 2

Fuel contents gauge capacitance values

A — Cable boxes

Code	Total capacitance value	
	Trimmer at Max. not less than	*Trimmer at Min. not more than*
JLA/103/60	387pF	477pF
JLA/103/61	387pF	477pF
JY86	1374pF	1540pF

B — Tank Terminal

Code	Capcitance
JKB1 Mod.01	17 ± 3pF

C — Coaxial cables

Code	Length (in.)	Capacitance
CA14	14	26 ± 3pF
CA26	26	47 ± 3pF
PR30	30	44 ± 5pF
PS54	54	83 ± 9pF
PS73	73	115 ± 12pF

continued . . .

TABLE 2 Fuel contents guage capacitance values — *continued*

D — Tank units

No.1 tank

Unit code	Initial capacitance (pF)	Range (pF)
TB44A	230 ± 5	240 ± 3
TB45A	230 ± 5	237 ± 3
TB46A	212 ± 5	216 ± 3
TB47A	212 ± 5	216 ± 3

No.2 tank

Unit code	Initial capacitance (pF)	Range (pF)
TB48A	226 ± 5	231 ± 3
TB49A	222 ± 5	227 ± 3
TB50A	230 ± 5	237 ± 3
TB51A	226 ± 5	230 ± 3

No.3 tank

Unit code	Initial capacitance (pF)	Range (pF)
TC17	230 ± 5	246 ± 3
TC18	230 ± 5	246 ± 3

E — Complete tanks

Tank	Capacitance - Empty and Out of Aircraft	Capacity - Installed Empty and Dry	Capacitance - Installed Wet	Unusable Fuel
No.1	940 ± 20pF	976 ± 25pF	985 ± 27pF	2 gal
No.2	940 ± 20pF	951 ± 25pF	975 ± 30pF	4 gal
No.3	1377 ± 70pF	1400 ± 70pF	1432 ± 80pF	5 gal

TABLE 3

Fuel contents gauge test values

A – Insulation resistance tests

Component	Condition	Insulation resistance
Tank unit	New	Not less than 20 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	New or used	Not less than 20 megohms
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 tests 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)	1500pF
'Tanks full'	2500pF
Range	1000pF

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 ± 0.03
1637	1646	3.00 ± 0.05
1801	1816	4.00 ± 0.05
2004	2010	5.00 ± 0.05
2242	2242	6.00 ± 0.05
2504	2500	7.00 ± 0.05

TABLE 4

Test point capacitance values

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

	USING QAA MOD.2 TEST SET			USING QAA MOD.03 OR 04 TEST SET		APPROXIMATE READING ON	
Test point	Test capacitance A (pF)	Test capacitance B (pF)	Adapters and cables used	Test capacitance B (pF)	Adapters and cables used	Aircraft indicator	Test set meter
				No.1 tank			
1	1453 ± 3	1299 ± 8	CE1, CC3	1295 ± 8	CE1, CC1	Zero contents	2mA
2	1011 ± 30	861 ± 33	CE1	861 ± 33	CE1	Zero contents	2mA
3	985 ± 27	831 ± 32	CE1, CC3	827 ± 32	CE1, CC1	Zero contents	2mA
				No.2 tank			
1	1453 ± 3	1299 ± 8	CE1, CC3	1295 ± 8	CE1, CC1	Zero contents	2mA
2	1011 ± 30	851 ± 36	CE1	861 ± 33	CE1	Zero contents	2mA
3	985 ± 27	821 ± 35	CE1, CC3	827 ± 32	CE1, CC1	Zero contents	2mA
				No.3 tank			
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

The values quoted in column 'A' are the true capacitance to be connected at each point, whilst those in column 'B' are the true capacitance values less the capacitance of the connecting cables and/or sockets. The 'B' values are the actual Test Set variable capacitor settings, and the 'A' values are the theoretical values. Both are given so that allowances may be made if a different method of connecting is used.

continued . . .

TABLE 4 Test point capacitance values — *continued*

The standard items of equipment supplied with each type of test set are given below

QAA MOD.02 TEST SET			QAA MOD.03 OR 04 TEST SET		
Code	**Description**	**Capacitance**	**Code**	**Description**	**Capacitance**
CG144	6-cored cable with plug and socket	Not applicable	CG144	6-cored cable with plug and socket	Not applicable
CE1	Coaxial cable with plugs	150 ± 3pF	CE1	Coaxial cable with plugs	150 ± 3pF
CC3	Double Waymouth adapter	4 ± 2pF	CC3	Pye-Waymouth adapter	8 ± 2pF

TABLE 5

Indicator calibration/current values

No.1 tank		No.2 tank		No.3 tank	
Indicator - Code AG26		**Indicator - Code AG27**		**Indicator - Code AG144**	
Indication pounds	Current (mA)	Indication pounds	Current (mA)	Indication pounds	Current (mA)
0	2.00	0	2.00	0	2.00
250	2.63	250	2.79	250	2.40
500	3.06	500	3.41	500	2.70
750	3.44	750	3.98	750	2.95
1000	3.73	1000	4.44	1000	3.20
1250	3.96	1250	4.82	1250	3.46
1500	4.24	1500	5.20	1500	3.71
1750	4.46	1750	5.57	1750	3.96
2000	4.72	2000	5.95	2000	4.22
2250	4.94	2250	6.38	2250	4.48
2500	5.15	2480 FULL	6.79	2500	4.74
2750	5.38			2750	5.02
3000	5.63			3000	5.30
3250	5.85			3250	5.58
3500	6.11			3500	5.89
3750	6.41			3750	6.24
3990 FULL	6.76			4000	6.62
				4280 FULL	6.90

Tolerance on all current values 0.05mA

FLIGHT INSTRUMENTS — GROUP F

(completely revised)

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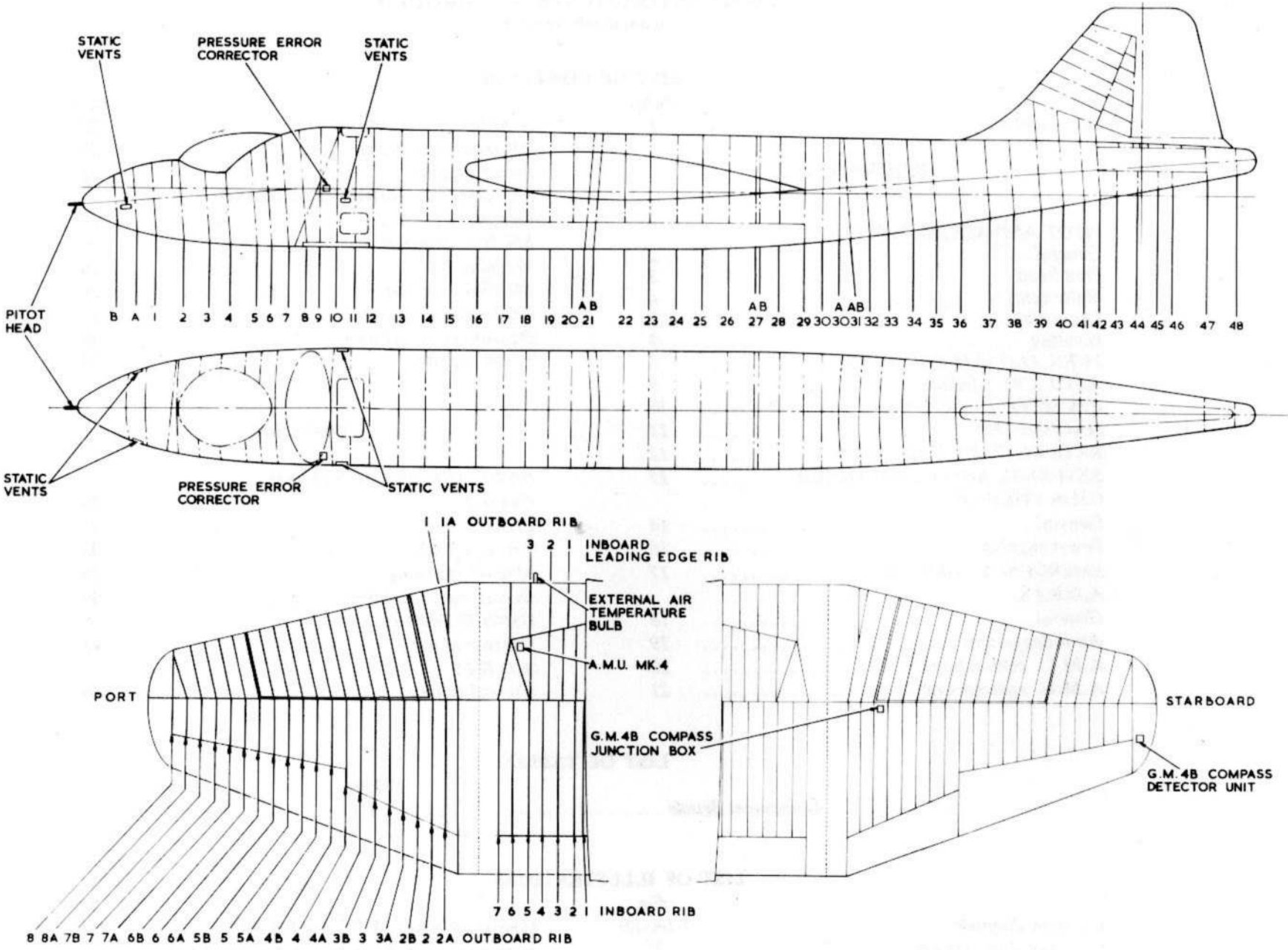
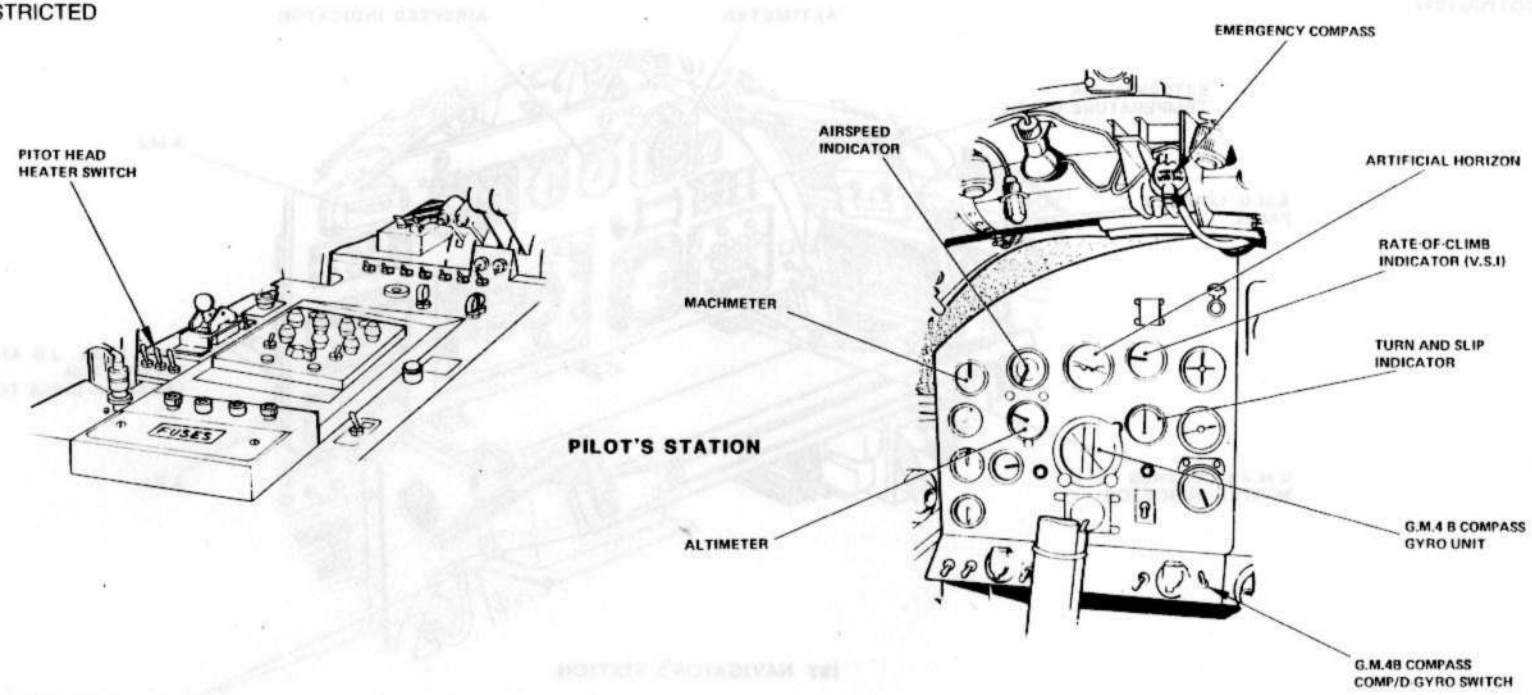


FIG.1. LOCATION DIAGRAM

UK RESTRICTED



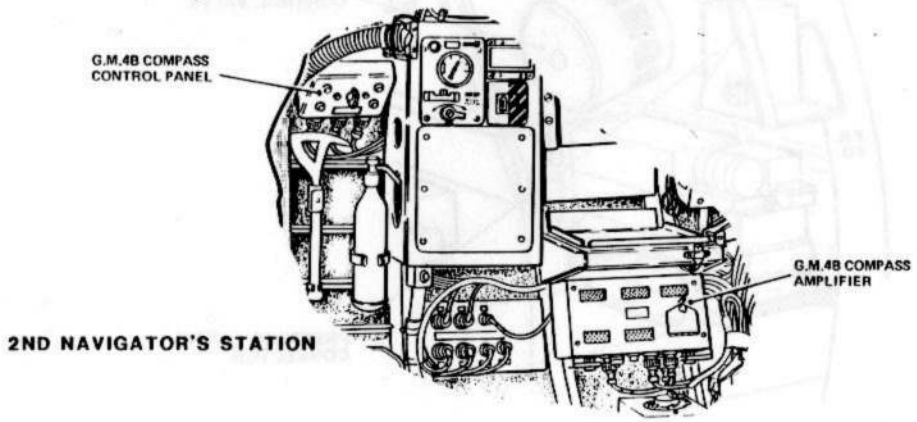


FIG.1A. LOCATION DIAGRAM

◀ STI/CAN/586c INCORPORATED ▶

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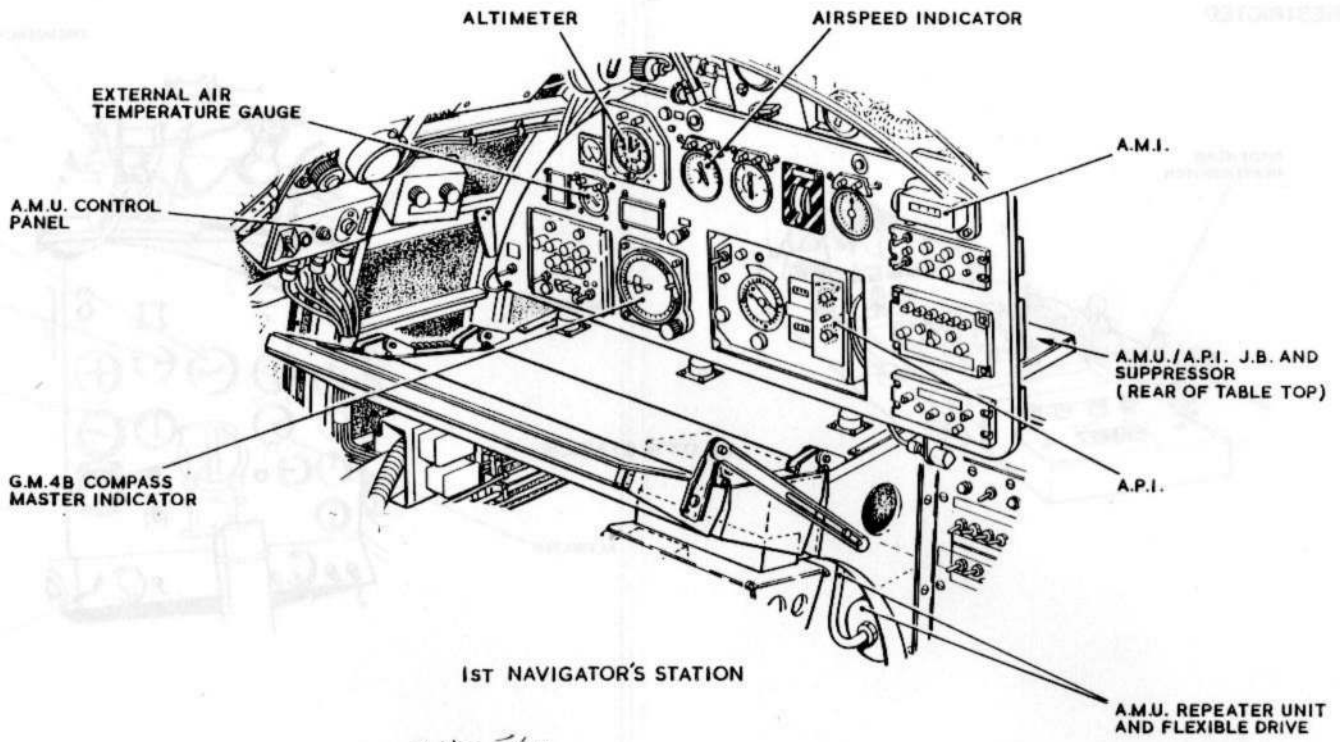
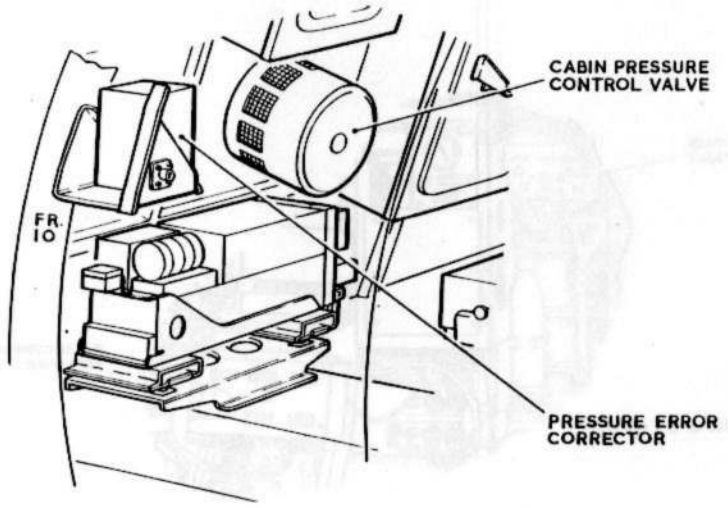


1ST NAVIGATOR'S STATION



UPPER EQUIPMENT COMPARTMENT

FIG.1B. LOCATION DIAGRAM

◀ 1st NAV'S STATION AMENDED ▶

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 relevant Air Publication. The location of the principle items of equipment relevant to this group are shown in figs.1-1A-1B.

DESCRIPTION

PITOT AND STATIC SYSTEM

General *(fig.2)*

2. Pitot and static pressures are taken from a Mk.8W pressure head installed on the plastic nose fairing at the forward station and static vents located on either side of the fuselage between frames A-B and 10-11.

Pitot head

3. Pitot pressure from the pressure head is connected via a common pipeline to the pilot's A.S.I. and machmeter, the navigator's A.S.I. the A.M.U. in the port main plane and the pressure error corrector (P.E.C.) in the upper equipment compartment. The pressure head is fitted with a de-icing heater which is controlled by a switch located on the pilot's console *(Sect.5, Chap.1, Group H refers).*

Static vents

4. Static pressure for the main flight instruments and the cabin pressure controller is taken from two static vent assemblies located one on either side of the fuselage at frames A-B. Each assembly has two separate vents, the front vent on each assembly being tee-ed together and are connected by a common pipeline to the pilot's A.S.I. machmeter, rate of climb indicator and altimeter, the navigator's A.S.I. and the A.M.U. The rear vents of the assemblies are also tee-ed together and are connected by a common pipeline to the cabin pressure control valve.

5. Static pressure for the navigator's altimeter and the P.E.C. which are used in the height encoding system *(para.25)*, is taken from two static vent assemblies located one on either side of the fuselage at frames 10-11. Each assembly has two vents, the top vents of each assembly being tee-ed together and connected by a common pipeline to the altimeter and P.E.C., the lower vents on each assembly being blanked off.

Drain traps

6. Moisture in the pipelines is collected by fifteen drain traps located at various points in the system as shown in fig.2. Each drain trap consists of either one of two types, a short length of tube having a closed end or a union and drain trap combined. Both types are connected into the pipelines by tee-pieces.

Bonding

7. 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.

TURN AND SLIP INDICATOR

8. The turn and slip indicator, mounted on the flight instrument 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 operates from one of two duplicated d.c. supplies controlled by the engine MASTER STARTING switches. A further supply, provided by the emergency battery, is connected via the TURN & SLIP EMERGENCY SUPPLY SW located below the instruments on the flight instrument panel. The power supplies to the instrument are fully described in Sect.5, Chap.1, Group D.

ARTIFICIAL HORIZON

9. Indication of the attitude of the aircraft in pitch and roll is given by a Mk.3C or D artificial horizon mounted on the flight

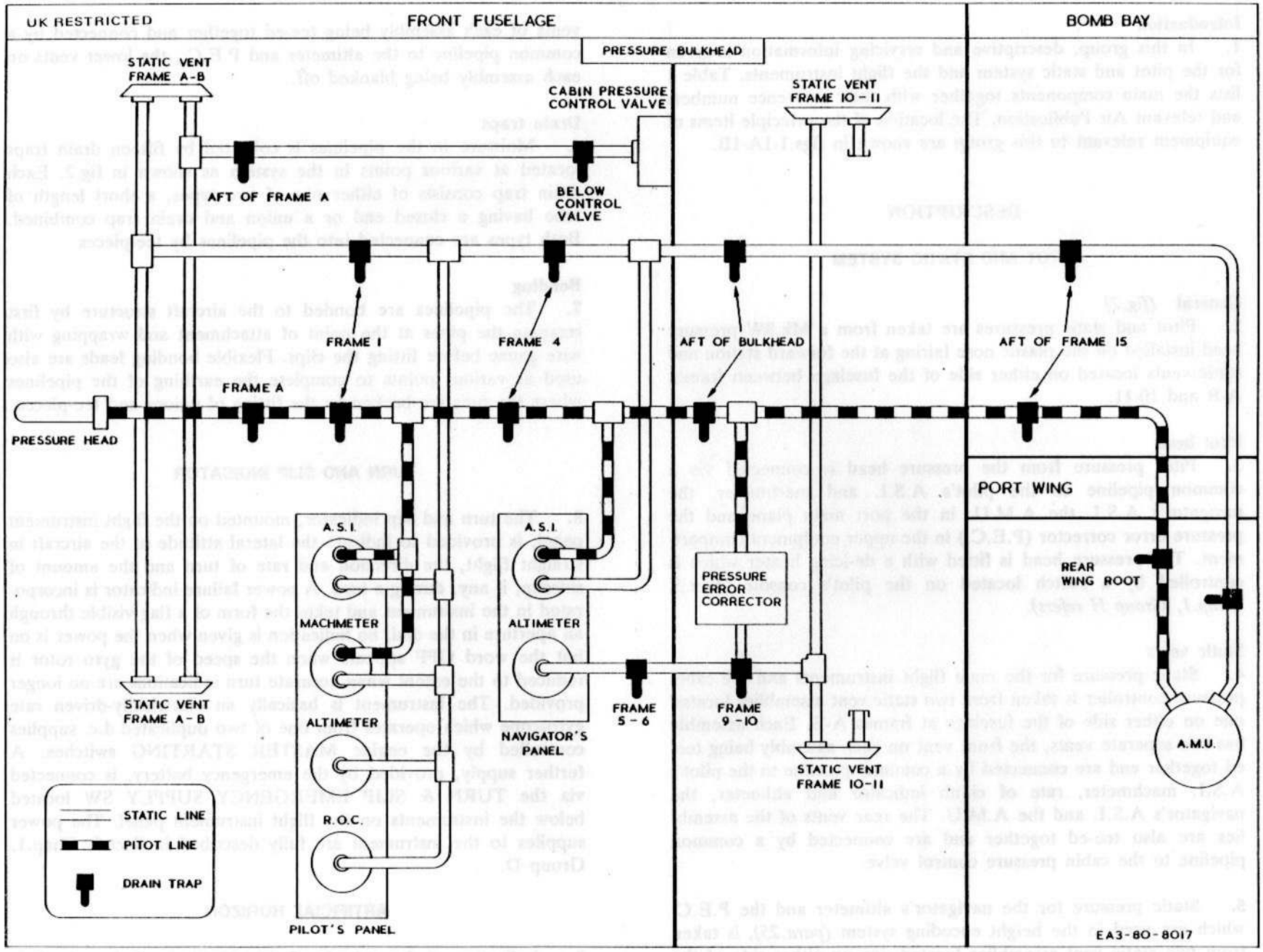


FIG. 2 PITOT AND STATIC SYSTEM

◂PITOT LINE TO PEC ADDED▸

instrument panel. The instrument is a gyroscopic unit operating from the 115 volts, 400 Hz, 3-phase a.c. power supplies described in Chap.1, Group D.

AIR SPEED INDICATORS

10. Two air speed indicators, one mounted on the flight instrument panel and the other on the 1st navigator's instrument panel, are installed in the aircraft. Both instruments are connected to the common pitot and static pipelines.

MACHMETER

11. A machmeter, fitted on the flight instrument panel, is operated from the pitot and static system.

RATE OF CLIMB INDICATOR

12. The instrument, which may be either a Mk.3P, Mk.3P*, or Mk.3Q is mounted on the flight instrument panel and connected into the static pipe line.

EXTERNAL AIR THERMOMETER

13. The temperature of the air outside the aircraft is shown by a thermometer on the 1st navigator's instrument panel. The thermometer indicator functions in conjunction with a resistance bulb which protrudes from the leading edge of the inboard end of the port main plane.

GM4B COMPASS

General

14. The 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 the A.P.I.

15. 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 2nd navigator's station and the gyro unit and master indicator on the flight and 1st navigator's instrument panels respectively. A switch, labelled COMP/D-GYRO and mounted on the starter panel below the flight instrument panel permits the pilot to operate the gyro unit as either a compass or directional gyro as required.

Power supplies

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

EMERGENCY COMPASS

17. In addition to the GM4B compass system an emergency magnetic compass is installed on the canopy coaming above the flight instrument panel. It is illuminated by an integral lamp which is controlled by the port RED flood lamps dimmer switch.

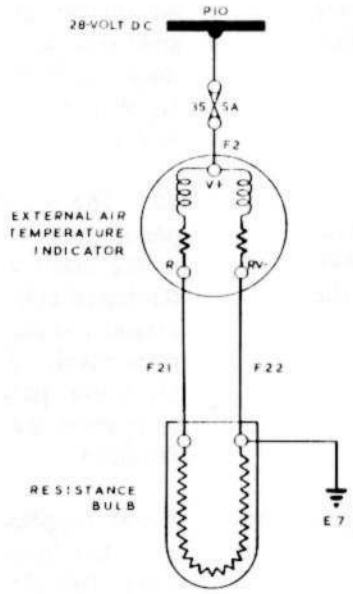
A.D.R.I.S.

General

18. The air mileage unit (A.M.U.) and the air position indicator (A.P.I.), together with the GM4B 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, A.M.I. and the A.P.I.

Air mileage unit

19. The Mk.4A A.M.U. is installed in the port wheel well and is mounted flush with the lower surface of the main plane. The electrical connections to it are made by screened cables and



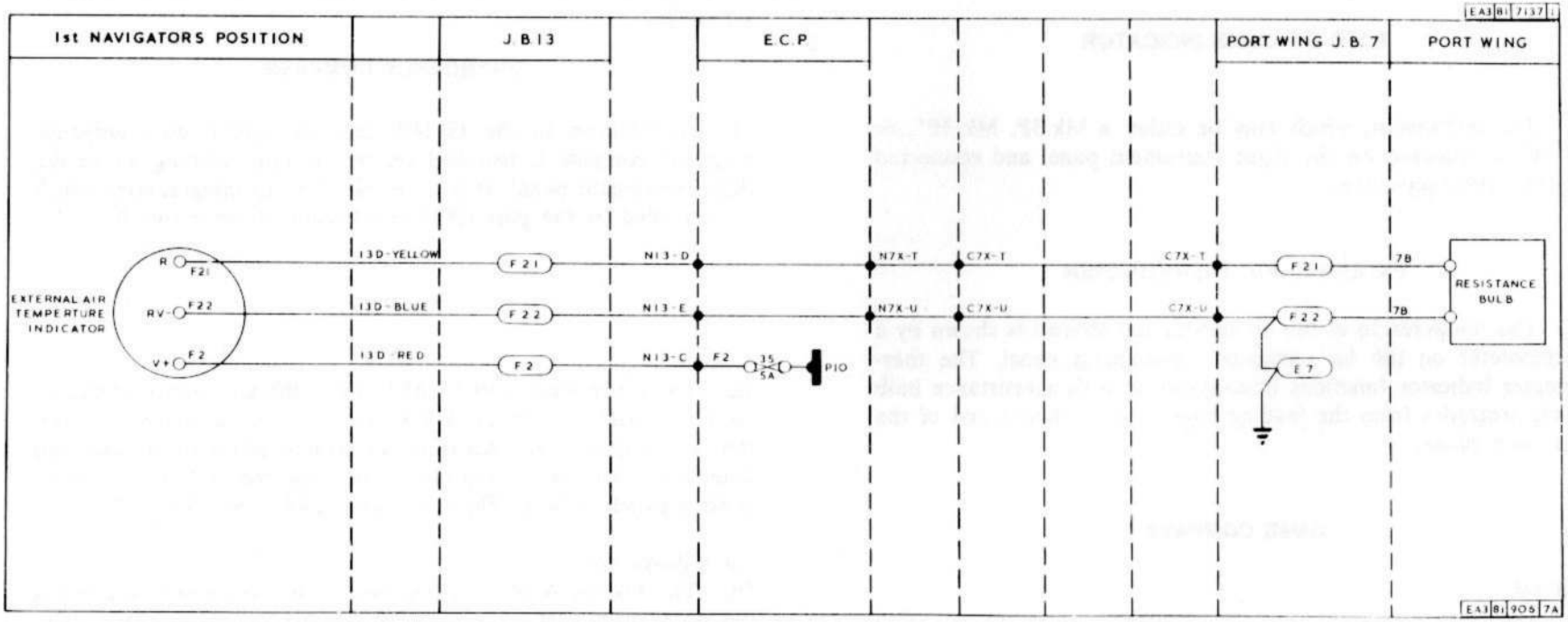


FIG. 3. EXTERNAL AIR THERMOMETER

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

20. The system is controlled from the A.M.U. control panel mounted on the port wall of the cabin above the 1st navigator's table. The panel includes the A.M.U. MAIN ON/OFF switch, an ELECT TRANS ON-OFF switch which controls the electrical transmission from the A.M.U. to the A.M.U. repeater unit, and the A.M.I. 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.

A.M.U. repeater unit

21. 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 1st navigator's table and is accessible from the port side of the pilot's seat.

A.M.I.

22. The A.M.I. is mounted on the 1st navigator's instrument panel above the A.M.U. control panel and provides a continuous indication, in nautical miles, of the air mileage flown. The indicator mechanism comprises a solenoid and counter operating levers, the solenoid being energized by electrical impulses from the A.M.U. for every 1/10th miles flown when the ELECT TRANS switch, on the control panel, is in the ON position. With the control panel switch in the OFF position the counters can be reset during flight.

Air position indicator

23. The A.P.I., which is fitted to the 1st 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 GM4B master indicator by 'M' type electrical transmission.

Power supplies

24. 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 the A.M.U./A.P.I. junction box. The suppressor and junction box are mounted on the port side below the 1st navigator's table either on the fuselage wall *(pre Mod.76 aircraft)*, or on the underside of the fixed table structure *(post Mod.76 aircraft)*.

AUTOMATIC HEIGHT ENCODING

General

25. A Mk.30A and Mk.29B altimeter provide height indications to the pilot and 1st navigator, and a height encoded signal for the I.F.F. system *(Sect.6, Chap.2, Part 3)*

Mk.30A altimeter

26. This altimeter, which is the master altimeter of the system, is located on the 1st navigator's instrument panel and is connected to the aircraft static system and the pressure error corrector unit. Monitor signals from the pressure error corrector are routed to the altimeter which contains a brush encoder, to provide an encoded height output for the I.F.F. system, and a synchro output, to drive the Mk.29B altimeter.

27. Height indications are presented on a dial, calbrated in feet x 100, and indicated by a pointer and digital counter. A knurled knob, on the lower left of the instrument, is used to select the barometric pressure which is displayed in a cut-out on the right of the dial.

Warning flag

28. A warning flag is embodied in the instrument and falls to mask the digital counter of the height display of the instrument if a system power failure occurs.

Mk.29B altimeter

29. This altimeter, which is located on the flight instrument panel, is fundamentally a servo-operated instrument, the servo

inputs being derived from the synchro output of the Mk.30B altimeter, but includes the facility to revert to normal barometric operation in the event of a system power failure.

30. Height indication and barometric pressure selection is identical to the Mk.30A altimeter and is described in para.27.

31. A knurled knob, on the lower right of the instrument, provides a manual selection to stand-by, S, or reset, R, operation. When the knob is selected to 'S' the altimeter reverts to normal barometric operation, a vibrator, incorporated in the instrument, is energized and the STBY flag appears in the cut-out above the digital counter. When the knob is selected to 'R' the altimeter will reset to synchro operation providing that the system power supplies are functioning correctly.

Automatic reversion

32. Should a power failure occur the altimeter will automatically revert to barometric operation, the STBY warning flag will appear and the vibrator will commence to operate.

Pressure error corrector

33. The pressure error corrector (P.E.C.) unit, which is located in the upper equipment compartment, contains pitot and static capsule assemblies which convert the pitot and static pressures present in the aircraft pipelines to electrical signals. These signals are corrected by a pressure error module and are used as a monitor signal for the Mk.30A altimeter.

34. The pressure error correction module is a plug in unit located in the rear portion of the unit casing. The Part No. of the module, which is specific to the aircraft type to which the unit it fitted, is visible through a small window in the rear of the casing.

Power supplies

35. The height encoding system operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. described in Sect.5, Chap.1, Group R & S.

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.

PITOT AND STATIC SYSTEM

General

36. As all instruments with the exception of the 1st navigator's altimeter and the P.E.C., that function by pitot and static pressure operate from common pipelines, any fault in the lines will normally affect them all. Any single instrument giving suspect readings should be checked to its 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 recalibrated.

◄ **Note . . .**

Static vent plates are NOT to be painted or polished. ►

Leakage tests

37. 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

38. The leak test set Ref. No.6C/849 described in A.P.112T-01244-1, 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. When carrying out the tests, pressure or suction should be applied to bring the test meter reading slightly above the test value to allow for the temperature differential caused by the compression or expansion of the air to settle.

Method of testing

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

Note . . .

During the tests, check that all indicator pointers move in the correct direction and that there is no undue lag between the aircraft instruments and the test indicator in reaching a similar indicated value. Undue lag is generally due to constrictions in the pipelines.

(1) Disconnect the pitot and static pipelines from the A.M.U. and seal them off. Seal the static vents on one side of the fuselage using Mk.2 plugs (6C/1059239).

(2) Connect and switch on electrical ground power *(Chap.1, Group P)* and ensure the TACAN INV. 'A' circuit-breaker in the M.E.P. is closed. Select the IFF/TACAN switch on the E.C.P. to ON.

Note. . .

The above connections and switch selections provide the power supplies for the A.H.E. instruments.

(3) Couple the pitot head, by means of the appropriate adapter, to the pilot connector on the tester and set the selector valve '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 exceed 3 minutes.

(4) Couple the forward static vent at frames A-B 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 test indicator reads just over 130 knots and check the time taken for the indicator reading to fall to 125 knots. This must exceed 3 minutes.

(5) Connect the tester and an air reservoir of 100 cu. in. 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 sec for the pitot line and 20 sec for the static line.

(6) Reconnect the A.M.U. and repeat the tests detailed in (3) and (4), but with the 100 cu. in. 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 sec for the pitot line and 50 sec for the static line. Disconnect the tester from the pressure head, and remove the air reservoir from the system.

(7) Connect the upper vent, between frames 10 and 11 by means of the appropriate 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 must exceed 3 minutes.

(8) On the pilot's altimeter select 'R' and ensure that the STBY FLAG DISAPPEARS.

(9) Using the pump, apply suction until the tester indicator reads 130 knots.

(10) Ensure both altimeters display a positive indication.

(11) Disconnect and blank off the pipe from the cabin pressure controller. Connect the aft static vent, located at frames A-B, via an adapter, to the pressure connector on the tester and set the selector to PRESSURE TO PITOT. Using the pump, apply pressure until the tester indicator reads just over 130 knots and check the time taken for the indicator reading to fall to 125 knots. This must exceed 3 minutes.

(12) Reconnect the cabin pressure controller, remove all test adapters and replace pressure head cover and static vent plugs. Switch off the IFF/TACAN switch and disconnect the electrical ground power.

Drying out the system

40. 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.

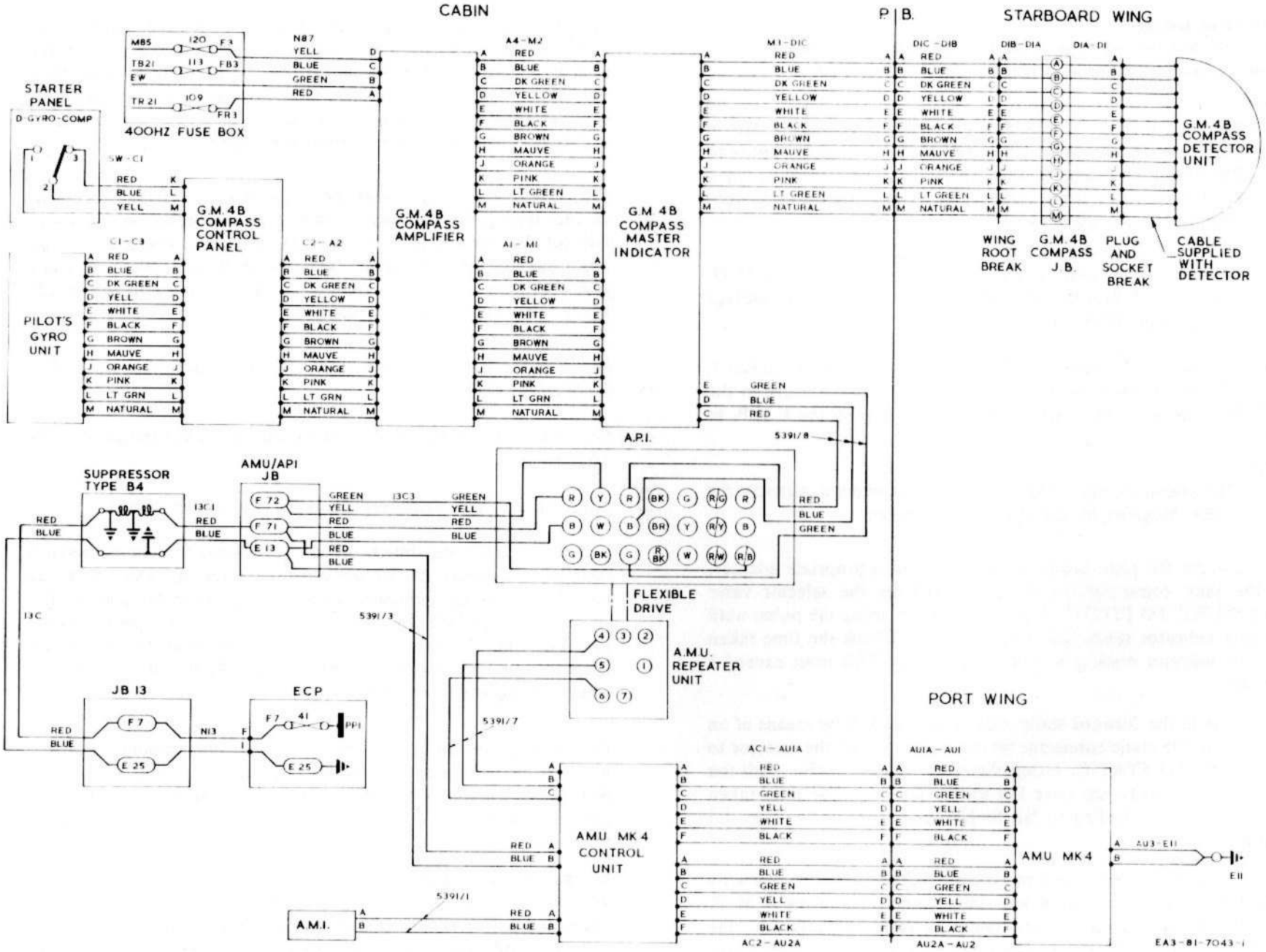


FIG. 4. G.M.4B COMPASS - A.P.I. AND A.M.U.

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.

41. The drying-out operation calls for the use of an instrument and auto-control testing trolley Ref. No.4F/1715 or 1856, a pitot head test adapter Ref. No.4F/1502, and a Mk.1 static vent test adapter Ref. No.6C/499.

42. 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 reconnect to one of the static vents by means of the Mk.1 static vent adapter. Repeat the previous sub-para.(3).

(5) Repeat sub-para.(3) for each of the three static vents on one side of the aircraft.

43. On the conclusion of the operation, remove the test trolley, reconnect all instruments and carry out the leak test detailed in para.39. 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.

44. 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.

GM4B COMPASS

Functional test

45. To check the functioning of the GM4B compass proceed as follows:-

(1) Switch on the d.c. and a.c. power supplies to the compass by operating the engine MASTER STARTING switches on the starter panel. Allow at least 2 minutes for the inverters to run up and check that the compensator lamps in the amplifier are alight; these are visible through small holes in 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 cross (x) is shown in the annunciator window of the gyro unit and that a similar indication is shown by the annunciator 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 E2B 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 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.

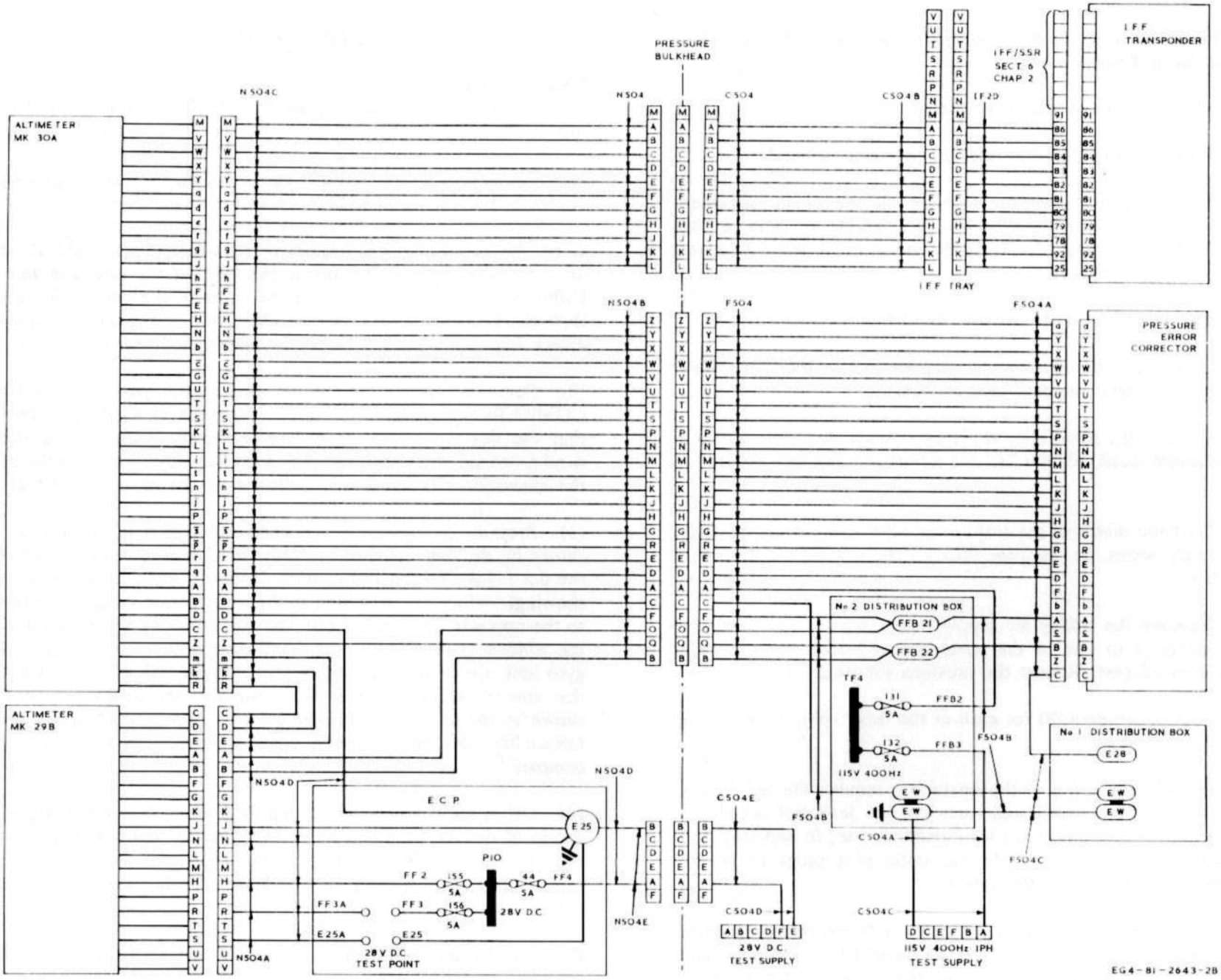


FIG. 5. INTERCONNECTION DIAGRAM — AUTOMATIC HEIGHT ENCODING

(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 10 deg of westerly variation on the master indicator. Check that the new card indication after synchronizing is 10 deg less than the previous readings. Return the variation scale to zero.

A.D.R.I.S.

Ground testing

46. 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. and A.M.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.

TABLE 1

Equipment details

Ref. No.	Equipment		Quantity	Relevant A.P.
6A/2945	Turn and slip indicator, Mk.2		1	A.P.112G-0302-1
6A/6102	Artificial indicator, Mk.3D		1	A.P.1275A, Vol.1, Sect.13
6A/4337742	Air speed indicator, Mk.9HP		2	A.P.112G-0926-1
6A/3384	Machmeter, Mk.2		1	A.P.112G-0910-1
6A/2697	Rate of climb indicator, Mk.3P	alternative	1	A.P.112G-1007-1
6A/4339155	Rate of climb indicator, Mk.3Q			
6A/4333460	Pressure head, Mk.8W		1	A.P.112G-0102-1
6A/1037475	Air thermometer, Mk.4 (Type B)		1	A.P.112G-0629-1
6A/1037398	Resistance bulb, Type A		1	A.P.112G-0601-1
	A.D.R.I.S. system			
6B/4343636	Air mileage unit, Mk.4A		1	A.P.112B-0811-1
6B/471	Control unit, A.M.U. , Mk.4		1	A.P.1275B, Sect.16
6B/4343591	Repeater unit		1	
6B/1158	Air position indicator		1	
6B/4343585	Air mileage indicator		1	A.P.112B-0803-1
	GM4B compass system			
6B/4343681	Detector unit, Type A		1	A.P.112B-0321-1
6B/634	Master indicator		1	
6B/4343640	Gyro unit, Type B		1	
6B/4343641	Amplifier, Type B		1	
6B/4343607	Mounting tray, Type A		1	
6B/408	Control panel, Type A		1	
6B/1048857	Compass, Type E2B		1	A.P.112B-0201-1
5L/9959121	Filament, non-magnetic		1	
	Automatic height encoding			
6A/6206302	Altimeter, Mk.30A		1	A.P.112G-1031-1
6A/6201976	Altimeter, Mk.29B		1	A.P.112G-1028-1
6A/6203321	Pressure error corrector		1	A.P.112G-1031-1
	Pressure error corrector module (Pt. No.L84340-00-080)		1