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SECTION 5

ELECTRICAL SYSTEMS AND INSTRUMENT INSTALLATION

LIST OF CHAPTERS OVERLEAF

SECTION 5

ELECTRICAL SYSTEMS AND INSTRUMENT INSTALLATION

LIST OF CHAPTERS

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Chapter 1 – ELECTRICAL SYSTEMS

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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 a Type K, 24 volt, 40 amp. hr. battery. 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 disconnecting 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 on 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 require 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 coaming panel and below them the starter panel. The console, take-off 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. Mounted at the bottom of the panel are the fuel pressure 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 switches, the cabin pressure warning horn override switch and two oxygen remote magnetic indicators. Further switches, which are employed in the V/U.H.F., standby U.H.F. and I.L.S. systems, and a V/U.H.F. and H.F. control unit are also located on the panel.

Coaming panel

20. This panel, mounted above the pilot's instrument panels, provides accommodation for various dimmer switches, standby turn and slip, compass and emergency lamps supply switches, anti-dazzle lamps switch, fire warning test switch and extinguisher push switches, No.1 and No.2 generator failure warning lamps, radar altimeter low level warning lamp, instrument supplies magnetic indicator, busbar voltmeter and accelerometer. The emergency compass is mounted on the coaming tube adjacent to the panel.

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.

Take-off panel

22. Services which essentially must be in operation during take-off are controlled by switches grouped on a panel above and to port of the pilot's seat.

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.

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 indicator 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, downward identification lamp, navigation lamps anti-collision lamps, taxying lamps, landing lamp, rudder trim, flare bay doors, camera doors, camera doors armament safety and photo flash jettison. An indicator for the flare bay doors, camera doors and armament safety are also mounted on the panel. Located under a small detachable panel is the console fuse panel. To port of the throttle box is the canopy jettison switch whilst the anti-icing switches and indicators and the banner target towing control unit are mounted to the rear of the console together with the fuse for the anti-collision lamps.

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. Whilst the left handgrip incorporates the camera control 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 camera services circuit breakers. On its aft sloping face are mounted the pilot's services, I.L.S. and No.2 inverter circuit breakers, the control switches for No.6, No.7 and No.8 inverters, the test switch for No.1 inverter and the Doppler control switch. 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. This panel may be hinged down to give access to the heavy current fuses and relays inside the assembly.

Radio junction box

28. This unit is mounted on the crate adjacent to the G.P.I. Mk.4A at the navigator's starboard station and is the main distribution point for the radio systems.

Navigator's port station

29. 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. The equipment mounted on the port wall consists of the hatch detonator switches, a cockpit lamp and other equipment concerned with the navigational instruments. Further equipments, located below the table, are concerned with the radio and radar systems. The banner target towing normal/emergency jettison switch is mounted on the panel adjacent ▶ to the airspeed indicator. ◀

Navigator's starboard station

30. At this station the controls are mounted on the cabin wall and the dummy ejection seat rail and comprise the camera distribution panel, the F95 and F97 camera relay boxes, cabin pressure warning horn and relay GM4B compass control unit, detonator resistor boxes, J.B.14, 400 Hz fusebox and other equipment associated with the instrument, radio and ◀ radar systems. A chaff dispensing control unit is mounted above the doppler control indicator ▶

Forward station

31. At this station is the equipment necessary to the navigator during the photographic day and night roles, this comprises the photographic sighting head or T3/T4 bomb sight and associated control panels, compass repeater and photoflash release and jettison switches. Other items consist of lighting and oxygen indicators.

Pressure bulkhead

32. 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

33. 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 the No.6, No.7 and No.8 inverters, No.1 and No. 2 distribution boxes, the explosion suppression relay box, the jettison microswitch box and numerous radio components. Access to the compartment is through a hatch in the upper surfaces of the fuselage.

Starboard equipment compartment

34. Situated at the starboard side of the nose-wheel bay, between the pressure bulkhead and frame 12, this compartment houses the main electrial panel assemblies, a.c. power supply inverters No.1 and 2 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.)

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

Flare bay

36. Located in the flare bay are the hydraulic valve actuators for the air brakes, alighting gear, camera doors, flaps and flare-bay doors: the rear tank fuel pumps, cock actuators and suppressors, J.B.s 1 and 3, the explosion supression panel and fuel contents 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, the upper anti-collision lamp, the downward identification lamp and various components used in the radio and radar systems. Access to the rear fuselage is through a hinged door on the underside of the fuselage, just aft of the flare 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-0407-3A, 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 re-assembly 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
B	Photographic
B1	Flare bay doors microswitch
B3	Flare bay doors control switch
B4	Photoflash jettison
B5	1.75 in. photoflash release
B6	Photographic/bomb sight
B7	Bomb sight head control
B8	'Flashes gone' indicators
B9	Armament safety indicator lamp press-to-test
C	Control surfaces
C2	Tail trim control
C3	Flaps control
C4	Flaps indicator
C5	Rudder trim control
C6	Rudder trim indicator
C7	Tail plane control indicator
C9	Air brakes
CC1	Aileron trim control
CC2	Aileron trim indicator
CC5	Tail plane control
CC7	Tail plane cut-in switch
F	Flight instruments
F2	External air thermometer
F3	GM4B compass
F4	Turn and slip indicator, alternative supply
F5	Turn and slip indicator
F6	Zero reader
F7	A.M.U.
F8	GM4B compass/G.P.I./zero reader
F10	G.P.I.
FF2	Height encoding
FF3	Height encoding
FF4	Height encoding d.c. test supply
FX4	Turn and slip indicator, emergency supply
H	Heating, ventilation and de-icing
H1	Cabin air control
H2	Cabin air indicator
H3	Cabin pressure warning
H4	Pressure head heater
H5	Vent valve heaters
H6	Windscreen heater
H7	Canopy de-mist
H8	Periscope sextant
HH1	Cabin air control, No.1 engine
HH2	Cabin air control, No.2 engine
HH3	Anti-icing, No.1 engine
HH4	Anti-icing, No.2 engine
HH7	Nose de-mist
J	Ignition
J1	No.1 engine starting
J2	No.2 engine starting
J5	No.1 engine relight switch
J6	No.2 engine relight switch
JJ1	No.1 engine ignition
JJ2	No.2 engine ignition
JJ3	No.1 engine ignition
JJ4	No.2 engine ignition
K	Cameras
K3	Camera doors control
K4	Camera doors indicators
K5	Camera doors control
KD7	Day cameras (F52)
KK1	F95 camera control
KK2	Heater and iris motor
KK3	F95 camera, port
KK4	F95 camera, starboard
KK5	F95 camera, forward station
◀ KK10	Split vertical F95 cameras ▶
KS1	Day camera (F49)
KS2	Camera drift/tilt control
KN1	Night camera (F89)
KN2	Night camera (F89)
KN3	Night cameras
KN4	Night camera (F97)
KN5	Night camera (F97)
KN6	Night camera, F89, starboard
KN7	Night camera, F89, port

continued. . .

TABLE 1 Circuit identification scheme – *continued*

IDENT	CIRCUIT
L	Lighting
L1	Navigation lamps
L2	Taxying lamps
L3	Landing lamp control
L4	Landing lamp
L5	Pilot's instrument panel lamps
L6	Pilot's instrument panel lamps
L7	Forward station and console lamps
L8	Pilot's red lamps, port
L9	Navigator's chartboard and cockpit lamps
LL1	Downward identification lamp
LL2	Emergency lamps and E2B compass lamp
LL3	Frequency card and take-off panel lamps
LL4	Fuselage servicing lamps
LL5	Forward station red lamps
LL6	Navigator's control units and E.C.P. lamps
LL7	Navigator's instrument panel lamps
LL9	Anti-collision lamps
LL10	Anti-dazzle lamps
M	A.C. power
M1	No.1 inverter supply
M2	No.2 inverter supply
M4	No.7 inverter supply
M5	No.6 inverter supply
M7	No.2 inverter control
M8	No.1 inverter control
MM4	No.7 inverter control
MM5	No.6 inverter control
MM8	No.1 inverter control
P	D.C. Power
P1	No.1 generator power line, PF1
	No.1 generator field
P2	No.2 generator power line, PF2
	No.2 generator field
P3	No.1 generator power line
P4	No.2 generator power line
P9	Battery positive
P10	Aircraft main busbar
P91	Battery isolation
PP1	E.C.P. busbar
PP2	E.C.P. busbar
PP3	Pilot's console services
PT1	No.1 generator volts test socket
PT2	No.2 generator volts test socket
Q	Engine instruments
Q3	No.1 engine oil pressure
Q4	No.2 engine oil pressure
Q5	Engine exhaust gas thermometer
Q7	Fuel contents Nos. 1, 2, 3, 4, 5 and 6 tanks
Q8	Fuel contents port wing tanks
Q9	Fuel contents starboard wing tanks
Q11/12/13	No.1 engine speed indicator
Q21/22/23	No.2 engine speed indicator
R	Radio
R1	Standby U.H.F. supply
R2	V/U.H.F. test socket
R3	Intercomm. amplifier
R4	V/U.H.F. upper/lower aerial relay
R5	Radio compass (A.D.F.)
R6	Radio compass (A.D.F.)
R7	H.F.
R8	H.F.
R9	I.L.S. supply
R10	V/U.H.F. main/standby aerial relay/radio J.B.
RR1	V/U.H.F. interconnection box
RR2	H.F.
RR4	Decca V.O.R.
RR5	Radio compass (A.D.F.)
RR6	I.L.S./A.D.F. audio change-over
RR7	V/U.H.F. pilot/nav. control
RR9	Intercomm.
RR42	Decca V.O.R.
S	Radar
S1	IFF/SSR
S2	I.F.F./S.S.R. aerial switching unit
S5	Doppler
S6	I.F.F./S.S.R. control
S7	I.F.F. press-to-test lamp

continued. . .

TABLE 1 Circuit identification scheme – *continued*

IDENT	CIRCUIT
S9	D.M.E.
SS1	Radar altimeter
SS2	Radar altimeter transmitter/ receiver
T	A.C. power
T1	No.1 inverter output
T2	No.2 inverter output
T8	Decca V.O.R.
U	Alighting gear
U1	Alighting gear control
U2	Alighting gear indicator
U12	Fatigue meter
V	D.C. power
V+	Busbar voltmeter
W	Warning and emergency
W1	No.1 generator failure warning
W2	No.2 generator failure warning
W3	Fuel pressure warning No.1 engine
W4	Fuel pressure warning No.2 engine
W5	Oxygen warning system
W6	Oxygen warning oxygen
X	Fire extinguishers and jettison
X1	Fire extinguishers
X3	Fire warning No.1 engine
X4	Fire warning, No.2 engine
X5	Canopy and snatch jettison
X6	Hatch jettison
X7	Canopy and hatch jettison, emergency
X9	Crash trip
X1P	No.1 engine fire warning push switch
X1S	No.2 engine fire warning push switch
XX1	Banner target towing jettison, emergency
XX2	Banner target towing jettison, emergency.
XX94	Explosion suppression
Y	Fuel cocks
Y1	Fuel cock belly tank, port
Y2	Fuel cock belly tank, starboard
Y3	Fuel cock rear tank, port
Y4	Fuel cock rear tank, starboard
Y5	Fuel cock top to belly
Y7	Wing tip fuel tank jettison
Y8	Fuel cock port wing tank
Y9	Fuel cock starboard wing tank
Z	Fuel pumps
Z1	Fuel pump belly tank, port
Z2	Fuel pump belly tank, starboard
Z3	Fuel pump rear tank, port
Z4	Fuel pump rear tank, starboard
Z8	Fuel pump wing tank, port
Z9	Fuel pump wing tank, starboard

Note . . .

Idents for 400 Hz 3-phase circuits have an additional letter indicating phase colour:-

R = Red phase
B = Blue phase
W = White phase earthed

Idents for 400 Hz 1-phase circuits drawn from the No.6 or No.7 inverters have an additional letter 'G'.

TABLE 2

Earth point location and services

Earth No.	Location Junction	Bonding	Service
E1	J.B.1	Frame 21-22, port	Alighting gear Fuel pumps and cocks Camera doors Flap control Two position dive brakes Fatigue meter F95 camera Photoflash jettison
E2		Frame 26	Banner target towing
E3	J.B.3	Frame 21-22, starboard	Photoflash release Flare bay doors control Fuel pumps and cocks Fire warning and extinguishers Vent valve heaters Fuel contents Flaps control Explosion suppression
E4	J.B.4	Aft of frame 12, starboard	F52 camera Internal lighting
E5	J.B.5	Frame 29-30, starboard	F49 camera F89 camera F52 camera Split vertical F95 cameras
E6	J.B.6	Frame 39, starboard	External lighting Rudder trim indicator and control Tail plane trim control Instrument power supplies Internal lighting I.F.F./S.S.R. 28 volt d.c. test, height encoding

continued. . .

TABLE 2 Earth point location and services – *continued*

Earth No.	Location: Junction	Location: Bonding	Service
E7	J.B.7	Port wing leading edge diaphragm	Engine anti-icing Engine starting External air thermometer Cabin air control Fire warning and extinguisher
E8	J.B.8	Starboard wing leading edge diaphragm	Fire warning and extinguishers Cabin air control Engine anti-icing Engine starting
E9	J.B.9	Port inner wing, Rib 6	Fuel contents Engine starting Fuel pumps and cocks Vent valve heaters External lighting ◀ Doppler ▶
E10	J.B.10	Starboard inner wing, Rib 6	External lighting Vent valve heaters Fuel pumps and cocks Engine starting Fuel contents
E11	Port wing	Port wing leading edge diaphragm	A.M.U.
E14	J.B.14	Frame 8, starboard	F97 camera Camera doors Intercomm.

continued. . .

TABLE 2 Earth point location and services – *continued*

Earth No.	Location: Junction	Location: Bonding	Service
E21	M.E.P.	Starboard equipment compartment – frame 10	Fire warning and extinguisher D.C. power supplies Port crash switch Instrument power supplies Internal lighting No.6 inverter No.7 inverter
E24	Navigator's starboard station	Sub-frame 8A	Detonators F89 camera Photoflash release Flare doors F49 camera F52 camera F97 camera Camera doors Instrument power supplies ◀ Split vertical F95 cameras ▶
E25	E.C.P.	Navigator's table structure	D.C. power supplies Instrument power supplies Fuel pressure warning Engine anti-icing Engine starting Aileron trim control and indicator Rudder trim control Flare doors Cabin air pressure warning Camera doors Explosion suppression Nose de-mist F95 camera Decca VOR I.F.F. fail

continued. . .

TABLE 2 Earth point location and services – *continued*

Earth No.	Location: Junction	Location: Bonding	Service
E25 (continued)	E.C.P.	Navigator's table structure	Pitot head heater Canopy de-mist Radar altimeter Radio compass Windscreen heater Oxygen warning Fire warning and extinguishers Internal lighting Flare bay doors, indication I.L.S./ADF audio Alighting gear Periscope mounting D.M.E. U.H.F. aerial changeover Radio junction box
E26	Navigator's port station	Sub-frame 8A, port	Detonators
E27	Pilots console	Frame 2 below console, port	Internal lighting Emergency batteries Detonators Photoflash jettison
E28	No.1 distribution box	Rear of pressure bulkhead, starboard	Two position dive brakes Instrument power supplies Engine exhaust gas temperature Explosion suppression I.L.S.
E29	No.2 distribution box	Rear of pressure bulkhead, port	Radar altimeter
E33	Rear fuselage	Forward of tail plane actuator, frame 45-46, starboard	Tail plane trim control

continued. . .

TABLE 2 Earth point location and services – *continued*

Earth No.	Location Junction	Bonding	Service
E100A	M.E.P.	Starboard equipment compartment	No.2 inverter
E103	M.E.P.	Starboard equipment compartment	No.1 inverter
E.DET	Port wing tip	Port wing, rib 8	Wing tip tank jettison
E.DET	Starboard wing tip	Starboard wing, rib 8	Wing tip tank jettison
EJ1	Engine starter panel	Top of engine starter panel, port	Engine starting
EJ2	Engine starter panel	Top of engine starter panel, port	Engine starting
EP	Port wing root	Port wing root, frames 17-18	D.C. power supplies
ES	Starboard wing root	Starboard wing root, frames 17-18	D.C. power supplies
EB	Battery compartment	Port equipment compartment, frame 10	Battery earth
EG	–	Starboard equipment compartment	Ground service earth Instrument power supplies 115 V, 400 Hz, single phase test, height encoding D.M.E. I.F.F./S.S.R. R.M.I. junction box Radar altimeter Doppler H.F. radio
ETH	–	Frames 11-12, port	Standby U.H.F.
HFE	–	Frame 9, starboard	H.F. radio H.F. aerial spark gap

continued. . .

TABLE 2 Earth point location and services – *continued*

Earth No.	Location Junction	Bonding	Service
EW	No.1 distribution box	Rear of pressure bulkhead, starboard	Instrument power supplies Oil pressure gauges Doppler Radio compass G.P.I. Mk.4A
E.UHF	–	Frame 32, starboard	V/U.H.F.
U.H.F. junction panel	Upper equipment compartment	Forward frame 12, port	V/U.H.F.
–	Port wing	Port wing, rib 4	Doppler

TABLE 3

Fuse numbers, ratings, circuit ident and locations

Service	Fuse No.	Rating (amps)	Circuit ident	Location
Secondary busbar PP1	1	160	PP1	
Secondary busbar PP2	2	160	PP2	
Spare	3	–	–	
Tail plane trim	4	60	C2	
Battery isolation	5	10	P91	
Fire extinguishers	6	20	X1	
Photoflash jettison	7	20	B4	
No.1 crash relay	8	10	X9	
Spare	9	–	–	
Spare	10	–	–	
Spare	11	–	–	M.E.P.
Spare	12	–	–	
Fuselage servicing lamps	13	5	LL4	
V/UHF aerial change-over	14	5	◀ R4 ▶	
Stand-by UHF	15	10	R1	
V/UHF test socket	16	5	R2	
Voltmeter	17	5	V+	
No.1 generator failure warning	18	10	W1	
No.2 generator failure warning	19	10	W2	
H.F.	20	5	R7	
Tail plane cut-in switch	21	5	CC7	
Periscopic sextant	22	5	H8	
Flare bay doors microswitch	23	10	B1	
Flare doors control	24	10	B3	
Flap control	25	5	C3	
Flap indicator	26	5	C4	
Rudder trim control	27	10	C5	E.C.P.
Rudder trim indicator	28	5	C6	
Spare	29	–	–	
Spare	30	–	–	
Tail plane control indicator	31	5	C7	
Tail plane control	32	5	CC5	
Aileron trim control	33	10	CC1	
Aileron trim indicator	34	5	CC2	
Navigator's instrument lighting	35	5	LL7	

continued. . .

TABLE 3 Fuse numbers, ratings, circuit ident and locations – *continued*

Service	Fuse No.	Rating (amps)	Circuit Ident	Location
Navigator's oxygen indicator	36	5	W5	
◄ Banner target towing	37	5	XX2 ►	
Air thermometer	38	5	F2	
Forward station red lamps	39	2.5	LL5	
Bomb sight gyro control unit	40	5	B31	
A.M.U. – A.P.I.	41	5	F7	
No.1 engine air gate valve control	42	5	HH1	
No.1 engine anti-icing	43	10	HH3	
No.1 engine master starting switch	44	10	J1	
Spare	45	–	–	
No.1 engine relight switch	46	5	J5	
Pilot's instrument lighting	47	5	L5	
Pilot's instrument lighting	48	5	L6	
No.1 inverter control	49	10	M8	
Exhaust gas thermometer	50	5	Q5	
Port wing tanks fuel gauge	51	5	Q8	
Alighting-gear control	52	10	U1	
Alighting-gear indicator	53	5	U2	E.C.P.
Fuel pressure warning No.1 engine	54	5	W3	
No.1 engine fire warning push switch	55	10	X1P	
Navigator's instrument lighting	56	5	LL6	
Camera doors control	57	10	K3	
Camera doors indicator	58	5	K4	
IFF/SSR control	59	5	S6	
IFF/SSR aerial switch unit	60	5	S2	
IFF/SSR transponder	61	5	S1	
Turn-and-slip indicator, alternative supply	62	5	F4	
Turn-and-slip indicator	63	5	F5	
Doppler control	64	5	S5	
Air brakes control	65	10	C9	
Decca V.O.R. indicator	66	5	RR42	
D.M.E.	67	5	S9	
Flashes gone indicators	68	10	B8	
Cabin air mixing valve control	69	5	H1 !	
Cabin air mixing valve position indicator	70	5	H2	

continued. . .

TABLE 3 Fuse numbers, ratings, circuit ident and locations – *continued*

Service	Fuse No.	Rating (amps)	Circuit Ident	Location
Cabin air warning	71	5	H3	E.C.P.
Pressure head heater	72	10	H4	
Vent valve heaters	73	20	H5	
Windscreen heater	74	10	H6	
Canopy de-misting	75	5	H7	
No.2 engine air gate valve control	76	5	HH2	
No.2 engine anti-icing	77	10	HH4	
Height encoding 28V D.C. test	78	5	FF4	
No.2 engine master starting switch	79	10	J2	
IFF/SSR test switch	80	5	S7	
No.2 engine relight switch	81	5	J6	
Forward station and console lights	82	5	L7	
Anti-dazzle lamps	83	5	LL10	
Navigator's lighting	84	5	L9	
Top tanks fuel gauge	85	5	Q7	
Starboard wing tank fuel gauge	86	5	Q9	
I/C amplifier	87	5	R3	
I/C J.B.7684	88	5	RR9	
V/U.H.F. main stand-by aerial relay/radio J.B.	89	5	R10	
Fuel pressure warning, No.2 engine	90	5	W4	
No.2 engine fire warning push switch	91	10	X1S	
No.1 engine fire warning	92	5	X3	
No.2 engine fire warning	93	5	X4	
Wing tip tank jettison	94	10	Y7	
No.2 inverter control	95	10	M7	
Pilot's oxygen indicator	96	5	W6	
Spare	97	–	–	No.1 distribution box
Spare	98	–	–	
Spare	99	–	–	
Spare	100	–	–	
Oil pressure gauges	101	2.5	Q3	
Radio compass	102	5	RR5	
Oil pressure gauges	103	2.5	Q4	
Radio compass	104	5	RB5	

continued. . .

TABLE 3 Fuse numbers, ratings, circuit ident and locations – *continued*

Service	Fuse No.	Rating (amps)	Circuit Ident	Location
Spare	105	–	–	No.1 distribution box
Spare	106	–	–	
Spare	107	–	–	
Spare	108	–	–	
GM4B compass amplifier	109	2.5	FR3	400 Hz fusebox
Spare	110	–	–	
Zero reader J.B.	111	2.5	FR6	
Spare	112	–	–	
GM4B compass amplifier	113	2.5	FB3	
Spare	114	–	–	
Zero reader J.B.	115	2.5	FB6	
Windscreen heater	116	5	HB6	
Spare	117	–	–	
G.P.I.	118	5	F8	
Zero reader J.B.	119	2.5	+ve 28V	
GM4B compass amplifier	120	2.5	F3	
Photographic sight or bomb sight (alternative fits)	121	2.5	BR6	
Spare	122	–	–	
Zero reader flight computer	123	2.5	FR8	
GM4B compass/G.P.I.	124	5	FR10	
Photographic sight or bomb sight (alternative fits)	125	2.5	BB6	
Spare	126	–	–	
Zero reader flight computer	127	2.5	FB8	
G.P.I.	128	5	FB10	
I.F.F./S.S.R. d.c. supply	129	5	SG1	No.2 distribution box
Radar altimeter	130	5	SSG1	
Height encoding	131	5	FFG2	
115V test supply (height encoding)	132	5	FFG3	
H.F.	133	5	RRG2	
D.M.E.	134	5	SG9	
Decca V.O.R. transformer	135	5	TG8	

continued. . .

TABLE 3 Fuse numbers, ratings, circuit ident and locations – *continued*

Service	Fuse No.	Rating (amps)	Circuit ident	Location
Decca V.O.R. 26V d.c.	136	5	RRG4	
Decca V.O.R. indicator	137	5	RRG42	
Tacan	138	5	–	
Spare	139	–	–	No.2 distribution box
Spare	140	–	–	
Doppler	141	3	SG5	
Spare	142	–	–	
Spare	143	–	–	
Spare	144	–	–	
Turn-and-slip indicator emergency supply	145	2.5	FX4	
Press-to-test, armament safety	146	2.5	B9	
Emergency lighting	147	2.5	LL2	
Landing lamp control	148	5	L3	Console
Navigation lamps	149	5	L1	
Identification lamp	150	5	LL1	
Taxying lamps	151	10	L2	
Landing lamp	152	20	L4	
Camera drift/tilt control	153	5	KS2	
Day cameras (F49)	154	10	KS1	
Night cameras	155	5	KN3	
Split vertical F95 cameras	156	20	KK10	Camera distribution panel
Spare	157			
Day cameras (F52)	158	5	KD7	
Photographic sight	159	5	B6	
T3/T4 bombsight control panel	160	5	B7	
Canopy jettison	161	40	X5	
Hatch jettison	162	40	X6	M.E.P.
H.F.	164	40	R8	
V/U.H.F.	165	40	RR1	
Chaff dispenser stripper unit No.2	166	40	A3	
No.1 inverter supply	167	◀ 125 ▶	M1	Inverter bay

continued. . .

TABLE 3 Fuse numbers, ratings, circuit ident and locations – *continued*

Service	Fuse No.	Rating (amps)	Circuit Ident	Location
Spare	179	–	–	
Spare	180	–	–	
Explosion suppression	181	5	XX94	
◀ Banner target towing	182	5	XX1 ▶	
No.1 inverter interlock relay	183	10	MM8	
Spare	184	–	–	
Spare	185	–	–	M.E.P.
Spare	186	–	–	
Fatigue meter	187	2.5	U12A	
No.1 generator volts test socket	188	5	PT1	
No.1 generator over-voltage relay	189	10	P11	
No.1 generator off-line switch	190	10	P15	
Spare	191	–	–	
No.2 generator volts test socket	192	5	PT2	
No.2 generator over-voltage relay	193	10	P21	
No.2 generator off-line switch	194	10	P25	
Night cameras, F89 port	195	10	KN7	
Night cameras, F89 starboard	196	5	KN6	Camera distribution
Night cameras, F89 control	197	5	KN1	panel
Night cameras, F89 control	198	5	KN2	
Night cameras, F97	199	10	KN4	
Night cameras, F97 control	200	5	KN5	F97 camera relay
Night cameras, photoflash release	201	10	B5	box
Camera door control	202	5	K5	
Height encoding	221	5	FF2	
Height encoding, 28V d.c. test point	222	5	FF3	
Radar altimeter TX/RX	223	5	SS2	
No.6 inverter control	224	5	MM5	
No.7 inverter control	225	5	MM4	E.C.P.
F95 camera, port	226	10	KK3	
Nose de-mist	227	5	HH7	
F95 camera, forward station	228	10	KK5	
I.L.S./A.D.F. audio changeover	229	5	RR6	
V/U.H.F. pilot/nav. control	230	5	RR7	

continued. . .

TABLE 3 Fuse numbers, ratings, circuit ident and locations – *continued*

Service	Fuse No.	Rating (amps)	Circuit Ident	Location
V.O.R.	231	5	RR4	E.C.P.
F95 camera control	232	5	KK1	
Radio compass	233	10	R6	
Frequency card and take-off panel lamps	234	5	LL3	
F95 camera, stbd.	235	10	KK4	
Heater and iris motor	236	20	KK2	
Flashing anti-collision lamps	241	5	LL9	Console
Spare	242	–	–	400 Hz. fusebox
Spare	243	–	–	
Spare	244	–	–	
No.1 engine inboard ignition unit	245	10	JJ1	E.C.P.
No.2 engine inboard ignition unit	246	10	JJ3	
No.1 engine outboard ignition unit	247	10	JJ2	
No.2 engine outboard ignition unit	248	10	JJ4	

FIG.1. ELECTRICAL INSTALLATION — PILOT'S STATION

(illustration overleaf)

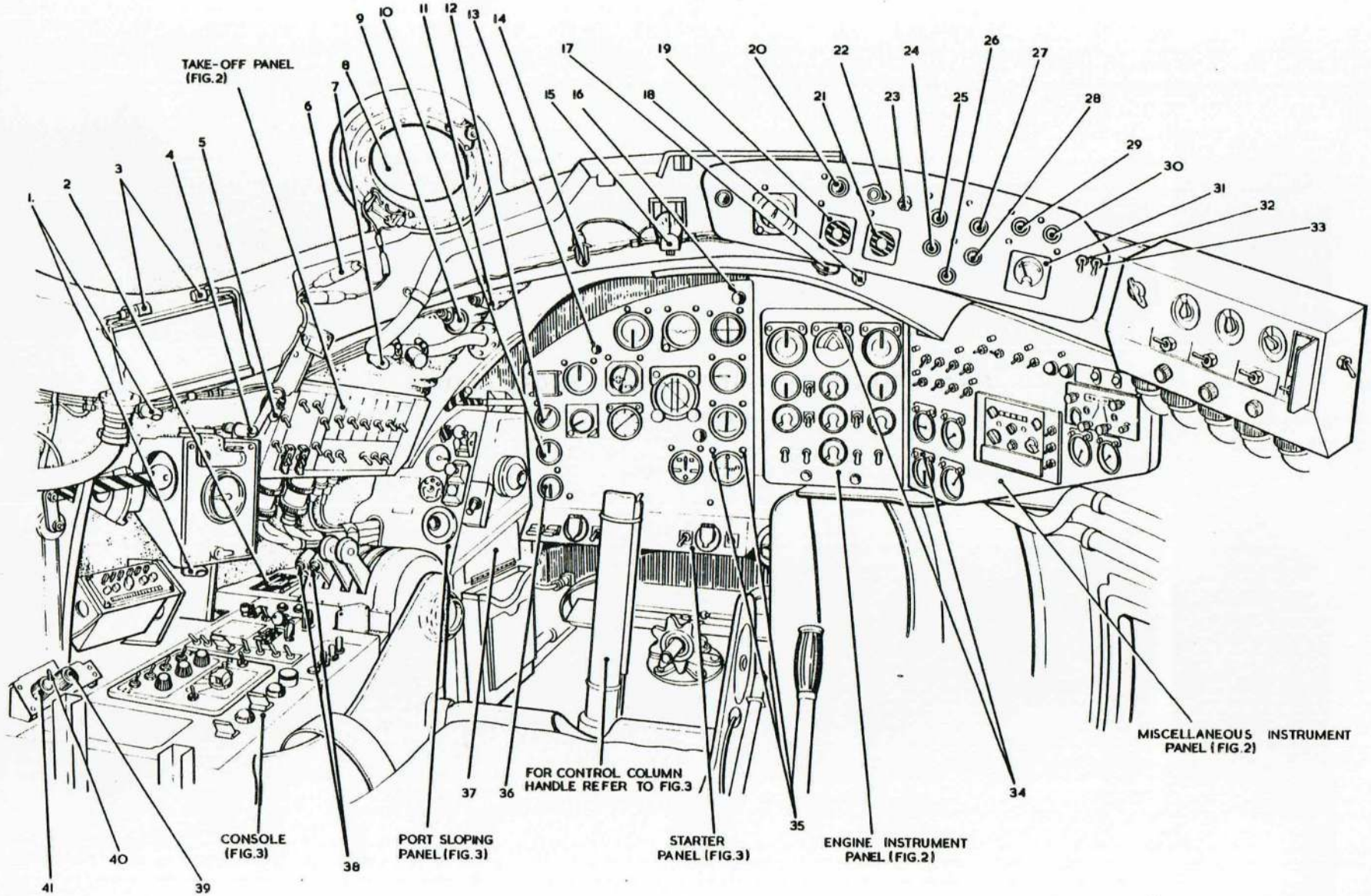


FIG. 1 ELECTRICAL INSTALLATION—PILOT'S STATION

◄ MOD 5439 EMBODIED ►

KEY TO FIG.1 (PILOT'S STATION)

1 CONSOLE RED FLOODLAMPS

2 CANOPY JETTISON SWITCH

3 FREQUENCY CARD RED FLOODLAMPS

4 OXYGEN REGULATOR RED FLOODLAMP

5 TAKE-OFF PANEL RED FLOODLAMP

6 WINDSCREEN HEATER CONNECTORS

7 TAKE-OFF PANEL RED FLOODLAMPS

8 WINDSCREEN HEATER

9 PORT ANTI-DAZZLE LAMP

10 TAIL PLANE TRIM POSITION INDICATOR

11 CONSOLE RED FLOODLAMP

12 RUDDER TRIM POSITION INDICATOR

13 I.F.F. FAIL LAMP

14 PORT EMERGENCY RED FLOODLAMP

15 EMERGENCY COMPASS LAMP

16 PILOT'S REMOTE OXYGEN INDICATOR

17 STARBOARD ANTI-DAZZLE LAMP

18 STARBOARD EMERGENCY RED FLOODLAMP

19 NO.1 ENGINE FIRE WARNING PUSH-SWITCH

20 INSTRUMENT SUPPLIES MAGNETIC INDICATOR

21 NO.2 ENGINE FIRE WARNING PUSH-SWITCH

22 FIRE WARNING LAMPS TEST PUSH-SWITCH

23 ANTI-DAZZLE LAMPS SWITCH

24 FLIGHT INSTRUMENT PANEL LAMPS DIMMER SWITCH

25 COAMING PANEL LAMPS DIMMER SWITCH

26 RADAR ALTIMETER LOW LEVEL WARNING LAMP DIMMER SWITCH

27 MISCELLANEOUS INSTRUMENT PANEL LAMPS DIMMER SWITCH

28 ENGINE INSTRUMENT PANEL LAMPS DIMMER SWITCH

29 NO.1 GENERATOR FAILURE WARNING LAMP

30 NO.2 GENERATOR FAILURE WARNING LAMP

31 BUSBAR VOLTMETER

32 EMERGENCY LAMPS SWITCH

33 TURN AND SLIP INDICATOR CONTROL SWITCH

34 BRIDGE LAMPS (TYPICAL)

35 PILLAR LAMPS (TYPICAL)

36 AILERON TRIM POSITION INDICATOR

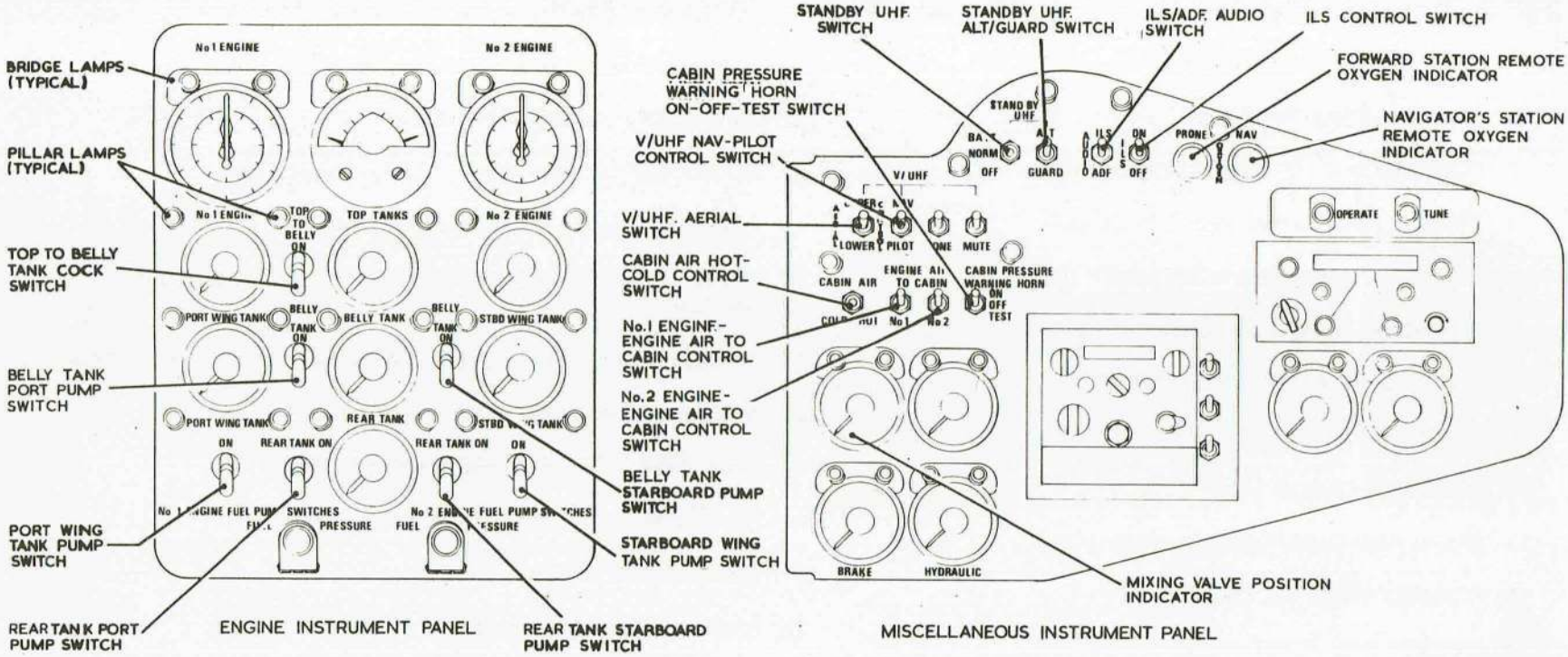
37 EMERGENCY BATTERIES (BEHIND PANEL)

38 ENGINE RELIGHT SWITCHES

39 PANEL LAMPS DIMMER SWITCH

40 FREQUENCY CARD LAMPS SWITCH

41 CONSOLE RED FLOODLAMPS DIMMER SWITCH



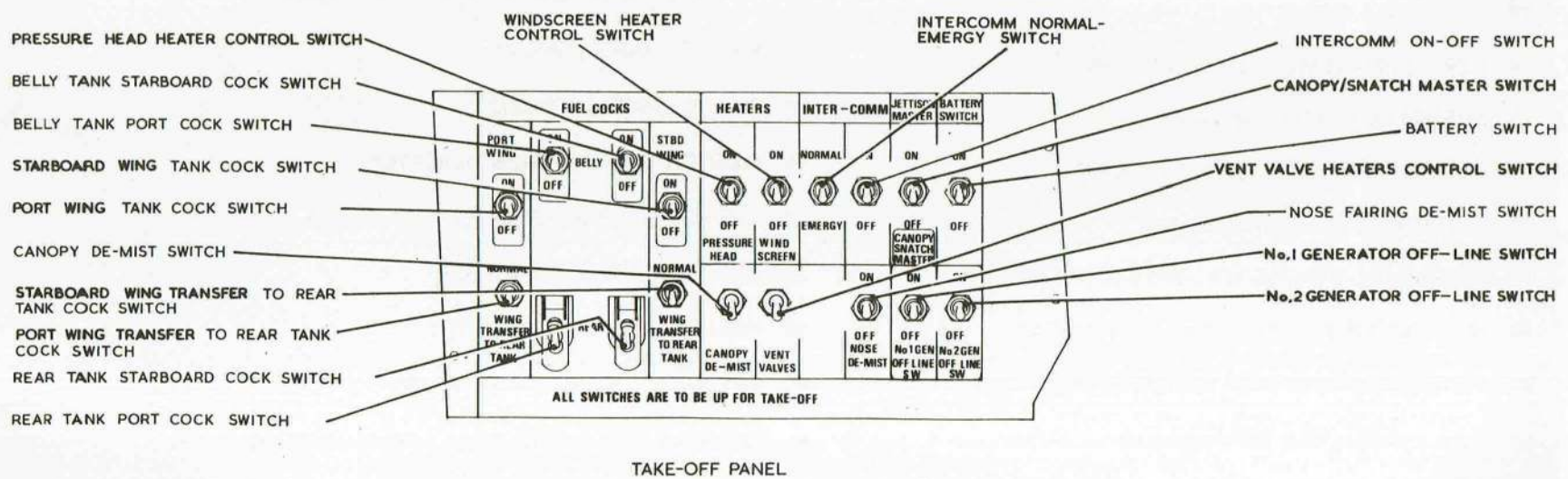


FIG. 2. PANEL DETAILS (1)

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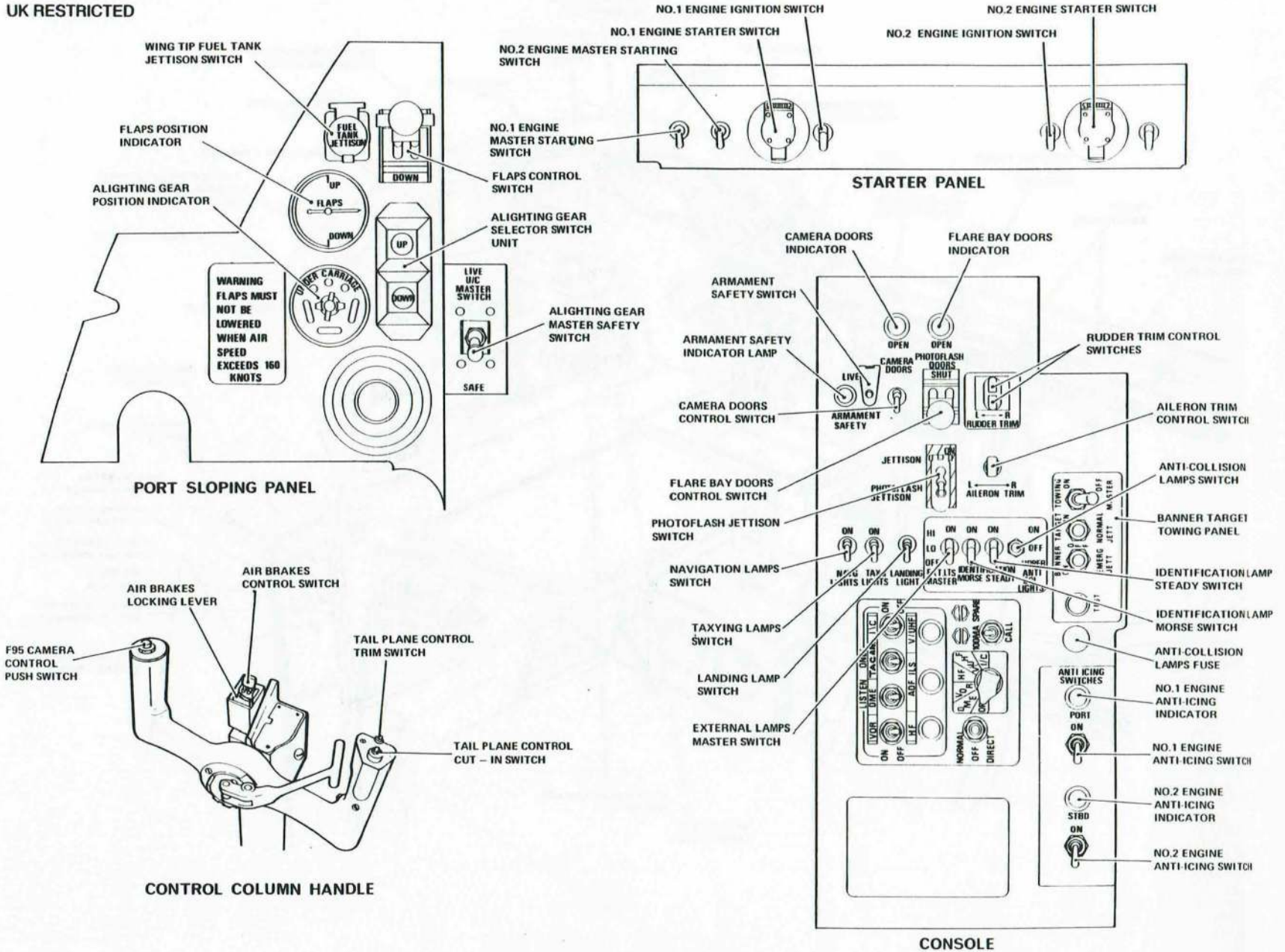

FIG. 3. PANEL DETAILS (2)

UK RESTRICTED

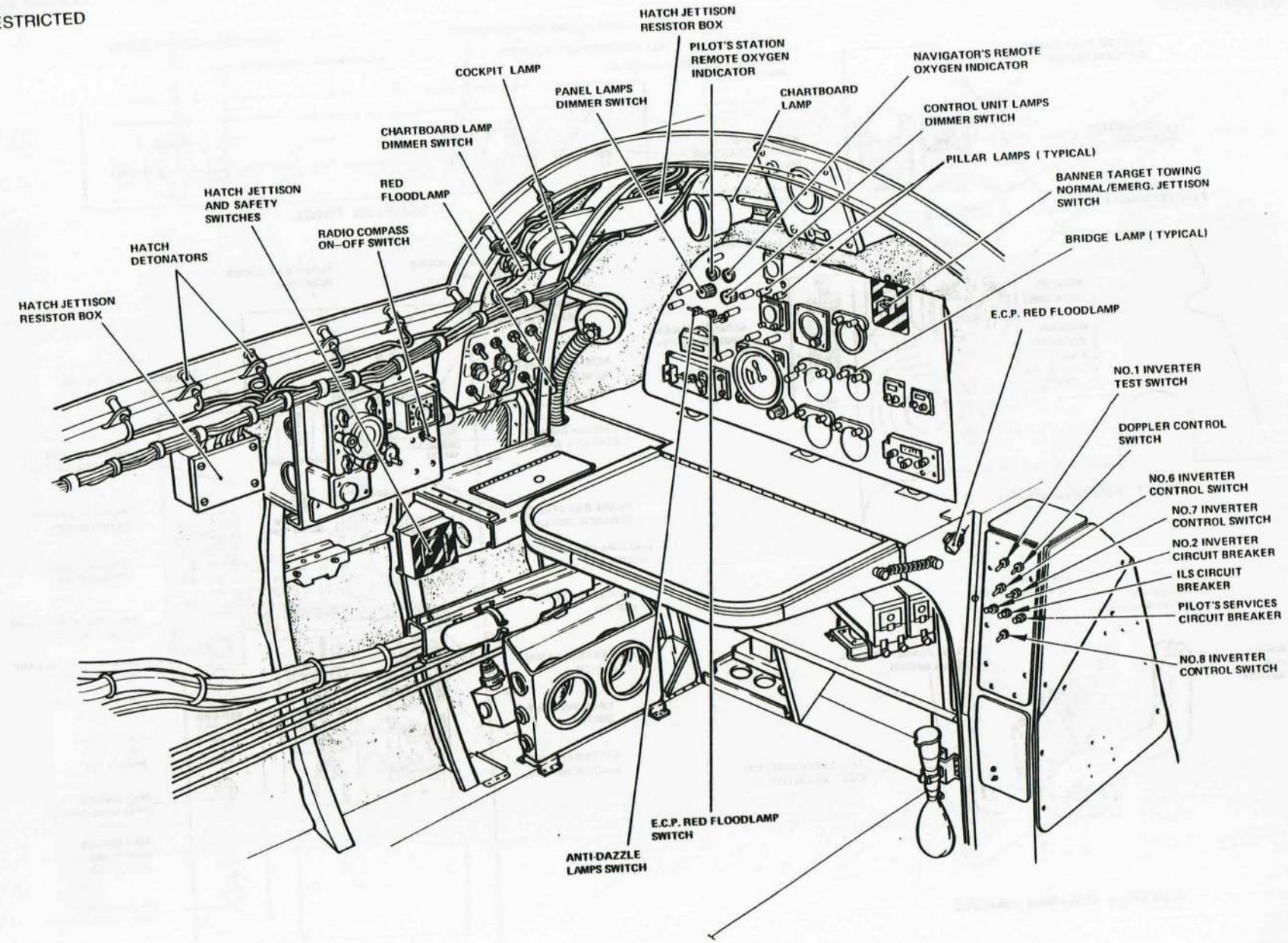

FIG. 4. ELECTRICAL INSTALLATION – NAVIGATOR'S PORT STATION

◀ SEM/CAN/0167/STC INCORPORATED ▶

UK RESTRICTED

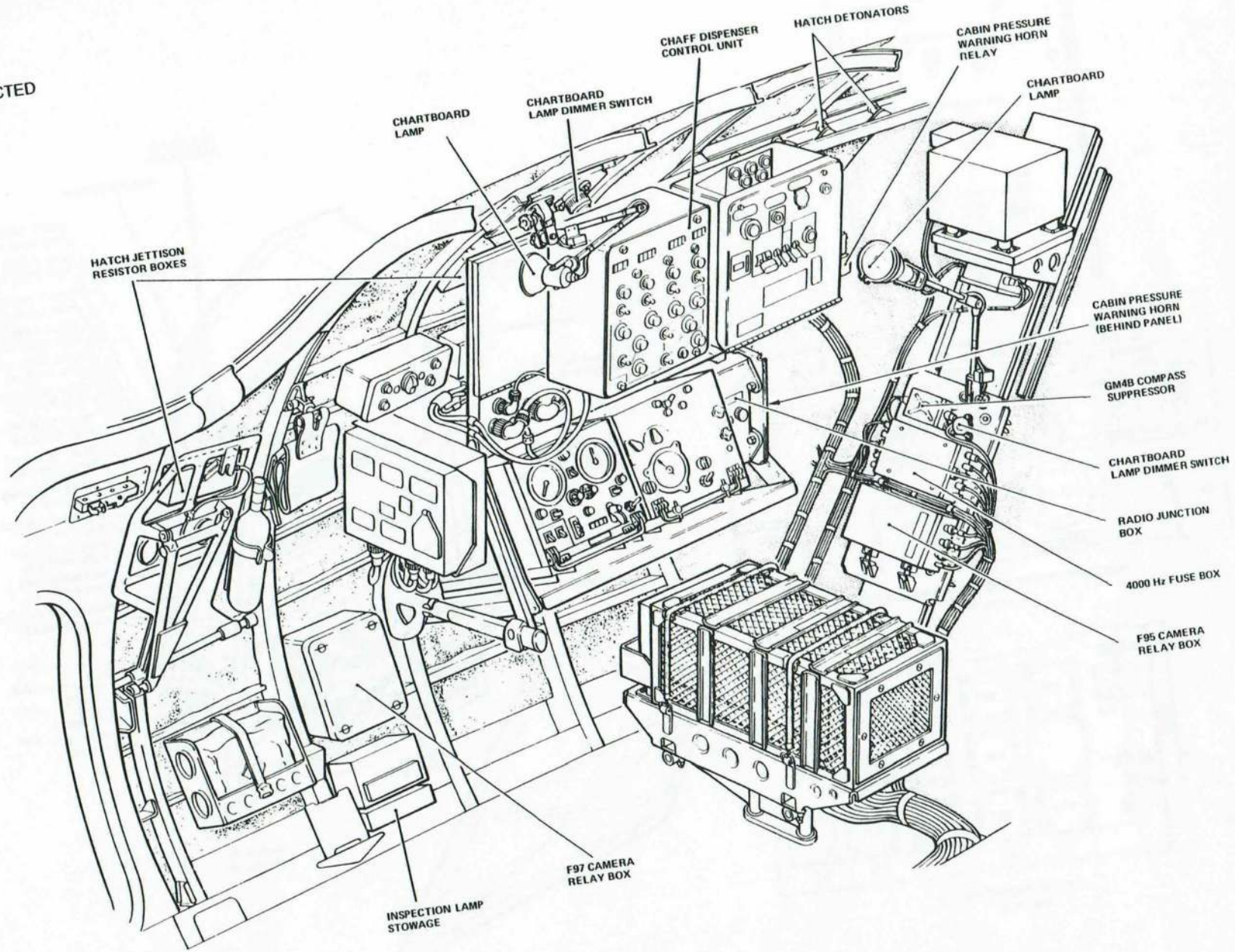

FIG. 5. ELECTRICAL INSTALLATION – NAVIGATOR'S STARBOARD STATION

◀ SEM/CAN/0167/STC INCORPORATED ▶

UK RESTRICTED

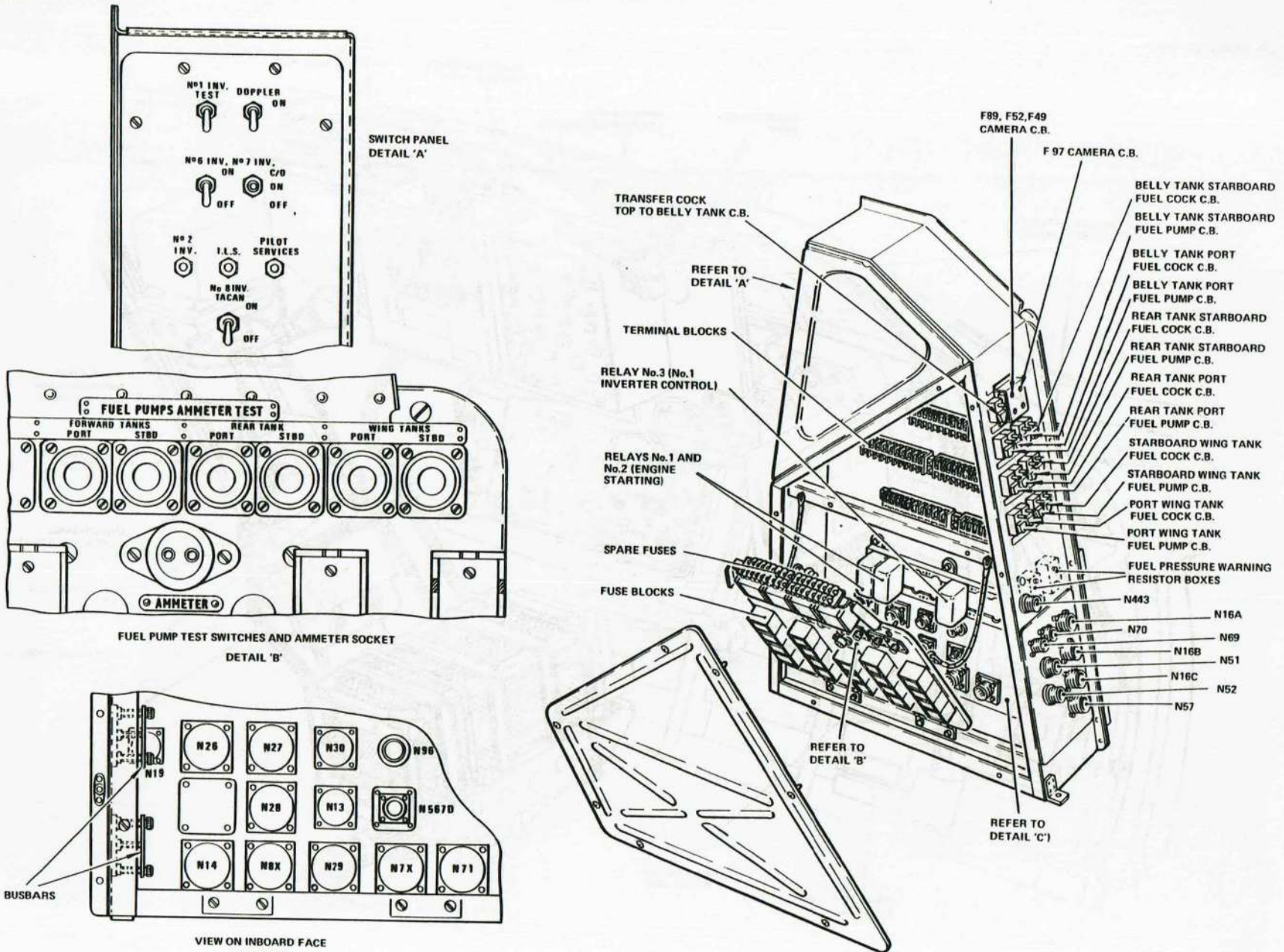

FIG. 6. ELECTRICAL CONTROL PANEL (E.C.P.)

◄ SEM/CAN/0167/STC INCORPORATED ►

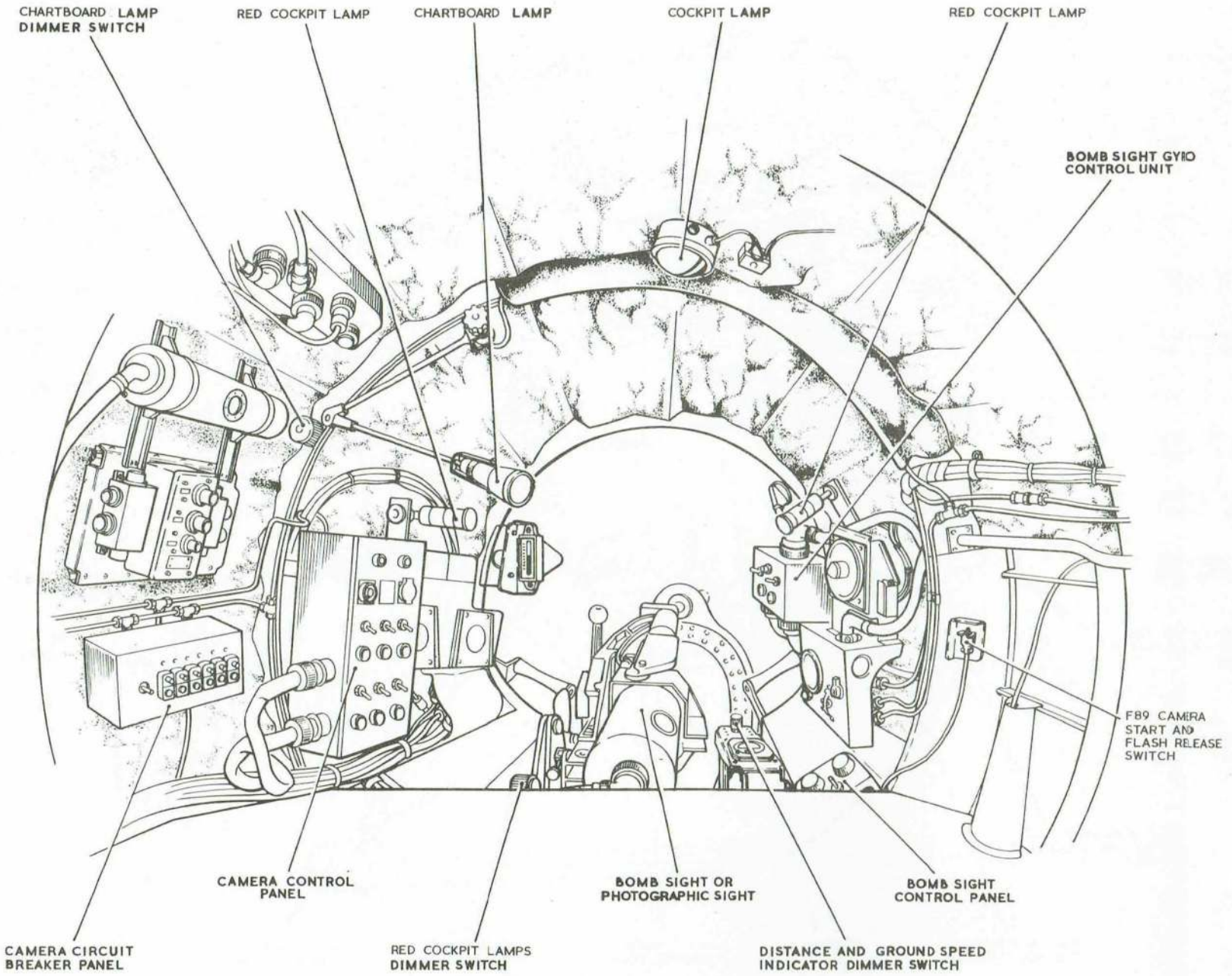

FIG. 7 .ELECTRICAL INSTALLATION – FORWARD STATION

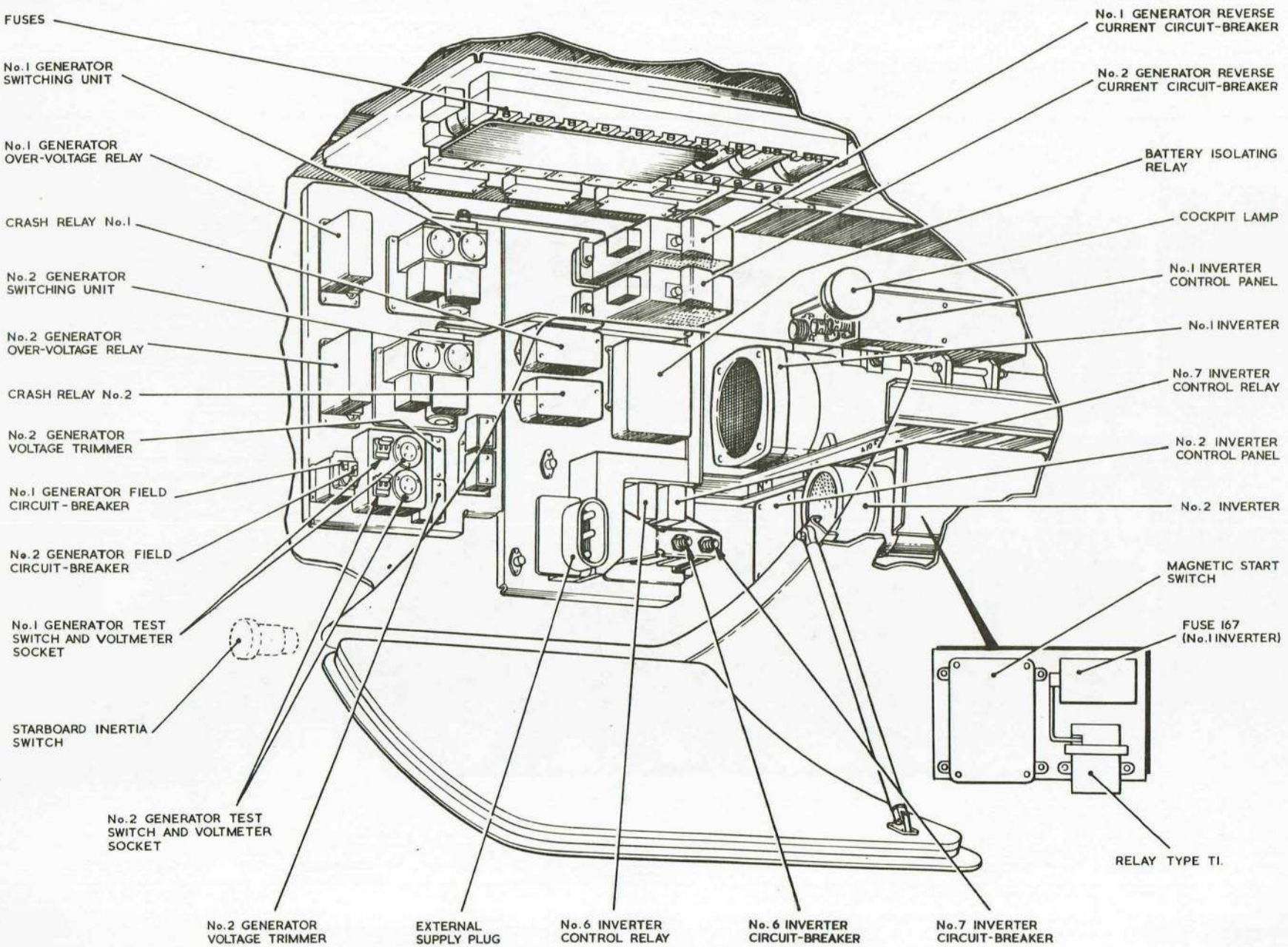

FIG.8. ELECTRICAL INSTALLATION-STARBOARD EQUIPMENT COMPARTMENT

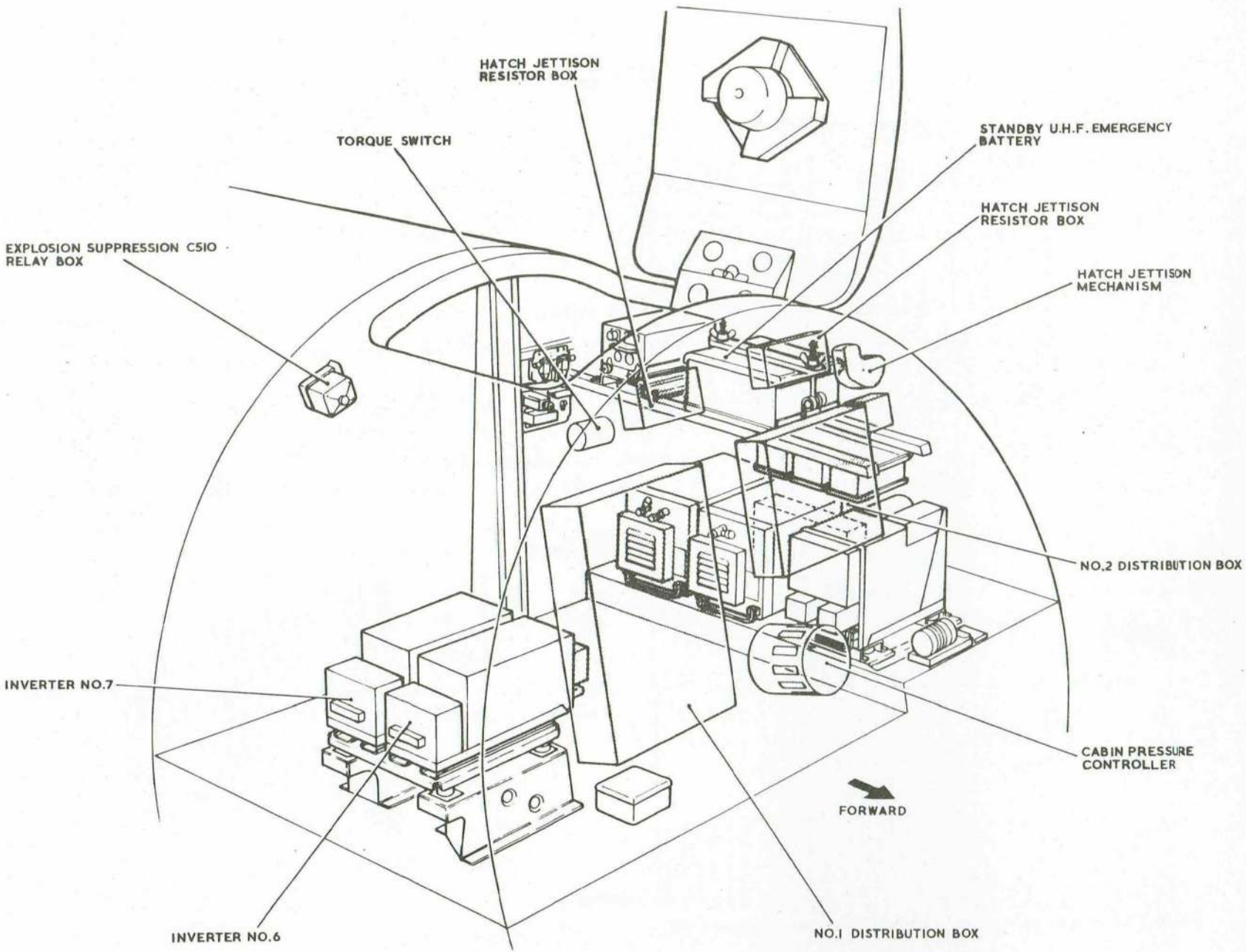

FIG. 9. ELECTRICAL INSTALLATION - UPPER EQUIPMENT COMPARTMENT

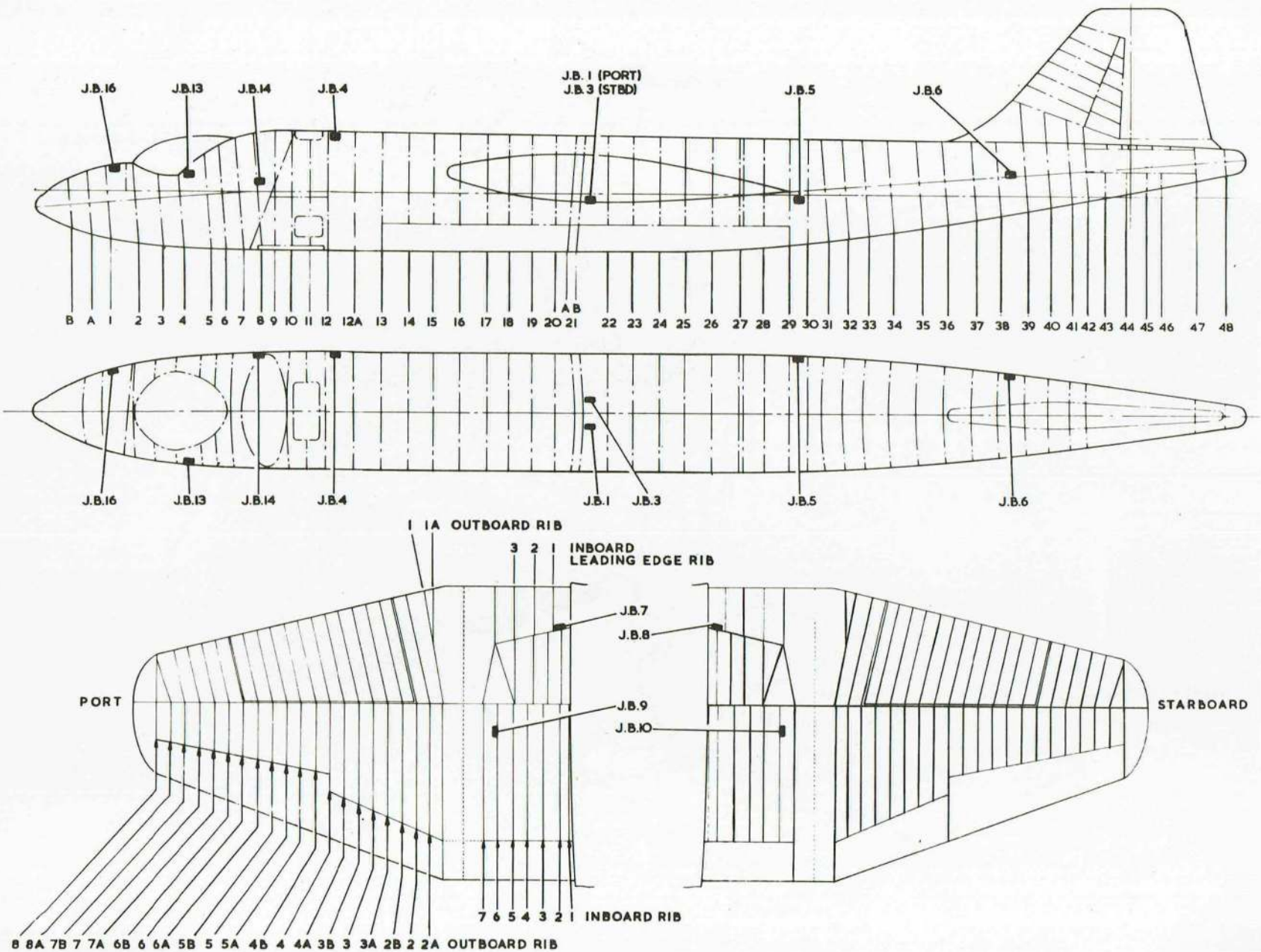

FIG.10. JUNCTION BOX. LOCATION DIAGRAM

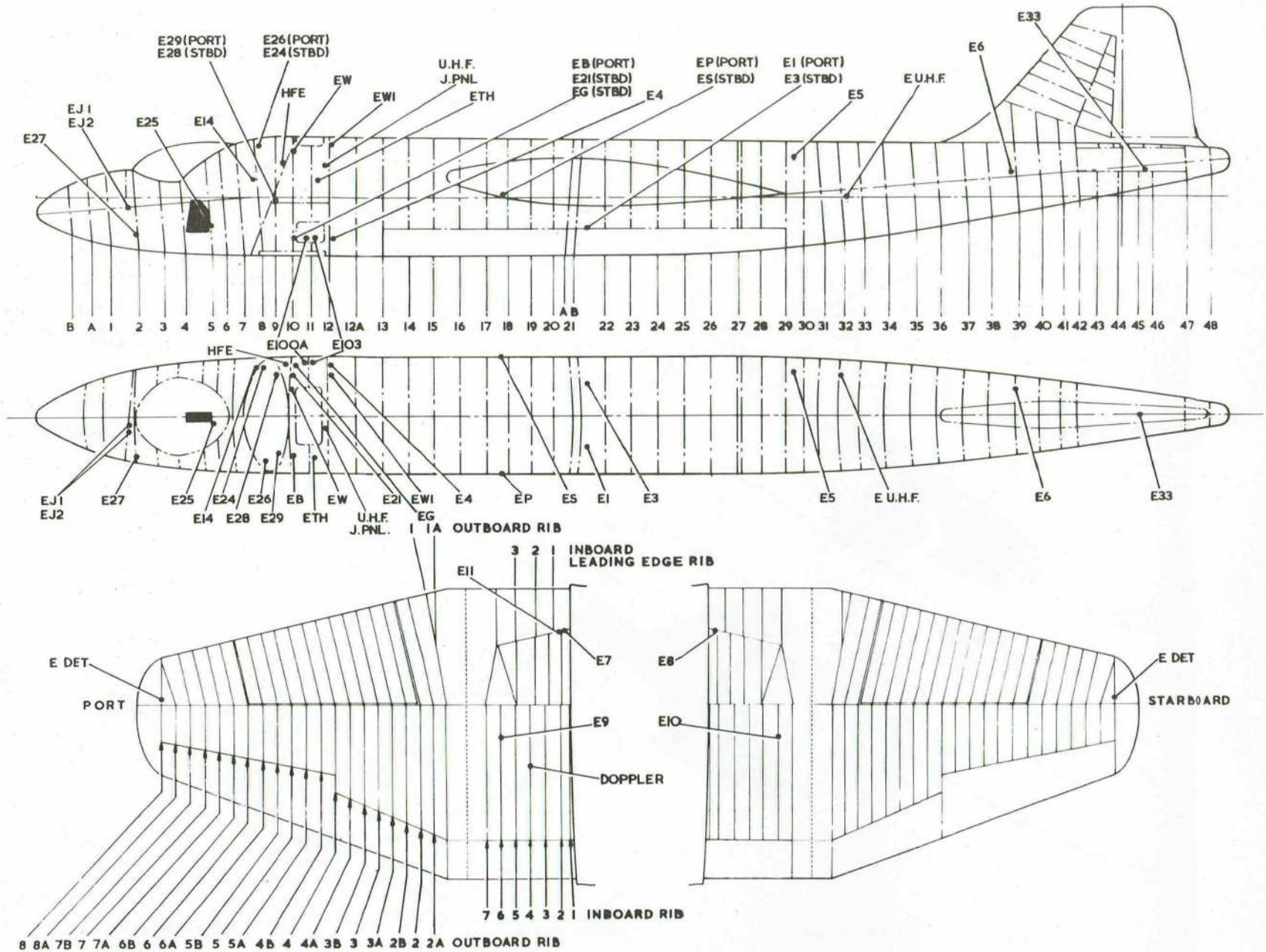

FIG.II EARTH POINT LOCATION DIAGRAM.

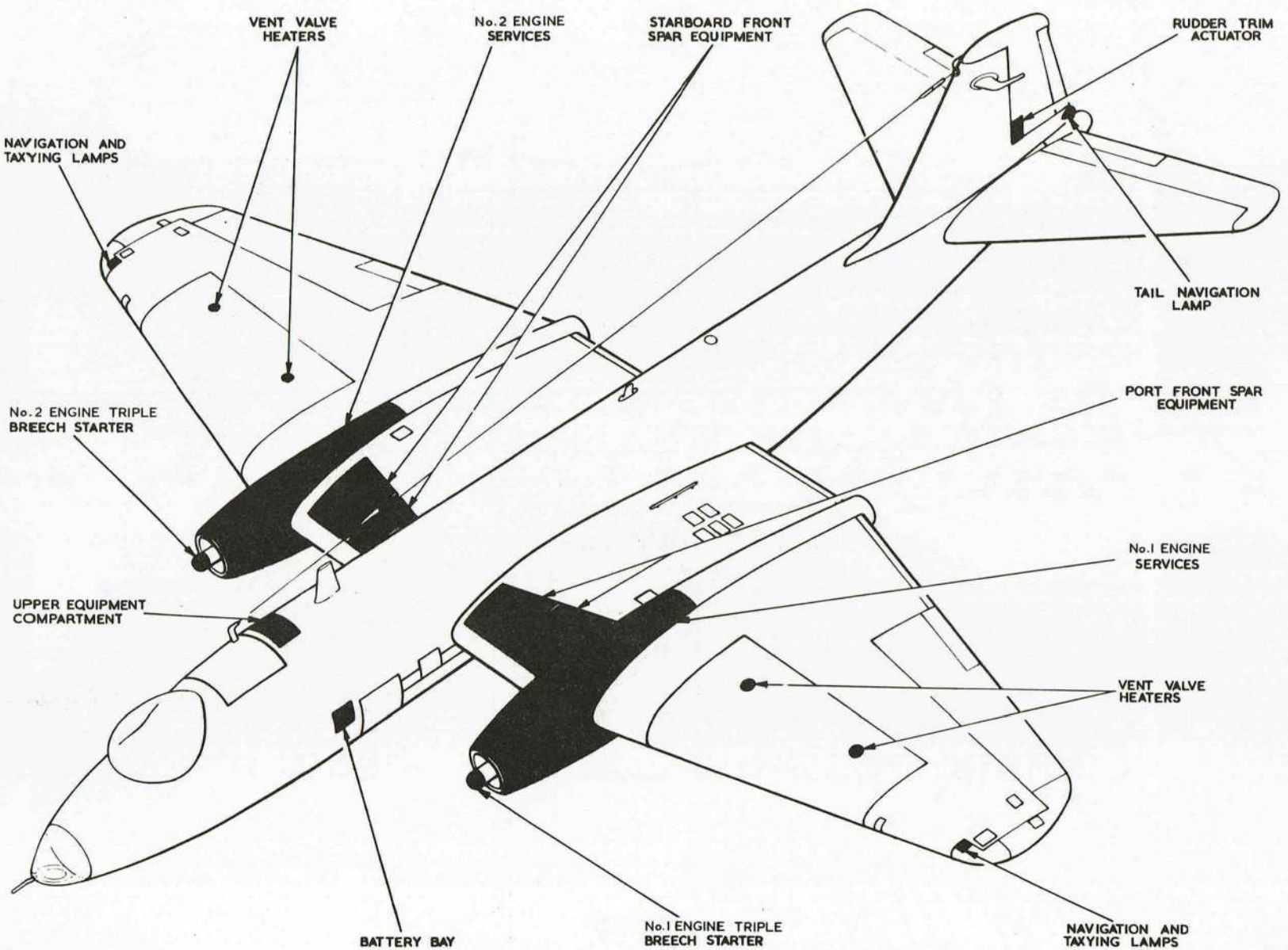

FIG. 12. ACCESS PANELS, UPPER SURFACE AND PORT SIDE.

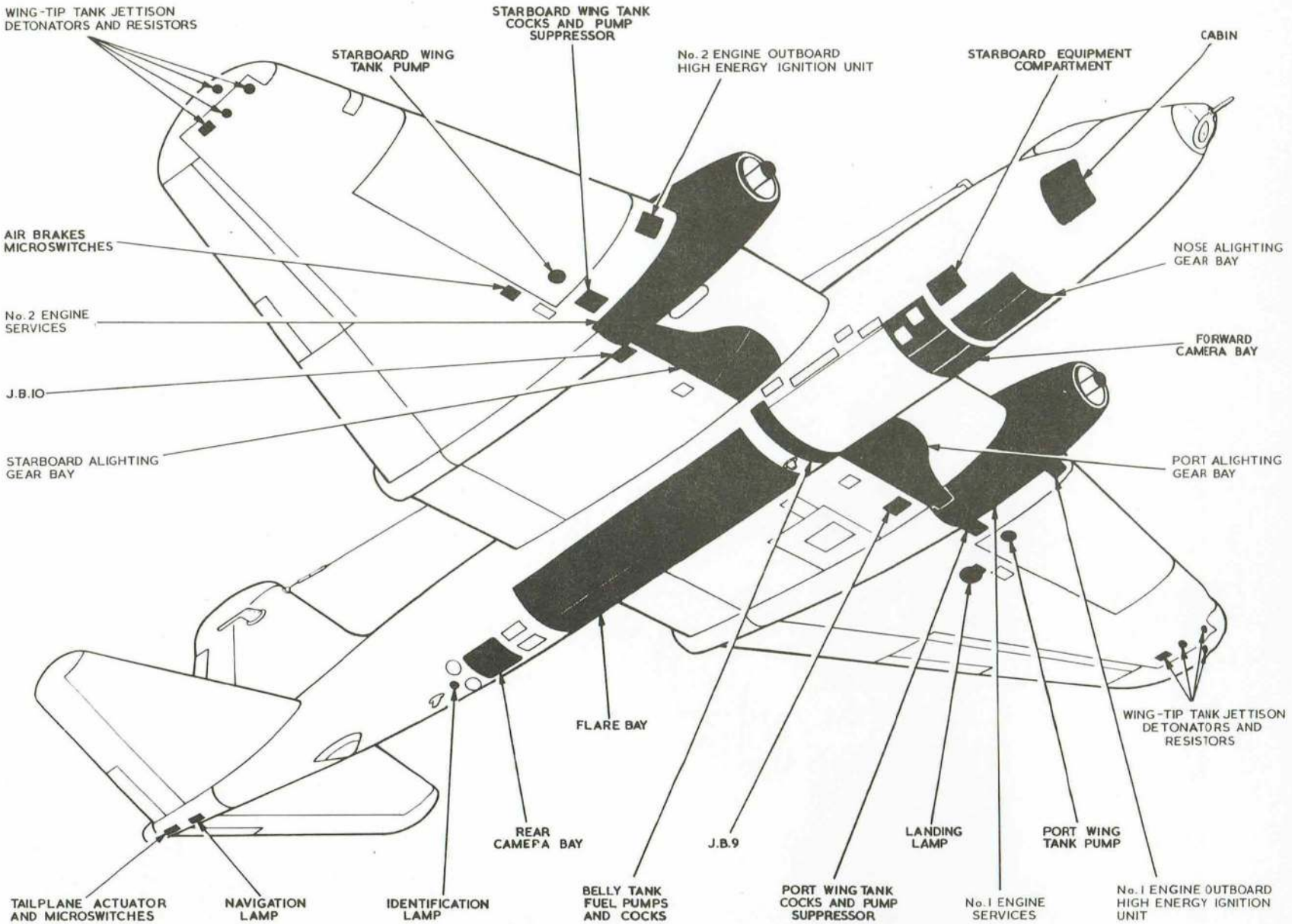

FIG.13. ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE.

ARMAMENT AND PHOTOGRAPHIC - GROUP A & B

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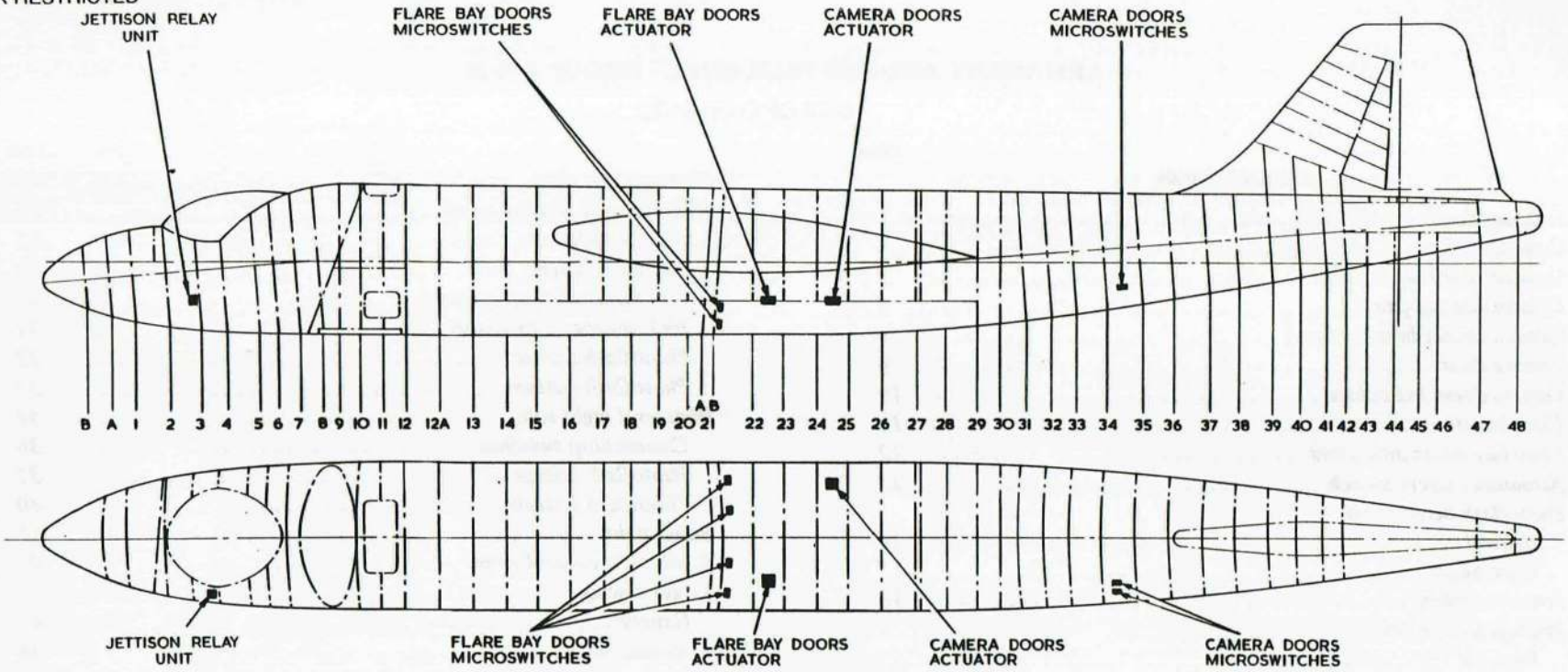
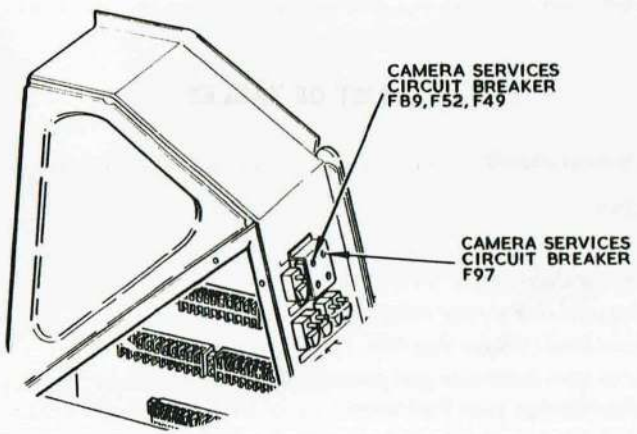
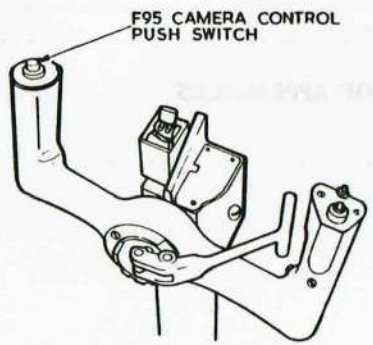
LIST OF ILLUSTRATIONS

UK RESTRICTED





ELECTRICAL CONTROL PANEL



PILOT'S CONTROL HANDLE

FIG. 1. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

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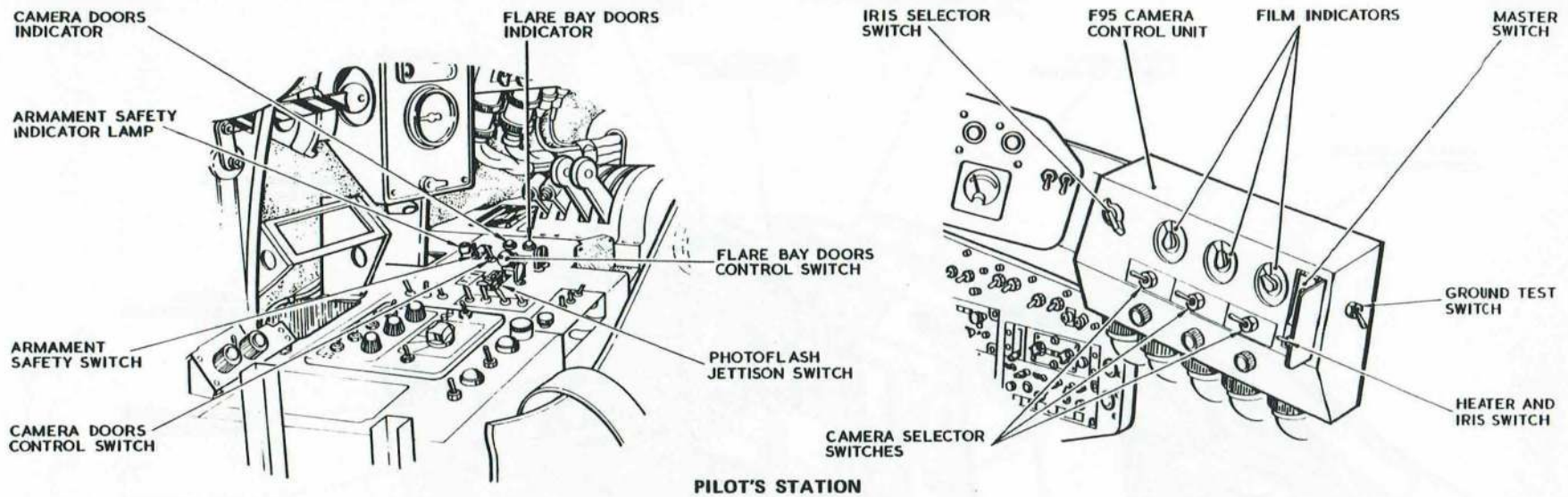


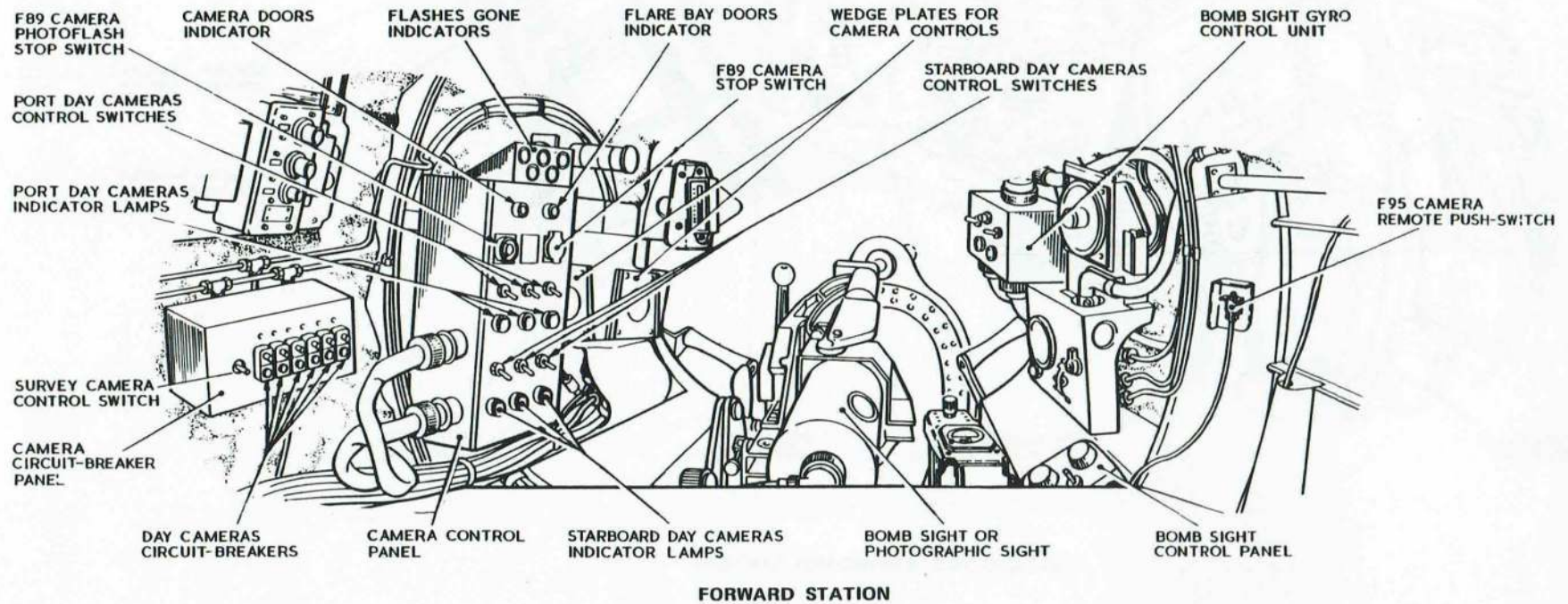
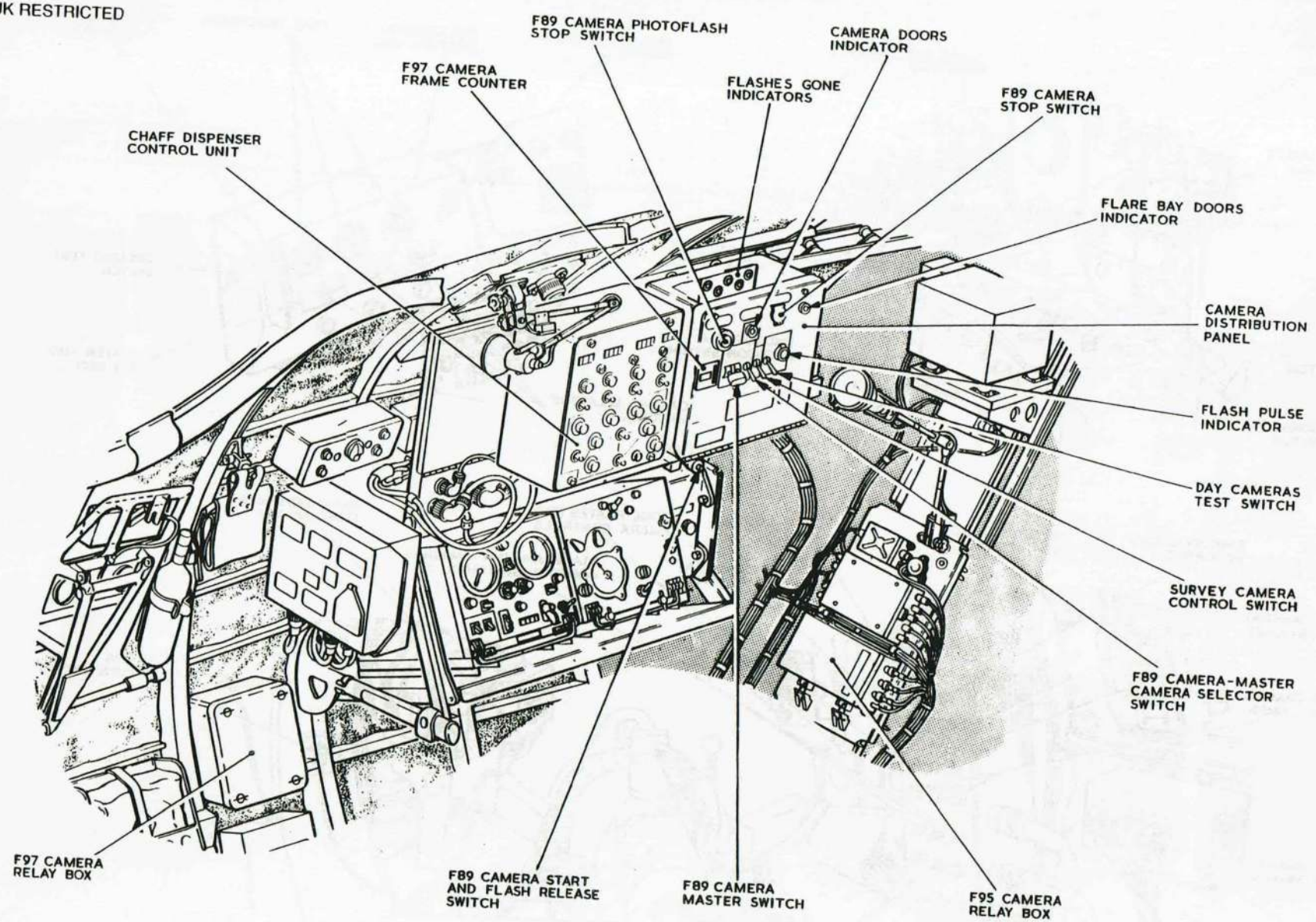


FIG. IA. LOCATION DIAGRAM

UK RESTRICTED



NAVIGATOR'S STARBOARD STATION

FIG. 1B. LOCATION DIAGRAM

◀ SEM/CAN/0167/STC INCORPORATED ▶

DESCRIPTION

Introduction

1. This group describes the various camera roles and the associated photoflash installation. It also includes information on the banner target towing facility. Table 1 provides a list of the main components their reference/part numbers and where possible the publications in which they are described. Location of the equipment is shown in fig. 1-1A-1B and the circuit and routeing diagrams have been divided into the individual roles to assist in carrying out fault finding and diagnosis. The various camera roles are:-

Day, and day survey soles
Low level day oblique role
Low level night role
High level night role

Further detailed information regarding the various camera installations can be found in Sect.5, Chap.2, Group A & B.

General

2. Certain items of equipment and a number of operations are common to all roles and these are described individually in the following paragraphs.

Camera distribution panel

3. This panel, which is located at the navigator's starboard station, houses the switches associated with the F89, F95, F97 and day survey cameras. On the same panel are the photoflash stop switch, the day cameras test switch and indicators for the flash pulse and flare bay doors.

4. A small bracket mounted on the top face of the panel holds five FLASHES GONE indicators and a stowage clip on the panel lower face holds the F89 CAMERA START AND FLASH RELEASE push-switch. Inside the panel box are the fuses, relays and terminal blocks with the relevant circuit interconnections. The right hand side face of the box houses the plug and socket connections to the aircraft wiring.

5. The switches and indicators on the panel are annotated as follows:-

CAMERA DOORS indicator
FLASH DOORS indicator
FLASH PULSE indicator
F97 PHOTOFLASH COUNTER
SURVEY CAMERA – ON/OFF switch
DAY CAMERAS – TEST/NORMAL switch
F89 CAMERAS – ON/OFF switch
F89 MASTER SELECTOR – PORT STBD switch
F89 CAMERA STOP push-switch
F89 PHOTOFLASH STOP push-switch

6. Within the panel are five relays, four of which are numbered 2 to 5 whilst the other is unidentified. The relays operate in the following circuits:-

relay No.2 – camera master control
relay No.3 – camera – camera doors interlock
relay No.4 – photoflash interlock
relay No.5 – photoflash going
unidentified – master camera control

Camera control panel

7. The camera control panel is mounted on the port wall at the forward station and controls the selection of the individual F52 camera circuits. Two relays, one for the port cameras, relay No.1 and one for the starboard cameras, relay No.2, are mounted in the panel and are energized from the camera control unit. An F89 CAMERA START AND FLASH RELEASE push-switch is connected to the panel by a flexible lead and is electrically connected in parallel with the similarly labelled switch on the camera distribution panel. Five PHOTO FLASHES GONE indicators are mounted on a bracket secured to the uppermost surface of the

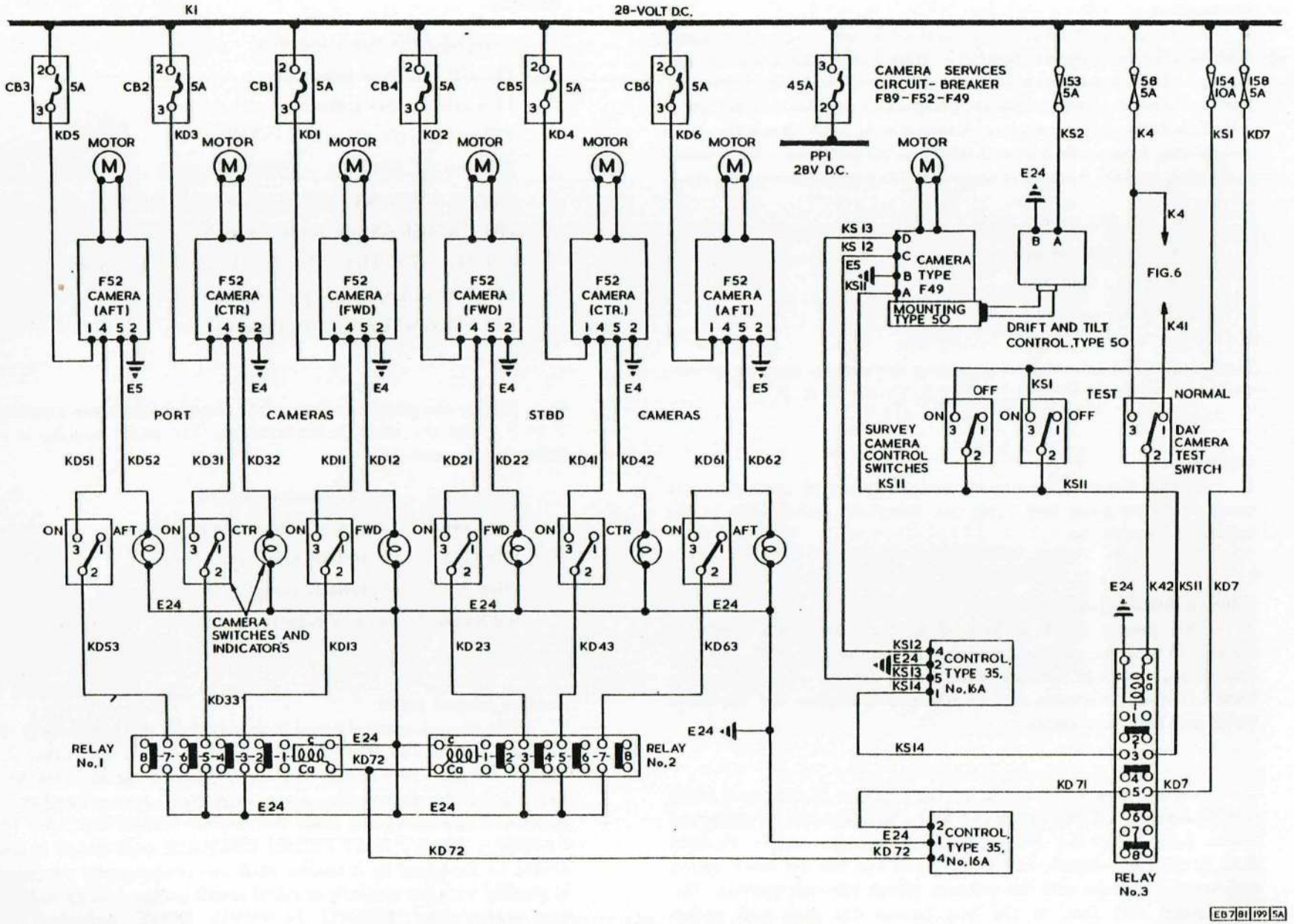


FIG.2. DAY, AND DAY SURVEY ROLES

panel. The switches and indicators mounted on the front panel are as follows:-

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

Camera circuit-breaker panel

8. This panel, mounted on the port wall at the forward station aft of the camera control panel, houses six circuit-breakers, one for each F52 camera and a SURVEY CAMERA ON-OFF switch.

Camera doors

9. Sliding doors at each camera location are operated by hydraulic jacks and controlled by an electrical actuator mounted in the roof of the flare bay, the electrical actuator being controlled by the CAMERA DOORS switch on the console and relay No.3 in the F97 camera relay box.

Camera doors indicators

10. Indication that the camera doors are open is given by three magnetic indicators located, one on the console, one on the camera control panel, and one on the camera distribution panel. The supply to these indicators is fed through two microswitches fitted adjacent to and operated by the centre camera bay doors, and relay No.3 in the F97 camera relay box. With the camera doors in the fully open condition each of the indicators will show white.

Flare-bay doors

11. The flare-bay doors are hydraulically operated and controlled by an electrical actuator mounted in the roof of the flare bay. Normal operation of the doors is controlled by a switch, annotated PHOTOFLASH DOORS – OPEN – SHUT, mounted on the pilot's console which, when selected to OPEN, directly operates the electrical actuator, causing the doors to open. When the switch is selected to SHUT the electrical actuator is fed via the normally-closed contacts of relay No.1 in the jettison relay unit in the pilot's console.

Flare bay doors indicators

12. Indication that the flare-bay doors are open is given by three magnetic indicators located one on the console, one on the camera distribution panel, and one on the camera control panel at the forward station. The indicators are energized by two microswitches, mounted on the flare bay forward bulkhead, which close when the doors are fully open. With the flare-bay doors in the fully open condition each of the indicators will show white.

Armament safety switch

13. The guarded ARMAMENT SAFETY switch, located on the pilot's console, has two positions, SAFE and LIVE, and controls the supply to the coils of the two photoflash safety relays located, one in the rear camera bay (F97 camera) and one on the flare beam (F89 camera). The switch, in the SAFE position, prevents the release of the photoflashes whilst in the LIVE position, with the flare bay doors fully open (microswitches made), it will energize the coils of both relays and allow the release of the photoflashes via the distributor.

Photoflash installation

General

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

Flare beam

15. The flare beam is fitted with two release slips, numbered 1

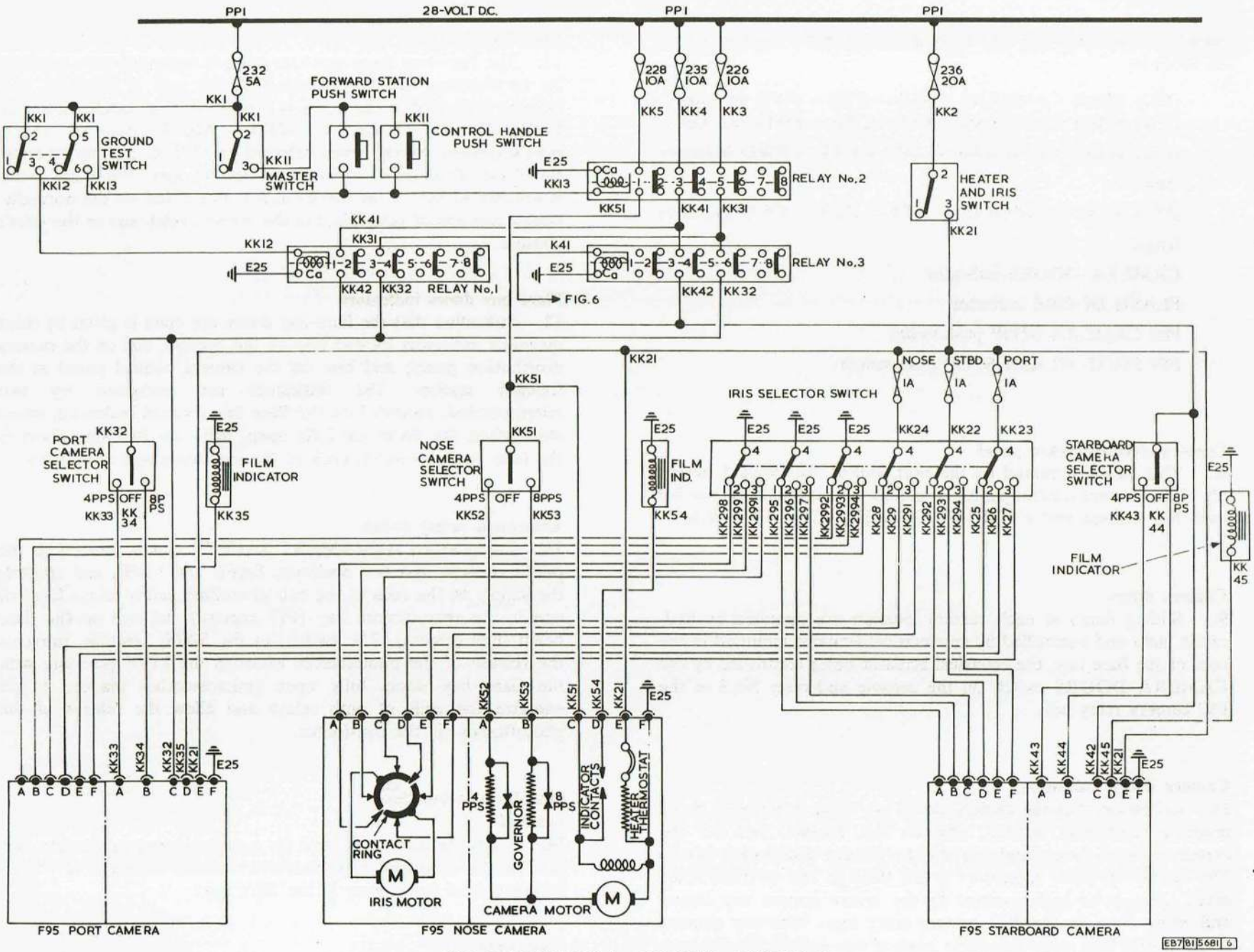


FIG. 3. LOW LEVEL OBLIQUE DAY ROLE

◄CONTROL HANDLE SWITCH CHANGED►

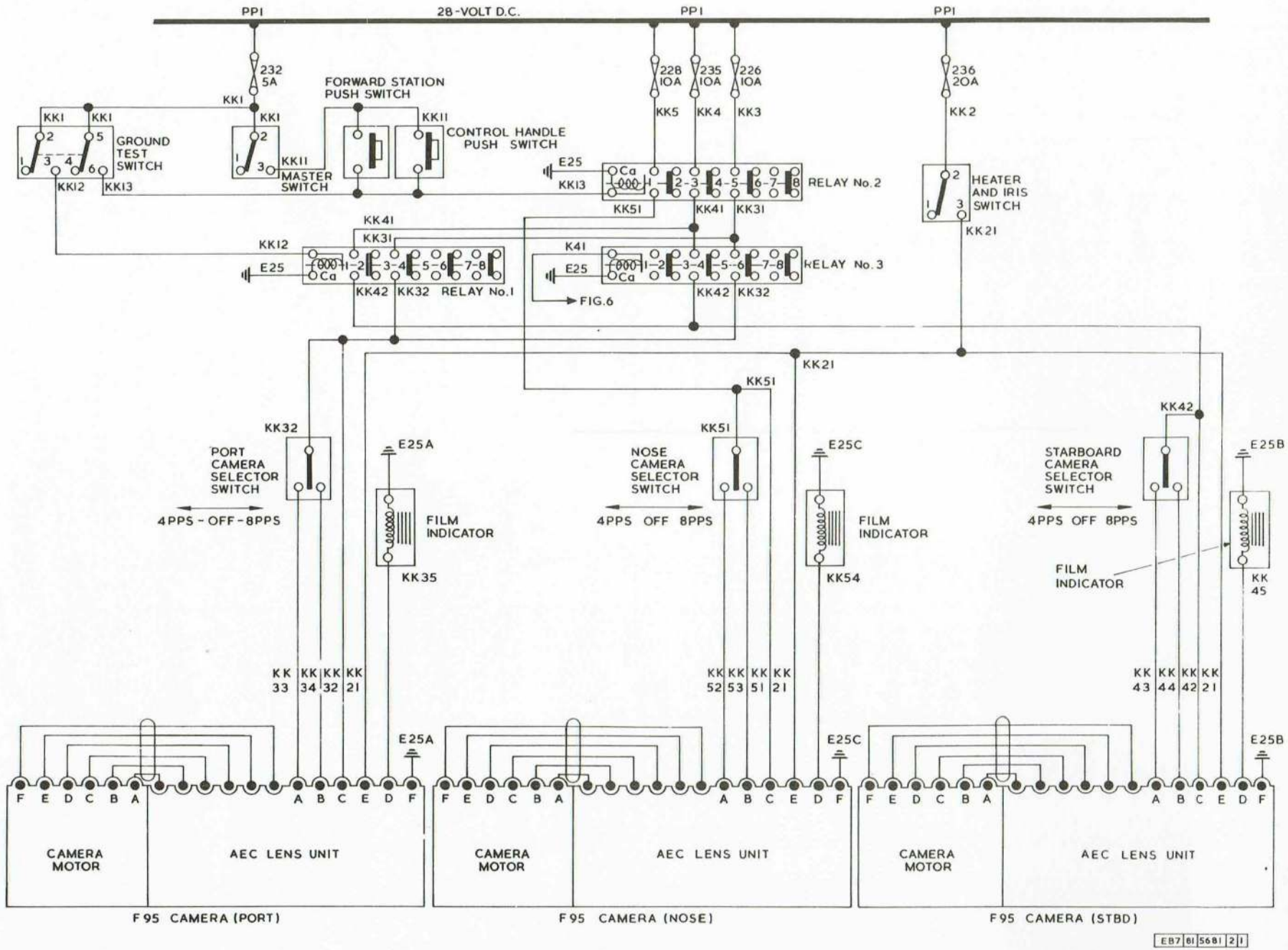


FIG. 3A. F95 CAMERAS WITH AEC LENS UNITS

and 2 from the forward end of the beam, which are used to carry either a Type 1, Mk.2 multi-store carrier at the No.1 position, for use in the high level night role, or a 252 × 1.75 in. photoflash crate at the No.2 position, for use in the low level night role. The two electrical slips are not electrically connected to the aircraft wiring and are used only as attachment points for the carriers. The manually-operated release mechanisms are operated by cables which run along the top of the beam and terminate in finger rings located under spring-loaded covers, labelled MANUAL RELEASE No.1 SLIP and MANUAL RELEASE No.2 SLIP, at the aft end of the beam. Cocking indicator sockets are provided at the aft end of the beam for checking that the release units are securely cocked. The beam is attached to the aircraft structure by ⅝ in. bolts at the forward end and dowel pins at the aft end. Adjustable crutching bolts are attached to each side of the beam for stabilizing whichever carrier is fitted to it. Detailed information on the flare beam and photoflash crate is contained in A.P.110G-0614-125F and A.P.110G-0520-125F respectively.

Power supplies

16. The power supplies from the main electrical busbar PP1 in the E.C.P. to the camera supply busbars are controlled by two circuit-breakers on the forward face of the E.C.P. These circuit-breakers, which are labelled CAMERA SERVICES – F89, F52, F49 and F97 respectively control the supplies to all the camera roles with the exception of the low level oblique day role cameras (F95) which draw their supplies direct from busbar PP1 in the E.C.P.

Photographic roles

Day role

17. Six Type F52 cameras are used in this role and are located two forward and two aft, port and starboard respectively in the forward camera bay and two mounted port and starboard in the centre camera bay. They operate from a 28 volt d.c. supply fed from busbar PP1 via the CAMERA SERVICES F89 – F52 – F49 circuit-breaker on the E.C.P. and six individual circuit-breakers, one for each camera circuit, on the camera circuit-breaker panel.

18. The cameras can be selected from two banks of three switches located on the camera control panel and labelled PORT CAMERAS – AFT – CTR – FWD and STBD CAMERAS – AFT – CTR – FWD. Visual indication that the cameras are operating is given by six indicator lamps located adjacent to their respective switches. Each camera can be operated at predetermined intervals from a Type 35, No.16A control unit which is positioned on a horizontal wedge plate at the port side of the photographic sight at the forward station. The 28-volt d.c. supply required for the camera control unit is drawn from fuse 158 via relay No.3, which is energized when the camera doors are open and the associated microswitches are made. Two more relays, operating in conjunction with the camera control unit, complete the earth circuits to the cameras via their respectives switches.

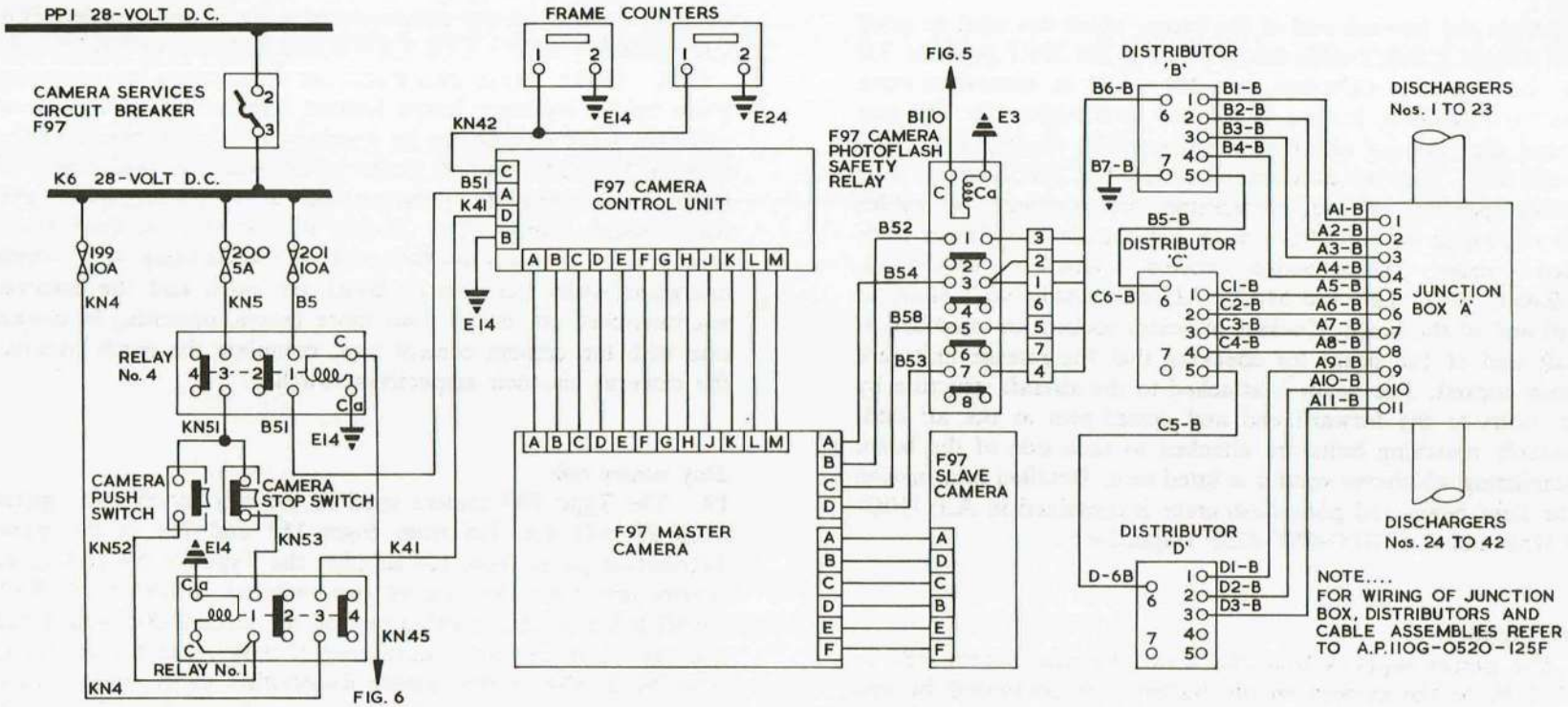
Day survey role

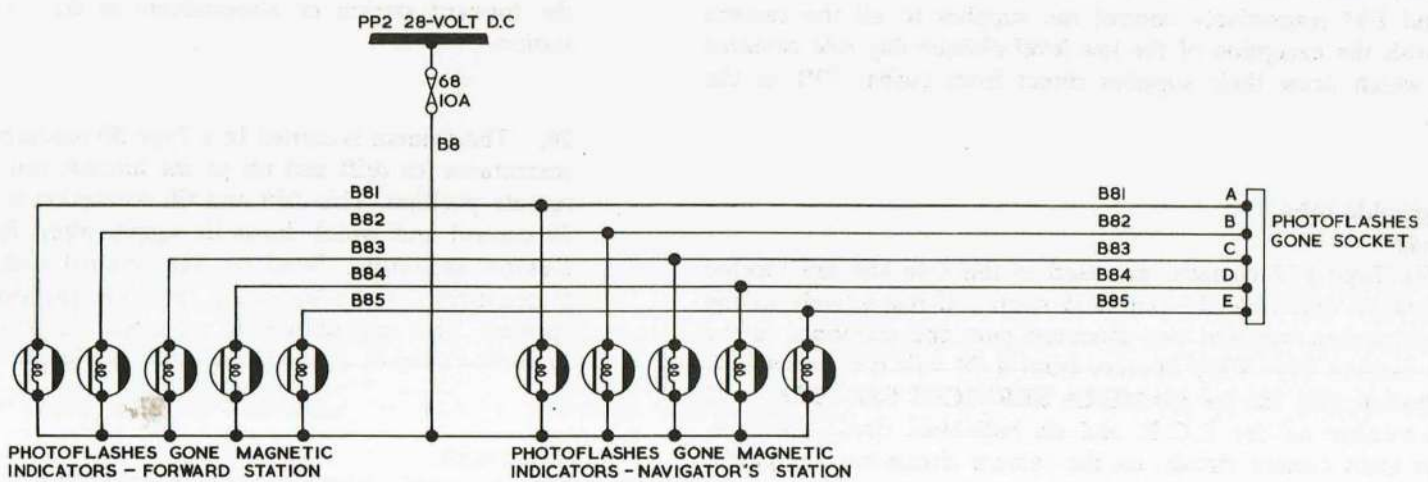
19. The Type F49 camera used in the day survey role operates from 28 volt d.c. fed from fuses 153 and 154 in the camera distribution panel. Fuse 154 supplies the Type 35, No.16A camera control unit via either one of two switches, annotated SURVEY CAMERA ON-OFF, located one on the camera distribution panel and the other on the camera control panel, and the contacts of relay No.3, also in the camera distribution panel, which is energized when the camera doors are open and the microswitches 'made'. The camera control unit is mounted on a wedge plate at the forward station or alternatively at the navigator's starboard station.

20. The camera is carried in a Type 50 mounting designed so that corrections for drift and tilt of the aircraft can be applied from a remote position. This drift and tilt correction is applied by a Type 50 control unit which draws its supply direct from fuse 153. Two Desynn indicators, fitted on the control unit and operated by transmitters on the mounting, indicate the degree of correction applied. The control unit is mounted on a wedge plate at the forward station or alternatively at the navigator's starboard station.

Test switch

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





EB7 | 81 | 6043 | 3A

FIG. 4. LOW LEVEL NIGHT ROLE AND PHOTOFLASH RELEASE – PHOTOFLASHES GONE INDICATORS

◄CIRCUIT TO SAFETY RELAY AMENDED►

Low level oblique day role

22. The three Type F95 cameras used in this role are located, one at the forward station and two in the forward camera bay. They operate from a 28-volt d.c. supply and are controlled by a master switch on the F95 camera control unit in conjunction with a push-switch, labelled F95 camera, on the control column left hand grip, or the push-switch at the starboard side of the forward station. The d.c. supplies to the cameras are fed from fuses 226, 228 and 235 in the E.C.P. via relays No.2 and No.3 in the F95 camera relay box. Relay No.3 forms a camera door interlock circuit, for the port and starboard cameras, and is only energized when the camera doors microswitches are 'made' thus preventing the cameras from operating until the doors are open. The supply to the nose camera is not routed through the contacts of relay No.3 and may therefore be operated without opening the camera doors. When F95 cameras with A.E.C. lens units are fitted, an adapter lead is required between the lens units and the cameras.

Camera control unit

23. The control unit, which is mounted above the entrance door in the cabin provides for individual selection and setting of each camera and embodies the following circuit control switches:-

Master switch

- this switch, labelled CAMERA MASTER, controls the supplies to all three cameras.

Ground test switch

- this switch enables tests to be made on the camera motors, and when selected to GROUND TEST, relay No.3 is by-passed and the camera motors operate regardless of the position of the camera doors.

Selector switches

- a selector switch, labelled 4PPS-OFF-8PPS, for each camera, controls the supplies to the individual cameras and determines the speed at which the camera operates.

Film footage indicators

- a film footage indicator, calibrated in quarters from 0 to F (full), indicates the amount of film remaining in each camera magazine.

Iris selector switch

- a rotary, three position, iris switch, labelled OPEN-2-3, controls the aperture setting of all three cameras. When F95 cameras with A.E.C. lens units are fitted, this switch is not connected in circuit.

Heater iris switch

- this switch, labelled HTR & IRIS, controls the supplies to the heating element in all three cameras.

F95 camera relay box

24. This relay box, mounted on the seat rail at the navigator's starboard station, houses three relays. Relay No.1 is the camera supply relay, relay No.2 is the camera doors interlock relay and relay No.3 is the ground test by-pass relay.

Photographic sight

25. As an aid to the camera day roles, a Type 1 photographic sight is installed above the sighting window at the aircraft forward station. It is a gyro controlled instrument requiring power supplies of 28 volt (nominal) d.c. and 115 volt, 400 Hz, 3-phase a.c. *(Group D)*, and functions in conjunction with a control panel adjacent to it.

Sighting head control panel

26. This panel mounted at the port side of the photographic sight, controls the d.c. supply to the sighting head collimator lamp. Housed in the panel is a dimmer resistance labelled COLLIMATOR LIGHT.

Low level night role

27. Two Type F97 cameras, located in the forward camera bay are used for the low level night role. They require a 28 volt d.c. supply which is drawn from busbar PP1 in the E.C.P . via the CAMERA SERVICES – F97 circuit breaker on the E.C.P. This supplies fuses 199, 200, 201 and 202 in the F97 camera relay box and is then distributed to the low level night role circuits.

F97 camera relay box

28. This box, located at the navigator's starboard station, houses the above fuses and relays No.1, 3 and 4 which are used in the camera control and door interlock circuits.

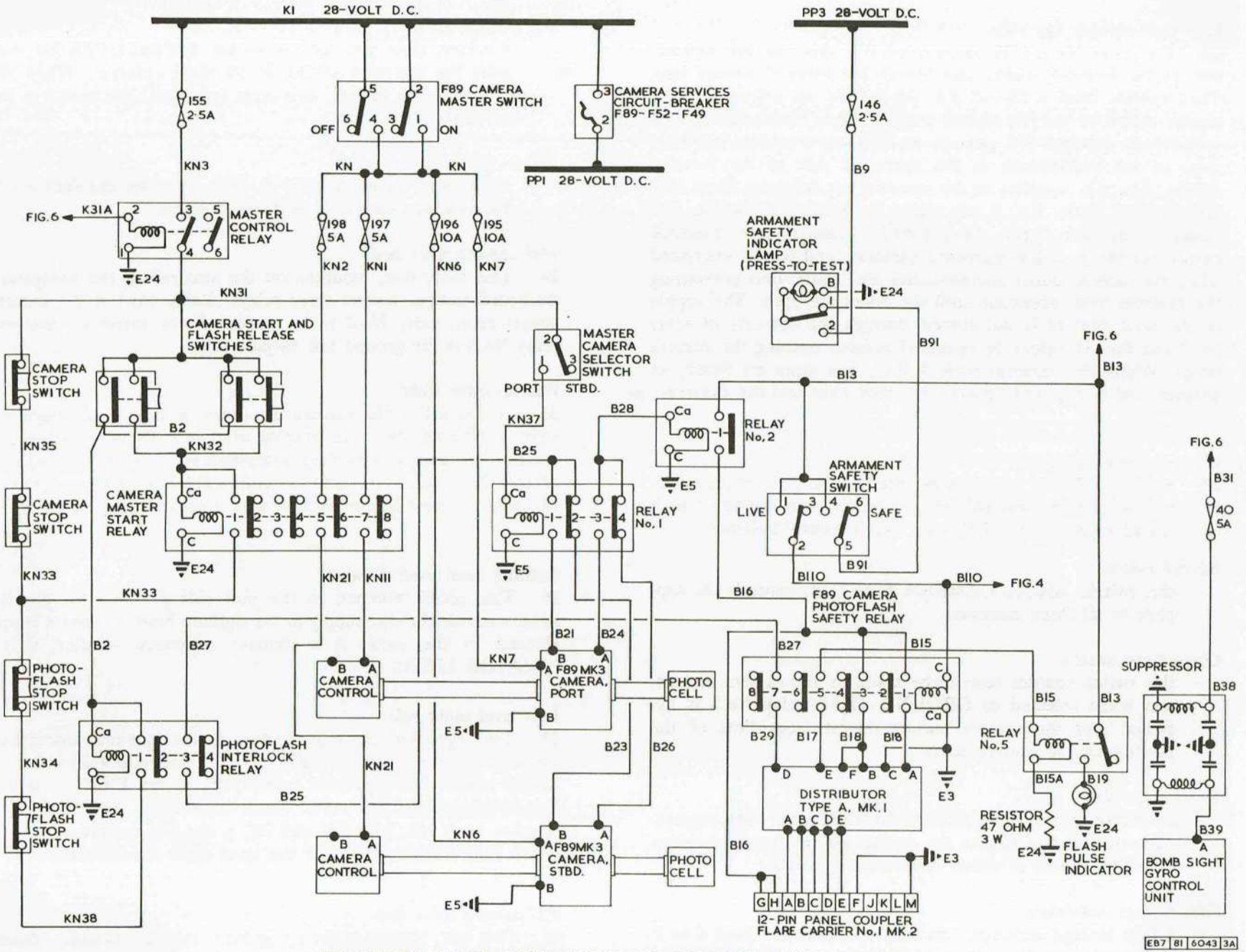


FIG.5 HIGH LEVEL NIGHT ROLE AND PHOTOFLASH RELEASE

29. Relay No.3 will, when the camera doors are open and the microswitches made, pass a feed to energize relay No.4 and complete the circuit to the camera START switch and relay No.1 thereby initiating camera operation. At the same time the positive feed from fuse 58 passes via relay No.3 to bring into circuit the camera doors indicators.

F97 camera firing control box

30. This unit is mounted on a wedge plate adjacent to the camera control panel at the forward station. It embodies the F97 camera START and STOP push-switches and a photoflash counter connected in parallel with a similar counter on the camera distribution panel.

F97 camera control unit

31. The camera control unit is mounted on a wedge plate adjacent to the camera distribution panel at the navigator's starboard station, or alternatively on a wedge plate adjacent to the camera control panel at the forward station. It is used to set the cameras to suit the conditions above the target. At the top left-hand corner of the unit is a three-position master switch labelled REMOTE, OFF and ON. When this switch is in the ON position the cameras operate, but when it is in the position marked REMOTE the cameras are started and stopped by the remote START and STOP push-switches on the F97 camera firing control box. The three-position switch can be locked in the REMOTE position by means of a spring-loaded flap. So that the photoflash distributors can be rendered inoperative when the cameras are being set-up or tested, a PHOTOFLASH MASTER SWITCH is provided on the front panel of the control unit. This switch can be locked in the OFF position by a spring-loaded flap.

Photoflash release

32. The release of 1.75 in. photoflashes is automatically controlled by the F97 cameras in conjunction with the CAMERA START and CAMERA STOP switches on the F97 camera firing control box and the PHOTOFLASH MASTER SWITCH on the F97 camera control unit. To prevent the photoflashes being released with the flare-bay doors closed the F97 camera photoflash safety relay forms an interlock between the flare-bay doors, microswitches and the F97 camera control unit. When the flare-bay doors are open a supply is completed via the microswitches to the ARMAMENT SAFETY switch on the pilot's console. With the switch selected to LIVE the circuit is completed to energize the coil of the F97 camera photoflash safety relay the contacts of which complete the circuit from the camera control unit to the flare distributors.

Photoflash jettison

33. The 1.75 in. photoflashes, or the crate which carries them, are not jettisonable in this role.

High level night role

34. Two Type F89 cameras, located port and starboard in the rear camera bay are used for the high level night role and require a 28 volt d.c. supply for their operation. This is taken from busbar PP1 in the E.C.P. via the CAMERA SERVICES – F89 – F52 – F49 circuit breaker on the E.C.P. to busbar K1 in the camera distribution panel. From here the supply is completed via the F89 camera master switch to fuses 195, 196, 197 and 198 also in the distribution panel.

35. In addition to controlling the power supply to the cameras, the F89 CAMERAS – ON/OFF switch controls the power supply to the Type 89 camera control units, mounted on wedge plates adjacent to the camera distribution panel or, alternatively, on wedge plates at the forward station, via the normally-open contacts of the camera master start relay in the camera distribution panel. The camera master start relay is controlled by either of the CAMERA START AND FLASH RELEASE switches, providing that the camera doors are open. Pressing either CAMERA START AND FLASH RELEASE switch energizes and closes the camera master start relay and the photoflash interlock relay.

Camera stop switches

36. Two switches, labelled F89 CAMERA STOP, one mounted on the camera distribution panel and the other on the camera control panel, are provided for stopping the cameras. Pressing either STOP switch results in the hold-on circuit of the camera master relay being broken causing the relay contacts to open interrupting the supply to both cameras.

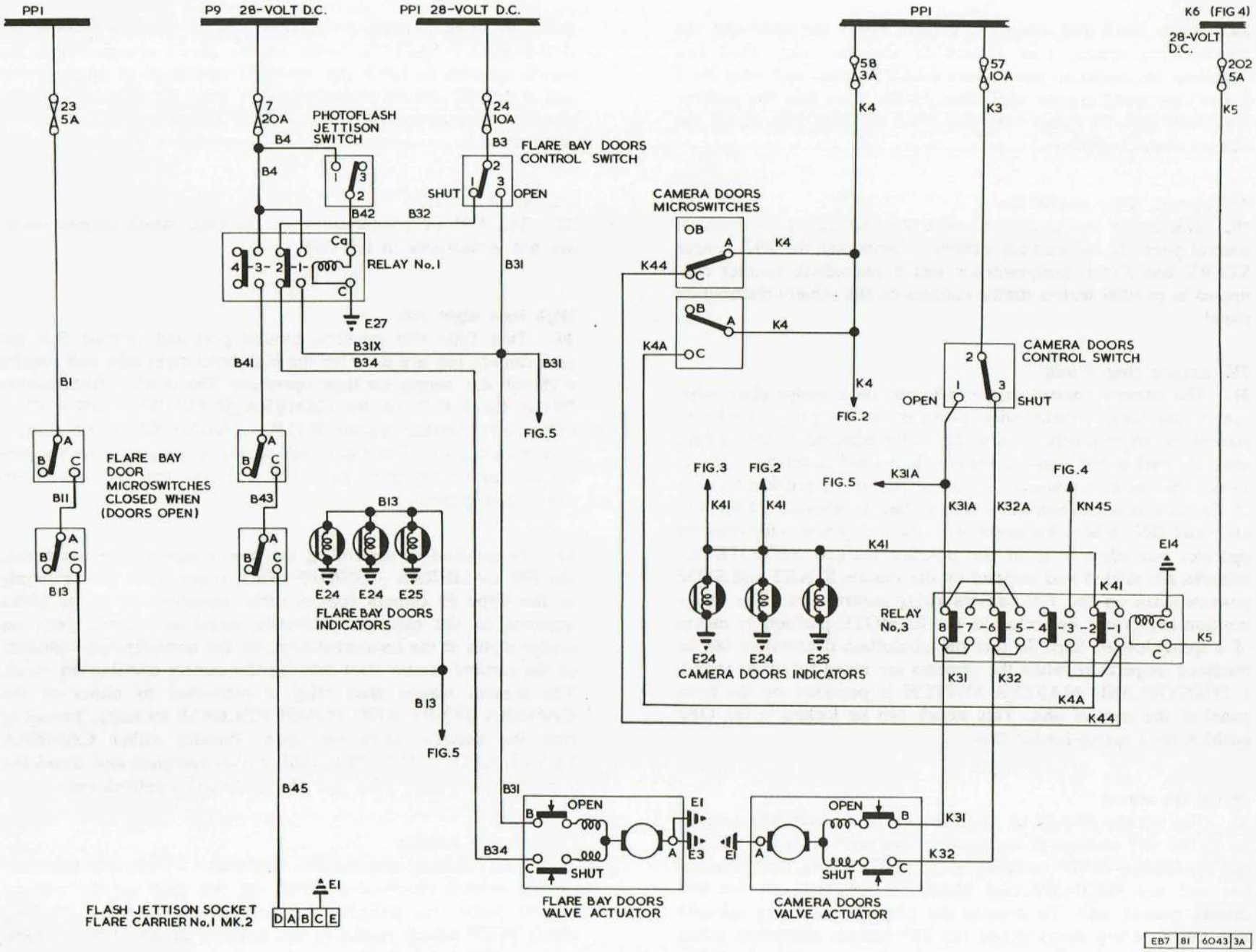


FIG.6. PHOTOFLASH JETTISON-FLARE BAY DOORS AND CAMERA DOORS CONTROL AND INDICATION

◄CIRCUIT CODE AMENDED►

Photoflash release

37. Selecting the CAMERA DOORS switch to OPEN feeds a d.c. supply to energize and close the camera master control relay. ON closing the relay feeds a supply to the CAMERA START AND FLASH RELEASE switches and the F89 MASTER CAMERA SELECTOR switch. When the latter is selected to STBD. MASTER the starboard F89 camera is the master controller for photoflash release, and when selected to PORT MASTER relay No.1 in the centre camera bay is energized with the result that the role of master is changed over from the starboard to the port camera. Pressing either CAMERA START AND FLASH RELEASE switch energizes the camera master start relay and the photoflash interlock relay, the retaining circuit of the relays being completed through the CAMERA STOP and PHOTOFLASH STOP switches. The CAMERA STOP switches control the retaining circuits of both relays, and the PHOTOFLASH STOP switches the photoflash interlock relay only.

38. Film now passes through the cameras and electrical pulses from the master camera are fed to the contacts of the F89 camera photoflash safety relay via relay No.1 and the photoflash interlock relay; simultaneously a pulse is fed via relay No.1 to energize the coil of relay No.2. When the flare bay doors are open, and the microswitches closed, the contacts of relay No.2 completes the circuit B1-B11-B13-B16 to the F89 camera photoflash safety relay. Circuit B13 also forms the supply to the ARMAMENT SAFETY switch, the contacts of relay No.3, and energizes the flare bay doors indicators which show white. Operation of the ARMAMENT SAFETY switch to LIVE:- energizes the coil of the F89 camera photoflash safety relay and completes the circuits to the Type A distributor which releases, at intervals, the photoflashes; completes the circuit to illuminate the armament safety indicator lamp.

39. As each photoflash is released relay No.5, in the camera distribution panel, is energized and completes circuit B13-B19 to the FLASH PULSE INDICATOR on the panel. Simultaneously, as each photoflash is released, one of the circuits B81, B82, B83, B84 and B85 is interrupted and appropriate FLASHES GONE magnetic indicator on the top of the camera distribution panel and camera control panel is de-energized and shows black.

Photoflash jettison

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

Bomb sight

41. A Type T3 or T4 bomb sight can be fitted as an alternative to the photographic sight to assist in the dropping of photoflashes. The sight is a gyro operated instrument requiring power supplies of 28 volts d.c. and 115 volts, 400 Hz, 3-phase a.c. *(Group D).* A gyro control unit, mounted at the starboard side of the forward station forward of the oxygen regulator controls the gyro unit in the sight. When a Type T3 bomb sighting head is fitted, a Type T3 gyro-control unit is used and similarly, if a Type T4 sighting head is fitted a Type T4 gyro-control unit is used, both types of gyro-control unit being interchangeable in the aircraft wiring.

Bomb sight control panel

42. This panel mounted at the starboard side of the sighting head, is used to control the d.c. supply to the sighting head collimator and drift scale lamps. The panel houses two dimmer resistances, one labelled DRIFT SCALE LIGHT and the other labelled COLLIMATOR LIGHT, and an ON/OFF switch which controls the power supply to the panel. When a Type T3 bomb sighting head is fitted, cable assembly N413 is connected between the bomb sight and the control panel and cable assembly N407B-N407 is connected between the control panel and the camera distribution panel. If a Type T4 bomb sighting head is fitted, cable assembly N409 is connected between the bomb sight and the control panel and cable assembly N407A-N407 is connected between the control panel and the camera distribution panel. The cable assemblies not in use are stowed in a stowage bag at the port side of the bomb sighting head.

◀ **Target towing**

General

43. 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 console panel and a normal/emergency jettison switch on the navigator's instrument panel..

Release unit

44. 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.

Master switch

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

Jettison switches

46. Two spring-loaded centre-off switches, annotated NORMAL JETT-ON and EMERG JETT-ON, located adjacent to the MASTER switch on the pilot's control panel, control the supplies to the normal and emergency hook lock solenoids, in the release unit, respectively. A switch, annotated NORMAL-EMERG-JETT, on the navigator's instrument panel, when set to EMERG overrides both switches in the pilot's control panel and supplies both the normal and emergency hook lock solenoids.

Cocking test lamp

47. A press-to-test warning lamp, annotated TEST, is located on the pilot's control panel 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

48. A 28 volt d.c. supply from busbar PP1 in the E.C.P. is routed via fuse 37 to terminal 5 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 taken from the 24 volt d.c. battery busbar, P9, in the M.E.P. is routed via fuse 182 to terminal 2 of the switch.

49. 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.

50. With the MASTER switch set in the ON position, when the navigator's NORMAL-EMERG-JETT switch is set to ON, supplies from terminal 2 on both the normal and emergency jettison switches, are fed via terminals 2 and 5 respectively of the navigator's switch to energize both the normal and emergency hook lock solenoids in the release unit. ▶

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
	Actuator Type 206 (flare bay doors) comprising:-		
5W/4511895	Actuator Type 200	1	A.P.113E-0248-1
5W/340	Adapter assembly	1	
27QM/4143276	Valve assembly	1	
	Actuator Type 216 (camera doors) comprising:-		
5W/4511895	Actuator Type 200	1	A.P.113E-0248-1
5W/341	Adapter assembly	1	
27QM/4143260	Valve assembly	1	
5CW/9499153	Relay Type 10B, No.15 (flare beam, F89 camera) (rear camera bay, F97 camera)	1 1	A.P.113D-1309-1
EB7.81.5077	Camera distribution panel	1	
EB7.81.1699	Camera control panel	1	
EB7.81.1647	Camera circuit-breaker panel	1	
EB7.81.5605	F95 camera relay box	1	
EA2.83.5635	F97 camera relay box	1	
◄ 9A/2138	Release unit	1	A.P.110G-0135-125F ►

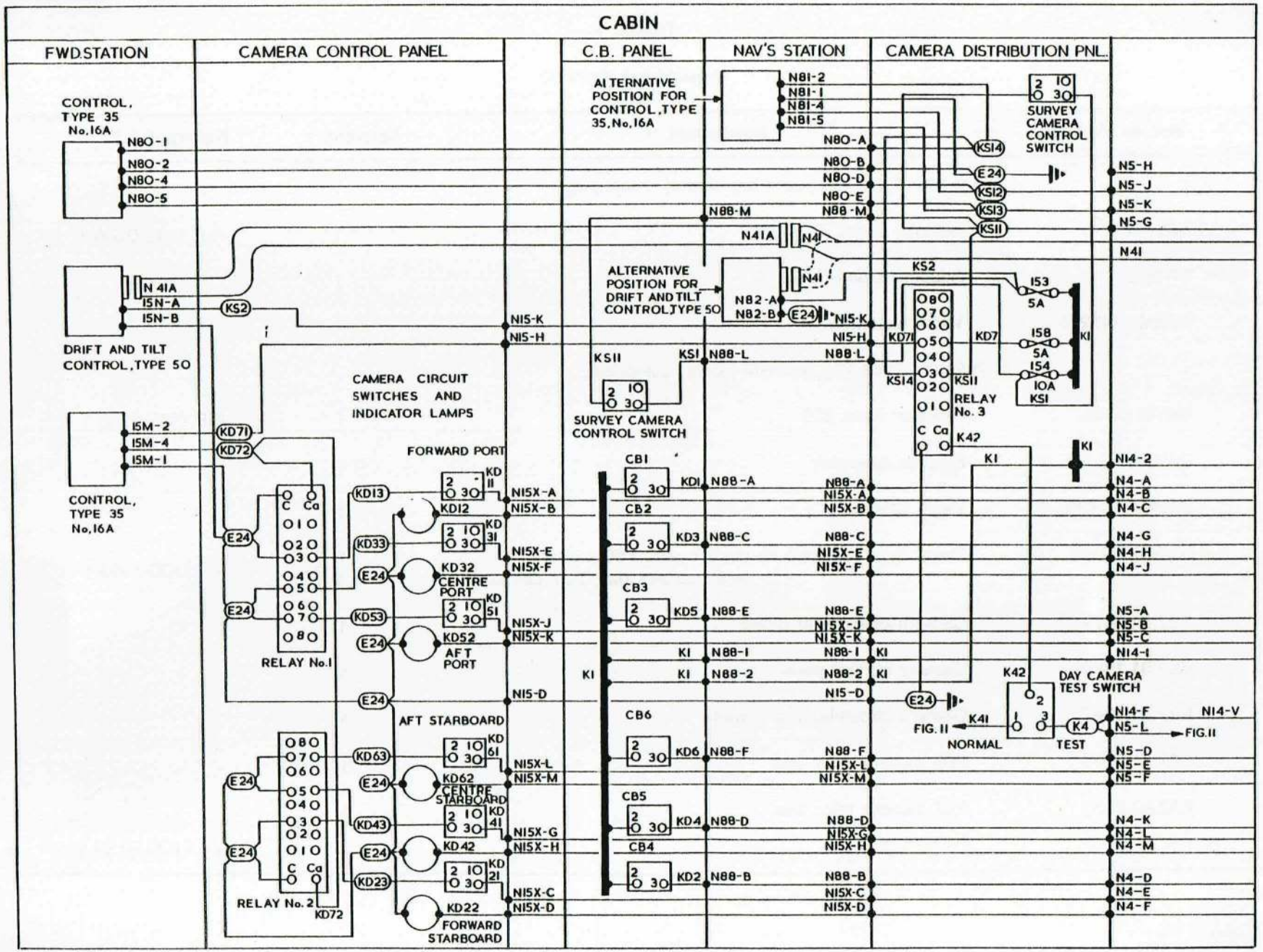


FIG. 7. DAY AND DAY SURVEY ROLES

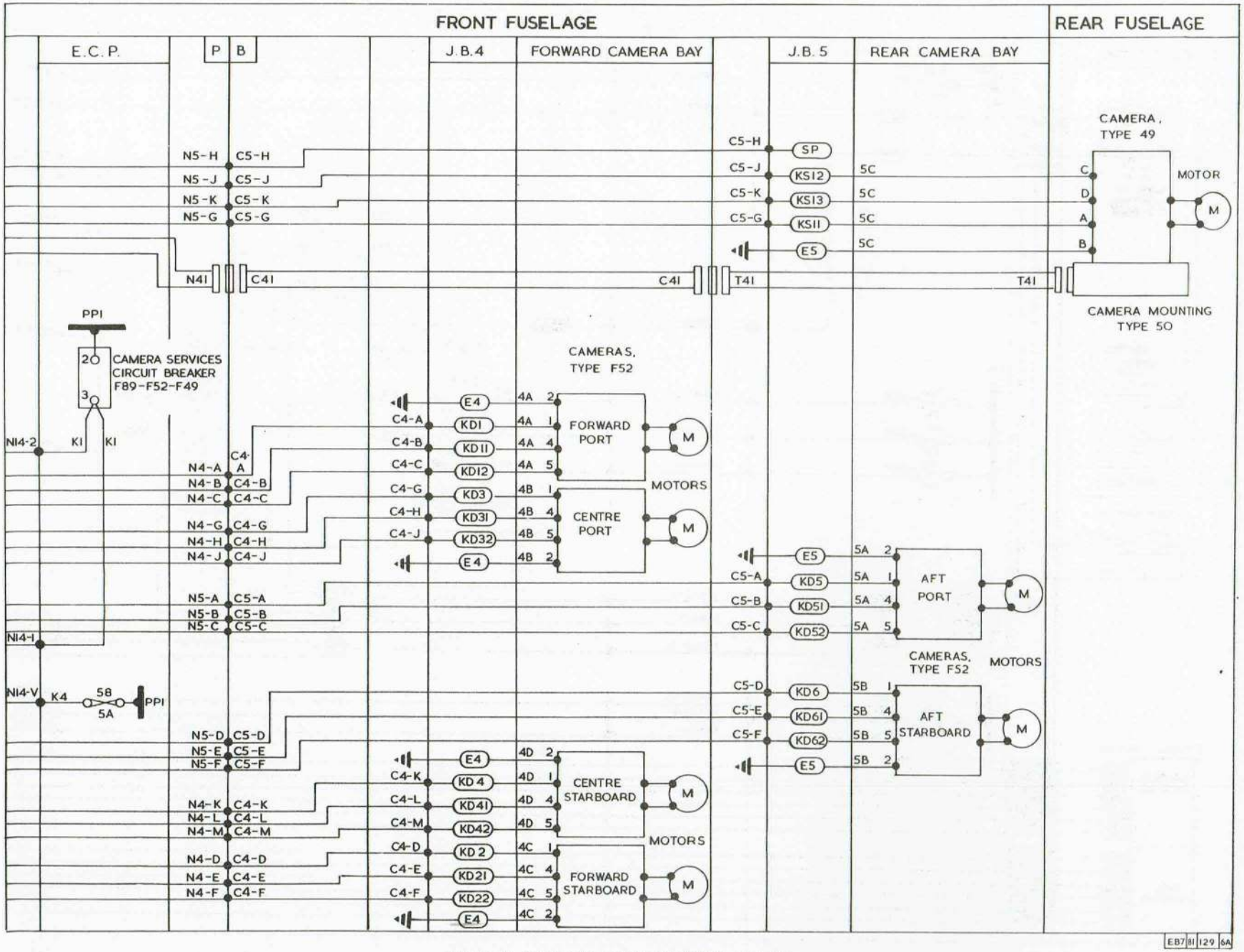


FIG. 7A. DAY AND DAY SURVEY ROLES

◄DRAWING NO. CHANGED►

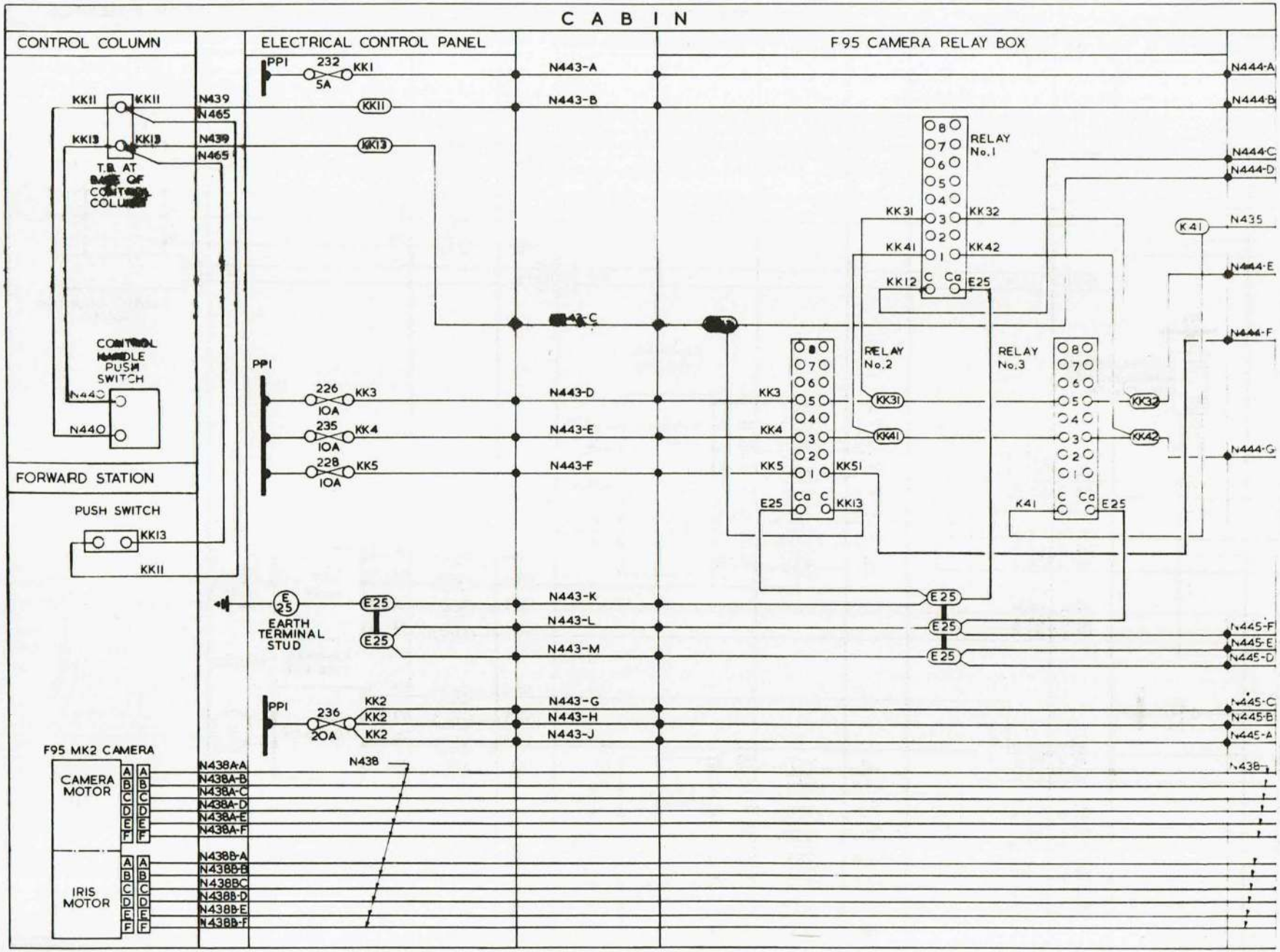


FIG.8.LOW LEVEL OBLIQUE DAY ROLE

◄CONTROL HANDLE SWITCH CHANGED►

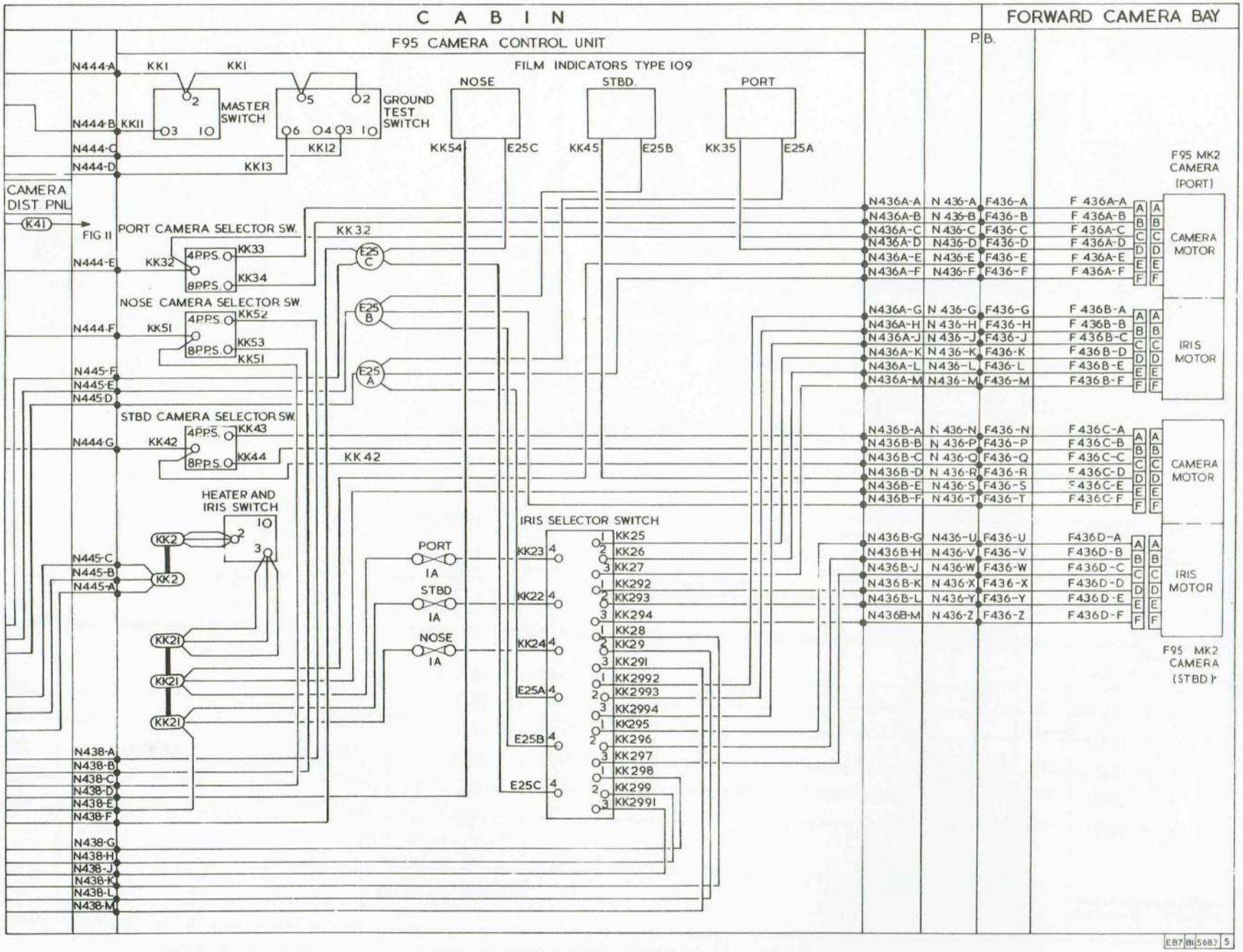


FIG.8A.LOW LEVEL OBLIQUE DAY ROLE

◄CIRCUIT CODES ADDED►

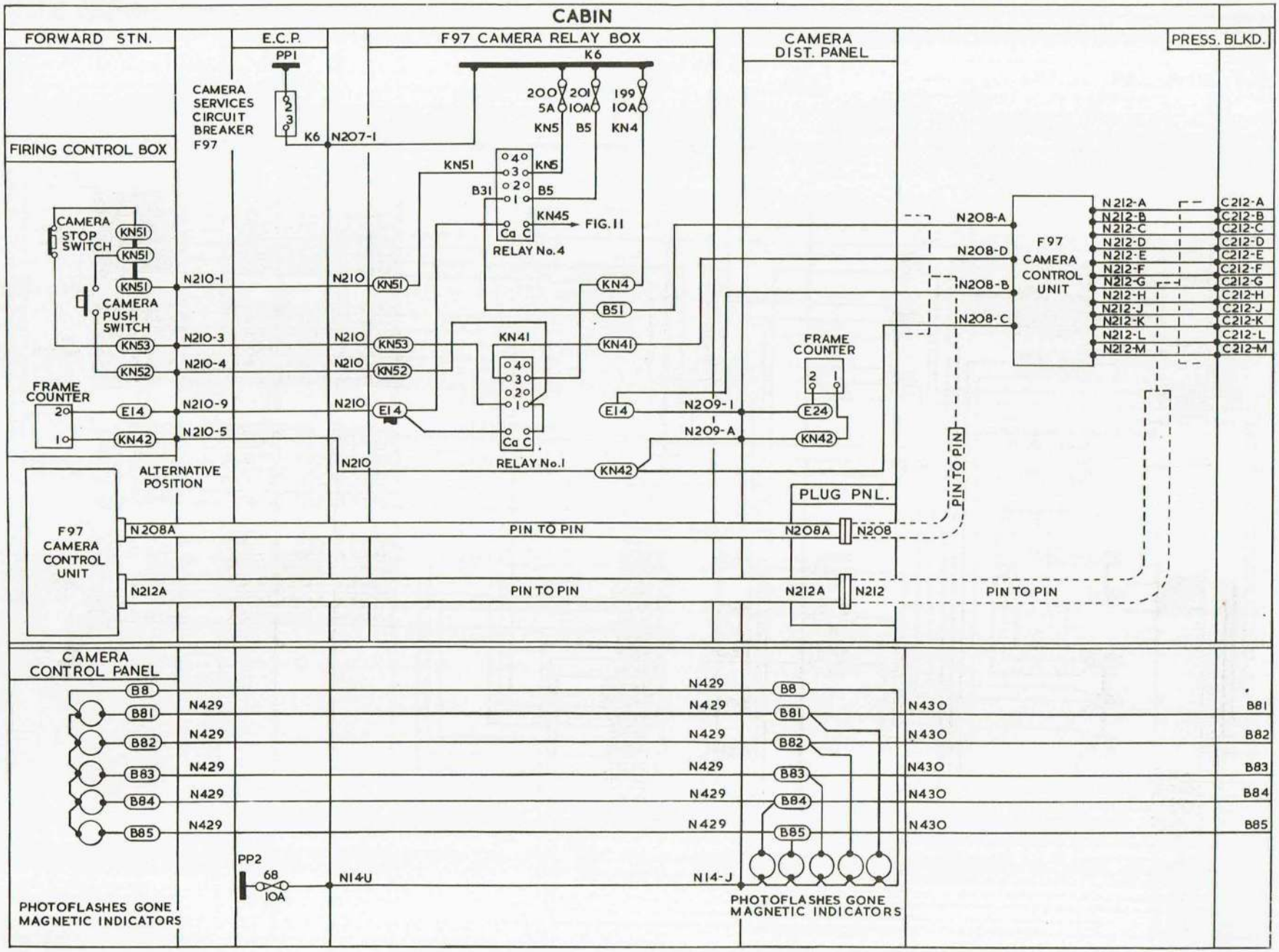


FIG.9. LOW LEVEL NIGHT ROLE AND PHOTOFLASH RELEASE—PHOTOFLASHES GONE INDICATORS

◄INDICATOR CIRCUIT AMENDED►

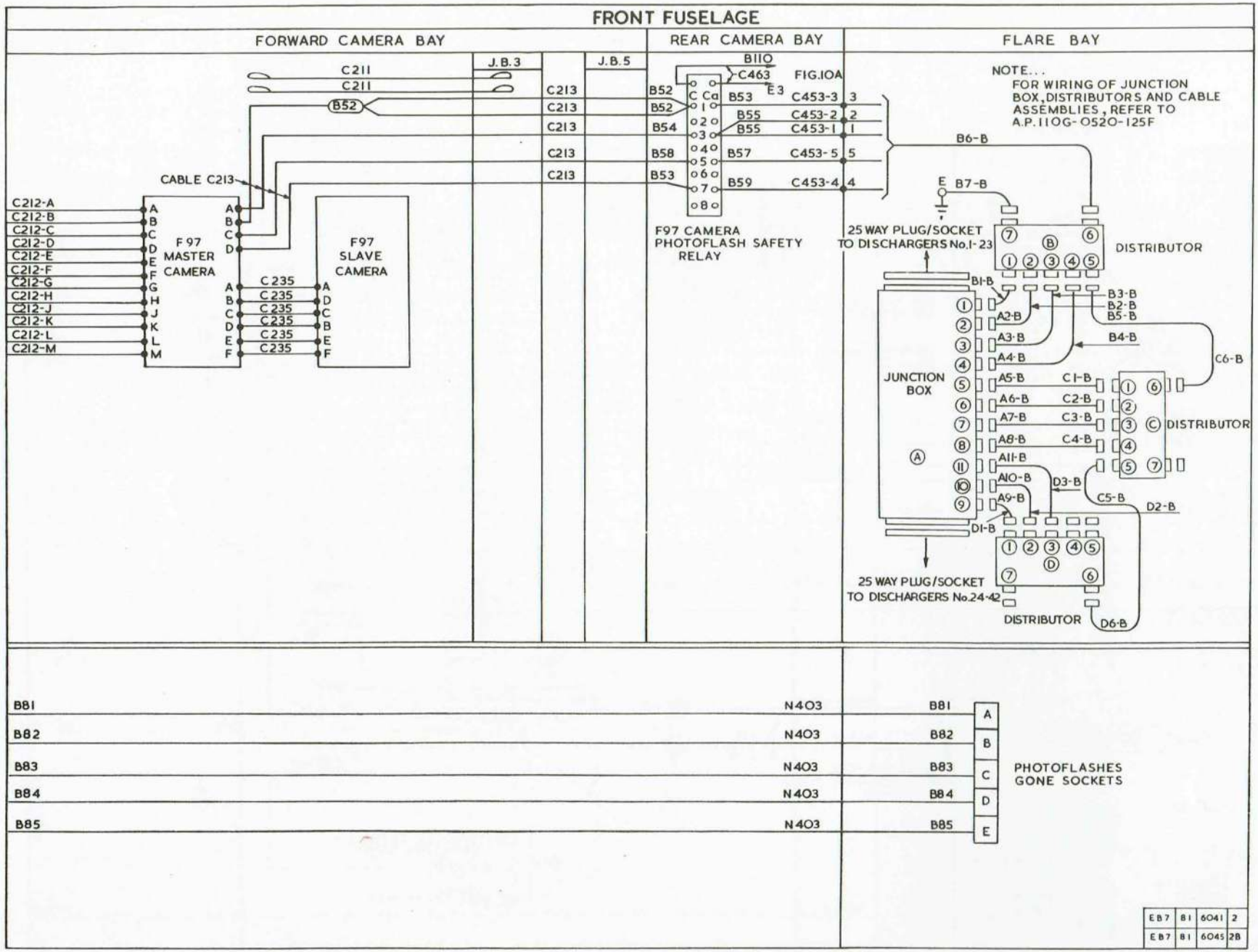


FIG.9A. LOW LEVEL NIGHT ROLE AND PHOTOFLASH RELEASE–PHOTOFLASHES GONE INDICATORS

◄ CIRCUIT TO SAFETY RELAY AMENDED ►

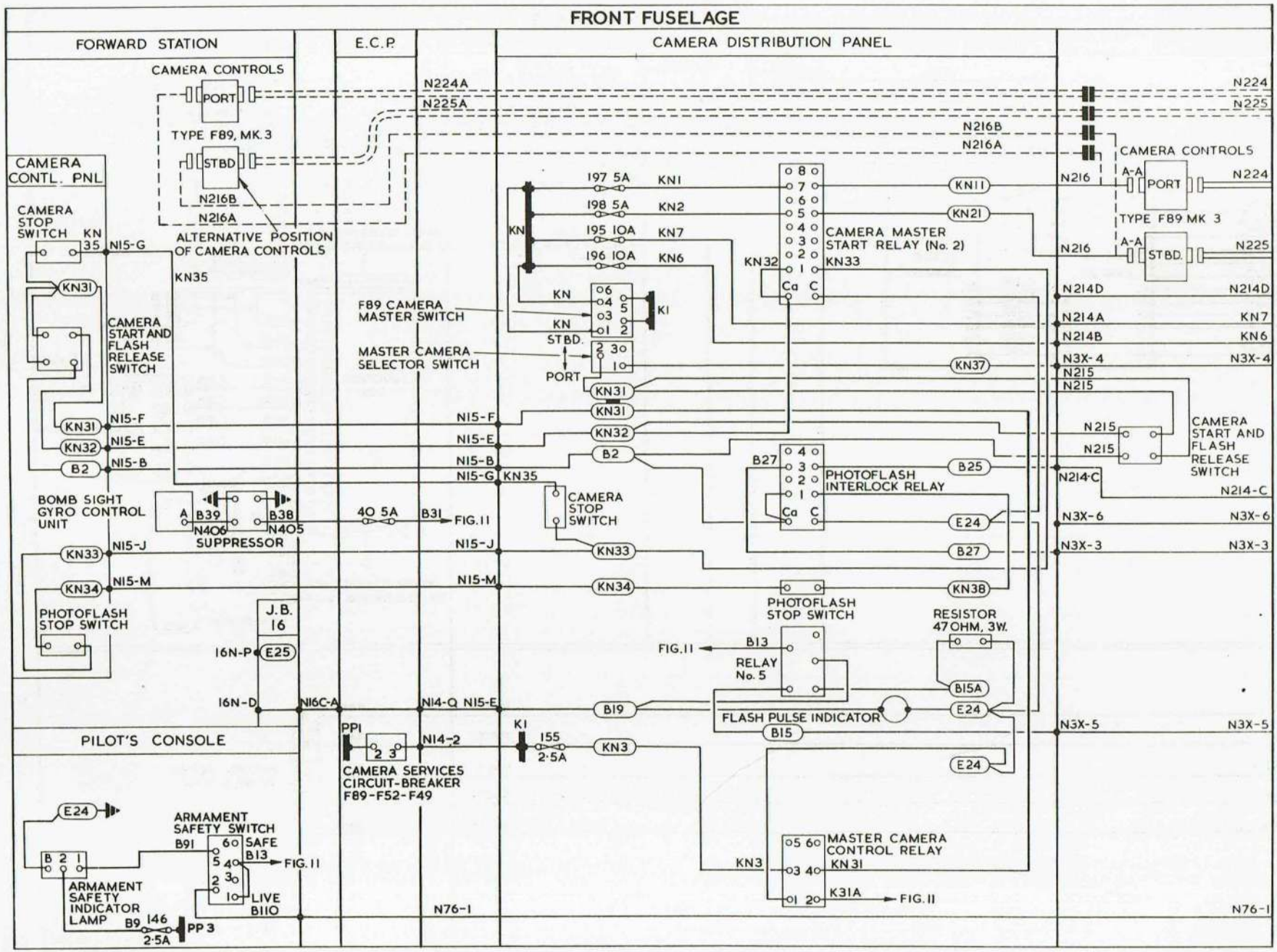


FIG. 10. HIGH LEVEL NIGHT ROLE AND PHOTOFLASH RELEASE

◄FUSE 146 RE-LOCATED►

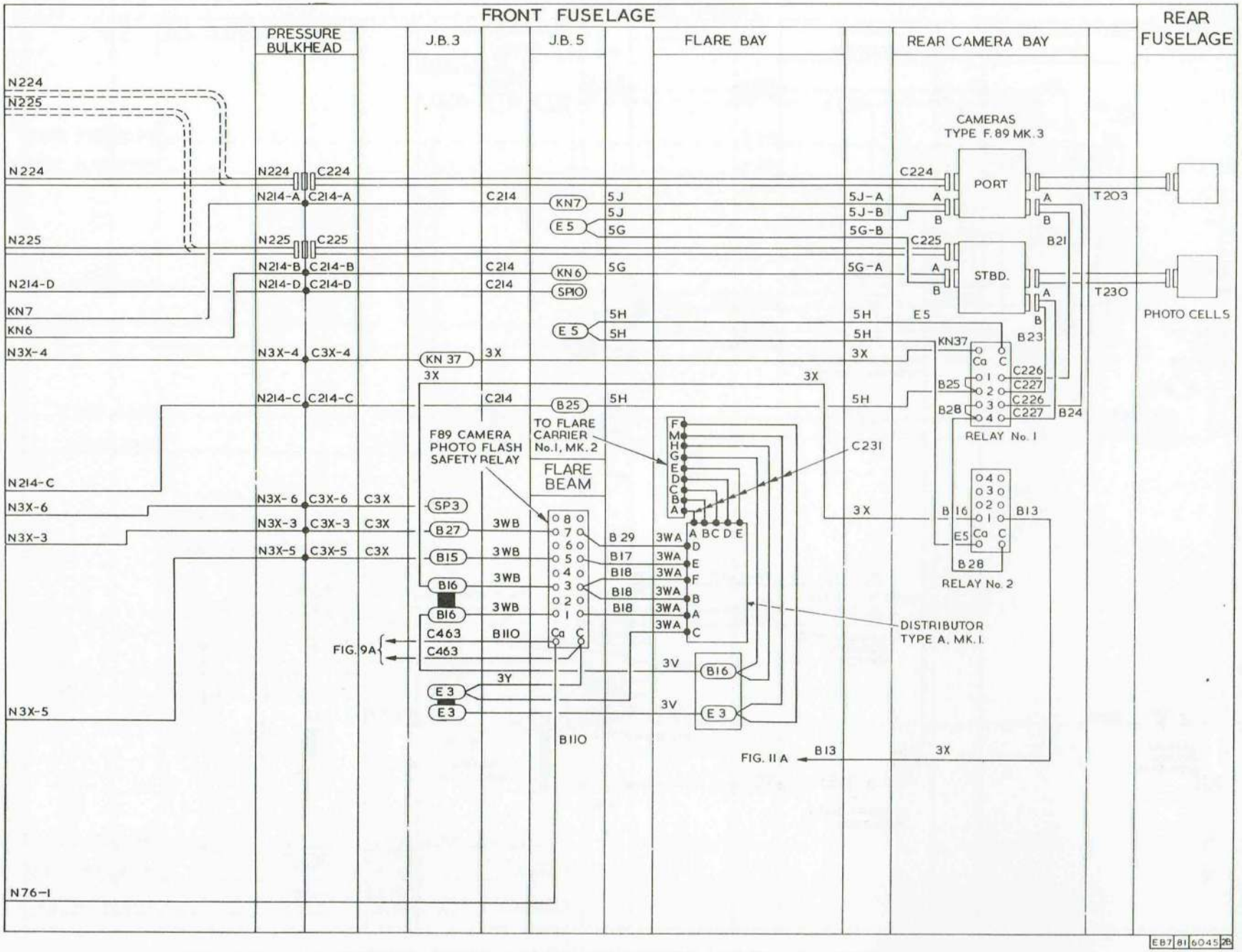


FIG. 10A. HIGH LEVEL NIGHT ROLE AND PHOTO FLASH RELEASE

◄ CIRCUIT CODE AMENDED►

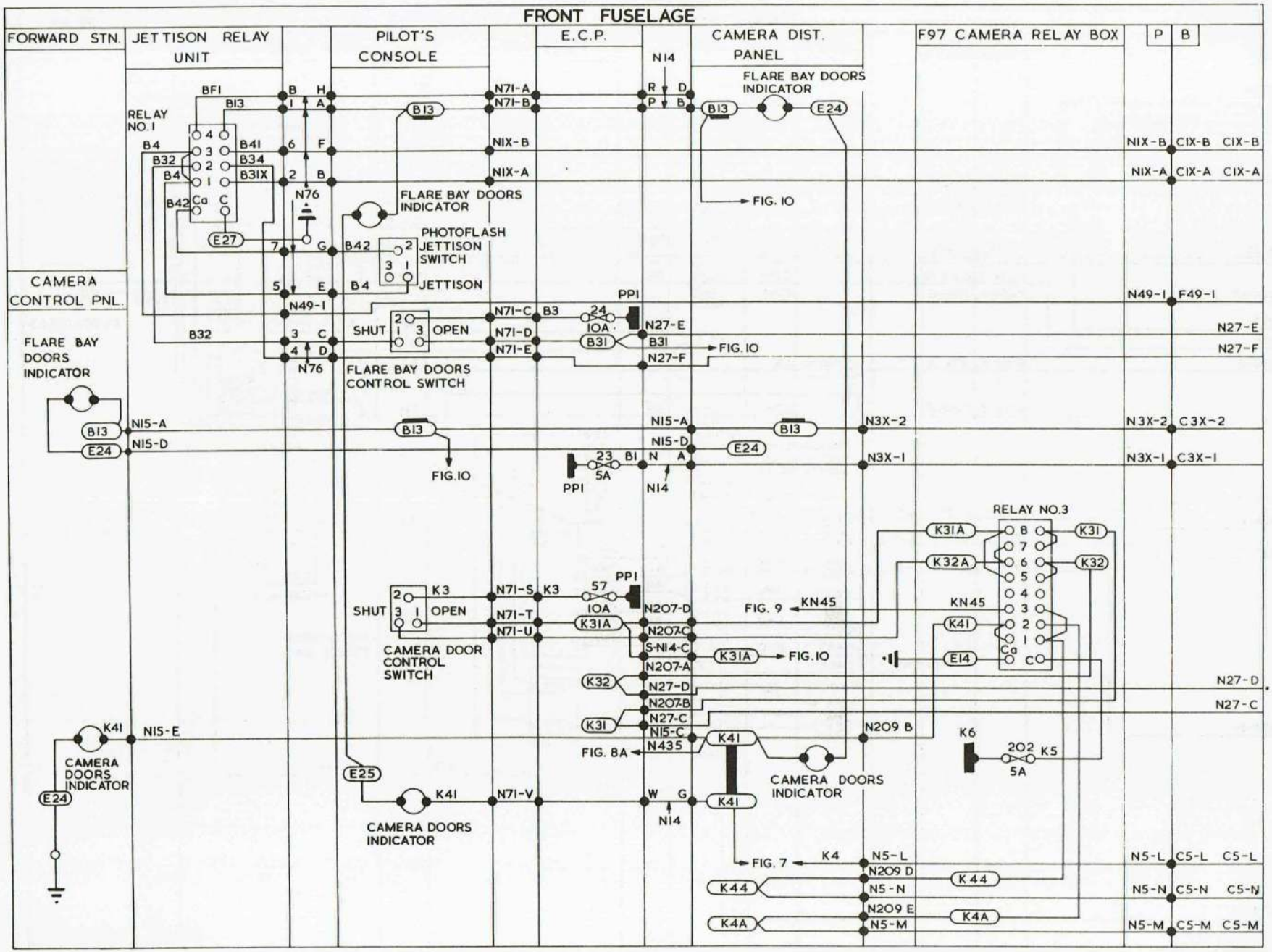


FIG.11. PHOTOFLASH JETTISON-FLARE BAY DOORS AND CAMERA DOORS CONTROL AND INDICATION

◄ PIN CODE AMENDED ►

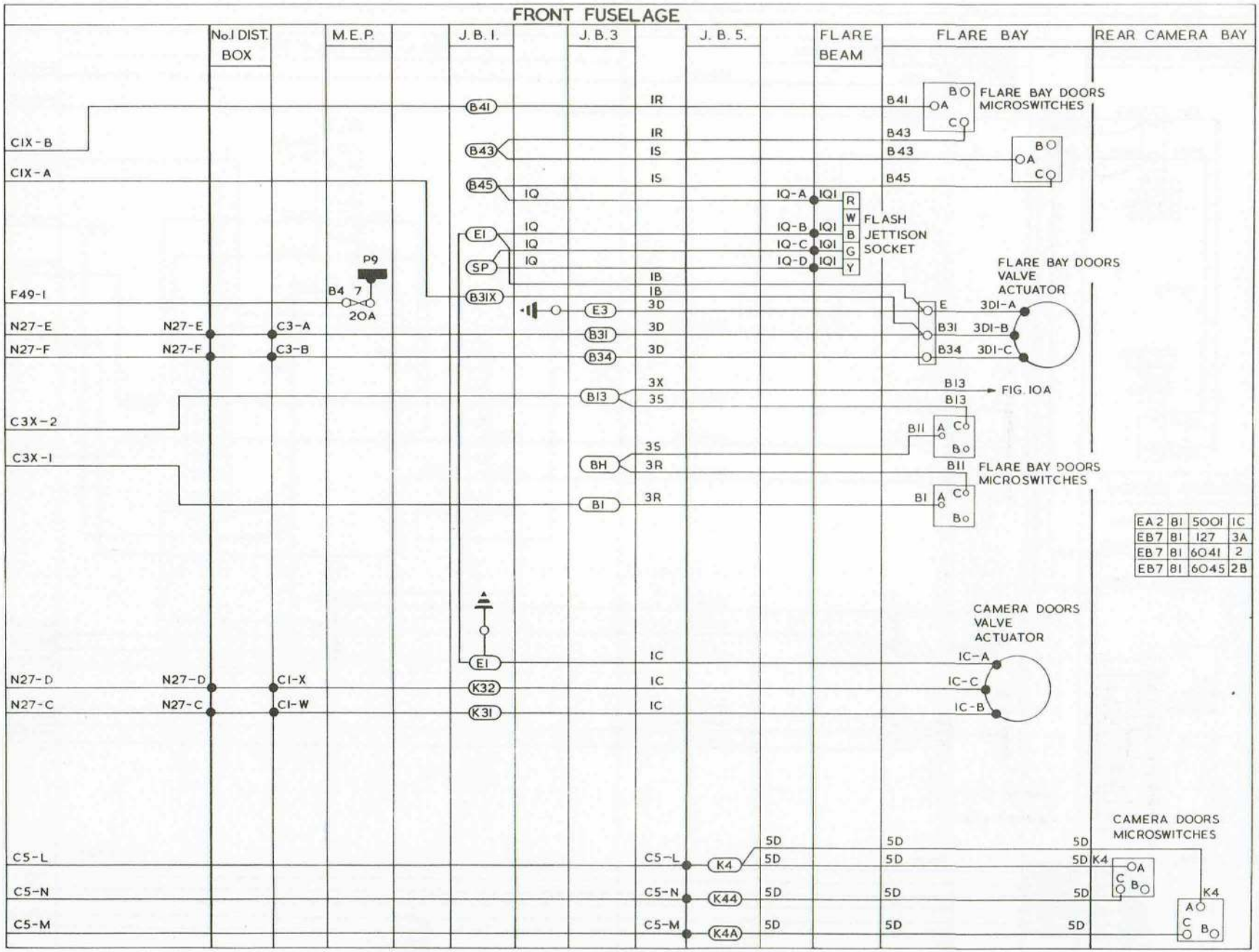


FIG.11A. PHOTOFLASH JETTISON-FLARE BAY DOORS AND CAMERA DOORS CONTROL AND INDICATION

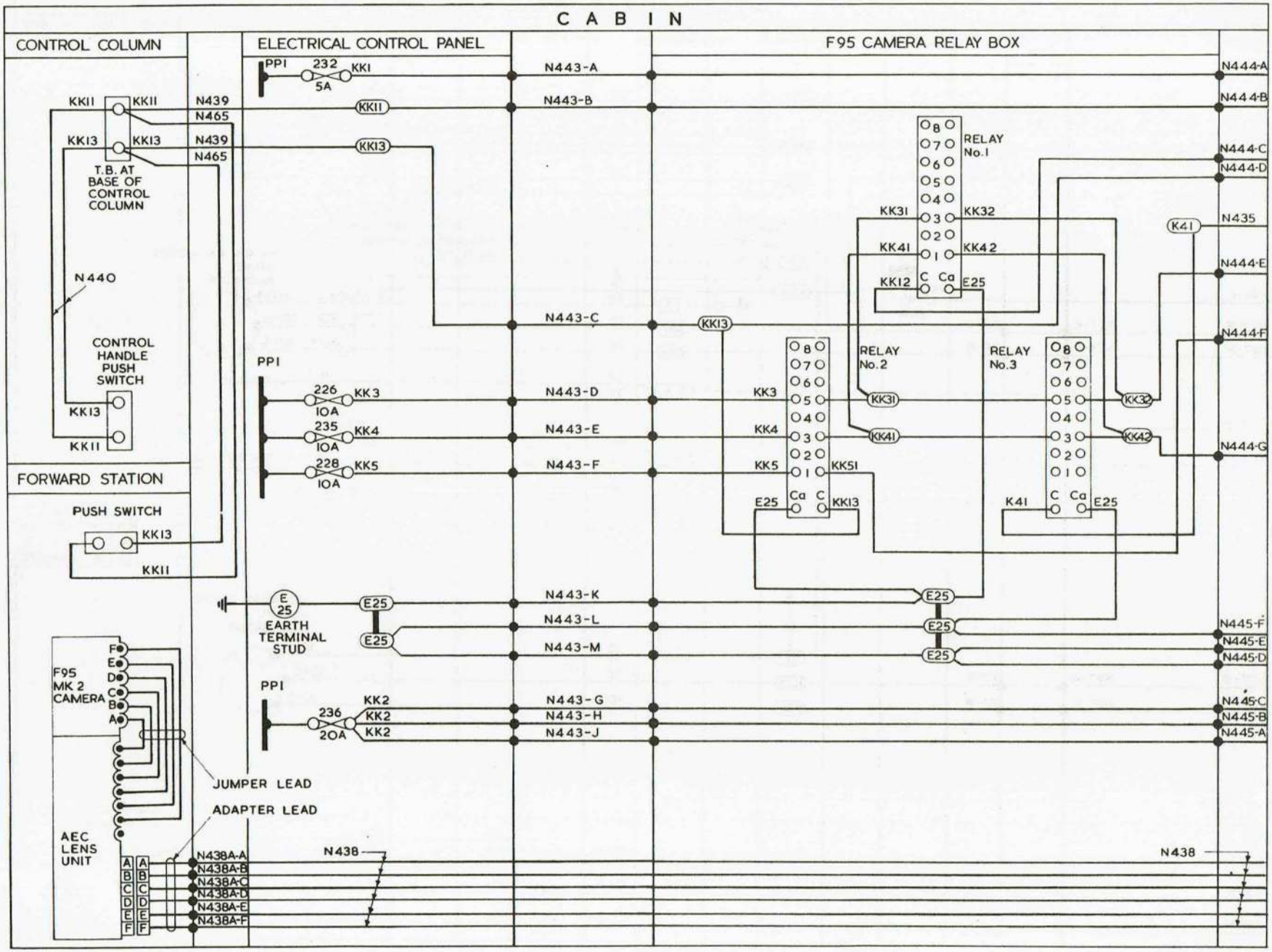


FIG. 12. F95 CAMERAS WITH AEC LENS UNITS

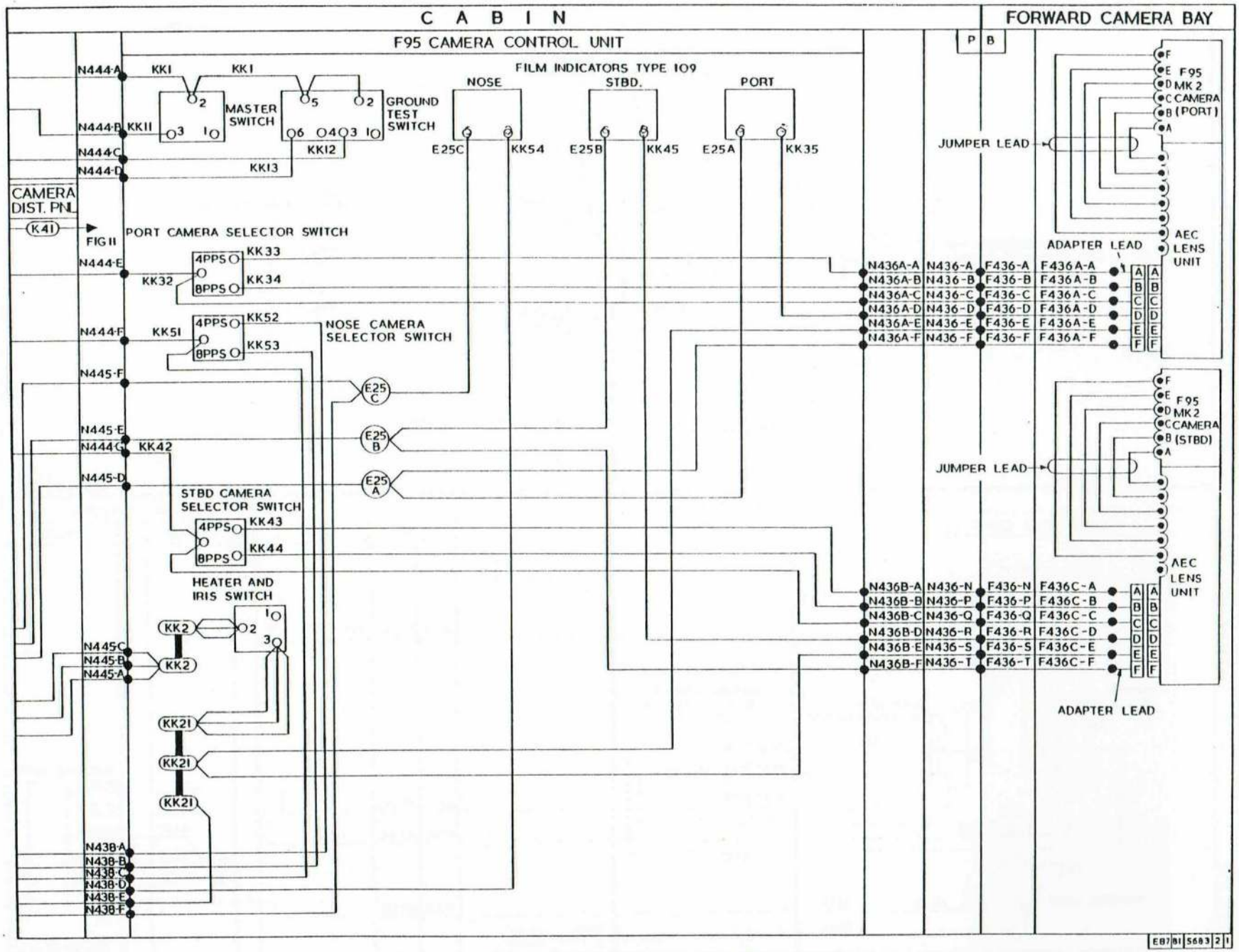


FIG. 12A. F95 CAMERAS WITH AEC LENS UNITS

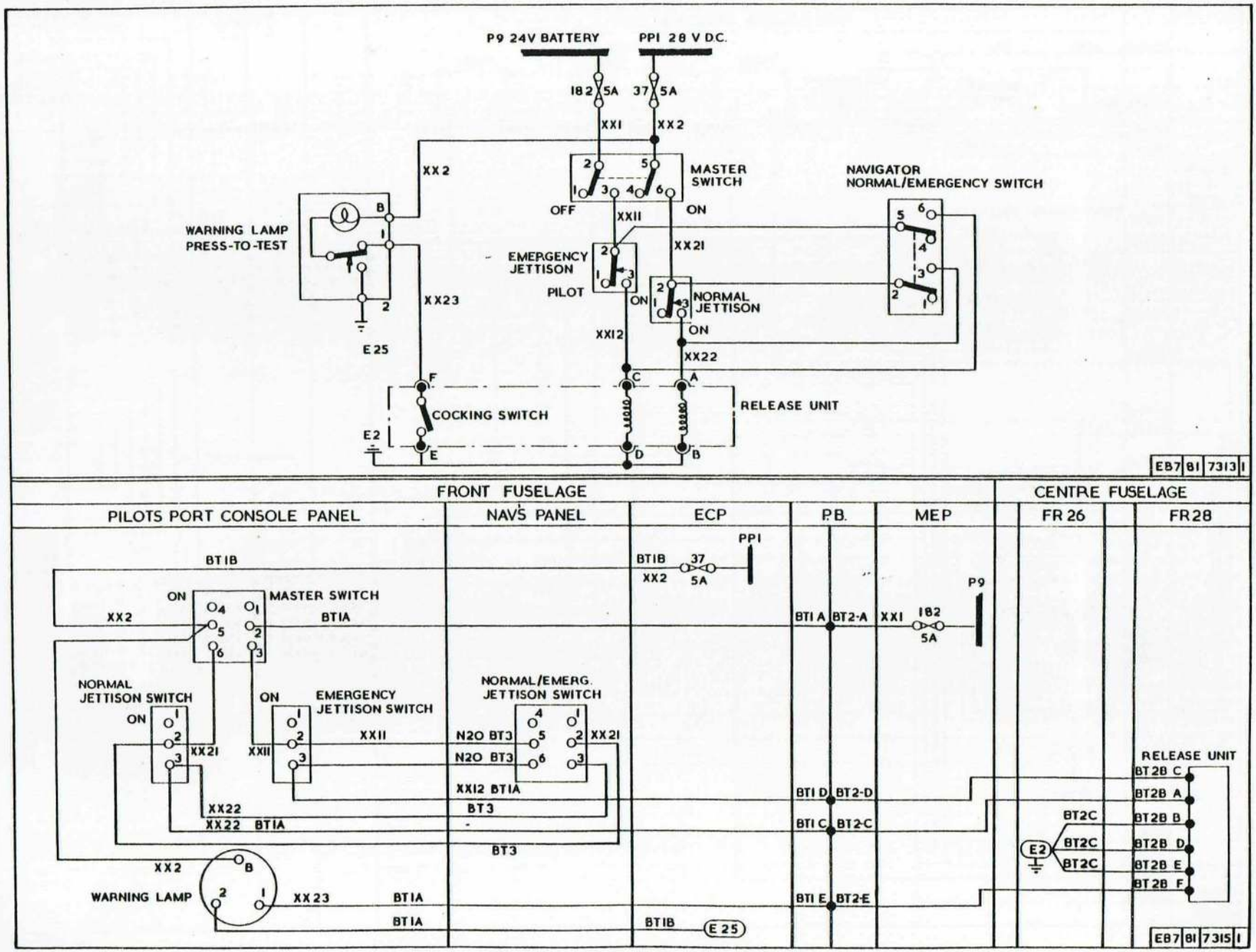


FIG. 13. TARGET TOWING

◀MOD 5439 EMBODIED▶

Appendix 1 CHAFF DISPENSER

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DESCRIPTION

General

1. The chaff dispensing installation comprises a control unit, located at the navigator's station and a chaff dispenser located at the forward end of port and starboard wing-tip pods. Each pod carries a cartridge discharger mechanism within its rear section, but this aircraft has no provision for their use. In addition to describing the system, this chapter provides details of servicing operations and methods of removal and re-assembly.

Power supplies

2. The supplies for the chaff dispenser installation are taken from the 28 volt d.c. busbars PP1 and P10 and are routed to the control unit (PL7) and each wing-tip pod respectively.

Control unit

◀ 3. The control unit, which is mounted at the navigator's starboard station, provides for the release of stores by the selected stripper units. ▶ Each stripper unit can be set by the control unit to a PROGRAMME or DIRECT mode of operation. In the PROGRAMME mode, the stripper unit can release stores in bursts of preset duration and at present intervals, and in the DIRECT mode in one-second bursts or at a continuously preset rate.

4. Electrical connections are made via connectors on the rear of the control unit. In this installation, the stripper units are connected to connectors PL1 and PL2.

5. Control of the control logic circuitry is effected by various toggle and rotary switches mounted on the front panel. Also fitted on the front panel are four electro-mechanical subtracting counters, operated by pulses from the stripper units and four indicator lamps to show that the store is being dispensed. Only the outer counters and indicators are used in this installation. A dimmer controls the intensity of general panel illumination.

6. The following sub-paragraphs describe the functions of the various switches. It must be noted that whilst certain switches, indicators and lamps are for specific channels other switches are used in the overall operation of the system. Not all switches are used in this installation.

(1) Four toggle switches annotated PROG-OFF-DIRECT provide for the mode operation of the stripper units; only the outer switches are used.

(2) Four rotary switches annotated RATE-PKTS PER SEC control the dispensing rates for the four stripper unit channels and are operative in the DISPENSE mode or in the DIRECT mode. The dispense rate can be varied between one and five packets per second, in steps of one packet. Only the outer switches are used in this installation.

(3) A lever lock toggle switch annotated PULL SELECT selects either the rotary switch DISPENSE (SECS) or the rotary switch FREQUENCY (PKTS/MIN) functions.

(4) The DISPENSE rotary switch controls the dispense period from 1 to 10 seconds.

(5) The FREQUENCY rotary switch controls the pulse repetition rate which is 1, 2, 3, 4, 5, 6, 8, 10, 12, 20, 30 pulses per minute, the pulse width being fixed at one second.

(6) A toggle switch annotated SECS – ½ MIN is an interval multiplier used to select either seconds or half minutes and is used in conjunction with the INTERVAL switch.

(7) A rotary switch annotated INTERVAL selects the interval from 1 to 10 seconds in one second steps. When SECS is selected on the above switch the time interval is direct reading. When ½ MIN is selected the time interval is multiplied by 30 seconds.

(8) A lever lock switch annotated CONT-OFF-PULSE selects the type of output from the control unit, either continuous (CONT) or pulse (PULSE). This control is only applicable to the PROGRAMME mode of operation. When set to PULSE a single pulse of the selected width will be emitted i.e. a pulse width of one second in the FREQUENCY mode and 1-10 seconds in the DISPENSE mode. When set to CONT, trains of pulses of the preset timing sequence will be emitted.

(9) A push button switch annotated DIRECT is used to dispense the store from the stripper unit set to the DIRECT mode of operation. If the switch is pressed for less than one second a single one-second pulse

(2) Ensure that all electrical supply sources are completely isolated, and disconnect the electrical leads at the filter box adjacent to the attachment bolt heads.

(3) Disconnect the main electrical leads from the 'tulip' connector in the wing-tip.

(4) Unscrew the knurled head plugs from the bolts and withdraw the detonators, taking care to handle them only by the leads.

(5) Using a servicing hoist Ref.No.4GC/6648 and lifting cradle Ref.No. 26FZ/95641, support the pod and remove the three nuts from the attachment bolts using spanner Ref.No.26FZ/95079. Carefully lower the pod.

(6) If a pod is not to be fitted immediately, refit the access panels and cover the attachment bolt blocks on the pod and the lower surface of the wing-tip with fabric patches Ref.No.32B/147 or 164.

Assembly

20. If a pod has been jettisoned from the aircraft, examine the wing-tip for resultant damage. To fit a replacement pod:–

(1) Remove the fabric patch from each attachment bolt block on the pod.

(2) Lubricate the threads of the attachment bolts with a thin coating of grease XG-278. Insert one or, if necessary, two spacing washers in each bolt housing, then, using two thin nuts locked together, screw the bolts securely into the anchor nut of the pod housing. Ensure that the navigation lamp contact bolts on the upper surface of the pod are clean.

(3) Remove the screwed blanking plugs and the patch covering the adjustable stop bolt from the lower surface of the wing-tip.

(4) Using a servicing hoist Ref.No.4GC/6648 and lifting cradle Ref.No. 26FZ/95641, offer up the pod so that the bolts line up with, and enter, the wing-tip bolt housings. Check that the navigation lamp contact bolts on the pod, line up with the contact studs on the wing-tip. Ensure that the rear bearing block on the top of the pod, aligns with the adjustable stop bolts in the wing surface. Ensure, during this operation, that the pod is held level to avoid damaging the trailing edge of the main plane.

(5) With the pod in position, fit the washers and stiffnuts, and tighten the nuts with spanner Ref.No.26FZ/95079 until the rubber seal is compressed. Check that a good contact is made between the attachment bolt packing blocks and the under surface of the wing-tip. Check that the clearance between the lip of the pod and the under surface of the wing-tip is between 0.10 to 0.20 in. If necessary vary the plywood laminates of the pod packing blocks to obtain this clearance. To ensure that the thread of the attachment bolt protrudes through the stiffnut, an extra spacing washer may be required in the bolt housings – operation (2).

(6) Torque load the nuts to 40 lbf. ft.

(7) Unlock the adjustable bolt stop and screw down until full contact is made with the pod bearing block, then relock the bolt.

(8) After satisfactory attachment of the pod, insert a detonator into each attachment bolt so that it rests on the bottom of the hole in the bolt without undue pressure from the distance tube. Check that the end of the distance tube is between 0.66 and 0.74 in. below the tip of the attachment bolt before tightening the detonator knurled head plug. Refer to A.P.110N-0312-1 for information upon the assembly of the detonator.

(9) Connect the main electrical leads to the 'tulip' connector in the wing-tip. Refit the access panel.

(10) Connect the electrical leads of the detonators to the filter box in the wing-tip and refit the blanking plates on the upper surface of the wing-tip. Renew the fabric patches.

TABLE 1

Equipment Details

Equipment	Location	Access	Air Publication
Control unit, WE1417	◀ Navigator's starboard station ▶	Cabin	A.P.113F-1104-12
Stripper unit and magazine	Wing-tip pods (forward)	Hinged nose section	A.P.113F-1104-12
Cartridge discharger (inoperative)	Wing-tip pods (rear)	Access panel (outboard)	

TABLE 2

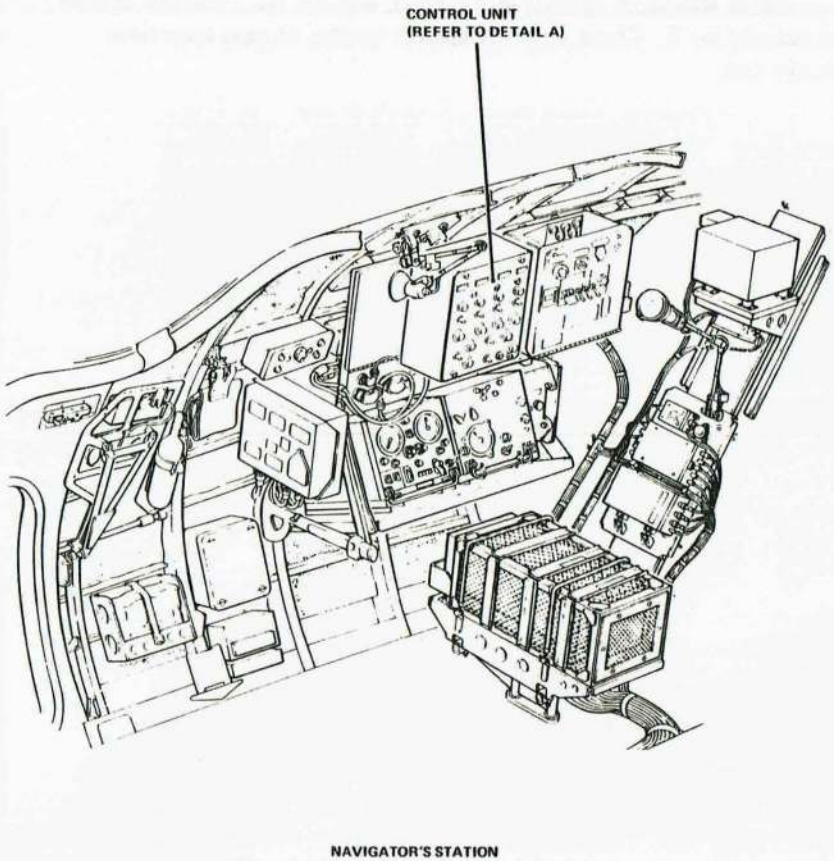
System Tests

Action	Result
(1) Start the servicing trolley, move the STRIPPER SELECTOR switch to No.1, and select power ON.	Motor in port stripper unit should run.
(2) Select FREQUENCY switch to 4 and BUR-CON switch to CON.	A package should be ejected 15 seconds after selecting the BUR-CON switch, and a further package should be ejected every 15 seconds.
Switch off the BUR-CON switch after 1 minute.	The No.1 counter should be reduced by 4. Check that the ejected lengths of tape have been cleanly cut.
(3) Select the RATE switch to 2, the DURATION switch to 1 and the BUR-CON switch to BUR. Put the PULSE switch momentarily to ON.	2 packages should be ejected in 1 second. No.1 counter should be reduced by 2.
(4) Select the INTERVAL switch to 8 and the REPEAT switch to ON.	2 packages should be ejected in 1 second, then 2 per second at intervals of 8 seconds thereafter.
Switch the REPEAT switch to OFF and the PULSE switch momentarily to ON.	The No.1 counter should be reduced by 8.
(5) Select the RATE switch to 3 and the PULSE switch momentarily to ON.	3 packages should be ejected in 1 second, and the No.1 counter should be reduced by 3.
(6) Select the RATE switch to 4 and the PULSE switch momentarily to ON.	4 packages should be ejected in 1 second, and the No.1 counter should be reduced by 4.

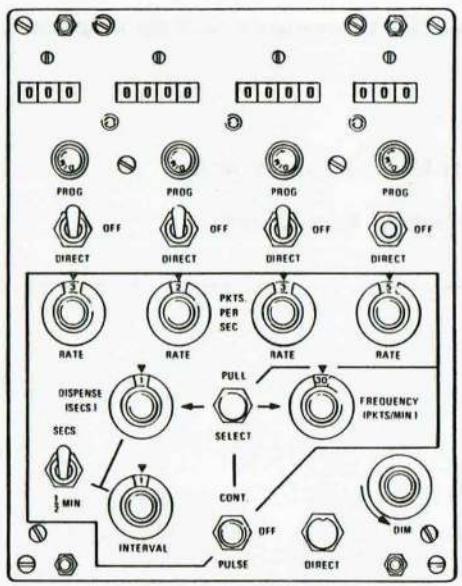
TABLE 2 System Tests – *continued*

Action	Result
(7) Select the RATE switch to 5 and the PULSE switch momentarily to ON.	5 packages should be ejected in 1 second, and the No.1 counter should be reduced by 5. Check that the ejected lengths of tape have been cleanly cut.
(8) Return the BUN-CON switch to OFF.	
(9) Ensure the packages are ejected continuously until the magazine is empty.	
Switch power OFF.	
(10) Repeat the preceding tests for No.2 stripper unit.	
(11) Collect and burn the contents of the packages.	

UK RESTRICTED



NAVIGATOR'S STATION



DETAIL A

FIG. 1. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

UK RESTRICTED

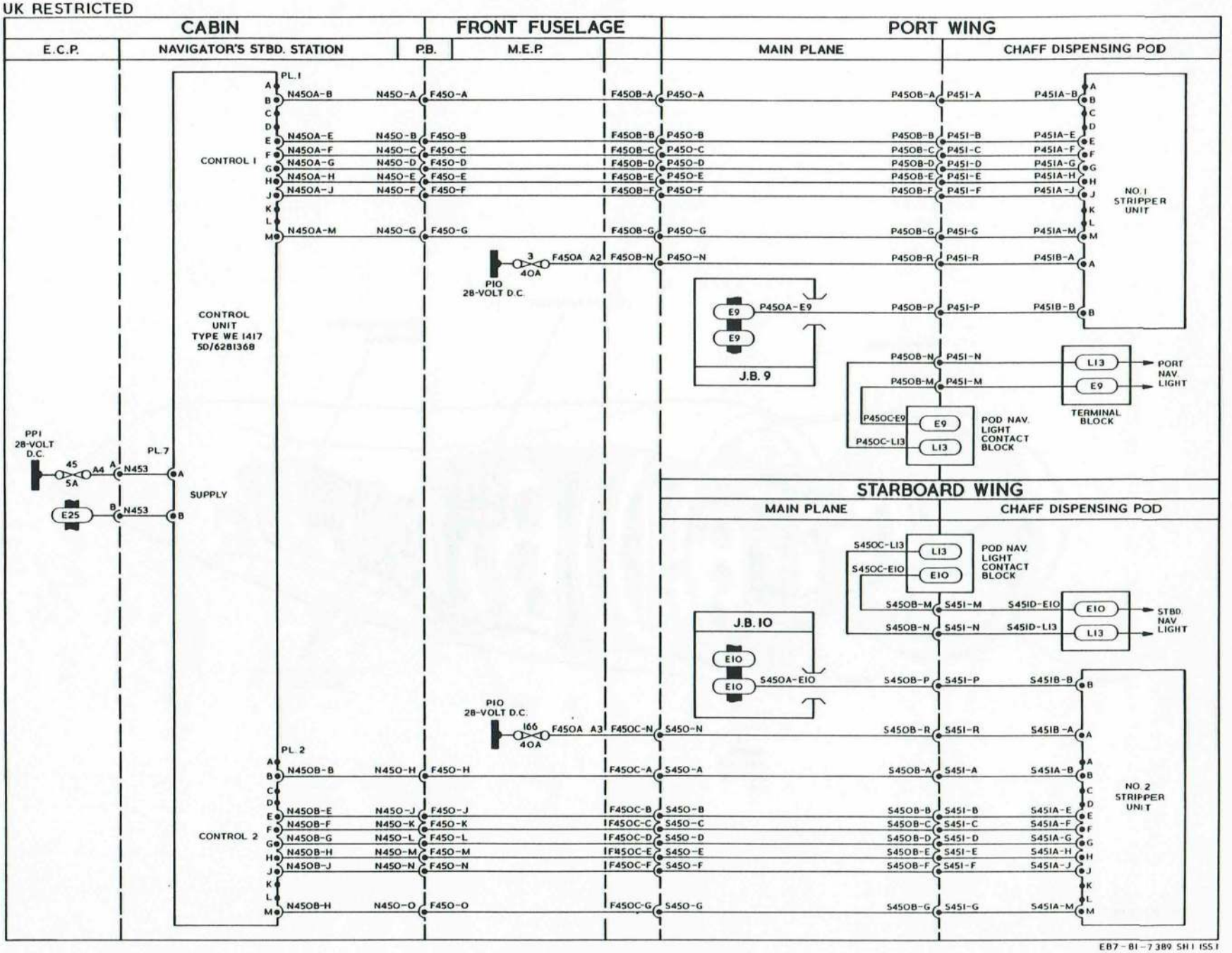


FIG.2. CHAFF DISPENSER

◄ SEM/CAN/0167/STC INCORPORATED ►

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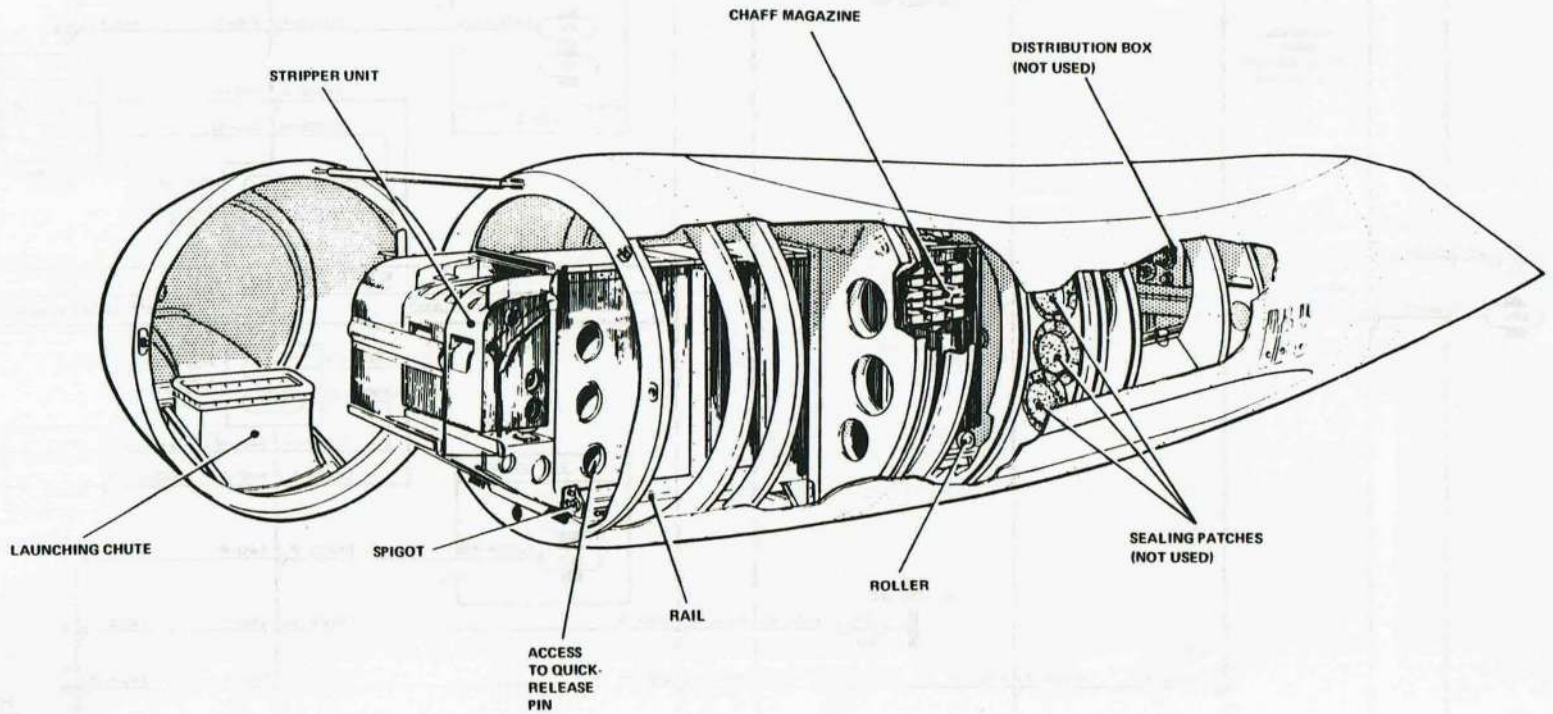

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FIG.3. CHAFF DISPENSER IN STARBOARD POD

CONTROL SURFACES — GROUP C

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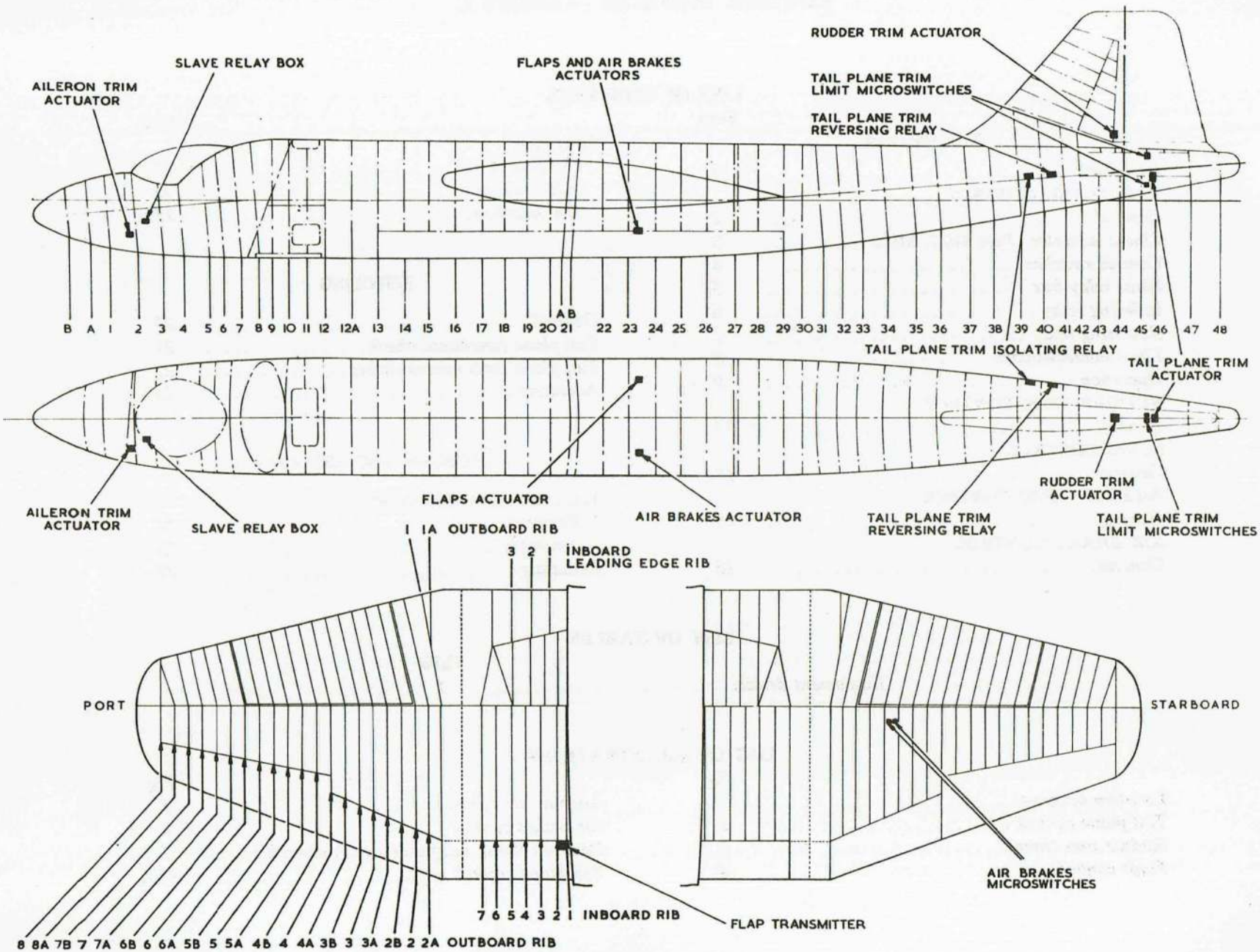
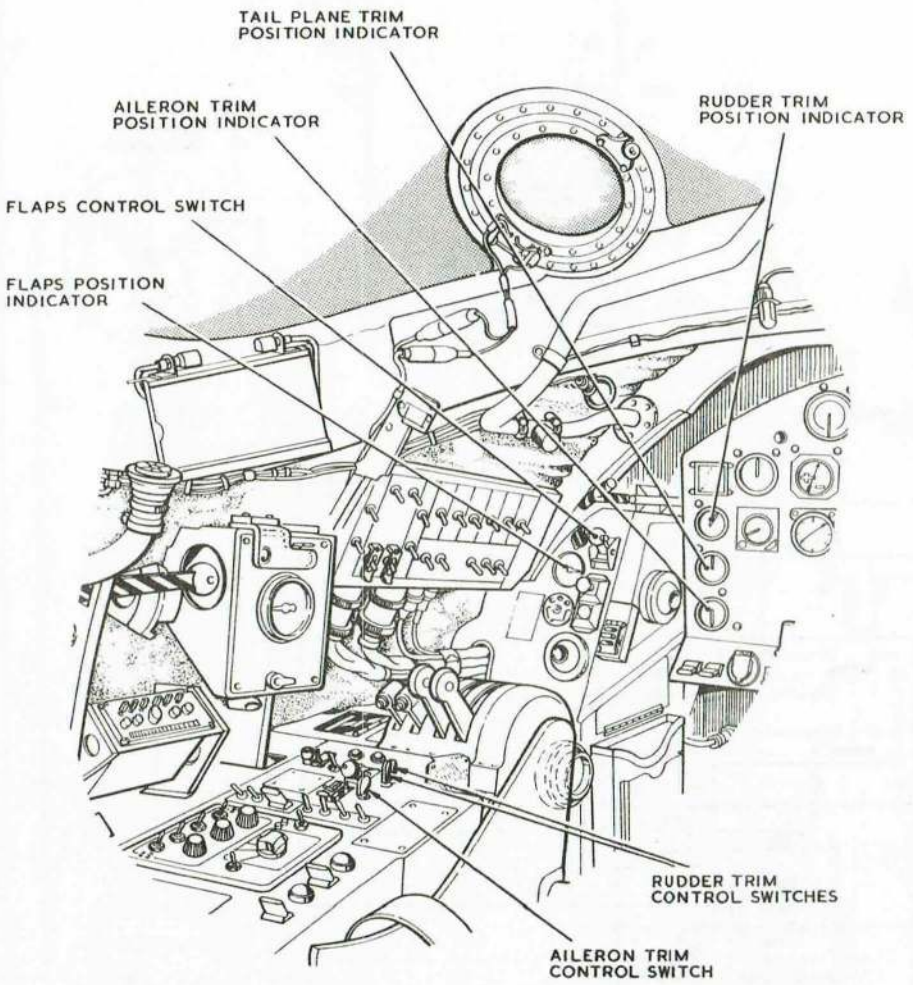
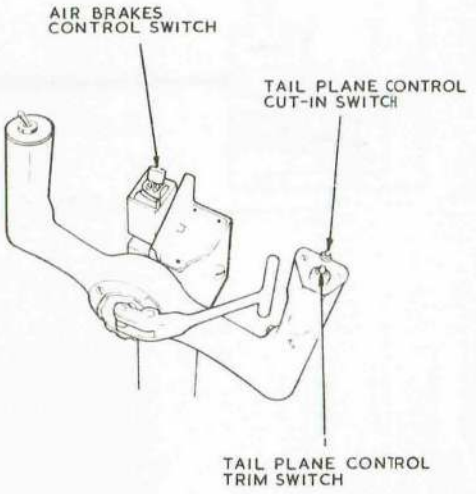


FIG. 1. LOCATION DIAGRAM

◄FLAP TRANSMITTER ADDED►





PILOT'S STATION

FIG.1A. LOCATION DIAGRAM

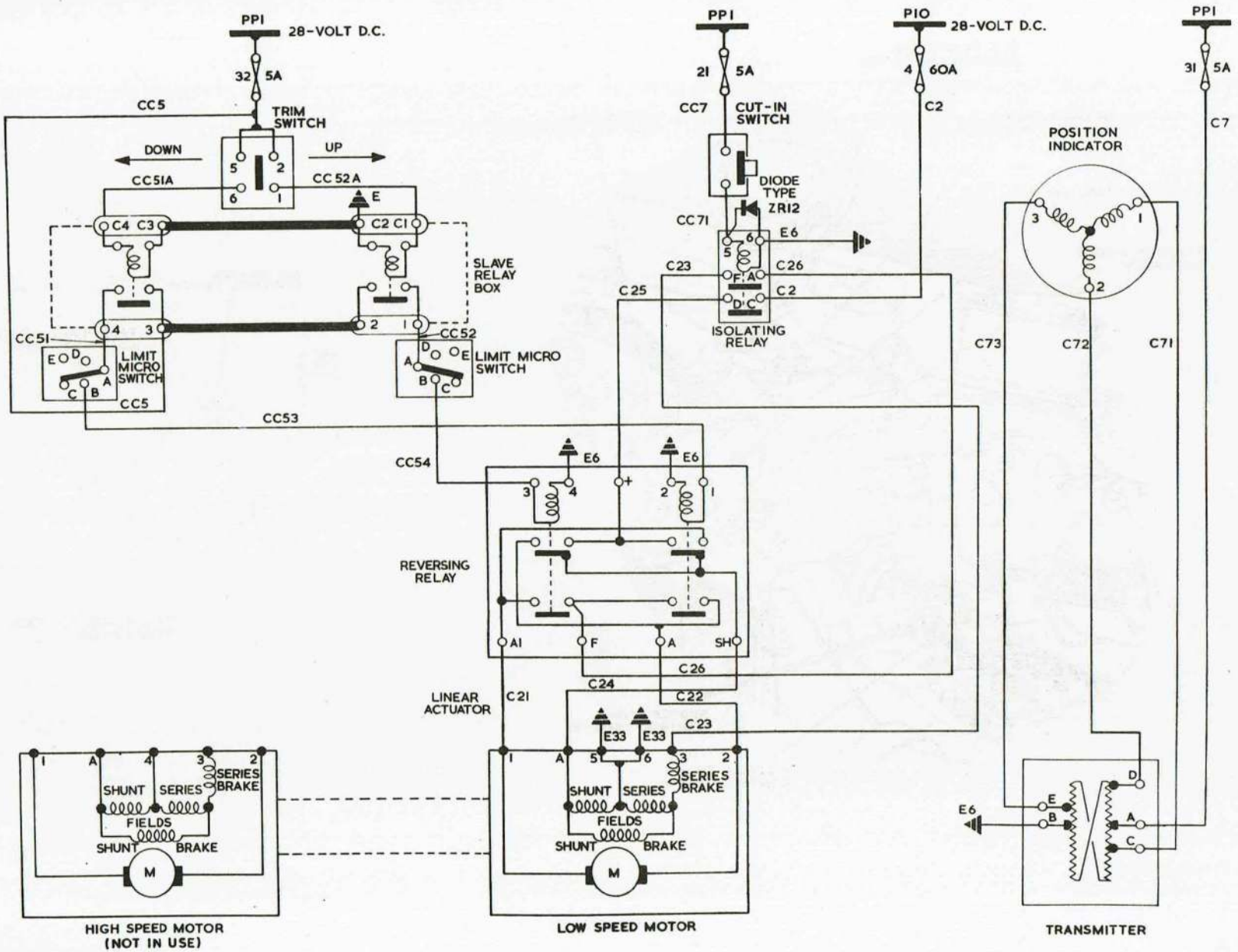


FIG. 2. TAIL PLANE CONTROL

◄RELAY CIRCUIT AMENDED►

DESCRIPTION

Introduction

1. This group describes the electrical circuits associated with the aircraft control surfaces, it also supplies the relevant circuit and routeing diagrams. Table 1 forms a list of the principal components of the systems 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.

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 in the control column handle. 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 4022, Mk.2

3. This type of actuator consists of a gear-driven ram assembly. Its design includes a high speed and a low speed integral motor but only the latter is used for this system. 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.

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 by 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.

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 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

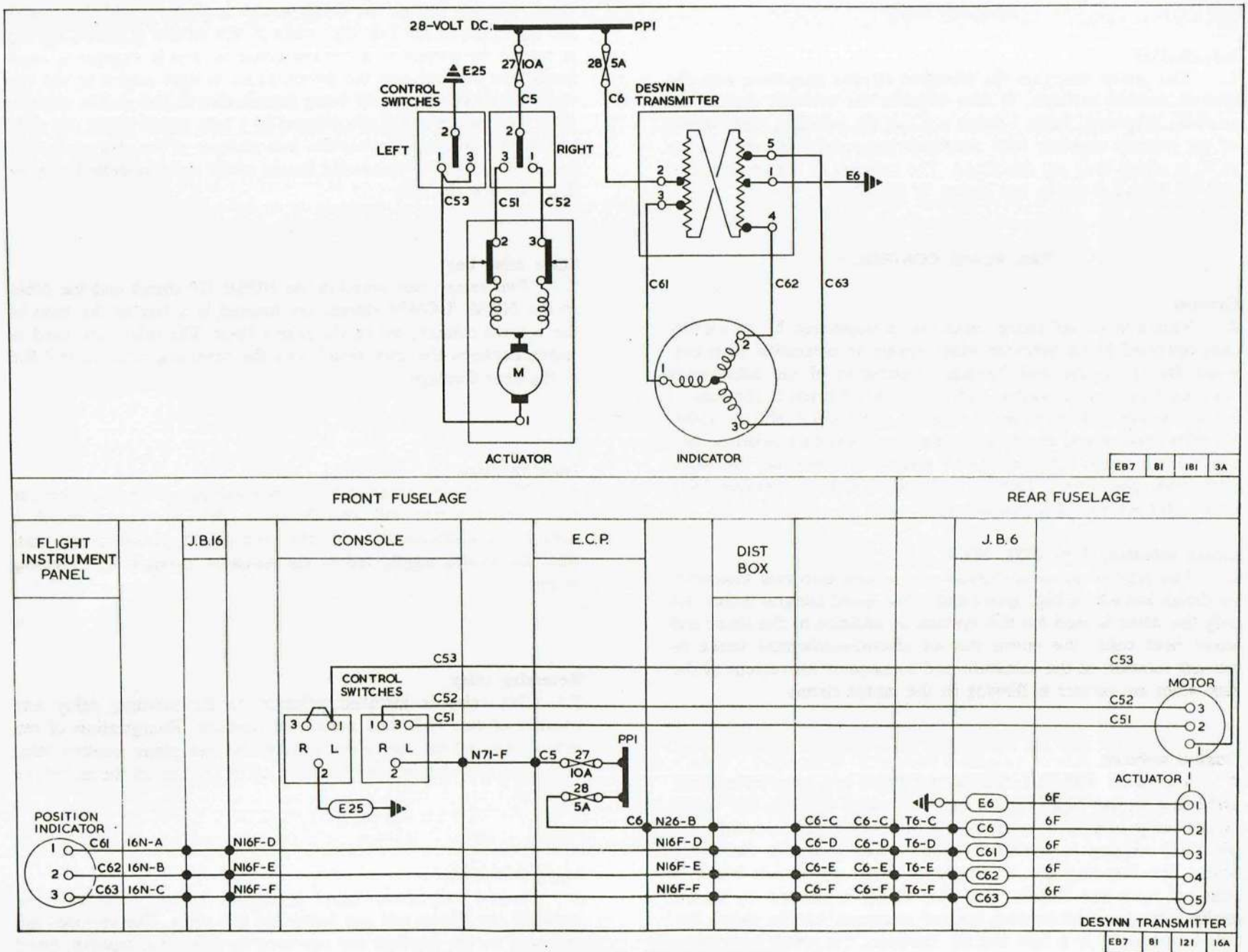


FIG. 3. RUDDER TRIM CONTROL

◄ TERMINAL IDENTS AMENDED ►

of travel. Setting of the limit switches is described in A.P.101B-0407-1A, 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 4 (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 low speed motor.

10. Selection of the trim switch to NOSE UP passes a supply from CC5 (fuse 32) 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, CC52, the 'up' limit microswitch. CC54, and terminal 3 on the reversing relay. The 'nose-up' contacts in the reversing relay close to complete the circuits from C2 (fuse 4) C25 to start up the low speed 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 32) and CC51A to energize the 'nose-down' relay which completes the reversing relay 'nose-down' solenoid circuit through CC5, CC51, the 'down' limit microswitch, CC53, and terminal 1 on the reversing relay. The 'nose-down' contacts of the reversing relay close, completing the circuits from C2 (fuse 4) 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 a 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 flare 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 alighting gear 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 conjuction with relay No.8 in the distribution box. A solenoid-operated hydraulic cock and actuator, installed in the flare 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

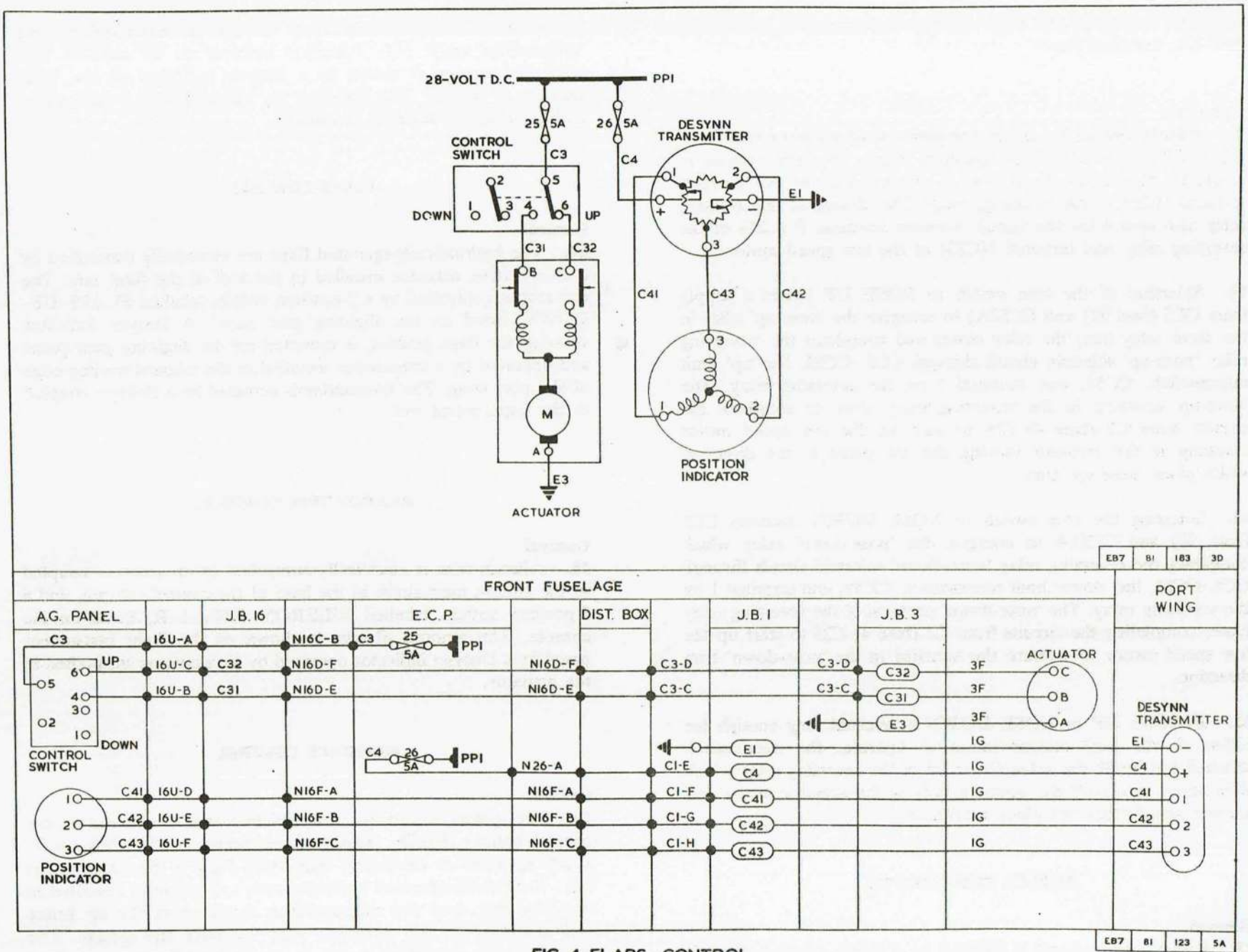


FIG. 4. FLAPS CONTROL

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 relay No.8. 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 relay No.8 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 relay No.8 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 functional check

21. The functional check detailed below should be made when specified in the Servicing Schedule and whenever the control circuit has been broken down in any way.

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

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

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

(4) Repeat (3) by 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-0407-1A, 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 airbrakes control systems, each incorporate a Type 200 electrical actuator which is also described in the relevant A.P. detailed in Table 1.

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

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

(5) After the switches have been reassembled in accordance with the 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 conjuction 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-0407-1A, Sect.3, Chap.4.

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
	Tail plane control		
◀ 5W/4520729	Actuator, Type 4022, Mk.2	1	A.P.113E-0142-16
5CW/4405478	Reversing relay, Type D5107/3	1	◀ A.P.113D-1374-13A6 ▶
5CW/4400158	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/4520727	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 FL 430	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	—

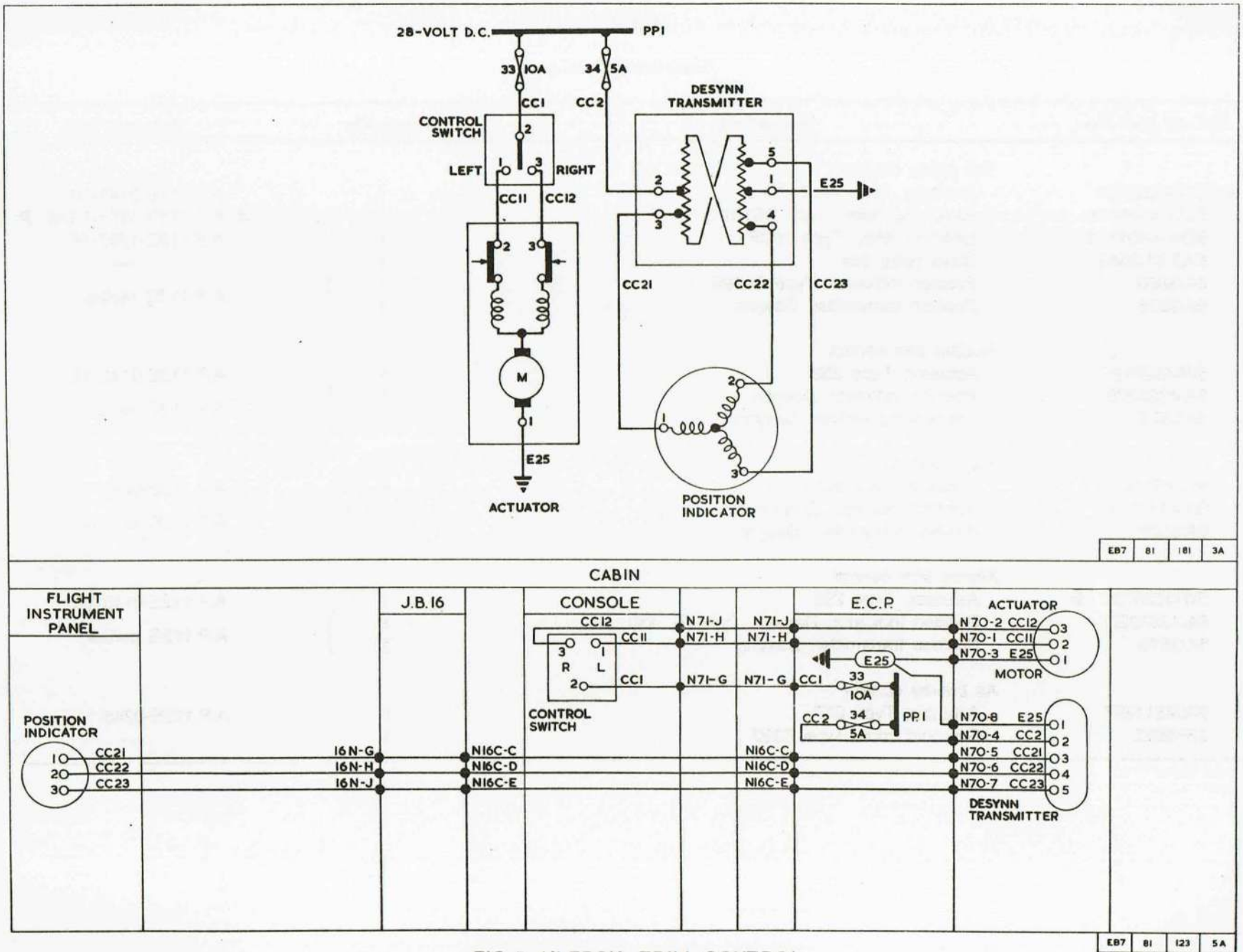


FIG. 5. AILERON TRIM CONTROL

◄CIRCUIT IDENTIFICATION CODES AMENDED►

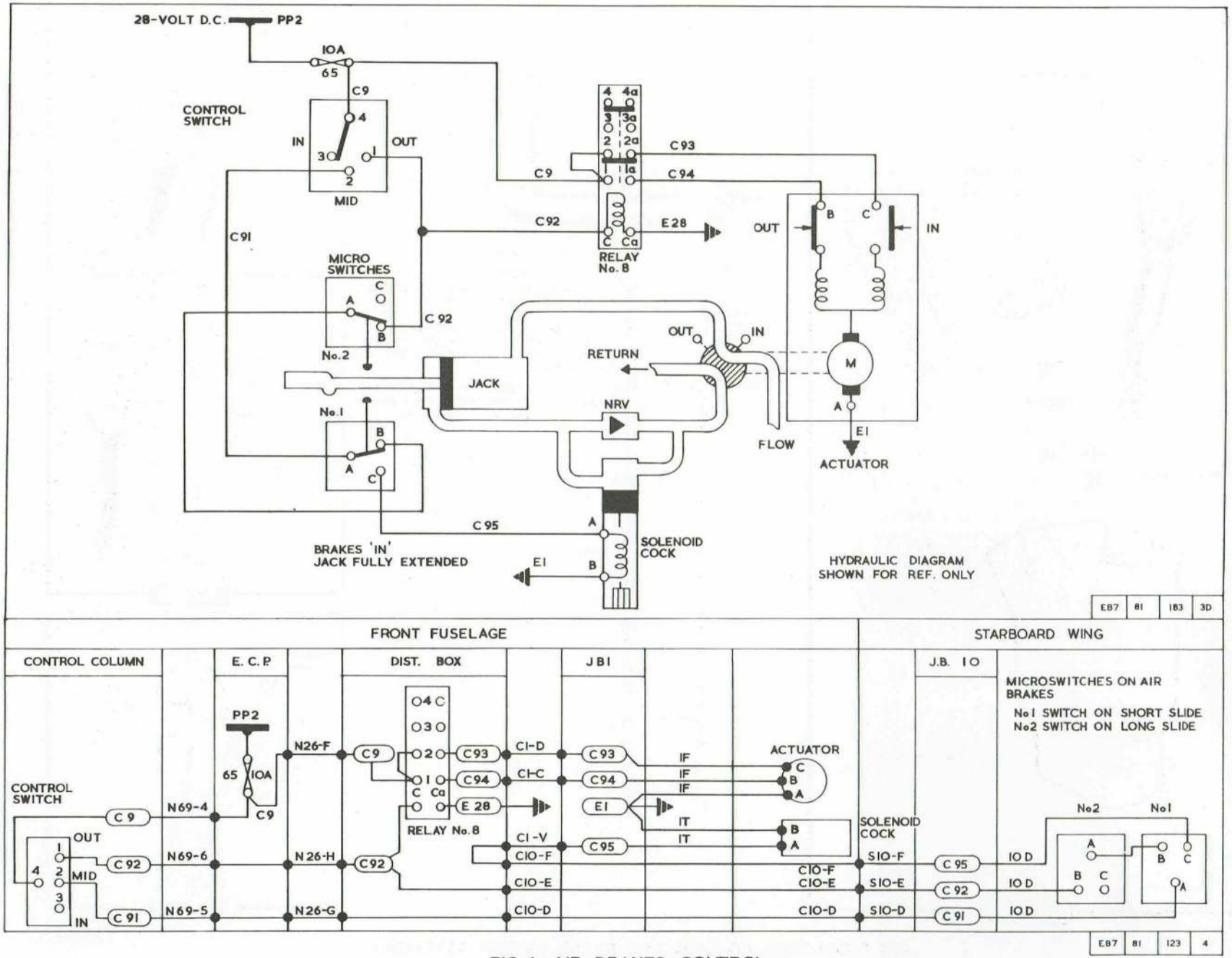


FIG. 6. AIR BRAKES CONTROL

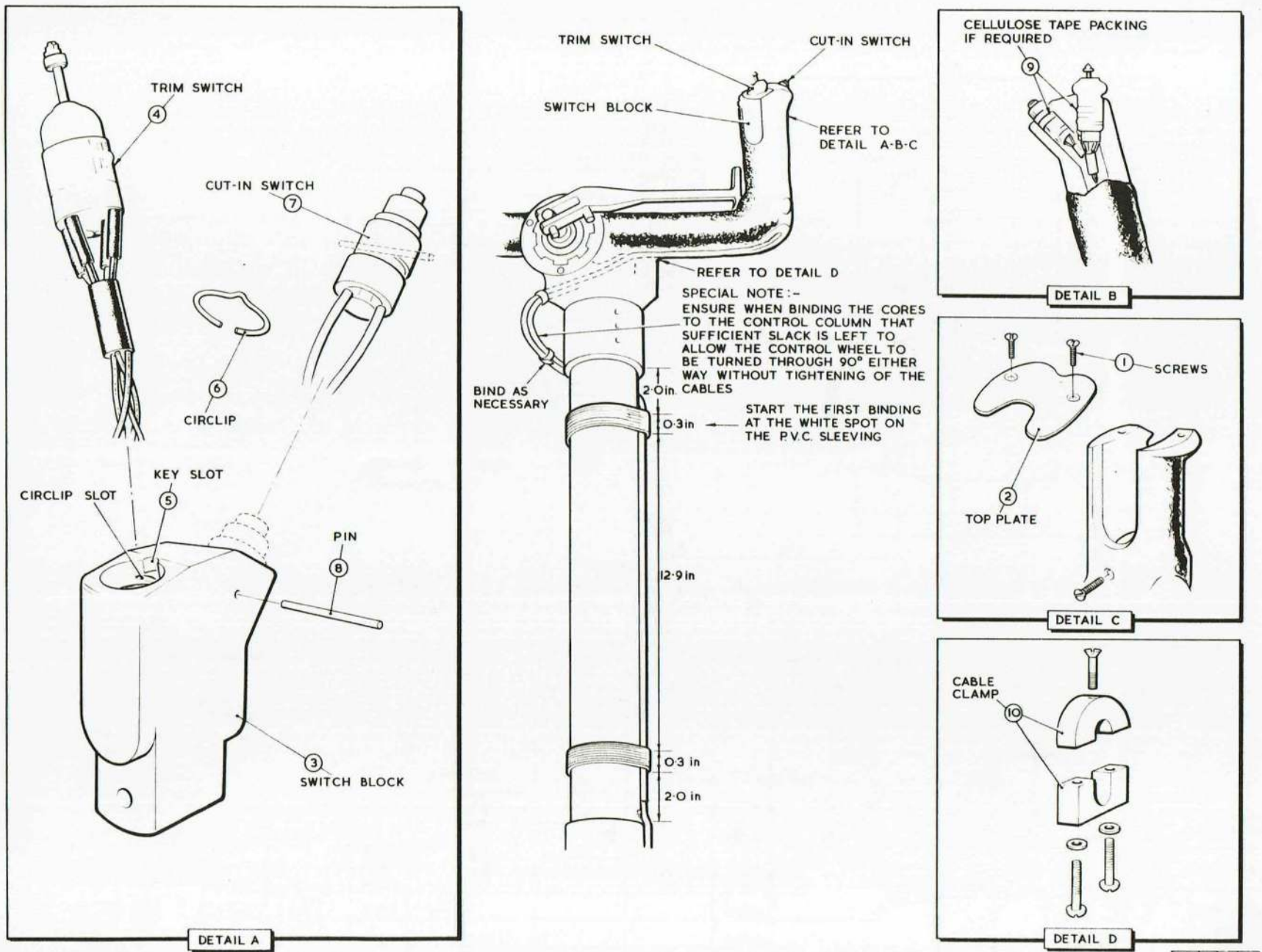


FIG. 7. CONTROL COLUMN TAIL PLANE SWITCH ASSEMBLY

FIG.8. TAIL PLANE CONTROL

(illustration overleaf)

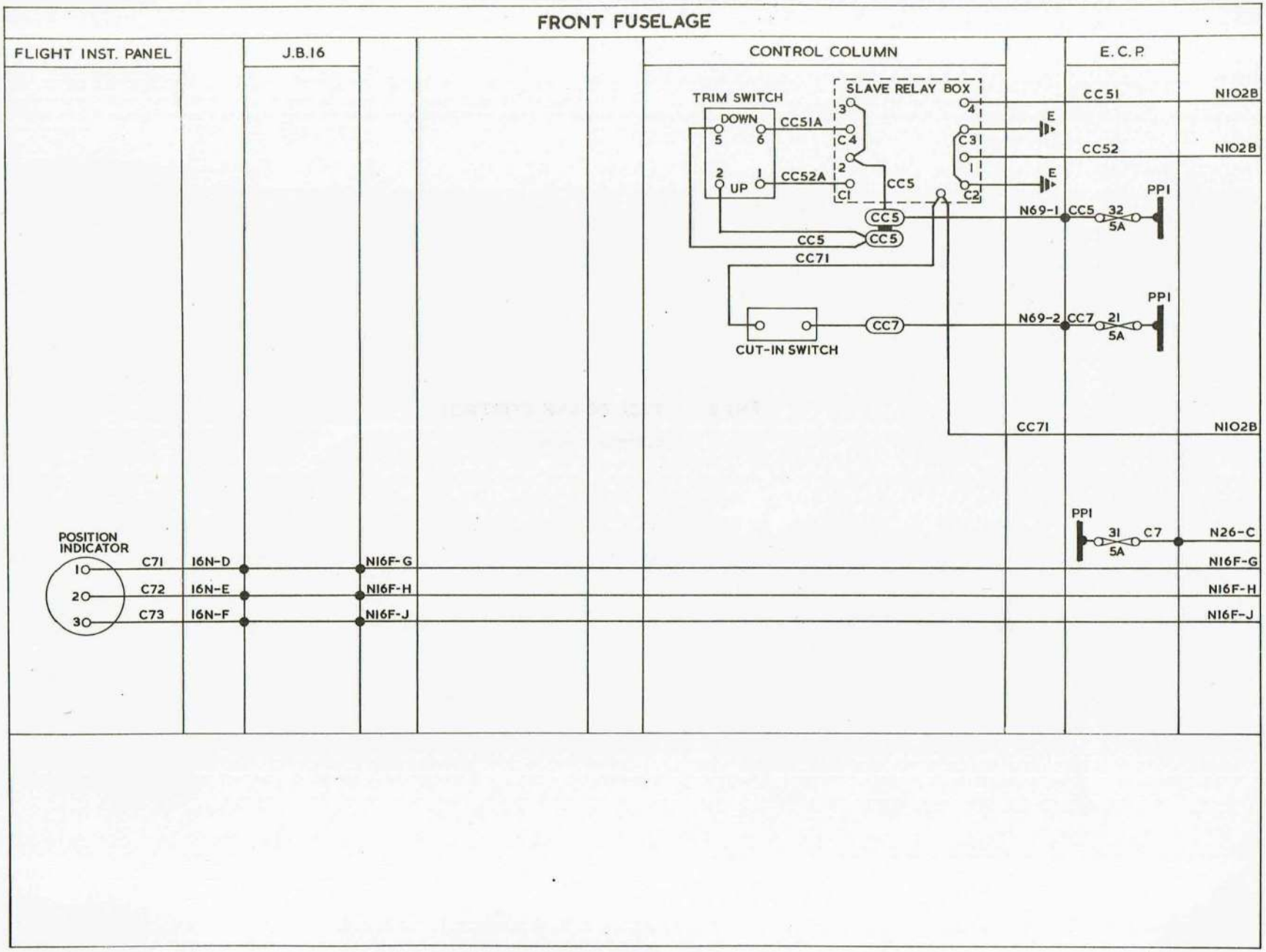


FIG. 8. TAIL PLANE CONTROL

◄SWITCH ANNOTATIONS ADDED►

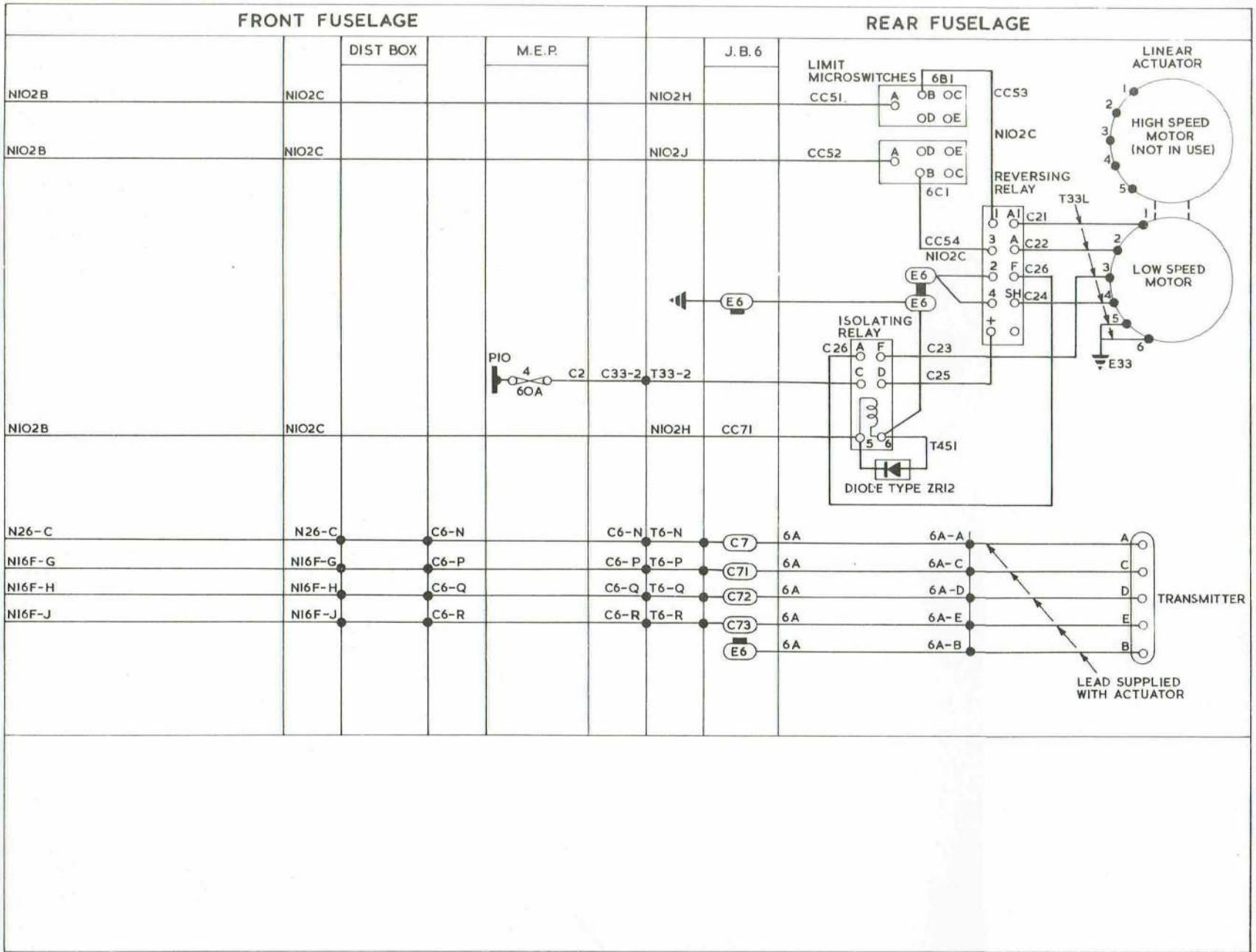


FIG.8A. TAIL PLANE CONTROL

INSTRUMENT POWER SUPPLIES — GROUP D

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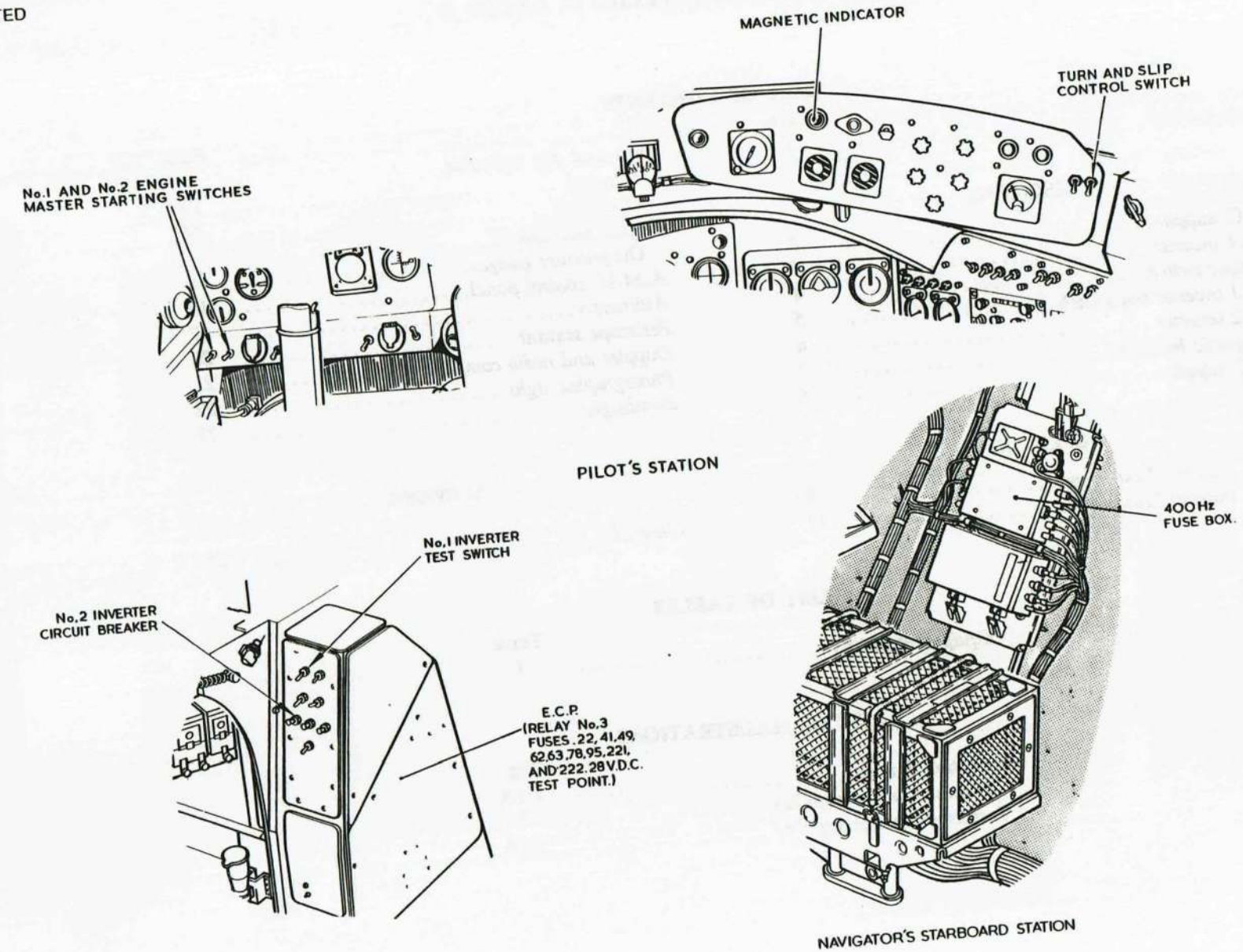

FIG. 1. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

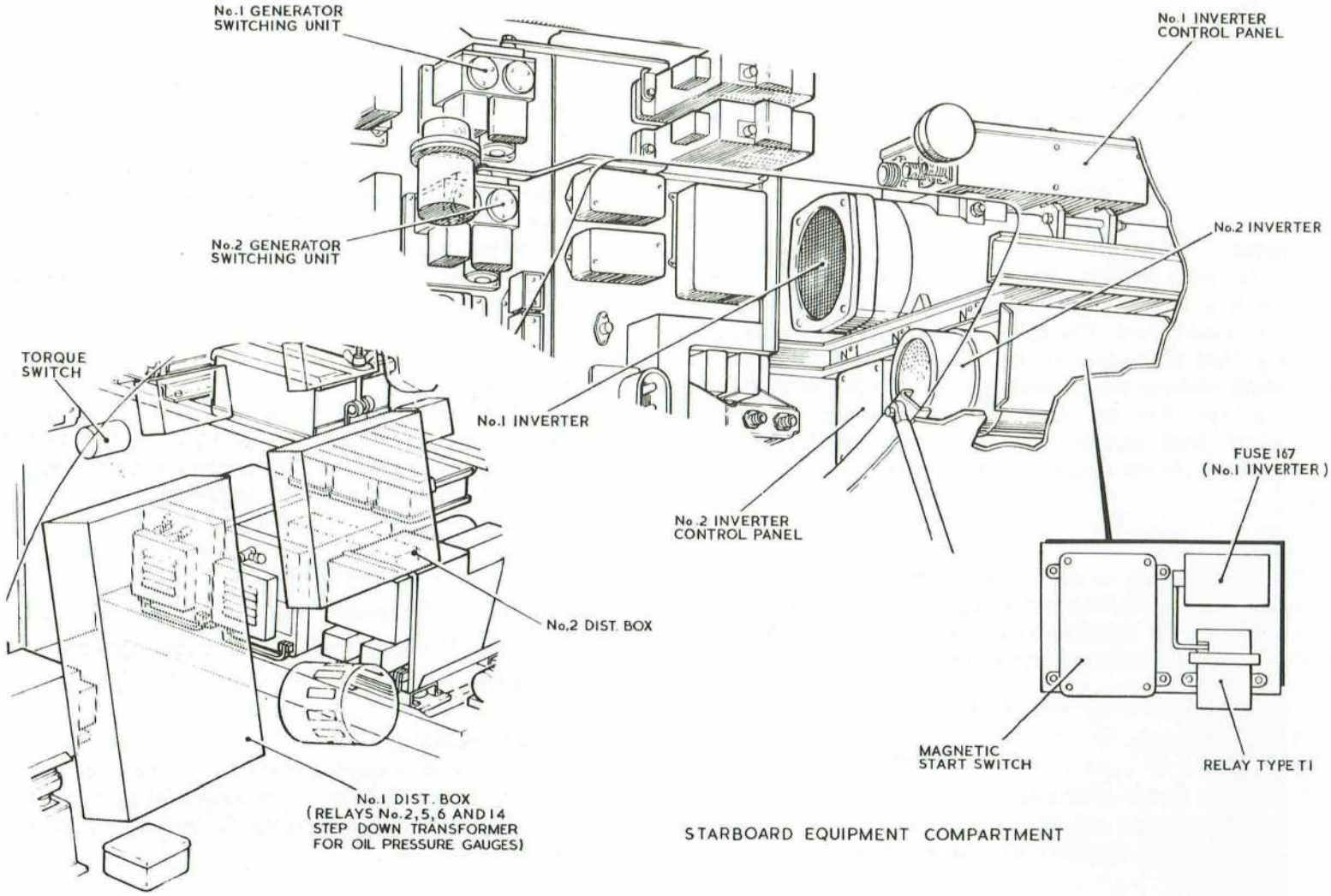

FIG. IA. LOCATION DIAGRAM

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 various engine, flight and navigational instruments, the radio compass and Doppler systems. The location of the principal items of equipment associated with this group are shown in fig.1-1A.

DESCRIPTION

A.C. supplies

2. The 115-volts, 400 Hz, 3-phase a.c. supply consists of two separate 3-phase busbar systems, one for normal use and one for essential or stand-by use. The normal busbars (TR1-EW-TB1) are fed from a Type 103A inverter (No.1) and its associated Type 15 control panel whereas the essential busbars (TR21-EW-TB21) are fed from a Type 100A inverter (No.2) and its associated Type 12 control panel. Both inverters and associated control panels are located in the starboard equipment compartment.

No.1 inverter

3. The 28-volt supply to the inverter is drawn from busbar P10 via fuse 167, a Type T1 relay and a magnetic start switch, which is utilized to reduce the initial starting current. The output from the inverter supplies the following equipments:-

Zero reader (computer and junction box)
Photographic sight } alternatives
Bomb sight gyro control unit }
Windscreen heater controller
Engine oil pressure gauges
G.M.4B compass amplifier and junction box
GPI Mk.4A
Radio compass

Torque switch

4. A torque switch, located in the upper equipment compartment, ensures that No.1 inverter does not come on line to supply the a.c. busbars until its output is of the correct voltage and phase sequence. It also operates in conjunction with relays No.6 and 14 during failure conditions to bring into circuit the No.2 inverter.

No.1 inverter test switch

5. A switch, labelled No.1 INV. TEST, is located on the switch panel of the E.C.P. and provides the facility to operate the inverter without the necessity of an engine run. The switch is connected in parallel with the contacts of the No.1 and No.2 generator switching units, and when selected to ON, with the No.1 engine MASTER STARTING switch also at ON, completes a circuit to energize the coil of relay No.3, the contacts of which complete the supply, via the normally-closed contacts of relay No.2, to start the inverter.

No.2 inverter

6. The 28-volt supply to the inverter is drawn from busbar PP2 via the No.2 INV circuit breaker, on the E.C.P. and the contacts of relay No.5 in the No.1 distribution box. The output from the inverter supplies the following equipments:-

Zero reader (junction box)
Windscreen heater controller
Engine oil pressure gauges
G.M.4B compass amplifier and junction box
Radio compass

Magnetic indicator

7. A Type B magnetic indicator, mounted on the pilot's coaming panel shows which of the two inverters is in use. The indicator shows white when No.2 inverter is on line and black when No.1 inverter is on line.

D.C. supplies

8. The equipment requiring d.c. for its operation obtains a 28-volt d.c. supply from various aircraft d.c. busbars which are fed by the main generating system *(Group P of this section)*. Should this system fail, the turn and slip indicator can be maintained from two 12-volt 4 amp hour emergency batteries *(para.15)*.

OPERATION

No.1 and No.2 inverters

9. The inverters are controlled by No.1 and No.2 engine MASTER STARTING switches respectively. With No.2 selected ON, No.2 inverter will start up via the normally-closed contacts of relay No.14 and the energizing of relay No.5 which allows a supply to pass from the No.2 INV. circuit breaker through the relay contacts to the inverter. The No.2 inverter will then maintain the equipments listed in para.6 and the magnetic indicator will show white.

10. With the No.1 engine MASTER STARTING switch selected to ON and one generator on-line, or the No.1 INV. TEST switch is on, No.1 inverter will start up and take over the load from No.2 inverter as soon as the torque switch reaches its pre-determined setting (98-volts).

11. When the torque switch contacts close a supply is completed to energize the coils of relays No.6 and No.14. The contacts of relay No.14 complete the No.1 inverter supplies to busbars TR21-EW-TB21 and break the circuit to the coil of relay No.5 thus causing the No.2 inverter to shut down. The contacts of relay No.6 complete an alternative path to the inverter start circuit to energize the coil of relay No.2, the contacts of which break the original path to the inverter start circuit and complete a hold-on circuit for the relay coil. The magnetic indicator will change to show black.

No.1 inverter failure

12. In the event of the failure of No.1 inverter, the torque switch contacts will open and de-energize the magnetic indicator and relays No.6 and No.14 and result in the instruments reverting to the stand-by supply from No.2 inverter *(para.6)*. In this condition the No.2 relay will remain energized through the hold-on circuit M81 completed through its own contacts. This causes the de-energization of the Type T1 relay and the subsequent opening of its contacts which disconnects the supply to No.1 inverter, causing it to close down to prevent it becoming burnt out and a fire hazard.

Turn and slip indicator

General

13. This instrument is provided with three sources of d.c. power supply, two from the main batteries and one from the emergency batteries (busbar X7).

Operation

14. The power supplies are initially controlled by a switch labelled TURN & SLIP–STANDBY mounted at the extreme right hand side of the pilot's coaming panel. Normally the switch allows operation of the indicator from the main batteries via the engine MASTER STARTING switches and a relay in J.B.16. Setting the No.2 engine MASTER STARTING switch to ON connects a supply from fuse 95 via fuse 63 to the coil of the relay which closes and operates the indicator via its contacts and contacts 3-2 of the switch.

15. Should the supply via fuse 63 fail, the relay becomes de-energized and the supply to the indicator is transferred by the relay contacts to fuse 62, the No.1 engine MASTER STARTING switch and fuse 49. If both normal supplies fail the indicator will continue to function from the emergency batteries (busbar X7) after selecting the TURN & SLIP–STANDBY switch to STANDBY.

Engine instruments

Oil pressure gauges

16. Engine oil pressures are indicated by two a.c. operated gauges mounted on the engine instrument panel. The instruments operate on 26-volts obtained from the 115-volt, three-phase, 400 Hz supply by two step-down transformers 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.

17. The 115-volt a.c. supply is normally provided by inverter No.1, and in the event of the failure of this service, the instrument load is automatically transferred to inverter No.2 as described in para.12. Circuit and routeing diagrams for the oil pressure gauges can be found in Sect.5, Chap.2, Group E.

A.M.U. control panel

18. The d.c. supply to the A.M.U. control panel is drawn from busbar PP1 via fuse 41, in the E.C.P., a Type B4 suppressor and the A.M.U. junction box.

Altimeters

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

Periscope sextant

20. The d.c. supply for heating and lighting this instrument is obtained from busbar PP1, via fuse 22 in the E.C.P. and a control switch on the sextant mounting.

Doppler and radio compass

21. The power supplies for the Doppler and radio compass are drawn from No.1 and No.2 inverter respectively. Should No.1 inverter fail the supplies to the Doppler are lost. The Doppler and radio compass supplies are described in Group R & S.

Photographic sight

22. The photographic sight requires power supplies of 28-volt d.c. and 115-volt, 400 Hz, 3-phase a.c. The d.c. supply is drawn, via the sight control panel, from fuse 159 in the camera distribution panel whilst the a.c. supplies are drawn from fuses 121 and 125 in the 400 Hz fusebox.

Bombsight

23. A bomb sight can be installed as an alternative to the photographic sight *(para.22)* and requires power supplies of 28-volt d.c. and 115-volt, 400 Hz, 3-phase a.c. The d.c. supply to the sight gyro control unit is drawn from fuse 159 in the camera distribution panel whilst the a.c. supplies are drawn from fuses 121 and 125 in the 400 Hz fusebox. A second d.c. supply is drawn from fuse 160, in the camera distribution panel, and is routed to the sight control panel.

24. Either a Type T3 or T4 bombsight can be fitted but the associated Type T3 or T4 gyro control unit and control panel must also be fitted. Both types of gyro control units are interchangeable in the aircraft wiring but if a Type T3 bombsight, and therefore a Type T3 control panel, is fitted cable assembly N407B-N407 is connected between the control panel and the camera distribution panel; similarly if a Type T4 control panel is fitted cable assembly N407A-N407 is connected between the control panel and the camera distribution panel. The cable assemblies not in use are stowed in a bag adjacent to the sighting head.

SERVICING

WARNING

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

General

25. Refer to the Air Publications listed in Table 1 for servicing information on the inverters and their associated control equipment.

TABLE 1

Equipment details

Ref.No.	Equipment	Quantity	Relevant A.P.
5UB/4342693	Inverter, No.1, Type 103A	1	113D-0106-16
5UB/4938	Inverter, No.2, Type 100A	1	113D-0104-16
5UC/6369631	Control panel, Type 12	1	113D-0721-16
5UC/4379154	Control panel, Type 15	1	113D-0780-13A6
5CW/5016	Magnetic starting switch, Type 1A, No.5	1	113D-13141-1
5CW/4400244	Torque switch, EAP 2340/2	1	113D-1384-1

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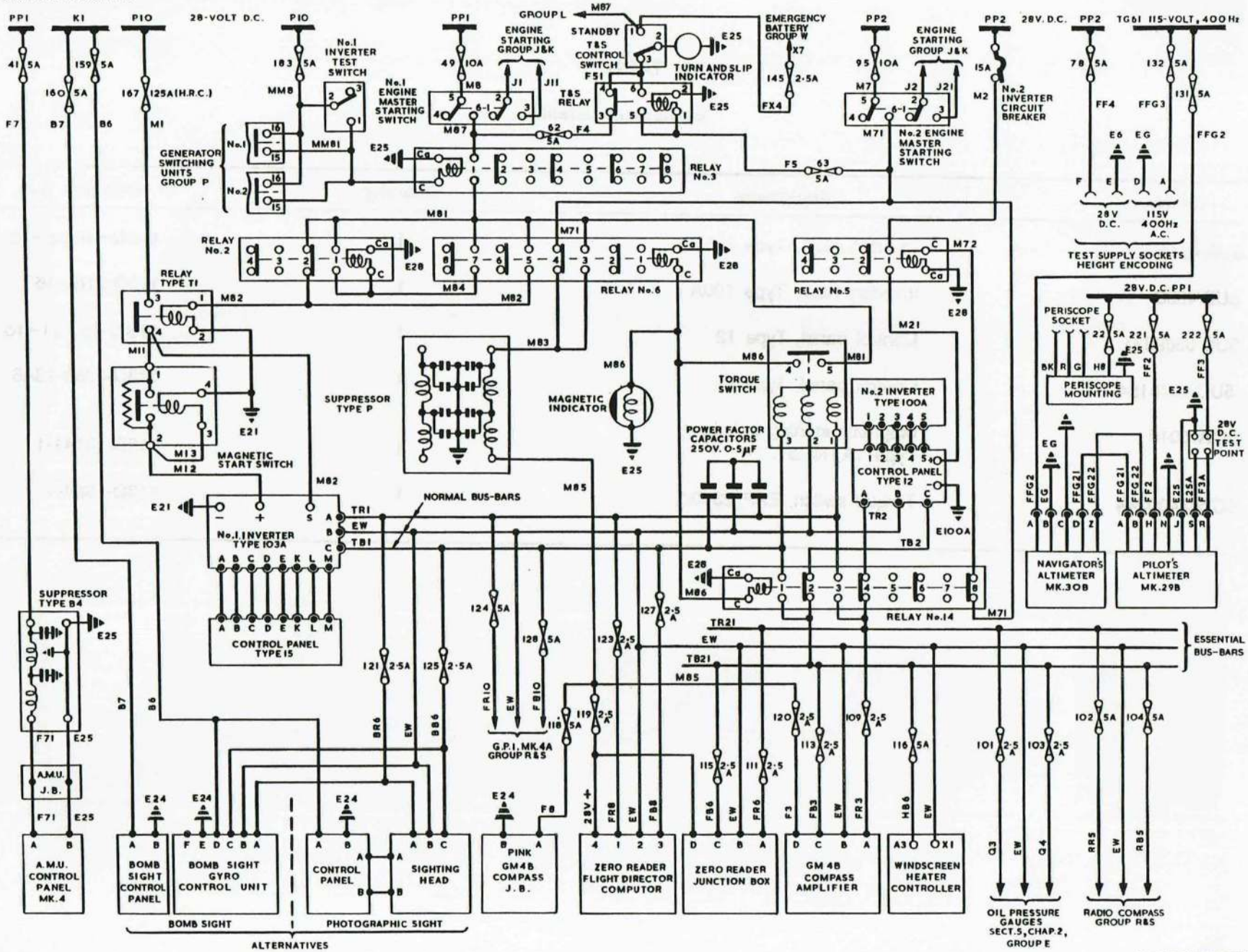

FIG. 2. INSTRUMENT POWER SUPPLIES

◄ UFR/CAN/171 INCORPORATED ►

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FIG.3 INSTRUMENT POWER SUPPLIES

(illustration overleaf)

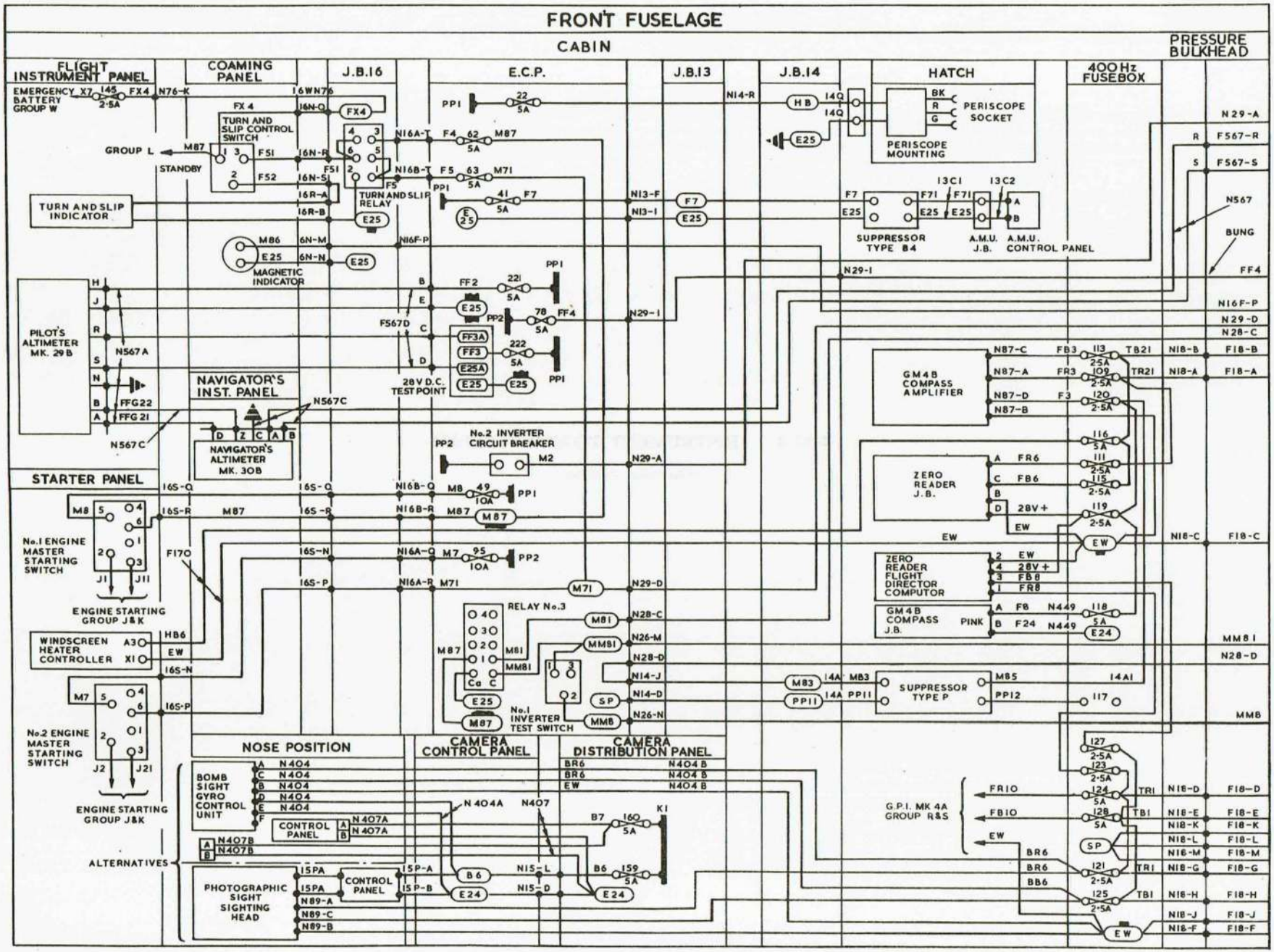

FIG.3. INSTRUMENT POWER SUPPLIES

◄PIN IDENTS AMENDED►

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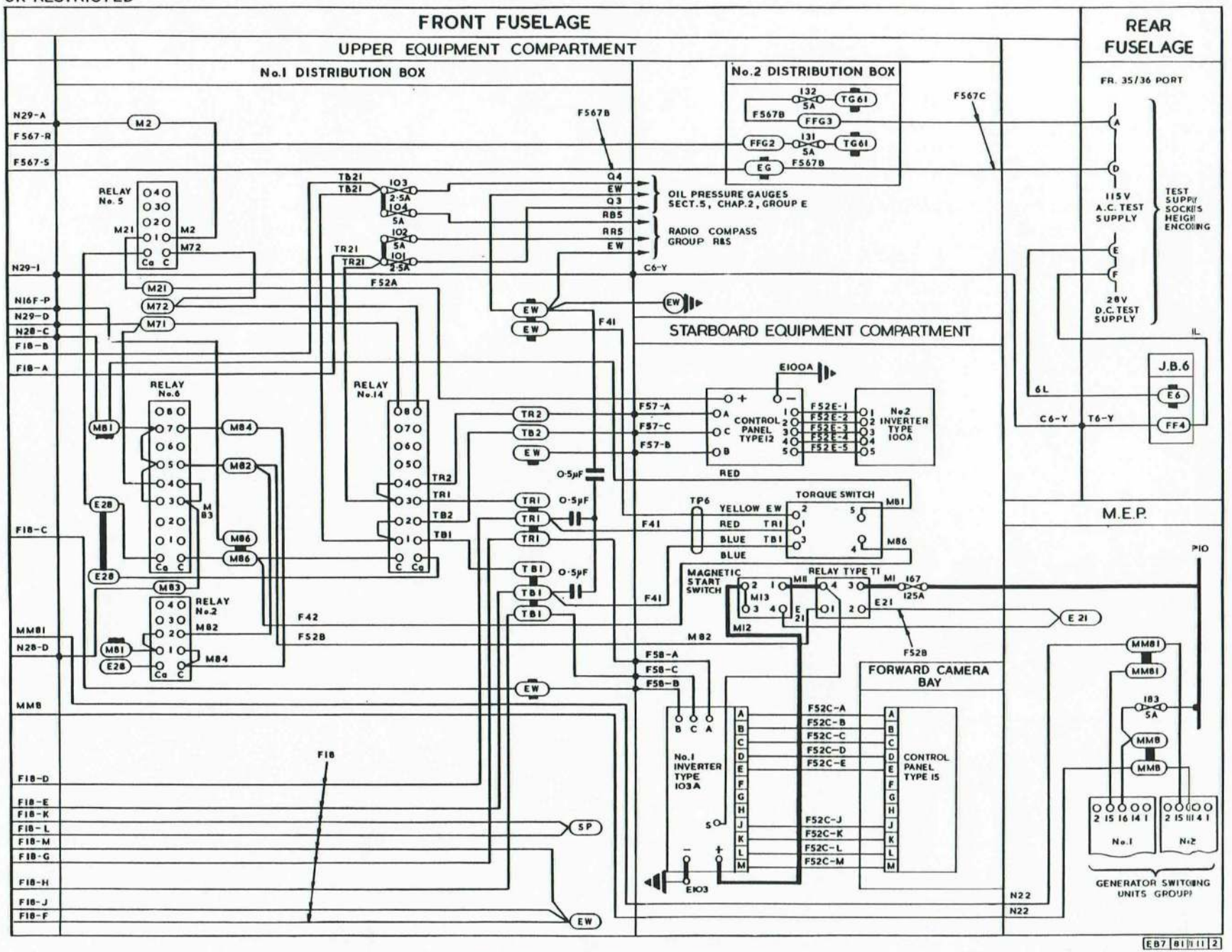
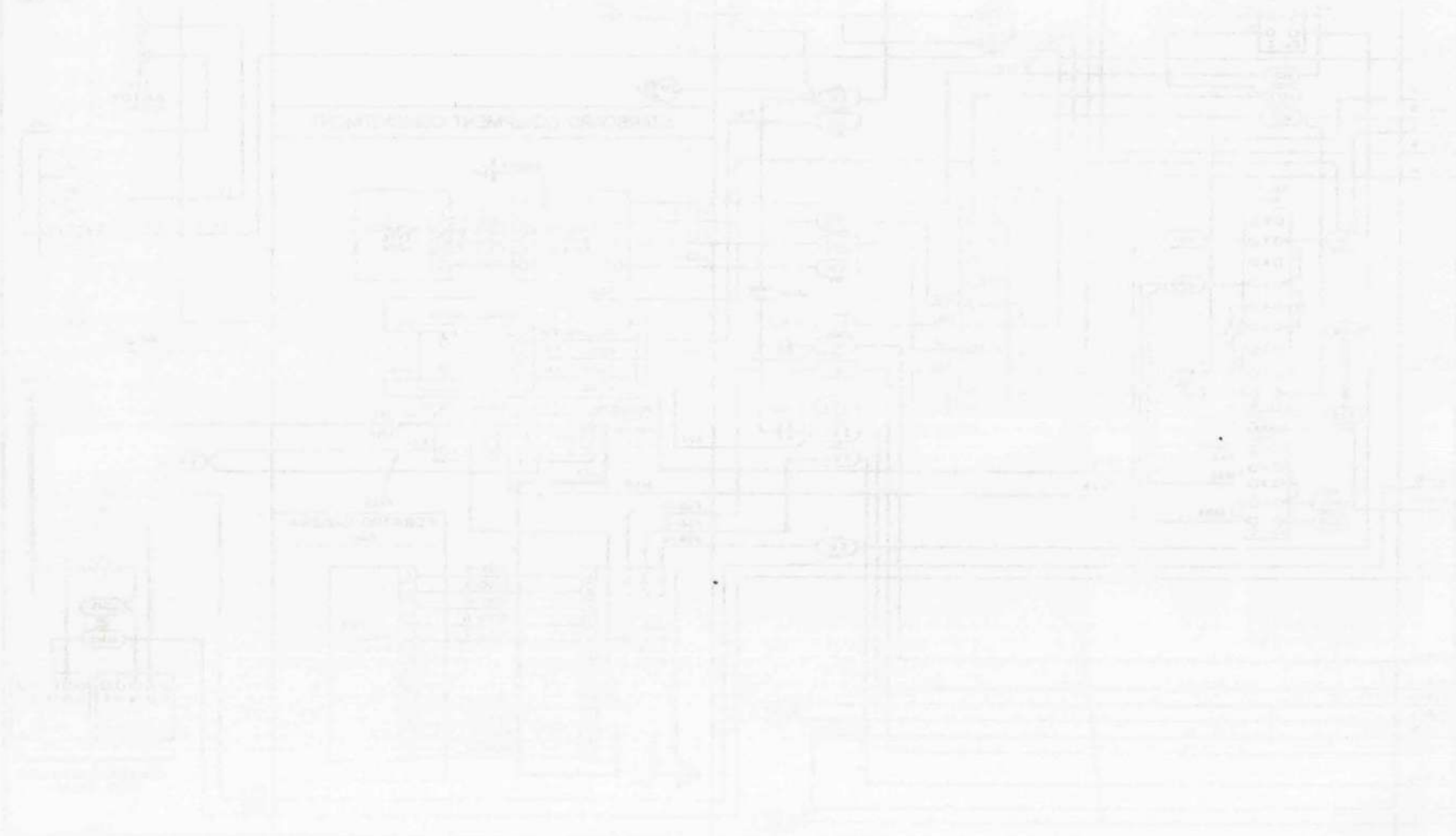


FIG.3A. INSTRUMENT POWER SUPPLIES

◄ UFR/CAN/171 INCORPORATED ►



ALIGHTING GEAR — GROUP G

(completely revised)

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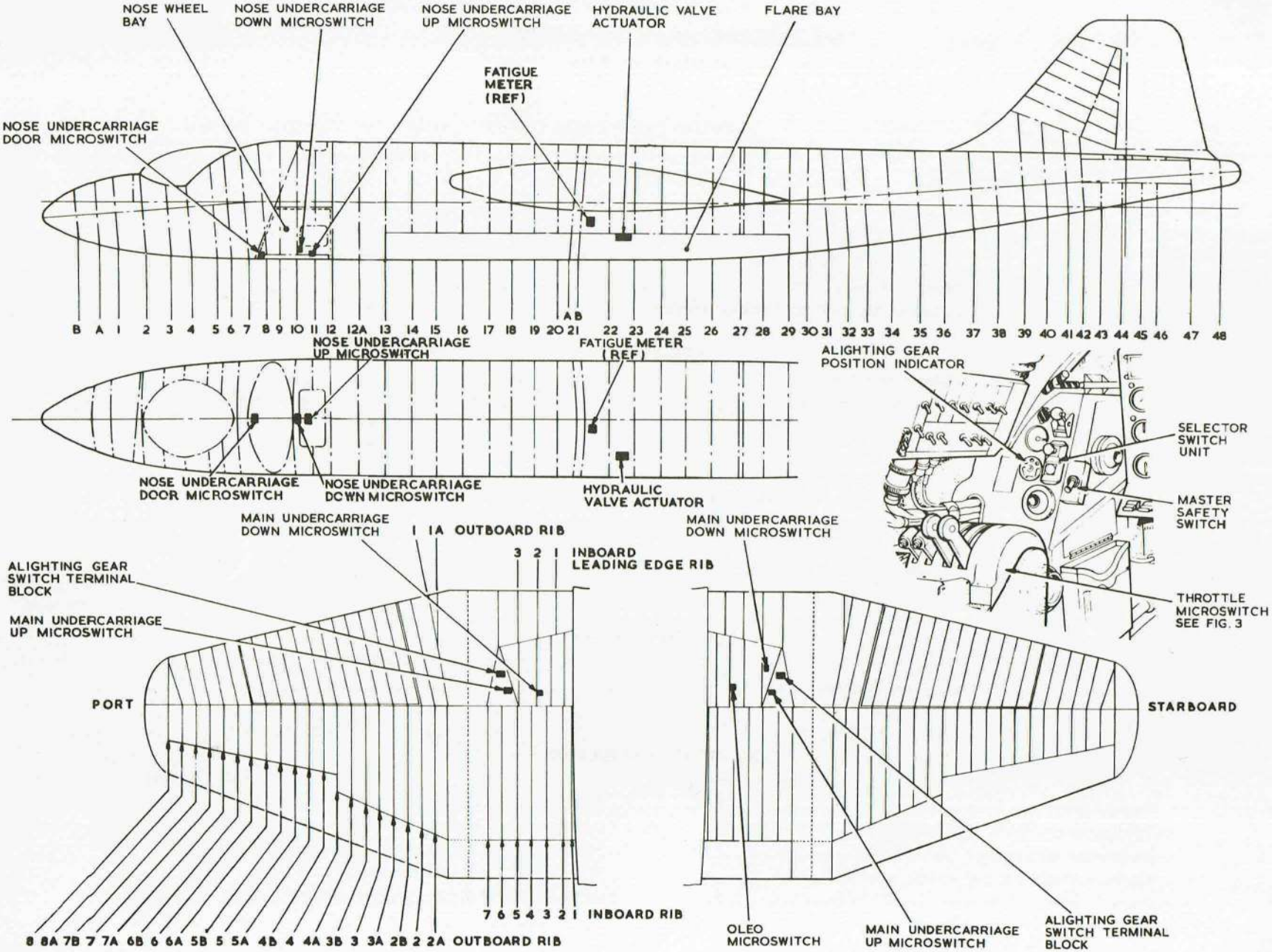

FIG. 1. LOCATION DIAGRAM

DESCRIPTION

General

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

Selector switch unit

2. The selector switch unit 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.

3. With the alighting gear selected UP, the selector switch circuit U12 energizes the fatigue meter *(Chap.2, Group D)* via fuse 187 in the M.E.P. and circuit U12A.

Emergency UP selection

4. 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

◀ 5. 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

6. A Type D or D1 alighting gear position indicator is mounted alongside the selector switch unit and operated by microswitches installed in the nose and main wheel bays. A microswitch fitted forward of the nose wheel leg is actuated by the nose wheel door and connected in parallel with the nose wheel UP switch. 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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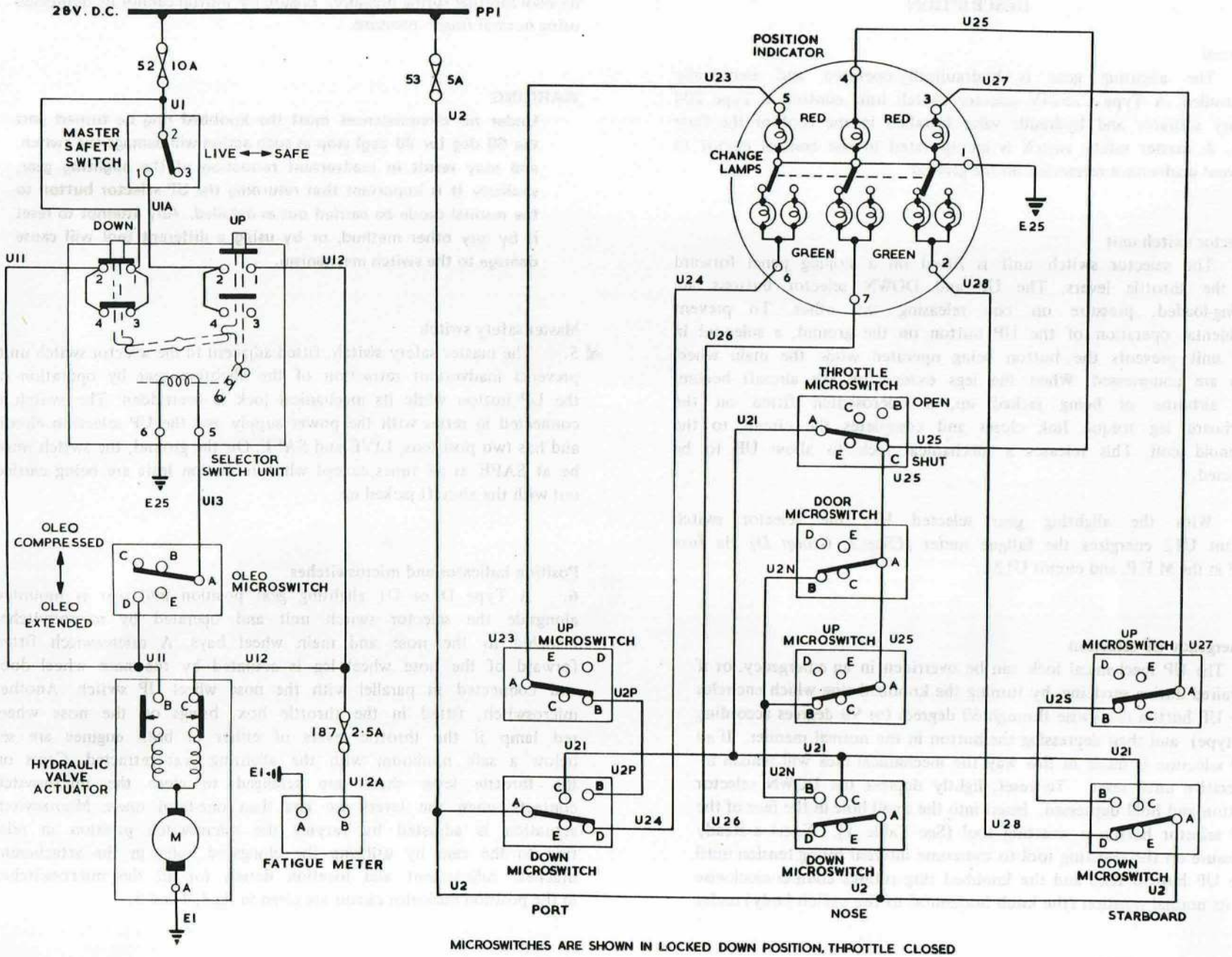


MICROSWITCHES ARE SHOWN IN LOCKED DOWN POSITION, THROTTLE CLOSED

FIG. 2. ALIGHTING GEAR CONTROL AND INDICATION

◄ SEM/CAN/0141/STC INCORPORATED ►

EB 7	81	185	ISS 10

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

7. The alighting gear indicator circuits are not switched, but fed direct from busbar PP1 which is controlled by the BATTERY ISOLATION switch on the pilot's take-off panel. 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 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

8. Due to the safety precautions necessary when the aircraft is on the ground *(para.2)* an electrical functioning check on this circuit can only take place with the weight of the aircraft removed from its main wheels. This allows the safety lock microswitch to operate and energize the locking coil in the selector switch unit and release the mechanical lock.

Actuator

9. Servicing of the actuator will normally be confined to checking the length of the brushes and removing carbon dust, two operations which require the removal of the motor end cover. Further information on servicing the actuator will be found in ◀ A.P.113E-0248-1. ▶

REMOVAL AND ASSEMBLY

Actuator

Removal

10.

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

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

(3) Remove the actuator.

Assembly

11.

(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-0407-1A, Sect.3, Chap.6).*

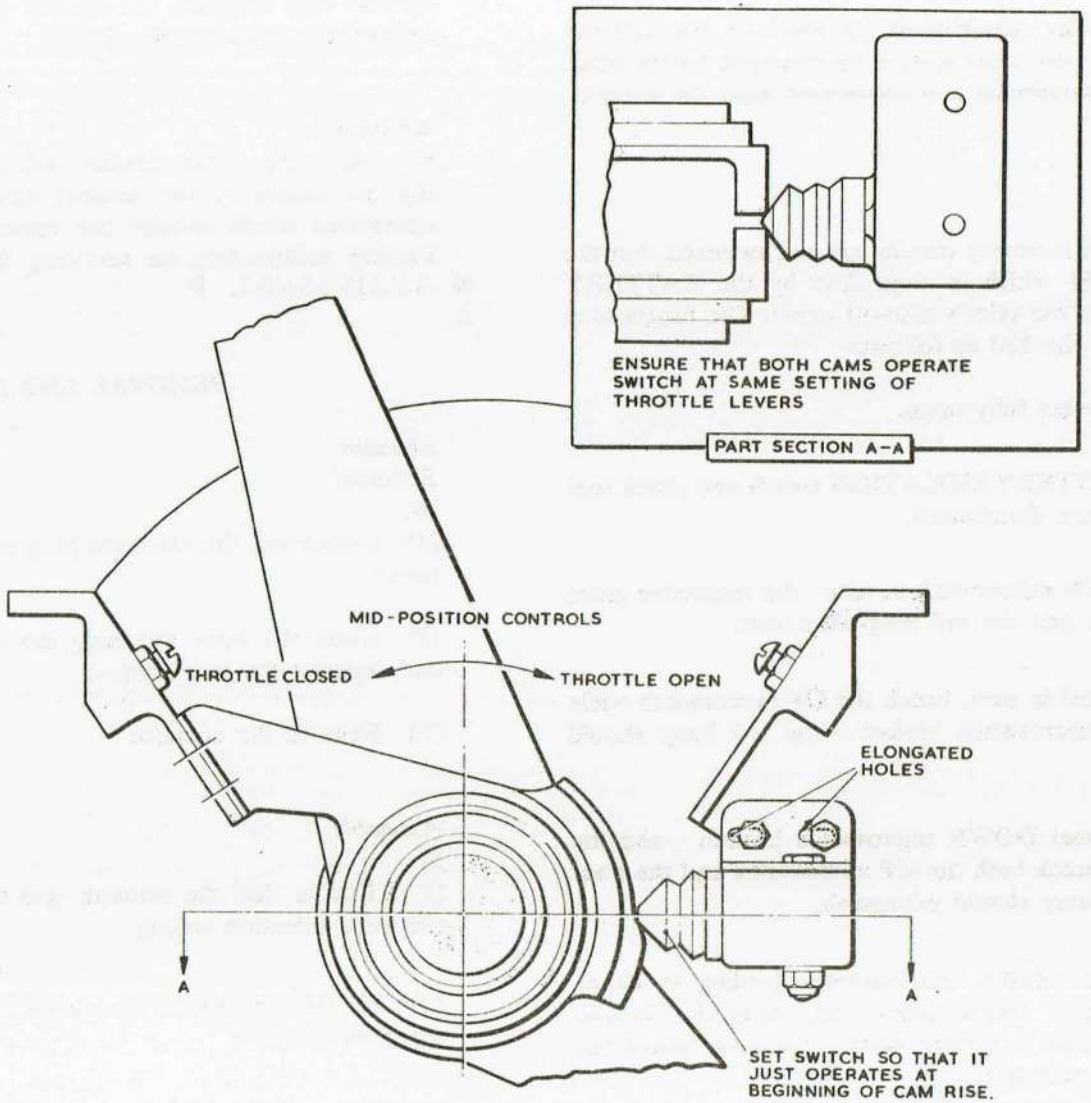


FIG. 3. MICROSWITCH ADJUSTMENT – THROTTLE BOX

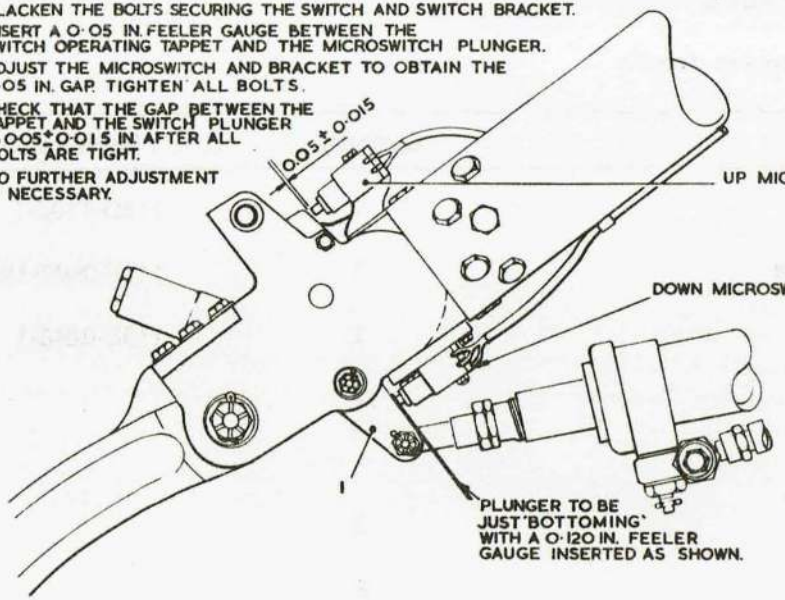
TABLE 1

Equipment details

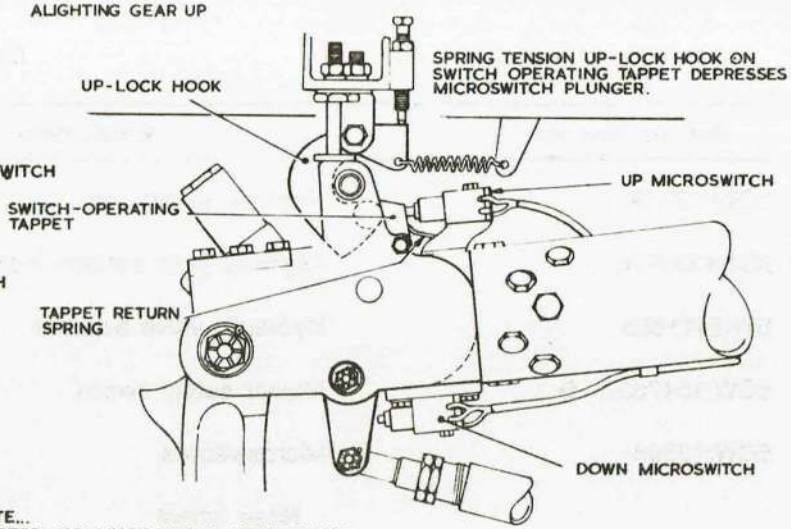
Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5CW/12963	Selector switch unit	1	113D-1130-1
◀ 5CX/4330226	Alighting gear position indicator	1	113F-0607-13A
5W/5411895	Hydraulic valve actuator	1	113E-0248-1
5CW/1047697 ▶	Master safety switch	1	
5CW/13598	Microswitches		
	Nose wheel	3	
	Main wheel (Port)	2	
	Main wheel (Starboard)	3	
	Throttle	1	

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.



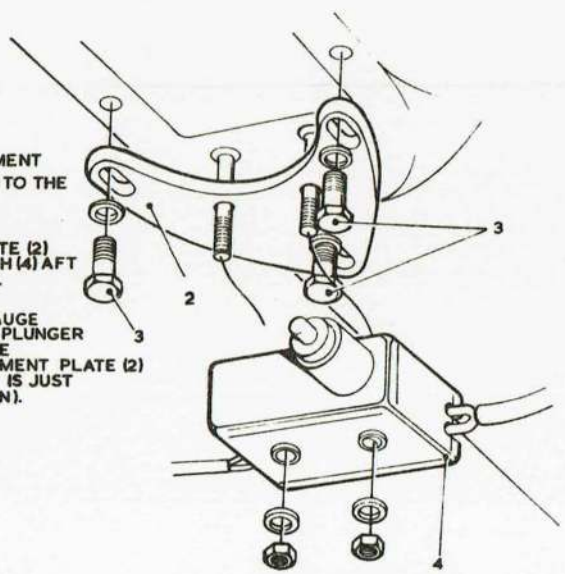
ALIGHTING GEAR UP



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-0407-1A, 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-0407-1A, SECT. 3, CHAP. 5)
4. RAISE THE NOSE WHEEL (A.P. 101B-0407-1A, 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.

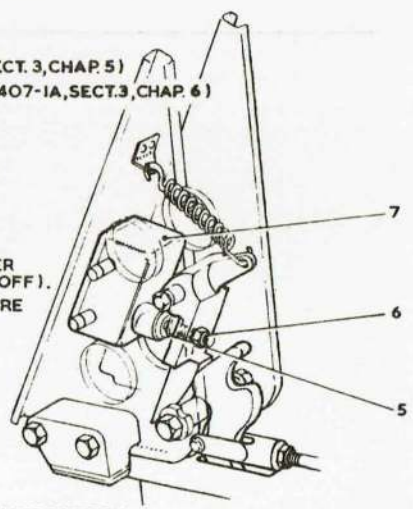
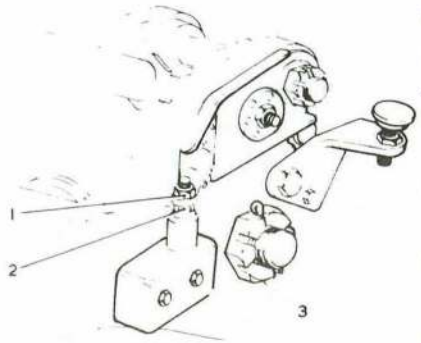


FIG. 4. MICROSWITCH ADJUSTMENT - NOSE UNDERCARRIAGE

EA9	40	1	155.23D
EA3	40	261	155.4
EA3	40	239	155.4A

DOWN MICROSWITCH



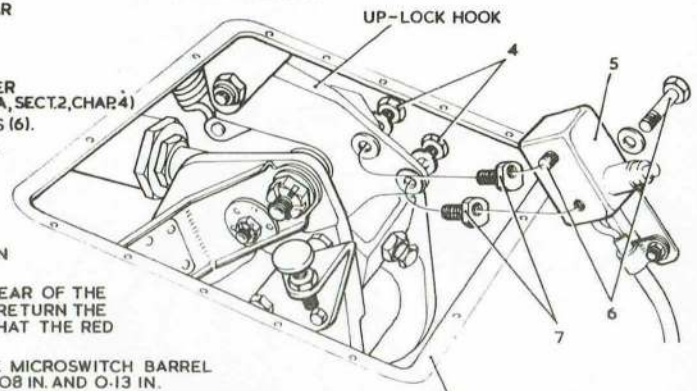
DOWN MICROSWITCH ADJUSTMENT

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-0407-1A, 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-0407-1A, 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.

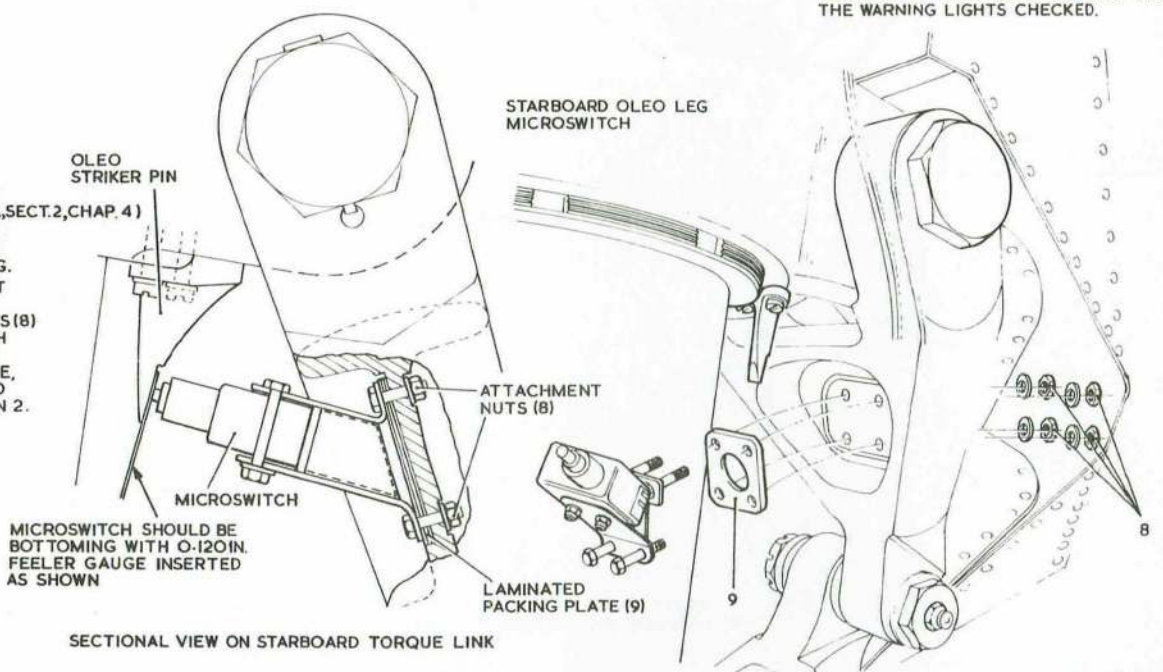
UP MICROSWITCH



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

STARBOARD OLEO LEG MICROSWITCH ADJUSTMENT

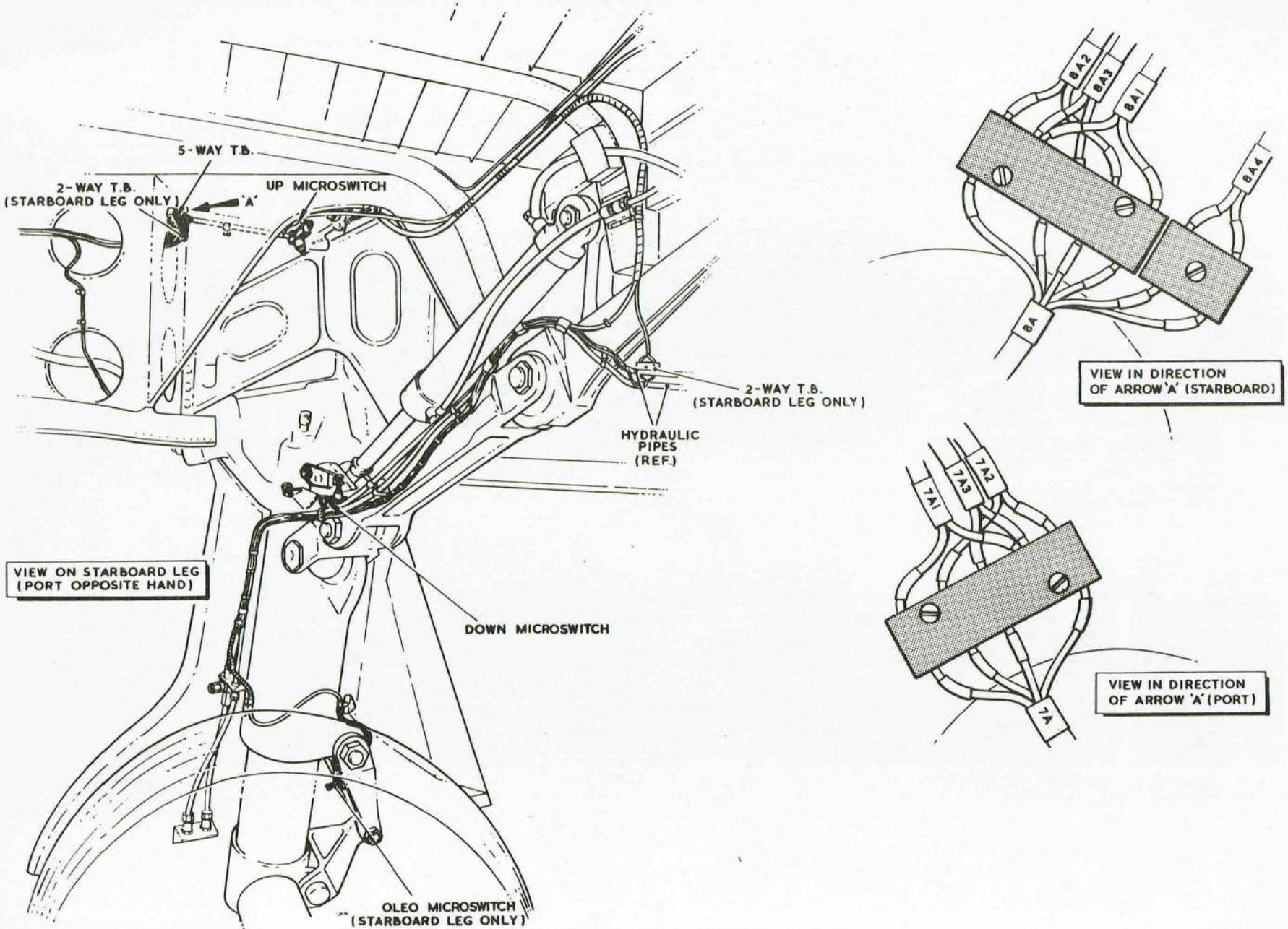
1. JACK AND TRESTLE THE AIRCRAFT WITH THE WHEELS CLEAR OF THE GROUND (A.P.101B-0407-1A, SECT.2, CHAP.4)
2. INSERT A 0.120 IN. FEELER GAUGE BETWEEN THE MICROSWITCH PLUNGER AND THE OLEO STRIKER PIN. THE PLUNGER SHOULD JUST BE BOTTOMING.
3. IF THE ADJUSTMENT (OPERATION 2) IS INCORRECT PROCEED AS FOLLOWS:-
   (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, REF. No. 26FZ/706, ADJUST THE MICROSWITCH TO OBTAIN THE CONDITION DESCRIBED IN OPERATION 2.
4. RE-CHECK THE ADJUSTMENT AFTER HAVING FINALLY REFITTED THE MICROSWITCH AND TIGHTENED THE SECURING NUTS



SECTIONAL VIEW ON STARBOARD TORQUE LINK

EA3	20	3417/8	6
EA3	40	237	4
EA3	40	253	4

FIG. 5. MICROSWITCH ADJUSTMENT – MAIN UNDERCARRIAGE



EB7 | 81 | 1307/8 | 28

FIG. 6. MAIN WHEELS - WIRING INSTALLATION

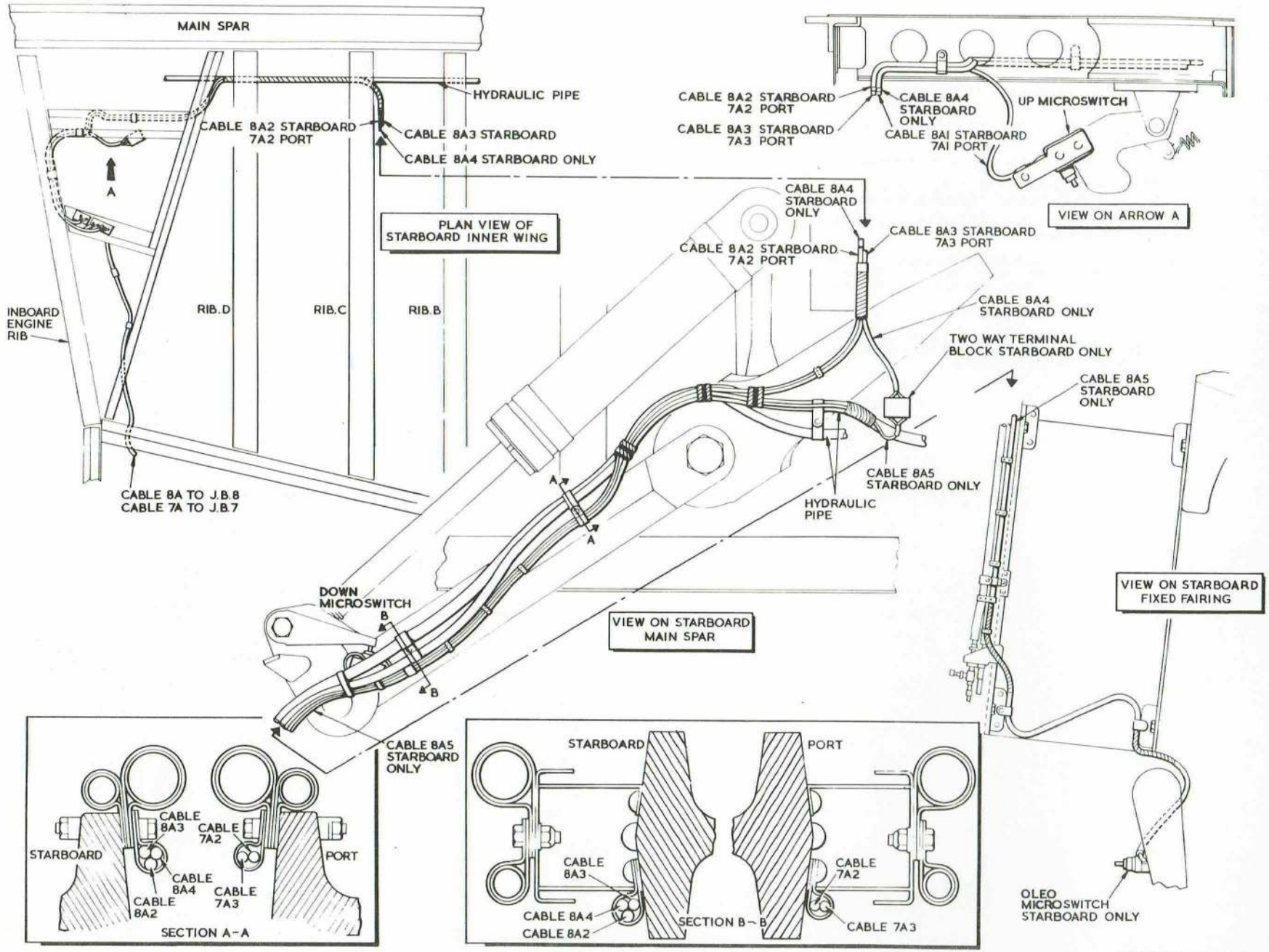


FIG. 6A. MAIN WHEELS—WIRING INSTALLATION

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-0407-1A, SECT. 2,CHAP. 4)
2. PREPARE THE ALIGHTING GEAR FOR HAND PUMP OPERATION (A.P.101B-0407-1A, SECT.2,CHAP.4)
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-0407-1A, SECT. 3,CHAP. 5)

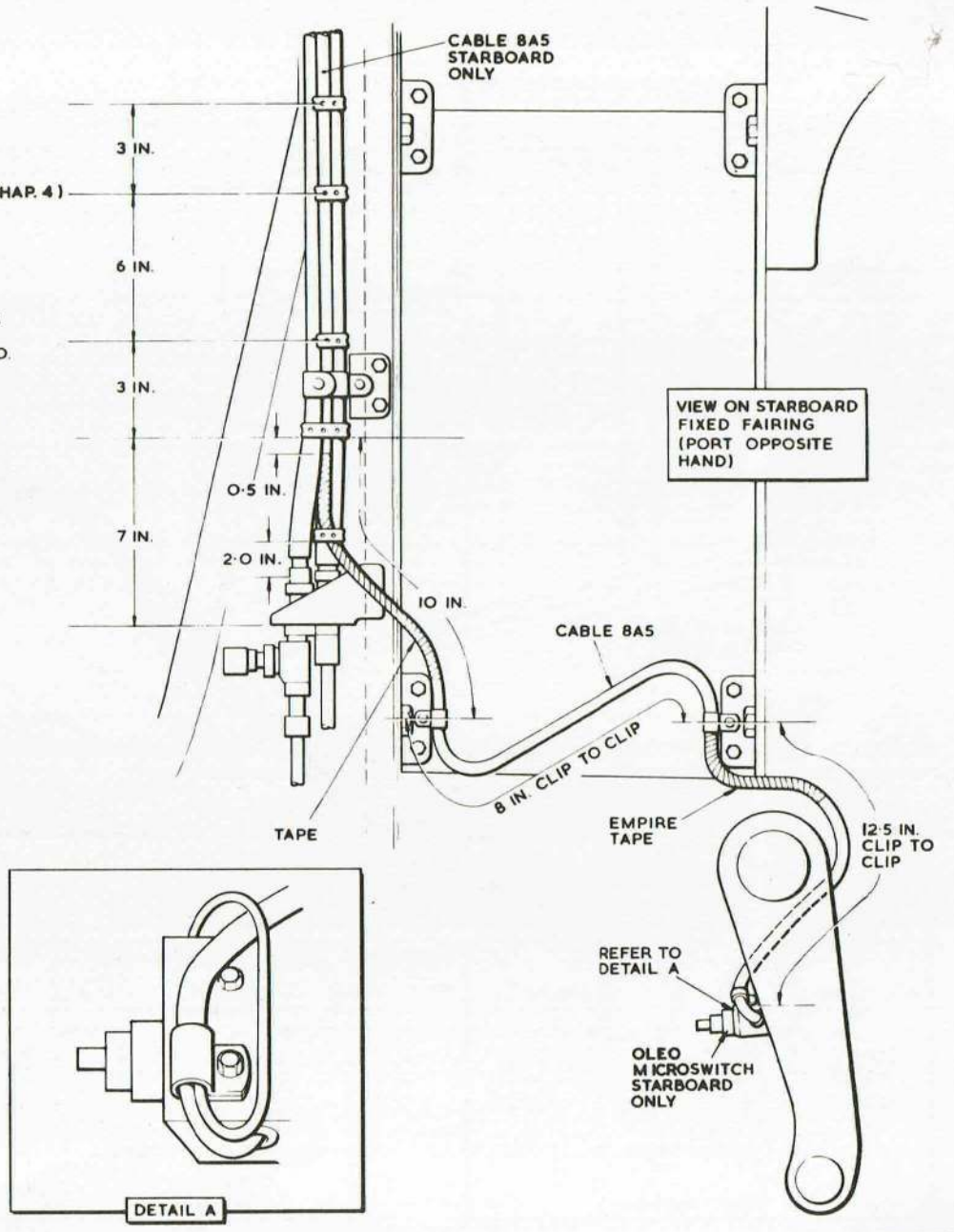


FIG. 6B. MAIN WHEELS - WIRING INSTALLATION

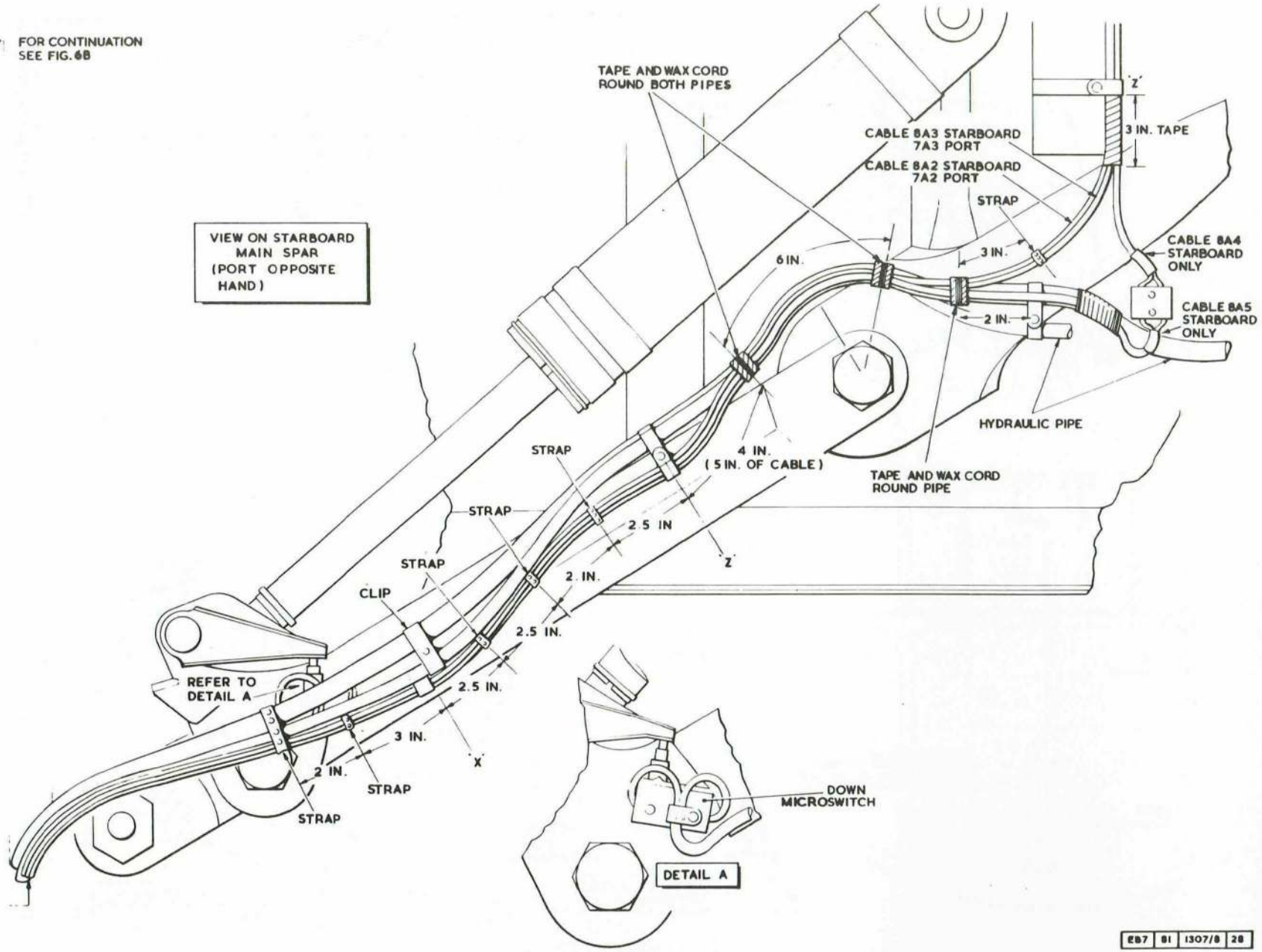


FIG. 6C. MAIN WHEELS - WIRING INSTALLATION

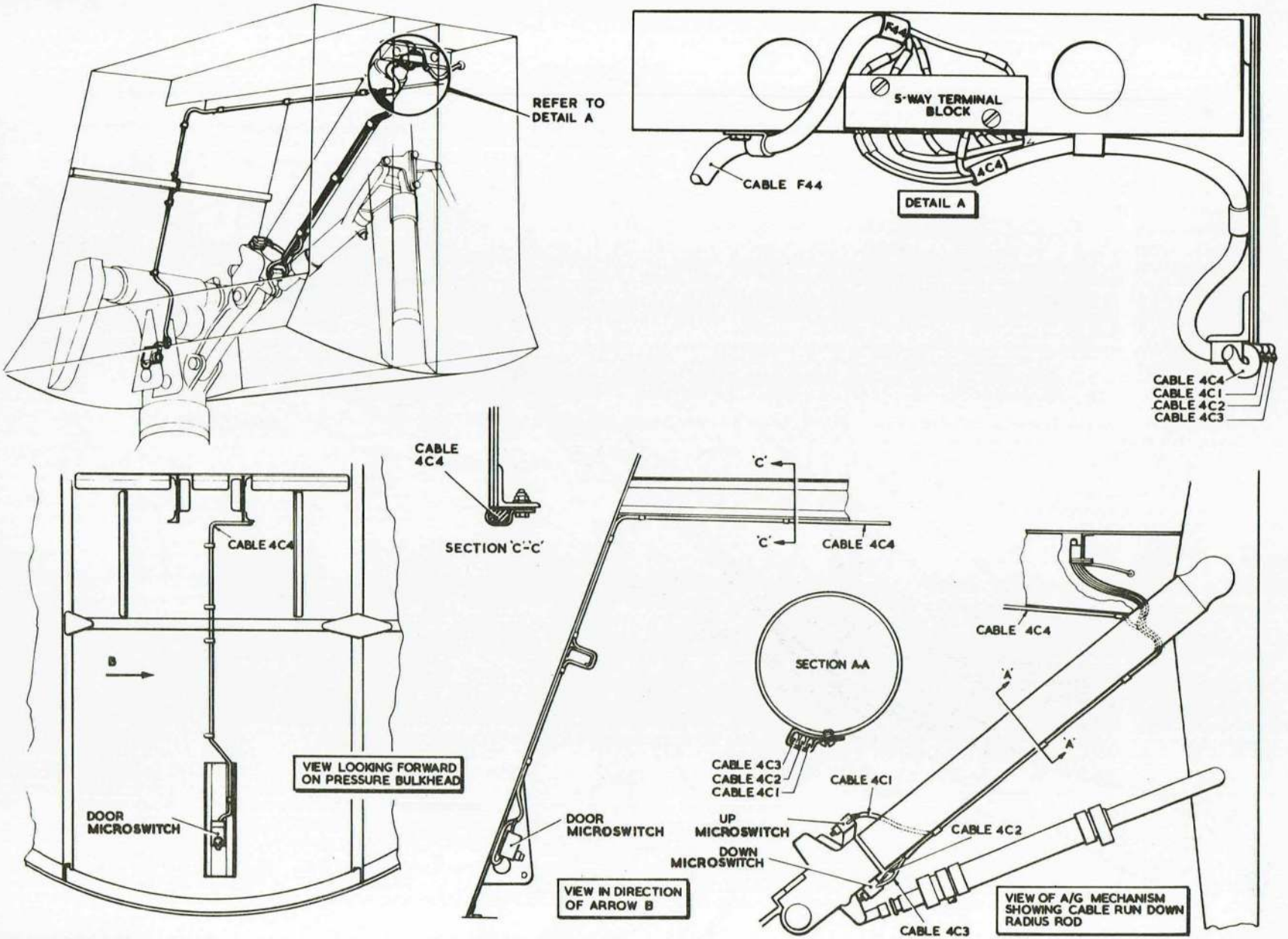


FIG.7. NOSE WHEEL - WIRING INSTALLATION

EA9 | 40 | 1 | 5

FIG.8. ALIGHTING GEAR CONTROL AND INDICATOR

(illustration overleaf)

UK RESTRICTED

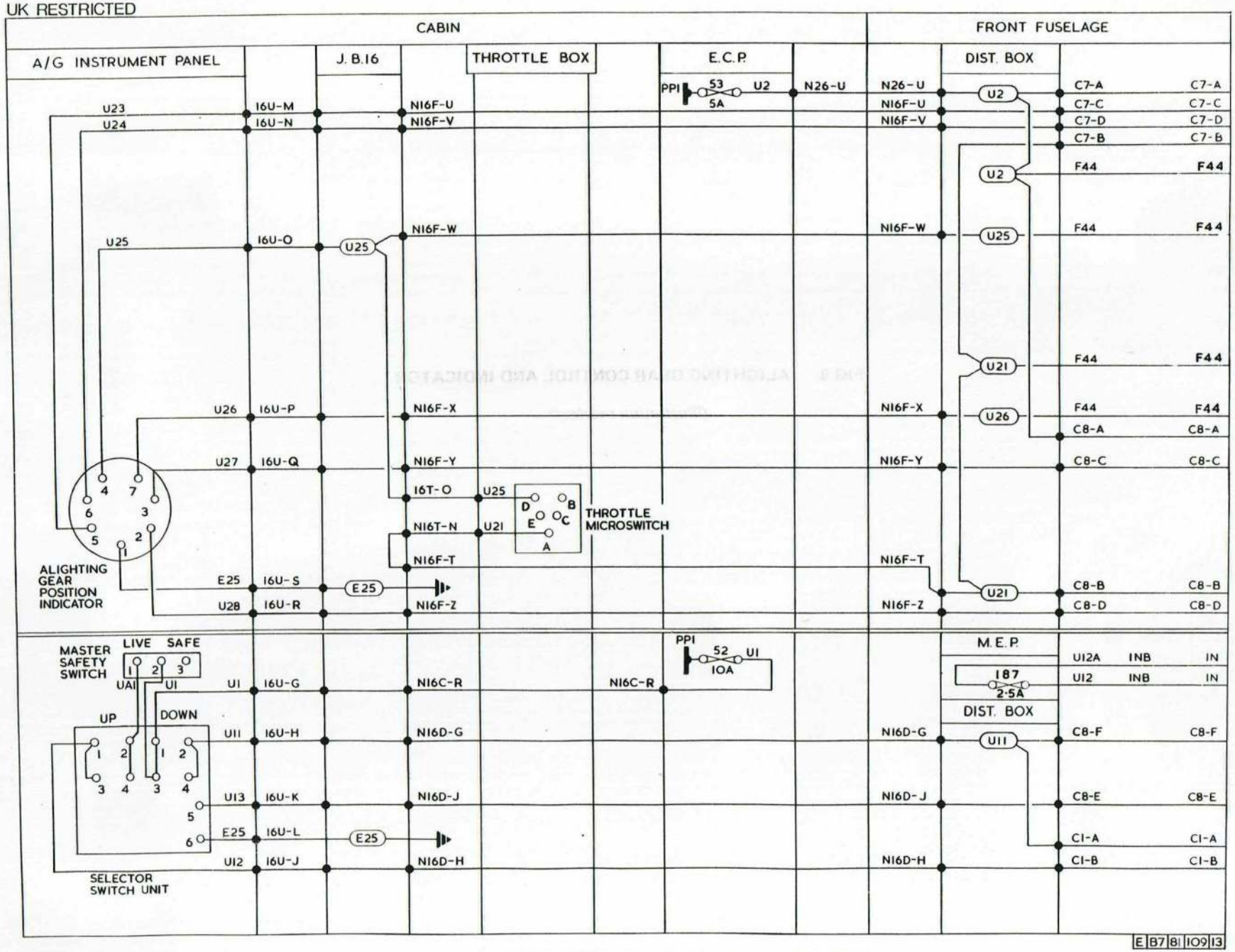
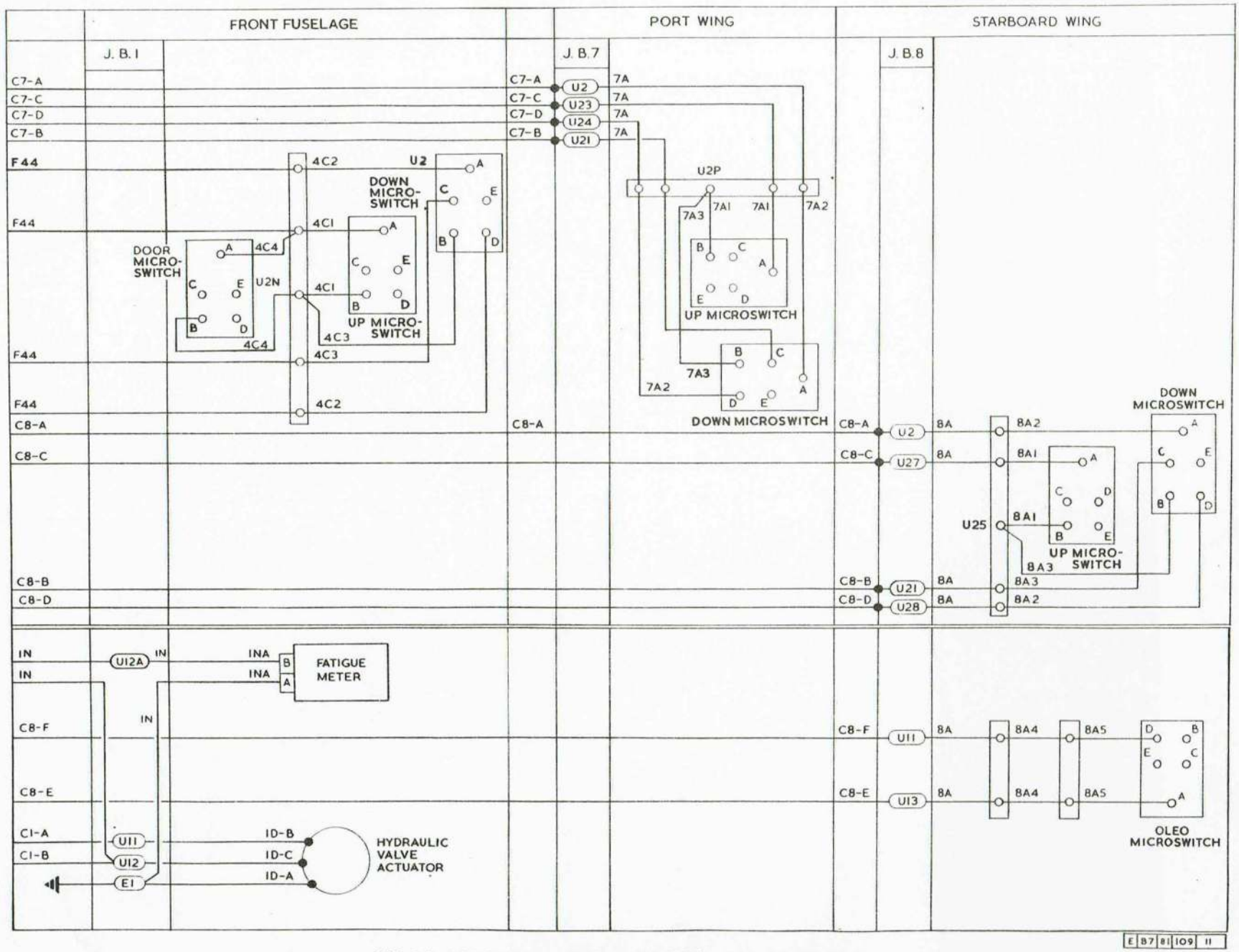


FIG. 8. ALIGHTING GEAR CONTROL AND INDICATOR

◄ SEM/CAN/0141/STC INCORPORATED ►



E 87 81 109 11

FIG.8A. ALIGHTING GEAR CONTROL AND INDICATOR

◄TERMINAL IDENTS AMENDED►

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

(completely revised)

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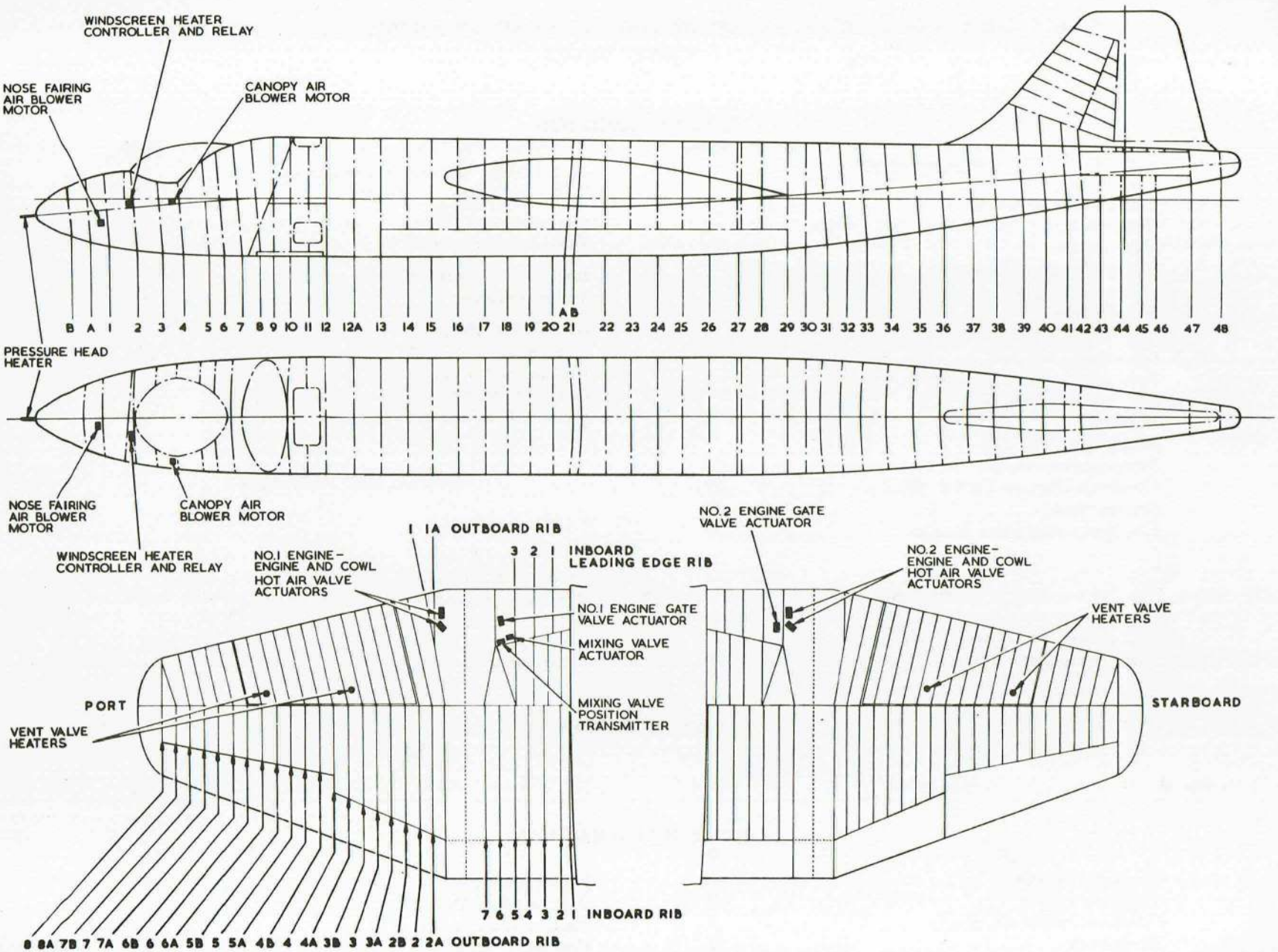

FIG.1. LOCATION DIAGRAM

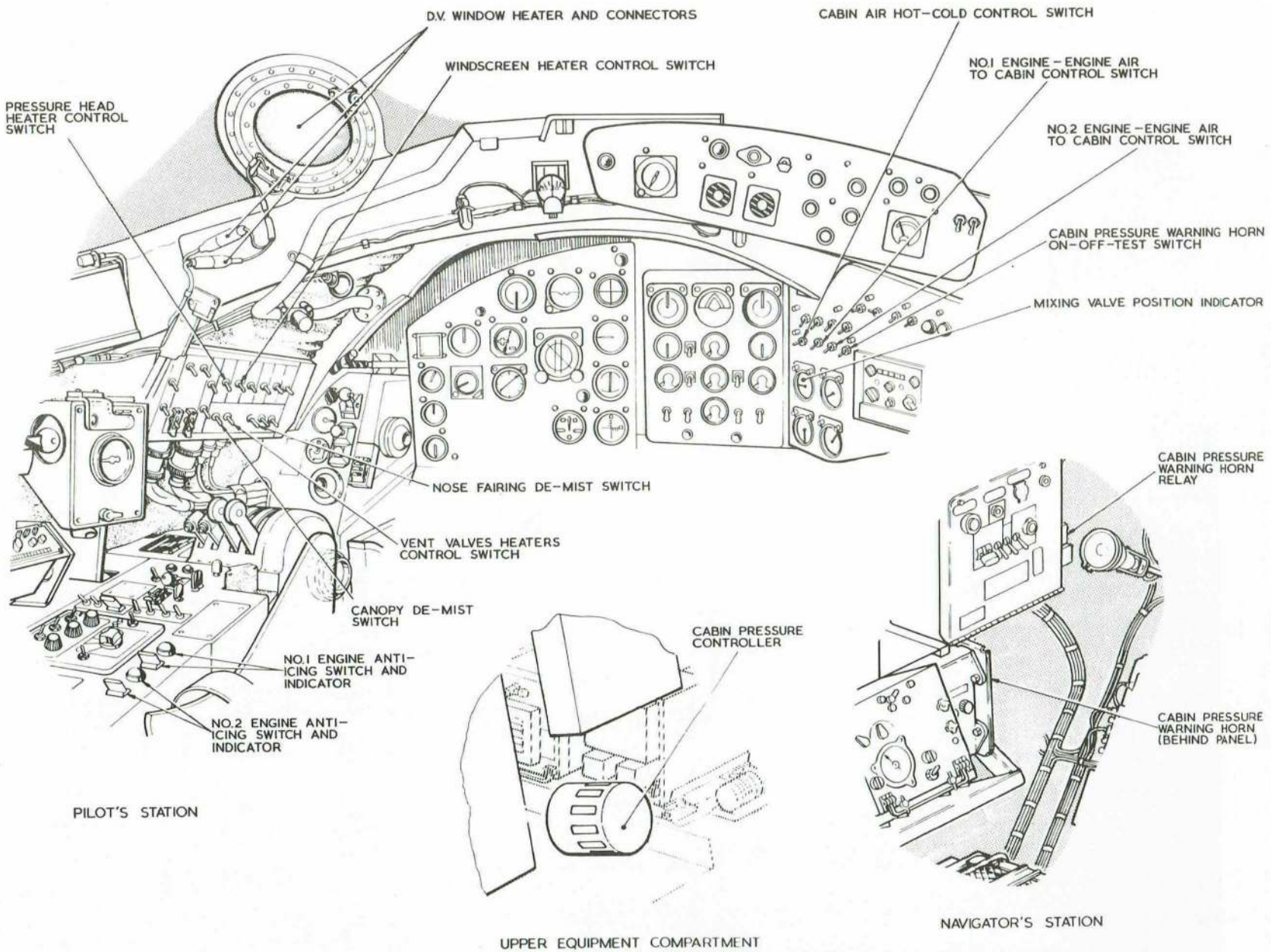

FIG.1A. LOCATION DIAGRAM

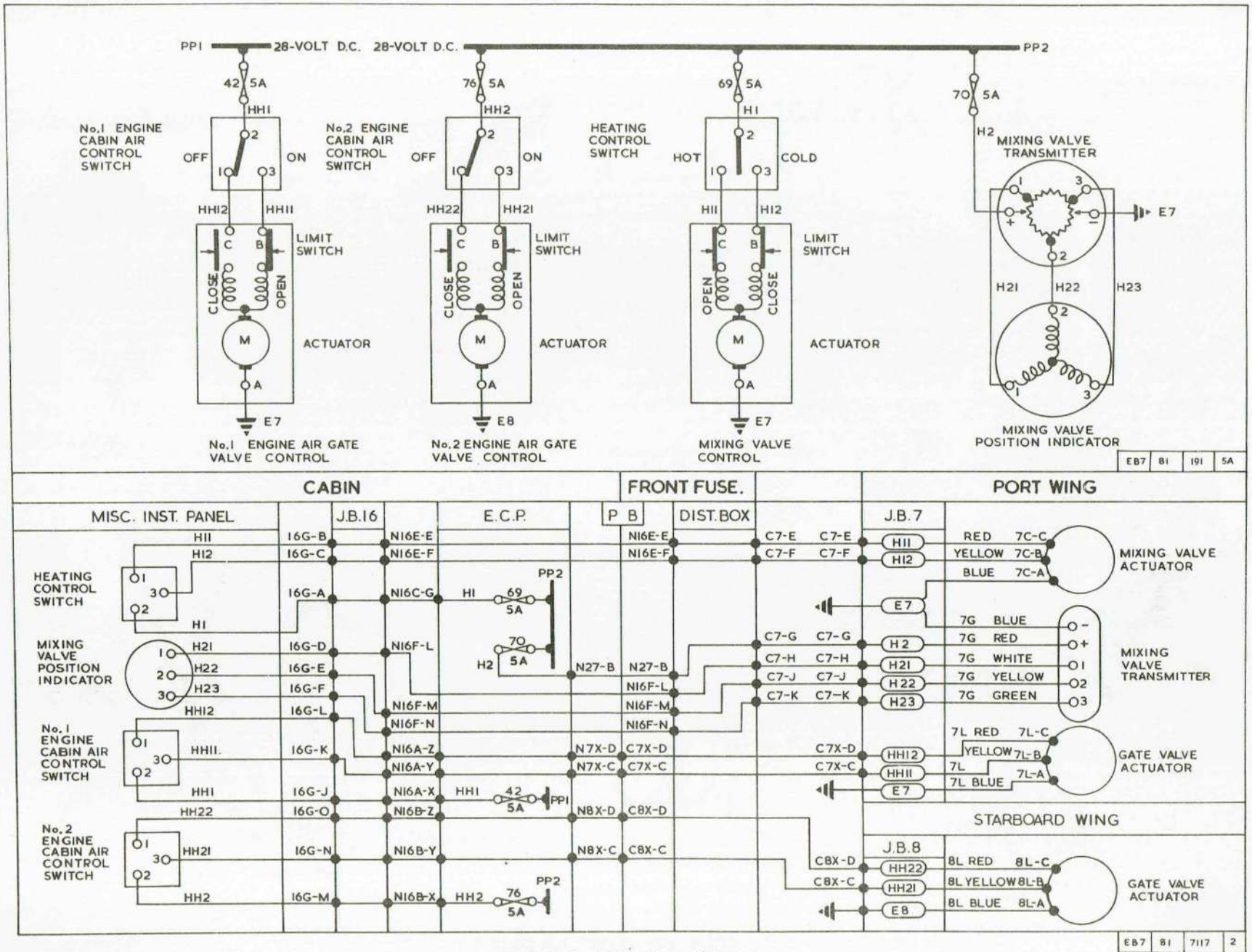

FIG.2. CABIN AIR SYSTEM

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 233 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 mixing 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-0407-1A, Sect.3, Chap.8. The location of principal items relevant to this group are shown in fig.1-1A whilst a list of equipment and relevant Air Publications are given in Table 1.

Gate valves

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

Cabin air pressure warning

3. A switch incorporated in the pressure controller operates a warning device whenever there is a serious loss of pressure. The closing of the switch contacts is arranged to energize a relay which in turn closes and provides a supply to a warning horn. Both the relay and the horn are mounted on the fuselage skin at the starboard side of the navigator's station. The pilot may switch off the warning horn by a 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

4. A pressure controller is mounted 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

5. Misting of the canopy and nose fairing is prevented by circulating dry air between their inner surfaces. Each system, which is totally independent, consists of a motor-driven air blower, an air dryer, containing silica gel crystals, and a filter. The de-misting system is fully described in A.P.101B-0407-1A, Sect.3, Chap.8B.

Canopy

6. The air blower for this system is located forward of the navigator's table, the air dryer is located in the fuselage roof forward of frame 1 and the filter is located on the port side of the canopy coaming tube. The power supply to the air blower is fed through a suppressor and is controlled by the CANOPY DE-MIST switch on the take-off panel.

Nose fairing

7. All the components for this system are located under the floor at the nose station. The air blower and dryer are located on the forward face of frame 1 and the filter is located on the fuselage skin, aft of frame B at the starboard side. The power supply to the air blower is fed through a suppressor and is controlled by the NOSE DE-MIST switch on the take-off panel.

ENGINE ANTI-ICING

General

8. Icing of the engine intakes and the engine cowling is pre-

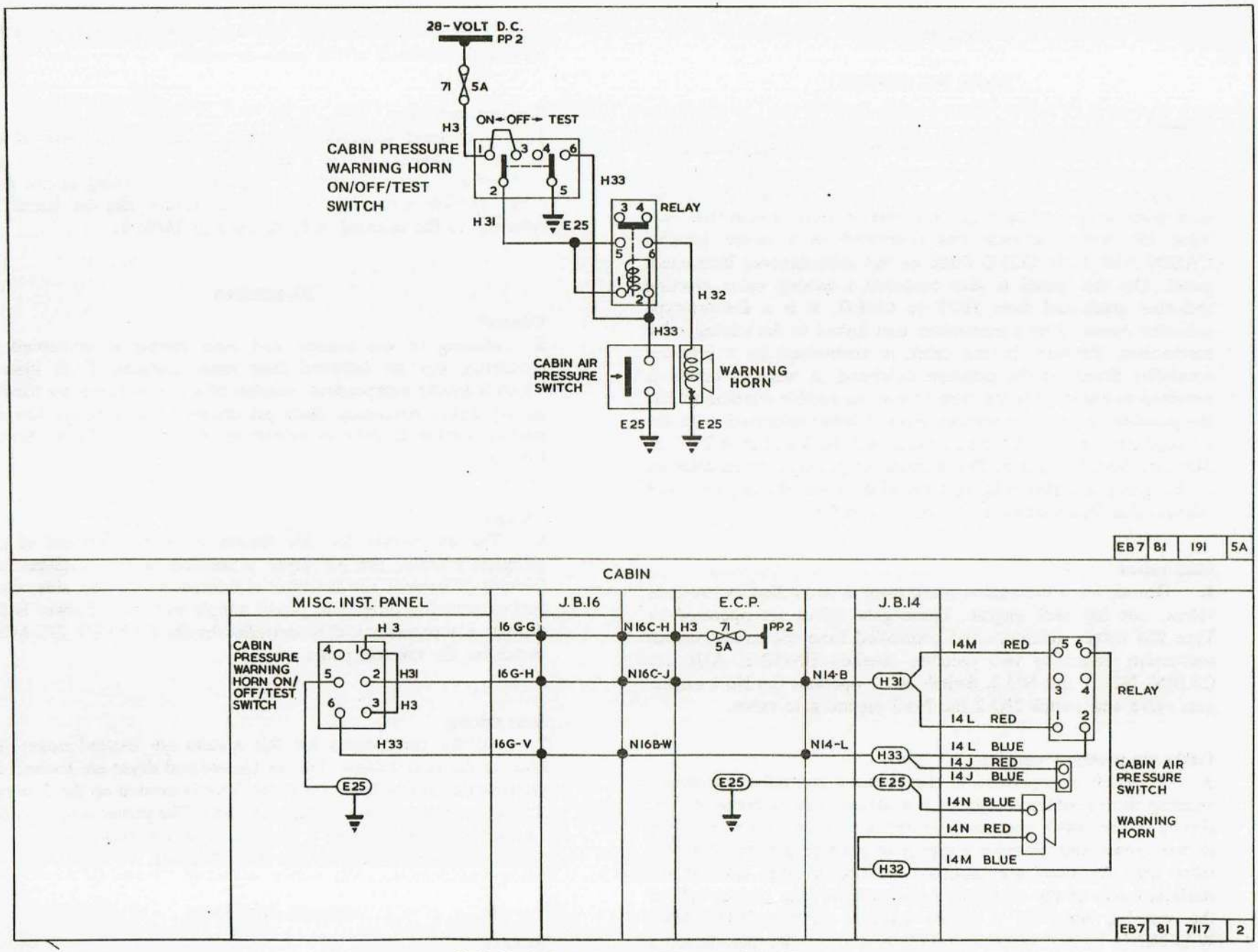

FIG. 3. CABIN AIR SYSTEM WARNING

◄SWITCH ANNOTATIONS AMENDED►

vented by ducting into these regions a supply of hot air tapped from the engine compressor stages. The engine intake hot-air supply is controlled by two gate valves which are operated by Type FKH/A/1 Teddington actuators. The hot air supply to the engine cowlings is controlled by two gate valves which are operated by Type 234 actuators.

9. Fitted to each engine is a Teddington thermostatic control unit, Type FDF/A/4020, these are inoperative but are still connected in circuit. Reference to the theoretical and routeing diagrams will show that the connecting plug pins are internally linked.

10. The control switches, which are annotated ANTI-ICING SWITCHES, PORT-ON-OFF and STBD-ON-OFF, are located on the console. In addition, two magnetic indicators which show white when energized, are also fitted on the console to indicate that the system is operating.

HEATER CIRCUITS

Direct vision window

11. 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 HEATERS, WINDSCREEN ON-OFF, on the take-off panel. Connections to the elements are made by non-interchangeable 2-pin plugs and sockets below the canopy coaming.

Controller, Plessey Type 4, Mk.1

12. 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

13. A heating element is embodied in the pressure head to prevent icing. The supply to the element, fed from busbar PP2 through a fuse in the E.C.P. is controlled by the HEATERS, PRESSURE HEAD ON-OFF switch on the take-off panel.

Fuel tanks vent valve heaters

14. Icing of the two vent valves fitted in each wing integral fuel tank and the fuselage tank is prevented by the use of the heater elements built into the valve assemblies. The heaters are controlled by the VENT VALVES ON-OFF switch on the take-off panel and protected by a fuse 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.

CABIN AIR SYSTEM

Valve actuators

15. Normal servicing of the valve actuators 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 both mixing and gate valve actuators is through the leading edge panels inboard of each engine.

Desynn indicator and transmitter unit

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

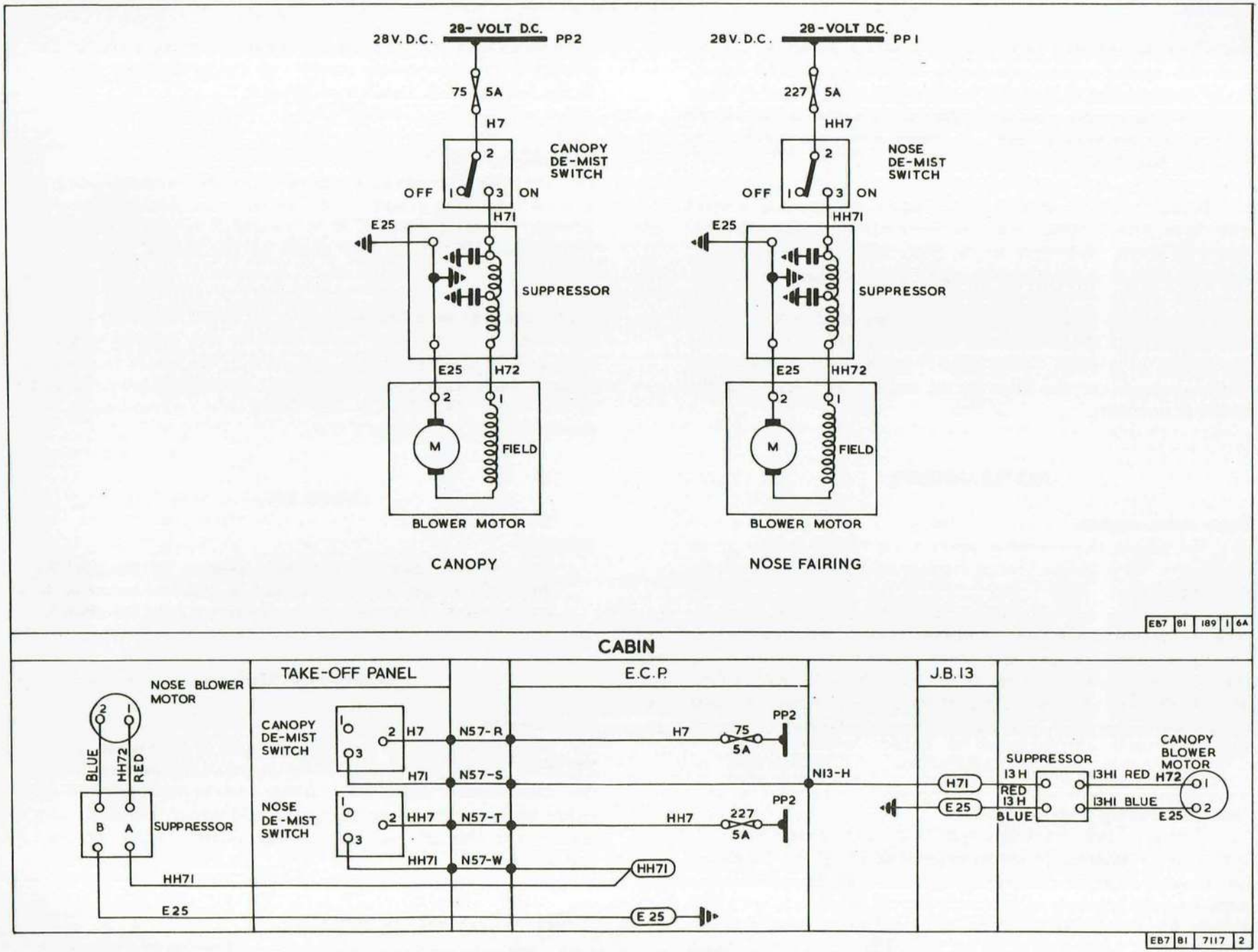

FIG.4. DE-MISTING

Cabin air pressure warning

17. 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.

18. A further test may be carried out by selecting the override 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 motors

19. Servicing of the blower motors 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.

ENGINE ANTI-ICING

Valve actuators

20. Normal servicing of the valve actuators is confined to checking brush length, examination of the commutator, and removal of any accumulated carbon dust, which can be accomplished by removing the motor end cover. Access to the gate-valve actuators is by removing the engine cowling, the actuators being outboard on each engine.

HEATER CIRCUITS

D.V. window checks

21. 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 terminal, 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

22. 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

23. Remove the fuses 74 and 144, and disconnect plugs and sockets (N 74) 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 74 and 144. 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 (N 74) 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.

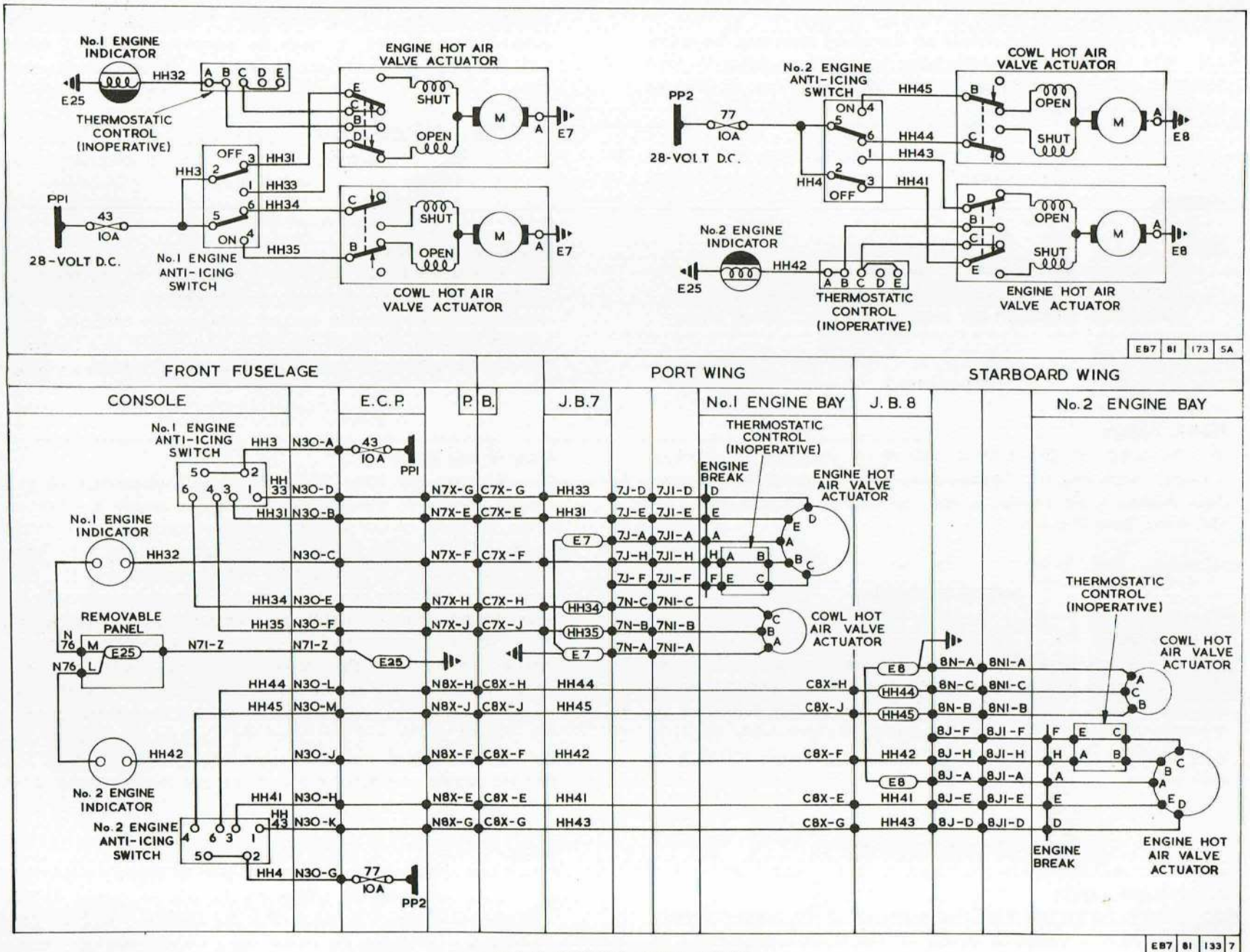

FIG. 5. ENGINE ANTI-ICING

Pressure head heater

24. 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

25. The removal of any actuator, the Desynn transmitter, or the pressure controller is described in A.P.101B-0407-1A, Sect.3, Chap.8

HEATER CIRCUITS

Direct vision window

26. 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

27. 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

28. 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.

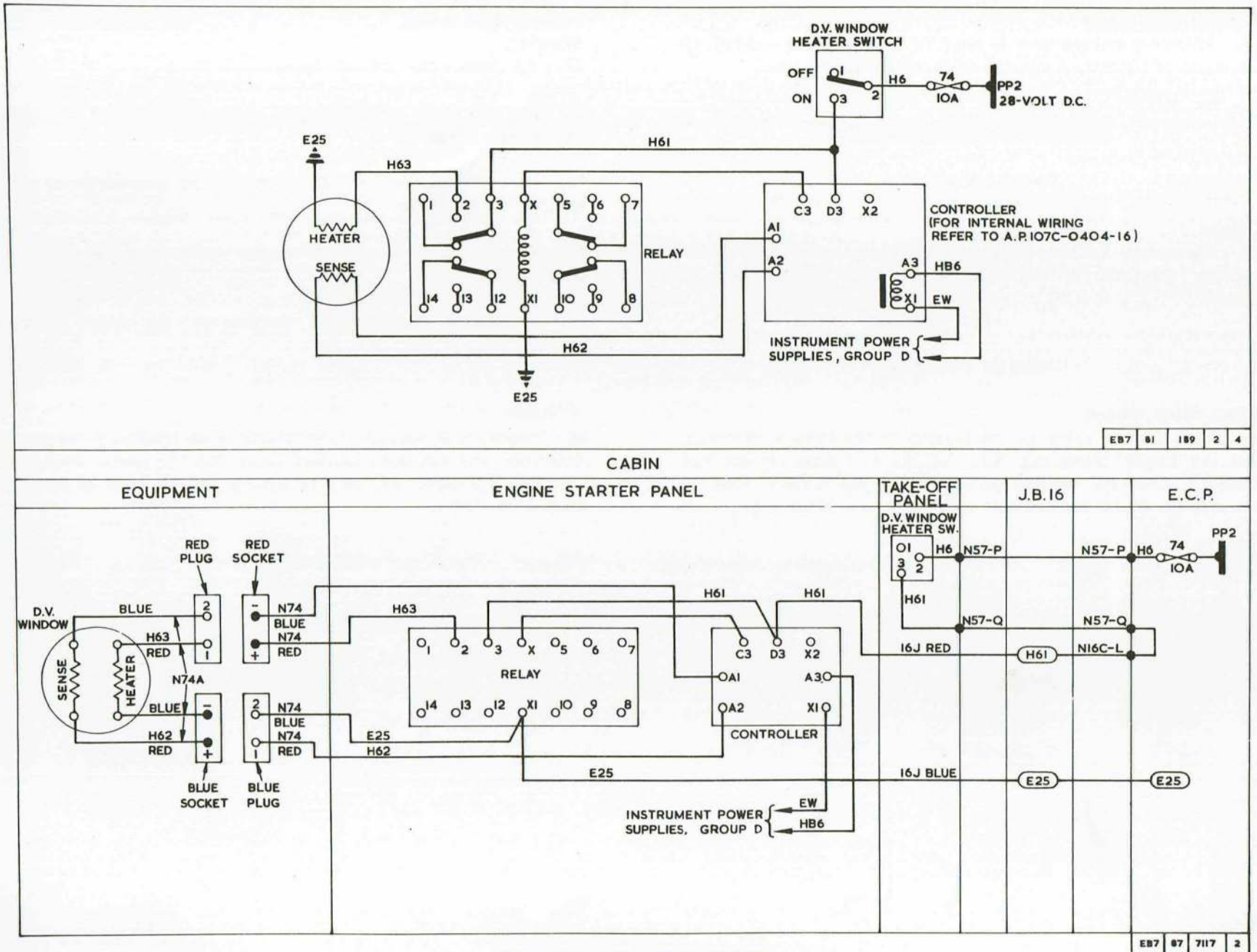

FIG.6. D.V. WINDOW HEATER

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5W/4511909	Actuator Type 233	1	A.P.113E-0249-1
◀ 5W/4511908 ▶	Actuator Type 234	4	
5UD/3310	Air blower Type 1 (Canopy)	1	A.P.113E-03104-1
5UD/4388048	Air blower Type 701 (nose)	1	A.P.113E series
5CY/7001363	Suppressor Type B4 (canopy)	1	A.P.113D-1902-1
5CY/4376472	Suppressor Type AEC 603002 (nose)	1	
◀ 27KD/4631299 ▶	Cabin pressure controller	1	A.P.107B-1407-16
5CZ/1961	Warning horn Type C	1	A.P.113F series
◀ 5UC/4395825 ▶	Controller, Plessey Type 4	1	A.P.107C-0404-16
6A/4333460	Pressure head Mk.8W	1	A.P.112G-0629-1
◀ 6A/4333350 ▶	Desynn indicator Type 505FL	1	A.P.112G-0559-1
6A/2133	Desynn transmitter Type C	1	

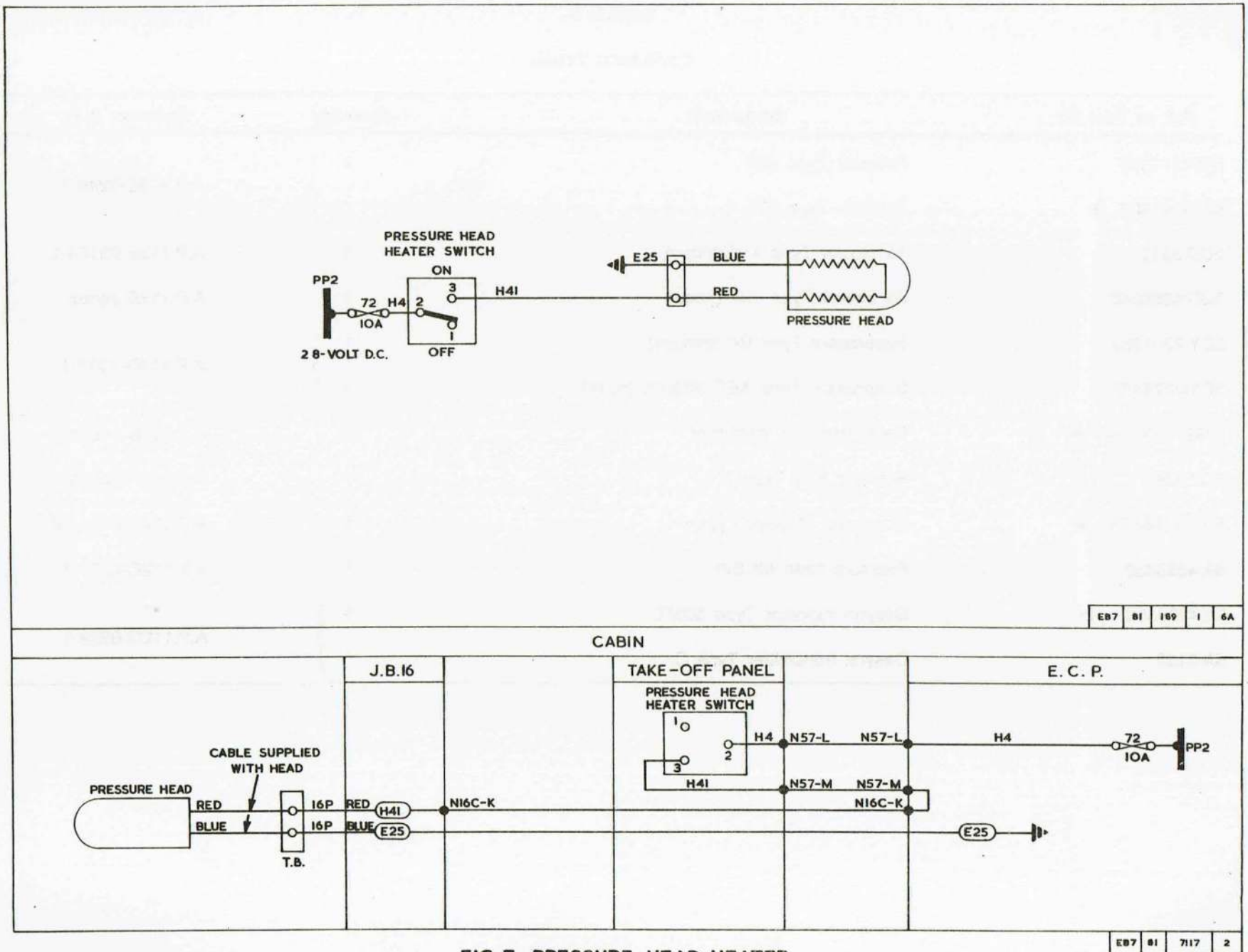

FIG. 7. PRESSURE HEAD HEATER

◄PIN IDENTS ADDED►

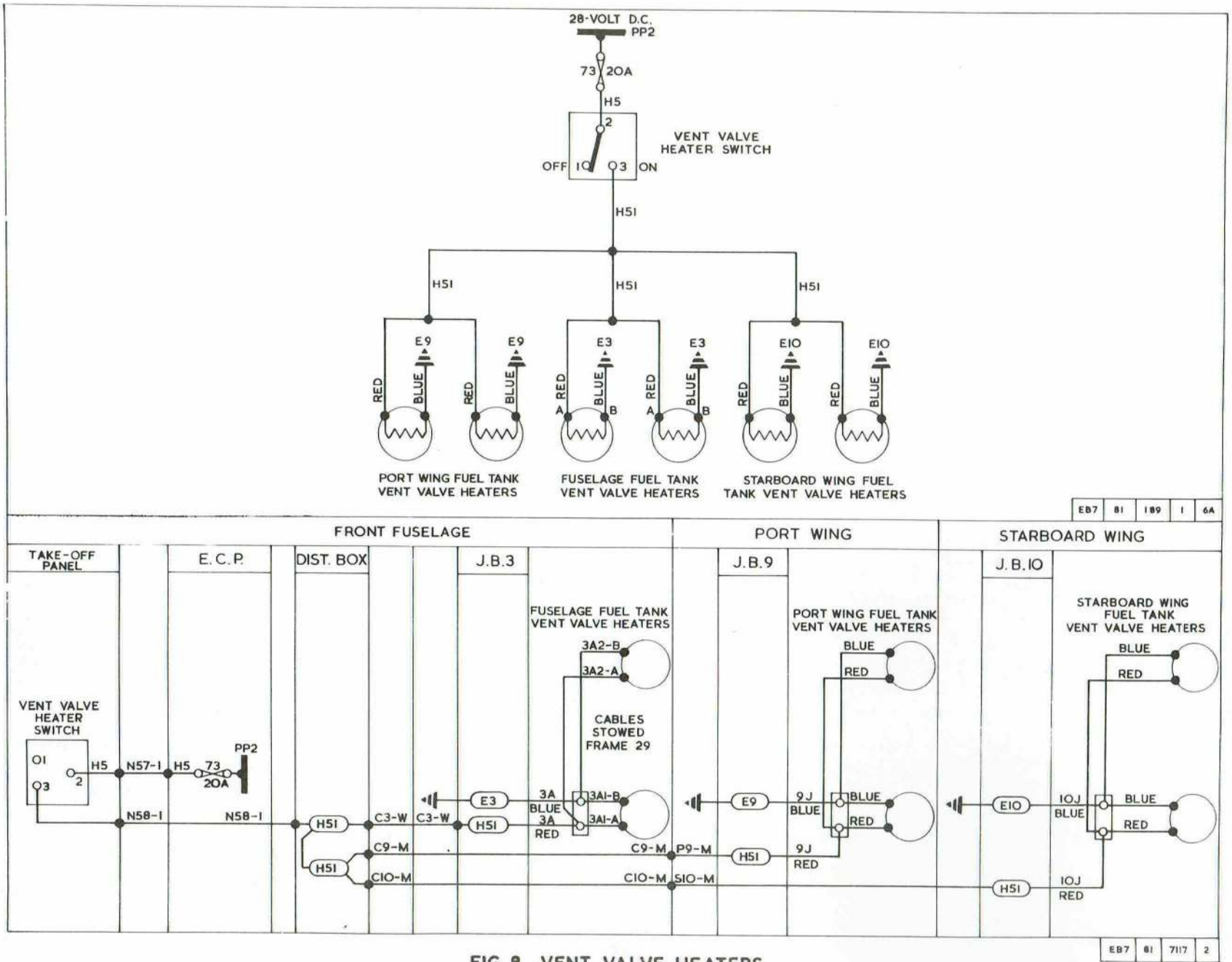

FIG. 8. VENT VALVE HEATERS

ENGINE SERVICES — GROUP J & K

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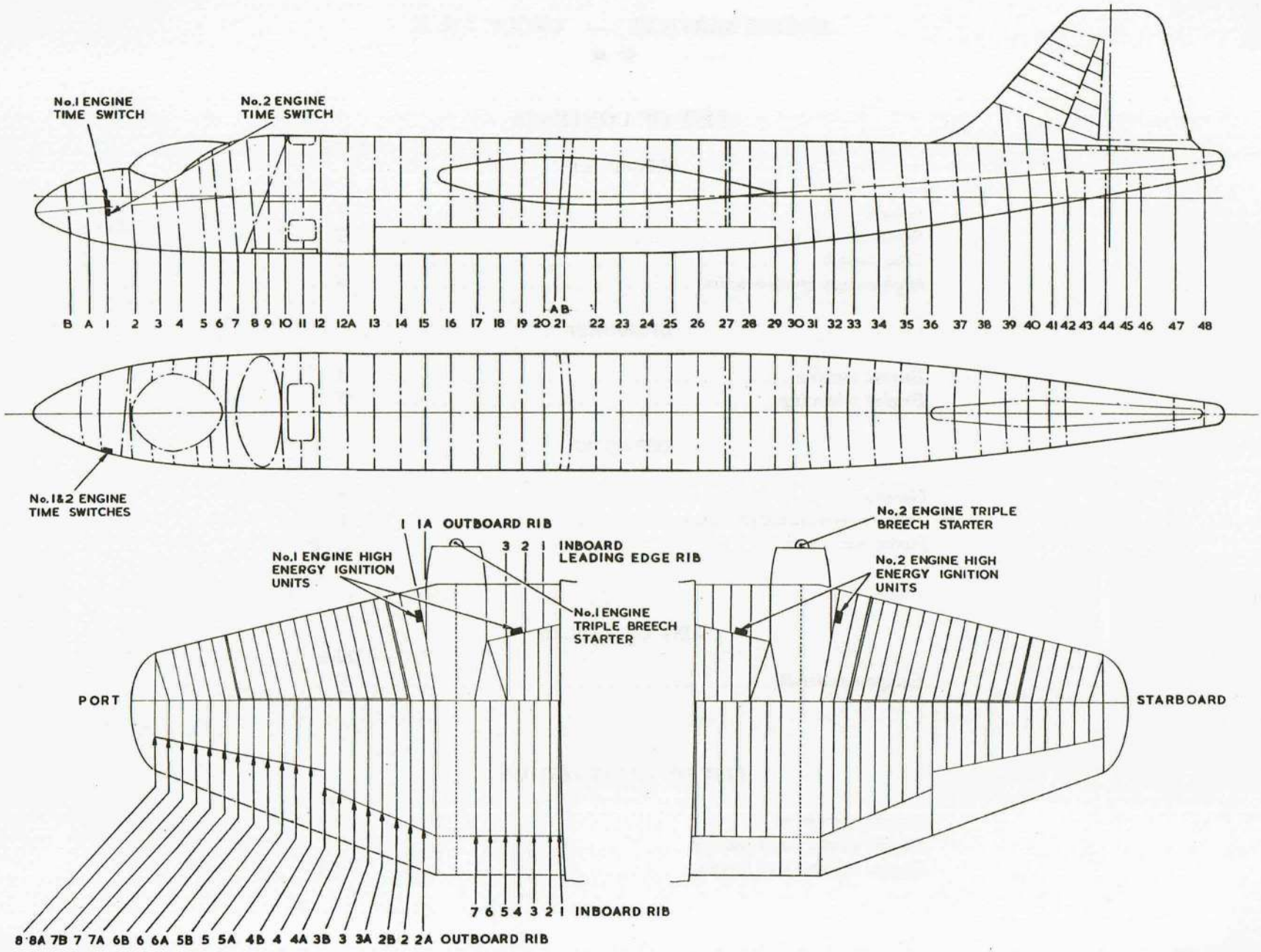

FIG.I. LOCATION DIAGRAM

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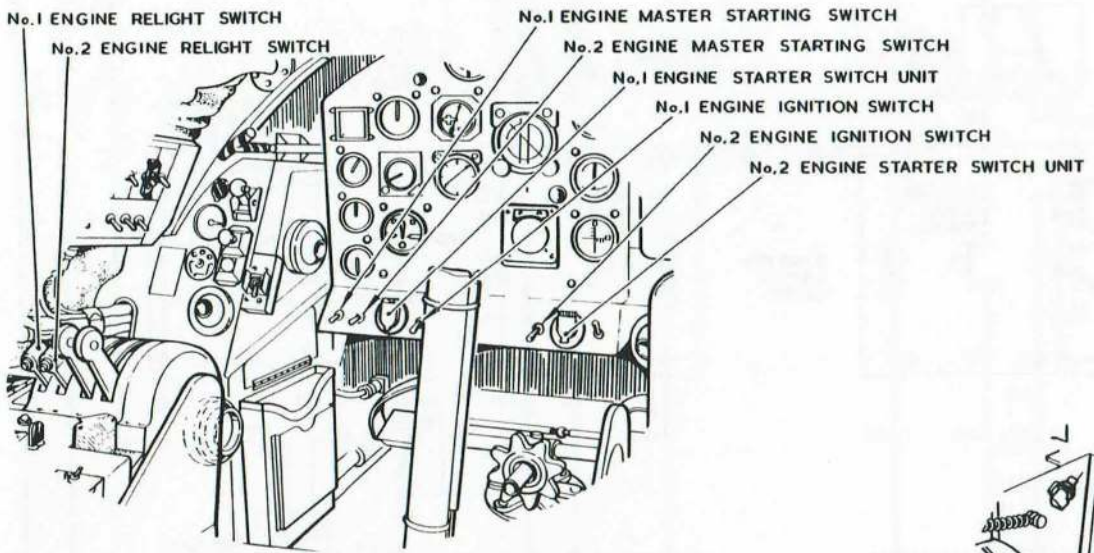
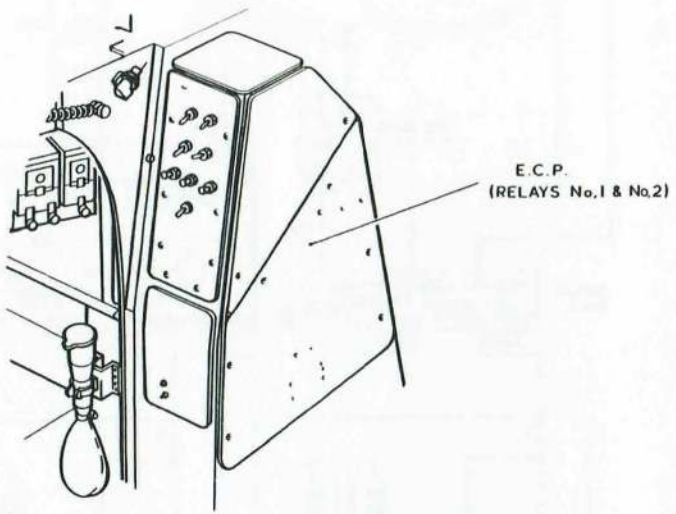


PILOT'S STATION



NAVIGATOR'S STATION

FIG. 1A. LOCATION DIAGRAM

◀ SEM/CAN/0167/STC INCORPORATED ▶

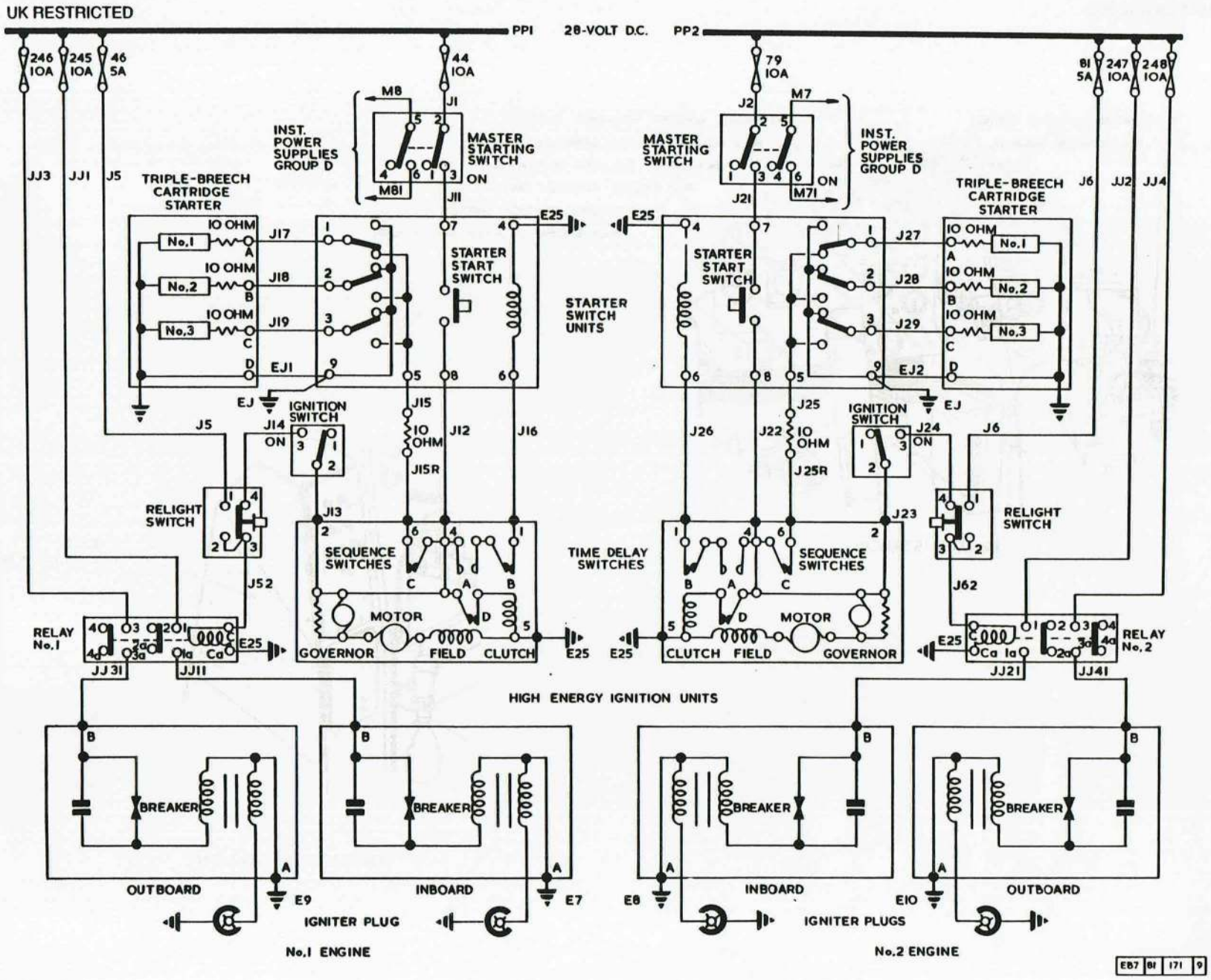


FIG.2. ENGINE STARTING AND IGNITION

DESCRIPTION

General

1. Each engine starting system comprises a triple-breech starter mounted at the centre of the air intake, two high-energy ignition units, and two igniter plugs which operate in conjunction with an ignition switch on the starter panel, a relay in the E.C.P., a starter switch unit, and a time-delay switch. The cartridge, when fired, releases gases which, fed to a small turbine in the starter unit, cause the turbine to rotate the engine long enough for light-up to occur.

Starter switch unit

2. The engine start switch and the mechanism for selecting the cartridge to be fired are embodied in a STARTER switch unit mounted on the starter panel. The STARTER switch push-button is linked by a push-rod to a rotary switch that selects the cartridge to be fired, and, as a safety measure, simultaneously earths the firing circuit of the other two cartridges. The push-button, after being pressed, is held depressed by a solenoid energized by a positive feed from contacts 'B' in the time switch until the functioning sequence of the switch is completed.

Time switch

3. After the STARTER switch push-button is pressed, engine starting is automatically controlled by a time switch, located in the nose forward of the rudder pedals. The switch embodies a magnetic clutch and a motor-driven switch mechanism designed to open and close a series of contacts, referenced A, B, C and D, in a set sequence.

High-energy ignition units

4. Two of these units are used in each engine circuit. One is mounted in the wing leading edge and access to it is obtained by taking off the wing top panel which is normally removed for servicing the generators. The other unit is mounted on the outboard engine rib and is accessible after the removal of a detachable panel on the underside of the wing.

OPERATION

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.** ▶

Engine starting

5. Pressing the STARTER switch push-button initiates the functioning of the time-delay switch as follows:-

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

(2) Contacts 'C', closed at start, open $5 \begin{smallmatrix}+2\\-0\end{smallmatrix}$ seconds later.

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

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

6. Providing that the MASTER STARTING and IGNITION switches are ON, the above cycle of operations will result in the following action:-

(1) The selected cartridge is fired.

(2) The STARTER switch push-button hold-in coil is energized.

(3) The relay in the E.C.P. closes to actuate the H.E. ignition units.

(4) The engine should start up.

Engine relighting

7. 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.

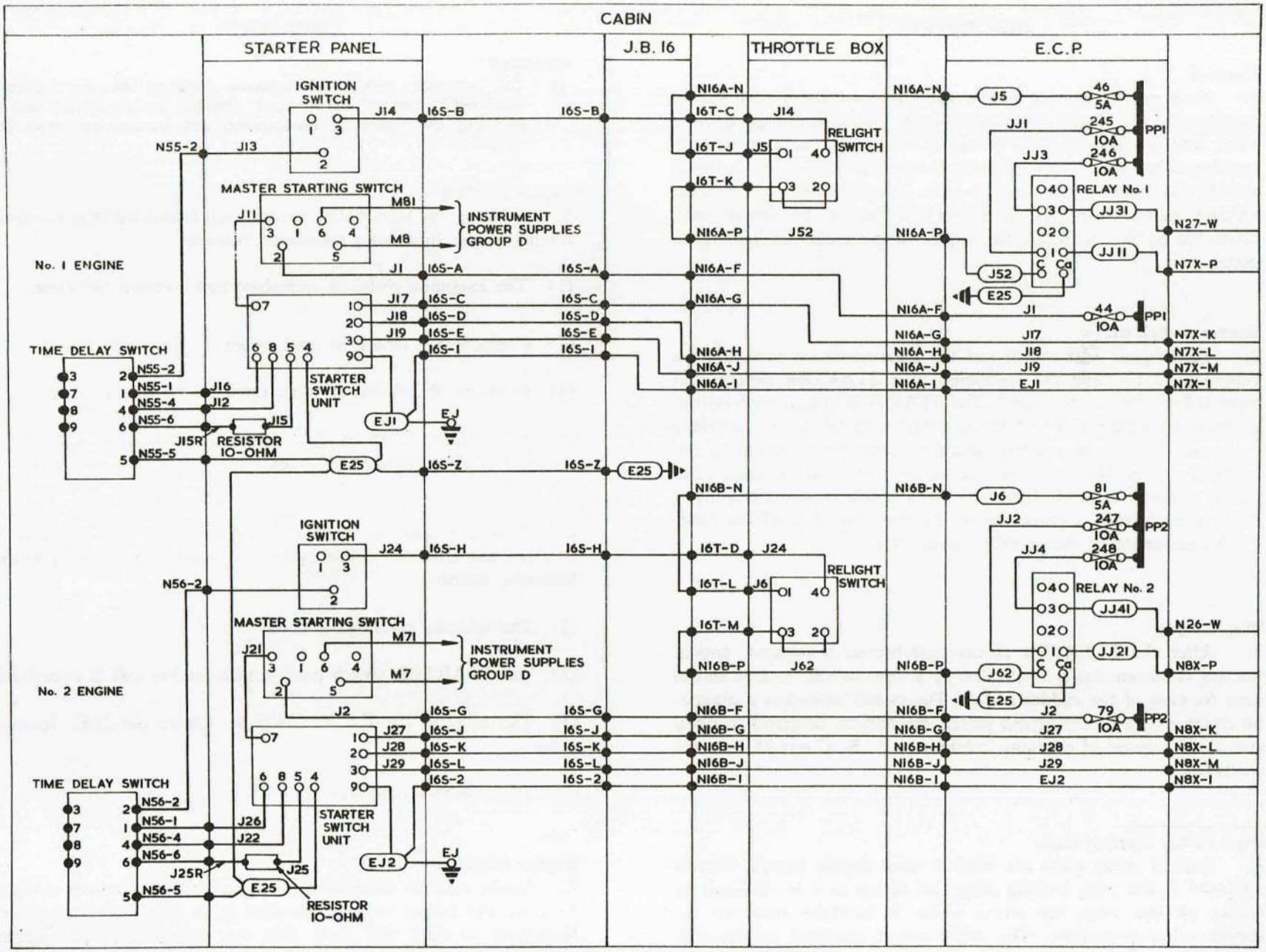


FIG. 3. ENGINE STARTING AND IGNITION

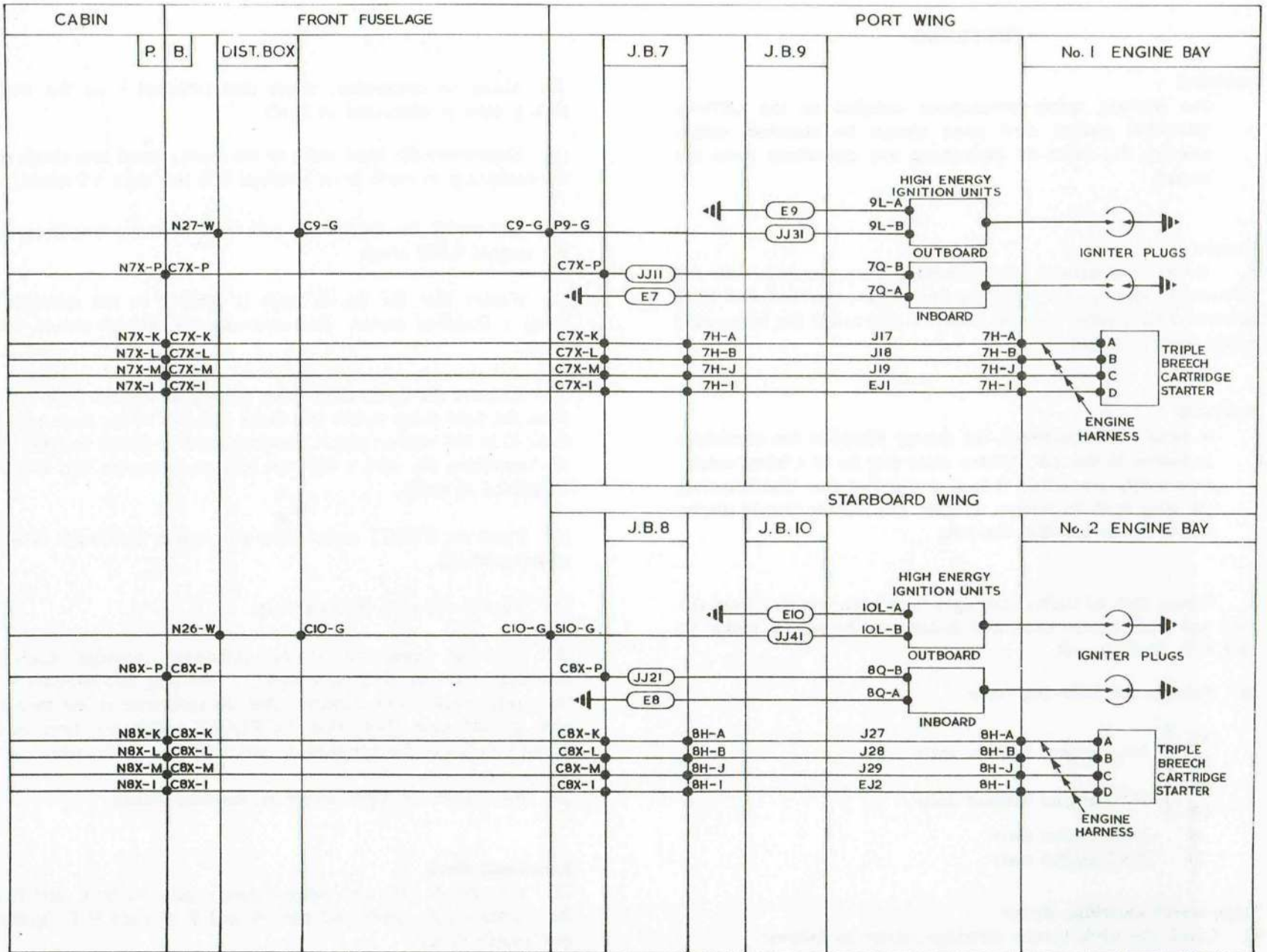


FIG.3A. ENGINE STARTING AND IGNITION

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. Before commencing the following tests, ensure that the instrument supplies have been checked, if not, the No.1 and No.2 inverter control fuses must be removed to protect the instrument power supplies circuit.

WARNING

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

9. Ensure that all starter cartridges have been removed from the No.1 and No.2 starter units and disconnect the supply socket to each H.E. ignition unit.

10. Remove the following fuses:-

245, 246	No.1 engine ignition units
247, 248	No.2 engine ignition units
44	No.1 engine start
79	No.2 engine start

Triple-breech cartridge starter

11. Check the triple-breech cartridge starter as follows:-

(1) Using an ohmmeter, check that terminal 9 on the starter switch units is connected to earth.

(2) Disconnect the local earth at the starter panel and check that the resistance to earth from terminal 9 is less than 1.0 ohms.

(3) Reconnect the local earth and check that the resistance does not exceed 0.025 ohms.

(4) Ensure that the starter body is earthed to the airframe by using a Bonding Tester. The resistance should not exceed 0.025 ohms.

(5) Remove the 4-pin socket from the starter and the 9-pin socket from the time delay switch and check that two of the three pins A, B or C in the starter socket are connected to pin D (earth). Test the remaining pin with a 500 volt Megger to ensure that it is not connected to earth.

(6) Press the START switch once and repeat the checks detailed at sub-para.(5).

(7) Repeat sub-para.(6) four times.

(8) Test the resistance of the individual cartridge leads by measuring between pins A, B and C at the plug and terminal 9 on the starter switch unit, ensuring that the resistance is less than 1.0 ohm in each case. Note that the START switch will have to be pressed to select the appropriate cartridge lead under test.

(9) Reconnect the 9-pin socket to the time switch.

Functional check

12. Connect 28 volt test lamps between pins A, B, C and D of the starter 4-pin socket and pins A and B of each H.E. ignition unit supply socket.

◀ Note . . .

Check fuses for correct rating and serviceability on refitment.

13. Connect 28 volt external supply to the aircraft and switch ON. Set No.1 engine MASTER STARTING and IGNITION switches to ON.

14. Check operation of starter cartridge and ignition circuits as follows:-

(1) Momentarily press the No.1 engine START switch.

RESULT: No effect.

(2) Refit No.1 engine start fuse *(para.10).*

RESULT: No effect.

(3) Momentarily press the No.1 engine START switch.

RESULT: Only one of the three No.1 engine cartridge test lamps will illuminate and then extinguish after 5 seconds. Note which lamp illuminates. The H.E. ignition test lamps should NOT illuminate.

(4) Refit the No.1 engine ignition fuses *(para.10).*

RESULT: No effect.

(5) Momentarily press the No.1 engine START switch.

RESULT: Only one of the three No.1 engine cartridge test lamps will illuminate and then extinguish after 5 seconds. Note that it is a different lamp to that at sub-para.(3). The H.E. ignition test lamps illuminate and then extinguish after 30 seconds.

(6) Wait until all test lamps are extinguished and the starter switch unit has reset then momentarily press the No.1 engine START switch.

RESULT: Same as at sub-para.(5) except that the third cartridge test lamp should illuminate.

(7) Press the No.1 engine START switch six times at 30 second intervals.

RESULT: A different cartridge test lamp should illuminate each time in the correct sequence and the H.E. ignition test lamps should illuminate every time.

(8) Press and hold the No.1 engine RELIGHT switch.

RESULT: The No.1 H.E. ignition test lamps should illuminate.

(9) Select No.1 engine IGNITION switch to OFF.

RESULT: The No.1 H.E. ignition test lamps should extinguish.

(10) Release the No.1 engine RELIGHT switch.

RESULT: No effect.

15. Select No.1 engine MASTER STARTING switch to OFF and switch OFF 28 volt external supply.

16. Remove test lamps from the No.1 engine starter and H.E. ignition unit sockets and reconnect sockets to starter and H.E. ignition units respectively.

17. Repeat the tests detailed in paras. 12 to 16 substituting No.2 engine for No.1 engine.

18. Refit the No.1 and No.2 inverter control fuses if removed at para.8.

19. Any suspected faults in the wiring should be investigated with the aid of the theoretical and routeing diagrams included in this group. ▶

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5CW/4402866	Time switch, Teddington Type FHM/A/25	2	113D-1404-16
5CW/4402868	Starter switch unit, Teddington Type FJB/A/3 or FJB/A/5	2	113D-1329-16
37A/1601	Ignition unit	4	113L series
37F/11005	Triple breech starter	2	

LIGHTING — GROUP L

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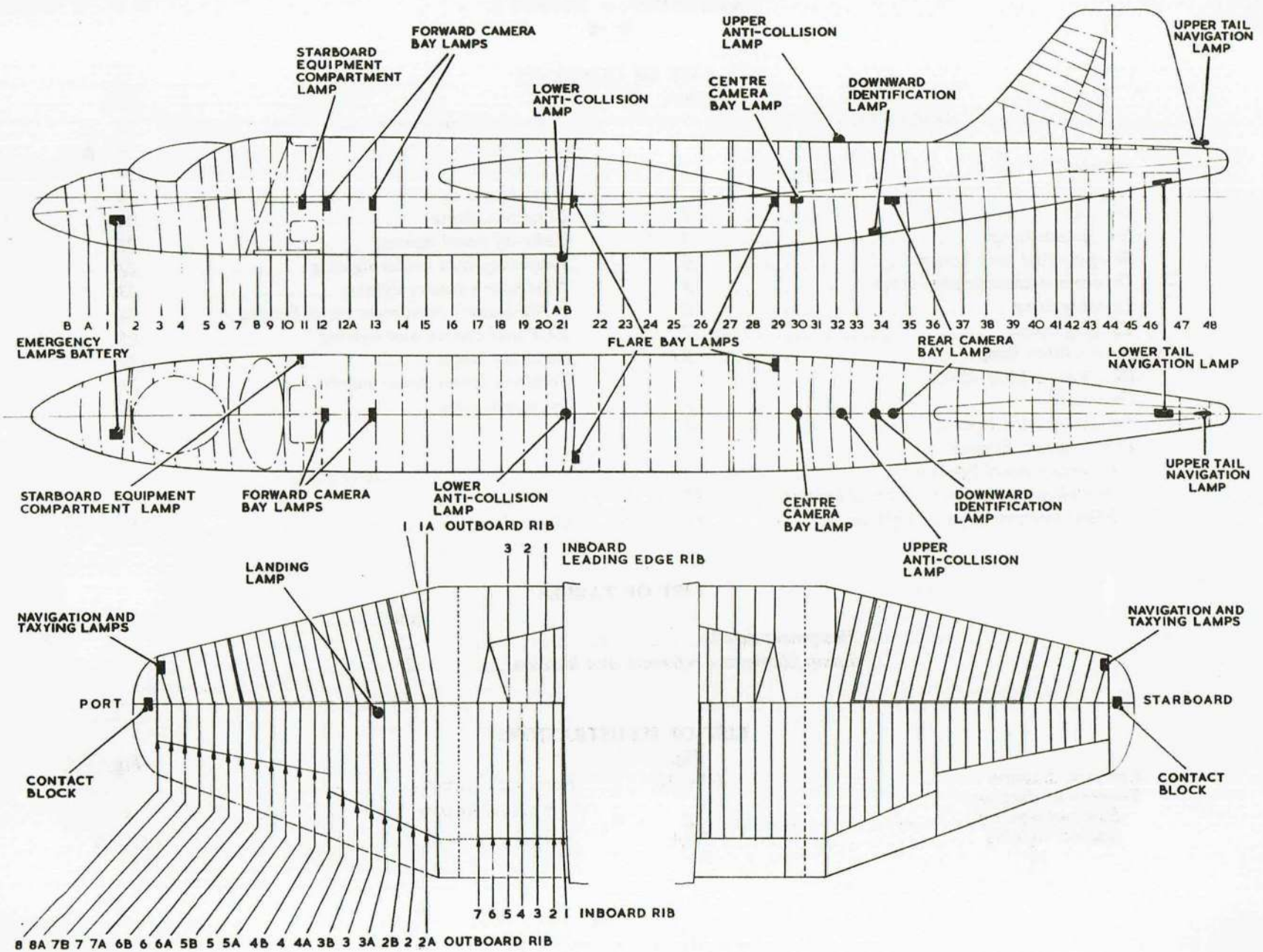

FIG.I. LOCATION DIAGRAM

UK RESTRICTED

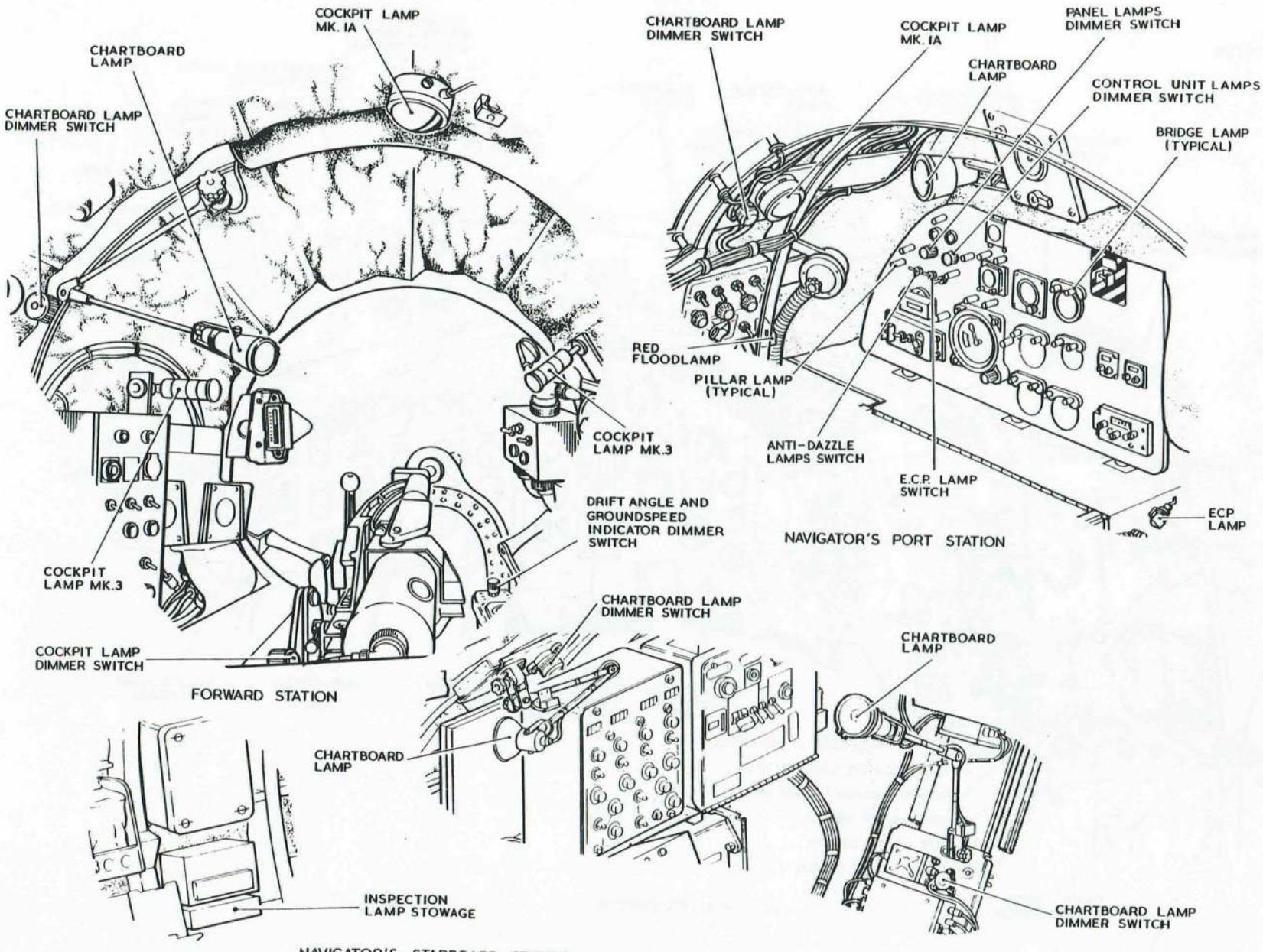

FIG.1A. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

UK RESTRICTED

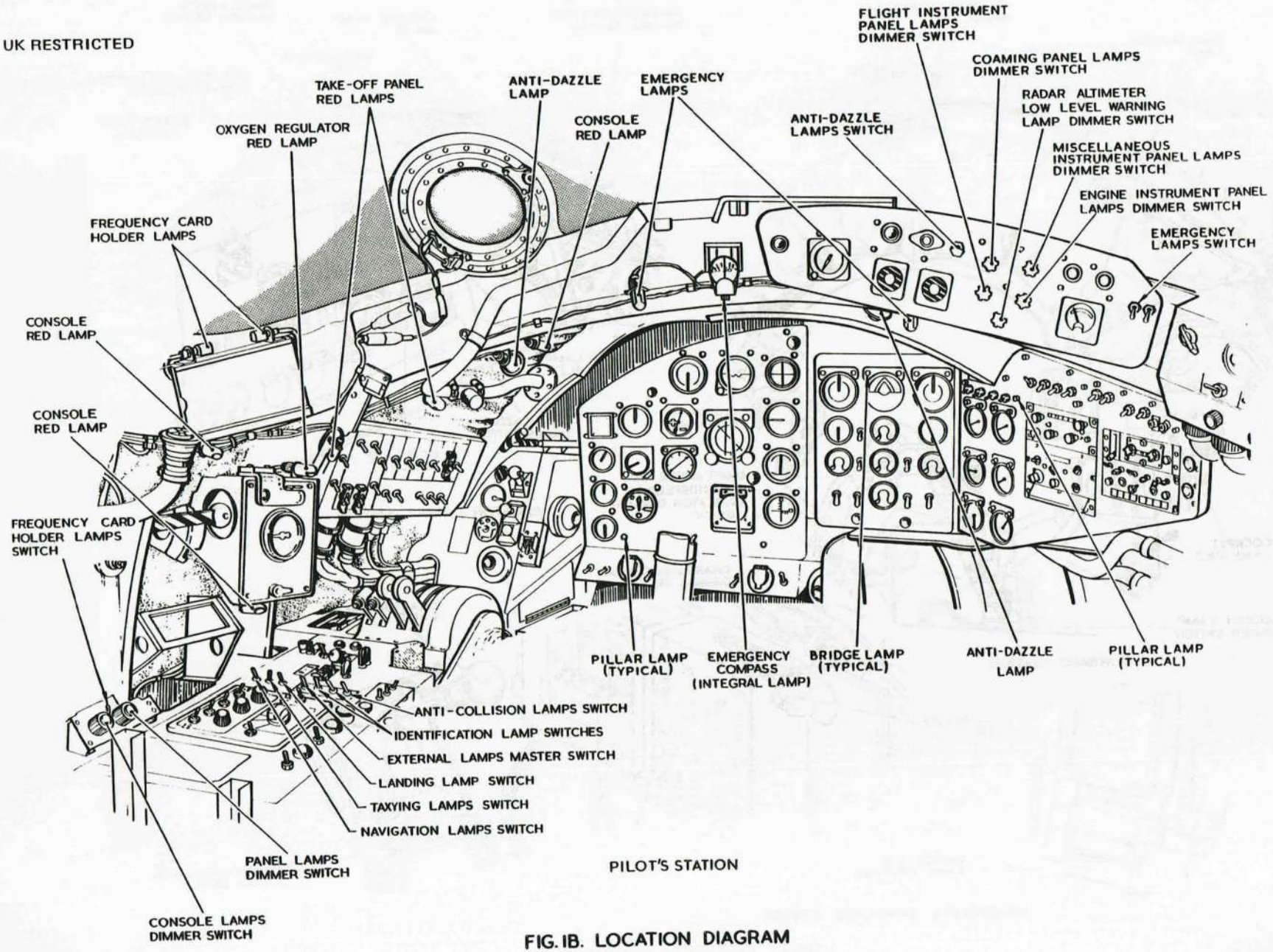

FIG. 1B. LOCATION DIAGRAM

DESCRIPTION

Introduction

1. This group describes the external and internal lighting installation. Location of the principal units is shown in fig.1, 1A and 1B. Circuit and routeing diagrams are provided. Details of lamps and dimmer switches are given in Table 1 and lamp filaments in Table 2.

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 EXT LTS MASTER ON/OFF, 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 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 NAVG LIGHTS ON/OFF, 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.

Downward identification lamp

5. A downward identification lamp is mounted on the underside of the fuselage just forward of frame 34. The lamp is controlled by two switches mounted on the pilot's console, and annotated IDENTIFICATION MORSE ON/OFF and STEADY ON/OFF respectively.

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 LIGHT 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 PP32/L4 via fuse 152 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 TAXG LIGHTS ON/OFF, mounted on the pilot's console.

Anti-collision lamps

8. Two anti-collision lamps are fitted; one on the upper fuselage, between frames 32 and 33 and one on the lower fuselage between frames 21A and 21B. A single flasher unit, in conjunction with a relay, controls the supply to both lamps. Operation of the lamps is controlled by a switch, idented ANTI COLL LIGHTS ON/OFF/UPPER, mounted on the pilot's console. When the switch is set to ON, a pulsating supply from the flasher unit is fed to both lamps. When the switch is set to UPPER, the pulsating supply is fed to the upper lamp only. In the event of failure of the pulsating supply a steady supply is maintained and lamp(s) remain illuminated but do not flash.

INTERNAL LIGHTING

General

9. The internal lighting circuits are operated from the aircraft 28 volt d.c. supplies. Normal illumination is provided by red and white lamps, an integral lamp in the emergency compass, bridge and pillar lamps on the instrument panels, chartboard lamps, Mk.1A and Mk.3 cockpit lamps. Selected radio equipments are

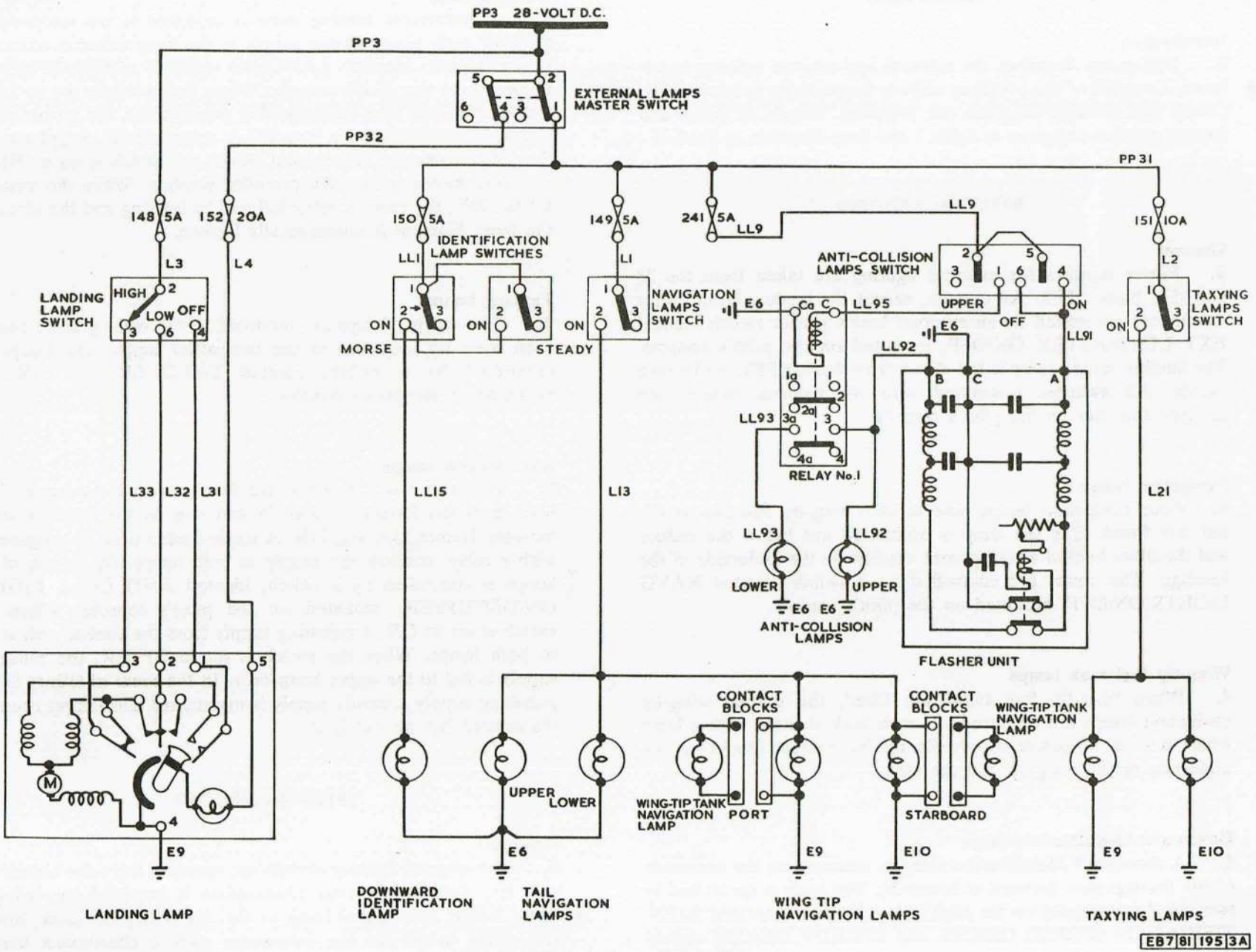

FIG.2. EXTERNAL LIGHTING

fitted with integral lighting. In the event of failure of the normal lighting, the emergency compass lamp is supplied from two 12 volt, series connected emergency batteries, and emergency floodlighting is supplied from a 2.4 volt emergency battery.

Forward station lighting

10. General lighting at the forward station is provided by a Mk.1A lamp which is controlled by an integral switch. A chartboard lamp, controlled by an adjacent dimmer switch, provides illumination for the camera controls. Two Mk.3 cockpit lamps are fitted; one mounted on the camera control panel on the port side, provides illumination for the F89A camera control panel, the other mounted in the starboard roof between frames A and B, provides illumination for the T4 bomb sight. Both lamps are controlled by a dimmer switch, idented NOSE REDS, mounted on the port side wall of the bomb sight well. The Doppler drift angle and ground speed indicator integral lighting is controlled by a dimmer switch located to starboard of the centre line of the cockpit, aft of the T4 bomb sight.

Pilot's station lighting

11. General illumination at the pilot's station is provided by pillar and bridge lamps mounted on the various panels. The brilliance of the lamps is controlled by four dimmer switches, idented COAMING, MISC INST, INST PANEL and ENG INST, mounted on the pilot's coaming panel.

Coaming panel lighting

12. General illumination of the coaming panel is provided by pillar lamps, the brilliance of which is controlled by a dimmer switch, idented COAMING, mounted on the coaming panel. For information on dimming of the radar altimeter low level warning lamp, refer to Sect.6, Chap.2, Part 4.

Miscellaneous instrument panel lighting

13. General illumination of the instruments on this panel is provided by pillar and bridge lamps controlled by a dimmer switch, idented MISC. INST. mounted on the coaming panel. The dimmer also controls the brightness of the internal lamps of the V/UHF and H.F. control units.

Flight instrument panel lighting

14. General illumination of the flight instrument panel is provided by pillar lamps. The GM4B compass indicator and the range and bearing indicator are illuminated by bridge lamps. The brilliance of all these lamps and the integral illumination of the radar altimeter indicator is controlled by a dimmer switch, idented INST PANEL, mounted on the coaming panel.

Engine instrument panel lighting

15. The instruments on the engine instrument panel are illuminated by both pillar and bridge lamps, the brilliance of which is controlled by a dimmer switch, idented ENG INST. mounted on the coaming panel.

Emergency compass

16. The emergency compass, under normal lighting conditions, is integrally illuminated by a 28 volt non-magnetic miniature lamp, the brilliance of which is controlled by the COAMING dimmer switch, mounted on the coaming panel.

Emergency lighting

17. In the event of failure of the normal instrument lighting, the pilot is provided with two floodlamps, mounted on the coaming tube, one on each side of the cockpit. Power supplies to the lamps are provided by a 2.4 volt alkaline battery, mounted in the floor well, forward of the rudder pedals. The lamps are controlled by a switch, idented COMP & EMGY LIGHTS, mounted on the coaming panel.

18. Emergency lighting is also provided for the emergency compass. The power supply, which is derived from two 12-volt series connected emergency batteries *(Group P)*, is connected when the COMP & EMGY LIGHTS switch *(Para.17)* is set to on. In the emergency condition, dimming facilities are not provided for the compass lamp.

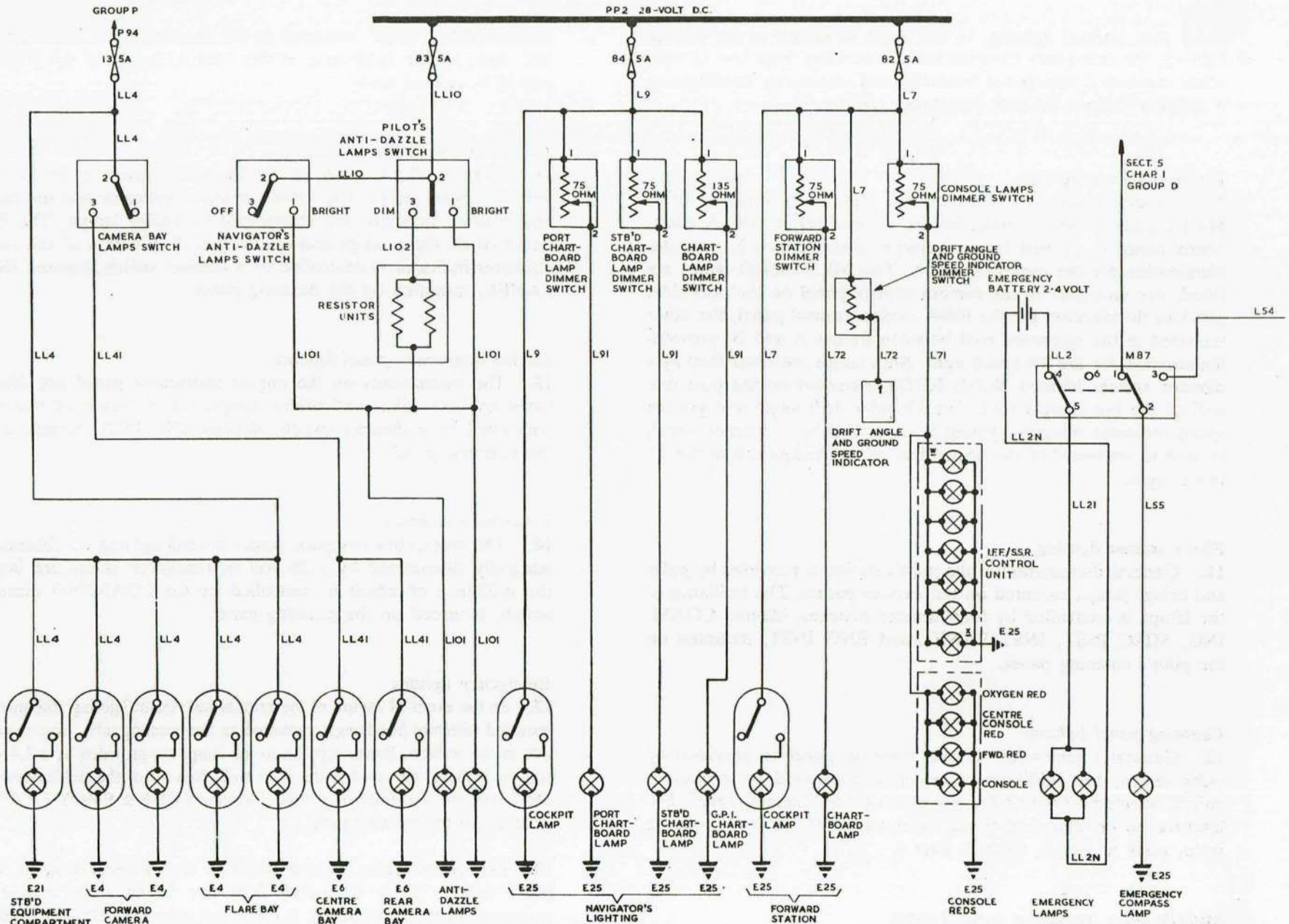

FIG.3. INTERNAL LIGHTING

◄CIRCUIT CODE AND ITEM ANNOTATION ADDED►

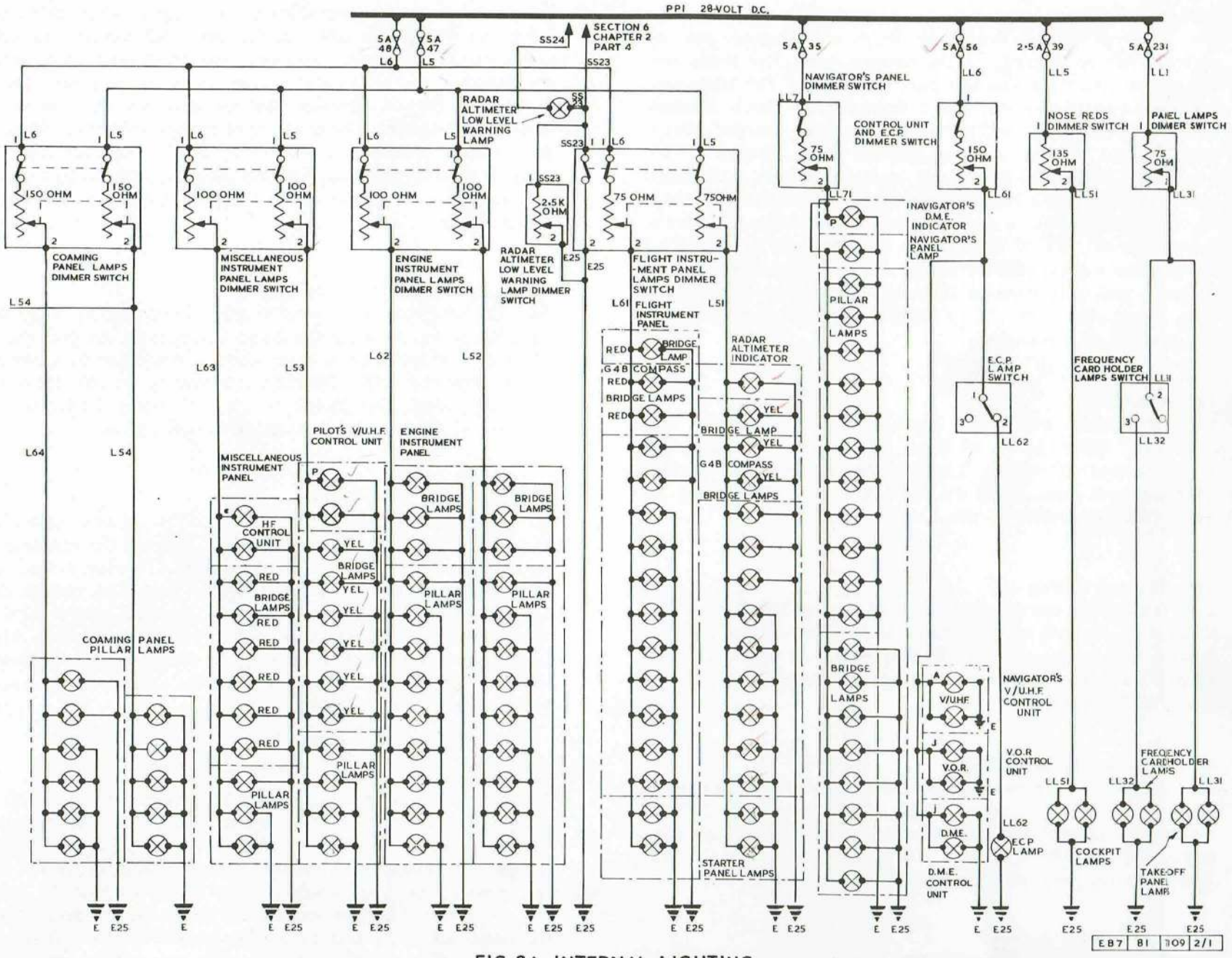

FIG. 3A. INTERNAL LIGHTING

Anti-dazzle lighting

19. Two high intensity anti-dazzle lamps are mounted, one on each side of the cockpit, on the coaming tube. The lamps are arranged to illuminate essential flight instruments. The lamps are controlled by two switches; one, a three-position switch, idented ANTI DAZZLE BRIGHT/OFF/DIM, mounted on the pilot's coaming panel, the other, a two-position switch, idented ANTI DAZZLE OFF/BRIGHT, mounted on the navigator's instrument panel. Dimming of the lamps is achieved by two parallel-connected 56 ohm resistor units, in series with the lamps, when the pilot's switch is set to DIM. If the navigator's switch is set to BRIGHT, this selection will override a DIM setting on the pilot's switch. The lamps are used to increase the intensity of illumination on essential flight instruments, if the pilot's vision is impaired temporarily by the operation of a photoflash.

Console lighting

20. The console and oxygen regulator are illuminated by red floodlamps, the brilliance of which is controlled by a dimmer switch, idented CONSOLE LIGHTS, which is mounted on the lighting control panel aft of the IFF/SSR control, the lighting of which is also controlled by this dimmer switch.

Take-off panel lighting

21. The take-off panel is illuminated by two red floodlamps, one mounted on the port coaming tube, the other on stringer No.6 at frame 2. The lamps are controlled by a dimmer switch, idented PANEL LIGHTS, mounted on the lighting control panel, aft of the IFF/SSR control unit.

Frequency card holder lighting

22. The pilot's frequency card holder, mounted on the port coaming tube between frames 3 and 4 is illuminated by two lamps, mounted on the card holder. The lamps are controlled by a switch, idented FREQUENCY CARD LIGHTS ON, mounted on the lighting control panel aft of the IFF/SSR control unit.

Navigator's station lighting

23. General lighting at the navigator's station is provided by a Mk.1A lamp which is controlled by an integral switch, positioned above the navigator's table on the port wall, bridge and pillar lamps on the instrument panel and three chartboard lamps, which are mounted, one at the port station above the instrument panel, one on the disused starboard seat rail and one adjacent to the camera wedge plates. The brilliance of the two chartboard lamps at the starboard station is controlled by dimmer switches mounted adjacent to each lamp and the chartboard lamp at the port station is controlled by a dimmer switch mounted adjacent to the Mk.1A cockpit lamp.

Navigator's instrument panel lighting

24. The navigator's instrument panel is illuminated by bridge and pillar lamps and by a red floodlamp mounted on the port wall at frame 6. The brilliance of these lamps is controlled by a dimmer switch, idented PANEL LIGHTS, mounted on the left side of the instrument panel. This dimmer switch also controls the intensity of the integral lighting of the navigator's DME indicator.

ECP and control unit lighting

25. A dimmer switch, idented CU LIGHTS, located on the left side of the navigator's instrument panel, controls the brilliance of the integral lighting of the navigator's V/UHF control unit, the DME control unit and the VOR control unit. The dimmer also controls the brilliance of the ECP lamp. The ECP lamp is fitted to the navigator's table structure and provides illumination when servicing at the ECP. The lamp supply is controlled by a switch, idented ECP LIGHT-ON, mounted on the navigator's instrument panel below the dimmer switches.

Servicing lamps

26. Seven Mk.1A servicing lamps are fitted in the fuselage aft of the pressure bulkhead. One lamp is mounted in the starboard equipment compartment. Two lamps are mounted in the forward camera bay, two in the flare bay and one each in the centre and rear camera bays. The integral switches of the lamps in the centre and rear camera bays are permanently left in the ON position and the lamps are controlled by a separate switch mounted on the starboard wall of the fuselage, above the rear camera bay door.

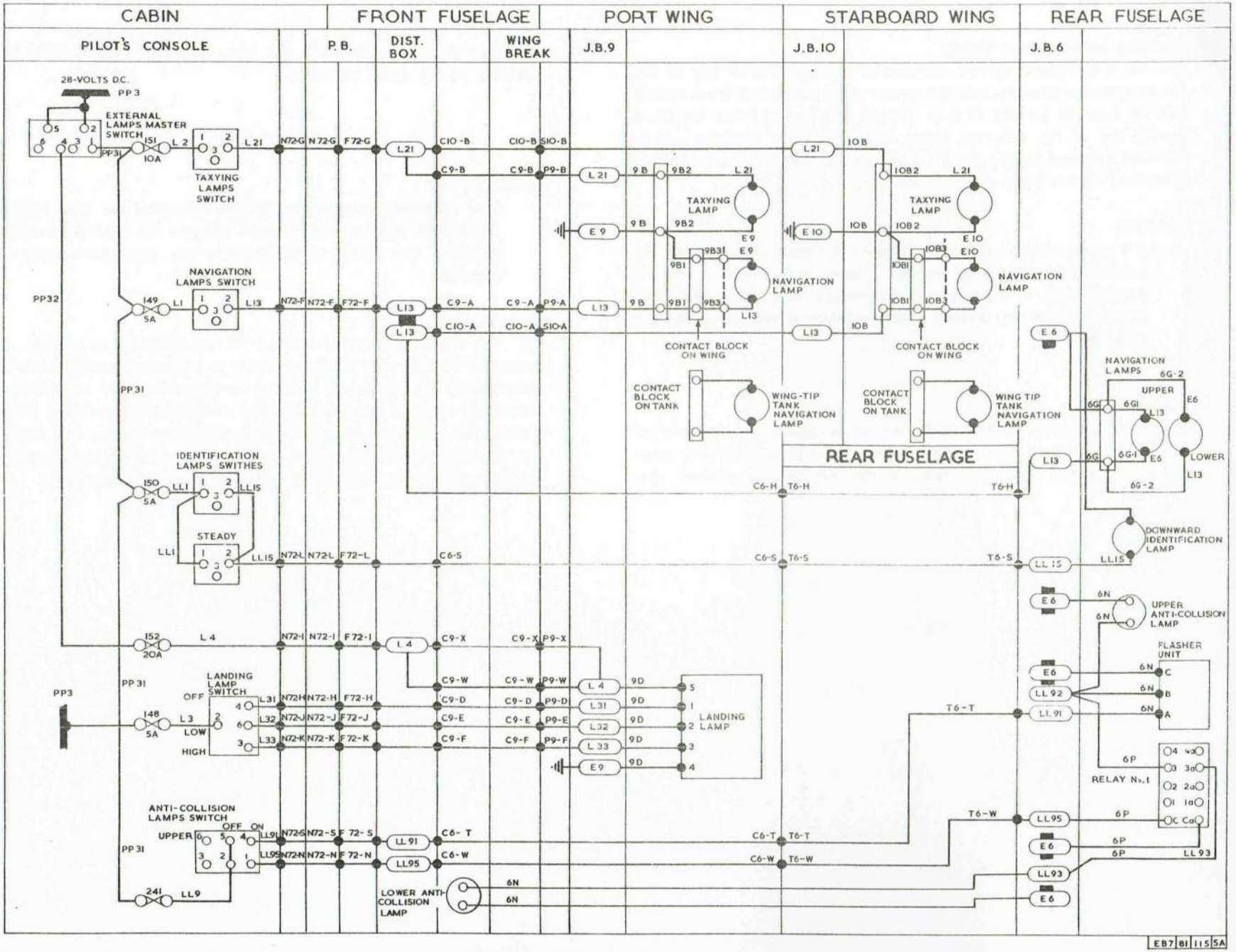

FIG.4. EXTERNAL LIGHTING

◄CABLE CODES ADDED►

Servicing lamps power supply

27. As a safeguard against the aircraft taking off with any of the servicing lamps illuminated, the power supply is taken from circuit P94 via fuse 13 on the M.E.P. Circuit P94 is fed from the third (small) pin of the external supply plug and only receives power when an external supply socket is connected, when the small pin is connected to the large positive pin.

CAUTION

If a conversion Plug/Socket Adapter Ref.No.105G/1 is used for connection between a two-pin supply plug and the aircraft supply plug, it is essential to ensure that the adapter is removed from the aircraft when external power supplies are removed.

Inspection lamp

28. An inspection lamp, which can be plugged into any one of the Mk.1A lamp sockets is stowed in a stowage bag located near the floor at the starboard side of the navigator's station. An extension lead for use with the lamp is stowed in another bag, adjacent to the lamp stowage.

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

29. All lighting circuits should be periodically examined and operated. Should any filament prove to be unserviceable it should immediately be replaced. 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.	Description	Quantity	Location
5CX/366	Lamp, cockpit Mk.3	2	Forward station
5CX/1982602	Lamp, chartboard, Type H	1	Forward station
5CX/4330002	Lamp, cockpit, Mk.1A	1	Forward station
◀ 5CW/4405520	Switch, dimmer, Type R	1	Forward station
5CW/2525	Switch, dimmer	2	Forward station
5CX/5133	Lampholder, Type D	2	Navigator's station
EA3.81.2517	Lamp, chartboard	1	Navigator's station (port)
5CX/1982602	Lamp, chartboard, Type H	2	Navigator's station (stbd)
5CX/4330002	Lamp, cockpit, Mk.1A	1	Navigator's station
5CW/2525	Switch, dimmer	1	Navigator's station (stbd)
5CW/4405520	Switch, dimmer, Type R	2	Navigator's station
5CX/5133	Lampholder, Type D	2	Pilot's station
5CX/5128	Lamp, anti-dazzle	2	Pilot's station
5CX/4058	Lamp, cockpit, Type C	8	Pilot's station
5CW/4405520	Switch, dimmer, Type R	2	Pilot's station
5CX/1143869	Lamp, pillar	53	Pilot's station
5CX/5352	Lamp, bridge, Type C	2	Pilot's station
5CX/4330351	Lamp, bridge, Type F	2	Pilot's station
5CX/1143240	Lamp, bridge, Type O	6	Pilot's station
5CX/5350	Lamp, bridge	1	Pilot's station
5CW/9112	Switch, dimmer	2	Pilot's station
5CW/9067	Switch, dimmer	1	Pilot's station
5CW/6208444	Switch, dimmer	1	Pilot's station
5CX/4330002	Lamp, cockpit, Mk.1A	1	Starboard equipment bay
5CX/4330002	Lamp, cockpit, Mk.1A	6	Camera bays
5CX/1053245	Lamp, downward identification	1	Lower rear fuselage
5CX/4330018	Lamp, navigation	1	Port wing tip
5CX/1043420	Lamp, navigation	1	Starboard wing tip
5CX/4330113	Lamp, navigation	2	Upper and lower tail
5CX/4330324	Lamp, anti-collision	2	Upper rear and lower front fuselage
5CX/4330093	Lamp, taxying	2	Port and starboard wing tip
5CX/4330151 ▶	Lamp, landing	1	Underside port wing
5945-99-104-4107	Flasher unit	1	Rear fuselage
5CZ/2742	Resistor unit	2	Coaming panel

TABLE 2

Lamp filaments – reference and location

Service	Location	Ref.No.	Quantity	Voltage	Wattage
Emergency lamps	Pilot's station	5L/9951130	2	2.5	0.75
Anti-dazzle lamps	Pilot's station	5L/9951282	2	28	12
Red lamps	Pilot's station	5L/9951283	16	28	3.5
Frequency card holder lamps	Pilot's station	5L/9951271	2	28	3.5
E2B compass lamp	Pilot's station	5L/9959121	1	28	0.04
Pillar and bridge lamps	Pilot's station	5L/9959182	85	28	1.1
Pillar lamps	Pilot's station	5L/9959122	4	28	2
Cockpit lamp, Mk.1A	Navigator's station	5LX/952254	1	28	6
Chartboard lamp	Navigator's station	5L/9953278	2	28	18
Chartboard lamp	Navigator's station	5LX/952254	1	28	6
Red lamp	Navigator's station	5L/9951271	1	28	3.5
Pillar lamps	Navigator's station	5L/9959182	26	28	1.1
ECP lamp	Navigator's station	5L/9951271	1	28	3.5
Inspection lamp	Navigator's station	5L/9953271	1	28	7
Cockpit lamp, Mk.1A	Forward station	5LX/952254	1	28	6
Cockpit lamp, Mk.3	Forward station	5L/9953271	2	28	7
Chartboard lamp	Forward station	5L/9953278	1	28	18
Cockpit lamps, Mk.1A	Flare and camera bays	5LX/952254	7	24	6
Cockpit lamp, Mk.1A	Starboard equipment bay	5LX/952254	1	24	6
Navigation lamps	Port and stbd wing tips	5L/9952431	2	28	24
Identification lamp	Underside rear fuselage	5L/9952604	1	24	80
Anti-collision lamps	Upper rear and lower front fuselage	5L/9952445	2	28	60
Taxying lamps	Port and stbd wing tips	5L/9952511	2	24	60
Landing lamp	Underside port wing	5L/9954717	1	26	240

FIG.5 INTERNAL LIGHTING

(illustration overleaf)

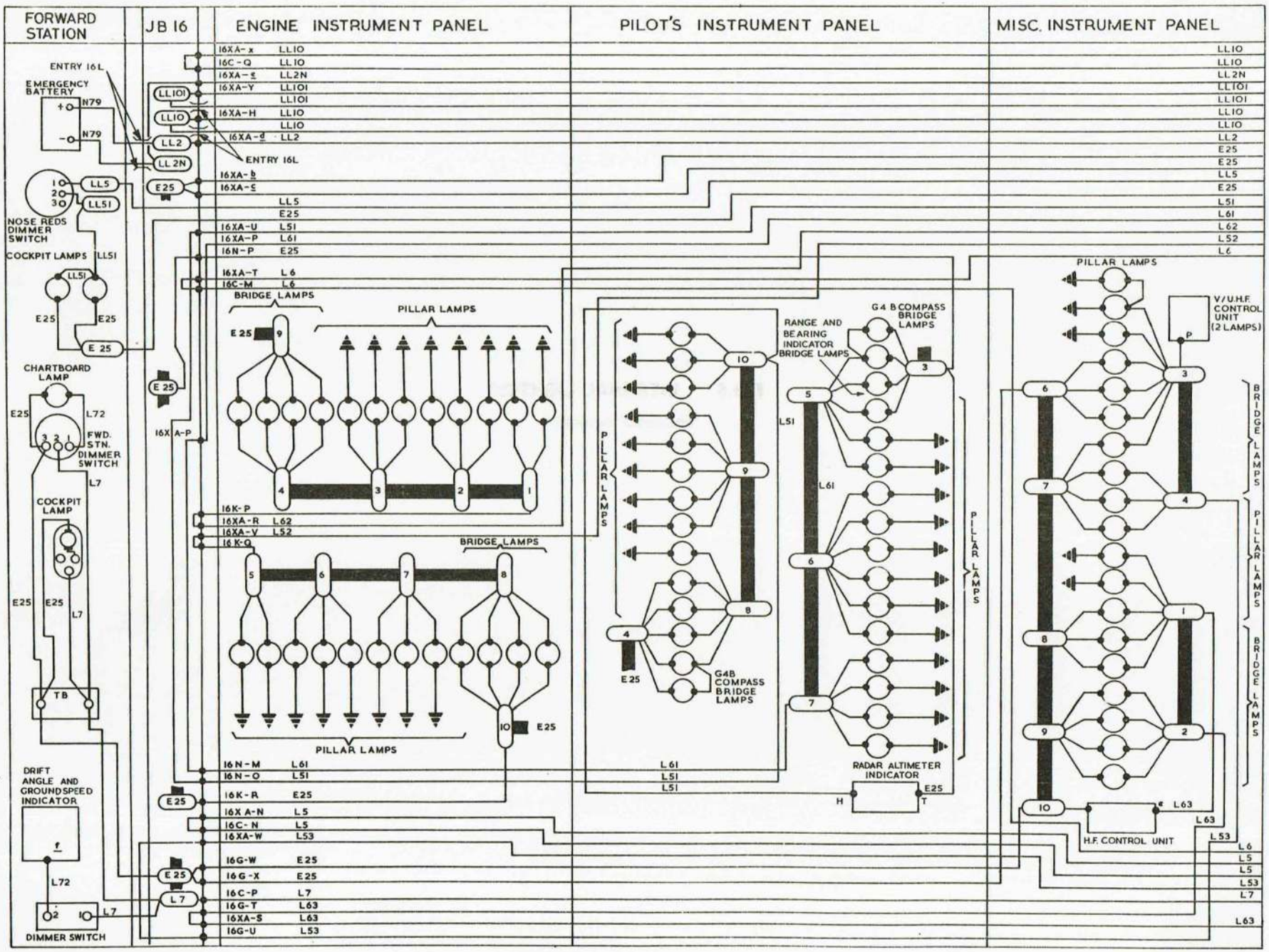

FIG. 5. INTERNAL LIGHTING

◄PIN IDENTS ADDED►

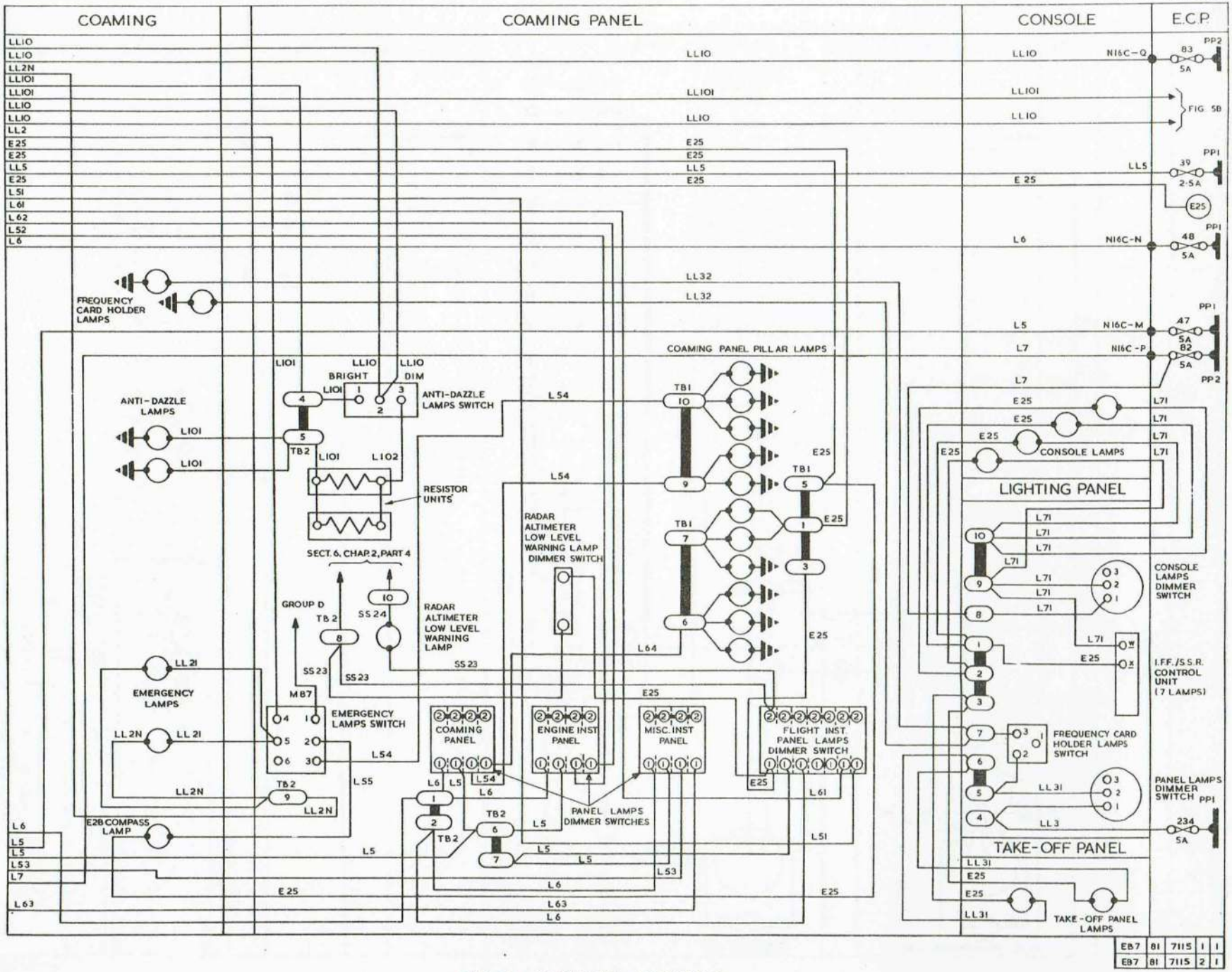

FIG. 5A. INTERNAL LIGHTING

◄NEW WIRING ADDED, PIN IDENT AND CIRCUIT CODE CHANGED►

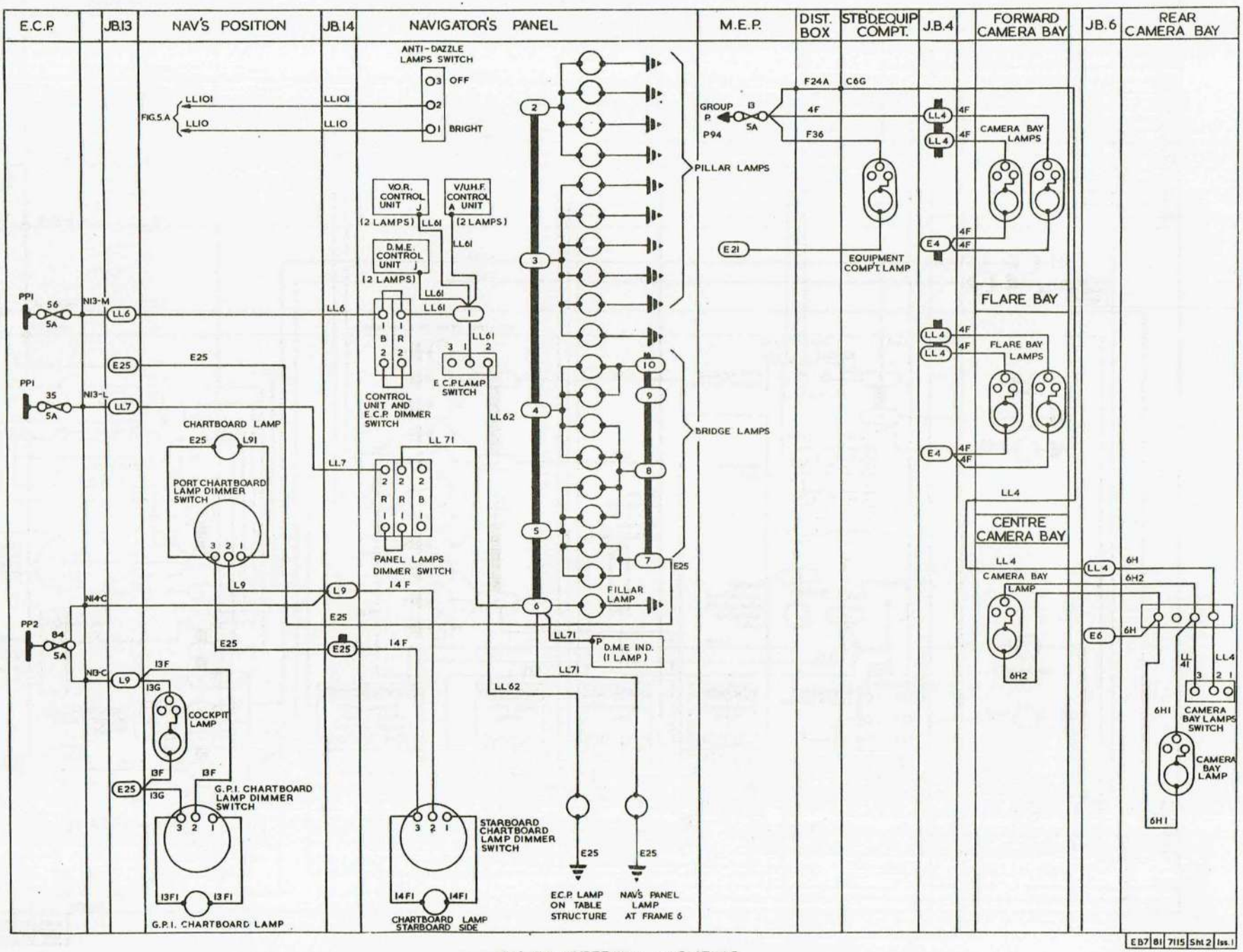

FIG.5B. INTERNAL LIGHTING.

◄J.B. TERMINAL DELETED. WIRING AMENDED►

D.C. POWER SUPPLIES — GROUP P

(completely revised)

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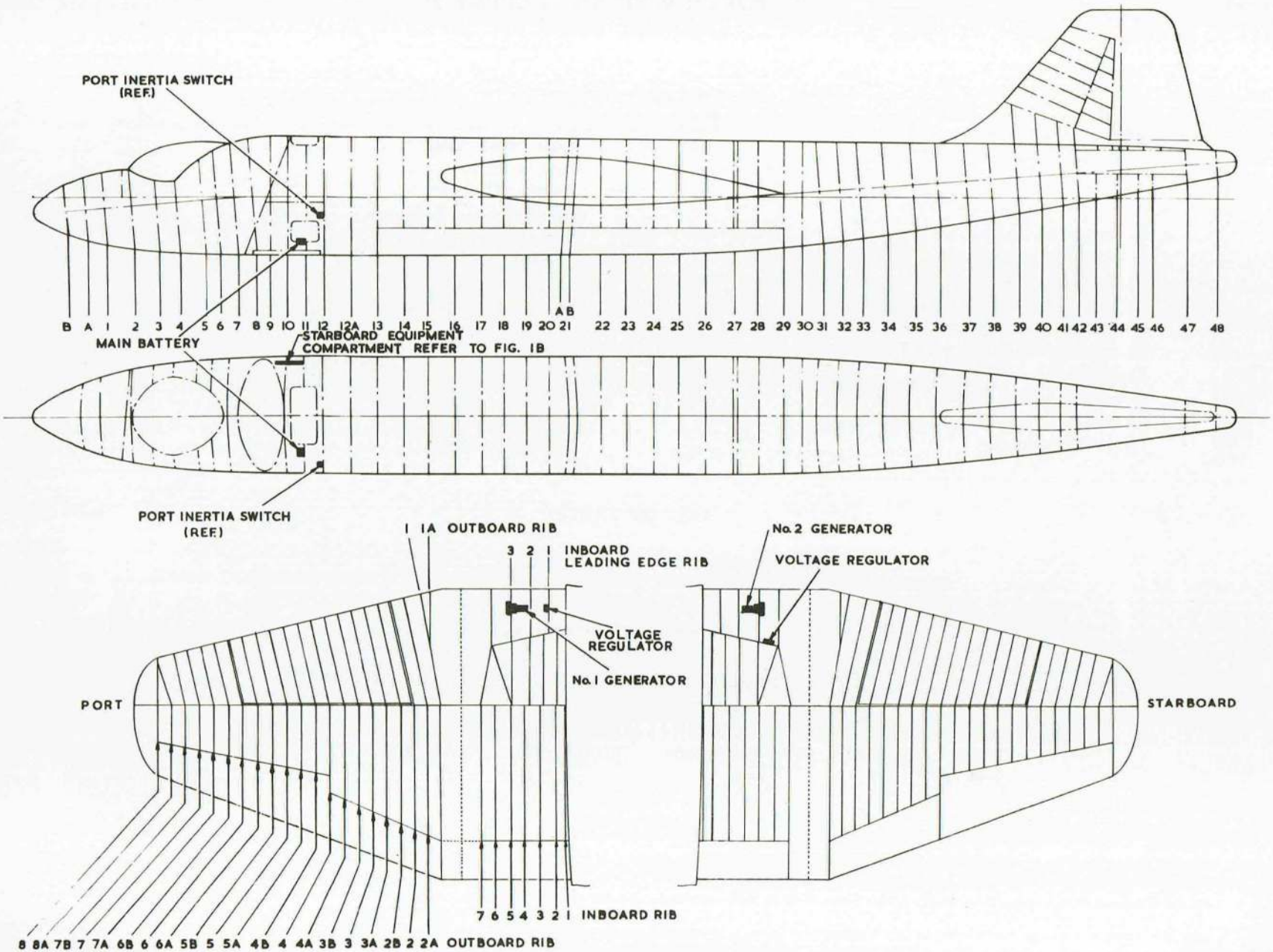

FIG.1.LOCATION DIAGRAM

Introduction

1. This group contains a description of the d.c. power supplies and gives details of the location, operation and servicing of the components of the generator and battery supply systems. Included in this group are circuit and routeing diagrams which cover the complete installation. The location of principal items relevant to this group are shown in fig.1-1A-1B.

DESCRIPTION

General

2. Power for the electrical services and battery charging is provided by two Type 519, 300-amp generators operating in parallel with an output voltage automatically controlled at 28-volts. Each generator is installed in the leading edge of the main plane and driven from the accessories gearbox of its respective engine (No.1 port - No.2 starboard). The positive terminal of each generator is connected to busbar P10 via a generator switching unit and a reverse-current circuit breaker, whilst the negative terminal connects to the main plane earth point. Also used in each generator circuit is a Type 18B overvoltage relay. Heavy duty cable used for the generator main cables and heavy duty terminals are provided at the wing breaks for connecting the wing and fuselage sections of the main positive leads. The generator switching unit and the reverse current circuit breakers are fitted on the main electrical panel (M.E.P.) together with overvoltage relays and other ancilliary equipment.

Generator, Type 519

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

Voltage regulator, Type 114

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

Reverse current circuit breaker, Type 1B

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

Generator switching unit

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

7. When the generator output reaches 20 to 22-volts a pick-up relay operates and closes two pairs of contacts, through one pair of which the generator output voltage is applied to a polarized differential relay coil. When the generator voltage exceeds the battery voltage by 0.3 to 1.0 volt the differential relay operates and closes contacts carried on an armature which is within the field of a permanent magnet (magnetic switch); the influence of the magnet

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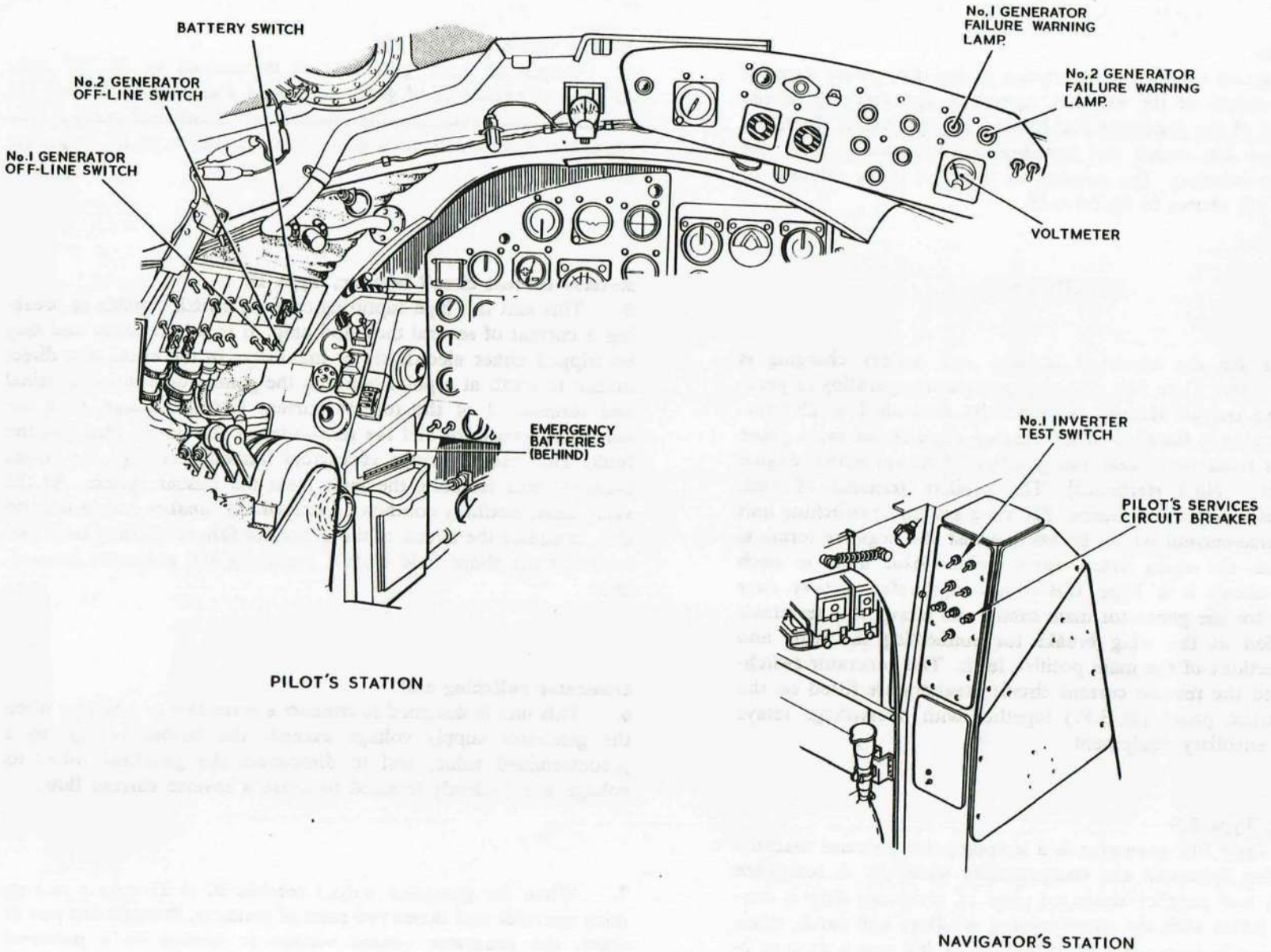

FIG. 1A. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

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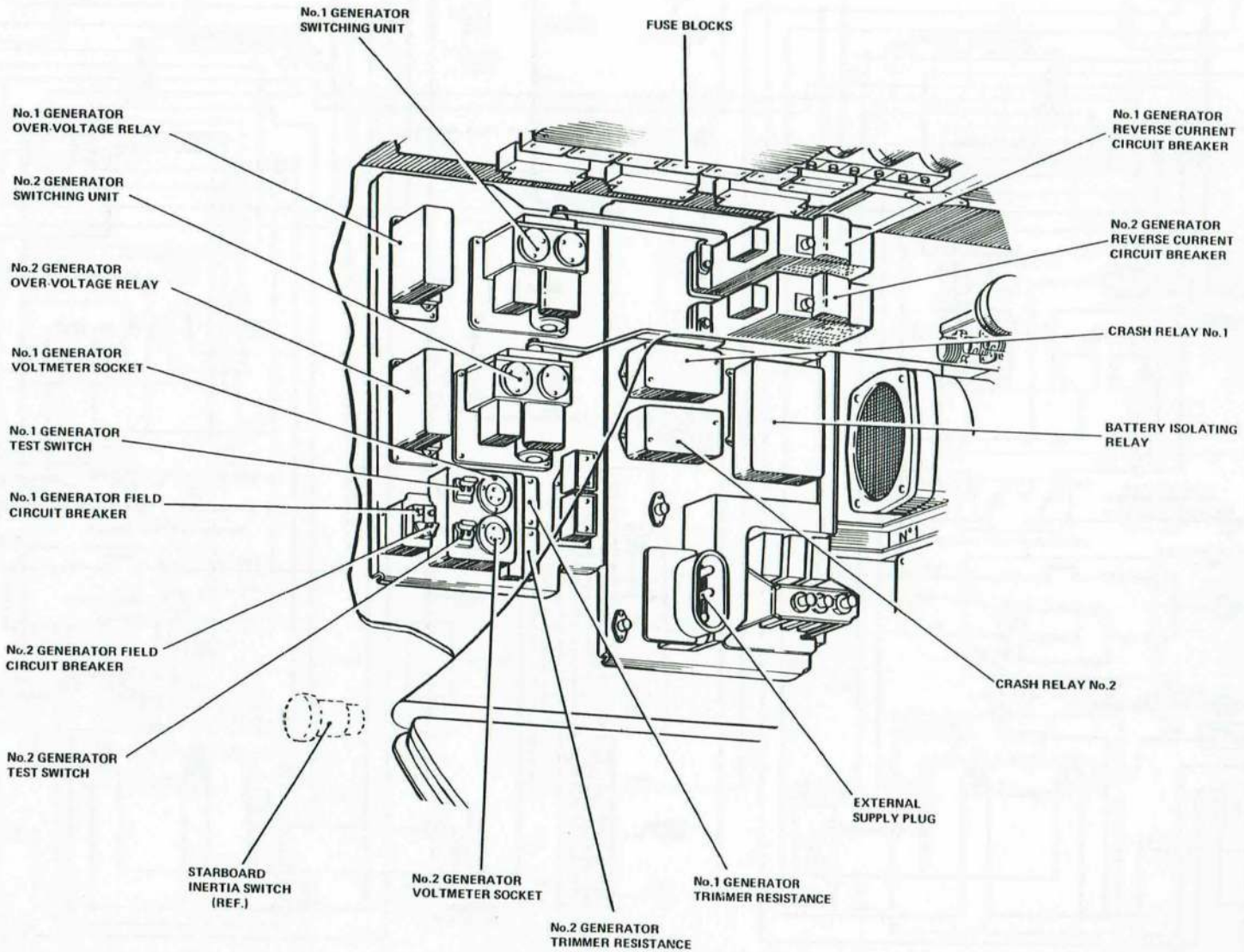

VIEW ON MAIN ELECTRICAL PANEL (M.E.P.)
STARBOARD EQUIPMENT COMPARTMENT

FIG. 1B. LOCATION DIAGRAM

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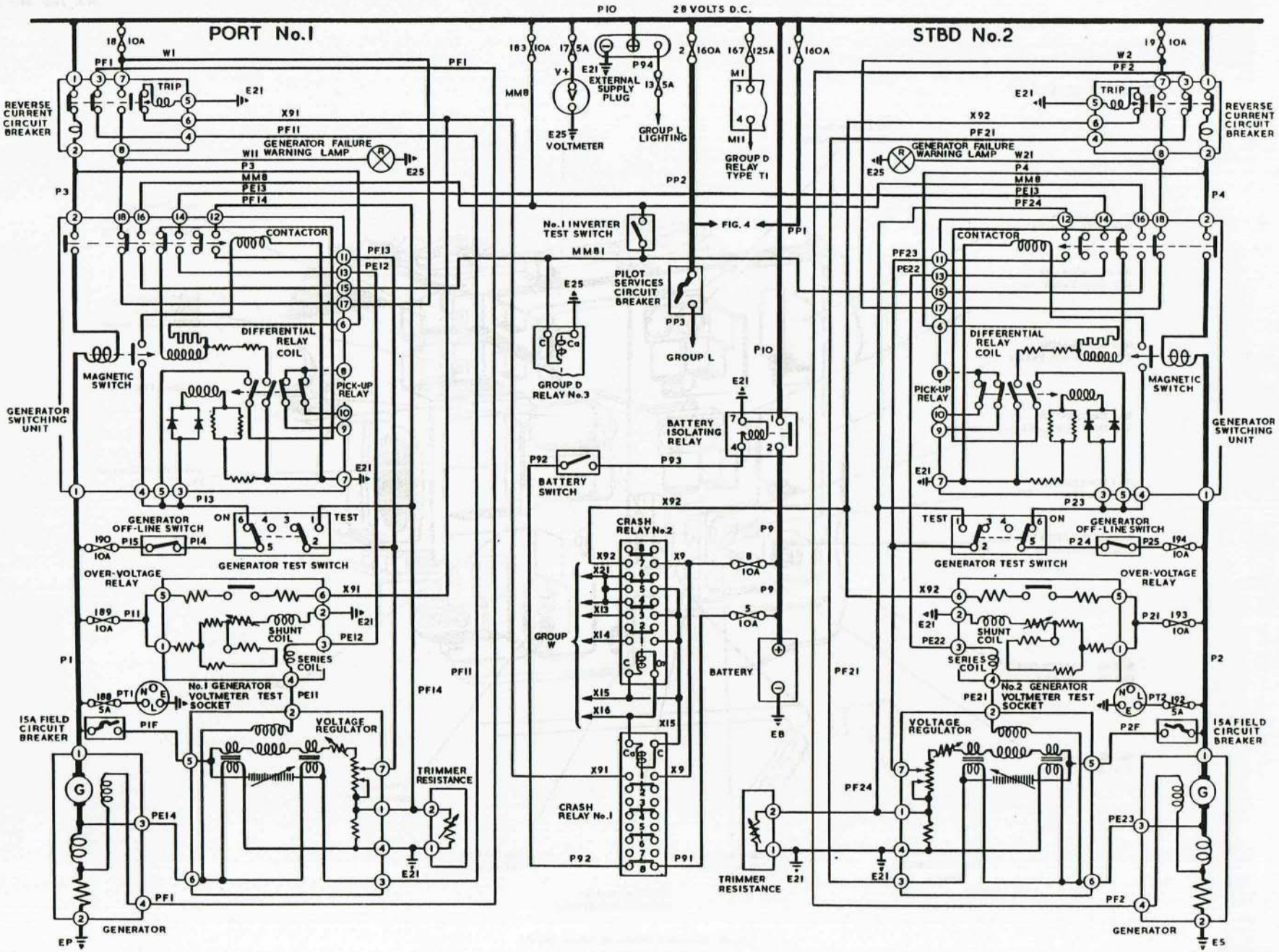

FIG.2. D.C. POWER SUPPLIES - THEORETICAL

◄ UFR/CAN/171 INCORPORATED ►

is such as to hold the armature stable to the side to which it was last operated. The contacts, when closed, connect the generator voltage to the operating coil of the contactor which, when energized, causes its main contacts to close, thus connecting the generator to the busbar via the reverse current circuit breaker contacts. The contactor carries three pairs of auxiliary contacts which, when the contactor is energized, close to complete three circuits. One set of contacts provides an interlock between the generators and the No.1 inverter (instruments normal supply), thus ensuring that the inverter does not start until one generator is charging; the other two pairs of contacts complete the equalizing and voltage regulator circuits respectively.

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

Overvoltage relay, Type 18B

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

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

Supply voltmeter

11. Continuous indication of the supply voltage at busbar P10 is given by a voltmeter on the pilot's coaming panel. The voltmeter indicates irrespective of whether the internal battery or an external supply is connected to busbar P10.

Generator failure warning lamps

12. Two generator failure warning lamps, annotated NO.1 GEN FAIL, NO.2 GEN FAIL, are fitted on the pilot's coaming panel. The tripping of either generator circuit lights its respective red warning lamp.

Generator OFF-LINE switches

13. Two generator off-line switches, labelled No.1 or No.2 GEN OFF LINE SW respectively are located on the take-off panel for the pilot's use. The switches are further labelled ON-OFF and are normally set to the ON position. They are connected in series with the ON circuit of the generator test switches described in para.14.

Generator test panel

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

Field circuit breakers

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

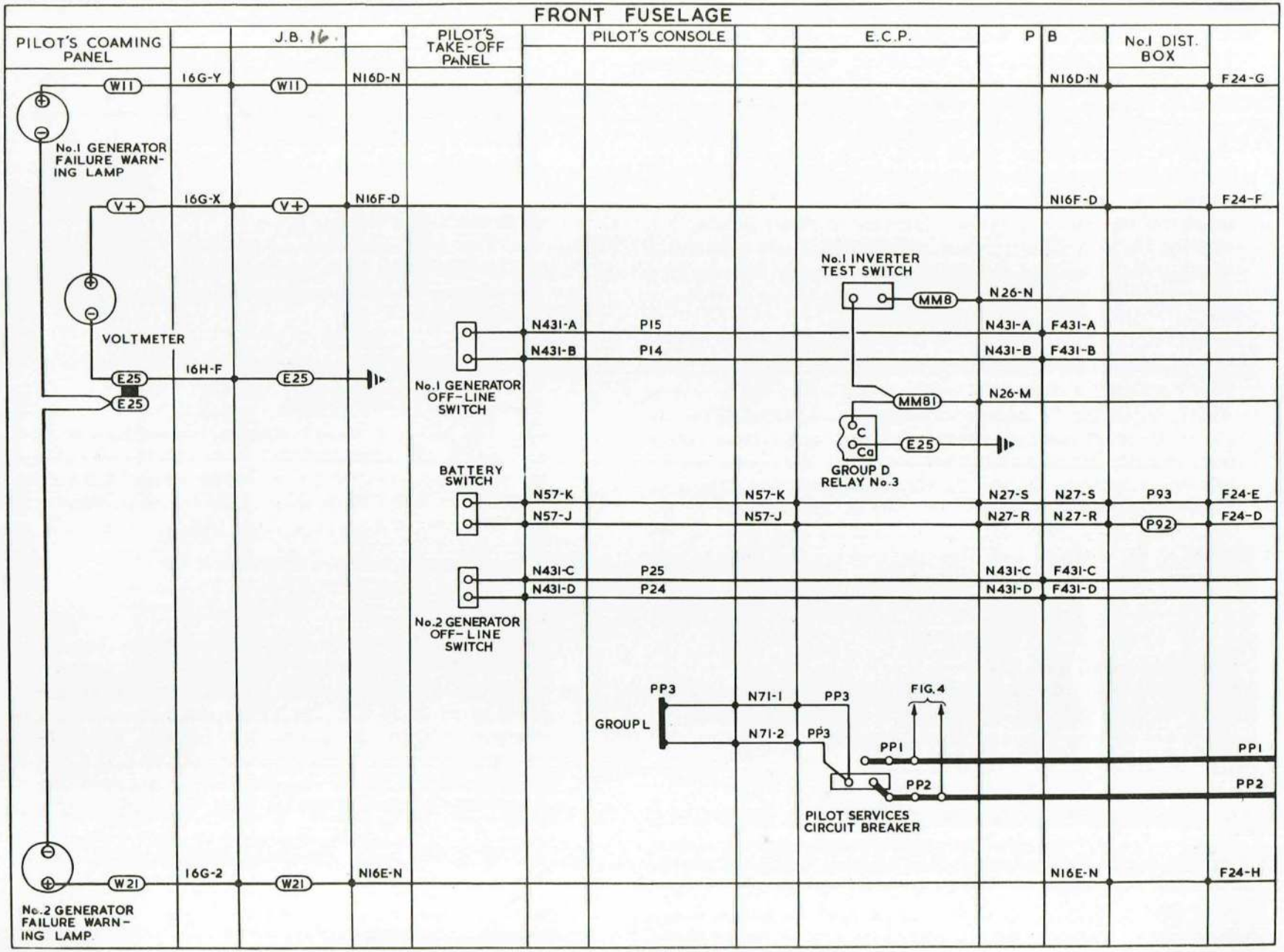

FIG.3. D.C. POWER SUPPLIES

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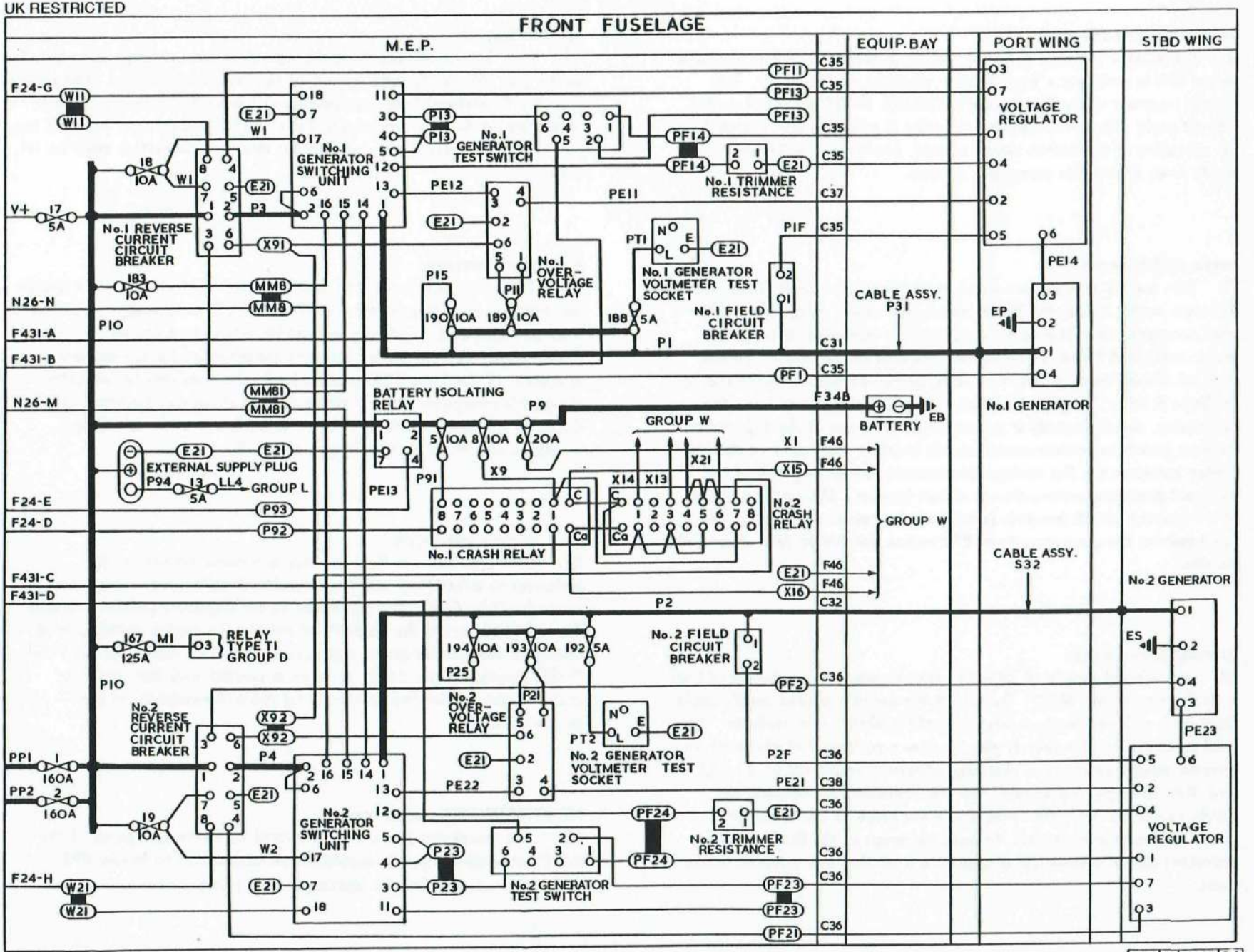

FIG. 3A. D.C. POWER SUPPLIES

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Battery isolating relay

16. Connection between the main battery busbar P9 and the generator busbar P10 is made via a Type R relay mounted on the M.E.P. The relay is normally controlled by the BATTERY SWITCH located on the take-off panel. In a crash landing the relay is automatically opened by the operation of the inertia switch system, which isolates the battery supply from all but the emergency circuits.

Inertia switch circuit

17. Two inertia switches are fitted on the forward face of frame 12, a starboard switch below the M.E.P. and a port switch in the port equipment compartment. The switches control the operation of two crash relays, numbered 1 and 2, *(Group W)* mounted on the M.E.P. In the event of a crash landing, the No.1 relay breaks the supply to the coil of the Type R relay; its contacts open and isolate the battery from the P10 busbar, simultaneously it causes the energization of the trip coil of the port generator reverse-current circuit breaker. Operation of the No. 2 relay energizes the fire extinguisher circuits and the trip coil of the starboard generator reverse-current circuit breaker. The opening of the reverse-current circuit breakers (caused by the energization of the trip coils) isolates the generators from P10 busbar and breaks their shunt field circuits.

External power supply

18. An external supply of 24-volts may be connected to the aircraft via a 3-pole plug on the M.E.P. To permit the use of a ground supply cable fitted with a 2-pole plug, an adapter, Ref.No.105G/11, is available. The third small pin on the aircraft plug receives a positive feed whenever an external supply socket or socket/plug adapter is connected to it. This feed, P94, after passing through fuse 13, becomes LL4 which is the supply to the Mk.1A lamp fitted above the hatch of the starboard equipment compartment and the servicing lamps in the fuselage. It is important that if a socket/plug adapter is used that it is removed before flight.

Main battery

19. One, 24-volt, 40 amp/h, nickel cadmium battery Type K, is installed in the port side of the fuselage, aft of the pressure bulkhead. The battery is of the 'Voltabloc' type construction and embodies a thermal switch which breaks the charging circuit if the battery temperature becomes too high. The generator busbar settings for this type of battery must be 28-volts.

Emergency batteries

20. Two series connected lead acid batteries rated at 12-volts, 4 amp/h are mounted on a tray in the port console and are accessible behind the map stowage panel. They are secured by rubber bungees and quick release clips. The emergency batteries are provided for the emergency operation of the Type E2B compass lamp, the turn-and-slip indicator, the pilot's emergency cockpit lamps and the detonator circuits. Circuit diagrams and further information are to be found in Sect.5, Chap.1, Groups L and W, in Sect.5, Chap.2, Group F.

No.1 inverter test switch

21. During normal use No.1 inverter is brought on line by the contactor in either No.1 and No.2 combined differential cut-out and contactor *(para.6)* which is dependent on the respective generator output. Therefore, to obviate the necessity of running the engine during ground testing of the inverter power supplies, a test switch annotated No.1 INV TEST, located on the E.C.P., is wired in parallel with the contactor contacts and enables the inverter to be run independently of the generator circuits.

PILOT SERVICES circuit breaker

22. This circuit breaker, which is located on the switch panel of the E.C.P., controls the power supplies from busbar P10 to busbar PP3 which, in turn, supplies the lighting circuits *(Group L)*.

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

23. Whilst the generator system continues to function satisfactorily, no attention is required in service other than ground running tests and routine examination of the components and connecting cables for security, cleanliness and freedom from corrosion or damage. Further information on the operation and servicing of individual components can be found by reference to Table 1 in this group.

Main battery

24. The battery must be removed and serviced in accordance with the aircraft servicing schedule. When the battery has been removed, the battery cables should be stowed on the insulated block provided.

Emergency batteries

25. The batteries are anchored to a tray by rubber bungees fitted with quick release clips. Two insulated terminals are provided below the tray for stowing the battery cables when the batteries are removed from the aircraft.

26. The batteries should be removed for servicing and charged at the rate shown on the battery label in accordance with the aircraft Servicing Schedule. It is essential that the battery tray and adjacent structure be kept clean and free from any trace of electrolyte which would cause corrosion.

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5UA/4357530	Generator, Type 519	2	113B-0210-16
5UC/4379340	Voltage regulator, Type 114	2	113D-0773-13A
◀ 5CY/4376067 ▶	Reverse current circuit breaker, Type 1B	2	113D-0803-1
5CW/6166	Generator switching unit, Type 6801	2	113D-1005-16
5CW/6165	Over-voltage relay, Type 18B	2	113D-1366-16
5CW/6185	Relay, Type R (battery isolating)	1	113D-0908-1
5J/9499955	Battery, nickel cadmium, Type K	1	113C-0303-1
5J/9101543	Battery, lead acid	2	113C-0207-1
5J/9101808	Battery, alkaline	1	113C-0306-1

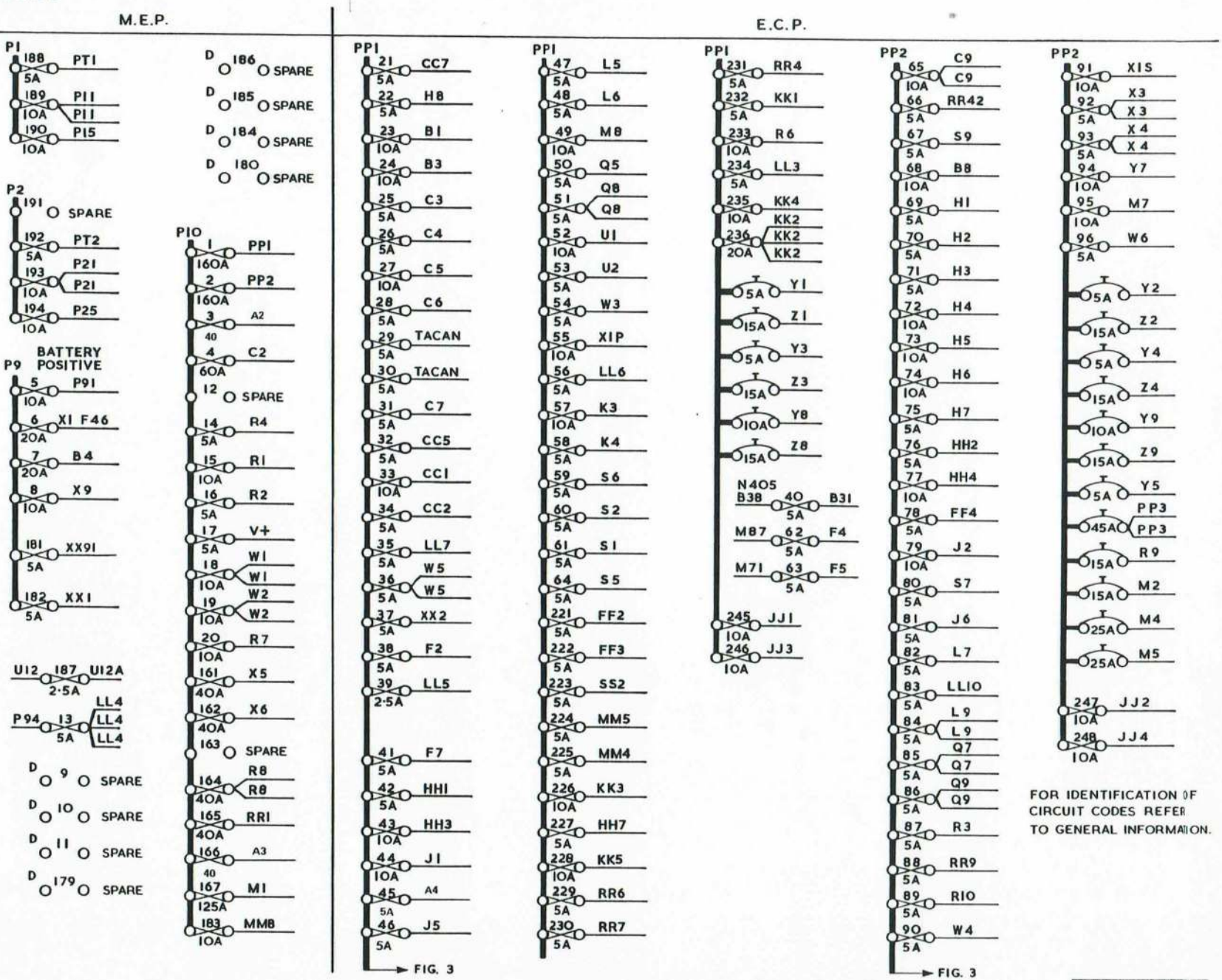

FIG. 4. POWER DISTRIBUTION

◄ UFR/CAN/171 INCORPORATED ►

FUEL PUMPS AND COCKS — GROUP Q

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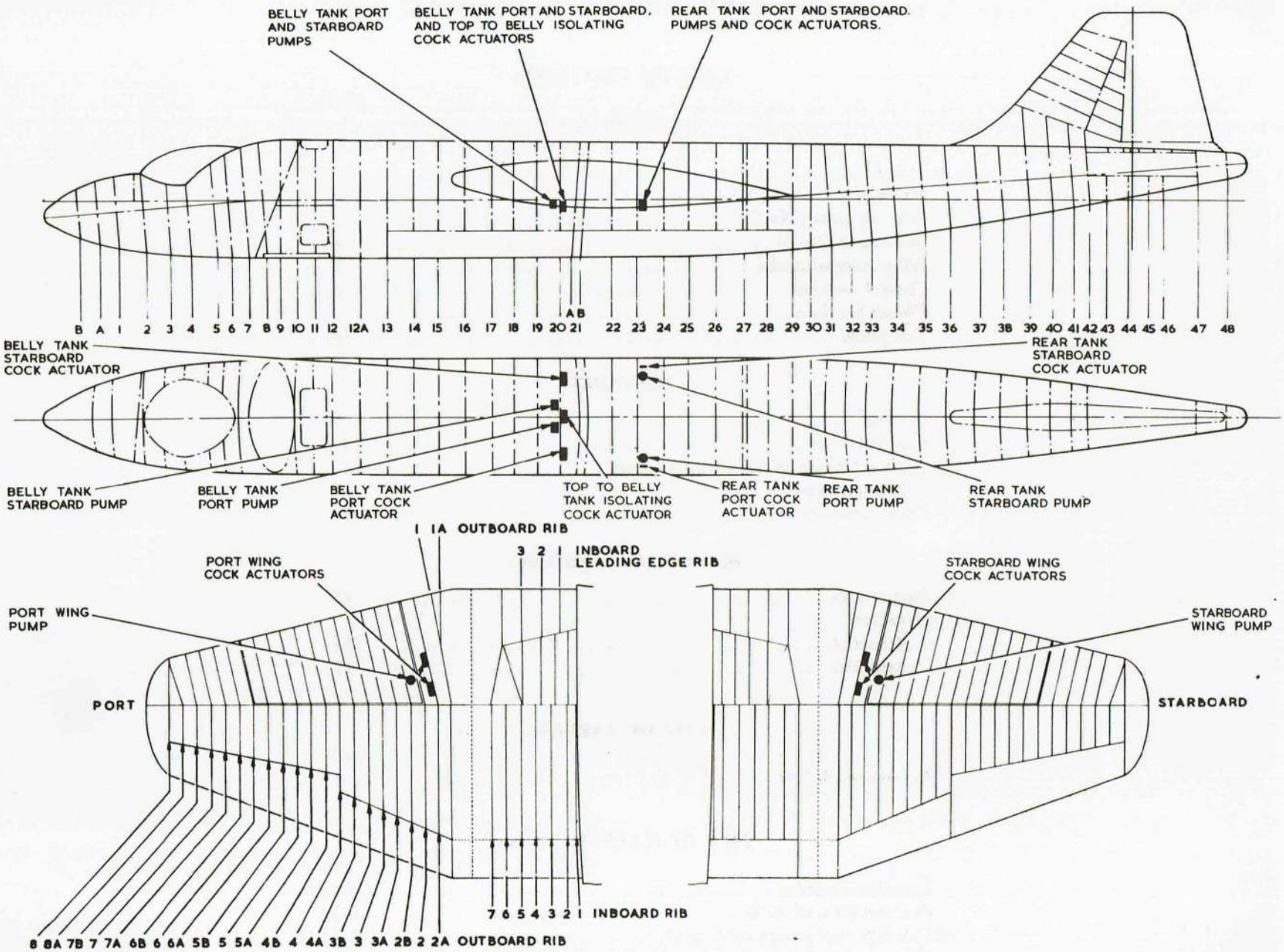

FIG. I. LOCATION DIAGRAM

DESCRIPTION

General

1. Six fuel tanks, consisting of top tanks, numbered 1 to 5, and a belly tank (No.6) are permanently installed in the fuselage, and an integral tank is installed in each wing. Detailed information on the fuel system is contained in A.P.101B-0407-1A, Sect.4, Chap.2. The power supply to each pump circuit passes through a suppressor, located near its associated pump, and is controlled by a switch on the engine instrument panel. Each cock actuator circuit is controlled by a switch on the pilot's take-off panel and both pump and cock circuits are protected by circuit breakers on the E.C.P.

Forward top tanks (No.1 to 4)

2. The top tanks, numbered 1 to 4 have neither pumps nor cocks and drain into the collector box at the aft end of the belly (No.6) tank. Fuel flow between these tanks and the collector box is controlled by a Type 222 electrically actuated cock which in turn is controlled by a switch on the engine instrument panel.

Rear top tank (No.5)

3. The No.5 tank incorporates two Type SPE1003 fuel pumps which project into the base of the tank through adapter plates in the roof of the flare bay.The pumps are positioned port and starboard and near to each is a fuel cock which is operated by a rotary actuator, Type 200.

Belly tank (No.6)

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

Wing integral tanks

5. Each integral tank is fitted with one Type PUL 907 fuel pump and two Type 219 cock actuators. One cock controls fuel delivery to the engine supply line and the other transfers the supply to the No.5 fuselage tank.

Control switches

6. All fuel pumps are controlled by switches mounted on the engine instrument panel. With the exception of the TOP TO BELLY TANK fuel cock switch, which is fitted on the engine instrument panel, all other cock switches are fitted on the pilot's take-off panel. The switches which control the cocks serving No.5, 6 and the integral tanks have two positions, ON/OFF. Two switches are used to control the cocks on each wing integral tank, one labelled ON/OFF and the other NORMAL/WING TRANSFER TO REAR TANK. With the latter set to the NORMAL position, the cock which controls the fuel supply to the engine line is then operated by the ON/OFF switch. Placing the NORMAL/WING TRANSFER TO REAR TANK switch to WING TRANSFER TO REAR TANK closes the engine supply cock to direct the fuel supply to the No.5 tank. The ON/OFF switch controls which ever cock is selected by the position of the NORMAL/WING TRANSFER TO REAR TANK switch.

Circuit breakers

7. Each pump and cock circuit is protected by a circuit breaker on the forward face of the E.C.P. The circuit breakers serving the pump circuits are rated at 15 amperes and those for the fuselage and wing integral cocks, 5 amperes and 10 amperes respectively.

Test panel

8. For checking the operation and current consumption of each fuel 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 on 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

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

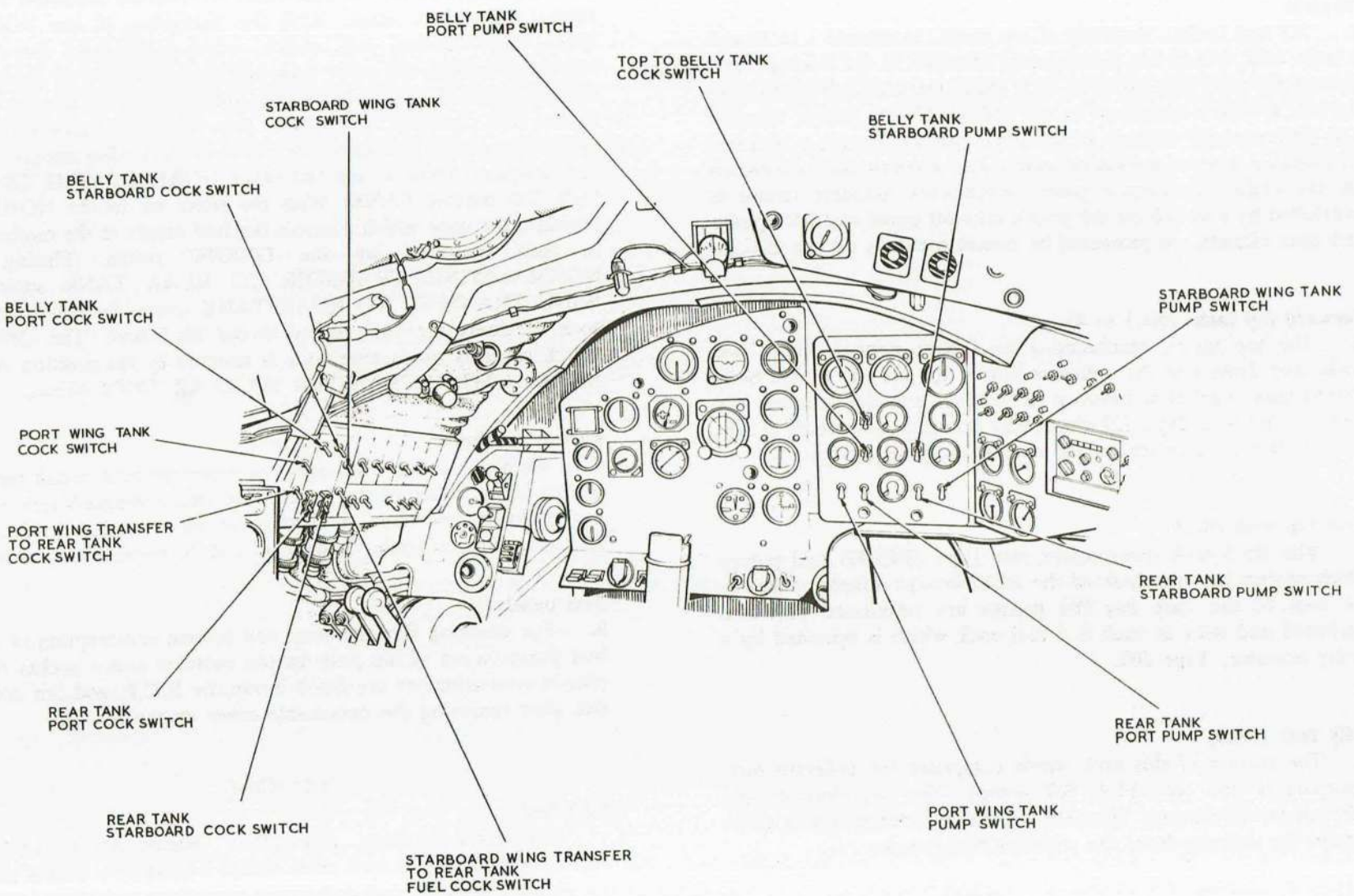

FIG.1A. LOCATION DIAGRAM

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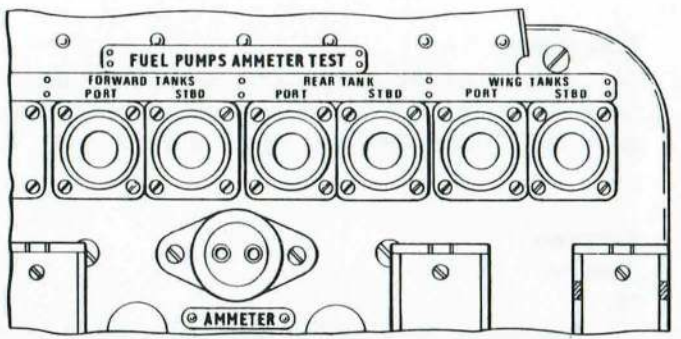
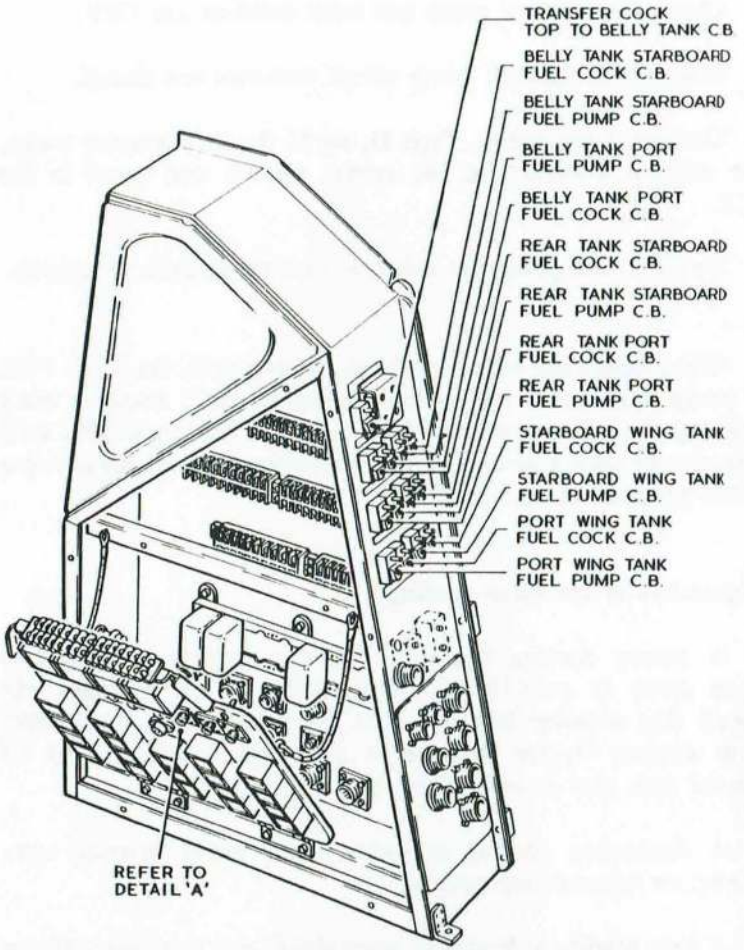


FUEL PUMP TEST SWITCHES AND AMMETER SOCKET
DETAIL 'A'



ELECTRICAL CONTROL PANEL (E.C.P.)

FIG. 1B. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

Fuel pump test

10. The following describes the procedure for checking the operation and current consumption of the fuel pumps:-

(1) Check that all fuel pump and cock switches are OFF.

(2) Ensure that the fuel pump circuit breakers are closed.

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

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

11. When operating with 24-volts at its terminals, the Type PUL 907 pump should take a maximum current of 10.25 amperes when sustaining a no-flow pressure of 15.75 lb/in^2. The Type SPE 1003 pump should take a maximum of 11.5 amperes when sustaining a no-flow pressure of 16.5 lb/in^2.

Interpretation of test meter readings

12.

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

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

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

Voltage drop

13. The test voltage given in para.11 as 24 is that which should be available at the pump terminals and does not take into consideration the voltage drop between the busbar supply and the pump units when on load. The drop between the busbar and the pumps in No.5 and No.6 tanks is approximately 2-volts and between the busbar and the wing integral tank pumps 3.6 volts. This voltage drop should be allowed for when making tests.

Cock actuators

14. The cock actuators Type 201, 219 and 222 incorporate Type 200 rotary actuators. Normal servicing of the units is usually confined to checking brush length and removing carbon dust, which can be done after the removal of the end cover from the motor.

REMOVAL AND ASSEMBLY

Fuel pumps

15. A fault on the pump motor necessitates the removal of the complete pump assembly. Instructions covering this procedure are given in A.P.101B-0407-1A, Sect.4, Chap.2

Actuators

Removal

16.

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

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

(3) Remove the actuator.

Assembly

17.

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

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

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

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

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
	Cock actuator, Type 201, Mk.8 (No.5 tank)	2	
	comprising:-		
5W/4511895	Actuator, Type 200, Mk.1	-	113E-0248-1
5W/337	Adapter assembly	-	
27FS/2206	Fuel cock	-	
	Cock actuator, Type 219, Mk.1 (Wing tanks)	4	
	(No.6 tank)	2	
	comprising:-		
5W/4511895	Actuator, Type 200, Mk.1	-	113E-0248-1
5W/343	Adapter assembly	-	
27FS/2237	Fuel cock	-	
	Cock actuator, Type 222, Mk.1 (No.6 tank)	1	
	comprising:-		
5W/4511895	Actuator, Type 200, Mk.1	-	113E-0248-1
5W/343	Adapter assembly	-	
27FS/2238	Fuel cock	-	
◀ 5UE/4412539 ▶	Pump, Type PUL.907 Mk.4 (Wing tanks)	2	113E-0418-6
	(No.6 tank)	2	
5UE/9104	Pump, Type SPE 1003 Mk.4 (No.5 tank)	2	113E-0438-1

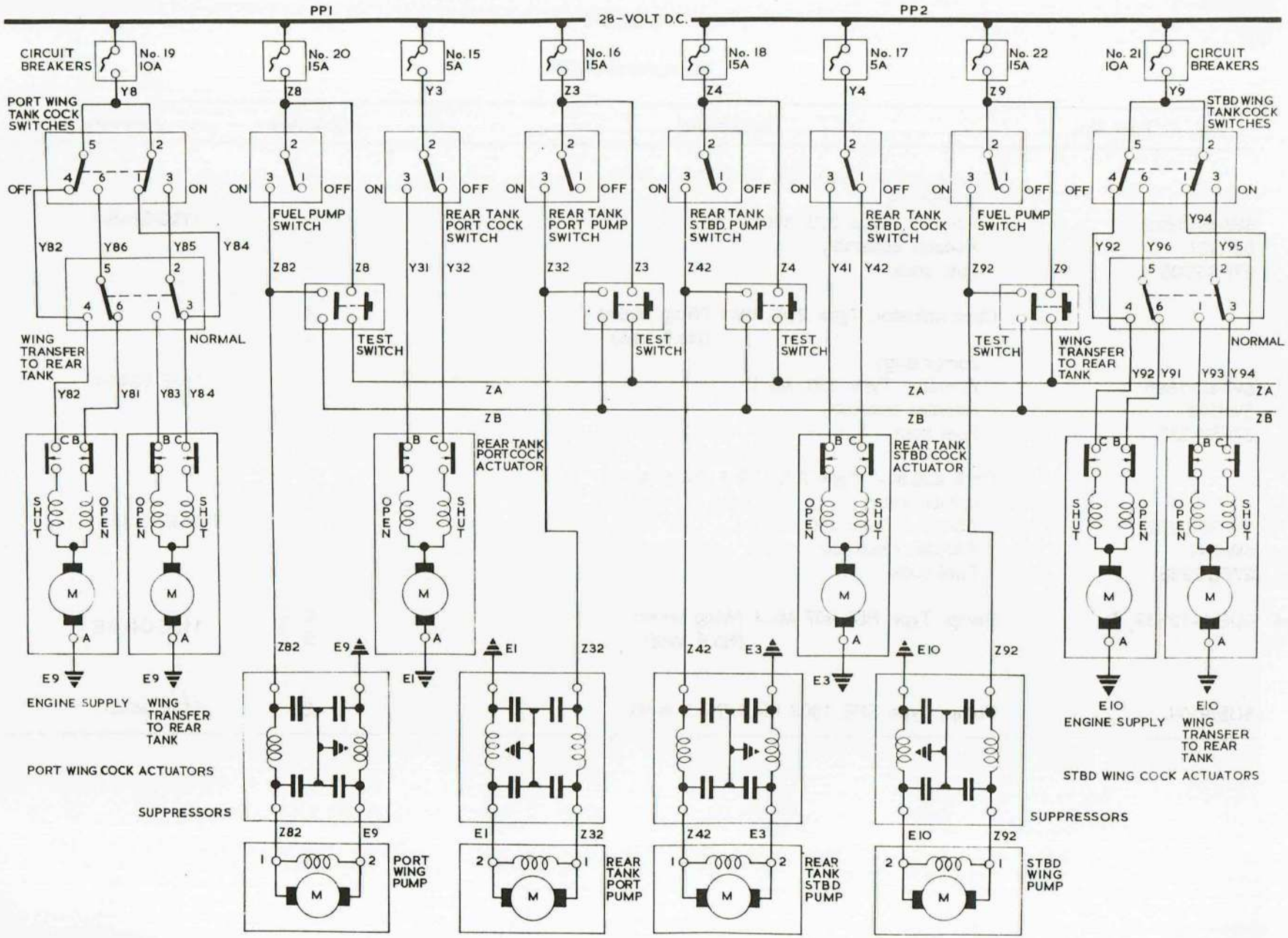


FIG. 2. FUEL PUMPS AND COCKS

◄SWITCH ANNOTATION ADDED►

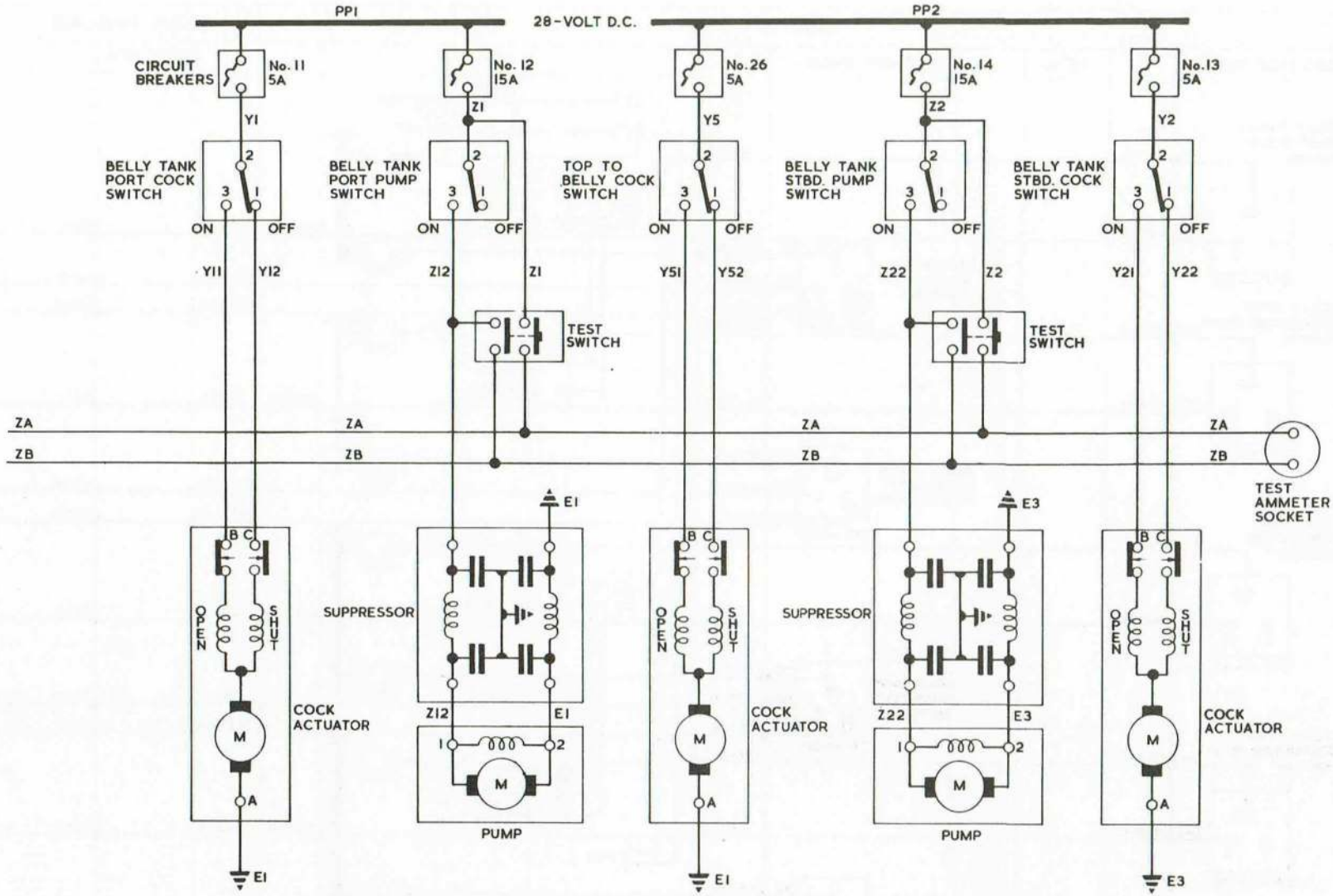


FIG. 2A. FUEL PUMPS AND COCKS

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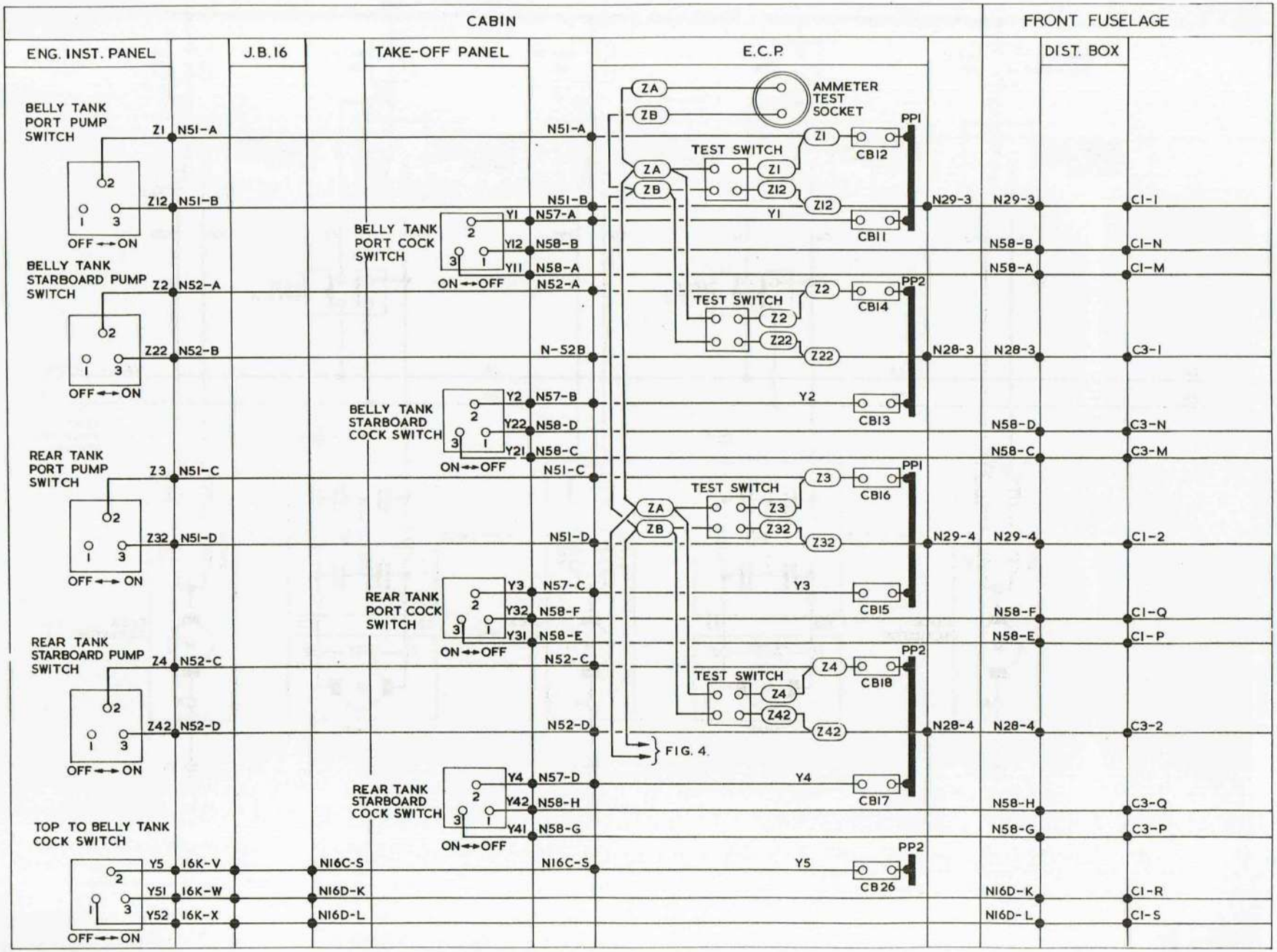

FIG. 3. FUSELAGE FUEL PUMPS AND COCKS

◄JUNCTION BOX PINS ADDED►

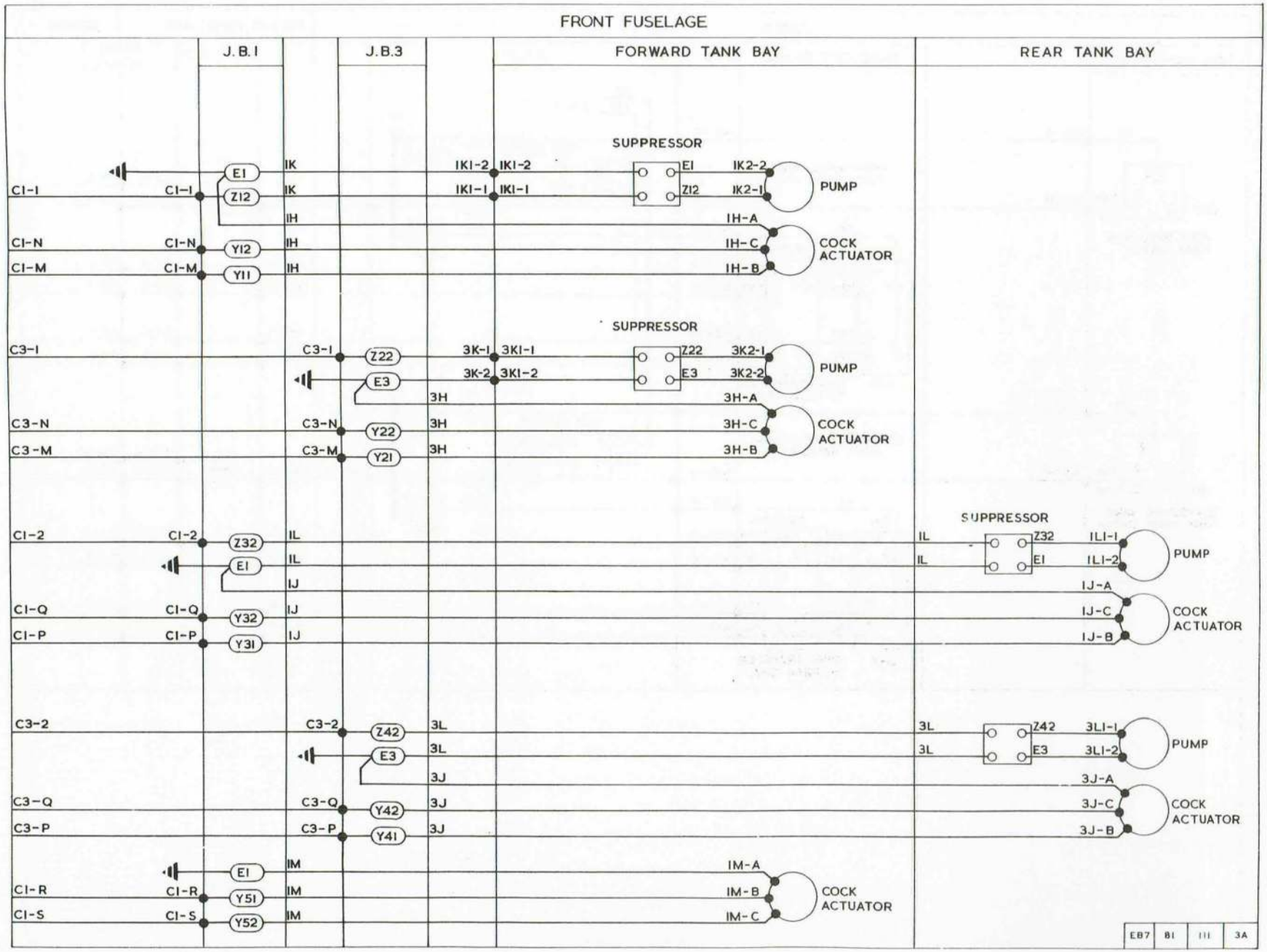

FIG.3A. FUSELAGE FUEL PUMPS AND COCKS

◄COLOUR IDENTS REMOVED►

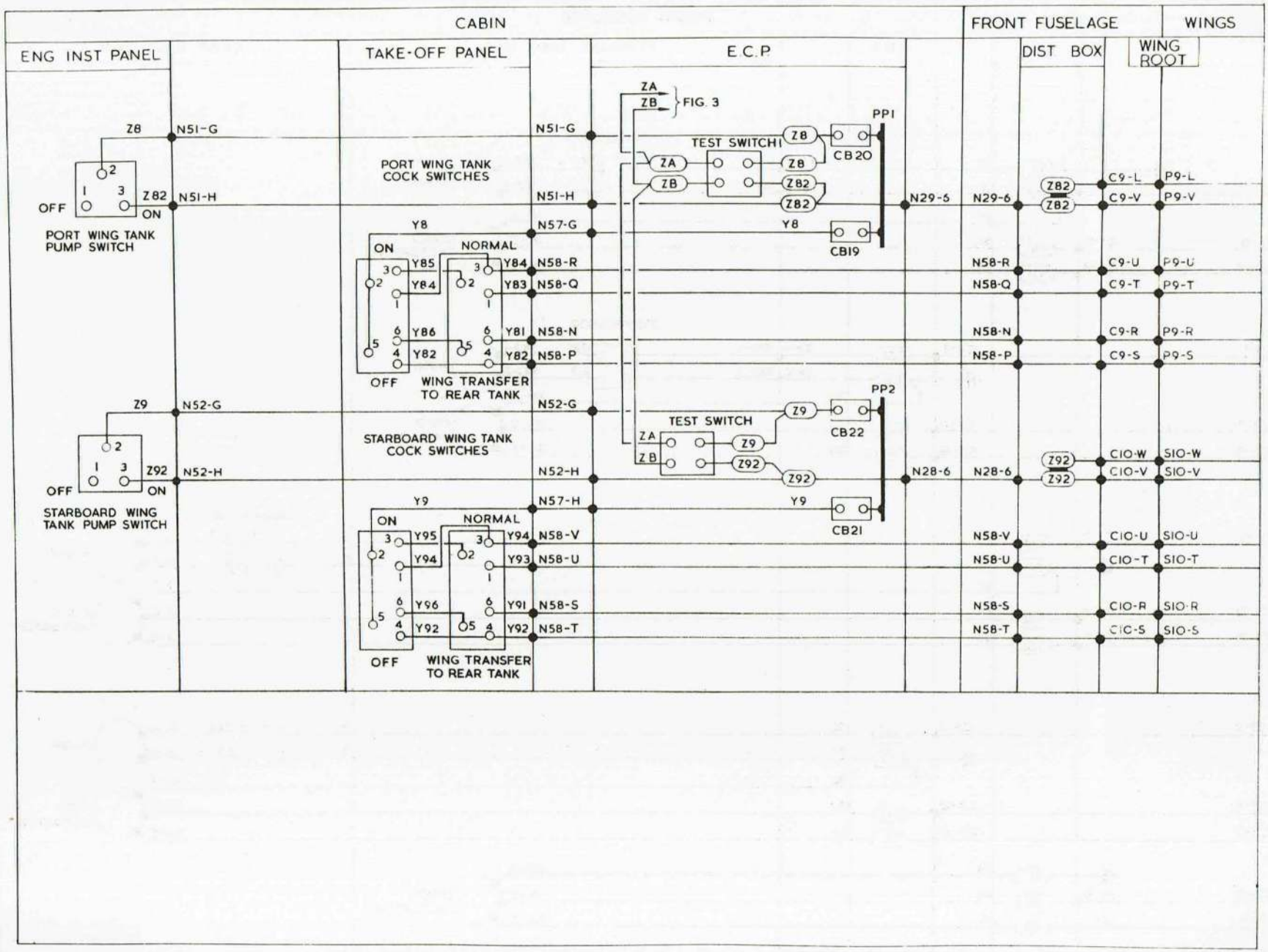

FIG. 4. WING FUEL TANK PUMPS AND COCKS

◄SWITCH ANNOTATIONS AMENDED►

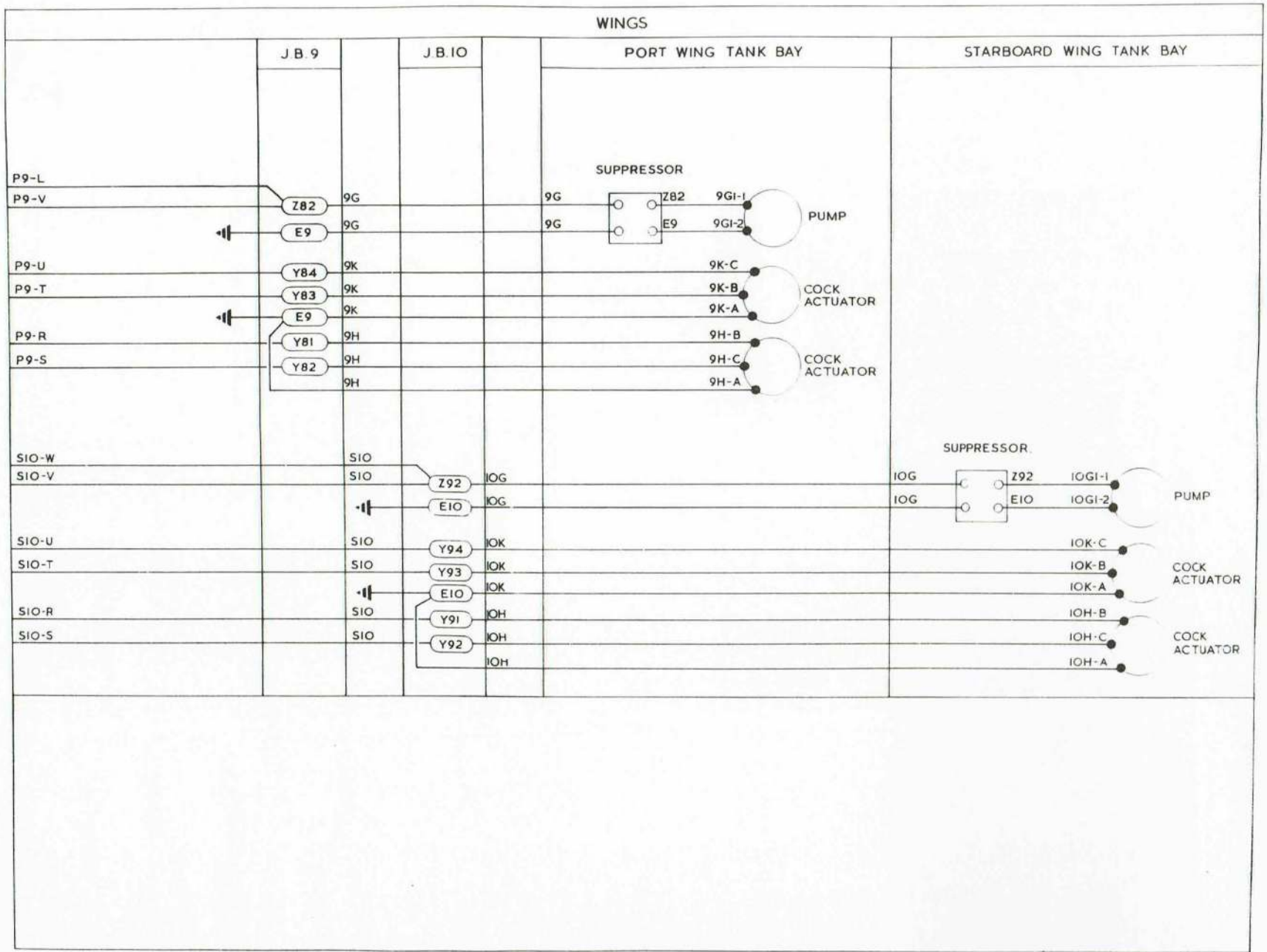

FIG.4A. WING FUEL TANK PUMPS AND COCKS

◄COLOUR IDENTS REMOVED►

RADIO AND RADAR POWER SUPPLIES – GROUP R & S

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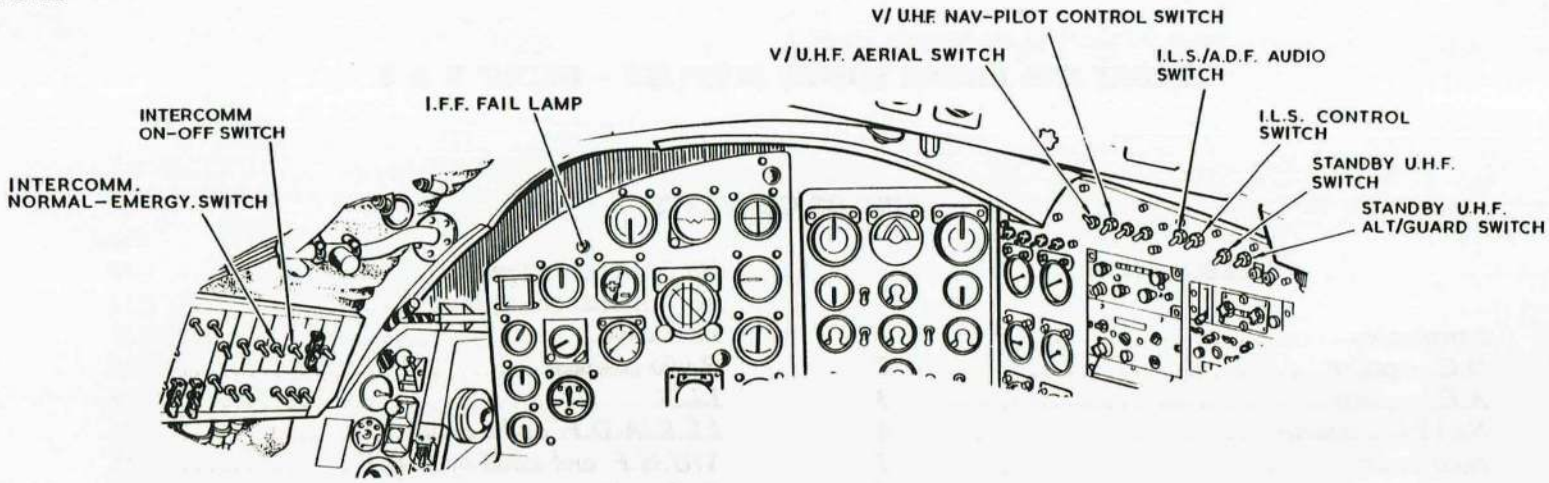
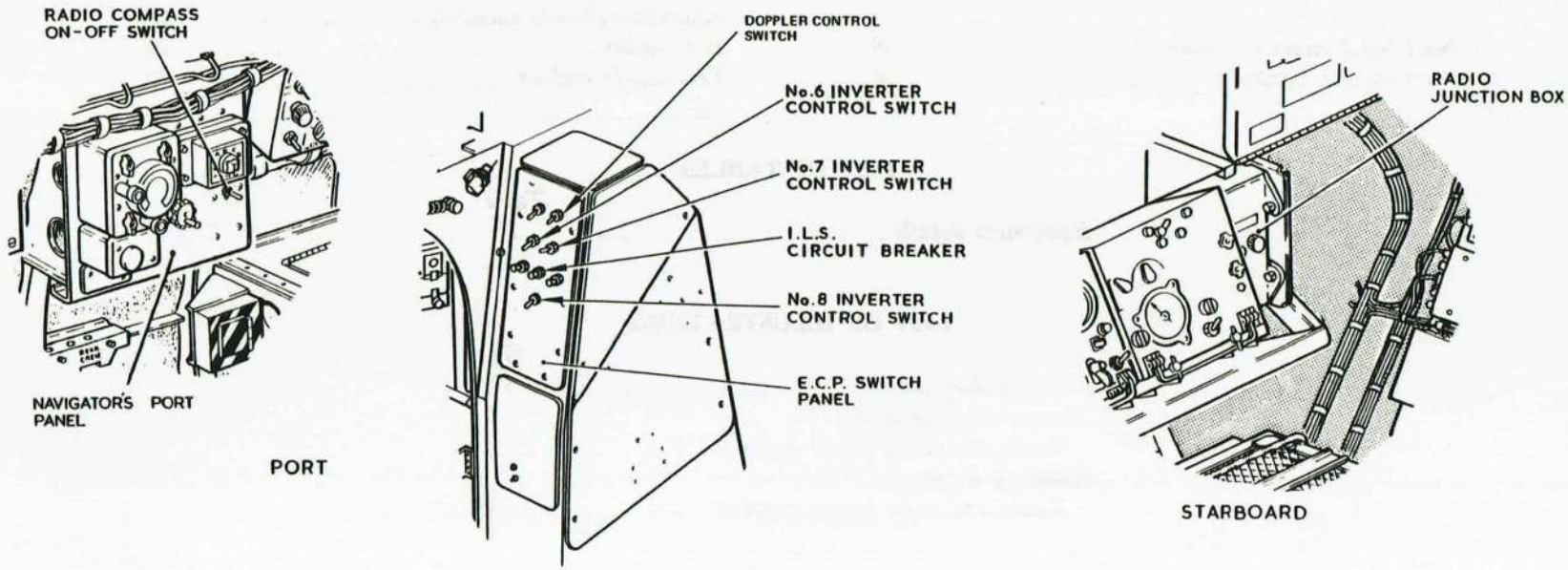


PILOT'S STATION



NAVIGATOR'S STATION

FIG. 1. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►

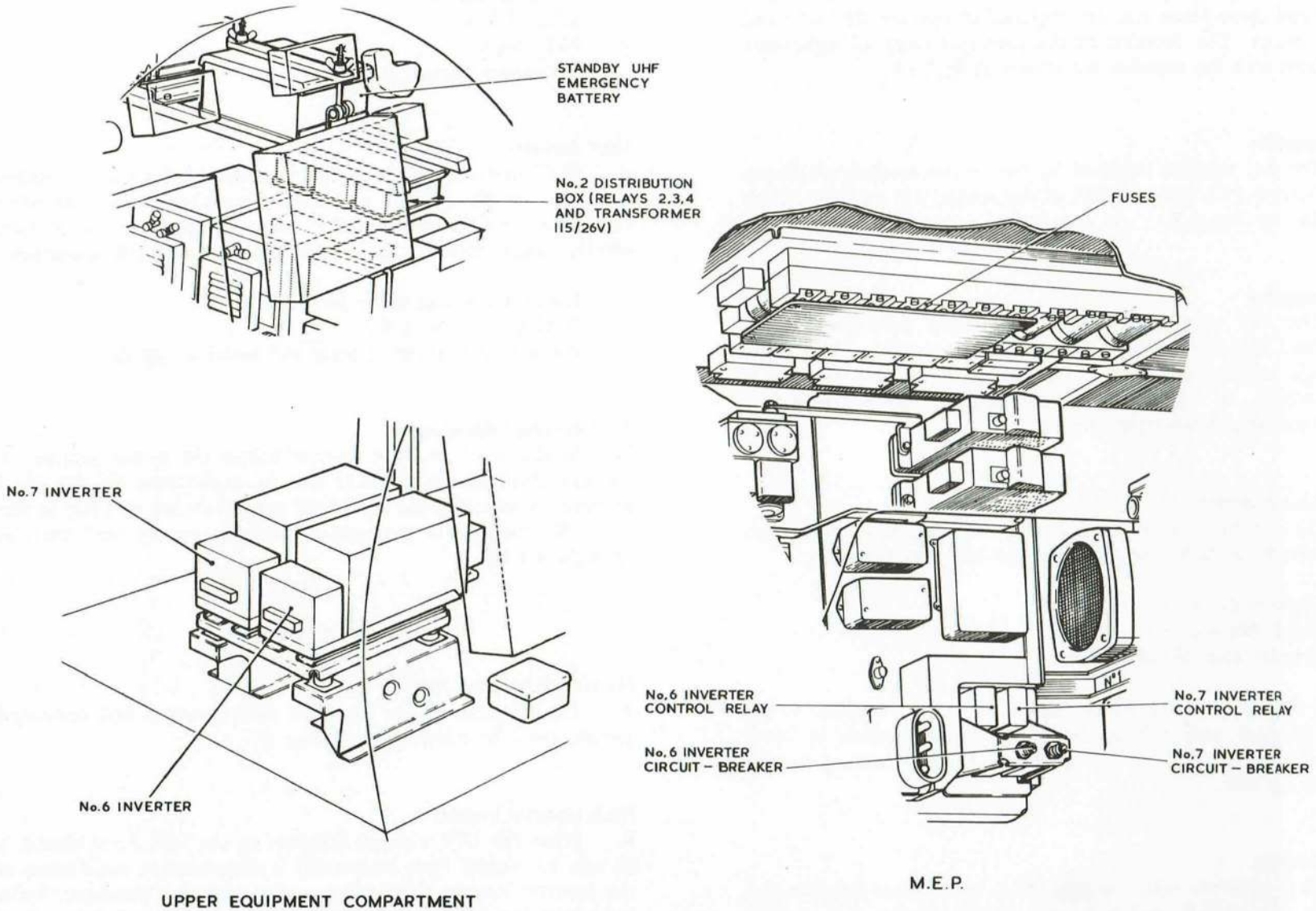


FIG.1A. LOCATION DIAGRAM

DESCRIPTION

Introduction

1. Power supplies of 28 volt d.c. and 115 volt, 400 Hz, single-phase and three-phase a.c. are required to operate the radio and radar system. The location of the principal items of equipment associated with the supplies are shown in fig.1-1A.

D.C. supplies

2. The d.c. supplies required by the various systems are drawn from busbars P10, PP1 and PP2 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 No.1/No.2 inverter *(Group D)* or from two, Type 208, static inverters, numbered 6 and 7, located in the upper equipment compartment. 26 volt, 400 Hz synchro supplies, are provided by a 115/26 volt step-down transformer.

No.1/No.2 inverter

4. No.1 inverter provides 115 volt, 400 Hz, three-phase and single-phase a.c. power supplies for the following systems:-

Radio compass
G.P.I. Mk.4A
Doppler control indicator

In the event of No.1 inverter failure the power supplies to the radio compass only will automatically be maintained by No.2 inverter, as described in Group D, and the remaining system supplies are lost.

No.6 inverter

5. No.6 inverter, which is controlled by a circuit breaker and relay on the M.E.P. and a control switch, annotated No.6 INV ON-OFF, on the E.C.P. switch panel, provides 115 volt, 400 Hz single-phase a.c. power supplies for the following essential systems:-

Radio altimeter
I.F.F./S.S.R.
H.F. radio
Altimeters (height encoding)

No.7 inverter

6. No.7 inverter, which is also controlled by a circuit breaker and relay on the M.E.P. and a control switch, annotated NO.7 INV ON-OFF-C/O on the E.C.P. switch panel, provides 115 volt, 400 Hz, single-phase a.c. power supplies for the following systems:-

Decca VOR (via the R.M.I. J.B.)
D.M.E. (via the J.B.)
Doppler transmitter/receiver and aerial assembly

No.7 inverter change-over

7. In the event of No.6 inverter failure the power supplies to the essential systems *(para.5)* can be maintained by the No.7 inverter by selecting the No.7 INV control switch to C/O; in this event the supplies to the systems normally fed by No.7 inverter *(para.6)* are lost.

OPERATION

No.1/No.2 inverter control

8. The operation of the No.1 and No.2 inverters and associated circuits are fully described in Group D.

No.6 inverter control

9. When the INV 6 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 No.6 INV ON-OFF control switch, on the E.C.P. switch panel, to ON completes a 28 volt d.c. supply from busbar PP1 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 the normally-closed contacts of relay No.2, in the No.2 distribution box, and circuit TG61 to the essential systems detailed in para.5.

No.7 inverter control

10. The operation of No.7 inverter circuit is identical to that described in para.9 with the exception that the control switch, on the E.C.P. switch panel, is annotated No.7 INV ON-OFF-C/O. The systems detailed in para.6 are supplied from circuit TG71.

No.7 inverter change-over

11. If the supply from No.6 inverter fails, the supply to the essential systems *(para.5)* can be maintained by selecting the No.7 INV ON-OFF-C/O switch, on the E.C.P. switch panel, to C/O. A supply is now completed from busbar PP1 to energize the coil of relay No.2, in the No.2 distribution box. The relay contacts change-over and connect the output from No.7 inverter to circuit TG61; simultaneously, the supplies to the systems detailed in para.6, and fed from circuit TG71, are lost.

Intercomm.

12. The intercomm. system operates from 28 volt d.c. supplies drawn from busbar PP1 via fuses 87 and 88, in the E.C.P. The earth return circuit from the system (J.B.7684) is controlled by either the INTERCOMM. ON-OFF or INTERCOMM NORMAL-EMERGY switches, on the take-off panel, when in the ON or EMERGY positions respectively.

Radio compass

13. The radio compass operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supplies are drawn from the output of No.1/No.2 inverter *(Group D)*. The d.c. supply is drawn from busbar PP1, via fuse 233, in the E.C.P., and the RADIO COMPASS ON-OFF switch, on the navigator's port panel.

I.L.S.

14. The I.L.S. system operates from a 28 volt d.c. supply drawn from busbar PP2 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 miscellaneous instrument panel.

I.L.S./A.D.F. audio switch

15. Operation of the I.L.S./A.D.F. audio switch, located on the miscellaneous instrument panel, to A.D.F., energizes a relay in the radio junction box. The relay, when energized, routes the audio output from the A.D.F. system into the intercommunication system. In the de-energized state, the relay routes the audio output from the I.L.S. system into the intercommunication system.

V/U.H.F. and stand-by U.H.F.

16. The V/U.H.F. operates from 28 volt d.c. supplies drawn from busbars P10, PP1 and PP2 via fuses in the E.C.P. and M.E.P. Fuses 165 and 14 in the M.E.P. provide the main supply, via the interconnecting box, and the supply to the upper/lower aerial relay respectively. The return circuit from the relay is controlled by the V/U.H.F. aerial switch, annotated AERIAL UPPER-LOWER, on the miscellaneous instrument panel. Fuse 230, in the E.C.P. provides the supply to the V/U.H.F. nav-pilot control switch, annotated CONTROL NAV-PILOT, on the miscellaneous instrument panel; this switch determines which control unit is controlling the system.

17. The stand-by U.H.F. operates from 24 volt d.c. supplies drawn from either, the 28 volt d.c. supply busbar P10, via fuse 15 and a dropper resistor, or from the 24 volt emergency battery supply. Selection of the supply is determined by the stand-by U.H.F. switch, annotated STANDBY U.H.F. BATT-NORM-OFF, on the miscellaneous instrument panel. When the switch is in the NORM position the supply is completed from busbar P10, via the fuse and dropper resistor and one set of switch contacts to the transmitter/receiver and the earth return circuit is completed via the second set of switch contacts. With the switch in the BATT position the circuit to the transmitter/receiver is completed from the 24 volt battery via the switch contacts.

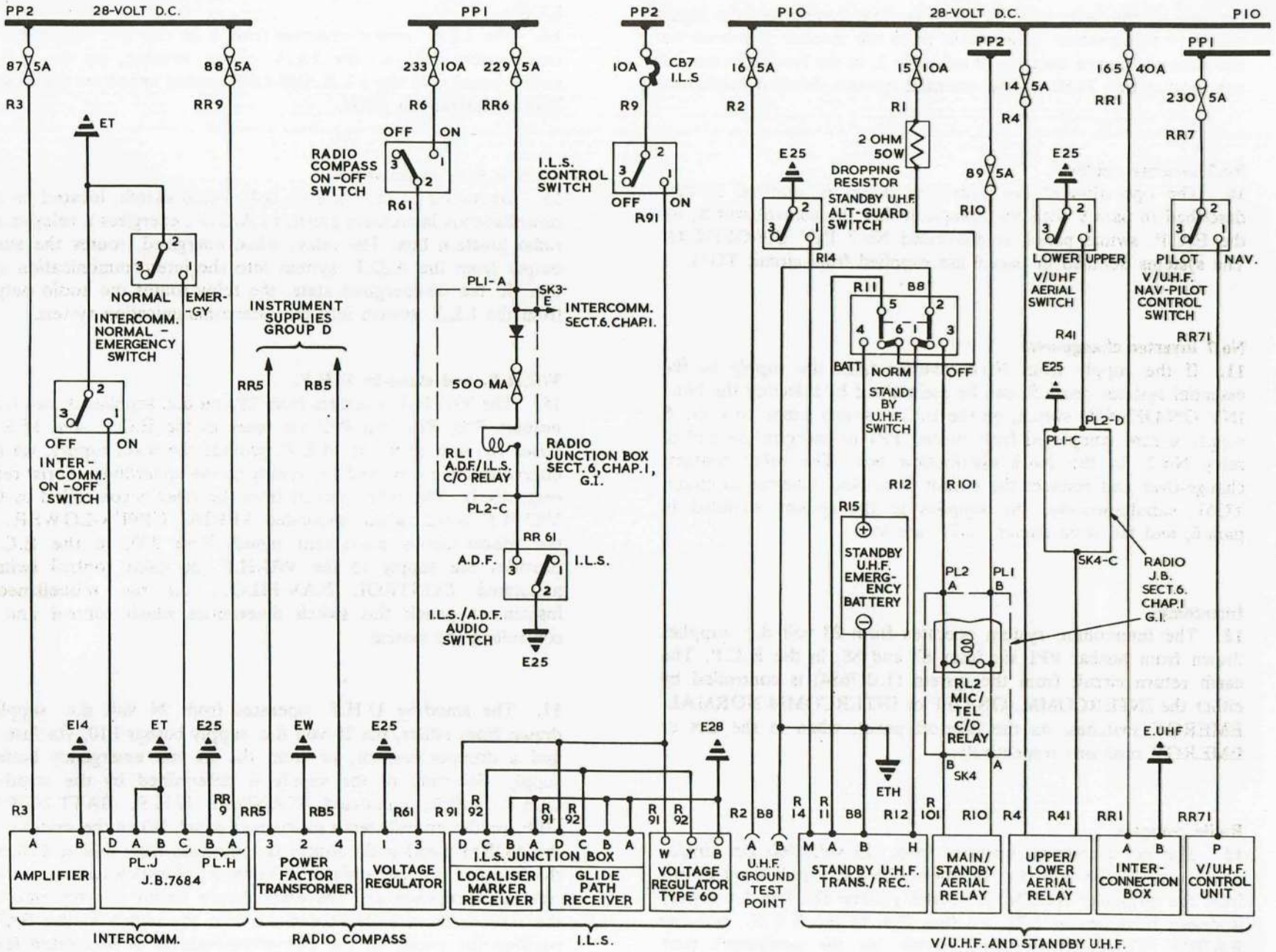


FIG.2. RADIO AND RADAR POWER SUPPLIES

◄ EARTH POINT AMENDED ►

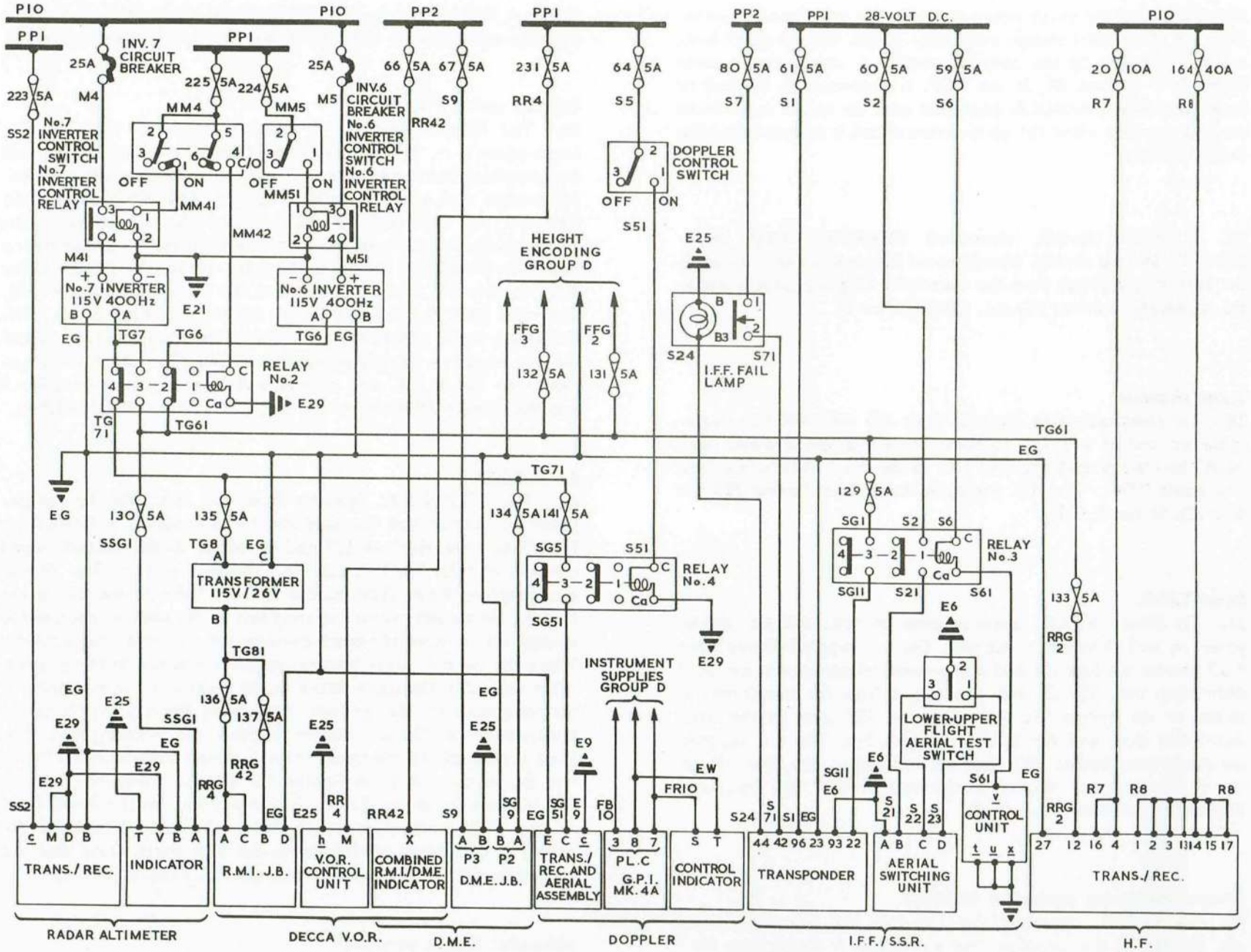


FIG. 2A. RADIO AND RADAR POWER SUPPLIES

◀ EARTH POINT AMENDED ▶

18. Control of the earth return circuit to the main/stand-by aerial relay and the mic/tel change-over relay, in the radio junction box, is also controlled by the switch contacts. A supply drawn from busbar PP2 via fuse 89, in the ECP, 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.

19. A further switch, annotated STANDBY UHF ALT-GUARD, located on the miscellaneous instrument panel, controls the earth return circuit from the alternative or guard circuits within the transmitter/receiver *(Sect.6, Chap.1, Part 1).*

Radar altimeter

20. The radar altimeter operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply is drawn from No.6/7 inverter output via fuse 130, in the No.2 distribution box, and circuit TG61. The d.c. supply is drawn from busbar PP1 via fuse 223, in the E.C.P.

Decca V.O.R.

21. The Decca V.O.R. operates from 26 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply is drawn from No.7 inverter via fuse 135 and a step-down transformer in the No.2 distribution box. The 26 volt a.c. output from the transformer is routed to the system via fuses 136 and 137, also in the No.2 distribution box, and the R.M.I. junction box. The d.c. supplies are drawn from busbar PP2, fuse 66, and busbar PP1, fuse 231, in the E.C.P. and are routed to the control unit and combined RMI/DME indicator respectively.

Distance measuring equipment (D.M.E.)

22. The D.M.E. operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply is drawn from No.7 inverter via fuse 134, in the No.2 distribution box, whilst the d.c. supply is drawn from busbar PP2 and fuse 67, in the E.C.P. Both supplies are routed to the system via the D.M.E. junction box.

Doppler and G.P.I. Mk.4A

23. The Doppler and G.P.I. operate from 115 volt, 400 Hz, single-phase a.c., 115 volt, 400 Hz, three-phase a.c. and 28 volt d.c. supplies. The single-phase a.c. supply to the Doppler transmitter/receiver and aerial assembly is drawn from No.7 inverter via fuse 141, in the No.2 distribution box, and is routed to the normally-open contacts of relay No.4, also in the No.2 distribution box. The 28 volt d.c. supply to the relay coil is drawn from busbar PP1 via fuse 64, in the E.C.P., and the Doppler control switch, annotated DOPPLER ON-OFF, on the E.C.P. switch panel. With the switch in the ON position the coil of the relay is energized and the a.c. supply is completed via its contacts. The three-phase a.c. supply to the G.P.I. and control indicator is drawn from No.1 inverter *(Group D)* via fuses 124 and 128, in the 400 Hz fusebox.

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 No.6/7 inverter via fuse 129 and is routed to the normally-open contacts of relay No.3 in the No.2 distribution box. The 28 volt d.c. supplies, drawn from busbar PP1 via fuses 59 and 60, 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 PP1 via fuse 61, in the E.C.P. A further d.c. supply, drawn from busbar PP2 via fuse 80, in the E.C.P., is connected to the IFF FAIL lamp on the flight 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 3).*

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 No.6/7 inverter via fuse 131, in the No.2 distribution box, whilst the d.c. supplies are drawn from busbar PP1 via fuses 221 and 222, in the E.C.P.

H.F. radio

26. The H.F. radio operates from 115 volt, 400 Hz, single-phase a.c. and 28 volt d.c. supplies. The a.c. supply is drawn from No.6/7 inverter via fuse 133, in the No.2 distribution box, whilst the d.c. supply is drawn from busbar P10 via fuses 20 and 164, in the M.E.P.

Test supply sockets

27. A 28 volt d.c. test supply socket, located in the upper equipment compartment, provides a d.c. power supply for the radio/radar test equipment. The supply to the test point is drawn from busbar P10, via fuse 16, on the M.E.P.

28. The height encoding system 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 IFF tray in the rear fuselage. The a.c. test supply is drawn from No.6/7 inverter via fuse No.132 in the No.2 distribution box, whilst the d.c. test supply is drawn from busbar PP2 via fuse 78, in the E.C.P.

TABLE 1

Equipment details

Ref.No.	Equipment	Quantity	Relevant A.P.
5UB/1959028	Inverter, Type 208	2	A.P.113D series
5UB/1959029	Mounting tray	2	
5CW/9729122	Relay, Type S1	3	
5UB/4342509	Transformer, Type LTS/50/Z1	1	A.P.113D-0454-1
5CW/9994741	Relay, Type A (Plessey)	2	A.P.113D-1313-1

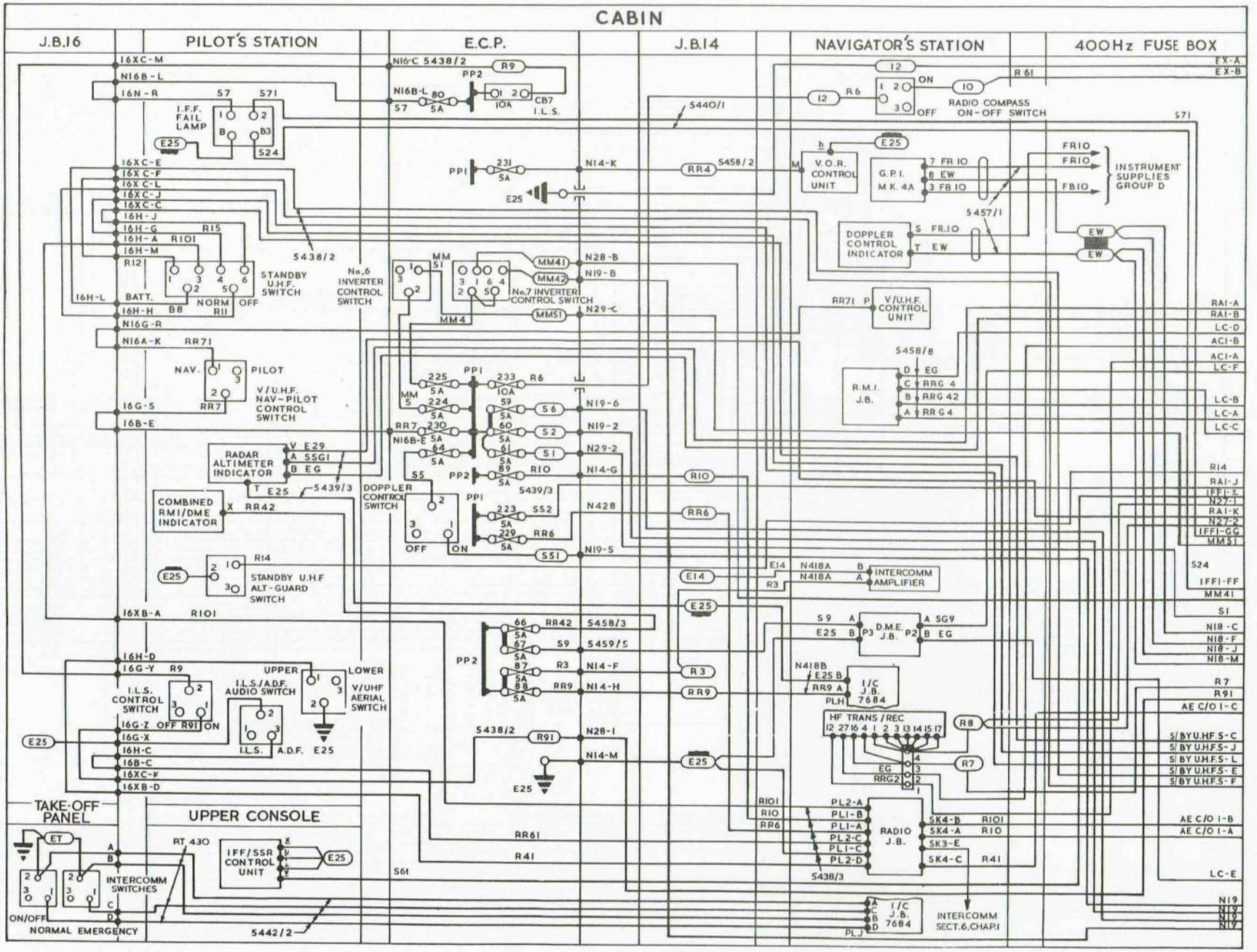


FIG.3. RADIO AND RADAR POWER SUPPLIES

◄ PIN IDENTS AMENDED ►

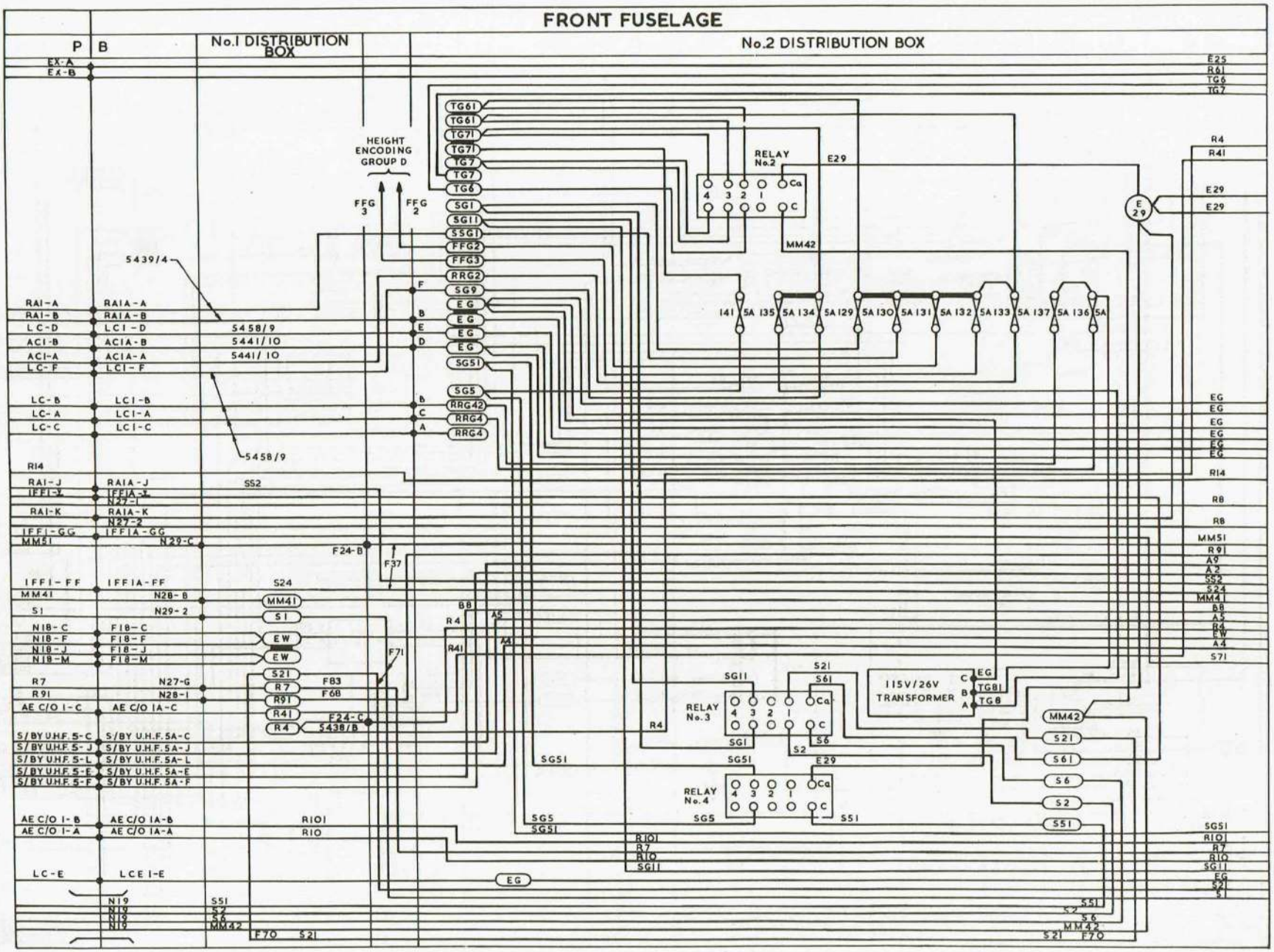


FIG.3A. RADIO AND RADAR POWER SUPPLIES

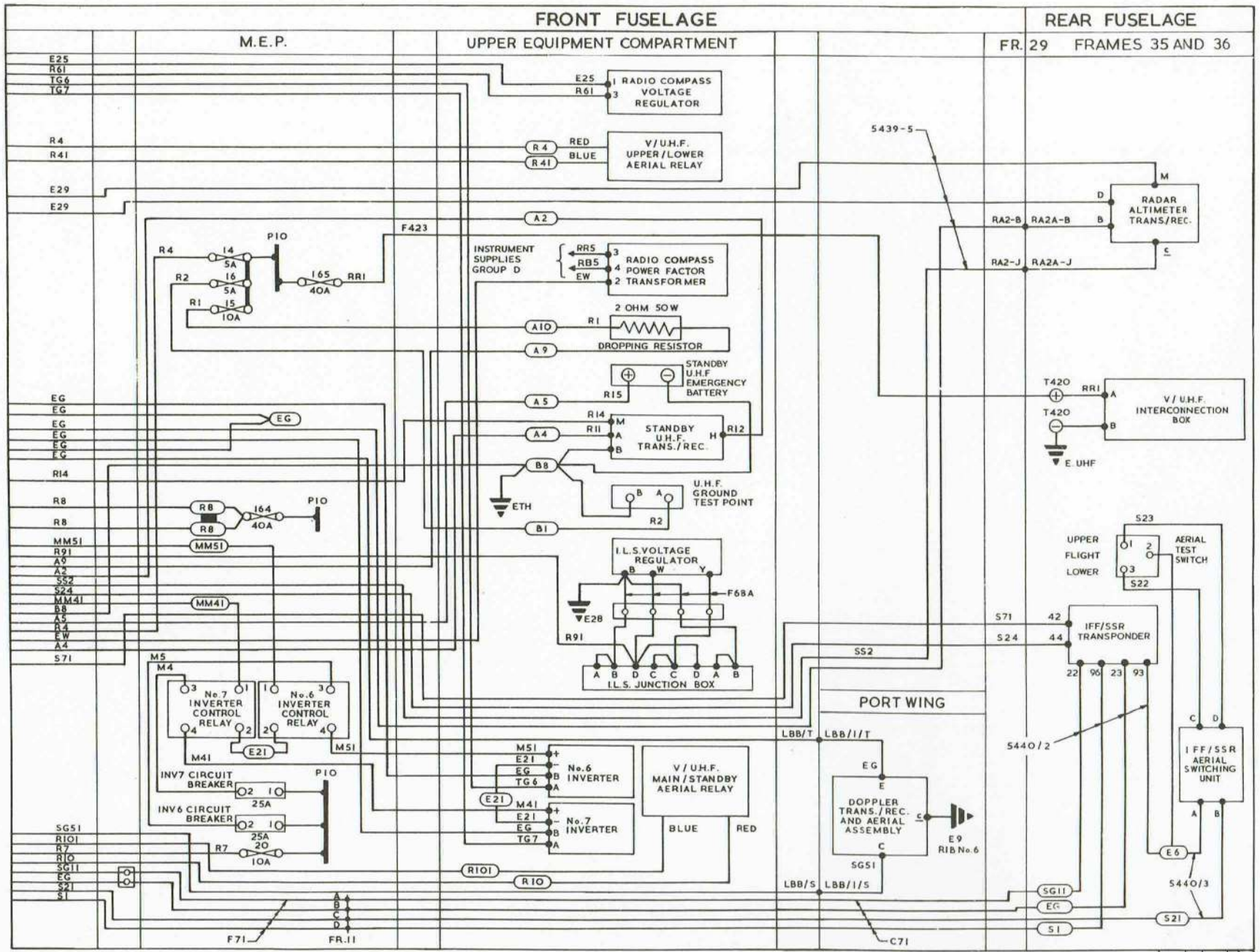


FIG.3B. RADIO AND RADAR POWER SUPPLIES

◄EARTH POINT AMENDED►

WARNING AND EMERGENCY — GROUP W

(completely revised)

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DESCRIPTION

Introduction

1. This group describes the electrical circuits associated with the warning and emergency services of the aircraft. Suitable theoretical and routeing diagrams are provided, while Table 1 lists the principal components, their reference or part number and where possible the associated A.P. in which they are described in full. Location of the units is shown on fig.1-1A-1B.

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 8AX) 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. Three Type 12A (or Type 4AX) extinguishers with single operating heads are also installed. One of these, used only under crash landing conditions, is located on the aft face of frame 27A in the rear fuselage. The others are installed one in each wing between rib E and the inboard engine rib. Indication of fire in the engine bays is given by warning lamps integral with the extinguisher push-button switches on the pilot's coaming 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 bottles 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 a 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 two relays, numbered 1 and 2, mounted on the M.E.P.

Test switch

6. A test switch, which when operated tests both warning lamps simultaneously, is fitted adjacent to the fire extinguisher buttons on the pilot's coaming 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 92) 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 93) 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 IN will pass a supply from circuit X1P (fuse 55) to X13 and discharge both the port Type 14A and Type 12A extinguishers 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 91) and X14 to discharge the starboard Type 14A and Type 12A extinguishers into the No.2 engine bay.

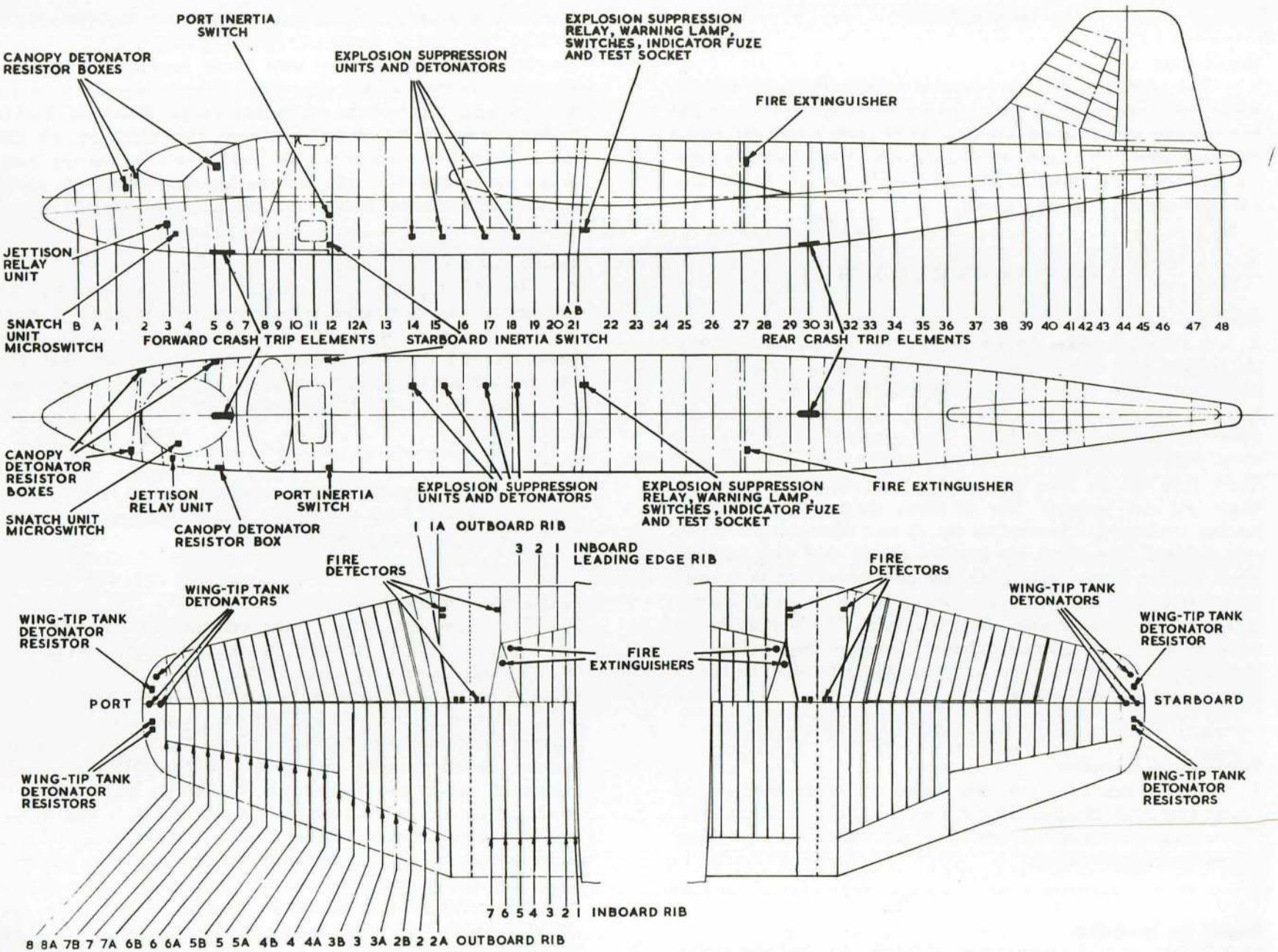
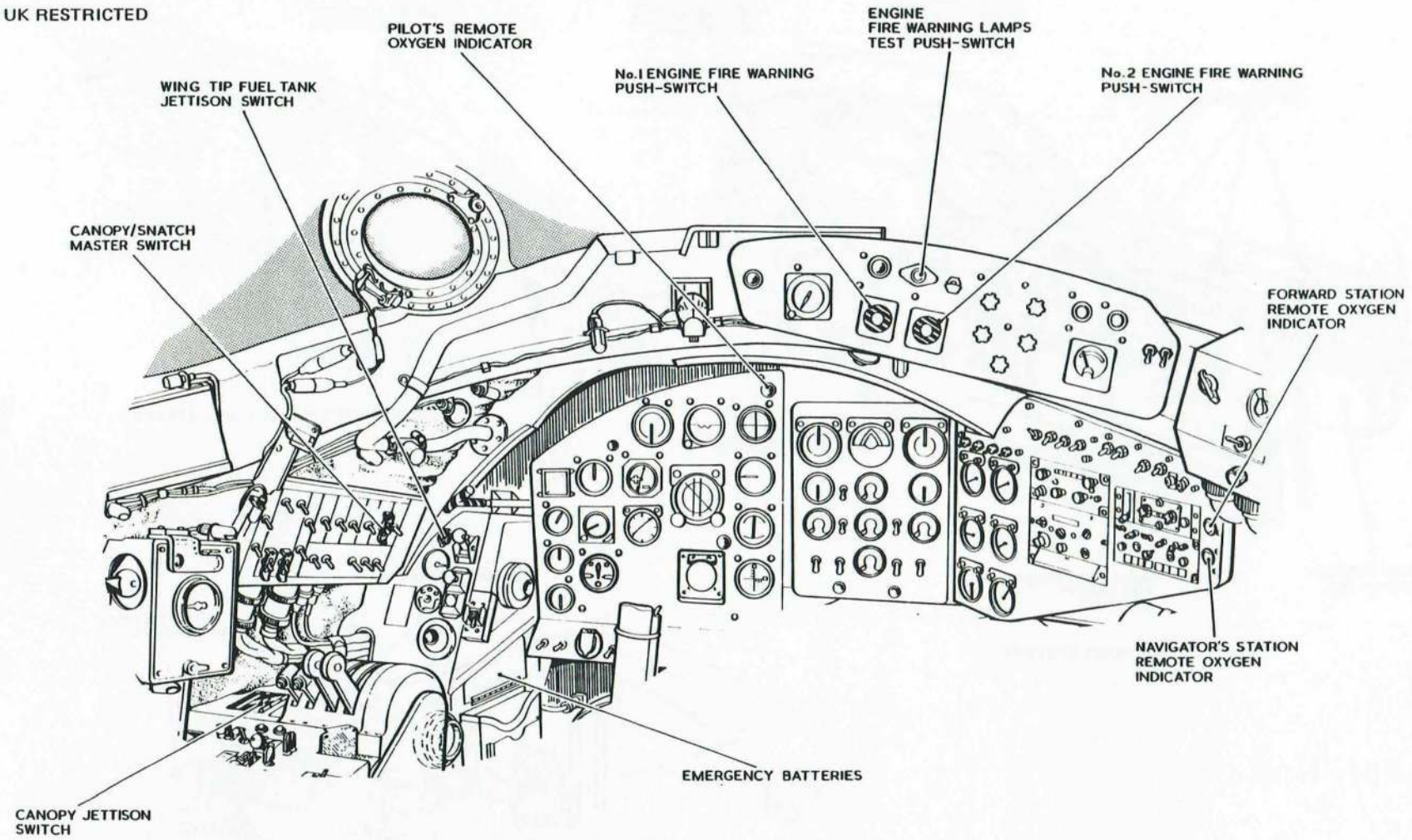


FIG. 1. LOCATION DIAGRAM



PILOT'S STATION

FIG.1A. LOCATION DIAGRAM

UK RESTRICTED

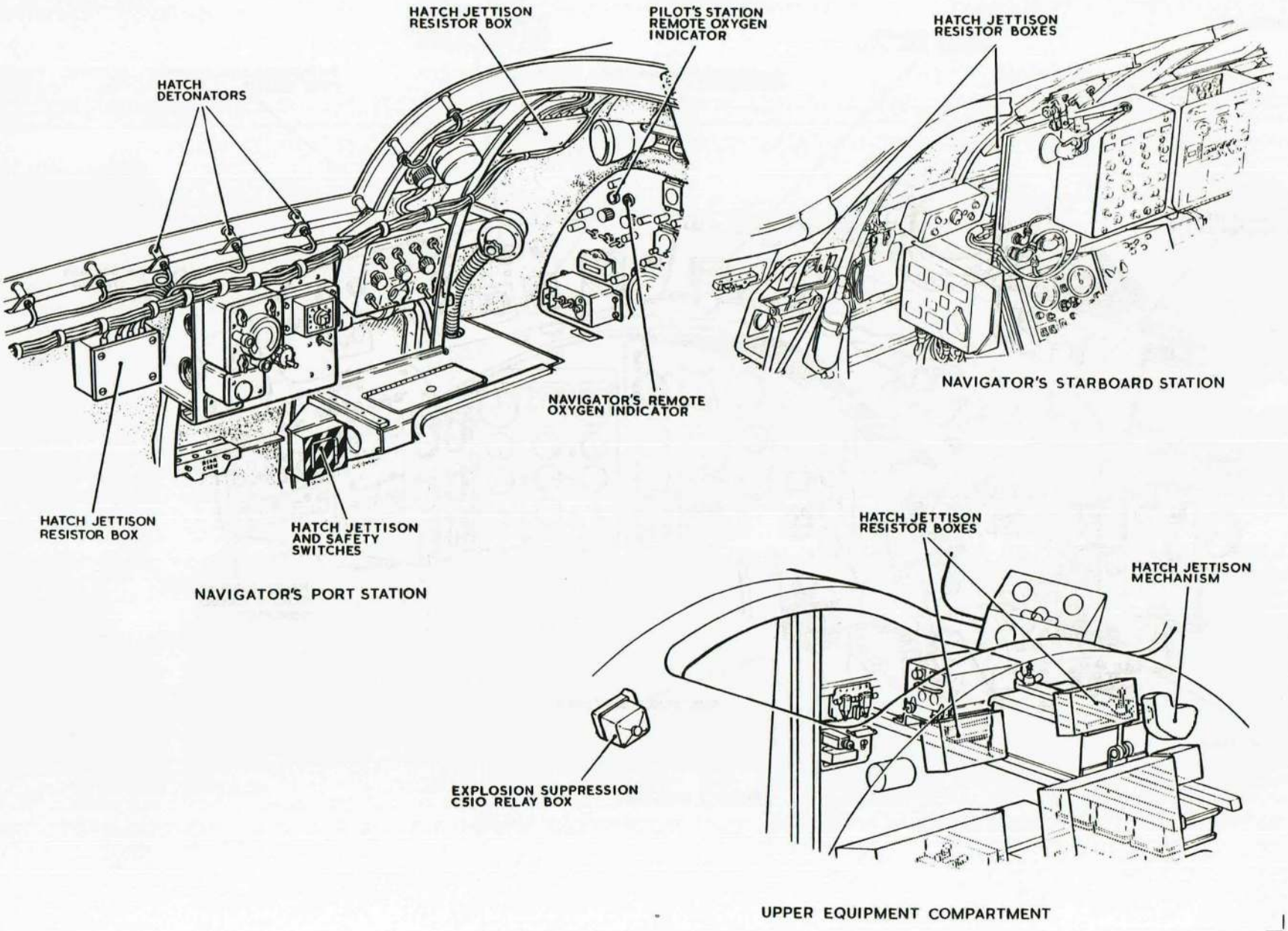
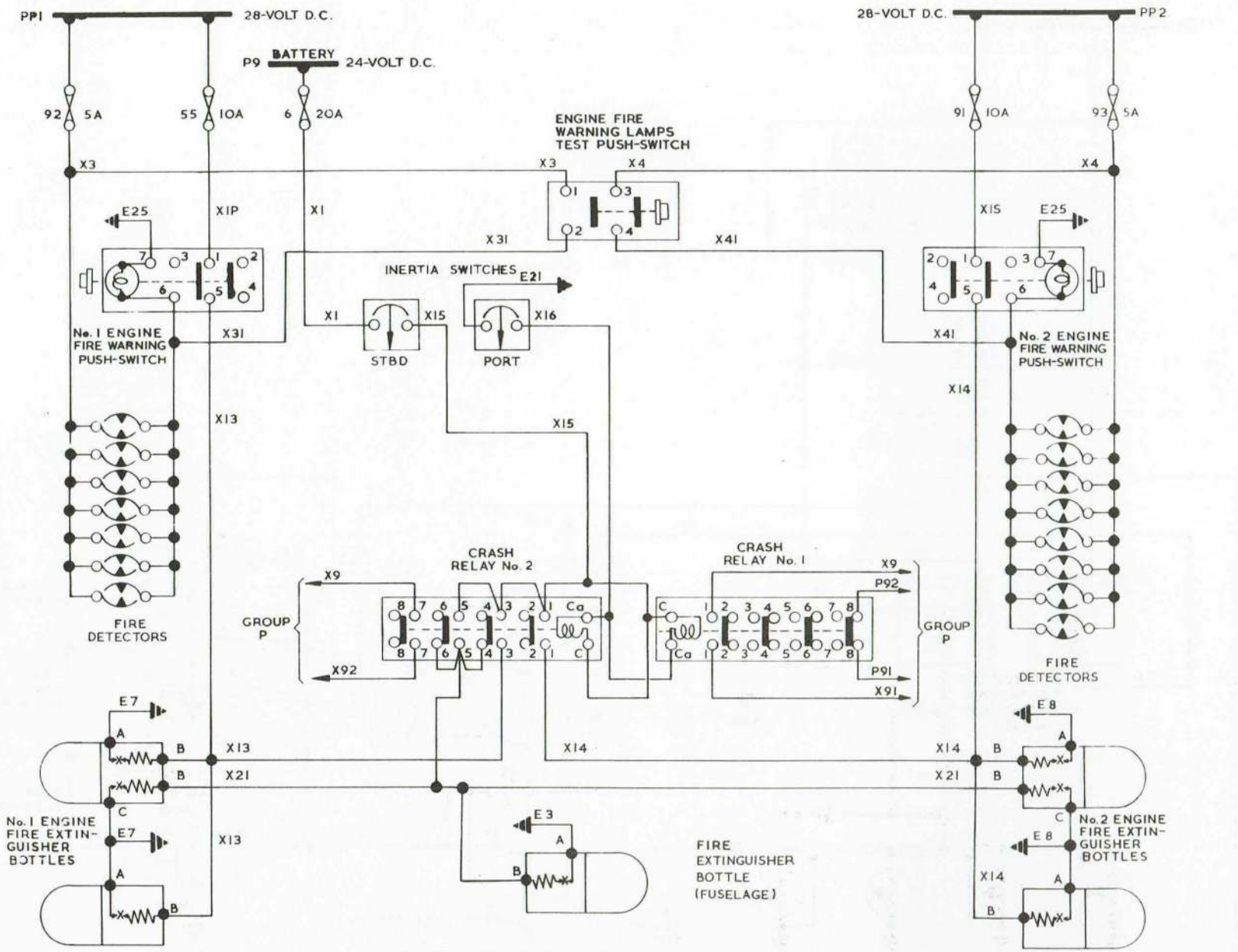


FIG.1B. LOCATION DIAGRAM

◄ SEM/CAN/0167/STC INCORPORATED ►



E87 | 81 | 221 | 7

FIG .2. FIRE DETECTORS AND EXTINGUISHERS

◀ CIRCUIT CODE AMENDED ▶

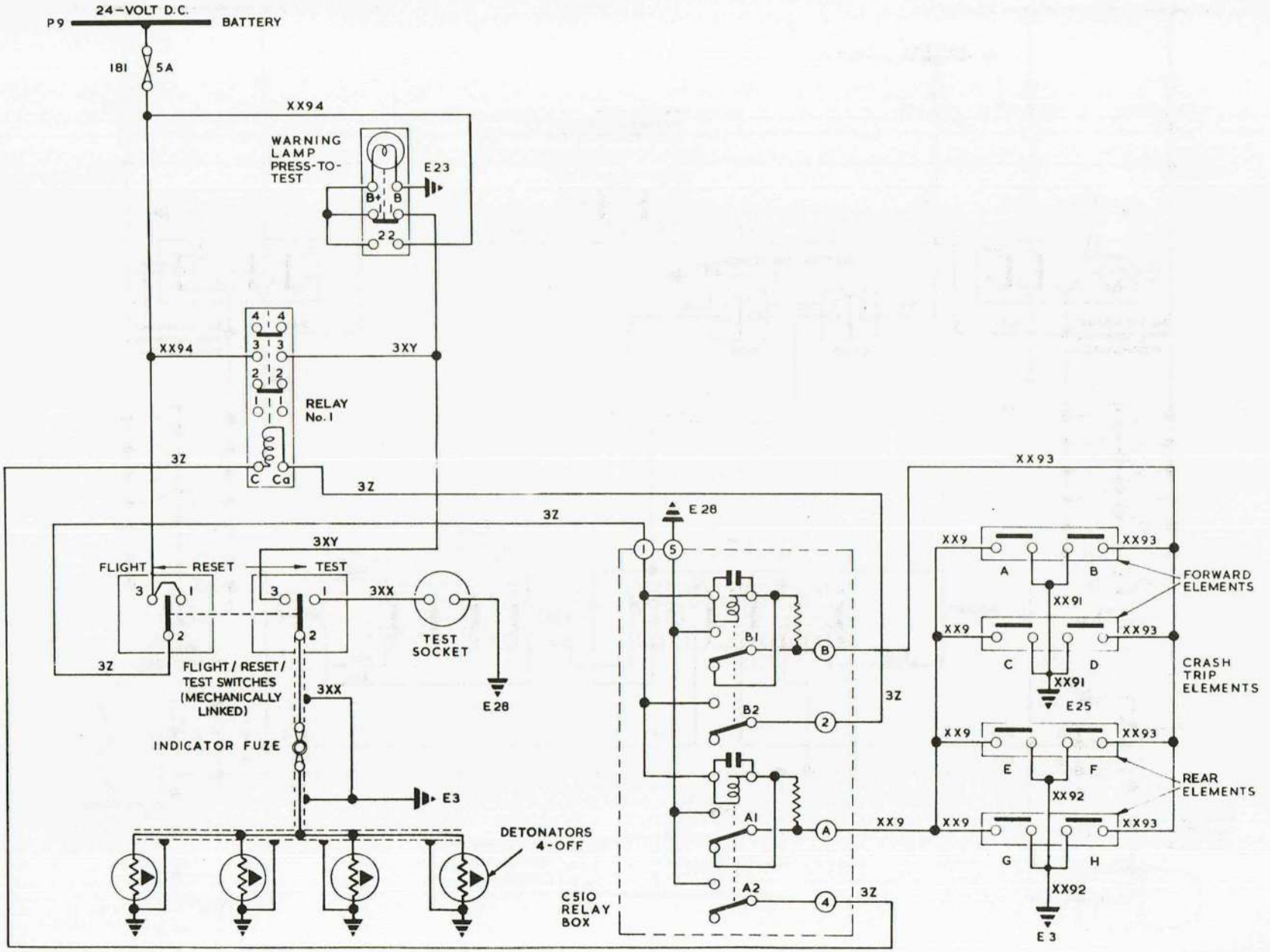


FIG.3. No.6 BELLY TANK EXPLOSION SUPPRESSION

◀ SWITCH POSITIONS AMENDED ▶

EB 7	81	5815	2A

Inertia switches - operation

8. If both inertia switches trip during a crash landing, a supply is fed from X1 (fuse No.6) via the starboard inertia switch and X15 to energize the No.1 and No.2 crash relays, the circuit being completed to earth through X16, the port inertia switch and E21. This action causes the following events to occur simultaneously:-

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

(2) The Type 12A extinguishers in the wings discharge into the engine bays.

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

(4) A supply is fed from fuse No.8 via X9 and crash relays No.1 and No.2 to close down both generators and to isolate them from busbar P10. No.1 generator is closed down via crash relay No.1 X91 and the No.1 reverse current circuit breaker which isolates the generator from the busbar and operates the No.1 generator failure warning lamp. No.2 generator is closed down via crash relay No.2, X92 and the No.2 reverse current circuit breaker which isolates the generator from the busbar and operates the No.2 generator failure warning lamp.

(5) Crash relay No.1 breaks circuit P91-P92-P93 to de-energize the Type R battery isolation relay *(Group P).* This disconnects the main battery from all aircraft circuits except those for canopy and hatch jettison, explosion suppression and the fire extinguishers.

NO.6 BELLY TANK EXPLOSION SUPPRESSION

Note. . .

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

General

9. This system is designed to minimize the risk of an explosion in No.6 Belly tank in the event of a crash landing. The system comprises four explosion suppression units complete with detonators mounted in the tank, and a crash trip installation which provides that the explosion suppression units are automatically discharged in a crash landing. The system is initially controlled by two ganged switches having three positions, FLIGHT-RESET-TEST lamp, which operate in conjunction with a relay, a PRESS-TO-TEST lamp,and a test socket; the switch and its associated equipment being mounted in the flare bay on the aft face at the starboard side of frame 21B. Prior to flight the switch is set to the FLIGHT position, the RESET and TEST positions being used for servicing purposes only.

Crash trip elements, Type 12C

10. Four crash trip elements are embodied in the explosion suppression system; the elements are mounted in pairs on the underside of the fuselage, two being installed forward of the nose wheel and two aft of the flare bay between frames 29 and 31. The elements are connected in parallel and are arranged to actuate a Type C510 relay box.

Graviner relay box, Type C510

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

Explosion suppression unit and detonator, Type 116, Mk.1

12. The explosion suppression unit consists of a cylindrical metal canister having a central detonator tube, in which a detonator is located. A mixture of aircraft engine fuel and an extinguishing agent is contained within the canister, the wall being scored in such a manner that, when burst by the detonator, it opens like the petals of a flower. This gives an even distribution of suppressant into the fuel tank and a minimum of loose particles from the canister.

Indicator fuze

13. An indicator fuze mounted on the aft face at the starboard side of frame 21B, indicates when the explosion suppressors in the

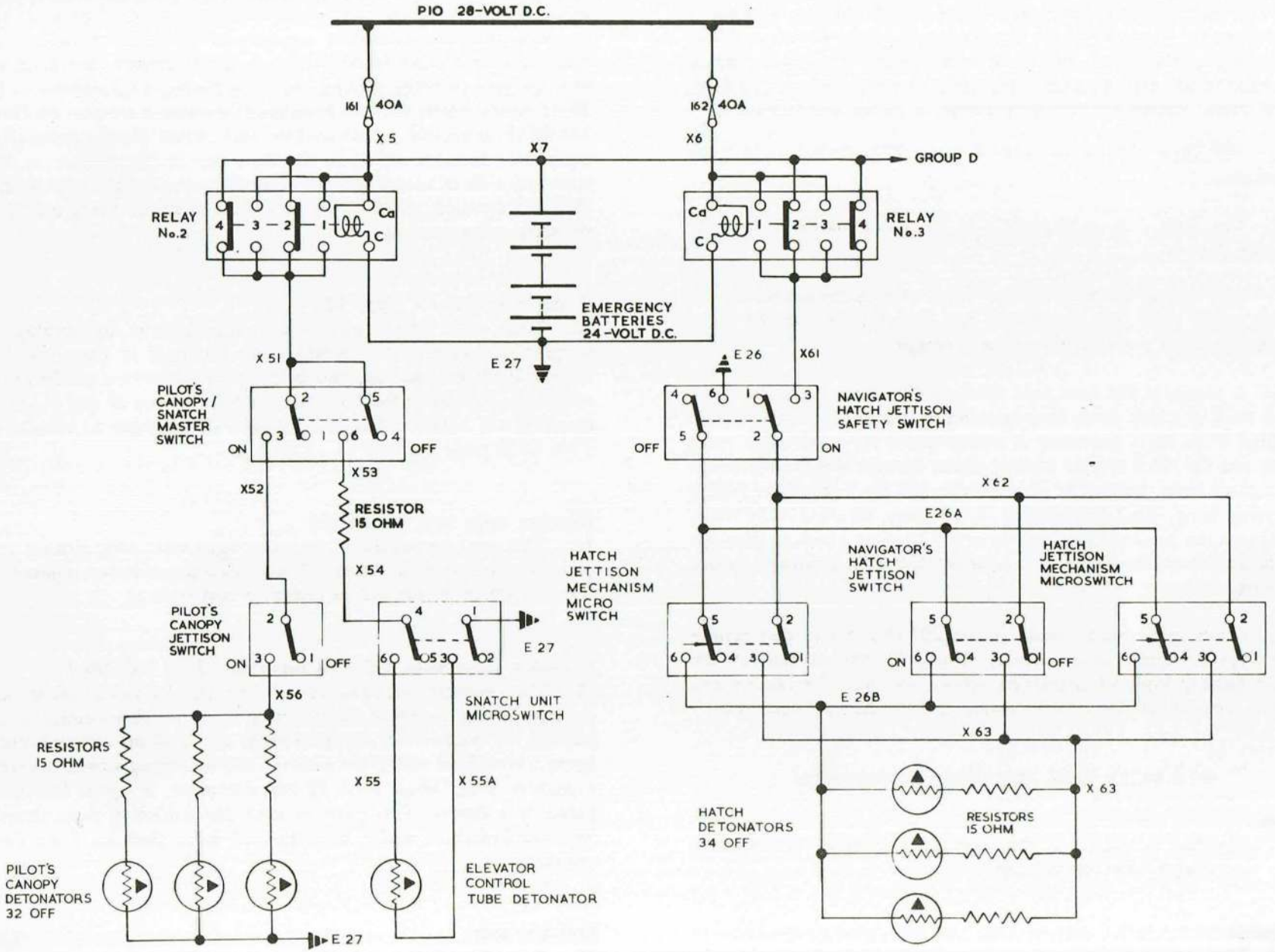


FIG. 4. CANOPY AND HATCH JETTISON

EB 7 | 81 | 217 | 3A

tank have been discharged. Also, by severing the electrical connection to the tank, the fuze obviates the possibility of an electrical spark occurring in the tank after suppression action.

Operation

14. In the event of a crash landing resulting in the crash trip elements closing, a supply is fed from fuse No.181 in the M.E.P. via XX94 through the FLIGHT-RESET-TEST, switch in the FLIGHT position to the coils of the relays in the Type C510 relay box. This completes the circuit momentarily, via the closed crash trip elements: the capacitors are charged, the relays operate and are held on through the resistors and the operated contacts.

15. The energized C510 relay box completes the circuit to the relay which is energized and feeds a supply to the warning lamp, and also, via the FLIGHT/RESET switch and indicator fuze, to the detonators in the suppression units.

DETONATOR CIRCUITS

General

16. 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.

17. Canopy jettison is controlled from the CANOPY/SNATCH MASTER switch on the take-off panel and a CANOPY JETTISON switch on the console. The detonator in the elevator control column severance unit is also controlled by the CANOPY/SNATCH MASTER switch together with a microswitch mounted on the snatch unit. The switch is operated by a gas-operated piston when the ejection seat face-screen or seat-pan firing handle is operated.

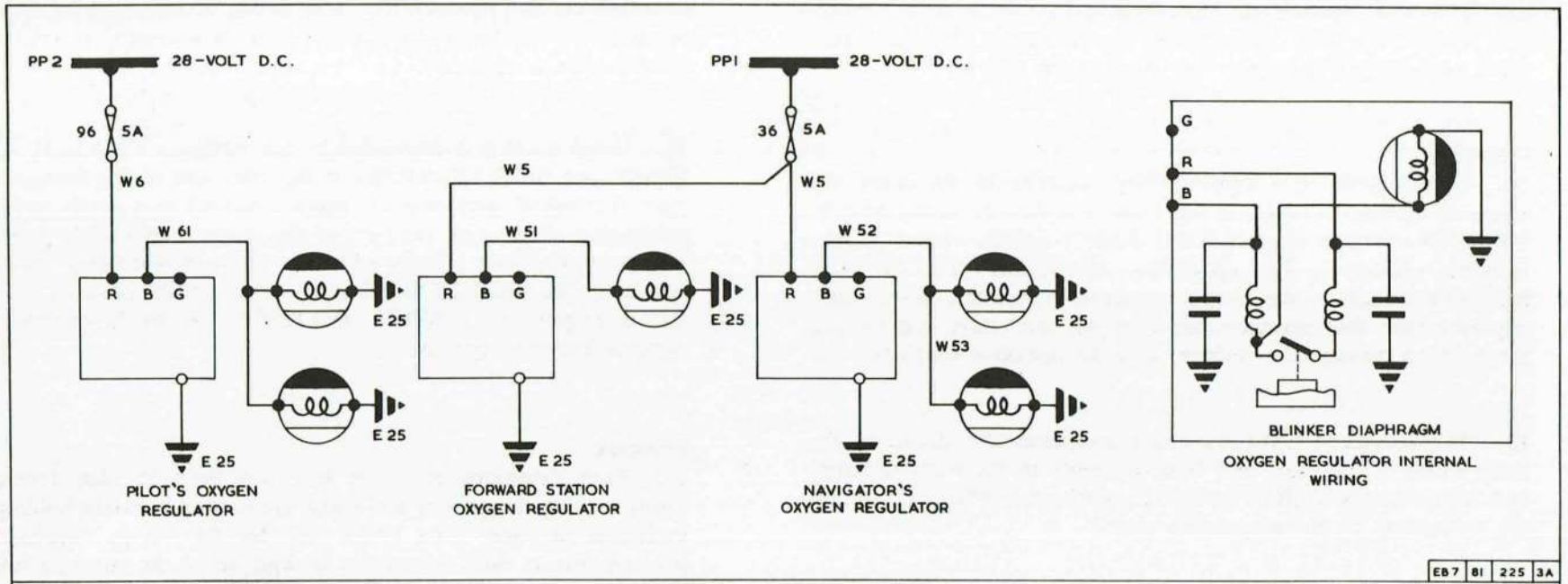
18. Hatch jettison is controlled by the navigator's HATCH JETTISON and SAFETY switches at the port side of the navigator's seat. Additional microswitches accommodated in a hatch jettison mechanism situated on the rear of the pressure bulkhead, provide for automatic hatch jettison when the ejection seat firing cable is operated. The SAFETY switch must be in the ON position before the corresponding HATCH JETTISON or hatch mechanism switches become operative.

Resistors

19. 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 in the jettison relay unit 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.

Power supplies

20. The normal power supply for operating the canopy, elevator snatch unit, and hatch detonator circuits is taken from the main battery busbar P10. 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 in the jettison relay unit located in the console. During normal operation the change-over 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.



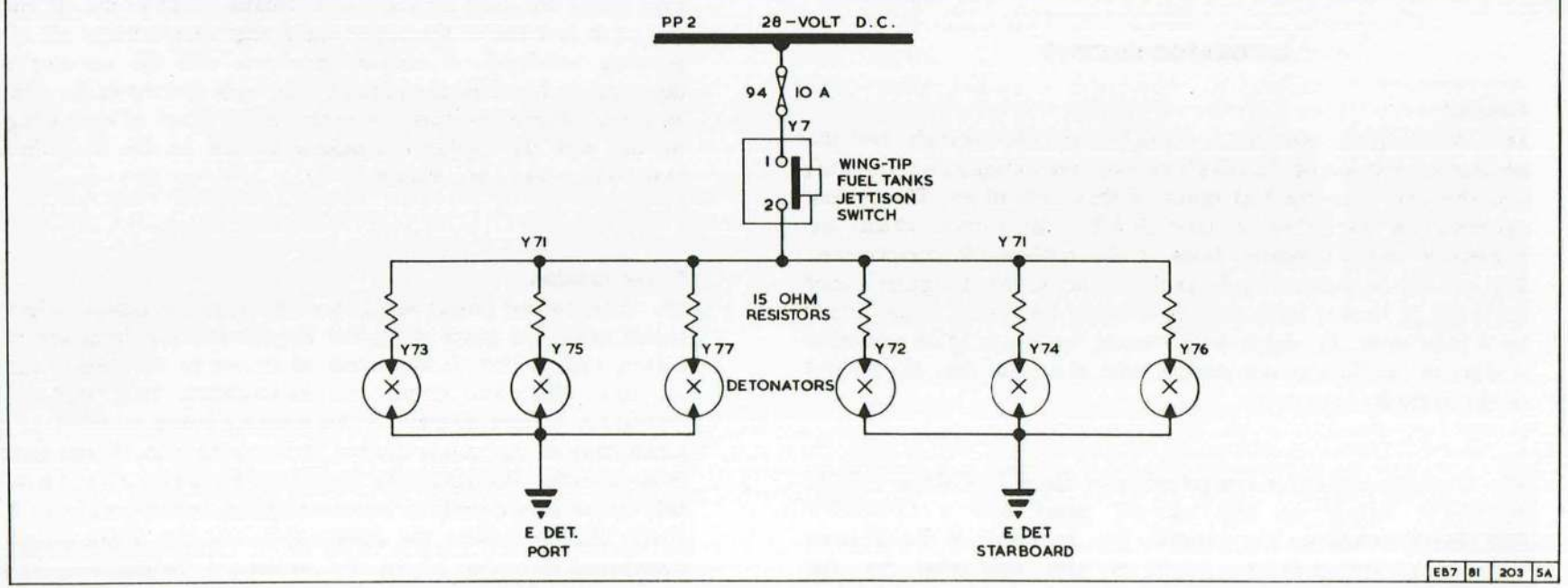


FIG. 5. OXYGEN WARNING – WING TIP FUEL TANK JETTISON

Canopy jettison and elevator snatch unit operation

21. 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 X53 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 X54 and X55 to fire the elevator control 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-0407-1A, Sect.3, Chap.11)* which results in the control column being jerked forward against the instrument panel to give the pilot ejection clearance.

Hatch jettison operation

22. Provided that the SAFETY switch is in the ON position selection of the corresponding jettison switch completes the circuit X61 through X62 to X63 to fire the hatch detonators. Operation of the ejection seat face-screen or seat-pan firing handle will cause the microswitches in the hatch jettison mechanism to be operated and, provided that the SAFETY switch is in the ON position, complete the circuit X61 through X62 to X63 to fire the hatch detonators. Selection of the HATCH JETTISON switch will also complete the circuit to jettison the hatch without seat ejection.

Wing-tip fuel tank jettison

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

OXYGEN WARNING SYSTEM

Oxygen indicators

24. Mk.17F regulators are provided at the pilot's, navigator's and forward stations. 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 diagram within the regulator making and breaking electrical contacts in series with the indicators. Because the regulators 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 as follows:-

	Location
Pilot's regulator	Flight instrument panel Navigator's instrument panel
Navigator's regulator	Navigator's instrument panel Miscellaneous instrument panel
Forward station regulator	Miscellaneous instrument panel

Power supply

25. The power supply for the system is not switched but fed direct from fuses 36 and 96 in the E.C.P. Fuse 36 protects the navigator's and forward station regulators and Fuse 96 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

26. Before any functional tests on the fire extinguisher circuits are commenced, all fire extinguishers must be disconnected. Ensure that fuses 55, 91, 92 and 93 are fitted in the E.C.P. and fuse 6 at the M.E.P.

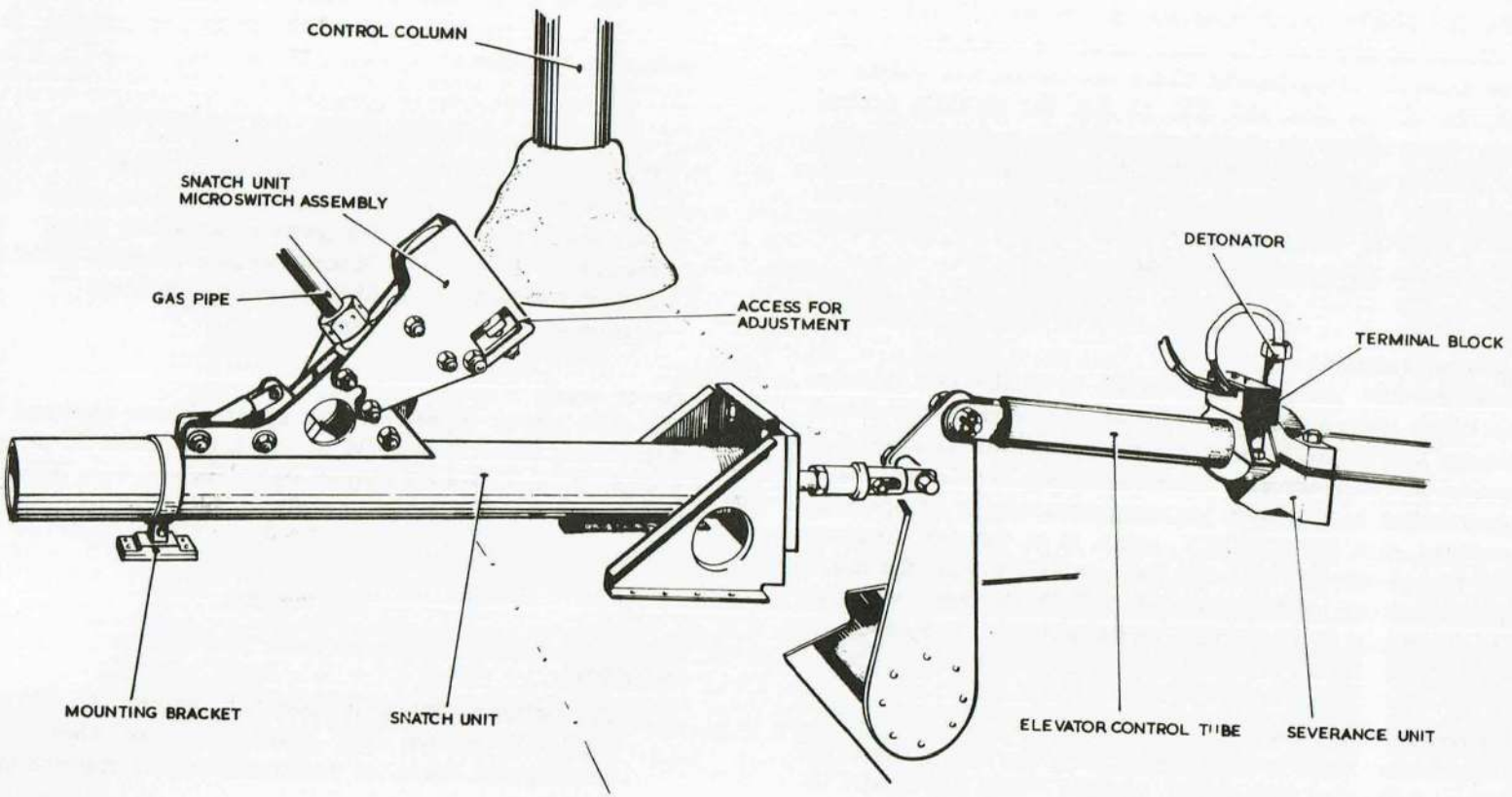


FIG.6 SNATCH UNIT ASSEMBLY

Engine fire circuits

Fire detectors

27. Functioning tests should be made periodically on the installed engine fire detectors, using a battery-operated muff-type heater Ref.No.5G/566 which should be placed on the barrel of each detector in turn. When the temperature of the barrel reaches approximately 300 deg C the detector switch contacts should close and operate the appropriate warning lamp.

Note. . .

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

28. If a heater unit is not available, 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.

Extinguishers

29. The following procedure checks the extinguisher circuits:-

(1) Connect a test lamp to pins A and B of the 2-pole Plessey socket on cables 7F and 8F in the port and starboard wheel wells respectively. (These cables connect to the Type 14A extinguisher heads directed to the engine bays.) Connect other test lamps to pins A and B on the 2-pole Plessey socket on cables 7P and 8P. (These cables connect to the Type 12A extinguishers installed between rib E and the inboard engine rib in each wing.)

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

Inertia switch circuit

30. This circuit should be checked as follows:-

(1) Connect a test lamp to pins A and B of the Plessey socket of cable 3B which has been disconnected from the Type 12A extinguisher at frame 27A.

(2) Connect test lamps to pins A and B of the Plessey sockets on cables 7F, and 8F, in the port and starboard wheel wells respectively. Connect test lamps to pins A and B of the Plessey sockets on cables 7P and 8P in the port and starboard wing respectively. Connect test lamps to pins B and C of the Plessey sockets on cables 7D and 8D in the port and starboard wheel wells respectively.

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

Extinguisher fuze test

WARNING

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

◀ **31.** The resistance of the extinguisher head fuzes should be periodically checked using a MK.5 or MK.6 safety ohmmeter as follows:-

(1) Ensure that all fire extinguisher bottle plugs are connected ▶

◀ and then check the resistance between the following terminals in the No.1 distribution box:-

X13 and E28 resistance should read between 2.86 to 3.36 ohms

X14 and E28 resistance should read between 2.80 to 3.36 ohms

X21 and E28 resistance should read between 1.82 to 2.13 ohms

Note . . .

E28 is a convenient earth point in No.1 distribution box.

(2) If the resistance values obtained in (1) are not within the limits shown, check the resistance of each individual fuze as follows:-

Fuselage fire extinguisher
Disconnect cable assembly 3B from Q.R. tags X21 and E3 in J.B.3 and check the resistance of the cable assembly and the fuze. A reading of 5.27 to 6.27 should be obtained.

No.1 Engine fire extinguisher (single head)
Disconnect cable assembly 7P from Q.R. tags X13 and E7 in J.B.7 and check the resistance of the cable assembly and the fuze. A reading of 5.186 to 6.186 ohms should be obtained.

No.1 Engine fire extinguisher (dual head)
Disconnect cable assemblies 7D and 7F from the Q.R. tags X13, X21 and E7 in J.B.7 and check the resistance of each cable assembly and each fuze. A reading of 5.165 to 6.165 should be obtained in each case.

No.2 Engine fire extinguisher (single head)
Disconnect cable assembly 8P from the Q.R. tags X14 and E8 in J.B.8 and check the resistance of the cable assembly and the fuze. A reading of 5.124 to 6.124 ohms should be obtained.

No.2 Engine fire extinguisher (dual head)
Disconnect cable assemblies 8D and 8F from the Q.R. tags X14, X21 and E8 in J.B.8 and check the resistance of each cable assembly and each fuze. A reading of 5.105 to 6.105 ohms and 5.093 to 6.093 ohms respectively should be obtained.

(3) When the above operations in (2) have been done satisfactorily, reconnect all cable assemblies and repeat the tests in (1). For further information on fire extinguisher head fuzes, refer to A.P.110N-0700 series. ▶

FIG.7. FIRE DETECTORS AND EXTINGUISHERS

(illustration overleaf)

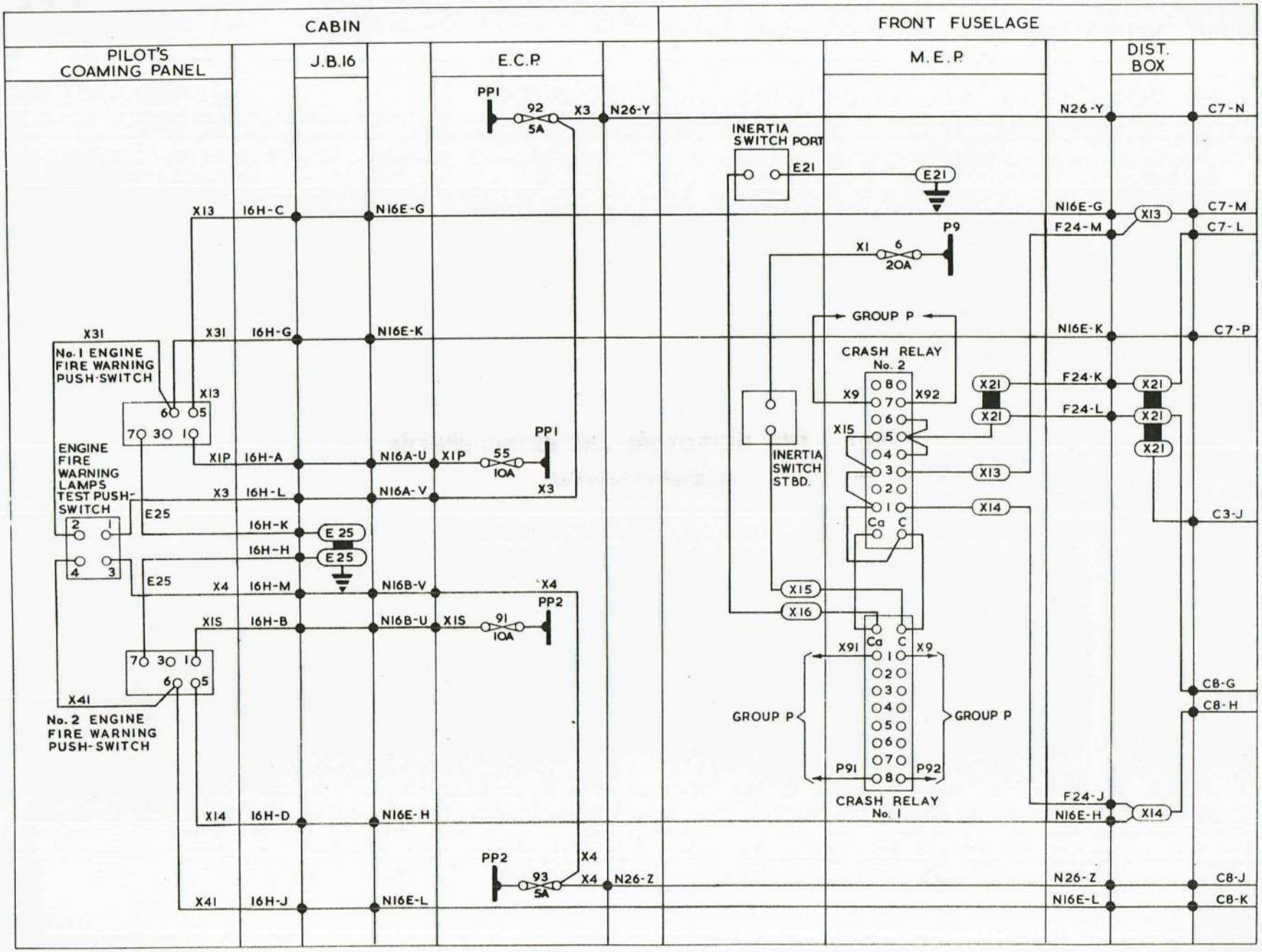


FIG. 7. FIRE DETECTORS AND EXTINGUISHERS

◄PIN IDENTS AMENDED►

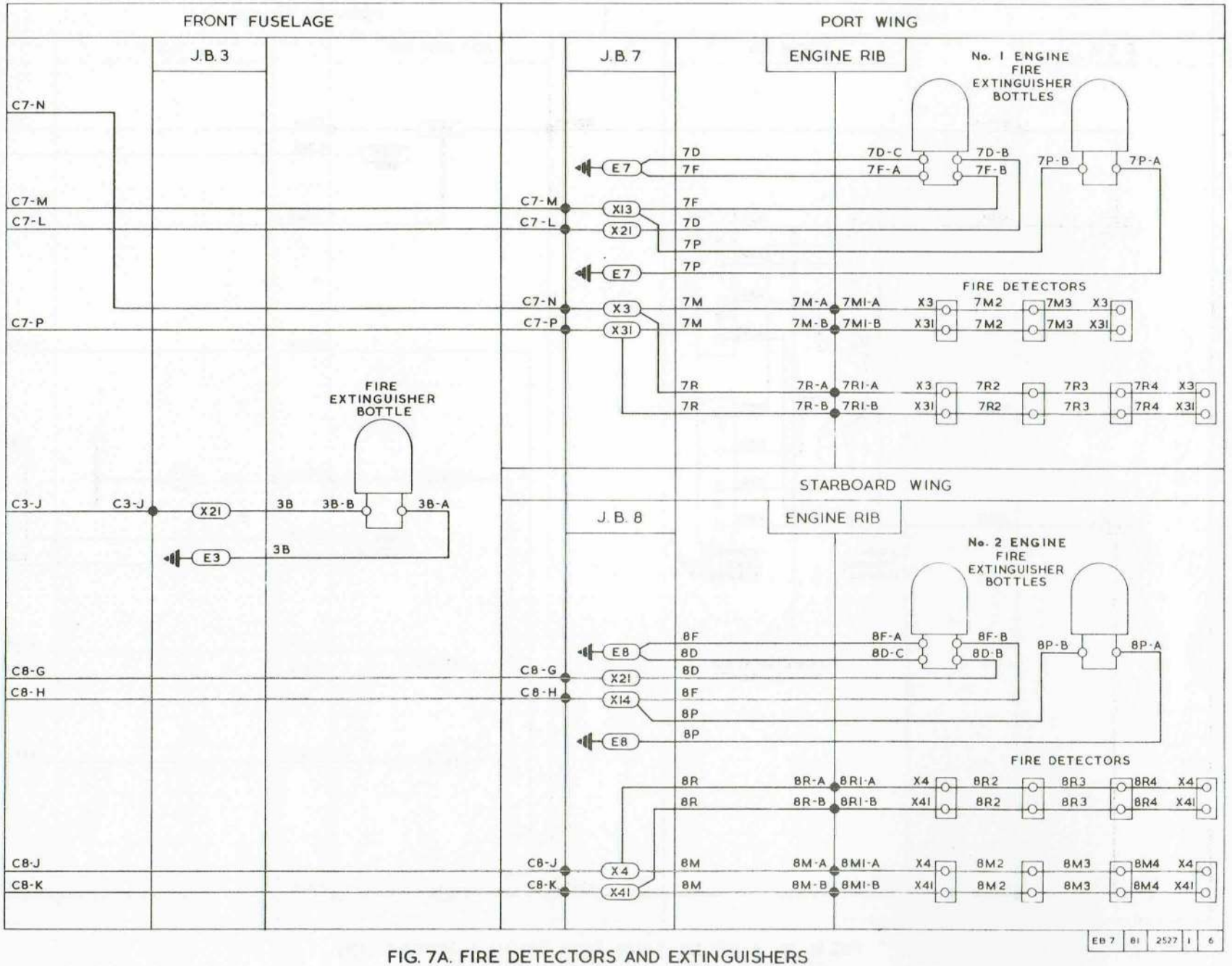


FIG. 7A. FIRE DETECTORS AND EXTINGUISHERS

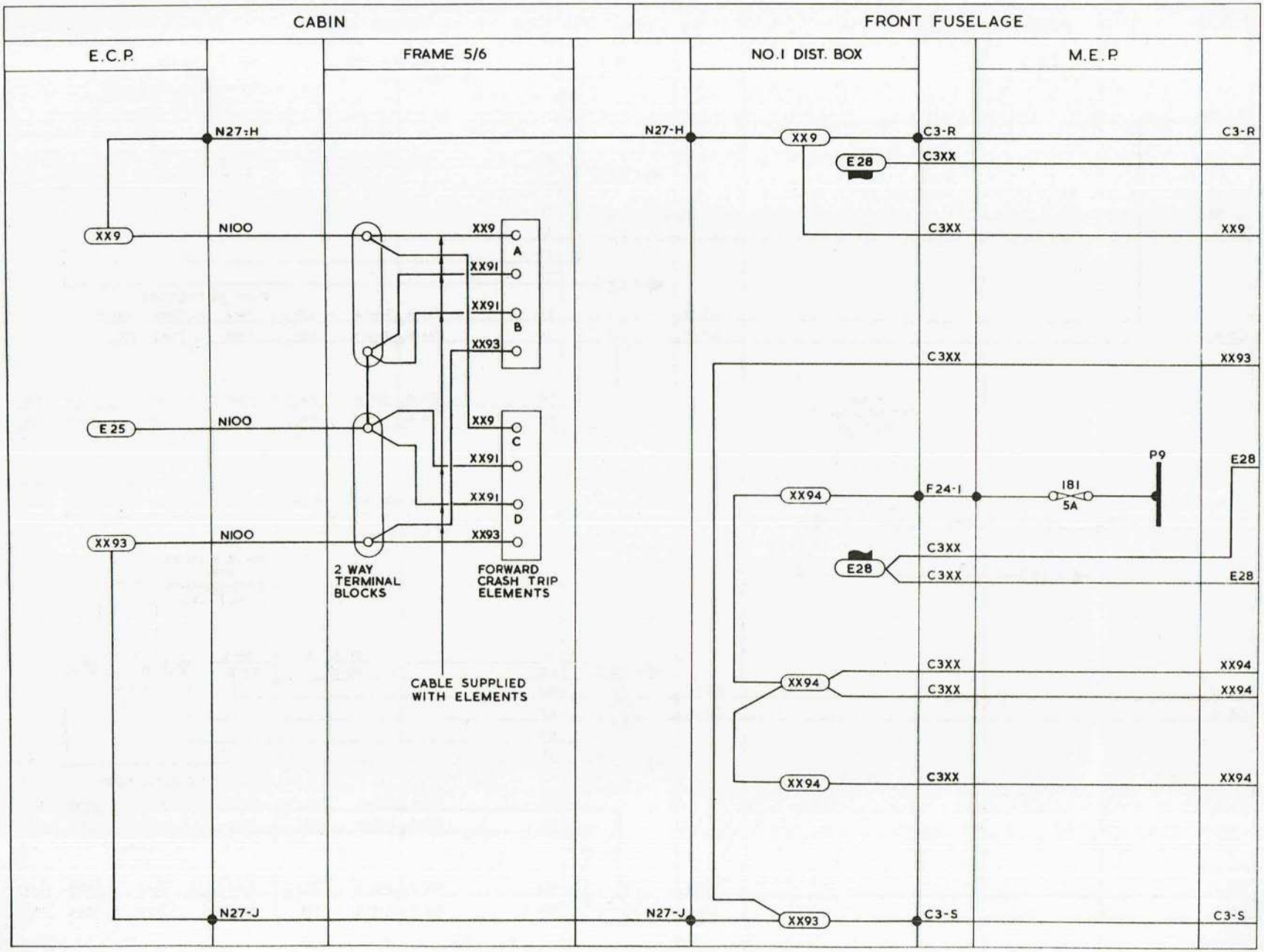


FIG.8. No. 6 BELLY TANK EXPLOSION SUPPRESSION

◀ CRASH TRIP ELEMENT IDENTS. ADDED ▶

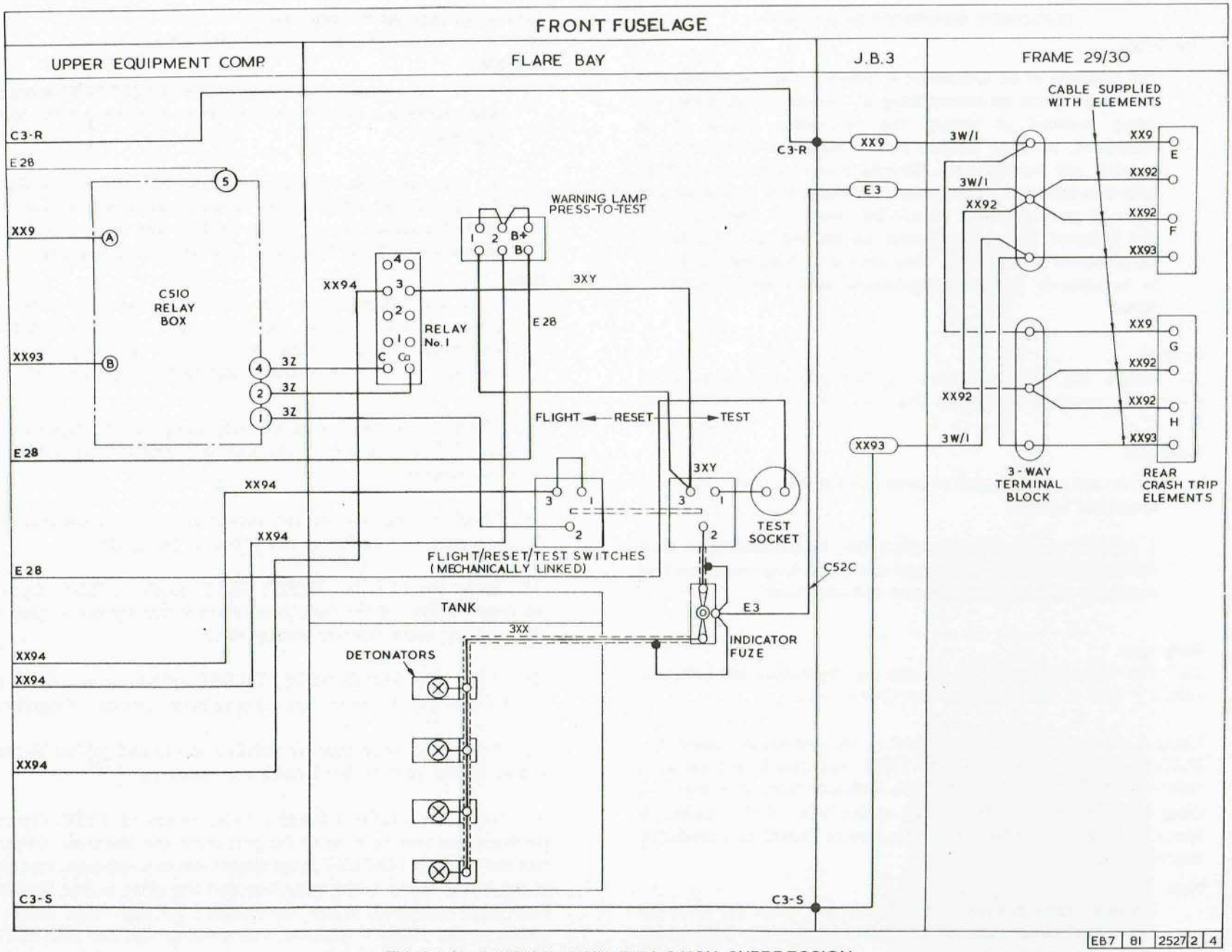


FIG. 8A. No.6 BELLY TANK EXPLOSION SUPPRESSION

◄ TERMINAL IDENTS AND CIRCUIT CODE ADDED ►

EXPLOSION SUPPRESSION SYSTEM

WARNING . . .

The attention of all concerned is drawn to the risk of injury to personnel by the accidental firing of detonators whilst they are being installed or tested. The detonators appear to be innocuous, but they contain plastic explosive and should be handled with extreme care. Circuits should always be opened before columns of suppressors are fitted and only approved types of test equipment should be used. The live detonators and indicator fuze are explosive stores and can constitute a lethal hazard to personnel. They should be handled and stored in accordance with the regulations contained in A.P.110N series.

General

32. Before any functional tests on the explosion suppression system are commenced, ensure that fuse No.181 is fitted at the M.E.P.

WARNING

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

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

Detonators

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

Using a safety ohmmeter, connected to the test socket, select the FLIGHT-RESET-TEST switch to TEST, and check that the total resistance of the detonators plus the indicator fuze, is within ± 2 ohms of the value recorded on the record card. If the reading is found to be outside these limits, the system should be considered unserviceable.

Note . . .

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

Explosion suppression circuit test

34. To test the explosion suppression system:-

WARNING

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

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

Note. . .

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

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

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

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

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

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

(6) Select the FLIGHT-RESET-TEST switch to TEST. Operate the front and rear sections of the port crash trip elements. Observe that the PRESS-TO-TEST lamp illuminates this indicates that both relays in the Type C510 relay box and the relay in the flare bay have been energized. Allow the FLIGHT-RESET-TEST switch to return to the RESET position, and observe that the PRESS-TO-TEST lamp is extinguished.

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

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

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

35. When the preceding tests have been satisfactorily completed and the WARNING (2) in para.34 has been observed, the FLIGHT-RESET-TEST switch should be returned to the FLIGHT position.

DETONATOR CIRCUITS

WARNING

During servicing involving any interference with the detonator circuits, fuses 161 and 162 at the M.E.P. and fuse 94 at the E.C.P. must be removed. The service batteries, emergency batteries and any external power supply must be disconnected.

General

36. Electrical tests on the system consist of:-

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

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

Note. . .

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

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

Preparation for circuit test

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

(1) Remove fuses 161 and 162 at the M.E.P. and fuse 94 at the E.C.P. Disconnect the service batteries, emergency batteries and any external power supply. Set the cocking lever of the hatch jettison mechanism to the locked position.

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

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

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

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

38. When the above preparations are completed proceed as follows:-

(1) Refit fuses 161 and 162 at the M.E.P. and fuse 94 in the E.C.P.

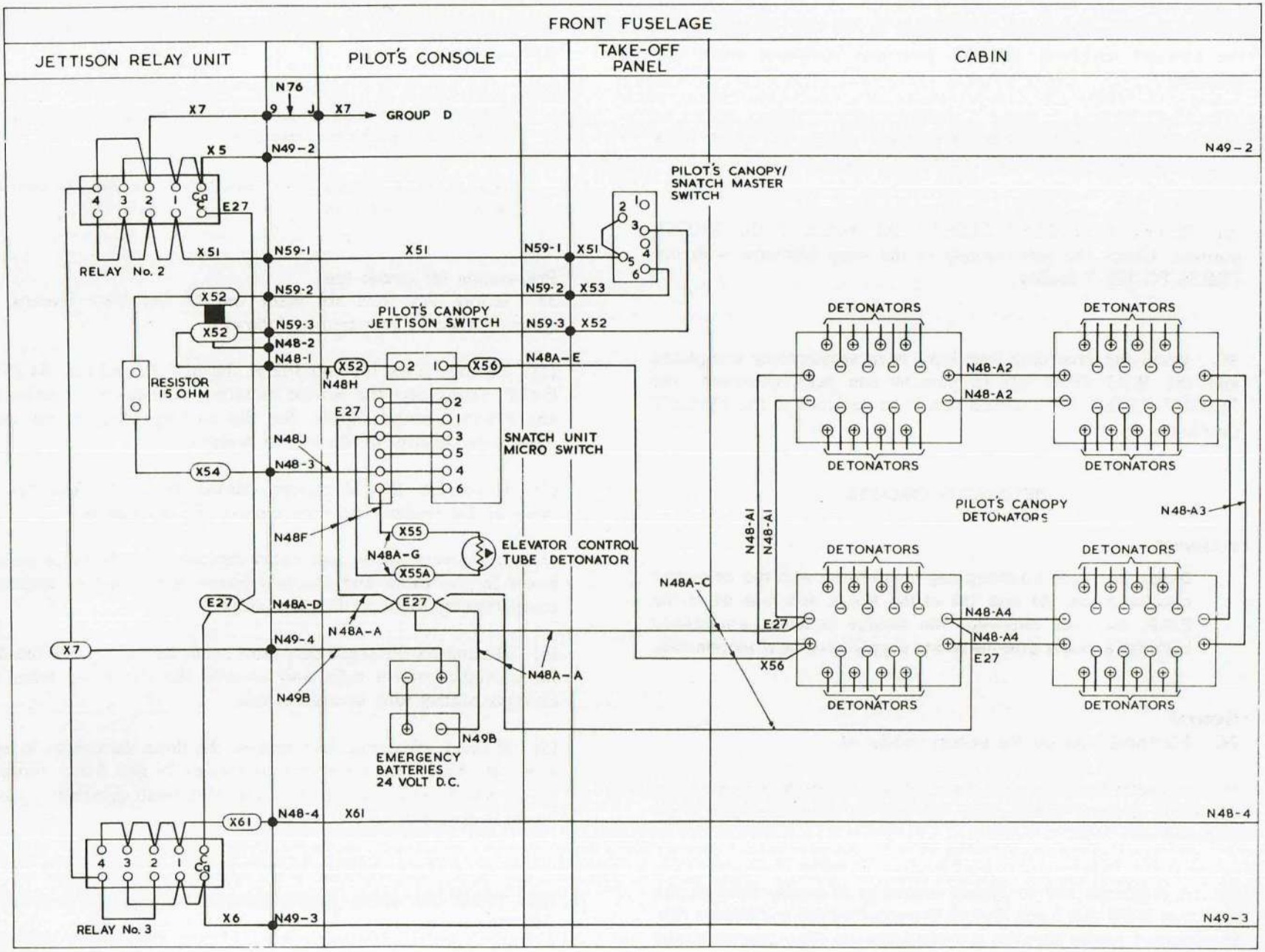


FIG. 9. CANOPY AND HATCH JETTISON

◀ TERMINAL IDENT. AMENDED ▶

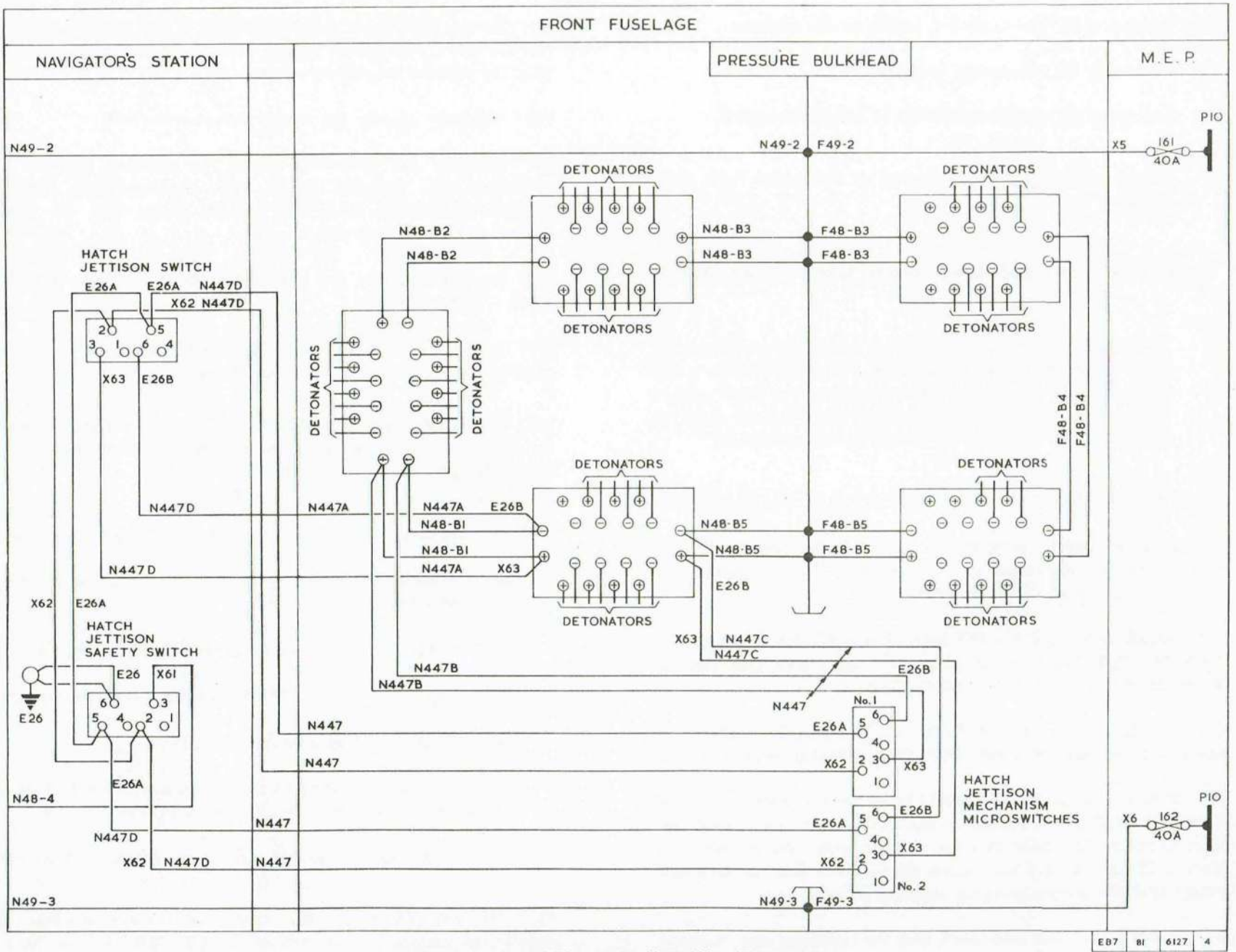


FIG. 9A. CANOPY AND HATCH JETTISON

◀ TEST SOCKET DELETED ▶

(2) Connect a 28 V d.c. ground supply to the aircraft.

(3) Reconnect the emergency battery.

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

Note. . .

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

Checking the canopy and elevator control tube detonator circuits

39.

Note. . .

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

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

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

(3) Switch OFF the CANOPY/SNATCH MASTER switch or the CANOPY JETTISON switch alternately and ensure that there is no 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 161 and check that the testmeter now reads 24 volts at both positions. Repeat (3).

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

(8) Manually operate the snatch unit microswitch.

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

(10) Replace fuse 161 and check that the meter now reads between 1.7 and 2.0 amp.

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

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

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

(a) Check the voltage at X55 to E27, the meter should read No volts.

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

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

(d) Ensure that all switches are OFF.

(e) Connect the ohmmeter to X55A and E27 and close the microswitch, the meter should read approximately zero.

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

40. On completion of the circuit tests, ensure that the microswitch clearance is as detailed in A.P.101B-0407-1A, Sect.3, Chap.11.

Checking the hatch detonator circuits
41.

Note. . .

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

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

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

(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 162 and check that the testmeter now reads 24 volts at both positions. Replace fuse 162.

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

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

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

43. Remove fuse 162 at the M.E.P. This action changes the supply from busbar P10 to the emergency battery supply busbar X7. Repeat the tests detailed in para.41-42, at least one pair of terminals is to be checked at each operation. Replace fuse 162 and disconnect all sources of supply.

Checking the wing-tip tank detonator circuit
44. Where applicable, test the circuit as follows:-

(1) Ensure that fuse 94 is refitted in the E.C.P. and switch ON power supply.

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

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

Detonator circuits resistance test
Precautions
46. This test is effected with the detonators installed, therefore,

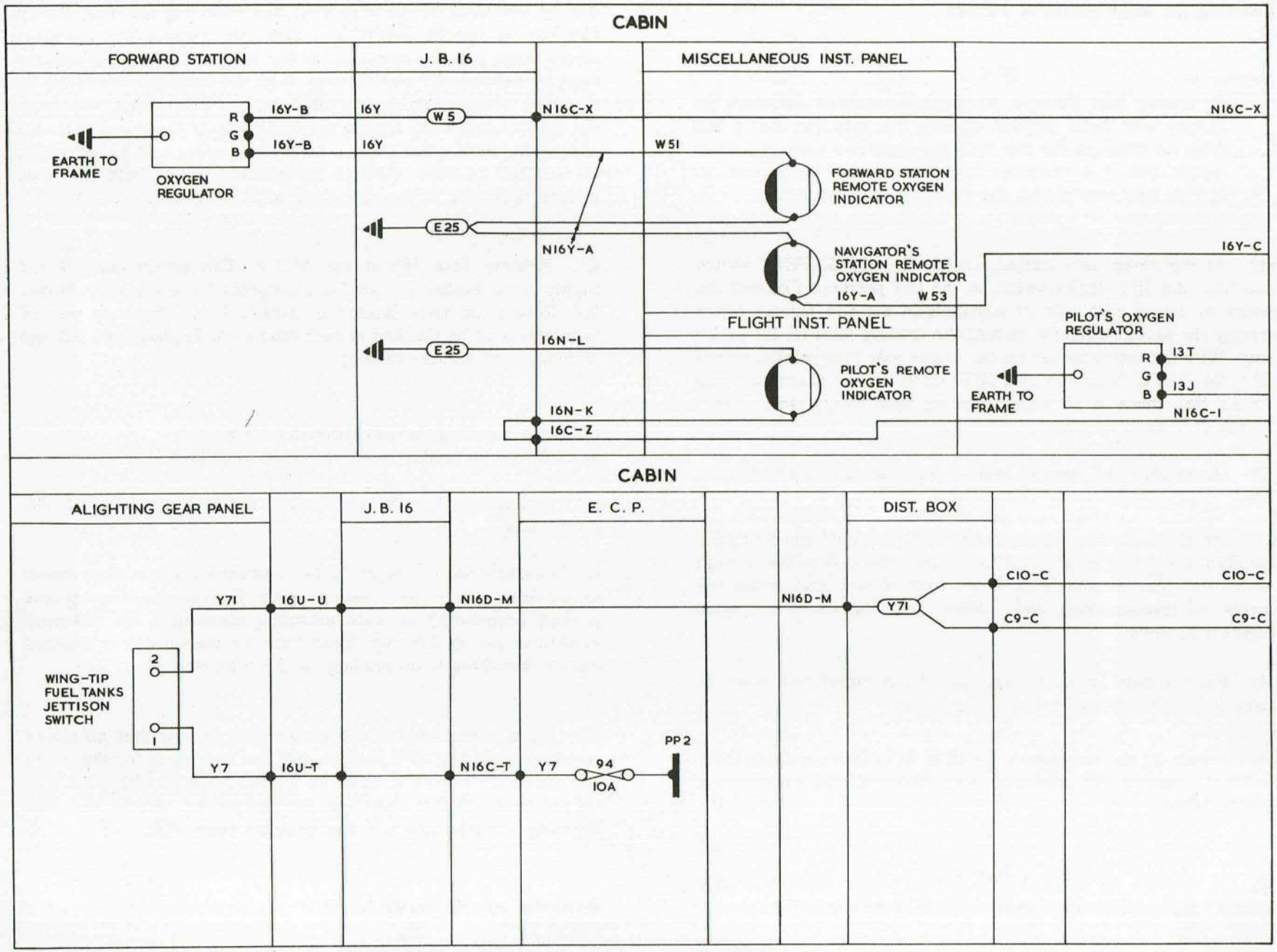


FIG. 10. OXYGEN WARNING—WING TIP FUEL TANK JETTISON

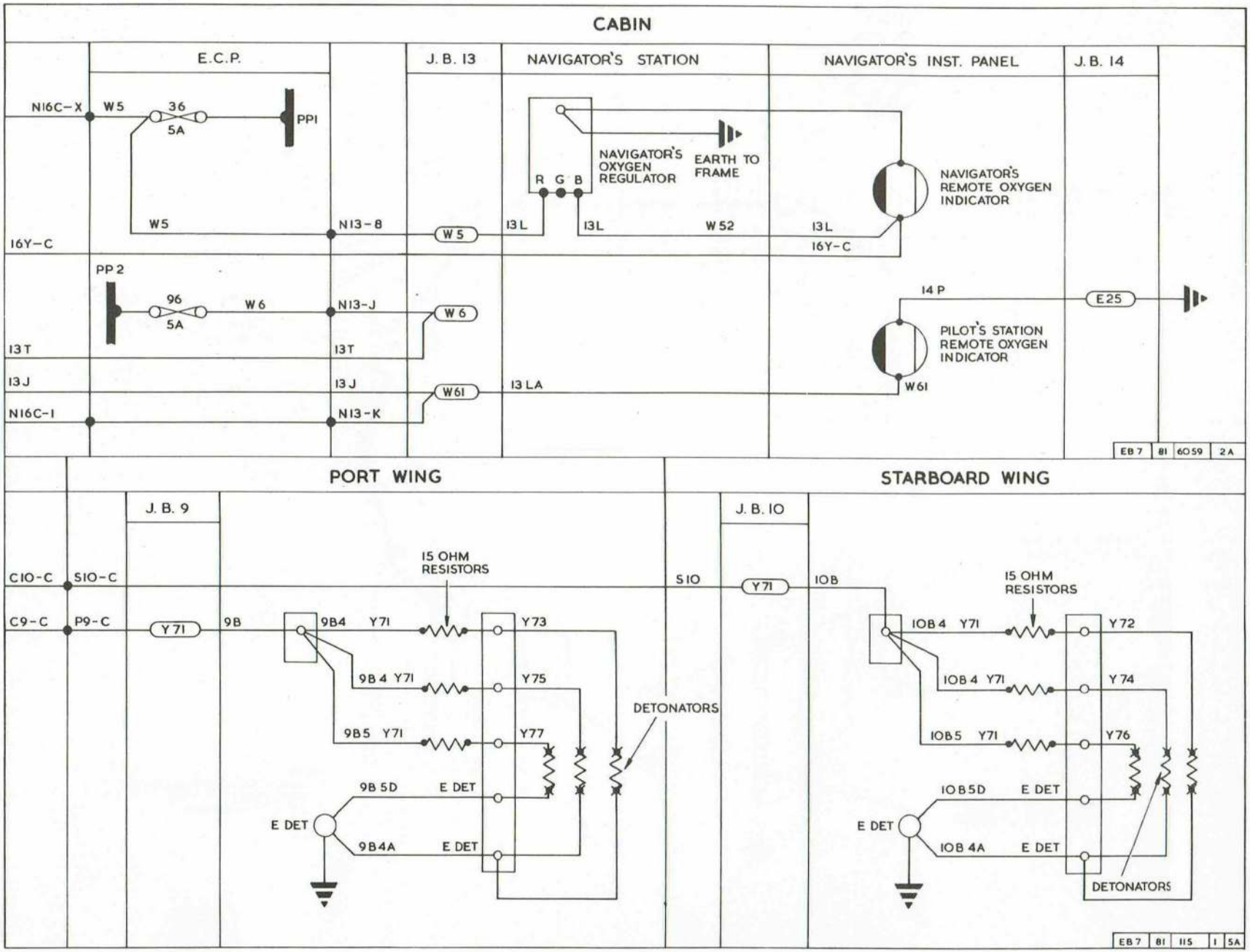


FIG. 10A. OXYGEN WARNING-WING TIP FUEL TANK JETTISON

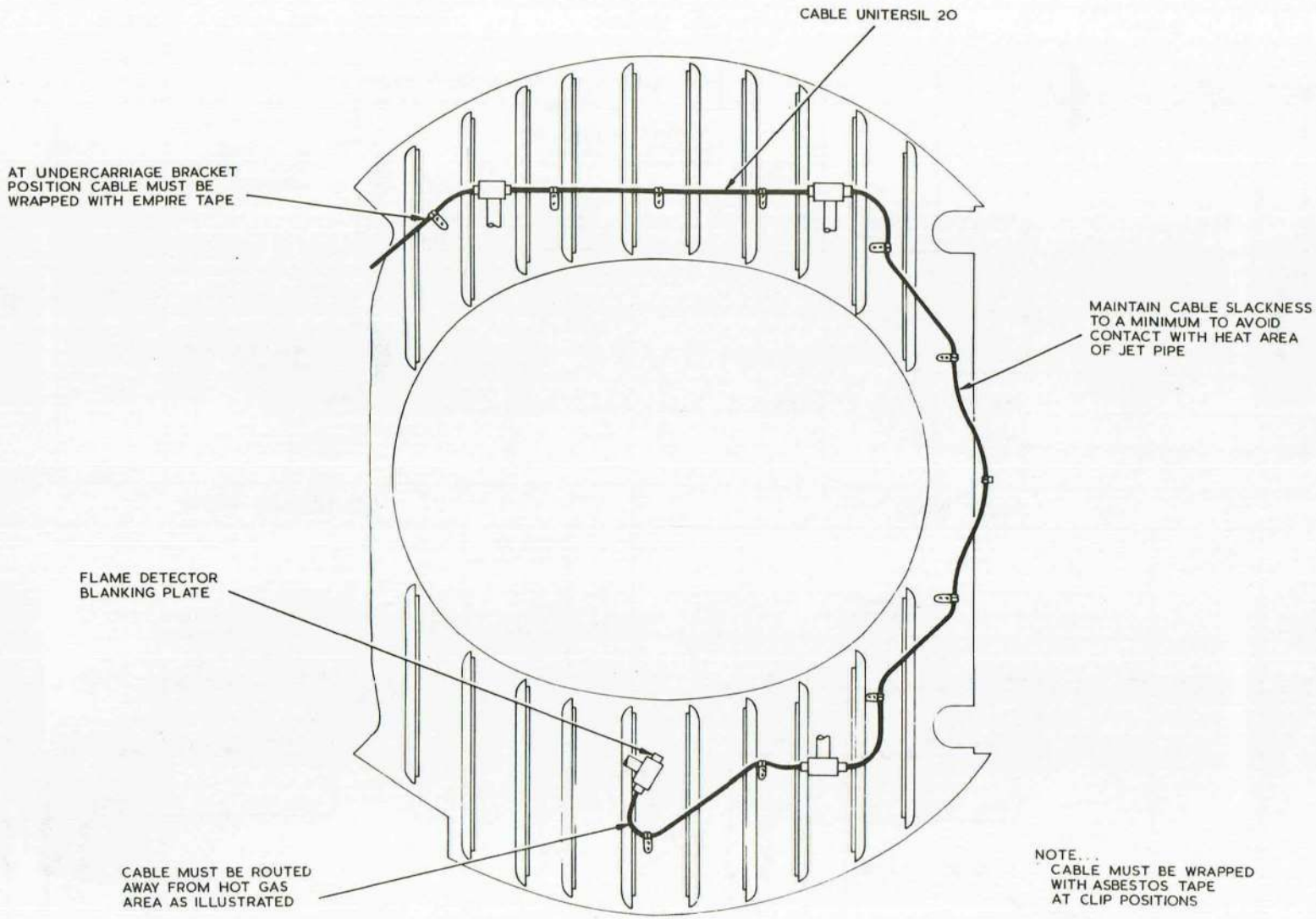


FIG. 11. FIRE DETECTOR CABLE ROUTEING-NO.1 ENGINE FIREWALL

EB7 | 81 | 603

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.120A-1001-1.

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

Pilot's canopy and navigator's hatch circuits

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

Elevator control tube detonator circuit

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

Wing-tip tank detonator circuit

49.

(1) Check the resistance across the terminals in the detonator terminal blocks in each wing tip. The ohmmeter should read between 0.8 and 1.6 ohms.

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

Detonator renewal

WARNING

Do not handle the tube of the detonator. All operations must be done by holding the electrical leads near to where they enter the plug of the detonator assembly. This is most important.

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

51. A full description of the canopy, hatch and snatch unit installations is given in A.P.101B-0407-1A, Sect.3, Chap.11. The installation of the wing-tip fuel tank detonators is described in A.P.101B-0407-1A, Sect.4, Chap.2.

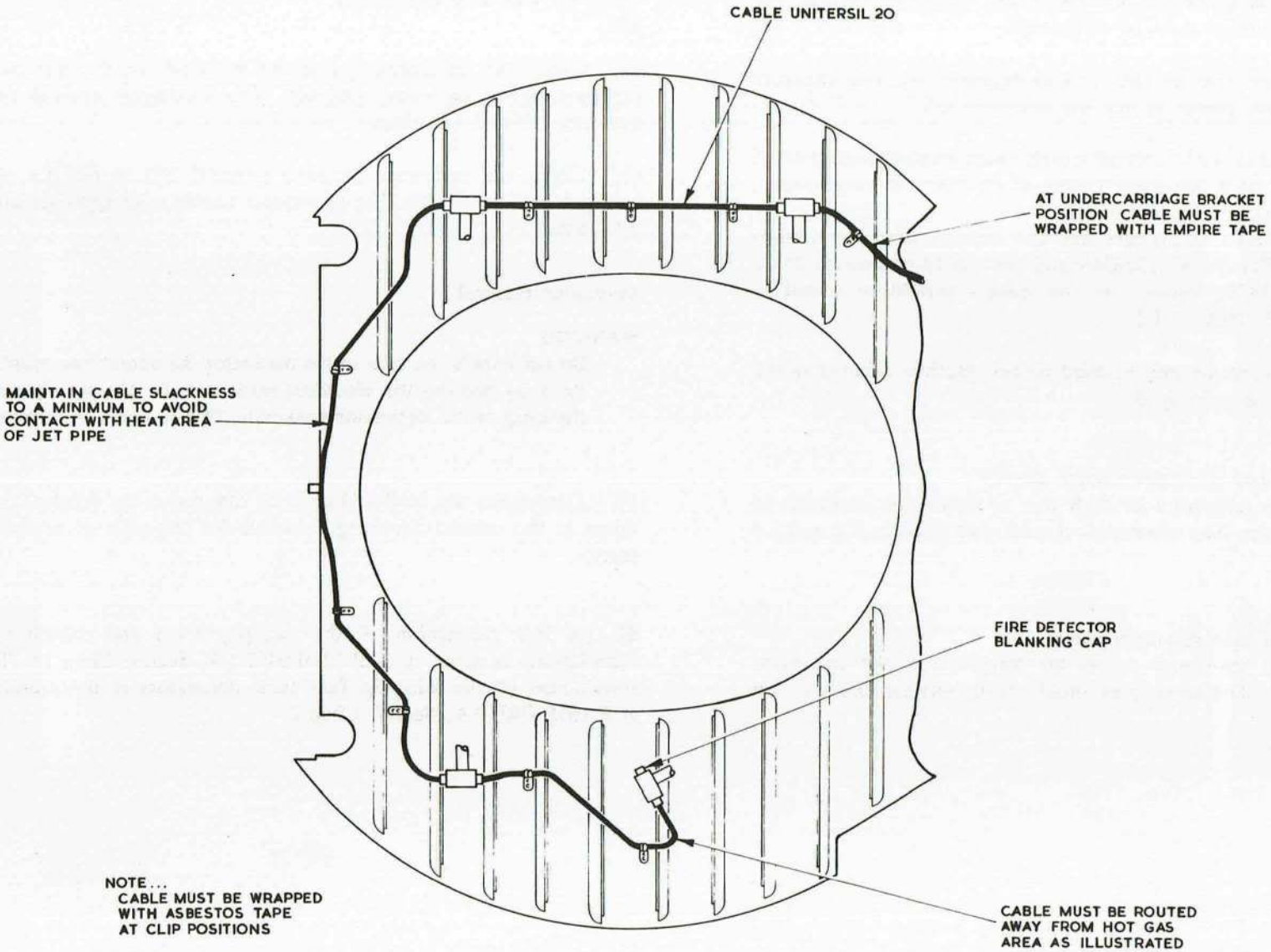


FIG.12, FIRE DETECTOR CABLE ROUTEING — NO.2 ENGINE FIREWALL

EB7 81 604

TABLE 1

Equipment details

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
5CW/4405743	Fire warning test switch	1	A.P.113D series
5CW/9438526	Fire warning push-switch	2	
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)	3	A.P.107E-0400-1A
27N/4526467	Fire extinguisher, Type 12A (alternatives)		
27N/7185521	Fire extinguisher, Type 138A (alternatives)	2	A.P.107E-0400-1A
27N/4526468	Fire extinguisher, Type 14A (alternatives)		
27N/256	Crash trip element, Type 12C	2	A.P.113D series
27N/210	Explosion suppression unit	4	A.P.110N series
27N/177	Indicator fuze, Type E304	1	A.P.107E-0301-1
	Relay box C510 comprising:–		
27N/253	Relay C509	1	A.P.107E-0303-1
27N/254	Relay base C508	1	
12G/1430	Detonator – explosion suppression	4	A.P.110N series
12G/9635206	Detonator 108, Mk.3 (alternatives – canopy and hatch)	66	
12G/9635204	Detonator 108, Mk.4 (alternatives – canopy and hatch)		
12G/9635205	Detonator 109, Mk.2 – elevator tube severance (for charge H.E.)	1	
	Detonator 109, Mk.2 – wing tip fuel tanks	6	
12G/9635203	Charge, H.E., No.1, Mk.3 elevator tube explosive collar	1	
5CZ/5003	Magnetic indicator	3	A.P.113F-0615-1
5CZ/6000	Magnetic indicator	2	
12K/9635263	Cartridge No.1, Mk.3 – Type A716-3	3	A.P.110N series
12K/9231213	Cartridge No.1, Mk.3 – Type A717-3	2	

Chapter 2 – INSTRUMENT INSTALLATION

LIST OF CONTENTS

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

GENERAL INFORMATION

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

General

1. This chapter contains a description of the instument system and information 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 Publications in which they are described.

Location of equipment

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

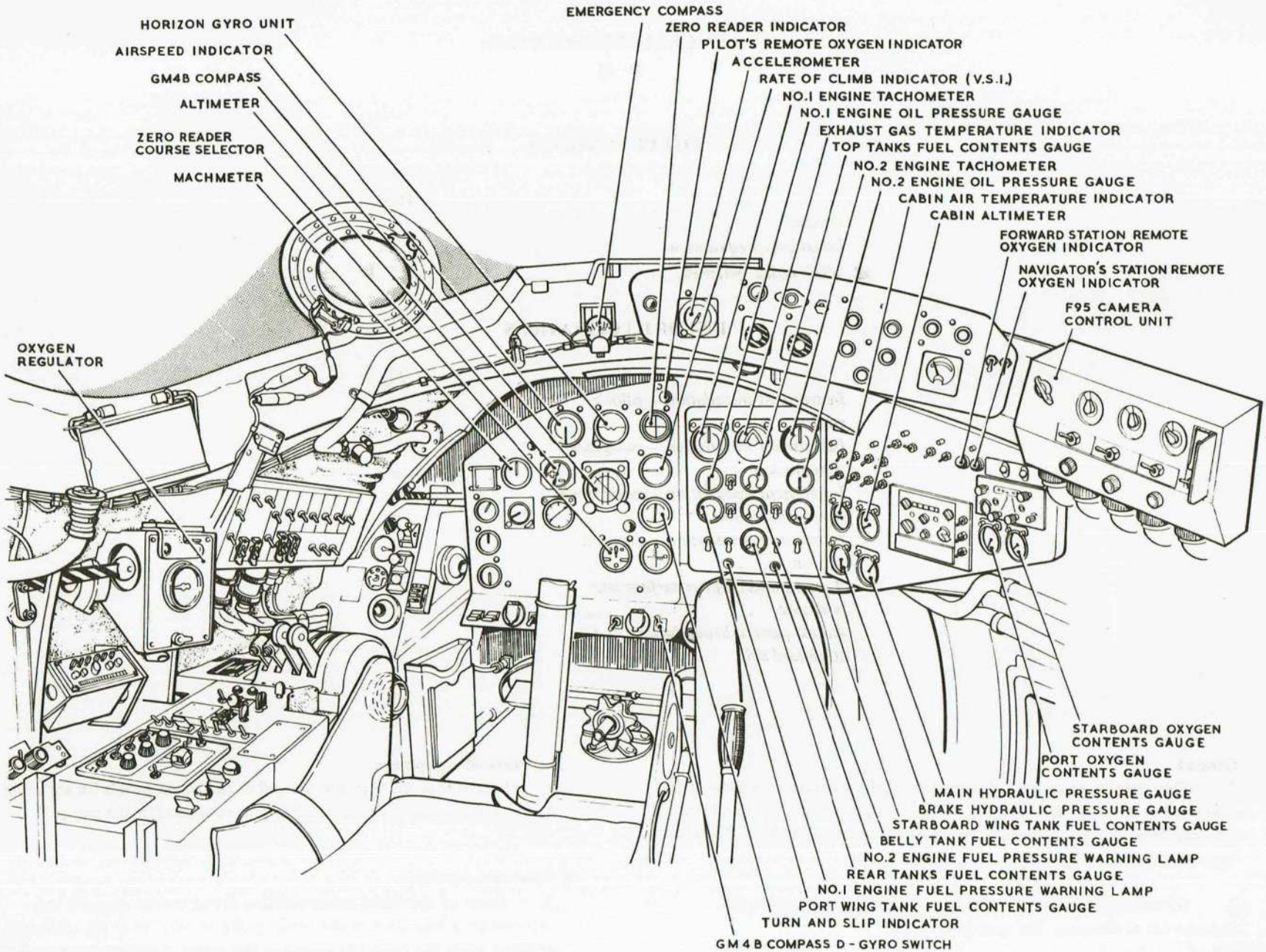


FIG. 1. INSTRUMENT INSTALLATION — PILOT'S STATION

101B-0407-1B/169/117362/207/2-80/BAe/1307

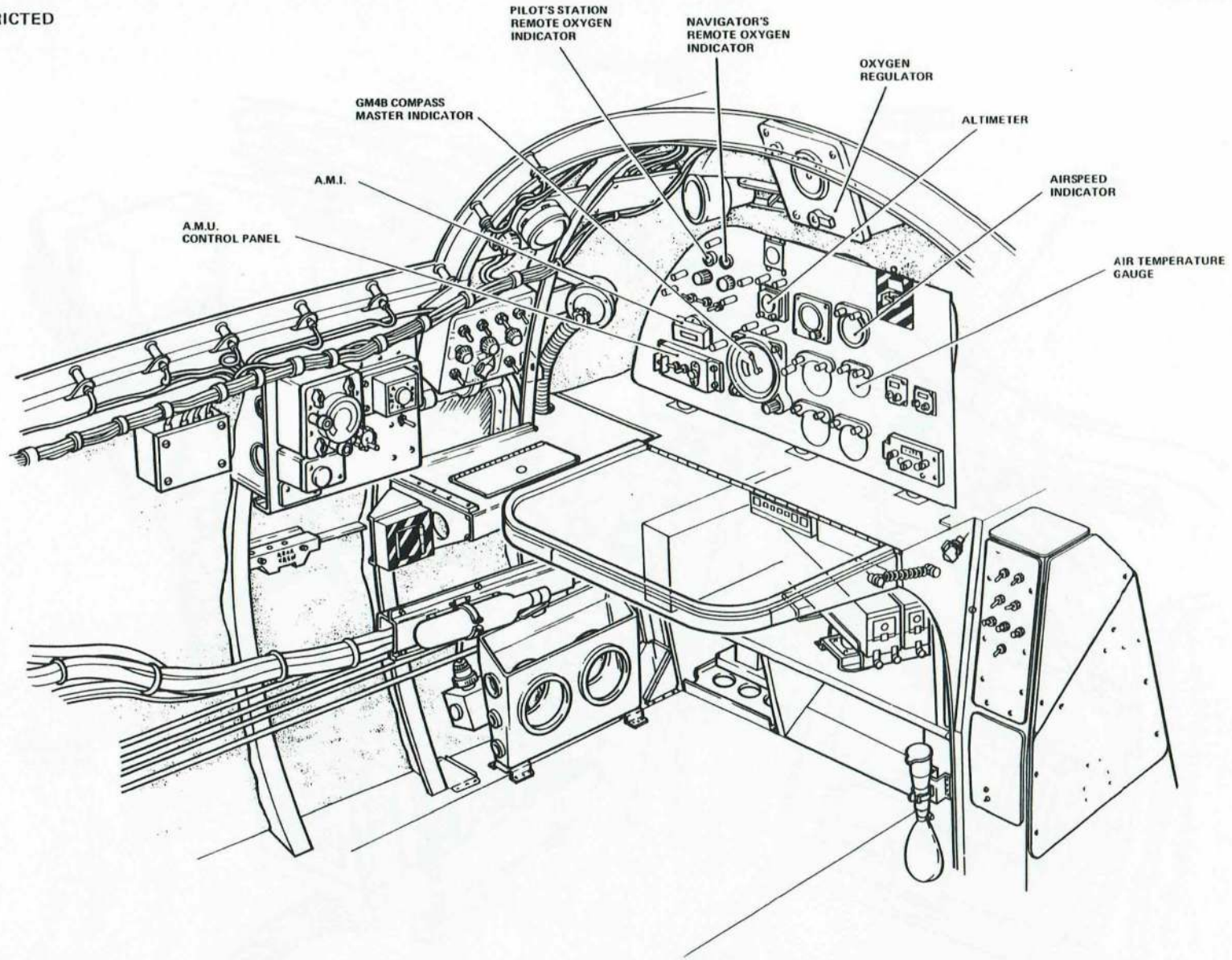


FIG. 2. INSTRUMENT INSTALLATION - NAVIGATOR'S PORT STATION

◄ SEM/CAN/0167/STC INCORPORATED ►

UK RESTRICTED

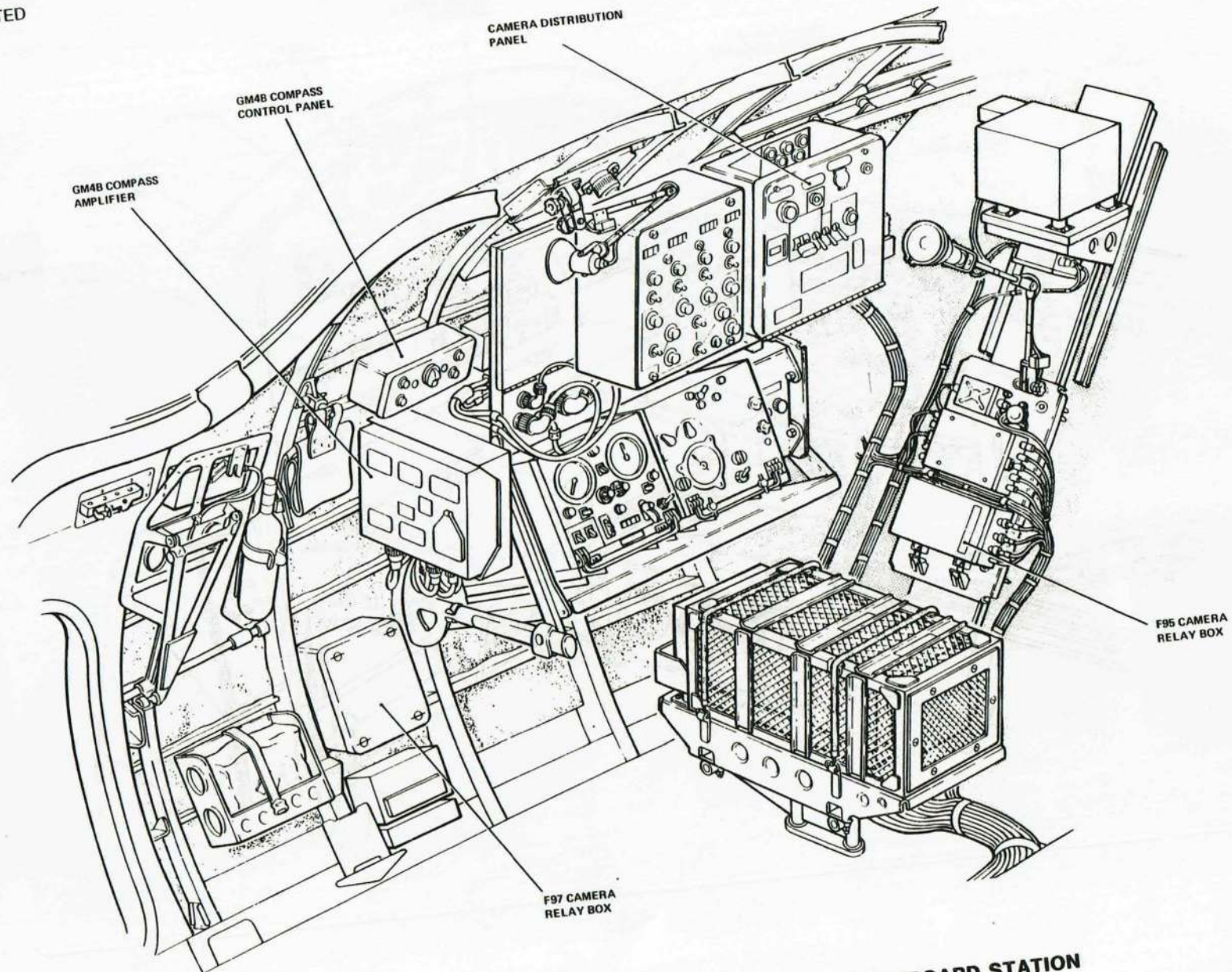


FIG. 3. INSTRUMENT INSTALLATION – NAVIGATOR'S STARBOARD STATION

◂ SEM/CAN/0167/STC INCORPORATED ▸

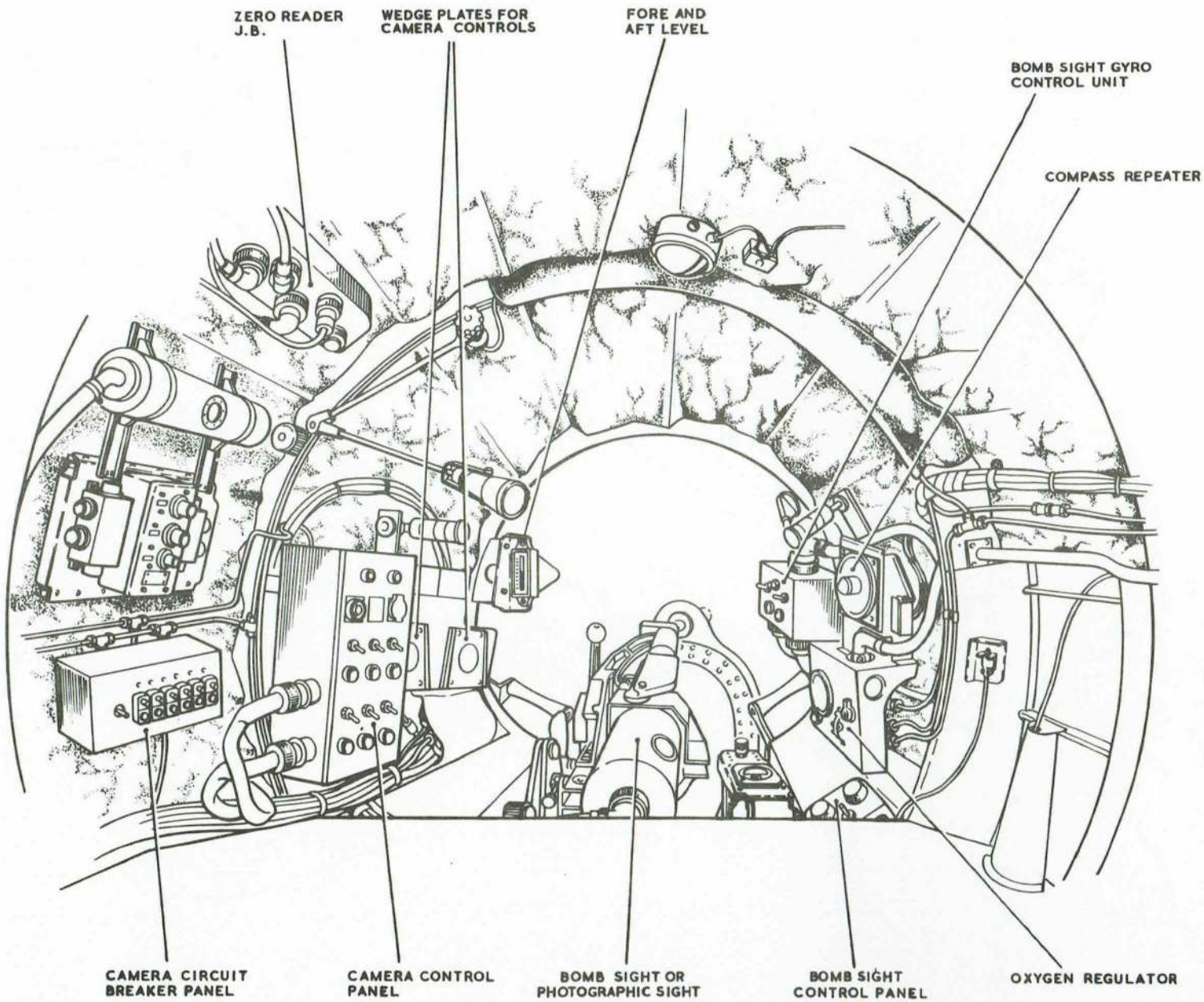


FIG.4. INSTRUMENT INSTALLATION — FORWARD STATION

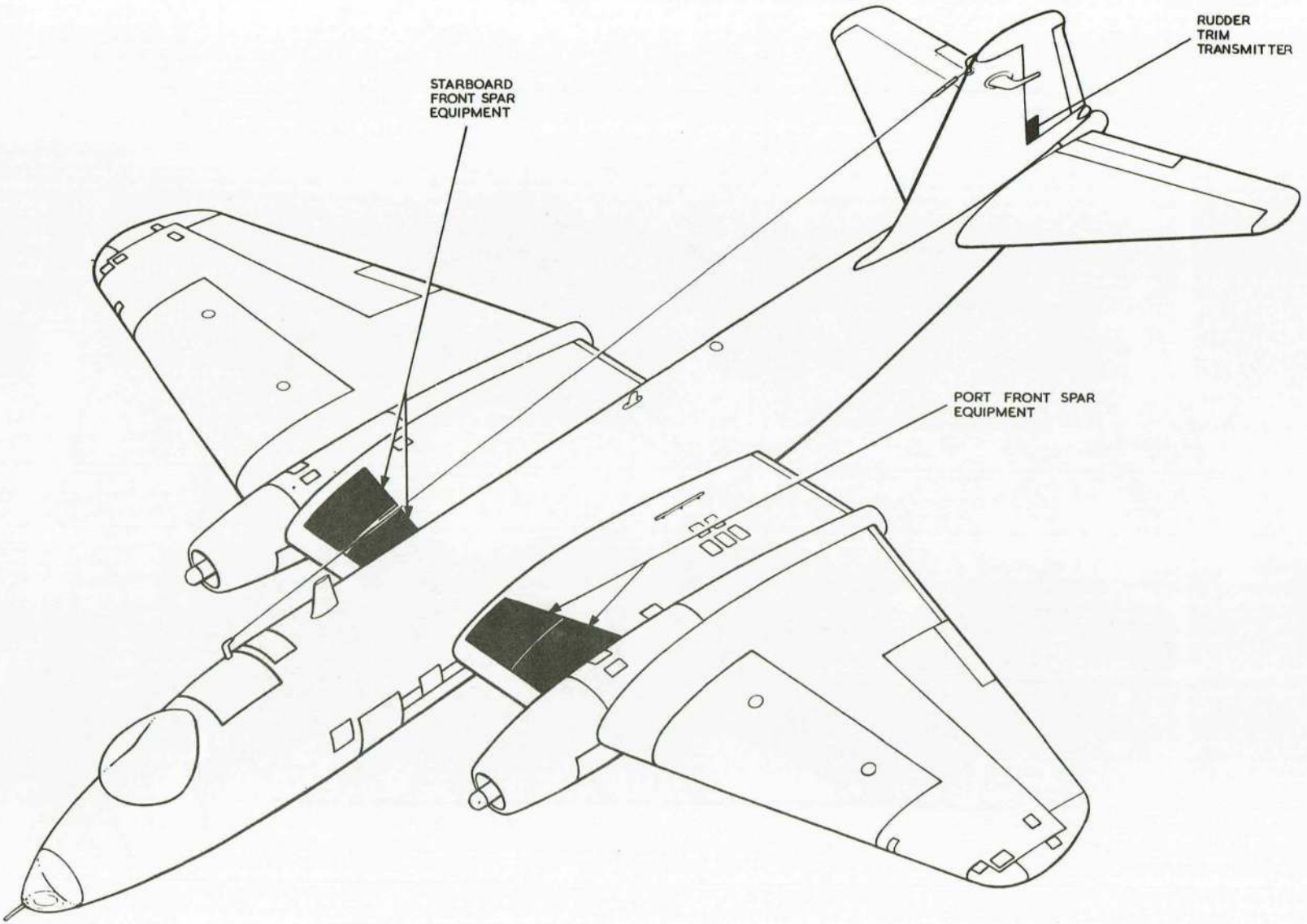


FIG.5.ACCESS PANELS, UPPER SURFACE AND PORT SIDE

UK RESTRICTED

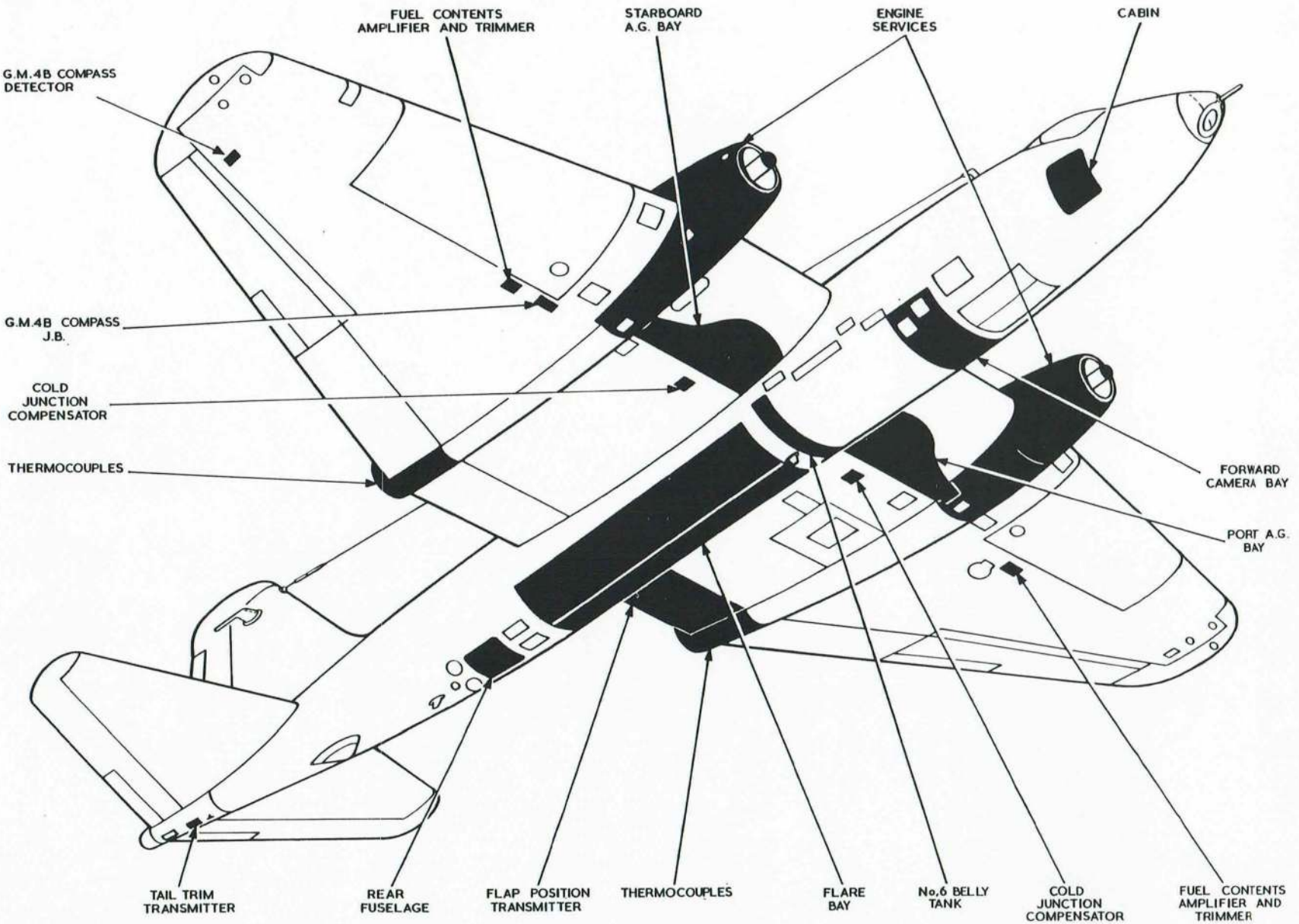


FIG.6. ACCESS PANELS, LOWER SURFACE AND STARBOARD SIDE

◄ MOD 5500 INCORPORATED ►

ARMAMENT AND PHOTOGRAPHIC – GROUP A & B

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LIST OF ILLUSTRATIONS

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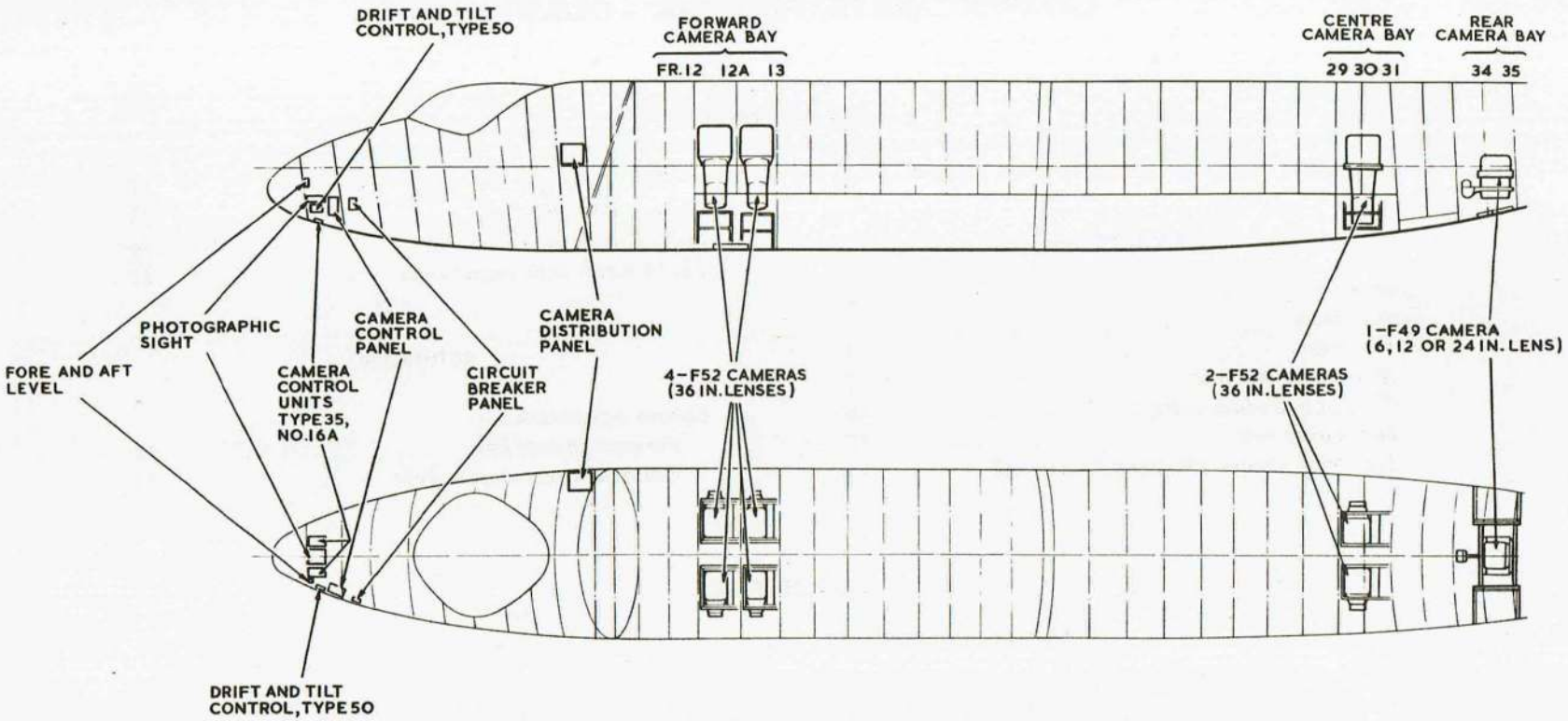
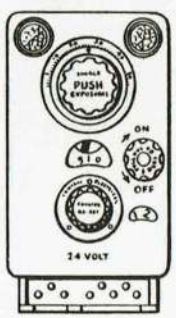
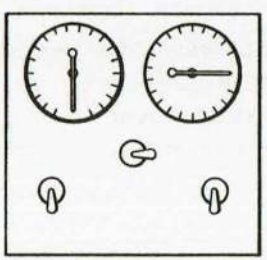


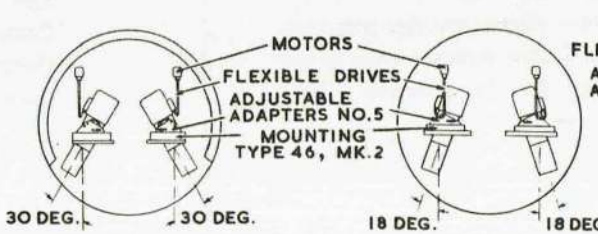
NOTE :- FOR F49 CAMERA INSTALLATION - REFER TO DAY SURVEY ROLE



CAMERA CONTROL TYPE 35, NO. 16A

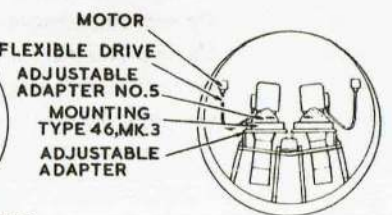


DRIFT AND TILT CONTROL, TYPE 50



FORWARD POSITION FORWARD BAY

REAR POSITION FORWARD BAY



CENTRE BAY

FIG. 1. CAMERA INSTALLATION - DAY ROLE

Introduction

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

DESCRIPTION

General

2. The cameras are accommodated in three bays, the forward bay situated between frames 12 and 13, the centre bay between frames 29 and 31 and the rear bay between frames 34 and 35. Details of the camera bays are to be found in A.P.101B-0407-1A, Sect.3, Chap.1.

Camera roles

Day role (fig.1)

3. For day photography a total of six F52 cameras fitted with 36-inch lenses and one F49 camera fitted with either a 6, 12, or 24-inch lens are used. Four of the F52 cameras are installed in the forward bay and two in the centre bay.

4. Each F52 camera in the forward bay is fitted in a No.5 adapter which is secured by four fixing bolts to the frame of a Type 46, Mk.2 mounting. The No.5 adapter enables the camera to be set to any one of the four angles in relation to the vertical axis of the aircraft.

5. Each of the two F52 cameras in the centre bay are fitted in No.5 adapter bolted to Type 46, Mk.3 mountings which are secured by clamps to the adjustable adapters located on the camera platforms. The adjustable adapter must be set to the 36-inch lens position.

6. The installation of the F49 camera in the rear bay is identical to that for the day survey role and is described in para.12.

Alternative day role (fig.2)

7. For this installation four F52 cameras with 20-inch lenses and one F49 camera with either a 6, 12, or 24-inch lens are installed in the aircraft. Two F52 cameras are installed in the forward position in the forward camera bay and two in the centre bay.

8. The cameras in the forward bay are fitted in No.4 adapters which are secured to Type 46, Mk.2 mountings whilst the cameras in the centre bay are fitted in No.4 adapters bolted to Type 46, Mk.3 mountings which are secured by clamps to adjustable adapters on the camera platforms. The adjustable adapter must be set to the 20-inch lens position.

9. The installation of the F49 camera in the rear bay is identical to that for the day survey role and is described in para.12.

Control units (day roles)

10. The cameras for both day roles, para.3 and 7, are controlled by two Type 35, No.16A control units and a Type 50 drift and tilt control unit.

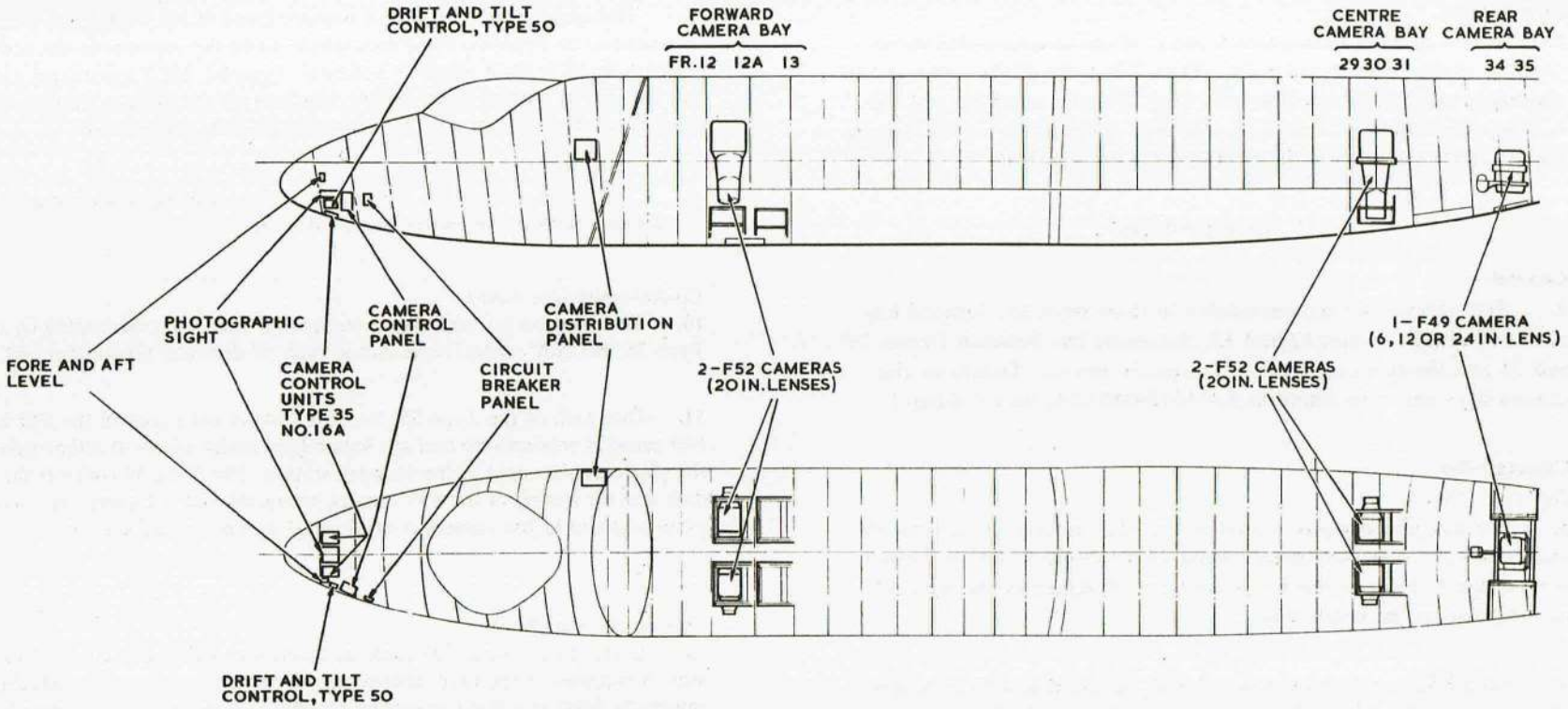
11. One each of the Type 35, No.16A control units control the F52 and F49 cameras respectively and are located on wedge plates at either side of the photographic sight at the forward station. The Type 50 controls the drift and tilt setting of the F49 camera mounting and is located on a wedge plate adjacent to the camera control panel at the forward station.

Day survey role (fig.3)

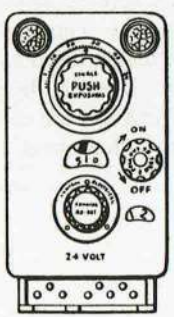
12. In this role a Type F49 camera, fitted with either a 6, 12 or 24-inch lens, is installed in the rear camera bay. When a 6-inch lens is used, the camera is fitted in a fixed mounting directly secured by eight pip pins to the four vertical members of the aircraft structure. For use with a 12 or 24-inch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

Low level oblique photography day role (fig.4)

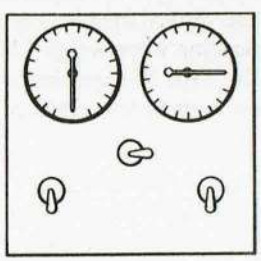
13. In this role three F95 Mk.2 cameras are fitted one in the nose and two in the forward camera bay. The cameras are controlled from a control unit mounted above the miscellaneous instrument panel on the canopy coaming tube and the toggle switch on the left-hand grip of the control column. On some installations, the F95 cameras have A.E.C. lens units fitted. When these are fitted, an adapter lead is required between the camera and the lens *(Table 1)*.



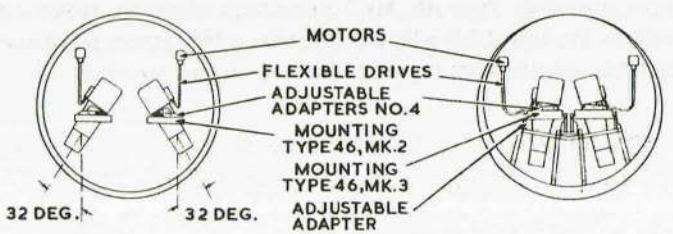
NOTE :- FOR F49 CAMERA INSTALLATION - REFER TO DAY SURVEY ROLE



CAMERA CONTROL TYPE 35, NO.16A



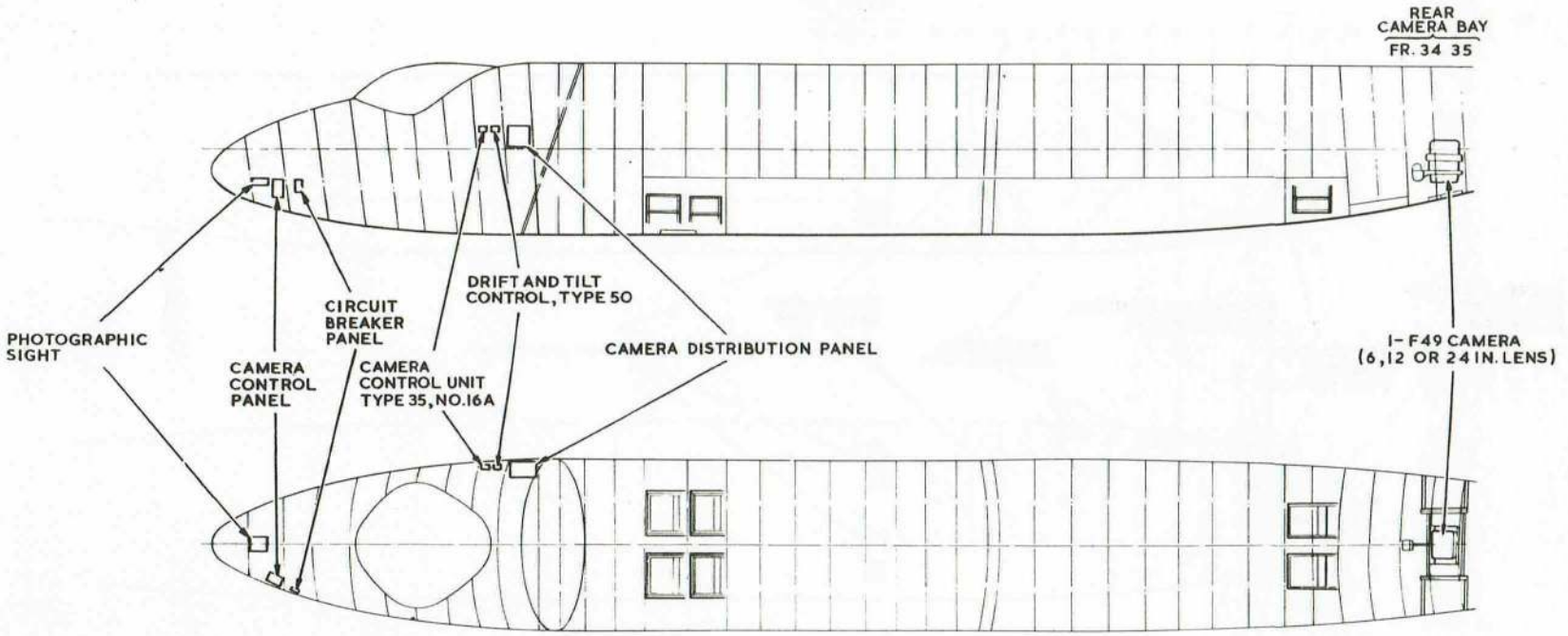
DRIFT AND TILT CONTROL, TYPE 50

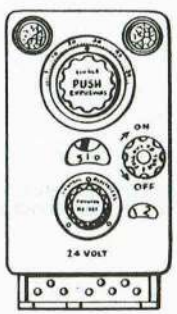


FORWARD POSITION - FORWARD BAY

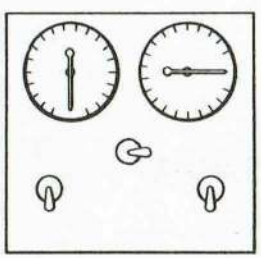
CENTRE BAY

FIG.2. CAMERA INSTALLATION - ALTERNATIVE DAY ROLE

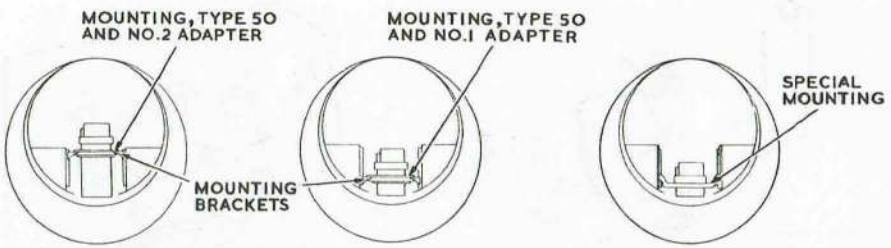




CAMERA CONTROL TYPE 35, NO.16A



DRIFT AND TILT CONTROL, TYPE 50

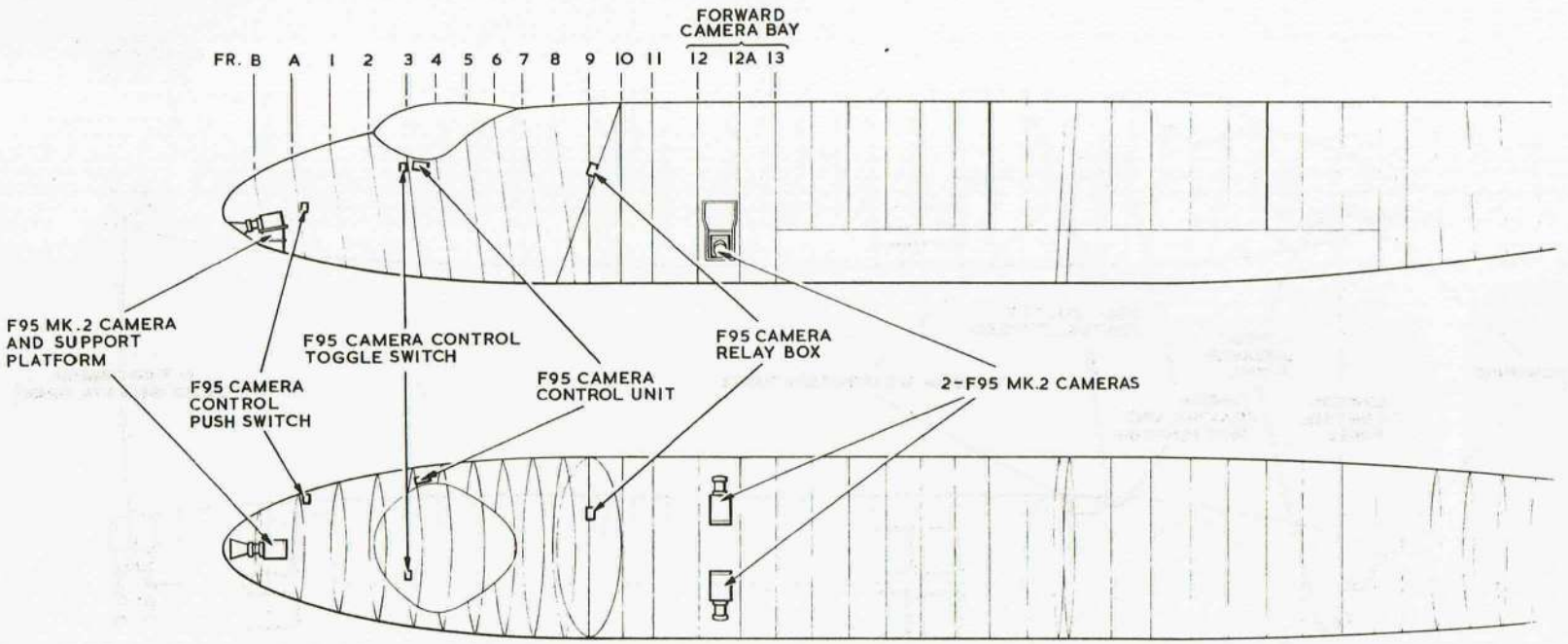


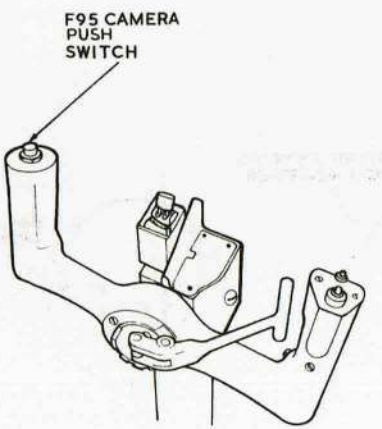
1-F49 CAMERA WITH A 24 IN. LENS REAR BAY

1-F49 CAMERA WITH A 12 IN. LENS REAR BAY

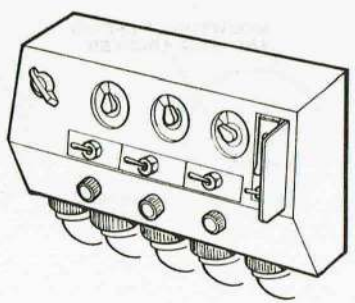
1-F49 CAMERA WITH A 6 IN. LENS REAR BAY

FIG.3. CAMERA INSTALLATION – DAY SURVEY ROLE

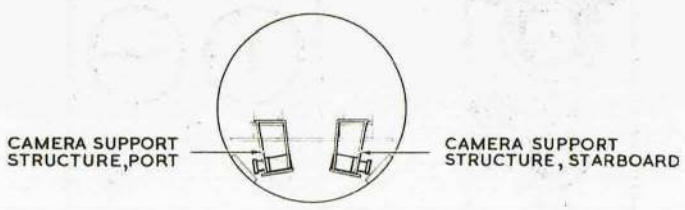




CONTROL HAND WHEEL



F95 CAMERA CONTROL UNIT



FORWARD BAY

VIEW LOOKING FORWARD
ON FRAME 12

FIG.4. CAMERA INSTALLATION – LOW LEVEL OBLIQUE PHOTOGRAPHY DAY ROLE

◄ CAMERA CONTROL SWITCH AMENDED ►

High level night role (fig.5)

14. For night photography two F89, Mk.2 cameras with 36-inch lenses are installed in the centre bay. The cameras are carried by No.3 adapters fitted to Type 46, Mk.3 mountings. These adapters enable the cameras to be tilted from the vertical in 3 degree increments from 0 to 27 degrees. Each camera is controlled by a Type 89, Mk.2 control unit mounted adjacent to the camera distribution panel and operated from a photo-cell unit installed forward of the day survey camera position in the rear camera bay. Each photo-cell is mounted in a Type 25, Mk.2 mounting clamped to the photo-cell bearer rails. Photoflash release is controlled by the Type 35, No.26 control unit mounted adjacent to the Type 89 control unit.

Low level night role (fig.6)

15. In this role two F97, Mk.2 cameras are installed at the aft position in the forward camera bay. The cameras are fitted to detachable support structures which are attached to mounting brackets on the forward face of frame 13 and secured to the brackets by special bolts and quick-release pins. The cameras are controlled by a 'firing control box', mounted on a wedge plate adjacent to the camera control panel at the forward station, in conjunction with a Type 97, Mk.2 control unit mounted on a wedge plate adjacent to the camera distribution panel at the navigator's starboard station. The procedure for fitting the cameras to the support structure is given in A.P.112P-0221-1. Located in the flare bay and installed for this role is a photoflash carrier accommodating 252 x 1.75 inch No.2, Mk.1 photoflashes.

Photographic sight (day role)

16. A Type 1 photographic reconnaissance sight is installed above the sighting window at the forward station. It is a gyro-operated instrument and it functions in conjunction with a control panel adjacent to it.

T3/T4 bomb sight (night role)

17. To assist in the dropping of photoflashes in the night role a Type T3 or T4 bomb sight is installed as an alternative to the Type 1 photographic sight *(para.16)*. It is a gyro operated instrument and functions in conjunction with a control panel, located adjacent to it, and a gyro control unit mounted at the starboard side of the forward station adjacent to the oxygen regulator.

SERVICING

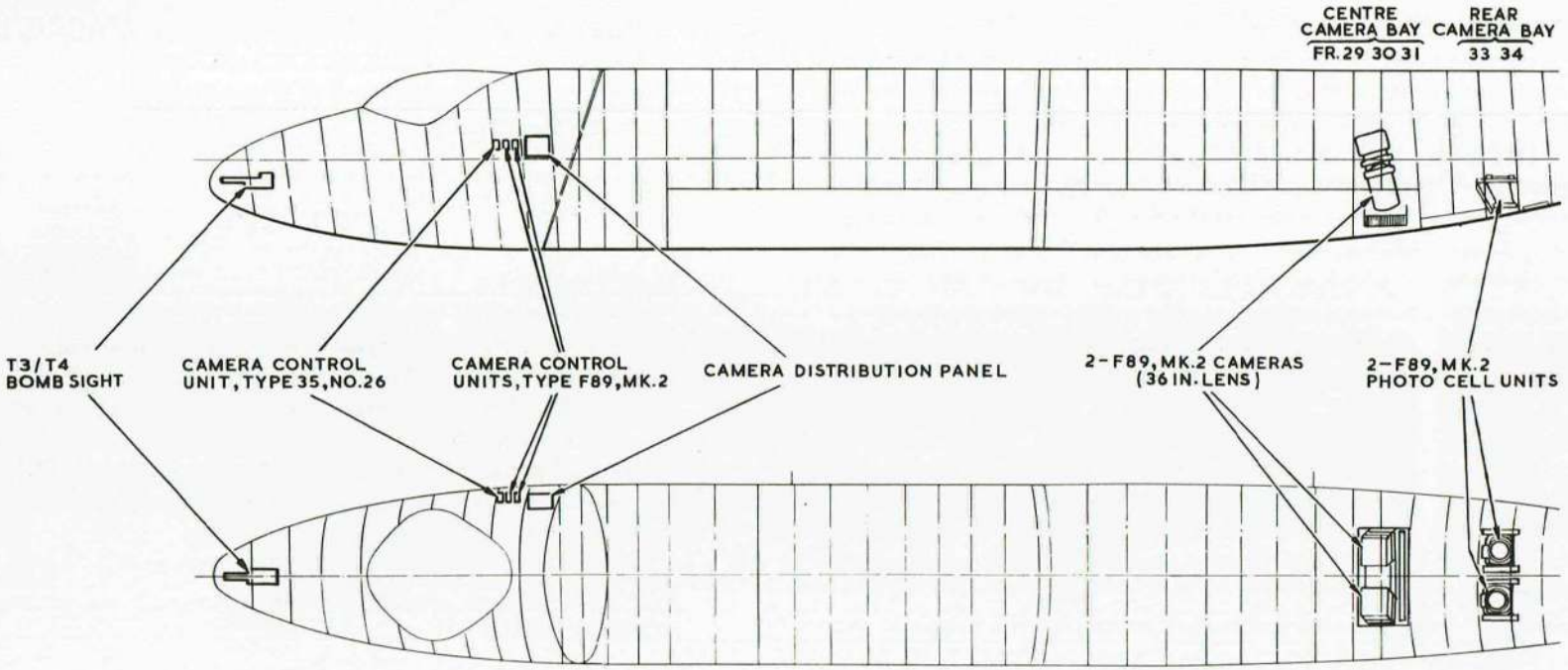
Camera installation

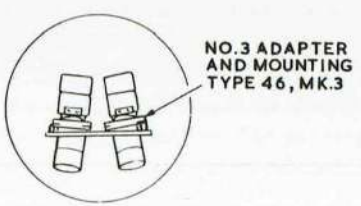
Forward camera bay

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

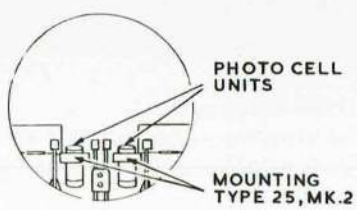
Centre and rear camera bays (fig. 7, 8 and 9)

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



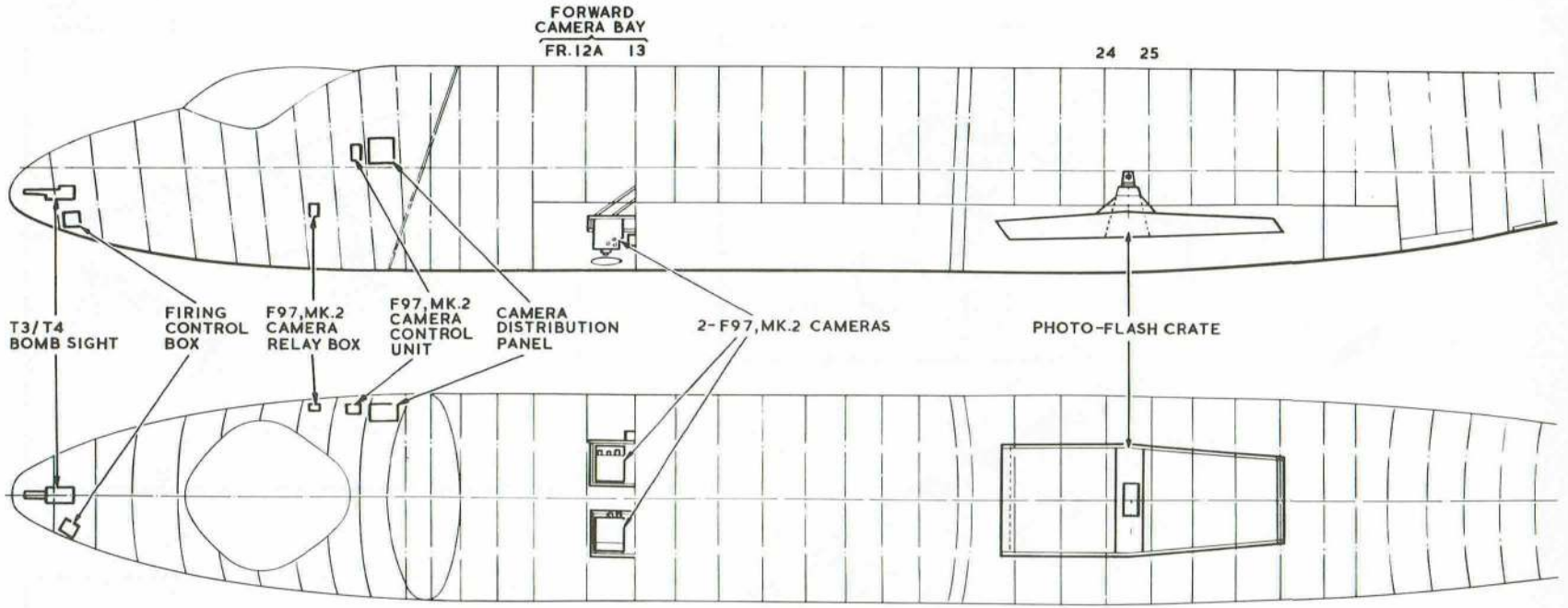


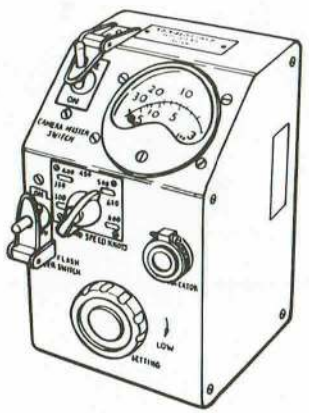
2-F89 CAMERAS CENTRE BAY



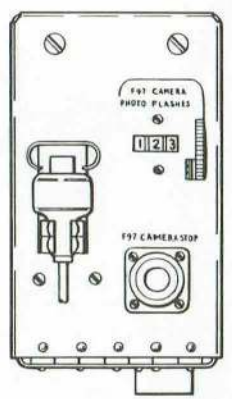
2-PHOTO CELL UNITS REAR BAY

FIG.5. CAMERA INSTALLATION-HIGH LEVEL NIGHT ROLE

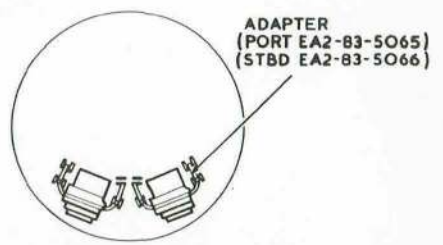




F97,MK.2 CAMERA CONTROL UNIT



FIRING CONTROL BOX



FORWARD BAY-AFT END

FIG.6. CAMERA INSTALLATION — LOW LEVEL NIGHT ROLE

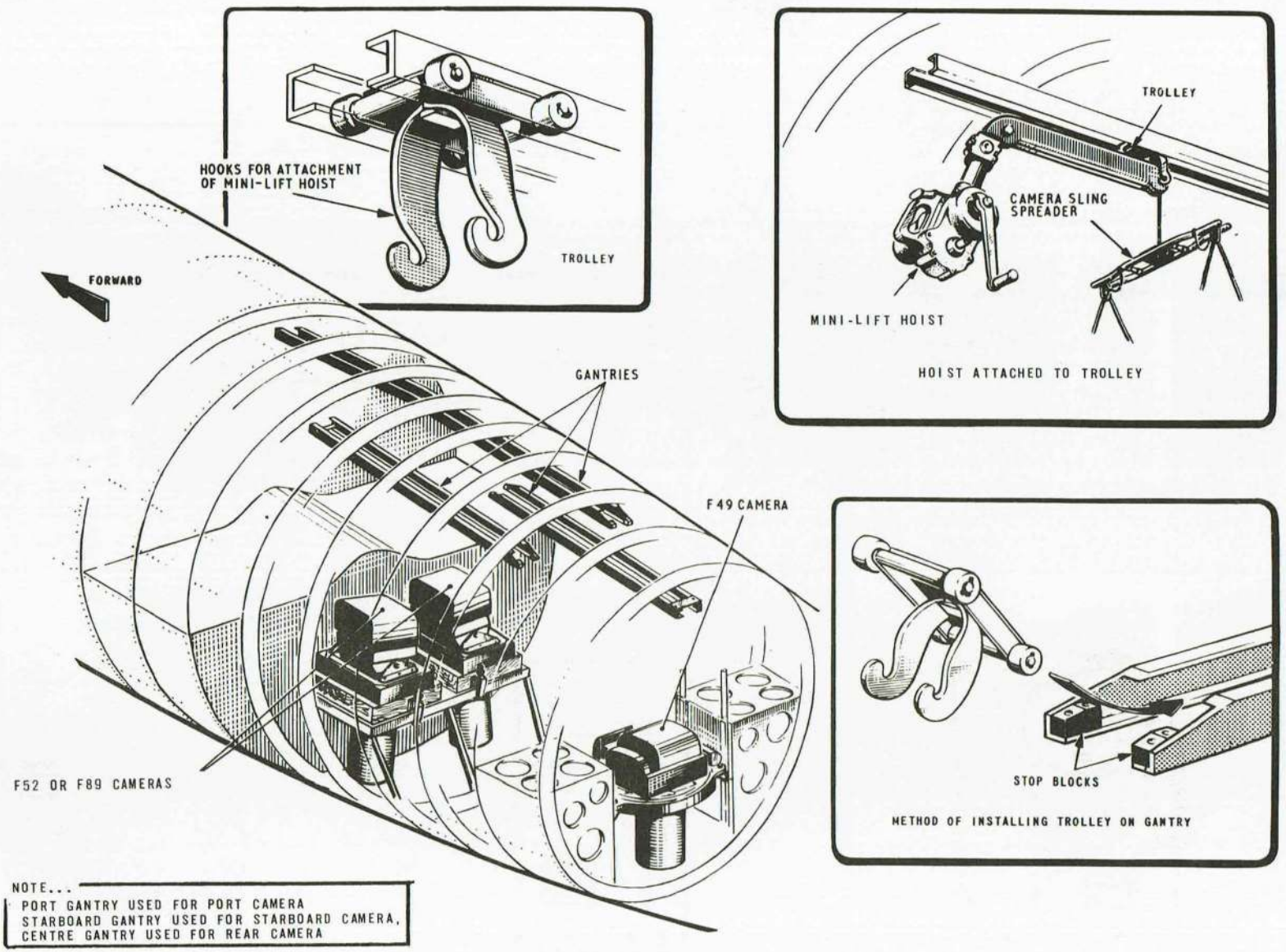
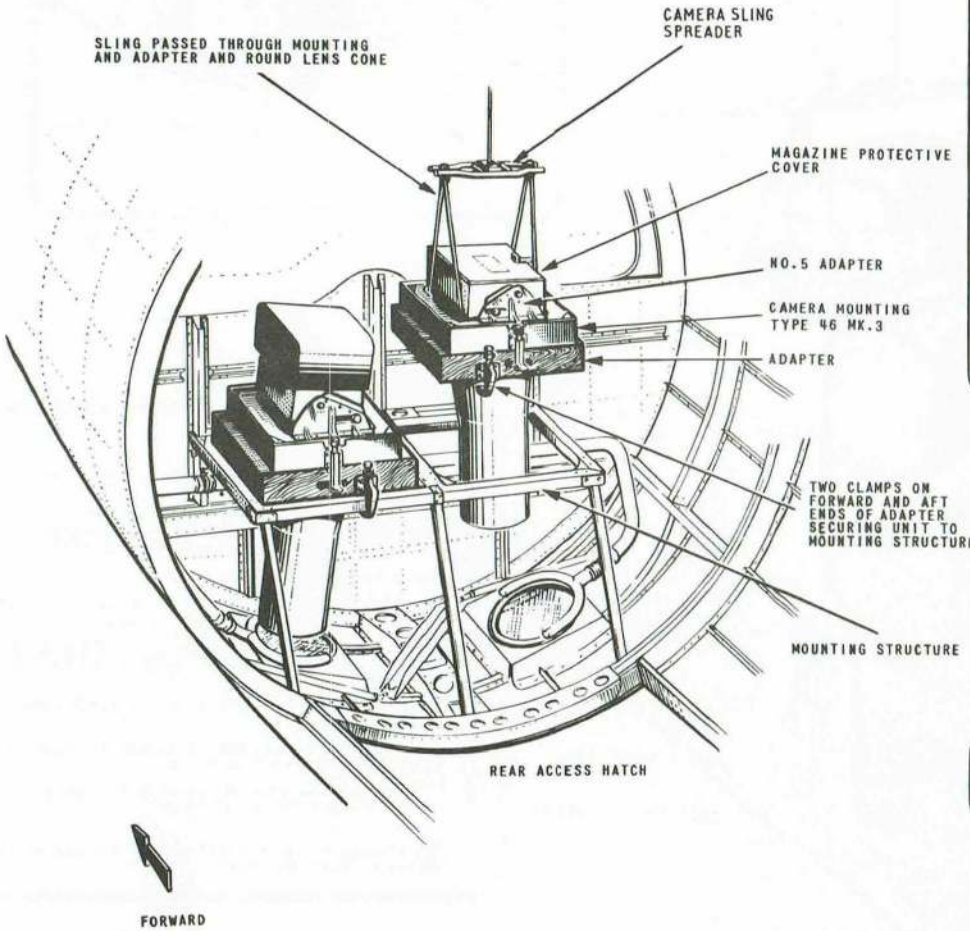


FIG.7. CAMERA LIFTING EQUIPMENT



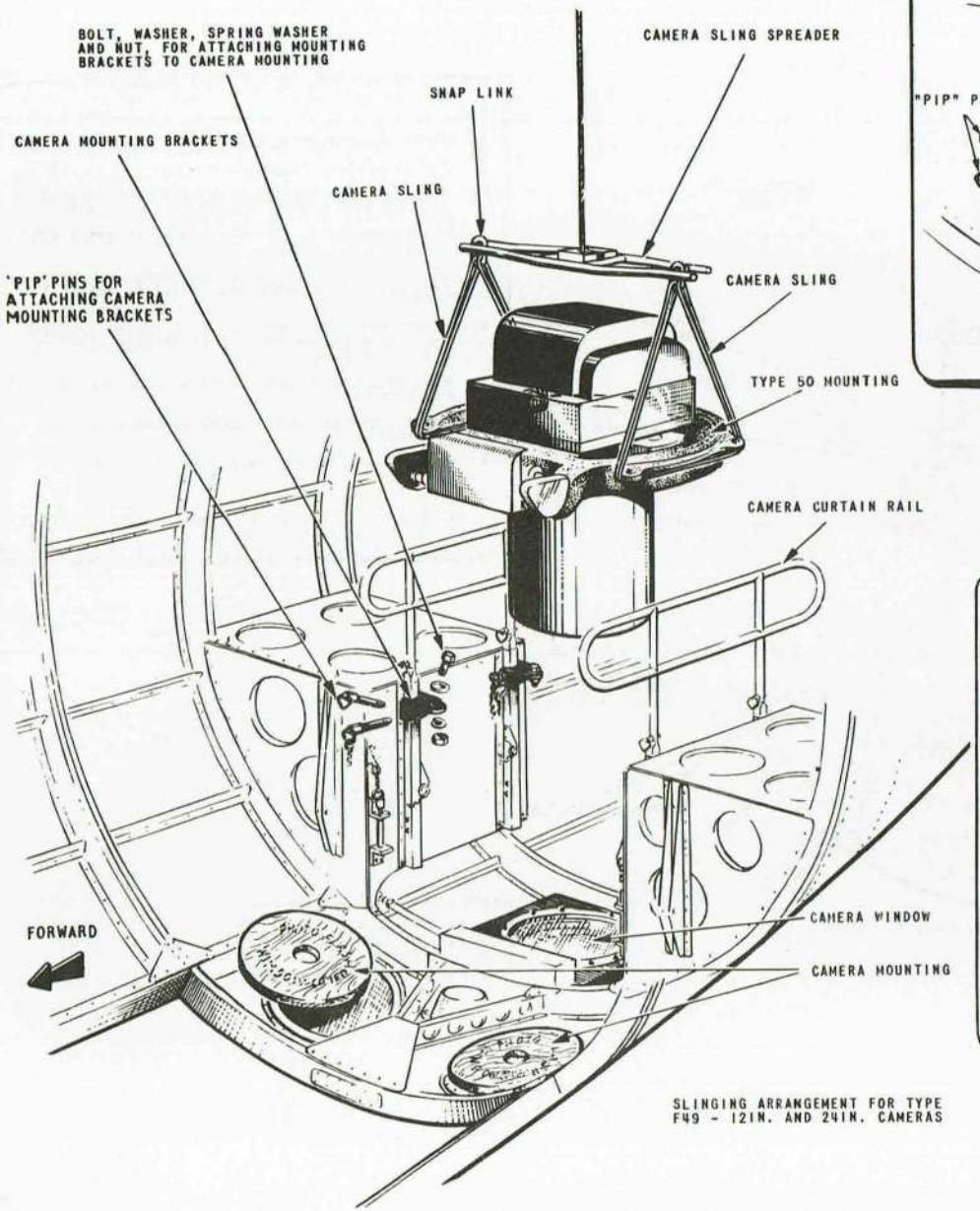
INSTALLATION OF F52 AND F 89 CAMERAS

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

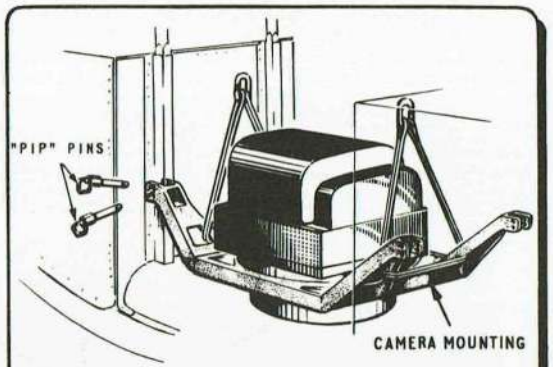
THE REMOVAL OF THE CAMERAS IS THE REVERSE OF THE PROCEDURE OUTLINED ABOVE.

NOTE...
F52 CAMERAS SHOWN.
REMOVAL AND INSTALLATION OF F89 MK.2 CAMERAS IS SIMILAR

FIG.8. CAMERA SERVICING IN CENTRE BAY



SLINGING ARRANGEMENT FOR TYPE F49 - 12IN. AND 24IN. CAMERAS



SLINGING ARRANGEMENT FOR TYPE F49 - 6IN. CAMERA

INSTALLATION OF F49 – 6 IN., 12 IN. AND 24 IN. CAMERAS

1. PLACE PHOTO-CELL WINDOW COVERS IN POSITION.
2. FIT TROLLEY TO APPROPRIATE GANTRY.
3. TAKE OFF CAMERA MAGAZINES AND PROTECT REGISTER GLASSES WITH COVERS, (EXISTING EQUIPMENT).
4. LOWER HOIST THROUGH HATCH.
5. ATTACH SLING TO MOUNTING AS SHOWN AND SECURE FREE ENDS TO SNAP LINK OF SPREADER SLING.
6. ATTACH HOIST TO CENTRE BLOCK OF SPREADER SLING AND LIFT MOUNTING AND CAMERA THROUGH HATCH AS HIGH AS POSSIBLE.
7. PUSH HOIST ALONG RAIL TO POINT DIRECTLY ABOVE CAMERA WINDOW.
8. LOWER HOIST, TILTING UNIT AS SHOWN TO CLEAR CAMERA RAILS AND MOUNTING STRUCTURE.
9. SEAT CAMERA AND MOUNTING IN POSITION AND SECURE TO MOUNTING BRACKETS ON STRUCTURE.

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

FIG.9. CAMERA SERVICING IN REAR BAY

TABLE 1

Photographic equipment

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
	General		
9/4532	Photographic sight] Alternative fit to T3/T4	1	
9/4533	Control panel] bomb sight equipment	1	
9/4552	T3 bomb sighting head	1	
9/4554	T3 gyro control unit	1	A.P.112E series
109/82	Control panel, 28 volt	1	
9/4566	T4 bomb sighting head] Alternative fit to T3	1	
9/4554	T4 gyro-control unit] bomb sight equipment	1	
9/4578	Control panel, 28-volt]	1	
	Day role		
◀ 14A/1099047	Camera, Type F52 – 36-inch lens	6	
14A/4290127	Camera motor, Type B	6	
14A/4695798	Flexible drive, Type C	6	
14A/4290202	Mounting, Type 46, Mk.2	4	A.P.112P-0221-I
14A/4131	Mounting, Type 46, Mk.3	2	
14A/4693773	Adapter, No.5	6	
EA2.83.5383	Adjustable adapter, mounting	1	
14A/1989732	Camera, Type F49 – 6-inch lens	1	A.P.112P series
EA2.83.1355	Mounting, F49 – 6-inch lens	1	
14A/1989728	Camera, Type F49 – 12-inch lens	1	
14A/4686	Adapter, No.1	1	
14A/3573	Mounting, Type 50 – 12/24-inch lens	1	
	Camera, Type F49 – 24-inch lens	1	A.P.112P series
14A/4687	Adapter, No.2	1	
14A/4014	Camera control, Type 35, No.16A	2	
14A/3575	Drift and tilt control, Type 50	1	
	Alternative day role		
14A/4290096	Camera, Type F52 – 20-inch lens	4	
14A/4290127	Camera motor, Type B	4	
14A/4695798	Flexible drive, Type C	4	A.P.112P-0221-I
14A/4290202 ▶	Mounting, Type 46, Mk.2	2	

continued . . .

TABLE 1 Photographic equipment — *continued*

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
Alternative day role — *continued*			
14A/4131	Mounting, Type 46, Mk.3	2	A.P.112P-0221-1
◀ 14A/4290203	Adapter, No.4	4	
EA2.83.5383	Adjustable adapter, mounting	1	
14A/1989732	Camera, Type F49 – 6-inch lens	1	A.P.112P series
EA2.83.1355	Mounting, F49 – 6-inch lens	1	
14A/1989728	Camera, Type F49 – 12-inch lens	1	A.P.112P series
14A/4686	Adapter, No.1	1	
14A/3573	Mounting, Type 50 – 12/24-inch lens	1	
	Camera, Type F49 – 24-inch lens	1	
14A/4687	Adapter, No.2	1	
14A/4014	Camera control, Type 35, No.16A	2	
14A/3575	Drift and tilt control, Type 50	1	
Day survey role			
14A/1989732	Camera, Type F49 – 6-inch lens	1	A.P.112P series
EA2.83.1355	Mounting, F49 – 6-inch lens	1	
14A/1989728	Camera, Type F49 – 12-inch lens	1	A.P.112P series
14A/4686	Adapter, No.1	1	
14A/3573	Mounting, Type 50 – 12/24-inch lens	1	
	Camera, Type F49 – 24-inch lens	1	
14A/4687	Adapter, No.2	1	
14A/4014	Camera control, Type 35, No.16A	2	
14A/3575	Drift and tilt control, Type 50	1	
Low level oblique day role			
14A/4984	Camera, Type F95, Mk.2	3	A.P.112P-0202-1A
14A/1038259	Lens, 12-inch, F4	3	
27FZ/34139	Camera support platform (nose)	1	
27FZ/34137	Camera support structure (port)	1	
27FZ/34138	Camera support structure (starboard)	1	
27FZ/34293	Camera control unit	1	
14A/6492	Lens, 4-inch T2.1 with AEC	3	A.P.112P-0202-1A
14A/6494	Lens, 12-inch T4.2 with AEC	3	
14A/6496	Adapter lead, lens to camera	3	

continued . . .

TABLE 1 Photographic equipment — *continued*

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
High level night role			
14A/4640	Camera, Type F89, Mk.2 — 36-inch lens	2	A.P.112P series
14A/4132	Adapter, No.3	2	
14A/4131	Mounting, Type 46, Mk.3	2	
14A/4743	Photo-cell	2	
14A/4004	Mounting, Type 25, Mk.2	2	
14A/4643	Camera control, Type F89, Mk.2	2	
14A/3389	Camera control, Type 35, No.26	1	
Low level night role			
◀ 14A/4695805	Camera, Type F97, Mk.2	2	A.P.112P series
14A/4290347	Magazine, Type F97, Mk.2	2	
14A/4276	Control, Type F97, Mk.2	1	
14A/4290385	Adapter, right-angle drive	1	
14A/4695798 ▶	Flexible drive, Type B	1	
27FZ/32690	Camera support structure (port)	1	
27FZ/32692	Camera support structure (starboard)	1	
EA2.83.5633	Camera firing control box	1	
Camera lifting equipment			
EB7.88.199	Minilift hoist, 250 lb	1	A.P.2817A, Vol.1
EB7.88.155	Trolley	1	
EB7.88.117	Sling spreader	1	

Appendix 1 – MOD.2173

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LIST OF ILLUSTRATIONS

DESCRIPTION

High level night role – Mod.2173 *(fig.1)*

1. For the high level night role, Mod.2173 introduces two F89, Mk.3 cameras fitted with 36-inch lenses. With this installation, photoflash release is controlled by the cameras, one of which is selected as the master. The cameras in turn are controlled from two F89 camera-control units fitted to the camera control wedge plates at the starboard side of the navigator's station, or alternatively, to the wedge plates in the nose. Each camera, fitted with a Type 123 mounting, is seated in a special adapter fitted to the camera platform in the centre camera bay. The adapter allows the camera to be tilted by one degree increments from 6 degrees forward to 9 degrees aft. The two photo-cells are fitted in a Type 25, Mk.2 mounting installed at the port photo-cell position in the rear camera bay.

SERVICING

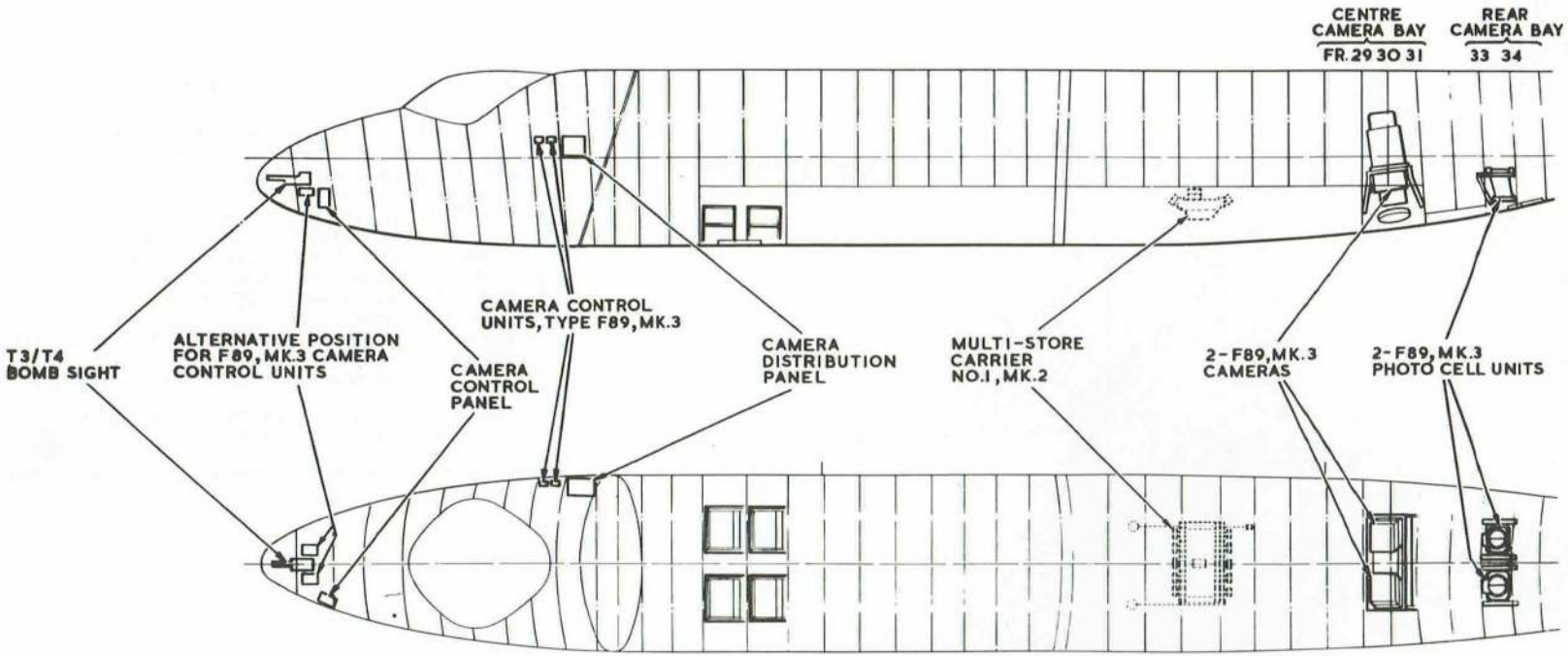
Camera servicing in centre bay

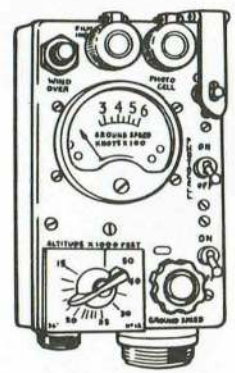
2. Installation of the F89, Mk.3 cameras in the centre camera bay is described in fig.2 of this appendix, whereas installation of the Mini-lift hoist, for lifting the cameras, is described in the main chapter.

TABLE 1

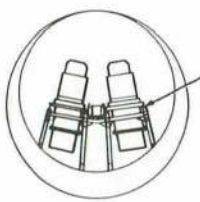
Photographic equipment – Mod.2173

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
High level night role			
14A/5530	Camera, Type F89, Mk.3 – 36-inch lens	2	A.P.112P series
14A/5528	Mounting, Type 123	2	
EA2.83.5079	Adapter, F89 camera	2	
14A/4743	Photo-cell	2	A.P.112P series
14A/4004	Mounting, Type 25, Mk.2	1	
14A/6177	Camera control, Type F89, Mk.3	2	
Camera lifting equipment			
EB7.88.199	Minilift hoist, 250 lb	1	
EB7.88.155	Trolley	1	
EA2.88.5005	Sling	1	

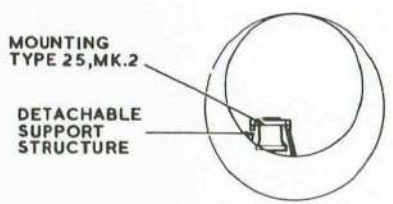




CAMERA CONTROL UNIT TYPE F89, MK.3

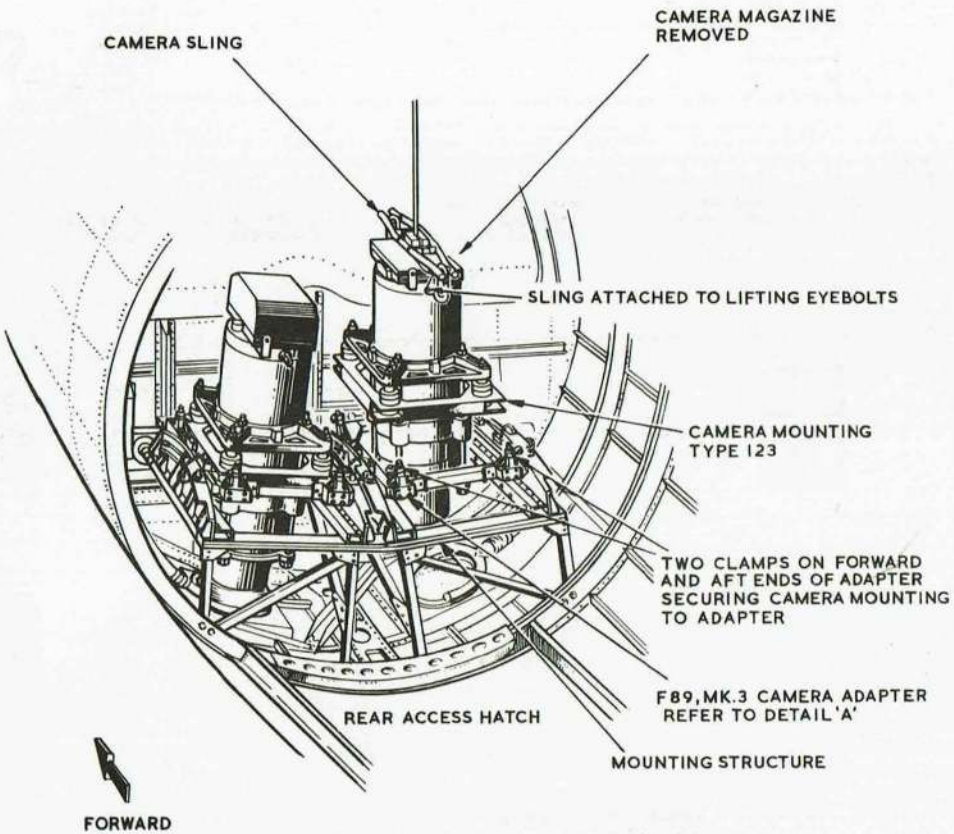


CENTRE BAY



FRAMES 33 AND 34 (LOOKING FORWARD)

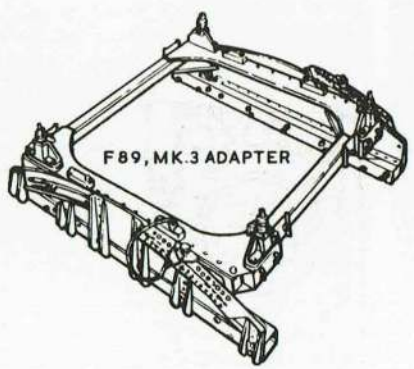
FIG.1. CAMERA INSTALLATION—HIGH LEVEL NIGHT ROLE—MOD.2173



INSTALLATION OF F89, MK.3 CAMERAS

1. PLACE PHOTO-CELL WINDOW COVERS IN POSITION.
2. FIT TROLLEY TO APPROPRIATE RAILS.
3. REMOVE CAMERA MAGAZINES AND PROTECT REGISTER GLASSES WITH COVERS (EXISTING EQUIPMENT).
4. PLACE THE CAMERA BELOW THE REAR HATCH.
5. ATTACH SLING TO THE CAMERA LIFTING EYEBOLTS..
6. ATTACH HOIST TO CENTRE BLOCK OF SLING AND LIFT CAMERA THROUGH HATCH AS HIGH AS POSSIBLE.
7. PUSH HOIST ALONG RAIL TO POINT DIRECTLY ABOVE CAMERA WINDOW.
8. LOWER HOIST AND SEAT CAMERA MOUNTING IN ADAPTER.
9. SECURE MOUNTING TO ADAPTER WITH CLAMPS.
10. REMOVE SLING AND LOCATE 'PIP PINS' IN EYEBOLTS.

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



DETAIL 'A'

FIG.2. CAMERA SERVICING IN CENTRE BAY — MOD.2173

Appendix 2 – SPLIT VERTICAL F95 CAMERAS

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DESCRIPTION

Split vertical F95 cameras

1. An installation is provided which caters for two F95 cameras to be fitted in the centre camera bay in a split vertical configuration. Control of the cameras is effected by a camera control box, fitted on the forward wedge plate in the nose of the aircraft on the port side. An electrical control box is also fitted in the nose of the aircraft on the aircraft centre line at frame B.

2. Power supplies of 28V d.c. are taken from fuse 156 in the camera distribution panel and each camera is protected by a circuit-breaker fitted on the camera control box. A MASTER ON indicator lamp is illuminated when the MASTER AND HEATER switch on the camera control box is selected to ON. Operation of the camera push switch illuminates a CAMERA(S) ON indicator lamp and causes the cameras to run. When the push switch is released, both cameras cease to run and the CAMERA(S) ON indicator lamp will extinguish. Both indicator lamps have a press-to-test facility. The electrical control box contains switches for the selection of the required camera and its aperture size. Film footage indicators are also provided.

TABLE 1

Photographic equipment

Ref. or Part No.	Equipment	Quantity	Relevant A.P.
14A/4984	Camera F95 Mk.2	2	A.P.112P-0202-1A
14A/4290336	Electrical control panel	1	
Command Mod.082	Camera control panel	1	
Command Mod.082	Camera mounts parts A, B, C and D	1 each	

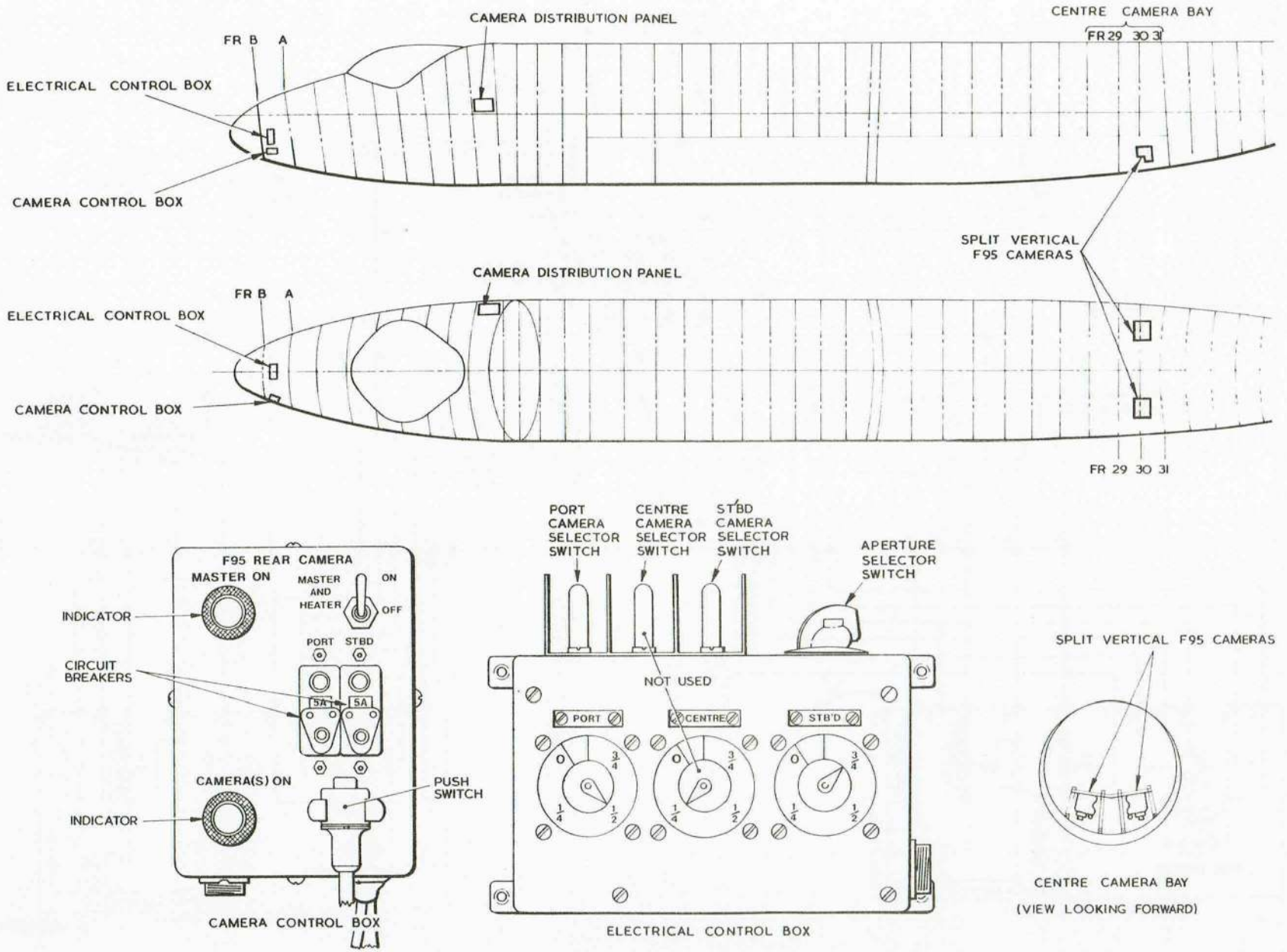

FIG. 1. CAMERA INSTALLATION - SPLIT VERTICAL F95 CAMERAS

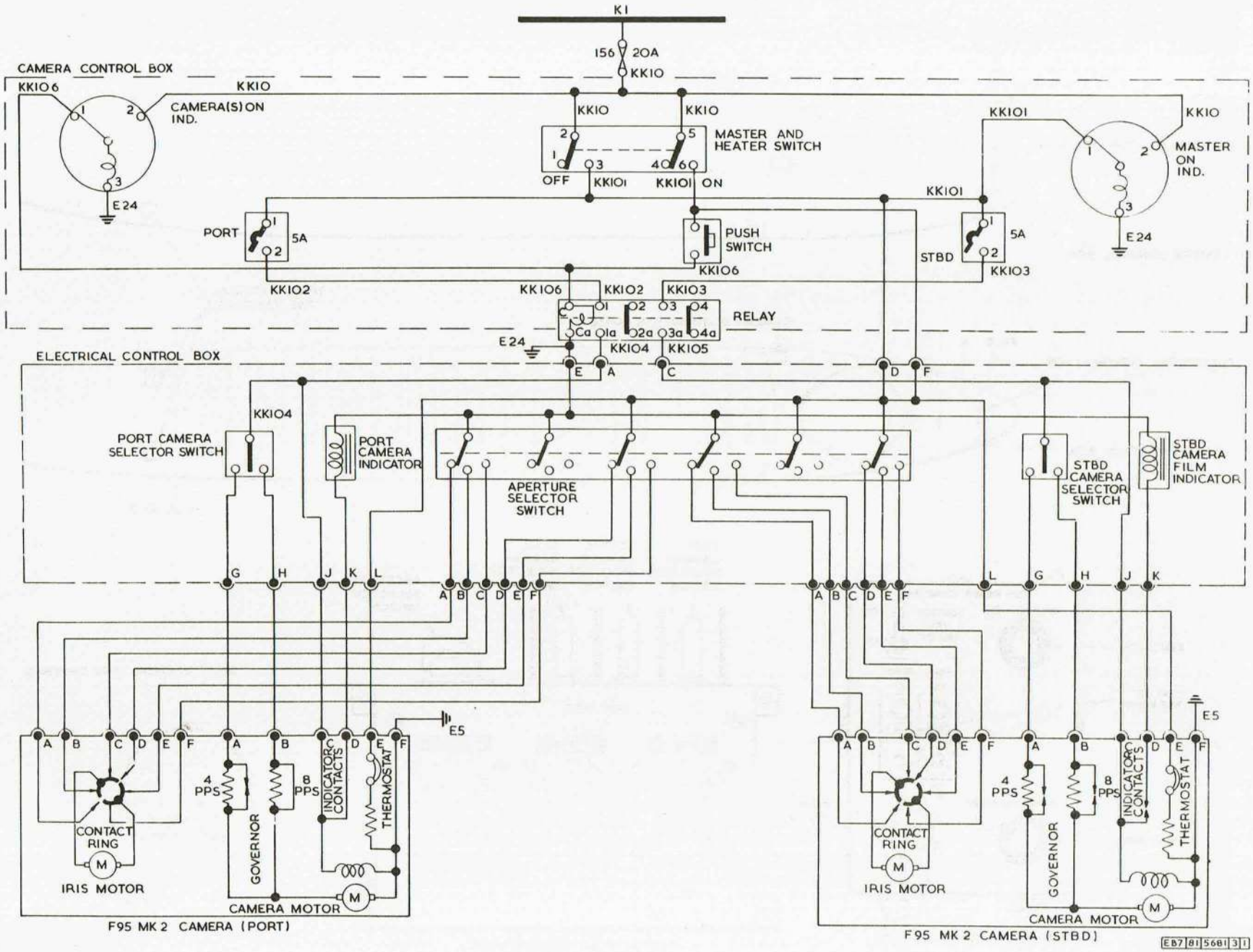

FIG. 2. SPLIT VERTICAL F95 CAMERAS

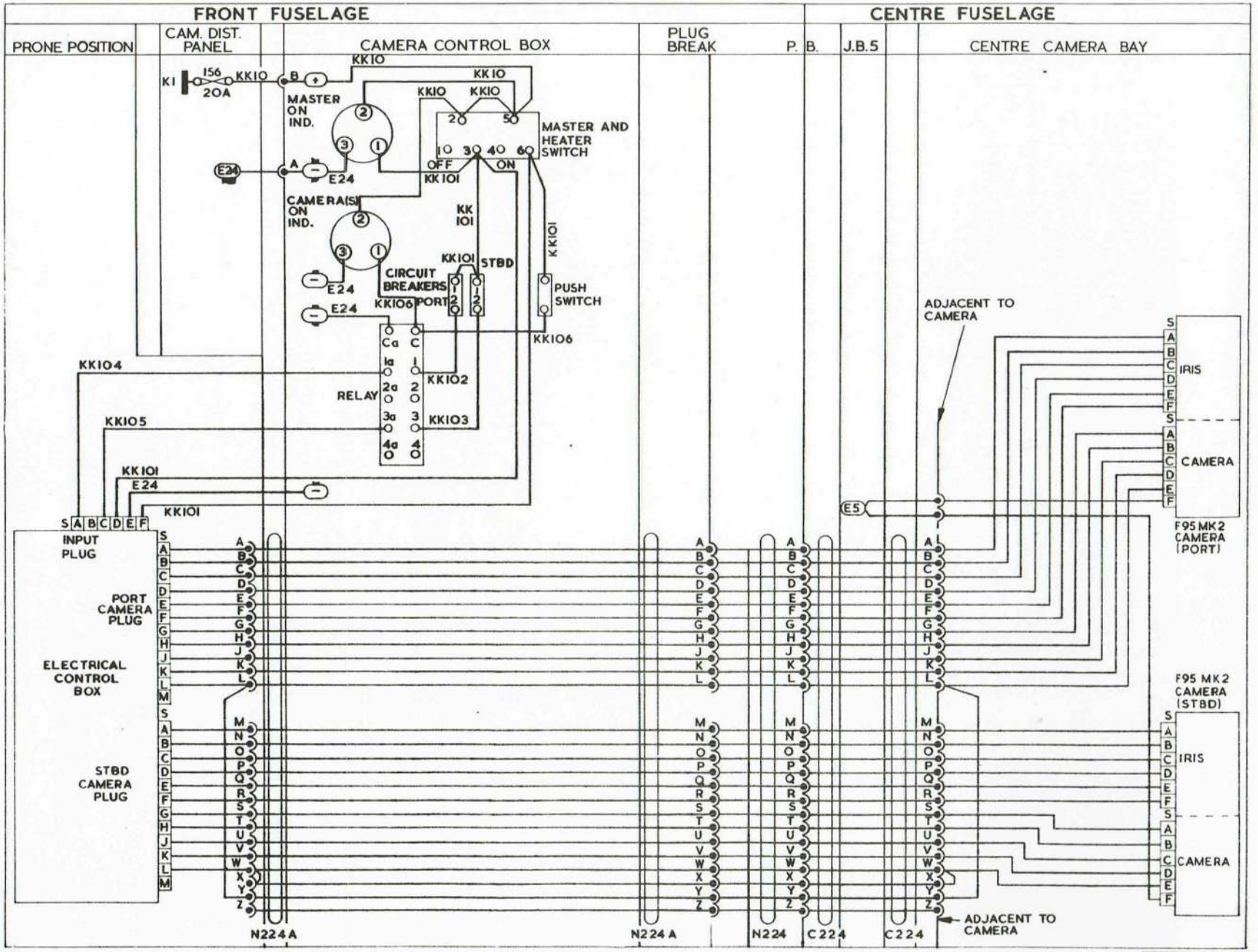

FIG.3. SPLIT VERTICAL F95 CAMERAS

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 A.P. in which they are described. The oxygen system as a whole is described in A.P.101B-0407-1A, Sect.3, Chap.10. The location of the principal items of equipment relevant to this group are shown in Fig.1-1A.

DESCRIPTION

Cabin altimeter

2. A Mk.21 altimeter having an operating range of 8000 to 50,000 ft. is fitted to the miscellaneous instrument panel to indicate the apparent height in the cabin due to the operation of the cabin pressurization system.

Hydraulic pressure gauges

3. Four Mk.14LL gauges, calibrated from 0-4000 lb/in^2, register the pressure 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 pressure in the main system accumulator and the brakes system accumulator is shown by two other gauges, one in the starboard wheel well for the main system accumulator and the other on the flare bay forward bulkhead for the brakes system accumulator.

Fatigue meter

4. A Mk.16 fatigue meter is fitted to the rear face of frame 21B in the flare bay. It is connected by a 2-way cable, fitted with a Plessey plug at the meter end only, to J.B.1 in the flare bay. The cable connects

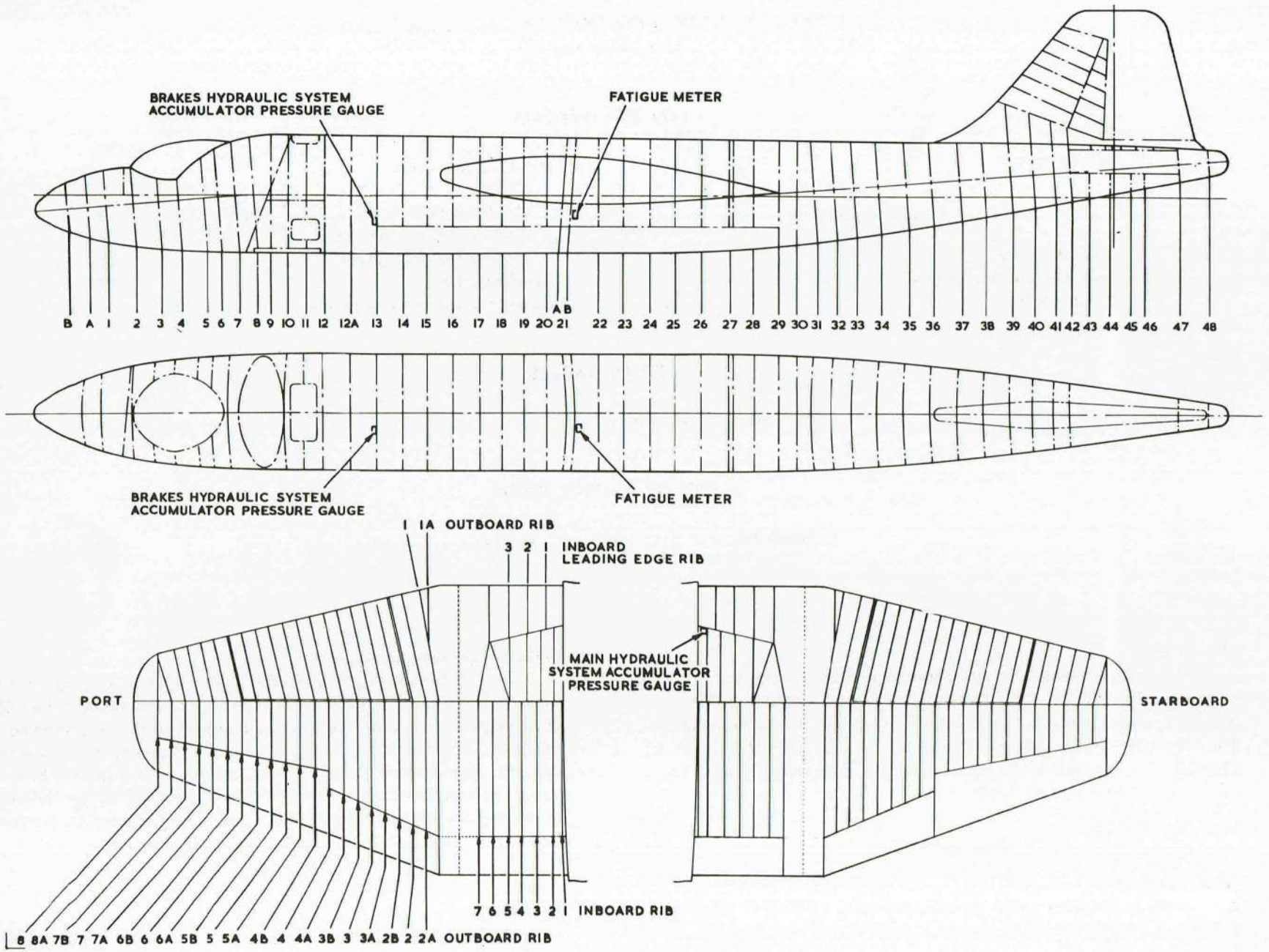

FIG.1. LOCATION DIAGRAM

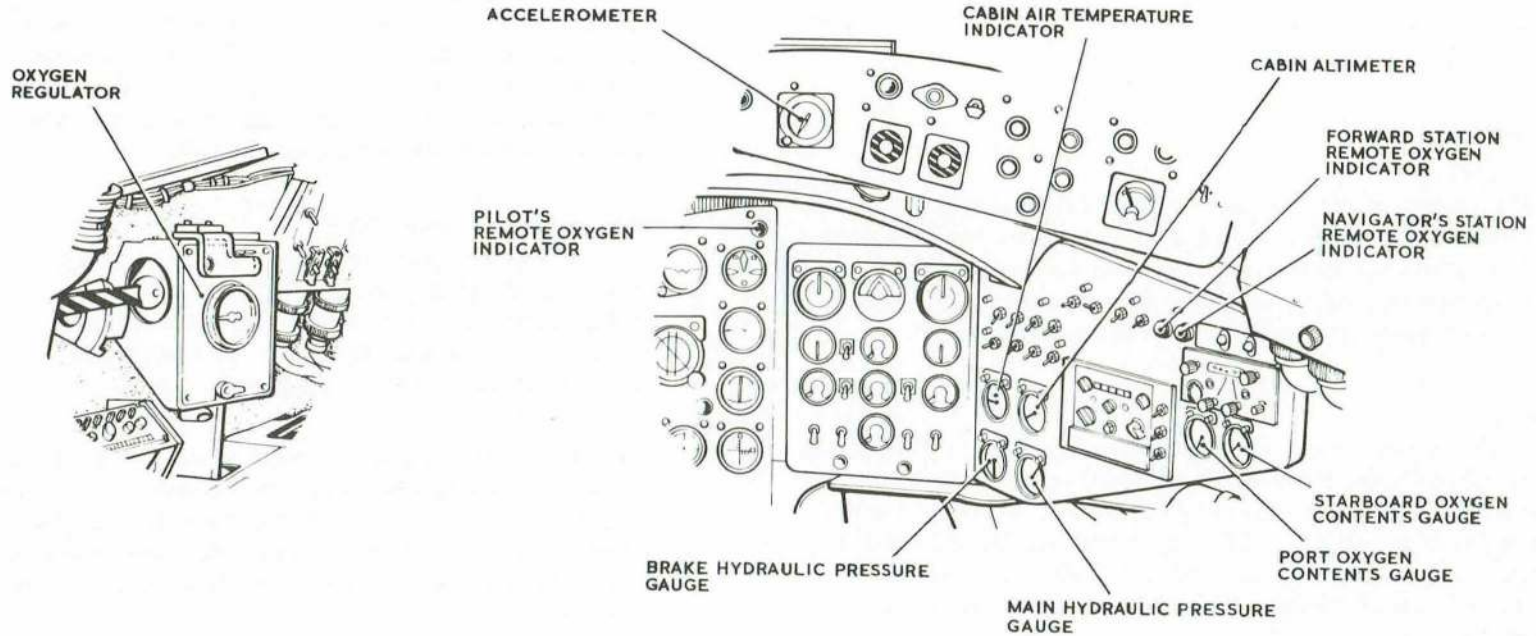

FIG.1A. LOCATION DIAGRAM

to circuit terminals U12A 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

5. The oxygen system as a whole is described in A.P.101B-0407-1A Sect.3, Chap.10, and the electrical services for the regulators and their associated magnetic indicators in Sect.5, Chap.1, Group W. A brief description of the Mk.17F regulators, remote magnetic indicators and oxygen contents gauges is contained in the following paragraphs; for further information reference should be made to the relevant A.P. detailed in Table 1.

Oxygen regulators

6. Three Mk.17F pressure demand regulators are installed in the cabin. One is mounted on the fuselage skin at the port side of the pilot's seat, one above the navigator's instrument panel and the other at the starboard side at the forward station.

7. 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 face plate. A diluter lever marked NORMAL OXYGEN – 100% OXYGEN, is fitted at the top of the faceplate. With the lever at NORMAL OXYGEN, the regulator operates automatically and delivers a mixture of oxygen and air to the users mask. When the diluter lever is changed over to 100% OXYGEN the regulator will deliver undiluted oxygen irrespective of altitude.

8. 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 pressures downstream 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 magnetic indicators

9. A remote magnetic indicator mounted on the pilot's instrument panel gives the pilot a direct frontal indication of the correct functioning of his regulator whilst the two remote indicators on the miscellaneous instrument panel enable the pilot to check the functioning of the regulators at the navigator's and forward stations.

10. Two further remote indicators mounted on the navigator's instrument panel provide a direct frontal indication of the correct functioning of his regulator and enable him to check the functioning of the regulator at the pilot's station. All these remote indicators are electrically connected in parallel with the indicators of their associated regulators.

Oxygen contents gauges

11. Two Mk.4 oxygen contents gauges 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 1/8 sector being coloured red.

Accelerometer

12. A Mk.2 accelerometer is mounted on the pilot's coaming panel to provide a visual indication of the acceleration forces being imposed on the aircraft structure during flight.

Cabin air temperature indicator

13. Information regarding the cabin air temperature indicator and its associated wiring diagrams can be found in Sect.5, Chap.1, Group H.

TABLE 1

Miscellaneous instruments

Ref. No.	Equipment	Quantity	Relevant A.P.
6A/1037854	Altimeter, Mk.21	1	◀ A.P.112G-1006-1 ▶
6A/2237916	Pressure gauge, Mk.14LL	4	A.P.112G-0400-1
6A/4327991	Fatigue meter, Mk.16	1	A.P.112G-0203-1
◀ 6D/2671 ▶	Oxygen regulator, Mk.17F	3	A.P.107D-0201-13A(N)
5CZ/5003	Magnetic indicator	5	A.P.113F-0615-1
6D/2237	Oxygen contents gauge, Mk.4	2	A.P.107D-0305-1
6A/3451	Accelerometer, Mk.2	1	◀ A.P.112G-0217-1 ▶

ENGINE INSTRUMENTS – GROUP E

(completely revised)

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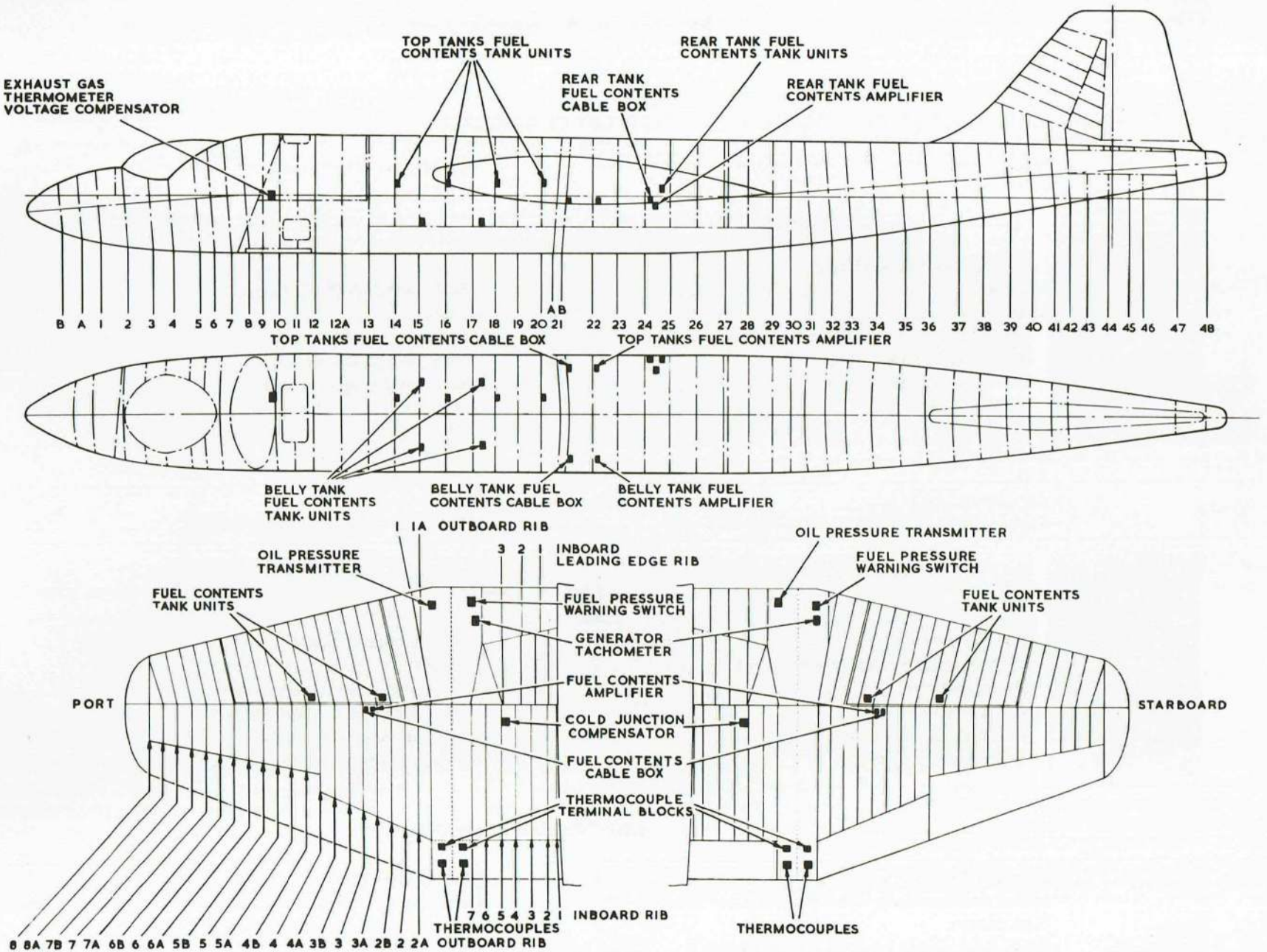
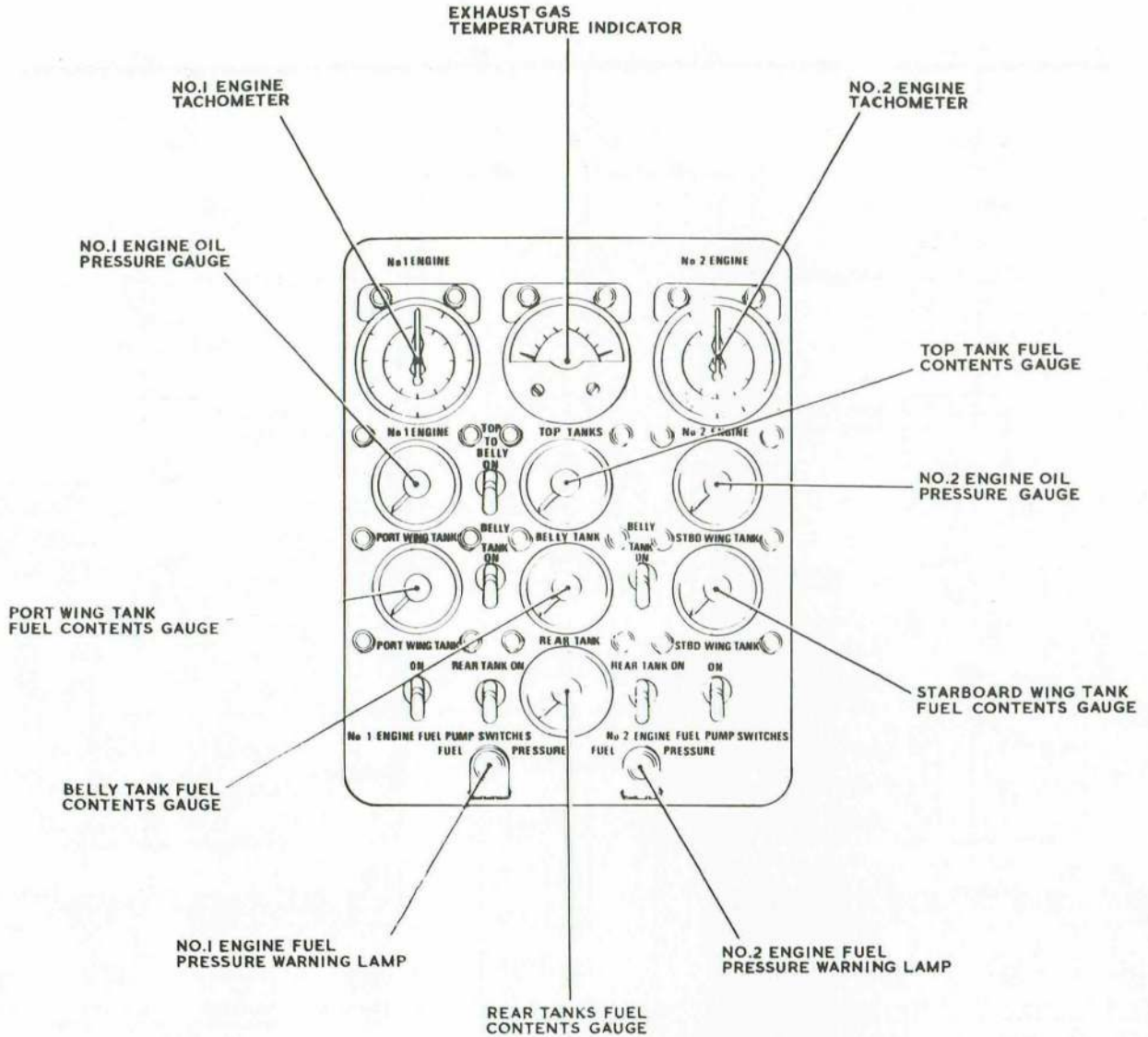
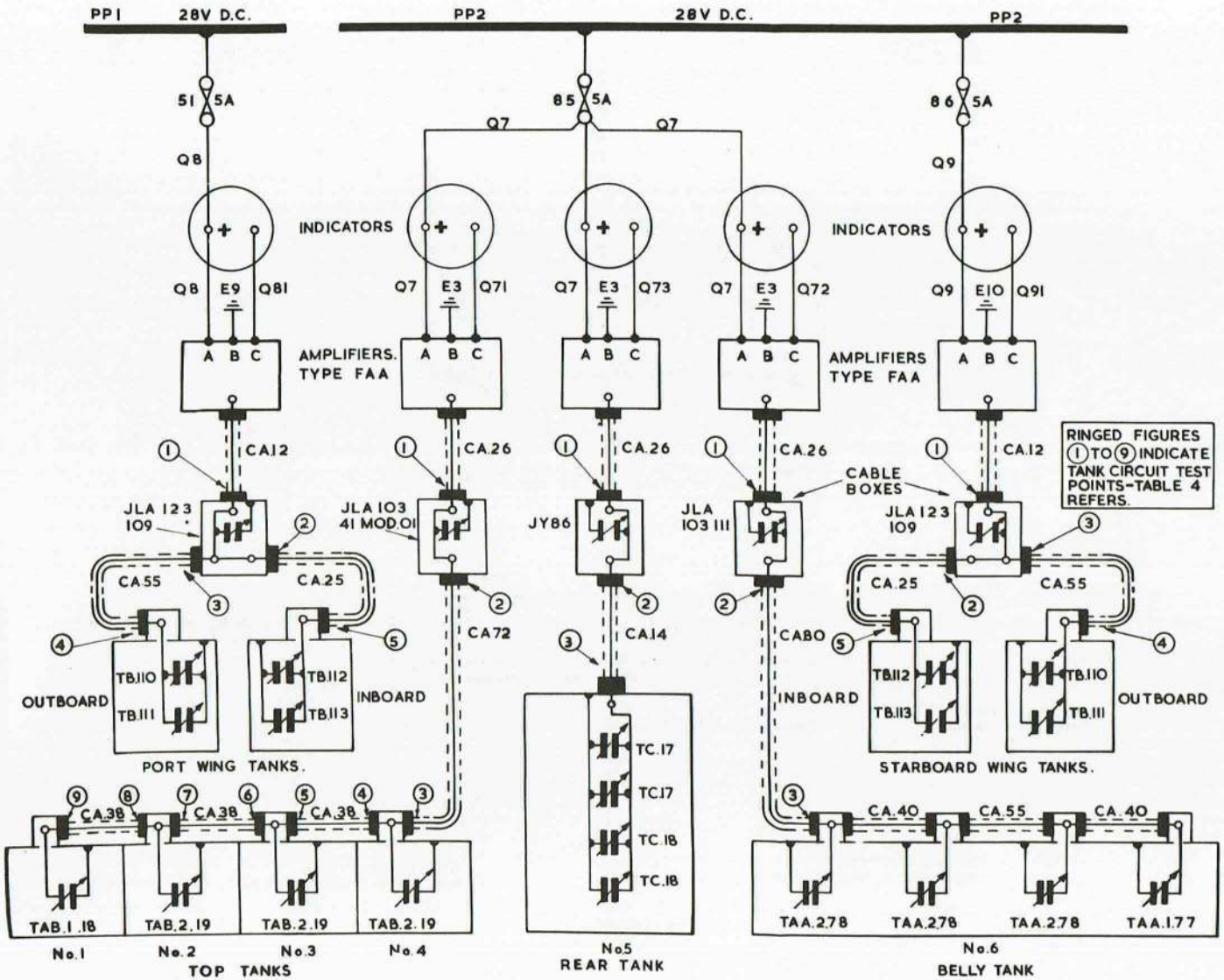


FIG.I. LOCATION DIAGRAM



ENGINE INSTRUMENT PANEL – PILOT'S STATION

FIG.1A . LOCATION DIAGRAM



EB7	81	165	1A

FIG.2. FUEL CONTENTS GAUGES – THEORETICAL

Introduction

1. In this group descriptive and servicing information is given for the engine instruments. Table 1 lists the main components together with their relevant A.P's. The location of the principal items of equipment relevant to this group is shown in fig.1-1A.

DESCRIPTION

FUEL CONTENTS GAUGES

General

2. The fuselage and wing integral tanks are fitted with Smith Waymouth Type electrical fuel contents gauges. No seperate fuel gauge installation is provided for the jettisonable wing tip tanks which may be fitted.

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

Tank units

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

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

Rear (No.5) tank system

5. The rear top fuselage tank (No.5) contains four flexible type tank units connected in parallel by coaxial cables to a coaxial terminal in the base of the tank.

Belly (No.6) tank system

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

Wing integral tanks

7. The integral tanks in the port and starboard wings are identical, in that each has two sections in which two channel type tank units are fitted. Connection between the units in each section is made by aluminium tubing. The rear unit in each section is connected by flexible cable to a coaxial terminal fitted to the aft face of the tank assembly.

Cable boxes

8. The connections between the tank gauge terminals and their respective amplifiers are made via cable boxes located in the vicinity of the tank terminal assemblies, the cables from the two terminals of each wing integral tank being taken to a common cable box mounted on the aft face of the wing spar. 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

9. A total of five Type FAA amplifiers are employed in the system. Three serving the fuselage tanks are located in the flare bay, two along the starboard wall and one on the port wall, while those for the wing integral tanks are situated in identical positions between ribs 3 and 3A, aft of the main spar in each wing. The amplifier units are made up of four circuits, i.e. oscillator, discriminator, rectifier and output. The oscillator frequency is determined by a parallel tuned circuit which is connected to the variable capacitance of the tank, thus any change in the quantity of fuel within the tank produces proportional changes of frequency in the oscillator. The change in frequency is converted at the discriminator into a change in oscillatory amplitude which is then rectified and applied to the grid of the output valve. This controls the output current and therefore the indicator reading. The accuracy of the system is dependant on the supply voltage being maintained at the required value and the dielectric constant of the fuel.

Indicators

10. Five Type AG indicators, one for each tank system, are installed on the engine instrument panel. The instruments, which are in effect milliammeters calibrated in pounds, differ only in their calibration ranges.

TACHOMETERS

11. Engine speeds are indicated by two Mk.10A tachometers mounted on the engine instrument panel. Each instrument has a range of 1200 to 12000 rev/min shown on two scales, an inner scale reading thousands of rev/min and an outer scale reading hundreds of rev/min. Basically, the instruments are 3-phase a.c. motors operating synchronously with Mk.8 tachometer generators mounted on, and driven by, their associated engines.

EXHAUST GAS THERMOMETERS

12. The temperature of the engine exhaust gas is shown by a Type B No.1 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.

13. Each group of thermocouples operate 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 Type A voltage compensator is embodied in the system and installed in the upper equipment compartment.

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

OIL PRESSURE GAUGES

15. Engine oil pressures are indicated by two gauges on the engine instrument panel. The instruments operate on 26-volts a.c. taken from the 115-volt, 400 Hz 3-phase supply by 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. The initial 115-volt a.c. supply is obtained from the normal flight instrument power supply described in Chap.1, Group D.

FUEL PRESSURE WARNING

16. Warning of low pressure in the engine fuel supply lines is given by two red indicator lamps mounted on the engine instrument panel. Each indicator is operated by the closing of a pressure switch fitted at the side of its associated engine. The switch contacts are set to close whenever the fuel pressure falls below $6\ ^{+1/2}_{0}$ lb/in^2. The indicator filaments, rated at 6 volts, are fed from the aircraft 24-volt 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

17. Apart from the normal examination of the installation for the security of components and obvious damage, the fuel gauge system requires no routine servicing other than functional tests. If a gauge should give erratic indications, its system should be checked in accordance with the instructions contained in the following paragraphs. For servicing and testing individual components reference should be made to A.P.112G-0725-1. Information on the use of the Smith Waymouth test set, Type QAA, is given in A.P.112G-0735-1.

18. 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.

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

Rear tank	5 gallons
Belly tank	30 gallons
Wing tank (inboard)	2 gallons
Wing tank (outboard)	2 gallons

20. Before trimmers are adjusted to obtain a zero reading, 30 gallons of fuel should be put into the belly tank, five gallons into the rear tank, and five gallons into each inboard and outboard wing tank. The booster pumps should then be run until they cease to deliver fuel

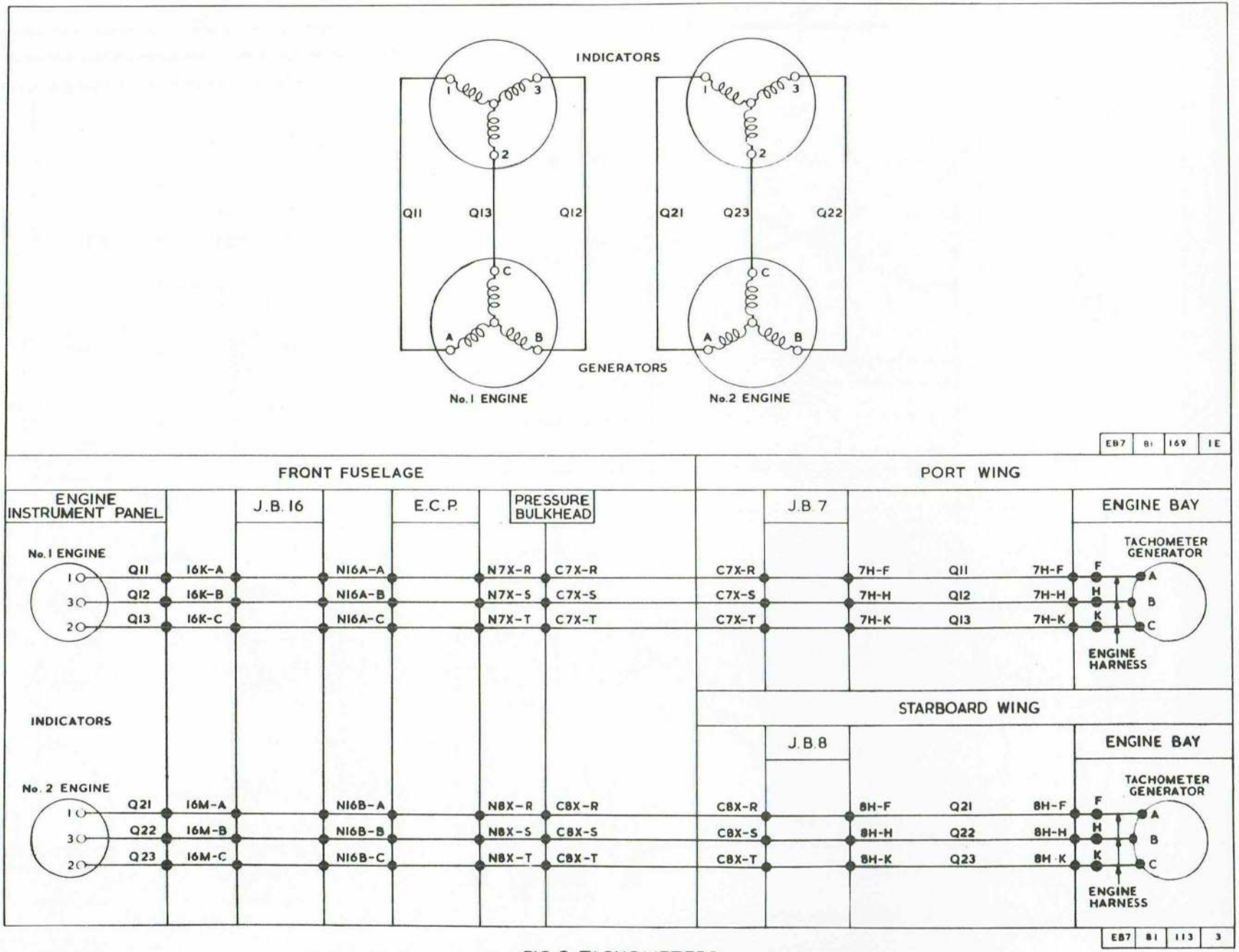


FIG.3. TACHOMETERS

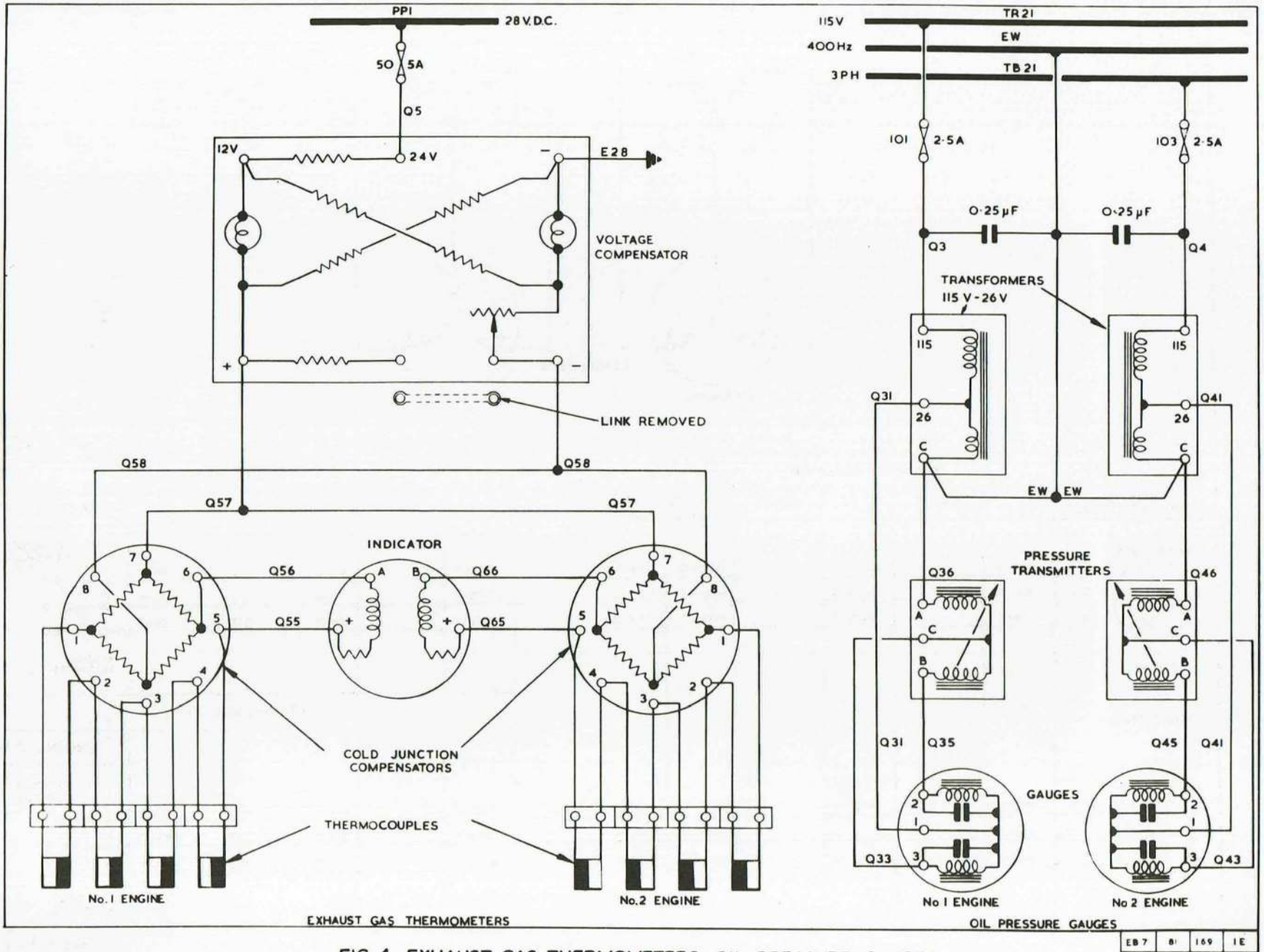


FIG. 4 . EXHAUST GAS THERMOMETERS - OIL PRESSURE GAUGES

Functional checks

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

22. 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.23 should be followed.

Tanks 'empty' checks

23. 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 9) indicate the points at which the systems should be broken down to allow the Smiths Waymouth test set to be connected into the circuit. The figures shown against the test points 1 to 9 in Table 4 are the values of capacitance that should be fed into the system at these points in order to obtain a zero reading on the gauge and a reading of approximately 2mA on the test set meter.

Checks on fitting new tanks

24. After the installation of new fuel tanks in the aircraft, special precautions are necessary before checks on their fuel gauge systems are undertaken. As the tank units in a new tank are dry they will feed a lower capacitance into the amplifier than will units which have previously been wetted with fuel. Units in a new tank should therefore be sprayed with fuel and allowed to drain before functional checks commence.

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

Amplifier removal

Fuselage tanks

26. During servicing involving the removal of the fuel gauge amplifiers, the flare doors should not be fully opened, as they then partially screen the amplifiers. With the Plessey plug and socket and the coaxial cable disconnected, the amplifiers are instantly removable on undoing the single fastener at the top of the units and lifting them out of the bottom slot of the brackets that carry them.

Wing integral tanks

27. Servicing of the wing tank amplifiers requires the removal of the access panels between ribs 3 and 3A under each outboard wing.

Changing tank units

No.5 tank

28. Instructions for removal installation, and folding for storage of the rear tank are given in A.P.101B-0407-1A, Sect.4, Chap.2, where warnings are given against the danger of damaging the flexible type tank units in the tank. To counter possible damage during storage, No.5 tanks are supplied without their tank units fitted. Before installing these units it is essential to check that their capacitance agrees with the figure given in Table 2B.

29. No.5 fuel tanks are manufactured both by the Marston Excelsior Company and the Fireproof Tank Company. Each make of tank can be recognised by its colour, the 'Marston' tanks being black whilst the 'Fireproof' tanks are green. Although the tanks are interchangeable, the method of fitting their tank units differs. In the 'Marston' tanks each unit is held in position by three rubber straps, with the ends of the units attached to the tank wall by 2 B.A. bolts vulcanised to the inner skin. The units in the 'Fireproof' tank are housed in perforated rubber sockets the same length as the units whilst the ends of the units are secured by rubber studs vulcanised to the tank inner skin. Access to the forward tank units is through the pump apertures; access to the aft tank 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.

30. The procedure for fitting or changing the tank units in No.5 tank is described under the tank installation in A.P.101B-0407-1A, Sect.4, Chap.2.

EXHAUST GAS THERMOMETERS

31. Access to each cold junction compensator is obtained by removing a detachable panel, aft of each main wheel leg, on the underside of the main plane. The voltage compensator is accessible through the hatch to the upper equipment compartment. Servicing the thermocouples involves the removal of engine cone fairings as described in A.P.101B0407-1A, Sect.4, Chap.1.

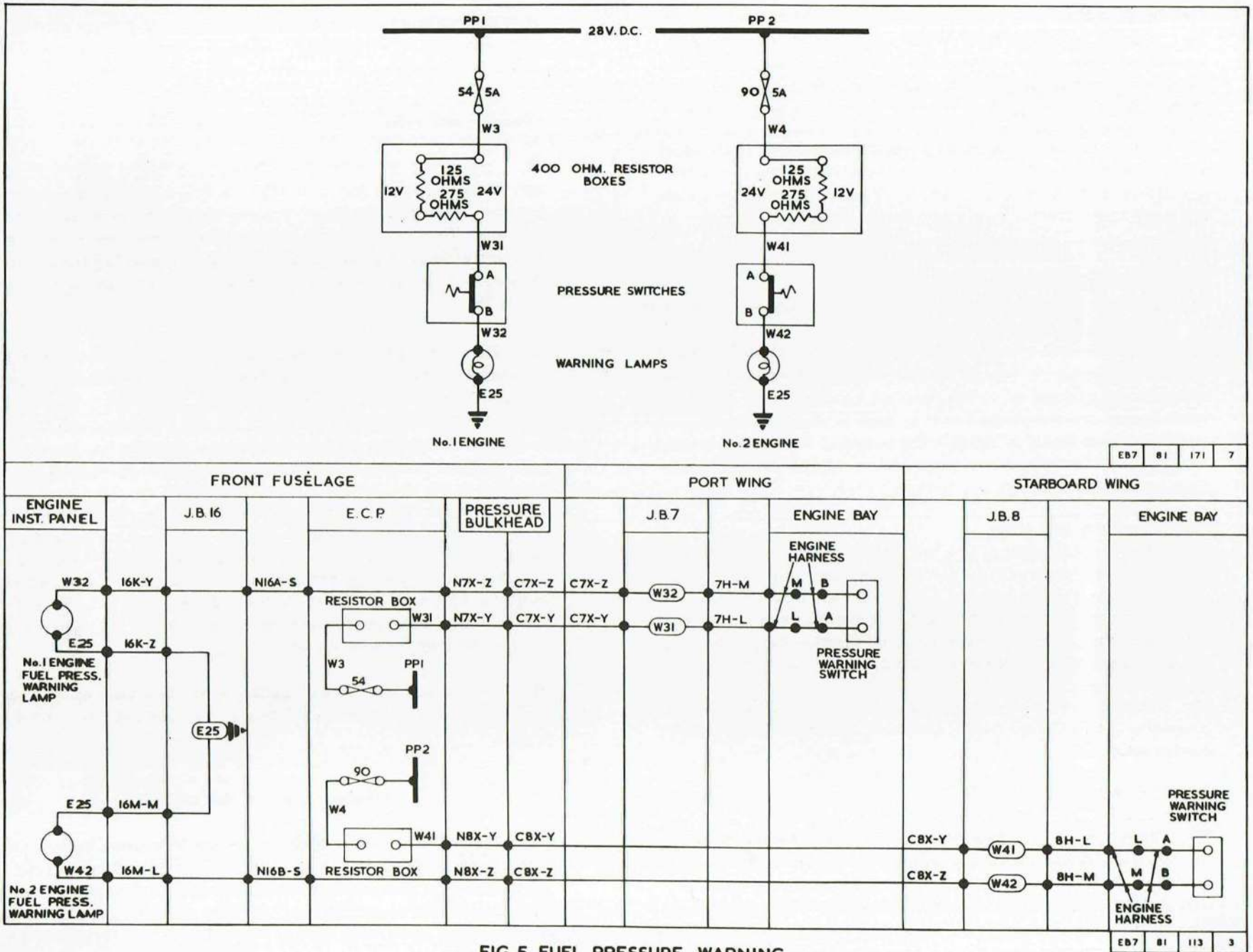


FIG.5. FUEL PRESSURE WARNING

TABLE 1

Engine instruments

Ref. No.	Equipment		Quantity	Relevant A.P.
	Smith Waymouth fuel gauges			
◀ 6A/4339125 ▶	Indicator, A.G.144	(Rear tank system)	1	
6A/4333474	Indicator, A.G.30	(Top tank system)	1	
◀ 6A/4333479 ▶	Indicator, A.G.29	(Belly tank system)	1	
6A/4333478	Indicator, A.G.28	(Wing tank system)	2	
6A/4333096	Amplifier, F.A.A.	(All systems)	5	
6A/7515	Cable box, JY/86	(Rear tank system)	1	
6A/2848	Cable box, JLA/103/41 Mod.01	(Top tank system)	1	
6A/4333141	Cable box, JLA/103/111	(Belly tank system)	1	
6A/4333334	Cable box, JLA/123/109	(Wing tank system)	2	
6A/4333112	Tank unit, TC17	(Rear tank)	2	A.P.112G-0725-1
6A/4333113	Tank unit, TC18	(Rear tank)	2	
6A/4333117	Tank unit, TAB/1/18	(Top tank No.1)	1	
6A/4333137	Tank unit, TAB/2/19	(Top tanks No.2, 3, 4)	3	
6A/4333138	Tank unit, TAA/1/77	(Belly tank)	1	
6A/4333139	Tank unit, TAA/2/78	(Belly tank)	3	
6A/4333330	Tank unit, TB110	(Wing, outboard)	2	
6A/4333331	Tank unit, TB111	(Wing, outboard)	2	
6A/4333332	Tank unit, TB112	(Wing, inboard)	2	
6A/4333333	Tank unit, TB113	(Wing, inboard)	2	
	Fuel pressure warning			
5CX/1085815	Warning lamp		2	A.P.113F-0235-1
6A/1062526	Resistance units		2	
6A/1912	Pressure switch unit		2	A.P.112G-1141-1
	Tachometers			
6A/2801	Indicator, Mk.10A		2	◀ A.P.112G-1246-1 ▶
6A/4333280	Generator Mk.8C		2	A.P.112G-1224-1
	Oil pressure gauges			
6A/4333074	Indicator, inductor type		2	
6A/4333075	Transformer, Type 213MV		2	A.P.112G-0517-16
6A/4333076	Transmitter, Type 482 PG/SB		2	

continued . . .

TABLE 1 Engine instruments — *continued*

Ref. No.	Equipment	Quantity	Relevant A.P.
	Exhaust gas thermometers		
6A/1674	Indicator, Type B, No.1 (Twin pointer)	1	A.P.112G-0628-1
6A/4332834	Cold junction compensator, Type B	2	
6A/4332835	Voltage compensator, Type A	1	
6A/1675	Thermocouples, Type B	8	
6A/1942	Extension leads	8	

TABLE 2

Fuel contents gauge capacitance values

A — Cable box capacitance values

Code	Total capacitance value	
	Trimmer at MAX. not less than	Trimmer at MIN. not more than
JY/86	1374 pF	1540 pF
JLA/123/109	165 pF	255 pF
JLA/103/41 Mod.01	1402 pF	1492 pF
JLA/103/111	1661 pF	1751 pF

B — Tank unit capacitance values

Code	Initial Capacitance (pF)	Range (pF)	Tank
TAB.1.18	278 ± 5	265 ± 3	No.1 Top
TAB.2.19	278 ± 5	265 ± 3	No.2, 3 and 4 Top
TAA.1.77	310 ± 3	265 ± 3	Belly
TAA.2.78	310 ± 3	265 ± 3	Belly
TC.17	230 ± 5	246 ± 3	Rear
TC.18	230 ± 5	246 ± 3	Rear
TB.110	155 ± 3	152 ± 3	Wing, outboard
TB.111	255 ± 3	222 ± 3	Wing, outboard
TB.112	240 ± 3	237 ± 3	Wing, inboard
TB.113	378 ± 3	379 ± 3	Wing, inboard

C — Coaxial cable capacitance values

Code	Length (in.)	Capacitance
CA12	12	22 ± 3 pF
CA14	14	26 ± 3 pF
CA25	25	45 ± 3 pF
CA26	26	47 ± 3 pF
CA38	38	68 ± 3 pF
CA40	40	72 ± 3 pF
CA55	55	99 ± 3 pF
CA72	72	129 ± 3 pF
CA80	80	144 ± 3 pF
PR30	30	44 ± 5 pF
PS54	54	83 ± 9 pF
PS73	73	115 ± 12 pF

D — Tank terminal capacitance values

Code	Capacitance
JCB1A Mod.01	17 ± 3 pF
JKB1 Mod.01	17 ± 3 pF

continued . . .

TABLE 2 Fuel contents gauge capacitance values — *continued*

E — Complete tanks

Tank	Capacitance — Empty and Out of Aircraft	Capacitance — Installed Empty and Dry	Capacitance — Installed Wet	Unusuable Fuel
Top No.1, 2, 3 and 4	278 ± 5 pF each tank	278 ± 5 pF each tank	281 ± 8 pF each tank	Nil
Rear	1377 ± 70 pF	1400 ± 70 pF	1432 ± 80 pF	5 gallons
Belly	1655 ± 23 pF	1655 ± 23 pF	1670 ± 23 pF	30 gallons
Wing, inboard	684 ± 20 pF	684 ± 20 pF	684 ± 20 pF	2 gallons
Wing, outboard	440 ± 20 pF	440 ± 20 pF	440 ± 20 pF	2 gallons

TABLE 3

Fuel contents gauge test values

A — Insulation resistance tests

Component	Condition	Insulation resistance	Component	Condition	Insulation resistance
Tank unit	New	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
Coaxial cables	New or used	Not less than 20 megohms			
Complete tank installation	Tank empty but wetted with fuel	Not less than 1 megohm			
Cable boxes JLA.123.109 JY.86	New or used	Not less than 20 megohms	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.
JLA.103.41 Mod.01 JLA.L03.111	New or used	As these boxes contain a coil connected to earth, they may be considered serviceable if they conform to the capacitance figures given in Table 2A.			

continued . . .

TABLE 3 Fuel contents gauge test values — *continued*

B — Capacitance/indicator values

Amplifier — Code FAA

Power supply — Nominal 28-volts — Current 0.7 amp approx.

Capacitance figures

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

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

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

TABLE 4

Test point capacitance values

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

Test Point	Using QAA Mod.04 Test Set: Test Capacitance A (pF)	Using QAA Mod.04 Test Set: Test Capacitance B (pF)	Using QAA Mod.04 Test Set: Adapters and Cables Used	Approximate Reading On: Aircraft Indicator	Approximate Reading On: Test Set Meter
			Top tank system		
1	1468 ± 3	1310 ± 8	CE1, CC1	Zero contents	2mA
2	1457 ± 34	1307 ± 37	CE1	Zero contents	2mA
3	1328 ± 29	1170 ± 34	CE1, CC1	Zero contents	2mA
4	1047 ± 24	897 ± 27	CE1	Zero contents	2mA
5	979 ± 21	821 ± 26	CE1, CC1	Zero contents	2mA
6	698 ± 16	548 ± 19	CE1	Zero contents	2mA
7	630 ± 13	472 ± 18	CE1, CC1	Zero contents	2mA
8	349 ± 8	199 ± 11	CE1	Zero contents	2mA
9	281 ± 5	241 ± 10	* CA18, CC1	Zero contents	2mA
			Belly tank system		
1	1468 ± 3	1310 ± 8	CE1, CC1	Zero contents	2mA
2	1670 ± 24	1520 ± 27	CE1	Zero contents	2mA
3	1526 ± 21	1368 ± 26	CE1, CC1	Zero contents	2mA

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

Note . . .

As the belly tank is inaccessible for normal servicing beyond point 3, if it is necessary to test beyond this point the tank should be dropped and each tank unit and cable checked individually to the values given in the preceding tables.

continued . . .

TABLE 4 Test point capacitance values — *continued*

Using QAA Mod.04 Test Set				Approximate Reading On	
Test Point	Test Capacitance A (pF)	Test Capacitance B (pF)	Adapters and Cables Used	Aircraft Indicator	Test Set Meter
			Wing tank system		
1	1478 ± 3	1320 ± 8	CE1, CC1	Zero contents	2mA
2	729 ± 23	579 ± 26	CE1	Zero contents	2mA
3	535 ± 26	377 ± 31	CE1, CC1	Zero contents	2mA
4	436 ± 23	286 ± 26	CE1	Zero contents	2mA
5	684 ± 20	526 ± 25	CE1, CC1	Zero contents	2mA
			Rear tank system		
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 connection is used.

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

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

TABLE 5

Indicator calibration/current values

Top tank system Indicator – Code AG30		Rear tank system Indicator – Code AG25		Belly tank system Indicator – Code AG144		Wing tank system Indicator – Code AG28	
Indication pounds	Current (mA)	Indication pounds	Current (mA)	Indication pounds	Current (mA)	Indication pounds	Current (mA)
0	2.00	0	2.00	0	2.00	0	2.00
500	2.68	250	2.91	250	2.40	250	2.51
1000	3.10	500	3.43	500	2.70	500	2.92
1500	3.52	750	3.73	750	2.95	750	3.37
2000	3.88	1000	3.99	1000	3.20	1000	3.85
2500	4.20	1250	4.24	1250	3.46	1250	4.23
3000	4.50	1500	4.49	1500	3.71	1500	4.62
3500	4.79	1750	4.72	1750	3.96	1750	4.97
4000	5.05	2000	4.94	2000	4.22	2000	5.29
4500	5.32	2250	5.20	2250	4.48	2250	5.60
5000	5.57	2500	5.42	2500	4.74	2500	5.88
5500	5.81	2750	5.64	2750	5.02	2750	6.20
6000	6.08	3000	5.88	3000	5.30	3000	6.51
6500	6.34	3250	6.15	3250	5.58	3250	6.79
7000	6.65	3500	6.47	3500	5.89	3430 FULL	6.99
7460 FULL	6.86	3750	6.75	3750	6.24		
		4000	7.07	4000	6.62		
		4290 FULL	7.20	4280 FULL	6.90		

Tolerance on all current values ± 0.05 mA

FIG.6. FUEL CONTENTS GAUGES

(illustration overleaf)

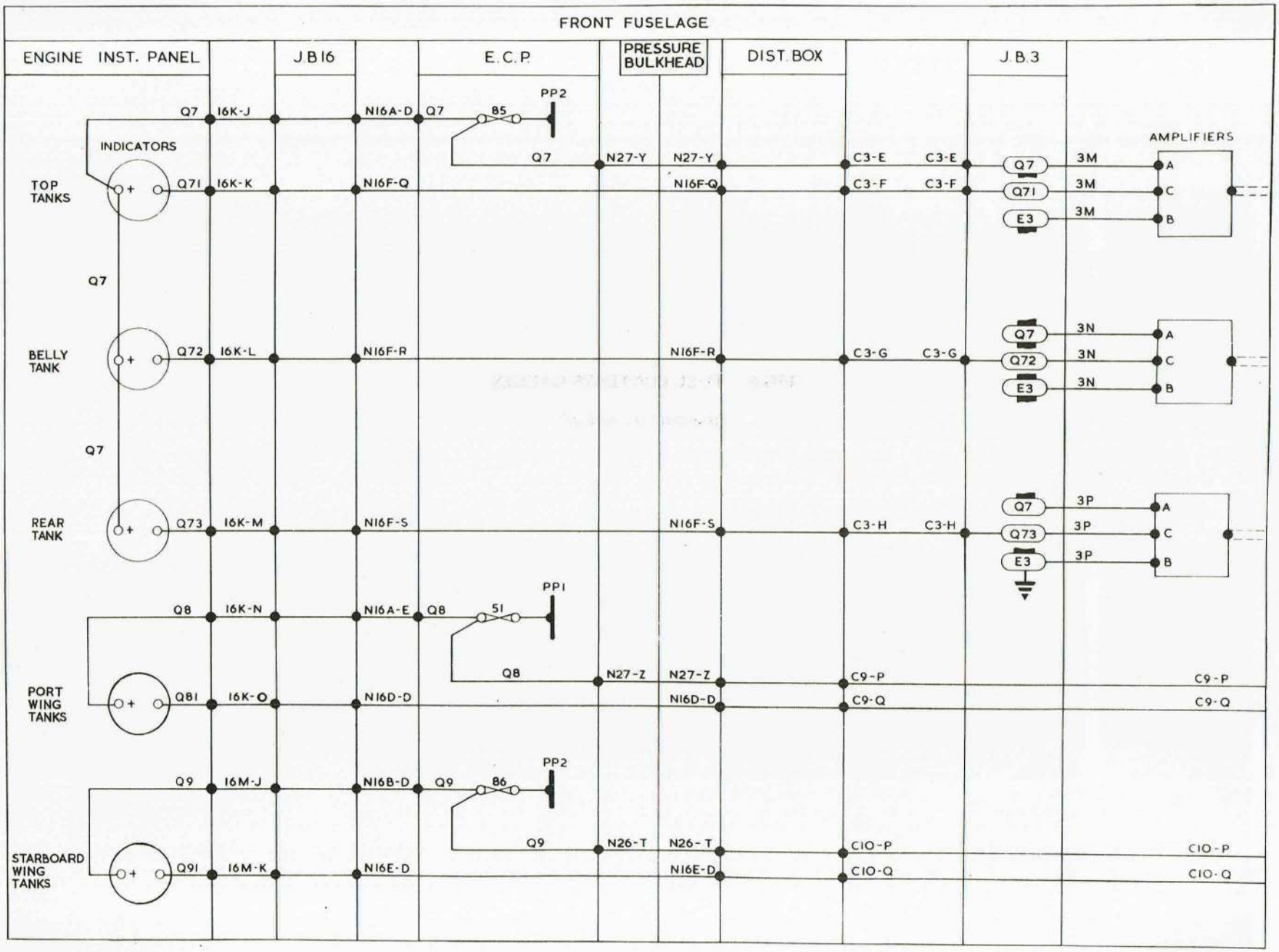


FIG.6. FUEL CONTENTS GAUGES

◄COLOUR IDENTS DELETED►

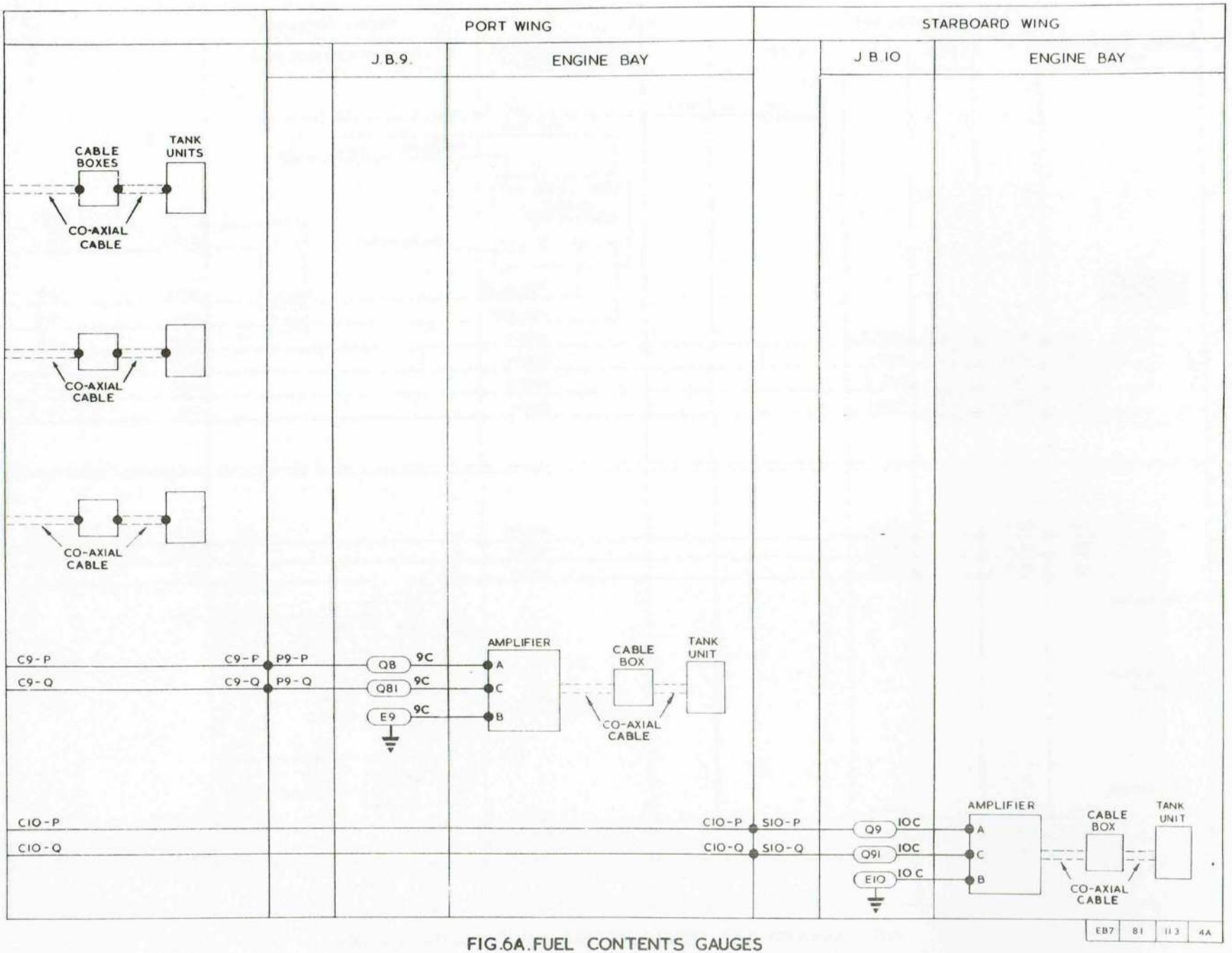


FIG.6A. FUEL CONTENTS GAUGES

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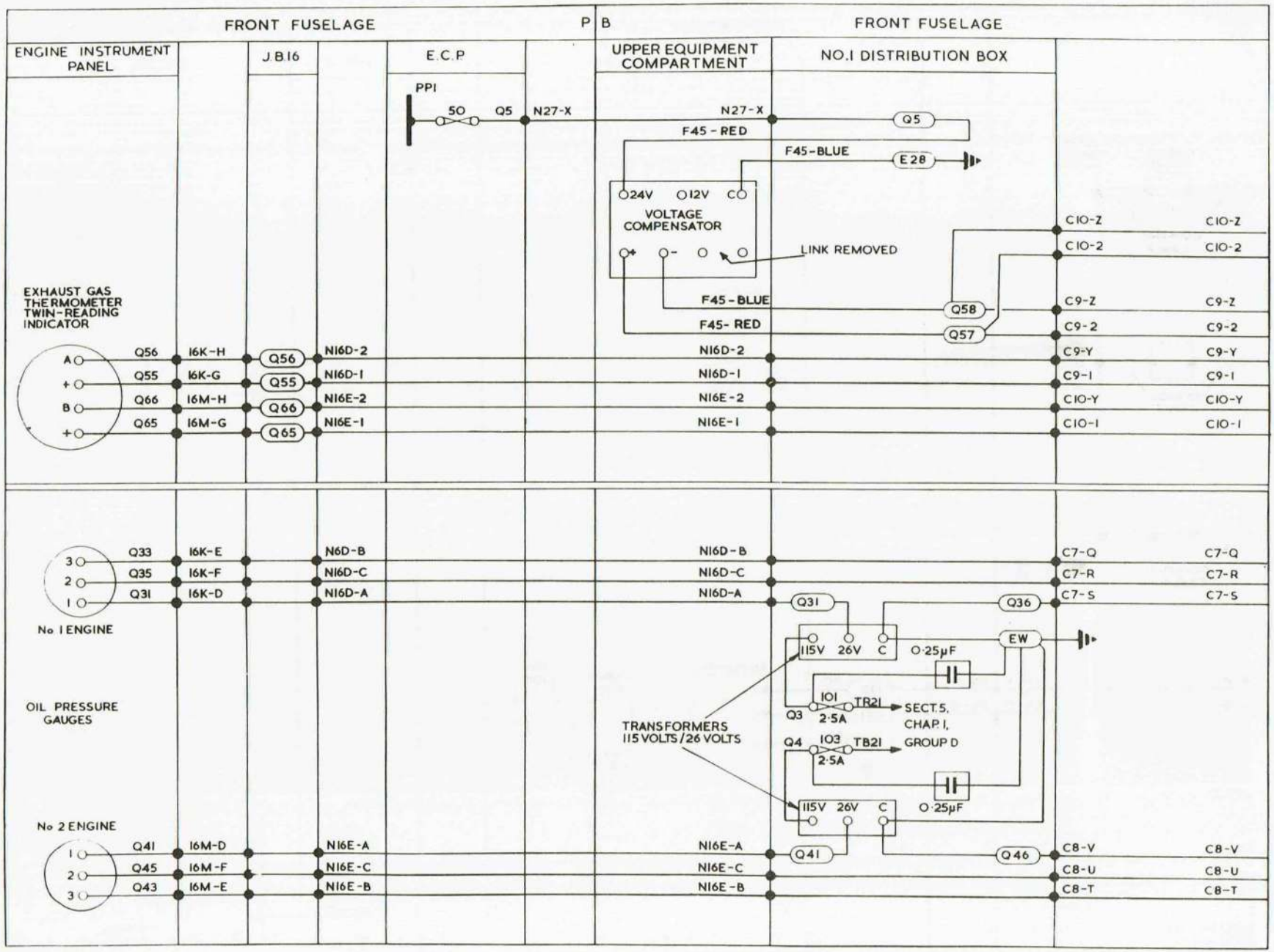

FIG.7. EXHAUST GAS THERMOMETERS-OIL PRESSURE GAUGES

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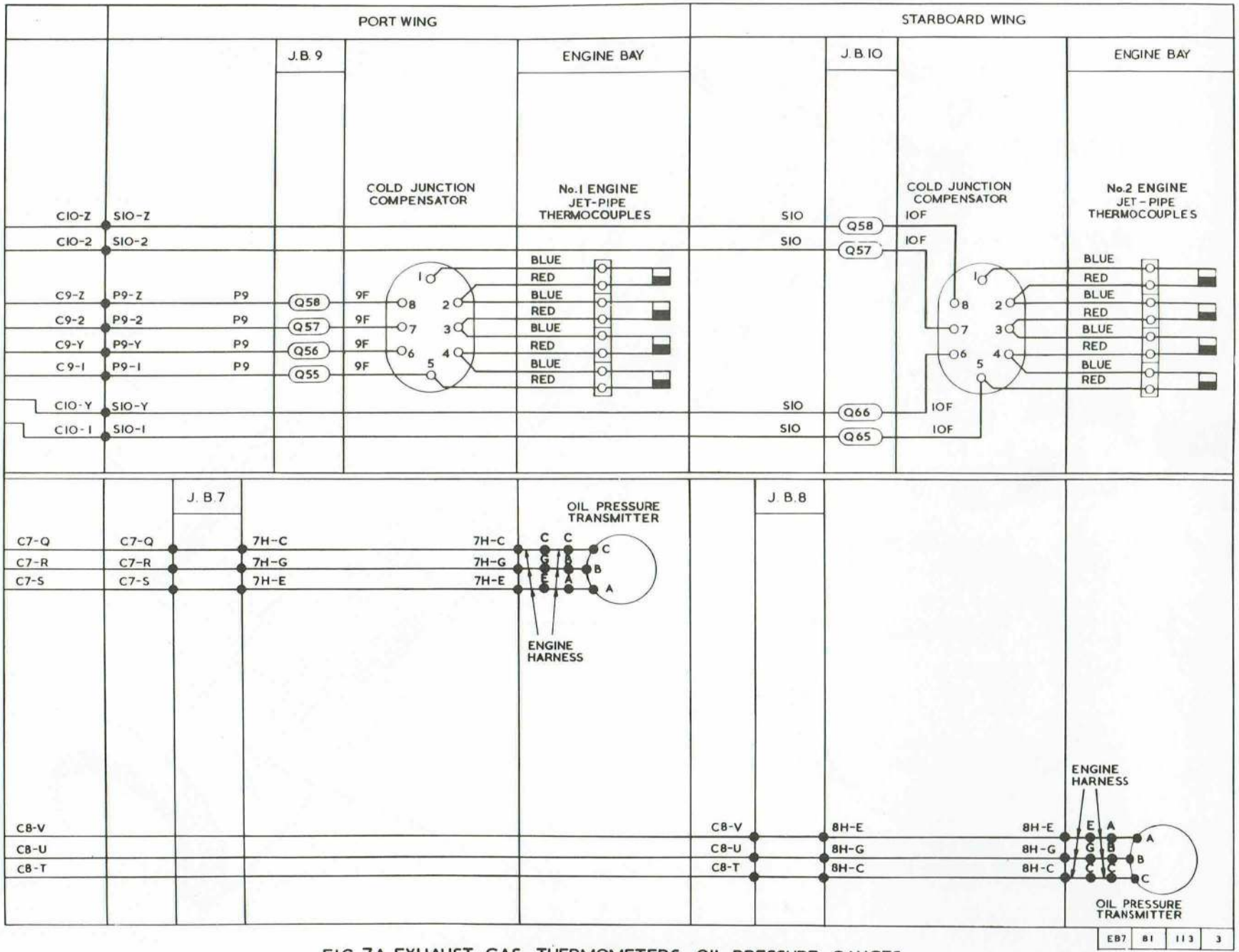

FIG. 7A. EXHAUST GAS THERMOMETERS - OIL PRESSURE GAUGES

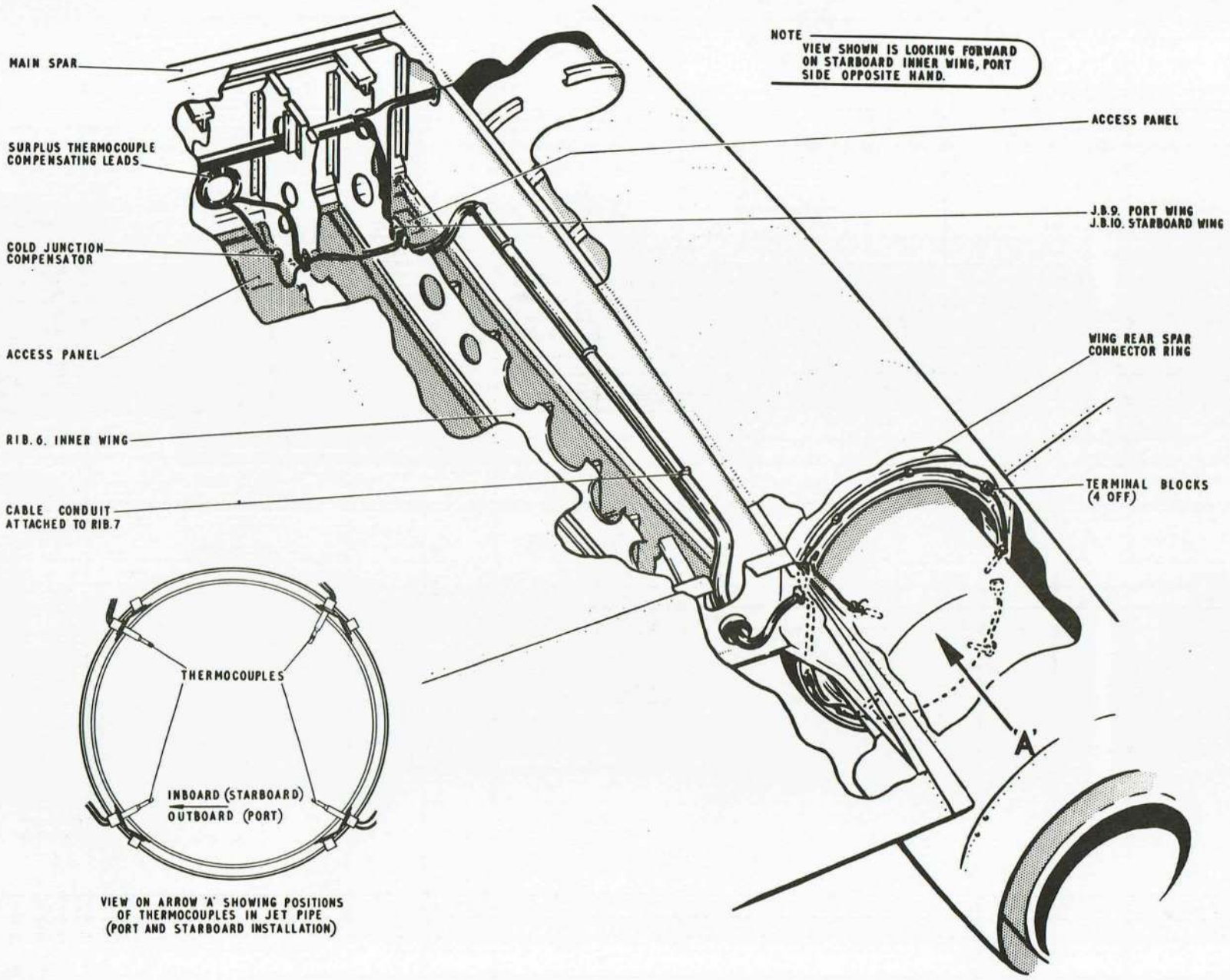

FIG. 8. THERMOCOUPLE INSTALLATION

FLIGHT INSTRUMENTS – GROUP F

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LIST OF TABLES

LIST OF ILLUSTRATIONS

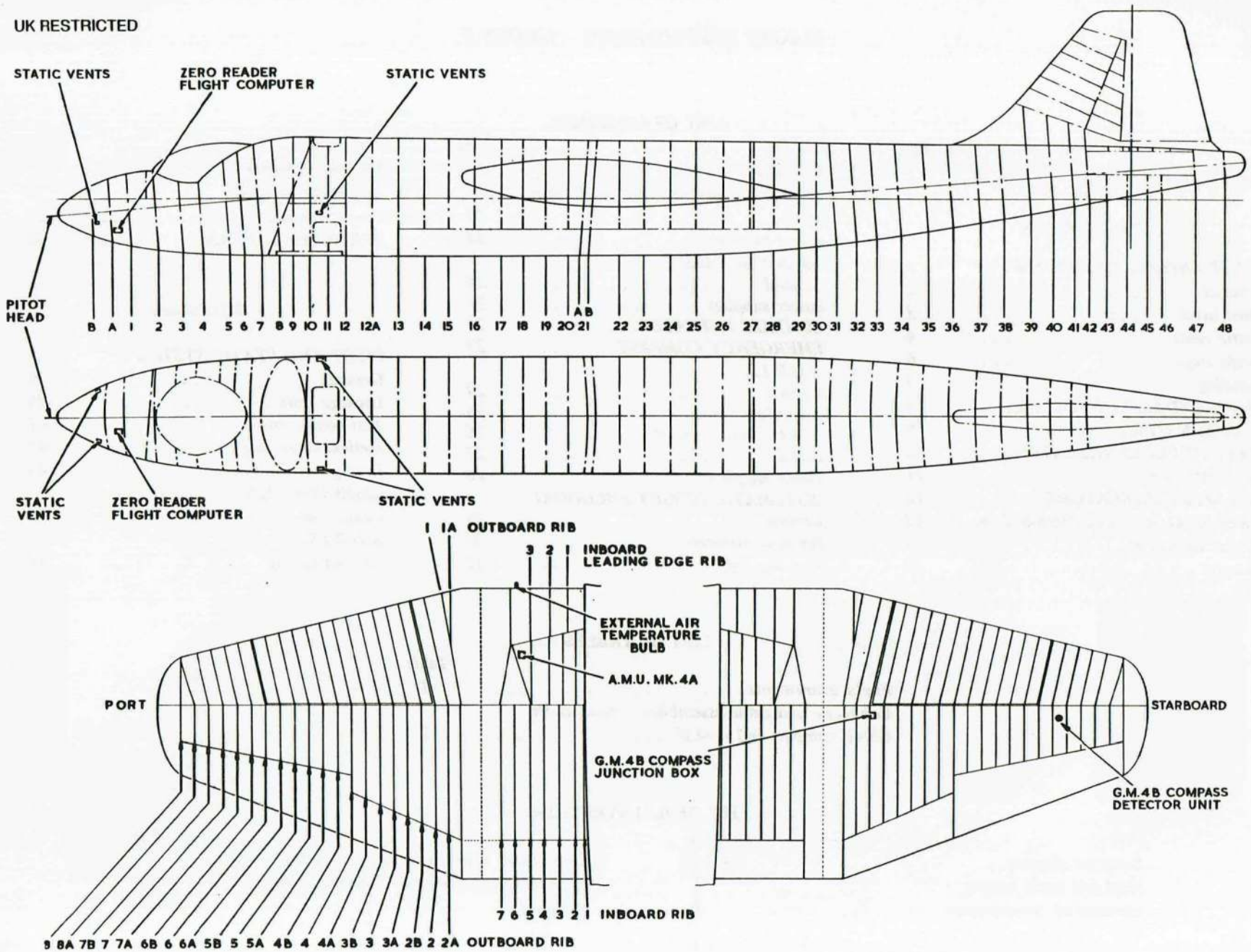
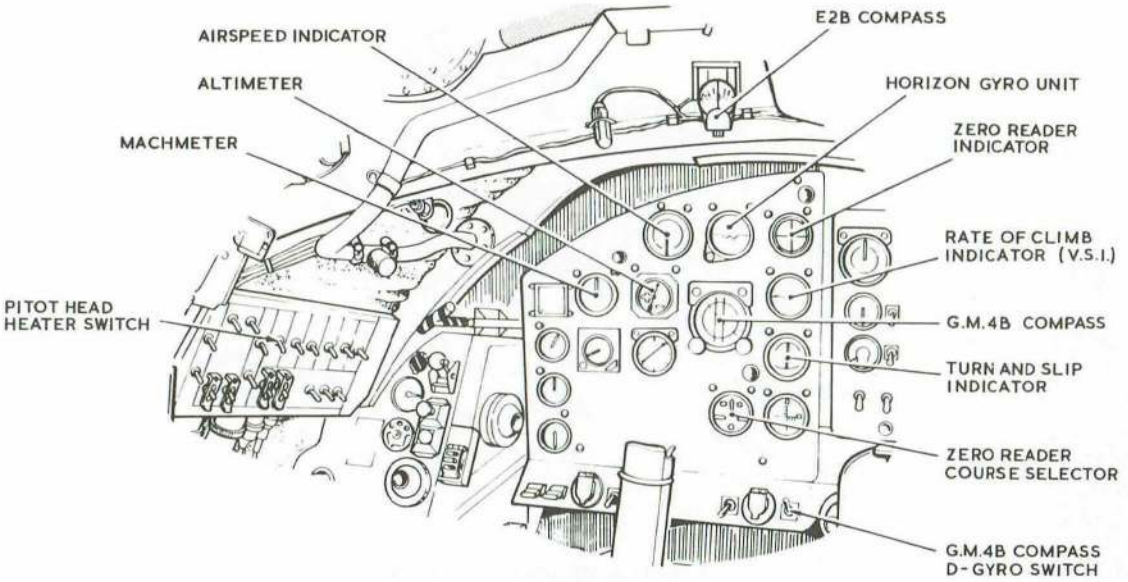
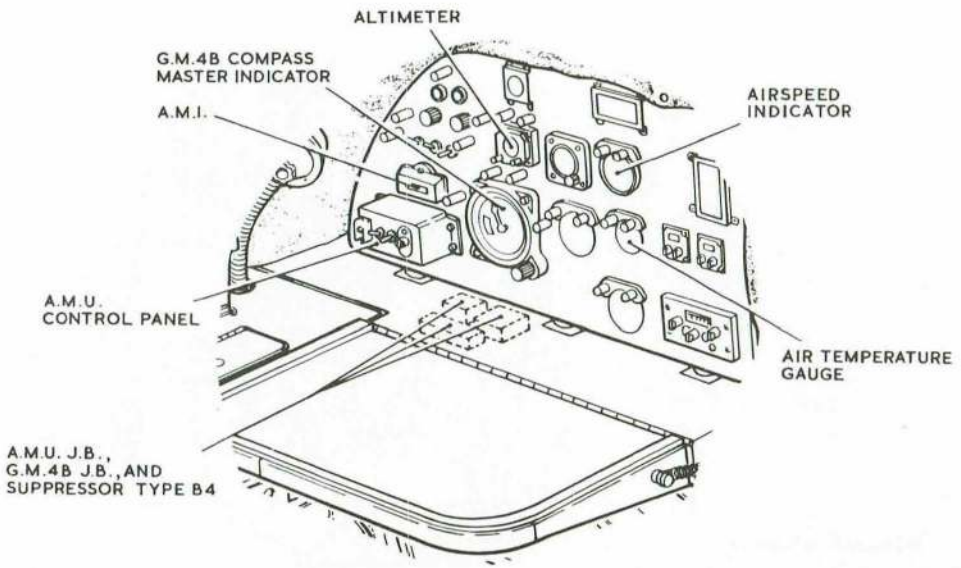


FIG.1. LOCATION DIAGRAM

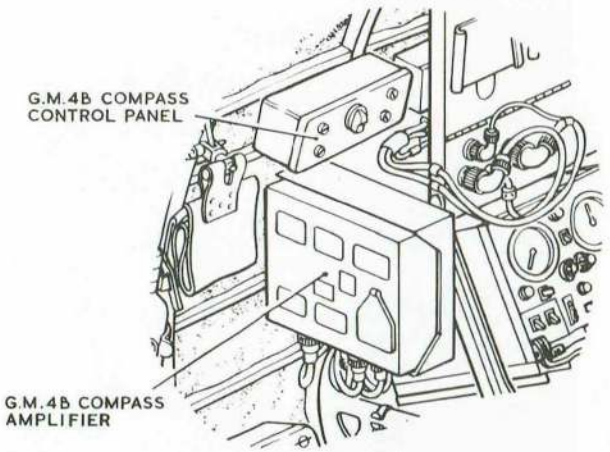
◄ MOD 5500 INCORPORATED ►



PILOT'S STATION

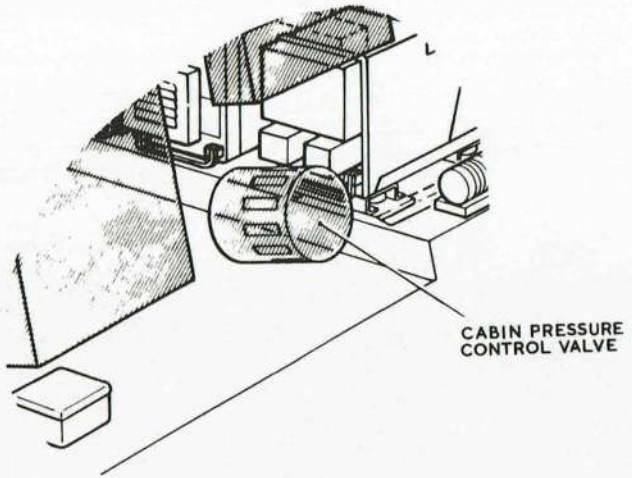


NAVIGATOR'S PORT STATION

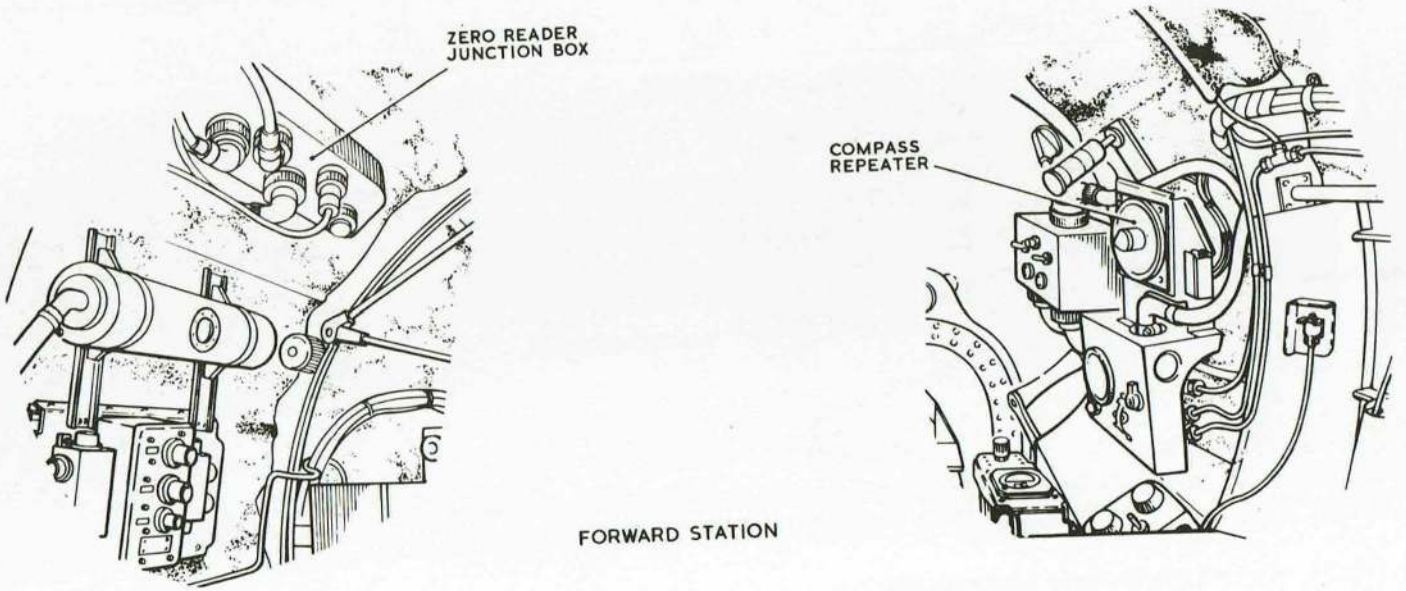


NAVIGATOR'S STARBOARD STATION

FIG.1A. LOCATION DIAGRAM



UPPER EQUIPMENT COMPARTMENT



FORWARD STATION

FIG 1B. LOCATION DIAGRAM

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 principal items of equipment relevant to this group are shown in fig.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. and the A.M.U. in the port main plane. The pressure head is fitted with a de-icing heater which is controlled by a switch located on the take-off panel *(Sect.5, Chap.1, Group H).*

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., the zero reader flight computer and the A.M.U. Connections are also provided near the A.M.U. for the use of a V.G. recorder. 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 of the navigator's altimeter which is the master altimeter in the height encoding system *(para.29),* 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; the lower vents on each assembly being blanked off.

Drain traps

6. Moisture in the pipelines is collected by ten 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 T-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 T-pieces.

TURN-AND-SLIP INDICATOR

8. The Mk.2 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 normally 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 STANDBY switch on the coaming panel. The power supplies to the instrument are fully described in Sect.5, Chap.1, Group D.

HORIZON GYRO UNIT

9. The horizon gyro unit is an electrically-operated gyroscopic instrument situated on the flight instrument panel. The instrument continuously simulates the roll and pitch attitude of the aircraft relative to the natural horizon, by registering the attitude of the aircraft against a stabilized reference provided by a gravity-controlled gyroscope. Attitude indication is shown by the roll angle scale and a miniature aircraft on the instrument bezel. Two references, a roll angle pointer

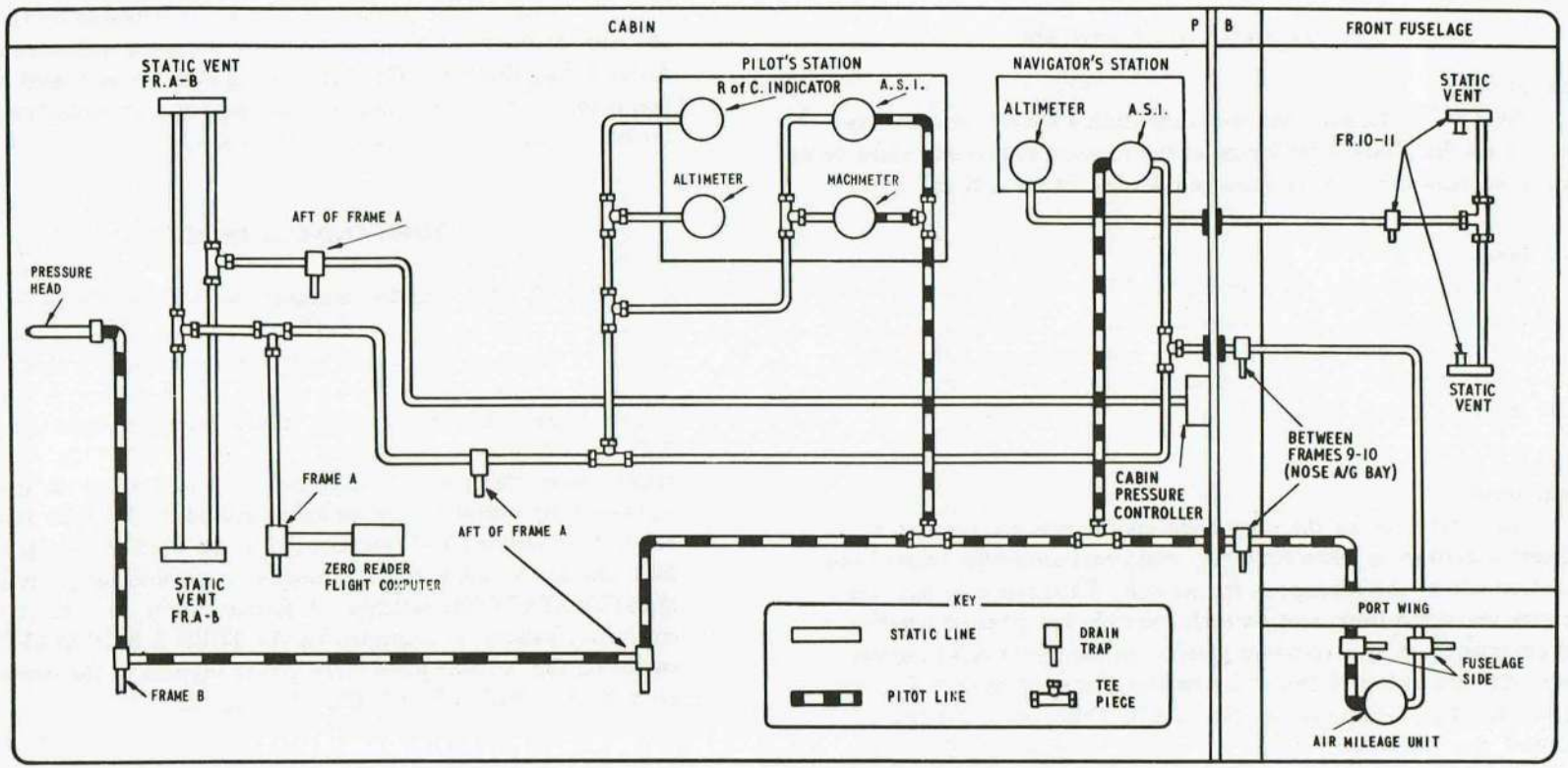


FIG. 2. PITOT AND STATIC SYSTEM

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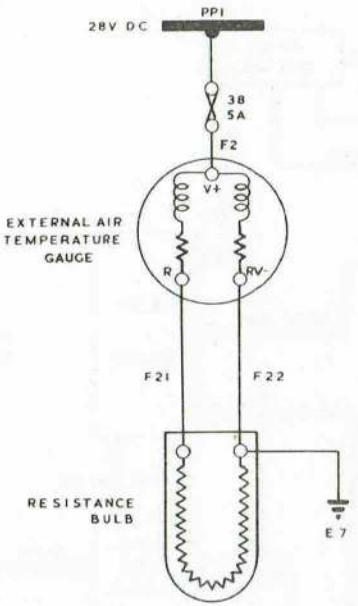

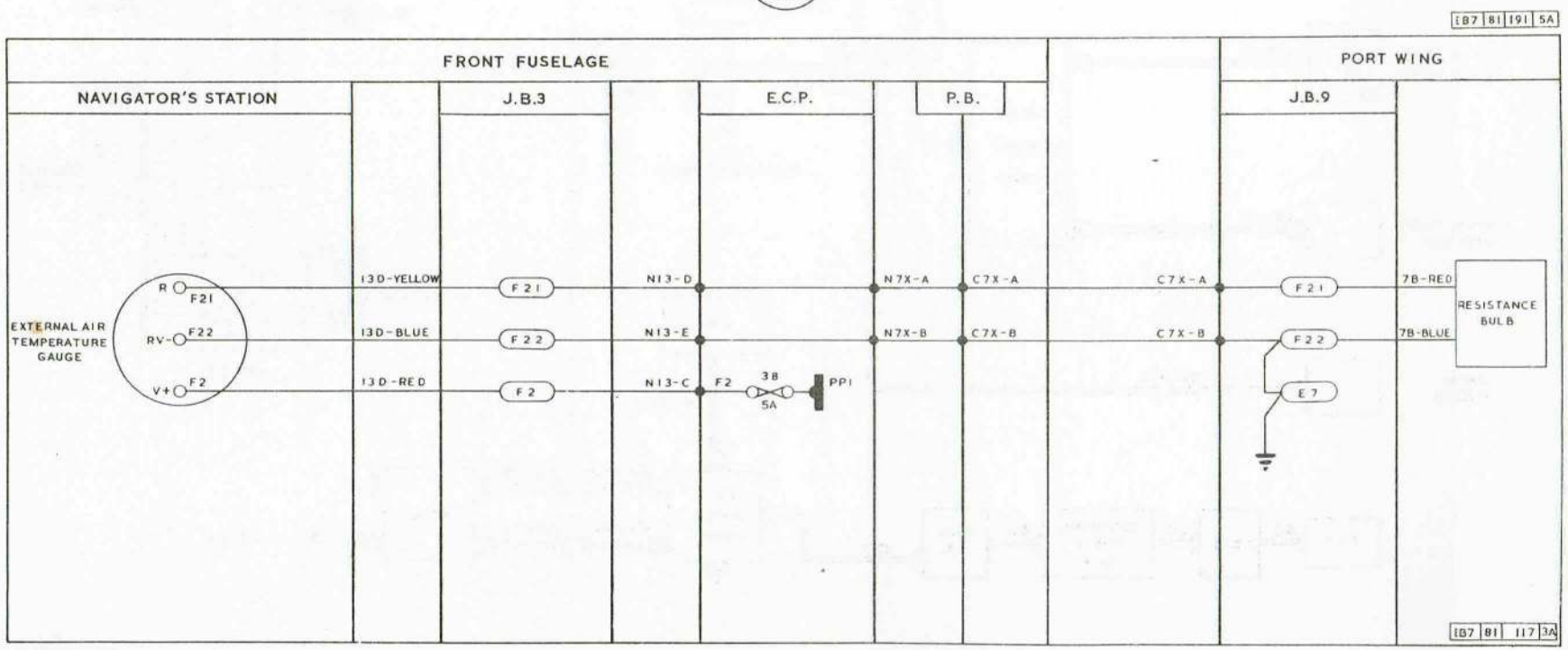

FIG. 3. EXTERNAL AIR THERMOMETER

◄BULB TERMINATIONS DELETED►

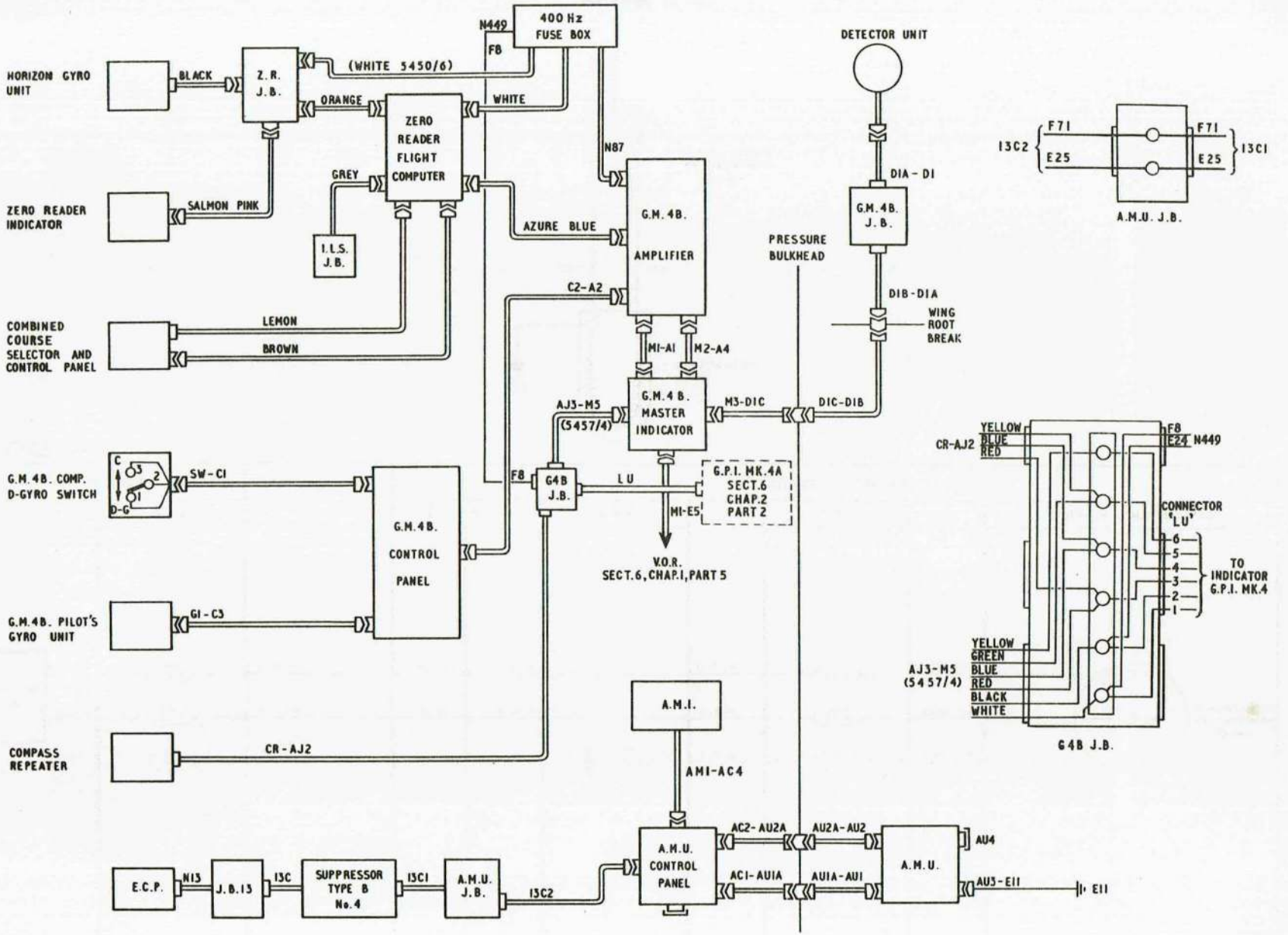

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FIG.4. ZERO READER, GM4B COMPASS AND A.M.U.

and a natural horizon bar, are coupled to the gyroscope. Deviation of the aircraft is indicated on the instrument by the horizon bar in relation to the miniature aircraft and by the movement of the roll angle pointer. The instrument transmits deviations of aircraft trim to the flight computer of the zero reader system *(para.14)*, and acts as a flight instrument in place of an artificial horizon. The power supplies to the instrument are fully described in Sect.5, Chap.1, Group D.

RATE-OF-CLIMB INDICATOR

10. This instrument, which is a Mk.3P or a Mk.3AP, is mounted on the flight instrument panel and is connected to the forward static vent common pipeline.

MACHMETER

11. A Mk.2 machmeter is mounted on the flight instrument panel and is connected to the pitot and forward static vent, common pipelines.

AIR SPEED INDICATORS

12. Two A.S.I.s are fitted, one a Mk.15A, mounted on the flight instrument panel, and the other, a Mk.9HP, on the navigator's panel. Both instruments are connected to the pitot, and forward static vent, common pipelines.

EXTERNAL AIR THERMOMETER

13. The temperature of the air outside the aircraft is indicated by a thermometer on the navigator's instrument panel. The instrument functions in conjunction with a resistance bulb which protrudes from the leading edge of the port main plane between the fuselage and the engine. The circuit is not switched but fed direct from the d.c. supply via a fuse in the E.C.P. *(fig.3)*.

ZERO READER

General *(fig.4)*

14. This installation comprises a flight computer which co-ordinates signals from the horizon gyro unit, GM4B compass, and the I.L.S. system to operate a single indicator in conjunction with a combined course selector and control panel.

15. The indicator, and the course selector and control panel are located on the flight instrument panel, together with the horizon gyro unit *(para.9)*. The flight computer, fitted in an anti-vibration mounting rack, is on the cabin floor forward of the pilot's station. A junction box for interconnecting the zero reader equipment is fitted at the port side in the roof of the nose, station forward of frame 1.

Indicator

16. The zero reader indicator incorporates vertical and horizontal indicating bars and two OFF flags. The vertical bar is actuated by heading and roll, and the horizontal bar by pitch. The flight path, as set on the course selector and control panel, is achieved when the bars intersect at a small circle in the centre of the instrument dial. The two warning flags indicate failure of the power supply, failure of H.T. in the flight computer, or that the output of one of the I.L.S. receivers has fallen below 270 micro amp.

Combined course selector and control panel

17. The course selector section of this instrument consists basically of a deviation synchro connected to a compass card and manually operated by a knob which encircles the control panel test button on the dial. The compass card is graduated in five-degree dimensions and registers against a lubber line on the dial. When a change of course is desired, rotation of the compass card knob to the required setting transmits a signal to the zero reader indicator which then shows a 'fly left' or 'fly right' indication on the dial. The control panel section of the instrument which, in conjunction with the course selector enables the pilot to select the desired flight path, contains four electrically- interlocked switches, labelled SELECTOR, TEST, ALTITUDE, AND PITCH.

Power supplies

18. The zero reader system operates from the power supplies of 28-volts d.c. and 115-volts, 400 Hz 3-phase a.c. as described in Sect.5, Chap.1, Group D.

GM4B COMPASS

General *(fig.4)*

19. The Mk.4B gyro-magnetic compass combines the functions of a directional gyro and magnetic compass and possesses the 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

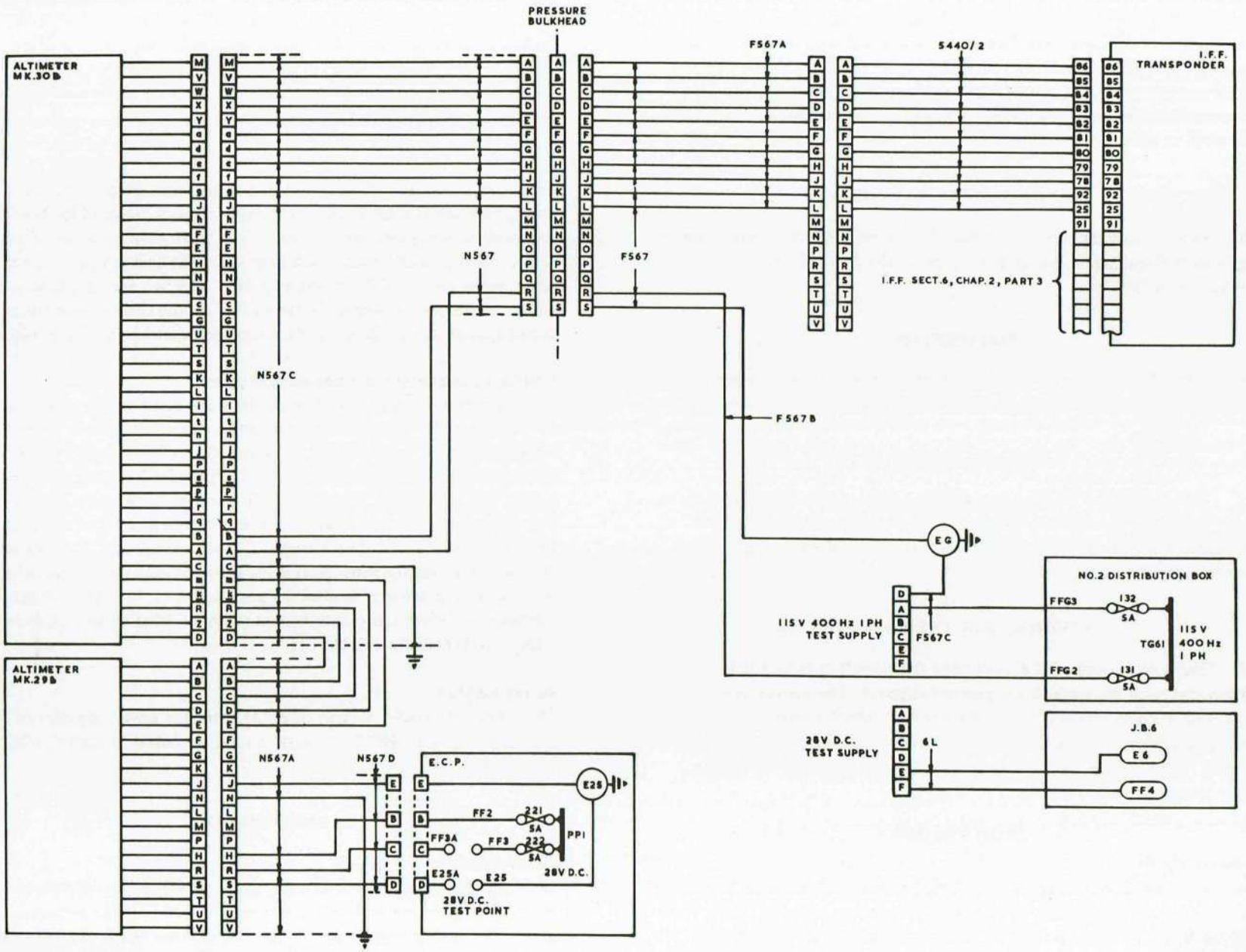

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FIG. 5. INTERCONNECTION DIAGRAM – AUTOMATIC HEIGHT ENCODING

detector unit and a monitoring system. By means of a repeater system, compass heading is fed into the zero reader flight computer and, via the GM4B junction box on the underside of the navigator's fixed table structure, to the compass repeater at the forward station and the G.P.I. *(Sect.6, Chap.2, Part 2).* Heading information, from the master indicator, is also fed to the VOR system, Sect.6, Chap.1, Part 5.

20. The installation consists of a detector unit, amplifier, control panel, gyro unit and master indicator. The detector unit is fitted in the starboard wing, frame 6B-7A, the amplifier and control panel at the starboard side of the navigator's station, and the gyro unit and master indicator, on the flight and navigator's instrument panels respectively. A switch, labelled COMP/D-GYRO and mounted on the starter panel, permits the pilot to operate the gyro unit as either a compass or directional gyro as required.

Power supplies

21. The compass system operates from the 28-volt d.c. and 115-volt, 400 Hz 3-phase a.c. power supplies as described in Sect.5, Chap.1, Group D.

COMPASS REPEATER

22. A Type 1 compass repeater is mounted at the starboard side of the forward station and provides remote indication of the aircraft heading by signals fed from the GM4B compass system.

EMERGENCY COMPASS

23. In addition to the GM4B compass system, an emergency magnetic compass is installed above the flight instrument panel. The compass incorporates direct lighting of the compass bowl, by means of a miniature 28-volt non-magnetic internal lamp, the intensity of illumination of which is varied by means of the COAMING dimmer switch mounted on the pilot's coaming panel. A further supply, provided by the emergency battery, is connected via the COMP & EMGY LGTS switch also on the coaming panel.

A.D.R.I.S.

General *(fig.4)*

24. The air mileage unit (A.M.U.) and the air mileage indicator (A.M.I.) maintain a continuous and accurate air plot in terms of distance flown. The main components comprise the A.M.U., A.M.U. control panel and an A.M.I.

Air mileage unit

25. 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 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

26. The system is controlled from the A.M.U. control panel mounted on the navigator's instrument panel. The control 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.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 from it.

A.M.I.

27. The A.M.I. is mounted on the 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.

Power supplies

28. The A.M.U. operates from 28-volts d.c. fed from the E.C.P. via J.B.13, a Type B4 suppressor and the A.M.U. junction box. The suppressor and A.M.U. junction box are mounted adjacent to the GM4B junction box *(para.19).*

AUTOMATIC HEIGHT ENCODING

General

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

Mk.30B altimeter

30. This altimeter, which is the master altimeter of the system, is located on the navigator's instrument panel and is connected to the aircraft static system. The altimeter 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.

31. Height indications are presented on a dial, calibrated 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

32. 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

33. 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.

34. Height indication and barometric pressure selection is identical to the Mk.30B altimeter and is described in para.31.

35. 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

36. 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.

Power supplies

37. 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.

PERISCOPE SEXTANT

38. This instrument is used for position fixing and for course checking by observing the altitude and azimuth of celestial bodies. When required for use it is fitted in a pressure sealed mounting fitted in the frangible hatch above the navigator's table. When not required for use the instrument is removed from the aircraft. A 28-volt d.c. supply *(Sect.5, Chap.1, Group D)* is provided for lighting and heating the instrument.

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

39. As all instruments, with the exception of the navigator's altimeter, 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 re-calibrated.

Note . . .

Static vent plates are NOT to be painted or polished.

Leakage tests

40. 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

41. 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

42. 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) Couple the pitot head, by means of the appropriate adapter, to the pitot 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.

(3) 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.

(4) 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.

(5) Reconnect the A.M.U. and repeat the tests detailed in (2) and (3), 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.

(6) 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.

(7) Disconnect and blank off the pipe from the cabin pressure controller. Connect the aft static vent, located in the nose, 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.

(8) Reconnect the cabin pressure controller, remove all test adapters and replace pressure head cover and static vent plugs.

Drying out the system

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

(1) Whenever the system is suspect.

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

44. 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.

45. 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, 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.

46. On the conclusion of the operation, remove the test trolley, reconnect all instruments and carry out the leak test detailed in para.40. 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.

47. 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

48. 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 two minutes for the inverters to run up and check that the compensator lamps in the amplifier are alight; these are visible through small holes on the front of the amplifier case. Failure of either lamp will cause the value of the current flowing through the compensator coil to alter, thus introducing compass errors. Set the variation scale on the Master Indicator to read '0'.

(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 stand-by compass.

(4) Offset the compass card 5 degree 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.

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

A.D.R.I.S.

Ground testing

49. 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.M.I. counters are operating efficiently.

Note . . .

The ground test speed of the A.M.U. may be anywhere between 70 and 270 knots.

TABLE 1

Flight instruments

Ref. No.	Equipment	Quantity	Relevant A.P.
6A/2945	Turn-and-slip indicator, Mk.2	1	A.P.112G-0302-1
6A/3360	Air speed indicator Mk.15A	1	A.P.112G-0916-1
6A/3147	Air speed indicator Mk.9HP	1	A.P.112G-0926-1
6A/3384	Machmeter, Mk.2	1	A.P.112G-0910-1
6A/2697	Rate-of-climb indicator, Mk.3P } alternatives	1 }	A.P.112G-1007-1
6A/2966	Rate-of-climb indicator, Mk.3AP } alternatives	1 }	
6A/4333460	Pressure head, Mk.8W	1	A.P.112G-0102-1
6A/2769	Air thermometers, Mk.4	1	A.P.112G-0629-1
◀ 6A/1037398	Resistance bulb	1	
	Zero reader		
6A/3119	Indicator	1	
6A/4333778 ▶	Combined course selector and control panel	1	A.P.1275A, Sect.23
6A/3122	Flight computer	1	
6A/5798	Horizon gyro unit, Mk.4A	1	
	GM4B compass system		
6B/4343681	Detector unit, Type A	1	
6B/4343641	Amplifier, Type B	1	
6B/4343607	Mounting tray, Type A	1	
6B/408	Control panel, Type A	1	A.P.112B-0321-1
6B/4352094	Master indicator, Type E5	1	
6B/4343640	Gyro unit, Type B	1	
6B/6341553	Repeater compass	1	
6B/1048857	Compass, Type E2B	1	A.P.112B-0201-1
5L/9959121	Filament non-magnetic	1	
	A.D.R.I.S. system		
6B/4343636	Air mileage unit, Mk.4A	1	A.P.112B-0811-1
6B/471	Control panel, A.M.U., Mk.4	1	A.P.1275A, Sect.16
6B/4343585	Air mileage indicator	1	A.P.112B-0803-1
	Height encoding system		
6A/6206302	Altimeter Mk.30B	1	A.P.112G-1031-1
6A/6201976	Altimeter Mk.29B	1	A.P.112G-1028-1
6B/4343797	Periscope sextant	1	A.P.112B-0501-16

TABLE 2

Connector and cable assemblies — zero reader, GM4B compass and A.M.U.

CONNECTOR M3-D1C (EA3-81-934)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Signal red - GM4B compass master indicator	A	Twelvevinmet small	Red	A	Socket - Pressure bulkhead
	B		Blue	B	
	C		Dk. Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	
	G		Brown	G	
	H		Mauve	H	
	J		Orange	J	
	K		Pink	K	
	L		Lt. Green	L	
	M		Natural	M	

CONNECTOR AC1-AU1A (EA3-81-2353)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Blue - A.M.U. control panel	A	Sextovinmet small	Red	A	Socket - Blue - Pressure bulkhead
	B		Blue	A	
	C		Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	

CONNECTOR AC2-AU2A (EA3-81-2355)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Red - A.M.U. control panel	A	Sextovinmet small	Red	A	Socket - Red - Pressure bulkhead
	B		Blue	B	
	C		Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR C1-SW (EA3-81-6243)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Mid Brown - GM4B compass control panel	K	Tripren 6	Red	3	Ring tongue tags - GM4B compass switch (engine starter panel)
	L		Blue	2	
	M		Yellow	1	

CONNECTOR G1-C3 (EB6-81-807)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Brilliant green - GM4B compass pilot's gyro unit	A	Twelvevinmet small	Red	A	Plug - Brilliant green GM4B compass control panel
	B		Blue	B	
	C		Dk. Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	
	G		Brown	G	
	H		Mauve	H	
	J		Orange	J	
	K		Pink	K	
	L		Lt. Green	L	
	M		Natural	M	

CONNECTOR GREY (EB6-81-1139)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Grey - Zero reader flight computer	1	Min. 12B	Red	A	Socket - Grey - I.L.S. junction box
	2		Blue	B	
	3		Dk. Green	C	
	4		Yellow	D	
	5		Orange	J	
	6		Pink	K	
	7		Lt. Green	L	
	8		Grey	M	
	9		White	E	
	10		Black	F	
	11		Brown	G	
	12		Violet	H	

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR SALMON PINK (EB6-81-1141)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Salmon pink - Zero reader indicator	A	Min. 6B	Red	A	Plug - Salmon pink - Zero reader junction box
	B		White	B	
	C		Blue	C	
	D		Green	D	
	E		Yellow	E	
	F		Black	F	

CONNECTOR LEMON (EB6-81-1143)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Lemon - Zero reader combined course selector and control panel	A	Min. 6B	Red	1	Socket - Lemon - Zero reader flight computer
	B		White	2	
	C		Blue	3	
	D		Green	4	
	E		Yellow	5	
	F		Black	6	

CONNECTOR AZURE BLUE (EB6-81-1145)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Azure blue - Zero reader flight computer	1	Min. 4B	Red	A	Plug - Azure blue - GM4B compass amplifier
	2		Yellow	B	
	3		Blue	C	
	4		Dk. Green	D	

CONNECTOR BROWN (EB6-81-1149)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Brown - Zero reader flight computer	1	Min. 25B	Red	A	Socket - Brown - Zero reader combined course selector and control panel
	2		White	B	
	3		Blue	C	
	4		Brown	D	
	5		Pink	E	
	6		Violet	F	
	7		Black	G	
	8		Yellow	H	

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR BROWN (EB6-81-1149) — *continued*

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Brown - Zero reader flight computer	9	Min. 25B	Lt. Green	J	Socket - Brown - Zero reader combined course selector and control panel
	10		Dk. Green	K	
	11		Grey	L	
	12		Orange	M	
	13		Red/Blue	N	
	14		Red/Dk. Green	O	
	15		Red/Yellow	P	
	16		Red/White	Q	
	17		Red/Black	R	
	18		Red/Brown	S	
	19		Blue/Yellow	T	
	20		Blue/White	U	
	21		Blue/Black	V	
	22		Blue/Orange	W	
	23		Dk. Green/Yellow	X	
	24		Dk. Green/White	Y	
	25		Dk. Green/Orange	Z	

CONNECTOR ORANGE (EB6-81-1151)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Orange - Zero reader junction box	A	Min. 12B	Red	1	Socket - Orange - Zero reader flight computer
	B		White	2	
	C		Blue	3	
	D		Brown	4	
	E		Pink	5	
	F		Violet	6	
	G		Black	7	
	H		Yellow	8	
	J		Lt. Green	9	
	K		Dk. Green	10	
	L		Grey	11	
	M		Orange	12	

continued . . .

TABLE 2 **Connector and cable assemblies — zero reader, GM4B compass and A.M.U.** — *continued*

CONNECTOR 13C2 (EB7-81-699)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - A.M.U. control	A	Duprenmet 12	Red	F71	Tails - A.M.U. junction
panel	B		Blue	E25	box

CONNECTOR A2-C2 (EB7-81-1713)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Orange - GM4B	A	Twelvevinmet small	Red	A	Socket - Orange - GM4B
compass amplifier	B		Blue	B	compass control panel
	C		Dk. Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	
	G		Brown	G	
	H		Mauve	H	
	J		Orange	J	
	K		Pink	K	
	L		Lt. Green	L	
	M		Natural	M	

CONNECTOR M2-A4 (EB7-81-1719)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Lemon - GM4B	A	Twelvevinmet small	Red	A	Plug - Lemon - GM4B
compass master indicator	B		Blue	B	compass amplifier
	C		Dk. Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	
	G		Brown	G	
	H		Mauve	H	
	J		Orange	J	
	K		Pink	K	
	L		Lt. Green	L	
	M		Natural	M	

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR M1-A1 (EB7-81-1721)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - Battleship grey - GM4B compass master indicator	A	Twelvevinmet small	Red	A	Plug - Battleship grey - GM4B compass amplifier
	B		Blue	B	
	C		Dk. Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	
	G		Brown	G	
	H		Mauve	H	
	J		Orange	J	
	K		Pink	K	
	L		Lt. Green	L	
	M		Natural	M	

CONNECTOR CR-AJ2 (EB7-81-1767)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Tails - compass repeater	—	Triprenmet	Red	—	Tails - GM4B compass junction box
	—		Yellow	—	
	—		Blue	—	

CONNECTOR N449 (EB7-81-5895)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Tails - GM4B compass junction box	F8	Unitersilmet 20	—	F8	QR tag — 400 Hz fuse box
	E24		—	E24	Ring tongue tag — 400 Hz fuse box

CONNECTOR WHITE (EB7-81-5947)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - white - Zero reader flight computer	1	Min. 4B	Red	FR8	QR tag
	2		Yellow	EW	Ring tongue tag — 400 Hz fuse box
	3		Blue	FB6	QR tag
	4		Dk. Green	+ve 28V	QR tag

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR WHITE (5450/6)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - white - Zero reader junction box	A	Min. 4C	Red	FR6	Tails - 400 Hz fuse box
	B		Yellow	EW	
	C		Blue	FB6	
	D		Green	+ve 28V	

CONNECTOR AJ3-M5 (5457/4)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Pink - GM4B compass master indicator	A	Min. 6C	White	F8	Tails - GM4B compass junction box
	B		Black	E24	
	C		Red	—	
	D		Blue	—	
	E		Green	—	
	F		Yellow	—	

CONNECTOR AU1A-AU1 (EB7-81-541)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Pressure bulkhead	A	Sextovinmet small	Red	A	Socket - A.M.U.
	B		Blue	B	
	C		Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	

CONNECTOR AU2A-AU2 (EB7-81-543)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Pressure bulkhead	A	Sextovinmet small	Red	A	Socket - A.M.U.
	B		Blue	B	
	C		Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	

continued . . .

TABLE 2 Connector and cable assemblies – zero reader, GM4B compass and A.M.U. – *continued*

CONNECTOR AU3-E11 (EA3.81.969)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - A.M.U.	A	Duprenmet 12	–	Tag and thimble	Earth terminal E11
	B		–		

CONNECTOR D1C-D1B (EB7-81-545)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Pressure bulkhead	A	Twelvevinmet small	Red	A	Socket - Wing root
	B		Blue	B	
	C		Dk. Green	C	
	D		Yellow	D	
	E		White	E	
	F		Black	F	
	G		Brown	G	
	H		Mauve	H	
	J		Orange	J	
	K		Pink	K	
	L		Lt. Green	L	
	M		Natural	M	

CONNECTOR D1B-D1A (EA3-81-919)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Plug - Wing root	A	Unipren 4	–	A	Tags and thimbles - GM4B compass junction box
	B	Metal braided	–	B	
	C		–	C	
	D		–	D	
	E		–	E	
	F		–	F	
	G		–	G	
	H		–	H	
	J		–	J	
	K		–	K	
	L		–	L	
	M		–	M	

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR D1A-D1 (EA3.81-917)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Tags and thimbles - GM4B compass junction box	A	Unipren 4	—	A	Socket - GM4B compass detector unit plug break
	B	Metal braided	—	B	
	C		—	C	
	D		—	D	
	E		—	E	
	F		—	F	
	G		—	G	
	H		—	H	
	J		—	J	
	K		—	K	
	L		—	L	
	M		—	M	

CONNECTOR N87 (5450/11)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - GM4B compass amplifier	A	Min. 4C	Red	FR3	400 Hz fuse box
	B		Green	EW	
	C		Blue	FB3	
	D		Yellow	F3	
	E		—	—	
	F		—	—	

CONNECTOR N13 (EB7-81-441/2)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - E.C.P.	A	Unipren in P.V.C. tubing	—	SP1	Tags and thimbles - J.B.13
	B		—	W5	
	C		—	F2	
	D		—	F21	
	E		—	F22	
	F		—	F7	
	G		—	L9	
	H		—	H71	
	J		—	W6	
	K		—	W61	
	L		—	S1	

continued . . .

TABLE 2 Connector and cable assemblies — zero reader, GM4B compass and A.M.U. — *continued*

CONNECTOR N13 (EB7-81-441/2) — *continued*

Termination	Pin	Cable type	Cable colour	Pin	Termination
Socket - E.C.P.	M	Unipren in P.V.C. tubing		S11	Tags and thimbles -
	1			E25	J.B.13
	2			SP7	

CONNECTOR 13C (EB7-81-473)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Tails - Suppressor	F7	Dupren 12	Red	F7	Tags and thimbles -
Type B4	E25		Blue	E25	J.B.13

CONNECTOR 13C1 (EB7-81-465)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Tails - Suppressor	F71	Duprenmet 12	Red	F71	Tails - A.M.U. junction
Type B4	E25		Blue	E25	box

CONNECTOR AM1-AC4 (EB7-81-5423)

Termination	Pin	Cable type	Cable colour	Pin	Termination
Tails - End A	A	Uniprenmet 12		A	End B
	B			B