Australian Air Publication **7211.001-1**

46

ROYAL AUSTRALIAN AIR FORCE

FLIGHT MANUAL

PILATUS PORTER

ISSUED FOR THE MANAGEMENT AND CONTROL
OF THE ROYAL AUSTRALIAN AIR FORCE.

BY COMMAND OF THE AIR BOARD.

Green
Secretary

DATE: 16 MAR 72

DEPARTMENT OF AIR
CANBERRA A C T

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It is certified that the amendments promulgated in the undermentioned Amendment Lists have been incorporated in the Publication:—

Amendment List		*Topic Affected*	**Amendment Effect*	*Amended By*	*Date*
No	*Dated*				
1	June 73		Insert change overpage.	[illegible signature]	27 June 73
2	July 75			[illegible signature]	14 May 79
3	Oct 75			[illegible signature]	14 May 79
4	Sept 75			[illegible signature]	14 May 79
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***Note.** Insert brief details of page(s) amended, inserted or cancelled.

WARNINGS

WARNING

When the aircraft is parked for prolonged periods in a wing-low attitude, fuel in the tank of the higher wing slowly flows to the tank in the lower wing. Should the total amount be less than one fourth of the total capacity of the tanks, and the incline great enough, fuel collects in the outboard portion of the lower tank, free of the outlets to the fuel feeder lines. When such a condition exists, the only usable fuel remaining in the system is that which is trapped in the fuel lines and collector tank. If the engine is started, and run on the trapped fuel without change of attitude to allow fuel flow to the feeder lines, fuel starvation will occur as soon as the trapped fuel is used up. Under such parking conditions, the aircraft is to be turned to create a wing level attitude. Time is to be allowed for fuel redistribution in the tanks before starting the engine.

WARNING

The fire extinguisher contains bromochlorodifluoromethane (BCF). It is advisable to ventilate the cockpit after the extinguisher has been used in the aircraft.

WARNING

The sliding door cannot be securely retained in any position other than closed.

WARNING

If there is any evidence of fire within the engine after shut-down, proceed immediately as described under "Motoring Run for Clearing the Engine".

WARNING

Should fire persist as indicated by sustained ITT, close the LP Cock and continue motoring. (See Section 3 EMERGENCY PROCEDURES FOR GROUND ENGINE FIRE).

WARNING

Do not attempt to restart an engine which is known definitely to have failed.

WARNING

When in approach pattern and/or flare out, 'beta' must be carefully selected in order to avoid inducing a speed below the stalling speed.

FOREWORD

AUTHORITY

Users are to regard this Flight Manual as an authoritative publication. It is compiled from data available from operating, technical, manufacturing and safety sources, and represents the best level of information available.

OPERATING INSTRUCTIONS

This manual provides the best possible operating instructions; however, on occasions these instructions may prove to be a poor substitute for sound judgment. Multiple emergencies, adverse weather, terrain and other considerations may require modification of the procedures.

AMENDMENT ACTION

To assist in maintaining this publication in an up-to-date condition, users are to bring to the notice of higher authority, without delay, any errors, omissions or suggestions for improvement. This should be done through your unit Flight Manuals Officer.

ARRANGEMENT

The manual is divided into seven generally independent sections to simplify reading it straight through or using it as a reference manual.

WARNINGS, CAUTIONS AND NOTES

The following definitions apply to 'Warnings', 'Cautions', and 'Notes' found throughout the manual.

WARNING

Operating procedures, techniques, etc which may result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc which may result in damage to equipment if not carefully followed.

Note

An operating procedure, technique, etc which is considered essential to emphasize.

CONTROL AND INDICATOR MARKINGS

The use of block capitals in the text when identifying switches, controls etc., indicates the actual markings on that item. Block capitals are also used when reference is made to a specific control position (whether that position is marked with a decal or not).

LIST OF EFFECTIVE PAGES

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Page No	AL	Page No	AL
Title Page	0	1-47	0
i	0	1-48 to 1-49	1
ii - Blank	0	1-50 to 1-52	0
iii	0	*1-53	3
iv - Blank	0	1-54 to 1-55	0
*v	4	*1-56	3
vi	4	*1-56A/(56B Blank)	3
*vii to ix	3	*1-57 to 1-58	3
x	0	1-59 to 1-60	1
1-1 to 1-4	1	1-61 to 1-62	0
*1-5	3	1-63 to 1-65	1
1-6	0	1-66	0
1-7 to 1-8	1	1-67 to 1-70	1
1-9	0	1-70A to 1-70B	1
1-10 to 1-11	1	1-70C/(70D Blank)	1
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1-15 to 1-20	1	1-74 to 1-75	1
1-21	0	1-76 to 1-77	0
*1-22	3	1-78	1
1-23	0	1-79 to 1-83	0
*1-24 to 1-25	3	1-84	1
1-26	1	1-85	0
1-27 to 1-28	0	*1-86	3
*1-29 to 1-30	3	1-87 to 1-88	0
1-31	1	2-1	0
*1-32	3	2-2	1
*1-32A to 1-32B	3	2-3 to 2-6	0
1-33	0	*2-7 to 2-13	3
*1-34 to 1-36	3	2-14	1
1-37	1	2-15 to 2-16	0
1-38 to 1-40	0	2-17 to 2-18	1
1-41 to 1-43	1	*2-19	3
1-44	0	2-20	1
1-45 to 1-46	1	3-1 to 3-2	0

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7-8	0		
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*A1-4	3		
A1-5 to A1-12	0		
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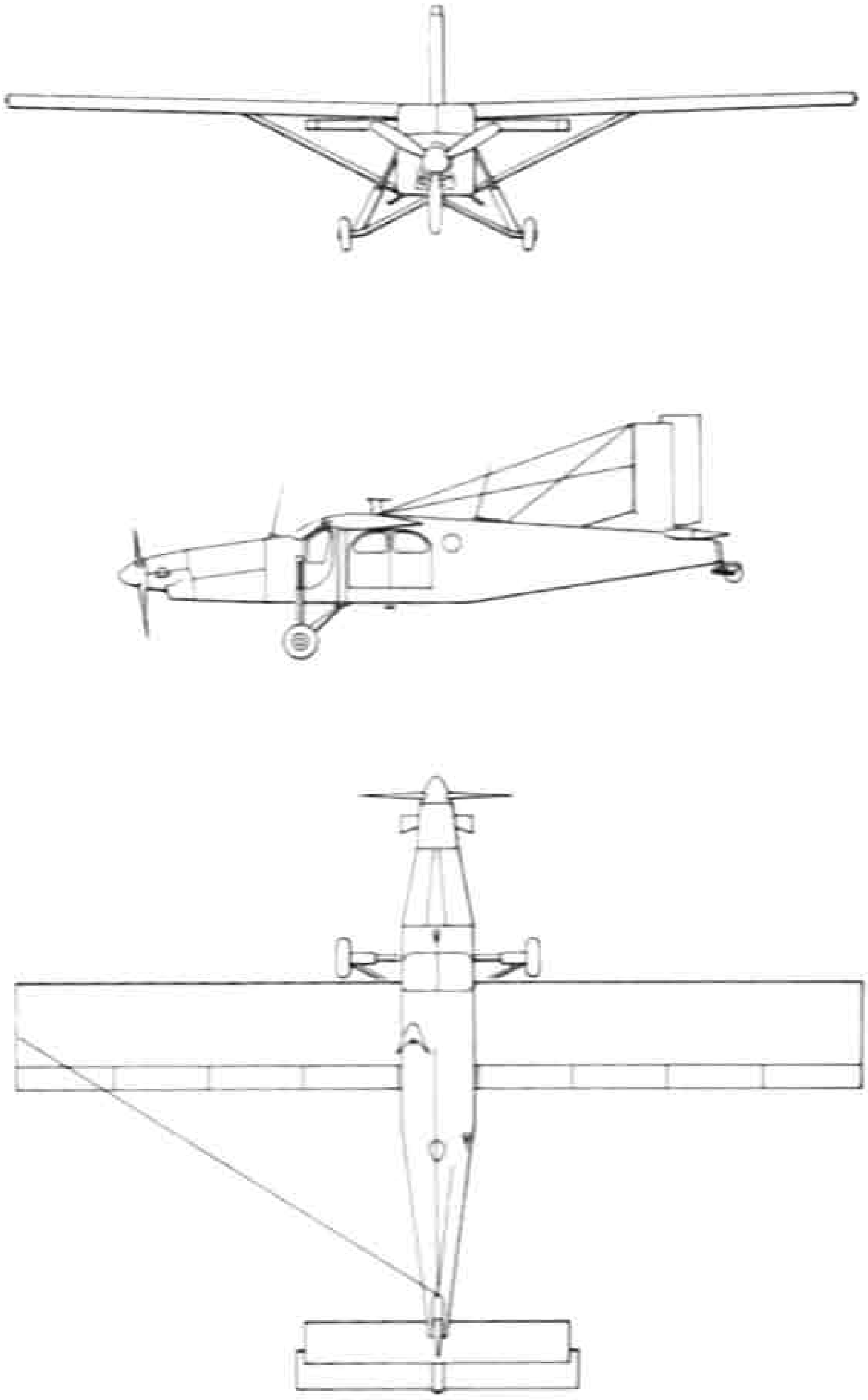


SECTION 1

DESCRIPTION AND OPERATION

THE AIRCRAFT (Ref. Figs. 1-1, 1-2, 1-3).

101. **Introduction.** The PC-6/B1-H2 Porter aircraft is a single engined, strut braced high wing monoplane of all-metal construction. It is designed for use as an all-purpose utility aircraft and has seating capacity for pilot, co-pilot and six passengers. Good climbing and low speed handling characteristics, STOL capability and a wide track landing gear enable the aircraft to be operated from rudimentary landing grounds. The aircraft is fitted with a conventional, fixed landing gear which has spring/oil shock absorbers. The brakes are hydraulically operated. A United Aircraft of Canada Limited (UACL) PT6A-20 free turbine engine provides power for the aircraft. The engine consists of a gas generator section and a free single stage power turbine which drives a Hartzell three bladed, full feathering, reversing, constant speed propeller.

102. **Flight Controls.** The principal flying controls are cable and push rod operated. The ailerons and elevators are fitted with 'Flettner' tabs to reduce control column loads; the ailerons are a differential frise type and are coupled to the rudder. No means of adjusting lateral trim in flight is provided but longitudinal trim can be varied by a cable-operated variable incidence tailplane, moved by a crank in the cockpit ceiling. Directional trim is given by a rudder trim tab operated by cables from a control at the left of the pilot's seat. The semi-span double-slotted flaps are operated, through chains and cables, by a crank mounted adjacent to the tailplane incidence control crank in the cockpit ceiling.

103. **Power Plant Control.** The power plant is controlled by operation of the power plant control lever. Operation of the lever varies engine power from reverse to take-off thrust. It is provided with a lift detent to prevent inadvertent selection of reverse thrust when reducing power in flight.

104. **Fuel System.** Fuel is carried in integral tanks in the inboard section of each wing. Each tank has two outlets, one to a collector box and one to a water drain tank. The collector box, which is fitted with an electrically operated boost pump, supplies fuel to the engine via an engine driven fuel pump. For aircraft prior to A14-702, the total usable fuel is 844 lbs (128 US Gal) and for aircraft A14-702 and subsequent the total usable fuel is 1122 lbs (170 US Gal).

105. **Electrical System.** Power source for the electrical system is a starter/generator which supplies aircraft power at 28V DC. The aircraft fuselage provides the earth return for the system with storage provided by a 28V 34 Ah nickel cadmium battery. A standard NATO external power source connector is fitted on the port side of the fuselage. Solid state inverters and a phase adaptor provide single and three phase 26V AC and 115V AC power for the radio communication/ navigation equipment and instruments.

106. **Oxygen System.** Oxygen is carried for two crew and four passengers in two 48.3 cubic ft cylinders mounted behind the cabin rear bulkhead. A charging point is provided on the port side of the fuselage and a pressure gauge, readable from the cabin, is installed on the rear cabin bulkhead. Two regulators for the crew are fitted in a console between the crew seats, while outlets for four constant flow masks are provided in the cabin.

107. **Furnishing.** Two crew seats with provision for seat-pack dinghy/survival kit stowage are bolted to the floor and are equipped with a full shoulder harness with inertia reel locking. Passenger seats, which have only a lap strap, slide in rails mounted in the cargo floor and are held in position by a locating shear-pin. When not required the passenger seats can be removed to allow the carriage of cargo and can be stowed on special rails provided in the aft fuselage, behind the rear cabin bulkhead. Fixed and removable fittings for the installation of two standard litters are also provided.

108. **Main Landing Gear and Tail Wheel.** The wide track landing gear is installed well forward of the aircraft's centre of gravity (CG). All three wheels are supported by mechanical springs inside hydraulic shock absorbers. The tail wheel is steerable.

109. **Radio Equipment.** A variety of radio equipment can be carried. The two crew positions and the first two passenger positions are the only positions provided with radio and intercommunication facilities.

110. Main Instrument Panel (Ref. Fig. 1-4). The main instrument panel is divided into four sub-panels. The No. 2, No. 3 and No. 4 instrument panels are integral with the main structure; the No. 1 instrument panel, located on the extreme left, contains vibration sensitive flight instruments and is therefore shock mounted. Engine and propeller instruments are mounted in the No. 2 instrument panel which is located to the right of the No. 1 instrument panel. The No. 3 instrument panel contains radio equipment and the No. 4 instrument panel, which is located on the extreme right of the main instrument panel contains radio equipment, instruments monitoring the fuel, oil and electrical systems, and the main circuit breaker (CB) panel. Both toggle and pushbutton CBs are used. The instruments are illuminated by white light provided by a mixture of integral, eyebrow and post lights, the intensity of which can be controlled by a rheostat located on the panel frame to the left of No. 1 instrument panel.

111. Miscellaneous Stores. Stores racks may be carried on a hard point on each wing. Means for electrical and manual jettison are provided.

112. Principal Dimensions (Ref. Fig. 1-1).

a. Length - 36 ft.

b. Wingspan - 49 ft 10½ in.

c. Chord - 6 ft 2¾ in.

d. Height to top of fin - 10 ft 6 in.

e. Propeller diameter - 8 ft 5 in.

f. Tailplane span - 16 ft 9½ in.

g. Under-carriage track - 9 ft 10 in.

Note

Refer to Fig. 2-3 for turning radius and ground clearance dimensions.

Wing Characteristics.

a. Area - 310.00 sq. ft.

b. Loading - 15.65 lb/sq. ft.

c. Aerofoil - NACA 64-514 constant over whole span.

d. Aspect Ratio - 7.97.

e. Angle of Incidence - 2°.

f. Dihedral Angle - 1°.

113. General Data.

a. Design Gross Weight - 4850 lbs.

b. Maximum AUW (Ferry Operations) - 5700 lbs.

c. Engine Model - UACL PT6A-20.

d. Fuel - See Servicing Diagram.

e. Oil - See Servicing Diagram.

f. Hydraulic Fluid for the Brake System and Shock Absorber Struts. See Servicing Diagram.

g. Battery - Nickel Cadmium 28V 34 Ah.

h. Main Wheel Tyre - 24-7 inch Type II Goodyear.
Pressure - 32 psi.

i. Oversize Main Wheel tyre - 11-12 x 8 Ply Goodyear.
Pressure - 15 psi.

j. Tail Wheel Tyre - 5-4 inch.
Pressure - 32 psi.

k. Accessories.

(1) Starter/Generator - LEAR SIEGLER 23046-001.

(2) Propeller - HARTZELL HC-B3TN-3C.

(3) Propeller Overspeed Governor - WOODWARD 210507.

(4) Constant Speed Unit - WOODWARD 210577.

ENGINE

114. Introduction. The PC-6/B1-H2 'Turbo Porter' is powered by a UACL PT6A-20 free turbine engine. The engine drives a three blade, constant speed, full feathering, reversible pitch propeller via a reduction gearbox. A power control lever, idle control and engine cut-off provide all necessary control of the engine during normal operation and are discussed further under **Engine Control System**. The engine has excellent handling and control characteristics and has many built in safe-guards. The following sections, which are named according to their function, comprise the engine:

a. ***Gas Generator.*** In this section fuel and air are combined to produce a gas of high kinetic and thermal energy.

b. ***Power Section.*** The power turbine extracts energy from the expanding gases provided by the gas generator. The propeller gearbox transmits this power to the propeller.

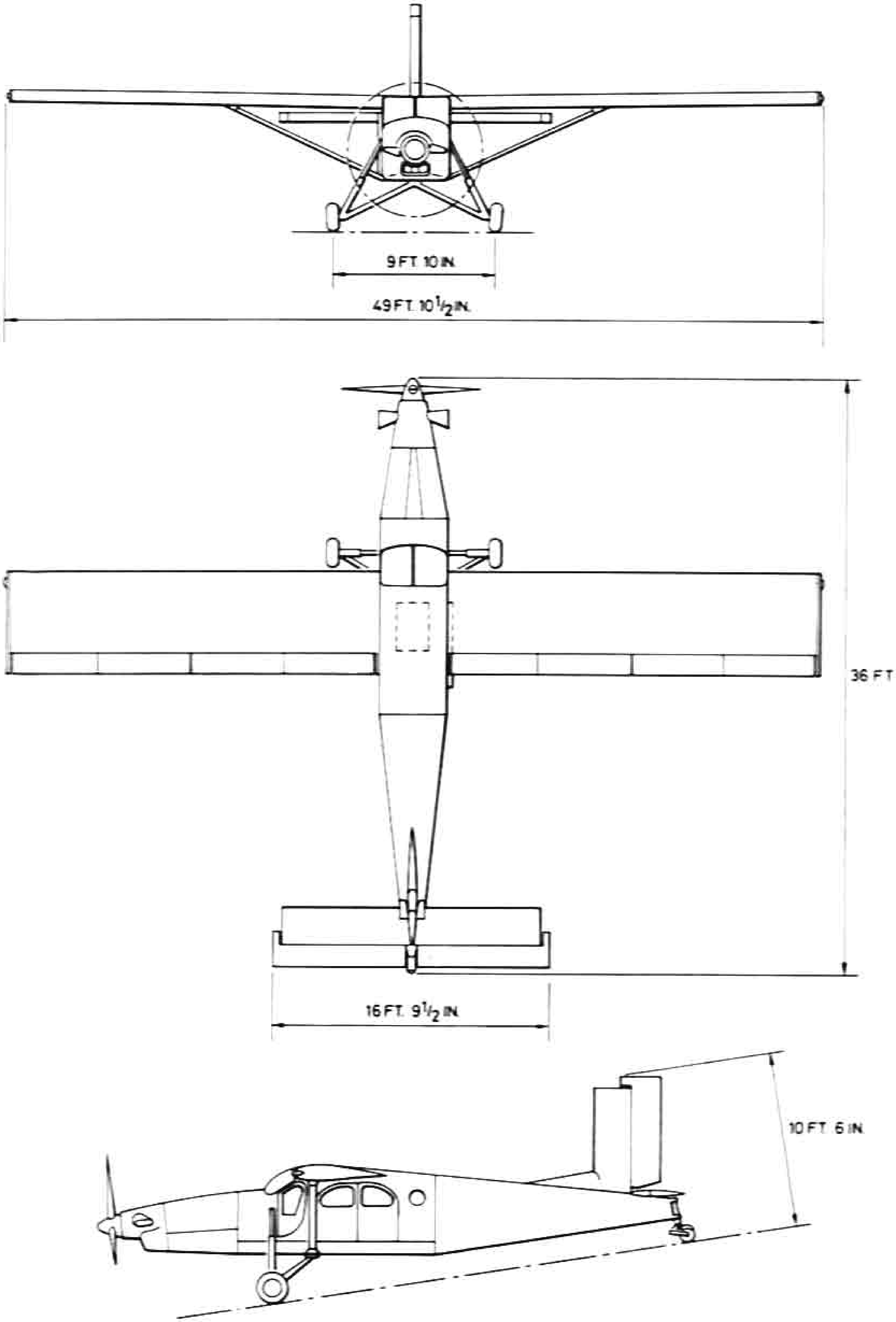


FIG. 1-1 AIRCRAFT DIMENSIONS

1. Radio Equipment
2. Door Emergency Release
3. Crew Entrance Door
4. Flux Valve (C14 Compass)
5. Fuel Filler Cap
6. Cabin Entrance Door - Sliding
7. Cabin Entrance Door - Hinged
8. First Aid Kit
9. Radio Equipment
10. Fuselage Access Door
11. Oxygen Charging Connection
12. Fuselage Access Panel
13. Floor Hatch
14. Trap Door
15. MA4A Stores Rack
16. Fuel Filler Cap
17. Survival Kit/One Man Dinghy
18. Direct Vision Panel
19. Crash Axe
20. Fire Extinguisher
21. Firewall
22. Battery
23. External Power Connection

Key to Fig. 1-2 General Arrangement

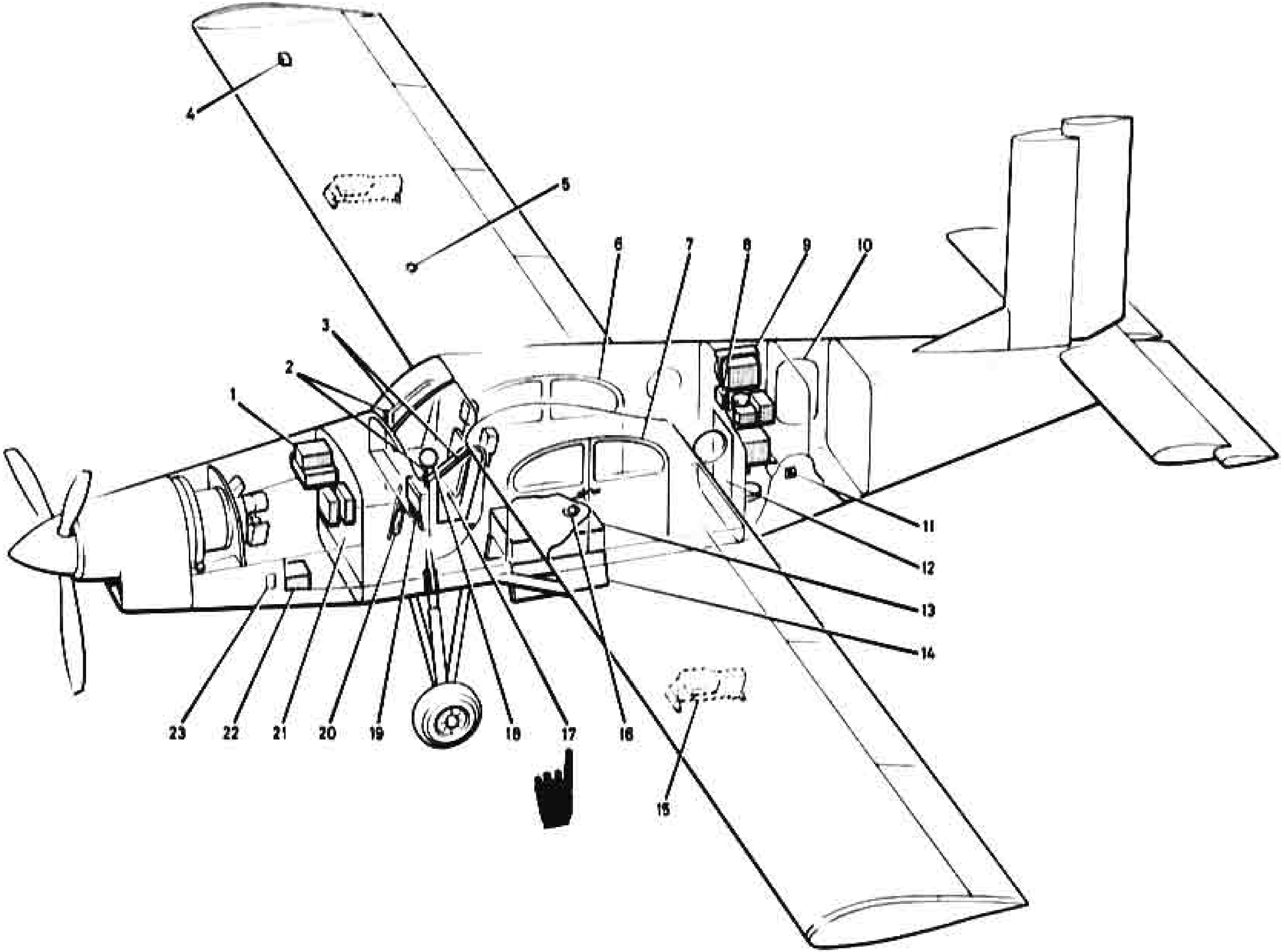


FIG.1-2 GENERAL ARRANGEMENT

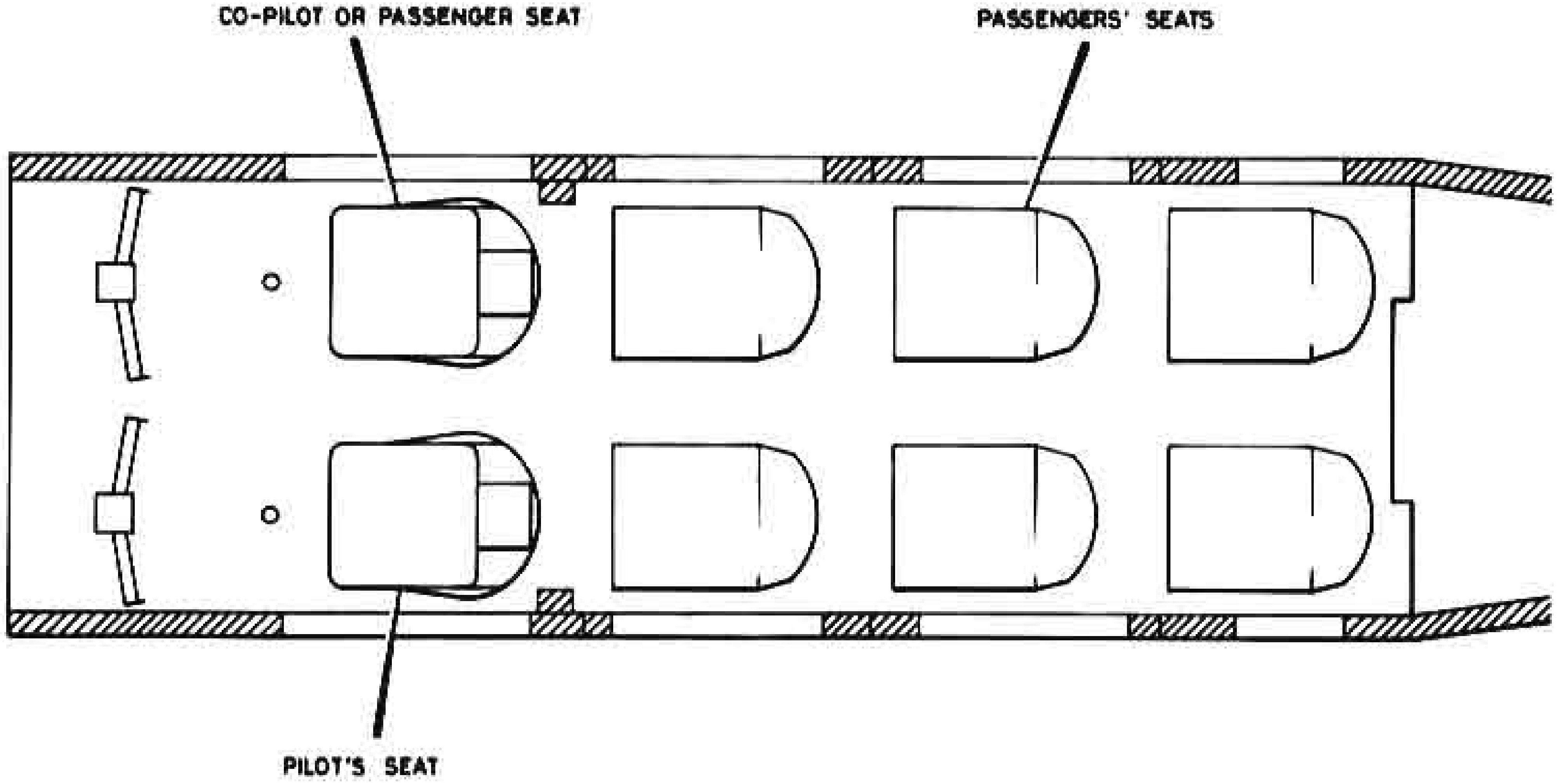
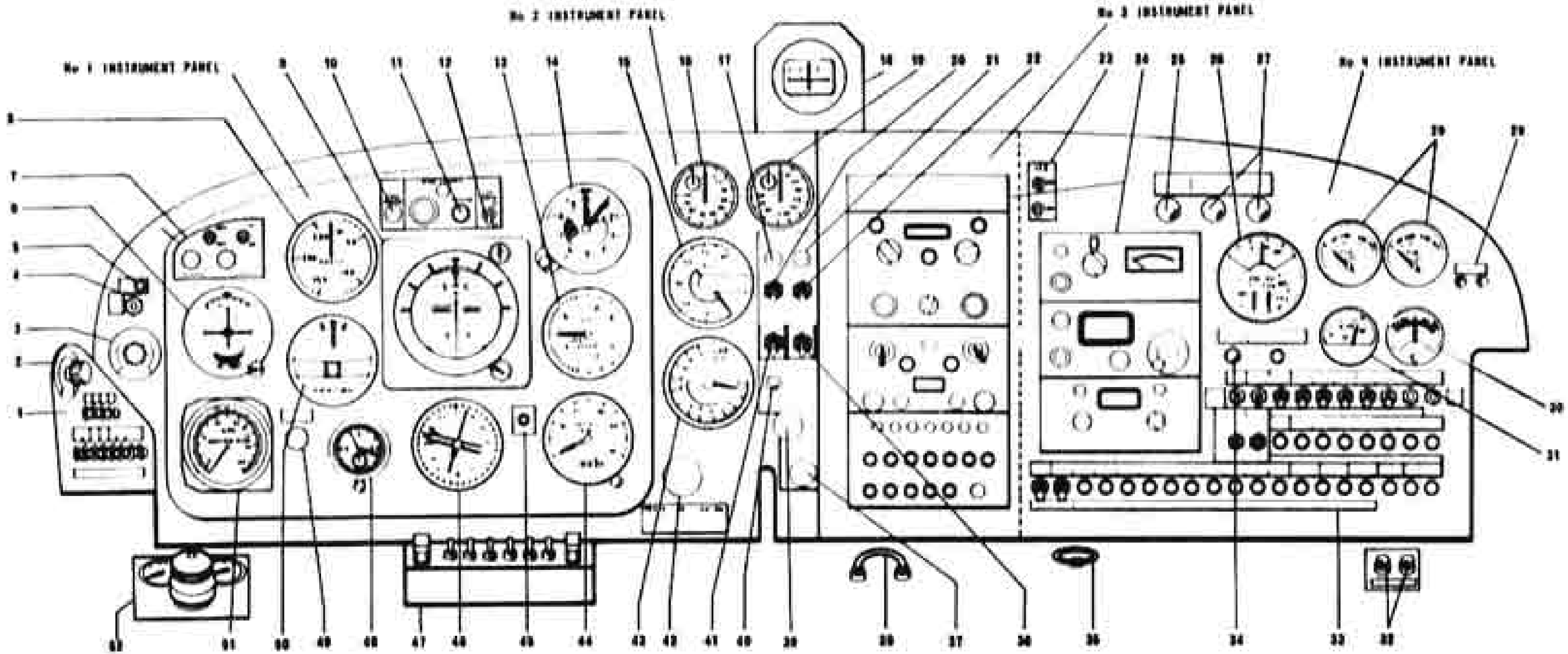


FIG. 1-3 CABIN DIAGRAM



1. AUX CIRCUIT BREAKER PANEL
2. INTENSITY FLOOD LIGHTS RHEOSTAT
3. INTENSITY INSTRUMENT LIGHTS RHEOSTAT
4. IGNITER SELECTOR SWITCH
5. VOR/VHF-FM HOMING NAV SELECTOR SWITCH
6. COURSE SELECTOR INDICATOR (CSI)
7. MARKER BEACON CONTROL PANEL
8. AIR SPEED INDICATOR (ASI)
9. ATTITUDE INDICATOR
10. STALL WARNING LIGHT
11. GYRO COMPASS ANNUNCIATOR/FAILURE WARNING LIGHT
12. FAST ERECTION SWITCH
13. INERTIAL - LEAD VERTICAL SPEED INDICATOR (IVSI)
14. ALTIMETER
15. TORQUE PRESSURE INDICATOR
16. PROPELLER TACHOMETER (Np)
17. ENGINE CONTROL HEATER WARNING LIGHT.
18. MAGNETIC COMPASS
19. GAS GENERATOR TACHOMETER (Ng)
20. ENGINE CONTROL HEATER SWITCH
21. BOOSTER PUMP WARNING LIGHT
22. BOOSTER PUMP SWITCH
23. DME AND NSR RECEIVER SELECTOR SWITCHES
24. COMMUNICATIONS CONTROL PANEL
25. OIL COOLER CONTROL
26. OIL/FUEL TEMPERATURE AND PRESSURE INDICATOR
27. VENTILATION AND HEATING CONTROLS
28. FUEL QUANTITY INDICATORS
29. 28 VOLT DC POWER SOCKET
30. AMMETER
31. VOLTMETER
32. COPILOTS PTT AND INTERPHONE BUTTONS
33. MAIN CIRCUIT BREAKER PANEL
34. GENERATOR WARNING LIGHT
35. FIRE EMERGENCY SHUT-OFF CONTROL
36. STARTER SWITCH
37. HI AND LO IDLE ENGINE CONTROL
38. PARK BRAKE CONTROL
39. HIGH PRESSURE FUEL COCK
40. FUEL FILTER CLOGGED WARNING LIGHT
41. IGNITION SWITCH
42. PROPELLER CONTROL
43. INTER-TURBINE TEMPERATURE INDICATOR (ITT)
44. TOTALISER/FUEL FLOWMETER
45. VOR/UHF-DF NAV SELECTOR SWITCH
46. RADIO MAGNETIC INDICATOR (RMI)
47. STORES SELECTOR BOX
48. CLOCK
49. PROPELLER LOW PITCH WARNING LIGHTS
50. TURN AND BALANCE INDICATOR
51. DME INDICATOR
52. OXYGEN PRESSURE DEMAND REGULATOR.

FIG 1-4 GENERAL ARRGT. MAIN INSTRUMENT PANEL

c. **Accessory Drives.** The engine provides mechanical drives to the following services:

(1) Front Accessory Drives (Propellor Reduction gearbox)

(a) Propellor overspeed governor
(b) Propellor CSU.
(c) Tachometer generator (Np).

(2) Rear Accessory Drives (Accessory Gearbox).

(a) Starter generator
(b) Low pressure engine driven fuel pump
(c) High pressure fuel pump & FCU
(d) Tachometer generator (Ng).

115. **Engine Fuel Control System.** (Ref. Fig. 1-5). The FCU selects the fuel flow required to produce the correct gas generator RPM (Ng) as selected by the power control lever. It senses and adjusts fuel flow, for the following conditions:

a. Selected Ng changes.
b. Outside air temperature (OAT).
c. Compressor discharge pressure.
d. Rate of acceleration with engine speed.
e. Changes when required by the Ng governor.

The FCU consists of the following sections:

a. Ng Governor.
b. Air Servo System.
c. Fuel Pressure Relief Valve.
d. Metering and Bypass Valve System.
e. Minimum Pressurizing Valve.
f. High Pressure (HP) Fuel Cock.

116. **Ng Governor.** The Ng governor senses Ng and bleeds off servo air to control the Ng to match that set in the Ng governor by the power control lever. The governor is also provided with an enrichment lever which changes the rate of air bleed to give faster acceleration response above 75%-80% Ng. Linkage connected to the Ng governor allows the governor to be pre-set to two idle speeds i.e. low idle (LO IDLE) 50.6% Ng and high idle (HI IDLE) 80% Ng. The low idle figure is affected by temperature and altitude and may vary upwards considerably. High Idle should always be between 75%-80% Ng.

117. **Air Servo System.** Air is bled from P3 and passed through a needle valve which adjusts the airflow for compressor inlet temperature. Part of this air is diverted through a restrictor to become governor servo air. The remainder is diverted into a bellows system where the air tends to decelerate and to accelerate the gas generator (GG). Air pressure changes to the bellows cause opening or closing of the metering valve, which increases or decreases fuel to the burner. The enrichment lever in the Ng governor determines the rate at which these changes take place. As a precaution

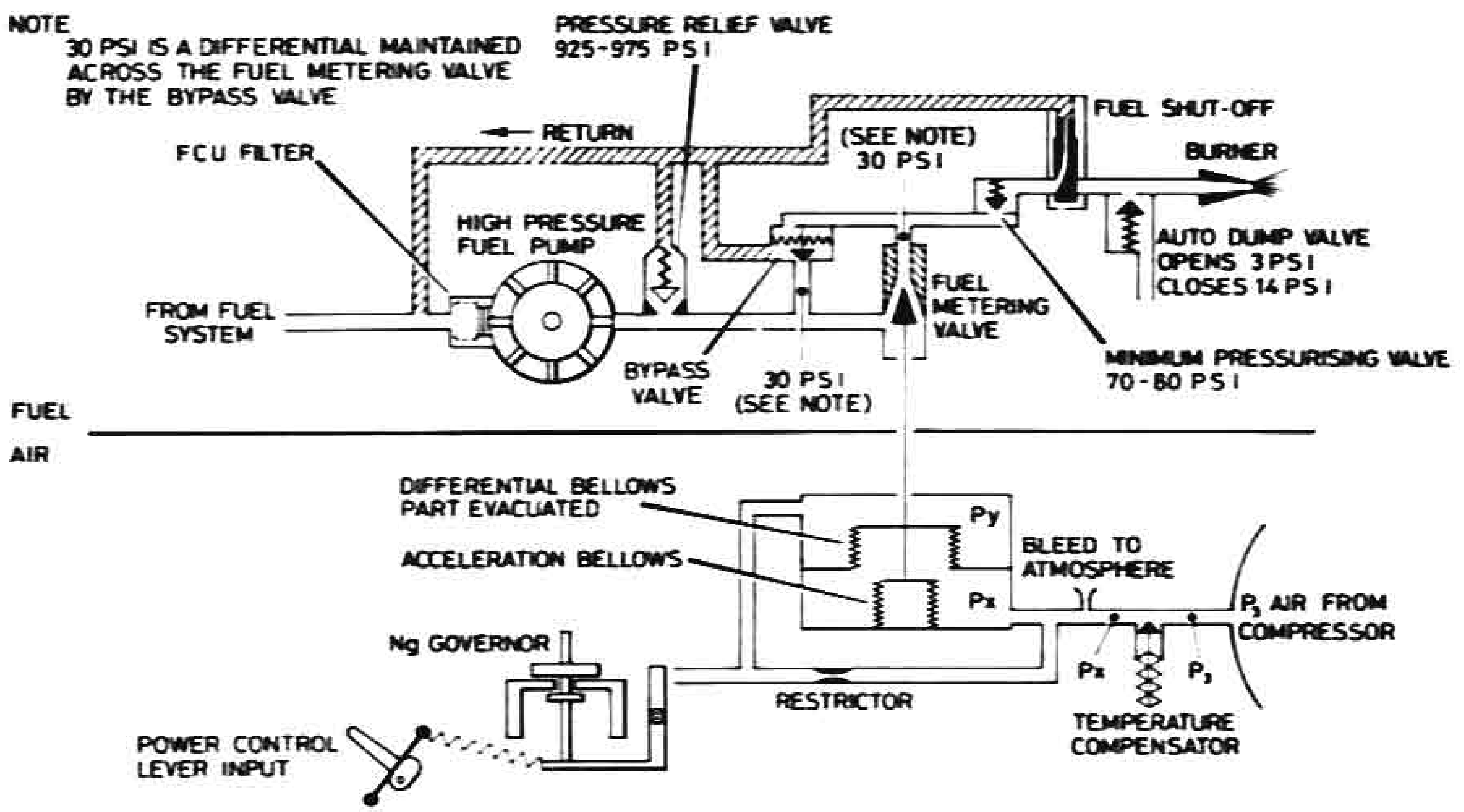


Fig. 1-5 **Engine Fuel Control System - Schematic**

against freezing, the air line from the compressor intake is heated by compressor bleed air.

118. **Fuel Pressure Relief Valve.** The fuel pressure relief valve is set at 925 - 975 psi and prevents excessive fuel pressure build-up in the FCU.

119. **Metering Valve and Bypass Valve System.** The fuel metering valve has a variable orifice which is adjusted by the air servo system. Position of this valve determines the rate at which fuel is allowed to pass into the engine. Once the fuel has passed through the metering valve, it is known as *'metered fuel'*. The bypass valve system ensures a steady flow rate through the metering valve, dependent on the size of the orifice only. Excess pump pressure is dumped by the bypass valve to maintain the difference. The bypass valve is set at 30 psi differential and also compensates for changes in fuel temperature.

120. **Minimum Pressurizing Valve.** The minimum pressurizing valve prevents fuel flow to the burners until the metered fuel pressure reaches 70-80 psi. This ensures a good spray pattern during the start-up cycle and positive fuel shut-off which prevents fuel nozzle dribble into the combustion chamber.

Note

Fuel nozzle dribble into the combustion chamber can lead to wet/hot starts.

121. **High Pressure (HP) Fuel Cock.** The high pressure fuel cock allows for fuel shut-off in the high pressure fuel system, cuts fuel flow to the burners and to the high pressure fuel pump. This ensures that the high pressure fuel pump does not run dry or over pressurize when the engine is windmilling.

Air System

122. **Introduction.** The engine has three separate air bleed systems: a compressor air bleed control, a bearing compartment air seal and bleed system and a turbine disc cooling system. A fourth system is available as an optional source of high pressure air for operating auxiliary equipment if required.

123. **Air Seals.** P2.5 air (air pressure at the 3rd stage compressor) is bled through a series of holes in the compressor rotor and provides air pressure in the cavity housing No. 1 and No. 2 bearings. This air pressure flows through the labyrinth seals and prevents flow of oil across the seals. Air pressure at compressor discharge (P3 air) is bled through a series of holes in a baffle around the compressor delivery duct. This air pressurizes the bearing cavity containing No. 3 and No. 4 bearings. Some of this air is also provided for cooling each face of the compressor and power turbines.

124. **Air Bleeds.** P3 air is tapped off at the compressor discharge ring and is used to provide hot air to the cabin heating system. P3 air is also used for the FCU servo control air system.

125. **Compressor Bleed Valve.** The compressor bleed valve automatically opens a port in the gas generator case to spill interstage compressor air (P2.5) and return it to the compressor inlet, thereby providing anti-stall or surging protection at low engine speeds (less than 80% Ng). The port closes gradually as higher engine speeds are attained.

126. **Air Intake System.** (Ref. Fig. 1-6). Engine air enters the air inlet on the bottom front cowling and is directed by two intake ducts to the compressor air intake screen. A bulkhead aligned with the engine frame forms the rear wall of the engine air intake compartment.

127. **Engine Cooling.** Cooling air enters the forward cowling gap aft of the propeller spinner, flows through the engine hot zone and finally exhausts through the openings around the engine exhaust pipes. The engine cold zone, aft of the engine air intake compartment bulkhead, is ventilated by ram air entering the scoop on the top of the cowling plate. The air flows through the compartment and exhausts through slots in the circular access cover located on the underside of forward fuselage section.

Ignition System

128. **Introduction.** The ignition system is an igniter type system employing two igniter units, at 5 and 7 o'clock positions, on the gas generator case. Two switches located in the cockpit facilitate system operation. The igniter selector is located on the extreme left of the instrument panel, above the instrument light dimmer switch. Provision is made for use of left or right igniters for ground starting and for use of both igniters for air starting.

Note

For ground starts alternate use of the left or right igniters is recommended. However, for all air starts, both igniters should be selected.

The ignition switch provides ON-OFF control of the ignition system and is located in the No. 2 instrument panel, adjacent to the starter switch. The basic system consists of a current regulator unit secured to the accessory gearbox housing, two screened igniter cables and two igniters. The current regulator unit contains four ballast tubes parallel-connected in pairs through the selector switch. Each tube comprises a pure iron filament surrounded by helium and hydrogen gases and is enclosed in a glass envelope sealed to an octal base. The iron filament, having a positive co-efficient of resistance, provides a stabilizing effect on the current passing through it. At low temperatures, ballast tube resistance is decreased to counteract power loss. At increased temperatures, resistance increases to maintain nearly constant igniter current. The ballast tubes provide an initial current surge for fast light-ups and thereafter maintain a constant flow to the igniters.

129. **Igniters.** The igniters, each of which is wired in series with a ballast tube consisting of a helical heating element, are fitted into a conventional type plug body. The igniters operate at approximately 2400°F (1316°C).

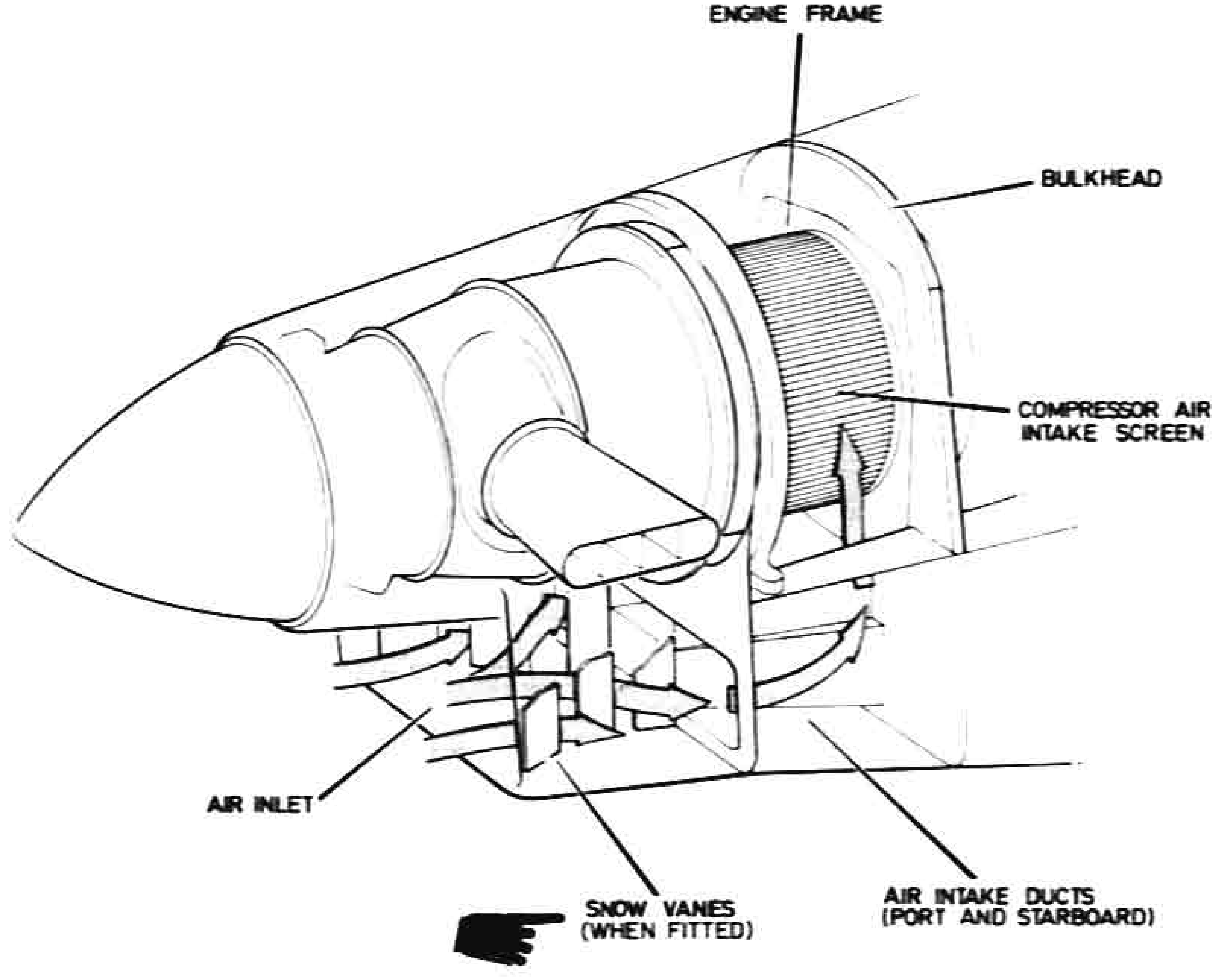


Fig. 1-6 Engine Air Intake

Starter/Generator

130. Introduction.

CAUTION

> The starter switch should not be operated for more than 25 secs at any one start, otherwise the starter may be damaged by excessive temperatures caused by the large starting currents.
>
> The power supply for starter operation should first be disconnected before connecting the generator to the load busbar.
>
> The starter should be allowed to cool for a minimum period of one minute before attempting a second start. Following three consecutive aborted starts, allow the starter to cool for a period of not less than 30 minutes before restarting.

The starter/generator is a combined unit designed to provide torque for engine starting and to generate DC power. It is mounted on the accessory gearbox case at the rear of the engine. The starter/generator is a self-excited unit incorporating four main poles and four interpoles and controlled by a starter switch located next to the ignition switch on the No. 2 instrument panel. An integral fan is also provided for cooling purposes, during all rated conditions of operation. As an engine starter, the unit can be energised either by the aircraft battery or from a ground power unit. As a generator, the unit provides 30V DC 200A to the aircraft main electrical busbar when driven within a speed range of 7200 to 12000 RPM. A voltage regulator is connected across the generator and regulates the generator output to 28V and maintains system voltage constant, when the generator is operating within its normal range and RPM. A reverse current relay automatically disconnects the generator from the load busbar when the generator voltage drops below that of the main busbar. This prevents damage to the generator which could be caused by the battery discharging back through the windings. Conversely, the reverse current relay connects the generator circuit to the battery circuit when

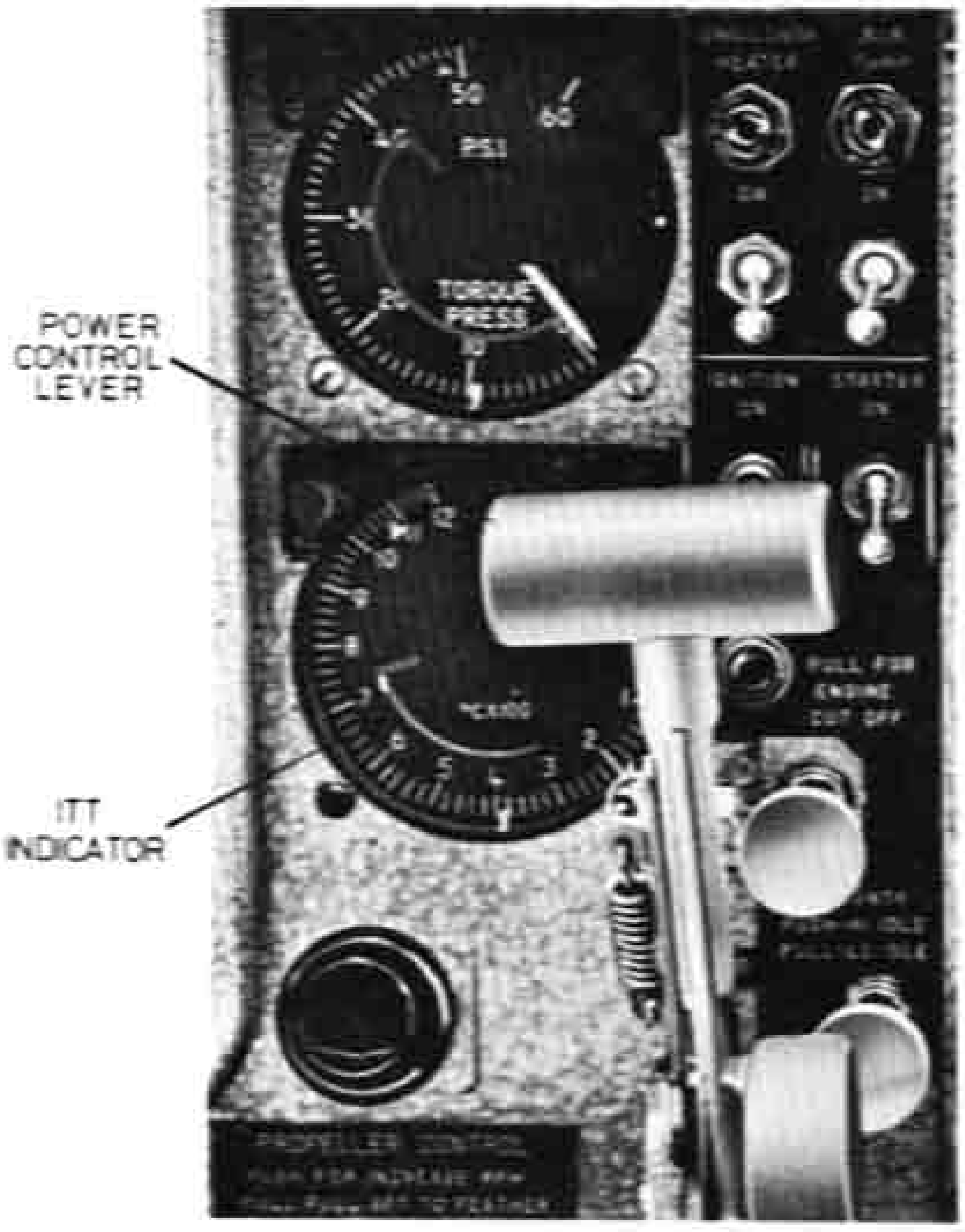


Fig. 1-7 Engine Controls

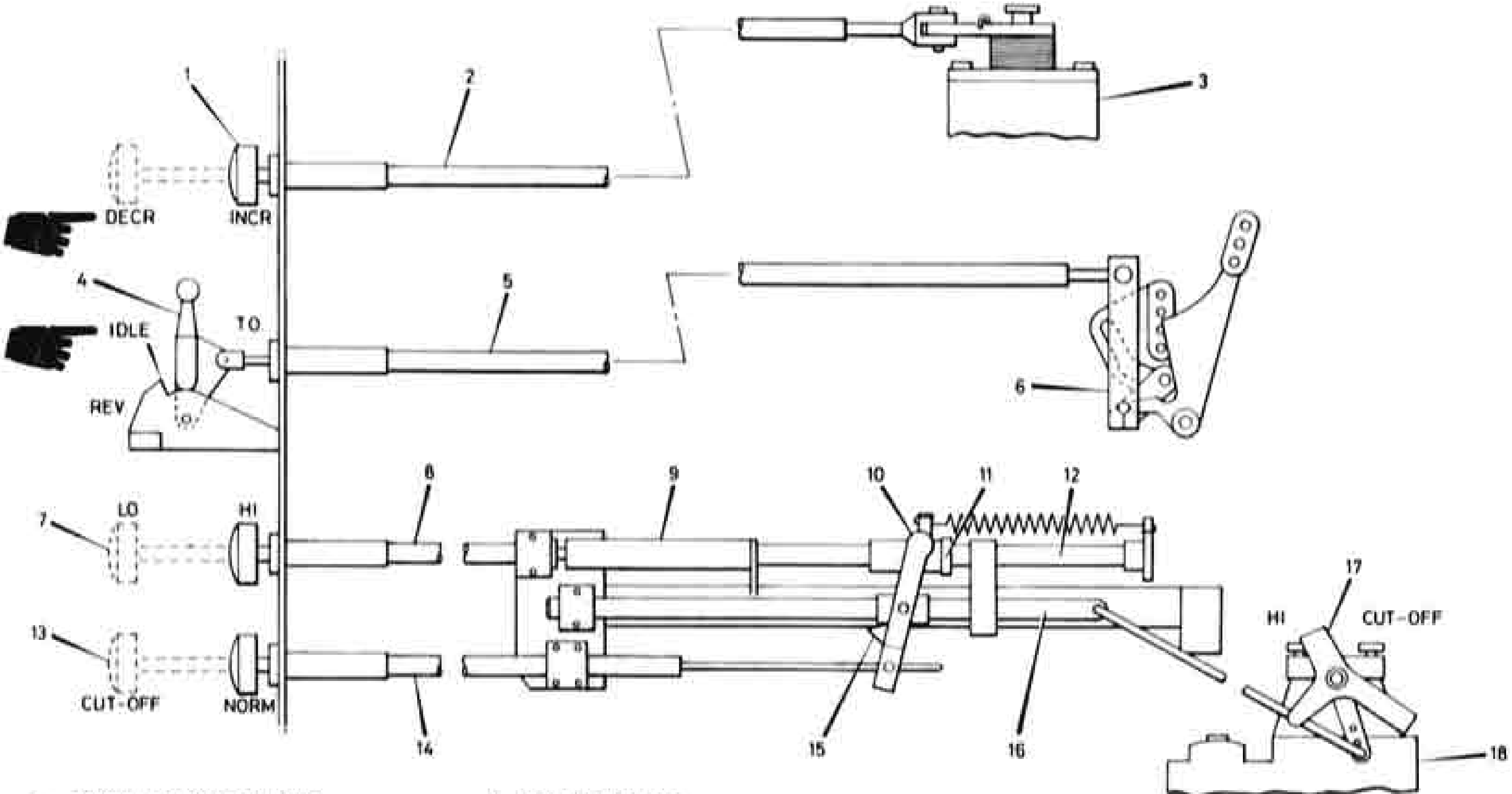
the generator output is 0.4V higher than either the battery or main busbar voltage.

131. Generator Warning. A red warning light on No. 4 instrument panel illuminates whenever the generator fails or becomes disconnected from the load busbar. This light also illuminates whenever external power or battery power is applied to the system and power is not being provided by the generator.

132. Generator Switch. With the engine running and the generator switch in the ON (up) position the generator supplies DC power to the electrical system and maintains battery charging.

Engine Control System (Ref. Figs. 1-7, 1-8)

133. Introduction. In the PT6A-20 engine installation the power control lever is the primary means of



1 PROPELLER CONTROL KNOB
2 TELEFLEX CABLE
3 PROPELLER GOVERNOR
4 POWER CONTROL LEVER
5 TELEFLEX CABLE
6 POWER CONTROL LINKAGE
7 IDLE CONTROL KNOB
8 TELEFLEX CABLE
9 IDLE CONTROL / CUT-OFF CONTROL TRANSMISSION
10 FORK SHAPED LEVER
11 SHOULDER
12 ROD
13 FUEL CUT-OFF CONTROL KNOB (H.P COCK)
14 TELEFLEX CABLE
15 TRIANGULAR STOP
16 ROD
17 LEVER
18 FUEL CONTROL UNIT (FCU)

FIG.1-8 ENGINE CONTROL SYSTEM - SCHEMATIC controlling engine power and (see Para 143) propeller blade angle.

134. **Power Control Lever**. The power control lever enables the pilot to vary engine power from reverse to take-off thrust. It is mounted in a quadrant at the base of No. 2 instrument panel. The power control lever is connected to two cams; one connects to the propeller reversing lever and the other to the gas generator governor speed scheduling lever. As the power control lever is moved forward from the detent, it progressively increases the tension on the gas generator governor spring, causing the governor to reset at a higher Ng. Forward movement of the power control lever causes Ng to increase from 50.6% Ng to 100% Ng at full travel. When the power control lever is lifted and moved aft of the detent a small cam causes the gas generator governor to be progressively reset from 50.6% Ng to 95% Ng. This provides power for reverse pitch.

135. **Idle Control Knob**. The idle control knob is mounted on No. 2 panel to the right of the power lever. The idle control facilitates engine starting and provides a reduction in noise levels during ground operation. This is accomplished by pulling the idle control knob from HI IDLE (75% min - 80% max Ng) to LO IDLE (50% min Ng). During approaches, HI IDLE should be selected to ensure sufficient acceleration for reverse and go-around (if necessary). The idle control is also interconnected with the HP cock and operates a linkage which selects two minimum settings of the gas generator governor.

a. ***LO IDLE - Minimum 50% Ng***. In this setting the power control lever has control of gas generator RPM through its complete range.

b. ***HI IDLE - Minimum 75% Maximum 80% Ng***. The power control lever controls the gas generator above the Hi Idle setting of 75%-80% only. For rapid acceleration HI IDLE must be selected.

136. **Fuel Cut-off Control (HP Cock)**. The fuel cut-off control is mounted on No. 2 instrument panel above the idle control knob and labelled ENGINE CUT-OFF. The cut-off control is connected through the idle control/cut-off transmission linkage to the cut-off valve of the FCU. When the cut-off control is pulled out, the valve plunger closes off an orifice, thereby preventing fuel from passing to the fuel nozzles. Fuel flow is restored when the cut-off control is pushed in to the full ON position.

Engine Instruments (Ref. Fig. 1-4)

137. **Gas Generator/Power Turbine Tachometers**. Two tachometers are fitted in the No. 2 instrument panel. Both units have their own generators and are not dependent on the power supply from the main busbar or the battery. The left hand tachometer indicates propeller RPM (Np) and the right hand tachometer indicates gas generator RPM (Ng). Scale range on both instruments is from 0 to 110 with an instrument tolerance of 0.5%. The larger pointer reads whole percentages of maximum revs and the sub-scale is a vernier scale reading units. An indication of 100 on the propeller tachometer represents a propeller speed (Np) of 2200 RPM and an indication of 100 on the gas generator tachometer represents a gas generator speed of 37500 RPM. Each tachometer is a hermetically sealed unit and consists of a synchronous motor, with magnetic coupling to the pointer, driven by the three phase supply from the tachometer generator. The generator for the propeller tachometer is mounted with the power turbine governor and the generator for the gas generator tachometer is mounted on the accessory gearbox housing.

138. **Torque Pressure Indicator**. A hermetically sealed torque pressure indicator, located on the No. 2 instrument panel, provides an accurate indication of engine power output. The indicator is graduated from 0-60 psi. The torque sensing system utilises a hydro-mechanical torquemeter integral with the first stage propeller reduction gear housing. The pressure produced by the torquemeter is balanced against the reduction gearbox static pressure to obtain a differential pressure which is proportional to the torque produced by the power turbine. Both the torquemeter pressure and the reduction gearbox static pressure are routed to a transducer which feeds an electrical signal, proportional to the torque produced by the engine, to the torque pressure indicator. A static inverter provides the 26V AC 400 Hz supply required to operate the transducer. The torque sensing system is protected by the ½A CB marked TORQUE XFMR on the auxiliary CB panel.

Note

Torque pressure is a function of ambient temperature and pressure and, as a result, decreases proportionally with increased temperatures and/or high density altitudes.

139. Inter-Turbine Temperature Indicator (ITT). This indicator is located below the torque pressure indicator and provides the pilot with an accurate indication of engine operating temperatures at a point between the compressor and power turbines. The ITT indicator is graduated from 0° - 1200°C. Temperature readings are obtained from ten individual thermocouple probes connected in parallel. Each probe protrudes through a threaded boss on the power turbine stator housing into an area near the leading edge of the power turbine vanes. Screened leads connect each probe assembly to an external electrical connector from which connections are made to the ITT indicator in the cockpit. The probes may be removed and replaced individually.

Note

For engine operating temperature limits, reference should be made to Section 5 of this Flight Manual.

The engine temperature sensing system is independent of power from the aircraft main supply.

140. Oil Pressure and Temperature Indicators. These indicators are located in the engine instrument triplex indicator. The oil temperature indicator is an electrically operated measuring instrument, utilizing a Wheatstone Bridge circuit, the variable resistance being inside a temperature bulb. The indicator is operated by the 28V DC electrical system and is protected by a 5A circuit breaker, labelled ENGINE INSTR., which is located on the auxiliary circuit breaker panel. The oil pressure indicator is of the bourdon tube type actuated system. The pressure is picked up downstream of the engine driven oil pump. The normal oil pressure range is 65 to 85 psi. The minimum oil pressure at idle is 40 psi.

PROPELLER AND PROPELLER CONTROL SYSTEM

141. Introduction. A single-acting hydraulic, reversing propeller, controlled by a constant speed unit (CSU), is used. An overspeed governor is provided as a safety device. A propeller control knob and the power control lever provide control of the propeller.

142. Propeller. The propeller is a three bladed HARTZELL HC-B3TN-3C of 8 ft. 5 in. diameter. The propeller hub is hollow and houses the oil servo system which changes the pitch of the propeller blades. The propeller blade angles, taken at the 30 in. station marked on each blade, are:

Feather	+86°
Fine	+9°30′
Min. (Beta range)	-0°30′
Max. Reverse	-10°30′

143. Propeller Control System.

CAUTION

When propeller governing speed below 75% is selected, feathering may result, evidenced by abrupt decrease in RPM and increase in torque. If this occurs, selection to higher RPM quickly restores propeller governing. The gas generator continues to operate even if feathering has occurred.

Do not deliberately feather at high power settings, (more than 15 psi torque), as transient over-torqueing of the engine may occur.

The propeller control is a push-pull cable control, with a push-to-release button in the knob, located at the bottom of No. 2 instrument panel. Fore and aft movement of the propeller control provides adjustment to the CSU to limit the RPM range of the CSU. Vernier adjustment of propeller speed within the constant speed range is obtained by rotating the knob of the propeller control. In the maximum decrease position, the propeller control feathers the propeller. Under normal flight conditions the constant speed unit acts as a governor to regulate the power turbine speed by varying the propeller blade angle. During low airspeed operation the CSU can be used to select the blade angle, the fuel topping governor controlling the power turbine speed (beta control). The propeller blade angle is controlled by oil pressure from the CSU. In the constant speed range, the setting of a slip ring behind the propeller hub determines the fine pitch stop. In the 'beta' control mode, closure of the power control lever resets the fuel topping governor and the position of the slip ring. The fuel topping governor is reset to a 96% speed setting. The repositioning of the slip ring allows the CSU, which senses the underspeed condition, to decrease the blade angle. Thus the setting of the power control lever determines the blade angle. Further closure of the power control lever will decrease the blade angle until maximum reverse blade angle is reached. If the propeller is feathered by operation of the propeller control knob, this releases the oil pressure from the propeller servo system and allows an internal spring in the propeller hub to move the blades to the feather blade angle.

144. **Constant Speed Unit (CSU).** The constant speed unit is mounted at the 12 o'clock position on the reduction gear front case. It is a conventional flyweight governor with a gear type oil pump. The governor controls the oil flow to the propeller servo system. The governor setting is controlled by the propeller control knob. In the event of control linkage failure, a spring attached to the propeller control knob holds the lever in its last selected position, or moves it to a higher speed setting. A high speed stop is adjusted to prevent the lever from travelling beyond the 100% position. Selection of the propeller control knob to the maximum decrease position, raises a pilot valve and the propeller moves to the feathered position. An override rod located inside the pilot valve connects through linkage to the propeller hub slip ring. In the constant speed range, when the blade angle reaches $9^\circ 30'$, the override rod raises the pilot valve and prevents oil flow to the propeller servo system. In the 'beta' control range the override rod is repositioned, allowing oil flow to the propeller until decreased blade angle is reached. The power control lever setting, which repositions the override rod, determines the actual blade angle.

145. **Propeller Overspeed Governor.** The propeller overspeed governor is a conventional flyweight governor with a hollow drive shaft and is installed in parallel with the CSU. It serves as a safety device in the event of a CSU failure. If propeller speed exceeds max. RPM the overspeed governor starts to govern at 103% and governs fully at 104%. The governor is provided with a solenoid valve to facilitate ground checking of the governor.

146. **Propeller Anti-Reversing System.** The propeller anti-reversing system is essentially a fail safe system, designed to prevent the propeller blades from moving to reverse blade angles in flight, through failure of the governing system. The system utilises an electro-mechanical switch, an electrical solenoid valve and a relay. The switch is mounted on the forward end of the engine and is connected to the propeller split ring collar through a bellcrank and actuating rod. The solenoid is integral with the CSU and is normally open during flight. The relay incorporates a solenoid and is connected between the power source and governor solenoid valve. Under normal conditions the relay is biased to the governor solenoid valve and so remains independent of the status of the electro-mechanical switch unless the pilot intentionally selects reverse. A micro-switch, mounted on the power lever quadrant, is in series with the relay and the aircraft busbar. A feedback collar controls blade angle from flight fine pitch ($9^\circ 30'$) to full reverse ($-10^\circ 30'$) and the axial position of the collar is proportional to the blade angle. If under normal flight operation a malfunction of the propeller governing system occurs tending to move the propeller blades towards reverse pitch, movement of the feedback collar beyond a predetermined blade angle ($-0^\circ 30'$) results in the anti-reversing switch actuating the solenoid valve. The solenoid valve blocks off the oil supply to the propeller dome, thereby preventing further decrease of the blade angle. The blade angle at which the solenoid valve is actuated is approximately 0°, but is dependent on the propeller adjustment. A micro-switch mounted on the power lever quadrant actuates the electrical relay, which prevents current from reaching the anti-reversing system whenever the pilot intentionally selects reverse. The propeller anti-reversing system circuitry is powered from the main DC busbar and protected by a 5A circuit breaker, labelled ANTI-REV VALVE, which is located on the main CB panel on No. 4 instrument panel. A red warning light, PROPELLER LOW PITCH WARNING, located on the No. 1 instrument panel, serves to warn the pilot of imminent reverse blade angles.

OIL SYSTEM (Ref. Fig. 1-9)

147. **Introduction.** Oil grades and specifications are shown in the Servicing Diagram, Fig. 1-58. The lubricating system provides a constant supply of clean lubricating oil to the engine, bearings, reduction gears, torquemeter, propeller and all accessory drives. The system also provides cooling to the bearings and conducts any foreign matter to the main oil filter, where it is precluded from further circulation. The major components are a pressure pump, four scavenge pumps, oil cooler, filter and an oil tank. The oil temperature is controlled by a remotely operated flap, which restricts the air flow through the oil cooler.

148. **Oil Tank.** The oil tank is an integral part of the compressor inlet case and is located in front of the accessory gearbox. It has a total capacity of 2.3 US gallons, of which 1.5 US gallons is usable oil. This capacity provides for an expansion space of 0.7 US gallons which is adequate for all normal operating requirements. The oil tank is equipped with an oil filler neck and quantity dip stick which is located on the accessory gear casing at the 11 o'clock position. Markings on the dip stick are in US quarts and indicate

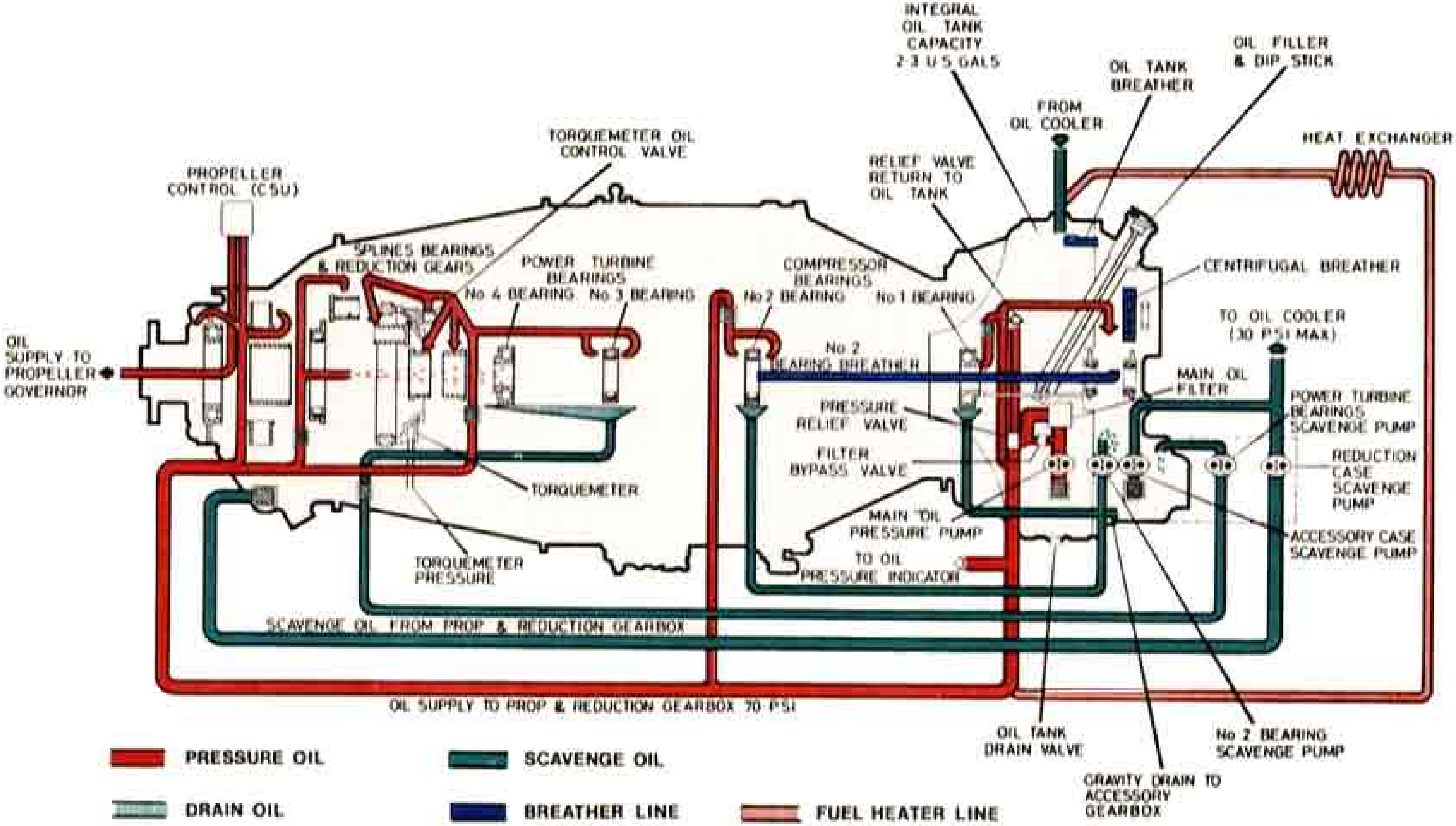


FIG 1-9 OIL SYSTEM - SCHEMATIC

the quantity of oil required to top-up the tank. A drain plug is provided at the bottom of the tank to facilitate oil drainage.

Note

Accurate readings may only be obtained within 30 minutes of shut-down.

149. **Oil Pump.** Pressure oil is circulated from the integral oil tank through the engine lubricating system by a self-contained gear-type pressure pump located in the lowest portion of the tank. The oil pump consists of two gears in a case housing, bolted to the front face of the accessory diaphragm. It is driven by the accessory gearshaft which also drives the internal double element scavenge oil pump. A removable screen is provided at the oil pump outlet. The oil pump body is provided with a check valve which is located at the end of the filter housing. The pressure oil is pumped through this spring loaded check valve into the filter housing.

150. **Oil Filter Assembly.** The oil filter assembly, which is secured in an alloy housing, is located in the compressor inlet case at the 3 o'clock position. It consists of either a disposable cartridge-type filter or an all-metal cleanable element, with a perforated flanged end, spring loaded bypass valve and check valve. Pressure oil flows through the check valve, through the filter and out to the engine, leaving any foreign matter to be deposited on the exterior of the element. The check valve, located in the end of the housing, prevents gravity flow into the engine after shut-down and allows element cleaning without draining the oil tank. A filter bypass valve provides an alternate passage for unfiltered oil flow through the engine in the event of a clogged filter. Engine oil pressure is regulated by a plunger type pressure relief valve, located on the inlet case just above the oil filter assembly. All oil in excess of regulated pressure is bypassed back to the oil tank.

151. **Pressure Oil System.** Lubrication of the accessory drives and bearings is supplied from the oil filter by the use of cored passages and transfer tubes. No. 1 bearing is lubricated by pressure oil through a fine strainer and nozzle in the centre section of the case, behind the bearing. The oil is sprayed by the nozzle into a collector ring, mounted on the end of the compressor hub, and fed through passages in the split inner race to the bearing by centrifugal force. Direct pressure oil supply is provided to the No. 2 bearing, reduction gearbox, front accessories and power turbine shaft bearings. The main pressure oil is delivered at 70 psi to the reduction gearbox where it is divided into three branches. One branch is led to the 1st stage reduction gears, splines, torquemeter, No. 3 and No. 4 bearings. Pressure oil to the torquemeter is fed through a metering valve which controls the flow into the torquemeter chamber. The position of the metering valve is dependent on the torquemeter piston which reacts in direct proportion to engine torque. The oil from the torquemeter is directed via an internal oil transfer tube and strainer in the power turbine support housing, to two demountable oil nozzles. The two oil nozzles are positioned one in front and one in the rear of No. 3 bearing to ensure sufficient cooling and lubrication. Two orifices, one in the No. 4 bearing support and the other in the transfer tube weldment, provide additional lubrication to the first stage sun gear coupling and No. 4 bearing. The second branch delivers oil to the 2nd stage reduction gears and the No. 4 bearing. Oil flow is directed to No. 4 bearing through an oil nozzle secured in the rear of the propeller oil transfer tube. Passages in the split inner races of the bearing line up with a drilled annulus on the power turbine shaft to provide access for centrifugal oil flow into the bearing assembly. The third branch provides oil from the internal annulus through cored passages to the propeller constant speed control unit, the accessory drive gears and the propeller thrust bearing. Oil mist provides lubrication to the 2nd stage carrier bearing.

152. **Scavenge Oil System.** The scavenge oil system includes two double-element scavenge pumps. One pump is located inside the accessory gearbox, the other is mounted externally. Both have separate housings and are driven from the accessory gearshafts. Oil from No. 1 bearing is returned by gravity to the bottom of the compressor inlet case and then, through internal passages both in the oil tank and accessory diaphragm, to the accessory gearbox. No. 2 bearing oil drains into an internal transfer tube leading rearward to the bottom of the oil tank. It is then scavenged via the accessory diaphragm into the accessory gearbox. No. 3 and No. 4 bearing compartment oil is scavenged through an internal transfer tube, then rearward to the front element of the external scavenge pump. This same pump also scavenges any reduction gearbox oil which drains rearward when the aircraft is subjected to extreme climbing attitudes. Scavenge oil from the propeller control, front thrust bearing, reduction gears and torquemeter bleed orifice, drains into the reduction gearbox sump. The oil is then scavenged by the rear element of the external scavenge pump.

153. **Breather System.** Breather air from the engine bearing compartments and accessory gearbox is vented overboard through a centrifugal breather, located in the accessory gearbox. The oil tank, in turn, vents into the accessory gearbox through its anti-overfilling arrangement.

154. **Centrifugal Breather.** The centrifugal breather, mounted on the rear face of the starter/generator gear shaft, consists of a shrouded aluminium alloy impeller. Breather air flows radially inward through the rotating impeller housing, where the oil particles are separated from the air mist by centrifugal force. The oil particles are thrown outward and drain freely to the bottom of the accessory gearbox. Relatively oil free breather air passes forward, through the hollow section of the gearshaft, to a cored passage in the accessory diaphragm. It is then routed via a transfer tube to a breather boss on the rear face of the accessory housing where an overboard vent line is provided.

155. **Oil/Fuel Heat Exchanger.** The heat exchanger, which utilizes engine oil to pre-heat the fuel in the engine system, is located in the accessory gearbox. It is heated by pressure engine oil and maintains the outlet fuel temperature within a 70°F (21°C) to 90°F (32°C) temperature range. A temperature control valve regulates the fuel temperature by either permitting oil flow through the heat core or bypassing it back to the engine oil tank.

156. **Oil Cooler Flap Control.** The oil cooler flap control is the left hand knob of three at the top of No. 4 instrument panel. When pulled out, the control progressively closes a flap under the engine cowling, thus reducing the airflow through the oil cooler and raising the oil temperature.

157. **Oil Replenishment Procedure.** (Ref. Fig. 1-58). The oil tank is integral with the engine compressor inlet. Access is gained by opening the port engine cowl. Total capacity of the oil tank is 2.3 US gallons. Usable oil is 1.5 US gallons.

Note

Oil brands must not be mixed.

1. Open engine cowl and remove oil tank filler cap by lifting centre lug and turning it to unlock.
2. Check quantity of oil to be added.
3. Add required quantity from newly opened can of oil.
4. Replace cap correctly.

Note

Ensure cap is correctly replaced and locked.

Accurate readings may only be obtained within 30 minutes of shut-down, otherwise over-filling may occur.

FUEL SYSTEM (Ref. Figs. 1-10, 1-11)

158. **Introduction.** Fuel grades and specifications are shown in the Servicing Diagram, Fig. 1-58. The fuel system is a gravity flow system with an engine driven pump to ensure sufficient fuel pressure at all times. A booster pump is also provided to maintain pressure during start-up, take-off, landing, unusual attitudes and shutdown.

159. **Operation.** One integral fuel tank is located in each wing in the area enclosed by the main and auxiliary spars and ribs 1 and 6 for aircraft with serial numbers A14-701 and below, and ribs 1 and 7 for aircraft with serial numbers A14-702 and above. Fuel from the tanks is fed into the top of the collector box, located behind the cabin rear bulkhead. A second outlet from each tank feeds into a water drain tank which is connected to, and mounted to the left and below, the fuel collector box. A spring loaded drain cock, accessible from the exterior of the aircraft through a small opening in the underside of the port fuselage, is fitted to the water drain tank. The fuel collector box houses an electrically driven booster pump which is operated by a switch located on No. 2 instrument panel, above the ignition switches. This booster pump remains on at all times during flight. The booster pump is also provided with a drain line to drain the fuel in the event of a pump seal failure. From the collector box, the fuel is fed via a two position ON/OFF cock (LP cock) and a paper element fuel filter and fuel flow transmitter, to the engine driven pump. The 74-micron fuel filter is provided with a bypass valve, set at nominal 2.5 psi cracking pressure, to ensure fuel flow in the event of a clogged filter element. If the filter element becomes clogged, an electrical switch in the filter closes and a red warning light marked CLOGGED FUEL FILTER, located on No. 2 instrument panel, lights. The filter is also equipped with manually operated breather and drain cocks. In the event of a clogged fuel filter or a booster pump malfunction during extreme climb attitudes of the aircraft, the engine driven pump ensures sufficient fuel pressure by drawing fuel from

the collector box. Before entering the FCU, the fuel is passed from the engine driven pump through the oil/fuel heat exchanger, which maintains the fuel temperature between 70°F (21°C) and 90°F (32°C) to prevent ice formation. FCU icing protection is also afforded by the fuel control senseline anti-icing system (Ref ANTI-ICING and DE-ICING SYSTEMS Para 1141).

160. Low Pressure Fuel Cock. The low pressure fuel cock is a rotary type two position selector. It is mounted on the firewall on the port side and is operated by an extension arm and handle in the cockpit adjacent to the pilots left knee. When the pointer is in the vertical position the fuel is OFF.

161. High Pressure Cock. The high pressure cock is an integral part of the FCU. It is operated by a push-pull control on the No. 2 instrument panel and is located directly below the red CLOGGED FUEL FILTER warning light. The cock is also provided with a locking device.

162. Fuel Tanks.

CAUTION

If vents become blocked, flow from either tank may be prevented. During flight, quantity indicators must be checked to ensure that both tanks are feeding.

For aircraft prior to A14-702 each tank has an individual usable capacity of 422 lbs (64 US Gals) and for aircraft A14-702 and subsequent each tank has an individual usable capacity of 561 lbs (85 US Gals). Fuel is taken from each tank by means of two supply lines, one connected near the front of the tank and the other at the rear, providing an uninterrupted flow under all flight conditions and leaving practically no unusable fuel. The inboard section of the tanks is vented to a common vent outlet on the top of the fuselage. The outboard section of each tank is vented through a short pipe combined with a float valve to prevent fuel loss due to centrifugal or gravitational forces.

CAUTION

In aircraft fitted with reticulated foam tank baffles (Porter Mod 19) a total of 30 lb and 45 lb respectively has been displaced from the small and large tank versions respectively.

163. Fuel System Water Drain. A second fuel line from the front inboard corner of each fuel tank connects through a common line to a water drain tank, which is mounted to the left of, and under the fuel collector box. The collector box and drain tank are interconnected. A spring loaded drain cock, accessible through a small opening in the port underside of the fuselage, is provided to the drain tank.

164. Fuelling Procedure.

WARNING

Ensure electrical power is switched off.

CAUTION

Ensure sufficient fire extinguishers are available and all fire precautions are observed.

Note

The two tanks are interconnected by a common line and some difference in level may occur by fuel transferring itself from one tank to another. Because transference occurs very slowly, each tank must be filled individually to ensure proper filling.

1. Bond aircraft to ground and to refuelling tanker.
2. Remove filler cap by lifting central hinged plate and rotating it.
3. Bond refuelling hose to bonding point next to filler cap.
4. Add fuel as required.
5. Check fuel quantity with fuel dip stick.

Note

The fuel dip stick is graduated in pounds and is located on the fuselage bulkhead to the right of the co-pilots seat.

6. Replace fuel tank caps and lock by rotating central part and pushing it flush with cap.

Note

Cap will lock in any position.

7. Remove bonding wires.
8. Adjust fuel totalizer to read correct quantity of fuel in tanks.
9. After approximately one hour, drain the water at drain point. (Port underside of fuselage).

1. Fuel On/Off L.P. Cock
2. Circuit Breaker Fuel Indicator
3. Circuit Breaker Fuel Flowmeter
4. Totalizer/Fuel Flowmeter
5. Fuel Filter Clogged Warning Light
6. High Pressure Cock
7. Booster Pump Switch
8. Booster Pump Light
9. Fuel Pressure Indicator
10. Fuel Quantity Indicator - Port
11. Fuel Quantity Indicator - Starboard
12. Float Valve
13. Fuel Tank Filler Cap
14. Vent Line
15. Vent Mast
16. Fuel Quantity Transmitter
17. Rear Supply Line
18. Fuel Collector Box
19. Booster Pump
20. Water Drain Tank
21. Spring Loaded Drain Cock
22. Pump Seal Drain Line
23. Fuel Filter (With Bypass Valve)
24. Engine Driven Fuel Pump
25. Oil/Fuel Heat Exchanger
26. Fuel Pressure Line
27. Front Supply Line
28. Fuel Tanks

Key to Fig. 1-10 Fuel System Controls and Plumbing

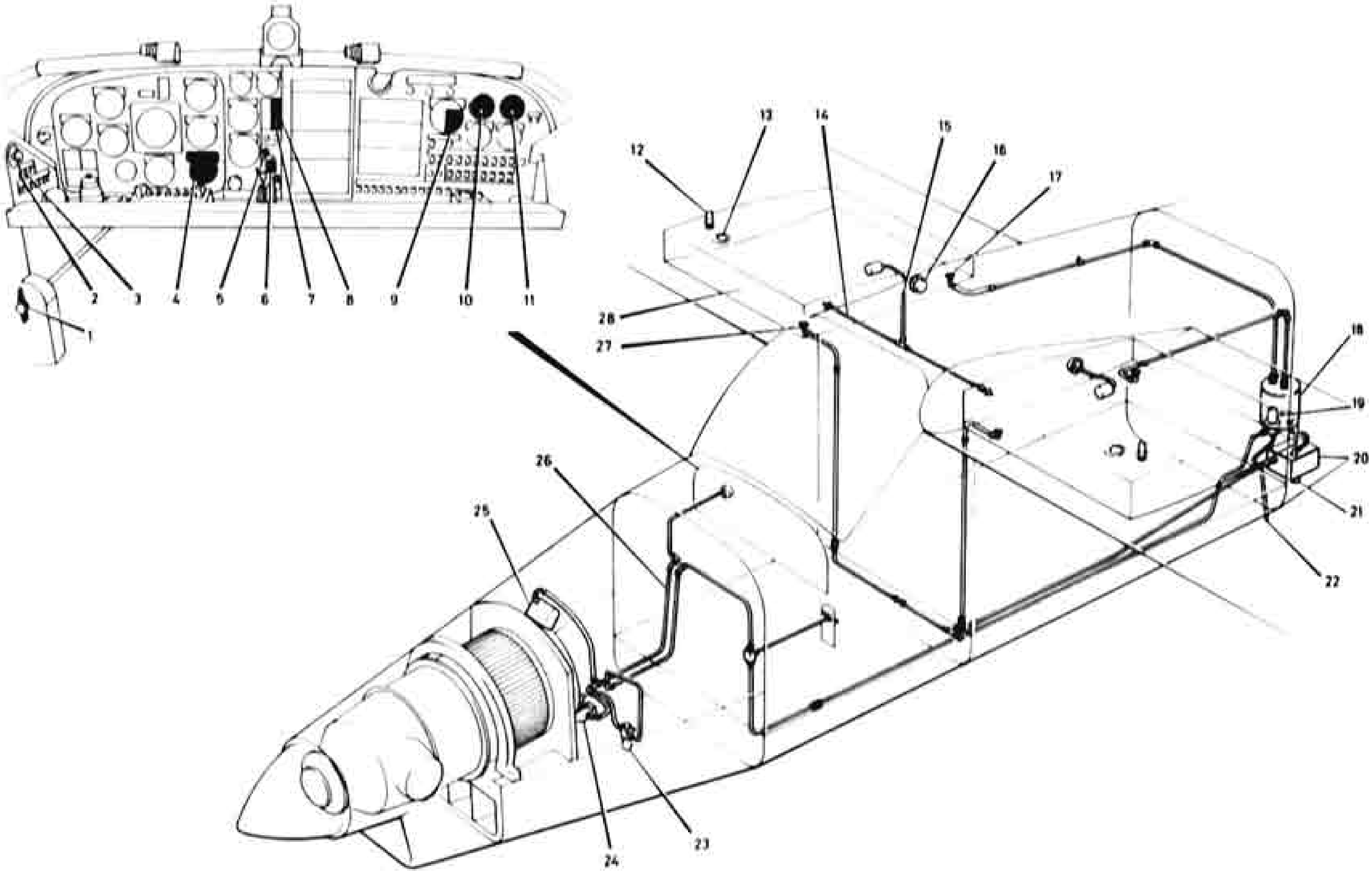


FIG. 1-10 FUEL SYSTEM CONTROLS AND PLUMBING

165. Fuel Starvation - Prolonged Parking in a Wing-Low Attitude.

WARNING

When the aircraft is parked for prolonged periods in a wing-low attitude, fuel in the tank of the higher wing slowly flows to the tank in the lower wing. Should the total amount be less than one fourth of the total capacity of the tanks, and the incline great enough, fuel collects in the outboard portion of the lower tank, free of the outlets to the fuel feeder lines. When such a condition exists, the only usable fuel remaining in the system is that which is trapped in the fuel lines and collector tank. If the engine is started, and run on the trapped fuel, without change of attitude to allow fuel flow to the feeder lines, fuel starvation will occur as soon as the trapped fuel is used up. Under such parking conditions, the aircraft is to be turned to create a wing level attitude. Time is to be allowed for fuel redistribution in the tanks before starting the engine.

166. Fuel Quantity Indicator. A float-actuated fuel quantity transmitter is mounted on the inboard rib of

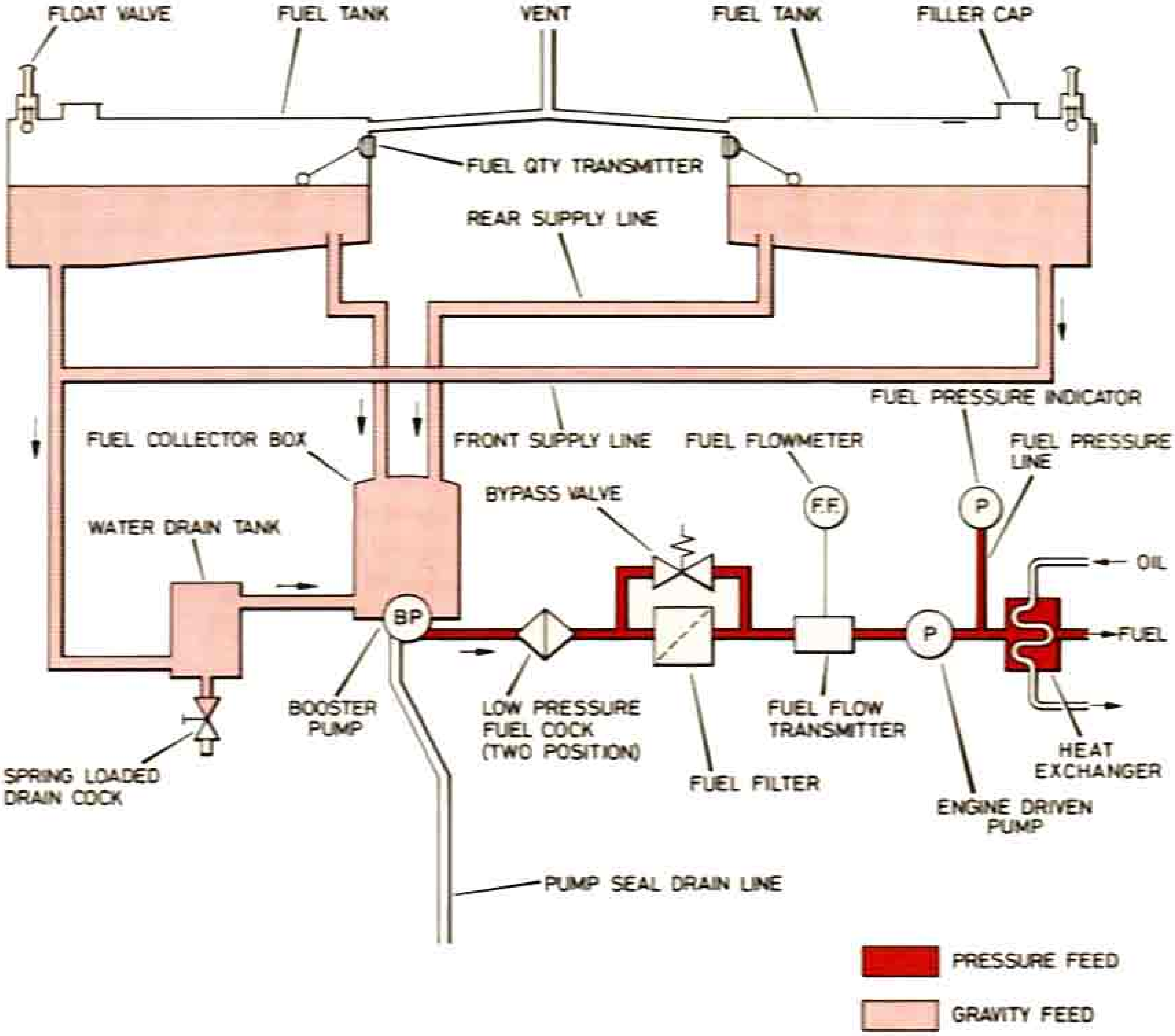


Fig. 1-11 Fuel System Schematic

each tank. Each transmitter is connected to its respective fuel quantity indicator mounted on No. 4 instrument panel and varies the voltage to the indicating system proportionally to the fuel quantity in its associated tank. The fuel quantity indicators are graduated in pounds. The system uses the 28V DC supply and is protected by a 3A CB, labelled FUEL INDIC, located on the auxiliary CB panel.

167. **Totalizer and Fuel Flow Indicator**. Fuel flow is measured by an electrical fuel flow transmitter downstream of the fuel filter. The signal from the transmitter is used to drive the totalizer and fuel flow indicator which is a combined instrument and is located on the lower right hand side of No. 1 instrument panel. The flowmeter indicates fuel flow in pounds per hour and the fuel totalizer indicates pounds of fuel remaining, by the use of a conventional four digit indicator. Electrical power to the instrument is provided by 28V DC. Circuit protection is provided by a 3A CB, labelled FLOWMETER, located on the auxiliary CB panel. The system comprises three parts:

a. Transmitter Type 1024G.

b. Electronic Relay Type AT1.256BG

c. Indicator Type 662TG

168. **Resetting the Totalizer**

CAUTION

Do not reset the indicator by means of the reset knob whilst running the engine.

Reset the indicator to tank fuel contents on completion of refuelling operations.

Note

For setting of Totalizer while using Emergency Fuels: See Appendix 1 Performance Data.

169. **Fuel Pressure Indicator**. The fuel pressure indicator is operated by pressure supplied from the engine driven pump, or prior to start from the pressure supplied from the auxiliary boost pump. The fuel pressure indicator is located in the engine instrument triplex indicator on No. 4 instrument panel. Minimum pressure for starting is 20 psi.

ELECTRICAL SYSTEM (Ref. Figs. 1-12, 1-13)

170. **Introduction**. The electrical system of the aircraft is single pole, negative earth type, and the complete aircraft is bonded for continuity. A 28V generator provides primary DC power for the system and a 24V battery provides secondary DC power. The generator acts as the engine starter until the engine reaches self-sustaining RPM. The AC power is provided from two DC driven, single phase AC static inverters. Both DC and AC power is supplied to busbars for power distribution in the aircraft.

171. **AC Power System**. The main components included in the AC system are:

a. Static Inverter, Model PC14A.

b. Static Inverter, Model PC15A.

c. Phase Adaptor 115V AC, 400 Hz, 3 phase, used in conjunction with Static Inverter, Model PC14A only.

d. Associated input and output protective circuit breakers located on the auxiliary circuit breaker panel.

172. **Static Inverter PC14A**. The inverter PC14A is a fully transistorized type static inverter, with a rated output of 115V AC, 400 Hz, 60 VA. The inverter provides a 115V, 400 Hz, 3 phase supply to the attitude indicator via the phase adaptor and a 26V, 400 Hz, single phase AC supply, through an auto-transformer, to the torquemeter.

173. **Static Inverter PC15A**. The PC15A inverter is a fully transistorized type static inverter, and its rated output is 26/115V AC, 400 Hz, 250 VA, single phase. The 26V AC output is supplied to the following items of equipment:

a. UHF Homing.

b. C14 Gyrosyn Compass.

c. Deviation Indicator.

d. ADF.

The 115V AC output is supplied to the following items of equipment:

a. UHF Homing.

b. C14 Gyrosyn Compass.

174. **DC Power System**. The starter/generator is the primary source of electrical power. A secondary power source for supplying initial power to start the engine is provided by a battery which also provides limited power to operate the electrical system in the event of generator failure. An external power receptacle is provided for ground operation of the aircraft electrical equipment when using a ground power supply unit. A generator ON/OFF switch is located on No. 4 instrument panel and the power source selector switch,

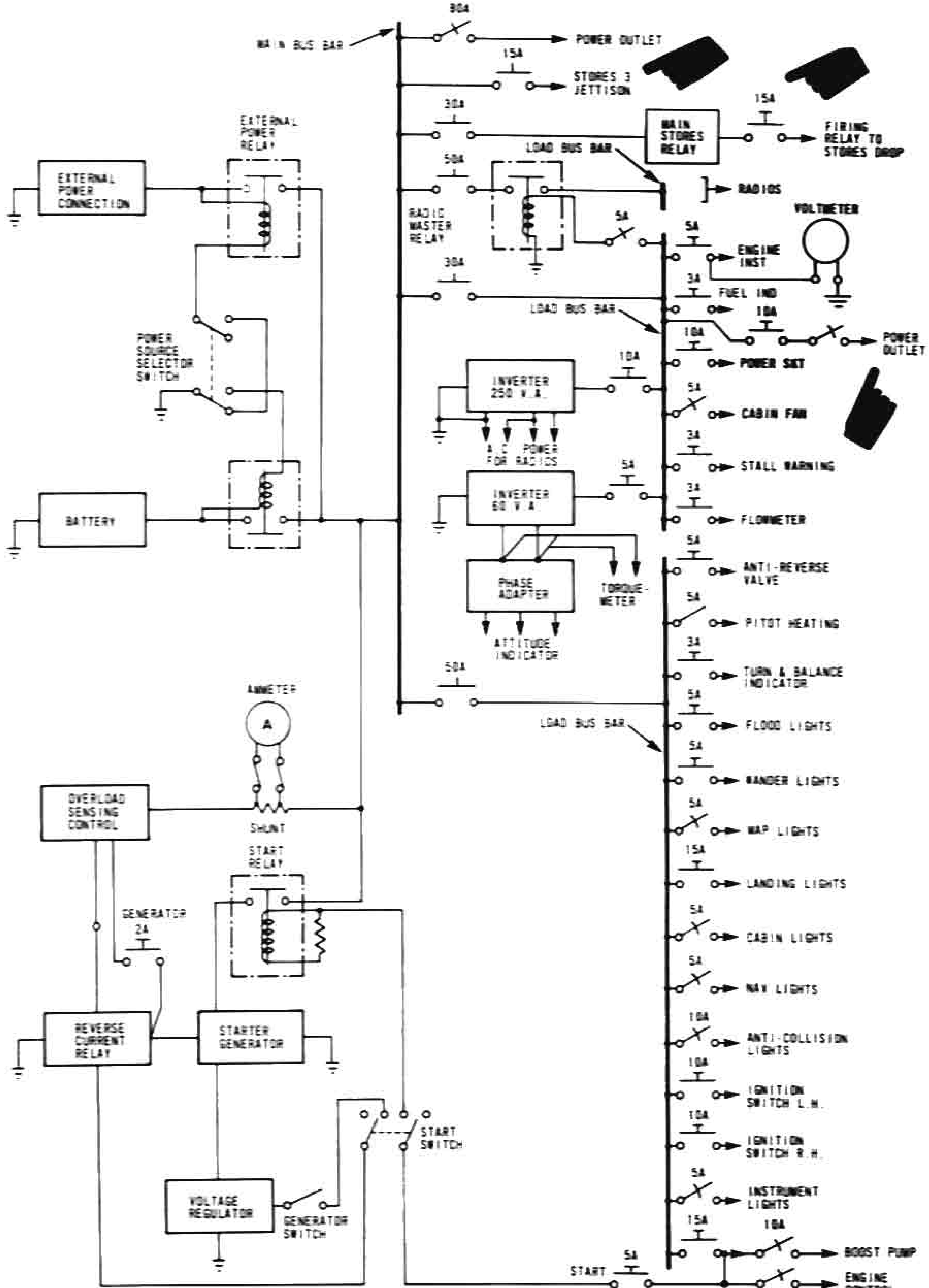


FIG 1-12 ELECTRICAL SYSTEM - SCHEMATIC

also located on No. 4 instrument panel, enables battery or external power to be selected. A warning light, marked GENERATOR PLT LIGHT and located on No. 4 instrument panel, illuminates whenever battery power or external power is supplied to the electrical system and power is not being provided by the generator. The battery charge or discharge level is indicated by an ammeter and the main busbar voltage is indicated by a voltmeter. Both the ammeter and voltmeter are mounted in No. 4 instrument panel. When the ammeter indicates that the generator is charging the battery, the voltmeter should give a reading between 27 and 28V.

Note

Whenever external power is applied, the power source selector switch is to be set to EXT POW.

The battery is a 19 cell nickel cadmium type and the charging voltage should not exceed 28V. Charging voltages in excess of 28V will cause battery overheating and subsequently render it irreparable.

175. **Power Source Selector Switch**. The power source selector is a three-position switch located on No. 4 instrument panel. The three positions are OFF, EXT POW and BTRY. With the switch selected to OFF, power supplies are not available within the aircraft. When the switch is positioned at EXT POW, the external power solenoid is energised and the engine can be started from a ground power supply unit, which also provides a supply for the electrical services in the aircraft. If the switch is set to BTRY, the battery power relay solenoid is energised and the engine can be started by the battery. In addition, the electrical services in the aircraft can be operated from the battery.

Note

Operation of the power source selector switch has no effect on generator supplies. Switching of generator supplies is achieved by operation of a separate switch.

As the battery is a secondary and emergency source of power, a fully charged state is desirable at all times. Whenever possible, in order to conserve the battery, external power is to be used for aircraft starting and ground operation of aircraft electrical systems.

176. **Generator Selector Switch.** The generator selector switch is located on No. 4 instrument panel near the power source selector switch. With the engine running and the generator selector switch selected to ON, generator power is connected to the electrical system and maintains a charge to the battery. When the generator selector switch is moved to OFF, the generator field is open circuited, causing a voltage drop and actuating the reverse current relay. The generator circuit is protected by the CB, marked GENERATOR CIRCUIT BREAKER, located on the main CB panel.

177. **Reverse Current Relay.** The reverse current relay is used to automatically disconnect the generator from the load busbar when generator voltage drops below that of the main busbar. This prevents damage to the generator and prevents the battery discharging back through the generator windings. In addition, the reverse current relay connects the generator circuit to the battery circuit when the generator output is 0.4V higher than the battery or main busbar voltage.

178. **Pilot Light.** A red warning light on No. 4 instrument panel (GENERATOR PLT LIGHT) illuminates whenever the generator fails or becomes disconnected from the load busbar i.e. when the generator voltage drops below that of the battery and/or main busbar voltage. The warning light also illuminates whenever external power or battery power is applied to the system and power is not being provided by the generator.

179. **Busbar.** The busbar is a distribution point and supplies power to the electrical systems through switches and circuit breakers. Power is supplied to the busbar in three ways:

a. external power through the external power relay (operated by power source selector switch),

b. battery power through the battery relay (operated by power source selector switch) and

c. generator power through the reverse current relay.

180. **Instrument and Cabin Lights.** (Ref. Fig. 1-14). The interior lights include one overhead light in the cabin and one in the cockpit, two floodlights mounted above the crew doors, two map lights mounted on the windscreen demister tube and one wandering lead light fitted to the console between the two pilots' seats. Instruments are equipped with integral eyebrow or post lights. The intensity of the instrument lights can

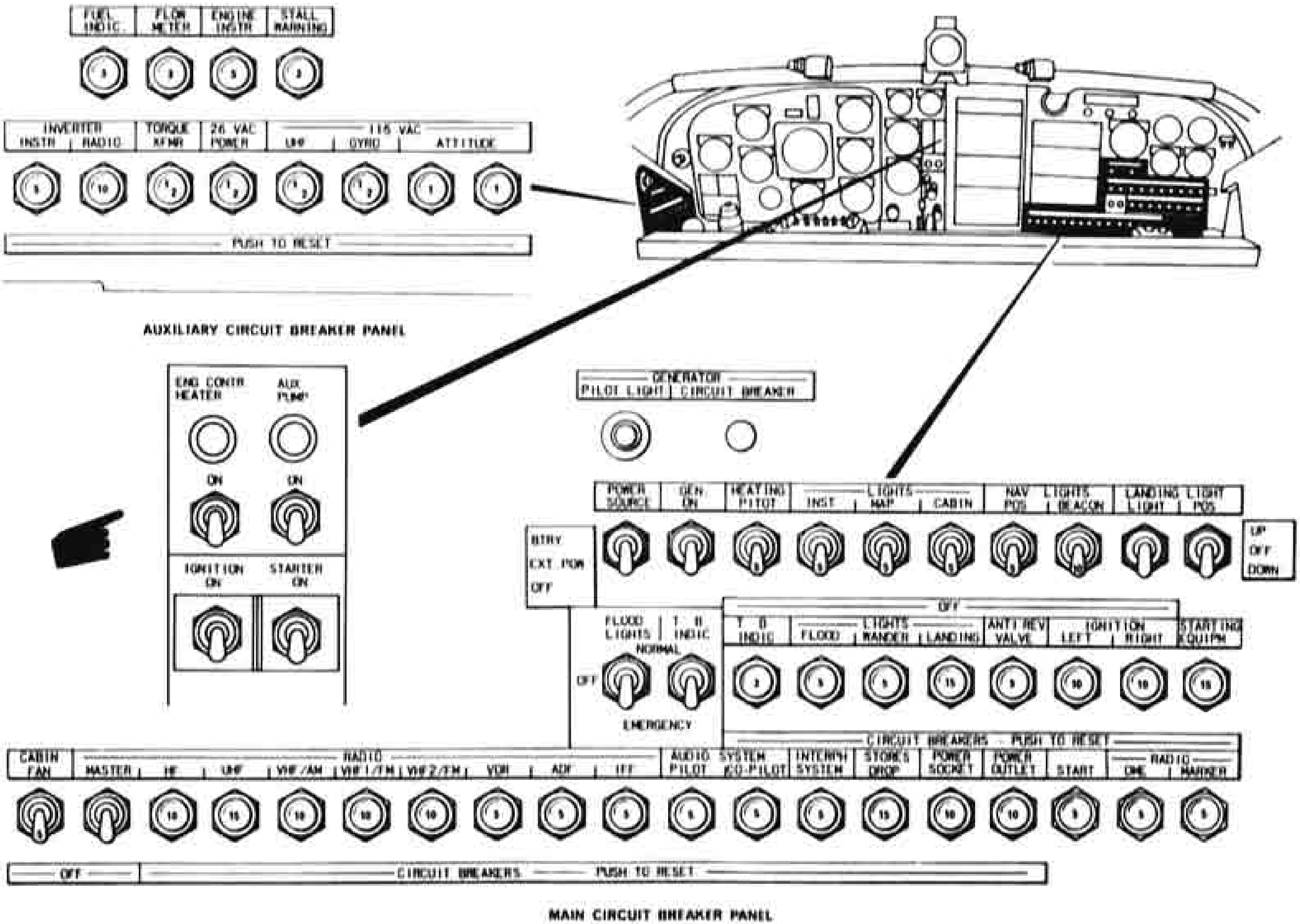


FIG 1-13 CIRCUIT BREAKER PANELS

MAIN CB PANEL

Gen CB – amp CB – When pulled, no output from generator.
Pitot heat – 5 amp switch CB – When in off pos, no pitot heat.
Lights, Insts – 5 amp switch CB – When in off pos, no inst lights or radio lights.
Lights, Map – 5 amp switch CB – When in off pos, no map lights.
Lights, Cabin – 5 amp switch CB – When in off pos, no cabin lights.
Nav Lts, position – 5 amp switch CB – When in off pos, no nav lights.
Nav Lts beacon – 10 amp switch CB – When in off pos, no beacons.
T & B – 3 amp CB – When pulled, no normal operation of T & B indicator.
Lights, Flood – 5 amp CB – When pulled, no normal operation of flood lights.
Lights, Wander – 5 amp CB – When pulled, no operation of wander light.
Lights, Landing – 15 amp CB – When pulled, no operation of landing light.
Anti-Rev – 5 amp CB – When pulled, no normal operation of Prop Low Pitch Warning Light, no operation of Anti-reverse valve.

Ignition Left – 10 amp CB – When pulled, no operation of left glow plug.
Ignition Right – 10 amp CB – When pulled, no operation of right glow plug.
Start Equip – 15 amp CB – When pulled, no operation of starter, aux pump and eng control heater.

Cabin Fan – 15 amp CB switch – When in off pos, no operation of cabin fan.
Radio Master – 5 amp CB switch – When in off pos, no operation of HF, UHF, VHF / AM, VHF 1 FM, VHF 2/FM, VOR, ADF, IFF, Audio Syst. Pilot, Audio Syst Co-Pilot and interphone system.

Radio CBs from HF to Interphone – When any of these CBs pulled, only specified system inoperative.

Stores – 15 amp CB – When pulled, no normal operation except Jettison operation.
Power Socket – 10 or 15 amp CB – When pulled, no output from 10 amp power outlet.
Start – 5 amp CB – When pulled, no operation of starter.
Radio DME – 5 amp CB – When pulled, no DME
Radio Marker – 5 amp CB – When pulled, NO MKR.

PORT CB PANEL

Fuel Ind – 3 amp CB – When pulled, no fuel quantity ind.
Flow Meter – 3 amp CB – When pulled, no fuel flow indication.
Eng Inst – 5 amp CB – When pulled, no voltmeter indication, no oil temp . indication, loss of ability to test overspeed governor, no press to test on following lights:
- Prop low pitch warning.
- Fuel filter clogged.
- Aux pump.
- Compass Power Fail.
- Pilot Light generator

Stall Warning – 3 amp CB – When pulled, no stall warning indication, buzzer or light, or press to test.

Inverter Inst – 5 amp CB – When pulled, no torque meter and attitude indicator.
Inverter Radio – 10 amp CB – When pulled whole of RMI system including needles becomes inoperative.
– ADF receiver will still operate but cannot be retuned and reception may be blurred.

Torque XFMR – ½ amp CB – When pulled, no torquemeter indication.
26V AC Pwr – 1½ amp CB – When pulled whole of RMI system including needles becomes inoperative.
– ADF receiver will still operate but cannot be returned and reception may be blurred.
115V AC, UHF – ½ amp CB – When pulled, no UHF.
115V AC, Gyro – ½ amp CB – No Gyrosyn campass.
115 AC, Attitude – two 1 amp CB's – When either or both pulled, no attitude indication.

ENGINE CONTROL CB CENTRE MAIN PANEL

Engine Control Heater – 5 amp switch CB – When in off pos, engine control heater inoperative.
Aux Pump – 10 amp switch CB – When in off pos, no aux pump operation.
Starter – 5 amp switch CB – When in off pos, no starter.

EMERGENCY CB
(on rear firewall lower, engine compartment)

Gen Warn Light – 5 amp cb – When pulled, no normal operation of gen warn light.
Emerg Power – 5 amp CB – No emergency operation of T & B indicator or flood lights.

Fig. 1-13A Circuit Breaker Function

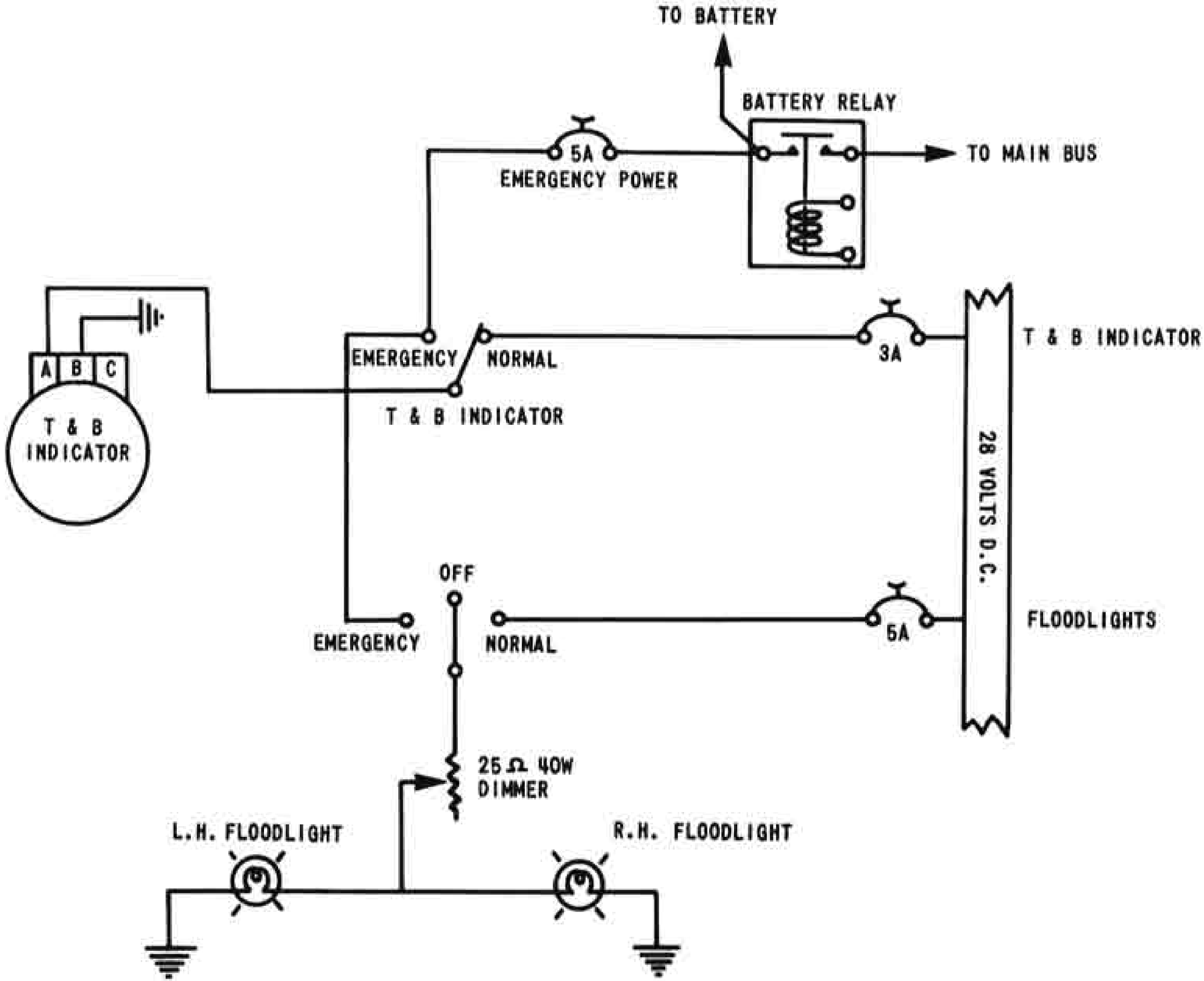


FIG 1-13B EMERGENCY ELECTRICAL SYSTEM

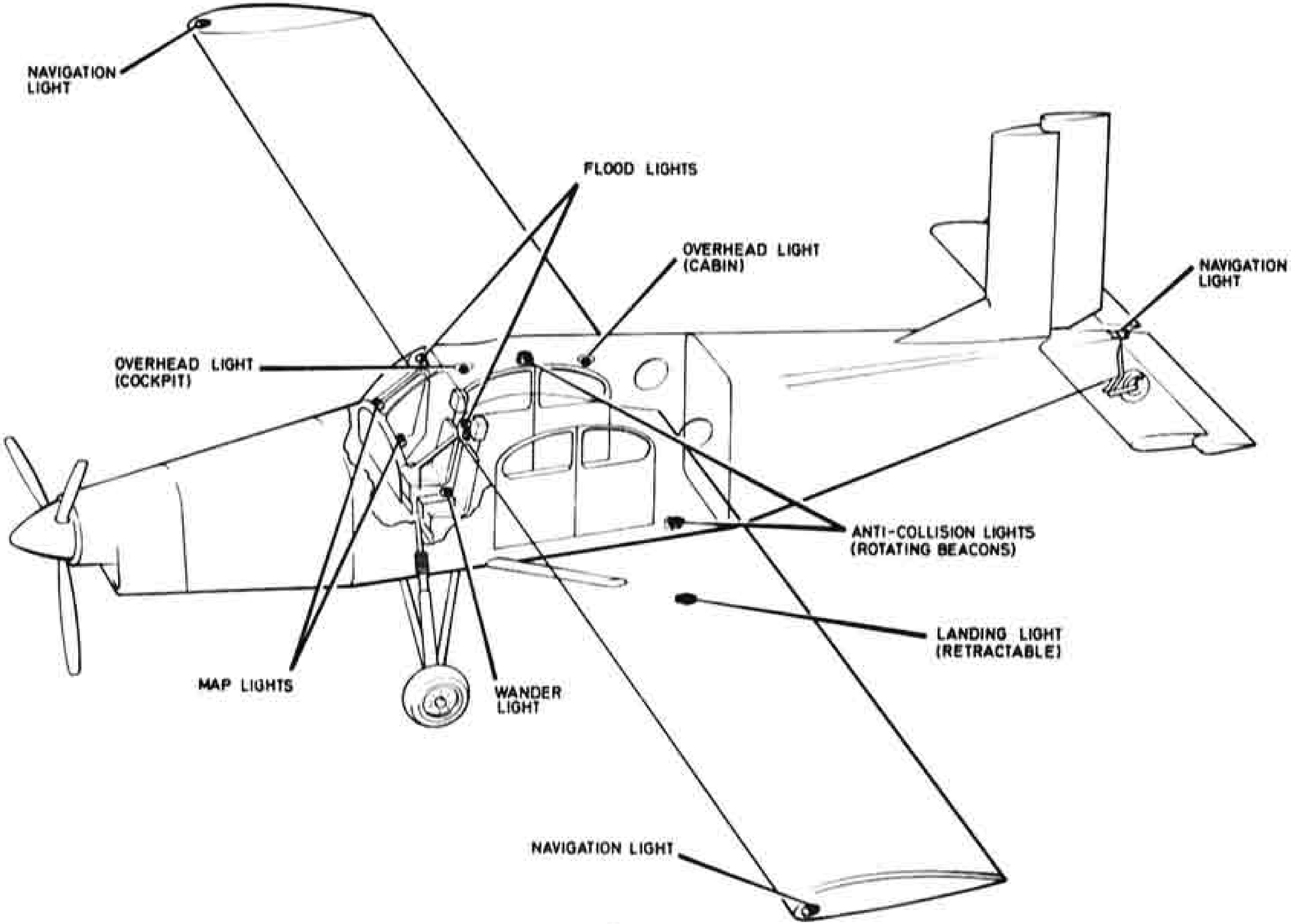


FIG. 1-14 EXTERIOR/ INTERIOR LIGHTING

be adjusted from a dimmer switch rheostat located on the left hand auxiliary CB panel. The floodlights are controlled by a switch mounted on No. 4 instrument panel. The intensity of the floodlights may be adjusted by a dimmer switch rheostat mounted on the panel to the left of No. 1 instrument panel. Protection of the lighting system is by circuit breakers located on the main CB panel on No. 4 instrument panel.

181. Exterior Lighting. (Ref. Fig. 1-14). Exterior lighting consists of a landing light, three navigation lights and two rotating anti-collision beacon lights.

182. Landing Light. The retractable landing light, located in the left mainplane, is rated at 28V, 250W and is controlled by two switches on No. 4 instrument panel. The switches are marked LANDING LIGHT/ POS and LANDING LIGHT/LIGHT. To illuminate the landing light both switches have to be selected. The POS switch when selected to DOWN causes the light to be swung down from its housing into the extended position. The light switch, when selected, causes the landing light to illuminate. Selection of the POS switch to UP causes the light to retract back to the housed position. Protection for the landing light circuit is provided by a circuit breaker on the main CB panel on No. 4 instrument panel.

CAUTION

The landing light cannot be extended when the load sway brace assembly is fitted.

183. Navigation Lights. Normal type navigation lights are fitted to the aircraft. The white navigation tail light is fitted in a small extension tube below the rudder. The navigation lights are operated by a switched marked NAV LIGHTS/POS which is located at the right hand bottom of No. 4 instrument panel.

184. Anti-Collision Lights. Two anti-collision lights, in the form of rotating beacons, one mounted above the cabin and one below, are fitted to the aircraft. They are both twin rotating lamps and are operated by a switch marked NAV LIGHTS/BEACON located at the bottom of No. 4 instrument panel.

185. Electrical Instruments. The electrical instruments, with the exception of the Ng tachometer, Np tachometer and the ITT indicator, which generate and

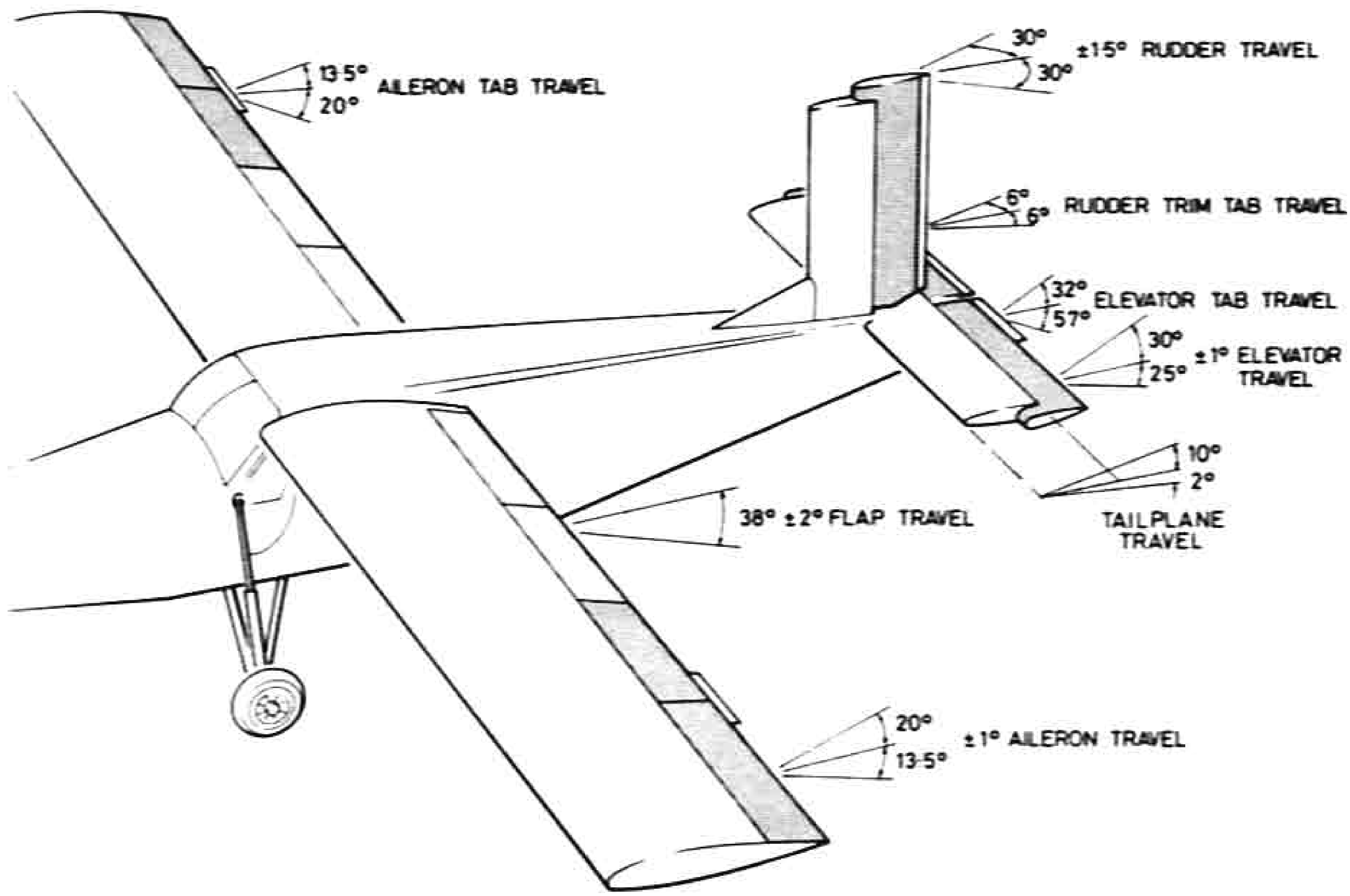


Fig. 1-15 Flight Control Surfaces

consume their own power, are connected to the busbar through circuit breakers located on the main or auxiliary CB panels. The AI, torquemeter, RMI, VOR and ADF are supplied with AC power from the inverters which are also connected to the busbar. The AC circuit breakers are located on the auxiliary CB panel.

186. Emergency Power. (**ref. Fig. 1-13B**) The source of supply for emergency power is the aircraft battery. In the case of a primary DC power failure in flight, (generator becomes unserviceable or goes off line) the Gen switch can be turned OFF and operation can continue on the battery. However, if the POWER SOURCE switch, is also selected OFF, then the only items of equipment that may be used are the FLOODLIGHTS and the T and B INDICATOR by activating the appropriate switches on the EMERGENCY panel located directly below the POWER SOURCE and GEN switches. The emergency circuit is protected by a 5 amp CB located on the Firewall in the engine compartment.

187. Emergency Power Selector Switches. There are two switches which are used for selection of emergency power to the cabin floodlights and turn and balance indicator. One is the FLOODLIGHT switch which is a three-position switch. The three positions are NORMAL, OFF and EMERGENCY. The other switch is the T + B switch which is a two-position switch. The two positions are NORMAL and EMERGENCY. Both switches are mounted next to one another on No. 4 instrument panel and are mounted within a red nameplate.

187A. Utility Power Socket. On aircraft modified by Porter Mod 11 a 28V DC utility power socket is installed at the rear of the centre console. An ON/OFF switch is located near the socket and a CB marked POWER OUTLET is located in the bottom row of CBs on the main CB panel. On aircraft modified by Porter Mod 51, the 10 amp power outlet at the rear of the centre console is replaced by an 80 amp power outlet similarly located. A circuit breaker/switch is installed adjacent to the outlet and the 10 amp POWER OUTLET CB is deleted from the bottom row of CBs on the main CB panel. On aircraft with both Mod 11 and 51, Mod 11 is moved to the top of the panel at the rear of the console.

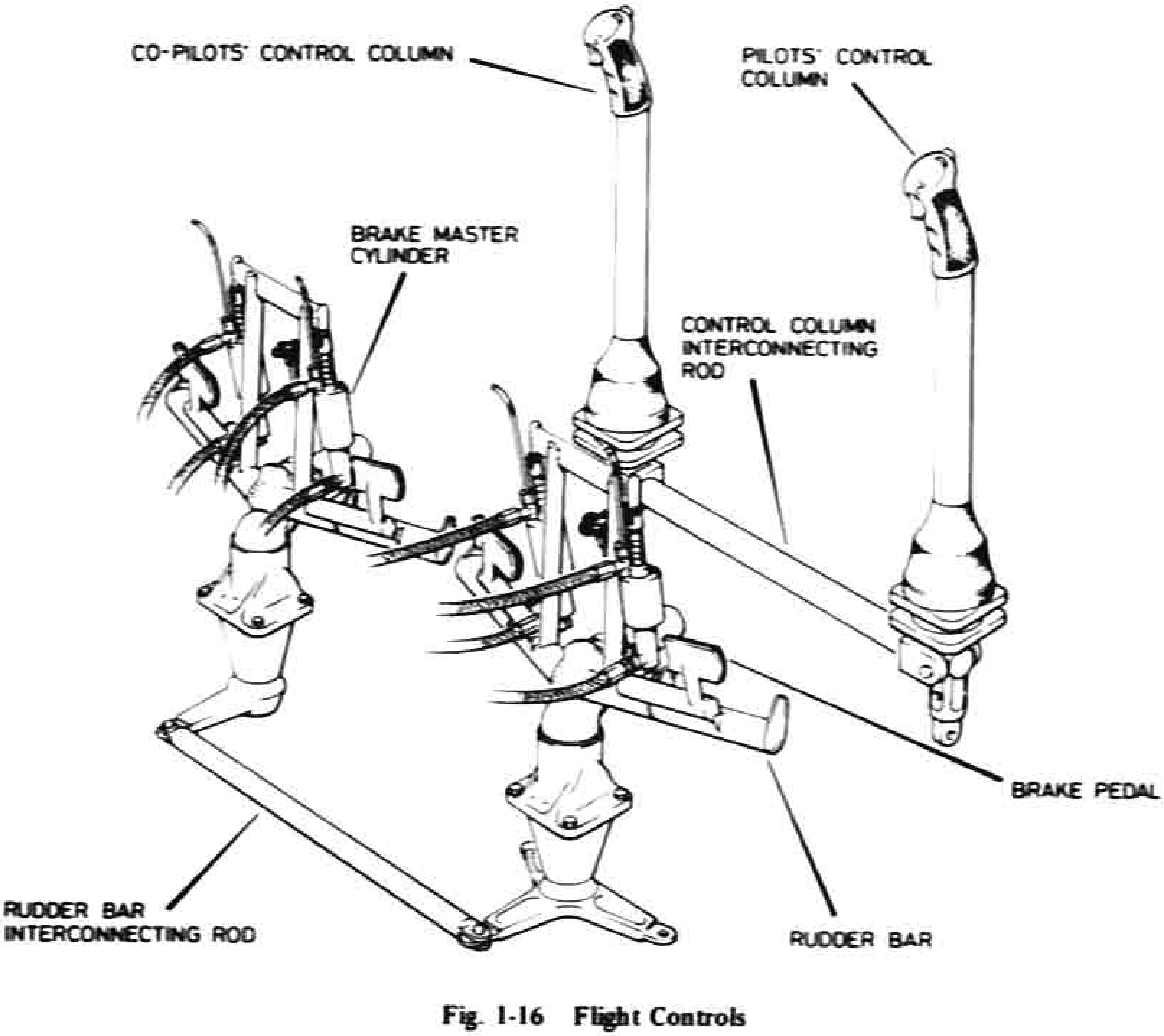


Fig. 1-16 Flight Controls

FLIGHT CONTROL SYSTEM (Ref. Fig. 1-15)

188. **Introduction.** The flight control system provides control of the aircraft by movement of the primary control surfaces. The primary control surfaces consist of a conventional rudder, elevators and ailerons. Two interconnected ailerons are suspended from each mainplane. To reduce pilot's control column load, 'Flettner' tabs are fitted to elevators and ailerons. The aircraft may be trimmed longitudinally by varying the incidence of the tailplane, but no means of trimming the aircraft laterally in flight is provided. The 'Flettner' tabs provide a means of lateral trimming of the ailerons on the ground. Dual controls may be fitted. The co-pilot control column is removable and may be stowed in a clip on the starboard side of the cockpit. All control surfaces are operated by push rods, cables and chains. Aileron mass balance arms project from beneath the outboard section of the ailerons.

189. **Control Column.** (Ref. Figs. 1-16, 1-17). The control column is a simple stick with a moulded hand grip attached to the top. The column is pivoted at floor level and conventional movement of the column controls the aircraft in pitch and roll. Lateral movement of the column is transmitted by a series of push rods, bellcranks and cables to operate the ailerons. Fore and aft movement of the column is transmitted by a series of push rods, bellcranks and cables to operate the elevator.

190. **Rudder Bar.** Conventional movement of the rudder bar rotates a bellcrank attached to the bottom of the rudder pedal torque shaft and the movement of the bellcrank is transmitted, via cables guided by pulleys, to the torque tube. The torque tube, which is located in the rear of the fuselage, moves the rudder.

191. **Rudder Trim Lever.** The rudder trim lever is located to the left of the pilot's seat. Movement of the lever is transmitted via a torque rod, cables, bellcrank and a push rod to the rudder trim tab. The trim tab may be deflected 6° to either side. A scale under the lever indicates the degree and direction of deflection.

192. **Horizontal Stabilizer Handle.** The horizontal stabilizer handle is set centrally in the cockpit roof. Turning the handle clockwise trims nose up and anti-clockwise nose down. This longitudinal trimming of the aircraft is achieved by varying the angle of incidence of the tailplane. Variation in incidence is effected by a screw jack actuator attached to the aft edge of the tailplane. The actuator is operated through cables and a chain, by turning the horizontal stabilizer handle. The tailplane incidence is variable to corres-

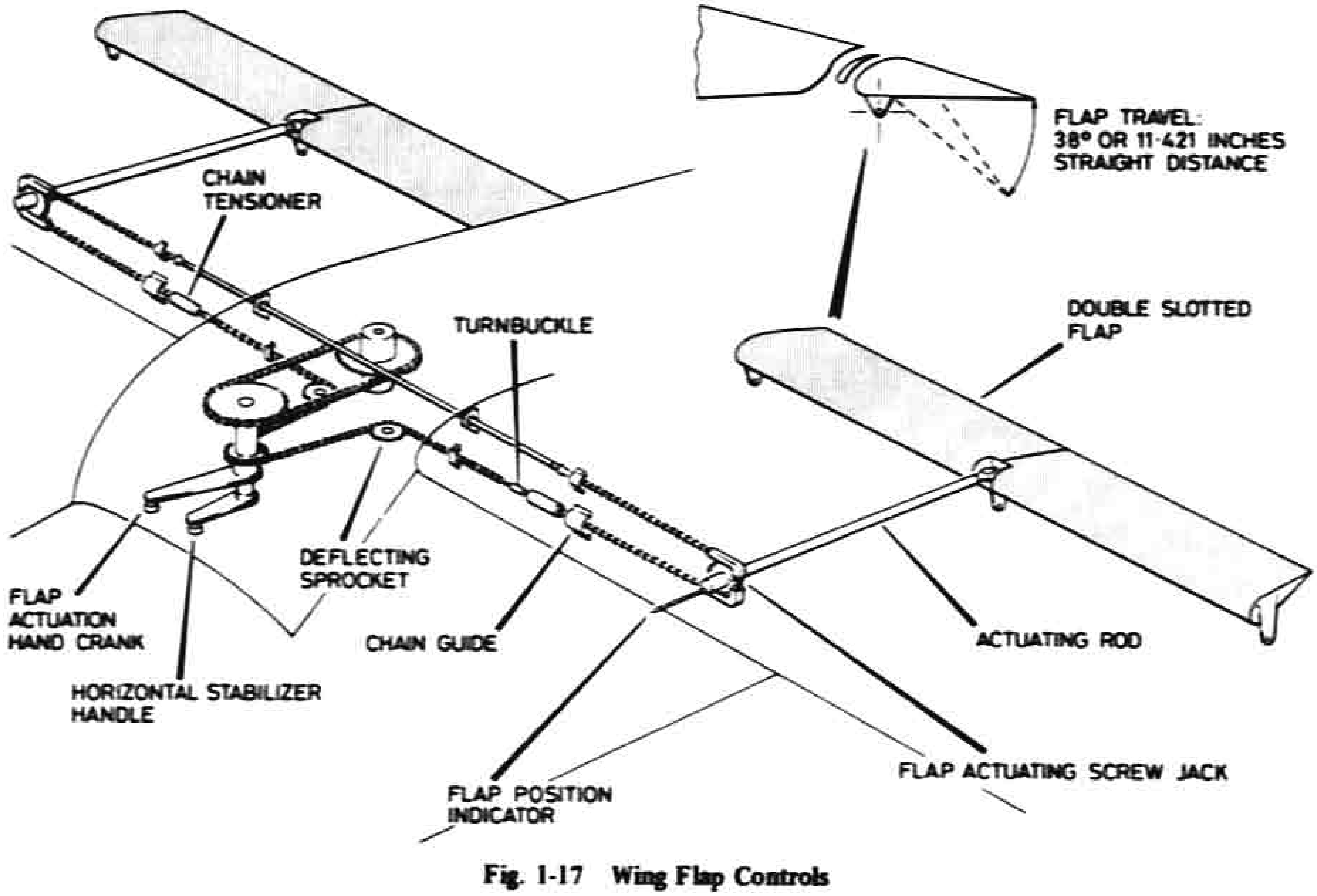


Fig. 1-17 Wing Flap Controls

pond to 7° nose up and 5° nose down, as indicated on the scale associated with the operating handle.

193. **Flight Controls Lock.** The flight control's lock is provided to secure the control column and rudder bar. This lock is only to be used in calm weather conditions: if the aircraft is picketed, the external control locks are fitted, see Para 1255 and Fig. 1-56. The internal lock, shown in Fig. 1-55, consists of a tubular framework, pivoted on a floor bracket. For information regarding engagement of the lock refer to Mooring Procedure. When the lock is disengaged, a spring holds the framework forward.

WING FLAPS (Ref. Fig. 1-17)

194. **Introduction.** Two flap sections are attached to each wing. They can be moved through an arc of 38° and are controlled by a hand crank which is mounted coaxially with the stabilizer trim crank in the roof of the cockpit.

195. **Flap Construction.** Each flap is a sheet metal structure having a single spar, with three full-chord pressed metal ribs and six nose ribs, to which are riveted a preformed leading edge and corrugated trailing edge skins. A slat is carried on three intermediate support ribs which are riveted to the nose ribs. The flap sections are interchangeable.

196. **Operation.** The wing flaps are extended or retracted by push rods which are activated by two screw jacks. Rotation of the handcrank in the cockpit operates the screw jacks via a system of chains and

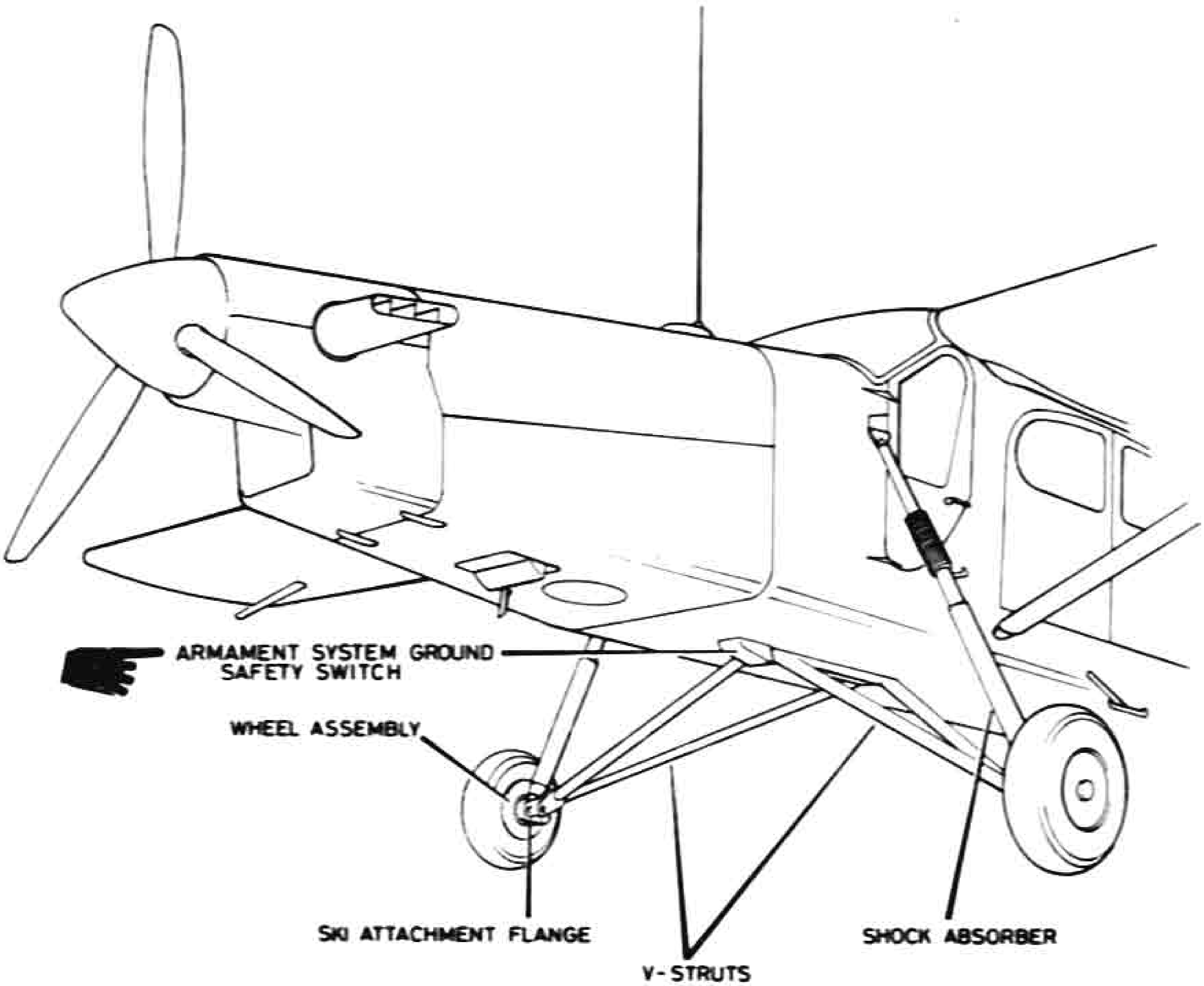


Fig. 1-18 Main Landing Gear

cables which is kept under tension by spring loaded tensioners in the leading edge of each wing. Eleven full turns of the hand crank are required to move the flaps through the full travel of 38°. A flap position indicator, consisting of a rod attached to the port screw jack, extends from the leading edge of the wing in direct proportion to the movement of the jack. Bands are painted around the rod to indicate flap positions of 15°, 28° and 38°.

LANDING GEAR

197. **Introduction.** Landing gear fitted to the aircraft consists of:

a. Main landing gear.

b. Tail landing gear.

198. **Main Landing Gear** (Ref. Fig. 1-18). The main landing gear comprises two V-struts, two shock absorbers and two wheel assemblies. The V-struts are hinged to the underside of the fuselage along the centre line on reinforced frames 2 and 3. A single axle, carrying a wheel assembly with brake disc and tyre, is located at the lower end of each strut. The lower ends of the oleo-mechanical shock absorber struts are anchored to fittings on the axle flange, and the upper ends are attached to reinforced brackets on the sides of the fuselage, forward of the crew compartment door frame.

199. **V-Strut.** The V-strut consists of preformed hollow steel parts welded together. Pivot axles are riveted into the upper end of the strut and ski attachment flanges are welded to the lower end. A web with a steel bush is provided as the attachment point for the shock absorber strut and is welded between the outer ski attachment flange, the brake housing flange, and the axle. The hollow tapered part of the axle which carries the wheel is welded into this assembly.

1100. **Shock Absorber Strut.** The shock absorber strut is attached to the fuselage and the axle flange. It compresses on impact and oil is forced through an

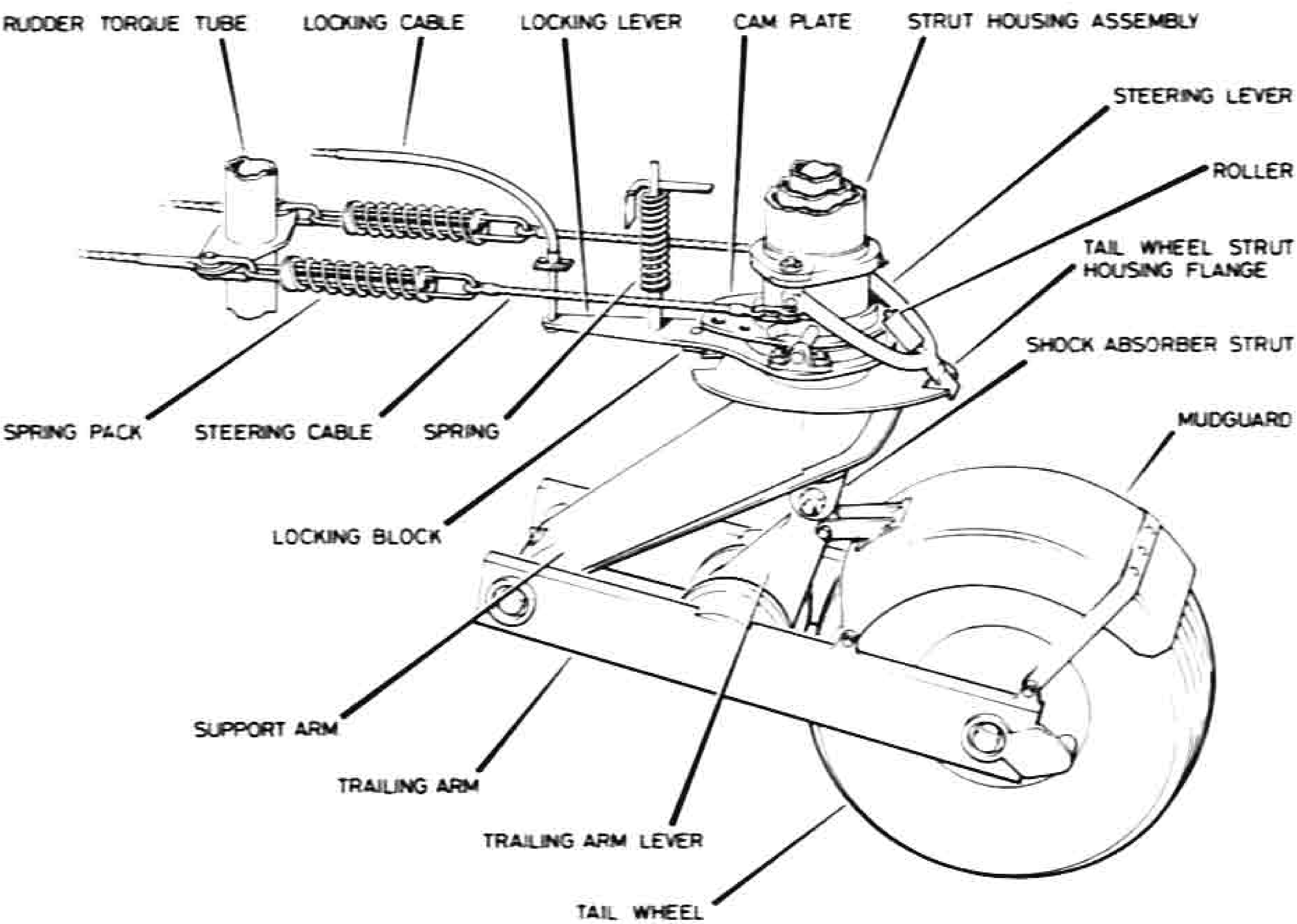


Fig. 1-19 Tail Landing Gear and Steering Mechanism

orifice within the assembly, thus absorbing and dampening the effect of any shock forces which may be imparted to the aircraft on landing or during ground operation. The total extension of the strut is approximately 8.9 in. and as the maximum extension is approached a cushion spring is compressed, dampening the movement.

1101. Wheel Assembly. Divided type wheels, constructed from magnesium alloy castings, are fitted to the aircraft. The two halves of the assembly are clamped together by eight bolts and each half is fitted with tapered roller bearings. A 24 x 7 in. pneumatic tyre and tube are fitted to the wheel and inflated to a pressure of 32 psi. An oversize main wheel, with an 11-12 x 8 ply Goodyear tyre which is inflated to a pressure of 15 psi, may be fitted.

1102. Tail Landing Gear (Ref. Fig. 1-19). The tail landing gear is mounted aft of the rear fuselage bulkhead. It comprises a strut, shock absorber, strut housing, trailing arm and tail wheel. The strut is located within the strut housing. The upper end of the strut is pivot mounted and the lower end, which protrudes from the housing, is fastened to a lever on the trailing arm. The upper end of the strut housing is anchored in a bearing block attached to the fuselage bulkhead and a support arm, extending from the lower end of the strut housing, is hinged to the trailing arm, which carries the tail wheel. Protection for the tail wheel is provided by a mudguard which is attached to the trailing arm and trailing arm lever. A 5 x 4 in. pneumatic tyre and tube are fitted to the wheel and inflated to a pressure of 32 psi. The tail wheel, which can be steered through an arc of 25° on each side of the neutral position, is controlled by cables attached to the rudder torque tube.

STEERING SYSTEM

1103. Introduction. The aircraft can be steered on the ground by manipulation of the tail wheel which is controllable through an arc of 25° to each side of the neutral position.

1104. Steering Mechanism (Ref. Figs. 1-19, 1-20). The tail wheel steering mechanism is attached to the tail wheel strut housing assembly and comprises a steering lever with cam follower, a cam plate, and a locking lever. The wheel is deflected by the steering lever which is attached by cables to the rudder torque tube in the rear fuselage. This in turn is controlled by the rudder bar in the crew compartment. The tail wheel can be locked in the neutral position by the locking lever which is attached by cables to a two-position control at the left of the pilot's seat. (Ref. Fig. 1-20). When the control is set to the aft position (STEERABLE), the locking lever on the tail wheel strut is released and the steering lever is engaged in the tail wheel strut housing flange, thus providing steering control. When the control lever is set to the forward position (LOCKED), the steering lever is disengaged and the locking lever is engaged in the tail wheel strut housing flange, thus locking the wheel in the neutral position. If the steering angle exceeds 25°, the cam follower on the steering lever rides up on to one of the cams on the cam plate and the steering lever is disengaged, leaving the tail wheel free to castor.

BRAKE SYSTEM (Ref. Fig. 1-21, Fig. 1-22)

1105. Introduction. The aircraft braking system comprises four hydraulic master cylinders, four pedal actuators, two hydraulic shuttle valves and two disc brakes arranged as shown in Fig. 1-21. A parking brake is also incorporated. The brakes can be controlled from both the pilot and co-pilot's position.

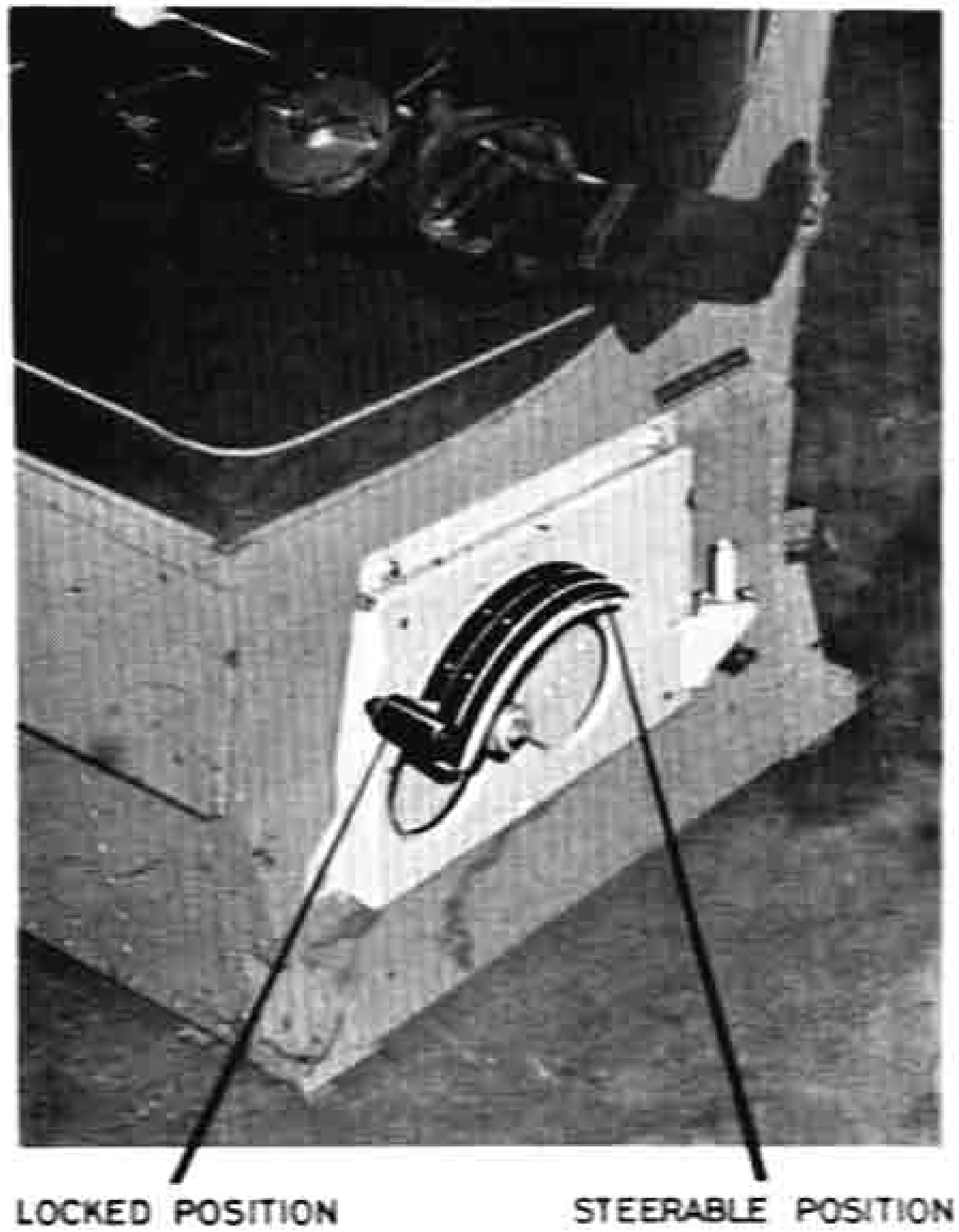


Fig. 1-20 Tail Wheel Locking Control

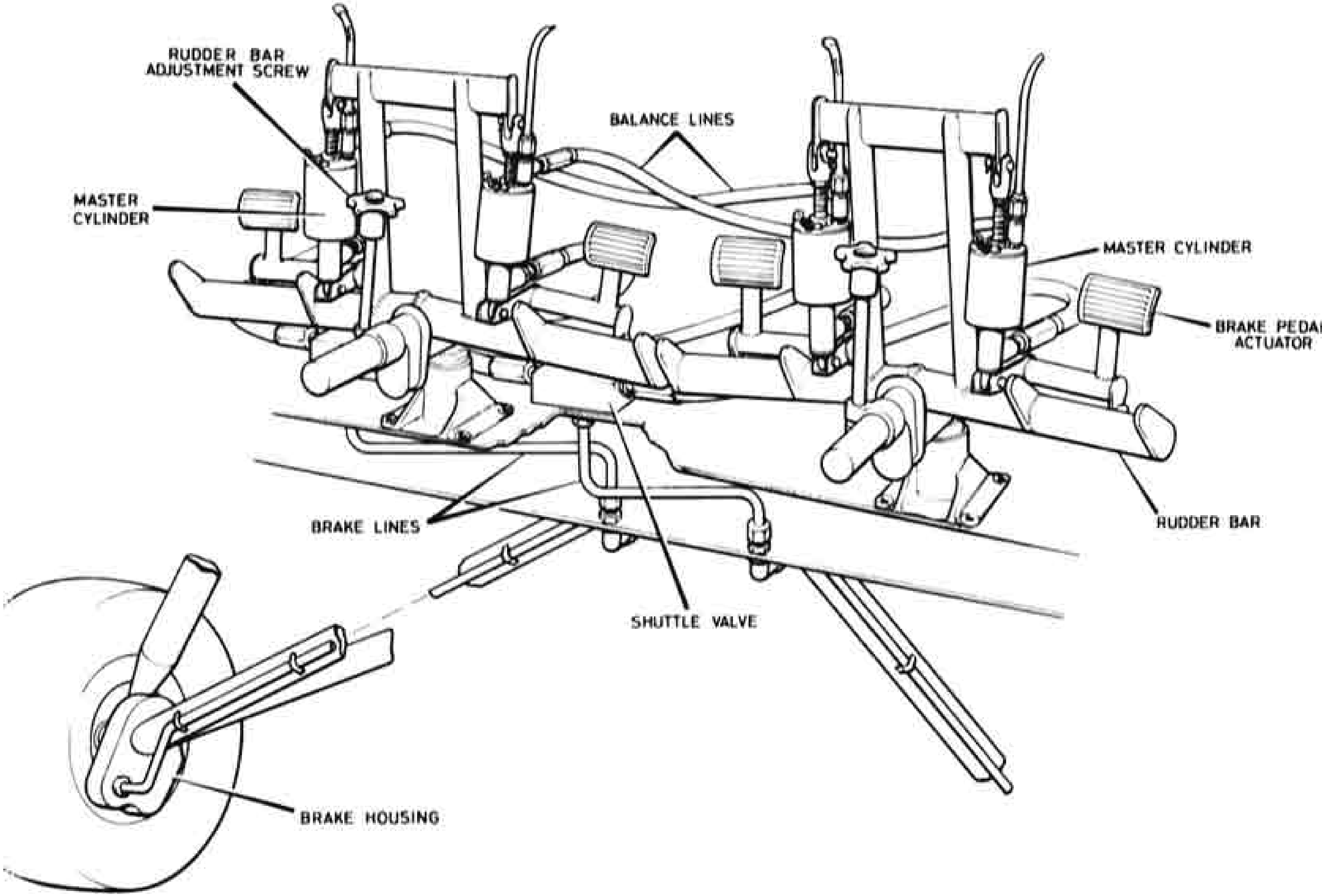


FIG. 1-21 BRAKE SYSTEM

1106. Master Cylinder. Each master cylinder incorporates an integral reservoir, a coil spring and a piston rod assembly. The upper end of each cylinder is connected by a serrated rod to the rudder bar assembly, and the lower end of each cylinder is connected to its associated foot pedal, which pivots on the rudder bar. The master cylinders are connected by flexible hydraulic lines to the two shuttle valves and the hydraulic fluid is carried from this point in aluminium and flexible lines to the disc brakes on each wheel.

Note

The specification for the hydraulic fluid used in the brake system is MIL-H-5606.

1107. Shuttle Valve. Two shuttle valves are incorporated in the braking system to allow the brakes to be controlled from either the pilot's or co-pilot's position. Each valve has two inlet ports and one outlet port. A piston (shuttle) is positioned in the cylinder by the application of hydraulic pressure to one of the inlet ports and is held in place by a spring loaded ball. When the valve is activated, the shuttle closes off one port and allows hydraulic fluid to pass through the outlet port.

1108. Brake Assembly. The single disc, single cylinder brake unit is machined from magnesium alloy. It is bolted to the torque flange on the V-strut and can be fitted to either wheel. When Porter Mod 8 is incorporated the single cylinder unit is replaced by a double cylinder unit.

1109. Operation of Brakes. (Ref. Fig. 1-22). When a brake pedal is depressed, the associated master cylinder moves upwards causing the piston to move downwards in the cylinder, thus compressing the spring and forcing hydraulic fluid through the shuttle valve to the disc brakes. When the pedal is released, the spring acts against the head of the piston to force the cylinder down and allow the hydraulic fluid to return to the reservoir. Control of the brakes is transferred from the pilot's position to the co-pilot's position, or vice-versa, by the operation of the shuttle valves. If pressure is applied to the pilot's brake pedals, the shuttle valve closes off the lines from the co-pilot's position and allows the flow of hydraulic fluid to the brakes to be controlled from the pilot's position. If greater pressure is applied to the co-pilot's pedals, the shuttle valve cuts off the lines from the pilot's position and control of the brakes is transferred to the co-pilot's position. When the pressure is released, the hydraulic fluid flows

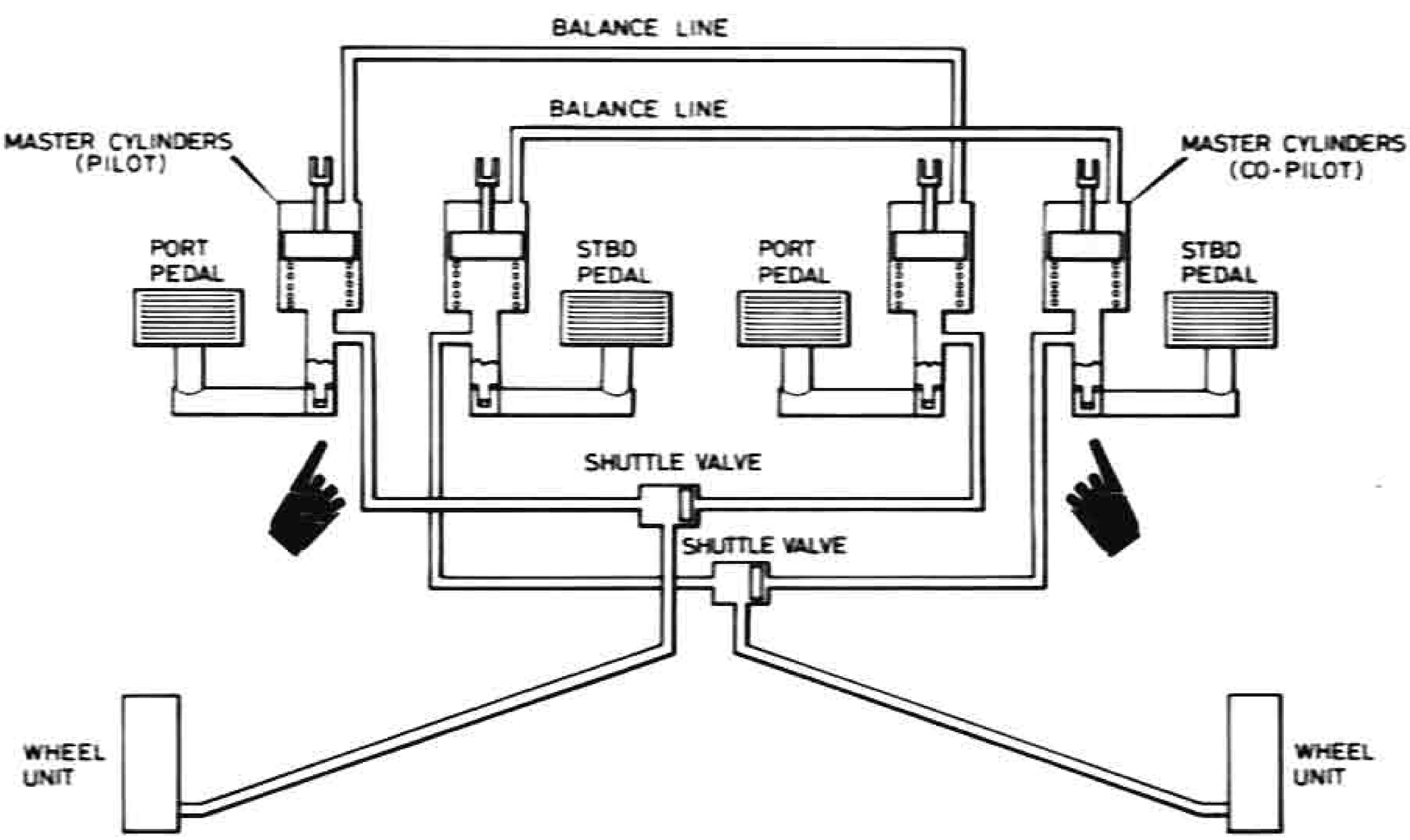
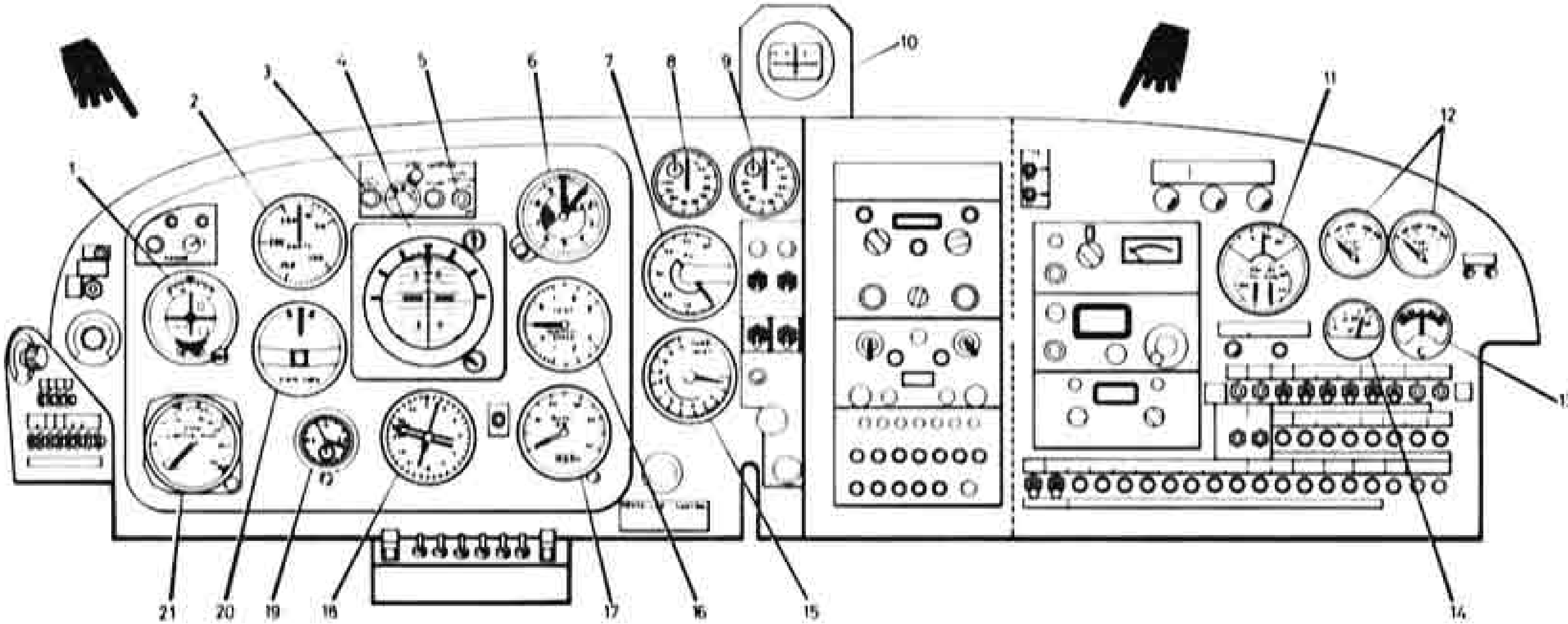


Fig. 1-22 Brake System - Schematic



1 COURSE SELECTOR INDICATOR (CSI)
2 AIR SPEED INDICATOR (ASI)
3 STALL WARNING LIGHT
4 ATTITUDE INDICATOR
5 FAST ERECTION SWITCH
6 ALTIMETER
7 TORQUE PRESSURE INDICATOR
8 PROPELLER TACHOMETER (Np)
9 GAS GENERATOR TACHOMETER (Ng)
10 MAGNETIC COMPASS
11 OIL / FUEL TEMPERATURE AND PRESSURE INDICATOR
12 FUEL QUANTITY INDICATORS
13 AMMETER
14 VOLTMETER
15 INTER-TURBINE TEMPERATURE INDICATOR
16 INERTIAL-LEAD VERTICAL SPEED INDICATOR (IVSI)
17 TOTALIZER / FUEL FLOWMETER
18 RADIO MAGNETIC INDICATOR (RMI)
19 CLOCK
20 TURN AND BALANCE INDICATOR
21 DME INDICATOR

FIG. 1-23 INSTRUMENTS – TYPICAL

back into the reservoir in the master cylinder and the brakes are freed. The two master cylinders associated with a particular brake are connected by a balance line to maintain an equal amount of hydraulic fluid in each master cylinder.

1110. Parking Brake. The control lever for the cable-operated parking brake is operated by the pilot and is located on the shelf below the main CB panel. To apply the parking brakes, the pilot's brake pedals are depressed, the cable brake control is pulled and the brake pedals are then released. This engages a spring loaded lever, attached to the top of each master cylinder, with a serration on the piston rod assembly. The parking brake is released by depressing and then releasing the pilot's brake foot pedals.

INSTRUMENTS (Ref. Fig. 1-23, 1-24)

1111. General. The aircraft is fitted with a single section blind flying panel which is shock mounted and contains the following vibration sensitive instruments:

a. Airspeed Indicator.
b. Altimeter.
c. Attitude Indicator.
d. Turn and Balance Indicator.
e. Inertial-Lead Vertical Speed Indicator (IVSI).
f. C14 Gyrosyn Compass System incorporating the RMI.
g. VOR Indicator.
h. Clock.
i. Totalizer/Fuel Flow Indicator.
j. DME Indicator (Mod 26).

The magnetic compass is located in its own bracket above the main panel in the mid-point position. The deviation card is fitted above the co-pilot side wanderlight. The outside air temperature gauge (OAT) is mounted on the upper section of the starboard cockpit door. These are the only flight instruments which are not mounted on the blind flying panel which is referred to as the No. 1 instrument panel.

1112. Pitot-Static Instrument System (Ref. Fig. 1-25).

CAUTION

Do not operate the heater element for more than 30 seconds during ground check.

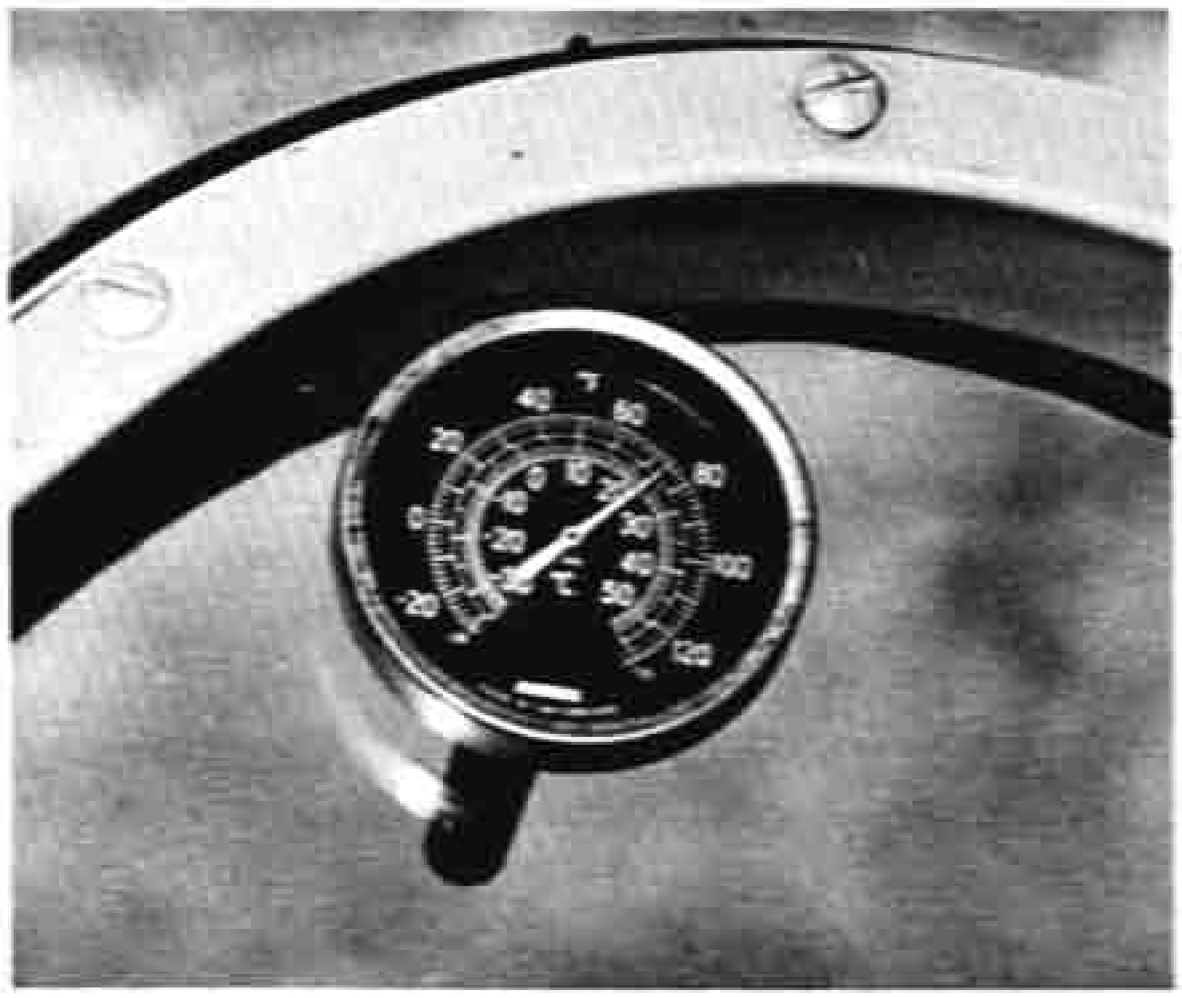


Fig. 1-24 Outside Air Temperature Indicator

The pitot system consists of a pitot-head with a heating element and pitot pressure chamber connected to the air speed indicator. The pitot tube is mounted under the port mainplane, parallel to the longitudinal axis of the aircraft, where it receives the impact of the relative airflow most effectively. Moisture, which may accumulate in the pitot line, is drained at the drain ports, located under the instrument panel. The pitot-head is fitted with a heater element to prevent condensation and ice formation.

1113. The static system consists of two static ports, one on each side of the aircraft, located at frame 8, jointly connected by a tee junction to a single static line running forward on the port side of the fuselage to the rear of the instrument panel, where it is connected by a distribution line to the airspeed indicator, altimeter, and vertical speed indicator. The pitot-static system is drained at drain ports located on the lower point of the lines and at the static distributor line. The drain point is mounted under the instrument panel on the left hand side.

Note

The pitot-head cover must be fitted while the aircraft is on the ground, and removed before flight. The static vents must be kept clean at all times. Painting is not permitted.

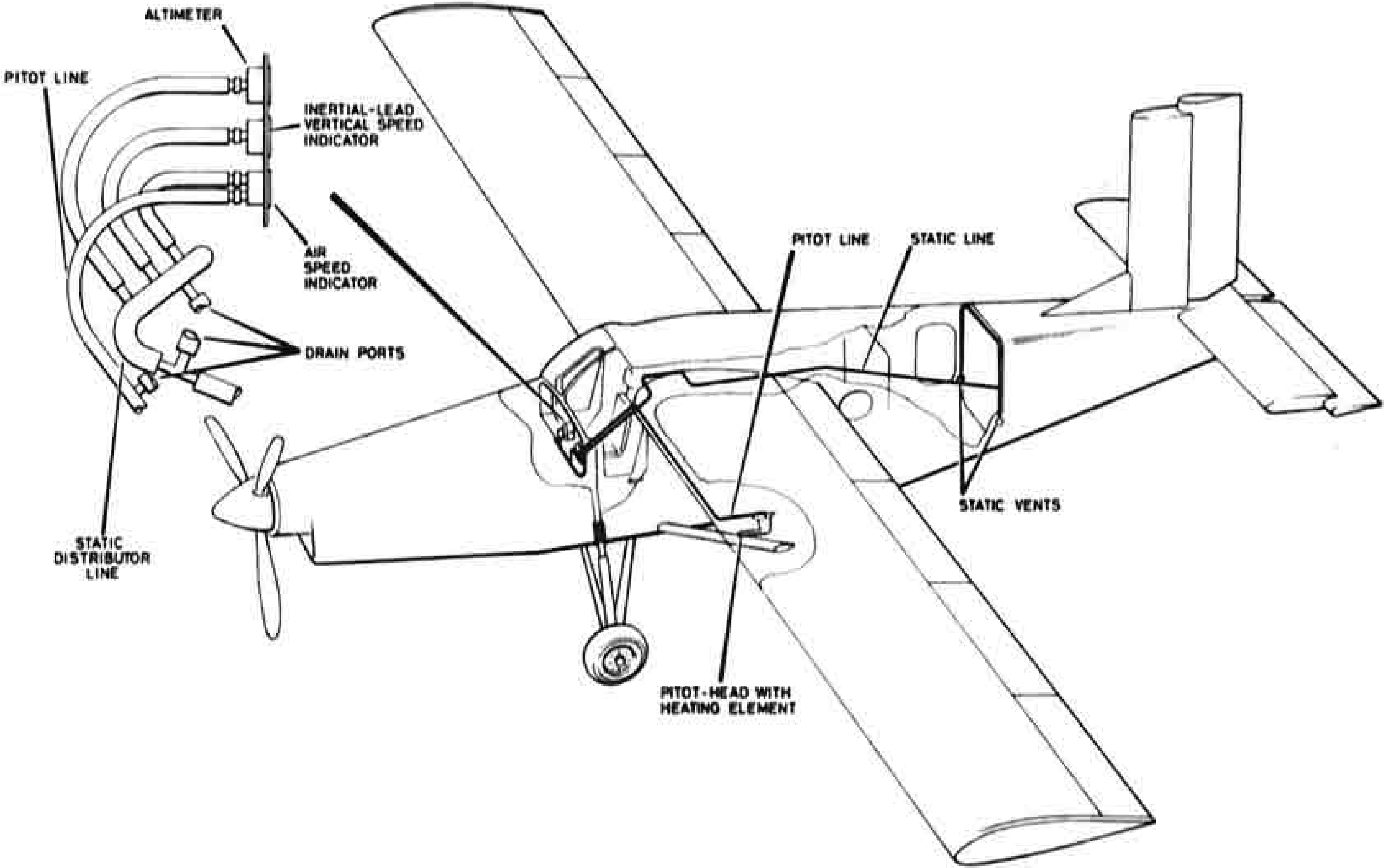


FIG. 1-25 PITOT-STATIC SYSTEM

1114. **Airspeed Indicator**. The airspeed indicator is a standard pitot-static instrument which measures the difference between pitot impact air pressure from the pitot tube and static pressure measured at the static vent. The difference is indicated on the instrument face in knots. The mechanism is housed in a sealed, moulded bakelite case.

1115. **Altimeter**. This instrument displays the height of the aircraft above a barometric datum. The instrument is calibrated in feet and graduated in increments of 100 ft., ranging from 0 ft. to 80000 ft. The barometric scale has a range of 955 millibars to 1050 millibars, and is graduated in 1 millibar increments. A yellow and black striped sector, located adjacent to 7 and 8 disappears when an altitude of 16000 ft. is reached. The altimeter is read by noting the position of all three hands in order, from the shortest to the longest. The shortest indicates tens of thousands, the intermediate thousands, and the longest hundreds of feet. The barometric scale is visible through an aperture in the dial at the 3 o'clock position and is reset by a knurled knob, on the front of the indicator. The altimeter is compensated for temperature.

1116. **Attitude Indicator (AI)**. The attitude indicator is an electro-mechanical unit which provides continuous indication of aircraft attitude in roll through 360° and pitch through 80° climb or dive. Signals for the operation of the instrument are received from a vertical gyroscope, mounted in the rear fuselage, access to this unit being through the rear fuselage door. Erection to a false horizon in turns is prevented by means of a rate switching gyro which deactivates the displacement gyro roll erection system at prolonged turn rates above 15°/min. The erection system operates at two rates, i.e. *'fast rate'*, greater than 15°/min and *'normal rate'*, approximately 1.5°/min. The fast rate operates immediately upon activation of the AI for approximately one minute while warming up, whenever the bank is indicating greater than 30° whilst straight and level and whenever the fast erection switch is turned ON. The fast erection switch, located directly above the AI, enables rapid re-erection of the gyro in the event of *'toppling'*. The switch should only be operated if any doubt exists as to the correctness of the display, and should be turned off when the instrument reads normal again, as the erection system is not designed to operate continuously in the fast mode. It will be noticed that operating the switch causes the OFF flag to appear, but the system will still follow aircraft attitude changes. Operation of the system requires the instrument inverter and the two attitude system circuit breakers labelled 'GYRO' and 'ATTITUDE' on the auxiliary CB panel to be closed. After approximately one minute warm-up the OFF warning flag should disappear, signifying normal system operation. Two knobs fitted to the indicator allow alterations to pitch and roll information in relation to the miniature image aircraft. The operating voltage for this unit is 115V AC, 400Hz, single phase. In flight the AI should give immediate and accurate indication of aircraft attitude.

1117. **Turn and Balance Indicator**. The turn and balance indicator is a combination of two instruments; a DC operated turn needle and a skid ball. The turn needle depends on gyroscopic precession for its indications. The rate gyro which is powered by the aircraft's DC supply, attains operational speed within a few seconds after the power source selector switch is turned ON. The system is protected by a 3A circuit breaker labelled T+B INDIC located on the main CB panel. The ball is actuated by gravitational forces. In the event of faulty circuit breaker operation, or failures in the normal power distribution system, the turn and balance indicator switch on the No. 4 instrument panel, is to be selected to the EMERGENCY (down) position. This allows direct 28V DC power from the battery to be applied to the instrument, bypassing the busbar.

1118. **Inertial-Lead Vertical Speed Indicator (IVSI)**. The Inertial-Lead VSI is identified by the letters IVSI which appear on the dial. Compared to a conventional VSI this instrument has no apparent lag. The IVSI differs from a conventional VSI in its internal construction by the addition of two accelerometers which generate pressure differences whenever there is a change in the normal acceleration of the aircraft. The pressure differences are transmitted to the sensitive diaphragm by pneumatic circuits. A velocity is added, as necessary, to the pressure leak velocity to obtain the total, nearly instantaneous vertical speed indication. Since the accelerometers are not vertically stabilized, some error is generated in turns.

Note

> The IVSI should not be used for directly controlling vertical speed when rapidly banking in excess of 40°. However, the indicator is not affected once in a steady turn. Thus the use of the IVSI should be limited to the manoeuvres of normal instrument flying.

1119. **Radio Magnetic Indicator (RMI).** The RMI consists of two navigation and bearing pointers superimposed over a compass card, which indicates heading information provided by the C14 gyrosyn compass sytem. The number one needle indicates ADF bearing and the number two needle indicates either VOR bearings or UHF homing bearings. The selector switch is located on the left side of No. 1 instrument panel.

Note

> The C14 Compass System is described under NAVIGATION EQUIPMENT, Para 1234 of this Flight Manual.

1120. **VOR Indicator.** This instrument is described under COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT, Para 1221 of this Flight Manual.

1120A. **DME Indicator.** This instrument is described under COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT, Para 1221A of this Flight Manual.

1121. **Clock.** The 24 hour clock and stop watch is installed on No. 1 instrument panel and is equipped with a second sweep hand and minute recorder. The winding, handsetting and operating of the clock is by means of the knurled button at the lower front of the instrument. Presentation is white on a black background and all markings are treated with a fluorescent lacquer.

1122. **Totalizer and Fuel Flow Indicator.** The totalizer and fuel flow indicator is described under FUEL SYSTEM, Para 167 of this Flight Manual.

Stall Warning System

1123. The stall warning system indicates to the pilot that the aircraft is approaching a stall condition. A warning is transmitted in both visual and aural form simultaneously. The stall warning is activated by a transmitter unit located in the leading edge of the port wing. The transmitter is electrically connected to a red stall warning light, located in the upper portion of No. 1 instrument panel, and a stall warning horn located beneath the instrument panel. The stall warning transmitter unit consists of a micro-switch, activated by a detector vane on the leading edge of the wing. Under most flight conditions the detector vane remains in the down position. As the stall is approached and the angle of attack is increased, the resultant relationship between the detector vane and the airflow is such that vane is moved upwards, thus activating the electrical circuit to the stall warning light and horn. (4-8 knots above actual stall speed).

EMERGENCY FACILITIES

1124. **Emergency Equipment** (Ref. Fig. 1-2).

WARNING

> The fire extinguisher contains bromochlorodifluoromethane (BCF). It is advisable to ventilate the cockpit after the extinguisher has been used in the aircraft.

The emergency equipment installed in the aircraft comprises the following items:

a. One crash axe, fitted to the front of the co-pilot's seat.

b. One first-aid kit, fitted to the forward side of the rear cabin wall (bulkhead 6).

c. One man dinghies with survival kits may be installed in the seat pans of the two crew seats.

d. One hand fire extinguisher, fitted below the instrument shelf between the two front seats.

1125. **Emergency Exits.** (Ref. Fig. 1-2). An emergency release lever is fitted to each of the two crew doors; the levers are painted black and yellow and are positioned as shown in Fig. 1-2. Operation of the lever causes the pin in the top hinge of the door to be removed; the lower hinge pin then lifts clear of its socket and the door is jettisoned.

DOORS (Ref. Fig. 1-26)

1126. **Introduction.** The aircraft has the following entrance and access doors.

a. ***Crew entrance doors.*** One hinged door on each side of the aircraft, providing access to the crew compartment.

b. ***Cabin entrance doors.*** One sliding door on the starboard side and two hinged doors on the port side. The sliding door may be opened for the despatching of cargo in flight.

c. ***Trap doors.*** Two hinged doors in the fuselage beneath the cabin which may be opened for the despatching of cargo in flight.

d. *Rear Fuselage Access Door and Panel.* Access to the fuselage is obtained through a panel in the rear wall of the cabin and through the rear fuselage door.

1127. **Crew Entrance Doors.** Each crew entrance door is a metal structure incorporating a perspex window. It is hinged at the top and bottom of the forward edge and the inside of the lower part of the door is lined with plastic material. Two locking pins at the rear edge of the door are operated by an internal or external handle: the external handle may be locked. An emergency lever in the cockpit causes the pin in the top hinge to be removed and the door is then jettisoned. A map and torch stowage pocket is fixed inside each door and an outside air temperature thermometer is mounted in the window of the co-pilot's door.

1128. **Starboard Door.**

WARNING

The sliding door cannot be securely retained in any position other than closed.

Entrance to the starboard side of the cabin is obtained through a sliding door which is a metal structure incorporating a perspex window. The lower section of the inside of the door is lined with a plastic material. The rear section of the rear window is pivoted and may be opened in flight for ventilation or photography purposes. The door slides on rollers which are fixed to the top of the door and held in an extruded runner fixed to the fuselage. Fore and aft movement of the door is limited by a rubber stop which is bolted into the end of the runner. An internal and external handle are fitted: the external handle may be locked with a key. To prevent the door from being opened inadvertently during flight, the internal handle is held by spring tension into a detent and must be pulled free before it can be turned to release the catch.

1129. **Port Side Doors.** Entrance to the port side of the cabin is obtained through two outward-opening hinged doors. Each door is a metal structure incorporating a perspex window; the lower section of the inside of the doors is lined with a plastic material. Each door is hinged by clevis pins to brackets riveted to the fuselage. The forward door is fitted with an external and an internal handle; these operate three latch bolts which fit into the fuselage and rear door. The external handle may be locked with a key and the internal handle may be set in one of the following three positions:

a. Handle down - all latch bolts are disengaged.

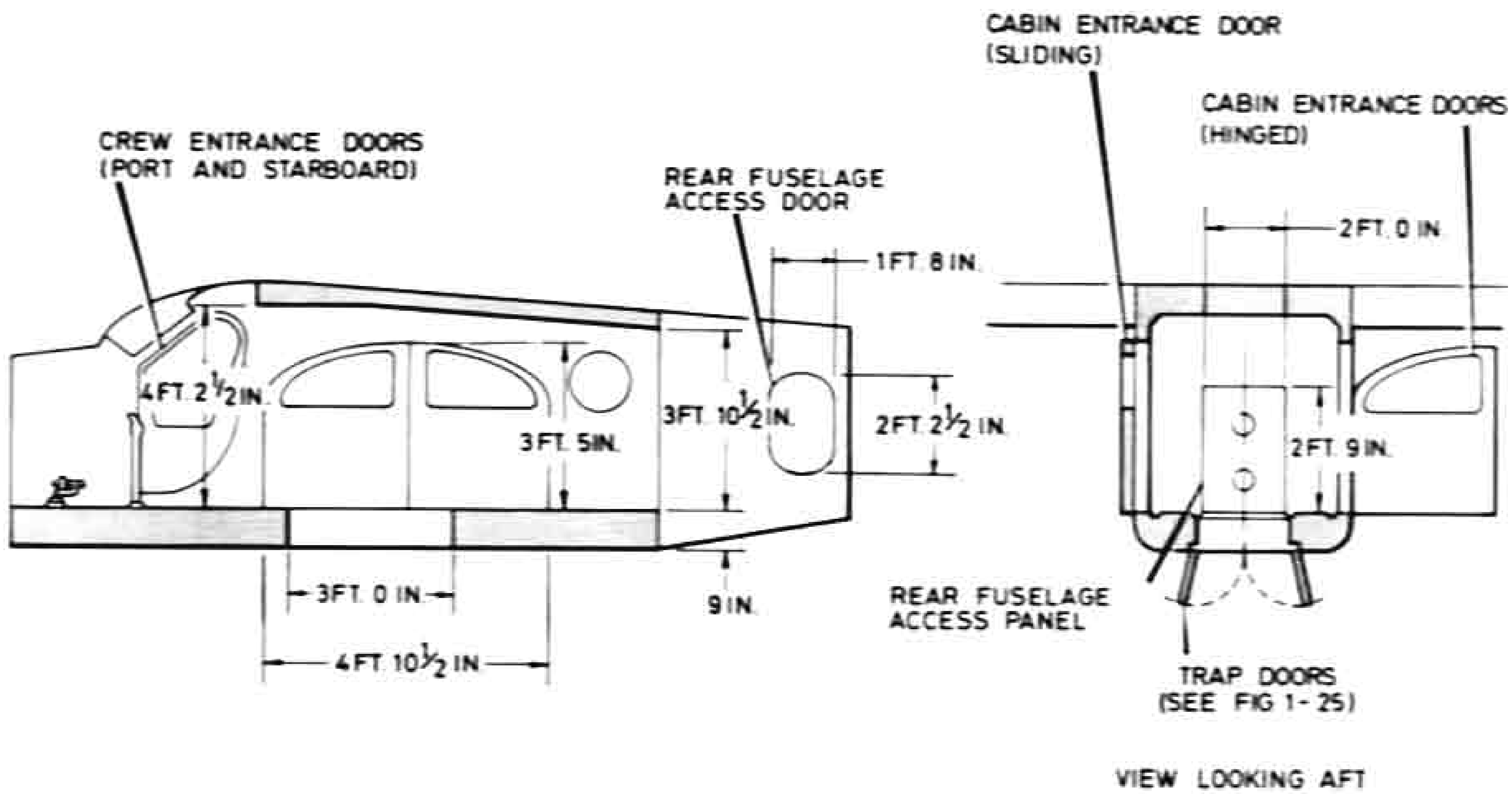


Fig. 1-26 Doors

b. Handle horizontal - all latch bolts are engaged.

c. Handle up - all latch bolts are engaged and cannot be disengaged by the external handle.

The rear door has an external handle only and a safety latch which prevents it from being unlatched until the front door has been opened. Each of the doors can be secured by gust latches. The latch for the forward door is fixed to the wing strut and engages a bracket on the door. The latch for the rear door is fixed to the fuselage. A stop on the inboard flap prevents the rear door from being opened unless the flaps are fully up.

1130. Trap Doors (Ref. Fig. 1-27). Two hinged doors of metal construction are fitted in the bottom of the fuselage and can support a maximum weight of 660 lbs. Only the port side door is latched; the starboard side door is held in the closed position by the flanged edge of the port side door which is held closed by two latches extending into the fore and aft edges of the door cut-out. A bracket extending forward from the front edge of each door carries two cables, one for closing the door and the other for holding the door open. A latch release cable extends to the crew compartment and terminates in a handle located at the left side of the pilot's seat or on the centre console between the seats when Porter Mod 21 is incorporated. The handle is painted black and yellow and labelled TRAP DOOR PULL RELEASE. The trap doors can only be opened from the pilot's position. Once the trap doors are fully open they are held in position by a retaining cable which is held taut by a bungee cord attached between the cable and the aircraft frame. The cables used for closing and for holding open the trap doors cannot be reached from the crew compartment and the trap doors must be closed from within the cabin. A handle is provided for pulling up the cables to close the trap doors; it is painted black and yellow and is located near the forward edge of the trap door opening. The handle operated by the pilot to open the trap doors must also be pulled when the trap doors are being closed to keep the latches disengaged until the doors have been pulled into position.

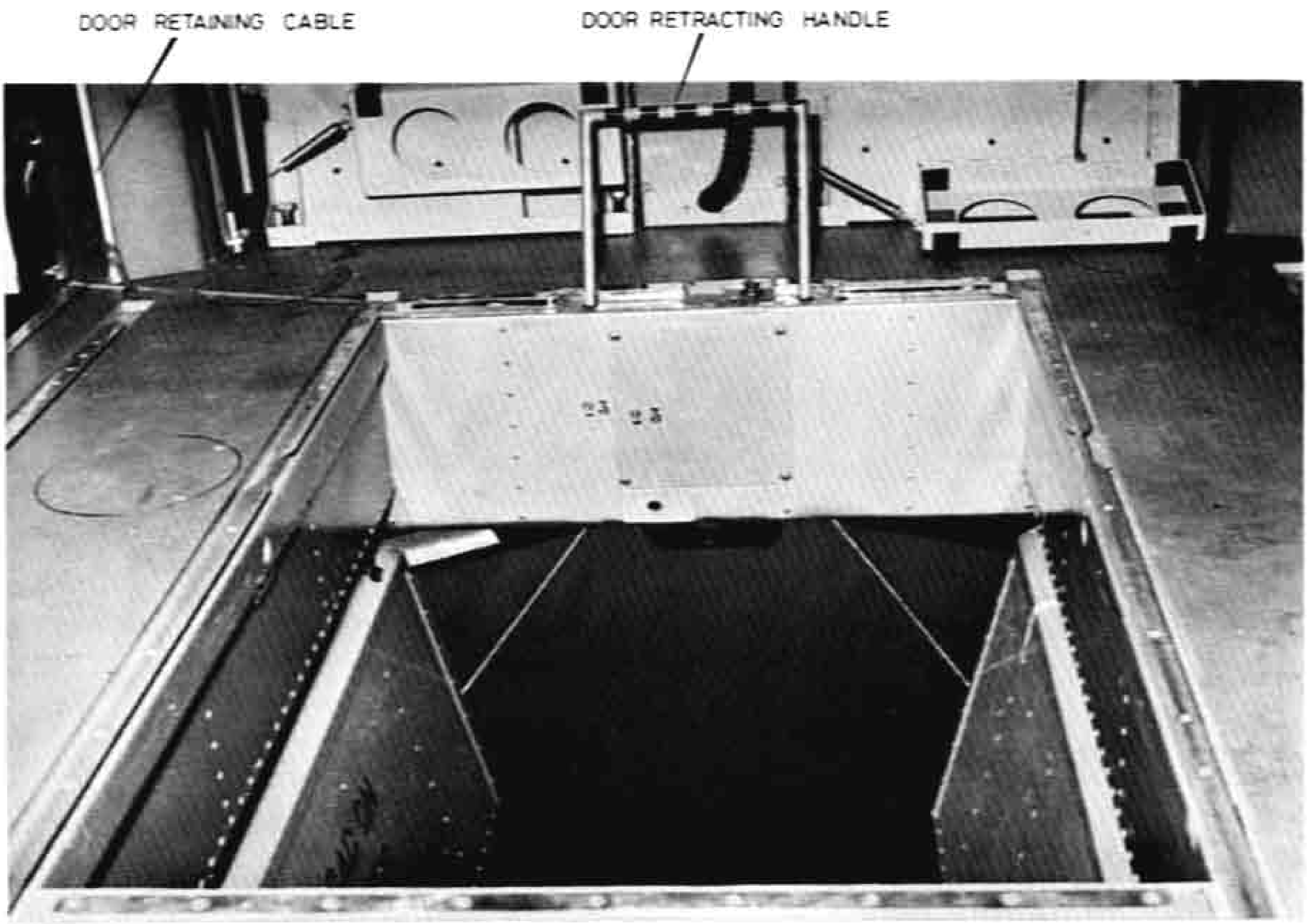


Fig. 1-27 **Trap Doors**

1131. Floor Hatch (Ref. Fig. 1-27). The trap doors in the fuselage are covered by a floor hatch which forms part of the cabin floor. The hatch is a metal structure with wooden panels and a plastic covering; it is held in place by two spring loaded lock-pins which extend into the fuselage. A cable from each pin extends to a ring in the centre of the hatch; when this ring is pulled the lock pins are disengaged and the floor hatch can be removed to provide access to the trap doors below.

1132. Rear Fuselage Access Door and Panel. Access to the rear fuselage from outside the aircraft is obtained through the rear fuselage door on the starboard side of the aircraft. The door is a metal plate, reinforced by a frame and stiffeners; it is hinged on the forward edge and held closed by two DZUS fasteners. Access to the rear fuselage from within the cabin is obtained through a panel in the rear wall of the cabin section. The panel is constructed of sheet metal, reinforced with stiffening angles, and is faced with a plastic material. The panel measures approximately 2 ft. x 2 ft. 9 in.; it is located by two dowels attached to the bottom of the panel and is retained by two metal clips at the top.

SEATS

1133. Introduction. Seating provided in the aircraft is as follows:

a. Two crew seats located in the crew compartment.

b. Six collapsible passenger seats which can be installed in the cabin or stowed in the fuselage.

1134. Crew Seats. (Ref. Fig. 1-28). Each crew seat is a metal structure with a padded head rest. It is bolted to the floor and fitted with the following items:

a. Shoulder harness and lap strap.

b. Inertia reel.

c. Inertia reel control box.

d. Oxygen mask stowage (inside head rest).

e. Supports for the PRC 25 manpack radio.

f. Crash axe (on front of co-pilot's seat only).

g. One man dinghy and survival pack (optional fit) in seat pan.

The crew seats are fitted with shoulder harness and lap strap. The inertia reel is connected to the shoulder harness and is operated, via the inertia reel control box, by a lever at the right hand side of the seat.

1135. Passenger Seats (Ref. Fig. 1-29, 1-30). Six collapsible passenger seats are provided in the aircraft and may be installed in the cabin in the positions shown in Fig. 1-29.

Note

The port and starboard seats are not interchangeable.

The passenger seat is a welded steel construction with a metal seat pan which holds a cushion. The seat back is hinged and folds flat for stowage; it is trimmed with a slip cover which is tied at the bottom. The cushion is of foam plastic laminate with a cover of synthetic material. A lap strap seat belt is secured to the seat by buckles. An oxygen mask is stowed in a bag under each of four of the seats. The seats are retained in T-rails on the floor of the cabin, running on flanged shoes. Cut-outs in the T-rail allow the seats to slide onto the rails. The seats are held in place by a spring loaded shear pin: this fits into one of a series of holes in the T-rail which can be selected to adjust the seat spacing. When not required the seats are folded and stowed in the fuselage as shown in Fig. 1-30.

CABIN VENTILATION AND HEATING

1136. Ventilating System. The cabin ventilation system is designed to provide fresh air to the cockpit and cabin at all times. Cold air taken from a point in the centre of the engine air intake duct is fed via flexible and rigid ducting, to cold air outlets positioned at each end of the instrument panel shelf. Unless cabin heat is selected, cold air is automatically supplied to these points. The desired flow is obtained by turning the knurled portion of the outlets clockwise. To increase the air flow, when the aircraft is stationary or taxying, an electrically operated blower is provided in the cold air duct. The blower is controlled by a switch labelled CABIN FAN on No. 4 instrument panel and is rated for operation up to 10000 feet. Operation in flight is unnecessary. Outlets are also provided at the pilots feet and to the right of the co-pilots seat for ventilation flow to the cabin.

1137. Heating System.

CAUTION

The P3 air is at 734°F (390°C) and piping in this region is dangerously hot.

Two push-pull controls labelled HEATING-AIR (HOT-COLD) and CABIN DEFROSTER, on No. 4 instrument panel, control the cabin heating and ventilation. Selection of the left hand control (HOT-COLD) results in:

a. Progressive closing of the cold air duct by a regulating (butterfly) valve with consequent diversion of the cold air into a mixing box.

b. Admission of hot air (P3 air) from the compressor into the mixing box via a regulating valve and a sound suppressor.

The distribution of the warm air resulting from the mixing of hot and cold air, is dependent upon the right hand control labelled CABIN DEFROSTER. When the push-pull control is pushed fully in, the warm air is distributed to:

a. The cabin hot air outlet located beside the co-pilots seat, at floor level.

b. Windscreen defroster duct.

c. Outlet near the pilots feet.

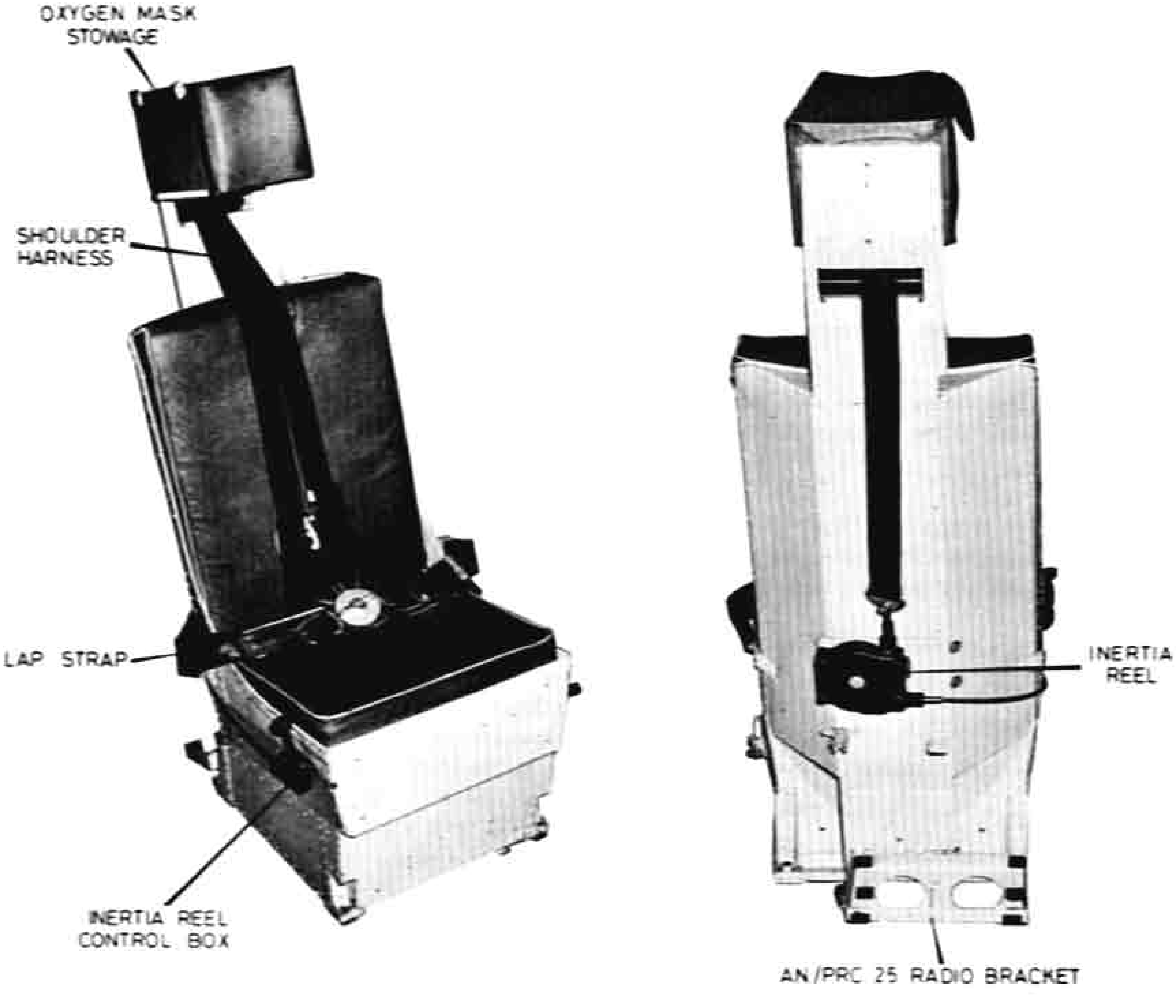


Fig. 1-28 Crew Seats

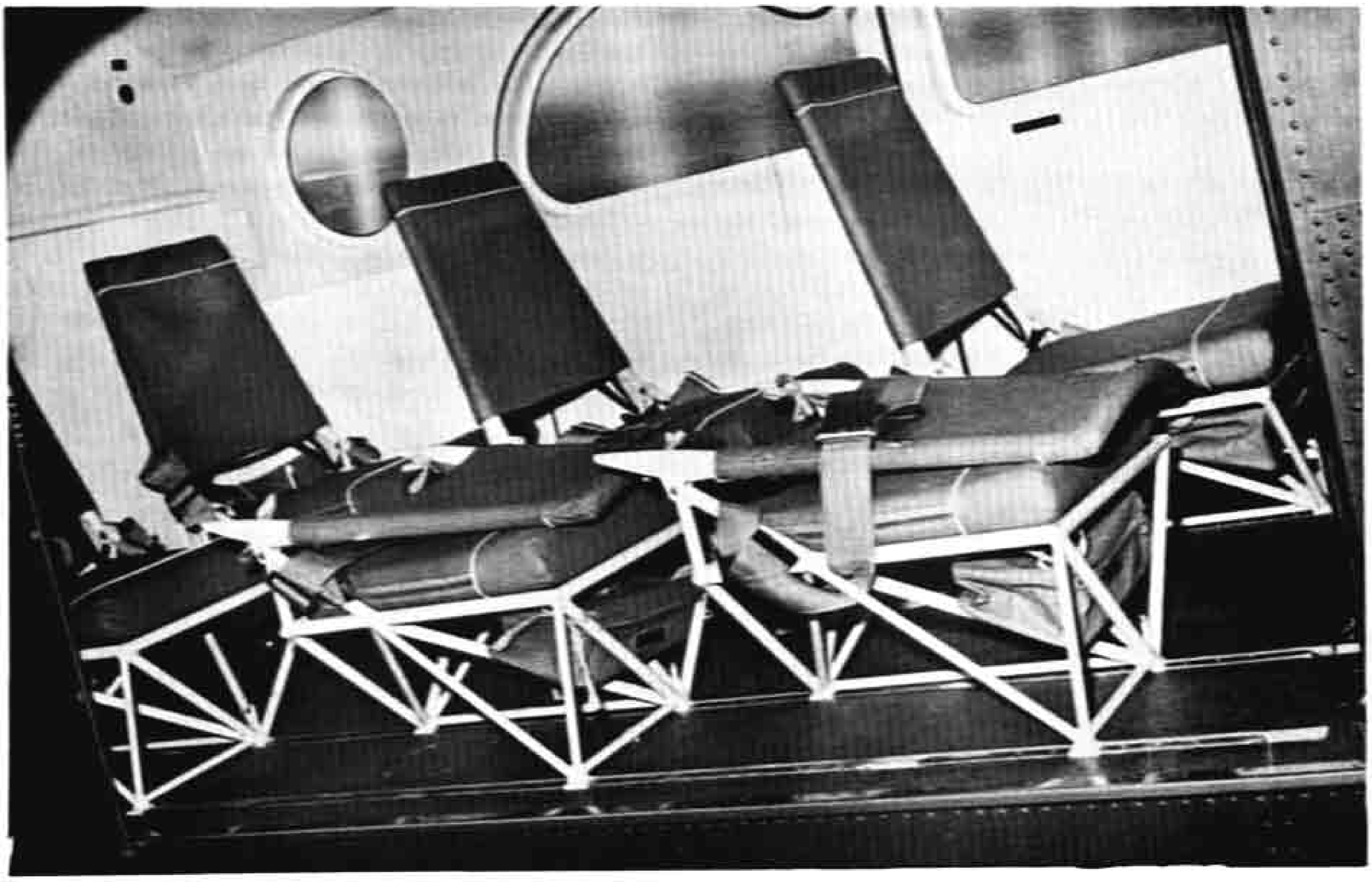


FIG. 1-29 PASSENGER SEATS INSTALLED

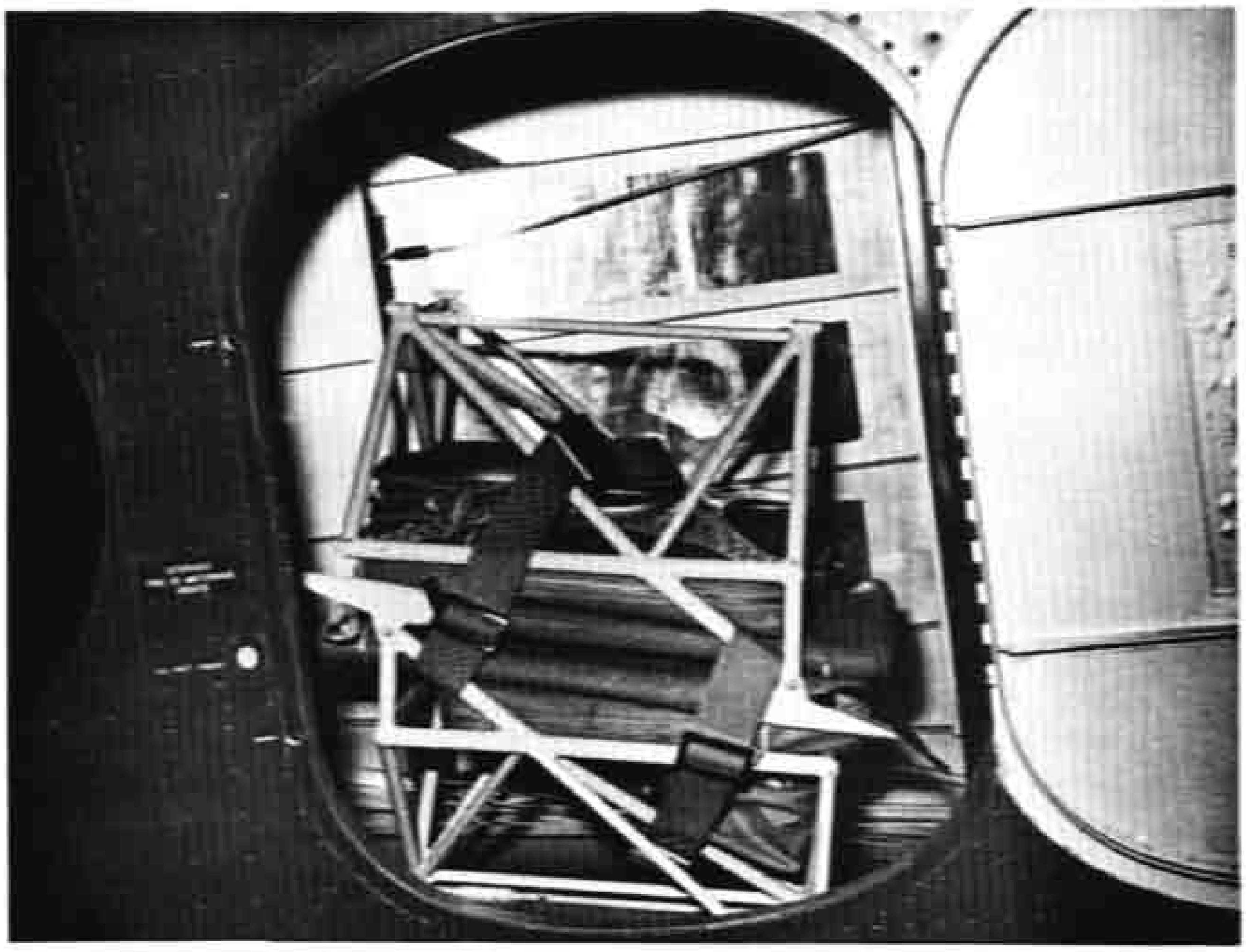
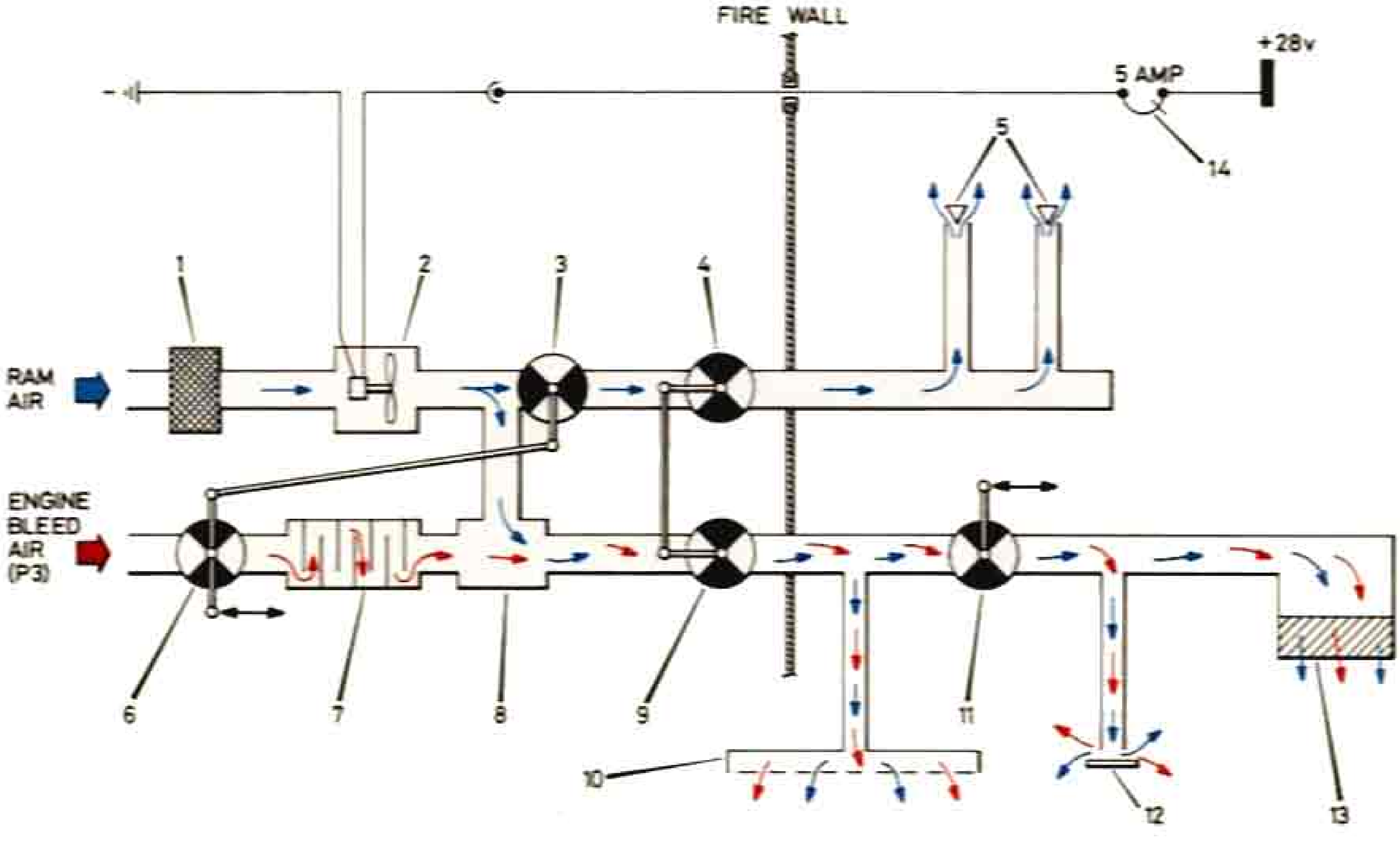


FIG. 1-30 PASSENGER SEATS STOWED

When the control is pulled fully out, a further regulating valve closes and all the warm air is diverted to the windscreen. Intermediate positioning is also possible on the HOT-COLD selector to give some measure of temperature control.

1138. Selection - CABIN DEFROSTER. The defroster outlet tube is mounted above the instrument panel and runs the full width of the windscreen. When CABIN is selected, air flows through the lower pipe to the pilots feet and the aft cabin, as well as to the defroster. When DEFROSTER is selected (pulled fully out), the cabin selector valve closes and all air in the lower duct flows through the windshield defroster.

1139. Fire Emergency Shut-Off Control (Ref. Fig. 1-32). In the event of smoke or fumes entering the cockpit during an engine fire, or malfunction, all air entering the cockpit and cabin can be shut-off. The fire-emergency shut-off control consists of a red ring located immediately below No. 4 instrument panel. It is marked with a placard. Operation of this ring, by pulling sharply, causes the emergency shut-off (butterfly) valves (3) and (12) in both the cold and warm air ducts to close. The valves are spring loaded and once operated, cannot be re-opened in flight.



1 AIR INLET SCREEN
2 CABIN FAN
3 REGULATING VALVE
4 FIRE EMERGENCY SHUT-OFF VALVE
5 AIR OUTLETS IN COCKPIT
6 REGULATING VALVE
7 SOUND SUPPRESSOR
8 MIXING BOX
9 FIRE EMERGENCY SHUT-OFF VALVE
10 WINDSCREEN DEFROSTER
11 SELECTOR VALVE
12 DEFLECTOR (COCKPIT FLOOR)
13 DISTRIBUTOR
14 CABIN FAN SWITCH

Fig. 1-31 Cabin Ventilation and Heating - Schematic

1140. Controls.

CAUTION

The cabin cold air inlet intake is protected by a small mesh gauze screen. Blockage of this screen by grass etc., will result in a reduction or complete stoppage of cold air flow. If cabin heat is selected when this occurs, the consequent insufficient dilution of the hot air will result in damage to the aircraft and its systems, and will be indicated by the smell of scorching. Cabin air must be selected OFF immediately.

Fig. 1-32 shows the location of the following controls.

a. Blower switch (switch type circuit breaker) (17).

b. Heat Selector (hot-cold) (5).

c. Heat diversion control (cabin defroster) (4).

d. Fire emergency shut-off control (6).

Note

Inspection of the intake gauze filter is a pre-flight servicing requirement.

ANTI-ICING AND DE-ICING SYSTEMS (Ref. Figs. 1-31, 1-32)

1141. Fuel Control Senseline Anti-Icing System. The engine control heater consists of a single heater element surrounding the enrichment pressure line (PX) between the temperature compensator and fuel control unit (FCU). To prevent icing of the senseline at low ambient temperatures the heater should be switched on at temperatures below 32°F (0°C). The power required to operate the heating element is 40W. The engine control heater switch is located near the auxiliary fuel pump switch on No. 2 instrument panel and is labelled ENG CONTR HEATER. The system is protected by the 15 amp STARTING EQUIPM CB located on the main circuit breaker panel. An amber pilot light above the switch illuminates when the heater element is energised. Protection of the engine control heater circuit is provided by the heater itself which incorporates a bimetallic strip. The compressor discharge pressure senseline (P3) is also insulated at the point where it traverses the engine air inlet duct as a guard against icing.

1142. Pitot Head - Heating.

CAUTION

Do not operate pitot-heater element for more than 30 seconds during ground check.

The pitot system consists of a pitot-head complete with heating element. The heating is controlled by a toggle type 5A circuit breaker labelled PITOT HEATING which is located near the GEN ON switch on No. 4 instrument panel.

1143. Windshield Heating. Windshield heating is accomplished by means of a demister outlet tube which is mounted above the instrument panel and runs the full width of the windshield. Warm air is directed to the windshield for anti-icing and demisting when the push-pull control knob, labelled CABIN DEFROSTER, on No. 4 instrument panel, is pulled fully out to the DEFROSTER position.

Note

For flight into known icing conditions see Section 5 OPERATING LIMITATIONS this Flight Manual.

COMMUNICATIONS AND ASSOCIATED ELECTRONIC EQUIPMENT (Ref. Figs. 1-33, 1-34, 1-35)

1144. Introduction. The types and loeation of radio communication and navigation equipment fitted in the aircraft are shown in Fig. 1-33. Descriptions and details of operation of the individual items are given in the succeeding paragraphs. The positions of the associated antennae are shown in Fig. 1-34.

1145. Signal Distribution Panel. (Ref. Fig. 1-36). Four signal distribution panels are fitted to the aircraft, one each for the pilot and co-pilot and one each for the forward cabin passengers. The pilot's panel is located on the lower left of No. 3 instrument panel and the co-pilot's panel is located between the pilots' seats. Each of the cabin panels is located above the cabin door beside the passengers' seats. The distribution panels, which are all identical in appearance, have one row of white push-to-set switches located along the top of the panel. These switches connect the users' microphone to one of six radio sets and/or the aircraft

1. Blower
2. Regulating Valve
3. Fire Emergency Shut-Off Valve
4. Push-Pull Control (Cabin Defroster)
5. Push-Pull Control (Hot-Cold)
6. Fire Emergency Shut-Off Control
7. Windscreen Defroster
8. Distributor
9. Air Outlets
10. Regulating Valve
11. Soft Copper Locking Wire
12. Fire Emergency Shut-Off Valve
13. Mixing Box
14. Sound Suppressor
15. Regulating Valve
16. Air Inlet Screen
17. Cabin Fan Switch

Key to Fig. 1-32 Cabin Ventilation and Heating System

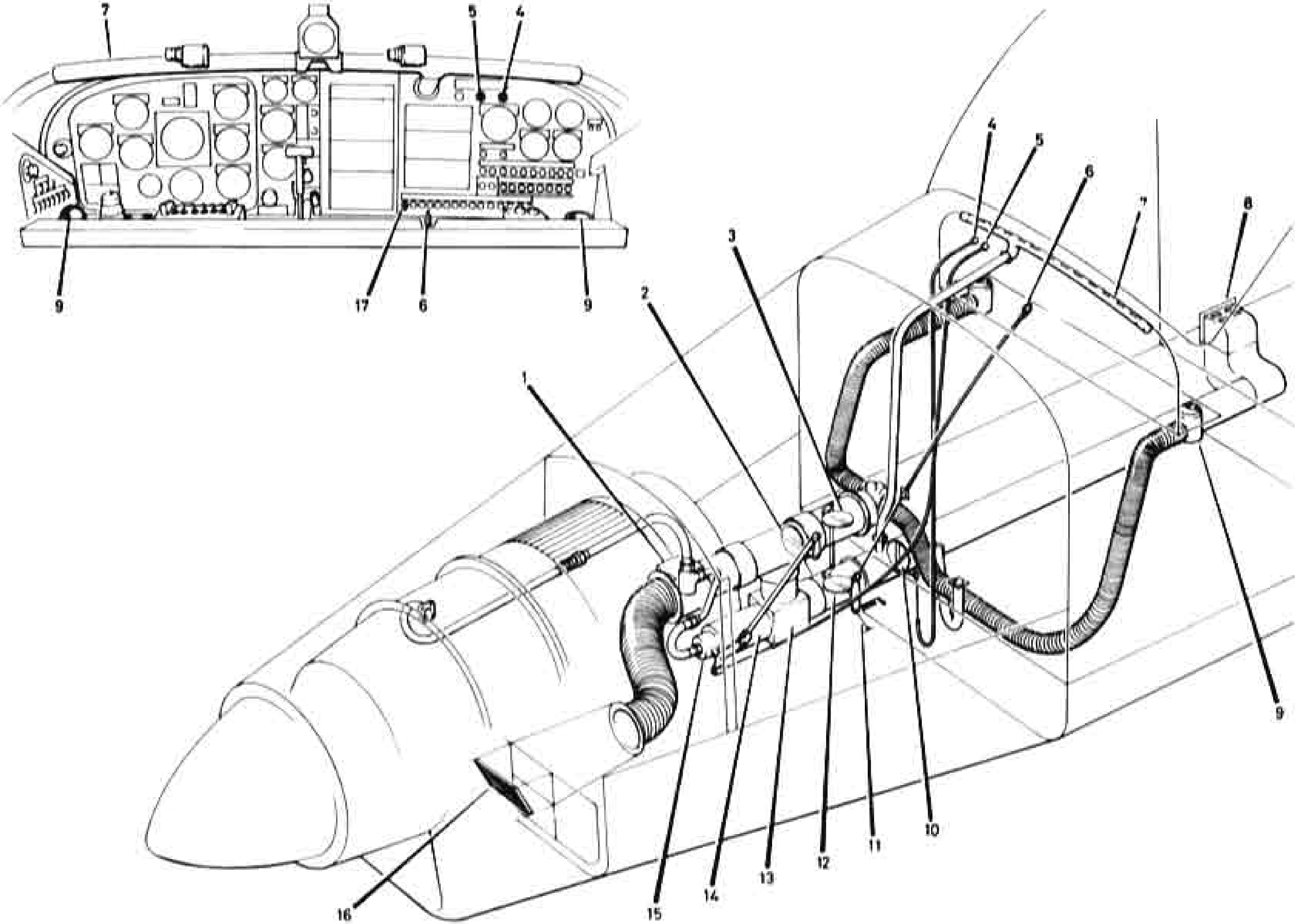
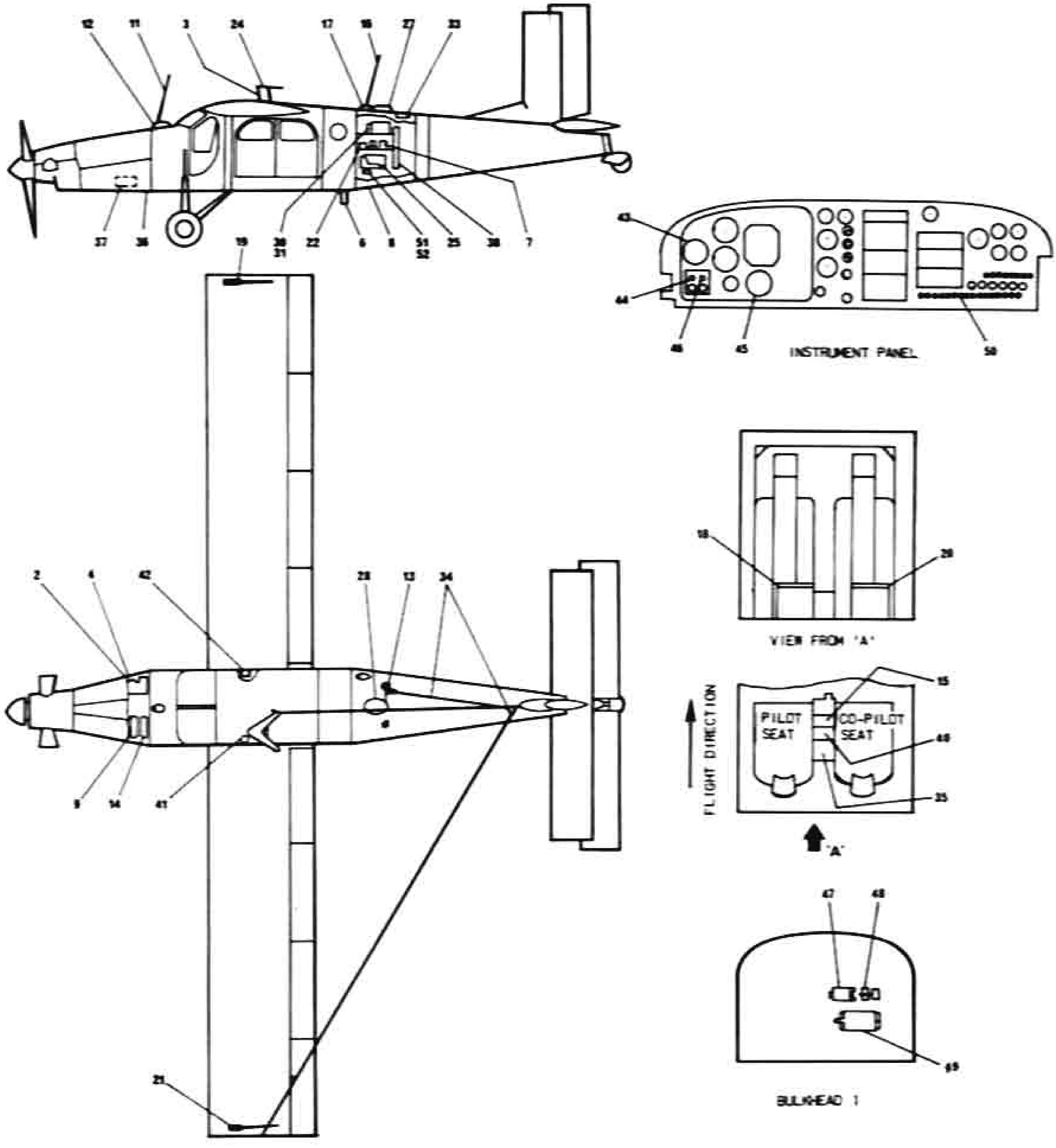


FIG. 1-32 CABIN VENTILATION AND HEATING SYSTEM

TYPE	DESIGNATION	FREQUENCY RANGE	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
VHF Radio or UHF Radio	Collins 618F-1A or AN/ARC-51BX	118.0 to 135.95 MHz 225.0 to 399.95 MHz	Transmitting, receiving Transmitting, receiving ADF	Pilot, Co-pilot * Pilot, Co-pilot *	Line of sight Line of sight	No 3 Instrument Panel No 3 Instrument Panel
FM Radio (2)	AN/ARC-54	30.0 to 69.95 MHz	Transmitting, receiving, re-transmitting, homing	Pilot, Co-pilot *	80 miles	No 3 Instrument Panel and between Pilots' seats
FM Radio (2)	AN/PRC-25	30.0 to 75.95 MHz	Transmitting, receiving, re-transmitting	Pilot, Co-pilot *	5 miles (up to 25 miles can normally be achieved)	Back of Pilot's and Co-pilot's seat
HF Radio	Sunair ASB-100	2 – 18 MHz 10 Channels	Transmitting, receiving	Pilot, Co-pilot *	2500 miles*	No 4 Instrument Panel
ADF	Bendix Technico DFA73A	190 – 1750 KHz	ADF Loop receiving (ANT) Test	Pilot, Co-pilot	Line of sight	No 4 Instrument Panel
VHF NAVCOM	Collins AN/ARN82	108.0 – 117.95 MHz navigation 118.0 – 126.95 MHz voice	VOR, Localizer	Pilot, Co-pilot	Line of sight	No 4 Instrument Panel
DME (Post Mod 26)	VAN 5		Distance Measurement	Pilot, Co-pilot	100 miles	Front of centre console between pilot's seats
Marker Beacon Receiver (Post Mod 26)	R-1041/ARN		Marker Beacon Reception	Pilot, Co-pilot	Within beacon transmission cone	Top left of No 1 instrument panel and top left of No 4 Instrument panel
				*All stations in the aircraft can use (i.e. transmit receive) all radio sets.	*Dependent on frequency and atmospheric conditions	

Fig. 1-33 Communications and Associated Electronic Equipment



'Collins' 618 F-1A

1. Transceiver 618 F-1A
2. Power Supply 4270-1
3. Part of Antenna 137 x -1

'Collins or Admiral' ARC-51 BX

4. Transceiver RT - 742
5. Control Unit C - 6287
6. Antenna AT-256 A/ARC

'Collins' ARA 50

7. Amplifier AM 3624/ARA 50
8. Antenna AS 090/ARA 48

'Admiral' AN/ARC 54 I

9. Transceiver RT - 348 ARC - 54
10. Control Unit C - 3835 ARC - 54
11. Antenna AS - 1703 ARC
12. Antenna Coupler CU - 942 ARC 54
13. Homing Antenna AS - 1922 ARN

'Admiral' AN/ARC 54 II

14. Mount MT - 1535 ARC 54
15. Space for Control Unit C - 3835 ARC - 54
16. Antenna AS - 1703 ARC
17. Antenna Coupler CU - 942 ARC 54

Man Pack PRC - 25 III

18. Transceiver PRC - 25
19. Antenna Pilatus

Man Pack PRC - 25 IV

20. Transceiver PRC - 25
21. Antenna Pilatus

'Collins' AN/ARN 82

22. Receiver 51 R - 8 A
23. Control Unit 313N-4C
24. Part of Antenna 137X-1

Bendix DFA - 73

25. Receiver DFA - 73 - 1
26. Control Unit CNA - 73 CB
27. Loop Antenna LPA 73 C-1
28. Sense Antenna Pilatus
29. Radio Range Filter HR - 16 - D

'Sunair' ASB - 100

30. Transceiver 99912
31. Power Supply 999-14
32. Control Unit 99896
33. Antenna Coupler 98356
34. Antenna Pilatus

'Bendix' AN/APX 72

35. Space for Transponder set
36. Space for Antenna
37. Space for Receiver Transmitter RT - 859
38. Junction Box
39. Audio Box Pilot
40. Audio Box Co-Pilot
41. Audio Box Pass
42. Audio Box Pass 2
43. Deviation Indicator ID-48
44. Switch ID-48
45. RM I ID 250
46. Switch RMI
47. Radio Noise Filter
48. Radio Master Relay
49. Inverter PC-15 A
50. CB Radio
51. Radio Range Filter HR 16D
52. Interphone Amplifier 6708-1

FIG 1-33A COMMUNICATIONS EQUIPMENT INSTALLATIONS

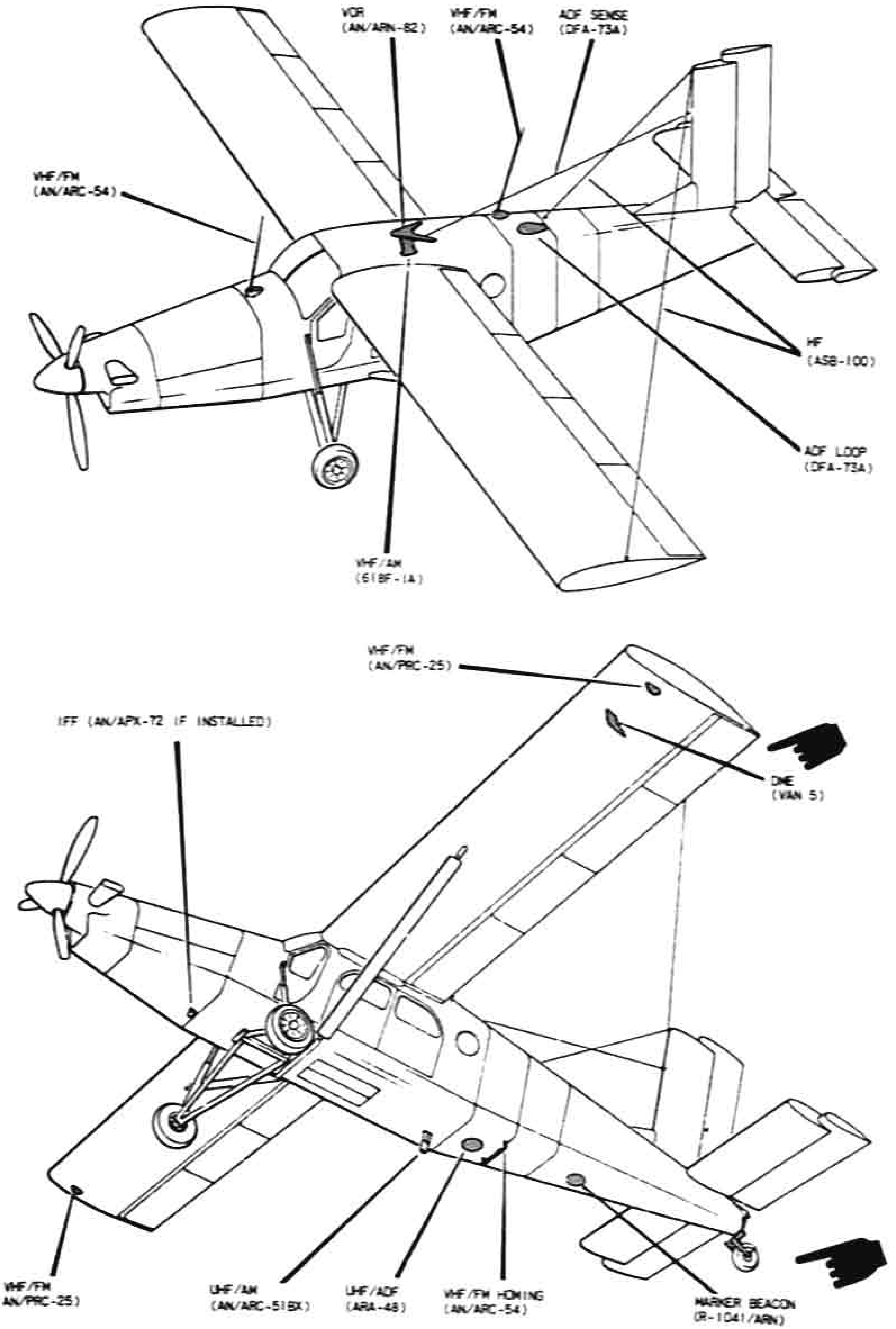
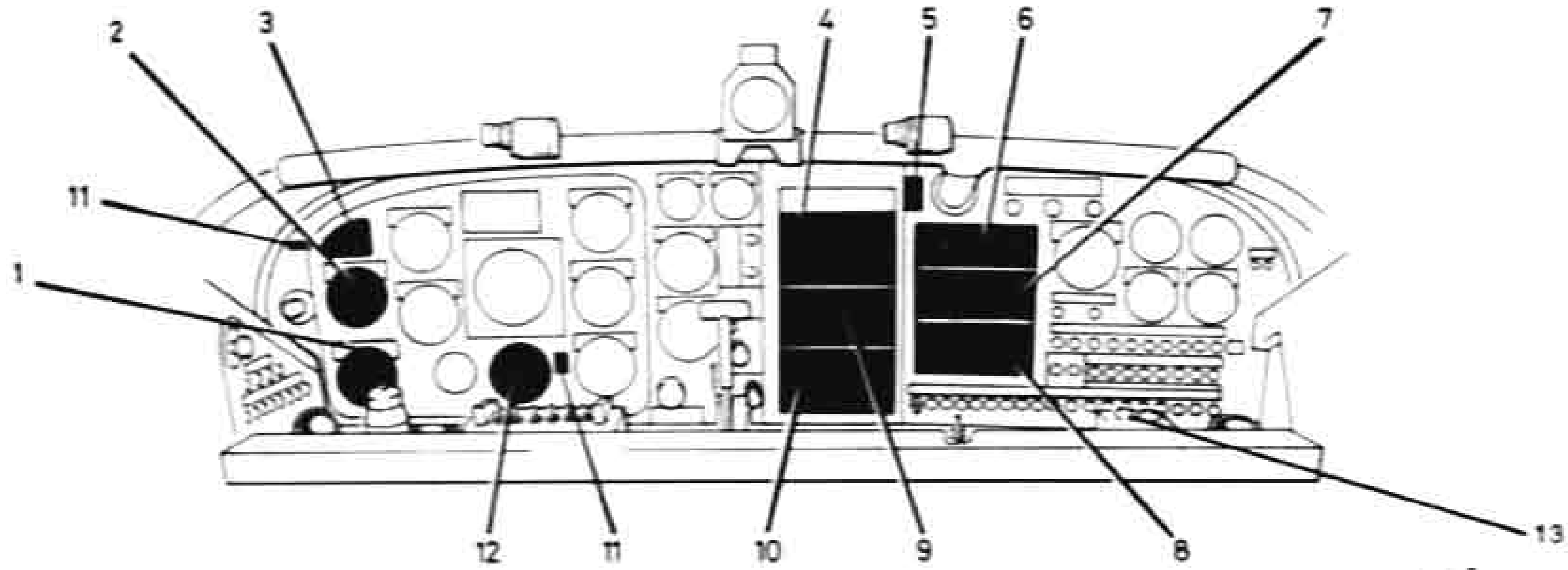


FIG 1-34 ANTENNAE INSTALLATIONS



1. DME INDICATOR (SEE FIG. 1-44B)
2. COURSE SELECTOR INDICATOR 331H-3G (SEE FIG. 1-44)
3. MB SENSITIVITY SWITCH AND INDICATOR LIGHT
4. VHF (AM) RADIO, COLLINS 618F-1A (SEE FIG. 1-37)
   OR
   UHF (AM) RADIO, AN/ARC-51BX (SEE FIG. 1-38)
5. ICS AUDIO SWITCHES FOR DME AND MB RECEIVERS
6. HF (AM/SSB) RADIO, SUNAIR ASB 100 (SEE FIG. 1-41)
7. ADF BENDIX-TECHNICO DFA-73A (SEE FIG. 1-42)
8. VHF NAVCOM, COLLINS AN/ARN-82 (SEE FIG. 1-43)
9. VHF (FM) RADIO, AN/ARC-54 (FM1 AND 2) (SEE FIG. 1-39)
10. SIGNAL DISTRIBUTION PANEL (SEE FIG. 1-36)
11. NAV SELECTOR SWITCHES
12. RADIO MAGNETIC INDICATOR (R.M.I.)
13. COPILOT INTERPHONE AND PTT SWITCH

Fig. 1-35 Communications Control Panels

intercommunication system. The aircraft intercommunication system is inoperative whenever the radio master switch is off and, in addition, the pilot's intercommunication button overrides all others in the aircraft. Two rows of toggle switches are also provided on the panel to enable selection of any required receiver. The lower left toggle switch is marked EMER and should be used when the signal level in the headset is too low. Selection of this switch disconnects the isolation amplifier from the system and the output from the selected receiver is fed directly to the headset. Each distribution panel has a volume control in the bottom right hand corner. CB's for the pilot and co-pilot audio systems and the intercommunication system are on the main CB panel.

Note

In the EMERG position it is only possible to monitor one receiver during emergency operations. All receiver toggle switches except the one to be monitored must be switched off.

1146. VHF (AM) Radio Collins 618F-1A (Ref. Fig. 1-37). The Collins Radio Type 618F-1A System consists of three units:

a. Transceiver 618F-1A
b. Fixed IF, Audio and Power Supply 427D-1
c. Part of Antenna 137X-1

Fig. 1-36 Signal Distribution Panel

The control unit is located at the top of No. 3 instrument panel and the audio and power supply unit is installed forward of the firewall under the engine cowling. The antenna is part of the combined VHF/VHF-NAV antenna mounted on the upper fuselage near the port trailing edge flap. A CB marked VHF/AM is located in the row of CB's at the bottom right hand side of the main CB panel on No. 4 instrument panel.

Controls

1147. Power Switch. The power switch is a two-position switch marked OFF/PWR, located at the centre bottom of the control unit. When the switch is selected to PWR, electrical power is supplied to the set. No power is supplied when the switch is in the OFF position.

1148. Volume Control. The volume control knob is located on the lower left hand side of the control unit. Turning the knob clockwise increases the audio output level of the set.

1149. Squelch Control. The squelch control is located at the lower right hand side of the control unit. When rotated, the control adjusts the squelch threshold level of the radio set.

1150. Frequency Controls. Two megahertz controls are located at the top left hand side and top right hand side of the control unit. The left hand control selects the first three digits of the operating frequency and the right hand control selects the fourth and fifth digits. Frequencies may be selected in the range 118.00 to 135.95 MHz. The frequency selected appears in the window between the two frequency controls.

Fig. 1-37 VHF(AM) Radio, Collins 618F-1A

1151. Normal Operation - VHF Radio Set.

1. VHF/AM & ICS CBs - Check in.
2. Radio Master Switch - ON.
3. VHF control unit Power Switch - PWR. Wait 30 seconds for warm up.
4. Switch UHF/VHF on signal distribution panel - ON (up).
5. UHF/VHF microphone push-to-set button on signal distribution panel - Depressed.
6. Frequency Controls - Select frequency required.
7. Volume Control - As required.
8. Squelch Control - As required.
9. Transmit - Press PTT switch on control column.

1152. Switching Off

1. VHF control unit Power Switch - OFF.

1153. UHF (AM) Radio AN/ARC-51BX. (Ref. Fig. 1-38). The AN/ARC-51BX is a completely transistorized airborne radio set providing amplitude modulated speech communication in the UHF band and may be installed in place of the Collins 618F-1A radio. The set can be used for two-way radio communication between aircraft, air-to-ground or air-to-ship. Transmission and reception are conducted on the same frequency using a common antenna. The UHF antenna is mounted on the underside of the fuselage to the rear of the anti-collision warning light. In addition, an auxiliary receiver is incorporated into the transceiver to monitor any pre-set guard frequency in the 238 - 248 MHz band, the normally used guard frequency being 243 MHz. The control unit provides for manual channel selection, guard-transmit selection or selection of any one of twenty pre-set channels. The transceiver is located on the starboard side of the aircraft, forward of the firewall under the engine cowls, in lieu of VHF (AM) transceiver 618F-1A and the control unit is fitted on the No. 3 instrument panel in lieu of the Collins 618F-1A VHF control unit.

Controls

1154. Function Select Switch. The function select switch is a four-position switch located at the right hand side of the control panel. The four positions are labelled OFF, T/R, T/R+G and ADF. When the switch is selected to OFF, no electrical power is available and the set is inoperative. With the switch selected to T/R, normal transmission and reception facilities are available but the guard receiver is switched off. The T/R+G position provides normal transmission and reception and, in addition, the guard channel is monitored. With the switch at ADF and the RMI selector switch on the lower left hand side of No. 1 instrument panel selected to ADF/UHF, the number two needle of the RMI will indicate the magnetic bearing of the transmitting station from the aircraft. On post Mod 26 aircraft the RMI Selector Switch is located between the RMI and the totalizer/Fuel Flow Indicator on No. 1 instrument panel.

1155. Volume Control. The volume control is located above the function select switch. When the control is rotated clockwise, the audio output level is increased.

1156. Squelch Disable Switch. The squelch disable (SQ DISABLE) switch is located at the top centre of the control panel. It is a horizontal two-way ON/OFF switch. When the switch is in the OFF position the squelch is disabled. When the switch is in the ON position squelch is operative.

1157. Pre-set Channel Control. The pre-set channel control is located at the top of the control panel to the left of the squelch disable switch. Rotation of the switch selects any one of 20 pre-set channels. The channel number appears in a window above the switch and the corresponding frequency appears to the right of the channel number.

1158. Mode Selector. The mode selector is located below the pre-set channel selector on the left hand side of the control panel. The switch positions are PRESET CHAN, MAN and GD XMIT. When the selector is set to PRESET CHAN, the radio will operate at whichever of the 20 pre-set channels is selected. When the selector is set to MAN, the radio will operate on the frequency selected manually using the frequency selector controls. With the selector set at GD XMIT, the transceiver is automatically set to the guard channel frequency.

1159. Frequency Selector Controls (Man). Three frequency selector controls are located across the bottom of the control panel. The left hand control selects the first two digits of the required frequency, the centre control selects the third digit and the right hand control selects the fourth and fifth digits. The frequency selected appears in the window above the centre control. Two UHF circuit breakers are provided, one on the main CB panel on No. 4 instrument panel and the other adjacent to the gyro CB on the auxiliary CB panel.

1160. Normal Operation - UHF Radio Set.

1. UHF and ICS circuit breakers - Check IN.
2. Radio Master Switch - ON.
3. Switch UHF/VHF on signal distribution panel - ON (up). UHF/VHF microphone push-to-set button on signal distribution panel depressed.
4. Function Select Switch - T/R.
5. Mode Switch:
   a. PRESET CHAN, for transceiver on pre-set channel.
   b. MAN, for transceiver on manual select channel.
6. Select required channel:
   a. Rotate Pre-set Channel Selector to required number.
   b. Rotate Frequency Selector controls until required frequency appears in window.
7. Volume Control signal distribution panel - Halfway.
8. Squelch Disable Switch - ON.
9. Volume Control UHF control unit - As required.
10. To transmit - Press PTT switch on control column.

1161. Switching Off.

1. Function Select Switch - OFF.

1162. Operation - Guard Transmit.

1. Mode Selector - GD XMIT.
2. To transmit - Press PTT switch on control column.

Note

> The guard frequency (243 MHz) is permanently selected within the set and is continuously monitored and received, in addition to the selected frequency, when the Function Select Switch is selected to T/R+G.

1163. Collins ARA-50 Direction Finder. The Collins ARA-50 direction finder is a lightweight airborne automatic direction finding system operating in the UHF band and is used in conjunction with the AN/ARC-51BX transceiver equipment. In operation the ARA-50 may be used for search and rescue operations and for determining the bearing of an operating transmitter (either ground based or airborne) with respect to the aircraft. The unit is located in the bay of the aircraft behind the rear bulkhead.

1164. Controls. The units of the Collins ARA-50 are inoperative until ADF is selected on the ARC-51BX control unit, thus providing AC and DC power to the ARA-50 units.

1165. Frequency Selection. The required ADF frequency is selected on the ARC-51BX control unit.

1166. Volume Control. Control of volume of the signal is achieved by rotation of the transceiver volume control.

1167. Operating Procedure.

1. AN/ARC-51BX Function Select Switch - ADF.
2. Frequency Selector Controls - Required frequency.
3. RMI Selector Switch - ADF/UHF.
4. When the aircraft is within reception range of the transmitter, the direction of the transmitter is indicated by the No. 2 needle of the RMI.
5. Whilst the antenna is searching for a signal, a 155Hz buzz is heard in the headset. When the antenna locks onto a signal, the buzz should stop.

1168. To Switch Off.

1. AN/ARC-51BX Function Select Switch - OFF.

1169. Pre-Flight Operational Check.

Note

When the direction finder is operated in an aircraft on the ground, reflections of the signal may cause considerable error in direction. Since this error may exceed 30°, no accuracy tolerances are established for this condition.

1. Select a station of known geographical bearing from the aircraft. (Tower frequency may be used if it supplies a suitable signal).
2. Frequency - Select as required on AN/ARC-51BX.
3. Select AN/ARC-51BX - ADF.
4. Volume Control - Adjust as required.
5. RMI Selector Switch - ADF/UHF.
6. Note that No. 2 needle of RMI shows the approximate direction of selected station.
7. Select other frequencies and repeat the test.

Operational Limitations

1170. Reception directly above Signal Source. When flying directly over a transmitting station, the ADF equipment may operate erratically and give false bearing indications. This is due to the loss of signal

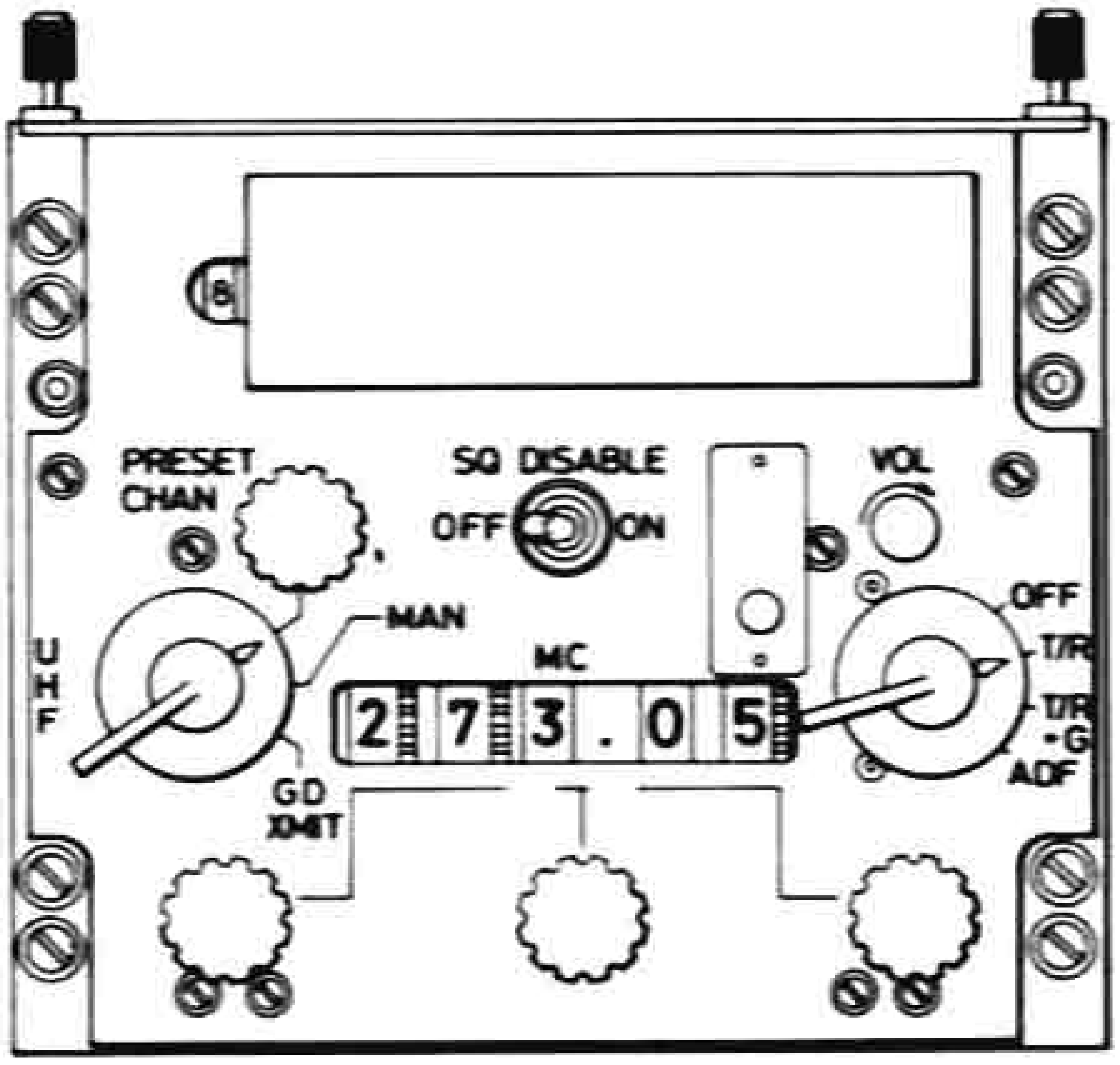


Fig. 1-38 UHF(AM) Radio, AN/ARC-51BX

that occurs in the cone of silence region at the transmitter site. The cone of silence is a null area through the radiation pattern of the transmitting station's antenna.

1171. Reception below Signal Source. If the transmitting station is an aircraft flying at a higher altitude than the receiving aircraft, ADF accuracy may be impaired because of deterioration of signal strength resulting from reflections at the surfaces of either or both aircraft.

1172. Reception from Signal Source below the Horizon. The signal radiated from a station below the horizon may be too weak to provide reliable bearing indications. If practicable, the aircraft should be flown to a higher altitude.

1173. Manoeuvring. Due to the propagation characteristics of received signals, some bearing instabilities will be observed during normal manoeuvring. Reliable homing or bearing signals may only be expected during straight and level flight.

1174. VHF (FM) Radio AN/ARC-54 (FM1 and FM2). (Ref. Fig. 1-39). The AN/ARC-54 is a lightweight airborne radio set, which provides the pilot and co-pilot with two-way communication between aircraft and ground stations within the tactical frequency modulation band 30.0 - 69.95 MHz. Additionally, the set is used for air-to-air communications and FM homing. Two radio sets may be connected back-to-back to provide an airborne retransmission facility. During retransmission, each radio set is tuned to a different frequency; signals received on each frequency are transmitted on the alternate frequency. When used with homing antenna, the AN/ARC-54 provides an FM homing facility, which allows the aircraft to be homed on any signals transmitted within the frequency range of 30.0 - 69.95 MHz. The two sets are located on the port side of the aircraft forward of the firewall under the engine cowling. The control units are located as follows:

a. FM1 - in the centre of the instrument panel under the control unit Collins 618F-1A or AN/ARC-51BX.

b. FM2 - between the pilot's and co-pilot's seats.

Controls

1175. Both FM1 and FM2 control units are identical and incorporate the controls detailed below.

1176. Mode Control. This is a four-position rotary type control located at the upper right hand corner of the control unit. The switch positions are OFF, PTT, RETRAN, and HOME. In the OFF position no power is provided to the radio set. When the switch is turned to PTT, power is applied and the set operates in a normal two-way communications mode. When the switch is turned to RETRAN, the set operates as a two-way relay station. With the switch selected to HOME, the set operates as a homing facility.

1177. Volume Control. The volume control is located at the upper centre of the control unit and is used to adjust the audio output level.

1178. Squelch Control. The squelch control is a three-position rotary type control located at the upper left hand corner of the control unit. The switch positions are DIS, CARR and TONE. When the switch is turned to DIS, the squelch circuit is disabled and when the switch is turned to CARR, the squelch circuit operates normally.

Note

The TONE position cannot be selected and the nomenclature is masked so that the AN/ARC-54 is compatible with older type ground facilities.

1179. Frequency Controls. Two frequency controls are located at the lower left and right hand sides of the control unit. The left hand control selects the whole MHz digits of the operating frequency and the right hand control selects the decimal MHz digits. The frequency selected appears in the window located between the two frequency controls. There are two circuit breakers provided, one for each set, and they are located on the main CB panel. Two FM antennae are fitted. FM1 antenna is in the centre of the upper engine cowling and FM2 antenna on the starboard side of the upper fuselage above the rear access door.

Normal Operation

1180. Two-Way Voice Communication.

1. Check FM1 and FM2 and ICS circuit breakers - IN.
2. Radio Master Switch - ON.
3. Switch VHF/FM 1 or 2 signal distribution panel - ON (up).
4. VHF/FM 1 or 2 microphone push-to-set button on signal distribution panel - Depressed.
5. Mode Control Switch of appropriate receiver - PTT.
6. Frequency - Select as required.

Note

A channel changing tone should be heard in the headset while the radio set is tuning. When the tone stops the radio set is tuned.

7. Squelch Control - As required.
8. Volume Control - As required.
9. After a warm-up period of 3 minutes, transmission is achieved by pressing the PTT switch and speaking into the microphone. Sidetone should be heard through the headset.

1181. Retransmit Operation.

1. Check FM1, FM2 and ICS circuit breakers - IN.
2. Radio Master Switch - ON.
3. Switch VHF/FM 1 or 2 signal distribution panel - ON (up).
4. Mode Control of FM1 and FM2 - RETRAN.
5. Squelch Control FM1 and FM2 - CARR.

Note

Do not attempt retransmission operation with the squelch controls set to DIS.

6. Frequency - Set FM1 and FM2 at least 5 MHz apart. (See AAP 7831-024-3, Vol 1, TM11-5821-244-12 page 13 para 18c.).
7. Volume Controls - As required.
8. Check for correct operation by monitoring the relayed signals.

Note

Either radio set may be used for normal operation by depressing the respective microphone push-to-set button on the signal distribution panel and depressing the PTT switch.

Fig. 1-39 VHF(FM) Radio, AN/ARC-54 (FM1 and 2)

1182. Homing Operation on FM1 only.

1. Check FM1 and ICS circuit breakers - IN.
2. Radio Master Switch - ON.
3. Switch VHF/FM1 signal distribution panel - ON (up).
4. VHF/FM1 microphone push-to-set button on signal distribution panel - Depressed.
5. Mode Control Switch of FM1 receiver - HOME.
6. RMI Selector Switch - VHF/FM.
7. Frequency of FM1 receiver - Select as required.
8. Squelch Control - CARR.
9. Establish communication with homing station and specify a key period of 10-30 seconds and a definite pause period.
10. Check that signal reception is of sufficient strength, flags out of sight on course selector indicator.
11. Head aircraft toward the homing station by altering course in the direction which causes the course selector indicator right/left vertical pointer to be centred on the horizontal pointer scale.
12. To ensure that the aircraft is heading TO the station and not FROM the station, alter the aircraft heading away from the homing station slightly and check that the vertical pointer deflects from the centre of the horizontal pointer scale **in the opposite direction of the turn**. If the vertical pointer deflects in the same direction as the turn, turn the heading of the aircraft through 180° and centralize the vertical pointer again.
13. To determine station passage, turn off course at 1 to 2 minute intervals, **each time in the same direction**. To return on course follow the vertical pointer back to the centre of the scale.

Note

The horizontal needle displays the relative strength of the station and should be used only as a guide for determining station passage.

14. Station passage will be indicated by a reversal of the vertical needle indication.

1183. Switching Off.

1. Mode Control Switch - OFF.
2. Signal distribution panel switch VHF/FM1 - OFF (down).

1184. VHF (FM) Radio AN/PRC-25 (FM3 and 4). (Ref. Fig. 1-40). The AN/PRC-25 radio set is a short-range, man-pack portable, frequency modulated (FM) transceiver, used to provide two-way voice communication. The frequency range is 30-75 MHz. When the operational role of the aircraft requires more than two VHF (FM) radios to be used, two man-pack radios AN/PRC-25 may be fitted. They are installed in brackets on the rear of the pilot's and co-pilot's seats and connected into the aircraft audio system by means of cables located on either side of the cabin, stowed in clips forward of the cabin doors. The braided cable is attached to either of the posts marked AUDIO on the set, and the smooth cable to the post marked ANT. Antennae for the sets are stowed inside the fuselage on the starboard side of the aircraft aft of the rear access door. They are screwed into mounts on either wing-tip. Unless a passenger is carried, the sets must be switched on and set to the required frequencies before flight, as they are inaccessible from the cockpit. On the signal distribution panel, the set behind the pilot is FM3 and the set behind the co-pilot FM4. The sets may be used for retransmission by use of a retransmission cable kit MK-456/GR (5995-00-973-1544). When used in this mode, both function switches are to be selected to RETRANS. Monitoring of operation is achieved through the headset.

Note

> Retransmission frequencies are to be set at least 3 MHz apart (See TM 11-5821-244-12).
>
> These sets have a battery life of 20 hours on a 9:1 receive/transmit ratio. Good communications can only be guaranteed when batteries are regularly replaced.

Controls

1185. **Band Switch.** The band switch is located at the lower left centre of the set. It is a two-position switch showing 30-52 in one position and 53-75 in the other. When turned to 30-52, the frequency selected is to be within the 30-52 MHz range. When turned to 53-75, the frequency selected is to be within the 53-75 MHz range.

1186. **Frequency Select Control.** Two frequency select controls are located at the centre of the set. The left hand control selects the left hand digits and the right hand control the right hand digits. The frequency selected appears in the window between the two controls.

1187. **Mode Switch.** The mode switch is a five-position rotary switch located at the right hand bottom corner of the set. The switch positions are OFF, ON, SQUELCH, RETRANS and LITE. When the switch is in the OFF position, no power is supplied to the set. With the switch in the ON position, the set is ready to function. The SQUELCH position reduces noise in the headset when no signal is being received. If the switch is set to the RETRANS position, the set is in a relay mode and if the switch is set to the LITE position, the frequency selected window is illuminated.

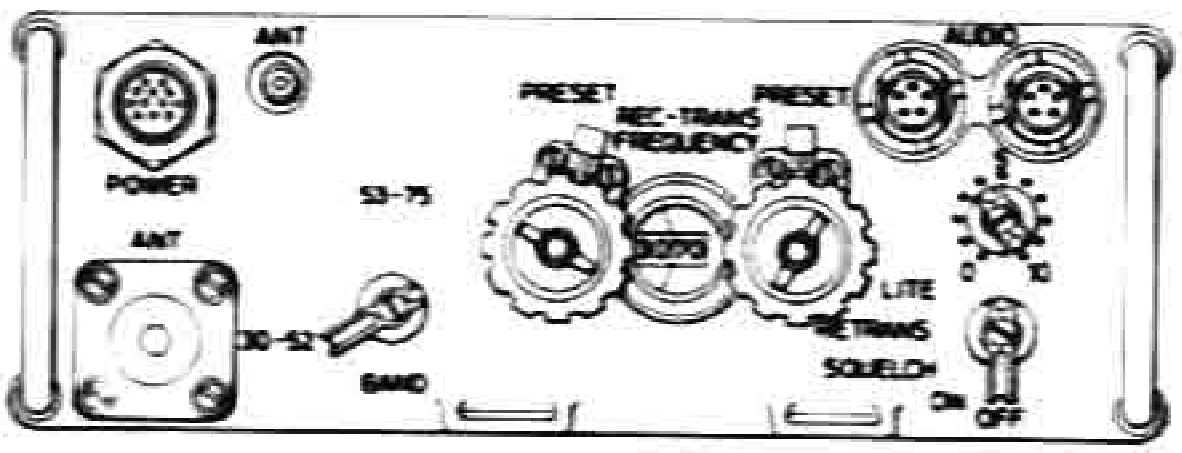


Fig. 1-40 VHF(FM) Radio, AN/PRC-25 (FM3 and 4)

1188. **Volume Control.** The volume control is a ten-position rotary switch, marked from 0 to 10 with 10 representing maximum volume.

Normal Operation

1189. **Two-way Voice Communication.**

1. Check ICS circuit breakers - IN.
2. Connect the antenna plugs.
3. Connect the plugs to either audio connector.
4. Radio Master Switch - ON.
5. Switch VHF/FM3 or 4 on signal distribution panel - ON (up).
6. VHF/FM3 or 4 microphone push-to-set button on signal distribution panel - Depressed.
7. Function Switch - ON.
8. Band Switch - Required operating frequency band.
9. Frequency Select Controls - Required operating frequency.
10. Volume Control - 4.
11. To transmit - Press PTT switch and speak into microphone.
12. Volume Control - Adjust to desired sound level.
13. Function Switch - SQUELCH. Adjust for required sensitivity and noise level.

1190. **Retransmission.**

1. Check ICS circuit breakers - IN.
2. Connect both sets together using retransmission cable kit MK-456/G. Use one AUDIO connector plug on each set.
3. Connect braided cable to other AUDIO connector on each set.
4. Connect smooth cable to ANT of each set.
5. Radio Master Switch - ON.
6. Frequency selected on each set to be at least 3 MHz apart.
7. Function Select Switch - RETRANS on both sets.
8. Switch VHF/FM3 or 4 on signal distribution panel - ON (up).
9. VHF/FM3 or 4 microphone push-to-set button on signal distribution panel - Depressed.
10. To monitor - Switch on FM3 or FM4 switch on signal distribution panel.

11. Transmission is still possible by depressing the appropriate push-to-set button on the signal distribution panel and pressing the PTT switch.

1191. Switching Off.

1. Turn Function Select Switch - OFF.

1192. HF (AM/SSB) Radio - Sunair ASB-100. (Ref. Fig. 1-41). The Sunair ASB-100 is a lightweight, airborne, ten-channel single side band (SSB) and amplitude modulated (AM) transceiver, designed for long-range voice communications in the 2-18 MHz frequency range. The transmitter/receiver and power supply unit are located on the starboard side of the aircraft behind the rear cabin bulkhead. The antenna tuner is located on the upper fuselage, inside the rear access door. The HF antenna runs from the centre of the fuselage to the top of the fin and then to the port wing tip. The control unit is located on the upper right hand centre of No. 3 instrument panel.

Controls

1193. ON/OFF and Volume Control. The ON/OFF and volume control is a rotary control switch and is the small inner control of the knob at the lower left hand corner of the control unit. Rotation fully in an anti-clockwise direction switches the set OFF. Rotation in a clockwise direction switches the set ON and increases audio output.

1194. RF Gain Control. The RF gain control is a rotary control switch and is the outer control of the knob at the lower left hand corner of the control unit. Rotation of the control in a clockwise direction increases the gain of the amplified RF signal and in an anti-clockwise direction reduces the gain.

1195. Channel Selector Switch. The channel selector switch, which is a ten-position rotary switch located at the centre of the control unit, allows selection of one of the ten pre-set channels. The selected channel number appears in the window above the control.

1196. Mode Switch. The mode switch is a three-position switch located at the right of the control unit. The three positions are AM, USB, LSB. The switch can be selected to AM and USB. LSB cannot be selected.

1197. Clarifier. The clarifier, which is a rotary control switch located at the top left of the control unit, varies the tone of voice output during SSB operation.

Fig. 1-41 HF(AM/SSB) Radio, Sunair ASB-100

1198. RF Output Meter. The RF output meter indicates the carrier level when the PTT switch is pressed.

1199. Normal Operation.

1. HF circuit breaker - Check IN.
2. Radio Master Switch - ON.
3. Switch HF on signal distribution panel - ON (up).
4. HF microphone push-to-set button on signal distribution panel - Depressed.
5. Volume Control ON/OFF switch - ON, volume as required.
6. Mode Switch - AM or USB as required.
7. Set Clarifier - Approx. half open.
8. Channel Selector Switch - Required channel.
9. RF Gain Switch - Set so that noise is just cut out in headset.
10. To transmit - Press PTT switch, check that needle of RF output meter oscillates.

1200. Switching Off.

1. ON/OFF Volume Control switch - OFF. Rotate fully anti-clockwise.

RADIO NAVIGATION EQUIPMENT

1201. ADF Bendix-Technico DFA-73A. (Ref. Fig. 1-42). The Bendix-Technico DFA-73A automatic direction finding system is a lightweight, transistorized, airborne navigational aid, which operates throughout the radio frequency range 190-1750 kHz in three bands. A self-test feature permits in-flight calibration and direction finding accuracy. The system provides the following modes of operation:

a. *ADF.* Used during homing, position

fixing or tracking to automatically supply continuous visual relative bearing indications of the associated radio transmitter site with respect to the aircraft.

b. *LOOP*. Used during homing or during position fixing to determine relative bearing of the associated radio transmitter site with respect to the aircraft. The LOOP antenna is manually operated, using a control located on the control unit, to null the received signal.

c. *ANT*. Used for tuning or as a general radio receiver.

d. *TEST*. Used during in-flight test procedures to check operation and calibration of the ADF system.

The receiver is located in the rear compartment. The control unit is located on the left hand side centre of No. 4 instrument panel.

Controls

1202. Mode Selector Control. The mode selector control is a five-position rotary switch located at the bottom left hand corner of the control unit. The five positions are marked OFF, ADF, ANT, LOOP and TEST respectively. With the switch selected to OFF, no power is supplied to the radio set. When the switch is in the ADF position, the system automatically provides the magnetic bearing of the aircraft with respect to a selected transmitter site. The receiver may be used for reception of a radio station when the switch is selected to ANT and when the switch is selected to LOOP, the set may be used for manual direction finding. The TEST position enables the system to be checked for operation and calibration during flight.

1203. Tune Max. Indicator. The tune max. indicator is located at the top left hand corner of the control unit. It is used in conjunction with the tuning selector to indicate when the set is correctly tuned.

1204. Frequency Band Selector. The frequency band selector is a three-position rotary switch located at the bottom centre of the control unit. Selection of the required band switches a shutter in the frequency window located above the selector. The shutter covers the two bands not selected so that only one set of figures is visible.

1205. Frequency Tuning Selector. The frequency tuning selector is a rotary switch located at the bottom right hand corner of the control unit. Rotation of the selector selects the frequency required. When close to the required frequency, pressing in of the outer ring while rotating, energises a beat-frequency oscillator. A beat is heard in the headset which ceases when the required frequency is selected exactly.

Fig. 1-42 ADF Bendix - Technico DFA-73A

1206. Volume Control. The volume control is a rotary switch located at the centre of the mode selector switch. Rotation of the volume control varies the audio output level of the set.

1207. Voice/CW Control. The Voice/CW control is a two-position switch located at the top right hand corner of the control unit. When the control is selected to VOICE, the set is used as a radio and when the control is selected to CW, a beat frequency oscillator is energised.

1208. Manual Loop Control. The manual loop control is a three-position switch located at the top centre of the control unit. With the switch in the centre position, the control is inoperative. When the switch is moved to the right, the No. 1 needle of the RMI is caused to move in a clockwise direction and when the switch is moved to the left, the No. 1 needle of the RMI is caused to move in an anti-clockwise direction.

1209. Frequency Calibration Check.

1. Mode Selector Switch - Make and **hold** in TEST position.

2. Tune to 285 kHz (in 190-400 band).

3. Adjust the tuning knob until a zero beat is obtained. The zero beat should occur within the limits of the horizontal bar marking above 285 kHz on the frequency tape. When zero beat occurs, calibration is within 1 percent and the ADF needle should indicate a relative bearing of $360° \pm 5°$.

4. Repeat the procedure with receiver tuned to 570 kHz (in 400-840 band) and 1282.5 kHz (in 840-1750 band).

5. Beat notes will also occur at multiples of 142.5 kHz throughout the tuning of the 400-840 and 840-1750 ranges. However, a calibration check carried out using the horizontal bar provided at the frequency given, is a sufficient check for the entire band in each case.

1210. ADF Bearing Check.

1. Mode Selector Switch - Make and **hold** in TEST position.

2. A receiver goniometer reading (receiver located in the rear compartment) of 0 ± 5° and the No. 1 needle of the RMI indicating the RMI heading index, confirms that there is no fault in the receiver, control unit, indicator or the interwiring. The bearing display may fluctuate at the frequency calibration points and at multiples of 142.5 kHz.

Normal Operation

1211. Receiver Tuning. To tune the receiver accurately to a signal of any type (broadcast station or NDB):

1. Mode Selector Switch - ANT.

2. Frequency Band Selector - Required frequency range.

3. Switch ADF V & R, signal distribution panel - ON (up).

Note

The ADF V (Voice) switch must be on for audio reception of station identification. The ADF R (Range) switch is used for audio reception of radio range stations, however, radio range stations are no longer in existence.

4. Frequency Tuning Selector - Rotate until required frequency corresponds with hairline indicator.

5. Either:

   a. adjust Frequency Tuning Selector slightly to obtain a maximum pointer deflection on tune max. indicator and adjust receiver volume control to obtain mid-scale deflection of pointer, or

   b. push the outer ring of the Frequency Tuning Selector to activate the zero-beat oscillator and rock the Frequency Tuning Selector back and forth until zero-beat is achieved in the headset.

6. Mode Selector Switch - As required (ADF, ANT, LOOP).

7. Voice/CW Switch - As required.

8. With the ANT mode of operation selected, the receiver can be tuned to a broadcast station by rotating the Frequency Tuning Selector until a maximum or most intelligible signal is received. The receiver can then be used effectively in the ADF mode.

9. Observe the No. 1 needle of the RMI. A strong transmitter signal prevents the needle from being moved more than a few degrees.

Operating Precautions

1212. The following notes summarize general operating precautions and should be read in conjunction with the previously detailed checks, tests and calibrations to ensure maximum efficiency of operation of the equipment:

   a. During periods of severe precipitation static, operate the LOOP mode and for best reception, use the LOOP control to obtain the maximum signal.

   b. Check frequency calibrations using the TEST mode functions or by comparison with actual transmitted station frequencies. If calibration is in error, report the defect to maintenance personnel.

   c. When homing, fly the aircraft so that the No. 1 needle of the RMI is at the heading index or fluctuates equally to either side of the heading index.

   d. A positive radio fix is determined by the intersection of two or more position lines which intersect at an angle of not less than 45°.

1213. VHF NAVCOM Collins AN/ARN-82. (Ref. Fig. 1-43). The Collins AN/ARN-82 receives VHF Omni-Range (VOR) Localizer (LLZ) and VHF Visual Aural Range (VAR) navigation signals in the frequency range 108.00 - 117.95 MHz and communications signals in the frequency range 118.00 - 126.95 MHz. The control unit is located at the left hand side of No. 4 instrument panel. When a particular station frequency is selected, the output of the receiver is fed to the RMI and the Course Selector Indicator (CSI). These instruments are both located on No. 1 instrument panel and include the following components which comprise the navigation system:

   a. ***Omnibearing Selector.*** This is a manually variable indicator on which the desired course is selected. The course selected serves as a reference for all VOR system indications.

b. *VOR/LOC Needle.* The needle indicates degrees of deviation from the selected course.

c. *TO/FROM Indicator.* This indicates whether the direction to the VOR station is within the semicircle centred about the radial selected on the course selector, or within the semicircle centred about the reciprocal of the selected course direction. If the station direction is within 90° of the selected course, a TO indication appears. If the station is within 90° of the reciprocal of the selected course, a FROM indication appears.

d. *Warning Flag.* The flag appears when the VOR, VAR or localizer signal is unreliably weak, or when a malfunction develops. The flag is concealed when the signals are reliable and the VOR VAR system is operating correctly.

e. *Radio Magnetic Indicator.* The number two needle of the RMI, when selected to VOR, continuously indicates the magnetic direction to the station by reference to the compass card.

In addition, the equipment receives the ground station identifying code which enables the pilot to positively identify the desired station.

Controls

1214. Power Switch. The power switch is a three-position rotary switch and is the outer element of the switch located on the lower left hand side of the control panel. The three positions are OFF, PWR, TEST. With the switch at OFF, power is removed from the receiver and with the switch at PWR, the receiver is operational. The operation of the receiver may be tested with the switch set to TEST.

1215. Volume Control. The volume control is the outer element of the control located at the lower right hand side of the control panel. Rotation in a clockwise or anti-clockwise direction increases or decreases the audio output level of the receiver.

1216. Megahertz Control. The megahertz control is the centre element of the switch located at the lower left hand side of the control panel. The left hand three digits of the required frequency are selected by rotating the control.

Fig. 1-43 VHF Navcom Collins AN/ARN-82

1217. Kilohertz Control. The kilohertz control is the centre element of the control located at the lower right hand side of the control panel. The right hand two digits of the required frequency are selected by rotating the control.

1218. Normal Operation.

1. Radio Master Switch - ON.
2. Power Switch - PWR.
3. Pilots ICS panel VOR switch - ON (up).
4. Frequency - Select as required.
5. Station - Identify and adjust volume.
6. Check No. 2 needle of RMI.
7. Power Switch - TEST. Check No. 2 needle of RMI indicates a relative bearing of 180°.
8. Power Switch - PWR. Check that No. 2 needle of RMI returns to original bearing.
9. Omni-bearing Selector - Desired heading or radial as required.

1219. Course Selector Indicator (CSI) 331H-3G. (Ref Fig. 1-44). The CSI 331H-3G provides a visual display of VOR, VAR and LLZ navigation information. The CSI requires VOR/LLZ signals or VHF/FM1 signals. Information displayed includes selected course and reciprocal course, deviation from a selected VOR, VAR or LLZ course, VOR/LLZ flag indication, deviation from the visual leg of a VAR and VOR to/from indication and glide slope flag (connected to VHF/FM1 only). Reciprocal course figures are right side up, to eliminate the possibility of confused bearings due to misinterpreted reciprocal radials. The CSI is located on the left hand side of the No. 1 instrument panel.

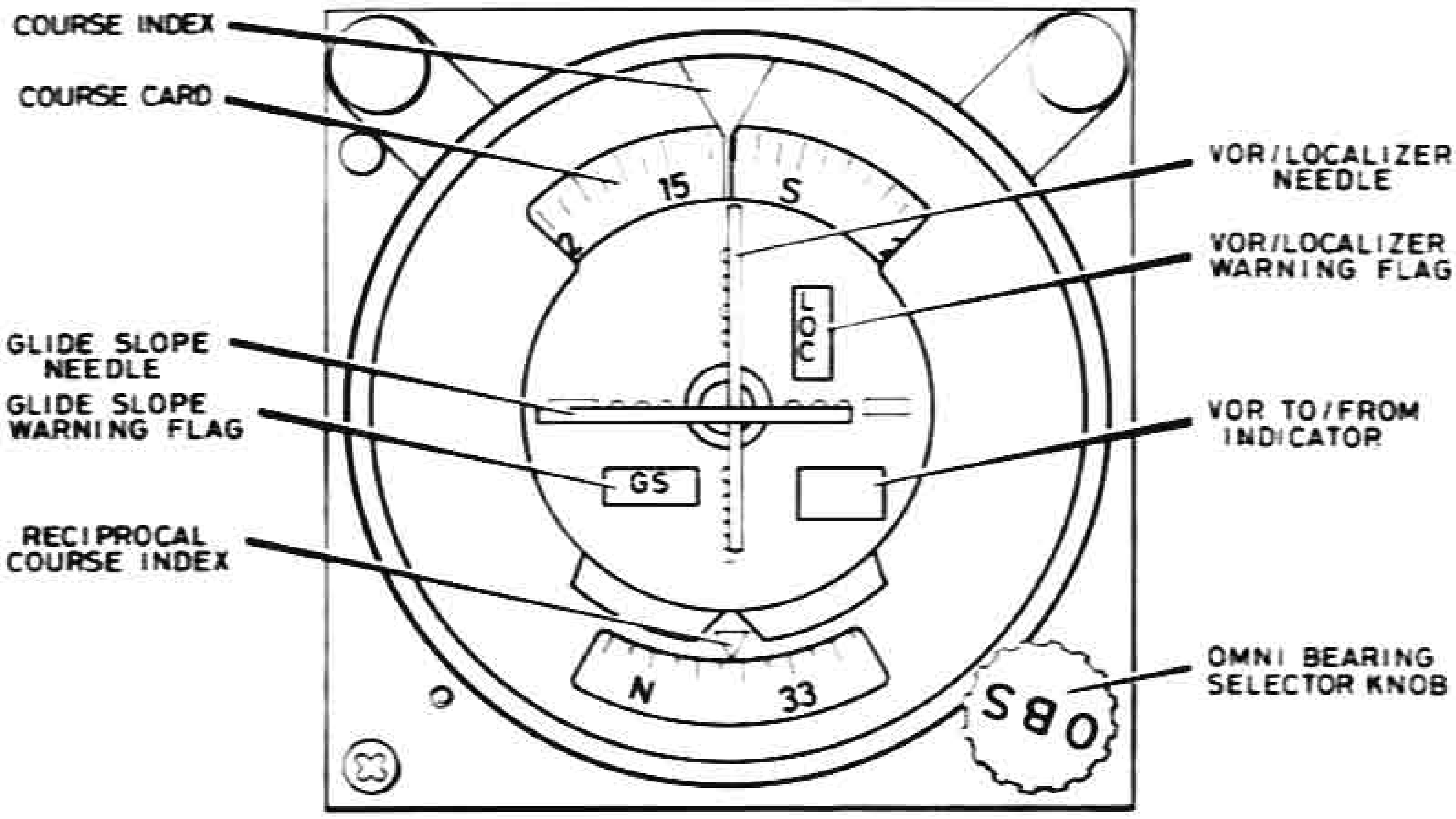


Fig. 1-44 Course Selector Indicator

1220. Indicator and Control Functions.

a. ***Course Index*** - Indicates selected radial.

b. ***Reciprocal Course Index*** - Indicates radial 180° from selected radial.

c. ***Course Card*** - Manually rotatable card, driven by OBS control, so that desired radial is directly beneath course index.

d. ***OBS (Omnibearing Selector) Control*** - Drives course card for course selection.

e. ***VOR : TO/FROM Indicator*** - Indicates whether direction to VOR station is within semicircle centred about course index direction (TO indication) or within semicircle centred about reciprocal course index direction (FR indication).

f. ***VOR/LLZ needle*** - Indicates direction of deviation and degree of deviation from selected VOR radial, VAR visual leg or LLZ path.

g. ***VOR/LLZ warning flag*** - Red LOC flag appears when VOR, VAR or LLZ signal is unreliably weak or when a malfuntion occurs in the navigation receiver.

h. ***Glide Slope Needle and Warning Flag*** - The horizontal needle displays the relative strength of the station and is used as a guide for determining station passage for FM homing.

Note

The glide slope needle remains centred and the warning flag visible whe signals are unreliably weak or when the receiver develops a fault.

1221. Radio Magnetic Indicator ID-250. The RMI is located on No. 1 instrument panel, in the centre, below the attitude indicator. The RMI contains three synchro systems providing three different continuously displayed bearing indications for navigation purposes:

a. Compass dial, synchro-driven by the C14 gyrosyn compass.

b. Needle No. 1 on the dial, driven by the ADF (DFA-73) giving an indication of the direction of the ADF ground station.

c. Needle No. 2 on the dial. This needle can be switched to ADF/VOR or to ADF/UHF by means of the RMI selector switch located on the left hand side of the No. 1 instrument panel for pre Mod 26 aircraft and between the RMI and Totalizer/Fuel Flow Indicator for post Mod 26 aircraft. The needle then provides an indication of the direction to the VOR ground station or an indication of the direction to the UHF station.

1221A. Distance Measuring Equipment (DME) VAN-5 (Post Mod 26 Aircraft). (Ref. Fig. 1-44A). The VAN-5 DME contains a transmitter, receiver and circuits for timing, distance, speed measurement and beacon identification. In operation, pairs of pulses are transmitted at the rate of approximately 110 pulse pairs per second. The spacing between the two pulses of a pair, and the duration of each pulse, are determined by the setting of the channel selector in the controller. Each ground beacon is adjusted to accept one of the 48 possible combinations of pulse spacing and pulse duration. An airborne interrogator within range transmitting with the correct combination will trigger the ground beacon which will then transmit a pulse in reply. The time between transmission of the interrogation by the airborne equipment and reception of the reply from the ground beacon is proportional to the slant distance of the aircraft from the beacon. Circuits in the interrogator automatically measure and display the equivalent distance on the indicator. The ground beacon also transmits additional pulses which form the beacon identification code and are converted into morse code letters which are heard in the headphones. As the distance changes, due to movement of the aircraft the pointer of the distance indicator moves to show the correct distance. The rate of change of distance is measured and is shown by a separate (outer) pointer on the indicator. This is the rate of closure and is equal to the aircraft ground speed when heading directly towards a beacon. The speed indicator permits homing on a ground beacon by manoeuvring the aircraft so that the rate of closure is maximum. A self test facility is provided by which both distance indication and code tone may be checked at any time. The equipment operates from 28V DC through a circuit breaker on the right hand side of the lower bank of circuit breakers on No. 4 instrument panel. Distance measurement is accurate to within ±1.3 miles at 30 miles, increasing to ±3.8 miles at 100 miles. Speed measurement is accurate to within ±12.5 knots at 100 knots, increasing to ±15.5 knots at 300 knots.

1221B. Interrogator VAN-5. This unit contains transmitter, receiver and ranging circuits. It is mounted on the bottom shelf of the radio crate in the aircraft stowage compartment.

1221C. Controller VCN-8. The controller has a system on-off switch, combined dual knob channel selector control, channel indicator window, and two press to test buttons to check operation of most of the interrogator circuitry. The controller is located at the front of radio console which is situated between the pilots' seats.

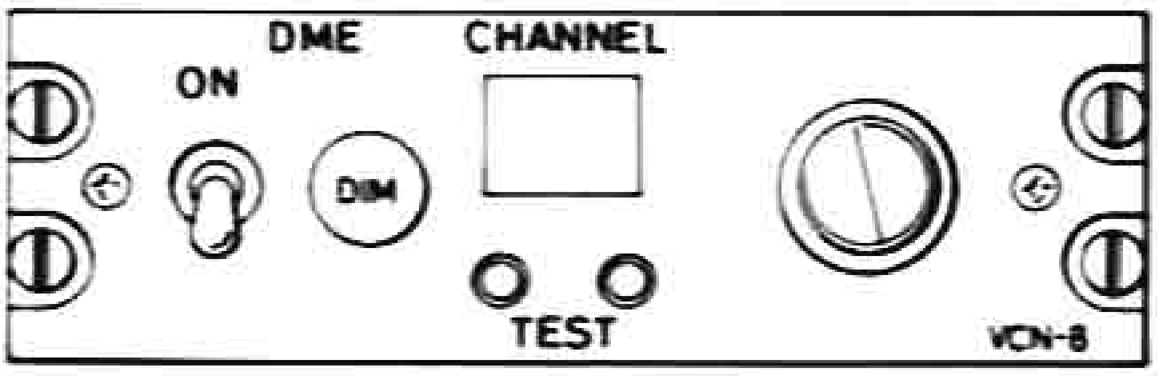


Fig 1-44A Controller VCN-8

1221D. Indicator VIN-5. Contains two separate meter movements, the distance (inner) scale reads 0-100 nautical miles, with an expanded scale for greater accuracy over the range 0-30 miles. The speed indicator (outer) scale reads 0-300 knots rate of closure ('knots to') and 0-50 knots rate of departure ('knots from'). As an aid to homing a knob is provided in the right hand bottom corner which may be used to move a mechanical index so that it shows the maximum rate of closure. When flying away from a beacon, the rate of departure may be read by pressing a spring-loaded push-button in the centre of the index knob. This temporarily reverses the speed indicator so that a rate of departure can be indicated on the 'knots to' scale. The indicator is mounted in the lower left hand side of the No. 1 instrument panel.

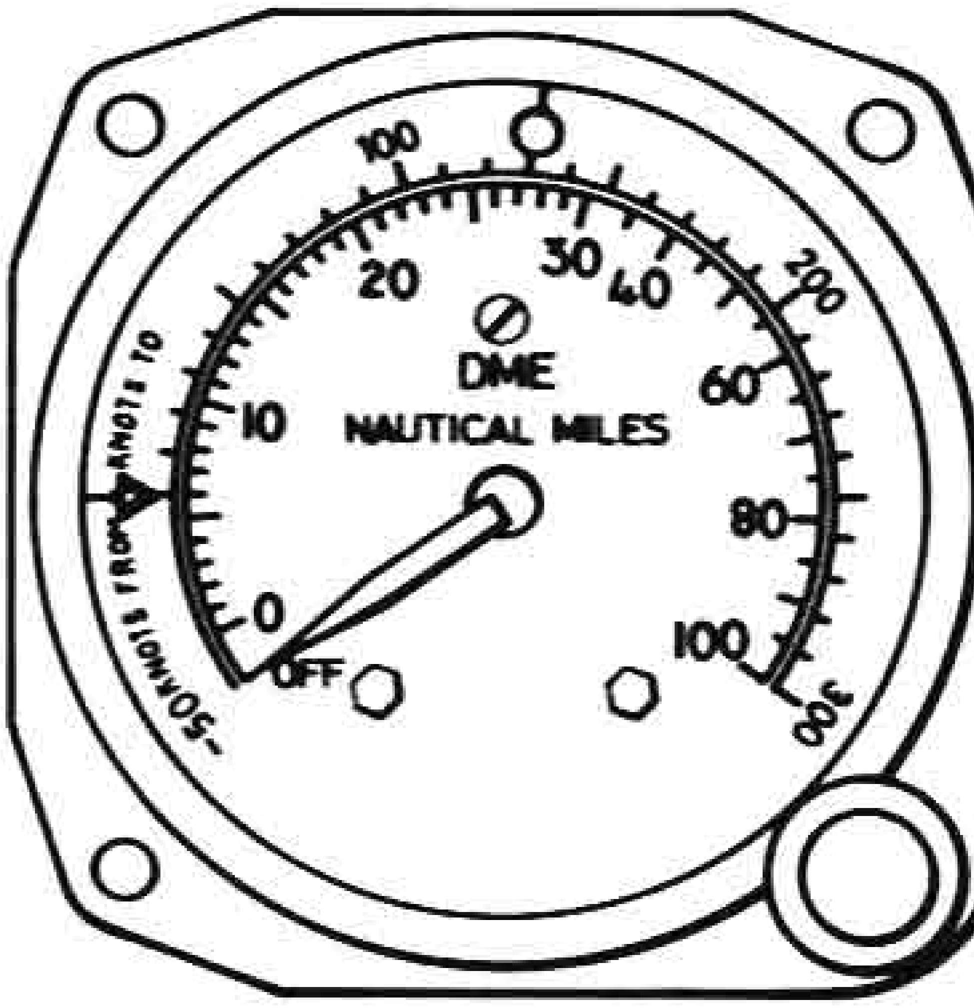


Fig. 1-44B Indicator VIN-5

1221E. Coding. The audio coding signal is supplied via the audio DME selector switch which is mounted at the top left hand side of No. 4 instrument panel.

1221F. Antenna. The antenna, VJN-5, is located on the underside of the port wing.

Operating Procedures

1221G. The operating procedures for the VAN-5 DME are as follows:

1. DME circuit breaker - IN.
2. System ON/OFF Switch - ON.
3. DME audio switch - ON (to identify channel).
4. Channel selector - to required channel. When lock on is achieved distance will be indicated by the distance pointer.
5. For departure speed indication above 50 knots - press rate of departure switch - right hand lower corner of indicator.
6. For accurate determination of maximum position of closure speed needle - place the mechanical bug over the rate of closure pointer by means of the knob behind the rate of departure switch and use as a reference.

Operational Checks

1221H. The operational checks for the VAN-5 DME are as follows:

1. Check that distance and speed indications agree with estimated conditions.
2. Check interrogator operation by selecting channel 48 and pressing the left hand push-button. Lock on will occur at a range of 1.7 miles. Still holding the left hand button down press the right hand button. This will then indicate correct operation of the code tone circuits. Releasing the push buttons will allow the equipment to function normally.

1221J. Switching Off.

1. System ON/OFF switch to OFF.

1221K. Marker Beacon Receiver R-1041/ARN. The marker beacon receiver provides aural and visual indication of passage over airways marker beacons and ILS outer and middle marker beacons. The marker beacon receiver is mounted in the radio crate which is located in the aircraft stowage compartment. The marker beacon receiver controls are located in the top left hand corner of the No. 1 instrument panel, these consist of an ON-OFF switch, HI-LO sensitivity switch, volume control and a marker beacon light.

1221L. Marker Audio. Audio is supplied via an audio selector switch (MKR) which is mounted at the top left hand side of No. 4 instrument panel.

1221M. Power Requirements. 28V DC is supplied via a circuit breaker located at the right hand end of the lower row of circuit breakers on No. 4 instrument panel.

1221N. Marker Beacon Antenna. The antenna is mounted on the underside of the aircraft fuselage.

Operating Procedure

1221P. The operating procedure for the R-1041/ARN marker beacon receiver is as follows:

1. Marker beacon circuit breaker - IN.
2. ON-OFF switch - ON.
3. HI-LO SENS - HI.
4. Audio Selector - ON.
5. Volume control - clockwise.

When the aircraft is flown over a marker beacon the light will illuminate and an audio identification will be heard in the headset.

Note

A PRESS TO TEST facility is fitted to the MARKER lamp.

1221Q. Switching Off.

1. ON-OFF switch to OFF.

OXYGEN SYSTEM (Ref. Fig. 1-45)

1222. **General Description.** Oxygen is carried in two 48.3 cu. ft. cylinders mounted on the rear of bulkhead 6. Each cylinder is fitted with a shut-off valve and charged from an external point on the port side of the rear fuselage. A pressure indicator mounted on bulkhead 6 is readable from the rear cabin compartment. High pressure oxygen is piped through stainless steel tubes to a shut-off valve, mounted on the port side fuselage wall in front of frame 2. Oxygen is then piped to the following:

a. a Scott regulating valve, mounted on the pilots instrument panel shelf, from where it is piped to four constant flow outlets, located overhead in the rear cabin compartment and
b. also via a 'T' piece to a pressure reducing valve, where it is further piped through

low pressure lines to two demand regulators, which are located at the centre console for the pilot and co-pilot.

1223. External Charging Point.

CAUTION

Remove the cylinders from the aircraft if battle damage is likely. To avoid ingress of moist air do not discharge the cylinders below 50 psi.

The external charging point is accessible through a hinged access panel on the port side of the rear fuselage.

1224. Oxygen Cylinders. Each oxygen cylinder is retained by two metal straps onto two brackets which are riveted to bulkhead 6. Each cylinder is equipped with a shut-off valve and pressure indicator, which has a range of 0-2000 psi.

1225. Constant Flow Regulator. The regulator assembly provides a constant flow of oxygen during flight at altitudes up to 30000 ft. and at temperatures of -20°F (-29°C) to +150°F (+66°C). The regulator is equipped with two gauges, one showing cylinder pressure and the other showing altitude calibrated in thousands of feet. Oxygen will only flow when the plug-in hose coupling for the passengers' outlets is inserted into the regulator outlet. Oxygen pressure regulation is achieved by turning the knob ('IN' for increase and 'OUT' for decrease in altitude). The altitude adjusted on the pressure regulator must correspond with the altitude in the cabin, to provide at each constant flow mask the right amount of oxygen required for that altitude. A pressure relief valve is incorporated in the regulator to prevent excessive pressure in the oxygen delivery system.

1226. Pressure Reducing Regulator for Demand Flow. (A14-702, 3, 4 and 5 and Post-Mod 31 aircraft). The purpose of the regulator is to reduce the pressure to 70-75 psi, for use with the oxygen breathing equipment.

Note

The regulator pressure adjustment is pre-set. Do not attempt to adjust during operation.

A relief valve which opens at pressures in excess of 100-110 psi is housed in the pressure reducing regulator.

1227. Demand Flow Regulator. The demand flow regulator operates at a pressure of 25-85 psi providing a flow of 100 litres/min. of oxygen. It functions for any type of demand mask that has an altitude range from sea level to 36000 ft. The rate of flow through the regulator is governed by individual requirements.

1227A. Pressure Demand Regulators (Post Mod 50 aircraft). Porter Mod 50 introduces two CRU47A pressure demand regulators for the pilot and co-pilot. Each regulator incorporates a visual flow indicator, a pressure indicator, three toggle-type switches to control regulator operation and an inlet filter to prevent the entry of foreign particles into the system. The following sub paras describe the controls and indicators of the CRU47A regulator.

a. ***OXYGEN SUPPLY LEVER.*** A manual, two-position supply lever is located at the lower right corner of each regulator. When the lever is set to ON, oxygen is supplied to the regulator unit; when the lever is at OFF, the oxygen supply to the regulator is shut off to prevent any waste of oxygen from the regulator unit when not in use.

b. ***DILUTER LEVER.*** The two-position diluter lever on each regulator unit may be used to shut off the air port manually and allow the regulator to deliver pure oxygen at all altitudes or to provide automatic mixing of air and oxygen as required to maintain normal body oxygen needs at all altitudes. When set to 100% OXYGEN, the regulator supplies pure oxygen without air dilution; with the lever at NORMAL OXYGEN, the normal air/oxygen dilution characteristics of the regulator are maintained. The lever is designed to prevent intermediate settings between 100% OXYGEN and normal OXYGEN.

c. ***EMERGENCY TOGGLE LEVER.*** The emergency toggle lever on each regulator may be set to one of three positions: EMERGENCY, NORMAL, and TEST MASK. With the lever at EMERGENCY, oxygen is supplied to the mask at continuous positive pressure for emergency use. With the lever at NORMAL, oxygen flow is controlled automatically by the regulator. The TEST MASK setting is used when a positive pressure is required at any altitude to test the fit of the mask around the face.

CAUTION

When positive pressure is required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to ensure no leakage, the continued use of positive pressure under these conditions will result in rapid depletion of the oxygen supply. Except when unscheduled pressure increase is required, the emergency toggle lever should remain in the centre (NORMAL) position.

d. ***Visual Flow Indicator.*** The visual flow indicator on each regulator is a slide-and-window device in which, during normal use of the oxygen mask, the indicator shows oxygen flow by blinking with the breathing cycle of the user. Oxygen flow ceases when the blinker is not visible.

e. ***Pressure Indicator.*** The pressure indicator on the regulator is a dial-type instrument indicating system pressure in pounds per square inch.

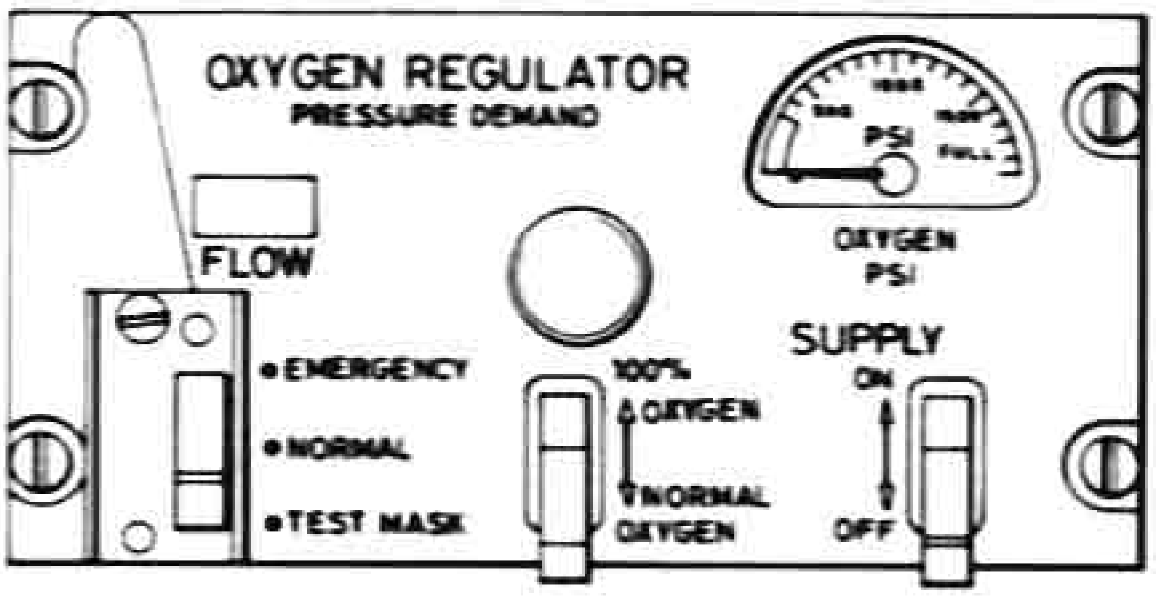


Fig. 1-44C Pressure Demand Regulator CRU47A

1228. Mask and Outlets for Demand Regulator. Two face masks with microphones are provided for the pilot and co-pilot. Each mask is connected to its respective demand regulator via a hose assembly. Oxygen will flow to the face demand mask only on inhalation. The automatic demand regulator will adjust itself to the breathing of the individual and provide the right flow rate for his rate of breathing. The mask can be taken off with no loss of oxygen, while connected to the demand regulator outlet.

1229. Masks and Outlets for Constant Flow Oxygen Supply. Four constant flow masks can be plugged into the respective outlets located overhead in the rear cabin. Flow indicators are fitted in the hoses to the masks. A red warning indication appears if there is no flow of oxygen to the mask. The standard connection at each constant flow mask has a calibrated metering

Persons Using Oxygen	Flight Duration (Hours)
1	12
2	6
3	4
4	3
5	2.4
6	2

Fig. 1-44D Oxygen Duration Chart - Aircraft Prior to A14-702 Pre-Mod 31

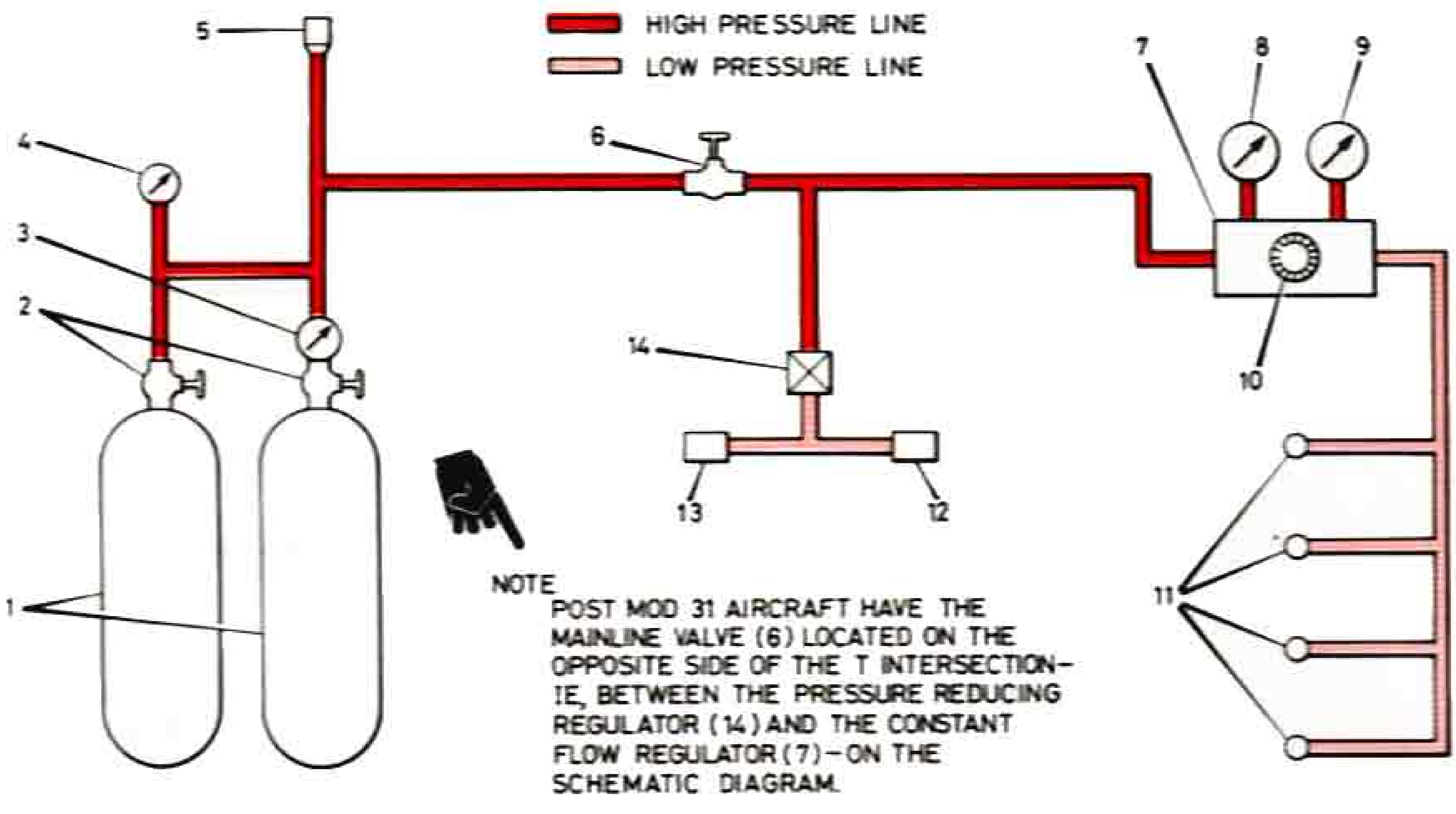


Fig. 1-45 Oxygen System - Schematic

orifice. A therapeutic connection, providing three times as much flow as the standard connection, should be used for persons having a respiratory or cardiac condition. To prevent passage of foreign matter which could cause clogging of the calibrated metering orifice, a filter screen is provided in each outlet. Constant flow masks, when not in use, should be disconnected from the outlet.

1230. Operation of Oxygen System. (Ref. Fig. 1-45).

1. Prior to flight open both cylinder shut-off valves (2).
2. Check oxygen pressure.
3. Open main line valve (6) in flight as required.
4. Connect only the required masks. The procedure is as follows:
   a. Plug the required passengers' hose connectors into overhead outlets (11) in the rear cabin.
   b. Plug pilot's and/or co-pilot's demand mask connector into the demand regulator outlets (12 and 13).

Note

For pre-Mod 31 aircraft, the constant flow regulator is to be set to 30000 ft. to ensure adequate inlet pressure for the pilot and co-pilot demand regulators.

5. Adjust the constant flow regulator for post-Mod 31 aircraft as follows:
   a. For constant flow use, adjust the regulator's altitude indicator to correspond to actual cabin altitude. A relief valve is provided on the regulator to protect the altitude indicator should the altitude setting exceed range indication.

Note

When 30000 ft. setting is selected, oxygen will be at maximum flow.

6. Check flow indication of each constant flow mask.

Figures indicated in this chart are obtained under the following conditions:

(a) Cylinder volumes - 95%, with a pressure of 1800 psi and a temperature of 70°F.

(b) Demand-values are calculated with a minimum consumption of 24 litres/minute.

(c) Constant flow consumption is calculated for SCOTT 8570 plug-in coupling.

Number of Persons	5,000 ft		10,000 ft		15,000 ft		20,000 ft		25,000 ft		30,000 ft	
	Cons. Ltr/min	Duration Hr/min	Cons. Ltr/min	Duration Hr/min	Cons. Ltr/min	Duration Hr/min	Cons. Ltr/min	Duration Hr/min	Cons. Ltr/min	Duration Hr/min	Cons. Ltr/min	Duration Hr/min
Pilot only	24	2-09	24	2-36	24	3-10	24	3-55	24	4-50	24	6-05
Pilot and Co-Pilot	48	1-04	48	1-18	48	1-35	48	1-57	48	2-25	48	3-00
Pilot and 1 Passenger	24.78	2-05	25.81	2-25	27.34	2-46	29.45	3-11	32.60	3-35	36.45	4-00
Pilot and 2 Passengers	25.56	2-01	27.62	2-15	30.68	2-28	34.90	2-41	41.20	2-50	48.90	2-59
Pilot and 3 Passengers	26.38	1-57	28.63	2-07	34.02	2-13	40.35	2-19	49.80	2-21	61.35	2-23
Pilot and 4 Passengers	27.04	1-54	29.24	2-08	37.36	2-00	45.80	2-03	56.40	2-04	63.80	2-17
Pilot and Co-Pilot and 1 Passenger	48.78	1-03	49.81	1-15	51.34	1-28	53.45	1-45	56.60	2-03	60.45	2-25
Pilot and Co-Pilot and 2 Passengers	49.56	1-02	51.62	1-12	54.68	1-23	58.90	1-36	65.20	1-47	72.90	2-00
Pilot and Co-Pilot and 3 Passengers	50.38	1-01	52.63	1-10	58.02	1-18	64.35	1-28	73.80	1-34	85.35	1-42
Pilot and Co-Pilot and 4 Passengers	51.04	1-00	53.24	1-02	61.36	1-14	69.80	1-21	80.40	1-25	87.80	1-29

FIG. 1-46 OXYGEN CONSUMPTION AND RANGE DURATION CHART (POST MOD 31 AIRCRAFT)

7. Check range as shown in the Oxygen Duration Chart (Ref. Fig. 1-46).

1231. Shut-down Procedure - After Flight.

1. Close the main line valve (6).
2. Drain the system by leaving the constant flow masks plugged in.
3. Turn the regulator knob (10) to the LEFT.
4. Remove all the constant flow masks from the connections and stow them in their respective stowages.
5. Close the cylinder valves (2).

1232. Safety Precautions.

WARNING

- Keep grease, oil, water and all foreign matter from oxygen system.
- Oil, grease or other lubricants in contact with oxygen create a serious fire hazard and such contact must be avoided.
- Do not permit smoking or use of an open flame in or near the aircraft while the oxygen system is being serviced.

CAUTION

All valves should be operated smoothly.

NAVIGATION EQUIPMENT (Ref. Fig. 1-47)

1233. Introduction. The Porter aircraft is equipped with a C14 Gyrosyn Compass system, plus a standby magnetic compass. The C14 Gyrosyn Compass system drives a single azimuth compass card on the RMI, to provide continuous drift free heading indications within ±1°.

1234. C14 Gyrosyn Compass System. (Ref. Fig. 1-48). The basic C14 compass system consists of a flux valve, gyro and synchronizer assembly, and an annunciator. The flux valve senses the horizontal component of the earth's magnetic field and converts this information into an electrical signal which is applied to the slaving circuits of the gyro. The slaving amplifier precesses the gyro to maintain continuous alignment to the actual magnetic heading sensed by the flux valve. The result is a drift free heading reference, self-maintained to an accuracy of ±1°. The annunciator monitors the output of the slaving circuits to give a visual indication of system synchronization.

1235. Flux Valve. The flux valve is a magnetic azimuth detector which senses the horizontal component of the earth's magnetic field. The flux valve is located in a stable magnetic location inside the starboard wing tip supported on a mount, on the aft side of the main spar. A compensator is attached to the flux valve. The compensator is a flat, compact unit containing four permanent magnets which may be rotated for B and C error corrections.

1236. Gyro and Synchronizer Assembly. The gyro and synchronizer assembly consists of a gyro and amplifier plus the synchronizer assembly. The gyro and amplifier assembly is a self contained unit, which provides gyro stabilized heading reference for the system. The gyro, an electrically driven element, is precessed to the magnetic heading reference of the flux valve by the output of an internal slaving amplifier acting through a precession torque motor. The heading output transmitters are also contained in the gyro and amplifier assembly. The synchronizer assembly is the mounting base for the gyro and amplifier assembly. The synchronizer assembly contains the automatic fast synchronization circuit, power adequacy circuit necessary system power supplies and auto-pilot interlock relay contacts. The gyro and synchronizer assembly is mounted on stringers, on the right hand cabin wall below the instrument panel aft of bulkhead 2.

1237. Annunciator. The annunciator is a null microammeter which monitors the output of the slaving amplifier of the gyro and amplifier assembly. The arrangement of the annunicator is such that when the system is synchronized the meter will be in the centre or null position. When the gyro output signal is less than the compass transmitter signal, the pointer of the annunciator is to the left (+) of its centre position. When the pointer is to the right (-) of its centre position, the gyro output signal is greater than the compass transmitter signal. The annunciator is mounted in the flight instrument group under the heading GYRO-COMPASS and is located in the lower left hand side of No. 1 instrument panel.

1238. Failure Warning Light. The red failure warning light which is labelled GYRO-COMPASS - FAILURE is located on the lower left hand side of No. 1 instrument panel. The following system functions are continuously monitored whether the system is operated with or without the RMI indicator.

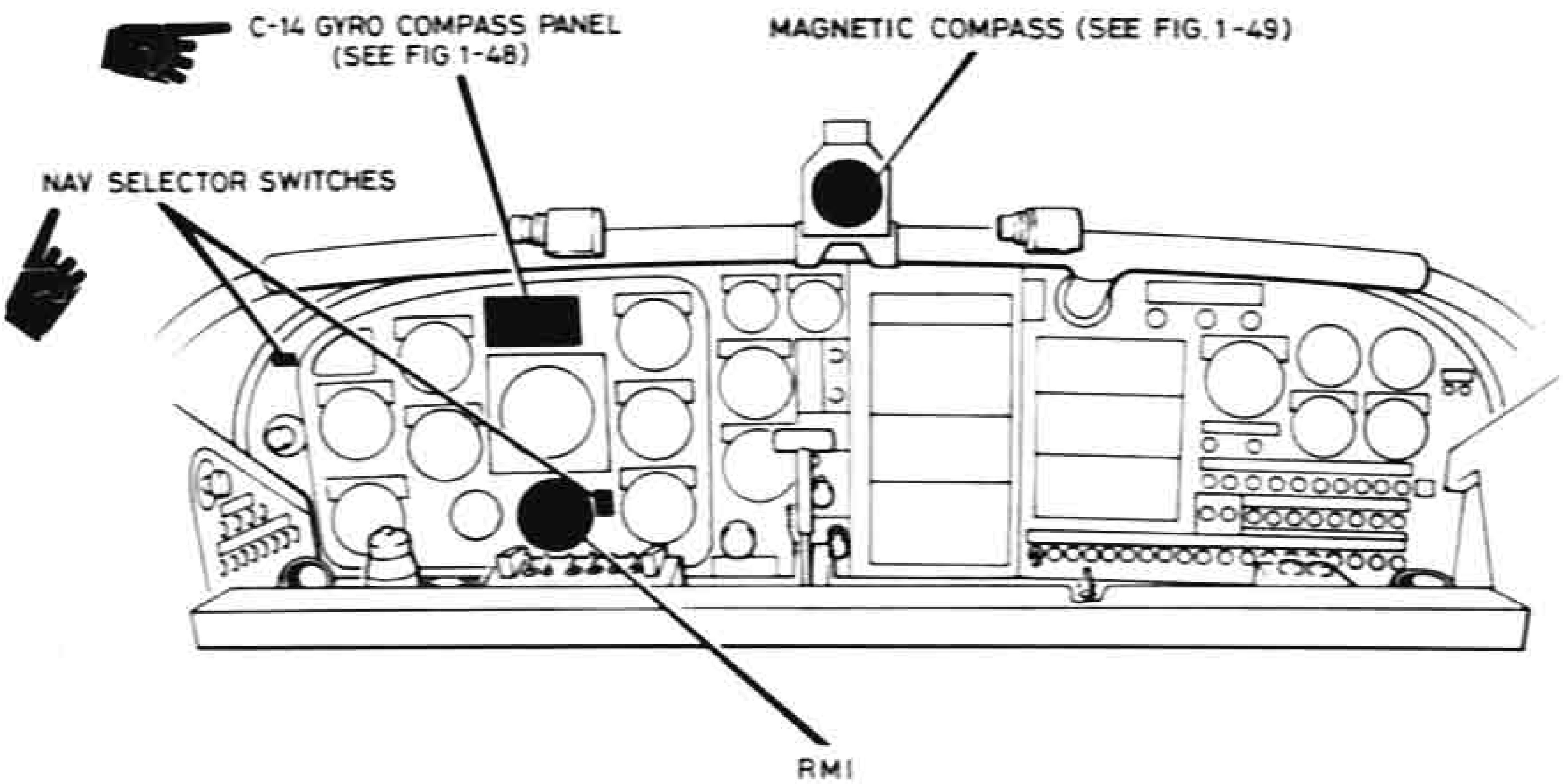


Fig. 1-47 Navigation Equipment

a. Loss of electrical power to the system.

b. Insufficient voltage to the system.

c. Reduction of gyro spin motor speed.

d. Slaving amplifier bias power supplied.

e. Errors between compass card position and flux valve output (system operating in fast sync. mode).

1239. Magnetic Compass. (Ref. Fig. 1-49). The magnetic compass is a standby compass with a liquid damping medium to reduce card oscillation. To minimize B and C errors, the compass is equipped with its own corrector box with adjustments on the face of the compass. The compass may be illuminated by a light which is operated by the instrument panel lighting switch. The magnetic compass is mounted in its own bracket, on the demister tube in the centre of the instrument panel.

CARGO LOADING EQUIPMENT

1240. Introduction. With the passenger seats removed, the cabin can accommodate approximately 60 cu ft of cargo, providing the weight does not exceed the maximum floor load (100 lbs/sq ft). The measurements of the largest single item which can be loaded into the

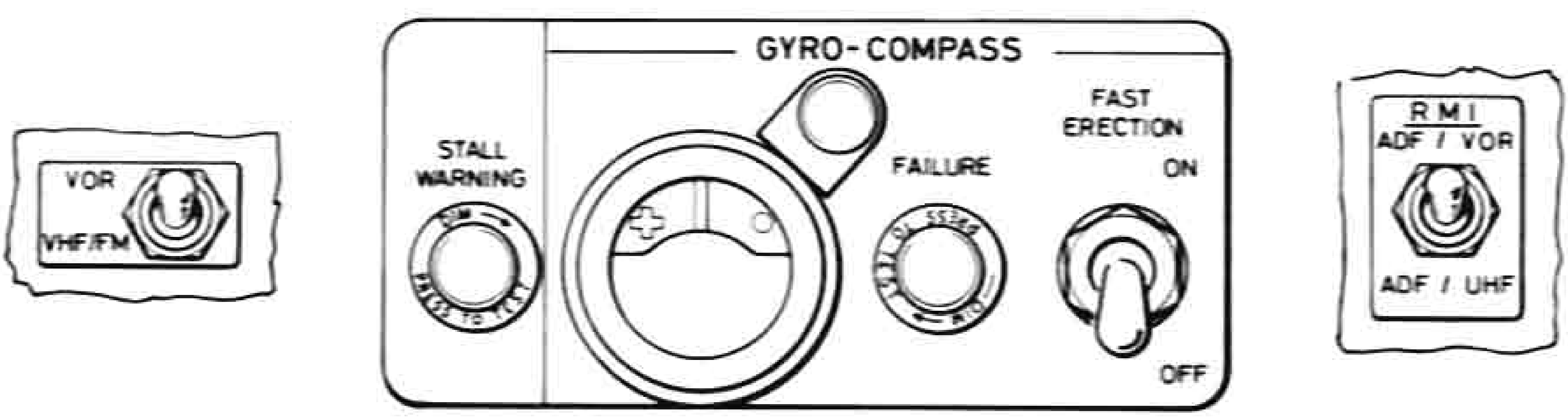


Fig. 1-48 C14 Gyro Compass Panel and Nav Selector Switches

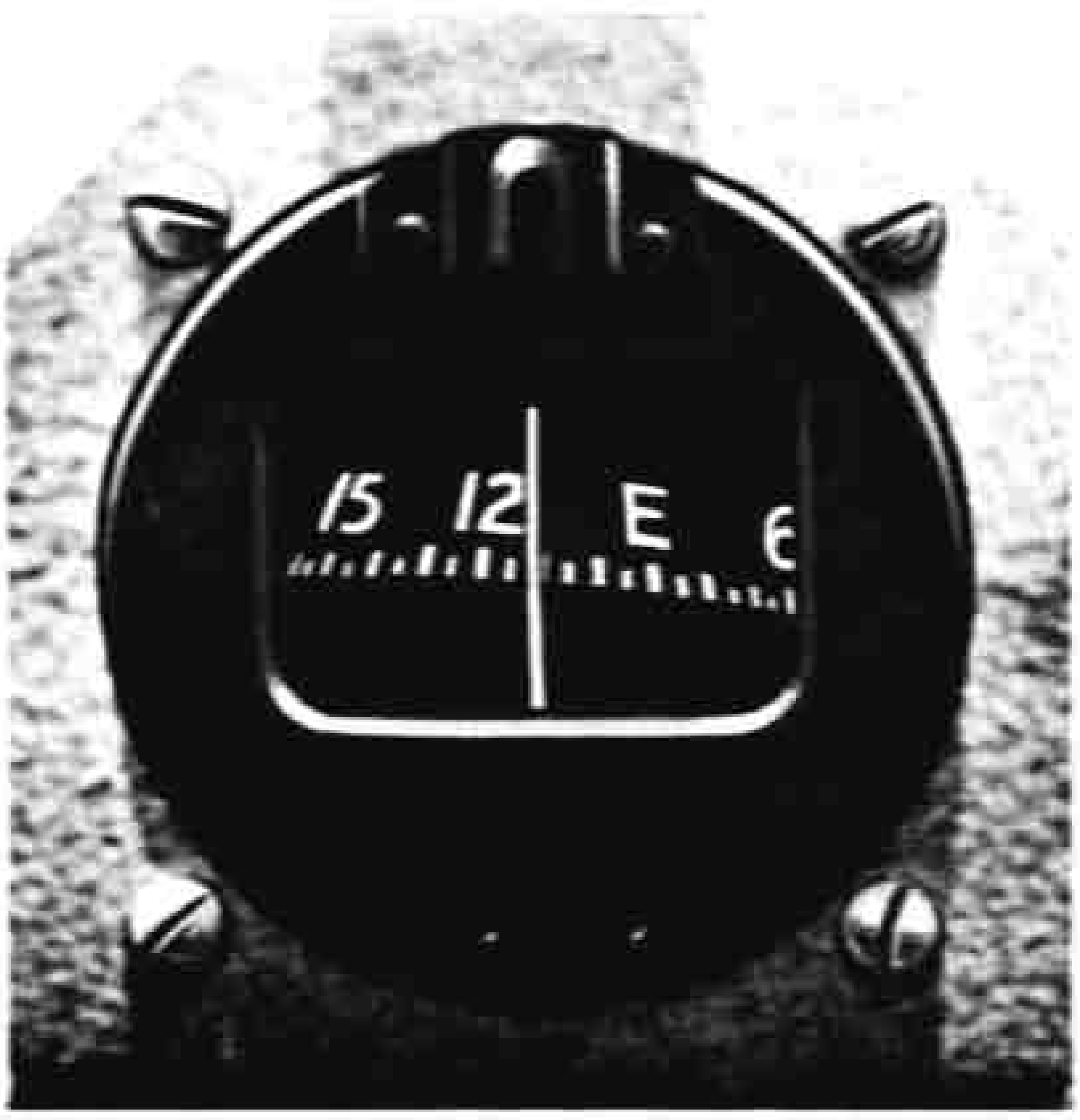


Fig. 1-49 Magnetic Compass

aircraft are 5 ft x 2½ ft x 3½ ft. The cargo can consist of stores and equipment which may, if necessary, be despatched in flight through the sliding door or the trap doors. The amount of cargo carried must be less if it is to be despatched in flight, in order to provide access space for the despatching crew.

1241. Cargo Tie-Down Fittings. (Ref. Fig. 1-50). Cargo is secured in the cabin by restraint straps attached to the cargo tie-down fittings. These fittings consist of a shoe which slides over the T-rail, a tie-down ring and a cam operated spring loaded pin. The pin locks the fitting into position by engaging in one of the holes in the T-rail; it is withdrawn from the rail by rotating the cam plate on the body of the fitting one quarter of a turn. A further one quarter of a turn returns the cam plate to the locking position.

PERSONNEL CARRYING EQUIPMENT

1242. Introduction. Facilities are provided for seating six passengers in the cabin. If no co-pilot is included in the crew, the co-pilot's seat may carry an extra passenger. The aircraft can be used to carry troops and incapacitated personnel.

1243. Troop Carrying Equipment. No special facilities are provided for carrying troops. However, adequate space is provided in the cabin and fuselage for seating six military personnel and stowing accompanying personal equipment.

1244. Casualty Carrying Equipment. (Ref. Fig. 1-51). The port side seats in the cabin can be replaced by two litters for carrying wounded or otherwise incapacitated personnel. The litters are mounted on brackets fitted to a removable stanchion, to plates on the cabin wall and to straps suspended from the cabin roof. A padded plate is fitted to cover protrusions on the rear of the pilot's seat when litters are installed. Seats may be installed on the starboard side of the cabin when the litters are in position. When installing the litters the following procedure is to be carried out:

a. *Bracket Stanchion*

1. Slide the foot of the stanchion over the T-rail in the cabin floor.

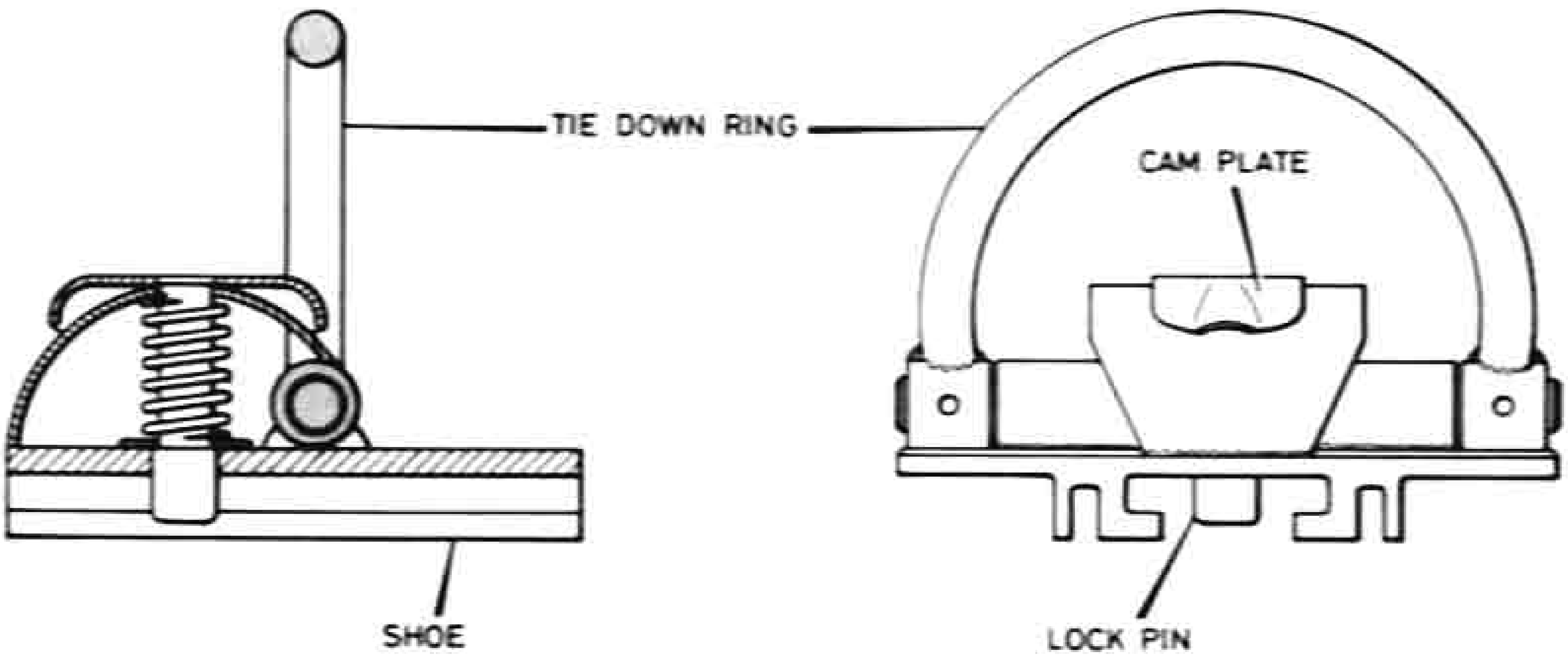


Fig. 1-50 Cargo Fittings

2. Hold the stanchion at an angle to the T-rail and slide it forward. As the top of the stanchion approaches the stud in the cabin wall, slide the cut-out in the stanchion under the stud.

3. Continue sliding the foot of the stanchion forward until the stanchion is vertical.

4. Engage the locking pin.

b. ***Bracket Plates***

1. Slide the bracket plate over the mounting plate on the cabin wall. Ensure that the spring clip locks into the plate

c. ***Straps***

1. Open the zip-fastener in the head lining.

2. Pass the upper loop of the strap over the bracket. Ensure that the spring plate closes properly.

3. Adjust the length of the strap so that it is not slack when the bottom clip is attached to the stud in the floor.

4. Adjust the position of the brackets on the strap if necessary.

5. Before installing the litters on the supports, open the pivoted panels on the rear bulkhead of the cabin to allow the litter handles to extend through.

When not required, the attachments for the litters are stowed in the aircraft.

PICKETING

1245. Introduction. Picketing, towing and manoeuvring of the aircraft by hand is to be carried out in accordance with the following procedures.

1246. Towing. (Ref. Fig. 1-52).

CAUTION

Towing or pushing on the tail wheel is not permissible if the gradient exceeds 12°.

The aircraft is to be towed using either of the following methods:

a. by cables attached to the towing fixtures on the main strut; in this case the aircraft is guided by the steering bar which is installed on the tail wheel as shown in Fig. 1-52 or,

b. by the tail wheel, using the special towing bar shown in Fig. 1-52.

1247. Fitment of Towing Cables. Towing cables are attached to the ski attachment fittings at the bottom of each V-strut using pins of 1 inch diameter and at least 4 inches in length. (Ref. Fig. 1-53).

Note

Minimum distance between aircraft axle and towing point is to be 15 ft.

1248. Installation of Towing Bar or Steering Bar. The towing bar or steering bar is attached to the tail wheel by fitting the slots in the U of the bar over the lugs on the inside of the tail wheel fork. (Ref. Fig. 1-52).

1249. Precautions. When the aircraft is to be towed the following procedures must be carried out:

1. Ensure that the tail wheel is unlocked by setting the tail wheel locking lever, located at the left hand side of the pilot's seat, to the TAIL WHEEL STEERABLE position. (Ref. Fig. 1-20 Steering).

2. Ensure that the rudder is unlocked. (Internal lock disengaged and external lock withdrawn.)

3. Position one man in the cockpit to control the brakes.

4. Check the brake system.

5. Position personnel for obstacle clearance.

1250. Manoeuvring Aircraft by Hand. When the aircraft is to be moved by hand, the same precautions must be taken as for towing. The aircraft is moved by pushing on the wing struts and guided by the steering bar which is attached to the tail wheel mount. If the aircraft is to remain in one position but mooring is not considered necessary, the internal lock should be fitted in accordance with para. 1254.

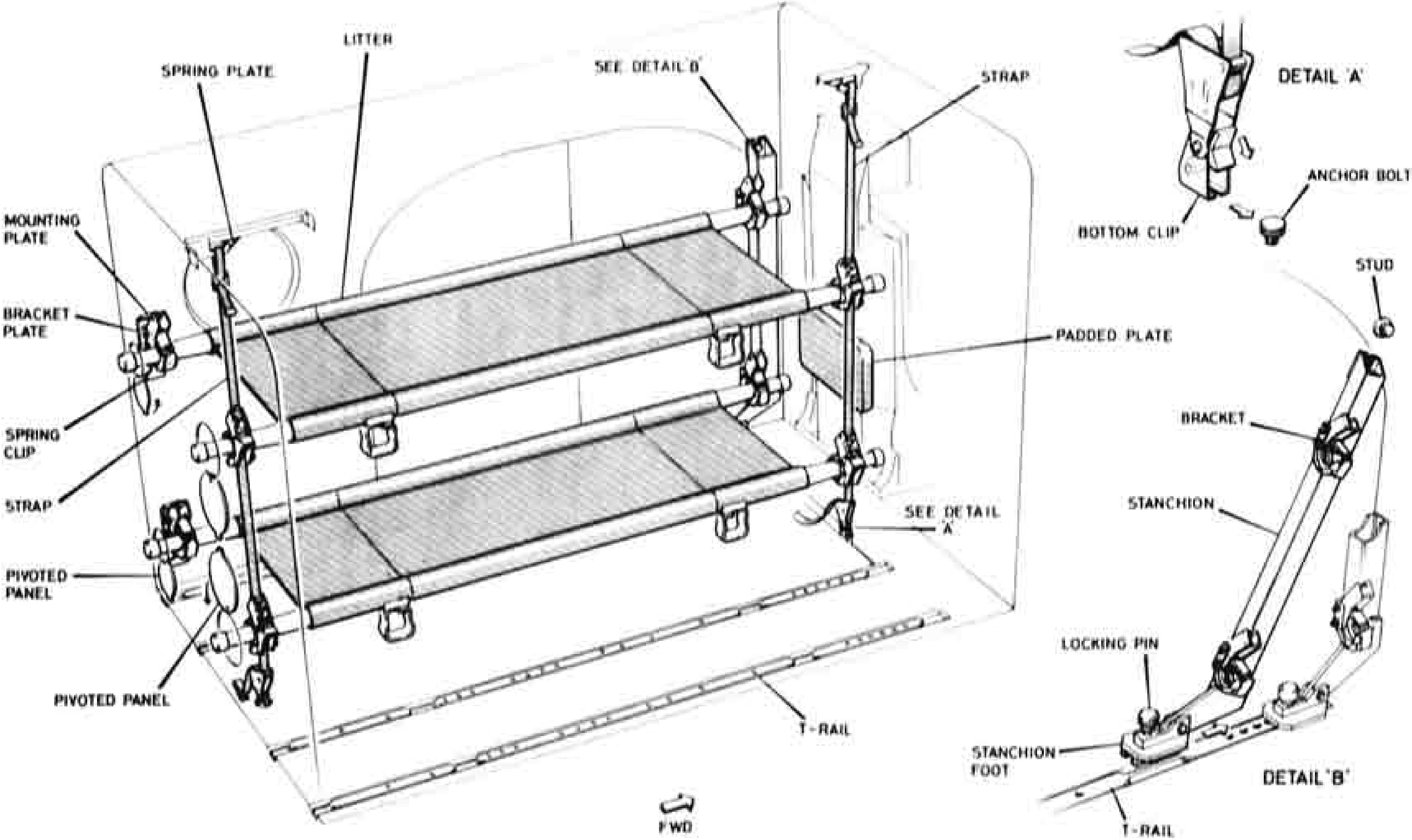


FIG. 1-51 LITTER INSTALLATION

1251. Mooring. (Ref. Fig. 1-54).

CAUTION

Tie-down ropes are to be replaced at frequent intervals as deterioration occurs, particularly in synthetic fibres.

Tie-down fixtures are built into the airframe structure at the following points:

a. One at the bottom of each undercarriage V-strut.

b. One at the rear fuselage, combined with a jacking point.

c. One on each wing at WS 214.2 in.

The recommended pattern for blocks and stakes is shown in Fig. 1-54. The aircraft is to be tied down with ½ in. manilla or nylon ropes attached as follows:

a. To tie-down points embedded in the hardstanding.

b. To concrete blocks or similar heavy transportable objects.

c. To steel pickets or stakes driven at an angle for at least 18 inches into hard ground.

1252. Mooring Procedure.

CAUTION

Do not use external locks and internal locks together.

Ensure that the propeller is tied down to prevent windmilling at zero oil pressure.

When an aircraft is to be moored the following procedure is to be carried out:

1. Face the aircraft into the wind or direction of forecast wind.

2. Using the external locks only, lock the controls. with the flaps up. Refer to para. 1255 and Fig. 1-56.

3. Fully fuel the aircraft.

4. Tie the aircraft down, using the wing tie-down points and the rear fuselage tie-down point. Use one rope to each wing fitting, arranged in an inverted V. Leave some slack in these tie-downs.

5. Fit the engine cover and pitot-head cover to the aircraft and secure with the attached straps and buckles. A cut-out is provided to fit around the ARC-54 front antenna coupler so that the antenna rod need not be removed. (Ref. Fig. 1-57).

6. Fit chocks fore and aft of each wheel.

Note

If winds in excess of 40 knots are forecast, the aircraft should be housed in a hangar.

1253. Control Locks. (Ref. Figs. 1-55, 1-56). Two methods of locking the controls can be used. In calm weather or light winds when it is not considered necessary to moor the aircraft, an internal lock is fitted; for other weather conditions external locks are fitted over the control surfaces.

1254. Internal Lock. (Ref. Fig. 1-55). The internal lock is a tubular structure which pivots on a floor bracket between the control column and the rudder pedals. When the lock is pulled aft, a pin extends into a band round the control column and a second pin engages in the rudder operating bracket to lock the rudder. When the lock is disengaged it is held forward by a spring. To engage the lock, carry out the following procedures:

1. Centre the controls.

2. Pull the top of the lock upwards, raising the spring loaded pin at the top of the lock.

3. Engage the pin in the band fastened around the control column.

4. Ensure that the lower pin has engaged the rudder operating bracket.

1255. External Locks. (Ref. Fig. 1-56).

CAUTION

Ensure that the flaps are fully up before attempting to fit the locks. The aileron/flap and aileron/wing tip locks can be forced on the wrong side of the aircraft, distorting the structure. Before installing these locks, check that the lock accommodates the aileron droop when the bungee cord is at the bottom. Remove external locks before lowering flaps.

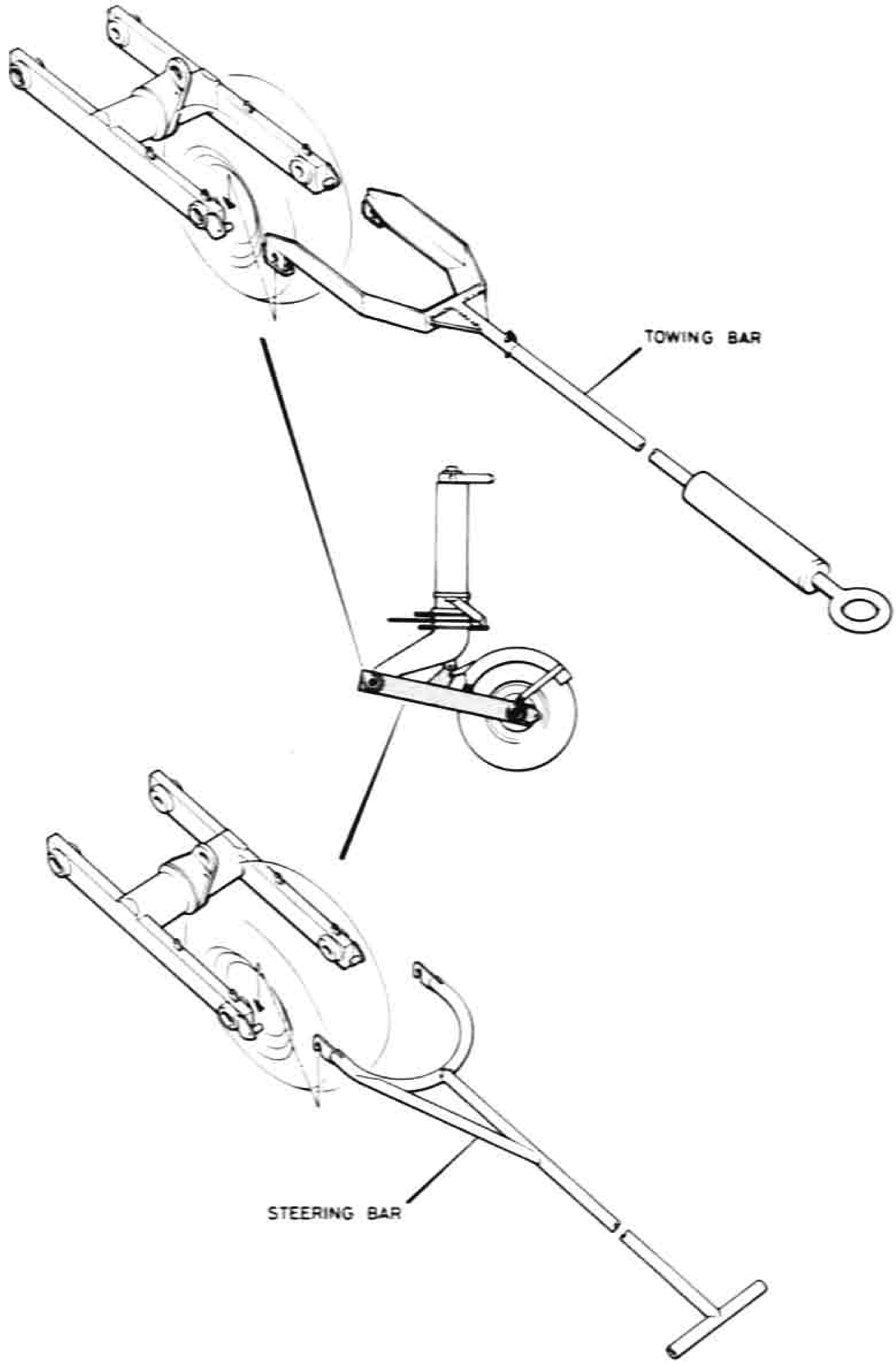


FIG. 1-52 TOWING AND STEERING ATTACHMENTS

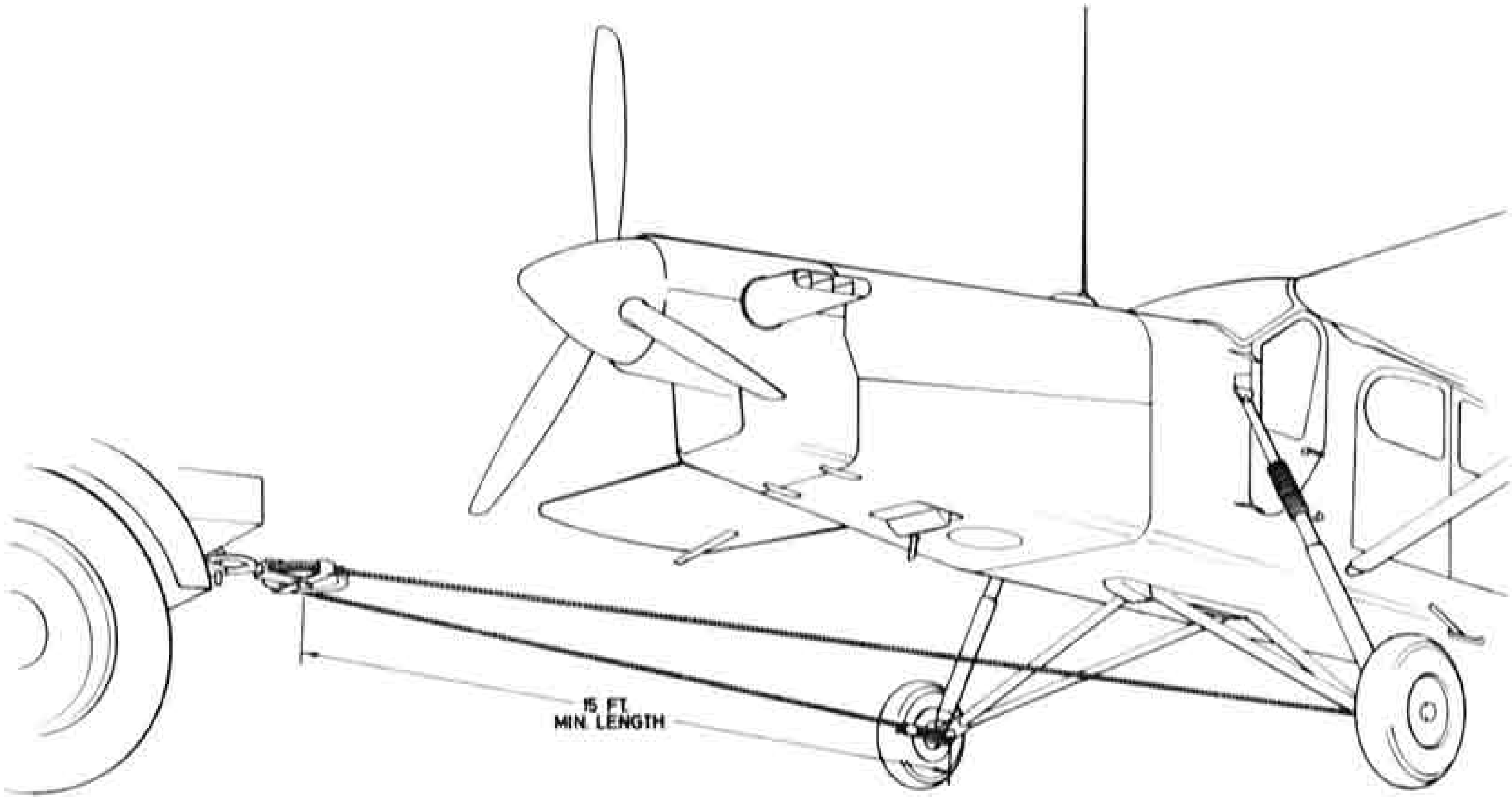


FIG. 1-53 TOWING CABLE

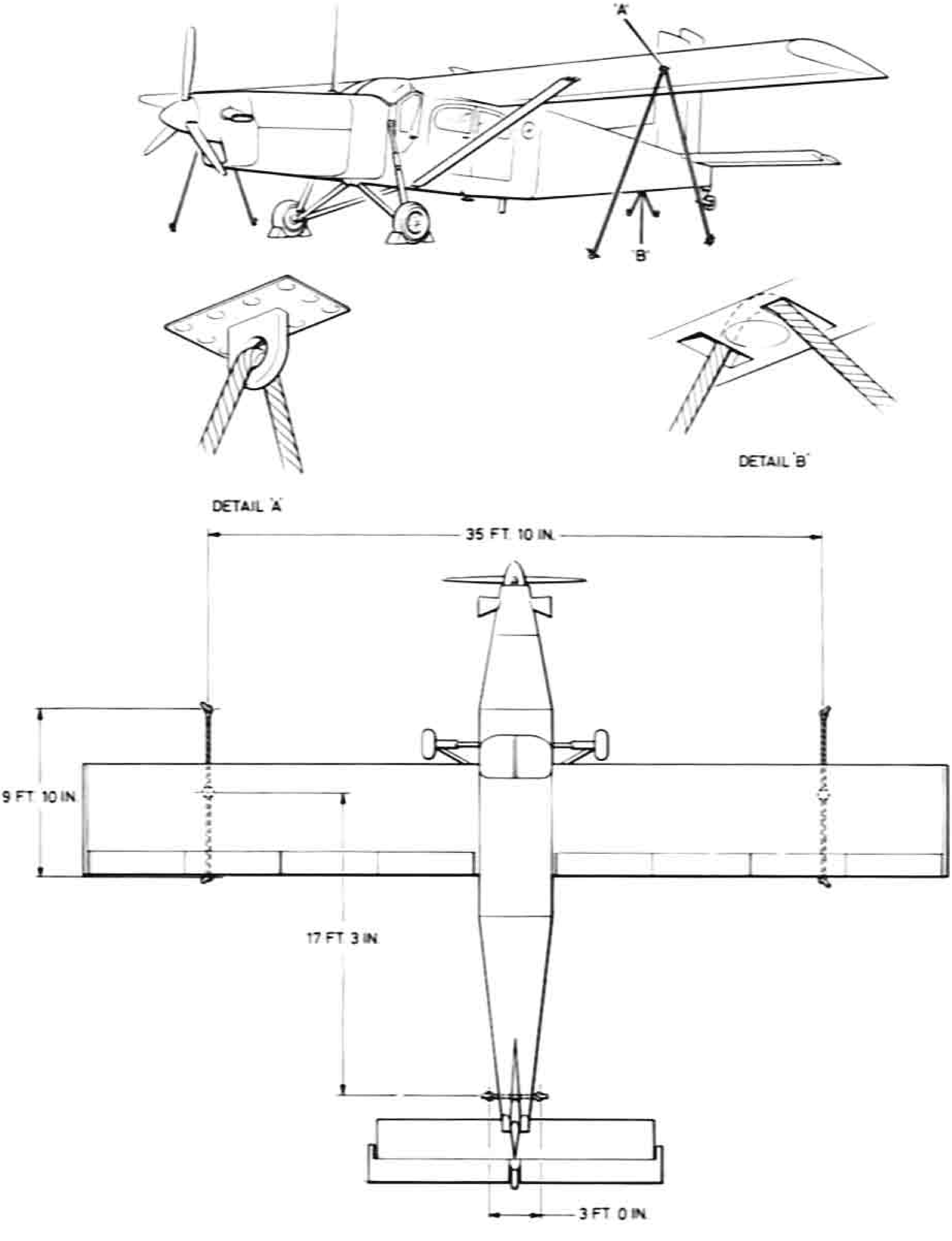


FIG.1-54 MOORING

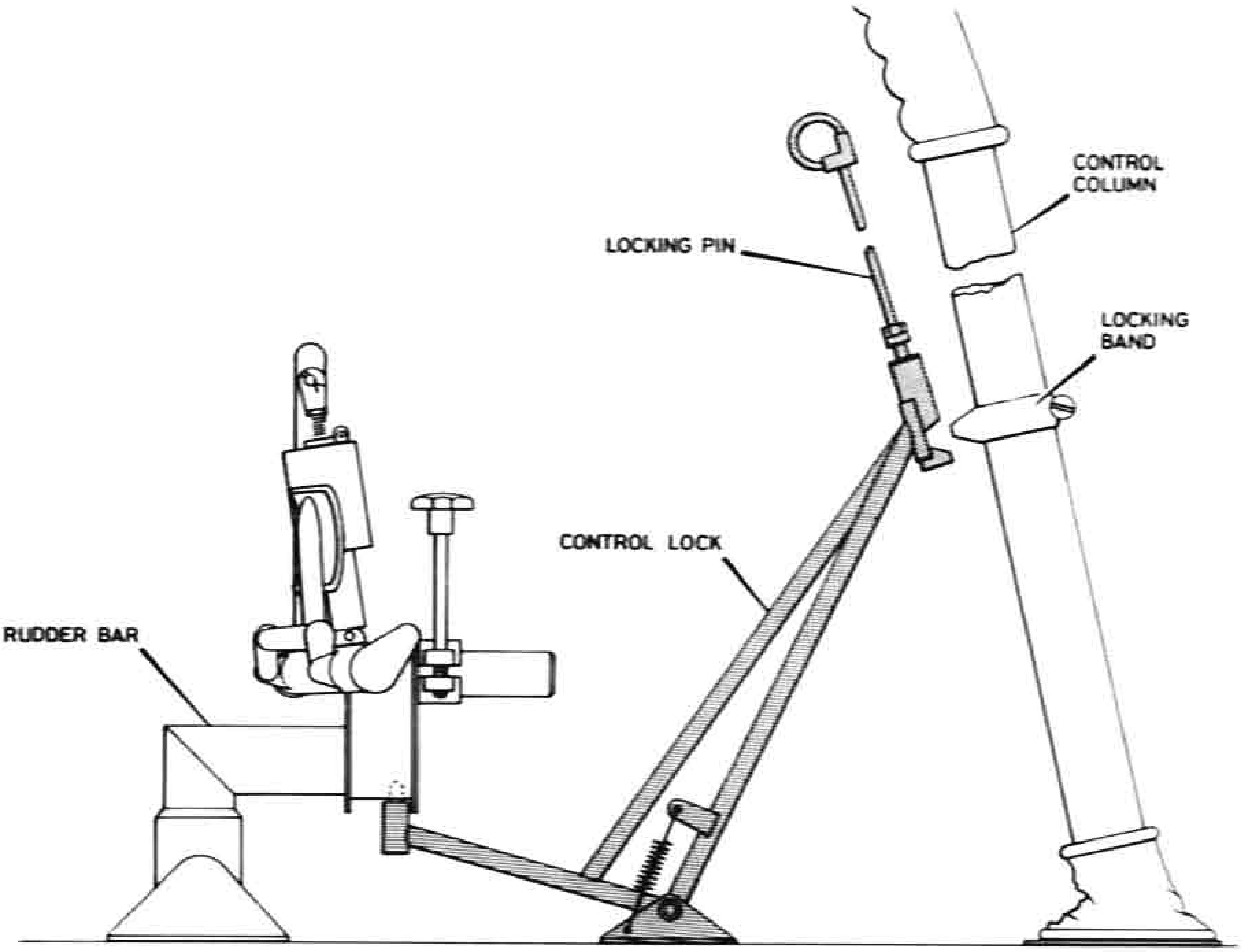


Fig. 1-55 Internal Control Lock

There are six external locking pieces which are painted red and, with the exception of the elevator lock, are made of sheet metal with felt padding. The locking pieces are:

a. Aileron/flap lock, left and right. These are stepped locks, designed to allow for aileron droop and are held in place by a bungee cord.

b. Aileron/wing tip lock, left and right. Similar to aileron/flap locks.

c. Rudder lock. This is fitted with two bungee cords and two stabilizer rods which pin into lock plates fitted to the stabilizer.

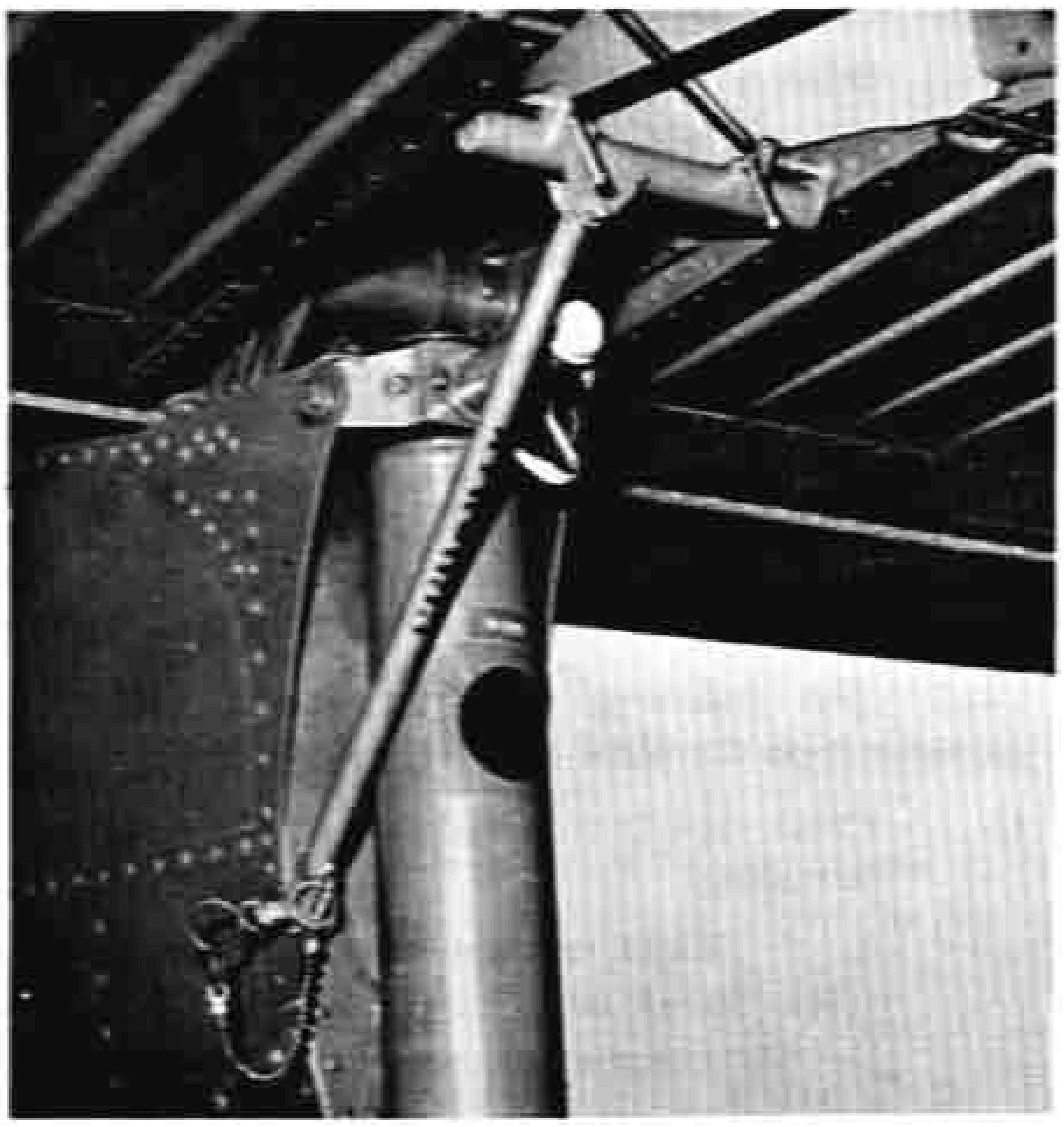
d. Elevator lock. This consists of two tubes of different lengths and diameters, pivoted at right angles. The shorter tube has a latch at each end and fits between the elevators with the latches engaged in holes in the elevator torque brackets. The longer tube fits to a bracket on the left hand side of the fuselage end frame.

Note

When positioning the shorter tube, ensure that the longer tube is to the port side of the aircraft.

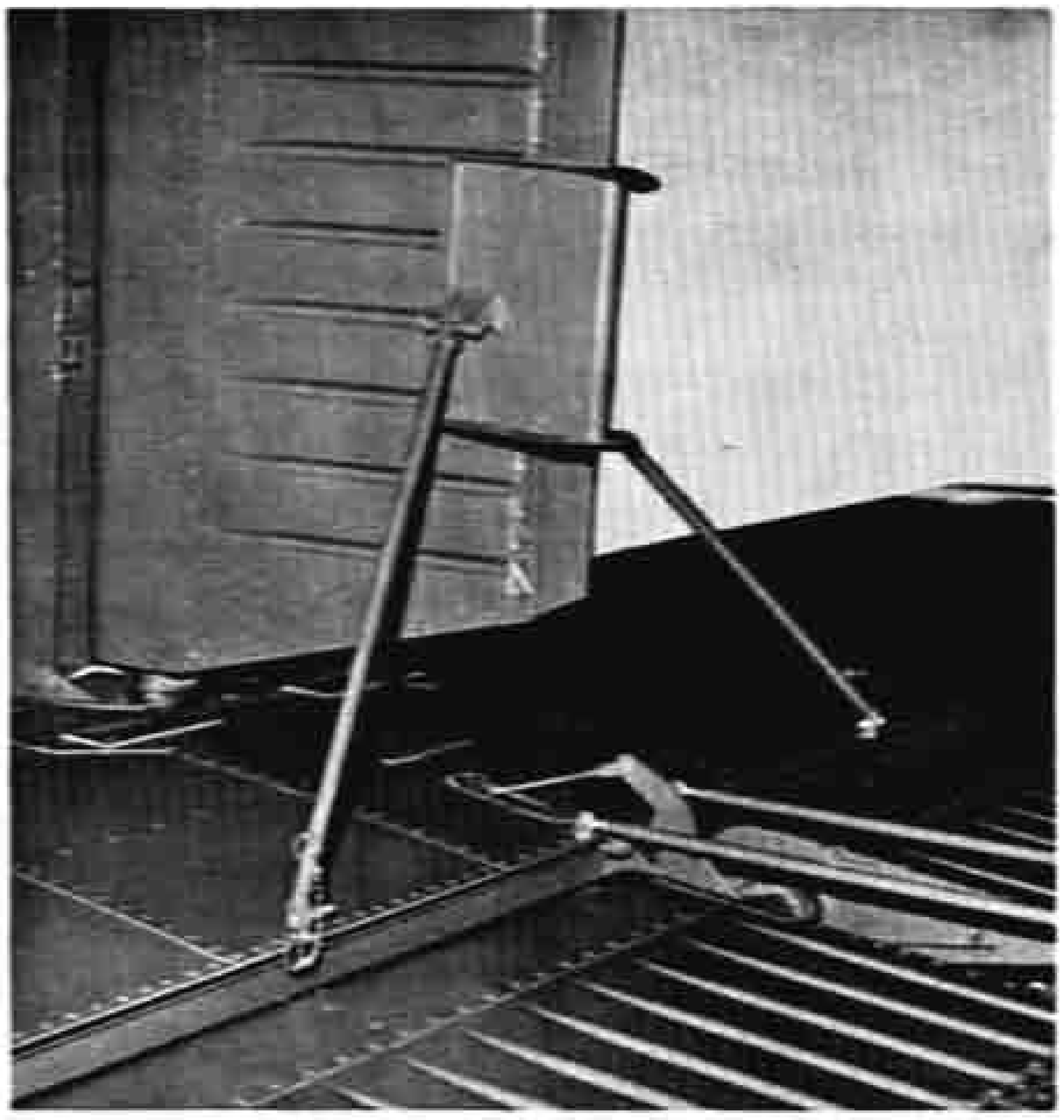
MISCELLANEOUS EQUIPMENT (Ref. Fig. 1-2)

1256. External Stores. External stores, up to a maximum weight of 500 lbs, can be carried on each MA4A stores rack mounted in supports bolted to a specially reinforced attachment point on each wing. The support is enclosed by a sheet metal fairing and includes forward and rear sway-braces, and linkage for a manual jettison system. A stores selector box, mounted in front of the pilot on the instrument panel

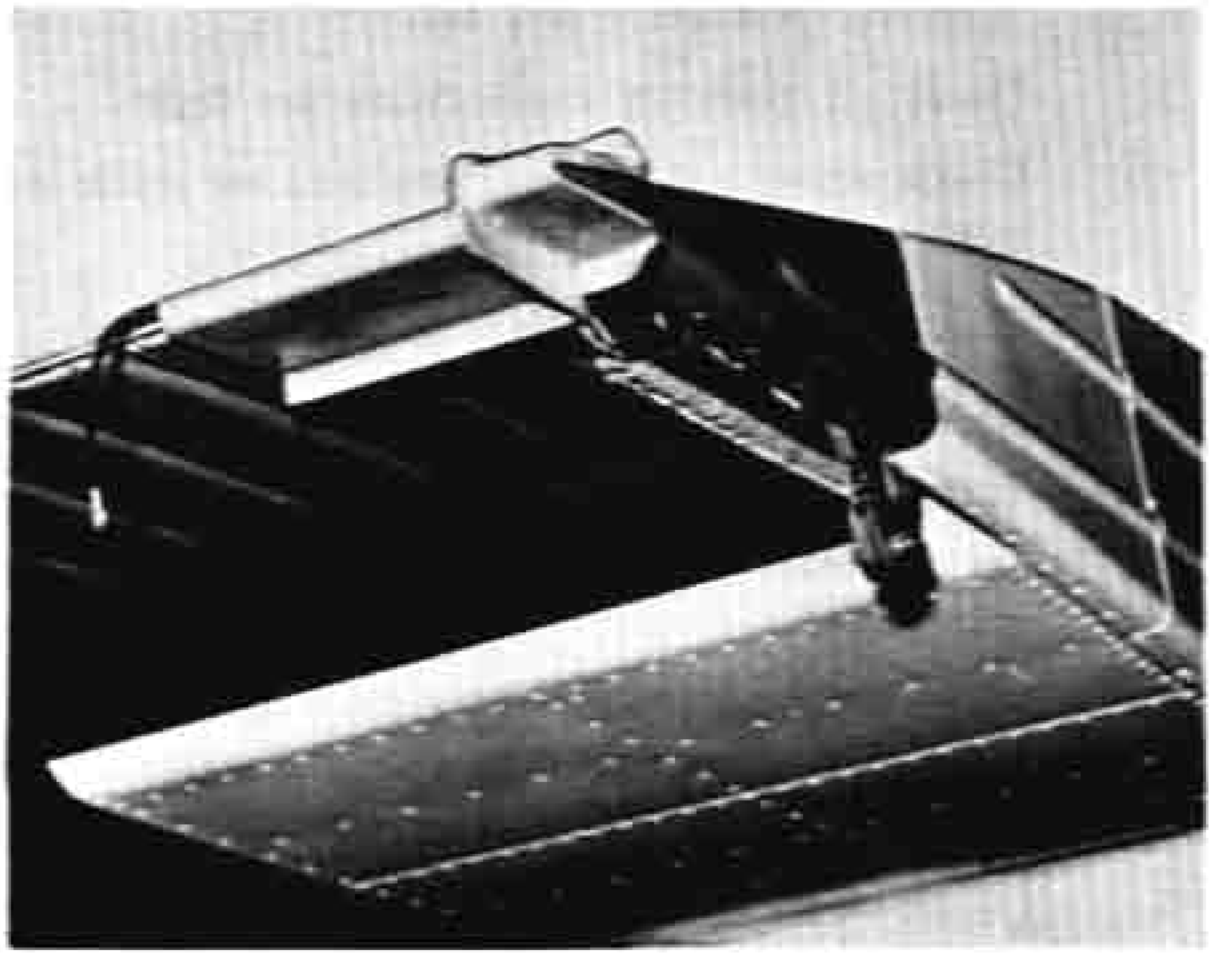


ELEVATOR LOCK

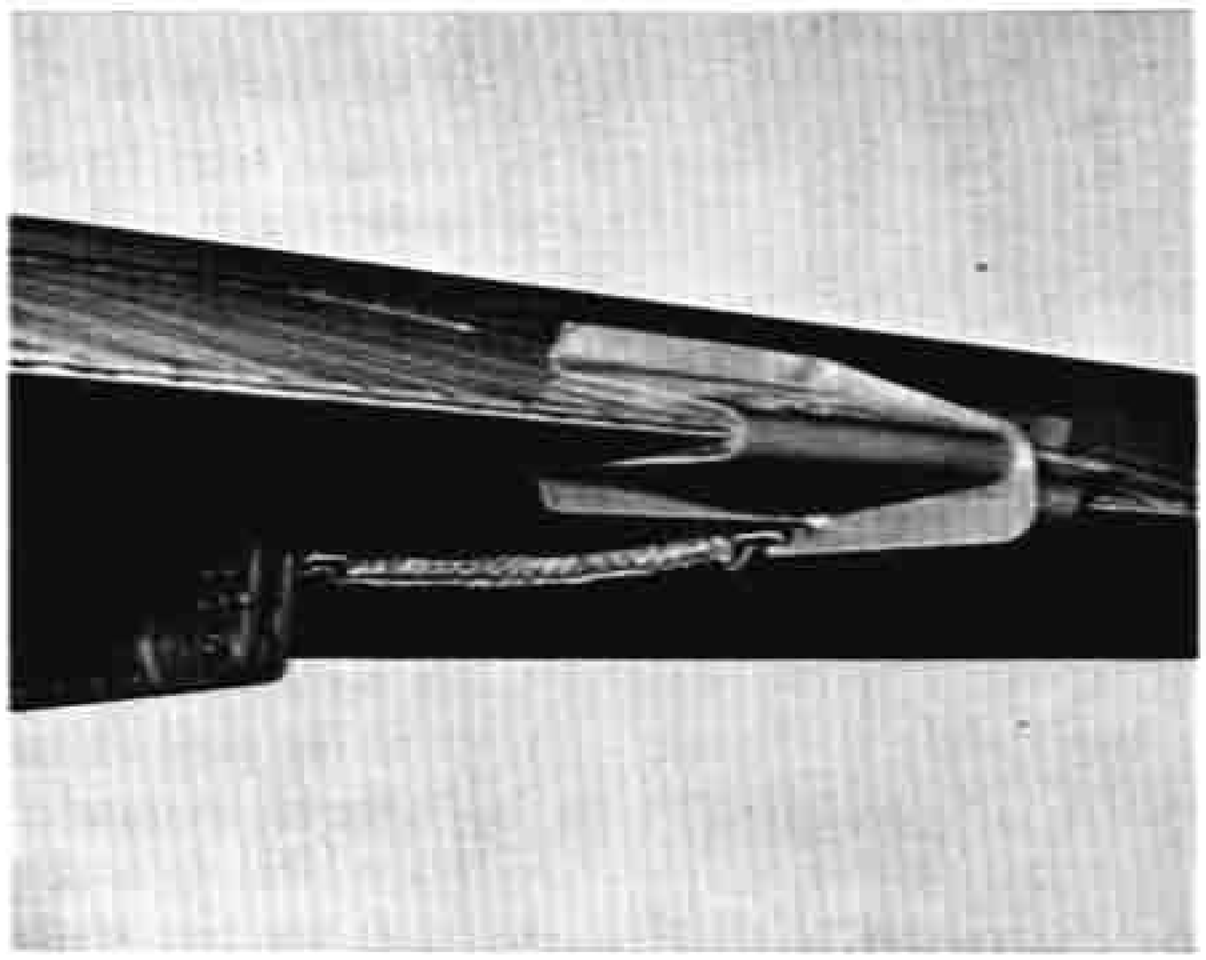
NOTE: When positioning the shorter tube, ensure that the longer tube is to the port side of the aircraft.



RUDDER LOCK



AILERON/WING TIP LOCK



AILERON/FLAP LOCK

FIG. 1-56 EXTERNAL CONTROL LOCKS

shelf, allows the selection of stores to be released, the actual release being controlled by a trigger on the pilot's control column. Eight switches are mounted on the stores selector box, four of which are the rocket selection switches, two control the dropping of stores from either wing, one is the jettison switch and one is a master switch. The master switch does not affect the function of the DROP or JETTISON switches in pre-Mod 40 aircraft. Mod 40 introduces a three-position master switch. It will be necessary to select either ROCKETS or STORES with the master switch. The master switch in post-Mod 40 aircraft does not affect the function of the JETTISON switch. A ground safety switch, actuated by the undercarriage V-struts, prevents the stores from being released and rockets from being fired while the aircraft is on the ground. During flight, stores can be jettisoned either electrically or manually.

1257. **Windscreen Direct Vision Panel.** (Ref. Fig. 1-2). A direct vision panel is incorporated in the port side of the perspex windscreen. In an emergency it can be removed, to provide the pilot with a clear view if the remainder of the windscreen is obscured. Two perspex plates are cemented to the lower part of the panel and fit into perspex blocks cemented to the windscreen. A catch is fitted to the upper part of the panel and engages with two further perspex plates on the windscreen, to keep the panel is position. A rubber seal is fitted to the panel to exclude draughts.

1258. **Fly Away Kit.** The fly away kit consists of:

a. ***Tool Kit.*** This kit contains tools for use by tradesmen maintaining the aircraft.

b. ***Tie-down Bag.*** The tie-down bag contains the tie-down rings.

1259. **WRE MAPS II Installation.** WRE MAPS II is a laser terrain profile recorder used for survey operations. The bulk of the installation is located in the cabin; a static probe is mounted on the port wing and a height display is installed in front of the pilot on the shelf below No. 1 instrument panel. Power is supplied to the equipment from the aircraft system by a plug and 80 amp circuit breaker located at the rear of the centre console. There is normally one operator centrally located behind the equipment on a bench seat, but for training purposes a second operator may be carried.

Weight and Balance Data.

1260. The weight and balance data of the WRE MAPS II installation is:

1. WRE MAPS II - 314 lbs at 155.6 inches aft of datum.
2. Bench seat 20 lbs.

Operating Limitations.

1261. The operating limitations associated with the WRE MAPS II installation are contained in Section 5.

Pre-flight Checks

1262. The following pre-flight checks are to be carried out on the WRE MAPS II installation.

1. Check equipment hold down bolts are in place as follows:
   a. Eight rack mounting bolts (these bolts also help to hold the floor and mounting structure to the seat rails).
   b. Two rear floor bolts.
   c. Four TRC (Transmitter Receiver Camera) floor and mounting structure to the seat rails.
   d. Three viewer mounting bolts (access to two rear bolts is through the open hatch door).
2. Check all knurled nuts on rack units are correctly positioned and tight.
3. Check all electrical connections are tight.
4. Check water and static connectors are made and tight.
5. Check main power supply plug is connected.
6. Check rack-to-aircraft earthing strap is in place.
7. Open hatch doors and inspect spring-loaded flap for damage. Check flap moves correctly under spring load.
8. Close hatch doors (security may be checked by **lightly** lowering viewer to make contact with doors).
9. Check viewer is fully retracted.
10. Inspect static probe on port wing for security.

1263. **Ferry Fuel Tank Installation.**

To be issued at a later date.

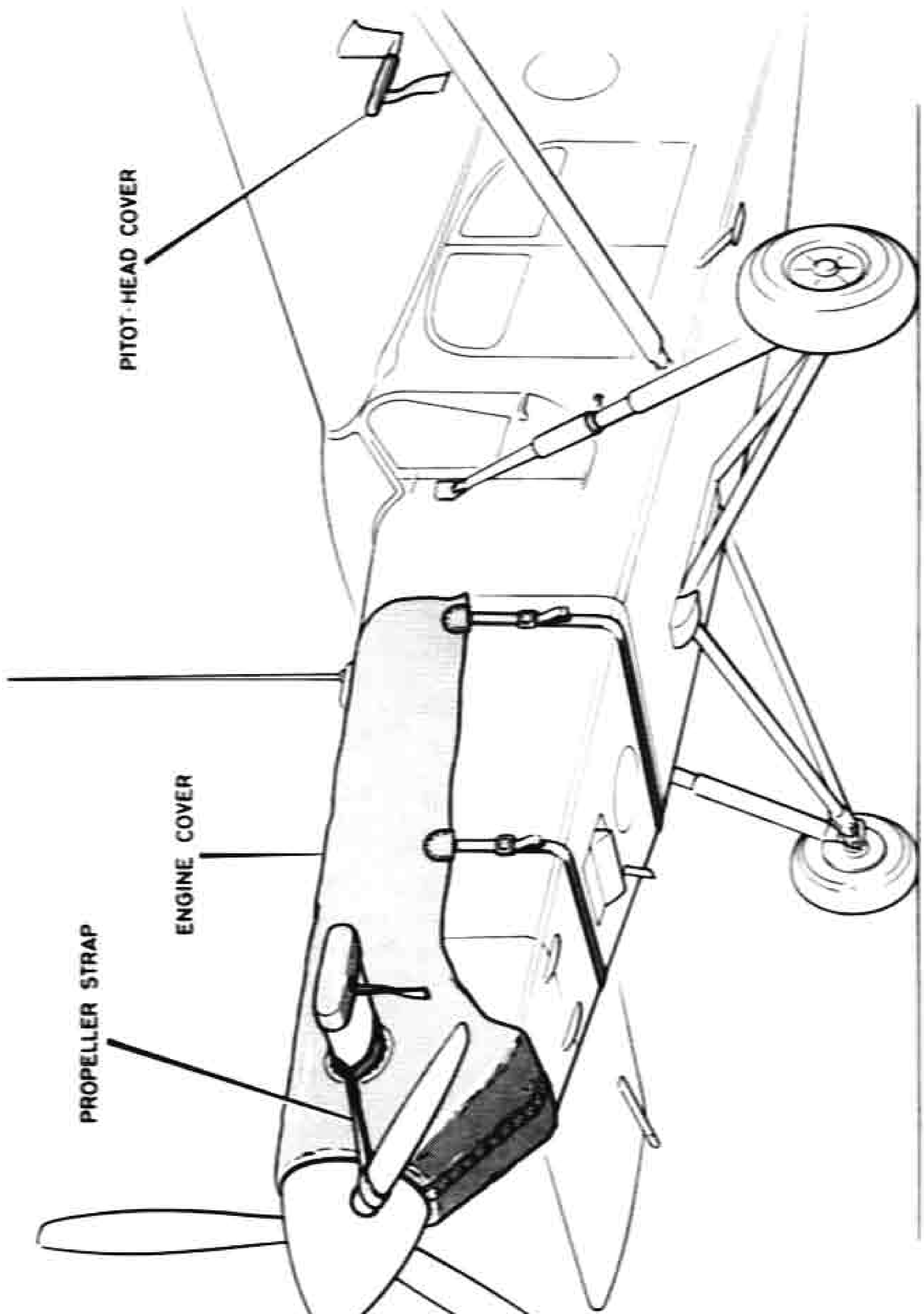


FIG.1-57 EXTERNAL COVERS

Servicing Diagram for Oils and Fuels

Engine Oil - Lubricating Oil, Aircraft Turbine Engine, 5 Centistoke

SEATO Code:	0-156
Specification:	MIL-L-23699B
Recommended:	Mobil Jet Oil 2
Alternate when Mobil Jet Oil 2 is unavailable	Use any 5 centistoke oil that is qualified to MIL-L-23699B. Report the use of emergency oil on return to base/unit.

Hydraulic Fluid - Hydraulic Fluid, Petroleum

SEATO Code:	H-515
Specification:	MIL-H-5606C
Recommended:	Mobil Oil HFC

Aviation Turbine Fuels - Recommended

RAAF Standard Fuel	Turbine Fuel Aviation, Kerosine type (with Fuel System Icing Inhibitor (FSII))
SEATO Code:	F-34
Specification:	DEF (Aust) 240A

Acceptable Alternative Fuels

SEATO Code:	F-35 Kerosine Type
Specification:	DEF (Aust) 208B
	or
SEATO Code:	F-44 Kerosine High Flash Type (NAVAL)
Specification:	DEF (Aust) 207B
	or
SEATO Code:	F-40 Wide Cut Type (JP-4)

Emergency Fuels - Aviation Gasolines - Operating Restriction

SEATO Code:	F-12 Avgas Grade 80/87 (unleaded) *50 hours
	or
SEATO Code:	F-18 Avgas Grade 100/130 (leaded) **30 hours
	or
SEATO Code:	F-22 Avgas Grade 115/145 (leaded) **30 hours

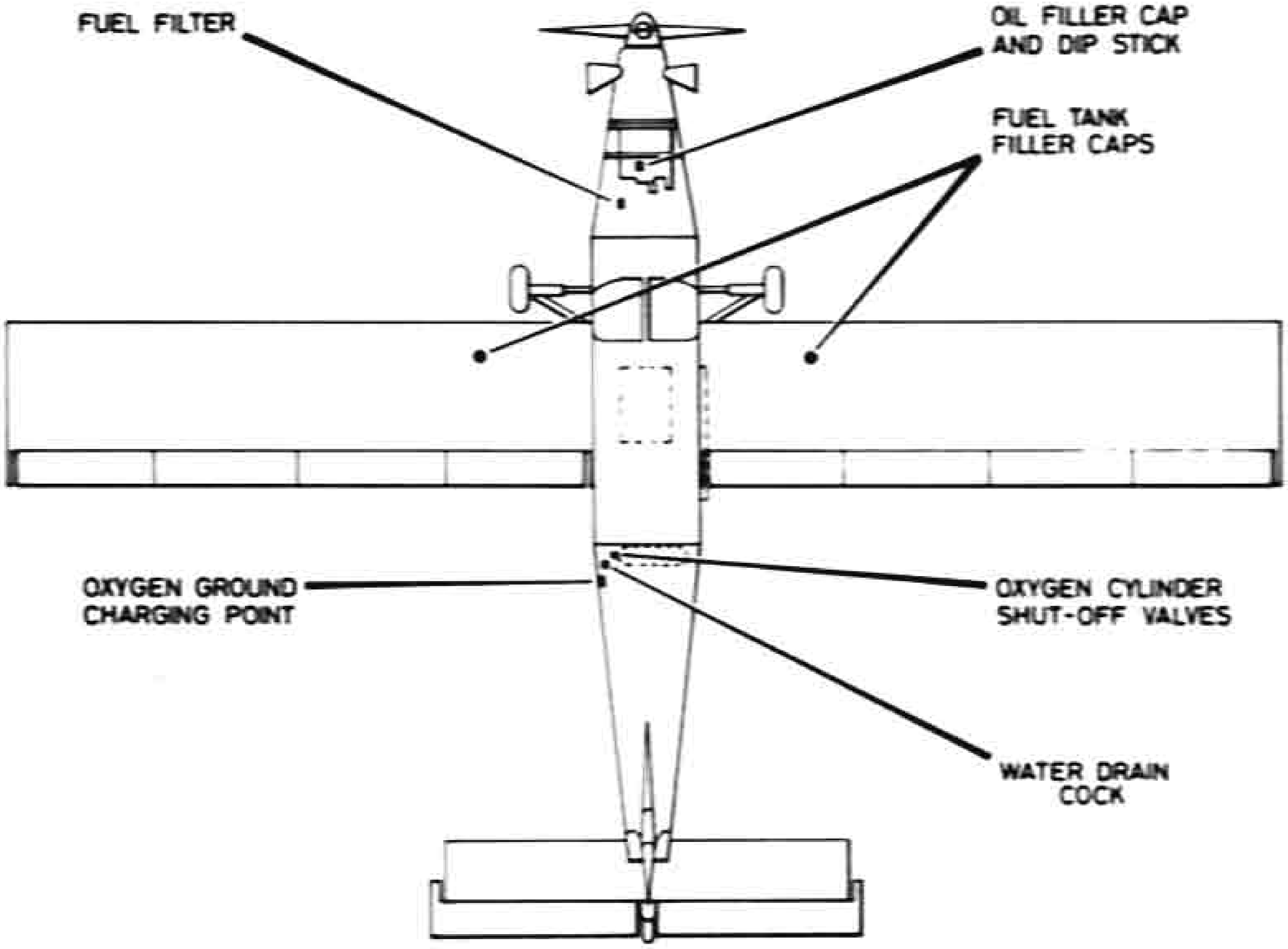
Note

Operation with gasoline containing tricrysel phosphate is more detrimental to combustor parts than leaded gasoline and therefore, any gasoline containing tricrysel phosphate is limited to one half the operating time of a leaded gasoline which does not contain tricrysel phosphate. Tricrysel phosphate is an additive contained only in some fuels marketed by the Shell Company and is known as TCP in the USA and as ICA elsewhere.

See Appendix 1 Performance Data for details governing use of Emergency Fuels.

Notes: * **Maximum of 50 hours operation between hot end inspections**

** **Maximum of 30 hours operation between hot end inspections and/or cleaning of combustor parts.**



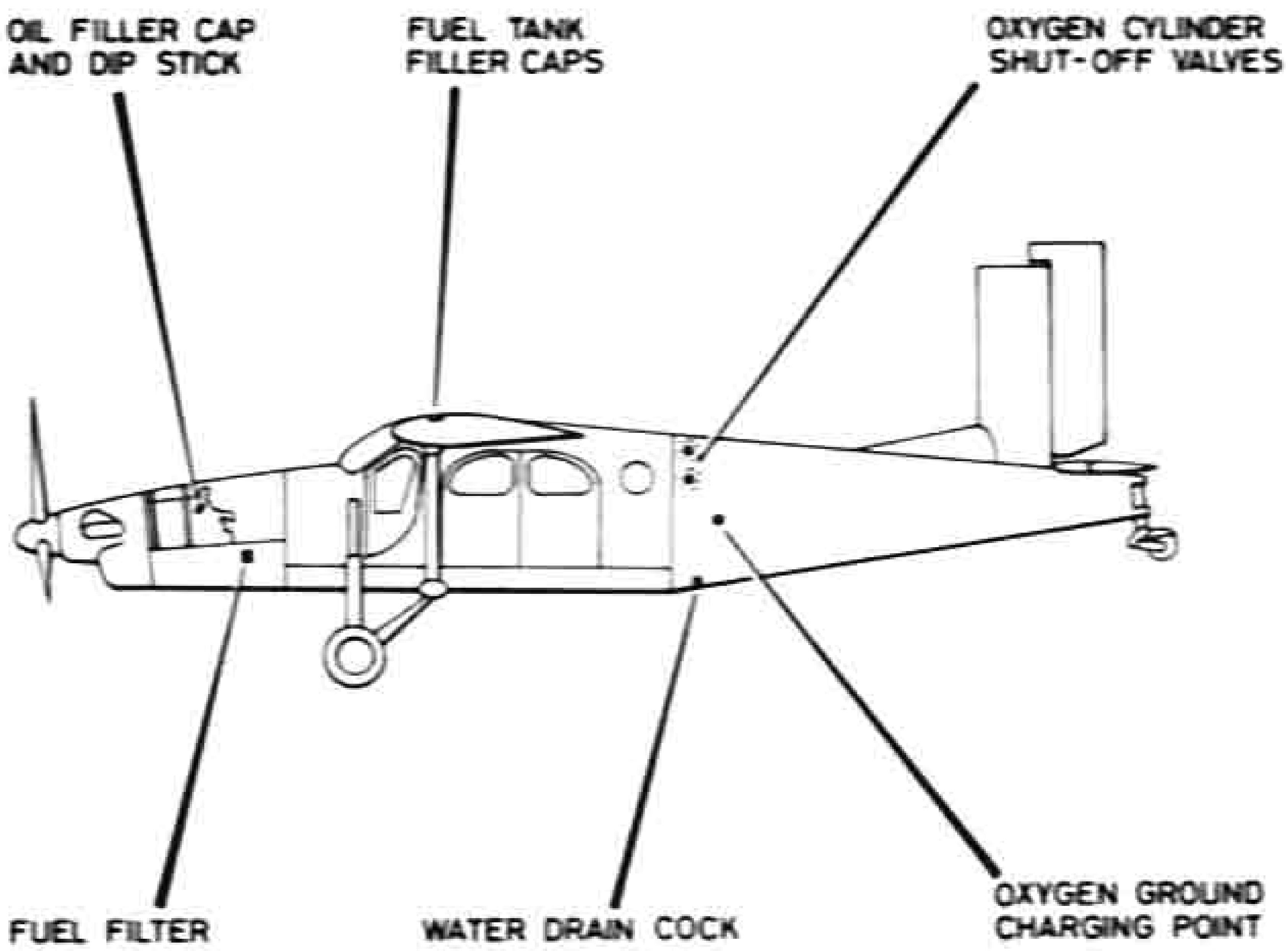


FIG. 1-58 SERVICING DIAGRAM

FLUID CONVERSION TABLES

Litres		Imp. Gal.	US Gal.		Imp. Gal.
4.546	1	0.220	1.201	1	0.8327
9.10	2	0.44	2.40	2	1.67
13.64	3	0.66	3.60	3	2.50
18.20	4	0.88	4.80	4	3.33
22.73	5	1.10	6.00	5	4.16
27.28	6	1.32	7.21	6	5.00
31.82	7	1.54	8.41	7	5.83
36.37	8	1.76	9.61	8	6.66
40.91	9	1.98	10.81	9	7.49
45.46	10	2.20	12.01	10	8.327
68.19	15	3.30	18.01	15	12.50
90.92	20	4.40	24.02	20	16.65
113.65	25	5.50	30.02	25	20.82
136.38	30	6.60	36.03	30	24.98
159.11	35	7.70	42.03	35	29.14
181.84	40	8.80	48.04	40	33.31
204.57	45	9.90	54.04	45	37.47
227.30	50	11.00	60.05	50	41.63
454.60	100	22.00	120.10	100	83.27

1 litre	= 1.7598 Imp. pints	1 US pint	= 0.8237 Imp. pint
1 Imp. pint	= 0.5682 litres	1 Imp. pint	= 1.201 US pint

Example: Convert 30 Imp. gal to litres. Read down the centre column to 30. The left-hand column indicates 136.38. This shows that 30 Imp. gal = 136.38 litres. Similarly the right-hand column indicates 6.60. This shows that 30 litres = 6.60 gal. Conversion of Imp. gal to US gal and vice versa is similarly carried out.

To find fuel consumption in gal/hr when flow rate is graduated in lb/hr:

$$\text{gal/hr} = \frac{\text{lb/hr}}{\text{Specific Gravity of fuel x 10}}$$

Example: Given a Specific Gravity (SG) for the fuel of .81 and a flow rate of 8.1 lb/hr, calculate the flow rate in gal/hr

$$\text{gal/hr} = \frac{\text{lb/hr}}{\text{SG x 10}}$$

$$\therefore \text{gal/hr} = \frac{8.1}{.81 \text{ x } 10}$$

$$\therefore \text{ANS:} = 1 \text{ gal/hr}$$

SECTION 2
NORMAL PROCEDURES

SECTION 2

NORMAL PROCEDURES

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List of Illustrations

SECTION 2

NORMAL PROCEDURES

201. **Introduction.** This section deals mainly with the duties of the pilot and co-pilot and the procedural steps necessary, in the form of amplified check lists, to operate the aircraft. Every phase of operation has been included in check list form. It is intended that, as far as possible, the flight crew will perform each action with direct reference to a check list, except during actual landing, take-off, touch and go landings, or under certain emergency conditions.

202. **Preparation for Flight.** Before making a pre-flight inspection, the pilot should be satisfied that:

- a. the aircraft is on suitable ground,
- b. no unsecured tools and equipment are in the backwash,
- c. chocks are in front of the wheels,
- d. a fire extinguisher is readily available and
- e. the taxi path is clear.

203. **Flight Restrictions.** Refer to Section 5 OPERATING LIMITATIONS of this Flight Manual, for any flight restrictions which may be imposed upon the aircraft for the intended mission or flight.

204. **Flight Planning.** Check the EE500 or EE501 maintenance form, for fuel required aboard the aircraft to accomplish the intended mission. Air speed and engine power settings are to be determined for the proposed flight, using data contained in Appendix 1 PERFORMANCE DATA of this Flight Manual.

205. **Weight and Balance.** The pilot is responsible for determining that the take-off and anticipated landing gross weight, plus weight and balance CG limits, are within the prescribed limits specified in Section 5 OPERATING LIMITATIONS of this Flight Manual. Reference should also be made to the Weight Sheet Summary AAP 7211.001-5 for loading information.

206. **Check Lists.** The check lists have been designed to provide a sequence of phases and actions, in a chronological order, to avoid retracing any steps. As far as possible, the checks have been grouped to keep control manipulation and ground operating time to an absolute minimum. All precautions which are to be observed during the various phases of the check list operations have been included.

PREFLIGHT CHECKS

207. **Before Exterior Inspection.** Before carrying out the external check of the aircraft, the pilot is responsible for checking Form EE500 or EE501 for status of the aircraft, and for confirming that the required inspections have been completed and signed off. The pilot should then check and carry out the following:

1. Chocks - In position at the main wheels.
2. Pitot Cover - Remove and stow.
3. External Control Locks - Remove and stow.
4. Brakes - ON. Park position.

Note

The park facility is fitted to the pilot's brakes only.

5. Power Source Selector Switch - OFF.
6. Fire Extinguisher - Secure.
7. Fire Axe - Secure.
8. Port and Starboard Seat Harness - Serviceable.
9. Elevator Trim - Full range. Leave in NEUTRAL.
10. Flaps - Fully down. 38° position.
11. Manual Stores Jettison - Fully down.
12. Controls - Unlocked.
13. Trap Door Release - Fully down.
14. Rudder Trim - Check full range. Leave in NEUTRAL.
15. Tail Wheel Locking Lever - Free travel. Leave LOCKED.
16. Loose Articles - Secure.

208. **Exterior Inspection.** Start at the port wing root and proceed clockwise around the aircraft.

1. Fairing - Secure. Check that there are no loose screws etc.
2. Wing Under-Surface - Condition. Check for any loose rivets, cracks and skin damage.
3. Inboard Section - Fuel Leakage. Check that there are no fuel leaks.

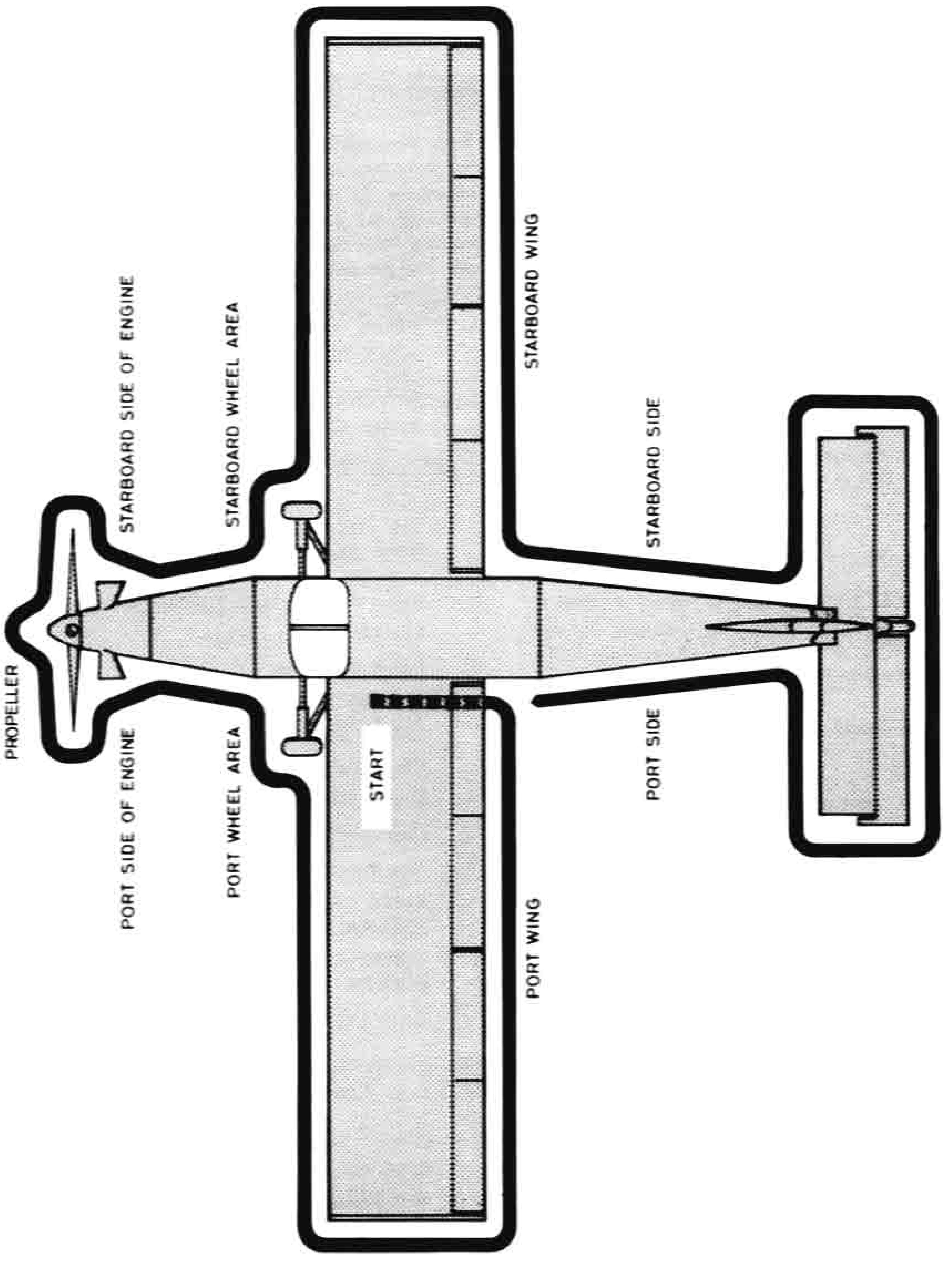


FIG. 2-1 EXTERIOR 'WALK-AROUND' INSPECTION

4. Flap-Hinge Mounts, Bolts - Secure. Ensure that bolts are not loose and bonding wire is unbroken.

5. Flap Actuating Rod - Secure.

6. Flap and Slot - Condition (upper and lower surface). Check for loose rivets. Check skin surfaces for damage.

7. Servo Tab - Condition. Hinge pin and connecting rod secure. Check end attachment bolts for security and locking and for damage to tab skin.

8. Mass Balance - Secure. Check for cracks etc.

9. Static Discharge Wicks - Secure. Three are fitted. Check that none is missing.

10. Wing Tip and AN/PRC25 Antenna - Secure.

11. Navigation Light - Condition, security.

12. Leading Edge - Condition. Check that there are no loose rivets or cracks in leading edge skin.

13. Stall Warning Device - Condition, security. Check Sensing Vane for free movement by moving it up and down with finger.

14. Inspection Panels - Security. Check for any loose screws etc. and for cracks.

15. Stores Rack - Condition, security.

16. Landing Light - Condition. Check that glass is clean and not damaged.

17. Port Strut and Bonding Wire - Condition. Bolts, retainer and mirror secure.

18. Pitot - Clear, secure.

19. Flap Indicator - ON 38° MARK.

20. Port Cockpit Door - Condition. Hinge pins engaged. Check for cracks and correct fitting of hinge pins.

21. Port Wing Upper Surface - Condition. Check for damage, loose rivets. Filler cap secured.

22. Fuel Tank - Dip contents if partly empty. Ensure filler cap is locked and secure.

23. Fuel Vent - Clear.

24. Antennae - Secure. Check attachment points for security and for cracks on skin.

25. Rotating Beacon - Condition, security. Ensure glass is clean and unbroken.

26. Centre Fuel Vent - Clear.

27. Windscreen - Clean.

28. Cowl Centre Section - Security. Check all fasteners for correct locking.

29. Port Main Undercarriage Strut - General condition. Check the upper fuselage fitting for condition, check vent screw is secure and correctly lockwired and check the dust boot and step for security. Inspect the filler valve nipple and screw to ensure they are correctly lockwired. Check for hydraulic fluid leakage.

30. Tyre - Cuts, creep and inflation. Check tyre for deep cuts and creep. Check tyre visually for inflation.

31. Brake Disc - Condition.

32. Brake Line - Leakage. Check for leaks, damage to brake lines etc.

33. V-Strut and Micro Switch - Condition, step and fairing secure, bonding wire intact. Check fairing for cracks and damage.

34. Inspection Panels - Secure. Check for loose or missing screws.

35. Port Cowls - Secure. Check all attachment fasteners for correct locking and security.

36. APU Connection - Panel secure, pins not bent.

37. Exhaust Pipe - Condition, clear. Check for cracks and loose attachment bolts.

38. Propeller Spinner - Secure. Check spinner for damage.

39. Propeller Mounting Flange - Oil, leaks.

40. Propeller Blades - Condition, oil leaks. Check for free rotation of propeller.

41. Air Intake - Condition, clear.

42. Starboard Exhaust Pipe - Condition, clear.

43. Starboard Cowls - Secure.

44. Forward Fuselage Under Surface - Vents, inspection panels.

45. Oil Cooler Flap - Condition, security.

46. Inspect the Starboard undercarriage, cockpit door and wing as for Port side.

209. Cabin Inspection.

1. Seats - Secure. Check seat securing bolts in the aircraft floor.

2. First Aid Kit - Secure.

Note

The First Aid Kit is located on the aft side of Bulkhead 6.

3. Bulkhead Door - Secure.
4. Oxygen - Check pressure.

Note

The pressure should read approximately 1800 psi dependent on ambient temperature.

5. Windows - Condition. Check for any cracks, crazing and for cleanliness.
6. Loose Article Check - Secure oxygen masks, headsets, AN/PRC 25 sets.
7. Passenger Signal Distribution Panels - Set as required.
8. Sliding Door - Condition. Check for freedom of movement, locked, and handle secure.
9. Cabin Step (Removed for side door stores dropping) - Secure.
10. Door Slide - Condition. Check that door stop is secure.
11. Antennae - All secure.

210. Rear Hatch.

1. Radio Equipment - All secure.
2. Oxygen Bottles - Both secure.
3. Fuel Collector Tank - Condition. Check for leaks.
4. Water Collector Tank - Condition. Check for leaks.
5. Control Cables - Condition. Check for fraying and obstructions.
6. AN/PRC 25 Antennae - Securely stowed.
7. Seats - Securely stowed in track provided.
8. Loose Articles - Check.
9. Hatch - Secure.

211. Rear Fuselage and Tail.

1. Static Vent - Clear.
2. Rear Fuselage Under Surface - Condition. Check for damage to the under surface skin, loose rivets etc.
3. Vertical Stabilizer - Condition. Check for damage to skin, loose rivets etc.
4. Horizontal Stabilizer - Condition. Check hinge bolts secure, inspection panels secure, leading edge undamaged. Check for loose rivets, cracks and skin damage on upper and lower surface. Tip fence secure and bonding wire unbroken.
5. Starboard Elevator - Condition. Check inspection panels for security, loose hinge bolts, security of servo tab hinge pin and connecting rod. Check that the two static discharge wicks are in place and secure.
6. Rudder - Condition. Check inspection panels for security, static discharge wicks in place and secure, bonding wire unbroken.
7. Navigation Light - Condition and security.
8. Steering Gear - Condition. Check security and tension of cables.
9. Oleo - Check extension. Check oleo for leaks.
10. Mud Guard - Condition and security.
11. Tail Wheel - Condition. Check for cuts, tyre creep and inflation.
12. Port Elevator and Horizontal Stabilizer - As for starboard.
13. Port Side Vertical Stabilizer - Condition. Check all panels are secure.
14. Port Static Vent - Clear. Ensure no paint etc. is over static vent holes.
15. Oxygen Filler Point - Hatch closed.
16. Water Drain - Leakage.
17. Rotating Beacon - Condition, security. Check for damage and that glass is clean.
18. Trap Door - Fully closed and secure.
19. Inspection Panels - Secure.
20. Cabin Step - Secure.
21. Port Doors - Condition. Ensure doors are closed and secure.

INTERNAL CHECKS

212. Before Starting Engine.

CAUTION

Prior to entering the aircraft, the pilot is responsible for ensuring that the air intake is clear of all foreign objects which could cause engine damage or possible subsequent engine failure. A check for signs of oil in the exhaust pipe and for evidence of oil leaking into the air intake should also be made.

1. Controls	– UNLOCKED, Check full and free movement in the correct sense (including duals)
2. Rudder Pedals	– ADJUSTED & FRICTIONED. Check both sets of pedals move in the correct sense.
3. Harness	– Fastened.
4. PARKING BRAKE	– ON.
5. RUDDER TRIM	– Neutral
6. TAIL WHEEL	– LOCKED.
7. C14 Compass Card	– Checked.
8. Port FLOOD LIGHT	– Adjusted.
9. Port Door Jettison	– Lock Wired.
10. FLOOD LIGHT RHEOSTAT	– As required.
11. INVERTER Circuit Breakers	– OUT.
12. Other Circuit Breakers	– IN.
13. Port Ventilator	– Adjusted.
14. Cabin Oxygen Regulator	– OFF (backed ½ turn).
15. Oxygen Master	– OFF.
16. STORES SELECTOR SWITCHES	– OFF.
17. NAV SELECTOR SWITCH	– As required.
18. INSTRUMENT LIGHT RHEOSTAT	– As required.
19. MKR BEACON	– OFF.
20. VOR Course Selector	– Condition.
21. DME	– Condition.
22. ASI	– Condition.
23. Turn and Balance	– Condition.
24. Clock	– Set.
25. Gyro Compass Indicators	– Condition.
26. AI FAST ERECTION	– OFF.
27. AI	– Condition.
28. RMI	– Condition.
29. Altimeter	– Set, Airfield Height.
30. IVSI	– Zero.
31. NAV SELECTOR SWITCH	– As required.
32. Fuel Totalizer	– Set.
33. Np Gauge	– Condition & Slippage.
34. Ng Gauge	– Condition & Slippage.
35. TORQUE PRESS, Gauge	– Condition & Slippage.
36. ITT Gauge	– Condition & Slippage.
37. PROPELLER CONTROL	– Max RPM
38. ENGINE CONTROL HEATER	– OFF.
39. AUX PUMP	– OFF.
40. IGNITION	– OFF.
41. STARTER	– OFF.
42. HP Cock	– CLOSED.
43. IDLE CONTROL	– LO IDLE.
44. POWER Lever	– RETARDED.
45. Friction Nut	– Adjusted.
46. Standby Compass	– Condition & Heading.
47. Map Lights	– Condition.
48. VHF/UHF	– Frequency OFF.
49. VHF/FM1	– Frequency OFF.
50. PILOT Signal Distribution Panels	– As required.
51. HF	– Frequency OFF.
52. ADF	– Frequency OFF.
53. VOR	– Frequency OFF.
54. OIL COOLER	– COLD.
55. CABIN Air	– As required.
56. Triplex Gauge:	
OIL Temp.	– Condition, Slippage.
OIL Press.	– Condition, Slippage.
FUEL Press.	– Condition, Slippage.
57. FUEL Gauges	– Condition.
58. Voltmeter	– Condition.
59. Ammeter	– Condition.
60. Switches	– OFF or as required.
61. Circuit Breakers	– In.
62. Starboard Ventilator	– Adjusted.
63. Starboard Door Jettison	– Lock Wire.
64. OAT	– Condition, NOTE.
65. Starboard FLOOD LIGHT	– Adjusted.
66. STANDBY Compass Deviation Card	– Note.
67. FLAPS	– UP.
68. ELEVATOR TRIM	– Neutral.
69. DME	– Frequency OFF.
70. CO-PILOTS Signal Distribution Panel	– As required.
71. VHF FM 2	– Frequency OFF.
72. Wander Light	– OFF.

213. Starting Engine.

CAUTION

- Engine starts should not be made at ambient temperatures of -40°F (-40°C), or below, without first preheating the engine.
- The starter switch should not be operated for more than 25 secs at any one start, otherwise the starter may be damaged by excessive temperatures caused by large starting currents.
- The starter should be allowed to cool for a minimum period of one minute before attempting a second start. Following three consecutive aborted starts, allow starter to cool for a period of not less than 30 minutes before restarting.
- The external power supply for starter operation should first be disconnected before connecting the generator to the load bus.
- If GG fails to ignite within 10 seconds, abort start.
- If maximum transient ITT exceeds 1090°C for longer than 2 secs, abort start.
- Do not feather the propeller above 15 psi as transient over-torqueing of the engine may occur.

1.	LP Cock	– OPEN
2.	IGNITION SELECTOR SWITCH	– LEFT or RIGHT (Opposite to last start.)

Note

Alternate use of left and right igniters is recommended for ground starts. Both igniters are used only after a wet start or for an air start.

3.	POWER SOURCE Switch	– As Required.
4.	VOLTMETER	– Min 24.7V.
5.	PROPELLER LOW PITCH Warning Light	– TEST
6.	STALL WARNING Light	– TEST
7.	ENGINE CONTROL HEATER Light	– TEST
8.	FUEL FILTER CLOGGED Warning Light	– TEST
9.	AUX PUMP	– ON, 25psi ± 5psi.
10.	IGNITION & STARTER	– ON
11.	OIL Pressure	– Rising

Note

To effect a satisfactory start GG RPM must be stabilized at 15% min.

12.	HP Cock	– OPEN, after Ng RPM stabilized (Min 5 secs)
13.	ITT	– Check.
14.	Starter & Ignition	– OFF, when Ng RPM 49–52%
15.	Oil Pressure	– Min. 40psi.
16.	Oil Temperature	– Max 80° C.
17.	GPU (if used)	– Disconnected.
18.	Power Source Selector Switch	–Select BTRY if GPU used.
19.	Generator	– ON.
20.	Generator Warning Light	– Out.
21.	Ammeter	– Charging.
22.	Inverter Circuit Breakers	– IN.
23.	Rotating Beacon	– ON.
24.	Radio Master Switch/Radio/NAV Eqpt.	– ON / as required

214. Unsatisfactory Start. An unsatisfactory start may occur if one or more of the following conditions takes place:

a. hot start,

b. false or hung start, or

c. no start.

215. Hot Start.

CAUTION

Pilot should be prepared to abort a start before temperature limits are exceeded. If greater than normal fuel flow is observed when the fuel shut-off lever is moved to open, a hot start may be anticipated, and the pilot should be prepared to abort the start before starting temperature limits are exceeded. (Max. ITT 1090°C for 2 secs only).

Note

Refer to SECTION 3 for Hot and Wet Start Emergency Procedures.

Hot start occurs when the turbine temperature exceeds starting temperature limit.

Note

The aircraft is to be placed unserviceable after a hot start.

Special Considerations

216. Compressor Stall. Engine compressor stall, to the degree of being audible, is not characteristic of normal engine operation and should be avoided. All movements of the power control lever should be smooth. Rapid or jerky movement may induce compressor stall and subsequent ***flame out*** of the engine.

217. AFTER STARTING

1.	Propeller	– Purge twice before first flight of day.
2.	Gyro Compass	– Fail light out, annunciating, Standby ± 4°.
3.	AI	– OFF Flag away.
4.	NAV Eqpt	– TEST.
5.	Radio	– Transmit.
6.	Altimeter	– set QNH.
7.	Chocks	– away.
8.	Brakes	– check.

218. Taxying. Signal chocks away, release the parking brake, roll forward and check brakes for correction operation.

Note

- Before turning, ensure tail wheel lock is disengaged.
- It is necessary to weave the nose to clear the taxi path.

Little power (approx. 70-75% Np) is required to keep the aircraft moving at the correct speed. The tail wheel of the Porter can only be steered through 25° either side of centre. When the angle exceeds 25°, the tail wheel becomes free-castoring. This makes the aircraft easy to taxi under all conditions except in strong cross winds, when continual brake application is necessary to overcome weathercock action of the keel surface. Forward visibility is reasonably good but the nose of the aircraft creates a blind spot on the starboard side. Before making a turn to starboard, a weaving manoeuvre is to be carried out to ensure that the blind spot is free from obstructions.

219. While Taxying Check.

1.	Turn and Balance	– Indication.
2.	AI	– Erect.
3.	RMI	– Indication.
4.	Standby Compass	– Indication.
5.	NAV aids	– Sensing.

220. Use of Reverse Thrust During Taxying.

CAUTION

Propeller damage will result from reversing or feathering on unsuitable ground. Maximum time for reverse thrust is 1 minute.

Position the aircraft carefully, ensuring taxi path is clear, preferably by use of wing walkers. Lock the tail wheel and use reverse thrust as required. The aircraft cannot be steered by the tail wheel or the brake.

221. Before Take-off.

1.	TAILWHEEL	– LOCKED.
2.	BRAKES	– Parked.
3.	RUDDER TRIM	– As required.
4.	ELEVATOR TRIM	– As required.
5.	PROPELLER CONTROL	– Max RPM.
6.	POWER Lever	– Friction Adjusted.
7.	AUX PUMP	– OFF, Check Pressure (25 ± 5) psi.
		– ON, Check Pressure (max 32 psi).
		– Contents.

8. FLAPS	– As required.
9. GYRO COMPASS FAIL Light	– OUT.
10. RMI	– Annunciating, Check synchronised with Magnetic Compass.
11. AI	– OFF, Flag Away.
12. Altimeter	– Set.
13. Engine	– Temps/Press in green arcs.
14. Switches	– As required.
15. Circuit Breakers	– IN.
16. Hatches	– Secure.
17. Harness	– Adjusted.
18. Controls	– Full and free movement in the correct sense.
19. Computer	– T/O & Climb Tq noted.
20. Radio	– Correct Frequency.

222. **Line-Up**. Align the aircraft with the runway and ensure the tail wheel is running straight. Carry out the line-up check.

1. Tail Wheel	– LOCKED.
2. HI IDLE	– Select.
3. OVERSPEED GOVERNOR (first flight of day)	– Depress TEST button, advance power lever to 30 psi tq. Ensure Np below 95%. Release button, observe increase in Np. Retard power lever to detent.
4. RMI	– Check hdg.
5. AI	– set.
6. Windsock	– check.
7. PITOT HEATER	– As required.
8. Clearance	– confirm cleared for T/O.

Take-Off (Ref. Fig. 2-4)

223. Engine Ratings and Power Settings.

CAUTION

Do not exceed ITT limits (Max. 750°C).

This rating is the maximum power permissible and corresponds to 550 SHP at sea level up to 59°F (15°C) ambient temperature. The max. allowable output torque must not be exceeded.

224. Before Setting Take-off Power.

1. Note OAT.
2. Note airfield pressure altitude.
3. Enter these readings on the torque computer and note take-off torque pressure.

225. Setting Take-off Power.

1. Advance the power control lever to obtain computed take-off torque pressure.
2. Note any increase in Ng and Np speeds above the maximum limits (101.5% Ng, 100% Np).

Note

Inability to reach computed torque due to ITT limitation is an indication of engine deterioration.

226. Take-off.

1. As aircraft gains speed, gently and smoothly **lower nose to take-off attitude.**
2. To maintain attitude until aircraft becomes airborne, apply slight back pressure.
3. At 60 kts IAS and 100 ft. AGL, carry out the after take-off check.

Note

As air speed is gained during take-off, an increase in torque pressure at a fixed power control lever position is normal and should be retained, provided limiting torque pressure is not exceeded. ITT also increases by up to 25°C during the take-off. To avoid exceeding the limit, ITT should not exceed 725°C before commencing take-off roll.

With a tail-low attitude maintained the aircraft can be flown off at 45 to 50 knots IAS.

227. **Short Take-off Technique**. The aircraft is held on the brakes as the power control lever is advanced to computed take-off torque. A three point attitude is maintained during the ground roll. Maintain lift-off attitude to 50 ft. Action after take-off is as for the normal take-off. If maximum angle of climb is required to clear obstacles, an IAS of 56 knots may be used in all conditions. Speeds in the range to 50 - 55 knots IAS may be used if necessary in calm conditions.

228. **Cross-wind Take-off Technique**. The take-off is commenced as for the short take-off. Once airborne, crab the aircraft into wind to maintain track on runway heading.

229. **Flapless Take-off.** A flapless take-off requires a 150% increase in distance over the short take-off ground roll and 120% increase in distance to 50 ft. AGL.

230. **Rough Field Operation and Effect of Large Wheels.** Operation on short, dry or short, wet grass has little effect on take-off distances. The oversize wheels do not have a significant effect on the distance used on tarmac or grass.

231. **After Take-off Check (60 KIAS, 100 ft.)**

1. FLAPS	– UP.
2. Propeller	– 92.5% Np.
3. CABIN FAN	– OFF.
4. OIL COOLER Flap	– As required (optimum oil temp 74° – 80° C).

FLIGHT CHECKS

232. **Climb.** Maximum climb power corresponds to 538 SHP at sea level on a standard day. Because of rapidly varying conditions in the climb, power should be set by using 92.5% Np and nominal ITT value (705°C) except where the maximum torque pressure will override the ITT limits. Nominal en route climbing speed is 80 knots IAS. Maximum rate of climb is achieved at 77 knots IAS at sea-level, reducing by approximately 1 knot per 2000 feet. The best angle of climb is achieved at 56 knots IAS, with 28° flap selected.

233. **Cruise.**

CAUTION

Sustained cruise at the limiting ITT is to be avoided.

Anticipate the cruise altitude selected, level out and reduce power after the IAS stabilizes, correcting for any decrease in yaw. The setting of cruise power must be accomplished by the use of the torque indicating system since this is the only system that is common to both aircraft performance and engine operating condition. The maximum approved power for cruising corresponds to 495 SHP at sea-level on a standard day. However, use of this rating will result in cruise speeds above the maximum structural cruising speed (118 kts). Cruise power should be set by using 92.5% Np and required torque pressure to maintain speeds of 118 kts IAS or lower. The maximum ITT limit (705°C) for cruising should be observed.

234. **Cruise IAS.** The cruise IAS noted below may be sustained at the relevant altitude.

Altitude	KIAS
0 - 5000	115 and below
5 - 8000	110 and below
8 - 12000	105 and below
12 - 16000	100 and below

Stalling

235. **Stalling Speeds.** Variation of stalling speed with aircraft weight is shown below.

Flap Angle	Aircraft Wt (lb) 4850	5700
	Stalling Speed KIAS	
0° Flap	51	53
15° Flap	48	49
30° - 38° Flap	45	46

236. **Pre-Stalling Checks.**

1. H - Height. Sufficient to recover by 2000 ft. AGL.
2. A - Area. Clear of airfields, built-up areas and cloud.
3. S - Security. Harness adjusted.
   Hatches - locked.
   Loose Articles secured.
4. E - Engine MAX RPM, HI IDLE. Temperatures and pressures in green arcs.
5. L - Lookout - Area clear.

237. **Low Flying.** Before descending, the following checks are carried out:

1. Fuel	– Check contents.
2. Radio	– Correct frequency.
3. Engine:	
HI IDLE	– Select.
OIL COOLER Flap	– As required.
Temps and Press	– Green arcs.
4. Gyro Compass	– Fail Light – OUT, annunciating, check with magnetic compass.
5. Altimeter	– Set QNH.
6. Wind	– Direction, strength.

7. Area	– Authorised.
8. Harness	– Secure.

238. Descent. Normal descent is at *en route* cruising IAS, 92.5% Np, torque to maintain rate of descent. Maximum rate of descent configuration.

1. IAS - 100 knots.
2. Propeller Control - In Max. RPM position.
3. Power Control Lever - Retard to detent.

Range speeds with propeller feathered are 70 knots IAS clean and 60 knots IAS with flap extended.

Before Landing (Ref. Fig. 2-4).

239. Rejoin Check.

1. Fuel - Check contents.
2. Radio - Correct frequency.
3. Engine - Select HI-IDLE.
4. Oil Cooler Flap - COLD.
5. Temperature/Pressures - Check both are in green arcs.
6. Gyro Compass - Fail light OUT, annunciating, check with magnetic compass.
7. Altimeter - SET destination QNH.

240. Down-wind Check.

1. Harness	– Adjusted.
2. Brakes	– OFF.
3. Tailwheel	– LOCKED.
4. PROPELLER CONTROL	– Max RPM.
5. HI IDLE	– Selected.
6. AUX PUMP	– ON, check press and contents.

Normal Approach and Landing

241. Base Leg (Ref. Fig. 2-4).

1. Lookout.
2. 30° bank turn. Whilst in turn:
   - (a) reduce power to 10 psi,
   - (b) trim nose up (approx. 3 turns),
   - (c) flap to 28° (below 82 knots) and
   - (d) commence descent when speed falls to 70 knots.
3. 400 ft. AGL. Commence turn onto finals.

242. Final Approach - Normal Approach.

1. Lookout.
2. Maximum 30° bank turn. Whilst in turn:
   - (a) flap to 38° (for full stop landing only).
   - (b) speed to 60 knots IAS and
   - (c) trim.

Use elevator to control IAS and engine power to control rate of descent (normal torque 10-12 psi). Adjust approach to commence round-out just short of touchdown point. Refer to APPENDIX 1 of Flight Manual, Fig. A-10 for Normal Landing Distance from 50 ft.

243. Flapless Approach. (Ref. Fig. 2-5). Speed 70 knots IAS on base leg and finals. Trim as required. Round-out point will be displaced further down wind than for a normal landing.

244. BETA Approach. (Ref. Fig. 2-6).

WARNING

When in approach pattern and/or flare out, 'beta' must be carefully selected in order to avoid inducing a speed below the stalling speed.

CAUTION

Full flap is only lowered for full stop landing since repeated application of high power in this configuration will cause cracking of the flap ribs. Maximum braking on a sealed surface can burst a tyre.

Speed in the descent, 70 knots IAS, flaps 28° - 38°. Commence descent when the touchdown point disappears under the exhaust pipe. Lead with forward control column movement. In the descent, apply full nose-up trim and check rate of descent is not above 2000 ft/min.

245. Short Landing (Ref. Fig. 2-7). Approach as for normal approach with 38° flap lowered. After touchdown, use maximum braking and reverse thrust. Maintain reverse thrust until aircraft stops.

246. **Reverse.** Reverse thrust is obtained by lifting the power control lever and moving it aft of the detent. The maximum permissible power in full reverse is 500 SHP, for not more than ONE minute. This rating is achieved at 41.6 psi torque and 95% Np. The limiting ITT (750°C) should not be exceeded.

247. **Cross-wind Landing.** Make the necessary allowances for wind effect when turning on final approach and for drift allowance during the final approach. In gusty, high wind conditions, full flap should not be used; the maximum allowable cross wind component is 15 knots. A small amount of power is retained throughout the round-out and sufficient rudder applied to align the aircraft with the runway. As soon as the aircraft has been aligned with the runway, the power control lever is fully retarded so that the aircraft will touchdown without delay. In strong cross winds, aileron may be needed to maintain wings level as the aircraft is being yawed straight.

Touch and Go Landings

248. **Go Around.** Take-off power should be applied smoothly when going round from either a missed approach or a bad landing. The application of power in the normal landing configuration i.e. 28° flap with full nose-up trim, causes a strong pitch-up which requires considerable strength to overcome. The pilot should be prepared for this by making the necessary trim change for nose-down. This removes the control column loads, enabling normal aircraft climb attitude for go-around to be maintained. At 100 ft. AGL, 60 kts IAS, after take-off checks are to be completed and normal circuit down-wind and base leg checks will apply.

249. **After Landing.**

1. LO-IDLE - Select.
2. Tail Wheel - STEERABLE. Control on LH side pilot's seat to be fully back.
3. Flaps - UP.
4. Trims - All NEUTRAL.
5. Pitot Heat - OFF.

250. **Shut-Down.**

WARNING

If there is any evidence of fire within the engine after shut-down, proceed immediately as described under "Motoring Run for Clearing the Engine".

CAUTION

While the aircraft is unattended, ensure that the propeller is tied down to prevent windmilling with zero oil pressure.

1. POWER Lever – RETARD.
2. PARKING BRAKE – ON.
3. CHOCKS – in position.
4. RADIOS – OFF.
5. AUX PUMP – OFF, check pressure (25 ± 5 psi). ON.

Note

Allow a minimum period of one minute for the engine to stabilize at below 650°C ITT maximum. Taxi time can be taken into account provided that taxiing is carried out with ITT below 650°C.

6. HP Cock – CLOSED.
7. Propeller – FEATHER, when Np below 40%. Select MAX RPM when propeller stops.
8. Aux Pump – OFF (when GG stops).
9. Switches – OFF.
10. Controls – Locked.
11. Pitot Cover – Fitted.

Note

During shut-down ensure that compressor decelerates freely.

251. **Motoring Run for Clearing the Engine.**

WARNING

Should fire persist as indicated by sustained ITT, close the LP cock and continue motoring. (See Section 3 EMERGENCY PROCEDURES FOR GROUND ENGINE FIRE).

The following procedure is used to clear an engine at any time when it is necessary to remove internally trapped fuel and vapour, or if there is evidence of a fire within the engine.

1. H P Cock - CLOSED.

2. Ignition Switch - OFF.
3. Power Source Selector Switch - BTRY (to supply current for the engine starter switch).
4. LP. Cock - OPEN.
5. Booster Pump - ON (to provide lubrication for the engine driven fuel pumping elements).
6. Engine Starter Switch - ON.

252. Before Leaving Aircraft.

1. Ensure that ALL switches in the cockpit are in the OFF position.
2. Check that the parking brake is set and chocks are positioned forward of the main wheels.
3. Install the internal control lock.

Note

If the aircraft is being left unattended overnight, install external control locks **only**.

4. Ensure fuel dump valve has operated.
5. Ensure ALL doors and panels are securely fastened.
6. Install cover on pitot head located under port wing.

Note

If high winds are forecast and aircraft is being left unattended overnight, Picketing Procedures - Ref. Para. 1245 Section 1 of this Flight Manual are to be carried out.

253. Post Flight.

1. It is the pilot's responsibility to enter any unserviceable conditions applicable to the aircraft in the approved maintenance forms.

EXHAUST DANGER AREAS

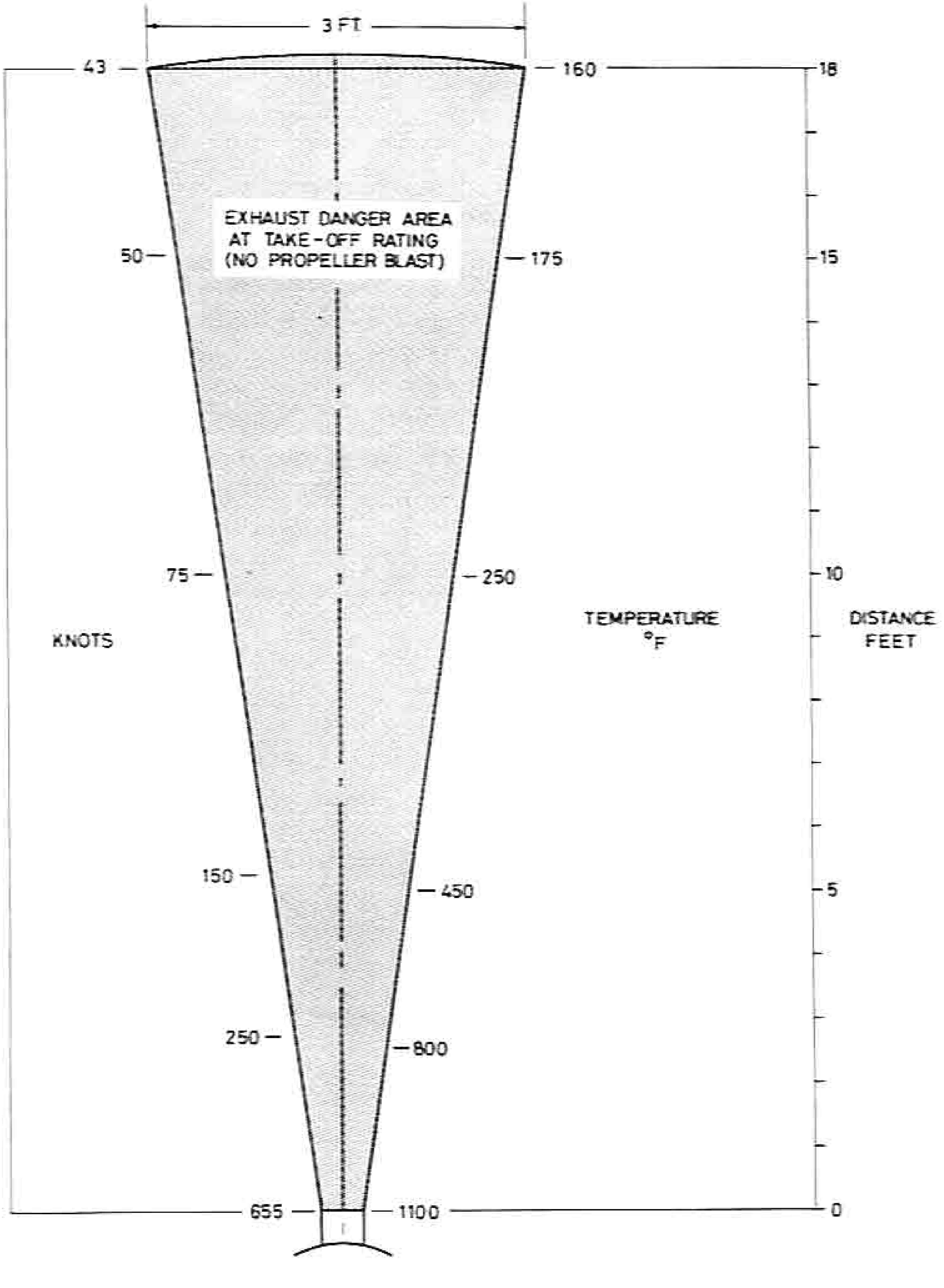
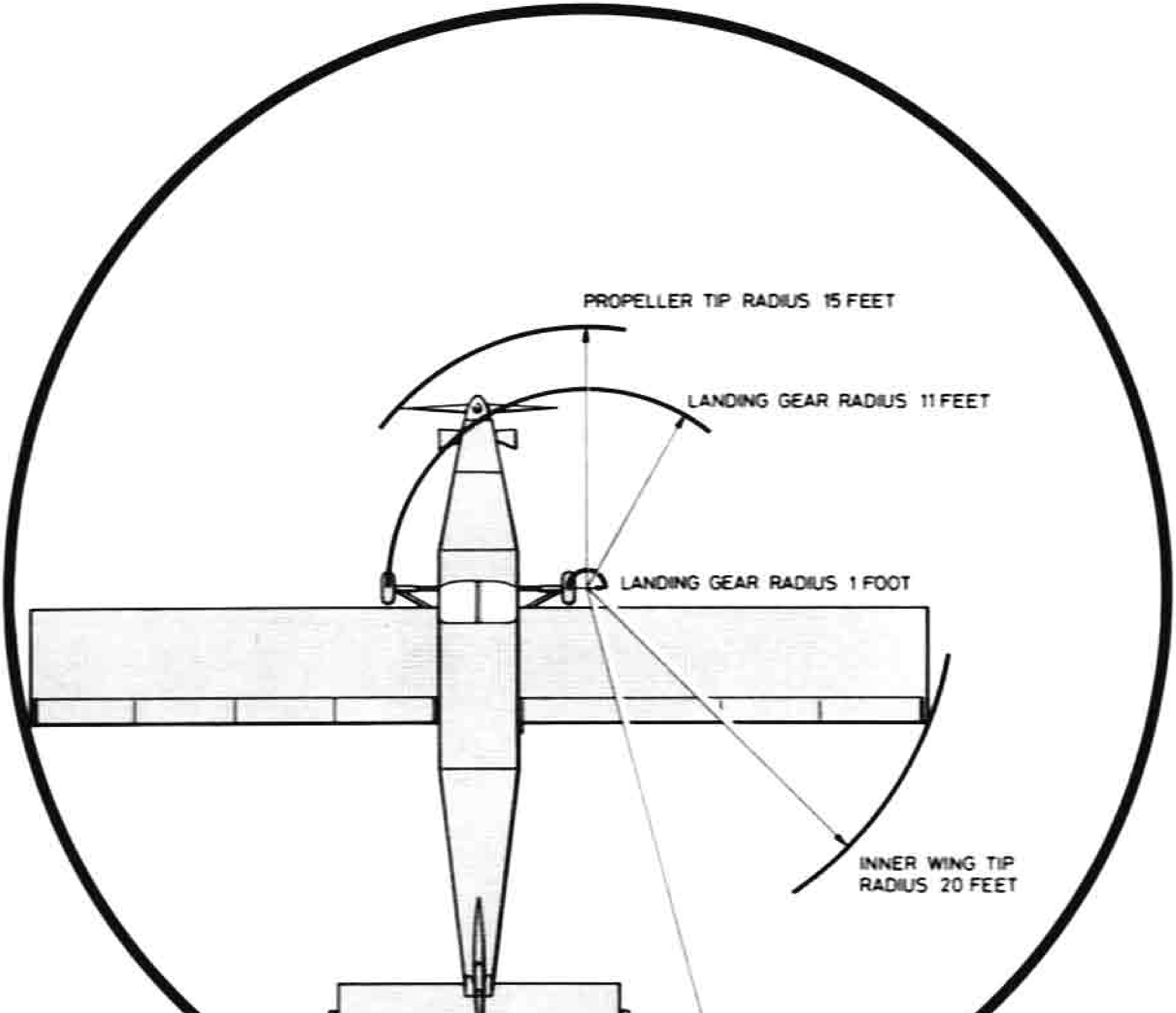


FIG. 2-2



VERTICAL CLEARANCES

WING TIP	9 FEET
VERTICAL STABILIZER TIP	11 FEET
PROPELLER	11 FEET

CAUTION

MINIMUM SPACE REQUIRED FOR TURNING IS 64 FEET

FIG. 2-3 TURNING RADIUS DIAGRAM

TYPICAL CIRCUIT

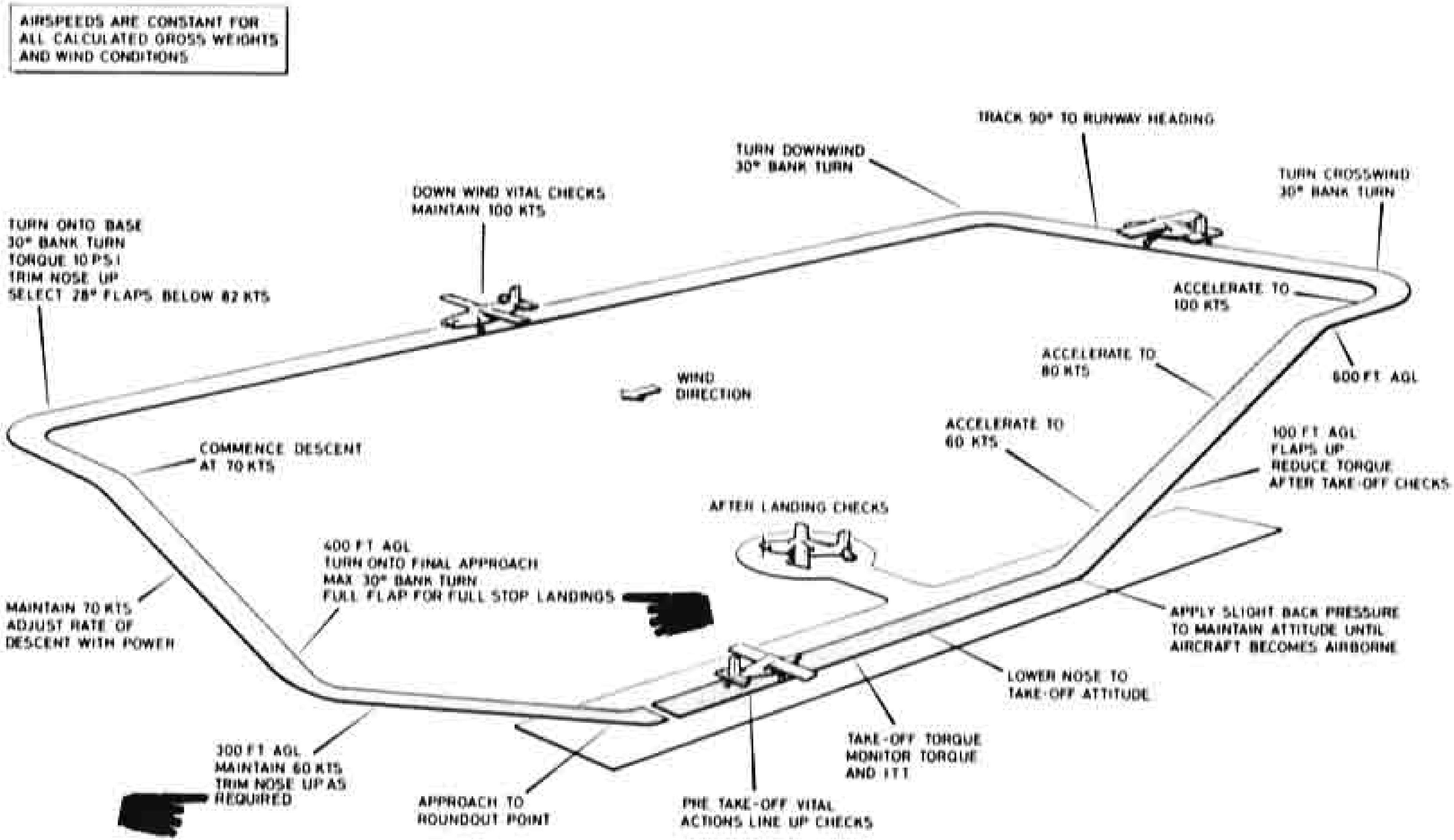


FIG. 2-4

TYPICAL FLAPLESS CIRCUIT

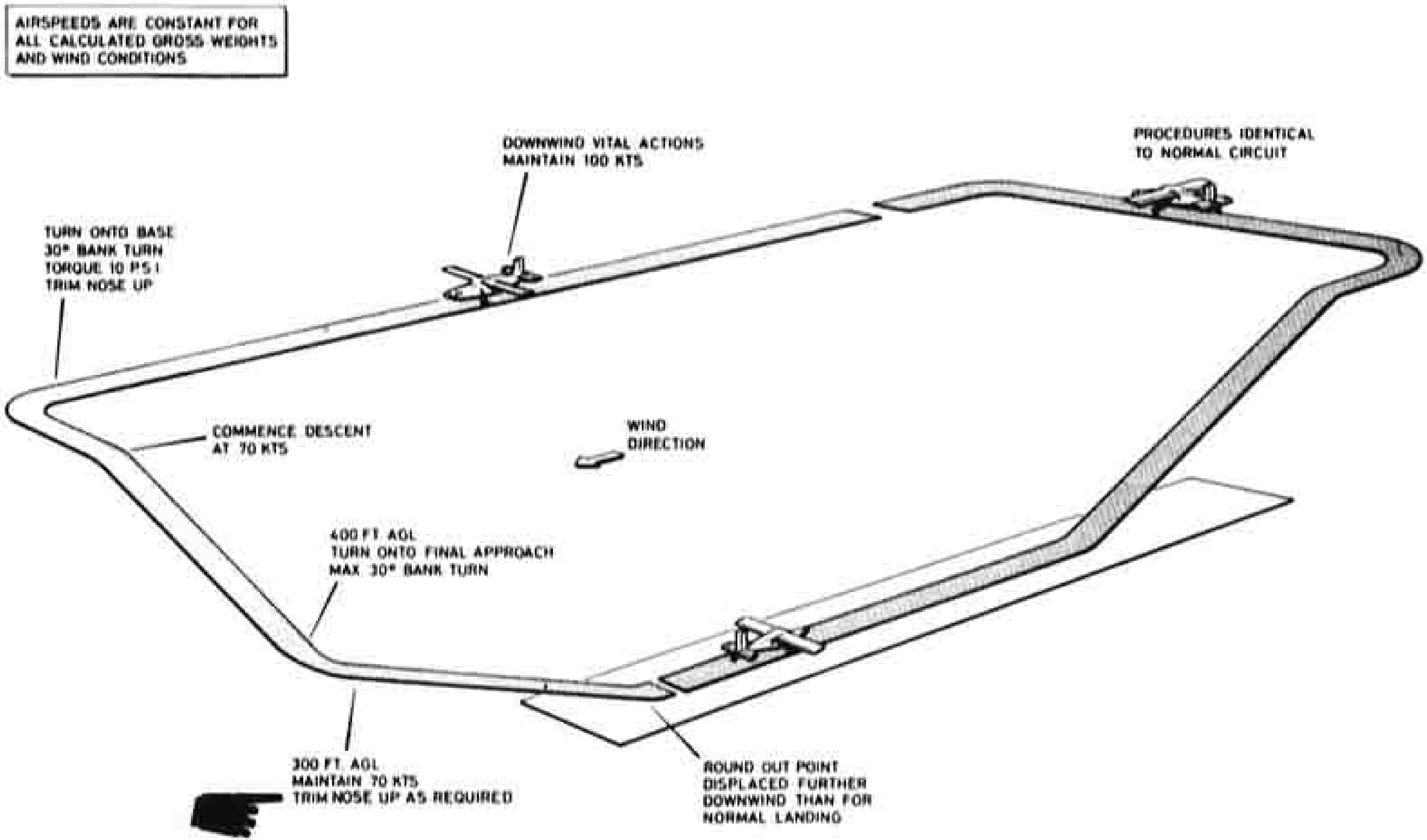


FIG. 2-5

TYPICAL BETA APPROACH

AIRSPEEDS ARE CONSTANT FOR ALL CALCULATED GROSS WEIGHTS AND WIND CONDITIONS

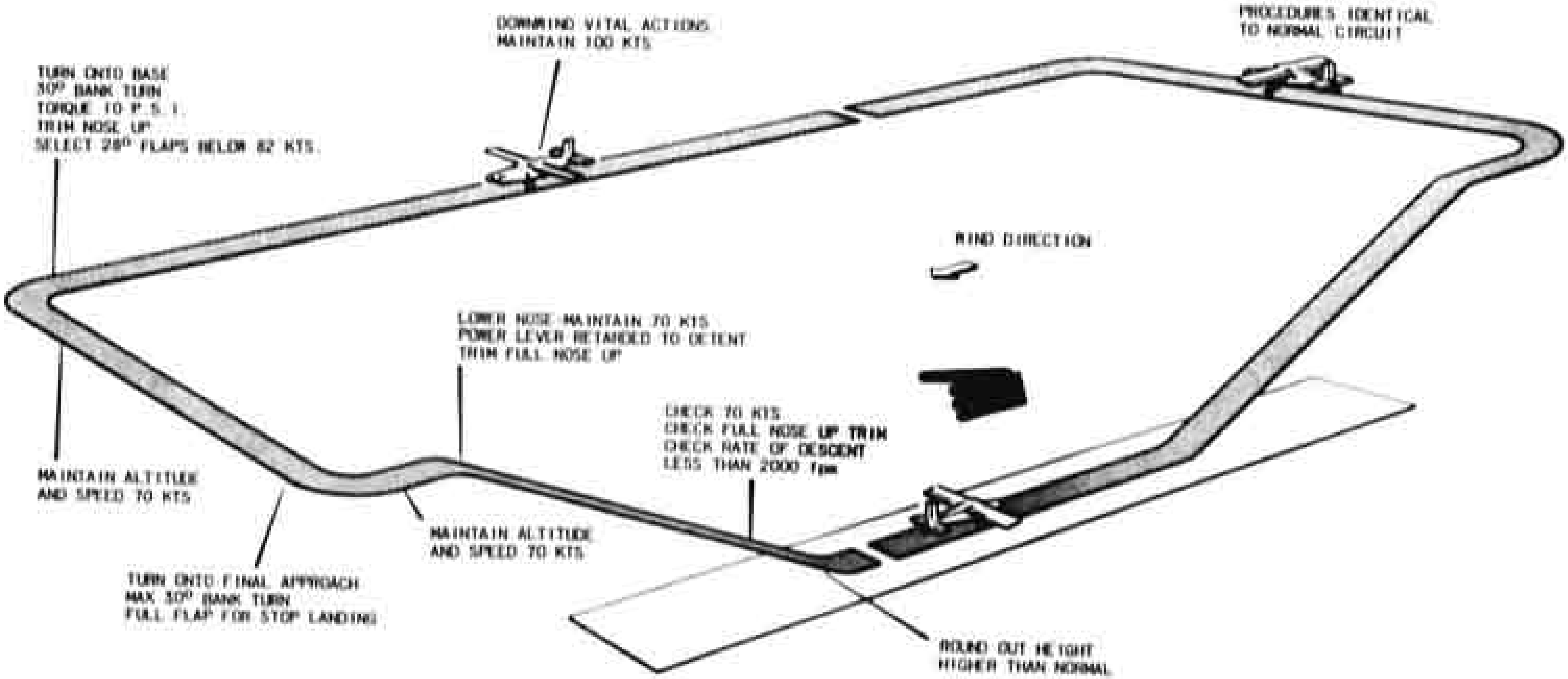


FIG 2-6

TYPICAL LOW LEVEL CIRCUIT / SHORT LANDING

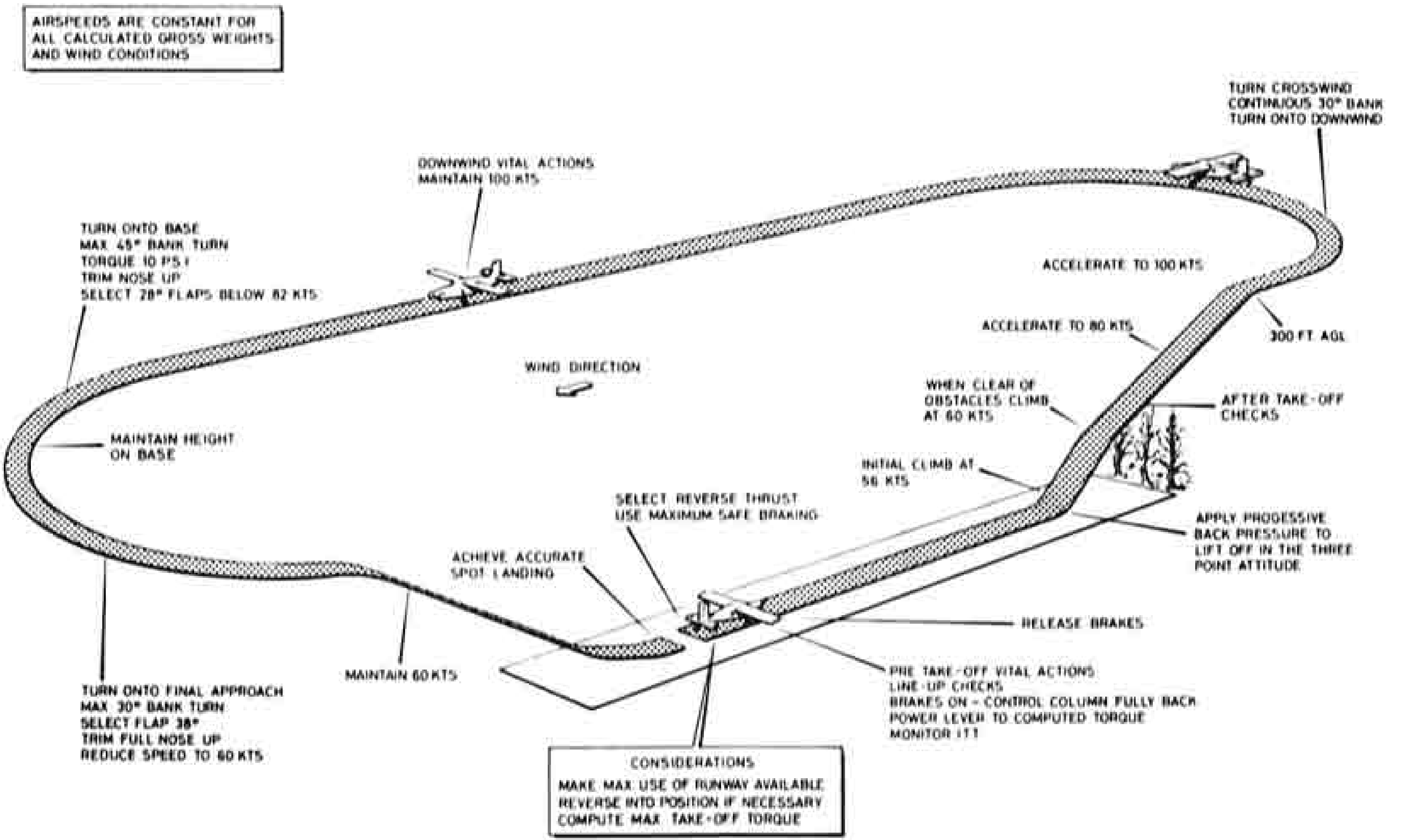


FIG. 2-7

SECTION 3
EMERGENCY PROCEDURES

SECTION 3

EMERGENCY PROCEDURES

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SECTION 3

EMERGENCY PROCEDURES

STARTING

301. Hot Start. Normal maximum ITT during start-up is in the range 700 - 800°C. Absolute maximum is 1090°C time limited to 2 seconds. If ITT is seen to accelerate rapidly above 850°C carry out hot start procedure and place the aircraft unserviceable. The Form EE500/501 entry is to include maximum ITT observed. The Hot Start procedure is as follows:

1. HP Cock - CLOSE.
2. Ignition - OFF.
3. Starter - ON until ITT falls below 650°C, then OFF.
4. Switches - OFF.

302. Wet Start.

CAUTION

- Do not exceed starter limit of 25 secs at any one start.
- Allow starter to cool for one minute before attempting a second start. Repeat start with both igniters selected and switch ignition ON 6 secs before engaging starter.
- After three consecutive unsuccessful starting attempts, a 30 min cooling period is required.

Clearing procedure to be used following a wet start.

1. HP Cock - CLOSE.
2. Ignition and Starter - OFF. Pause for 10 seconds.
3. Engine - Clear, as follows:
   (a) LP Cock - OPEN.
   (b) Power Source Selector Switch - BTRY or APU as applicable.
   (c) Aux Pump – ON (25 ± 5 psi).
   (d) Starter - ON for 10 seconds.
   (e) Starter - OFF.
   (f) Aux Pump – OFF (After GG stopped).
   (g) Power Source Selector Switch - OFF.

Note

If engine fails to light on second attempt, repeat clearing procedure. Attempt further start using same procedure.

FIRE

303. Ground Engine Fire

WARNING

If fire persists, indicated by sustained ITT, close LP cock and continue motoring.

The following procedure is used if there is evidence of a fire within the engine.

1. HP Cock - CLOSE.
2. Ignition Switch - OFF.
3. Starter - ON until ITT falls below 650°C, then OFF.
4. Switches - OFF.

Note

Engine Fire During Flight - Refer to Shutdown Procedure for Engine Failure, this Section of the Flight Manual.

304. Cabin Fire. The following emergency procedure is used if there is evidence of a cabin fire:

1. MAYDAY - Transmit
2. Power Source Switches - OFF.
3. Cabin Air Emergency Shut Off – PULL.
4. Cabin Heat Control - PUSH.

Note

The Cabin Air Emergency Shut-Off operates the cold and warm air duct shut-off butterfly valves. Once these valves have been closed (by pulling the shut-off control) they cannot be re-opened in flight.

If fire/smoke ceases:

1. Do not switch on electrics.
2. Land as soon as possible.

If fire/smoke persists:

1. Apply fire extinguisher to base of fire.
2. If fire still continues make emergency landing.

Note

After the fire is extinguished, ventilate the cabin using the Smoke and Fume Elimination emergency procedures, see para 314.

305. Wing Fire.

1. MAYDAY - Transmit.
2. Flight Area - CLEAR TO OPEN AREA and select emergency landing site.

Note

Landing is to be made as soon as possible. Prior to touchdown, carry out the following CRASH ACTIONS as for forced landing.

1. LP Cock - CLOSED.
2. Power Source Selector Switch - OFF.
3. Helmet Visor - DOWN.
4. Harness - LOCKED.
5. Doors - Unlocked.

306. Electrical Fire. Isolate the appropriate electrical circuit by operating the circuit breaker. Carry out the emergency procedure for Fuselage Fire. When the fire has been extinguished, carry out Smoke and Fume Elimination procedures.

ENGINE FAILURE

307. Engine Failure after Take-off. If the engine fails after take-off, carry out the following EFATO check:

1. Propeller - FEATHER IMMEDIATELY.
2. MAYDAY - Transmit.
3. LP Cock - CLOSED.
4. Power Source Selector Switch - OFF (ON for engine failure at night).
5. Landing Light - ON for engine failure at night.

Place aircraft in a gliding attitude, choose a suitable landing area, apply flap as required and as far as possible, land straight ahead.

308. In-Flight Engine Fire/Mechanical Failure

WARNING

Do not attempt to restart an engine which is known definitely to have failed.

In case of an in-flight engine failure or engine fire, the following emergency procedure is to be used:

1. Power Control Lever - RETARD.
2. HP Cock - CLOSED.
3. Propeller - FEATHER.
4. LP Cock - CLOSED.
5. Cabin Air Emergency Shut-Off - PULL.
6. Cabin Heat - COLD.
7. MAYDAY - Transmit.
8. Switches - OFF.

309. Engine Flame-out. The symptoms of an engine flame-out will be the same as for an engine failure. A flame-out will be noticed by a drop in interstage turbine temperature (ITT), torquemeter pressure and RPM. The flame-out may result from the engine running out of fuel, or possibly may be caused by unstable engine operation. The following actions are to be carried out in the event of a flame-out:

1. Power Control Lever - RETARD.
2. LO-IDLE - SELECT.
3. Ignition - ON.

If no start above 50% Ng RPM:

4. HP Cock - CLOSE.
5. Propeller - FEATHER (to reduce drag).
6. Ignition - OFF.
7. Engine Control Heater - ON.

A relight procedure may be initiated after flame-out occurs, provided the pilot is certain that the flame-out was not the result of a malfunction which might make a relight hazardous.

310. Relight Procedure. Satisfactory relights are possible at altitudes up to 10000 feet and with airspeeds up to 100 knots IAS. The relight procedure is as follows:

1. LP Cock - OPEN.
2. Ignition Selector - BOTH.
3. Propeller - MAX RPM.
4. Power Source Selector Switch - BTRY (min. 24.7V).

5. Radio Master Switch - OFF.
6. Circuit Breakers - IN.
7. Aux Pump - ON (25 ± 5 psi).
8. Ignition and Starter - ON.
9. Oil Pressure - Rising.
10. HP Cock - OPEN after Ng RPM stabilized above 15% for 5 secs.

Note

A successful relight will be indicated by a rise in GG RPM and ITT and should be obtained within 10 seconds.

11. Ignition and Starter - OFF.
12. Radio Master Switch - ON.

If no relight occurs within 10 seconds of opening the HP cock:

1. HP Cock - CLOSED.
2. Ignition and Starter - OFF.

If another relight attempt is to be made, repeat the entire Restart Procedure.

311. Booster Pump Failure. Booster pump failure is indicated by a fuel pressure drop of approximately 2 psi. No emergency action is required by the pilot as the engine will run satisfactorily without the booster pump. The booster pump malfunction must be reported.

312. Fuel Filter Clogged (Bypass Opened). When the fuel filter is clogged, a red light on the engine instrument panel labelled FUEL FILTER CLOGGED becomes illuminated. In the event of this light illuminating in flight, the pilot is to land the aircraft at first opportunity. After landing, check the fuel filter. If it is obstructed, the whole fuel system plus the fuel control unit is to be cleaned prior to the next flight.

313. Propeller Anti-reverse Failure. In the event of either an unintentional coarsening or feathering of the propeller, the anti-reverse valve circuit breaker marked ANTI-REV VALVE, located on the main CB panel, is to be tripped and is not to be reset until after landing.

Note

When the anti-reverse valve circuit breaker is tripped, the PROPELLER LOW PITCH WARNING light will NOT illuminate when the power control lever is moved back to the reverse position, or the propeller moves back into the reverse range.

314. Smoke and Fume Elimination. Smoke and fume elimination may be accomplished by opening the cockpit doors and starboard sliding door of the aircraft. No difference in flight behaviour will be experienced. If smoke and toxic fumes are extensive, in both the cockpit and main cabin, prior to opening the starboard door, it is recommended that the pilots and passengers don oxygen masks. The pilot's oxygen demand regulators are to be selected for *maximum rate* of oxygen flow until smoke has been eliminated.

315. Bail Out. If it becomes necessary to bail out from the aircraft due to an extreme emergency condition, the following actions are to be carried out by the pilot:

Note

The following procedures apply ONLY IF NO PASSENGERS ARE CARRIED.

1. MAYDAY - Transmit. (Reason for emergency).
2. Attitude - Trim slightly nose-down.
3. Cockpit Door - Pull on jettison handle to release.
4. Harness - Disengaged.
5. Position - Hands on fore and aft door sill and kick well clear.
6. Parachute - Open when well clear of aircraft.

EMERGENCY DESCENT

316. Maximum Rate Descent. The procedure is as follows:

1. Propeller - MAX RPM.
2. Power Control Lever - RETARD TO DETENT.
3. IAS - MAINTAIN 100 KTS, trim for no load on control column.

Note

In descent, maintain a constant lookout and high rate of descent.

4. Temperature and Pressure - Check in green arcs.

Note

Anticipate levelling-off by commencing at a height which is equal to 10% of rate of descent above desired level-off height.

5. Power Control Lever - Advance smoothly.
6. Attitude - Check the trim of the aircraft.

LANDING EMERGENCIES

317. Forced Landing Without Power. (Ref. Fig. 3-1). Forced landings without power (FLWOP) may be classified as follows:

a. Engine failure immediately after take-off.

b. Engine failure at low level (below 1500 ft. AGL).

c. Engine failure at high level.

For a. and b. see Engine Failure after Take-off, Emergency Procedures, this Section of the Flight Manual.

318. Engine Failure at High Level. In the event of engine failure, immediate actions should be:

1. Convert excess speed to height.
2. Trim aircraft for 70 knots IAS glide.
3. If engine failure is due to flame-out, carry out 'hot' relight procedure simultaneously with 1 and 2. Shut-down if unsuccessful.
4. If engine failure is due to other reasons, or if the engine is on fire, carry out the appropriate emergency procedures.

319. Plan of action for Forced Landing. (Ref. Fig. 3-1). For selection of field and 1000 ft. area, the following considerations are to be taken into account:

a. wind strength and direction,

b. obstacles approach and over-shoot,

c. size and shape,

d. surface condition,

e. slope and

f. select 1000 ft. area.

320. A MAYDAY call may be transmitted before or after attempting a relight depending on height available. Attempt to relight (if the failure is due to flame-out and hot relight is unsuccessful) in accordance with appropriate procedures. Maintain a glide speed of 70 knots. At the 1000 ft. area to landing, use flap as required to achieve a touchdown point one third into the field. The approach can be adjusted by the use of flap, slipping turns, 'S' turns or side slips. Maintain 60 knots IAS after flap is selected. Select full flap when field is assured. Carry out crash actions detailed in Para 305 Wing Fire. Land into the wind, if possible, and apply brakes to bring aircraft to a full stop.

EMERGENCY ENTRANCE (Ref. Fig. 3-2)

321. Emergency entrance to the crew compartment is gained by breaking the perspex windows in both the pilot's and co-pilot's entrance doors. The window area is surrounded by a one-inch thick yellow broken line for emergency rescue identification. A yellow stencil labelled "BREAK THRU FOR EMERGENCY RESCUE", complete with directional arrow, is also provided for further identification. The crew entrance doors also have instructions for door handle operation (TURN - PULL) and fire extinguisher location.

DITCHING

322. The ditching characteristics of the aircraft are unknown. The technique is to land tail down with full flap selected. It is desirable to land into wind if possible, however, this is dependent upon the swell. If the seas are large it may be necessary to land along the swell. Carry out normal crash actions except, pilots doors are to be jettisoned immediately prior to touchdown.

Note

The passengers' sliding door is to remain closed until after touchdown.

EMERGENCY JETTISONING

323. Emergency jettisoning presents no problem with the Porter aircraft and is carried out by use of the sliding door on the starboard side of the aircraft.

AIRCRAFT SYSTEMS

324. Electrical Power System

a. *Excessive Generator Charge Rate* (more than 20 amps greater than normal).

(1) Generator Switch - OFF.

(2) Check battery voltage.

b. *If Battery Voltage Below 23.5V*

(1) Generator - ON.

(2) Battery - OFF.

c. *If Battery Voltage Above 23.5V* (Battery serviceable)

(1) Battery - ON.

(2) Generator - OFF.

(3) All unnecessary electrics - OFF.

(4) Land as soon as possible.

Note

If possible check circuit breakers to isolate cause.

TYPICAL FORCED LANDING WITHOUT POWER

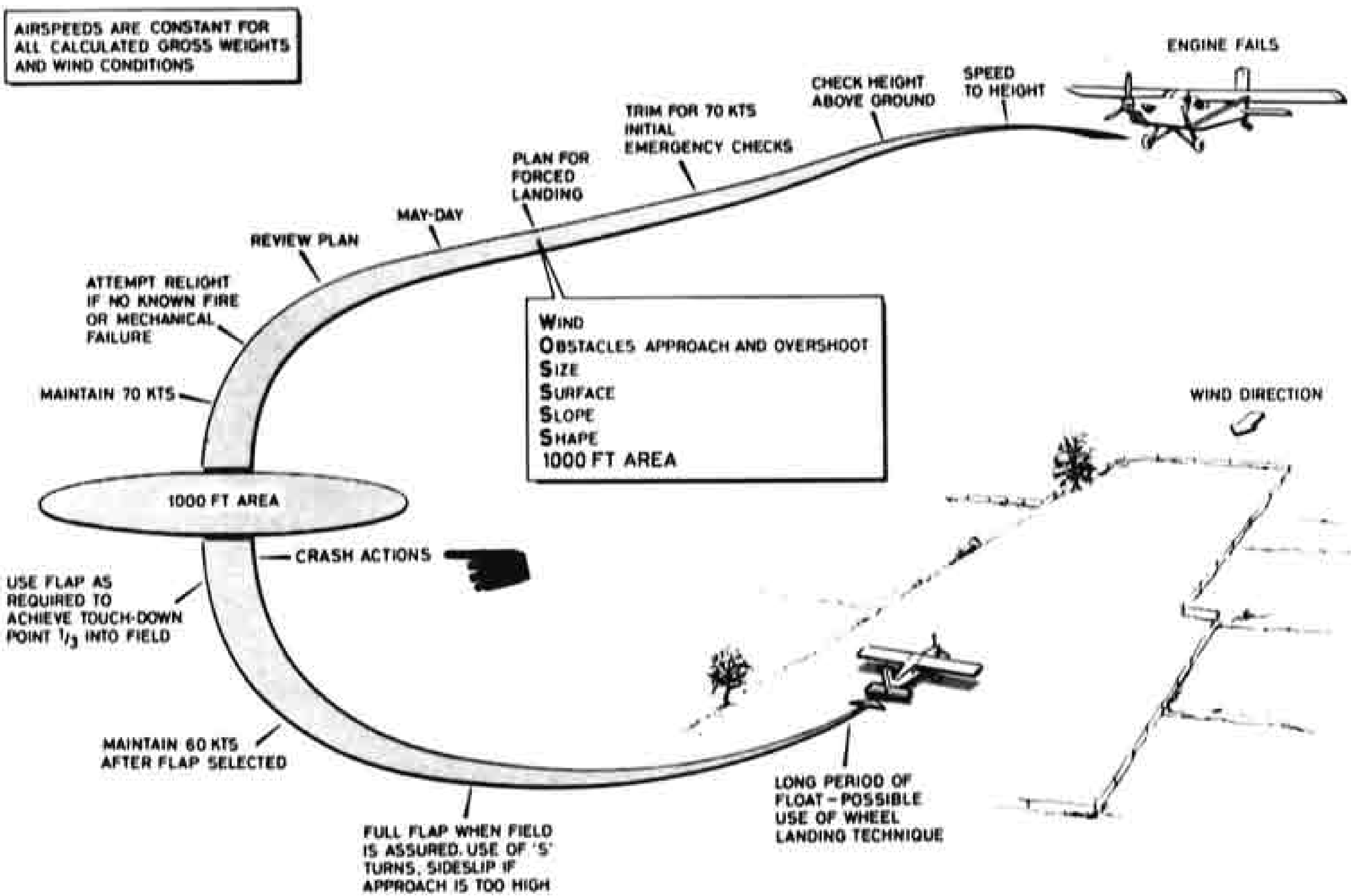

FIG. 3-1

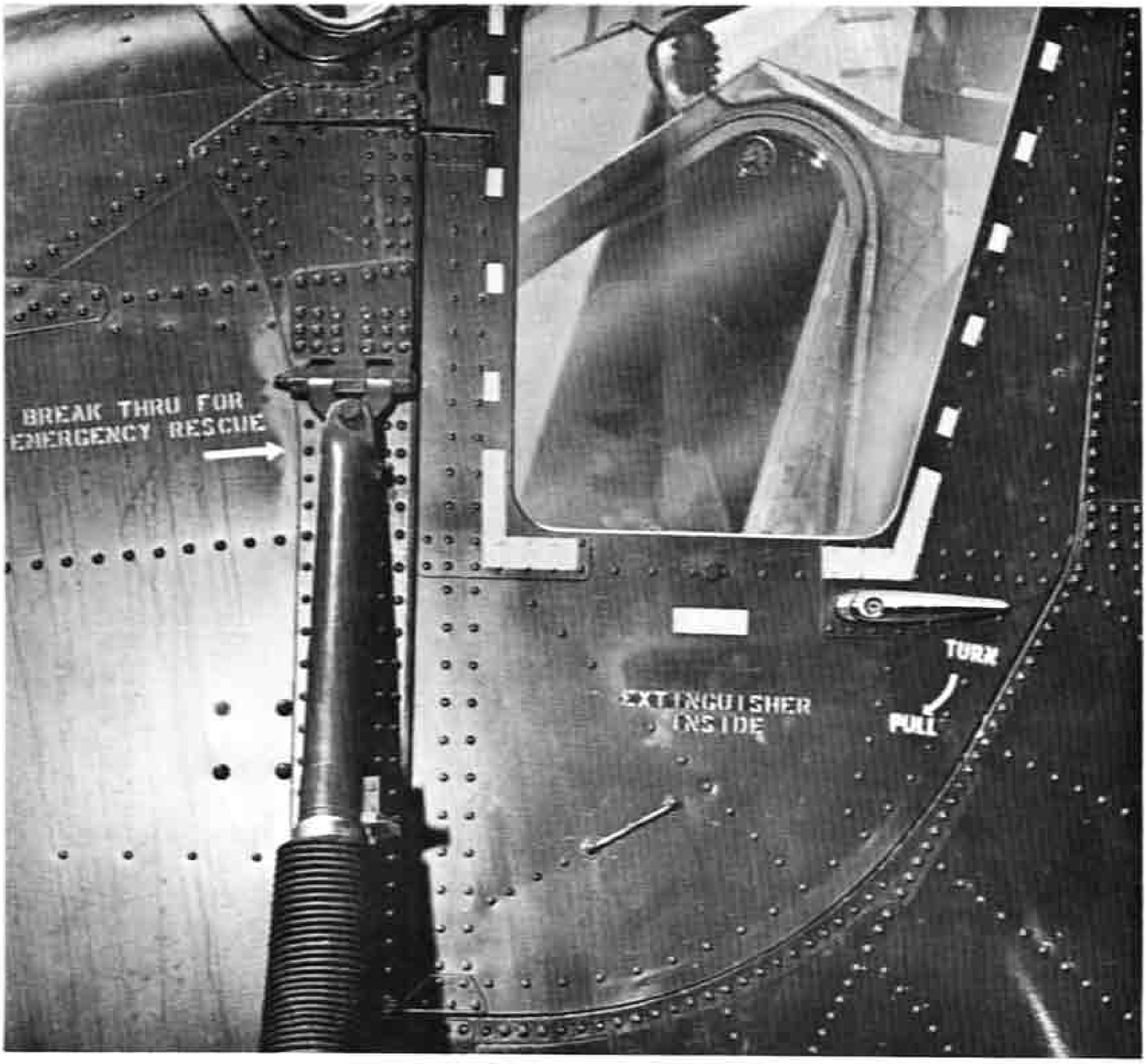

FIG. 3-2 EMERGENCY ENTRANCE

SECTION 4
CREW DUTIES

SECTION 4

Not Applicable

SECTION 5
OPERATING LIMITATIONS

SECTION 5

OPERATING LIMITATIONS

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SECTION 5

OPERATING LIMITATIONS

MINIMUM CREW REQUIREMENT

501. The minimum crew required to fly the aircraft is one pilot. Additional crew members as required i.e. co-pilot, flight despatcher etc. may be included at the discretion of the pilot.

INSTRUMENT MARKINGS (Ref. Fig. 5-1)

502. Engine Instrument Markings

Torque Pressure Indicator

Normal (green arc)	0 - 42.5 psi
Maximum take-off or reverse	42.5 (red radial)
Maximum acceleration (red arrow)	48.5 psi.

Interstage Turbine Temp (ITT)

Cruise (green arc)	300 - 705°C.
Cautionary (yellow arc)	705 - 750°C.
Maximum take-off or reverse (red radial)	750°C.
Maximum for starting (red arrow)	1090°C.

Fuel Pressure

Minimum (red radial)	5 psi.
Normal (green arc)	5 - 50 psi.
Maximum (red radial)	50 psi.

Oil Temperature

Cautionary (yellow arc)	-40 - +10°C.
Normal (green arc)	10 - 80°C.
Cautionary (yellow arc)	80 - 93°C.
Maximum (red radial)	93°C.

Oil Pressure

Minimum (red radial)	40 psi.
Cautionary (yellow arc)	40 - 65 psi.
Normal (green arc)	65 - 85 psi.
Maximum (red radial)	85 psi.

Gas Generator Tachometer (Ng)

Maximum governing (red radial)	101.6%
Topping governor limit	102.7%.

Propeller Tachometer (Np)

Maximum (red radial)	100%.
Maximum overspeed (red arrow)	110%.

Note

The above limitations are based on the use of AVTUR fuel.

503. Flight Instrument Markings.

Airspeed Indicator

Flaps down (white arc)	45 - 82 knots.
Flaps up (green arc)	51 - 118 knots.
Cautionary (yellow arc)	118 - 151 knots.
Maximum (red radial)	151 knots.

ENGINE LIMITATIONS (Ref. Fig. 5-1)

504. If standard fuel (AVTUR) is not available, refer to Servicing Diagram page 1-86 for alternative fuels. Maximum permissible sustained torque at maximum cruise and below, is 42.5 psi. Np setting is not to exceed power limitations.

Note

For every 10°C (18°F) below -30°C (-22°F) ambient temperature, reduce the maximum allowable Ng by 2.2%.

505. Normal Oil pressure is 65 - 85 psi. At gas generator speeds above 28,000 RPM (75%), oil pressures in the range 40 - 65 psi are undesirable and should be tolerated only for the completion of the flight and preferably at a reduced power setting. Oil pressures below 40 psi are unsafe and require that the engine be shut-down. To increase the life of the engine, operating oil temperatures in the range 74 - 80°C are recommended. A minimum oil temperature of 55°C is recommended for fuel heater operation at take-off power. The maximum continuous rating is primarily intended for emergency use or at the discretion of the pilot. Acceleration torque and ITT maximums and the starting ITT maximum are limited to two seconds. Reverse power operation is limited to one minute.

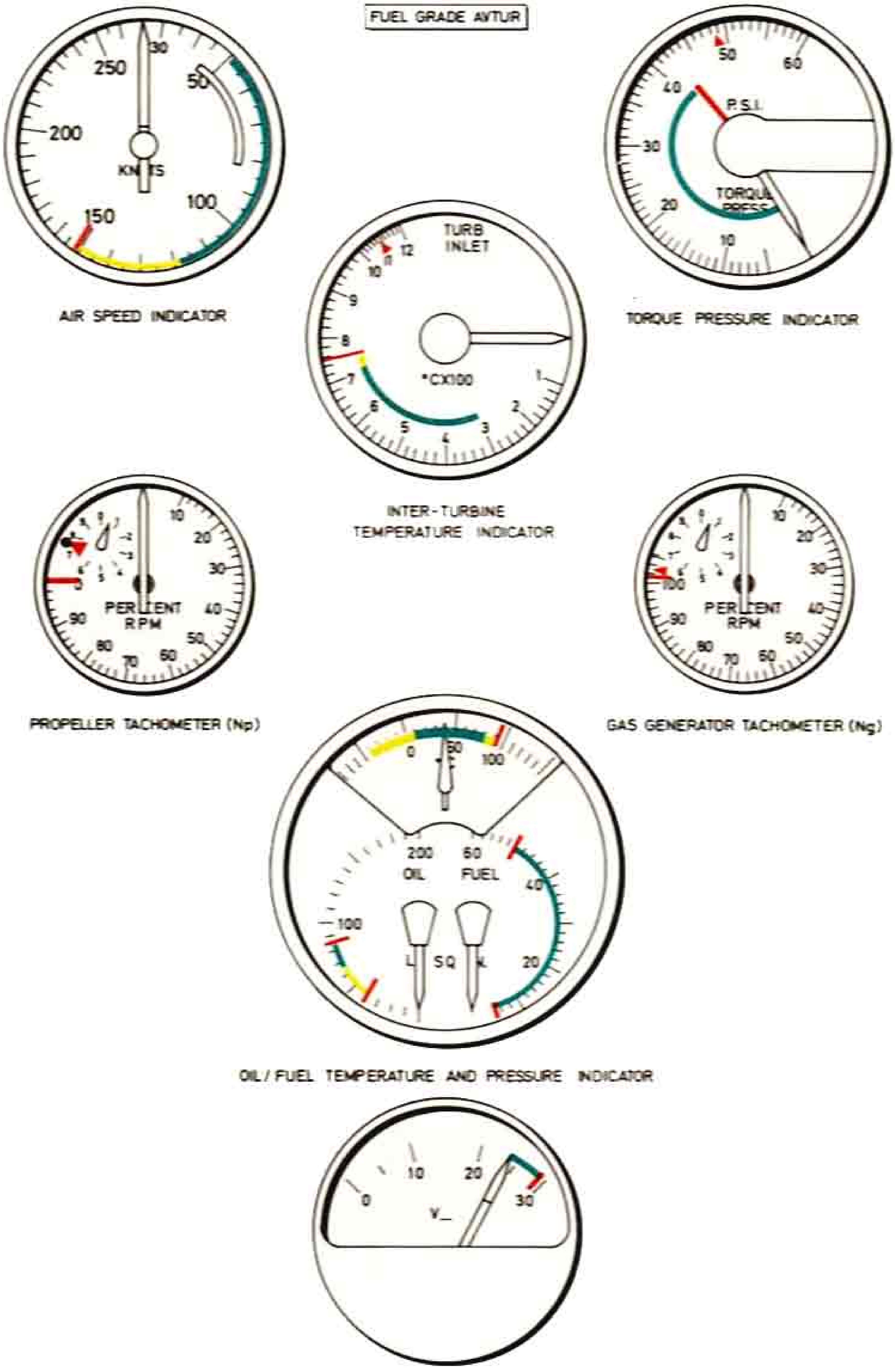


FIG. 5-1 INSTRUMENT MARKINGS

506. Exceeded Engine Limitations.

CAUTION

Whenever the engine speeds cannot be controlled by retarding the power control lever, either the engine is to be shut-down or a landing is to be made as soon as possible.

Whenever a prescribed engine limit (RPM, torque ITT) is exceeded, the incident is to be noted in the Form EE500/501. It is particularly important to record the maximum value registered by the instrument plus the duration of the incident.

507. Engine Rating. (Ref. Fig. 5-2).

a. ***Take-off.*** The take-off rating is the maximum power permissible and corresponds to 550 SHP at SL up to 70°F (21°C) ambient temperature. The maximum allowable output torque is not to be exceeded.

b. ***Maximum Continuous.*** The maximum continuous rating corresponds to 550 SHP up to 70°F (21°C) ambient temperature, at sea level and under static conditions. This rating is for *emergency use* only.

c. ***Maximum Climb.*** The maximum climb rating corresponds to 538 SHP at sea level on a standard day and is the maximum power approved for normal climb.

508. Torque Pressure - Power Calculations

a. $$SHP = \frac{RPM\ (Np) \times Torque\ Pressure}{170}$$

b. Calculation of shaft torque may be made as follows:

Shaft Torque (lb. - ft.) = 30.87 x torque pressure (psi).

PROPELLER LIMITATIONS

509. A reading of 100% represents a free turbine speed of 33000 RPM. The maximum permissible reading for acceleration is 110%. The maximum permissible power in the full reverse position is 500 SHP.

AIRSPEED LIMITATIONS

510. Fig. 5-3 shows the airspeed limitations in Knots Indicated Air Speed (KIAS) for 4850 and 5700 lbs. max. All-Up-Weight (AUW) values.

Operating Condition	Operating Limits							
Power Setting	**SHP**	**Torque psi**	**Nominal ITT**	**Max ITT**	**Ng %**	**Np %**	**Oil Press. psi**	**Oil Temp.**
Take-off Max Continuous	550	42.5		750	101.5	100	65 to 85	10 to 99
Max Climb	538	42.5	705	725		100	65 to 85	0 to 99
Max Cruise	495	42.5		705		100	65 to 85	0 to 99
Lo Idle				685			40 min	-40 to 99
Starting				1090				-40 min
Acceleration		48.5		850	102.6	110		0 to 99
Max Reverse	500	42.5		750	101.5	95 89	65 to 85	0 to 99

Fig. 5-2 Engine Operating Limits

Action	Weight	
	4850	5700
	Airspeed KIAS	
Never Exceed (V_{NE})	151	140
Structural Cruising (V_{NO})	118	118
Manoeuvring (V_P)	106	106
Skis Lowering or Lifting	73	73
Flap Extending (V_{FE})	82	82

Fig. 5-3 Airspeed Limitations

MANOEUVRES

511. Spins and aerobatic manoeuvres are not permitted. Maximum flight load factors are shown in Fig. 5-4.

ACCELERATION LIMITATIONS (Wing Tanks Fitted)

512. For approved ferry operations, with max. AUW of 5700 lbs., the maximum angle of bank is 60°. Airspeed V_{NE} (never exceed), in straight and level flight, with flaps up, is 140 knots IAS.

CENTRE OF GRAVITY LIMITATIONS (Ref Fig 5-5).

Datum Point: The horizontal datum point is fuselage station O which is 118.11 inches forward of the leading edge of the wing.

513. CG Range. 4850 lb. Max. AUW - 136.8 ins - 143.5 ins (aft of datum). 5700 lb. (Ferry tanks installed) - 136.8 ins - 148.0 ins (aft of datum).

Note

Ferry Tank Installation has been designed according to SPECIAL FLIGHT PERMITS AND OPERATING RESTRICTIONS FOR EXTENDED FLIGHTS WITH OVERWEIGHT AIRCRAFT.

Weight (lbs)	4850	5700
Load Factors	+3.72 to -1.49	+3 to -1.2

Fig. 5-4 Maximum Flight Load

Reference to Loading and Balance summary (AAP 7211.001-5) and Weight and Balance Charts (Fig 5-5 and Fig 5-6) will provide the pilot with the necessary information on CG limits.

WEIGHT LIMITATIONS

514. General

a. **Take-off Weight.**
   (1) Normal Operations: 4850 lbs.
   (2) Overload Operations: 5700 lbs (for approved ferry operations only).
   (3) Underwing Stores: 5500 lbs (provided all weight in excess of 4850 lbs is carried on wing suspension points).

b. **Landing Weight.** The maximum landing weight is 4850 lbs.

Note

For operations above 4850 lbs AUW, tyre pressures are to be increased from 32 psi to 34 psi.

515. Weight Limitations Charts. The Weight and Centre of Gravity Limitations are shown on page 5-8 of this section and on the Aircraft Loading Chart. (Refer Fig. 5-6). These charts are intended for use in pre-flight planning where weight and CG vary considerably depending on the requirements of the operation.

Note

Fig. 5-5 may be on a transparent sheet so that it can be used as an overlay to Fig. 5-6.

516. Instructions for Use.

1. Determine basic weight for the particular aircraft from the Loading and Balance Summary or Aircraft Weighing Record EE191 if more current and plot this point (a) on Fig 5-5.
2. Place Fig. 5-5 on Fig. 5-6 so that point (a) is superimposed on origin and align sheets so that horizontal (weight) lines are parallel.
3. Plot fuel weight from Fig. 5-6 onto Fig. 5-5 (wing tank fuel only).
4. Move this new plotted point until it is over the origin and again ensure paralleling of weight lines on both sheets.
5. In turn plot pilot and passenger loads etc. according to their individual weights and moment arms, remembering to move the new point to the origin before plotting the next one.
6. The final point plotted shows the approximate AUW and CG for take-off. An accurate calculation should then be made, especially when near limiting values, to ensure safe operation.

Configuration	IAS Kts	Rate of Descent Ft/Min	Torque PSI	Np%	Oil Pressure PSI	Oil Temp
Lo Speed Beta	70	1700-1800 (2000 max)	6 - 8	93 - 95	65 to 85	0 to 99
Hi Speed Beta	100	4000 max	5 - 6	93 - 95	65 to 85	0 to 99

Fig. 5-4A Beta Performance Limits

OTHER LIMITATIONS

517. **Single Load Weight Limitation.** The maximum single load which may be despatched is 500 lb. provided it can be pre-positioned at the sliding door exit or on the floor hatch doors.

518. **Floor Loading.** The maximum floor loading is 100 lbs./sq. ft.

519. **Cross Wind Component.** The maximum cross wind component for landing and take-off is 15 knots.

520. **Airframe Icing.** Flying into predicted and actual icing conditions is not permitted. Operation in falling snow is not permitted unless snow vanes are installed.

521. **Altitude.** Maximum operating altitude is 25,000 feet.

522. **Starter Operating Limitations.** The starter operating limits are:

25 secs ON, 1 min OFF, 25 secs ON, 1 min OFF, 25 secs ON, 30 mins OFF.

523. **WRE MAPS II Installation - Operating Limitations.** The following limitations apply with WRE MAPS II installed:

a. VNE - 118 KIAS.

b. Maximum angle of bank - 30°.

c. Maximum altitude - 22,500′ AMSL.

d. Maximum AUW for take-off - 5700 lb.

e. Maximum AUW for landing - 4850 lb.

f. G limits - Maximum +1.5, Minimum 0.

g. The laser gun is not to be operated with the hatch doors open below 1000′ AGL.

h. The floor hatch doors are to be closed for take-off and landing.

i. The installation is to be inspected for security on the 'pre-flight'.

j. A maximum of two personnel may be carried in the rear cabin.

k. The equipment is to be installed as per RAAF Supplement No 21 to AAP 7211.001-2-1.

524. **Flight with Doors Removed.** The Porter aircraft may be operated with various combinations of doors removed, subject to certain restrictions. Operation of the aircraft in the following configurations at altitudes up to 10,000 ft. is permissible:

a. Pilots door removed and speeds up to 105 KIAS.

b. Pilots and co-pilots doors removed at speeds up to 105 KIAS.

c. Sliding door open at speeds up to 110 KIAS.

d. Floor hatch open at speeds up to 110 KIAS.

e. Pilots door removed and sliding door open at speeds up to 105 KIAS.

f. Pilots door removed and floor hatch open at speeds up to 105 KIAS.

525. The following additional restrictions apply when operating with doors open or removed:

a. Smoking is prohibited.

b. All loose articles in the cabin must be tied-down or stowed.

c. Cabin air-conditioning valve is to be in the full fresh air position.

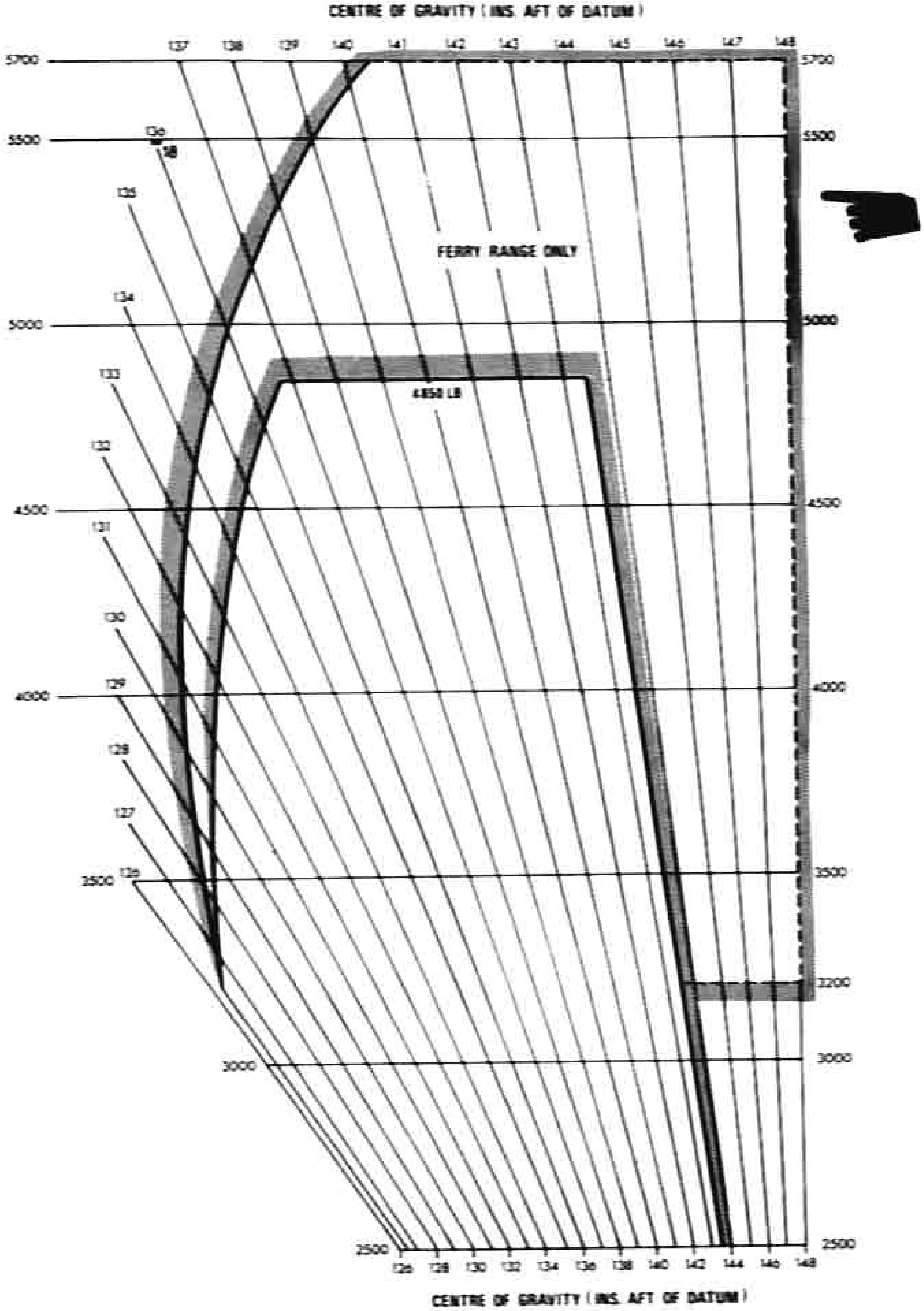
d. Maximum angle of bank is 45°.

e. Take-off and landing with the floor hatch open is not permitted when:

(1) Equipment installed over the hatch is susceptible to stone damage.

(2) There is a possibility that equipment such as tie-down straps or static lines could hang down through the hatch.

WEIGHT & CG LIMITATIONS



PERFORMANCE DATA NOTE:

ALL WEIGHT LIMITS SHOWN ARE TO BE USED AS A GUIDE ONLY SINCE PERFORMANCE DATA IS BASED ON STANDARD DAY CONDITIONS. FOR EXACT WEIGHTS LIMITED BY PERFORMANCE, REFERENCE MUST BE MADE TO APPENDIX 1 PERFORMANCE DATA

FIG 5-5

AIRCRAFT LOADING CHART

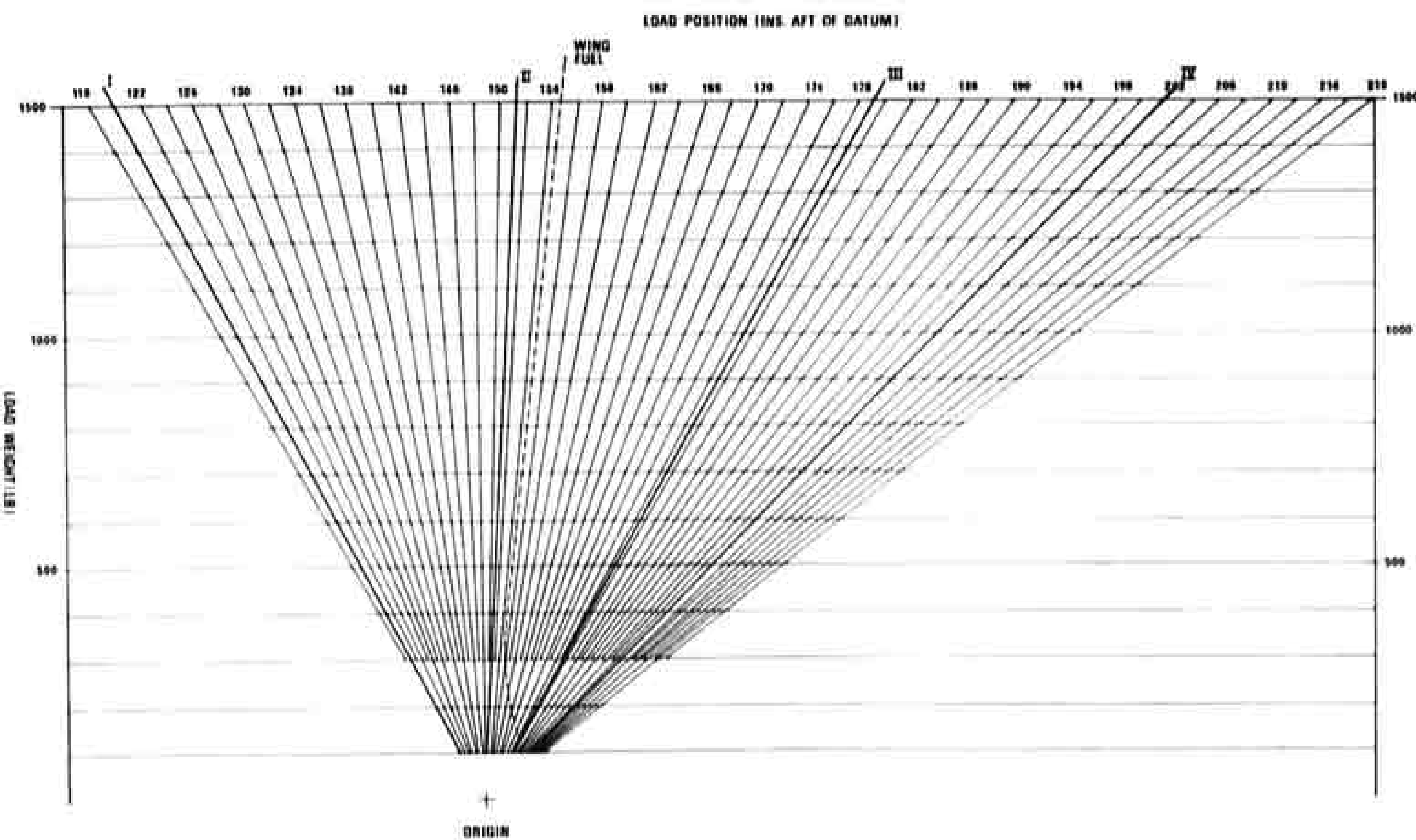


FIG 5-6

f. Opening or closing of the sliding door in flight is only to be carried out at speeds below 105 KIAS.

526. **Flight Limitations - ZEISS and WILD RC10 Survey Camera Installations.** Porter aircraft may be operated with a Zeiss survey camera or Wild RC10 survey camera and NF2 navigation sight installed. The operating procedures and limitations when using either survey camera are as follows:

a. VNE 118 KIAS.

b. Maximum altitude 22,500 AMSL.

c. Max angle of bank 30 degrees.

d. G limits +0.5 minimum, +1.5 maximum.

e. Maximum AUW for take-off 5,400 lbs.

f. Maximum landing weight 4,850 lbs.

g. Floor hatch doors are to be closed for take-off, landing and filter changes.

h. The NF2 navigation sight on the Wild RC10 installation is to be retracted for take-off and landing.

i. A maximum of two personnel may be carried in the rear cabin.

j. The camera installation is to be checked for security on each pre-flight inspection.

527. In addition to the requirements of para 526, the following are to have been incorporated in the aircraft for flights above 10,000 ft:

a. Porter Modification 50 - Installation CRU47A Oxygen Regulators.

b. Porter Modification 54 - Provision of Additional Oxygen.

c. STI Porter/38 - Lubrication of Flying Controls.

SECTION 6
FLIGHT CHARACTERISTICS

SECTION 6

Not Applicable

Relevant information is covered in Section 5 - Operating Limitations

SECTION 7
ALL WEATHER OPERATION

SECTION 7

ALL WEATHER OPERATION

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ALL WEATHER OPERATION

701. Introduction. This section is concerned with the operation of the Porter aircraft under all weather and night flying conditions. The procedures and necessary flight operating techniques for carrying out typical instrument approaches, using the equipment fitted in the aircraft are shown in chart form in Figs. 7-1 - 7-5. The instrument approach aids which can be used with this aircraft are:

a. NDB,

b. LOCALIZER,

c. VAR,

d. VOR,

e. DME and

f. Ground Controlled Approach (GCA).

Flight into known icing conditions is not covered, as operation of the aircraft in these conditions is prohibited, refer to Section 5, Operating Limitations of this Flight Manual. As flights in areas of severe turbulence and thunderstorm activity are to be avoided, no coverage of operations in these conditions is included. The check lists contained in Section 2, Normal Procedures of this Flight Manual cover operations in all weather conditions.

702. Instrument Flight Procedures

a. ***Instrument Flight Rules (IFR) Capabilities.*** The Porter has been flight tested and found to be acceptable for instrument flight under IFR conditions.

b. ***General Control Techniques.*** The pilot must appreciate the separate use of flight controls and their effect on the flight instrument indications. When carrying out any manoeuvre under IFR conditions, the recommended technique is as follows:

(1) Change the attitude of the aircraft and then adjust power settings to suit that change.

(2) Adjust the aircraft trim as required.

(3) Maintain a close watch on instrument indications, particularly the indications of the AI.

(4) Adjust attitude and trim as required.

c. ***Before Taxying.*** Carry out the checks detailed in Section 2 para 217.

d. ***While Taxying.*** Carry out the checks detailed in Section 2 para 219.

e. ***Instrument Take-off (ITO).*** During the take-off run, maintain a constant heading on the compass (the runway in use where applicable), as lateral movement will not be apparent from the cockpit. Immediately after lift-off, transfer attention to the flight instruments and check climb attitude on the AI, wings level and the required nose up attitude. Note that the altimeter reflects a positive rate of climb and that the ASI indicates that speed is increasing.

Note

Do not initiate a turn until a normal climb is established and height is at least 500 ft AGL. Use a flapless take-off if the cloud base is **200 ft or lower**.

f. ***Instrument Climb.*** Once the climb has been established at the required airspeed, adjust aircraft trim as necessary. Refer to the AI during the climb to maintain a wings level and the required nose up attitude. Once airspeed and power settings have been stabilized, carry out after take-off and cruise checks.

Note

During the climb the angle of bank should not exceed that of a standard rate turn (3° per sec.).

g. ***During Instrument Cruising Flight.*** Before carrying out operations in IFR conditions, Para 234, Section 2 should be studied. Power settings and airspeeds to be maintained during cruising flight will largely depend upon the distance of the flight and the altitude at which the flight is made. The airspeeds required can be obtained by reference to Section 2 of this Flight Manual.

h. ***Descent to Station Approach.*** Commence descent to approach altitude after obtaining clearance, as applicable. Continue descent to final approach altitude or maintain a holding pattern as directed.

Note

When passengers are carried, the rate of descent should not exceed 500 ft/min.

703. Instrument Approaches

a. ***General.*** If weather conditions dictate, it may be necessary to terminate the flight with an instrument approach. The aircraft is capable of performing the typical approach patterns as shown in Figs. 7-1 - 7-5 to the minimum altitudes as published for the appropriate facility. Normally, 100 KIAS is used for all approach manoeuvres and during final approach.

b. ***Ground Controlled Approach*** (Ref. Fig. 7-1). A rate of descent of approximately 400 ft/min. and a speed of 100 KIAS should be used during a GCA approach. Due to the slow approach speed of the aircraft or because of other traffic, the GCA controller may request acceptance of a shorter pattern.

c. ***Radio Approaches*** (Ref. Fig. 7-2, 7-3, 7-4, 7-5). The procedures necessary to carry out an NDB, LOCALIZER, VOR, VAR or DME approach are shown on the charts for the respective approaches.

704. Ice and Rain. Flights into predicted and actual icing conditions are prohibited. Operation in falling snow is prohibited unless snow vanes are installed at the engine air inlet. Actual flight into rain has no serious effect on the operation of the aircraft, since the engine can ingest up to 17% water. However, as the aircraft is not fitted with windscreen wipers, considerable reduction of the pilot's forward vision from the cockpit will be experienced.

705. Night Flying

a. ***General.*** Night flying presents few problems. Closer attention must be paid to the flight instruments to maintain the aircraft attitude when there is a lack of sufficient outside references. During flight, slight reflection of the rotating beacon by the propeller will be noticed and during final approach, reflection of the landing light will be noticed. However, the effect will be slight and will only cause minor inconvenience to the pilot.

b. ***Aircraft Lighting.*** Lighting in the cockpit is extremely good, but if used incorrectly can cause glare. The instrument panel lighting intensity is controlled by a rheostat, which, if turned to the MAX position, will cause an excessive glare reflection on the windscreen. The floodlights also produce excessive glare. In the event of instrument panel light failure, the instruments can be illuminated by tilting the pilot's floodlight well down and using the co-pilot's floodlight to illuminate the instruments. This action will cause a considerable amount of glare on the co-pilot's side, but a minimum for the pilot.

c. ***Before Flight Preparation.*** Before the commencement of night flying, the pilot should attend a meteorological briefing to ascertain en route and/or local predicted weather conditions. He should also familiarize himself with the airfield lighting layout, including taxi-path and obstruction lights as applicable and any pertinent information for night flying operations.

d. ***Night Inspections.*** Before starting the engine, all interior and exterior lights are to be checked for correct operation. The intensity of instrument lighting should be adjusted for the maximum comfort of the pilot.

e. ***Pre-flight Inspection.*** The pre-flight checks should be carried out in daylight whenever possible. Particular attention should be paid to ensure that navigation, rotating beacon and landing lights are functioning correctly and are undamaged.

f. ***Taxying.***

CAUTION

The aircraft should be stopped and the landing light illuminated if any doubt exists regarding possible obstructions during taxying.

When taxying at night, extra caution is necessary to ensure that the aircraft is not moving too quickly. It should be appreciated that some difficulty may be experienced in judging distance at night.

g. ***Take-off.*** The procedure for take-off at night is similar to that for ITO, see para 702e.

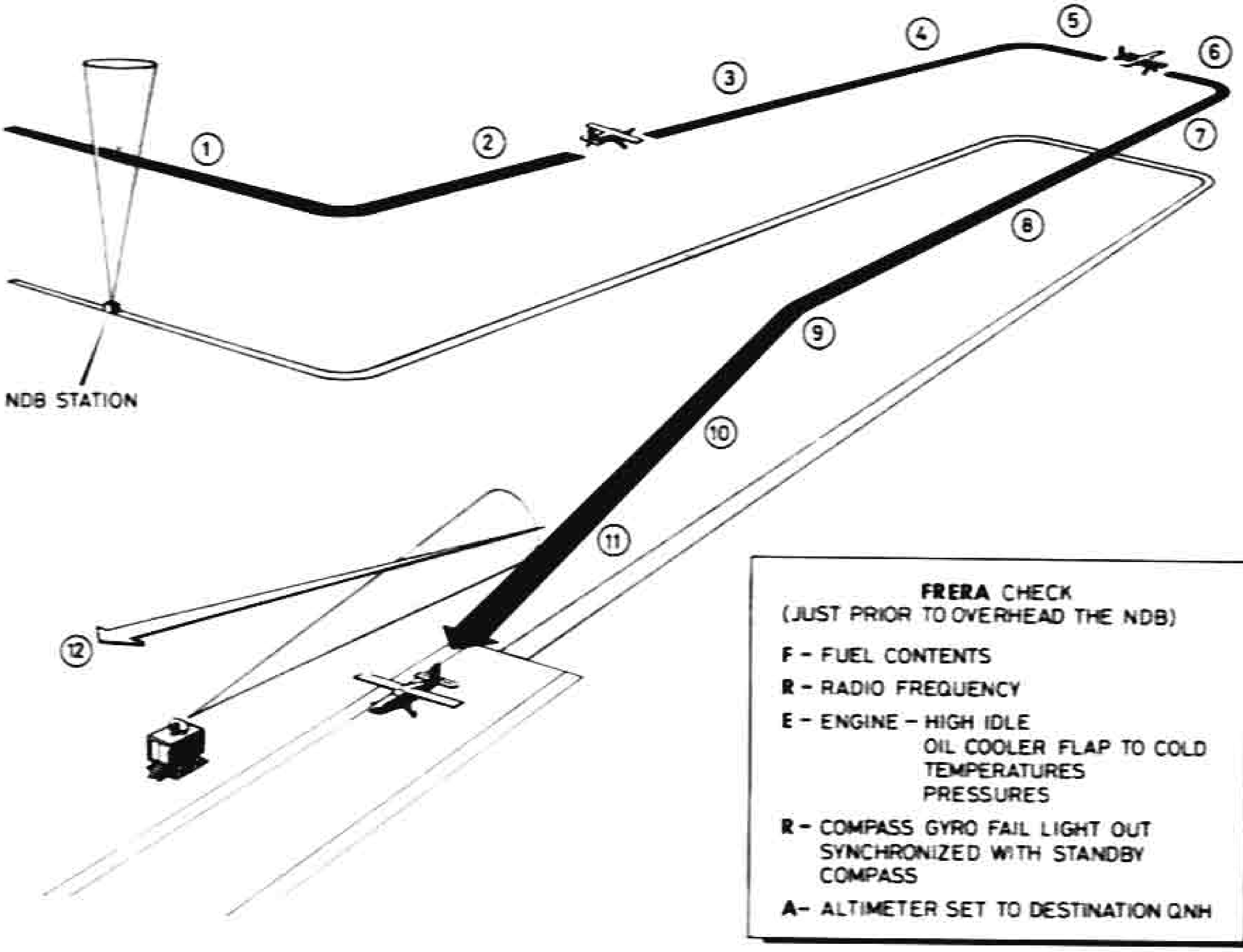
h. ***Double Flare Path.*** Touchdown must be effected between the second and double flares. If this cannot be achieved, an overshoot must be initiated. On full stop landings, the aircraft must be brought to a halt before the end of the flare path.

i. ***Tactical Flare Path.*** Some apprehension may be felt at the thought of a landing with only the aid of vehicle lights. However, once the pilot has grasped the essentials of the approach and touchdown, the method is the simplest form for landing at night. The greatest difficulty of the approach is the lack of an aid to judge the approach angle. It is mandatory for the pilot to 'go-around' if the aircraft is not on the ground by the time the pool of light is reached, as beyond this point, there is no reference for the judgment of height above the ground.

j. ***Engine Failure After Take-off.*** If an engine failure occurs after take-off at night, switch on the landing light, carry out the EFATO checks as though it were a daylight operation, with the exception that the power source selector switch is to remain in the ON position.

k. ***Engine Failure in the Circuit.*** In the event of engine failure in the circuit, carry out the FLWOP checks, and request illumination of the most suitable runway and taxi-path lights.

TYPICAL GROUND CONTROLLED APPROACH (GCA)



1. HEADING AND DESCENT TO ESTABLISH AIRCRAFT ON DOWNWIND LEG
2. DURING DOWNWIND LEG GCA CONTROLLER DESCRIBES PATTERN, GIVES DECISION ALTITUDE, EMERGENCY AND MISSED APPROACH PROCEDURES
3. ON COMMAND, COMPLETE DOWNWIND VITAL ACTIONS.
4. CONTROLLER GIVES HEADING FOR BASE LEG
5. AIRCRAFT DESCENDS TO INITIAL APPROACH ALTITUDE
6. CONTROLLER GIVES HEADING TO INTERCEPT RUNWAY CENTRE LINE
7. AIRCRAFT ON EXTENDED RUNWAY CENTRE LINE AT INITIAL APPROACH ALTITUDE
8. FINAL LANDING CHECKS COMPLETED. MAINTAIN 100 KTS IAS
9. PRECISION FINAL APPROACH STARTED, COMMENCE DESCENT. ACKNOWLEDGE NO FURTHER TRANSMISSIONS
10. MAINTAIN ACCURATE HEADING AND GLIDE-PATH INFORMATION. SMALL ALTERATIONS TO HEADING AND RATE OF DESCENT TO BE EXPECTED
11. ½ MILE DECISION ALTITUDE, LOOK AHEAD AND LAND VISUALLY OR CARRY OUT MISSED APPROACH PROCEDURE
12. COMPLETE AFTER TAKE-OFF AND CLIMB CHECKS.

FIG. 7-1

TYPICAL VOR APPROACH

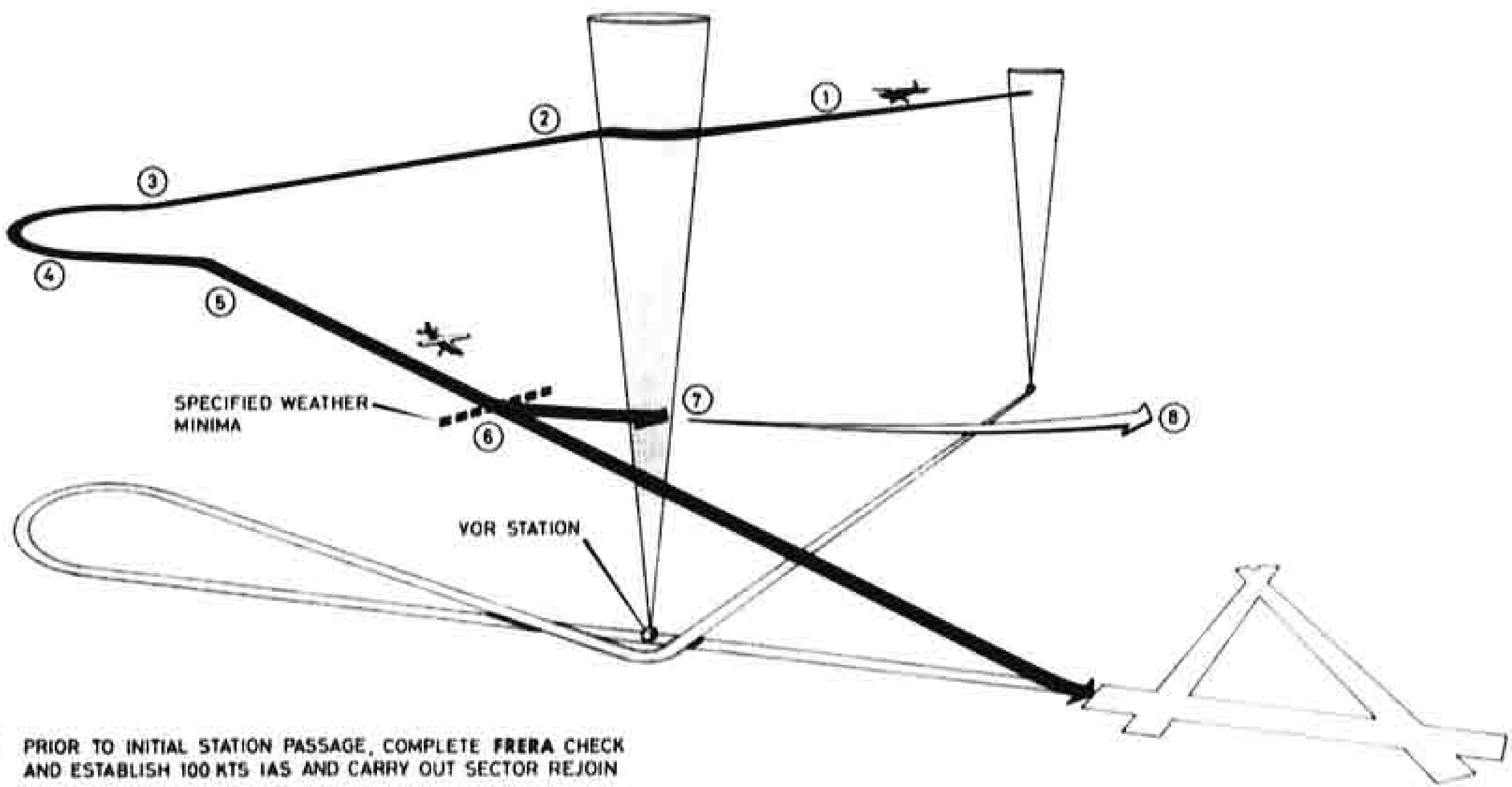


FIG. 7-2

1. PRIOR TO INITIAL STATION PASSAGE, COMPLETE **FRERA** CHECK AND ESTABLISH 100 KTS IAS AND CARRY OUT SECTOR REJOIN
2. ON DEPARTING HIGH STATION, SELECT OUTBOUND TRACK ON OMNIBEARING SELECTOR (OBS) AND COMMENCE DESCENT WHEN WITHIN 2 DOTS (±4°) USING COURSE SELECTOR INDICATOR.
3. COMMENCE STANDARD PROCEDURE TURN AT SPECIFIED TIME / DME FIX DOWNWIND CHECKS TO BE COMPLETED IF PUBLISHED, STRAIGHT-IN APPROACH
4. SELECT INBOUND TRACK ON OBS. COMMENCE STANDARD RATE TURN ONTO SPECIFIED TRACK. MAINTAIN TRACK 1 DOT (± 2°)
5. WHEN ON INBOUND TRACK DESCEND TO WEATHER MINIMA POINT. PILOT DETERMINES RATE OF DESCENT AND MAINTAINS TRACK ± 2°
6. IF VISUAL, PROCEED TO RUNWAY IN USE FOR NORMAL LANDING. IF STILL IFR, FLY LEVEL UNTIL LOW STATION IS REACHED
7. CARRY OUT MISSED APPROACH PROCEDURE AS SPECIFIED ON CHART
8. COMPLETE AFTER TAKE-OFF AND CLIMB CHECKS.

TYPICAL LOCALIZER APPROACH

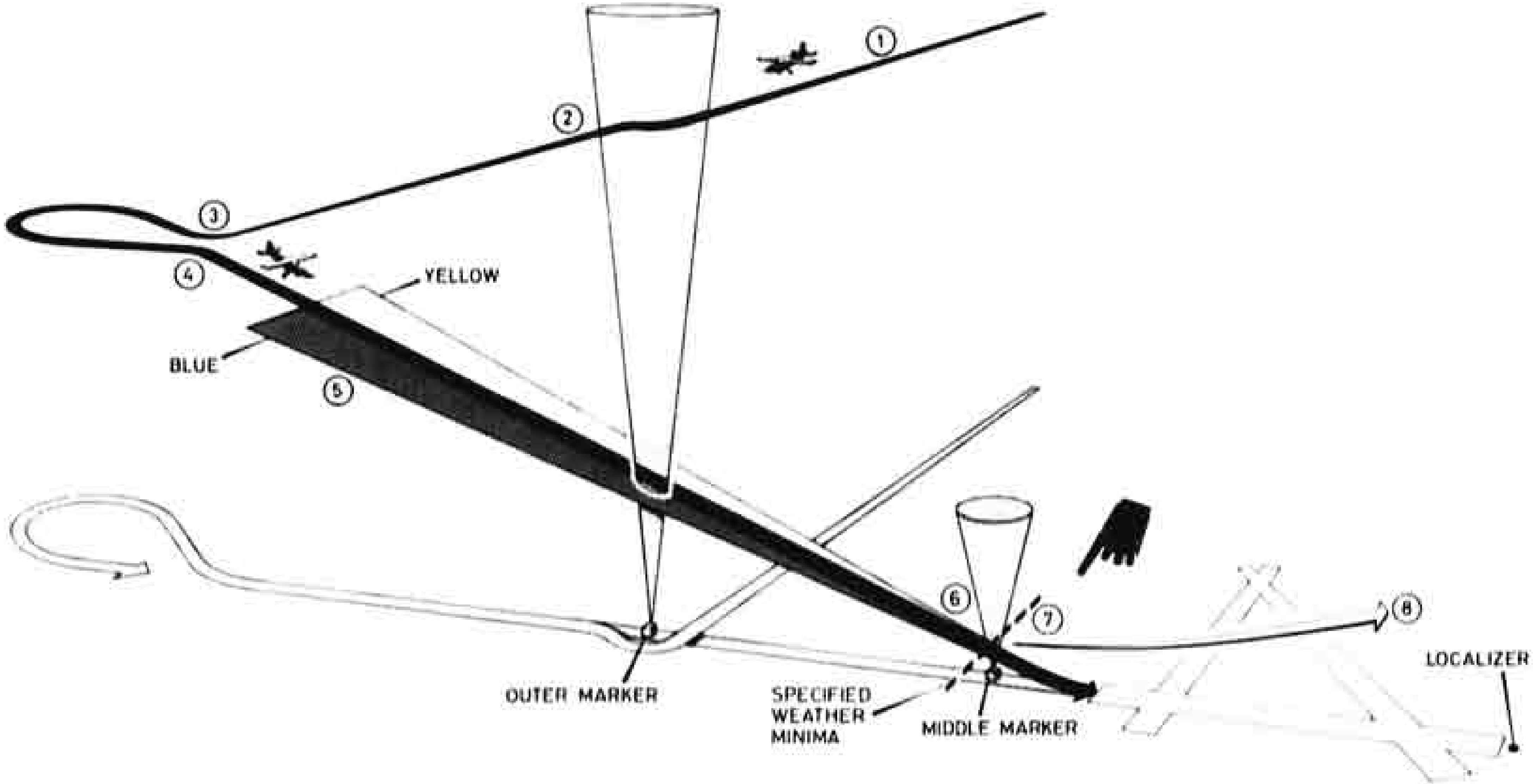


FIG.7-3

1. COMPLETE **FRERA** CHECK AND ESTABLISH 10 KTS IAS AND CARRY OUT SECTOR REJOIN.
2. ON DEPARTING HIGH STATION, COMMENCE DESCENT MAINTAIN 2 DOTS (±1°) ON OUTBOUND TRACK.
3. COMMENCE STANDARD PROCEDURE TURN AT SPECIFIED TIME / DME FIX DOWNWIND CHECKS COMPLETED IN TURN.
4. COMMENCE DESCENT ON DME/RADAR FIX WHEN WITHIN 2 DOTS (±1°) ON INBOUND TRACK.
5. WHEN ON INBOUND TRACK DESCEND TO WEATHER MINIMA POINT.
6. IF VISUAL, PROCEED TO RUNWAY IN USE FOR NORMAL LANDING. IF STILL IFR, FLY LEVEL UNTIL LOW STATION IS REACHED. MAINTAIN TRACK TO WITHIN 1 DOT (±½°).
7. CARRY OUT MISSED APPROACH PROCEDURE AS SPECIFIED ON CHART.
8. COMPLETE AFTER TAKE-OFF AND CLIMB CHECKS.

TYPICAL NDB APPROACH

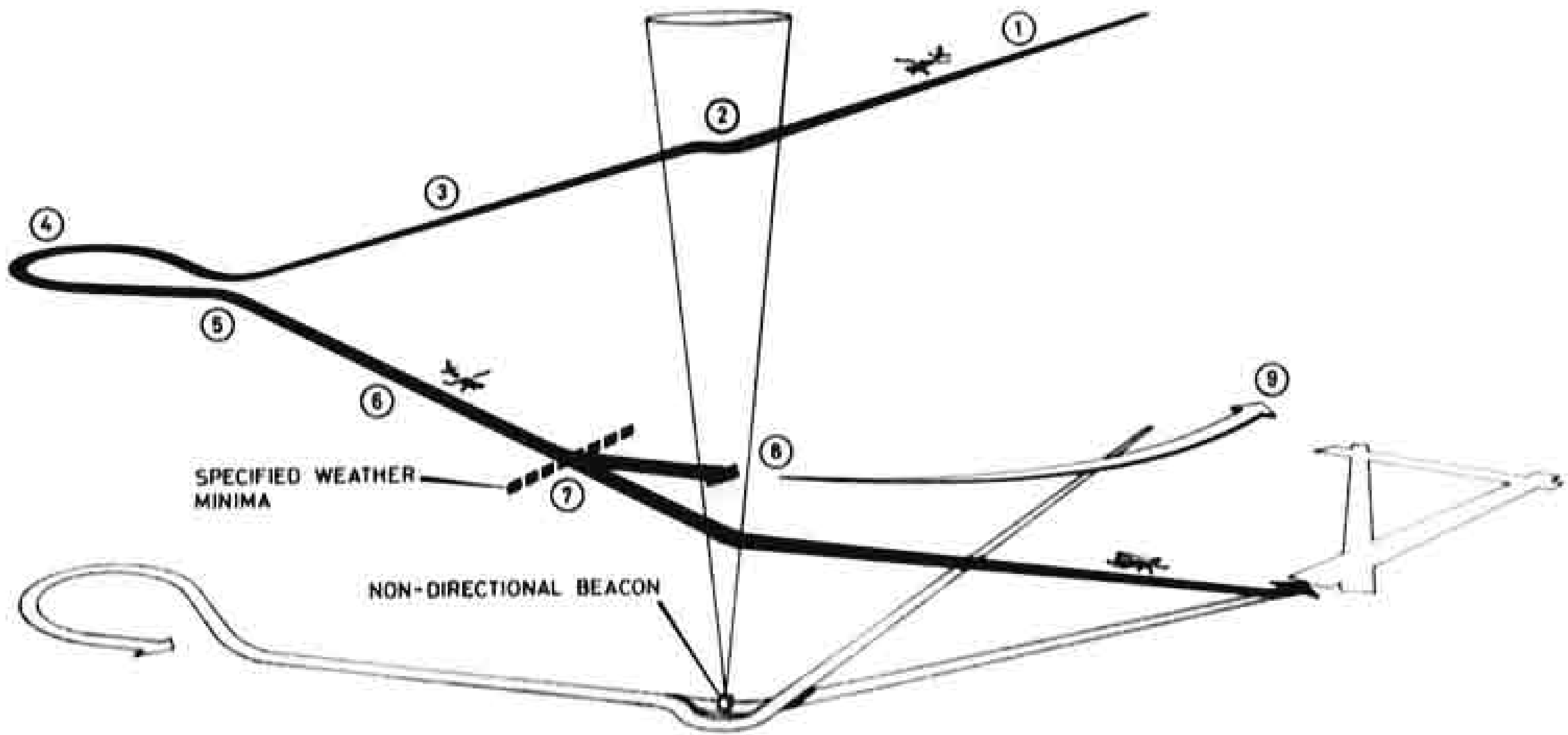


FIG. 7-4

1 PRIOR TO INITIAL STATION PASSAGE, COMPLETE **FRERA** CHECK AND ESTABLISH 100 KTS IAS AND CARRY OUT SECTOR REJOIN.

2 AT HIGH STATION COMMENCE DESCENT AND ENSURE AIRCRAFT IS WITHIN 5° OF OUTBOUND TRACK.

3 ADJUST LENGTH OF OUTBOUND LEG TO ACHIEVE OPTIMUM MANOEUVRING TIME INBOUND.

4 ADJUST STANDARD PROCEDURE TURN INBOUND TO ROLL OUT WITHIN 5° OF REQUIRED TRACK.

5 DO NOT RECOMMENCE DESCENT UNTIL WITHIN 5° OF INBOUND TRACK.

6 DURING INBOUND LEG STAY WITHIN ±2° OF TRACK AND MAINTAIN 100 KTS IAS.

7 IF VISUAL, PROCEED TO RUNWAY IN USE FOR NORMAL LANDING. IF STILL IFR, FLY LEVEL UNTIL LOW STATION IS REACHED.

8 CARRY OUT MISSED APPROACH PROCEDURE AS SPECIFIED ON CHART.

9 COMPLETE AFTER TAKE-OFF AND CLIMB CHECKS.

TYPICAL DME APPROACH

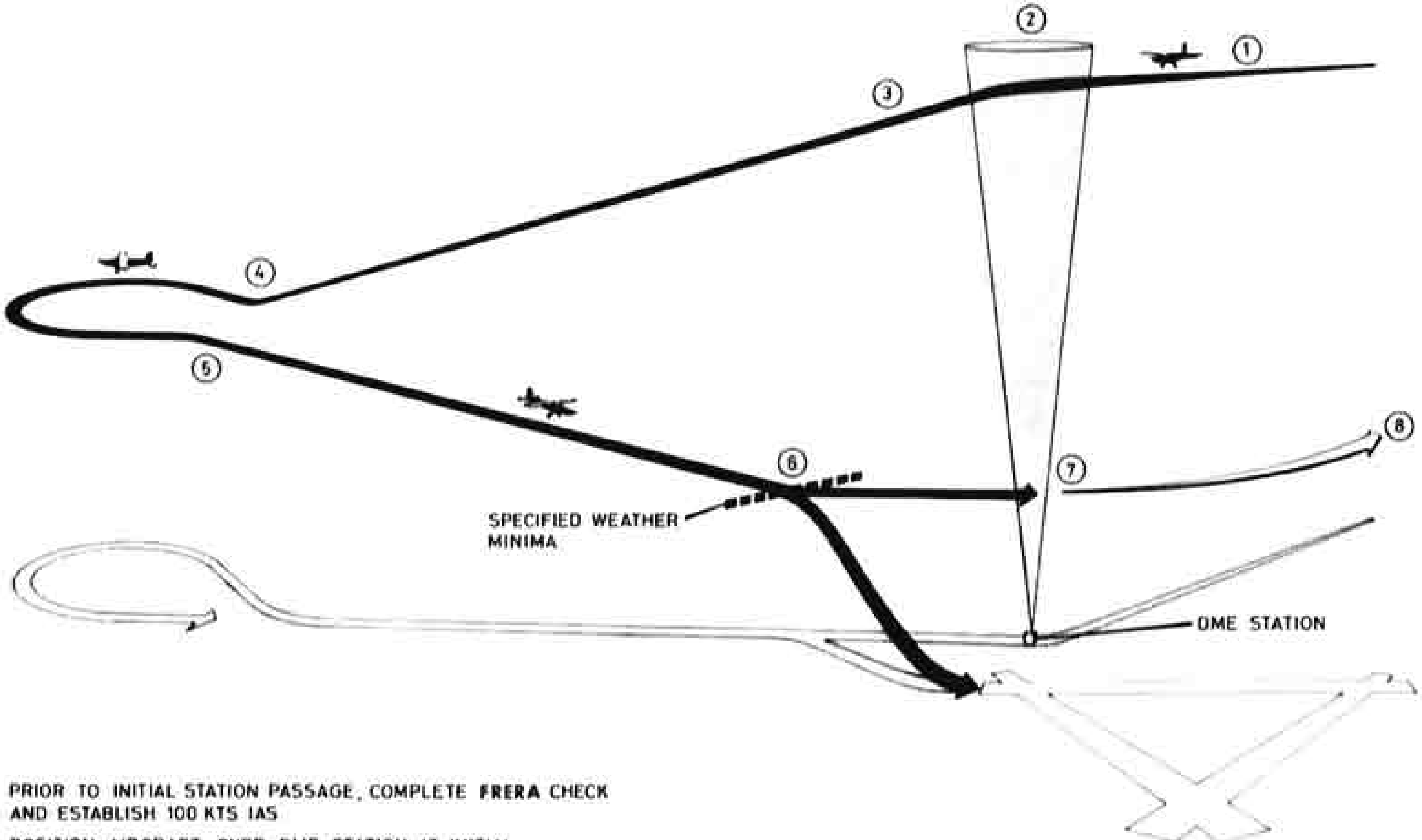


FIG. 7-5

1 PRIOR TO INITIAL STATION PASSAGE, COMPLETE **FRERA** CHECK AND ESTABLISH 100 KTS IAS

2 POSITION AIRCRAFT OVER DME STATION AT INITIAL APPROACH ALTITUDE

3 COMMENCE DESCENT ON SPECIFIED HEADING. SPEED 100 KTS IAS

4 COMMENCE STANDARD PROCEDURE TURN AT SPECIFIED TIME/DME FIX AS SHOWN ON CHART

5 WHEN ON INBOUND HEADING DESCEND TO WEATHER MINIMA POINT. PILOT DETERMINES RATE OF DESCENT AND MAINTAINS 100 KTS IAS

6 IF VISUAL, PROCEED TO RUNWAY IN USE FOR NORMAL LANDING. IF STILL IFR, FLY LEVEL UNTIL DME STATION IS REACHED.

7 CARRY OUT MISSED APPROACH PROCEDURE AS SPECIFIED ON CHART

8 COMPLETE AFTER TAKE-OFF AND CLIMB CHECKS

APPENDIX 1
PERFORMANCE DATA

APPENDIX 1

PERFORMANCE DATA

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APPENDIX 1

PERFORMANCE DATA

A101. Introduction. The information containea on the charts in this Appendix is based on the recommended operation procedures and techniques specified in Section 2 NORMAL PROCEDURES of this Flight Manual. The Standard Atmosphere Table, Density Altitude Chart, Temperature Conversion and Take-off and Landing Cross Wind Chart, reference Figs. A-4, A-5, A-6 and A-7 respectively have been included and are self explanatory. Figs. A-1, A-2 and A-3 are also provided in this Appendix and may be used for FLIGHT PLANNING purposes.

A102. Take-off Ground Roll Chart (Fig. A-8). The following sample problem has been presented on the above chart, by the use of the 'chase-arounds'. Given:-

Aircraft AUW = 4650 lbs.
OAT = 14°C
Pressure Alt. = 2000 ft.
Torque = 37.5 psi
Tailwind = 3 knots
Runway Slope = -1.5%
ANS. GROUND ROLL = 550 ft.

A103. Take-off and Climb to 50 ft. Chart (Fig. A-9). The following sample problem has been presented on the above chart, by the use of the 'chase-arounds'. Given:-

Aircraft AUW = 4900 lbs.
OAT = 17°C
Pressure Alt. = 4000 ft.
Torque = 35 psi
Headwind = 8 knots
Runway Slope = 1.5%
ANS. TAKE-OFF DISTANCE = 1075 ft.

A104. Normal Landing Distance from 50 ft. (Fig. A-10). The following problem has been presented on the above chart as a typical example of the use of the chart. Given:-

Aircraft AUW = 3900 lbs.
OAT = 13°C
Pressure Alt. = 4000 feet
Headwind = 5 knots
Runway Slope = 1.5%
ANS. LANDING DISTANCE = 1575 ft.

A105. Tactical Landing Distance from 50 ft. (Fig. A-11). The following problem has been presented as a typical example of the use of this chart for tactical purposes. Given:-

Aircraft AUW = 3700 lbs.
OAT = 10°C
Pressure Alt. = 4000 ft.
Headwind = 2 knots
Runway Slope = 1%
ANS. LANDING DISTANCE = 750 feet.

FLIGHT PLANNING

A106. Time to Climb - Fuel used in Climb (Fig. A-1). The following Figs. A-1, A-2 and A-3 may be used for flight planning purposes. They are based on climb IAS 80 knots, using climb power described in Section 2. Normal Procedures of this Flight Manual.

Time (mins)			4	5	7	10	12	15	18	23	28
Height (x1000)	0	2	4	6	8	10	12	14	16	18	20
Fuel Used (lb)			30	40	50	60	70	82	100	120	130

Fig. A-1 Time to Climb - Fuel Used in Climb

A107. Cruise IAS (Fig. A-2). The IAS noted below may be sustained at the relevant altitude.

Altitude	KIAS
0 - 5,000	115 and below
5 - 8,000	110 and below
8 - 12,000	105 and below
12 - 16,000	100 and below

Fig. A-2 Cruise IAS

A108. Fuel Flow (Fig. A-3). The following fuel flows may be safely used for flight planning:

Flight Mode	Fuel Flow lbs/hr
Cruise (at max sustained IAS)	260
Descent En route	220
Holding (at 100 kts)	220
Climb	310

Fig. A-3 Fuel Flow

A 109. Use of Emergency Fuels

WARNING

To allow for variations in the heat content of various types or batches of fuels, a 10% reduction in range/endurance at any given power setting is to be planned when AVGAS is used.

Apart from a reduction in range/endurance resulting from the use of AVGAS, the Fuel flow indicator and totalizer readings have to be adjusted. Because these instruments are calibrated for use with AVTUR, normal setting procedures and readings are inaccurate (These instruments indicate mass flow but measure quantity flow). When using AVGAS the fuel flow indicator will over-read by approximately 10% and the following procedure must be used.

1. Use conversion scale, Fig A-12, for setting the totalizer.
2. To determine remaining endurance in flight at any given power setting, apply the indicated fuel flow to indicated "lbs remaining".

Note

A fuel mixture containing more than 10% AVGAS is to be regarded as 100% AVGAS.

STANDARD S L CONDITIONS:	CONVERSION FACTORS:
TEMPERATURE 15°C (59°F)	1 IN. Hg 70.727 LB/SQ FT
PRESSURE 29.921 IN. Hg 2116.216 LB/SQ FT	1 IN. Hg 0.49116 LB/SQ IN.
DENSITY .0023769 SLUGS/CU FT	1 KNOT 1.151 M.P.H.
SPEED OF SOUND 1116.89 FT/SEC 661.7 KNOTS	1 KNOT 1.688 FT/SEC

ALTITUDE FEET	DENSITY RATIO σ	σ - 1/2 $\frac{1}{\sqrt{\sigma}}$	TEMPERATURE °C	°F	SPEED OF SOUND KNOTS	PRESSURE IN. Hg	PRESSURE RATIO δ
0	1.000	1.0000	15.000	59.000	661.7	29.921	1.0000
1000	.9711	1.0148	13.019	55.434	659.5	28.856	.9644
2000	.9428	1.0299	11.038	51.868	657.2	27.821	.9298
3000	.9151	1.0454	9.056	48.302	654.9	26.817	.8962
4000	.8881	1.0611	7.076	44.735	652.6	25.842	.8637
5000	.8617	1.0773	5.094	41.169	650.3	24.896	.8320
6000	.8359	1.0938	3.113	37.603	648.7	23.978	.8014
7000	.8106	1.1107	1.132	34.037	645.6	23.088	.7716
8000	.7860	1.1279	-0.850	30.471	643.3	22.225	.7428
9000	.7620	1.1456	-2.831	26.905	640.9	21.388	.7148
10,000	.7385	1.1637	-4.812	23.338	638.6	20.577	.6877
11,000	.7155	1.1822	-6.793	19.772	636.2	19.791	.6614
12,000	.6832	1.2011	-8.774	16.206	633.9	19.029	.6360
13,000	.6713	1.2205	-10.756	12.640	631.5	18.292	.6113
14,000	.6500	1.2403	-12.737	9.074	629.0	17.577	.5875
15,000	.6292	1.2606	-14.718	5.508	626.6	16.886	.5643
16,000	.6090	1.2815	-16.699	1.941	624.2	16.216	.5420
17,000	.5892	1.3028	-18.680	-1.625	621.8	15.569	.5203
18,000	.5699	1.3246	-20.662	-5.191	619.4	14.942	.4994
19,000	.5511	1.3470	-22.643	-8.757	617.0	14.336	.4791
20,000	.5328	1.3700	-24.624	-12.323	614.6	13.750	.4595
21,000	.5150	1.3935	-26.605	-15.889	612.1	13.184	.4406
22,000	.4976	1.4176	-28.587	-19.456	609.6	12.636	.4223
23,000	.4806	1.4424	-30.568	-23.022	607.1	12.107	.4046
24,000	.4642	1.4678	-22.549	-26.588	604.6	11.597	.3876
25,000	.4481	1.4938	-34.530	-30.154	602.1	11.103	.3711
26,000	.4325	1.5206	-36.511	-33.720	599.6	10.627	.3552
27,000	.4173	1.5480	-38.492	-37.286	597.1	10.168	.3398
28,000	.4025	1.5762	-40.474	-40.852	594.6	9.725	.3250
29,000	.3881	1.6052	-42.455	-44.419	592.1	9.297	.3107
30,000	.3741	1.6349	-44.436	-47.985	589.5	8.885	.2970

FIG. A-4 STANDARD ATMOSPHERE TABLE

DENSITY ALTITUDE CHART - ICAO

MODEL: PC-6/B1-H2
DATE: JULY 1971
DATA BASIS: FLIGHT TEST

ENGINE: UACL PT6A 20
FUEL GRADE: AVTUR
FUEL DENSITY: 6.34 LB/GAL

-16

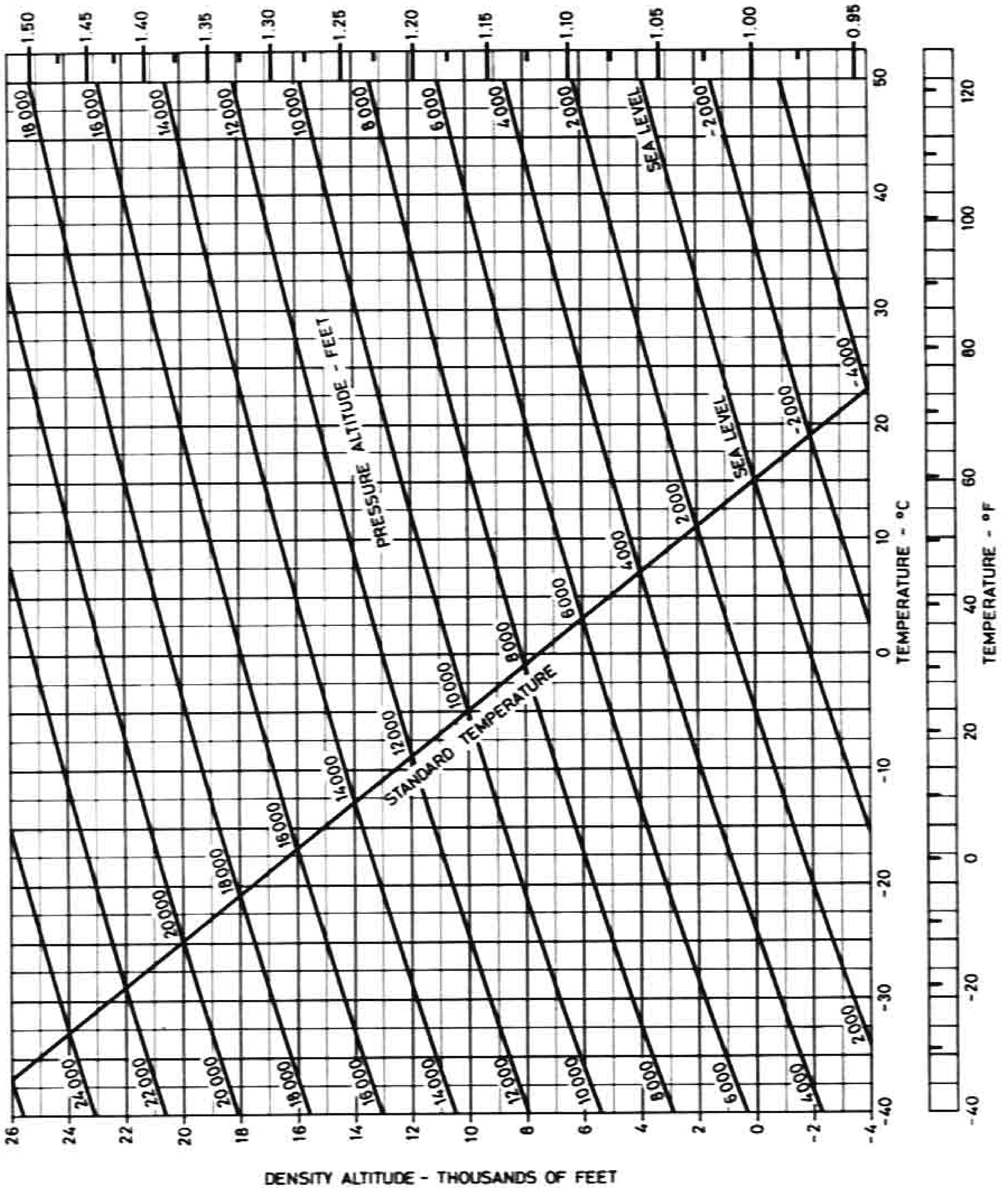
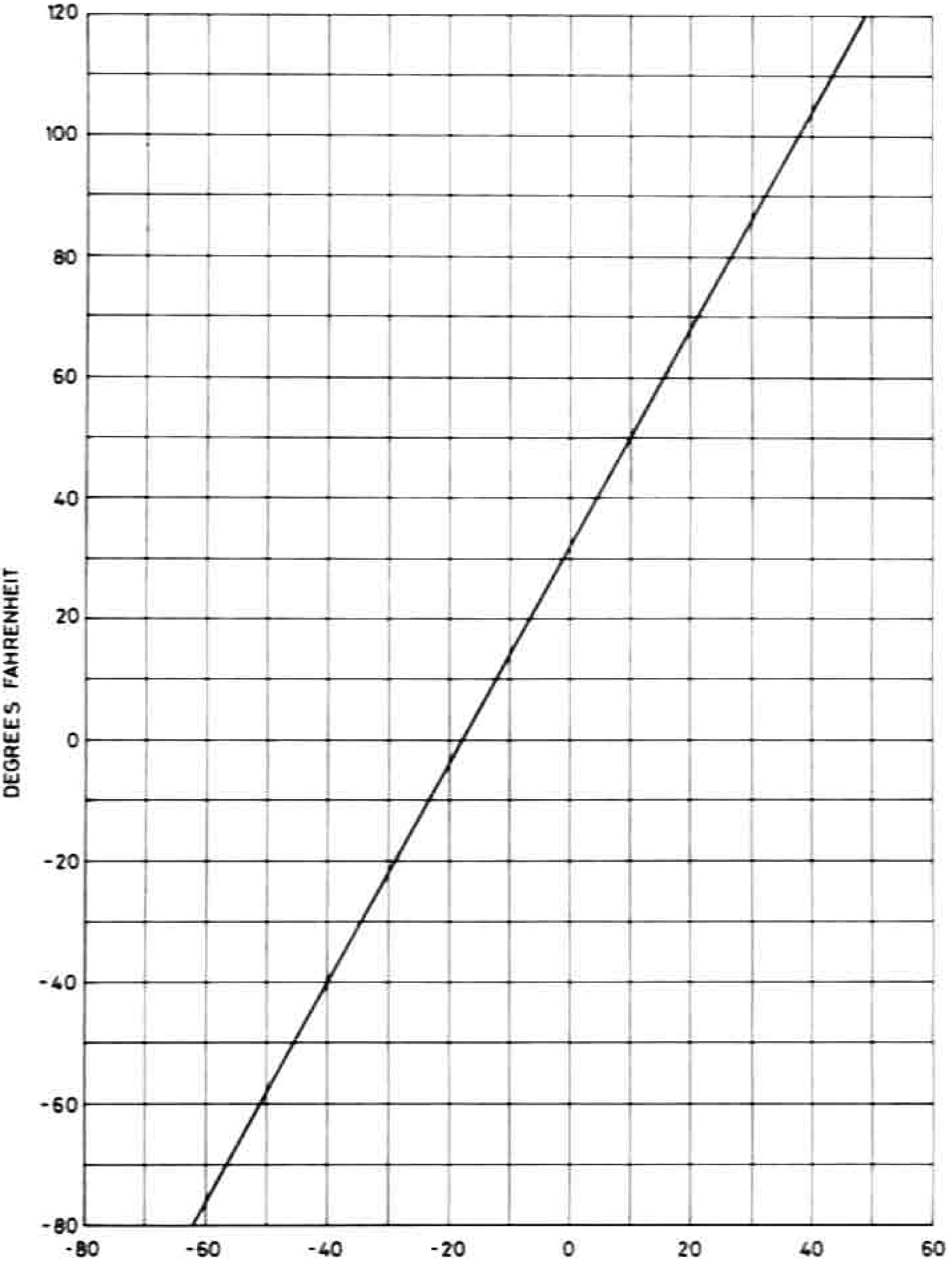


FIG. A-5

TEMPERATURE CONVERSION CHART

MODEL: PC-6/B1-H2

ENGINE UACL PT6A-20



°F (9/5 °C)+32°

°C 5/9(°F-32°)

FIG. A-6

TAKE-OFF AND LANDING CROSS-WIND CHART

MODEL : PC-6/B1-H2
DATE : JULY 1971
DATA BASIS: FLIGHT TEST

ENGINE: UACL PT6A-20
FUEL GRADE: AVTUR
FUEL DENSITY: 6.34 LB/GAL

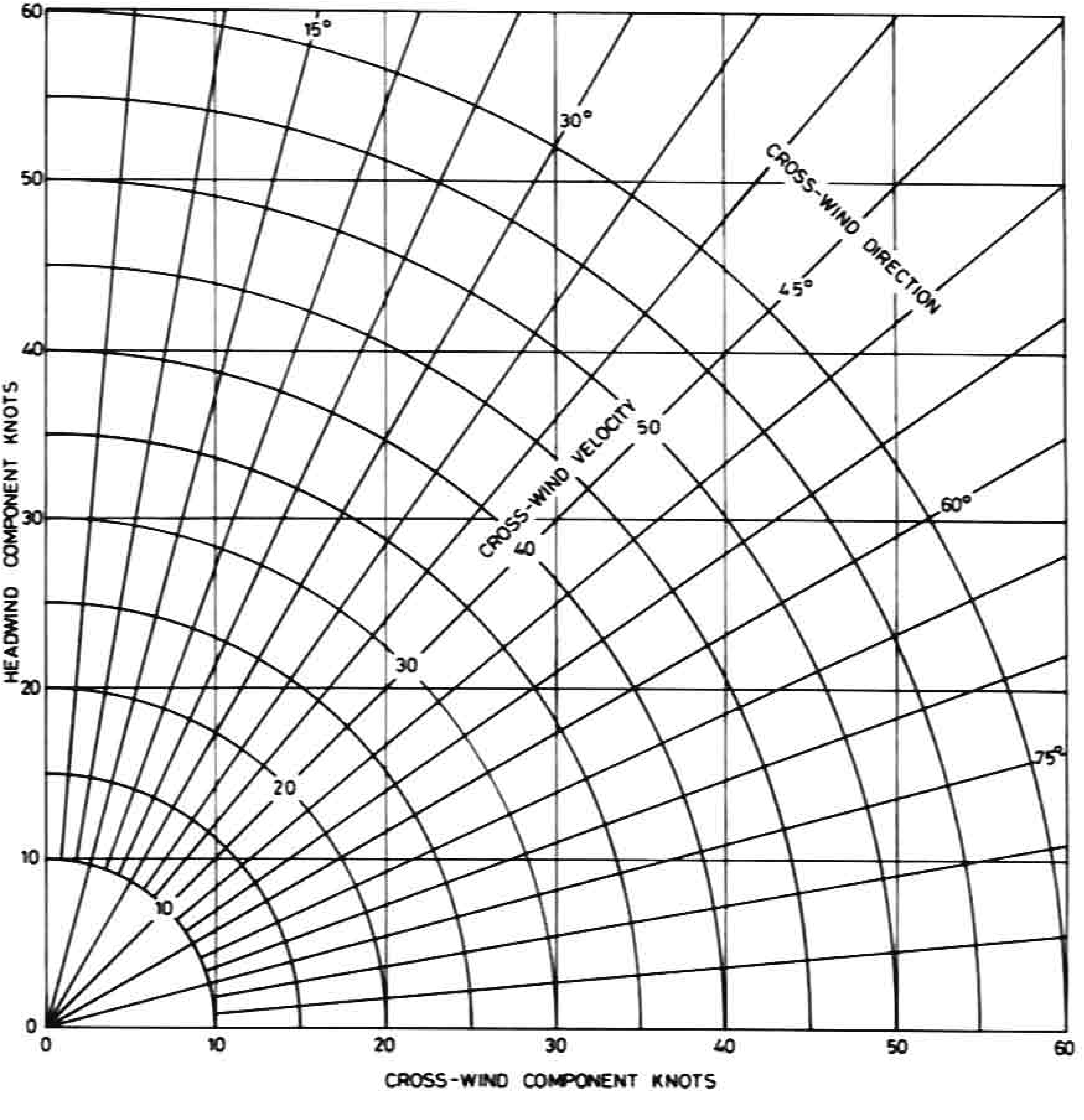


FIG. A-7

TAKE-OFF GROUND ROLL

MODEL : PC-6/B1-H2
DATE : JULY 1971
DATA BASIS : FLIGHT TEST

ENGINE : UACL PT6A-20
FUEL GRADE : AVTUR
FUEL DENSITY : 6.34 LB/GAL

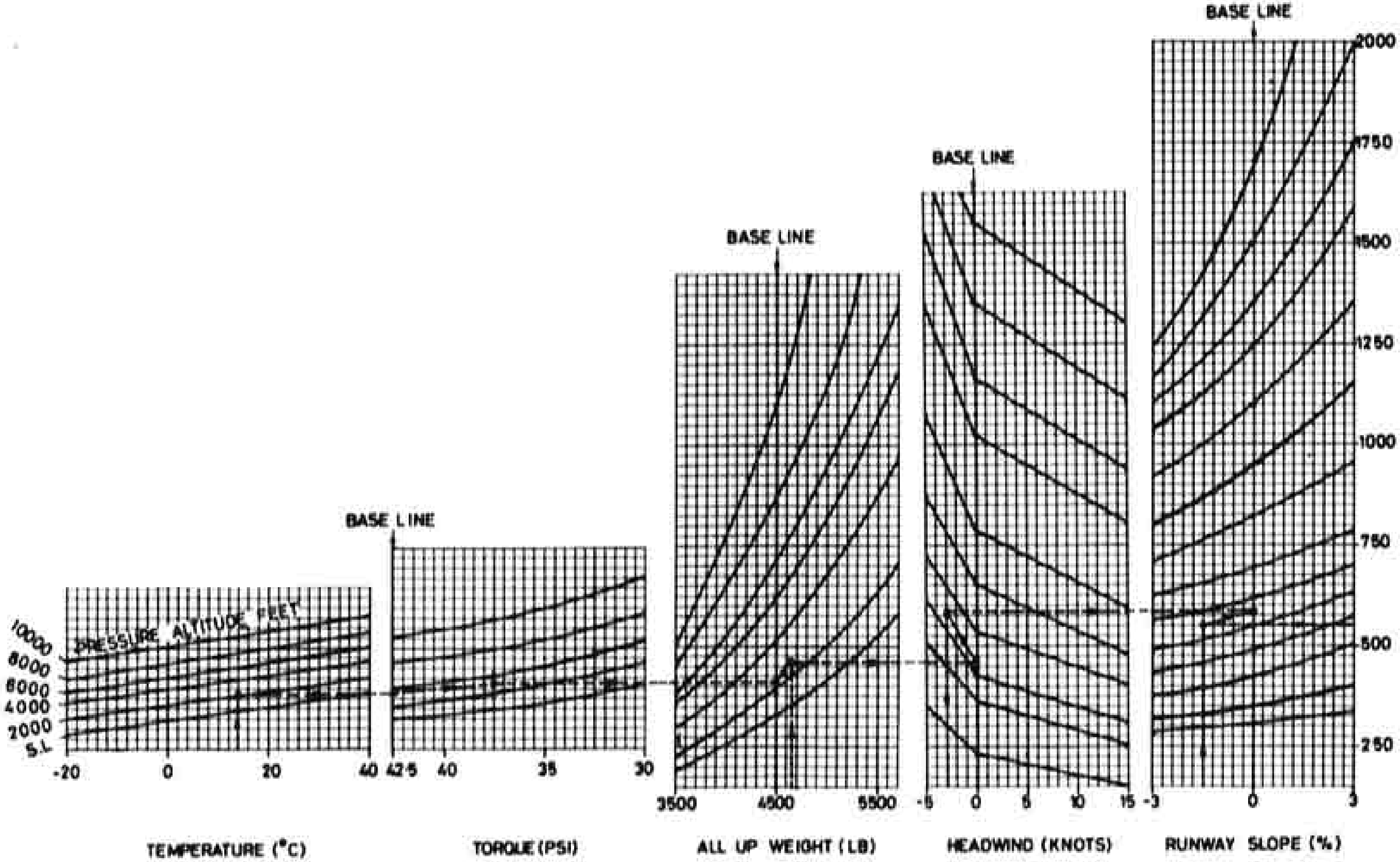


FIG. A-8

TAKE-OFF AND CLIMB TO 50 FT.

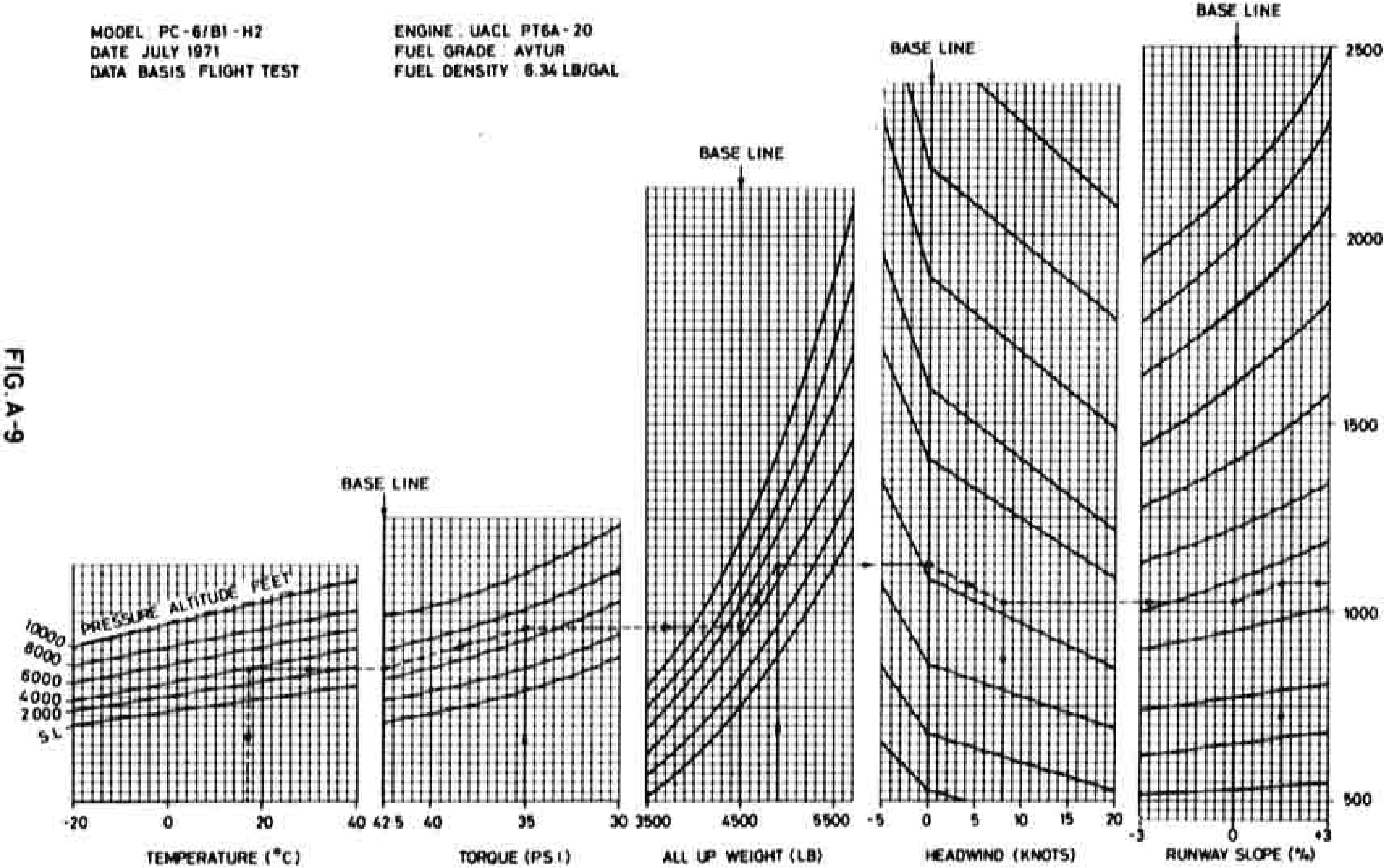


FIG. A-9

NORMAL LANDING DISTANCE FROM 50 FT.

MODEL PC-6/B1-H2
DATE : JULY 1971
DATA BASIS : FLIGHT TEST

ENGINE : UACL PT6A-20
FUEL GRADE : AVTUR
FUEL DENSITY : 6.34 LB/GAL

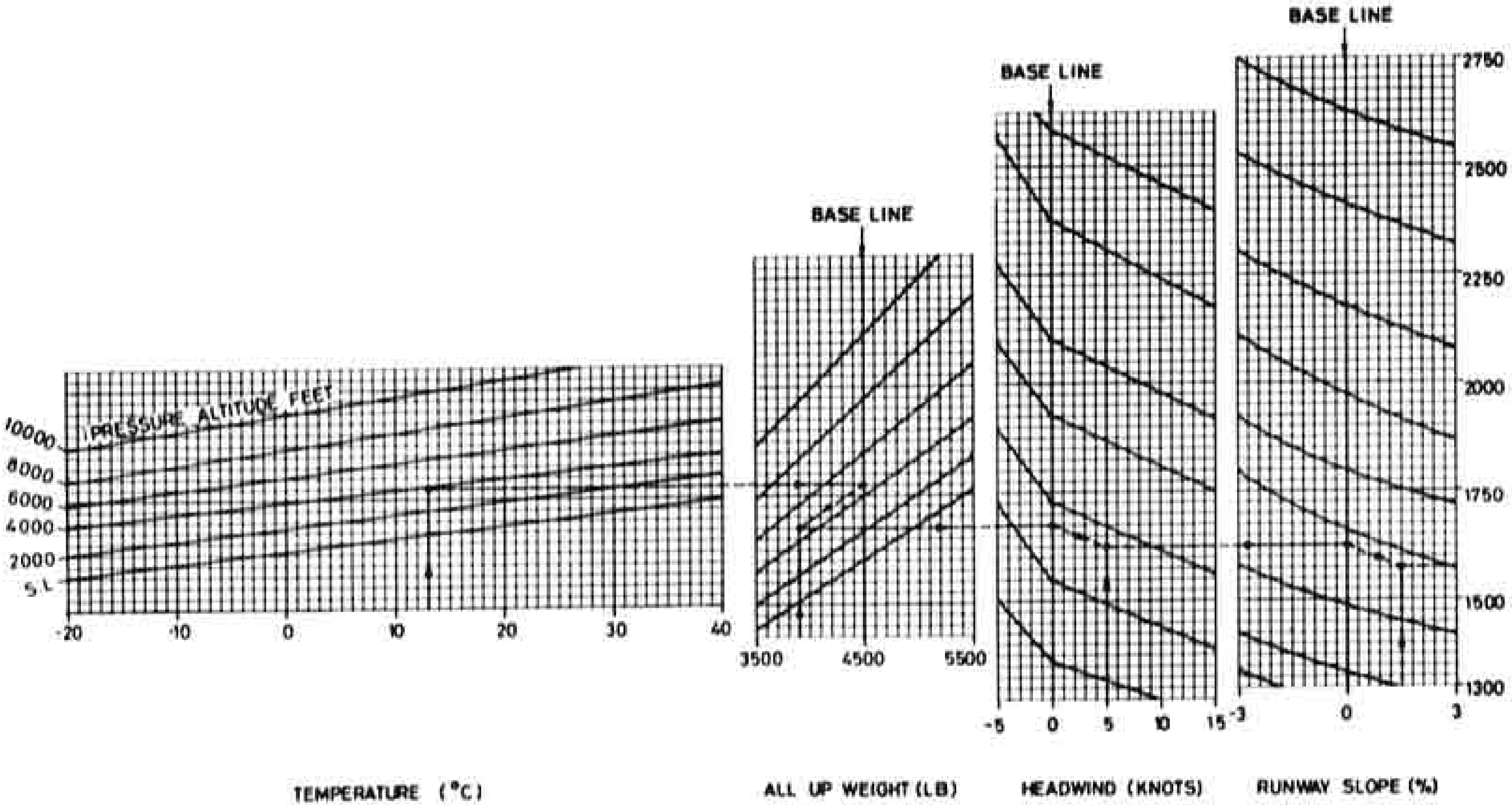


FIG. A-10

TACTICAL LANDING DISTANCE FROM 50FT.

MODEL PC-6/B1-H2
DATE JULY 1971
DATA BASIS FLIGHT TEST

ENGINE UACL PT6A-20
FUEL GRADE AVTUR
FUEL DENSITY 6.34 LB/GAL

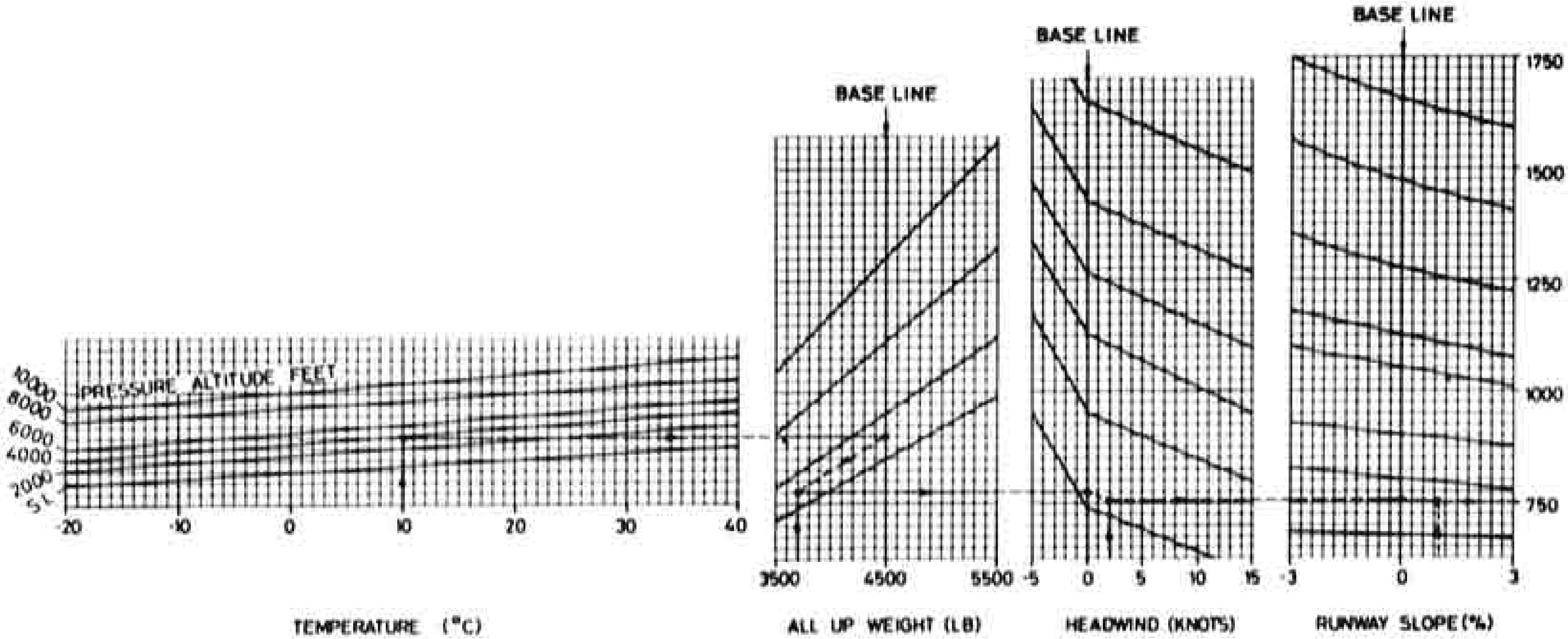


FIG. A-11

FUEL FLOW CONVERSION CHART FOR USE WITH AVGAS EMERGENCY FUEL

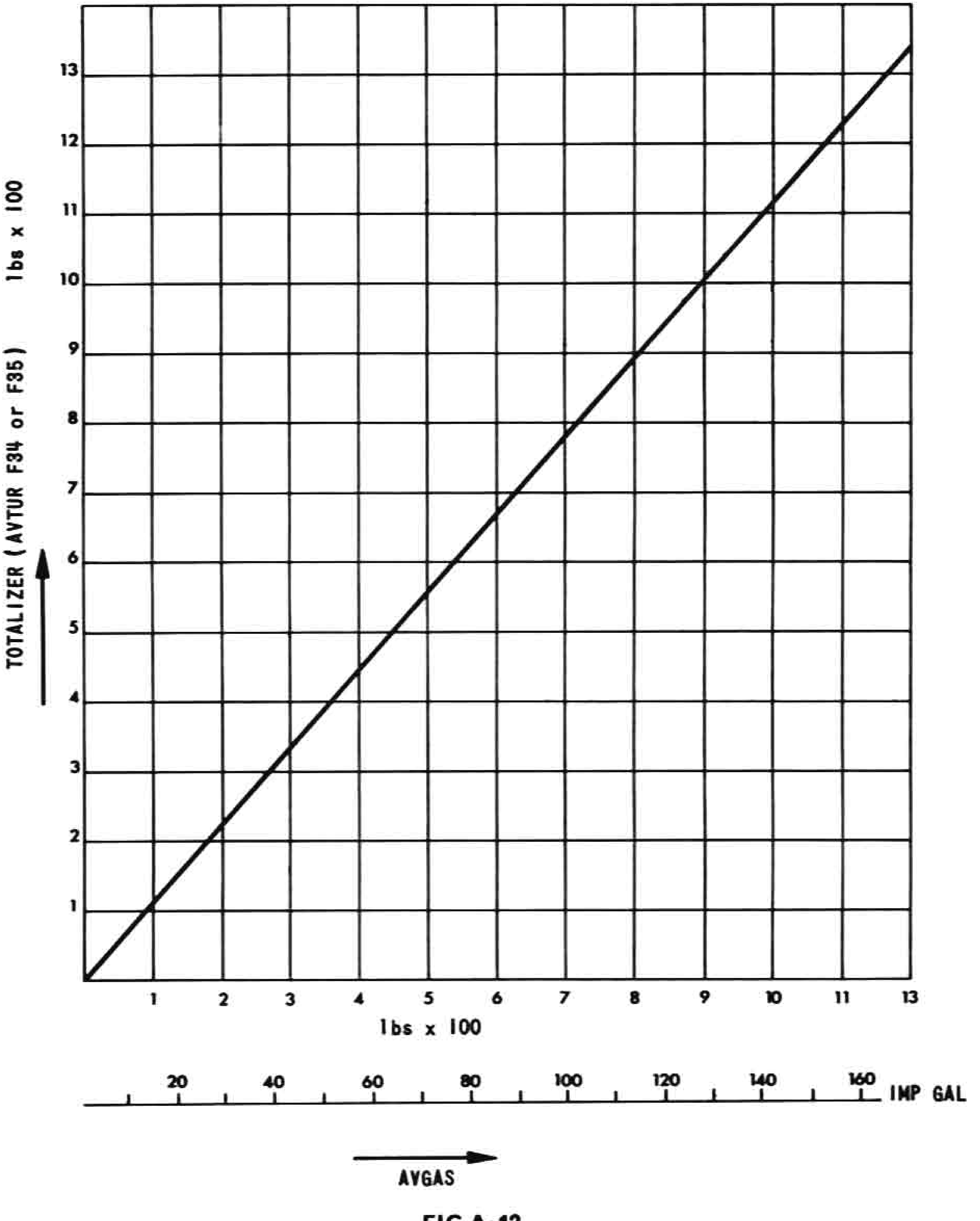


FIG A-12

ALPHABETICAL INDEX

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