FURLONG

FLIGHT MANUAL

USAF SERIES
C-7A
AIRCRAFT

THIS PUBLICATION REPLACES T.O. 1C-7A-1 DATED 5 JAN 1967.

SEE WEEKLY INDEX T.O. 0-1-1-3A FOR CURRENT STATUS OF FLIGHT MANUAL, SAFETY SUPPLEMENTS, OPERATIONAL SUPPLEMENTS AND FLIGHT CREW CHECKLISTS.

COMANDERS ARE RESPONSIBLE FOR BRINGING THIS PUBLICATION TO THE ATTENTION OF ALL AIR FORCE PERSONNEL CLEARED FOR OPERATION OF SUBJECT AIRCRAFT.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

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3 OCTOBER 1967

INSERT LATEST CHANGED PAGES, DESTROY SUPERSEDED PAGES.

LIST OF EFFECTIVE PAGES

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CURRENT FLIGHT CREW CHECKLISTS

T.O. 1C-7A-1CL-1
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NUMBER	DATE	TITLE	DISPOSITION

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This portion is to be filled in by you when you receive your flight manual and added to as you receive additional supplements. Safety Supplements outstanding at the time of preparation of this page are listed below for your convenience.

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NUMBER	DATE	TITLE	DISPOSITION
1C-7A-1S-3	3 May 1967	Landing Procedures	Section II

OUTSTANDING SUPPLEMENTS

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NUMBER	DATE	TITLE	DISPOSITION
1C-7A-1S-4	3 May 1967	Magnetic Chip Detector System	
1C-7A-1S-5	15 June 1967	RPM Restriction	

TABLE OF CONTENTS

IN ORDER THAT YOU WILL GAIN THE MAXIMUM BENEFITS FROM THIS MANUAL, IT IS IMPORTANT THAT YOU READ THIS INTRODUCTION CAREFULLY.

SCOPE

This manual contains the necessary information for safe and efficient operation of the C-7A aircraft. These instructions provide you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and therefore, basic flight principles are avoided. This manual provides the best possible operating instructions under most circumstances; however, multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

PERMISSIBLE OPERATIONS

The Flight Manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from WRAMA, WRNEO before any questionable operation is attempted which is not specifically permitted in this manual.

SAFETY AND OPERATIONAL SUPPLEMENTS

Information involving safety will be promptly forwarded to you by Safety Supplements. TWX-type Safety Supplements covering loss of life (called Interim Safety Supplements), will get to you in 48 hours; those concerning serious damage to equipment within 10 days by mail (in a formal printed form). Operational information not involving safety but of an urgent nature will be forwarded to you by Operational Supplements. These will be forwarded by TWX (interim) or by mail (formal), depending upon the urgency of the information. Interim supplements are normally replaced by formal printed supplements at an early date. Formal printed supplements are identified by red letters "SS" for safety supplements and black letters "OS" for operational supplements printed around the borders of the pages. The currency of Safety Supplements and Operational Supplements affecting your aircraft and Flight Manual can be determined by refering to the Weekly Index of Safety Supplements (T.O. 0-1-1-3A). The title block of each supplement and the title page of this manual should also be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements - current supplements must be complied with, but there is no point in restricting your operation by complying with a replaced or rescinded supplement. As a further aid, supplement records for both Safety Supplements and Operational Supplements are included in this manual following the A page; however, these records can be only as current as this manual.

WARNINGS, CAUTIONS, AND NOTES

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

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

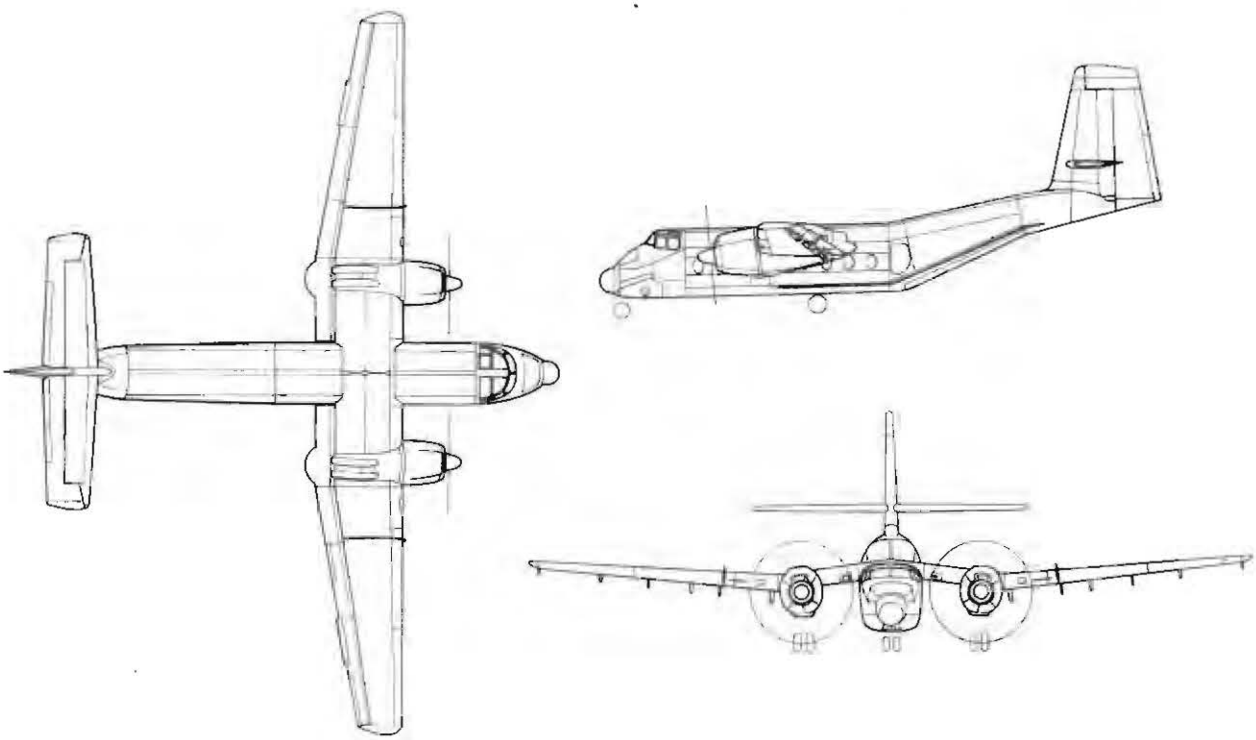
CAUTION Operating procedures, techniques, etc., which will result in damage to equipment if not carefully followed.

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

YOUR RESPONSIBILITY - TO LET US KNOW.

Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded through your Command Headquarters to Warner Robins Air Materiel Area, ATTN: WRNEO, Robins Air Force Base, Georgia.

the aircraft



SECTION I
DESCRIPTION

TABLE OF CONTENTS.

THE AIRCRAFT.

The de Havilland C-7A is an all metal, high wing, land based monoplane powered by two reciprocating engines with full feathering, hydromatic propellers. Reverse thrust is available for aerodynamic braking on the ground. The aircraft has a fully retractable tricycle landing gear and an electrically operated cargo door and ramp located on the aft end of the fuselage. The C-7A can land and take-off on short runways and semi-prepared strips.

INTERIOR.

The fuselage is divided into the cargo compartment and the flight compartment. A sliding door separates the two compartments. The cargo compartment capacity in addition to the flight engineer is 31 passengers or 25 paratroops and equipment. When configurated for aeromedical evacuation the capacity is 20 litters with one attendant, or NATO configuration of 14 litters with 11 seats available for ambulatory patients and medical attendants.

AIRCRAFT DIMENSIONS.

The principal dimensions of the aircraft are:

Wing Span	95 ft 7 1/2 in.
Length	72 ft 7 in.
Height	31 ft 9 in.
Track of outer landing gear wheels	25 ft 8 1/2 in.
Cargo Compartment	
Length	345 in.
Width (Minimum)	73 1/2 in.
Height (Minimum)	75 in.

AIRCRAFT WEIGHT.

The maximum gross weight for normal operations is 28,500 pounds. For detailed weight and loading information refer to Sections V and VII.

CREW.

Crew stations are provided for a pilot, copilot, and a flight engineer. The pilot and copilot are seated on left and right sides, respectively, of the sliding radio console. The flight engineer's station is normally in the center of the flight compartment behind the pilot and copilot. The flight engineer must be seated in the cargo compartment during take-off and landing.

ENGINES.

The aircraft is powered by two Pratt and Whitney Twin Wasp R-2000-7M2, fourteen cylinder, double row radial engines. Each engine incorporates an engine-driven, single-speed supercharger. Two augmentors, which are large tubes that extend aft from the firewall to the wing trailing edge, are installed in each nacelle. Exhaust stacks carry exhaust gases from the cylinders to the forward ends of the augmentors. Open space remains around the stacks where they terminate at the augmentors. The augmentors function as ejection pumps to draw cooling air across the engine, and use the heat energy in the exhaust gas and engine cooling air for additional thrust. Engine fire detectors and an extinguishing system are provided. At take-off, each engine will produce 1450 BHP at 2700 RPM, under standard day conditions at sea level.

ENGINE CONTROLS.

Throttle levers.

Two throttle levers, one for each engine, are located on the overhead console (figure 1-3), and move in a quadrant marked REVERSE PITCH and THROTTLE CLOSED at the aft end, and OPEN at the forward end. The throttles are connected to their respective engine throttle valves by individual mechanical linkage. When both throttles are retarded below a setting of approximately 17-20 inches Hg, a micro-switch is actuated to energize the landing gear warning circuit. A friction lever on the left side of the console increases the friction of both throttles when rotated clockwise. Propeller reversal is effected electrically, when both throttle levers are in the idling position, by moving the levers upwards approximately 1-inch. When the levers are raised, micro-switches are contacted, and hydraulic pressure moves the propeller blades to the reverse pitch stops. The propeller feathering buttons will illuminate, indicating operation of the auxiliary pumps followed by illumination of the propeller reverse blue lights. Reverse power is increased by moving the throttle levers aft.

Mixture levers.

Two mixture levers, one for each engine, are mounted on the overhead console, (figure 1-3), and move in a quadrant marked IDLE CUT-OFF, AUTO LEAN, and AUTO RICH. The mixture levers are connected to their respective carburetors by mechanical linkage. A friction lever on the right side of the console increases the friction of both mixture levers when rotated clockwise. Mixture levers have a detent at the AUTO LEAN setting to minimize the possibility of inadvertent movement to the IDLE CUT-OFF position.

Carburetor hot-air levers.

Two carburetor hot-air levers marked CARB HEAT, LH and RH are located on the overhead console, (figure 1-3), and move in quadrants marked HOT and COLD.

Each lever is mechanically linked to interconnected hot and cold air valves in the related carburetor intake duct. With the lever in COLD the hot air valve is closed and the cold air valve is open to admit ram air, filtered air, or alternate air, whichever is selected on the carburetor air induction switches. With the lever in HOT, the cold air valve is closed and, downstream, the hot air valve is open to admit exhaust heated air. Intermediate positions of the levers may be selected to give varying degrees of carburetor heat.

Carburetor air induction system.

Two carburetor air induction switches, one for each engine, are located on the overhead console. Both switches are located outboard of the right-hand carburetor hot-air lever. The switches are marked CARB AIR with positions ALTERNATE, FILTER, and RAM. When RAM is selected, the ram air valve at the entry of the duct is open and passes unfiltered air direct to the carburetor. When FILTER is selected, the ram air valve is closed and filtered air enters the duct. When ALTERNATE is selected, the ram air valve is closed and an alternate air valve is open to admit cylinder-heated unfiltered air into the duct. Irrespective of the switch selection, normal induction air is excluded when the carburetor hot-air lever is at HOT position. Power is supplied from the emergency bus through a 5-ampere circuit breaker on the main circuit breaker panel.

Note

> The valve actuator motors are of the reversible type. Should electrical failure de-energize the system, the valves will remain in the position at which the failure occurred.

Accessory compartment cooling system selector switch.

A two-position toggle switch on the engine switch panel (figure 1-9) is marked VENT DOORS with positions AUTO-OPEN and CLOSE-MAN. In the AUTO-OPEN position the actuators are automatically controlled by the weight switch on the nose gear. In the CLOSE-MAN position the weight switch is overridden and the doors will remain in the closed position.

IGNITION SYSTEM.

The engine ignition system is a dual magneto type, both magnetos serving each cylinder. The left magneto fires the rear spark plugs, the right magneto fires the front spark plugs, thereby providing two independent sources of ignition.

general arrangement

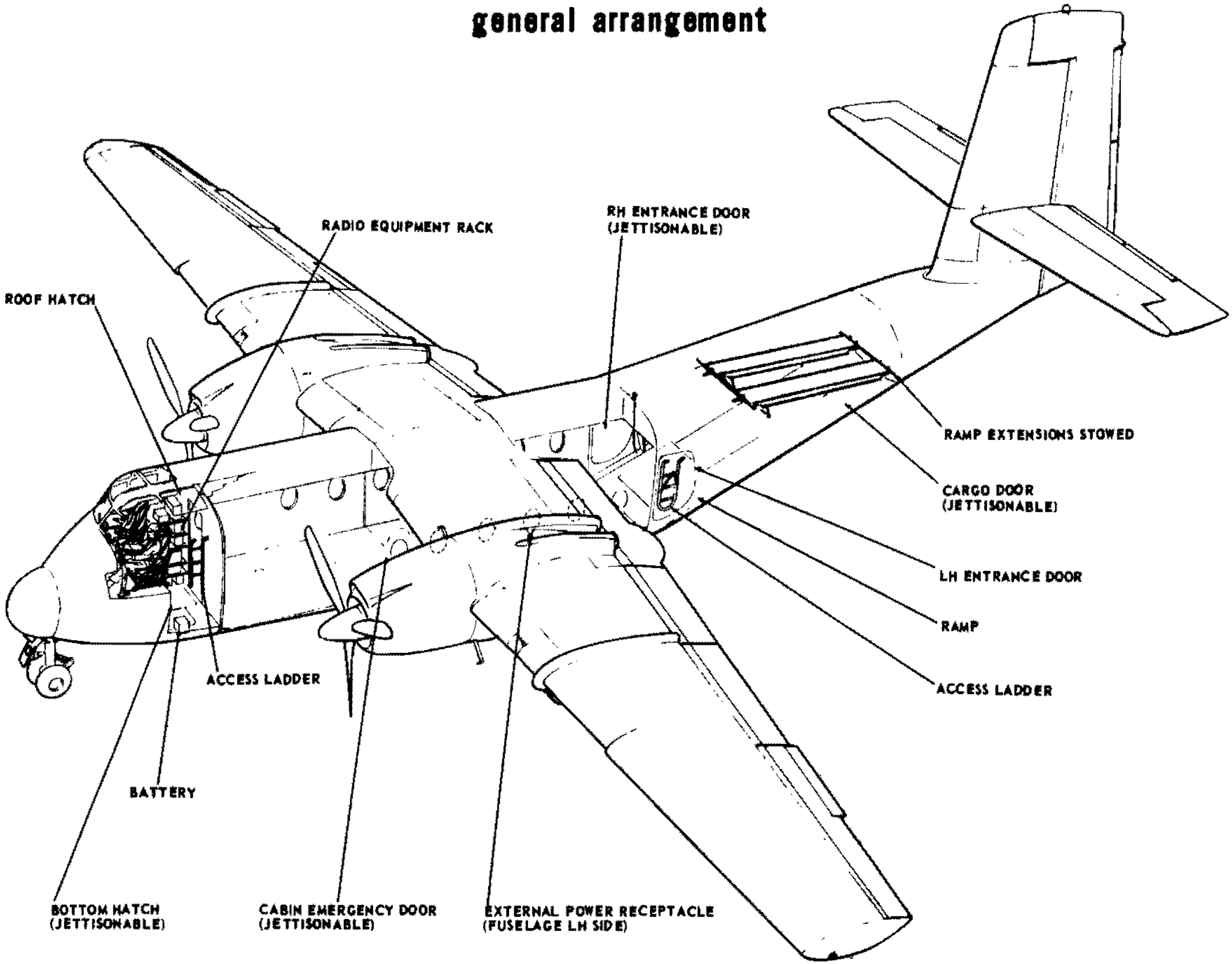
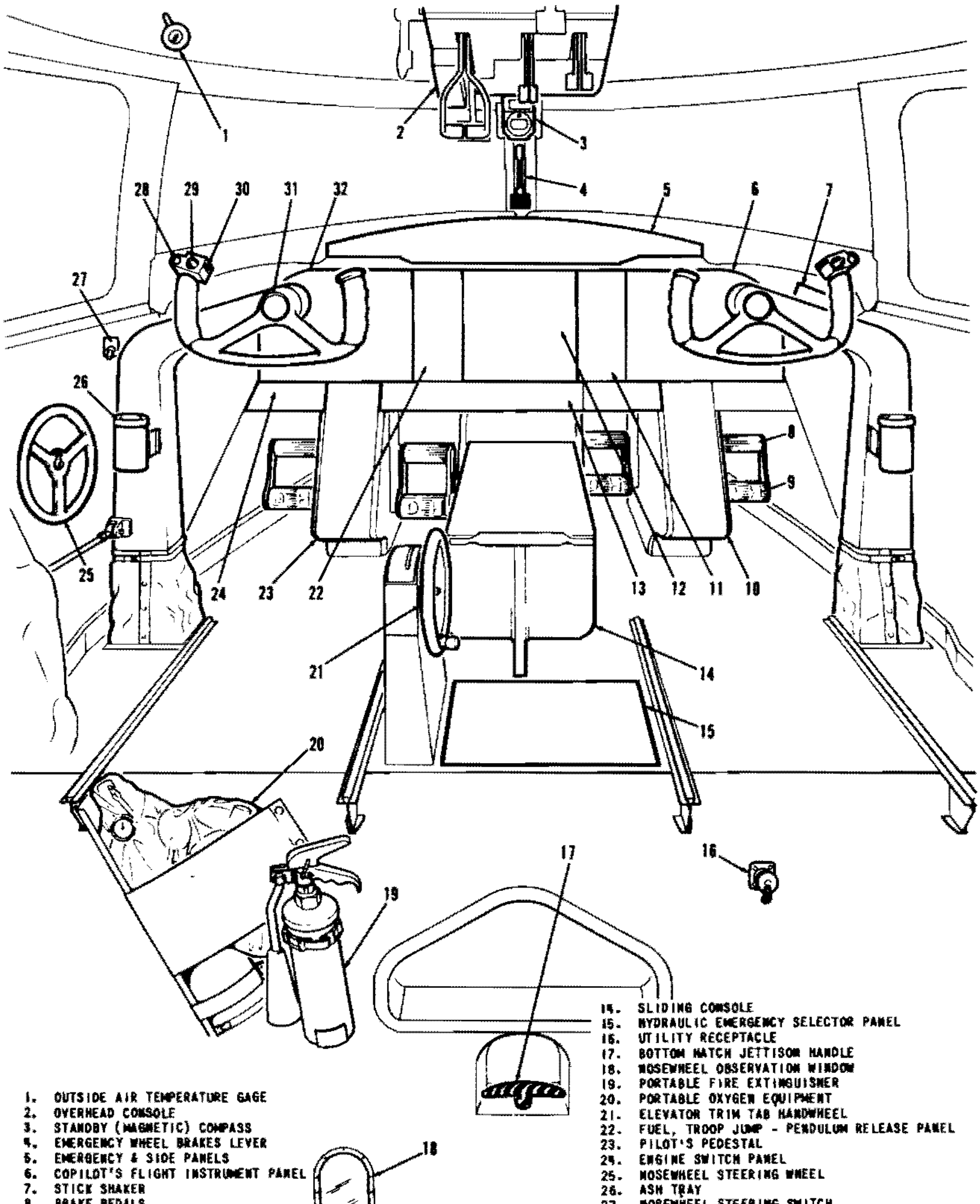


Figure 1-1 General Arrangement

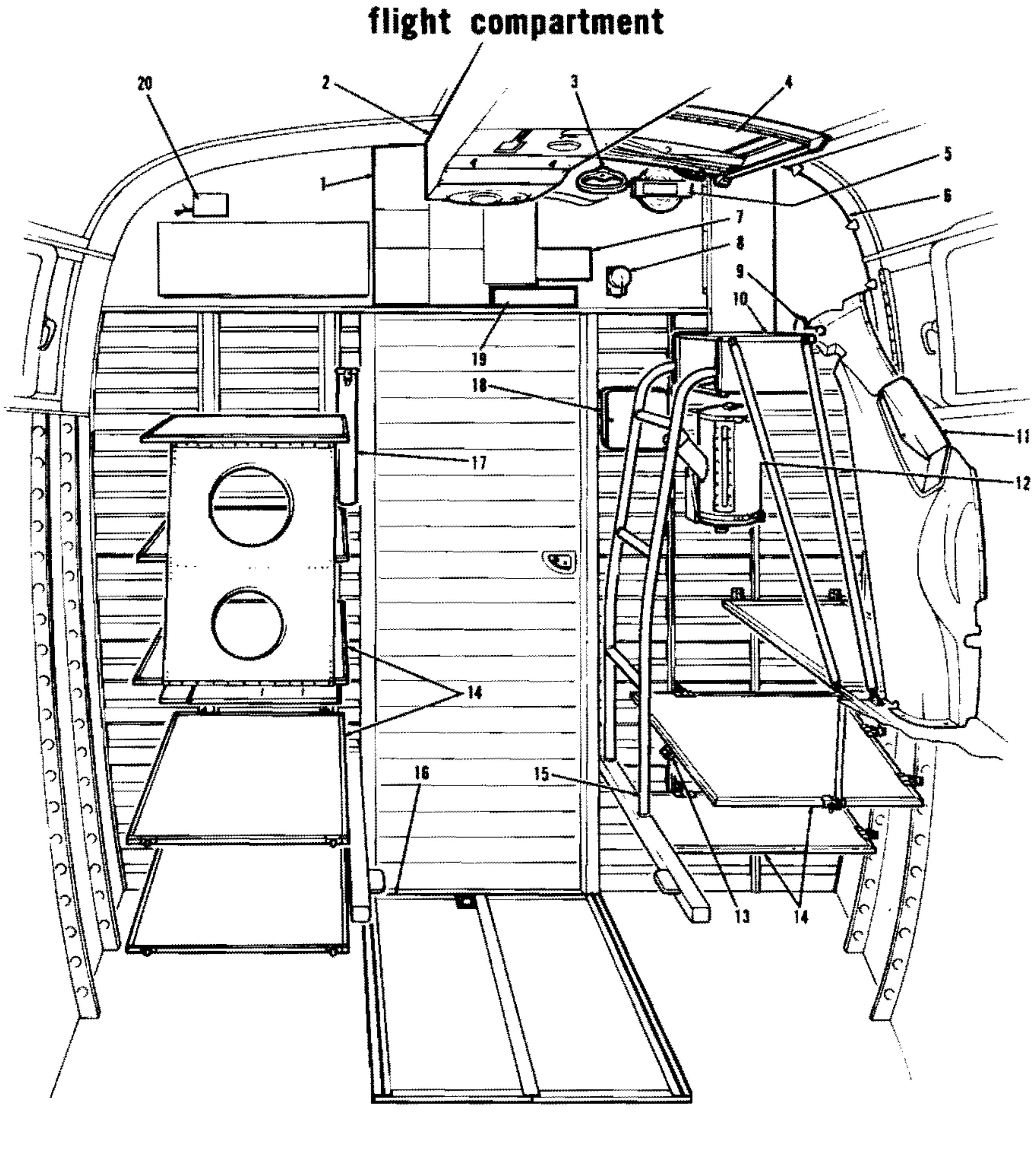
flight compartment



1. OUTSIDE AIR TEMPERATURE GAGE
2. OVERHEAD CONSOLE
3. STANDBY (MAGNETIC) COMPASS
4. EMERGENCY WHEEL BRAKES LEVER
5. EMERGENCY & SIDE PANELS
6. COPILOT'S FLIGHT INSTRUMENT PANEL
7. STICK SHAKER
8. BRAKE PEDALS
9. RUDDER PEDALS
10. COPILOT'S PEDESTAL
11. VOLTAMMETER, AC-DC POWER & DEICING PANELS
12. ENGINE INSTRUMENT PANEL
13. CENTER SWITCH PANEL
14. SLIDING CONSOLE
15. HYDRAULIC EMERGENCY SELECTOR PANEL
16. UTILITY RECEPTACLE
17. BOTTOM HATCH JETTISON HANDLE
18. NOSEWHEEL OBSERVATION WINDOW
19. PORTABLE FIRE EXTINGUISHER
20. PORTABLE OXYGEN EQUIPMENT
21. ELEVATOR TRIM TAB HANDWHEEL
22. FUEL, TROOP JUMP - PENDULUM RELEASE PANEL
23. PILOT'S PEDESTAL
24. ENGINE SWITCH PANEL
25. NOSEWHEEL STEERING WHEEL
26. ASH TRAY
27. NOSEWHEEL STEERING SWITCH
28. AUTO PILOT RELEASE BUTTON (PROVISION)
29. AILERON TRIM TAB SWITCH
30. MICROPHONE SWITCH
31. CONTROL COLUMN
32. PILOT'S FLIGHT INSTRUMENT PANEL

4-1-3

Figure 1-2 (Sheet 1 of 2) Flight Compartment



1. CIRCUIT BREAKER AND FUSE PANELS
2. OVERHEAD CONSOLE
3. MAIN GEAR EMERGENCY EXTENSION HANDLE
4. ROOF HATCH
5. EMERGENCY SLIDE
6. HEATING CONTROL PANELS
7. TACAN/RADAR ALTIMETER C.B. PANEL
8. IGNITION ANALYZER RECEPTACLE
9. HYDRAULIC PRESSURE SHUT-OFF VALVE HANDLE
10. FIRST AID KIT STOWAGE
11. MAP AND DATA CASE
12. HYDRAULIC FLUID RESERVOIR AND SIGHT GAGE
13. H.F. LOAD UNIT DC CONTROL CIRCUIT BREAKER
14. RADIO EQUIPMENT RACKS
15. ACCESS LADDER
16. FLOOR DOOR
17. WEIGHT AND BALANCE COMPUTER
18. SPARE LAMPS AND FUSES STOWAGE
19. CARGO DOOR AND RAMP FORWARD SWITCH PANEL
20. WEATHER RADAR C.B. PANEL

N-1-2

Figure 1-2 (Sheet 2 of 2) Flight Compartment

Ignition switches.

Two ignition switches are located on the overhead console (figure 1-3), and are marked IGNITION, each having positions marked OFF, R, L, and BOTH. The switches control the supply of electrical energy from the magnetos to the spark plugs. When in the Off position the switch grounds the circuit of both magnetos.

Induction vibrator switch.

An induction vibrator, three-position toggle switch, marked VIB, L, and R is located on the engine switch panel (figure 1-9) and is spring-loaded to the center (off) position. When in either L or R position, power from the main bus is directed through the STARTING circuit breaker to the respective engine induction vibrator and from there to the right-hand magneto, providing a boosted spark for engine starting.

ENGINE PRIMING.

The engine priming system provides for atomized fuel to be injected into the supercharger throat preparatory to starting the engine.

Primer switch.

The primer three-position toggle switch is located on the engine switch panel (figure 1-9) and is spring-loaded to the center (off) position, and is marked PRIME, L, and R. When held in either the L or R position, the circuit to the respective primer valve is energized from the main bus through the 10-ampere circuit breaker, thus opening the valve and, with the booster pump operating, fuel is injected into the supercharger throat through the priming jets.

STARTER.

The starter system for each engine consists of a direct-cranking starter and a starter relay. Electrical power for the starter is taken from the main bus through the 10-ampere starting circuit breaker.

Starter switch.

The starter three-position toggle switch is located on the engine switch panel (figure 1-9) and is marked L and R for the left and right engines respectively, and is spring-loaded to the center (off) position. When the switch is operated, power is supplied through the 10-ampere STARTING circuit breaker to the starter relay, which closes to complete the circuit to the starter motor.

ENGINE INSTRUMENTS.

The engine instruments, (figure 1-4) one complete set for each engine, are mounted on the engine instrument panel and the center portion of the electrical switch panel immediately below. A manifold pressure gage and a tachometer are each dual instruments, combining readings from both engines on a single dial. See figure 5-1 for the operating ranges and limitation markings.

Manifold pressure gage.

The manifold pressure gage is an electrically-operated autosyn type and registers the intake manifold pressures of both engines. The instrument has a single dial with dual pointers rotating about a common axis. The pointers are marked L and R to indicate left and right engine readings respectively. AC power is supplied by the operating inverter through the 26-volt, 400-cycle AC bus through a 1-ampere fuse.

Tachometer.

The tachometer is a dual instrument and is powered by an engine-driven tachometer generator on each engine; it indicates the speed of each engine in rpm. Dual pointers rotating about a common axis register on a single dial, the pointers being marked L and R for the left and right engines respectively.

Carburetor air temperature gage.

The carburetor air temperature gage is an electrically-operated resistance type and is connected to a resistance bulb located at the carburetor air intake of the engine. Power is supplied from the emergency bus through the 5-ampere engine instrument circuit breakers.

Cylinder head temperature gage.

The cylinder head temperature gage is an electrically-operated resistance type connected to a resistance bulb in No. 2 cylinder of the engine. Power is supplied from the emergency bus through the 5-ampere engine instrument circuit breakers.

Fuel pressure gage.

The fuel pressure gage is an electrically-operated autosyn gage which registers fuel pressure at the carburetor inlet. Power is supplied by the inverter through the 26-volt, 400-cycle AC bus through the 1-ampere engine instrument fuses.

Oil pressure gage.

The oil pressure gage is an electrically-operated autosyn gage which registers oil pressure at the engine rear case. Power is supplied by the inverter through the 26-volt, 400-cycle AC bus through the 1-ampere engine instrument fuses.

Oil temperature gage.

The oil temperature gage is an electrically-operated resistance type and registers oil inlet temperature. Power is supplied from the emergency bus through the 5-ampere engine and instrument circuit breakers.

overhead console-typical

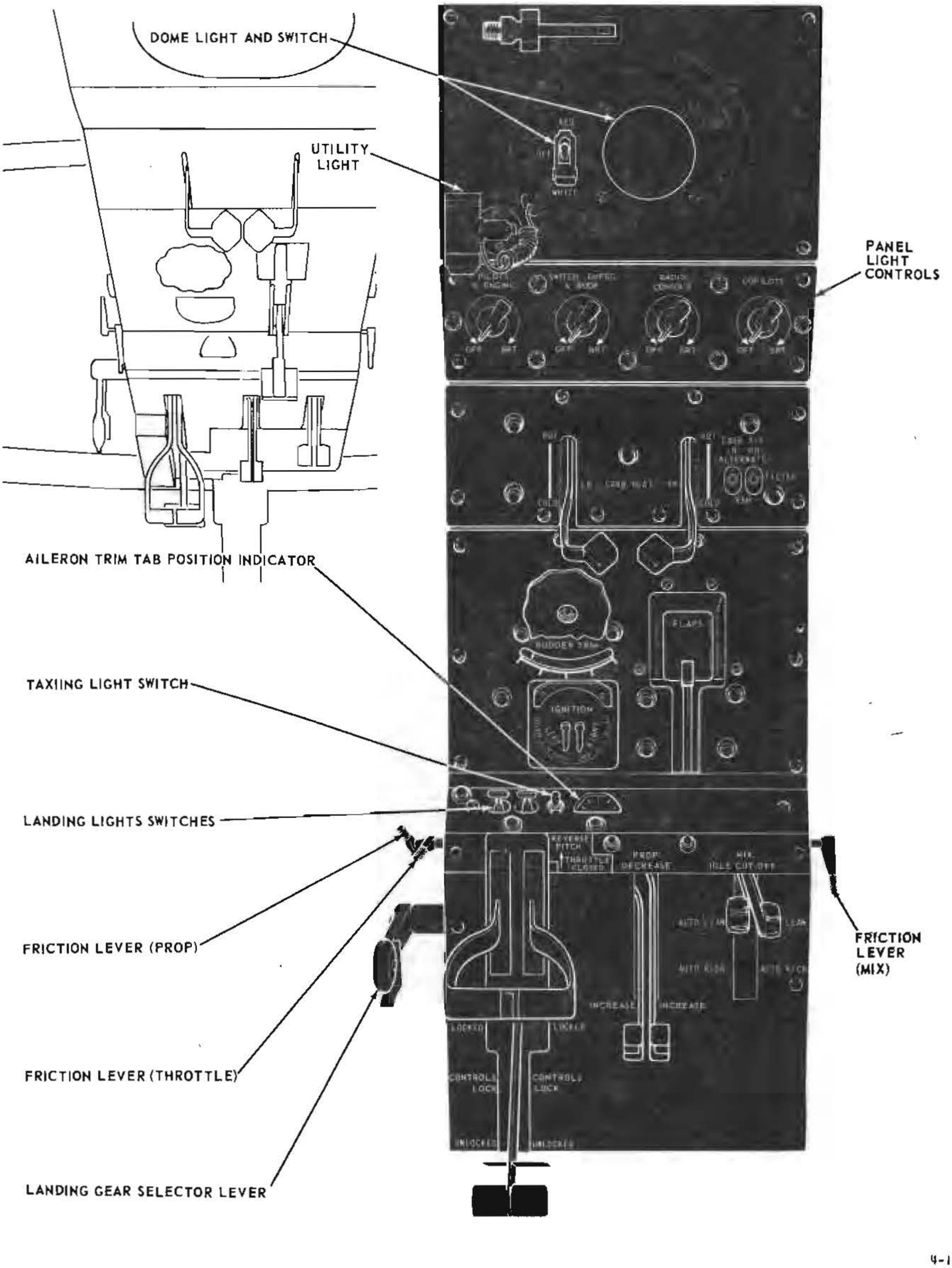


Figure 1-3 Overhead Console - Typical

Oil low pressure warning light.

An amber press-to-test warning light (figure 1-4) marked LOW OIL PRESS is provided for each engine and are located on the engine instrument panel. The light will illuminate when the respective engine oil pressure drops below 45 ± 2 psi. Power is supplied from the emergency bus and the circuit is protected by the 5-ampere circuit breaker marked PRESS WARN, FUEL & OIL.

Low oil level warning light.

An amber press-to-test warning light (figure 1-4) marked LOW OIL LEVEL is provided for each engine oil tank, and they are located on the engine instrument panel. The main purpose of the lights is to indicate when oil transfer should take place if long range ferry fuel and oil tanks are installed. (Refer to Section VII for ferry tanks installation.) The lights however, will provide an indication of low oil level at all times, and will illuminate when approximately 9 gallons of oil have been used (approximately 11.4 usable gallons remaining) in the respective tank. Power is supplied from the emergency bus and the circuit is protected by the 5-ampere circuit breaker marked PRESS WARN, FUEL & OIL.

Fuel low pressure warning light.

A red press-to-test warning light (figure 1-6) is provided for each engine. The lights are marked LH and RH ENGINE LOW PRESSURE, for the left and right engines respectively. A light will illuminate when fuel pressure at the carburetor inlet on the engine drops below 15 psi. Power is supplied from the emergency bus and the circuit is protected by the 5-ampere circuit breaker marked PRESS WARN, FUEL & OIL.

CHIP DETECTOR WARNING LIGHTS.

Two amber press-to-test warning lights are located on the right emergency side panel (figure 1-18). The lights, one for each engine, are marked CHIP DETECTOR and provide visual indication of a possible impending engine failure due to material failure (e.g. ferrous chips). These chips are detected by a magnetic chip detector plug installed in the oil sump drain and rocker manifold drain of each engine. The plug is connected electrically to the warning light and, when particles bridge an electrically insulated gap, the circuit is completed to activate the warning light. The circuit is protected by a 5-ampere circuit breaker marked CHIP DET.

PROPELLERS.

The aircraft is equipped with three-bladed, full feathering reversible pitch Hamilton Standard hydromatic propellers. Governor settings are controlled from the flight compartment by means of the propeller lever for the respective engine. Automatic and manual feathering controls are provided, auto-feathering being provided for use during take-off only. Propeller reversing is effected electrically by moving the throttle levers approximately one-half inch upwards in the idling or closed position. Engine power is increased by moving the throttle levers further aft. Propeller governing does not take place in reverse pitch, the propeller acting as a fixed-pitch unit of minus 8 degrees. Engine speed must not be allowed to exceed 2700 rpm. The propeller control unit contains the propeller system fluid supply, which is independent of the engine oil supply, and which is pressurized by a main pump geared to the engine shaft. An auxiliary pump and electrical motor provide pressurized fluid when needed to assist or take the place of the main pump. A governor in the unit controls the constant speed operation. The propeller electrical system is powered from the main bus through circuit breakers on the ENGINE circuit breaker panel. The propeller manual feathering circuits are protected by the 10-ampere LEFT and RIGHT circuit breakers, and the auto-feathering switch circuit by the 5-ampere AUTOM. SW. circuit breaker. The propeller reverse circuit is protected by the 10-ampere PROP REV circuit breaker.

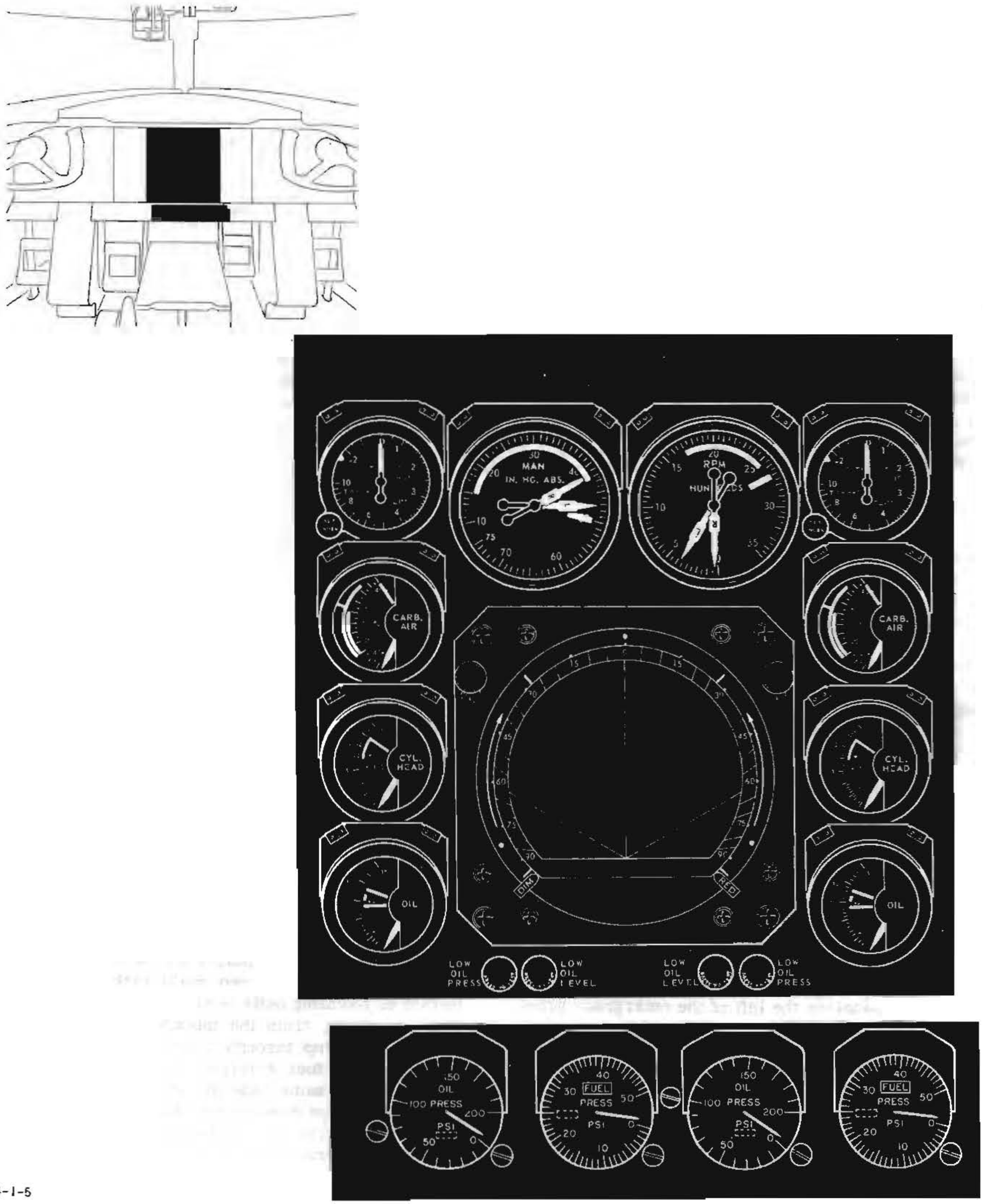
Propeller levers.

Two propeller levers are located on the overhead console (figure 1-3) and move in a quadrant marked PROP. INCREASE, and DECREASE. A friction lever marked PROP, on the left side of the overhead console, increases the friction of both propeller levers when rotated clockwise.

Propeller feathering buttons.

Two guarded propeller feathering buttons are on the emergency panel (figure 1-18). Each button is marked FEATHER-PUSH, UNFEATHER-PULL. The action of depressing a button operates the auxiliary pump to supply hydraulic pressure to feather the propeller. During the feathering operation a red light in the button remains illuminated. When the feathering cycle is completed the button is automatically released to the neutral position. After feathering has started the feathering cycle can be stopped by pulling the button out to the neutral position. If this is done before engine speed has dropped below approximately 500 rpm, the blades will return to the pitch corresponding to the rpm setting of the governor. If engine speed has dropped below 500 rpm, the normal unfeathering procedure should be observed. After a propeller has been completely feathered, unfeathering is accomplished by pulling out the button until propeller rotation begins (500 - 600 rpm) and then releasing it to the neutral position. During the unfeathering operation the light in the button will illuminate, and will go out when the button is released. Once the propeller is rotating, the blades will return to the pitch setting of the governor.

instrument panel (engine)-typical



4-1-5

Figure 1-4 Instrument Panel (Engine) - Typical

Autofeathering switch.

A two-position toggle switch at the left of the emergency panel (figure 1-18) is marked AUTO FEATHERING, ON and OFF. The switch electrically arms the automatic feathering circuit from the main bus through the 5-ampere propeller feather automatic switch circuit breaker. Once the system is armed operation is automatic. Any variation in thrust in excess of 45 ± 2 1/2% between the two engines will result in automatic feathering of the propeller on the engine developing the lower thrust. When a propeller has been automatically or manually feathered, a blocking relay in the circuit prevents the other propeller from feathering automatically. The autofeathering system will operate with either or both manual feathering circuit breakers pulled.

Autofeathering indicator light.

A green, press-to-test, indicator light (figure 1-18) adjacent to the autofeathering switch, is powered from the main bus through the 5-ampere propeller feather automatic switch circuit breaker and will illuminate when the autofeathering switch is selected ON, and will go out when the switch is selected OFF. It will also go out if either propeller is feathered while the automatic feathering switch is ON.

Propeller fluid low level lights.

Two amber lights, one for each propeller hydraulic system, are located adjacent to the respective feathering button, and are marked PROP OIL. Power is supplied from the main DC bus through the 10-ampere propeller reverse circuit breaker. A light will illuminate if the oil level in the respective propeller integral oil control drops approximately 3.3 quarts below the fully serviced level of 13.3 quarts.

Note

> With thrust indicating system selector in the EMERG OFF position, the thrust indicators are inoperative. However, the autofeather system will operate because the differential pressure switch is connected directly to the thrust indicator pitot heads.

Propeller reverse indicator light.

Two blue lights, one for each propeller, are mounted on the side panel to the left of the emergency panel, and marked PROP REVERSE. The lights are actuated by the propeller No. 2 blade micro-switch when the blades reach approximately 7 degrees reverse pitch. The power for the system is from the main DC bus through the propeller reverse 10-ampere circuit breaker.

OIL SYSTEM.

Each engine has a separate oil system. Each system consists primarily of an oil tank, an oil cooler, an engine-driven oil pump, an oil emergency shutoff valve, an oil dilution valve, piping and controls for engine lubrication, and oil dilution. The oil tank has a total volume of 29.7 gallons, consisting of 22.2 gallons of oil, 20.4 gallons of which is usable oil, and 7.5 gallons airspace. A flap, adjustable on the ground, is incorporated in the oil cooler air exit duct and is normally set in the down (closed) position except in extreme hot weather conditions. For oil specification and grade, and oil quantity data, see figure 1-19.

Oil emergency shutoff switches.

Two guarded oil emergency shutoff switches, one for each engine, are on the emergency panel, (figure 1-18), and each is marked OIL SHUTOFF with the guard marked HYD & ENG. Each switch is electrically connected to the fuel, hydraulic, and oil emergency shutoff valves of its respective engine and, in addition, the respective propeller deicing circuits are routed through this switch. When the switch is selected to the up position, the emergency shutoff valves of that engine are simultaneously closed by power from the emergency bus, through the 5-ampere fuel and oil valve circuit breaker and propeller deicing is rendered inoperative on that side.

Oil dilution switches.

Two oil dilution switches, marked OIL DILUTION, L, R, and OFF and ON, are located at the extreme left side of the engine switch panel (figure 1-9). They are two-position, momentary-contact, toggle switches spring-loaded to the OFF position. When the switches are held to the ON position the oil dilution valves in the fuel and oil systems are opened by power from the main bus through the 10-ampere starter circuit breaker to allow fuel to be metered into the oil system.

FUEL SYSTEM.

Fuel is carried in two main tanks (figure 1-5) which have a total capacity of 4968 pounds (828 gallons). One tank is located in each outer wing and consists of ten rubber cells interconnected by a manifold which drains into the inboard (No. 1) cell. On some aircraft, the inboard five cells in each wing are of self-sealing construction, with No. 1 cell having an armor plated cell access panel. The total capacity of the two main tanks which incorporate self-sealing cells is 4836 pounds (806 gallons). Fuel is drawn from the inboard cell by an engine-driven fuel pump through a fuel tank selector valve, strainer, and fuel emergency shutoff valve to the engine on the same side as the tank. An electrically driven fuel boost pump in the inboard cell is provided to: (1) augment the engine-driven fuel pump; (2) provide fuel pressure in the event of failure of the engine-driven fuel pump; and (3) provide fuel pressure for crossfeed operation. A crossfeed line and a fuel tank crossfeed valve enable fuel from either tank to be supplied to the engine on the opposite side.

Fuel system-schematic-typical

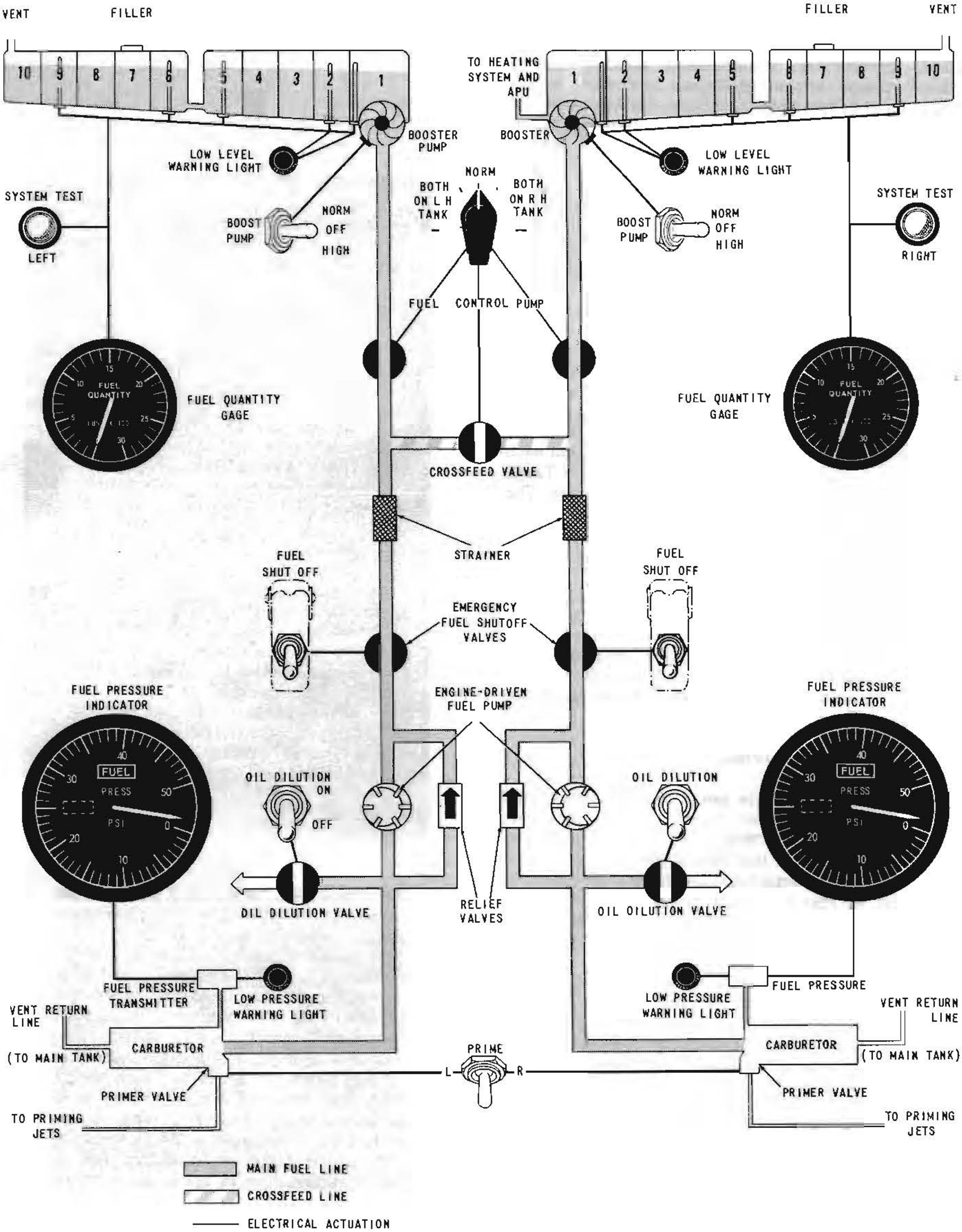


Figure 1-5 Fuel System Schematic - Typical

Each tank has a filler neck in No. 7 cell, and is vented to the wing undersurface. For fuel specification see figure 1-19. A fuel panel in front of the pilot and to the left of the engine instrument panel incorporates the fuel tank selector switch, booster pump switches, fuel quantity indicators, fuel low level warning lights, fuel quantity test switches, and fuel low pressure warning lights. (For long range ferry fuel system refer to Section VII.)

Fuel tank selector switch.

The rotary type fuel-tank selector switch located on the fuel panel (figure 1-6), on some aircraft, has four positions marked, in sequence from the left, OFF, BOTH ON RH TANK, NORMAL, and BOTH ON LH TANK. On some aircraft the switch has four positions marked, in sequence from the left, OFF, BOTH ON LH TANK, NORM, and BOTH ON RH TANK. On all Model C-7A aircraft, when the switch is OFF the fuel supply to both engines is shut off; at BOTH ON RH TANK fuel is pumped from the right tank to both engines; at NORMAL the crossfeed valve is closed and fuel is fed from each tank to its respective engine; at BOTH ON LH TANK fuel is fed from the left tank to both engines. The switch is connected electrically to two motor-driven selector valves and a motor-driven crossfeed valve in the fuel supply lines. Power is supplied from the emergency bus through the 5-ampere fuel and oil valve circuit breaker. A spring-loaded button, to the right of the selector, must be depressed before the switch can be moved to the OFF position. A line schematic of the fuel system is marked on the fuel panel and indicates the fuel flow to the engines both in the normal and crossfeed positions of the switch.

Fuel booster-pump switches.

Two three-position toggle switches on the fuel panel (figure 1-6) are marked BOOST PUMP; the three positions are marked NORM, OFF, and HIGH. The switch should be in the NORM position for take-off, climb, and landing to insure an adequate fuel supply at normal pressure in the event of failure of the engine-driven fuel pump. For cruising, the switch should normally be in the OFF position. In the HIGH position, sufficient pressure is available, should an engine-driven fuel pump fail, for the normal operation of both engines from one tank. The switches electrically control the actuation of the related fuel booster pumps and are powered from the main bus through the 20-ampere boost pump circuit breakers.

Fuel quantity gages.

Two fuel quantity gages are located on the fuel panel (figure 1-6). They are marked USABLE FUEL and are calibrated from 0 to 3000 pounds in 100 pound increments. The gages are used with electrical capacitance type probes to indicate the amount of usable fuel in the related tanks. Power is supplied

fuel panel – typical

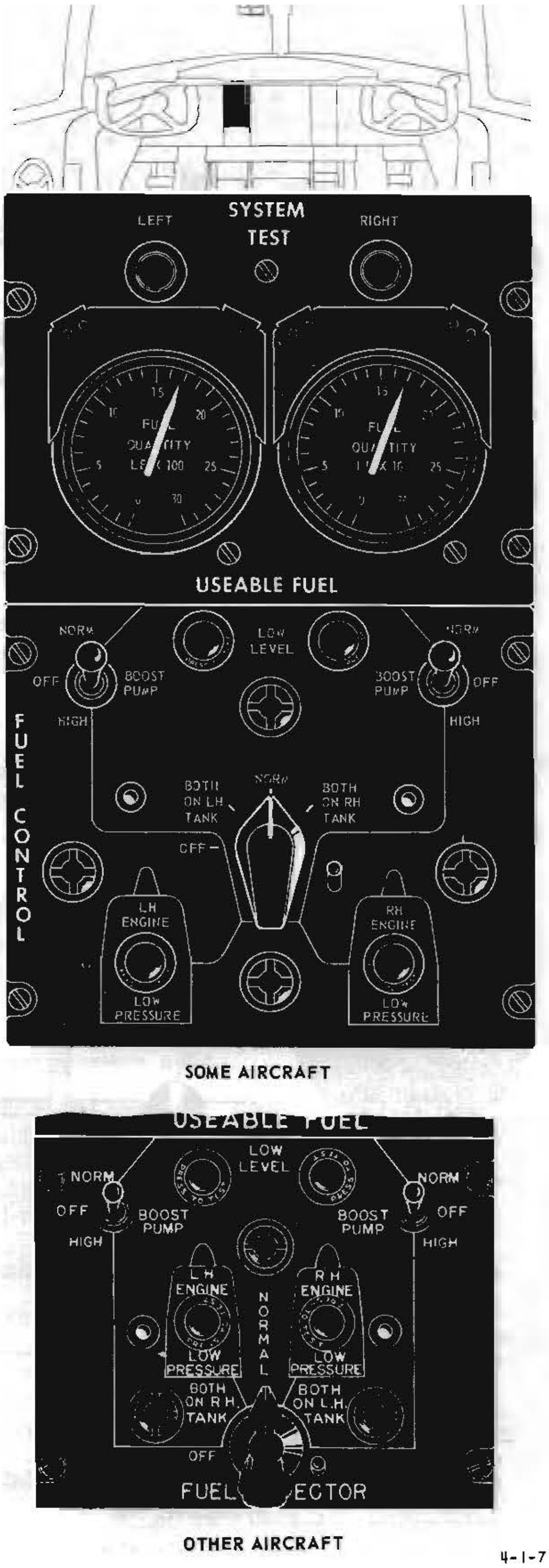


Figure 1-6 Fuel Panel - Typical

by A-phase 115-volt, 400-cycle AC from the inverter through the 1-ampere fuel quantity fuses.

Fuel quantity indicating system test switches.

Two button-type test switches (figure 1-6) on the fuel panel, immediately above the fuel quantity gages, are marked SYSTEM TEST and LEFT and RIGHT respectively. When the switches are pressed, the pointers in the related fuel quantity gages should fall to zero.

Fuel low level warning lights.

Two amber press-to-test fuel low level warning lights, one for each tank, are located on the fuel panel (figure 1-6) and marked LOW LEVEL. The warning lights are set to illuminate when the fuel in the relevant tank drops below 110 pounds (100 pounds when self-sealing tanks are installed). Power is supplied from the emergency bus through the 5-ampere engine instrument circuit breakers.

Fuel emergency shutoff switches.

Two guarded emergency switches marked FUEL SHUT OFF are located on the emergency panel (figure 1-18). Each switch is connected to a shutoff valve in the fuel supply line to its respective engine. When selected up, the respective shutoff valve is closed. Power is supplied from the emergency bus through the 7-ampere fuel and oil valves circuit breaker.

ELECTRICAL POWER SUPPLY SYSTEM.

The electrical power supply system is primarily a 28-volt direct current installation. It is supplemented by a 115-volt, 400-cycle alternating current installation, powered by the dc system through an inverter.

DIRECT CURRENT POWER SUPPLY SYSTEM.

The DC system is a 28-volt, single conductor system grounded to the aircraft structure. Power is supplied by two engine-driven, 300-ampere, 30-volt generators regulated to a nominal 28 volts, with a 24-volt, 34-ampere-hour battery as a standby source; and through an external power supply for ground operations. Power is distributed through a multiple bus network consisting of a main, secondary, emergency and battery bus (figure 1-7).

Generator switches.

Two generator switches are located on the electrical power panel (figure 1-11) in front of the copilot's position and are marked LH GEN and RH GEN respectively with positions marked ON, OFF and RESET. With the switch at ON the respective generator will be connected to the main bus, provided the generator output is 0.35 to 0.70-volt greater than the main bus voltage. The RESET position of the switch activates the tickler to restore the generator field circuit if the generator field relay trips due to excessive voltage (32-34) in the system. When the generator drops off the line due to an undervoltage condition, it will automatically return to the line when the proper voltage is restored.

Generator warning lights.

Two generator press-to-test red warning lights marked GEN WARN, are located adjacent to their respective generator switches on the electrical power panel (figure 1-11). The appropriate light will illuminate if the output of the respective generator does not exceed the main bus output by 0.35 to 0.70-volt. The lights intensity can be controlled by the warning lights intensity switch. The generator warning lights circuit is protected by the 5-ampere circuit breaker marked GEN WARN LIGHTS on the DC power section of the circuit breaker panel. (See figure 1-10.)

Voltammeters.

Two voltammeters marked DC, one for each generator, are located above the DC electrical power panel (figure 1-11), and indicate the main bus voltage and the amperage (or load) on the respective generator. Each indicator has two scales, one marked VOLTS and the other AMPS. Red and black colored test jacks, marked VOLTMETER, LH AMMETER and RH AMMETER, are located adjacent to the flight compartment heating control panel.

Battery.

A 24-volt, 34-ampere-hour nickel cadmium battery and a sump jar, are located below the flight compartment floor. (See figure 1-1.) Access is gained through a hatch in the flight compartment floor hatch well.

Battery master switch.

The guarded battery master switch is located on the engine switch panel, (figure 1-9), and is marked BATTERY MASTER and OFF at the up and down positions respectively. With the switch in the BATTERY MASTER position, the battery energizes the main bus if generator output voltage is less than battery voltage. With the switch in the OFF position the battery supplies power to the battery bus only. With the battery master switch OFF and the emergency bus switch at EMERG, the battery is directly connected to the emergency bus.

Main bus.

The main bus distributes power necessary for normal flight operation, and is energized by one or both generators when the appropriate generator switches are ON and a generator voltage output is 0.35 - 0.70-volt greater than the main bus voltage output, or output provided by external power. When the generator output is less than stipulated (e.g. two generator failure) the main bus will be energized by

DC electrical system- schematic-typical

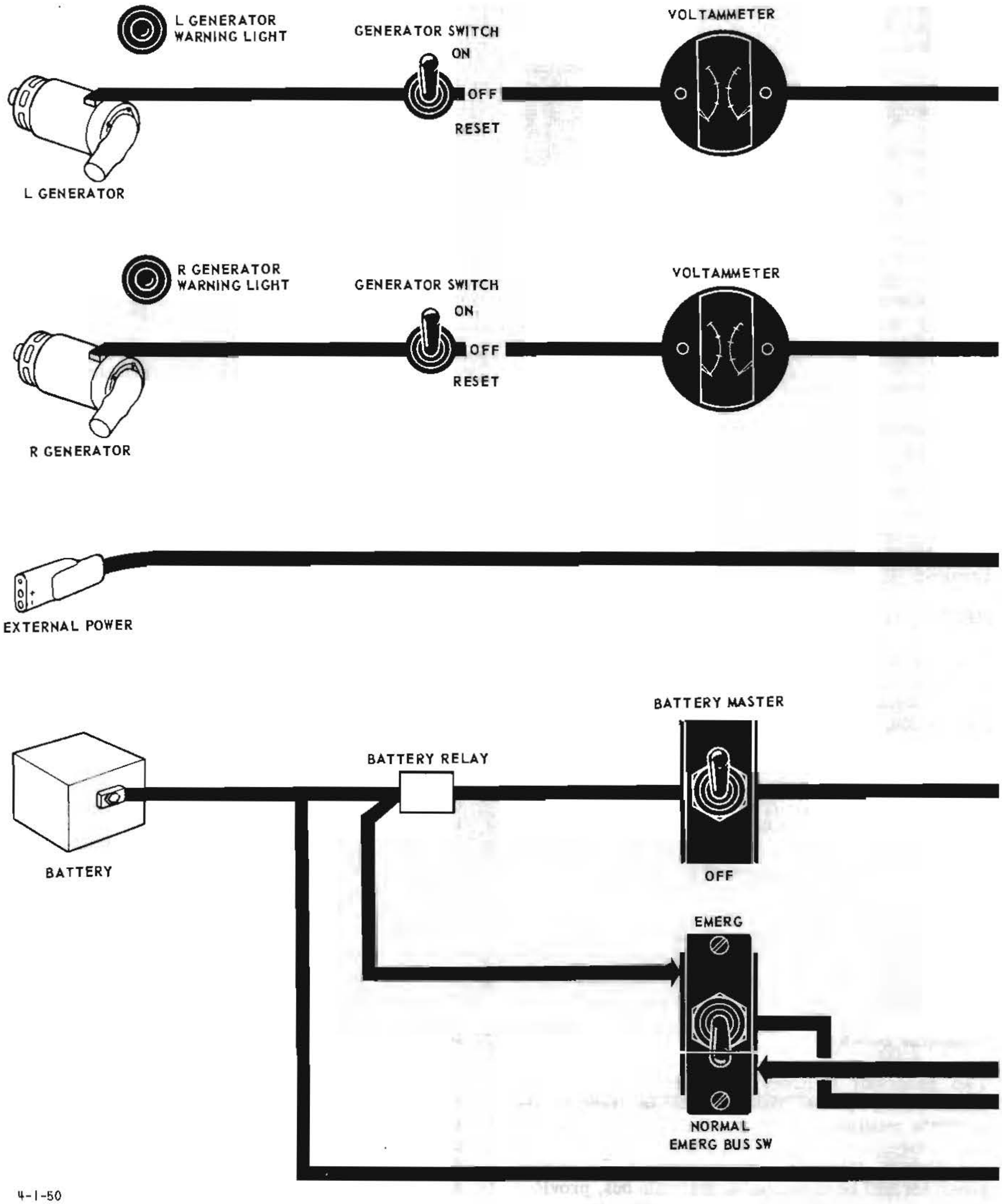


Figure 1-7 (Sheet 1 of 2) DC Electrical - Schematic - Typical

DC electrical system-schematic-typical

Figure 1-7 (Sheet 2 of 2) DC Electrical - Schematic - Typical

the battery, provided the battery master switch is at BATTERY MASTER.

Secondary bus.

The secondary bus (figure 1-7) distributes power to electrical equipment considered of secondary importance to flight safety. The secondary bus is energized from the main bus through the secondary bus relay and two bus control relays. Each generator energizes its own bus control relay; should one generator fail, the secondary bus will be deenergized. However, should certain items of electrical equipment supplied by the secondary bus be required for flight, the secondary bus may be supplied from the remaining generator by selecting ON the SEC BUS RESET switch to override the secondary bus relay.

Secondary bus reset switch.

The secondary bus reset switch is located on the circuit breaker panel (figure 1-10) and is marked SEC BUS RESET. The switch is guarded and when the guard is down the switch is OFF. If a generator fails, the guard and switch may be selected up to override the secondary bus relay and allow the selection of services normally powered from the secondary bus.

Emergency bus.

The emergency bus distributes power to items of electrical equipment considered essential to flight safety, and is normally powered from the main bus. Should failure of both generators cause main bus power to fail, then the battery will automatically supply the main bus, and thus the emergency bus also. Under these conditions battery power should be conserved by switching the EMERG BUS SW to EMERG and the BATTERY MASTER switch to OFF. This will deenergize the main bus and allow the emergency bus to be supplied directly from the battery.

Emergency bus switch.

The emergency bus switch is located on the circuit breaker panel (figure 1-10) and is marked EMERG BUS SW with positions EMERG and NORMAL. In the normal positions, the main bus supplies the emergency bus; in the emergency position the emergency bus is connected directly to battery power.

Battery bus.

The battery bus (figure 1-7) is energized from the battery and supplies power to the flight compartment dome and the utility light on the overhead console.

Circuit breakers.

The main circuit breaker panels are located on the forward face of the flight compartment rear bulkhead aft of the pilots position. Radar circuit breakers are located in the top right corner of the same bulkhead. Heater circuit breakers are located on the heater control panel on the left top side of the same bulkhead. An HF power control circuit breaker is located on the left radio shelf under the hydraulic reservoir. The cargo compartment utility and static line retriever circuit breaker is located on the left side of the cargo compartment at the extreme forward end. The cargo door and ramp door circuit breakers are located in the ceiling at the aft end of the cargo compartment on the ramp and door control panel. All circuit breakers are of the thermal, push-to-reset type.

External power receptacle.

The external power receptacle (figure 1-20) is located on the left side of the fuselage adjacent to the main gear. An access door protects the receptacle when not in use. When an external power source is connected to the receptacle the main, secondary, and emergency DC buses are energized.

DC utility receptacle.

Four covered DC utility receptacles are provided in the aircraft, one in the flight compartment on the right side near the floor doors, one on the left forward side of the cargo compartment under the static line retriever storage mounts, one on the interior lights panel facing the left passenger door, and one in the tail section aft of the cargo door opening. The flight compartment receptacle is powered from the main bus and is protected by the 10-ampere circuit breaker marked FRONT; the two rear receptacles are powered from the secondary bus and are protected by the 20-ampere circuit breaker marked REAR. The forward fuselage receptacle is powered from the main bus and protected by a 50-ampere circuit breaker marked UTILITY RETRIEVER.

ALTERNATING CURRENT POWER SUPPLY SYSTEM.

The AC power supply system consists of three 115-volt 400-cycle, 3 phase inverters and one single phase 400-cycle inverter, which converts 28-volt DC to 115-volts AC power.

MAIN/STANDBY INVERTER.

The main/standby inverters provide power to the AC instrument buses (figure 1-8). On some aircraft the main inverter is powered from the secondary bus and the standby inverter from the emergency bus. With these two buses energized, automatic changeover from the main to standby inverter takes place if the main inverter fails, or if the external power source is disconnected from the aircraft when the engines are inoperative and the inverter switch and battery MASTER switch are at MAIN and BATTERY MASTER. On some aircraft the main and standby inverters are powered by the emergency bus. Automatic changeover on these aircraft only occurs when the main inverter fails. The circuits are protected

AC electrical system-schematic-typical

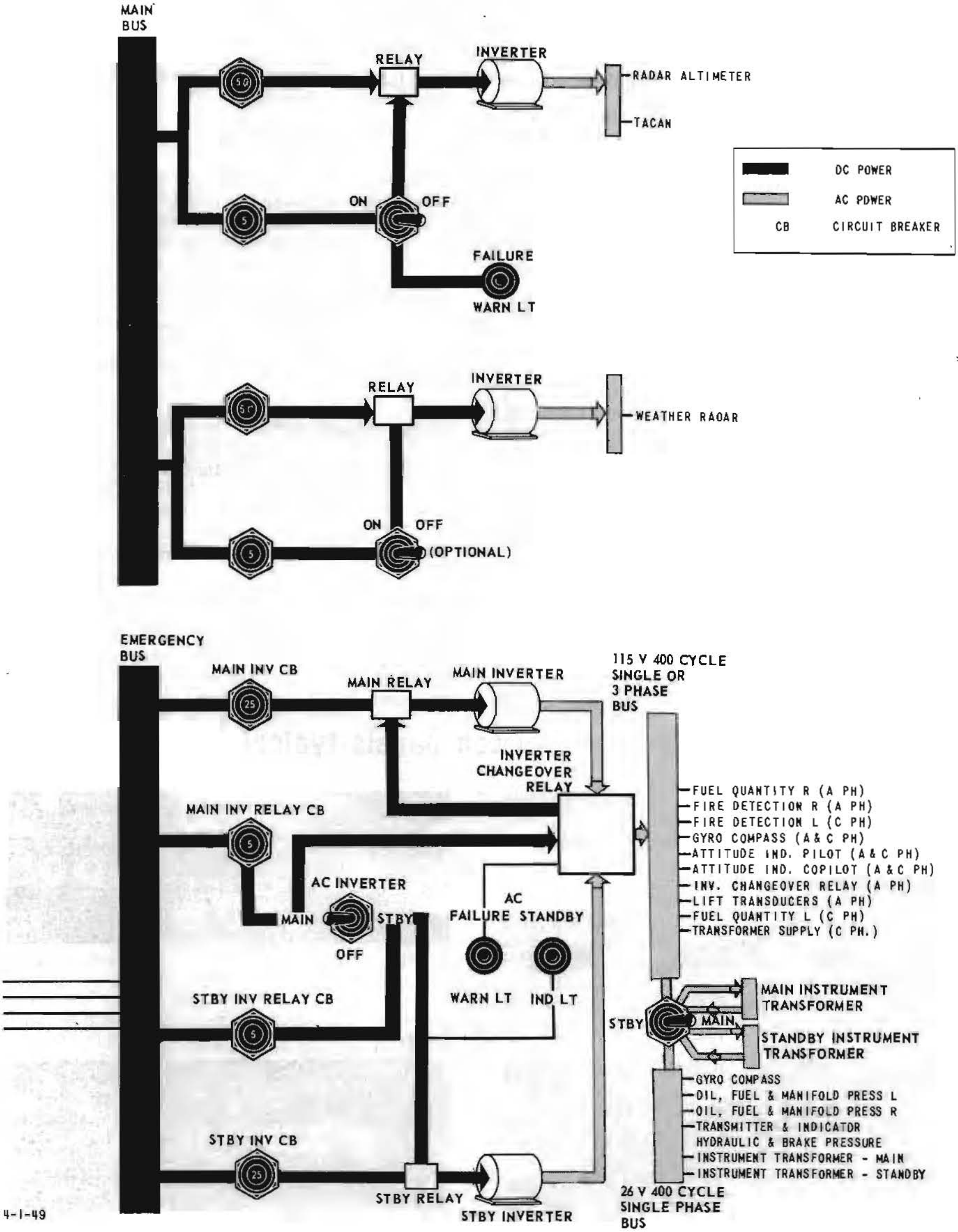


Figure 1-8 AC Electrical - Schematic - Typical

by 25-ampere circuit breakers labeled INVERTER POWER MAIN and STANDBY.

WEATHER RADAR INVERTER.

The weather radar inverter, 115-volt 400-cycle, 3 phase provides AC power to operate the WEATHER RADAR SYSTEM.

TACAN/RADAR ALTIMETER INVERTER.

The tacan/radar altimeter inverter, 115-volt, 400-cycle, single phase, is powered by the main DC bus and provides power to operate the tacan/radar altimeter systems.

Inverter switches.

The main/standby inverter switch is a three-position toggle switch located on the electrical power panel (figure 1-11) in front of the copilot's position. The switch is marked INVERTER with positions marked MAIN, OFF, and STBY. When selected to MAIN or STBY the inverter energizes the AC instrument buses. When the switch is selected to OFF, both inverter circuits are deenergized. The TACAN/RADAR ALTIMETER inverter switch is located on a panel below the main standby inverter switch (figure 1-11). The weather radar inverter is controlled by either the RADAR MASTER switch or the RADAR INVERTER switch, either of which is located on the sliding radio console (figure 4-9).

AC failure light.

In conjunction with the main/standby inverters an AC failure warning light marked FAILURE is located on the AC power panel (figure 1-11). The light will illuminate if the inverter switch is at OFF, if the inverter switch is at STBY and the standby inverter fails, or if the inverter switch is at MAIN and both inverters fail. The light circuit is protected by the 3-ampere circuit breaker marked FAILURE LIGHT on the INVERTERS section of the circuit breaker panel.

AC standby inverter light.

An AC standby light marked STANDBY is located on the electrical power panel (figure 1-11). The light will illuminate when the main inverter fails and the standby inverter comes into operation, and also when the inverter switch is in the STBY position. The light circuit is protected by the 5-ampere circuit breaker marked RELAYS-STANDBY on the INVERTERS section of the circuit breaker panel.

Tacan/radar altimeter inverter AC failure light.

An AC failure warning light marked FAILURE is located on the TACAN/RADAR ALTIMETER control panel (figure 1-11). The light will illuminate if the inverter switch is ON, but the output of the inverter is not within normal voltage limits.

Alternating current instrument transformers.

Two 115/26 volt AC instrument transformers, main and standby, reduce the 115-volt AC supply from the inverter to provide 26-volt AC for the flight and engine instruments. Two one-ampere fuses, MAIN and STBY, protect the circuits to each transformer against overload.

electrical switch panels-typical

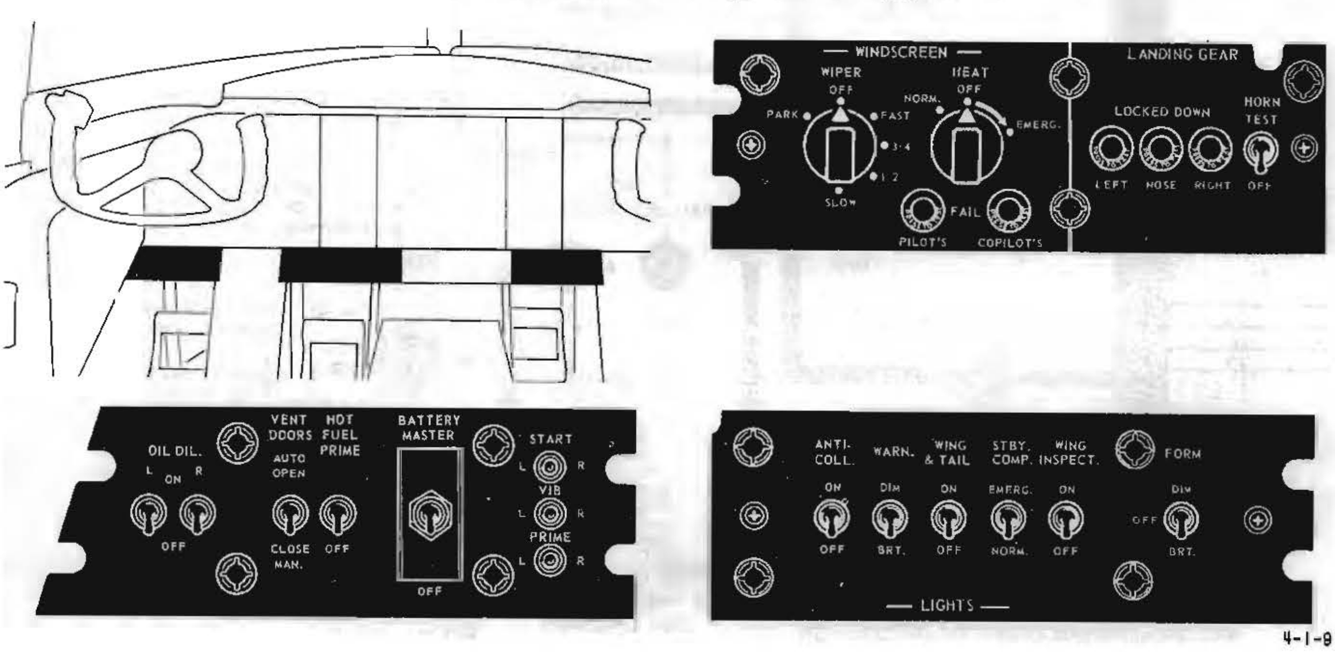
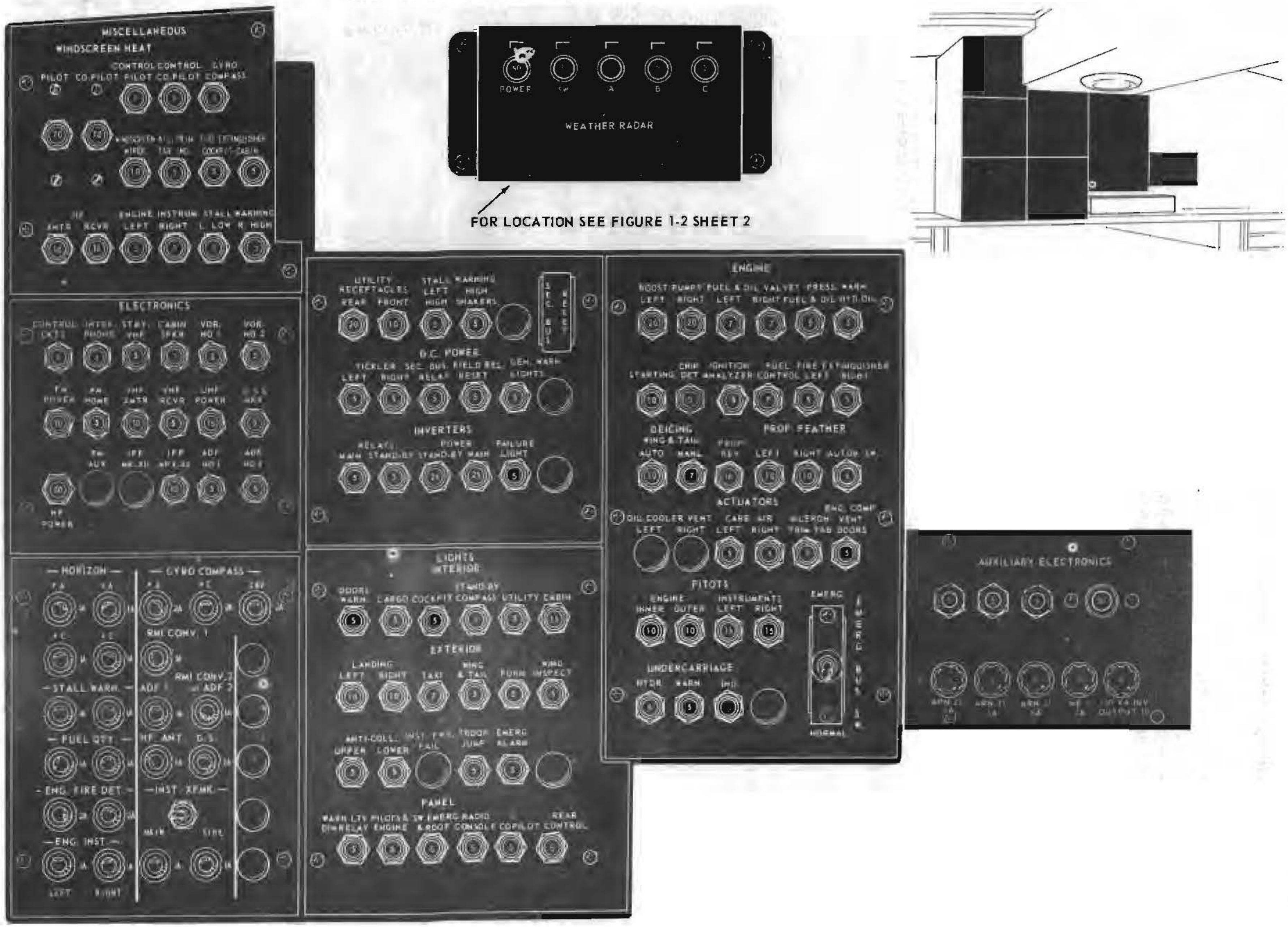


Figure 1-9 Electrical Switch Panels - Typical

circuit breaker and fuse panels -typical



FOR LOCATION SEE FIGURE 1-2 SHEET 2

4-1-10

Figure 1-10 Circuit Breaker and Fuse Panels - Typical

Instrument transformer selector switch.

An instrument transformer switch on the AC fuse panel (figure 1-10) is marked INST. TRANSFORMER, with positions MAIN and STBY. Malfunction of the main instrument transformer will be indicated by illumination of the 26 V AC failure light. Positioning of the selector switch to STBY will allow the instruments to be powered through the standby instrument transformer.

Instrument transformer failure light.

An instrument transformer failure light on the copilot's flight instrument panel (figure 1-16), is marked 26 V AC. The light will illuminate if the 26-volt AC power from the main instrument transformer fails.

HYDRAULIC POWER SUPPLY SYSTEMS.

The normal hydraulic system (figure 1-12) is primarily powered by two engine-driven hydraulic pumps, one on each engine, which supply fluid at pressure from the hydraulic reservoir to operate the landing gear, wing flaps, wheel brakes, and nose wheel steering circuits. In the event of a malfunction of the engine-driven pumps, or when they are inoperative, power can be supplied for operation of all the circuits of the normal hydraulic systems by means of a manually-actuated hydraulic handpump in the flight compartment, provided the handpump selector (figure 1-14) is positioned at NORMAL SYSTEM. In the event of low fluid level in the hydraulic reservoir, or malfunctioning of the system, the handpump can be used to supply power for the emergency system, provided the handpump selector is positioned at EMERGENCY SYSTEM. In this condition the handpump draws fluid from the emergency reserve level of the hydraulic reservoir to replenish the wheel brakes hydraulic accumulator and to extend the nose gear, provided the brake accumulator handpump charging and nose gear down handpump selectors are at ON.

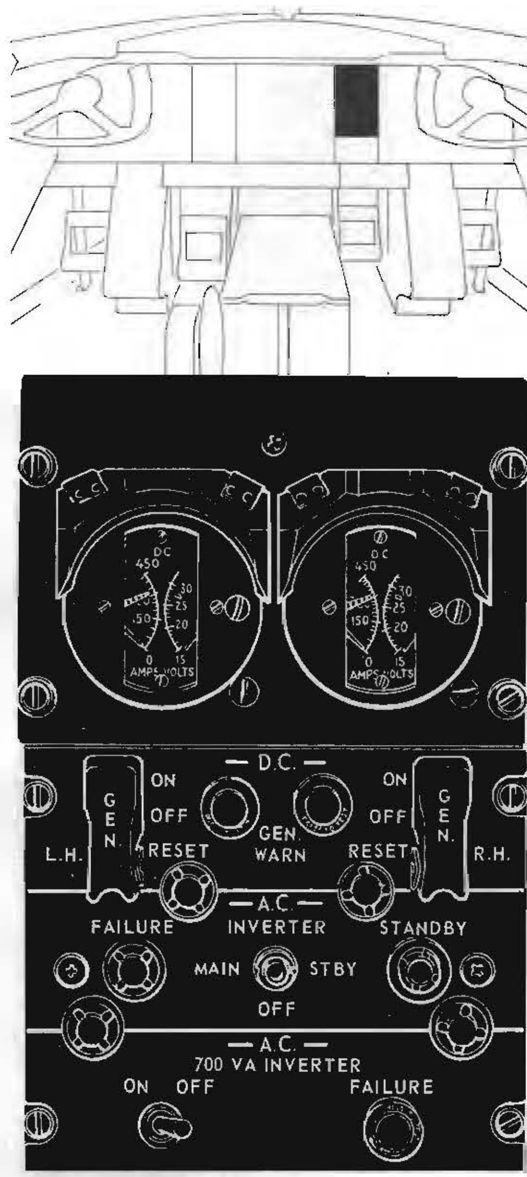
NORMAL HYDRAULIC SYSTEM.

The normal hydraulic system consists of the engine-driven hydraulic pumps, hydraulic reservoir, filters, check valves, thermal relief valves, a hydraulic system pressure gage, pressure switches, low pressure warning lights, a pressure shutoff valve, and the handpump. Fluid drawn from the reservoir by the engine-driven pumps is supplied at a regulated nominal pressure of 3000 psi to the actuating cylinders of the various hydraulic circuits, through a series of filters, selector valves, check valves, and restrictors. The handpump is used to supply power in the event of malfunctioning of the engine-driven pumps, or when they are inoperative.

Hydraulic reservoir and sight gage.

The hydraulic reservoir is installed forward of the bulkhead behind the pilot's seat. A sight gage on the reservoir is marked at the full and refill points. The total capacity is 1.8 gallons with 0.28 gallon expansion space. The normal system has 1.17 gallon usable, with 0.35 gallon reserved by a standpipe for emergency use.

ac-dc power panels



4-1-11

Figure 1-11 AC - DC Power Panels

Hydraulic pressure shutoff valve lever.

The hydraulic pressure shutoff lever is immediately forward of the cabin and flight compartment heating control panels, on the bulkhead behind the pilot's seat. The lever is marked HYDRUULIC PRESSURE SHUT-OFF VALVE with positions marked ON and OFF, the forward position of the lever being ON and the aft position OFF. In the event of a serious loss of fluid in flight, selection of the lever to OFF shuts off the hydraulic fluid supply to all circuits. The fluid in the

hydraulic system-schematic

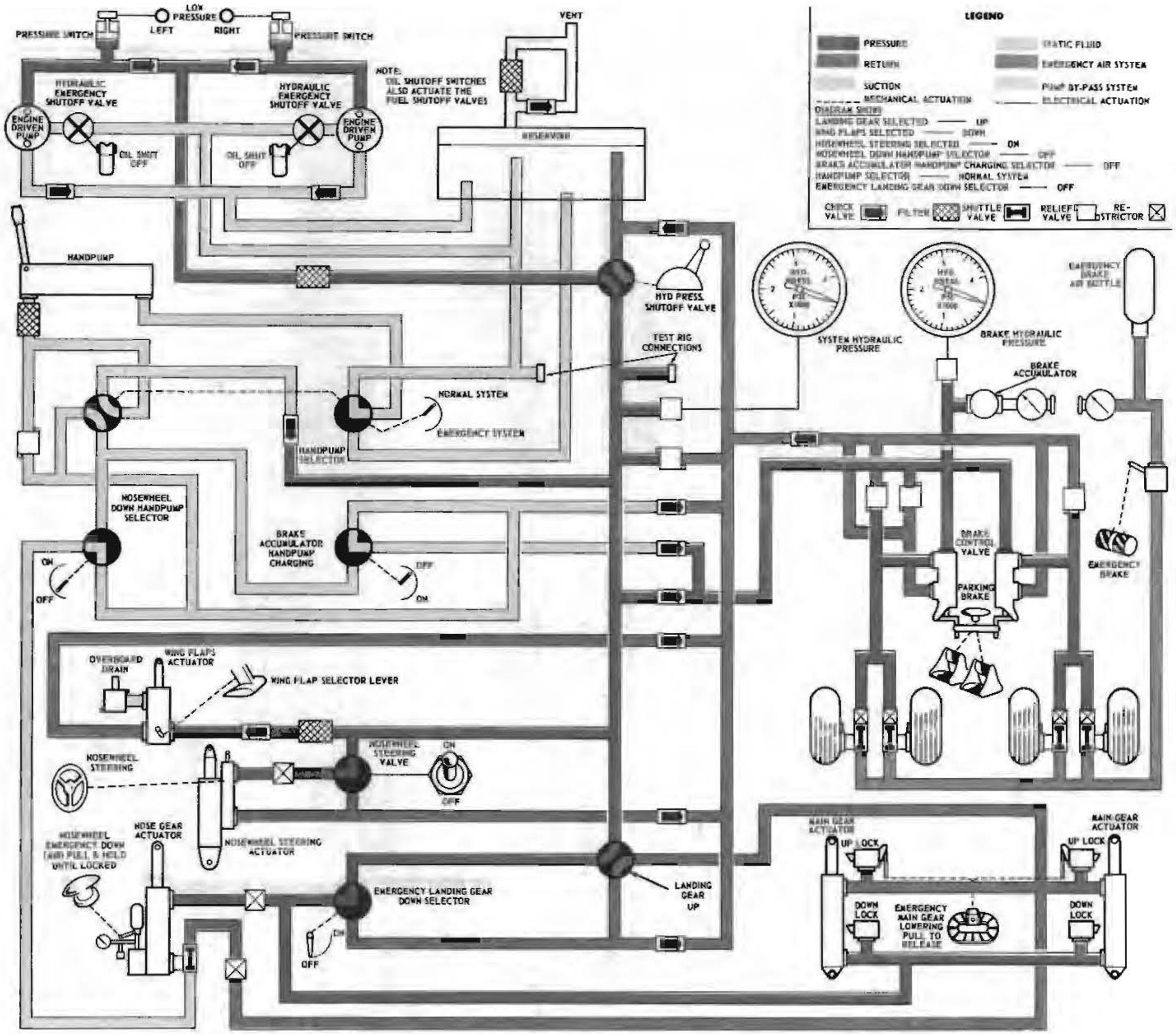


Figure 1-12 Hydraulic System-Schematic

4-1-12

wheel brake system, however, will permit the brakes to be operated enough times for a normal landing, provided the brake hydraulic pressure gage is registering near normal pressure before applying the brakes.

CAUTION

The hydraulic pressure shutoff valve lever must not be left in an intermediate position. A closed or partially closed valve will cause excessive heating of the hydraulic fluid due to restriction of flow and resultant damage to hydraulic system seals.

Hydraulic system pressure gage.

The hydraulic system pressure gage mounted on the pilot's pedestal (figure 1-13), is remotely operated by an electro-hydraulic pressure transmitter connected to the pressure line of the normal hydraulic system. Power is taken from the 26-volt, 400-cycle AC bus, protected by a 1-ampere fuse labeled ENG INST RIGHT. The gage is marked SYSTEM HYDRAULIC PRESSURE and is calibrated from 0 to 4000 psi.

Hydraulic low pressure warning lights.

Two hydraulic low pressure amber warning lights are mounted above the hydraulic pressure gage on the pilot's pedestal (figure 1-13) and are marked HYDRAULIC PUMPS, LOW PRESSURE, and LEFT and RIGHT respectively. The press-to-test lights are powered from the main bus and will go out when the pressure in their respective systems reaches 1500 psi, and will illuminate when the pressure drops to 1100 psi. The lights are protected by a 5-ampere circuit breaker labeled PRESS WARN HYD OIL. Malfunctioning of one pump does not appreciably affect the system except for a slight increase in retraction time of the landing gear and does not, therefore, constitute an emergency. The low pressure warning lights are provided to give an indication that a pump is defective.

Note

The low pressure warning lights may flicker during gear extension under certain conditions, but a momentary flicker does not indicate a fault in the system.

EMERGENCY HYDRAULIC SYSTEM.

The emergency hydraulic system consists of the hydraulic handpump and four selector valves (figure 1-14). The four selector valves are for nosewheel down, brake accumulator charging, landing gear emergency down, and system selection. The system is used, in the event of low fluid level in the hydraulic reservoir or malfunctioning of the normal hydraulic system, to supply fluid at pressure from the emergency reserve level of the reservoir to replenish the wheel brakes hydraulic accumulator and to extend the nose gear. Before the system can be used, the handpump selector must be positioned at EMERGENCY SYSTEM and each of the other three selectors at ON as desired.

Hydraulic handpump and handle.

The hydraulic handpump is beneath an access door in the flight compartment floor at the forward left side of the sliding console (figure 1-14). The removable handpump handle is stowed in clips on the back of the copilot's seat and, when inserted into the handpump socket, can be actuated with a fore-and-aft motion to supply pressure to the hydraulic system.

Hydraulic handpump selector.

The hydraulic handpump selector on the hydraulic emergency selector panel (figure 1-14) is marked HANDPUMP SELECTOR, with positions NORMAL SYSTEM and EMERGENCY SYSTEM. When positioned at NORMAL SYSTEM, the hydraulic handpump can be actuated to supply pressure to the normal hydraulic system in the event of malfunction of the engine-driven pumps or when they are inoperative. When positioned at EMERGENCY SYSTEM, the handpump can only be used to replenish the wheel brakes hydraulic accumulator and to extend the nose gear, provided their selectors are at ON. When the panel cover is raised, an internal microswitch activates two lights powered from the main bus through a 5-ampere circuit breaker labeled UTILITY.

Note

The emergency hydraulic system does not extend the main gear. The main gear emergency extension is mechanically actuated.

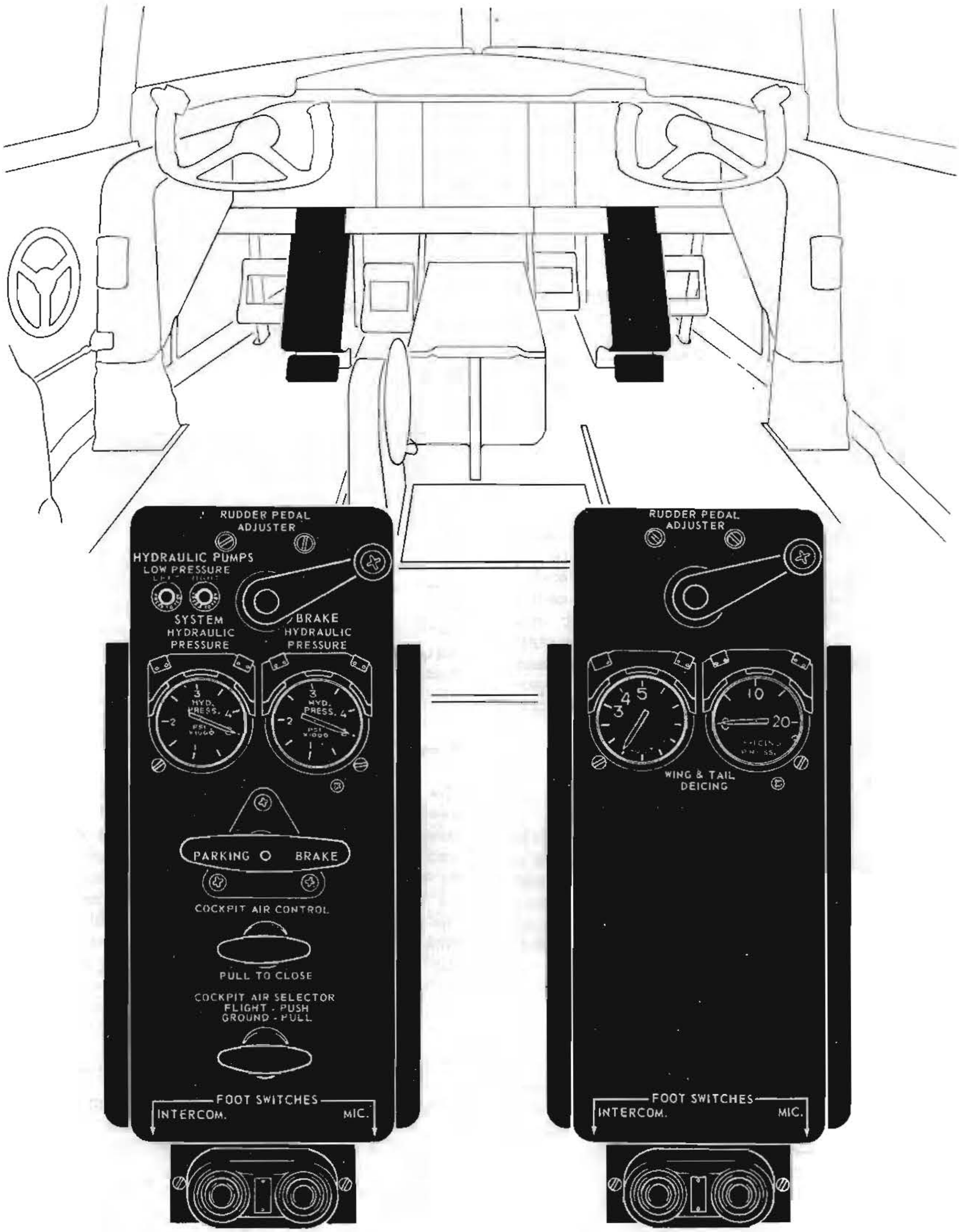
FLIGHT CONTROLS.

The primary flight control surfaces consist of ailerons , elevators, and rudder. They are actuated mechanically from either the pilot's or copilot's position by interconnected and conventional wheel-type control columns and rudder pedals. The range of aileron movement, however, varies in accordance with the position of the wing flaps. Trim tabs, operated from the flight compartment, are located on the right outboard aileron, the elevators, and on the rudder. An artificial stall warning system is incorporated.

Control column.

A control column with a W-type control wheel (figure 1-2) is provided at both the pilot's and copilot's positions. Movement of the control column fore or aft mechanically actuates the elevators and controls the aircraft in the pitching plane. Rotation of the control wheel mechanically actuates the ailerons and provides lateral control of the aircraft. A momentary contact aileron trim tab switch, a microphone switch, and space provision for an automatic pilot release button are provided on the outboard handgrip of each control wheel.

pilot and copilot pedestals



4-1-13

Figure 1-13 Pilot and Copilot Pedestals

Aileron trim switch.

The momentary contact aileron trim tab switch on the control wheel (figure 1-2 sheet 1) is marked L/W DWN and R/W DWN with arrows indicating the direction of movement. The switch electrically operates the trim tab, hinged to the right outboard aileron, through an actuator in the aileron powered from the secondary bus, protected by a 5-ampere circuit breaker labeled AILERON TRIM TAB. The deflection of the trim tab is shown on the aileron trim tab position indicator.

Aileron trim tab position indicator.

The aileron trim tab position indicator is located on the overhead console (figure 1-3). The indicator is operated electrically, and is powered from the secondary bus through the aileron trim tab circuit breaker. The pointer moves over a scale graduated in increments of 3.75° and shows the deflection of the trim tab. The extremities of the scale are marked L and R. Tab travel is: UP 15° ± 1°, DOWN 15° ± 1°.

Elevator trim tab handwheel.

The elevator trim tab handwheel is mounted on a pedestal at the right of the pilot's seat (figure 1-2 sheet 1). Rotation of the handwheel mechanically actuates the elevator trim tabs. The position of the elevator trim tabs is indicated by a pointer in a window at the top of the pedestal which is marked NOSE DOWN (forward), TAKE-OFF RANGE, and NOSE UP (aft). Each indicator graduation represents 5° of tab travel. Tab travel is: UP 10° ± 1°, DOWN 20° ± 1°.

Rudder pedals.

Rudder pedals (figure 1-2, sheet 1), which mechanically operate the rudder, are provided at both the pilot's and copilot's positions. Toe brake pedals, which are an integral part of the rudder pedals, are located immediately above them. Each rudder bar can be adjusted for reach by a handle marked RUDDER PEDAL ADJUSTER, on the pedestals in front of the pilot's and copilot's positions.

Rudder trim tab handwheel.

The rudder trim tab handwheel on the overhead console (figure 1-3) is marked RUDDER TRIM. Rotation of the handwheel mechanically actuates the rudder trim tab. The position of the trim tab is indicated by a pointer moving over a scale adjacent to the handwheel. The scale is graduated in increments of 7.5° of tab travel, and is marked LH at one end and RH at the other. Tab travel is: LEFT $15^\circ {+2^\circ \atop -1^\circ}$ RIGHT $15^\circ {+2^\circ \atop -1^\circ}$.

Controls gust lock handle.

The gust lock handle is located immediately forward of the throttles on the overhead console (figure 1-3). The handle is marked CONTROLS LOCK, with two positions marked UNLOCKED forward and LOCKED aft. When in the LOCKED position with the aileron and rudder controls neutral and the control column forward, the controls will mechanically lock. The gust lock handle prevents the throttles being advanced beyond a position allowing approximately 1600 rpm. A trigger on the gust lock handle must be pulled down before the handle can be released from the locked or unlocked positions.

WING FLAPS.

A double-slotted full-span type wing flap system is actuated by pressure supplied from the normal hydraulic system (figure 1-12) to a wing flap actuator in the cargo compartment roof; movement is then transmitted from the actuator through mechanical linkage to the flaps. Operation of the wing flaps is controlled by the wing flap selector lever in the flight compartment, through an internal follow-up valve which allows the flaps to be positioned at any point within flap range. Movement of the flaps is indicated on the wing flap position indicator in the flight compartment. Since the ailerons droop with the lowering of the flaps, the range of aileron movement varies in accordance with the position of the flaps. Movement of the flaps is also mechanically transferred to the horizontal stabilizer so that it trims automatically throughout the full flap range. Wing flaps are held mechanically in the UP position, and hydraulically in all other positions.

Wing flap selector lever.

The wing flap selector lever is located in the overhead console (figure 1-3). A spring-loaded button is inset in the lever handle. The lever is marked FLAPS and has the normal operating settings marked 15° to 40° in 5° increments. Detents are provided at the 15° and 20° positions. Operation of the lever actuates the wing flaps through hydraulic and mechanical linkage, and the movement of the flaps is recorded on the wing flap position indicators. The spring-loaded button in the lever handle must be depressed before the lever can be moved from one position to another.

Wing flap position indicator.

The wing flap position indicators are on the left side of the pilot's and copilot's flight instrument panels (figures 1-15 and 1-16) adjacent to the airspeed indicator. Each indicator is marked FLAP POSITION and is graduated in 5° increments from 0° to 40°, with numerals at the 10° marks. The indicators are mechanically operated and indicate wing flap position.

STALL WARNING SYSTEM.

An artificial two-stage, stall warning stick shaker system is incorporated into the flight control system. Low and high intensity stick shakers are mounted on each control column and are automatically energized during flight as follows; the low intensity shakers at approximately 8 knots above the stall speed, and the high intensity shakers at approximately 4 knots above the stall speed. This warns the pilot and copilot of the approach to the stall by vibration of both control columns. The stick shakers can be energized for test purposes, when the aircraft is on the ground, by means of a test switch. Electrical power for the lift transducers and lift computers is supplied from the 115-volt, 400-cycle, AC bus, protected by two 1-ampere fuses. High and low stick shaker motors, energized by the lift computers, receive operating power from the DC emergency bus through three 3-ampere circuit breakers labeled STALL WARNING L. LOW, R. HIGH, and LEFT HIGH, and a 5-ampere circuit breaker labeled STALL WARNING HIGH SHAKERS.

Low intensity stage.

The low intensity stage consists of a left lift transducer, a flap position potentiometer, a lift computer, low intensity stick shakers, and a test switch. The circuit can only be tested in the left position of the test switch. The vane of the left lift transducer will respond to movement of the stagnation point as the stall is approached, and change the voltage to the lift computer. The lift computer compensates this voltage for flap position, detected by the flap position potentiometer, and operates the low intensity stick shakers to provide a mild vibration of both control columns at approximately 8 knots above the stalling speed. The low intensity stick shakers are operative through all flap and power settings.

High intensity stage.

The high intensity stage is a duplication of the low intensity stage except that two lift transducers, two lift computers, and two flap position potentiometers are installed. In addition, the high intensity stage only operates when either or both throttles are more than 3/4 inch forward of the fully closed position measured on the console, and the flap setting is 19° or more. This stage provides a very pronounced control column vibration, compared to that of the low intensity stage.

Stall warning test switch.

A three-position toggle switch on the pilot's instrument panel (figure 1-15) is marked STALL WARN TEST. The center (off) position is unmarked, and the other positions are marked LEFT and RIGHT respectively. Selection of LEFT or RIGHT enables a circuit continuity check of the high intensity stick shakers to be carried out. The circuits of both low intensity stick shakers can be checked only when the switch is selected to LEFT. The tests also insure that both AC and DC power are available to the systems.

LANDING GEAR.

The landing gear is a tricycle type installation consisting of two main gear units and a steerable nose gear unit. All units are fully retractable and are operated hydraulically (figure 1-12). Each main gear unit consists of a pneudraulic shock strut, a drag strut, an up-lock and a down-lock, and a hydraulic retraction actuator that retracts the unit into the engine nacelle. The nacelle doors are mechanically connected to the main gear unit so that on extension and retraction of the gear unit the doors are opened and closed accordingly. Each main gear unit has two 11.00 x 12 wheels, one on each side of the shock strut, equipped with disc type brake units. The nose gear unit consists of a pneudraulic shock strut and a hydraulic retraction actuator that also serves as a drag strut. The actuator retracts the gear unit into a well in the fuselage nose. The doors are opened and closed by a mechanical linkage connected to the shock strut in such a way that the aft doors are closed and the forward fairing remains open when the gear unit is down. The steerable nose gear unit adjusts automatically in the fore-and-aft direction when the nosewheel tires are off the ground. The nose gear unit has two 7.50 x 10 wheels, one on each side of the shock strut. When the landing gear is fully retracted, all units are covered by their respective doors. Selection of the landing gear to either the up or down position is controlled by the landing gear selector lever on the overhead console. The landing gear selector valve, electrically operated by the lever from the emergency bus, is also electrically connected to a weight switch on each gear unit which prevents retraction of the landing gear when the shock struts are compressed. When all units are up and locked, the selector valve is arranged to automatically relieve the hydraulic pressure in the landing gear system. Should a system malfunction occur, the landing gear may be lowered by means of the controls provided for this emergency. These controls include the hydraulic emergency selector panel, the hydraulic handpump and handle, and the main gear emergency extension handle. Refer to Section III for the procedure to be followed for emergency lowering of the landing gear.

Landing gear selector lever.

The landing gear selector lever, on the left side of the overhead console (figure 1-3), is marked LANDING GEAR with positions UP and DOWN, and is electrically connected to the landing gear selector valve through a two-position switch. The selector lever, recognized by its wheel-shaped handle, has a trigger which must be depressed to release the lever locking pawl before the lever can be moved from one position to another. The wheel-shaped handle contains a red warning light. Power for the selector valve and warning light are supplied from the emergency bus through 5-ampere circuit breakers labeled

UNDERCARRIAGE HYDR and UNDERCARRIAGE WARN.

Landing gear indicator lights.

Three green, press-to-test indicator lights are on the electrical switch panel (figure 1-9) and are marked LANDING GEAR and LOCKED DOWN. The lights are individually marked LEFT, NOSE, and RIGHT and each will come on when its respective gear unit is locked down. The intensity of the lights is controlled by the warning lights intensity switch at the right side of the electrical switch panel. Power is supplied from the main bus through a 5-ampere UNDERCARRIAGE IND circuit breaker.

Landing gear index marks.

A white and red index mark is painted on the inboard side of each main gear locking mechanism, and are visible from the cargo compartment. Alignment of the marks on the individual gear indicates a locked down condition.

Landing gear warning horn and warning light.

The landing gear warning horn in the flight compartment is powered from the emergency bus and protected by a 5-ampere circuit breaker labeled UNDERCARRIAGE WARN. The horn will sound and the red warning light in the landing gear selector lever handle will illuminate if both throttles are closed to approximately 17 - 20 in. Hg, and the landing gear is not locked down.

Landing gear warning horn and warning light test switch.

A two-position toggle switch, spring loaded to OFF, is located on the electrical switch panel (figure 1-9), and is marked HORN TEST. The switch is used for ground testing the operation of the warning horn. If the throttle levers are closed, a test of the warning light in the landing gear selector lever can be made.

Note

The tests only check the operation of the horn and light and do not constitute a continuity check of the electrical system.

Emergency landing gear down selector handle.

A handle on the emergency hydraulic selector panel (figure 1-14) is marked EMERGENCY LANDING GEAR DOWN SELECTOR with positions OFF and ON. The handle, when moved to ON, operates a valve which allows hydraulic return fluid from the up side of the landing gear actuators to bypass the landing gear selector valve and enter the common return line to the reservoir. This bypass action allows for any electrical or other malfunction of the landing gear selector valve, which might cause it to remain in the 'up' position. Therefore, for any emergency operation of the main gear or nose gear, the handle must be selected ON. As an additional safeguard this handle overrides the nose gear emergency extension handle, which cannot be pulled until the emergency landing gear down selector is moved to ON.

CAUTION

If the emergency landing gear down selector handle is moved slightly out of the OFF position, the landing gear will fail to retract when the landing gear selector lever is placed in the UP position.

Main gear emergency extension handle.

A main gear emergency extension handle, on the bulkhead behind the pilot's seat (figure 1-2 sheet 2) is marked EMERGENCY MAIN GEAR LOWERING PULL TO RELEASE. Pulling the handle mechanically releases each main gear up lock and allows the gear to extend and lock down by gravitational force and slipstream pressure.

Nose gear down handpump selector.

A nose gear down handpump selector on the hydraulic emergency selector panel (figure 1-14) is marked NOSEWHEEL DOWN HANDPUMP SELECTOR with positions OFF and ON. When the selector is at ON, the nose gear may be pumped down by actuation of the hydraulic handpump, provided the HANDPUMP SELECTOR is at EMERGENCY SYSTEM, and the EMERGENCY LANDING GEAR DOWN SELECTOR is at ON.

Nose gear emergency extension handle.

The nose gear emergency extension handle on the hydraulic emergency selector panel (figure 1-14) is marked NOSEWHEEL EMERGENCY DOWN (AIR) PULL & HOLD UNTIL LOCKED. Before pulling the handle, insure that the EMERGENCY LANDING GEAR DOWN SELECTOR is at ON. When the handle is pulled, it releases a compressed air charge from an air bottle to force the nose gear down. The handle must be held extended until the nose gear is locked down.

Note

The compressed air charge in the air bottle can only be used once in flight. It should be used only as a last resort if the gear unit cannot be extended by the emergency hydraulic system.

Nose gear observation window.

On some aircraft an observation window at the left of the step in bulkhead 60.0 in the flight compartment permits visual in-flight inspection of the nose gear by a crew member should doubt exist regarding nose gear condition.

emergency hydraulic selector panel

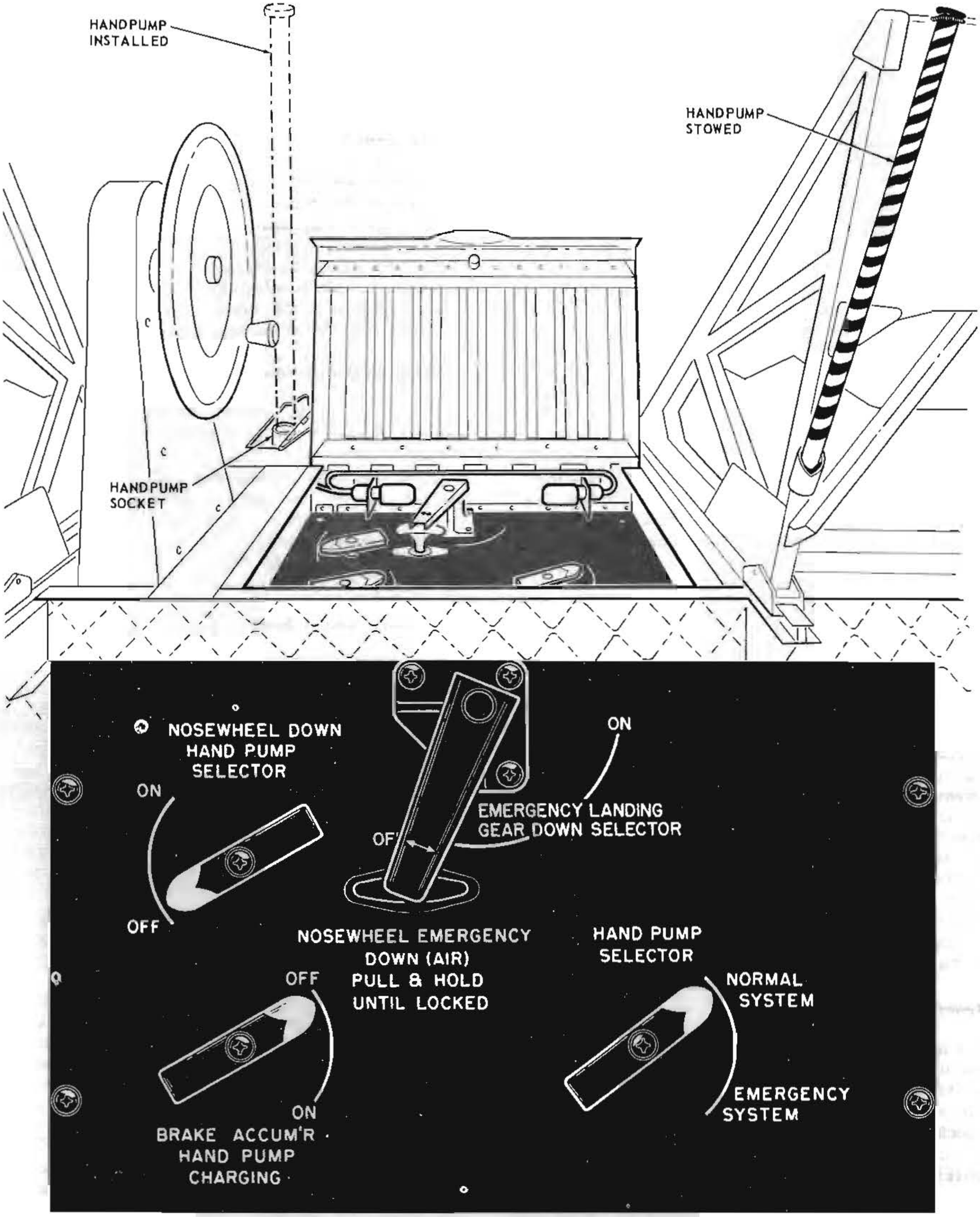


Figure 1-14 Emergency Hydraulic Selector Panel

NOSEWHEEL STEERING.

Ground steering of the aircraft is controlled by a nosewheel steering wheel, through a 62° range of directional movement of the dual nosewheels, when the steering system is operative. The system consists of an electrical nosewheel steering switch, a hydraulic nosewheel steering valve, a hydraulic nosewheel steering actuator, and a nosewheel steering wheel that is connected mechanically to the steering actuator. Selection of the steering switch to ON actuates the steering valve, to allow pressure from the hydraulic system (figure 1-12) to pass to the steering actuator. Movement of the steering wheel mechanically selects the direction and amount of travel of the actuator, which hydraulically positions the dual nosewheel to the required angle. The system is irreversible so that the dual nosewheels maintain the direction and angle of displacement selected by the steering wheel when the steering switch is at ON. When the nose gear shock strut is fully extended, a weight switch overrides the hydraulic actuator and the dual nosewheels are centered by self-centering cams. When the system is inoperative, steering can be accomplished by differential application of the brake pedals, but turns should be made slowly and at a large radius to preclude imposing excessive side loads on the nose gear unit. The nosewheel steering valve is powered from the emergency bus through a 5-ampere UNDERCARRIAGE HYDR circuit breaker.

CAUTION

Do not attempt to restrain or operate the steering wheel when the steering switch is at OFF. Manual control of the steering wheel in this condition would cause fluid to be emptied from the nose gear shimmy damper during ground maneuvering.

Nosewheel steering wheel.

The nosewheel steering wheel is on the left side of the flight compartment (figure 1-2 sheet 1) and is marked NOSEWHEEL STEERING. The rim of the wheel has a radial line, denoting nose gear centered, with directional arrows marked LEFT and RIGHT. An indicator pointer attached to the axle of the wheel provides a fixed datum reference.

Nosewheel steering switch.

The nosewheel steering two-position switch is above and forward of the nosewheel steering wheel on the left side of the flight compartment (figure 1-2 sheet 1). The switch is marked NOSEWHEEL STEERING with positions marked ON and OFF.

WHEEL BRAKES SYSTEM.

The wheel brakes system is controlled from the pilot's and copilot's brake pedals which are connected mechanically and hydraulically to disc type brakes in the main wheels. The brakes are operated by hydraulic fluid from the wheel brakes hydraulic accumulator, which is supplied with pressure from the hydraulic system (figure 1-12) and is fed through brake control valves and safety valves to the wheel brakes. A parking brake is incorporated in the system. An emergency air system, consisting of an air bottle and an air control valve and a wheel brakes emergency lever, is connected directly to the wheel brakes.

Brake pedals.

The pilot's and copilot's brake pedals are the upper portions of the rudder pedals in the flight compartment (figure 1-2, sheet 1). The brake pedals are connected mechanically to the wheel brake control valves, and must be depressed to transmit hydraulic pressure to the wheel brakes. The degree of braking action applied to the wheel brakes is dependent on the force exerted on the brake pedals.

Parking brake handle.

The parking brake handle mounted on the pilot's pedestal (figure 1-13), is a push-pull, turn-to-lock type marked PARKING BRAKE. To apply the parking brakes, depress the brake pedals and pull the parking brake handle fully out, then turn it 90° clockwise to lock it in the extended position. To release the parking brake, the brake pedals should be depressed and, at the same time, the handle turned 90° counterclockwise and pushed fully in.

Emergency wheel brakes lever.

The emergency wheel brakes lever is mounted on the windshield center post (figure 1-2, sheet 1) and is marked EMERGENCY BRAKE. Pulling the handle mechanically operates a valve in the emergency brake air system and allows the compressed air from the air bottle to be applied progressively to the brake discs of the main wheels, in the event of hydraulic system malfunction.

CAUTION

The emergency wheel brakes lever must not be operated with a pumping action otherwise the compressed air supply will be depleted rapidly.

Brake accumulator handpump charging selector.

The brake accumulator handpump charging selector on the emergency hydraulic selector panel (figure 1-14) beneath an access door in the flight compartment floor, is marked BRAKE ACCUM'R HAND PUMP CHARGING with positions OFF and ON. The selector should be positioned at ON and the hydraulic handpump selector at NORMAL SYSTEM, in the event of malfunctioning or failed engine driven pumps. The hydraulic handpump selector should be at EMERGENCY in the event of low fluid level. Actuation of the handpump will then replenish the brakes accumulator to a safe operating level.

Brake hydraulic pressure gage.

The brake hydraulic pressure gage mounted on the pilot's pedestal (figure 1-13), is remotely operated by an electro-hydraulic pressure transmitter connected to the pressure line of the brake system. Power is taken from the AC instrument bus through a 1-ampere fuse labeled ENG INST RIGHT. The gage is marked BRAKE HYDRAULIC PRESSURE and is calibrated from 0 to 4000 psi.

INSTRUMENTS.

The pilot and copilot are each provided with a set of flight instruments, each set grouped on a panel directly in front of the individual. One magnetic standby compass and two clocks are installed.

PITOT-STATIC SYSTEM.

There are two independent pitot static systems, one on each side of the fuselage (figure 1-17). Each system consists of an electrically heated pitot head and below it, two independent static ports. The left pitot head is connected to the pilot's airspeed indicator. The right pitot head is connected to the copilot's airspeed indicator, the two thrust indicators and the fan air pressure switch of the cabin heating and ventilating system. The lower static port of each system is connected to the pilot's airspeed indicator, altimeter and vertical velocity indicator. The upper static port of each system is connected to the copilot's airspeed indicator, altimeter and vertical velocity indicator. Power for pitot head heat is taken from the DC emergency bus through the 15-ampere PITOT INSTRUMENT L and R circuit breakers and is controlled by the pitot heat switch on the de-icing panel. The lift transducer anti-icing system is controlled through the pitot heat switch. Refer to Section IV.

Note

> If a discrepancy occurs between the pilot's and copilot's airspeed indicators, a malfunction in the thrust indicating system or the fan air pressure switch should be suspected. If this occurs, the right pitot head can be isolated from the malfunction and routed only to the copilot's airspeed indicator by selecting the EMERG OFF position of the thrust indicator selector.

Thrust indicators.

A thrust indicator (figure 1-4) is installed for each engine. Each indicator is a direct reading type and registers the difference between the dynamic pressure in its respective propeller slipstream and the dynamic pressure in the free-air stream. In addition to the right fuselage pitot head, each instrument has two pitot heads mounted one on each side of its respective engine nacelle. A thrust marker operated by a set knob at the base of the instrument may be preset as desired to provide a reference for maintaining thrust settings. The electrical power for pitot head anti-icing is from the secondary bus, and is protected by 10-ampere circuit breakers labeled PITOT ENGINE INNER and OUTER.

CAUTION

> With the thrust indicator selector in emergency position, the thrust indicators are unreliable.

Thrust indicating system selector.

A two-position thrust indicator selector on the copilot's flight instrument panel (figure 1-16) is marked THRUST IND. FREE STEAM PRESS. with positions NORMAL and EMERG OFF respectively. At NORMAL the free-air pressure at the pitot head on the right of the fuselage nose is fed to the thrust indicators (in addition to slipstream pressure), copilot's airspeed indicator and heating system fan air pressure switch. At EMERG OFF, the free-air pressure is fed only to the copilot's airspeed indicator. This position should be selected (counterclockwise 180°) if a malfunction occurs in the thrust indicating system.

CAUTION

> If the thrust indicator selector is moved to EMERG OFF in flight the heating fan air pressure switch will be inoperative and the cabin heating system will revert to ground mode. In this event the combustion air fan circuit breaker on the CABIN HEAT & VENTILATION panel should be pulled to prevent damage to the combustion air fan. To insure that flight compartment heating system remains in flight mode, check that COCKPIT AIR SELECTOR is at FLIGHT position.

Note

> Should a discrepancy occur between the readings of the pilot's and copilot's airspeed indicators, a malfunction of the thrust indicators or fan air pressure switch should be suspected.

Airspeed indicators.

Two airspeed indicators (figure 5-1) are installed. Each instrument is graduated in 5-knot increments from 30 to 260 knots, with a numeral at the 30-knot graduation, the 50-knot graduation, and at each 50-knot graduation thereafter. Each instrument is connected to a separate pitot and static source, thus providing independent operation. Colored markings are applied, with no parallax error, to the instrument

pilot's instrument panel-typical

Figure 1-15 Pilot's Instrument Panel - Typical

4-1-8

glass to indicate ranges of airspeed. A white index mark provides indication of any movement of the glass face in relation to the instrument case. A color-coded annular ring is mechanically connected to the flap indicator. Extension or retraction of the flaps, causes the ring to move around the airspeed indicator dial, and the color coding is visible through an unpainted portion of a plexiglass cover. The colored portion consists of a white arc and a yellow radial. The yellow radial indicates the maximum speed for flap selection, and will constantly show the maximum allowable flight speed at all flap angles. The white arc represents the range of airspeed for that particular amount of flap; the lower end of the white arc shows the level flight stall speed at maximum gross weight.

Altimeters.

Three altimeters (figures 1-15 and 1-16) are installed, two barometric and one radar. The two barometric altimeters are the three-pointer type. The long pointer indicates 100's of feet, the small pointer indicates 1000's of feet and the triangular-tipped pointer indicates 10,000's of feet. A striped low altitude warning symbol is visible at altitudes below 16,000 feet. On altimeters with the low altitude warning symbol at the nine o'clock position, there is an additional 10,000-foot reference. This reference is a white stripe that follows the 10,000-foot pointer around the inner perimeter of the altitude scale. A barometric pressure set knob is located at the bottom left of the instrument and is used to set the barometric scale. The pilot's altimeter is connected to both lower fuselage static ports while the copilot's is connected to both upper static ports.

The radar altimeter is installed on the pilot's instrument panel (figure 1-15). Altitude is displayed by a single pointer and is reliable from 0-10,000 feet over land and 0-20,000 feet over water. Reliability is reduced in banks of 60° or more and climb or dives of 70° or more. A reliability circuit disables the indicator and masks the pointer when signals are unreliable.

Turn and slip indicators.

Two four-minute turn and slip indicators are installed (figures 1-15 and 1-16). A one-needle width deflection indicates the aircraft is turning one and one-half degrees per second while two needle widths indicate a turn of 3 degrees per second. The ball indicates "quality" of turn, i.e., coordinated, slipping or skidding. The instruments are powered from the 28-volt DC bus and protected by 5-ampere circuit breakers.

Vertical velocity indicators.

Two vertical velocity indicators are installed (figures 1-15 and 1-16). Each instrument is graduated in hundreds of feet per minute for the first 1000 feet of climb or descent. Thereafter, the scale is graduated in 500-foot increments with the numerals 1, 2 and 3 to indicate thousands of feet per minute climb and descent. The pilot's indicator is connected to both lower fuselage static ports. The copilot's indicator is connected to both upper static ports.

Attitude indicators.

Two attitude indicators with self-contained gyros are installed, one on each pilot's flight instrument panel (figures 1-15 and 1-16). The pilot's instrument is limited to ± 27° of pitch and is unlimited in bank. The copilot's instrument, which also supplies radar antenna stabilization signals, is limited to ± 70° of pitch and 100° of bank. On some aircraft the instruments are automatically erected and erection times vary from 3 to 15 minutes. For instruments having a caging knob, the gyro may be manually erected. Some indicators have an attitude warning flag to indicate insufficient electric power to the instrument. Indicators not having an attitude warning flag can be distinguished by absence of the flag prior to application of power. The miniature aircraft may be adjusted relative to the horizon bar by use of the pitch trim knob. Three-phase, 115 volt, AC power from the inverter drives each instrument gyro. Two one ampere fuses labeled horizon ØA and ØC protect each circuit.

CAUTION

> The attitude warning flag is an indication of insufficient electric power only. It does not appear with malfunctions of other components within the instrument. Instruments without an attitude warning flag should not be used for instrument flight until 15 minutes after electric power has been applied.

Copilot's attitude indicator.

The copilot's attitude indicator, in addition to providing normal indications of aircraft attitude, is modified to provide roll and pitch signals for stabilization of the weather radar system antenna (radar on operate or contour modes). The instrument is installed on the copilot's flight instrument panel (figure 1-16) and provides a visual indication of the aircraft's attitude in relation to the horizon. A 115-volt, 400-cycle, three phase AC supply from the radar inverter (with the radar operating) or aircraft inverter drives the instrument gyro. The circuit from the radar inverter is protected by a 2-ampere circuit breaker on the radar power panel, while two fuses on the AC fuse panel protect the aircraft inverter circuit. The miniature aircraft can be adjusted to compensate for pitch trim by means of a pitch trim knob at the lower edge of the instrument. The instrument is limited to indicate 70° in pitch and 100° in bank. The gyro should be caged prior to engine start and approximately one minute allowed after engine start (with inverter switch at MAIN) for the inverter to achieve full output, and for the gyro erection system to begin operation, before uncaging it. Several minutes are required for the gyro

copilots instrument panel – typical

Figure 1-16 Copilot's Instrument Panel - Typical

pitot static system - schematic

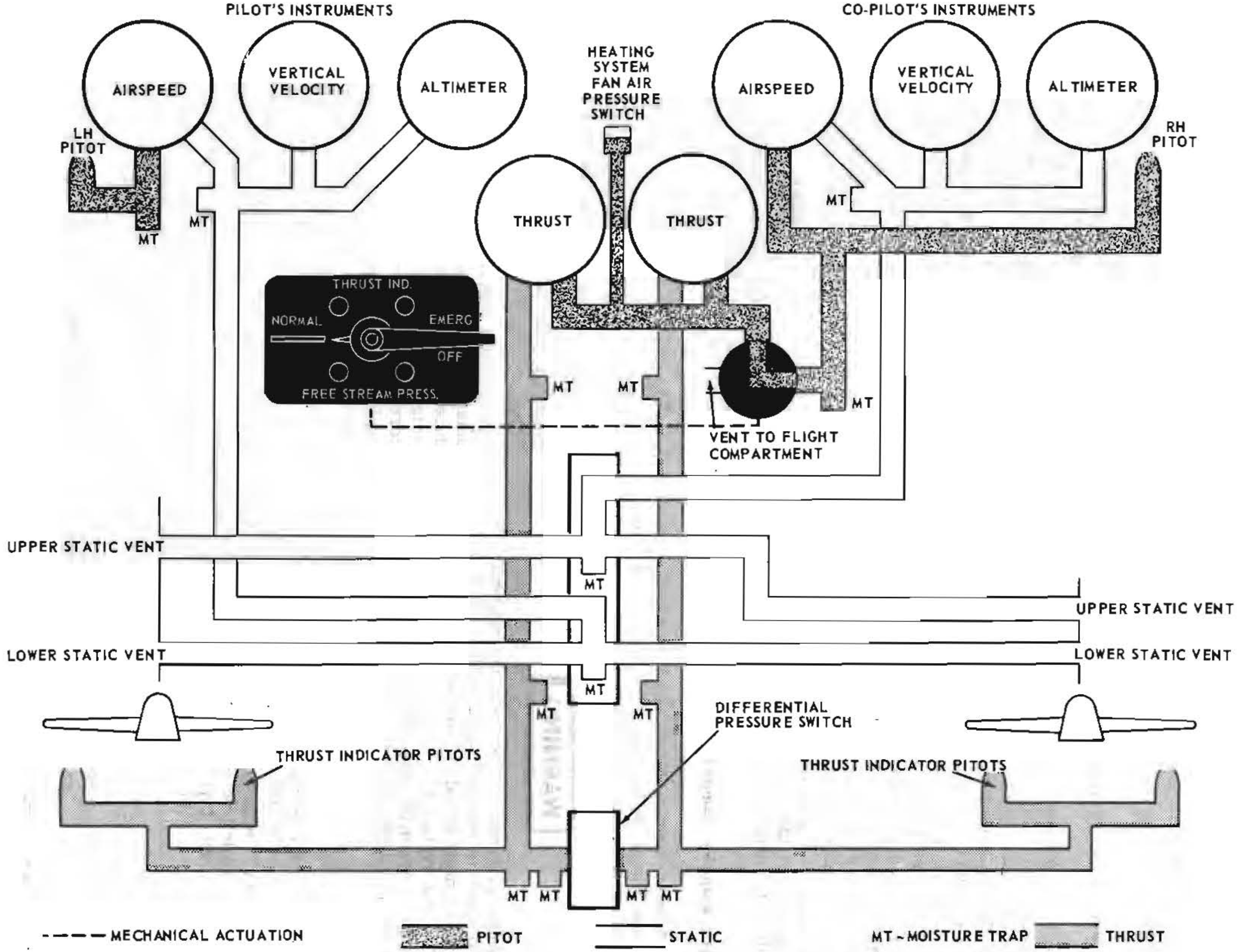


Figure 1-17 Pitot Static System - Schematic

4-1-16

to completely erect to true vertical. Low power or power failure to the gyro is indicated by the appearance of a fluorescent disc in the gyro power failure indicator.

Note

> The gyro should always be caged when inverter output is switched off.

Radar gyro power failure indicator.

The radar gyro power failure indicator is a rotating (cup-shaped) disc type indicator and is connected electrically to the input side of the gyro control. One half of the cup-shaped disc is painted black and the other is painted fluorescent. The normal presentation of the indicator is for the black painted surface to be visible to the operator, if however low input voltage or a failure in one or more phases of gyro input power occurs the fluorescent side of the disc will become visible. In the event of gyro power failure indication, the weather radar system should be switched off, automatically the gyro power transfer relay will be deenergized and the gyro will be powered from the aircraft instrument buses.

Magnetic standby compass.

The magnetic standby compass is mounted on the windshield center post, (figure 1-2 sheet 1) with its correction card immediately above it.

WARNING

> When reference to the standby magnetic compass is necessary, the windshield heat switch must be OFF. With windshield heat ON, the cycling of electric power creates erratic magnetic deviation and causes unreliable standby compass indications.

Clocks.

Two clocks of the elapsed time, eight-day type are each located on a side panel (figure 1-18). A stopwatch knob and a winding/setting knob are at the top-right and bottom-left respectively of each instrument. On some aircraft Type A-13A clocks replace the stopwatch clocks. Each A-13A clock is an eight-day center-second movement, and incorporates an elapsed time, mechanism. An elapsed time, zero-reset flyback knob and a winding/setting knob are at the top-right and bottom-left respectively of each instrument.

Outside air temperature gage.

A direct-reading outside air temperature gage is installed in the flight compartment roof (figure 1-2, sheet 1) above the pilot's seat and is graduated in degrees Fahrenheit and Centigrade.

Short-field approach speed indicator.

A short-field approach speed indicator is located on the side panel above the pilot's flight instrument panel. The indicator is calibrated for the final approach phase of a short-field landing, flaps 40°.

The instrument dial is marked SLOW and FAST on the left and right side respectively, of a triangular shaped index mark. Alignment of the pointer with the triangle during the final approach represents the optimum approach speed for an aircraft gross weight of 28,500 lb (1.23 V_S at 40° flap setting). A diamond shaped index mark on the SLOW side of the dial represents the optimum approach speed for all aircraft gross weights up to 26,000 lb (1.16 V_S at 40° flap setting). For gross weights between 28,500 lb and 26,000 lb, short-field approaches are made by positioning the pointer between the two index marks, the exact location being decided by interpolation, depending upon gross weight. For example, at a gross weight of 27,250 lb the optimum approach speed indication would be midway between the two index marks.

Note

> The approach speeds appropriate to gross weight, as shown in Performance Data T.O. 1C-7A-1-1, will be maintained by use of the indicator.

With flaps at 30°, the approach speed indicator may be used in the same manner as for 40° flap setting. However, because pointer position is related to angle of attack, a specific pointer position at weights below 26,000 pounds will give slightly higher speed margins above the power-off stall at 30° flap than at 40° flap.

The optimum approach speed is determined by the computation of factors supplied by the right wing lift transducer, which compensates for variations in gross weight up to 26,000 lb. Maintaining the pointer in the correct location for gross weight will hold a constant angle of attack. Any change in the angle of attack will affect the location of the airflow stagnation point at the wing leading edge and vary the load on the lift transducer vane, thus producing a deflection of the indicator pointer to a fast or slow value.

EMERGENCY EQUIPMENT.

Emergency equipment in the aircraft consists of fire detecting and extinguishing systems for the engines and combustion heaters, portable fire extinguishers, an alarm bell system, emergency exits, first aid kits and a crash axe.

FIRE DETECTING AND EXTINGUISHING SYSTEMS.

Fire detecting and extinguishing systems are provided to detect and combat fire in the engine and forward nacelle and the combustion heaters. The engine fire detecting system employs continuous wire-type elements to monitor the engine areas, while the heater fire detecting system employs a bimetal type element in each heater combustion chamber. Power for the detecting system is taken from the 115-volt, 400-cycle AC bus, while DC power is taken from the emergency bus for engine fire extinguishing and from the main bus for heater fire extinguishing. These circuits are protected by two 2-ampere fuses labeled ENG FIRE DET, two 5-ampere circuit breakers labeled FIRE EXTINGUISHER LEFT and RIGHT, and two 5-ampere circuit breakers labeled FIRE EXTINGUISHER COCKPIT and CABIN.

Freon for the engines and carbon dioxide for the heaters is stored under pressure in containers and is discharged into the overheat area by the operation of the applicable control. All fire controls are grouped on the emergency panel in the flight compartment. Indicator discs are provided on the outside of the aircraft for ground checking of the container condition. A means of testing the warning lights and the engine fire detecting circuit is provided. For the purpose of engine fire detecting and extinguishing, each engine nacelle is divided into three zones; zone 1 is the front of the engine forward of the auxiliary firewall, zone 2 is between the auxiliary and the main firewalls and forms the engine accessories compartment, while zone 3 extends from the main firewall aft to the front spar and includes the main gear well. One fire detecting element monitors zone 1 while the other element monitors zones 2 and 3. Extinguishing agent is provided only for zones 2 and 3.

Engine fire extinguisher handles.

Two engine fire extinguisher handles, one for each engine, are located on the emergency panel (figure 1-18) in the flight compartment. The handles are marked FIRE-PULL and incorporate red warning lights. When either handle is pulled a cartridge is electrically detonated and a slug is fired into the appropriate extinguisher container, instantly releasing the extinguishing agent to blanket the fire area in zones 2 and 3 of the appropriate engine. If a second release of extinguishing agent is required, the handle is pushed in and turned 90° counterclockwise and pulled again. In this case the second container will be discharged.

Note

Each container can be discharged once only. Therefore, both containers can be discharged into one engine, or each can be discharged into its respective engine.

Engine fire warning lights.

Two engine fire warning lights are incorporated in the engine fire extinguisher handles (figure 1-18), marked RIGHT ENGINE ZONES 2 AND 3 and LEFT ENGINE ZONES 2 AND 3 respectively, and two on the emergency panel are marked ENG FIRE ZONE 1.

Note

When a warning light illuminates to indicate an overheat condition it will go out when the condition no longer exists. The light will illuminate again if a further overheat condition occurs.

Engine fire detection test switch.

A toggle switch marked FIRE DETECTION, is located in the center of the emergency panel (figure 1-18). The switch is spring-loaded to the down (off) position. When held (up) in the TEST position all engine fire warning lights should illuminate. Failure of the lights to illuminate indicates a fault in the detecting circuit, control units, or individual lights.

Note

The test switch is not connected to the heater fire warning lights.

Engine fire extinguisher indicating discs.

A yellow and a red colored disc are located on the underside of each wing between the nacelle and the fuselage (figure 1-20). When a fire extinguisher handle is pulled, a plunger operated by the pressure of the extinguishing agent punctures the yellow disc. Should either container reach an excessive temperature, a thermal plug in the container will melt and allow the extinguishing agent to blow out the red disc and exhaust to atmosphere.

HEATER FIRE DETECTING AND EXTINGUISHING SYSTEMS.

The combustion heaters of the flight and cargo compartment heating systems are each provided with a fire detecting circuit and an indicator light, a one-pound bottle of carbon dioxide (CO_2) fire extinguishing agent, and two indicating discs. Each heater fire detecting and extinguishing system is independent of the other, but both function in the same manner. When the temperature in a heater becomes excessive, it causes a bi-metal fire detecting element in the heater combustion chamber to complete an electrical circuit, powered from the main bus, and the appropriate heater fire warning light on the emergency panel in the flight compartment will come on. When the light comes on, the guarded extinguisher switch below the light should be selected to its up position to complete an electrical circuit from the main bus. This energizes a solenoid which actuates a rod on the bottle, mounted on the heater tray, containing the extinguishing agent. The rod unseats the check and main valves at the top of the bottle and the contents pass through piping to the heater combustion chamber, and to a spray ring around the heater inlet duct. At the same time the yellow indicating disc is punched out to show that the extinguishing system has been operated. If the pressure in the bottle reaches a dangerous level, usually due to excessive temperatures, a disc in the flood valve of the bottle will break and the extinguishing agent released will blow out the red indicating disc.

emergency and side panels

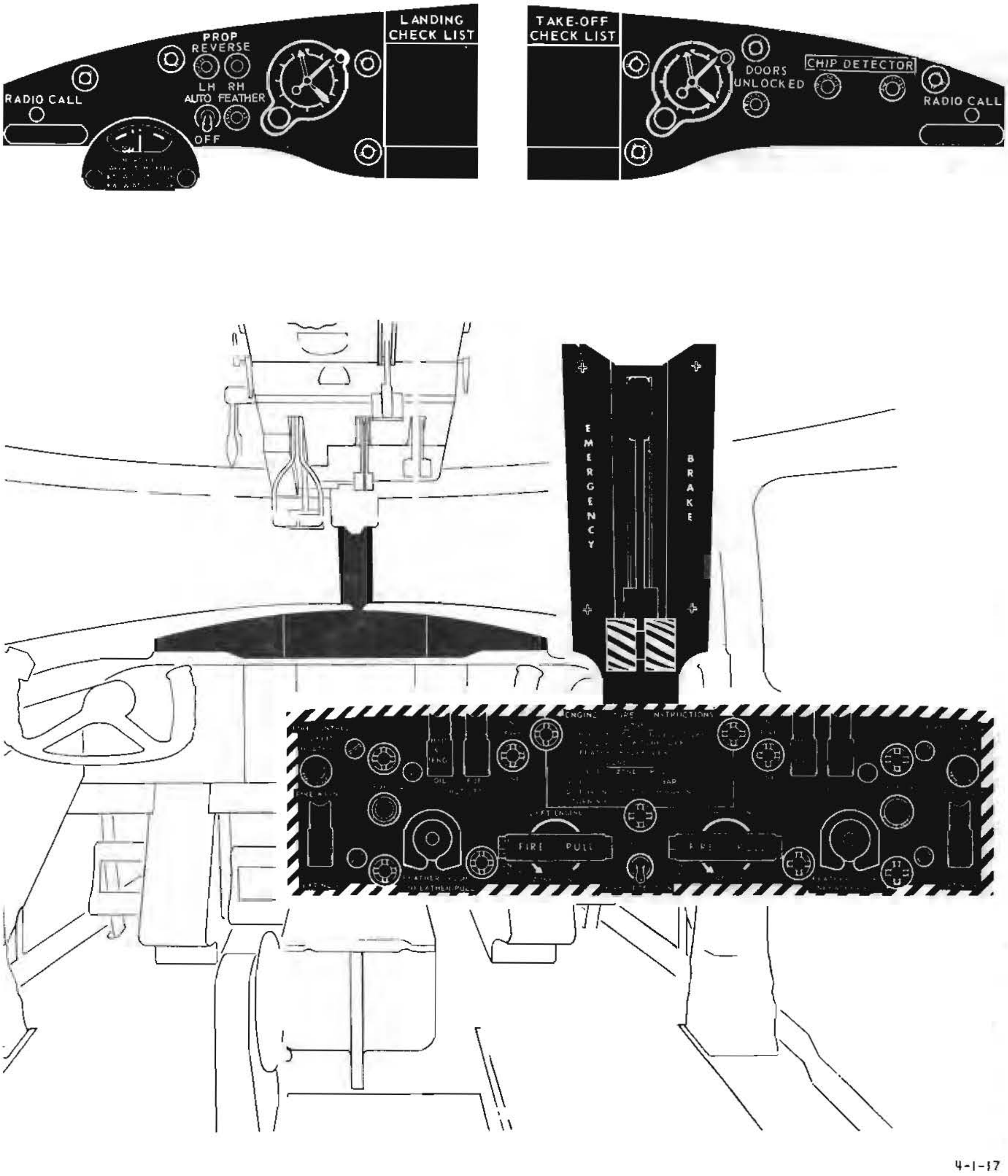


Figure 1-18 Emergency and Side Panels

Heater fire extinguisher switches.

Two guarded heater fire extinguisher switches are provided below their respective warning lights on the emergency panel (figure 1-18) in the flight compartment. Selecting the appropriate switch operates a solenoid valve to release extinguishing agent in the heater combustion chamber and from a spray ring around the heater inlet duct.

CAUTION

The heater air control handles should be selected to close the air supply ducts when a heater fire is indicated.

Heater fire warning lights.

Two press-to-test heater fire warning lights are mounted on the emergency panel (figure 1-18). The lights are marked FIRE CONTROL, COCKPIT HEATER FIRE WARN, and FIRE CONTROL, CABIN HEATER FIRE WARN respectively. The appropriate light will illuminate when an overheat condition exists in either the flight compartment or cargo compartment heater.

Heater fire extinguisher indicating discs.

A yellow and a red colored disc are provided for both the flight compartment and cargo compartment heater fire extinguishing systems. The two discs for the flight compartment are on the left side of the aircraft nose while those for the cargo compartment are on the right side of the fuselage, forward of the wing. The discs indicate in a similar manner to the engine fire extinguisher indicating discs.

PORTABLE FIRE EXTINGUISHERS.

Three Type CF3Br portable fire extinguishers are mounted in quick release clips, one below the pilot's seat, one on the aft face of the cargo compartment forward bulkhead, and one on the left cargo compartment wall immediately aft of the cargo compartment passenger door. The extinguishing agent is released when the hand-operated lever at the top of the extinguisher is depressed.

EMERGENCY EXITS.

Two emergency exits are provided in the flight compartment and four in the cargo compartment.

Flight compartment.

The flight compartment exits consist of a hatch in the roof, immediately aft of the pilot's position, and a bottom hatch in the well behind the pilot's and copilot's seats. Access to the bottom hatch is gained by opening the two doors in the flight compartment floor. The hatch may then be opened by pressing a button and turning a handle, marked EXIT RELEASE-PRESS BUTTON AND TURN HANDLE, located on the aft part of the hatch. The hatch may be jettisoned, if required, by operating a handle located in a recess in the bulkhead above the doors and marked BOTTOM HATCH JETTISON - OPEN INSIDE DOORS BEFORE PULLING HANDLE. The upper doors must be opened first as they would be difficult to open during flight with the lower hatch jettisoned. The roof hatch is opened by pressing a button adjacent to the handle and turning the handle, located on the roof at the hatch, marked EXIT RELEASE - PRESS BUTTON AND TURN HANDLE. The roof hatch is hinged on the right-hand side and is not jettisonable. A webbing strap marked EMERGENCY SLIDE is fitted below the roof hatch on the bulkhead and is provided to aid escape from the flight compartment. The flight compartment bottom hatch may be used for exit during flight but the roof hatch, due to its proximity to the propellers, is for use on the ground only with the engines stopped.

Cargo compartment.

The cargo compartment emergency door, on the left side near the wing leading edge is jettisonable. The handle is marked EMERGENCY EXIT - LEFT GUARD AND TURN HANDLE TO OPEN. The right passenger door is jettisonable, and has a jettison lever handle above the door marked CABIN DOOR JETTISON - PULL LEVER DOWN. The cargo door may be opened but must not be jettisoned during flight. The left passenger door is not jettisonable. The cargo door may be jettisoned, on the ground to provide an additional emergency exit. The cargo door is jettisoned by pulling a handle, located on the left side of the cargo compartment aft of the passenger door, marked CARGO DOOR JETTISON - LIFT GUARD AND PULL HANDLE. When the cargo door is jettisoned, the draftproof door is automatically retracted. The cargo door may also be jettisoned from outside the aircraft by a handle, located on the right side of the fuselage aft of the passenger door, marked CARGO DOOR JETTISON - OPEN HATCH AND PULL HANDLE.

MISCELLANEOUS EQUIPMENT.

The following paragraphs describe the miscellaneous items of equipment in the aircraft.

First aid kits.

Four first aid kits are provided, one in the flight compartment and three in the cargo compartment. The flight compartment kit is in a stowage above the access ladder on the left side. The cargo compartment kits are in brackets attached to the cargo compartment walls, one on the left side aft of the emergency door, one on the left side forward of the passenger door, and one on the right side forward of the passenger door.

Crash axe.

A crash axe for emergency use is mounted on the flight compartment bulkhead, in the cargo compartment to the left of the interconnecting door. The axe is strapped into position by Velcro tape which fastens around the handle, and is released by peeling one end of the tape off the other end.

ENTRANCE DOORS.

Entrance to the aircraft may be made through either of two passenger doors, a flight compartment bottom hatch, or by the cargo door and ramp.

Passenger doors.

Two passenger doors at the aft end of the cargo compartment, one on either side, are provided. Both doors are fitted with flush handles which spring out for grasping when a button on the handle is pressed. Both doors are provided with door-stays to hold the doors open on the ground; the stays are stowed on the inside of each door at a position marked STOWAGE DOOR STAY.

Flight compartment bottom hatch.

Entrance may also be made to the flight compartment by means of the flight compartment bottom hatch. The hatch incorporates a handle similar in operation to the passenger doors. When the flight compartment bottom hatch is opened from the outside, the folding doors in the flight compartment floor must be pushed upwards to gain access to the flight compartment.

Cargo compartment / flight compartment door.

A sliding door separates the flight compartment from the cargo compartment. The door may be opened from either side by pressing down a spring-loaded knob marked OPEN. The door may be locked, from the flight compartment side only, by means of a slide catch marked LOCK ON-OFF. A label on the flight compartment side of the door reads THIS DOOR MUST REMAIN OPEN WHEN CARGO IS CARRIED. The door is held in the fully open position by a lever catch.

Draftproof door.

A retractable draftproof, semi-rigid door separates the cargo compartment from the tail compartment and the cargo door. A strap and a cable are provided as hand grips to be used for extending the door and for aiding spring assists in retracting the door. The door will automatically retract if the cargo door is jettisoned.

SEATS.

The pilot and copilot seats are identical and each is of tubular construction with a fiberglas seat pan and cushioned seat. Each seat is adjustable horizontally and vertically and can be located at the required position by means of spring-loaded levers at the sides and front of the seat respectively; arm rests are also provided and are hinged to the side frames of the seat back in such a manner that they can be raised and moved back when not required. Each seat is equipped with a Type MB-2A shoulder harness attached to the Type MA-1 inertia reel or the Type MA-2 multi-directional harness reel. The reel is mounted behind the seat and is controlled by a lock lever at the left side of the seat pan. A Type MD-1 safety belt is attached to the bottom of the seat-back assembly. A hand-hold above each windshield is provided for use when vacating the seat.

Horizontal adjustment levers.

The flight compartment seats can be individually adjusted horizontally through a range of four inches and locked at any one of five positions by means of two interconnected levers, one at each side of the seat base. The levers are spring-loaded to the down position, and pulling either of them up mechanically withdraws two eyebolts from their engagement holes in each guide rail and allows the seat to be moved forward or aft to the desired position. Releasing the spring-loaded levers allows the eyebolts to engage with the holes nearest to that position when the seat is readjusted slightly forward or aft.

Vertical adjustment lever.

The flight compartment seats can be individually adjusted vertically through a range of seven inches and locked at any one of seven positions by means of a lever pivoted at the left side under the front of the seat pan, and spring-loaded to the aft position. Pulling the lever forward from the right side mechanically withdraws two eyebolts from their engagement holes in the frame assembly bottom slides, and allows the seat to be moved upward under the influence of two springs, or downward under the influence of the occupant's weight, to the desired position. Releasing the spring-loaded lever when the desired height is reached allows the eyebolts to engage with the holes nearest to that position. Insure that eyebolts are securely engaged.

Shoulder harness reel lock lever.

A two-position shoulder harness reel lock lever, with quadrant assembly, is attached to the left side of each pilot's seat pan. The lever is used to actuate the reel mechanism into the "manual lock" (lever forward), or the "automatic lock" (lever aft), position. In the manual lock position the seat occupant is restrained against any forward or sideways movement, and this position is used for take-off and landing. In the automatic lock position the seat occupant may lean forward 18 inches, if desired. In aircraft fitted with the Type MA-1 reel, should an inertia force of between 2 and 3g be subjected to the aircraft, the reel will lock and prevent the seat occupant from being thrown forward. It will also lock, at increased 'g' increments, within a 120° forward arc. In aircraft fitted with the Type MA-2 reel, should an acceleration be imparted to the seat occupant, in any direction, of between 2 to 3g, the reel will lock and prevent the seat occupant from being thrown forward or sideways. In both types of reel, after being locked automatically, unlocking is carried out by moving the reel lock lever fully forward and then fully aft. This will return the reel to the automatic lock position.

WARNING

When the lever is in the forward position at manual lock, leaning forward is restricted. Therefore, prior to an emergency landing, all the required switching operations should be carried out before selecting manual lock.

AUXILIARY EQUIPMENT.

Equipment not directly contributing to the flight of the aircraft, but which enables the aircraft to perform certain specialized functions, is described in Section IV. The following systems and equipment are covered:

1. Heating and Ventilating Systems.
2. Deicing System.
3. Oxygen System.
4. Lighting Equipment.
5. Alarm Bell System.
6. Ignition Analyzer.
7. Winterization Equipment.
8. Radios.
9. Navigation Equipment.
10. Radar.

servicing data

FUEL QUANTITY

FUEL TANK (STANDARD OR SELF-SEALING)			FULLY SERVICED GAL	FUEL* POUNDS	USABLE IN LEVEL FLIGHT (APPROX) GAL
NORMAL	LEFT WING TANK	Standard	414	2484	414
		Self-sealing	403	2418	403
	RIGHT WING TANK	Standard	414	2484	414
		Self-sealing	403	2418	403
	TOTAL (Normal Configuration)	Standard	828	4968	828
		Self-sealing	806	4836	806
FERRY	FORWARD TANK		480	2880	480
	REAR TANK		480	2880	480
	TOTAL (Maximum for ferry)		1788	10,728	1,742

*Fuel weight is based on 6.0 pounds per gallon under standard day conditions at sea level. Total weight of fuel depends on specific gravity and the temperature. The fuel quantity gages do not have the notation full, and variations in gage readings should be anticipated when the tanks are full.

OIL QUANTITY

EACH MAIN OIL TANK	GAL	AUXILIARY OIL TANK (Used with long range ferry tanks)	GAL
USABLE OIL	20.4		
AIRSPACE	7.5		
SUMP (Trapped to engine but drainable)	1.8	USABLE OIL	18.0
TOTAL TANK VOLUME	29.7		

NOTE

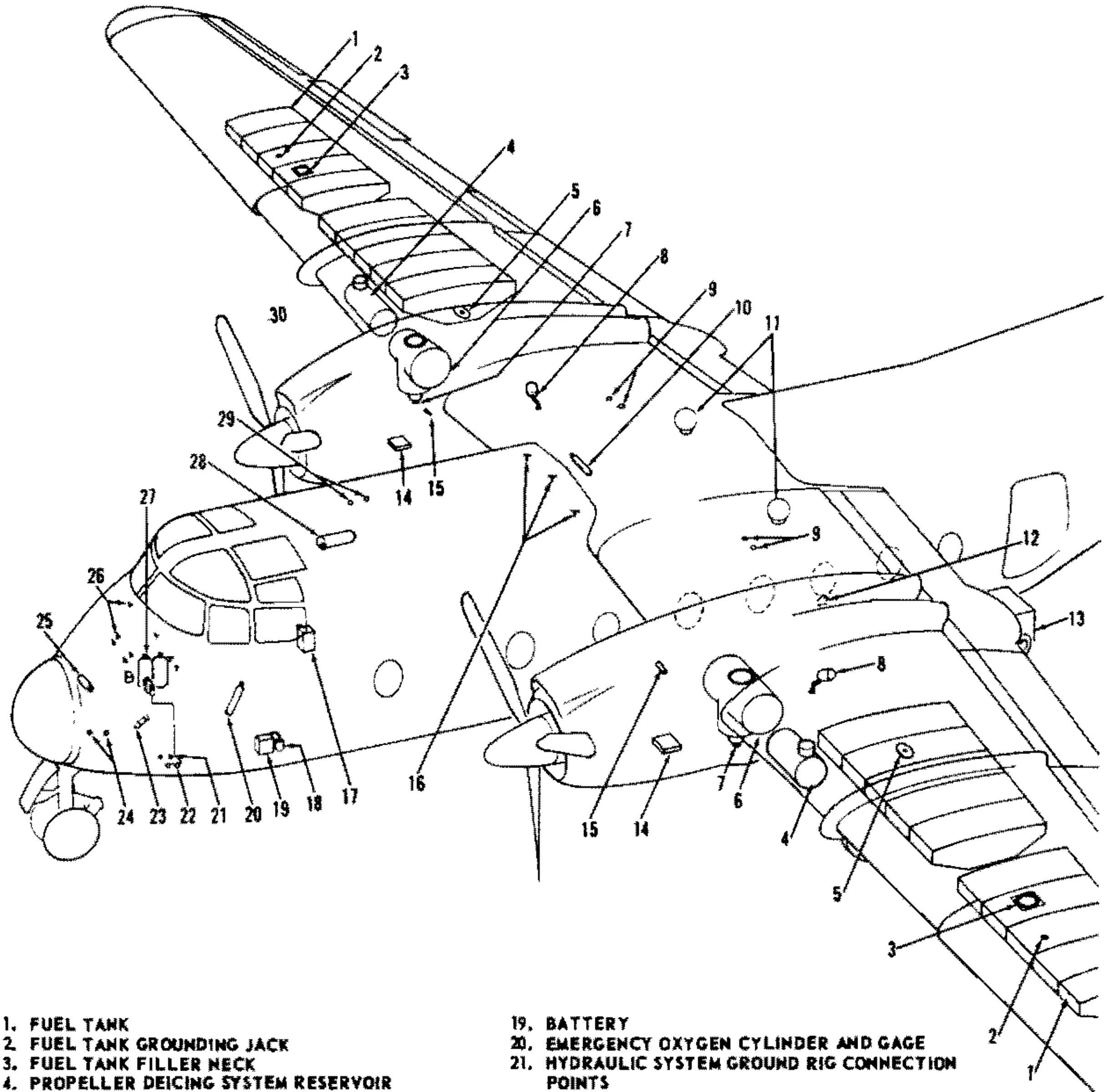
22.2 gal oil are required to replenish a tank after a complete oil change.

FLUID SPECIFICATIONS

FUEL:	MIL-G-5572, GRADE 115/145
ALTERNATE FUEL:	MIL-G-5572, GRADE 100/130
OIL:	MIL-L-22851 TYPE II GRADE 1100
HYDRAULIC FLUID:	MIL-H-5606
DEICING FLUID:	MIL-F-5566
PROP DEICER FLUID:	MIL-F-5566
ENGINE FIRE EXTINGUISHER FLUID:	FREON 13B1 and 13B2 (TROPICAL)

Figure 1-19 Servicing Data

servicing diagram



1. FUEL TANK
2. FUEL TANK GROUNDING JACK
3. FUEL TANK FILLER NECK
4. PROPELLER DEICING SYSTEM RESERVOIR
5. FUEL TANK BOOSTER PUMP AND MANIFOLD WATER DRAINS
6. OIL TANK
7. OIL TANK DRAIN
8. FUEL SYSTEM FILTER DRAIN
9. ENGINE FIRE EXTINGUISHER INDICATING DISCS (ON WING LOWER SURFACE)
10. CABIN HEATER FIRE EXTINGUISHER CONTAINER
11. ENGINE FIRE EXTINGUISHER CONTAINER
12. EXTERNAL POWER RECEPTACLE (LH SIDE OF FUSELAGE)
13. EXTERNAL POWER CART
14. ENGINE DRAIN BOX
15. OIL PRESSURE TRANSMITTER (COLD WEATHER SERVICING POINT)
16. THRUST INDICATING SYSTEM MOISTURE TRAPS
17. HYDRAULIC SYSTEM RESERVOIR
18. BATTERY SUMP JAR
19. BATTERY
20. EMERGENCY OXYGEN CYLINDER AND GAGE
21. HYDRAULIC SYSTEM GROUND RIG CONNECTION POINTS
22. BRAKE ACCUMULATOR, EMERGENCY AIR BOTTLES CHARGING POINTS
23. NOSE GEAR DOWN EMERGENCY AIR BOTTLE
24. FLIGHT COMPARTMENT HEATER FIRE EXTINGUISHER INDICATING DISCS
25. FLIGHT COMPARTMENT HEATER FIRE EXTINGUISHER CONTAINER
26. PITOT STATIC SYSTEM MOISTURE TRAPS
27. OXYGEN CYLINDERS (2) AND GAGE (AIRCRAFT SERIAL NO. 62-4171 AND SUBSEQUENT). RH SIDE ACCESS DOOR.
28. OXYGEN CYLINDER (1) AND GAGE (AIRCRAFT PRIOR TO SERIAL NO. 62-4171)
29. CABIN HEATER FIRE EXTINGUISHER INDICATING DISCS (ON FUSELAGE SIDE)
30. HYDRAULIC FLUID SUMP FILLER PLUGS (NOT SHOWN) FOR REVERSIBLE PROPELLERS ARE LOCATED ON THE TOP LH SIDE OF EACH PROPELLER CONTROL UNIT.

4-1-18

Figure 1-20 Servicing Diagram

SECTION II
NORMAL PROCEDURES

TABLE OF CONTENTS

PREPARATION FOR FLIGHT.

OPERATING RESTRICTIONS.

For operating restrictions and limitation imposed on the aircraft, refer to Section V of this handbook.

FLIGHT PLANNING.

Determine the fuel quantity, power settings, airspeed etc., necessary for the successful completion of the proposed mission by using performance data contained in T.O. 1C-7A-1-1.

TAKE-OFF AND LANDING DATA CARD.

The Take-off and Landing Data Card is included with the Pilot's Abbreviated Checklist, T.O. 1C-7A-1CL-1. Prior to each flight, the applicable performance data will be entered on the Take-off and Landing Data Card.

CHECKLISTS.

This flight manual contains only amplified checklists. The abbreviated checklists have been issued as a separate technical order, T.O. 1C-7A-1CL-1. For information pertaining to use of the checklist, refer to AFR 60-9.

The pilot is responsible for the proper use of the checklist. He will insure that it is used in direct reference during ground and flight operations except during take-off, climb, landing, or critical emergencies. (in these instances flight crews will refer to the applicable checklist before performing the operation, or afterward to insure completion of all phases of the operation concerned.) The nomenclature P, CP, FE and LM used hereafter will refer to the pilot, copilot, flight engineer and loadmaster respectively. The checklist may be read by the copilot or flight engineer as briefed by the pilot. Upon completion of each checklist, the pilot will be advised that the checklist called for has been completed. Certain items in the checklist that are accomplished by the copilot or flight engineer require coordination with the pilot. These items are indicated by a circle around the number of the item (e.g.,(2)). The crew member performing checklist duties will not proceed past a circled item without specific approval by the pilot. Some checklist items may be performed simultaneously (e.g., pilot checks reversing and copilot checks wing and tail deicing).

WEIGHT AND BALANCE.

Check the aircraft weight and balance (refer to DD Form 365C in the weight and balance form binder of individual aircraft). Obtain take-off gross weight and loading data. From this and flight information, complete anticipated landing gross weight and MAC index. Weight limitations are covered in Section V. A weight and balance computer is provided with the aircraft. It is the responsibility of the pilot to ascertain that the aircraft has been properly loaded.

ENTRANCE.

The crew will normally enter the aircraft through either of the passenger doors, located in the aft left and right fuselage, or ramp at the rear of the aircraft. However, if necessary, entrance through the roof hatch or emergency escape hatch in cockpit floor area is permitted.

STANDARD TERMINOLOGY.

To assume complete understanding by all crew members, the following terminology and procedures will be used:

Standard Power Terminology.

1. Max Power
2. METO Power
3. Climb Power
4. Cruise Power

The checklist challenge will be standard terminology. During cruise power changes the pilot will control throttle movement and call for the proper RPM settings by stating desired RPM. Example: "RPM-twenty-one-fifty."

Flap Settings.

Flap settings will be requested in the following manner:

"Flaps thirty."

As Required Items.

Whenever a checklist item is affected by climatic conditions or hours of darkness, AS REQUIRED will be indicated on the checklist for the usual action entry. However, during accomplishment of the checklist, the actual position of the item will be stated.

PREFLIGHT CHECKS.

The visual inspections which must be accomplished prior to flight are the BEFORE INTERIOR INSPECTION, INTERIOR INSPECTION, and EXTERIOR INSPECTION. The pilot is responsible for assuring that the visual inspections have been accomplished. The actual accomplishment may be delegated to the copilot or flight engineer.

Note

The basic flight crew consists of a pilot, copilot, and flight engineer.

Note

The pilot is responsible for insuring that the maintenance personnel have performed the dash 6 inspections in accordance with T.O. 1C-7A-6. The visual inspections requirements of this manual are predicated upon this assumption. However, checks of any equipment involving safety are duplicated in the preflight checks.

THRU-FLIGHT INSPECTION.

When an aircraft is flown by the same crew during the same day, with no crew rest involved, and is assigned tactical or administrative missions requiring intermediate stops, only items preceded by an asterisk (*) need be checked. The remaining items may be checked at the discretion of the pilot. All items in the BEFORE TAKE-OFF and subsequent checks must be accomplished for all flights. For flight when engines are not shut down, air crews may proceed from the AFTER LANDING checklist to the BEFORE TAKE-OFF checklist.

Note

An ignition system check should be performed prior to each take-off.

BEFORE INTERIOR INSPECTION.

1. External power unit	In place
2. Fire extinguisher	In place
3. Wheel chocks	In place
4. Gear down locks	Installed
5. Static ground wire	In place
6. Pitot and canopy covers	Removed

INTERIOR INSPECTION

1. Forms 781 and applicable publications	Checked
a. Status of aircraft	Checked
b. Fuel, oil, deicing fluid, and oxygen service	Checked
2. Form 365F and load adjuster	Checked
3. Navigation publications	Checked
4. Hydraulic panel	Checked
a. Handpump selector	NORMAL
b. Emergency landing gear down selector	OFF
c. Nosewheel down selector	OFF
d. Brake accumulator charging selector	OFF
e. Nosegear air bottle selector	IN
5. Battery switch	OFF
6. Emergency panel	Checked
a. Engine fire extinguisher handles	IN/horizontal
b. Fuel emergency shutoff switches	DOWN/guarded
c. Oil emergency shutoff switches	DOWN/guarded
d. Cockpit heater fire extinguisher switch	DOWN/guarded
e. Cargo compartment heater fire extinguisher switch	DOWN/guarded
7. Brake emergency lever	IN/secure
8. Landing gear selector lever	DOWN
9. Ignition switches	OFF
10. Flaps	40 degrees

Note

Visually check that flaps are in FULL down position. If necessary use hand pump to lower flaps. Use brakes to deplete hydraulic pressure.

11. Hydraulic handpump handle	Stowed
12. Carburetor air	COLD/RAM
13. Oxygen supply valve	As required
14. Portable fire extinguisher	Checked
15. Portable oxygen unit	Checked
a. Smoke mask	Attached

16. Access ladder	Stowed
17. Hydraulic reservoir	Checked
18. First aid kit	Checked
19. Hydraulic pressure shutoff valve	ON
20. Heater and ventilation panel	Checked
a. Master switches	OFF
b. Fuel switch	OFF
c. Ignition switches	OFF
d. Anti-icing switches	OFF
21. Emergency slide	Checked
22. Main gear emergency handle	Checked/secure
23. Cargo door master switch	ON
24. Seat belt/smoking sign switches	ON
25. Emergency lights	Checked/OFF
26. Circuit breaker panel	Checked
a. Circuit breakers	IN
b. Emergency bus switch	NORMAL
c. Secondary bus switch	RESET
d. FM power switch	OFF
e. Instrument transformer	MAIN
f. Fuse caps	Secure
27. Emergency exit jettison handle	Safetied
28. Emergency escape exit	Checked
a. Inverter and battery access panels	Secure
b. Escape hatch release handle	Locked
29. Copilot's attitude indicator	Caged
30. Generator switches	ON
31. Power	ON
a. Battery voltage	Checked/OFF
b. External power	ON

Note

When external power is not available the battery will be used to complete the power on checks.

32. DC warning and indicating lights — Checked

    a. Hydraulic low pressure (2)

    b. Landing gear (3)

    c. Fuel low pressure (2)

    d. Oil low pressure (2)

    e. Generator failure (2)

    f. Inverter failure (2)

    g. 26 volt AC failure (1)

    h. Doors unlocked (1)

33. Pitot heat — Checked

WARNING

Physically touch the pitot heads for heat. Do not leave the heat applied and wait before feeling the heads as serious burns may result.

34. Propeller anti-icing — Checked (if use is anticipated)

35. Lights — Checked (if use is anticipated)

    a. Anti collision

    b. Wing and tail

    c. Wing inspection

    d. Formation

    e. Landing

    f. Taxi

    g. Panel

    h. Standby compass

    i. Dome

    j. Utility

36. Press to test lights — Checked

    a. Oil low level (2)

    b. Fuel low level (2)

    c. Marker beacon (1)

    d. Automatic feather (1)

    e. Propeller reverse (2)

f. Cockpit heater fire (1)

g. Propeller low oil level (2)

h. Cabin heater fire (1)

i. Chip detectors (2)

j. Ramp 15° (1)

37. Windshield anti-icing	Checked (when use is anticipated)
a. Press to test lights	Checked
b. Windshield heat switch	NORMAL
c. Failure lights	Out
d. Windshield heat switch	OFF

Note

If the ambient temperature is greater than 81°F (27°C), do not operate windshield anti-icing on the ground.

38. Landing gear warning switch	TEST

Note

When the gear warning switch is placed in the test position, the warning horn should blow and the warning light in the gear selector handle should illuminate. Both throttles must be in the closed position during this check.

39. Alarm bell	Checked
40. Troop jump lights	Checked
41. Inverters	Checked

a. Turn switch to MAIN and check both inverter lights are out

b. Turn switch to STANDBY and check the standby inverter light illuminates

c. Leave the inverter switch on STANDBY

42. Engine fire detector system lights	Checked

CAUTION

Inoperative fire detection circuits must be corrected prior to flight. Fires in certain accessory areas could develop before detected by other means.

43. Fuel system	Checked
a. Quantity and distribution	Checked

b. Indicating system — Checked

(1) Press the fuel quantity test button and note a decrease on the fuel gages

(2) Release the buttons and note the gages return to original settings

c. Crossfeed — Checked

Note

When engines are not running, position fuel pumps to NORMAL prior to selecting HIGH to preclude damage to the carburetor diaphragm.

(1) Turn the left boost pump to NORMAL and check left fuel pressure increases

(2) Turn the fuel selector to BOTH ON LH TANK and check right fuel pressure increases

(3) Turn the left booster to HIGH and note pressure increase

(4) Turn the fuel selector to NORMAL and check right fuel pressure decreases

(5) Turn the left boost pump OFF and check left fuel pressure decreases

(6) Repeat the procedure with the right boost pump and fuel selector

44. Inverter — OFF

45. Secondary bus switch — DOWN/guarded

46. Power — As required

TOP OF AIRCRAFT CHECK

1. Fuselage general condition — Checked

a. Antennas

b. Cargo compartment heater ducts

2. Left wing — Checked

a. Thrust pitot head

b. Augmentors

c. Oil cooler

d. Top accessory vent door

e. Oil quantity

f. Oil tank filler cap dipstick and access cover panel

g. Propeller deicing quantity, filler cap and access panel

h. Fuel tank filler cap and access cover panel

i. Wing skin and control surface general condition

3. Right wing	Checked
a. Thrust pitot head	
b. Augmentors	
c. Oil cooler	
d. Top accessory vent door	
e. Oil quantity	
f. Oil tank filler cap dipstick and access cover panel	
g. Propeller deicing quantity, filler cap and access panel	
h. Fuel tank filler cap and access cover panel	
i. Wing skin and control surface general condition	

CARGO COMPARTMENT CHECK

1. Oxygen compartment	Checked
a. Pressure	Checked
b. Filler valve	Closed
2. Static line retriever	Stowed
3. Portable fire extinguisher	Checked
4. Crash axe	Checked
5. Preheat outlet cover	Secure
6. Pendulum release handle	Checked
a. Cable	Recessed
b. Handle	Secure
7. Storage compartments	Checked

Note

A minimum of two (2) quarts of hydraulic fluid and tie-down equipment will be stowed in the storage compartment.

8. Ventilation levers	As desired

9. Emergency exit	Checked
10. First aid kits	Checked
11. Anchor lines and attachments	Checked
12. Door emergency exit	Checked
13. Ramp extensions	Stowed
14. Ramp door	Checked
15. Cargo door jettison handle	Safetied
16. Steady strut	Stowed
a. Attachment pin	Stowed
17. Ramp and cargo door control handles	Checked
18. Cargo loading light	Checked

CAUTION

The light should be stowed with the lens down to prevent scorching or burning of material in the stowage well.

19. Left troop door	Checked

EXTERIOR INSPECTION

1. Left aft fuselage — Checked
   a. Condition of skin
   b. Passenger door
   c. Windows
   d. Emergency exit
2. Left inboard wing — Checked
   a. Flaps and flap well
   b. Condition of skin
   c. Engine fire extinguisher discs
   d. Fluid leaks
3. Left wheel well — Checked
   a. Gear doors
   b. Fluid leaks
   c. Drag strut and linkage
   d. Uplocks
   e. Electrical installations

exterior inspection diagram

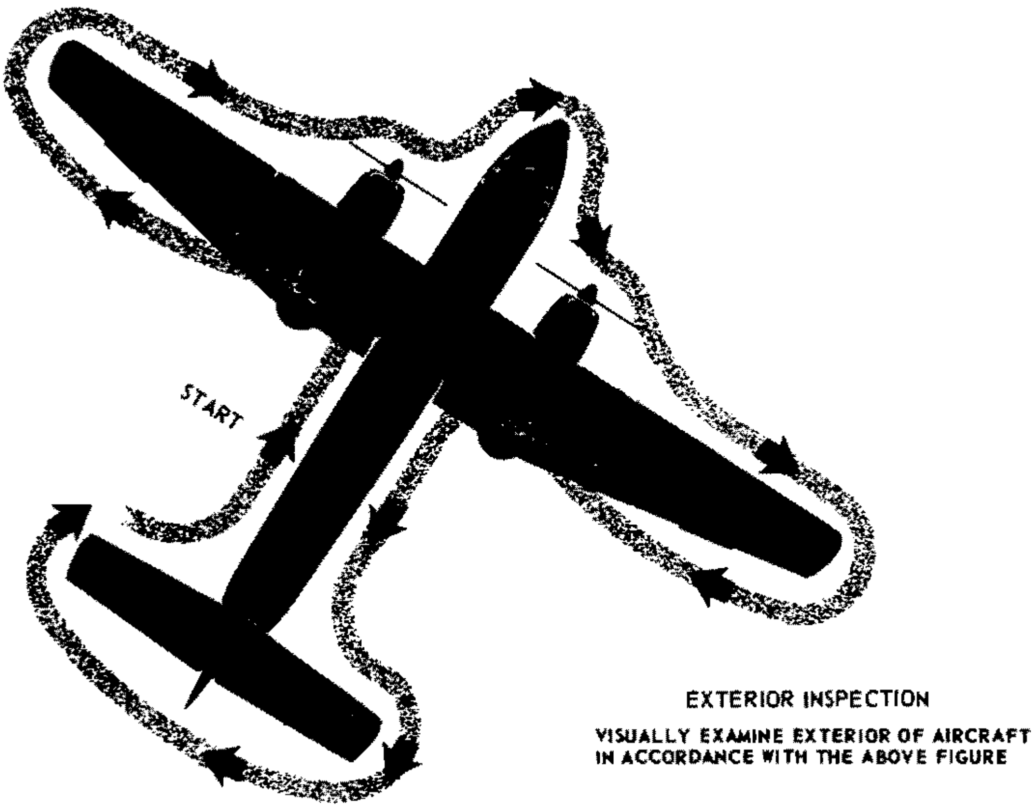


Figure 2-1 Exterior Inspection Diagram

4. Left main gear — Checked

   a. Strut (7 1/2 - 9 1/2" extension)

   b. Tires and wheels

   c. Brake assembly

Note

Check that brake pins are not recessed 5/16 inch or more within the threaded bushing and that disc-to-puck-housing distance does not exceed 7/16 inch.

   d. Weight switch

   e. Static ground

   f. Pneudraulic lines

5. Left outboard wing — Checked

   a. Augmentor tubes

   b. Fluid leaks

   c. Flaps and flap wells

   d. Control surfaces

e. Control hinges	
f. Navigation light	
g. Access panels	
h. Deicing boots	
i. Stall transducer	
j. Landing light	
6. Left engine	Checked
a. Vent doors	Open
b. Fluid leaks	
c. Cowling	
d. Engine intakes	
e. Propeller assembly	
(1) Check dome plug and retainer nut are safetied	
(2) Check dome, hub and control unit for leaks and security	
(3) Check condition of blades	
7. Thrust indicator pitot heads	Checked
8. Left inboard wing leading edge	Checked
a. General condition	
b. Heater intake	
9. Left forward fuselage	Checked
a. Skin and antennas	
b. Brake accumulator pressure (800-850 PSI)	
c. Brake emergency air pressure (1500 to 1600 PSI)	
d. Hydraulic leaks	
e. Nose access door	Closed/secure
f. Static ports	
g. Cockpit heater fire extinguisher discs	
h. Top access panel	
i. Cockpit heater ducts	
10. Pitot tube	Checked

11. Nose gear	Checked
a. Door safety pins	
b. Nose gear doors	
c. Nose steering limit blocks	
d. Steering disconnect pins	
e. Weight switch	
f. Tires and wheels	
g. Strut (8 1/2 - 10 1/2" extension)	
h. Taxi light	
12. Pitot tube	Checked
13. Right forward fuselage	Checked
a. Radome	
b. Cockpit heater duct	
c. Top access panel	
d. Static ports	
e. Hydraulic lines	
f. Emergency air bottle (1200 to 1300 PSI)	
g. Oxygen system pressure (1800 $\pm$ 50 PSI)	
h. Nose access door	Closed/secure
i. Bottom escape hatch	
j. Antennas	
k. Cargo compartment heater fire extinguisher discs	
14. Right inboard wing leading edge	Checked
a. Ram air intake duct	
b. General condition	
15. Thrust indicator pitot heads	Checked
16. Right engine	Checked
a. Propeller assembly	
(1) Check dome plug and retainer nut are safetied	
(2) Check dome, hub and control unit for leaks and security	
(3) Check condition of blades	

b. Engine intakes

c. Cowling

d. Fluid leaks

e. Vent doors

17. Right outboard wing — Checked

a. Landing light

b. Stall transducer

c. Deicing boots

d. Access panels

e. Navigation light

f. Control hinges

g. Control surfaces

h. Flaps and flap wells

i. Fluid leaks

j. Augmentor tubes

18. Right main gear — Checked

a. Pneudraulic lines

b. Weight switch

c. Brake assembly

Note

Check that brake pins are not recessed more than 5/16 inch within the threaded bushing and that disc-to-puck-housing distance does not exceed 7/16 inch.

d. Tires and wheels

e. Strut (7 1/2 - 9 1/2" extension)

19. Right wheel well — Checked

a. Gear doors

b. Fluid leaks

c. Drag strut and linkage

d. Uplocks

e. Electrical installations

20. Right inboard wing — Checked

a. Fluid leaks

b. Engine fire extinguisher discs

c. Condition of skin

d. Flaps and flap well

21. Right aft fuselage	Checked	
a. Condition of skin		
b. Passenger door		
c. Cargo door jettison handle		
22. Empennage	Checked	
a. Vertical stabilizer, rudder and trim tabs		
b. Horizontal stabilizer, fairings, elevators and trim tabs		
c. Cargo door		
d. Steady strut	As required	
23. Static ground wire	Removed	

BEFORE STARTING ENGINES.

1. Forms 781 and 365F and navigation publications	Checked	P
2. Aircraft commander's briefing	Complete	P
*3. Passenger briefing	Complete	P
*4. Seats, rudder pedals, safety belt, shoulder harness	Adjusted	P, CP

Note

The pilot's rudder adjustment handle will be positioned so as not to obstruct the view of the hydraulic gages and warning lights.

5. Radios	OFF	P, CP
6. Cockpit air handles	As desired	P
*7. Parking brakes	Set	P

CAUTION

If hydraulic pressure has been depleted, the brake system must be pressurized to a minimum of 2000 psi by use of the hydraulic handpump before engines are started.

*8. Chocks	Remove	P, FE
9. Engine switch panel	Set	P
a. Oil dilution switches	OFF	
b. Vent door switch	As desired	

c. Hot fuel prime switch	OFF	
d. Battery switch	OFF	
10. Windscreen panel	Set	P
a. Windshield wiper switch	OFF	
b. Windshield heat switch	OFF	
11. Oxygen regulators	Set	All
12. Gyro compass mode switch	SLAVE	P
13. Auto feather switch	OFF	P
14. Instruments	Checked	P, CP
15. Electrical power panel	Set	CP
a. Generator switches	ON	
b. Inverter switch	As required	

Note

Inverter switch will be off for battery starts.

16. Free stream pressure selector	NORMAL	CP
*17. Carburetor air	Set	P
a. Heat levers	COLD	
b. Air switches	RAM	
*18. Flaps selector	40°	P
19. Ignition switches	OFF	P
20. Mixture levers	IDLE CUTOFF	P
21. Propeller levers	FULL INCREASE	P
22. Gust lock	LOCKED	P
23. Throttles	Set	P

Note

Open throttles approximately 1/2 inch from closed position for starting.

24. Landing gear selector	DOWN	P
*25. Down locks/pitot covers/chocks	Aboard	FE
*26. Before starting engine checklist	Complete	CP

STARTING ENGINES.

*1. Propellers/Fireguard	Clear/posted	P, CP
*2. Power	ON	P
*3. Navigation lights	ON	CP
*4. Command radio	ON	P
*5. Right engine	Start	P, CP

Note

Prior to engine start, the copilot will momentarily turn the inverter switch to standby and note manifold pressure setting to use during ignition and power checks. The pilot will engage the starter switch and after the minimum propeller revolutions are noted, he will direct the copilot to turn the ignition switch on. Simultaneously the pilot will engage the vibrator and primer switches and hold until the engine starts. Immediately after the engine starts, the starter and vibrator switches will be released. The copilot will turn the inverter switch to STANDBY and check the oil pressure. The pilot will stabilize engine at 800 rpm with throttles and prime. When proper engine indications are noted, the pilot will direct the copilot to move the mixture lever to RICH. When a 50 - 100 rpm drop is noted, the primer switch will be released.

a. Booster pump NORMAL

b. Engage starter switch

(1) Turn prop through 15 blades when engine has been shut down for a period of one (1) hour or longer

(2) Turn prop through 6 blades if engine has been shut down less than one (1) hour

c. Ignition switch ON

d. Engage vibrator switch

e. Engage primer switch

CAUTION

Do not use mixture lever to prime engine except for extreme cold weather operations. Simultaneous use of both primer and mixture lever often results in exhaust system fires and/or liquid locks. With hot engines and at high density altitude, it may be necessary to delay the initiation of prime until the engine fires.

f. Set throttles for 800 rpm

g. Turn inverter switch to STANDBY

h. Check oil pressure indication

CAUTION

If a positive indication of oil pressure is not indicated immediately, or if 30 psi is not indicated within 30 seconds shut the engine down and investigate.

i. Move mixture levers to RICH

j. Turn the booster pump switch OFF

*6. Pressures	Checked	P, CP

Note

Check oil, fuel, hydraulic and suction pressures for proper indications.

*7. External power	As required	FE
*8. Battery switch	ON	P
*9. Left engine	Start	P, CP

Note

Repeat the same starting procedures for left engine.

*10. Pressures	Check	P, CP

Note

Check oil, fuel, and hydraulic pressures for proper indication.

*11. Throttles	1000 rpm	P

CAUTION

Do not exceed 1000 rpm until oil pressure stabilizes within normal operating limits. Then, do not exceed 1200 rpm until oil temperature reaches 40°C and CHT reaches 80°C.

Note

1000 rpm is recommended for all static ground operations.

*12. Carburetor air switches	As required	CP
*13. Starting engines checklist	Complete	CP

BEFORE TAXIING.

*1. FM power switch	ON	CP
*2. Flaps	UP	CP
*3. Radio console/TACAN/radar alt inverter	As required	P, CP
a. Radios	ON	
b. Navigation equipment	ON	
c. Radar inverter	ON	
d. Radar function switch	STANDBY	

CAUTION

Caution must be exercised in ground operation to preclude a strong return which will damage the indicator. Should operation on the ground be necessary, make sure the scanning area is clear of large structures or aircraft. As an extra precaution, place antenna tilt control in 15° up position. This system may be employed to check operation of the set in runup position prior to take-off in instrument conditions.

e. IFF/SIF	STANDBY	
*4. Alarm bell	Checked	P
*5. Ignition switch safety check	Checked	CP

a. Throttles closed

b. Turn ignition switches from BOTH, to LEFT to RIGHT, to OFF momentarily, then back to BOTH

Note

Perform this check as rapidly as possible.

WARNING

If the engine does not cease firing during this check, it is an indication that the magneto ground wire is open at some point and any subsequent ignition check will be unreliable. Shut down the engine and warn personnel to keep clear of the propeller until the difficulty has been corrected.

6. Stall warning and flap check	Checked	P

a. Close throttles

b. Check flaps are at zero degrees

c. Turn stall warning test switch to the right and note that neither high intensity shakers operate

d. Move test switch to the left, and note both low intensity stick shakers operate

e. Hold switch to left and lower flaps to 40°. Both low intensity shakers should continue to operate

f. Turn switch to right and note stick shakers stop

g. Hold switch to right and advance both throttles approximately 3/4 inch from fully closed position. Both high intensity stick shakers should operate and the approach speed indicator pointer should move fully into the SLOW zone

h. Move switch to left, both high intensity stick shakers should continue to operate, augmented by both low intensity stick shakers. The indicator pointer should return to the triangular index

i. Release switch to OFF. Set throttles to 1000 RPM. Select flaps to zero degrees. Check that the flaps retract to the full up position. Shakers may continue to operate for approximately 10 seconds. Indicator pointer should remain at the triangular index

7. Generators — Checked — CP

a. Check volt readings 27.5V plus or minus 0.5V and that ammeter readings coincide within 10% of the total load

b. Turn left generator switch OFF and check that left ammeter reading drops to zero and right ammeter increases. Check that left generator failure light illuminates

c. Turn left generator switch ON

d. Repeat procedure for right generator

8. Wing and tail deicing — Checked — CP

Note

Check only if icing conditions are anticipated.

a. Set mode switch to MANUAL

b. Check vacuum pressure, 4 to 9 in. Hg

c. Check deicing pressure, 14 to 16 psi

d. Check deicing boot operations

e. Set mode switch to OFF

9. Flight controls	Checked	P, FE

Note

Controls will be visually checked through the full range for proper movement.

10. Gust lock	LOCKED	P
*11. Altimeters	Set	P, CP

a. Obtain taxi clearance and altimeter setting from the control tower

WARNING

It is possible to set the altimeter 10,000 feet in error and have the correct setting on the barometric scale. This occurs when the barometric pressure set knob is continuously rotated, until the barometric scale is out of view and the scale reappears from the opposite side. If the correct altimeter setting is then replaced on the barometric scale, the altimeter will be in error by approximately 10,000 feet. To avoid this, always check the ten thousand feet pointer for proper indication when setting the altimeter.

*12. Cargo/passenger doors	As required	FE

WARNING

The cargo door may be open during ground operations. Passenger doors will be kept closed when engines are running.

*13. Before taxiing checklist	Complete	CP

TAXIING.

When the nosewheel is lightly loaded or while taxiing on wet surfaces, skidding or skipping of nosewheel may develop. These conditions can be prevented by slow taxi speed, gentle brake applications, and avoiding abrupt steering changes. In turns or crosswind conditions, asymmetrical power may be necessary. Differential braking imposes excessive side loading on the nosewheel and should be avoided if possible.

CAUTION

Excessive or prolonged use of the brakes while taxiing will cause overheating of the brake assemblies with possible wheel failure and/or tire or brake fire resulting. Taxi speed can normally be controlled by use of minimum engine power and propeller reversing. 800 rpm is the minimum continuous power recommended during taxiing to minimize spark plug fouling.

CAUTION

Flaps must be retracted when taxiing over rough terrain. Extreme caution must be exercised and very low taxi speeds observed.

CAUTION

Avoid turns with brakes locked on one side to prevent damage to the tires or the main landing gear. When possible, avoid braking to a stop in turns, since damage to the nose landing gear and/or supporting structure may result. See figure 2-2 for minimum space and clearances required for turning.

CAUTION

Reverse taxiing is not recommended. However if reverse taxiing is necessary, the nosewheel steering switch must be on. Reverse taxiing should be started and stopped with the nosewheel centered, the aircraft should be stopped with forward thrust. Sharp turns and use of brakes should be avoided. Brakes should be applied gradually when braking is necessary.

*1. Brakes	Checked	P, CP

Note

Hydraulic pressure must be continually monitored during ground operations.

*2. Flight instruments	Checked/Set	P, CP

a. Check that the turn needle is indicating turn in the proper direction and that the ball is free in the race

b. Check the heading indicators for proper indication

c. Uncage copilot's attitude indicator

3. Propeller reversing	Checked	P, CP

a. Set carburetor air switches to filter

b. Set throttles to idle and push into reverse position. Feather button lights should come ON, reverse lights should come ON, feather button lights should go OUT

c. Move throttles into reverse range and check thrust indicator for "O" reading

d. Move throttles into normal idle position and check for binding. The feather button lights

minimum turning radius and ground clearance

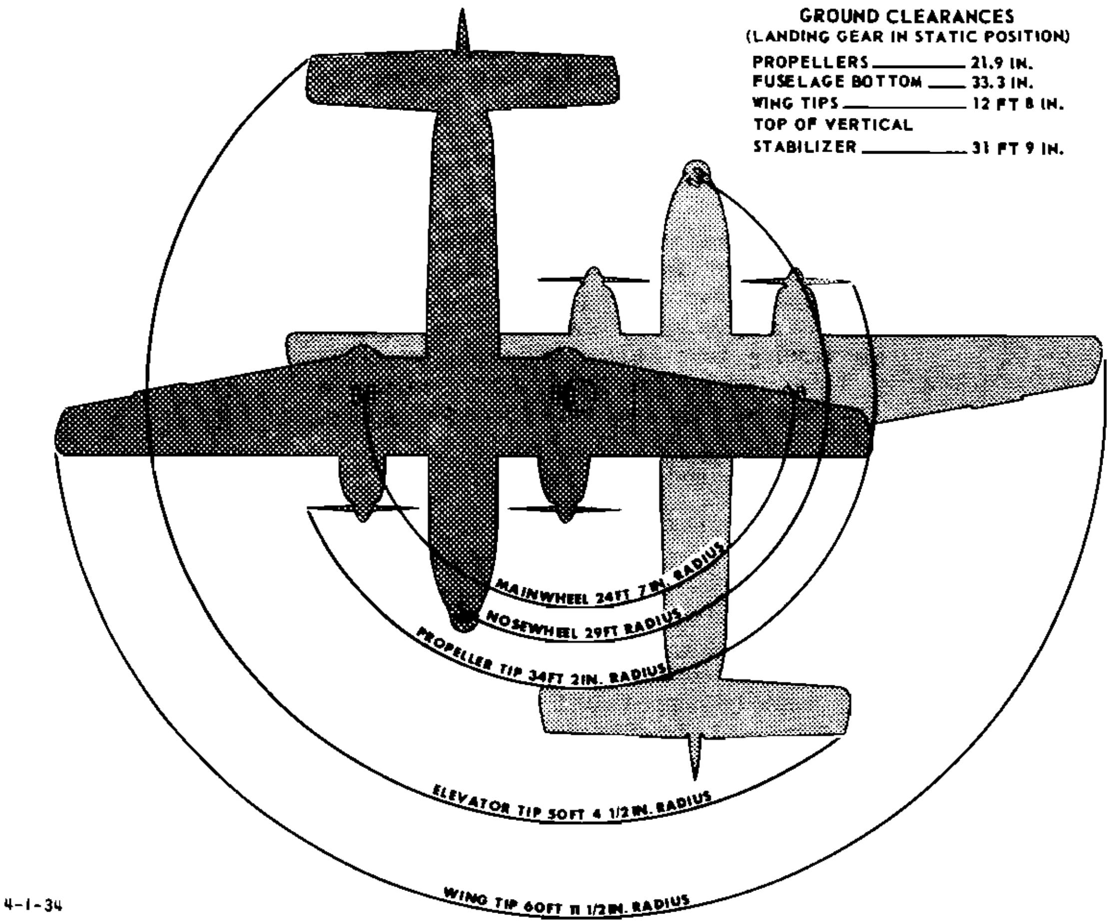


Figure 2-2 Minimum Turning Radius and Ground Clearance

should come ON, reverse lights should go OUT, feather button lights should go OUT. Check thrust indicators for positive thrust indication

e. Carburetor air switches — As required

CAUTION

During feathering, unfeathering, and the reversing cycles the propeller auxiliary pump motor is operating. To prevent burn-out of propeller auxiliary pump motor, operations must be restricted to 20 seconds on (intermittent duty) and 10 minutes off.

*4. Taxi checklist	Complete	CP

ENGINE RUNUP.

1. Nosewheel, parking brakes	Centered/set	P
2. Engine instruments	Checked	P, CP

Note

Do not advance throttles beyond 1200 RPM until oil temperature reaches 40°C and CHT reaches 80°C.

3. Autofeather system	Checked	P, CP

a. Set throttles at 1000 RPM

b. Turn autofeather switch ON and check autofeather indicator light illuminates

c. Advance right throttle until left feathering button pulls in

Note

The feathering button light should illuminate and the autofeathering light should go out.

d. Return the right throttle to 1000 RPM and simultaneously pull out the left feathering button after a 200 RPM drop is observed

Note

At the instant feathering commences a pressure differential of 45 ± 2 1/2 percent thrust should be indicated.

e. Reset the autofeathering switch by turning it OFF and then ON

f. Repeat the procedure to check the right engine autofeather system

g. Turn autofeather switch OFF

Note

If automatic feathering is inoperative check manual feathering at 1900 RPM by depressing each button in turn and pulling out after a drop of 100 RPM.

4. Propeller operation	Checked	P, CP

a. Set throttles to 1900 RPM

b. Set propeller levers to full decrease and check that the RPM decreases and stabilizes to between 1100 and 1350 RPM

c. Return the propeller levers to full increase and check the RPM return to 1900 RPM

Note

It may be necessary to exercise the propeller several times to obtain 1900 RPM.

5. Carburetor heat — Checked — CP

a. Set left carburetor heat lever to HOT

b. Check for a rise in CAT and decrease in RPM

c. Return lever to COLD position and check for a decrease in CAT and an increase in RPM

d. Repeat procedure for right carburetor heat lever

*6. Ignition system and power — Checked — P, CP

a. Set throttle to field barometric pressure

b. Check that the tachometer indicates 2200 ± 50 RPM, and that all instruments are within desired range. Check thrust indicators for similar readings

Note

When making a power check, approximately 2 RPM should be added for each knot of headwind and 2 RPM subtracted for each knot of tailwind.

c. Turn ignition switch to the RIGHT position and observe RPM

Note

A drop of 50 to 75 RPM is normal. Maximum drop is 100 RPM provided no engine roughness is encountered. The maximum spread between drops of right and left magnetos should not exceed 40 RPM. It is essential that all readings be allowed to stabilize between ignition switch changes. This must not be construed to mean that the engines will be allowed to operate on single ignition at this speed for an extended period of time as preignition or detonation may occur. A period as long as 30 seconds is not considered excessive but should not be exceeded.

CAUTION

When RPM drop exceeds 150 or excessive roughness is encountered or ignition is accidentally turned OFF, retard throttle to idle RPM before returning magneto switch to BOTH.

d. Return ignition switch to BOTH position to stabilize RPM

e. Repeat this procedure with ignition switch in LEFT position

Note

If unacceptable magneto check occurs use de-fouling procedure in Section VII.

f. Repeat the ignition check on the other engine

7. Gust lock	LOCKED	P
8. Radios and navigation equipment	Checked	P, CP
*9. Engine runup checklist	Complete	CP

BEFORE TAKE-OFF.

1. Crew briefing	Complete	P

a. Type take-off

b. Performance data

(1) Maximum manifold pressure

(2) Take-off airspeed

c. Cockpit signals and communications procedures

Note

Only special procedures (weather, formation, etc) need be covered. If any crew member is not completely familiar with his duties and procedures, as outlined in emergency section, these areas will be covered.

2. Trim	Set	P
3. Carburetor heat/air	As required	CP
4. Flap lever	Set	CP
5. Mixture levers	AUTO RICH	CP
6. Propeller levers	Full increase	CP
7. Autofeather switch	ON	P

WARNING

Take-off conditions such as gusty crosswinds, inoperative nosewheel steering or a suspected inaccuracy of the thrust differential system may require the autofeather switch to remain OFF.

WARNING

The autofeathering switch must be selected ON before take-off only, and selected to OFF after the power reduction following initial climb. Its use during landing could be hazardous if a go-around is attempted and one propeller feathers due to uneven acceleration of the engines.

8. Fuel panel	Set	P
a. Fuel boost pumps	NORMAL	
b. Fuel quantity	Checked	
9. Hydraulic pressure	Checked	P
10. Instruments/warning lights	Checked	P, CP
a. Flight instruments		
b. Flap position indicator		
c. Engine instruments		
d. Warning lights		

Note

Maximum CHT for initiating the take-off roll is 180°C and the minimum is 80°C.

11. Inverter switch	MAIN	CP
12. Lights	As required	CP
13. Roof hatch	Secure	FE
14. Cargo compartment and engines	Checked	FE
a. Check engines for fuel, oil and hydraulic leaks		
b. Check doors and escape hatches are closed secure		
c. Check brakes for overheat condition		
d. Check that passengers are secure for take-off		

Note

The flight engineer will visually check both main gear brakes for evidence of overheating due to dragging brakes during taxiing.

Note

If ground operating time exceeds 10 minutes, comply with antifouling procedure outlined in Section VII.

15. Before take-off checklist	Complete	CP

LINE UP

1. Flight controls	Checked	P

Note

Controls must be checked for freedom of movement prior to flight anytime the gust lock is placed on and then released.

2. RMI's/standby compass	Checked	P, CP
3. IFF	As required	CP
4. Anti-icing switches	As required	P, CP
5. Line-up checklist	Complete	CP

TAKE-OFF.

Depending upon the conditions encountered, various techniques for take-off must be employed in order to achieve satisfactory performance. At night the use of landing lights throughout the take-off run is recommended. Take-off data presented in the performance data section of the flight manual should be consulted to predict the expected performance for the specific conditions involved in each take-off. No visual or verbal comments will be given to the pilot if the aircraft performance is normal. Any discrepancy which is noted will be brought to the attention of the pilot in the manner directed by the pilot during the pre-take-off briefing. Procedures for normal take-off, short-field take-off and crosswind take-off are given in the following paragraphs.

NORMAL TAKE-OFF

7° flap is recommended at weight of 26,000 to 28,500 pounds or 15° flap at all weights below 26,000 pounds. Taxi the aircraft a short distance to align the aircraft with the runway and to center the nosewheel. Release brakes and advance the throttles gradually to maximum power (50 in. Hg, 2700 RPM at sea level standard day).

During the take-off roll, the pilot maintains directional control with nosewheel steering until flight controls become effective. Concurrently, the copilot shall hold the control column in the neutral position and keep the wings level with ailerons. As speed increases, the pilot discontinues nosewheel steering and maintains directional control throughout the take-off roll by coordinated use of aircraft controls according to the circumstances of speed, crosswinds and runway conditions. As the airspeed increases, the pilot will ease back on the control column and allow the aircraft to lift off at safe single engine airspeed. For a smooth transition to take-off attitude, rotation of the aircraft should be started prior to reaching take-off airspeed.

Note

If the nosewheel steering system is inoperative, the take-off procedure is the same for a normal or short-field take-off except rudder; differential power and brakes may be used as required to maintain directional control. The nosewheel steering switch will be OFF.

SHORT-FIELD TAKE-OFF

When making a short-field take-off, position the aircraft on the extreme threshold of the runway and center the nosewheel. Brakes will be applied and throttles advanced to maximum power. After all engine instruments have stabilized, release the brakes and accelerate to take-off speed. Initial directional control will be maintained by nosewheel steering. Concurrently, the copilot shall hold the control column in the full aft position and keep the wings level with ailerons. When rudder control becomes effective for directional control, the pilot will discontinue use of nosewheel steering and transition to the yoke. After the aircraft becomes airborne, the gear and flaps should be simultaneously selected up.

WARNING

Due to aircraft design, some pilots cannot obtain full left aileron during maximum performance take-offs when the control column is in the full aft position.

CAUTION

Caution must be used after take-off to prevent aircraft from over-rotating to an angle which will cause a drop in airspeed and result in a stall.

CROSSWIND TAKE-OFF

Crosswind take-offs with regard to directional control of the aircraft, are made essentially the same as normal take-offs. Initially, the yoke should be slightly forward and the aileron placed into the wind, to provide positive ground directional control. The pilot maintains directional control with nosewheel steering and differential power while the copilot maintains wing level attitude with the ailerons. Transition to the yoke should be delayed until take-off airspeed is reached. For maximum permissible crosswind components and take-off airspeeds, refer to T. O. 1C-7A-1-1.

CAUTION

Excessive differential power may cause inadvertent autofeathering of the downwind engine.

NO FLAP TAKE-OFF

No flap take-offs may be used regardless of aircraft weight, and are mandatory above 28,500 pounds. The procedure is similar to a normal take-off, except that the nosewheel is lifted just clear of the runway at approximately 65 knots. This pitch attitude is maintained until the aircraft becomes airborne at safe single engine airspeed.

AFTER TAKE-OFF/CLIMB.

Procedures for normal climb and maximum climb are given in the following paragraphs. METO power referred to in this checklist is the maximum power that can be used for an indefinite period as long as the mixture levers remain in the AUTO RICH position. (42.5 in. Hg and 2550 RPM at sea level). Normal climb is at 95 knots IAS with power set to 35 in. Hg and 2250 RPM.

1. Gear	UP	P
(2) Flaps	UP	CP

Note

The gear and flaps should be retracted simultaneously immediately after the aircraft is airborne.

WARNING

The flap lever will initially be set to half of the take-off setting. When it is determined the flaps are retracting properly, the flap lever will be placed in the up position. This is necessary to preclude an instantaneous full retraction in event of restrictor valve failure.

(3.) METO power	Set	P, CP

Note

As the airspeed passes through safe single engine airspeed, reduce power to METO power setting.

Note

If a maximum climb is planned the checklist may be completed prior to establishing normal climb power. Maintain 95 knots IAS during maximum climb.

(4.) Climb power	Set	P, CP

Note

After flaps are fully retracted and airspeed passes through single engine best climb speed, reduce power to normal climb power settings.

5. Autofeather switch	OFF	P
6. Landing and taxi lights	OFF	CP
7. Cargo compartment and engines	Checked	FE
a. Check engines and propellers for fluid leaks		
b. Check gear doors, cargo compartment, load, and security of passengers		
8. NO SMOKING sign	As required	FE
9. After take-off/climb checklist	Completed	CP

MAXIMUM CLIMB

Maximum climbs are normally used in conjunction with shortfield take-offs when obstacles must be cleared. After take-off immediately retract gear and flaps and establish a climb angle which will safely clear obstacles. Maintain maximum power until gear and flaps are fully retracted and obstacles have been cleared. When clear of obstacles, transition to normal or METO climb, as desired. Maximum climbs will not be performed beyond that point at which obstacles are cleared. When a higher rate of climb is desired, maintain METO power and 95 knots until desired altitude is reached.

During maximum performance climbs, maintain airspeeds at or above computed take-off speed. As flaps retract, airspeed must be increased a minimum of 3 knots for each 5° flap retraction to prevent the aircraft from stalling. So that airspeed will increase above these minimum values as rapidly as possible, climb angle should be no steeper than necessary.

CRUISE.

Note

Refer to T.O. 1C-7A-1-1 for power settings for desired BHP.

(1.) Cruise power	Set	P, CP
2. Boost pump switches	OFF	P

Note

Boost pumps will be operated in NORMAL above 10,000 feet or when fuel pressure fluctuates within limits.

3. Mixture levers	As required	CP

Note

Mixture levers are moved one at a time to AUTO LEAN. Refer to Section V for auto lean limitations.

CAUTION

Manual leaning of mixture beyond AUTO LEAN is prohibited.

4. FASTEN SEAT BELT sign	As required	FE
5. Cargo compartment and engines	Checked	FE

a. Check engines and propellers for fluid leaks

b. Check for proper heating and lighting

c. Check security of passengers and cargo

Note

Cargo compartment and engines will be checked hourly.

6. Cruise checklist	Complete	CP

DESCENT.

Conditions permitting, the descent from cruising altitude should be made using cruise power settings. If a considerable reduction in manifold pressure is required, the RPM should be reduced accordingly to provide one inch of Hg per 100 RPM. If a rapid descent is necessary, use a clean configuration and descend at 170 knots IAS, power off. The descent checklist should be completed prior to entering the downwind leg of the traffic pattern.

CAUTION

Rapid descents should be avoided.

1. Windshield heat/anti-icing	As required	P, CP

CAUTION

Should the descent necessitate passing through probable icing conditions, apply carburetor heat prior to entry, and maintain a carburetor air temperature of 15°C throughout. It is possible that a rapid descent from a very cold level into visible moisture at a warmer level can create airframe icing even though the ambient temperature may not be conducive to ice formation.

2. FASTEN SEAT BELT/NO SMOKING sign	ON	FE

Note

The flight engineer will notify the pilot when the cargo and passengers are secured for landing.

3. Crew briefing	Completed	P
a. TOLD card	Reviewed	
b. Special instructions	Briefed	
4. Radar function switch	As required	CP
5. Fuel panel	Set	P
a. Fuel boost pump switches	Normal	
b. Fuel tank selector	Normal	
6. Descent checklist	Complete	CP

BEFORE LANDING.

1. Carburetor air	As required	CP

Note

The filter position will be selected for landing in areas of sandy or dusty conditions and when reverse is anticipated.

2. Mixture levers	Auto Rich	CP
3. Propellers	2250 RPM	CP
4. Gear	DOWN	P, FE

Note

The pilot will check the green indicator lights - ON, hydraulic pressure within limits, the gear selector red light - OUT. The flight engineer will visually check the main gear down lock index marks, and report conditions to the pilot.

(5) Flaps	As desired	CP
(6) Propellers	Full increase	CP

Note

Move propeller levers to full increase RPM when throttles are retarded below governing speed.

7. Hydraulic pressure/gear	Checked/down	CP, FE
8. Before landing checklist	Complete	CP

LANDING.

NORMAL LANDING

Variable flap settings may be used. Refer to T.O. 1C-7A-1-1 for threshold airspeeds and distances.

Every landing should be planned according to runway length available and the general prevailing operating conditions. Normal landings should be planned to promote safe, smooth, and unhurried operating practices; to preclude abrupt reverse power changes; and to save wear and tear on brakes. On final approach, begin to decrease airspeed at a point that will allow a gradual slow-up to Normal Threshold Airspeed.

Note

Threshold airspeed is that airspeed at which roundout is initiated.

Roundout should be planned to arrive at the touchdown point at an airspeed above stall speed as computed from the appropriate performance chart (see T.O. 1C-7A-1-1). After the main wheels touch down, lower the nosewheel smoothly to the runway before elevator control is lost. When the main landing gear and nose landing gear are firmly on the ground, the copilot will maintain wing level attitude and hold forward pressure on the control column to insure adequate nosewheel steering capability.

Note

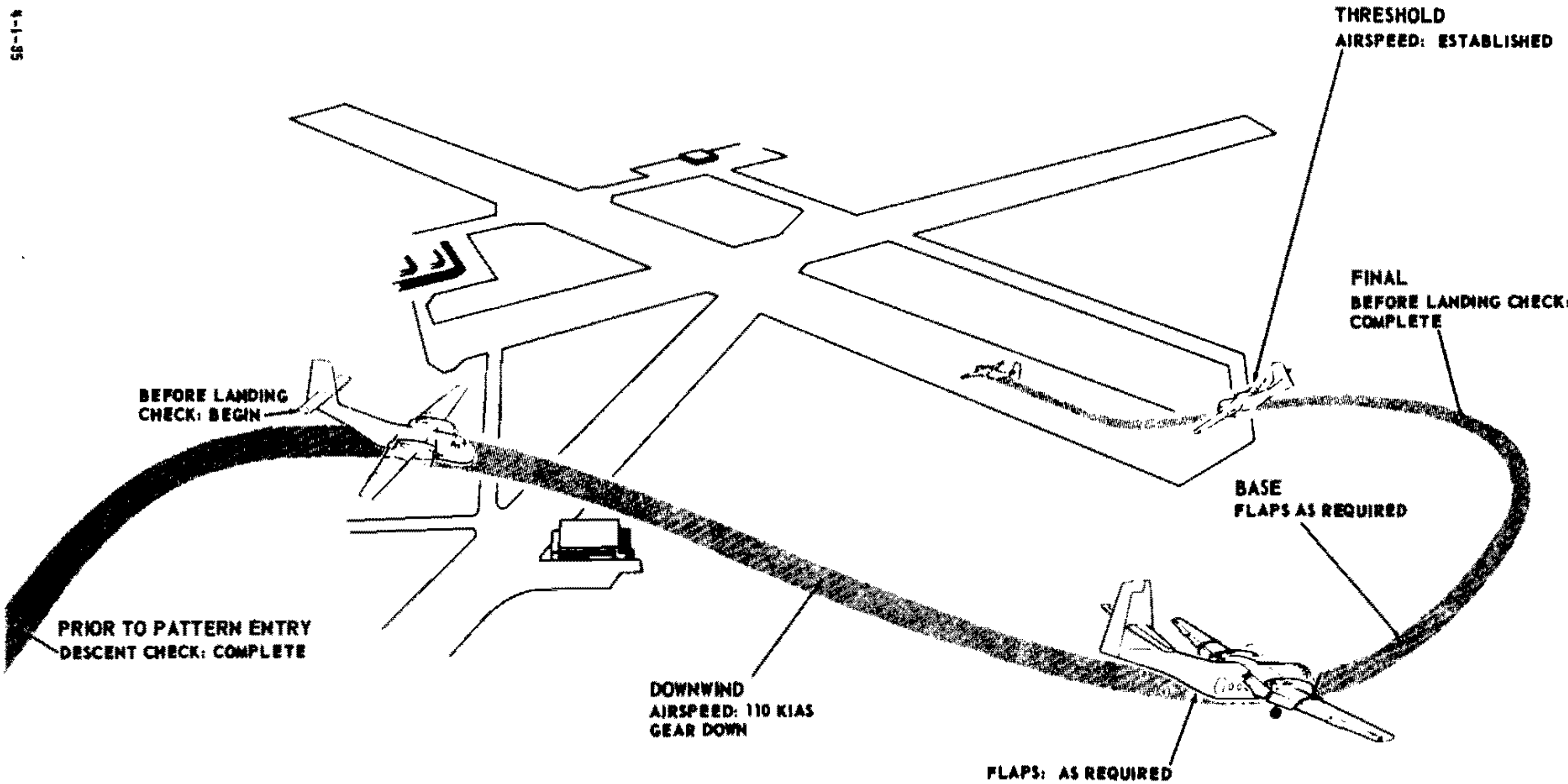
Forward pressure on the control column must not be such that the nose gear strut is fully compressed and shock absorption nullified.

Concurrently, the pilot maintains directional control and decelerates the aircraft through the coordinated use of the rudder, nosewheel steering, and brakes, according to the speed, wind, and runway conditions. If necessary, differential power may be used to assist in maintaining directional control. Reverse thrust may be applied if needed. Brakes must be checked during the landing roll. When the landing roll is complete and the aircraft slowed to taxi speed, engage the gust lock prior to turning off the runway.

CAUTION

During gusty wind conditions, the threshhold airspeed will be recommended threshold airspeed plus one-half the gust factor. (Any increase in touchdown speed will increase landing ground roll distance). Landings will not be conducted if the computed crosswind component is not in the recommended area of the applicable crosswind component landing chart.

landing pattern-typical



NOTE:
REFER TO T.O. 1C-7A-1-1 FOR LANDING DISTANCE, THRESHOLD & TOUCHDOWN SPEEDS

Figure 2-3 Landing Pattern - Typical

CAUTION

Do not transmit on HF frequencies when flying below 90 kts IAS with flaps less than 20° down, or below 70 kts IAS with flaps 20° or more down. The high RF energy level generated during transmission will affect lift transducer signals near stall speeds and nullify stick shaker operation and short-field approach speed indication.

CROSSWIND LANDING

Correct the approach drift by lowering the upwind wing, applying opposite rudder and differential power as required; maintain the correction throughout the flare. Immediately after touchdown, lower the nosewheel to the ground. Normally nosewheel steering will be adequate for maintaining directional control during ground roll. In strong crosswind, it may be necessary to augment nosewheel steering with rudder, brakes and differential power while the copilot maintains a wing level attitude with aileron. (Refer to T.O. 1C-7A-1-1 for maximum permissible crosswind components).

SHORT-FIELD LANDING

Short-field landings are accomplished with 30/40° flaps, and at short-field threshold airspeed as computed from T.O. 1C-7A-1-1.

Note

Threshold airspeed is that airspeed at which roundout is initiated.

Upon completion of turn to final approach, establish and maintain short-field threshold airspeed by a combination of pitch and power. Short-field threshold airspeed should be maintained until the aircraft commences roundout. Power required to maintain the desired airspeed during the approach should be maintained down to the commencement of the roundout. Power should then be reduced at a rate that places the throttle levers at IDLE by the time the aircraft has reached the level attitude during the flare. During the short-field approach, care should be taken to accurately monitor and maintain the approach airspeed down to the commencement of the flare.

Note

On aircraft equipped with short-field approach speed indicator, the indicator may be used to maintain the optimum approach speed, provided 40° of flaps are used. Short-field approach speed indicator readings should be adjusted as desired by appropriate change in engine power.

Note

This aircraft, in common with most large aircraft capable of operating at low airspeeds, has low response rates to control deflection in the landing configuration. Therefore, during turbulent conditions, large control motions may be required and airspeeds should be increased as appropriate to turbulence and wind conditions.

CAUTION

Do not use reverse pitch prior to touchdown. Immediately after the main wheels are firmly on the ground, move the throttles into the reverse range. Normally the throttles should be returned to the forward thrust idle position before resulting debris can cause restriction to visibility or engine damage.

CAUTION

To preclude the possibility of overstressing the center wing section upon landing, do not apply initial braking until the main wheels are firmly on the ground. The most effective braking is obtained by repeated use of maximum brake for periods not to exceed one second followed by a momentary complete release of the brakes. Maximum braking should be used only when normal braking would be inadequate.

CAUTION

Due to aircraft design, the average pilot cannot obtain full left aileron during maximum performance landings when the control column is in the full aft position.

NO FLAP LANDING

Base leg airspeed will be 110 knots IAS. (Refer to T.O. 1C-7A-1-1 for Normal Threshold Airspeeds.)

GO-AROUND

(1.) Power	As required	P, CP
a. Advance the propeller levers to full increase RPM		CP
b. Advance throttles to maximum power		P
(2.) Flaps	UP	CP
3. Gear	UP	P
4. Carburetor air	As required	CP
5. Accomplish climb checklist		P, CP

TOUCH AND GO LANDINGS.

Touch and go landings require a significant element of caution because of the many actions that must be executed while rolling on the runway at high speed or while flying within the immediate proximity of the ground. Touch and go landings should be made only when authorized or directed by the major command concerned. The actions required during touch and go landings are divided into three categories: on the runway, after take-off, and before landing. This procedure and checklist is designed for use when touch and go landings are being accomplished and the aircraft remains in the traffic pattern area. Before the first touch and go, all normal checklists should be completed through the before landing checklist. After the first touch and go, this checklist may be used until the aircraft either departs the traffic pattern or makes a full stop taxi-back landing. Once the aircraft is on the runway the pilot will call for the appropriate take-off flap setting, and the copilot will position the flap lever to required position, reset the trim tabs, turn on the autofeather switch, and check the flap indicator for proper indication. The pilot will then advance the power and continue with the take-off.

ON THE RUNWAY

(1.) Flaps	As required	CP
2. Carburetor air	As required	CP
3. Trim tabs	Set for take-off	CP
4. Autofeather switch	ON	CP
5. Throttles	As required	P

AFTER TAKE-OFF

(6.) Gear and flaps	UP	P, CP
(7.) METO power	Set	P, CP
(8.) Climb power	Set	P, CP
9. Autofeather switch	OFF	P

BEFORE LANDING

10. Gear	DOWN	P, FE
(11.) Flaps	As desired	CP
(12.) Propellers	Full increase	CP
13. Hydraulic pressure/gear	Checked/down	CP, FE
14. Before landing checklist	Complete	CP

AFTER LANDING.

1. Gust lock	LOCKED	P

Note

Engage gust lock after aircraft is slowed to taxi speed prior to turning off runway. The remainder of the checklist should be delayed until the aircraft clears the runway.

2. Carburetor heat/air	As required	CP
3. Flaps	UP	CP
4. Fuel boost pumps	OFF	P
5. Windshield heat switch	OFF	CP
6. Inverter switch	STANDBY	CP

7. Anti-icing/deicing switches	OFF	CP
8. Lights	As required	CP
9. Radio console	As required	CP

a. Radios

b. Radar function switch

c. IFF

Note

Turn the IFF to OFF or STBY to eliminate signals which may block the controllers scope and interfere with the control of airborne aircraft.

10. After landing checklist	Complete	CP

POST FLIGHT ENGINE CHECKS.

Post flight engine checks are to be made upon completion of the last flight of the day, prior to entering the parking area. Where possible, head aircraft into the wind.

1. Nosewheel, parking brake	Centered/set	P
2. Ignition switch safety check	Checked	CP

Note

Follow the same procedure as outlined in BEFORE TAXIING checklist.

3. Ignition system and power	Checked	P, CP

Note

Follow the same procedures as outlined in ENGINE RUN-UP checklist. The carburetor induction switch will be at RAM for power check.

4. Gust lock	LOCKED	P
5. Idle speed and mixture check	Complete	CP

a. Close throttles

b. Check idle speed (650 $\pm$ 25 RPM)

c. Slowly move left mixture lever toward IDLE CUT-OFF position until a decrease in RPM is noted.

Note

If the RPM rises more than 20 RPM, it is an indication that the idle mixture is too rich; if less than 10 RPM, the idle mixture is too lean.

d. Return the mixture to AUTO RICH

e. Repeat check on right engine

6. Post flight engine checklist	Complete	CP

ENGINE SHUTDOWN.

1. Nosewheel, parking brake	Centered set	P
2. Trim tabs	Centered	CP
3. Copilot's attitude indicator	Caged	CP
4. Heater switches	OFF	P, FE
5. TACAN, radar altimeter/radar inverters	OFF	CP
6. Right engine mixture lever	IDLE CUT-OFF	CP

Note

Should engine continue firing in idle cut-off, close the throttle, turn off the fuel tank selector switch and slowly open the throttle.

7. Flaps	As desired	CP

Note

When another take-off is scheduled, the flaps may be set at 40°. Flaps will be positioned UP on the last flight of the day.

8. Hydraulic pressure	Checked	P
9. Left engine mixture lever	IDLE CUT-OFF	CP
10. Ignition switches	OFF	CP

Note

Do not turn ignition switches OFF until the engines have completely stopped.

11. Radio	OFF	CP
12. Inverter switch	OFF	CP
13. Lights	OFF	ALL
14. FM power switch	OFF	CP
15. Battery switch	OFF	P
16. Wheel chocks	In place	FE
17. Parking brake	Released	P
18. Engine shutdown checklist	Complete	CP

BEFORE LEAVING THE AIRCRAFT.

Make appropriate entries in the Form 781 covering any limits in the Flight Manual that have been exceeded during flight. Entries must also be made when, in the judgement of the pilot, the aircraft has been exposed to unusual or excessive operations, such as hard-landing or excessive braking action during aborted take-offs. The flight engineer will complete the following items as required.

1. Landing gear ground locks	Installed	FE
2. Covers/dust excluders	Installed	FE
3. Servicing/securing	As required	FE

SECTION III

EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION.

This section contains the procedures to be used in coping with the various emergencies that may be met during flight and landing. A thorough knowledge of these emergency procedures will enable crew members to perform these emergency duties in an orderly manner, and to judge more quickly the seriousness of the emergency. This will permit early planning for a bailout or forced landing and will greatly increase the crew's chances for survival. The procedures consist of items classified as critical or noncritical. The critical items are actions that must be performed immediately to avoid aggravating the emergency and causing injury or damage. Critical items are presented in boldface type and must be committed to memory. Noncritical items are actions that contribute to an orderly sequence of events. After determining that an emergency exists, the pilot should establish communication with a ground station. The ground station should be given a complete description of the emergency, the action taken, an accurate position report and the pilot's intentions. The ground station should be further notified of any changes or developments in the emergency, so that the station can alert Air Rescue Service or other agencies to stand by, if necessary. In checklists presented, the codes P, CP, and FE stand for pilot, copilot, and flight engineer. This presentation does not preclude the pilot from redelegating the duties at crew briefing.

Note

Crew members should never initiate a procedure before receiving command from the pilot.

ENGINE SHUTDOWN CONDITIONS.

If any of the following conditions occur in flight, corrective action may be limited, and in most cases will require the affected engine to be shut down.

Engine fire.

Engine failure.

Certain propeller malfunctions (see PROPELLER FAILURES in this section).

Fuel leaks.

Excessive drop in oil pressure.

Excessive rise in oil temperature/pressure.

Unusual vibration or roughness.

Chip detector warning light.

When it is necessary to continue operation of an engine with any of these conditions present, in the interest of safety of the aircraft and crew, operate the engine with extreme caution, and at the minimum power required.

GROUND EMERGENCIES.

GROUND ENGINE FIRE SHUTDOWN PROCEDURE

If an engine fire develops during starting, discontinue priming, but continue cranking with the starter and open the throttle. If the fire goes out, shut down the engine and investigate. If the fire continues to burn, continue with the ground engine fire shutdown procedure below. If the engine is already running and an engine fire develops, stop the aircraft, if moving, open the throttle and attempt to blow out the fire. If this action fails to extinguish the fire, immediately execute the ground engine fire shutdown procedure and notify the control tower.

1. MIXTURES — **OFF** — **CP**

2. FUEL SHUTOFF — **UP** — **P**

3. OIL SHUTOFF — **UP** — **P**

4. BOOST PUMPS — **OFF** — **P**

5. FIRE EXTINGUISHER — **AS REQUIRED** — **CP**

Note

If fire exists in Zone 2 or 3, after engine stops, actuate the fire extinguisher - AS REQUIRED.

Note

If first shot does not extinguish the fire, push the fire extinguisher handle fully in, turn counterclockwise 90° and pull for second shot.

6. Ignition switches — OFF — CP

7. Electrical power — OFF — P

Note

The external power unit will be disconnected if being used.

8. Fight the fire — FE

Note

A red colored push-in panel located to the rear of each engine nacelle at the lower left cowl is marked FIRE ACCESS. Pushing in the panel will allow access for a hand fire extinguisher, which may be discharged into the engine accessories compartment.

TAKE-OFF EMERGENCIES.

ABORT PROCEDURES.

Should a malfunction occur during the take-off roll prior to take-off airspeed and while the aircraft is on the ground, proceed as follows:

Retard the throttles to idle or to reverse power if required.

Use reverse power and brakes to stop the aircraft.

Note

> Nosewheel steering should be used during propeller reversing and wheel braking. This is especially important if the abort decision was made because of an engine failure, since maximum wheel braking during single engine reversing can only be applied if steering is used to maintain a straight path.

Follow GROUND ENGINE FIRE SHUTDOWN PROCEDURE in this section if required.

ENGINE FAILURE DURING TAKE-OFF.

If an engine failure occurs below computed take-off speed, abort the take-off in accordance with ABORT PROCEDURES in this Section. Normally, take-off airspeed will be above minimum control airspeed except during a shortfield take-off. If engine failure occurs immediately after take-off, before minimum control airspeed is attained, it does not necessarily mean that flight ends. It may be most advantageous to land straight ahead the moment after the engine becomes inoperative. If the pilot does not desire to land immediately, he should insure that he has sufficient control of the aircraft to continue with the take-off. If the airspeed is so low that sufficient lateral or directional control cannot be maintained, power must be reduced to attain control. If flight cannot be maintained, prepare for a crash landing, and land straight ahead with gear down.

INFLIGHT EMERGENCIES.

INFLIGHT ENGINE SHUTDOWN PROCEDURE

If an engine failure occurs at a time when additional power is required to maintain safe flight, increase power prior to isolating the failed engine. Conditions permitting, attempt to return the affected engine to normal operation by reducing power, placing the mixture lever to AUTO RICH, booster pump to NORMAL, switching fuel tanks and adjusting carburetor heat. Maintain directional control and do not allow airspeed to dissipate below single engine best climb airspeed. If normal or partial power output cannot be realized, shut down the affected engine immediately in accordance with the inflight engine shutdown procedure below. Cargo and equipment should be jettisoned if safe altitude cannot be maintained. If directional control, altitude, or airspeed cannot be maintained, the passengers and crew should be alerted for bailout. Normally, flight on one engine is possible; however, the aircraft should be landed at the nearest suitable landing field.

SHUTDOWN

1. GEAR/FLAPS — AS REQUIRED — P, CP
2. THROTTLE — CLOSED — P

WARNING

> Do not retard throttle in case of fire.

3. PROPELLER — FEATHER — CP
4. MIXTURE — OFF — CP
5. FUEL SHUTOFF — UP — CP
6. OIL SHUTOFF — UP — CP
7. FIRE EXTINGUISHER — AS REQUIRED — CP

Note

> If fire exists in Zone 2 or 3, after engine stops, actuate the fire extinguisher - AS REQUIRED.

Note

If first shot does not extinguish the fire, push the fire extinguisher handle fully in, turn counterclockwise 90 degrees and pull for second shot.

APPLY POWER TO GOOD ENGINE

8. Mixture lever	AUTO RICH	CP
9. Propeller lever	As required	CP
10. Throttle	As required	P
11. Boost pump switch	NORMAL	P

CLEAN UP

12. Propeller lever	Full decrease	CP
13. Boost pump switch	OFF	P
14. Ignition switch	OFF	CP
15. Generator switch	OFF	CP
16. Nonessential electrical equipment	OFF	CP
17. Secondary bus reset switch	UP	CP
18. Fuel tank selector	As required	P

Note

During extended flight on one engine, symmetrical fuel load should be maintained by use of crossfeed selection.

WARNING

Do not attempt to restart an engine which was shut down because of fire or any other engine malfunction unless, in the opinion of the pilot, a greater emergency exists.

SINGLE ENGINE FLIGHT CHARACTERISTICS.

The aircraft has good flight characteristics during single engine operation. Gear tabs and trim tabs are provided to assist the pilot in maintaining directional control. Should an engine fail in flight, the initial yaw should be controlled by rudder and a bank of 3° to 5° towards the operative engine. Adequate trim is available to relieve control pressures as long as safe single engine or higher airspeeds are maintained. In a clean configuration all normal maneuvers may be performed during single engine operations. The airspeed should be closely monitored and the angle of bank restricted during all maneuvers.

DETECTION OF INOPERATIVE ENGINE.

Should engine failure occur, the inoperative engine can be determined by:

Noting the change in directional trim.

Noting a drop in thrustmeter readings.

Observation of the affected engines, i.e., engine roughness, spewing of oil, or backfiring.

Noting abnormal cylinder head temperature.

PRACTICE MANEUVERS WITH ONE ENGINE INOPERATIVE

Engine failures may be simulated for practice when desired. To simulate a feathered propeller, set the power to indicate zero thrust (approximately 1500 rpm and 15 in. Hg). Checklist procedures for engine failure can be called out without actually performing the operations named. Practice all maneuvers at a safe altitude. Select a base point and set up a simulated field elevation. Traffic patterns can be flown at the normal altitude above the base point.

During practice feathering, perform engine shutdown in accordance with INFLIGHT ENGINE SHUTDOWN PROCEDURE in this section.

Note

During practice feathering, simulate actuating the fuel and oil emergency shutoff switches and fire extinguishers.

TURNS.

Turns can be safely made in either direction with one engine inoperative, if airspeed is maintained sufficiently high in respect to minimum control speed and stall speed. Banking into the dead engine increases minimum control speeds and safe single engine airspeeds.

LANDING AND GO-AROUND.

Landing and go-around with a feathered engine may be simulated at altitude by flying a traffic pattern over a basic altitude. Roll out most of the rudder trim during approach to the touchdown point. During practice go-around, note the time required to establish safe climb conditions. Note the altitude lost while gear and flaps retract.

ENGINE RESTART IN FLIGHT

To restart an engine in flight, the procedure is as follows:

WARNING

An engine will not be restarted unless it can be determined that it is safe to do so. Place the oil emergency shutoff switch to DOWN and turn the engine over with the starter every 30 minutes if a restart is anticipated.

1. Airspeed — 130 knots IAS maximum — P

Note

At 110 knots IAS or below, the airflow may be insufficient to windmill the propeller and the starter may have to be used.

CAUTION

As a precaution against overspeeding during unfeathering, it is recommended that the propeller lever of the feathered engine be set to DECREASE RPM, the throttle be closed and airspeed reduced to 130 knots or below.

2. Throttle — Closed — CP
3. Propeller lever — Full decrease — CP
4. Mixture lever — IDLE CUTOFF — CP
5. Fuel emergency shutoff switch — Down and guarded — CP

single-engine control speeds

MINIMUM CONTROL AIR SPEED

FLAPS-15°

FLAPS-0° and 7°

OPERATIVE ENGINE - MAXIMUM POWER

INOPERATIVE ENGINE PROPELLER- **WINDMILLING**

LANDING GEAR- **DOWN**

66 **KNOTS IAS** **70**

Minimum control airspeed is based on take-off configuration, inoperative engine propeller windmilling, maximum power on the operative engine, and no more than 5° of bank towards the operative engine.

SAFE SINGLE-ENGINE AIR SPEED

FLAPS-15°

FLAPS-0° and 7°

OPERATIVE ENGINE - MAXIMUM POWER

INOPERATIVE ENGINE PROPELLER- **FEATHERED**

LANDING GEAR- **UP**

75 **KNOTS IAS** **84**

Safe single-engine airspeed is the lowest airspeed at which a rate of climb of 100 fpm will be possible with the propeller of the inoperative engine feathered, landing gear retracted, and flaps at take-off setting. The above airspeeds are based on standard day conditions at sea level. An increase in ambient temperature or altitude will result in a deterioration in performance.

4-1-37

Figure 3-1 Single-engine Control Speeds

SINGLE ENGINE BEST CLIMB SPEED

MODEL: C-7A
DATE: SEPTEMBER 1967
DATA BASIS:ESTIMATED

ENGINE(S): (2) R-2000
FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

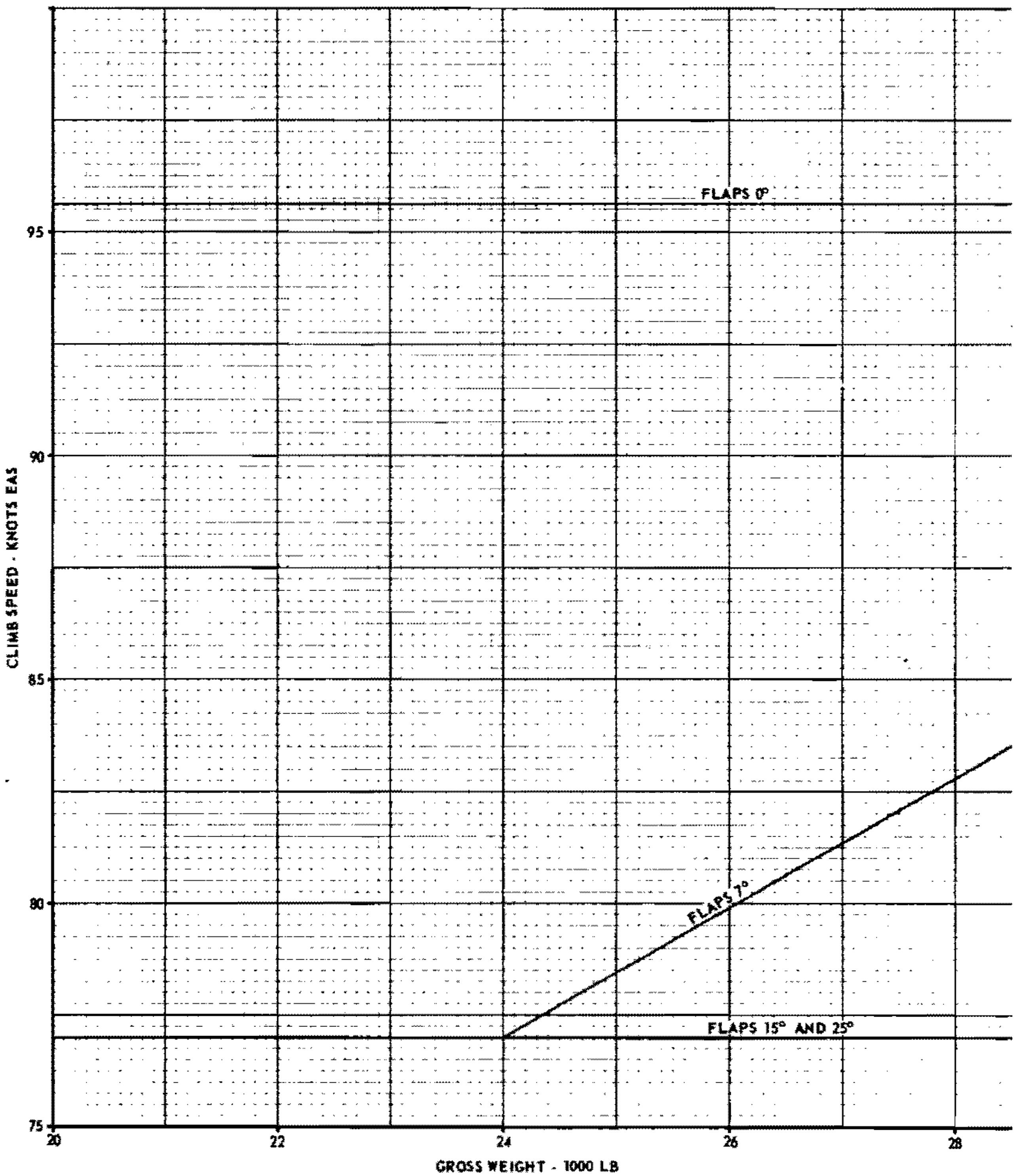


Figure 3-2 Single Engine Best Climb Speed

MAXIMUM GLIDE
CLEAN CONFIGURATION

MODEL: C-7A
DATE: SEPTEMBER 1967
DATA BASIS: FLIGHT TEST

ENGINE(S): (2) R-2000
FUEL GRADE: 100/130
FUEL DENSITY: 6.0 LB/GAL

EXAMPLE: BOTH PROPS ARE FEATHERED. FIND DISTANCE FLOWN DURING DESCENT FROM 14,900 FEET TO 9000 FEET.

ENTER CHART AT 14,900 FEET ON VERTICAL SCALE AND FIND THE CORRESPONDING VALUE OF 30.5 NAUTICAL MILES ON THE HORIZONTAL SCALE.

REPEAT THE PROCESS AT 9000 FEET AND FIND THE CORRESPONDING VALUE OF 18.5 NAUTICAL MILES.

THE DESCENT RANGE 30.5 - 18.5 = 12 NAUTICAL MILES.

GROSS WEIGHT POUNDS	BOTH PROPS FEATHERED CAS KNOTS	ONE PROP WINDMILLING CAS KNOTS
20,000	90	77
22,000	94	80
24,000	98	84
26,000	102	87
28,000	107	91

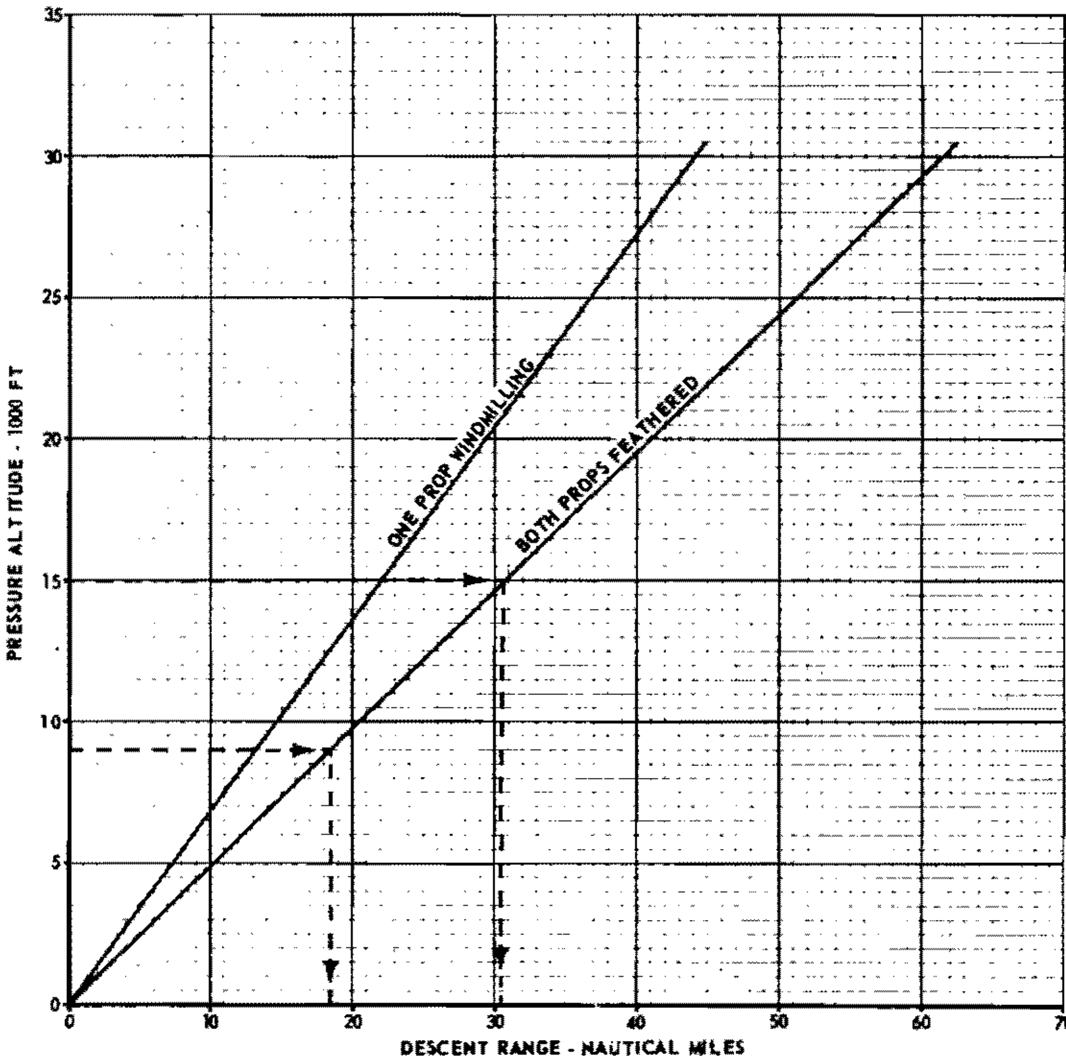


Figure 3-3 Maximum Glide

6. Oil emergency shutoff switch	Down and guarded	CP
7. Secondary bus switch	Down and guarded	CP
8. Propeller reverse circuit breaker	In	CP

WARNING

With the propeller reverse circuit breaker out, the number 2 blade switch will be rendered inoperative and the propeller may go into reverse if the propeller governing system fails.

9. Starter switch	As required	P

CAUTION

If an engine has been shut down for less than fifteen minutes, use the starter to crank propeller through 6 blades prior to unfeathering to check for a hydraulic lock. If an engine has been shut down for more than 15 minutes crank through 15 blades to insure adequate engine pre-oiling.

10. Booster pump	NORMAL	P
11. Ignition switch	BOTH	CP
12. Propeller feathering button	Pull	CP

Note

Pull the feathering button out and hold until the tachometer indicates 500-600 RPM then release. Check that the feathering button returns to the neutral position. Maximum time for propeller auxiliary pump operation is 20 seconds continuous operation. If the propeller hesitates due to hydraulic lock, push the feathering button full in and refeather the propeller to preclude damage to the engine.

WARNING

The feathering button must be released before 800 RPM is reached. As the propeller unfeathers, monitor the RPM for engine overspeed. The RPM should govern at 1200 RPM and stabilize at approximately 1300 RPM. If the RPM continues to increase unchecked, a runaway propeller is evident. Employ RUNAWAY PROPELLER PROCEDURES in this section.

13. Oil pressure	Checked	CP
14. Mixture lever	AUTO RICH	CP

15. Engine instruments	Checked	CP
16. Generator	ON	CP
17. Electrical equipment	As required	CP
18. Booster pump	OFF	P
19. Power	As required	P

Note

If engine has been shut down for a period of time that the oil temperature has dropped below the minimum required, engine oil pressure will be abnormally high, operate engine at 1500 RPM and 15 in. Hg MAP until oil temperature has reached a minimum of 40°C.

PROPELLER FAILURES.

A propeller malfunction will be indicated by one of the following conditions.

Propeller oil low-level warning light or visible propeller oil leak.

An engine overspeed.

RPM surge or fluctuation.

Failure of propeller to feather or unfeather.

PROPELLER OIL LOW LEVEL WARNING LIGHT.

Should a propeller oil low level warning light illuminate, monitor the tachometer and the propeller. If the RPM fluctuates or visible oil is detected, immediately shut down the affected engine in accordance with INFLIGHT ENGINE SHUTDOWN PROCEDURES in this section.

ENGINE OVERSPEED

An engine overspeed will be detected by tachometer indications and an audible beat. If an overspeed occurs during take-off, attempt to control the propeller by the propeller lever. If at any time in flight the propeller overspeeds and does not immediately govern to the desired RPM, accomplish the following procedure:

RUNAWAY PROPELLER

Should an excessive and uncontrollable overspeed occur, proceed as follows:

1. THROTTLES	**RETARD**	**P**
2. AIRSPEED	**REDUCED**	**P**

Note

Reduce airspeed to just above stall speed.

3. PROPELLER	**FEATHER**	**CP**

Note

Should the propeller fail to feather, check that the propeller feather circuit breaker is in.

4. Employ INFLIGHT ENGINE SHUTDOWN PROCEDURE after propeller has feathered	P, CP

WARNING

If an excessive RPM condition is not brought under control immediately, excessive vibration, with possible blade failure may occur.

WARNING

If unable to feather, maintain the slowest safe airspeed possible, move the passengers away from propeller line of rotation, and land as soon as possible.

WARNING

If the propeller fails to feather and there is no evidence of fire, the oil emergency shutoff switch should be left DOWN to supply oil to the engine for lubrication and to prevent engine seizure. If the propeller fails to feather and minimum safe altitude cannot be maintained, re-establish power to zero thrust if possible. If fire is evident, the oil emergency shutoff switch should be pushed UP.

PROPELLER FLUCTUATION.

An actual propeller fluctuation will be accompanied by an audible beat and/or aircraft vibration. Press to test the propeller oil low level warning light and visually check the propeller to insure that the malfunction is not due to oil starvation. Move the propeller levers through complete pitch ranges several times in an attempt to re-establish governor control. If the fluctuation is due to an electrical malfunction, it may be controlled by pulling the propeller reverse circuit breaker.

CAUTION

If the propeller reverse circuit breaker is out, the propeller oil low level warning light and propeller reverse system will be inoperative.

PROPELLER LINKAGE CONTROL FAILURE.

Engine RPM will stabilize at approximately 2200 RPM if the propeller governor cable, cable pulleys or linkage fail.

FIRES.

ENGINE FIRE.

Should an engine fire occur, it will be indicated by either Zone 1 or Zone 2 and Zone 3 fire warning lights. In both cases the engine must be shut down immediately in accordance with INFLIGHT ENGINE SHUTDOWN PROCEDURE in this section.

CAUTION

The engine fire extinguisher should be activated only if the Zone 2 and 3 fire warning light illuminates.

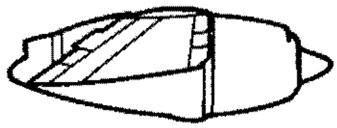
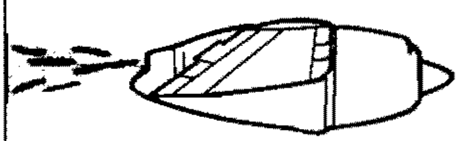
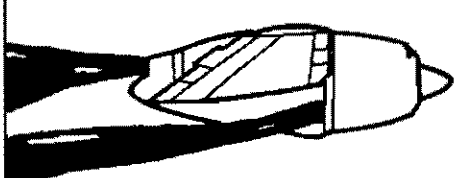
WARNING

The fuel pump for the heaters is located in the right wing. In the event of fire in the right nacelle, both heater systems must be shut down as soon as possible.

WARNING

Do not restart the engine.

engine smoke and flame identification chart

CONDITION	CAUSE	ACTION
 1. AFTER BURNING	Excessively rich mixture	Reduce power. Lean mixture
2. BLACK SMOKE WITH ROUGH ENGINE 	Detonation after fire or backfire from lean mixture	Reduce power
3. BLACK SMOKE	Possible oil leak	Monitor oil pressure and quantity light. If pressure drops below minimum feather
 4. BLUISH GREY SMOKE	Damaged or worn piston rings permitting cylinder to pump oil	No inflight action possible. Record on Form 781 and monitor condition
 5. BLACK OR BLUISH GREY SMOKE	Oil fire	Use fire and feather procedures
 6. FLAME	Gasoline fire	Use fire and feather procedures
 7. DENSE WHITE SMOKE	Fire in induction system, magnesium engine case has probably ignited	Use fire and feather procedures. Alert crew for bailout as fire can cause major structural damage

9-1-66

Figure 3-4 Engine Smoke and Flame Identification Chart

COMBUSTION HEATER FIRE

A fire in either of the combustion heater systems will be indicated by the appropriate heater fire warning light. Should a heater fire occur, proceed as follows:

FLIGHT COMPARTMENT HEATER FIRE

1. MASTER SWITCH	OFF	FE
2. AIR CONTROL HANDLE	PULL	P
3. FIRE EXTINGUISHER	UP	CP

Note

Should smoke be detected in the aircraft, employ SMOKE ELIMINATION procedure in this section.

4. OXYGEN	100%	ALL

CARGO COMPARTMENT HEATER FIRE

1. MASTER SWITCH	OFF	FE
2. AIR CONTROL HANDLE	PULL	FE
3. FIRE EXTINGUISHER	UP	CP

Note

Should smoke be detected in the aircraft, employ SMOKE ELIMINATION procedure in this section.

4. OXYGEN	100%	ALL

FUSELAGE FIRE

Should a fire develop inside the aircraft, it should immediately be fought with hand fire extinguishers by the FE and LM. 100% oxygen should be used. All entrances and windows should be kept closed until the fire is out. After the fire is out employ SMOKE ELIMINATION procedure in this section.

CAUTION

Fire extinguishing agent (CF_3Br) should not be allowed to come in contact with the skin as it may cause frostbite or low temperature burns. The extinguishers should be discharged one at a time to prevent inadvertent splashing.

WING FIRE

Except for an engine fire that spreads to the wing, in all probability a wing fire will originate electrically. It is essential, therefore, to deenergize the offending circuit if it can be isolated and, as additional circuits could be damaged by the fire and create other possible hazards, to deenergize all nonessential services for the remainder of the flight. The circuits contained in the outboard wings are:

a. Heater fuel pump

b. Landing lights

c. Fuel booster pumps

d. Fuel quantity

e. Gyro compass

f. Navigation lights

g. Formation lights

h. Aileron trim

i. Stall warning

j. Fuel low level light

k. Pitot heat (lift transducers)

The actions to be taken subsequently depend entirely on whether or not the fire persists; its locality and severity, with due regard to the fuel tanks; and aircraft altitude. Sideslipping the aircraft will assist in diverting the fire as necessary. If the fire persists or increases and indications of consequent structural failure are evident, the aircraft should be abandoned, ditched or landed as soon as possible.

ELECTRICAL FIRE

When fire or smoke in the aircraft is suspected to be of electrical origin but the source is not determined, proceed as follows:

1. EMERGENCY BUS	**EMERG**	**CP**
2. BATTERY	**OFF**	**P**
3. GENERATORS	**OFF**	**CP**
4. OXYGEN	**100%**	**ALL**
5. Fight the fire		FE

WARNING

If fire continues to persist it is probable that a short circuit exists in one of the emergency bus power systems. Isolate each system by pulling circuit breakers until the defective system is identified.

6. Electrical system switches	OFF	ALL

Note

If the defective system cannot be identified, turn all electrical systems off.

7. Generators and battery switches	ON	P, CP

a. Turn the battery and generators on, one at a time, after the smoke/odor has cleared, check for a defective system

b. Turn system switches on individually, allowing sufficient time between turning systems on to observe results before energizing the next system

c. Continue to turn on electrical systems until the defective circuit is detected. When identified, the defective system should be left off

d. If cause of fire cannot be identified, land as soon as possible, use only those systems required for flight

SMOKE/FUMES ELIMINATION.

If smoke or fumes are detected in the aircraft, proceed as follows:

WARNING

Smoke and fumes elimination procedures will not be used until fire has been extinguished.

CAUTION

Use smoke mask attached to the walk-around oxygen bottle when smoke and fumes are present.

Turn the ventilating system on.

Open the pilot's fresh air vent.

Open the cargo door.

ENGINE CHIP DETECTION.

Should an engine chip detection warning light illuminate in flight, land as soon as possible and have the engine inspected.

FUEL SYSTEM FAILURES.

FUEL PRESSURE-DROP - ENGINE STOPS.

Should a low fuel pressure warning light illuminate and the engine stop, close the throttle and check the engine for fuel leaks. If there is no evidence of a fuel leak, proceed as follows:

Turn the boost pump to HIGH. If the warning light does not go out, turn the boost pump off, turn the other boost pump to HIGH and turn the fuel tank selector to feed both engines from the other tank. If the low fuel pressure warning light continues to glow, shut down the affected engine in accordance with INFLIGHT ENGINE SHUTDOWN PROCEDURE in this section.

Note

If operation of the affected engine is restored, the boost pump should be turned to NORMAL.

FUEL PRESSURE-DROP - ENGINE OPERATES NORMALLY.

Should the fuel pressure drop below normal operating limits and the engine continue to function normally, make a visual check for fuel leaks in the engine nacelle and at the aft end of the augmentor tubes. If fuel leaks are noted, shut down the engine immediately by moving the mixture lever to IDLE CUT-OFF and then follow INFLIGHT ENGINE SHUTDOWN PROCEDURES in this section.

If the cause of the fuel pressure drop cannot be determined and no evidence of a fuel leak exists, the engine may be operated only if necessary while the crew maintains a watch for fire.

Shut down the engine prior to making any throttle movement or change in aircraft attitude. The engine must be shut down by moving the mixture lever to IDLE CUT-OFF and then follow INFLIGHT ENGINE SHUTDOWN PROCEDURE in this section.

WARNING

It is possible to fly for several hours having a suspected fuel leak but no evidence of fire. This condition may be due to the airflow with its cooling and dispersing effects serving to prevent fire outbreak. Retarding the throttles or changing the aircraft attitude which changes the airflow characteristics, may cause a fire to develop. For this reason, the engine must be run at the same power setting until no longer required.

CAUTION

Should a fuel low pressure warning light illuminate, it must be accepted as indication of low fuel pressure, regardless of the fuel pressure indicated. Should the fuel pressure gage indicate a pressure below normal operating limit, but the warning light fails to illuminate, press-to-test the warning light and make visual checks for fuel leaks before deciding the fault is due to a defective gage only.

ELECTRICAL SYSTEM FAILURES.

It is extremely difficult to anticipate all the possible electrical failures and procedure for each failure. However, a broad analysis of the situation indicates that failures fall into three possible categories:

1. Loss of one or more of the primary power sources.

2. Malfunctions of the main bus or distribution system.

3. Malfunctions within equipment items.

Malfunctions in the distribution system and load circuits should be controlled through protection devices such as circuit breakers, fuses and current limiters. Should one of these devices fail to operate, considerable smoke can result and some emergency action on the part of the crew may be needed. Loss of the main DC bus is unlikely. Loss of one or more of the primary power sources, however, will require the crew to take prompt action by closely watching electrical loads, so that the remaining power sources will not be overloaded.

FAILURE OF ONE GENERATOR

Should a generator power failure warning light illuminate, proceed as follows:

1. Generator switch	RESET/ON	CP/FE

a. Push the generator switch down to the RESET position and then ON

b. Manually reset the field control relay by pushing the manual reset lever down should the electrical reset switch fail

Note

The generator field reset circuit breaker must be in to accomplish resetting the field control relay. Only one attempt should be made to reset the circuit breaker.

Note

Main bus voltage will be indicated on both voltmeters even though one generator is inoperative. If the affected generator continues to drop off the line, it may be due to an over-voltage condition. In this case the voltmeters will show a momentary increase immediately after RESET/ON. If the voltage of the operative generator is too high it must be adjusted before the generator can be returned to the line.

2. Ammeter	Checked	CP

Note

The field control relay has been reset if the failed generator ammeter indicates a load and warning light is extinguished.

If generator output cannot be restored, the generator must be turned OFF and the following procedure employed. The aircraft must be landed at the nearest suitable airfield.

3. All unnecessary electrical equipment	Off	ALL
4. Generator switch	OFF	CP
5. Secondary bus reset switch	UP	CP

6. Ammeter	Checked	CP

CAUTION

Do not allow the operating generator output to exceed 300 amperes.

CAUTION

Periodically check the engine to ascertain that the failed generator does not cause an engine fire.

FAILURE OF TWO GENERATORS

Should both generators fail, proceed as follows:

1. GENERATORS	**RESET**	**CP**

Note

The generator field reset circuit breaker must be in to accomplish resetting the field control relay. Only one attempt should be made to reset the circuit breaker.

a. Select either (NOT BOTH) generator switch ON.

b. If power is restored proceed as for failure of one generator

c. If electrical power is not restored the following items must be accomplished:

2. EMERGENCY BUS	**EMERG**	**CP**
3. BATTERY	**OFF**	**P**
4. All unnecessary electrical equipment	OFF	P, CP
5. Generator switch (select one)	ON	CP, FE

a. Manually reset the field control relay by pushing the manual reset lever down should the electrical reset switch fail

6. Ammeter	Checked	CP

Note

The field control relay has been reset if the ammeter indicates a load and the warning light is extinguished.

Note

If generator output cannot be restored, the generators must be turned OFF. Conserve the battery as much as possible and land at the nearest suitable airfield.

WARNING

Propeller feathering pumps are inoperative when the main DC bus is deenergized.

Should a generator be restored employ FAILURE OF ONE GENERATOR procedure to restore remaining generator.

If power is restored proceed as follows:

7. Emergency bus switch	NORMAL	CP
8. Battery switch	ON	P
9. Electrical equipment	As required	CP

Note

Individually select each system and attempt to determine the cause of the malfunction.

AMMETER FAILURE.

Should the ammeter for either generator indicate zero when other electrical indications are normal, check for a malfunctioned ammeter as follows:

Press to test generator failure light.

Turn off the generator switch for the affected generator.

Check for an increase on the opposite ammeter.

Note

An increased reading will indicate that both generators are operating and that malfunction is in the ammeter circuit.

Turn the generator switch on if the opposite ammeter reading increases. If no increase is noted, proceed with FAILURE OF ONE GENERATOR procedure in this section.

RUNAWAY AILERON TRIM.

Should a runaway trim occur, proceed as follows:

Reduce airspeed to relieve control pressure. Physical control of the aircraft will not be difficult. If the trim can be reversed, pull the aileron trim circuit breaker as the trim passes through the neutral position.

INVERTER FAILURES.

MAIN INVERTER.

Should the standby inverter light illuminate while both generators are operating proceed as follows:

Check that the inverter circuit breakers are in.

Turn the inverter switch off then on to MAIN. If the standby light continues to glow, select the inverter to STANDBY.

Note

When the standby light illuminates, it indicates that the inverter circuit has been automatically transferred to the standby inverter.

If the inverter failure light and the 26 volts AC failure light illuminates with the inverter switch at MAIN, select the standby inverter. If the standby inverter light comes on, it indicates failure of the main inverter and changeover relay.

STANDBY INVERTER.

Should the standby inverter light go out while the standby inverter is operating, the AC failure light should illuminate to indicate a complete AC power failure. Should this happen, proceed as follows:

Check that the inverter circuit breakers are in.

Check that the DC power circuit breakers are in.

Turn the inverter switch OFF and then to MAIN.

If the AC failure light and the standby inverter light both go out, leave the inverter switch at MAIN. If the AC failure light continues to glow, turn the inverter switch OFF.

MAIN INSTRUMENT TRANSFORMER.

Failure of the main instrument transformer is indicated by illumination of the 26 volts AC failure light. Select the standby instrument transformer. If the 26 volts AC failure light goes out either the 1-ampere fuse has blown or the main instrument transformer is inoperative.

CARGO JETTISON.

Jettisoning of cargo can be dangerous, due to possible loss of aircraft control or structural damage; therefore, the aircraft commander must consider carefully the emergency situation, mission requirements, availability of suitable drop area and whether jettisoning is necessary.

Parachutes or restraining harness will be worn by personnel jettisoning cargo. Cargo should be jettisoned out the ramp and cargo door opening. The ramp and cargo door should be in the airdrop position.

Note

> Relatively light weight cargo should be jettisoned by hand.

JETTISONING PALLETIZED CARGO ON ROLLERS.

Cargo palletized on rollers, but not rigged for airdrop, may be jettisoned if the aircraft gross weight limitation and MAC limitations are observed. If cargo is loaded on multiple pallets, pallets may be jettisoned one at a time provided the position of the pallets remaining in the aircraft does not cause the center of gravity to exceed limits. If a malfunction of the extraction system exists, the cargo may be jettisoned by pushing out or gravity extraction.

JETTISONING CARGO NOT ON ROLLERS.

Jettison of large heavy palletized or unpalletized cargo resting on the floor should be attempted only as a last resort.

CARGO JETTISON TECHNIQUE.

Detailing of emergency procedures is not practical because of the many variables. The following provides a basic procedure applying to emergency jettison of palletized cargo on rollers, but must be supplemented by sound pilot judgement for the specific conditions:

Establish nose up attitude to obtain a component of gravity for the extraction force.

Apply power to accelerate the aircraft to increase the effective extraction force.

CAUTION

> During cargo jettison, move the elevator control slowly, smoothly and no more than is necessary, to avoid the possibility of exceeding structural limits.

BAILOUT PROCEDURES.

In-flight evacuation exits are shown in figure 3-6. If the aircraft is under control and time permits, the order of preference for bailout exits are ramp and cargo door, right entrance door and the flight compartment bottom hatch. When time and aircraft control permit, proceed as follows:

Give bailout warning over the interphone system and three short rings on the alarm bell.

Reduce airspeed if possible.

Note

> The recommended airspeed for bailout is 100 knots IAS.

If possible, head the aircraft toward an unpopulated area.

Open the ramp and cargo door.

If unable to open the ramp and cargo door, jettison the right entrance door and flight compartment bottom hatch.

Note

> The flight compartment bottom hatch may be jettisoned by operating a handle located in a recess in the bulkhead above the upper doors and marked BOTTOM HATCH JETTISON - OPEN INSIDE DOORS BEFORE PULLING HANDLE. The upper (inside) doors must be opened first as they would be difficult to open during flight with the bottom hatch jettisoned.

Note

> The cargo compartment emergency door, on the left of the cargo compartment near the wing, is jettisonable. The handle is marked EMERGENCY EXIT - LIFT GUARD AND TURN HANDLE TO OPEN. The right passenger door is jettisonable and has a jettison lever handle above the door marked CABIN DOOR JETTISON - PULL LEVER DOWN.

WARNING

> The cargo door may be opened but must not be jettisoned during flight.

Give bailout warning over the interphone system and by one long ring on the alarm bell.

LANDING EMERGENCIES.

HYDRAULIC SYSTEM FAILURES.

Failure of an engine driven hydraulic pump will be indicated by the illumination of its respective warning light. The other pump will maintain sufficient system pressure to operate the hydraulic systems. Should a loss of hydraulic pressure occur due to both hydraulic pumps failing or the engines not operating, the main hydraulic system can be pressurized with the hydraulic hand pump by placing the handpump selector to NORMAL SYSTEM. All normal systems will be operational at a reduced rate. If a leak in the system develops, the hydraulic pressure shutoff valve must be turned off immediately, and remain off during the remainder of the flight. The emergency procedures must then be used to extend the landing gear and charge the brake accumulator.

Note

Hydraulic fluid will become extremely hot when the hydraulic pressure shutoff valve is turned OFF. Land as soon as possible to minimize danger of heat damage to hydraulic seals.

LANDING GEAR MALFUNCTION.

Should one or more landing gear indicator lights fail to illuminate when the gear is selected down and the selector lever light remains illuminated, press to test the indicator light(s). If the light(s) illuminate when pressed, it can be assumed that the associated gear(s) is not locked down. Should the selector lever light illuminate only while the gear is in transit and the indicator light(s) fail to illuminate when pressed, it can be assumed that a fault exists in the circuit to the indicator light(s). In either case, the throttles should be closed to check the warning horn. A visual check should be made of the main gear red/white index marks for alignment, and of the nose gear condition through the nose gear observation window. If visual inspection indicates the gear(s) is not down and locked check system pressure, fluid level, circuit breakers and proceed with emergency landing gear extension procedures.

LANDING GEAR EMERGENCY EXTENSION.

Emergency extension of the landing gear is listed as two separate procedures since different operations are used for the main gear and the nose gear. The nose gear should be lowered first as more time is required for this operation and less drag is imposed than from the main gear. When emergency extension procedures have been used, the aircraft should be stopped on the runway and the down locks installed.

NOSE GEAR EXTENSION.

Should the nose gear fail to extend when a normal selection is made, proceed as follows:

1. Landing gear selector	DOWN	P

WARNING

If the main gear is extended and the nose gear has failed to extend, retract the main gear and attempt to lower the nose gear with the emergency system after relieving the pressure. Turning the hydraulic pressure shutoff valve off will relieve the pressure.

2. Handpump selector	EMERGENCY SYSTEM	FE
3. Emergency landing gear down selector	ON	FE
4. Nosewheel down handpump selector	ON	FE
5. Handpump	Actuate	FE

Note

Continue handpump operation until the nose gear indicator light indicates the gear is down and locked.

Should the nose gear fail to extend after having used both normal and handpump systems, continue as follows:

6. Nosewheel emergency down (air)	Pull	FE

Note

Pull the selector up and hold until the nose gear indicator light indicates the gear is down and locked.

CAUTION

The nose gear emergency air bottle should be actuated only during an emergency. The nose gear must remain extended until the system is bled on the ground.

MAIN GEAR EXTENSION

Should either or both main gear fail to extend when a normal selection is made, proceed as follows:

1. Landing gear selector	DOWN	P
2. Emergency landing gear down selector	ON	FE
3. Main gear emergency extension	Pull	FE

Note

Extension of the gear may be assisted by the application of "g" forces, or an increase in airspeed.

CAUTION

Visually check the gear down lock index marks and indicator lights to determine if the gear is in the down and locked position.

FAILURE OF GEAR TO RETRACT.

Should the gear fail to retract when selected "UP", proceed as follows:

Check hydraulic pressure.

Select the nosewheel steering switch "OFF" then "ON".

Check the hydraulic circuit breaker is in.

Check the hydraulic system quantity.

Check the hydraulic emergency panel to insure the emergency landing gear down selector is completely in the OFF position.

If the gear will not retract after completing the above checks, place the landing gear selector handle in the DOWN position and land at a suitable airfield with crash and rescue equipment standing by.

WARNING

Do not recycle gear. If the gear fails to retract as the result of failure of the gear to shorten, the gear may collapse on landing, even with all indications that the gear is down and locked. Land with caution. Use minimum braking action to minimize the possibility of structural failure.

WING FLAP EMERGENCY OPERATION.

Should a hydraulic failure occur, due to loss of engine driven pumps, the wing flaps can be actuated as follows:

Turn the handpump selector to NORMAL SYSTEM.

Turn all other hydraulic selectors off.

Place the wing flap selector to the desired flap setting.

Operate the handpump lever until the flaps are extended to the desired setting.

BRAKE SYSTEM FAILURE

If sufficient pressure is not available in the normal brake system for adequate braking, proceed as follows:

1. Handpump selector	As required	FE
a. In case of pump failure	NORMAL SYSTEM	
b. In case of low fluid level	EMERGENCY SYSTEM	
2. Brake accumulator handpump charging selector	ON, all other selectors OFF	FE
3. Handpump lever	Actuate	FE

Note

Actuate the handpump lever until 3000 psi is indicated on the brake pressure gage. Continue pumping during the landing roll until the aircraft is stopped.

CAUTION

Use brakes as little as possible during the landing roll. Use reverse power to assist stopping the aircraft.

Note

If brake pressure and reverse power is not sufficient to stop the aircraft, pull the emergency air brake handle steadily aft.

CAUTION

The emergency air brake handle must not be operated with a pumping action as this will rapidly deplete the compressed air supply.

Note

After the aircraft is stopped, the engines should be shut down and chocks installed. No attempt should be made to taxi after brake failure.

LANDING WITH ONE ENGINE INOPERATIVE

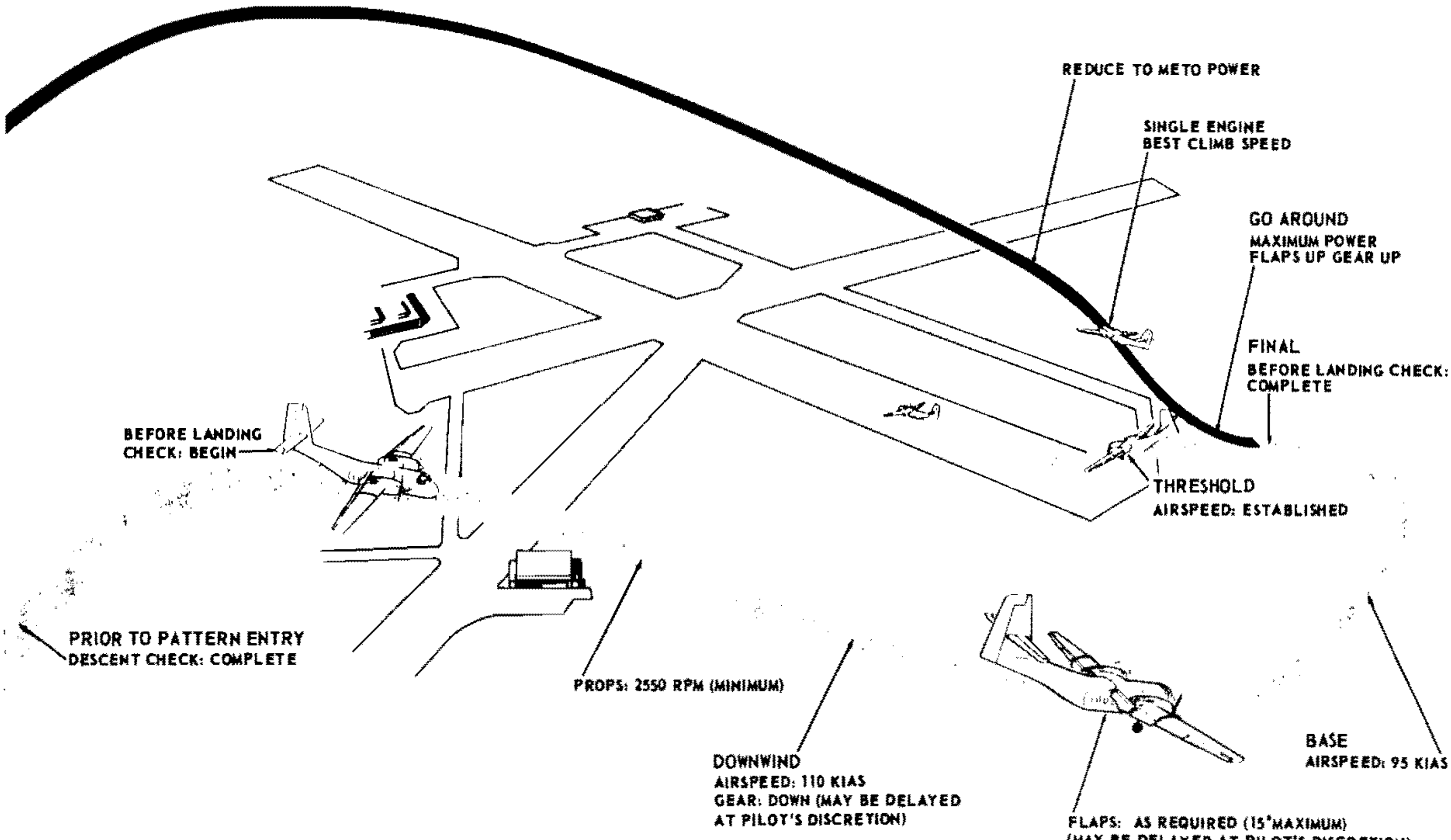
The approach for landing with one engine inoperative (figure 3-5) is made in the same manner as for a normal landing except flaps should not be extended more than 15 degrees until landing is assured. The airspeed should be maintained above safe single-engine airspeed until committed to land.

A normal landing should be made. Directional control should be maintained by nosewheel steering, differential braking and reverse power on the good engine.

SINGLE ENGINE GO-AROUND

The decision to go-around should be made before lowering flaps more than 15 degrees. The pilot should consider the advantages of a controlled crash landing versus an unsuccessful go-around, especially if aircraft perform-

single engine landing and go-around – typical



NOTE:
DO NOT EXCEED 15° FLAP SETTING UNTIL LANDING IS ASSURED

Figure 3-5 Single Engine Landing and Go-around - Typical ance is critical or altitude and go-around conditions are marginal. If a single engine go-around is to be made, the procedure to follow is:

1.	PROPELLER	FULL INCREASE	CP
2.	THROTTLE	MAXIMUM POWER	P
3.	FLAPS	UP	CP
4.	GEAR	UP	P

Note

The gear and flaps should be retracted simultaneously to reduce drag as soon as possible. Single engine best climb speed should be attained prior to initiating a climb. It may be necessary to sacrifice altitude to obtain single engine best climb speed.

LANDING WITH TIRE FAILURE.

Nose landing gear tire failure.

If one or both nosewheel tires are flat at time of landing, a normal landing may be made. Use brakes as little as possible. Hold the nose off the runway as long as possible and as speed decreases, gently lower the nose gear to the runway prior to loss of elevator control. Use nosewheel steering to maintain directional control. If necessary use asymmetric reverse power to assist in directional control. Taxiing is not recommended.

Main landing gear tire failure.

If a main wheel tire is flat at time of landing, a normal landing should be made. Lower the nose gear as soon as possible and use reverse power and nosewheel steering to maintain directional control. If both tires on a main landing gear are flat, there will probably be a tendency to swerve towards that side. Line up and land on the side of the runway with good tires. Touch down the nose gear as soon as possible, hold forward pressure on the control column, and assure directional control with the nosewheel steering system and asymmetric reverse power. Use wheel brakes (on the side opposite the flat tires only) to assist in maintaining directional control. Use reverse power cautiously but to the fullest extent possible to reduce landing roll to a minimum. Do not attempt to taxi.

LANDING WITH GEAR RETRACTED.

Landing with one or both main gears retracted

If one main gear cannot be extended, the recommended procedure is to retract the other main gear and land with only the nose landing gear down. (Refer to GEAR UP LANDING.)

LANDING WITH NOSE GEAR RETRACTED AND MAIN GEARS DOWN.

If the nose gear fails to respond to normal and emergency operating procedures, an emergency landing may be accomplished. An aft CG is desirable. Make a normal approach and landing holding the nose of the aircraft up as long as possible but not until elevator control is lost. The nose should be gently lowered to the runway. (Refer to GEAR UP LANDING.)

GEAR-UP LANDING.

Before making a gear-up landing, burn off as much fuel as practicable and perform the following:

Select radio distress frequency, select IFF/SIF if necessary, inform appropriate control facility and request runway be foamed.

Give warning over the interphone system and give six short rings on the alarm bell.

Open the side escape hatch and cargo door.

Jettisoning of cargo should be considered.

Stow or secure all loose equipment.

Turn off heaters and all unnecessary electrical equipment.

Take crash landing position, passengers behind cargo.

Turn on the FASTEN BELTS/NO SMOKING signs.

Fasten shoulder harness and inertia reel locks.

WARNING

The pilot is prevented from bending forward when shoulder harness is locked; therefore, insure that all controls which cannot be easily reached are properly positioned before locking the harness.

Make a normal approach, flaps as desired.

Assume a normal landing attitude.

Give warning over the interphone and give one long ring on the alarm bell prior to impact.

After contact with the runway, move mixture levers to IDLE CUT-OFF, turn off ignition switches, select fuel emergency shut-off and oil emergency shut-off switches up.

If fire is evident, pull the fire extinguisher control handles prior to turning off the battery switch and abandon the aircraft immediately after movement stops.

LANDING ON SOFT GROUND OR UNPREPARED RUNWAYS.

If it should become necessary to land on soft ground or an unprepared runway, the decision to land with gear extended or retracted must be made by the pilot. However, if the decision is to land with the landing gear retracted, the recommended procedure is to land with the nose gear extended and the main gear retracted. Procedures outlined in GEAR-UP LANDING should be followed. If the nature of the terrain is not too rough, it is advisable to land with all gear down, using the short field landing technique.

MAXIMUM GLIDE AND LANDING WITH BOTH ENGINES INOPERATIVE.

In the clean configuration with both propellers feathered, the recommended glide speeds are contained in T.O. 1C-7A-1-1. The descent should be planned to arrive over the threshold of the landing area at 1500 ft. From this point, put the landing gear down and initiate a continuous turn to position the aircraft on final at 800 feet approximately 1/2 mile from touchdown point. Flaps will be lowered as conditions dictate to control touchdown point and final approach speeds.

emergency escape routes, exits and equipment

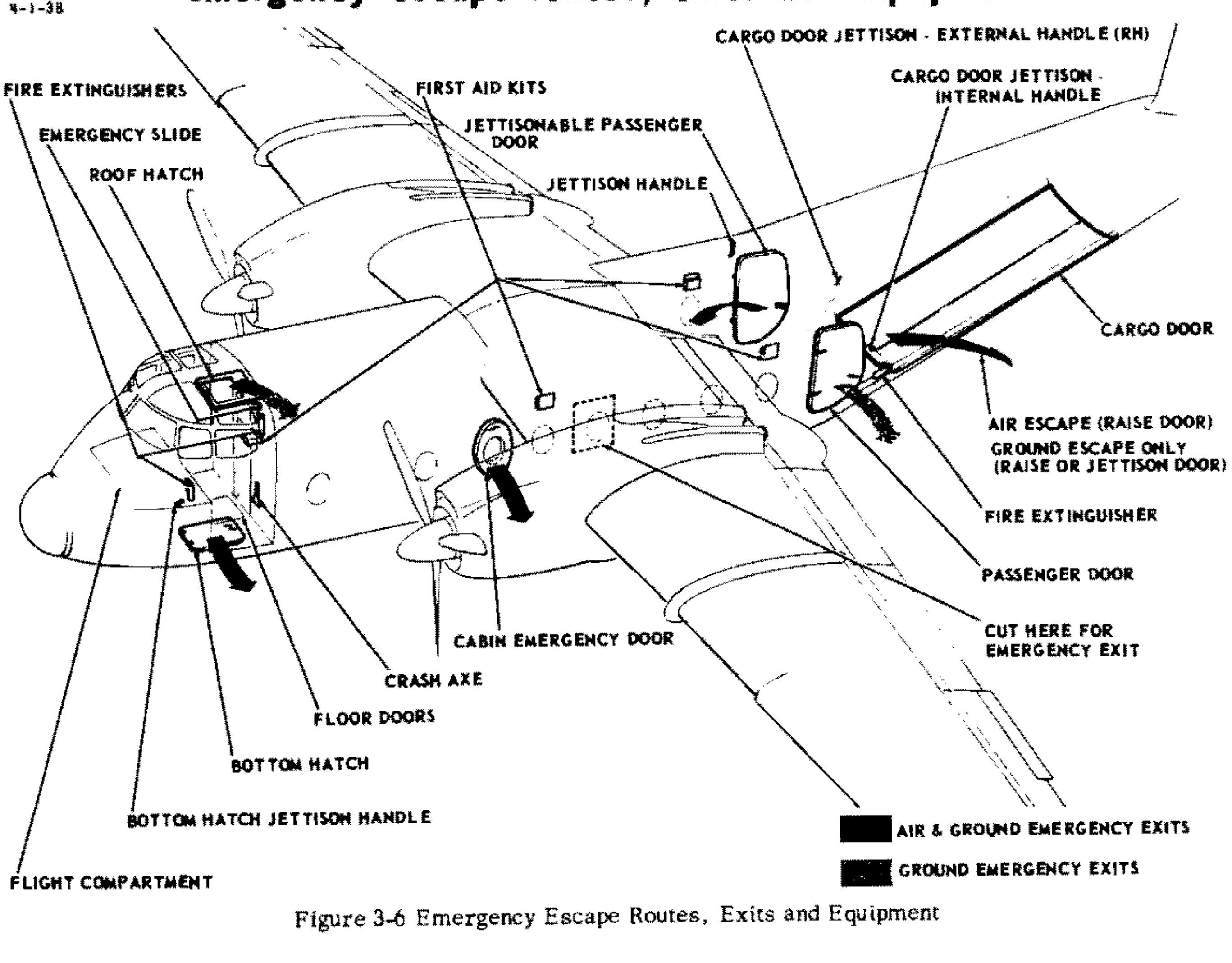


Figure 3-6 Emergency Escape Routes, Exits and Equipment

CAUTION

To provide continuous hydraulic pressure, one or both propellers must be windmilling. If both propellers are feathered, the landing gear will have to be lowered using the emergency system and the flaps by using the handpump and the normal system.

NOSEWHEEL STEERING FAILURE.

Should a malfunction of the nosewheel steering system occur, or with the loss of normal hydraulic system pressure, the nosewheel steering switch should be turned off. Directional control will be maintained through coordinated use of flight controls, differential power and differential brakes according to the prevailing circumstances of speed, crosswinds, engine out and runway conditions.

CAUTION

With the nosewheel steering off, no attempt should be made to restrain or operate the steering wheel. Manual control of the steering wheel in this condition would cause fluid to be emptied from the nose gear shimmy damper.

CAUTION

Avoid taxiing into congested areas.

NOSEWHEEL SHIMMY.

Nosewheel shimmy is an indication of an unbalanced condition of one or both nosewheel tires or failure of the steering system. If this occurs during takeoff, the decision regarding whether to abort or to continue will depend on the severity of the shimmy and whether the refusal point has been passed, back pressure on the yoke will reduce nosewheel shimmy on takeoff. If shimmy occurs during the landing roll, decelerate gradually and apply up-elevator to keep as little load on the nosewheels as possible. In landing with a known shimmy condition, keep the nosewheels off the ground as long as possible, but touch down while elevator effectiveness allows gentle lowering of the nose.

EMERGENCY ENTRANCES.

Emergency entrances are those used by ground rescue personnel (figure 3-7).

External releases.

Both entrance doors, the cargo compartment emergency door, the flight compartment bottom hatch, and the flight compartment roof hatch are equipped with external releases. The cargo door may be jettisoned by using the control on the right side exterior of the aircraft.

Chopping area.

A chopping location marked in yellow is painted on the left side of the fuselage beneath the wing. The location is marked on the inside and outside of the fuselage.

DITCHING.

DITCHING CHARACTERISTICS.

Ditching characteristics of the C-7A are not known; however, scale model ditching tests indicate that structural damage to the fuselage may occur which will cause rapid flooding of the flight and forward cargo compartments. On the basis of these tests, it is concluded that the following results can be expected upon ditching.

Note

The characteristics assume the aircraft is ditched in a nose high attitude with flaps at 40°, and touching down with power on.

Upon contact with the water, the aircraft may experience a pronounced nose-down attitude. The forward fuselage may momentarily be immersed, resulting in structural damage to the flight and forward cargo compartments which will permit rapid flooding up to the level of the wings. The aircraft will probably settle rapidly in a nose-down attitude. As the nose settles during the final part of the ditching run, the cockpit and fuselage will fill with water fairly fast.

DITCHING PROCEDURES.

WARNING

The aircraft should only be ditched as a last resort. It is recommended that the occupants bail out rather than ditch whenever possible.

In ditching situations in which the passengers can safely bail out, the large life raft in the cargo compartment should be dropped by parachute. This should be accomplished at an altitude of 500 feet and at an airspeed of 110 knots IAS after the passengers have bailed out and are in the water. The drop should be planned so that the life raft will land upwind of the survivors. The parachute, if partially inflated after contact with the water, will carry the raft towards the survivors. No provisions are made to inflate the raft during descent; therefore, the possibility of the raft being blown away from the survivors faster than they can maneuver to it is minimized. The ditching charts (figure 3-8) give duties of personnel prior to, and during ditching. Figure 3-9 illustrates the emergency exits and evacuation routes used during ditching.

The following are the standard alarm signals for ditching:

SIX SHORT RINGS .... PREPARE FOR DITCHING

ONE LONG RING .... BRACE FOR IMPACT

EMERGENCY DITCHING EQUIPMENT.

Ditching equipment should be in readiness at all times when flying over water. Prior to each over-water flight, the pilot will ensure that the necessary equipment is aboard, in serviceable condition, and stowed in the proper places.

EMERGENCY DITCHING EXITS (FLIGHT CREW).

Refer to figure 3-9 for emergency exits. Normally, crew members in the flight compartment will use the roof escape hatch for exit after ditching. Crew members in the cargo compartment will normally exit through the cargo door.

EMERGENCY DITCHING EXITS (PASSENGERS).

The loadmaster and flight engineer will normally assist in evacuating passengers and carrying out duties outlined in the Ditching Chart (figure 3-8) The loadmaster will be responsible for briefing the passengers prior to flight. He will explain the use of the emergency equipment. The loadmaster will normally be seated in the passenger seat forward of the left entrance door when passengers are carried. All occupants of the cargo compartment will exit through the cargo door.

PREPARATION FOR DITCHING.

Plans for ditching cannot be made without taking the wind direction into consideration. Waves move downwind, and the spray from the wave crest is also blown downwind. Swells, however, do not always indicate wind direction and can be very large even when the wind is calm. Swells are the results of underwater disturbances. Over a sea, a pilot must be more exacting and alert when judging height.

emergency entrances

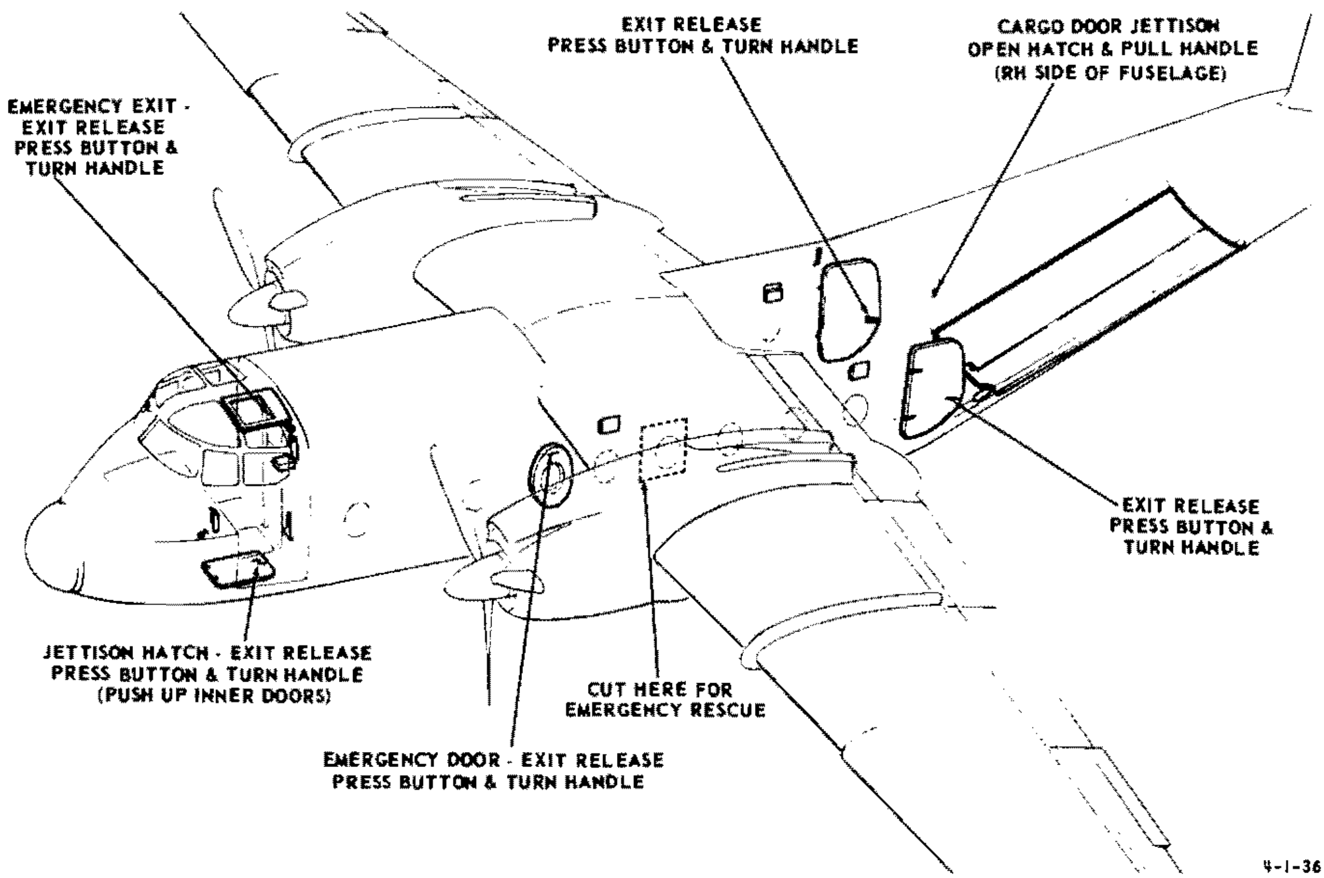


Figure 3-7 Emergency Entrances

ditching chart

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 MINUTES LEFT)	AFTER DITCHING
PILOT'S DUTIES	1. Order crew to prepare for ditching, giving approximate time remaining. Order crew to start emergency procedures. Each crew member will acknowledge. 2. Transmit on VHF UHF "Mayday" 3 times, and identification 3 times. Transmit tone for 20 seconds and request fix or bearing. 3. Obtain flashlight. 4. Don anti-exposure suit and life vest. Fasten shoulder harness and safety belt.	1. Alert cargo compartment personnel with interphone and six short rings on the alarm bell. 2. Order copilot to transmit final distress signal. 3. If applicable, order all crew members and passengers to turn on emergency flashlights connected to life vests. 4. Order all crew members and passengers to secure themselves in ditching position. 5. Lock shoulder harness. 6. Immediately before ditching, warn personnel over interphone to "Brace for impact", and order copilot to give one long ring on alarm bell.	1. Check flight station and cargo compartment to insure that all personnel and emergency equipment have been evacuated. 2. Exit through flight station escape hatch or cargo door and inflate life vest. 3. Board life raft and receive emergency equipment.
COPILOT'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. IFF/SIF to emergency. Transmit emergency signal on HF radio followed as soon as possible by emergency message. 3. Obtain D/F service, bearings, fixes, etc. 4. Obtain flashlight. 5. Don anti-exposure suit, and life vest, fasten shoulder harness and safety belt. 6. Continue transmitting outlined emergency message as required.	1. Transmit final distress signal and intentions of pilot as to ditching. 2. Lock shoulder harness. 3. On orders from pilot, give one long ring on alarm bell.	1. Exit through flight station emergency escape hatch, or cargo door. 2. Inflate life vest and board life raft.

Figure 3-8 (Sheet 1 of 2) Ditching Chart

ditching chart (cont)

CREW MEMBER	FIRST ACTION	DITCHING IMMINENT (10 MINUTES LEFT)	AFTER DITCHING
FLIGHT ENGINEER'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Obtain drinking water container and flashlight. 3. Open cargo door. Check ramp fully closed and draftproof door up and secure. 4. Don anti-exposure suit and life vest.	1. Secure loose articles in flight compartment. 2. Select a seat in cargo compartment and fasten safety belt.	1. Assist in launching life rafts. 2. Exit through cargo door with container of water. 3. Inflate life vest, and board life raft.
LOADMASTER'S DUTIES	1. Acknowledge pilot's order to prepare for ditching. 2. Advise passengers of impending emergency. 3. Prepare to jettison cargo and advise pilot when ready. Jettison on command. 4. Obtain flashlight. 5. Don anti-exposure suit and life vest. 6. Rebrief passengers in evacuation and distribution on life rafts. 7. Notify pilot when cargo compartment is prepared for ditching.	1. Insure that passengers are behind cargo if possible and properly seated. 2. Secure all loose equipment. 3. Fasten safety belt.	1. Launch life rafts. 2. Direct evacuation of passengers. 3. Exit through cargo door. 4. Inflate life vest and board life raft.

Figure 3-8 (Sheet 2 of 2) Ditching Chart

ABANDONING AIRCRAFT.

Evacuation of the aircraft after ditching should be accomplished in an orderly manner in the shortest time possible. This cannot be done well without practice and in the event that the fuselage is dark and filling with water, further difficulty can be expected.

WARNING

The crew and/or passengers must not leave ditching positions until it is ascertained that the aircraft has stopped forward movement. Serious injuries can occur as the result of personnel unfastening safety belts prior to the aircraft coming to a full stop.

Immediately after the aircraft comes to a stop, additional emergency equipment may be collected and distributed to each crew member. The crew members must carry out their duties (figure 3-8) and then evacuate the aircraft through the appropriate exit carrying the required equipment. They must also see that each piece of equipment for use in the life raft is secured by lines to prevent its being lost overboard.

WARNING

Assure that personnel are outside the aircraft and clear of escape exits prior to inflating life vest.

CREW DUTIES.

When it is certain that the aircraft has come to a complete stop, each crew member will proceed with the following duties:

The pilot and copilot will check each other to see if either has been injured. The copilot exits through the roof hatch and receives equipment being passed to the pilot, the pilot will exit through the roof hatch.

The flight engineer and loadmaster will check to see if either has been injured. They will jettison the life raft through the cargo door and inflate. The loadmaster will assist passengers in evacuating through the cargo door and pass emergency equipment to the life raft. The flight engineer insures that all emergency equipment has been removed and all passengers have been safely evacuated, and then exits through the cargo door.

DITCHING TECHNIQUE.

If possible, burn off as much fuel as possible to lighten the aircraft and reduce stalling speed. Empty tanks also help keep the aircraft afloat.

If possible, jettison cargo to lighten the aircraft.

Prior to commencing approach, turn on the "FASTEN BELTS, NO SMOKING" signs. Passengers should be warned to tighten their safety belts and lean towards the nose of the aircraft as far as possible, half turning and resting head on arms, and bracing their arms against the next passenger.

Open the cargo door.

Note

The cargo door must be fully open prior to touchdown as structural damage may preclude opening while in the water.

Check that the cargo ramp is fully closed.

ditching exits

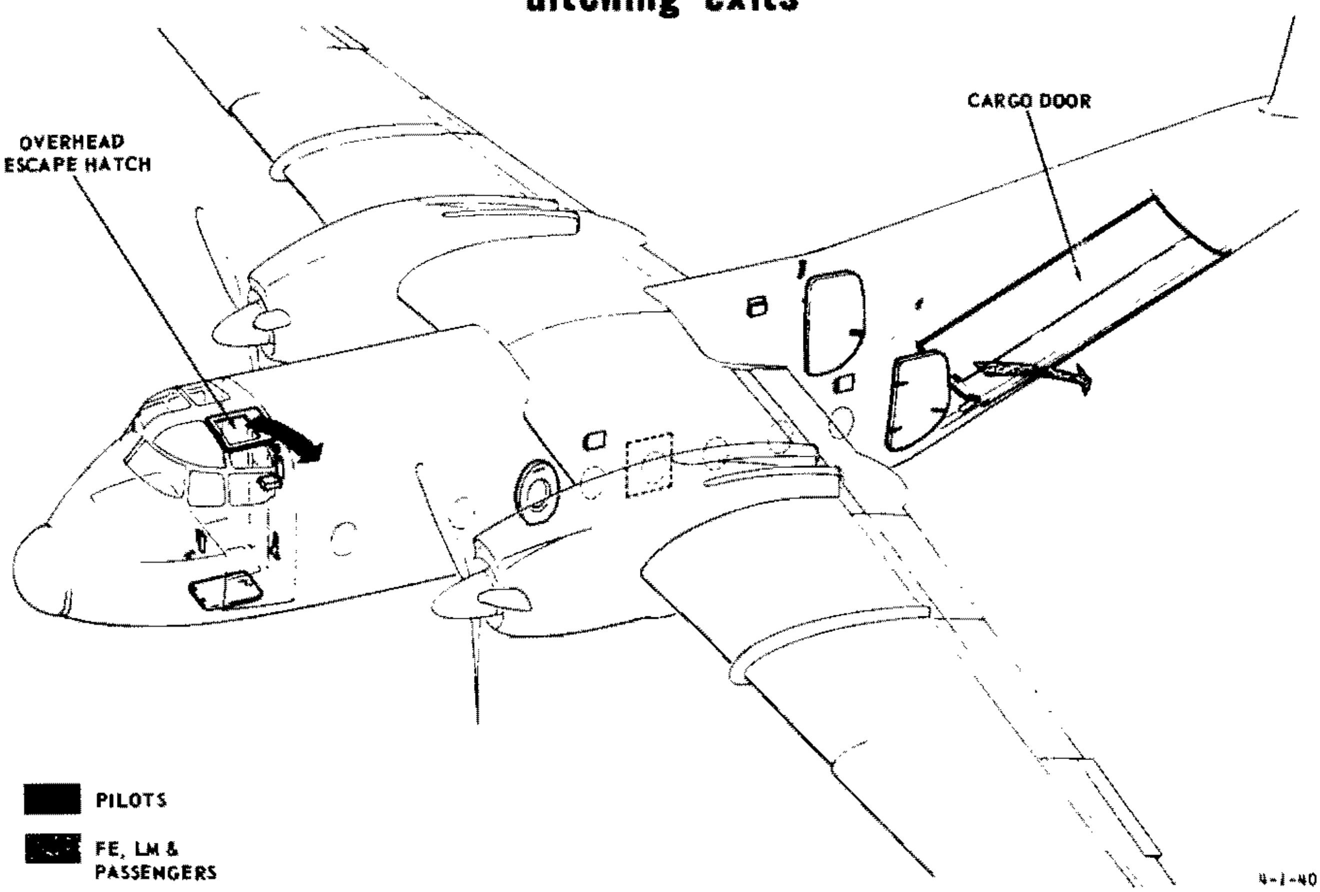


Figure 3-9 Ditching Exits

DITCHING.

Best results will be obtained by following the procedures outlined below:

Ditch while power is available. Power will allow the pilot to choose the spot for ditching, and the most favorable landing position and attitude.

Use 40 degree flaps.

Execute a normal approach and assume a normal landing attitude.

Touch down with power on and insure that the aircraft does not contact the water in a fully stalled attitude.

WARNING

> Under no circumstances should the aircraft be stalled in, since this will result in severe impact and cause the aircraft to nose into the water.

In daylight it is recommended that the aircraft be ditched along the top of the swell, paralleled to the rows of swells, if the wind does not exceed 30 knots. In high winds, it is recommended that ditching be conducted upwind to take advantage of lowered forward speed. However, it must be remembered that the possibility of ramming nose-on into a wave is increased, as is the possibility of striking the tail on a wave crest and nosing in.

CROSSWIND DITCHING.

The basic rules for ditching listed in DITCHING will still apply, in addition to the following:

Crab the aircraft to kill drift.

Land on the downwind side of the swell or wave.

UPWIND DITCHING.

The basic rules for ditching listed in DITCHING will still apply, in addition to the following:

Maintain nose-up attitude, avoid striking wave face.

Touch down immediately behind the crest of a rising wave, avoid the face of the wave.

Hold nose up after first impact.

NIGHT DITCHING.

Night ditching will be conducted with the aid of instruments to establish proper attitude of aircraft.

Make an instrument approach, holding airspeed the same as for DITCHING. At 500 to 700 feet above the water, set up approximately 200 feet per minute rate of descent with 40 degrees of flaps.

Use landing lights as necessary.

Hold wings level to avoid digging a wing into water and cartwheeling the aircraft.

Close throttles and turn off electrical power immediately upon contact with the water.

SECTION IV
AUXILIARY EQUIPMENT

TABLE OF CONTENTS

INTRODUCTION.

This section includes the description, normal operation, and emergency operation of all equipment not directly contributing to flight but which enables the aircraft to perform certain specialized functions.

HEATING AND VENTILATING SYSTEM.

The flight and cargo compartments are each provided with a flight and ground operable heating system. The ducting and outlets of each system can also be used for ventilation on the ground and in flight when either heater is out. Each system consists of a combustion heater with the necessary components and ducting controls to regulate the temperature inside the flight compartment and cargo compartment within a range of 40° to 80° F. Within each system are fans, recirculation ducts, and air selector valves to provide for ground operation; and an outlet from the cargo compartment heating system provides hot air for preheating the engines on the ground. The electrical controls for each heater are on a panel mounted on the forward face of the bulkhead behind the pilot. Fuel for both heaters is provided from the fuel tank in the right wing by an electrically driven fuel pump outboard of the engine nacelle.

DC power for each temperature control system, and ground operation provision, is supplied from the secondary bus through push-to-reset circuit breakers, and through a switch type circuit breaker for each heater fuel control system. Provision is made for hot-day ram air ventilation of the flight compartment and cargo compartment. A fan air pressure switch which is operated by ram air from the copilot's pitot pressure line, serves both the flight compartment and cargo compartment heating systems. In the cargo compartment system the air selector valves are moved automatically to their ground or flight position by an electrical actuator operated by the fan air pressure switch. In flight the pressure switch maintains the combustion air fan and the ventilating air fan inoperative in both systems. The cargo compartment heater mixing valve can be controlled manually in the event of malfunction of the automatic control circuit.

FLIGHT COMPARTMENT HEATING SYSTEM.

The flight compartment combustion heater is rated at 50,000 BTU and consumes 0.66 gallon of fuel per hour maximum. It is mounted in the nose section of the fuselage and is accessible through a removable panel forward of the windshield. The left and right ram air ducts in the nose of the fuselage have 20- and 10-ampere electrically heated anti-icing intakes respectively, and both are powered from the secondary bus through the 25-ampere push-to-reset circuit breaker. They are both controlled by the 5-ampere switch - type circuit breaker, under the INTAKE ANTI-ICING marking, on the lower section of the heating control panel (figure 4-2). The left duct supplies ram air, in flight, to the heater combustion chamber where it mixes with fuel and is ignited by a spark plug. The current for the spark plug is supplied through normal or standby vibrator contacts in an ignition unit. The exhaust gases flow through heat exchanger passages and are vented to the atmosphere. The right duct supplies ventilating ram air, in flight, which is passed over the hot walls of the heat exchanger. The resulting warm air is distributed to ten outlets in the flight compartment.

Temperature control system.

The temperature control system of the heater is automatic. It consists of a heater outlet duct thermostat, compartment thermostat, temperature selector, and a temperature control box. The heater is protected from overheating by a cycling thermal switch and a high limit thermal switch in the heater outlet duct. The cycling switch, in conjunction with a relay, operates the cycling solenoid in the fuel control unit to restrict the continuous operating temperature to a maximum of 250°F. The high limit switch operates at 350°F to energize the heater electrical system should the cycling switch malfunction. A further safeguard is provided by a fire detecting element in the heater outlet duct which will illuminate the fire warning light on the left side of the emergency panel if the temperature rises to 550°F.

Preparation for operation.

Before the heater can be started on the ground or in flight, the following conditions must exist:

1. The cockpit air control handle on the pilot's pedestal must be pushed fully in (open).

2. The cockpit air selector handle on the pilot's pedestal must be positioned for ground or flight operation as appropriate.

3. A combustion ram air pressure equivalent to approximately 80 knots IAS must be sensed by the ram air pressure switch.

4. The heater discharge temperature must be less than 350°F.

Provided these conditions exist, when the master switch and fuel pump are turned on, the heater will start operating provided the start switch is depressed. The start switch indicator light will illuminate to show that the system is energized.

HEATER CONTROLS.

The lower section of the heating control panel (figure 4-2), on the bulkhead behind the pilot's seat, is marked COCKPIT HEAT & VENTILATION and contains the switches and controls necessary for operation of the flight compartment heater, and for control of the heater intake anti-icing elements.

Heater fuel pump switch.

The heater fuel pump two-position switch is marked FUEL and OFF. The switch controls the electrical circuit of the fuel pump in the right wing, which supplies fuel to both the flight compartment and cargo compartment heaters.

Heater ignition switch.

The heater ignition switch is of the toggle type and has two positions, marked EMERG and NORMAL. When operating in the normal position and the heater fails, select the emergency position. Enter the discrepancy in form 781 at the completion of the flight. The EMERG position provides a standby set of vibrator contacts to restore ignition.

Heater master switch.

The heater master two-position toggle switch is labeled MASTER SWITCH. The switch controls the DC power from the secondary bus to the heater and fuel control system.

Heater start switch.

The heater start push-type switch is marked PUSH TO START and controls the electrical power to a hold-in relay supplying the heater ignition unit electrical circuit. A light in the switch will illuminate when the circuit is energized. The master switch must be on before the start switch is depressed.

Heater Temperature Selector. The heater temperature selector is marked TEMP SELECTOR and is graduated in °F with numerals at 40, 60, and 80. The selector sets the temperature control system of the heater to maintain the temperature in the compartment, as sensed by the compartment thermostat and the heater outlet duct thermostat.

Heater and Fan Circuit Breakers. A 5-ampere push-to-reset circuit breaker marked HEATER protects the heater electrical circuit. A 10-ampere push-to-reset circuit breaker marked FAN protects the circuits of the combustion ram air fan and ventilation return air fan.

Heater Intake Anti-icing Circuit Breakers. Below the INTAKE ANTI-ICING marking is a 5-ampere switch-type circuit breaker control marked CONT, for selection of the heater intake anti-icing circuit, and a 25-ampere push-to-reset circuit breaker marked HEATER for circuit protection.

Air Control Handle. The air control handle on the pilot's pedestal is marked COCKPIT AIR CONTROL and PULL TO CLOSE. The handle is used to mechanically adjust a butterfly-type valve in the heater outlet duct to regulate the amount of ventilating air entering the flight compartment. When the handle is pushed in, the valve is opened and releases its pressure on a microswitch to allow operation of the heater. When the handle is pulled fully out, the valve closes and operates the microswitch to de-energize the heater electrical circuit; this position should be selected in the event of fire.

Air Selector Handle. The air selector handle on the pilot's pedestal is marked COCKPIT AIR SELECTOR, and FLIGHT-PUSH, GROUND-PULL. The handle is used to mechanically actuate two butterfly-type valves, one in the ventilating ram air intake duct and one in the ventilating air return duct. When the handle is pulled out to the GROUND posi-

flight compartment heating and ventilating system

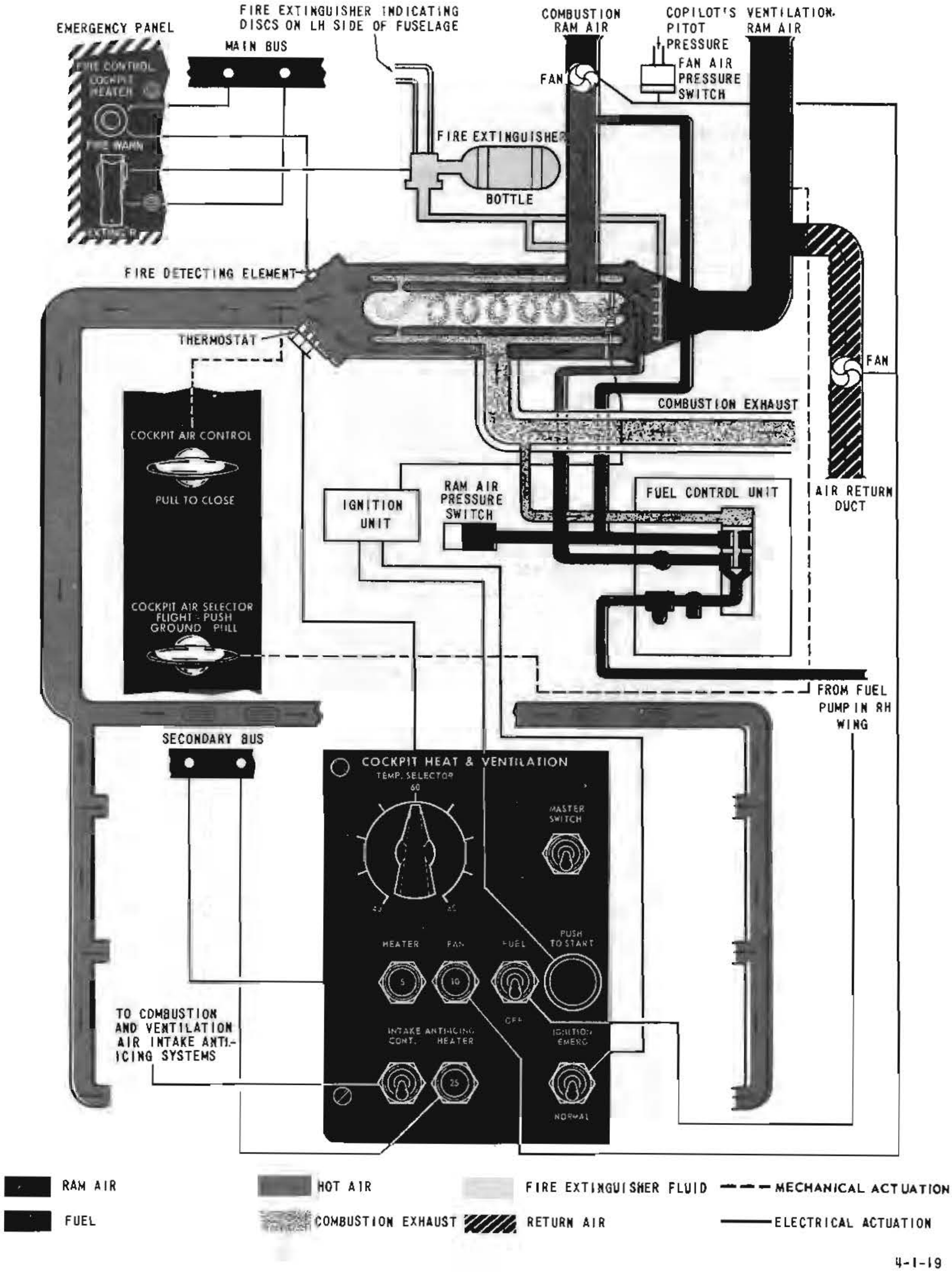


Figure 4-1 Flight Compartment Heating and Ventilating System

heating control panel

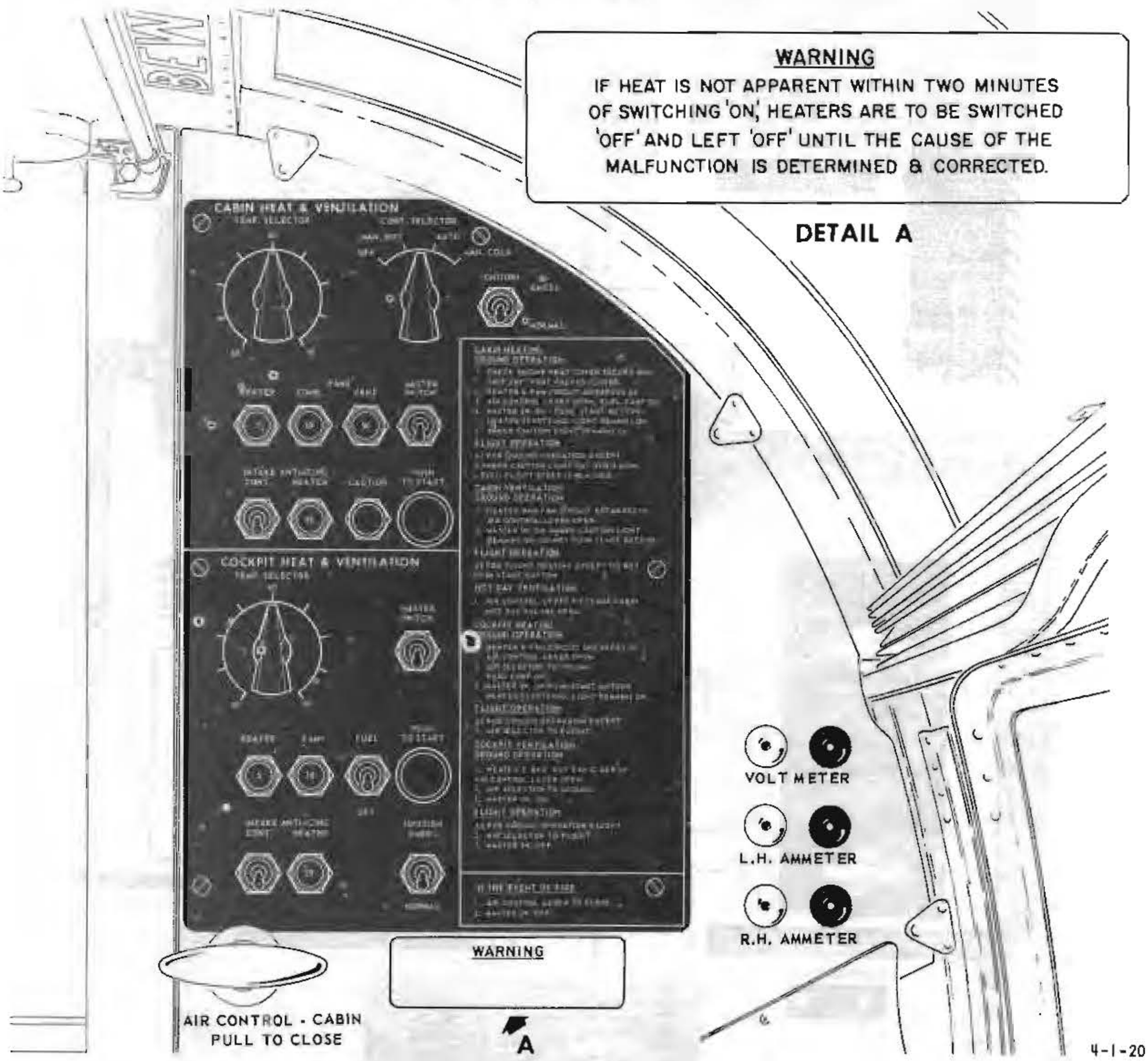


Figure 4-2 Heating Control Panel

tion the ram air intake duct valve operates a micro-switch which energizes two fans, one in the ram air intake duct to supply combustion air and one in the air return duct to recirculate the air from the flight compartment. An air pressure switch, in the fuselage nose section, deenergizes the circuit of the fans after take-off upon attaining an airspeed of approximately 85 knots IAS; and prevents operation of the fans should the air selector handle be inadvertently left at GROUND position during flight. The air pressure switch is pressurized from the copilot's pitot line and is common to both the flight compartment and cargo compartment heating systems.

OPERATION.

Ground and flight operation of the heating system is covered in the following paragraphs.

Ground operation.

1. Heater and fan circuit breakers - Set.
2. Cockpit air control handle - Push in (open).
3. Cockpit air selector handle - GROUND.
4. Fuel pump switch - Up (on).
5. Heater ignition switch - NORMAL.
6. Temperature selector - Set to desired temperature.
7. Master switch - UP (on).
8. Start switch - Depress.

9. Start switch indicator light - Should illuminate and remain on during heater operation.

Note

On transition from Ground to Flight operation of the heater, it will be noted that only actions 3 & 8 of the following paragraphs are necessary.

Flight operation.

1. Heater and fan circuit breakers - Set.

2. Cockpit air control handle - Push in (open).

3. Cockpit air selector handle - FLIGHT.

4. Fuel pump switch - Up (on).

5. Heater ignition switch - NORMAL (EMERG if NORMAL is inoperative).

6. Temperature selector - Set to desired temperature.

7. Master switch - Up (on).

8. Start switch - Depress.

9. Start switch indicator light - Should illuminate and remain on during heater operation.

CARGO COMPARTMENT HEATING SYSTEM.

The cargo compartment combustion heater is rated at 200,000 BTU and consumes 2.66 gallons of fuel per hour maximum. It is mounted in the right side of the cargo compartment roof immediately aft of the flight compartment bulkhead. The ventilating ram air duct, in the leading edge of the right wing does not have an anti-icing intake. In flight, the duct in the left wing supplies ram air to the heater combustion chamber where it mixes with fuel and is ignited by a spark plug. The current for the spark plug is supplied through normal or standby vibrator contacts in an ignition unit. The exhaust gases then flow through heat exchanger passages and are exhausted to atmosphere. The duct in the right wing supplies ventilating ram air in flight, and the flow of air divides before reaching the heater. Some of the air passes over the hot walls of the heat exchanger, and some of it passes through a heater bypass duct. The heated air and cold bypass air rejoin at the discharge end of the heater, where the degree of mixing is controlled by an electrical actuator-operated mixing valve which is positioned according to cargo compartment temperature selector requirements. Variations are sensed by the cargo compartment thermostat in the rear exhaust outlet and the heater outlet duct thermostat. The flow then passes to eight outlets along each side of the cargo compartment and to one outlet in the cargo compartment roof at the rear. Two interconnected ventilating air exhaust outlets in the cargo compartment roof pass used air to atmosphere, through the cargo compartment exhaust vent, during flight. During ground operation, mechanically interconnected electrical actuator-operated valves in the combustion air duct, ventilation air duct and cargo compartment exhaust vent are closed; and a combustion air bypass duct and ventilating air bypass duct are opened, and a fan in each is energized. An amber colored CAUTION light will illuminate during operation of the fans. The combustion air fan draws air through the ram air intake in the left wing and passes it to the heater combustion chamber. The ventilation air fan draws cargo compartment air through the cargo compartment air exhaust outlets and recirculates it over the hot walls of the heat exchanger and then passes the heated air to the outlets on each side of the cargo compartment. (See figure 4-3).

Temperature control system.

The temperature control system of the heater is basically automatic. However the heater mixing valve can be manually controlled, in the event of failure of the automatic control circuit, by means of a control selector on the upper section of the heating control panel. The system consists of a heater outlet duct thermostat, cargo compartment thermostat, temperature selector, control selector, and a temperature control box. Cargo compartment temperature is automatically controlled in a similar manner to that given for the flight compartment heater. The heater is protected from overheating and is safeguarded in a similar manner to that given for the flight compartment heater. However, the fire warning light for the cargo compartment heater is on the right side of the emergency panel.

Preparation for operation.

Before the heater can be started on the ground or in flight, the following conditions must exist:

1. The cargo compartment air control handle, located below the heating control panel, must be pushed fully in to open the valves in the tee duct at the outlet end of the heater and allow the safety microswitch to complete the electrical circuit.

2. A combustion ram air-pressure equivalent to approximately 80 knots IAS must be sensed by the ram air pressure switch.

3. The heater discharge temperature must be less than 350°F. Provided these conditions exist when the master switch and fuel pump switch are turned on, then the heater will operate when the start switch is depressed. The start switch indicator light illuminates to show that the system is energized. The mechanically interconnected air selector valves are automatically positioned for the type of operation, ground or flight, by an electrical actuator operated by the fan air pressure switch in the fuselage nose section. When the air pressure sensed

cargo compartment heating and ventilating system

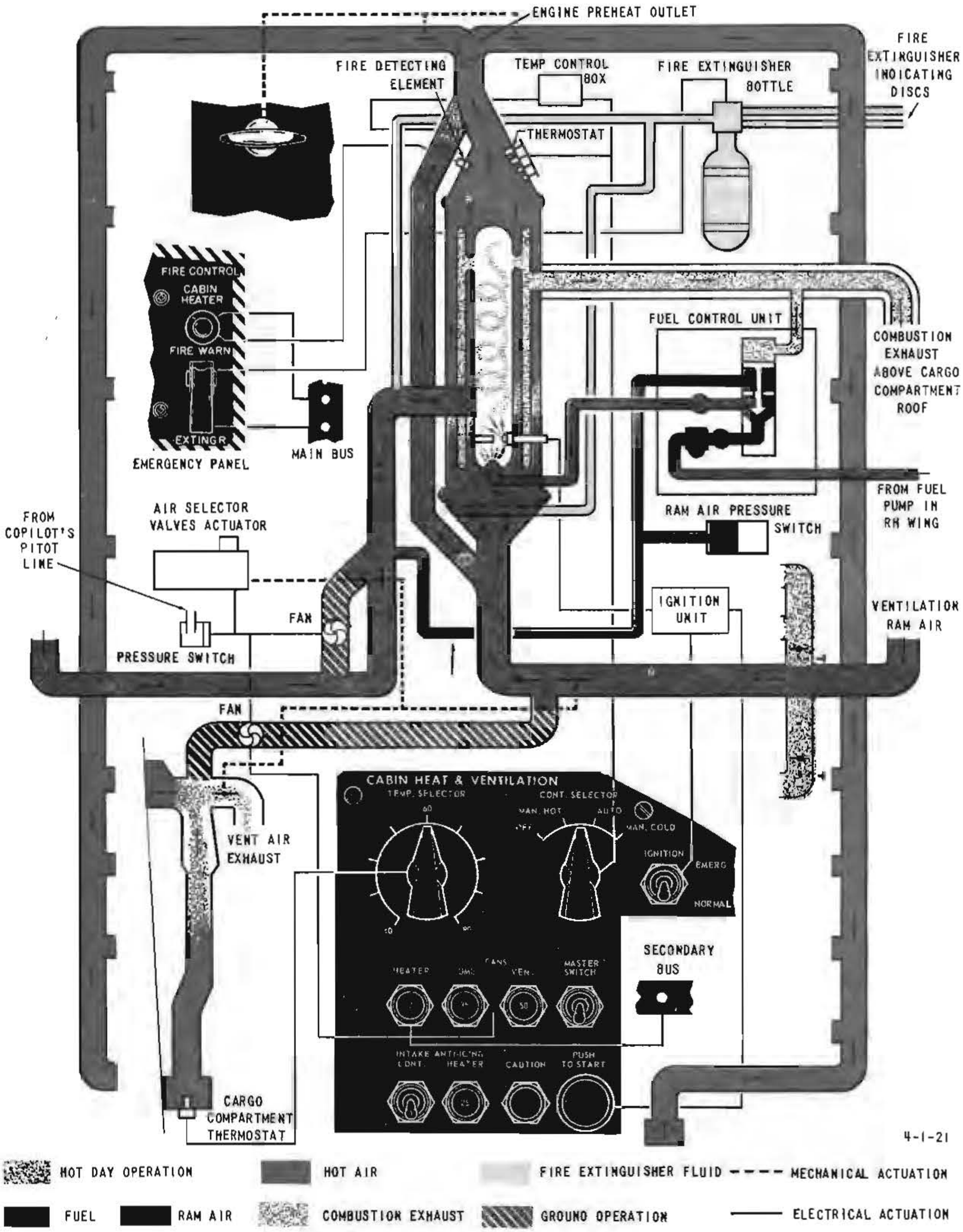


Figure 4-3 Cargo Compartment Heating and Ventilating System

by the switch is less than the equivalent of 85 knots IAS the selector valves are positioned for ground operation, the fans are energized and the CAUTION light illuminates. Above 85 knots IAS the selector valves are positioned for flight operation, and the fans are deenergized and the CAUTION light is off.

HEATER CONTROLS.

The upper section of the heating control panel (figure 4-2), on the bulkhead behind the pilot's seat, is marked CABIN HEAT & VENTILATION and contains the switches and controls necessary for operation of the cargo compartment heater, and for control of the heater combustion ram air intake anti-icing element. The heater fuel pump electrical circuit is controlled by the fuel pump switch on the lower section of the heating control panel. For a description of the ignition, master and starter switches, refer to flight compartment heater.

Heater temperature selector.

The heater temperature selector is marked TEMP SELECTOR and graduated in °F with numerals at 40, 60, and 80. The selector sets the temperature control system of the heater to maintain the temperature in the cargo compartment, as sensed by the cargo compartment thermostat and the heater outlet duct thermostat.

Heater control selector.

The four-position control selector is marked CONT SELECTOR with positions OFF, MAN HOT, AUTO, and MAN COLD. The selector setting determines the type of operation of the heater. In the AUTO position the mixing valve, at the junction of the heater outlet and heater bypass duct, is automatically controlled by the temperature control system to regulate the amount of cold bypass air mixing with the heated air from the heater. In the MAN HOT position the temperature control system is bypassed and the mixing valve is moved to close the heater bypass duct to allow heated air only to be fed to the cargo compartment outlets. In the MAN COLD position the temperature control system is bypassed and the mixing valve closes the heater outlet to allow cold air only to be fed to the cargo compartment outlets. During manual operation the mixing valve can be positioned at intermediate settings by moving the control selector to OFF when the desired setting is reached. The valve takes approximately 45 seconds to move from MAN HOT to MAN COLD.

Heater and fans circuit breakers.

A 7-ampere push-to-reset circuit breaker marked HEATER protects the heater electrical circuit. Two push-to-reset circuit breakers protect the FANS circuit; the 5-ampere breaker marked COMB for the combustion air fan, and the 20-ampere breaker marked VENT for the ventilating air fan. When the winterization equipment hi-capacity fans are installed, the 5- and 20-ampere breakers will be replaced by 35- and 50-ampere breakers respectively.

Caution light.

An amber light marked CAUTION will illuminate when the ventilating air fan and combustion air fan are in operation. If the light illuminates in flight, indicating that the fans are energized, the COMB fan circuit breaker should be pulled to deenergize combustion fan and light circuit.

Cargo compartment air control handle.

The cargo compartment air control handle, below the heating control panel, is marked AIR CONTROL - CABIN, PULL TO CLOSE. The handle is used to manually position butterfly-type valves to regulate the amount of ventilating air entering the cargo compartment. When the handle is pulled to fully close the valves, the heater electrical system is deenergized. Pull the handle in the event of fire. When the handle is pulled to fully close the valves, a microswitch is actuated to deenergize the heater electrical system; select this position in the event of fire.

OPERATION.

Normal and emergency operation of the cargo compartment heating system is covered in the following paragraphs.

Normal operation.

Cargo compartment heater operation, both on the ground and in flight, is similar. Automatic positioning of the system air selector valves, and control of the fans, occurs at an air pressure equivalent to approximately 85 knots IAS; below this speed the system is placed in ground operation, and above this speed it is placed in flight operation. To start the heater proceed as follows:

1. Engine preheat outlet cover - Check secure during preflight inspection.
2. Hot day duct valves - Closed.
3. Heater and fans circuit breakers - Set.
4. Cargo compartment air control handle - Push in (open).
5. Fuel pump switch - Up (on).
6. Control selector - AUTO.
7. Temperature selector - Set to desired temperature.
8. Heater ignition switch - NORMAL (EMERG if NORMAL is inoperative).

9. Master switch - Up (on).

10. Start switch - Depress.

11. Start switch indicator light - Should illuminate and remain on during heater operation.

WARNING

If heat is not apparent within two minutes of switching on, heaters will be switched off and left off until the cause of the malfunction is determined and corrected.

12. Amber CAUTION light - Should illuminate and remain on to indicate that the fans are energized during ground operation. It should go out at airspeeds above 85 knots IAS, to indicate that the fans are deenergized and the air selector valves are in their flight operating positions.

WARNING

In the event of fire the cargo compartment air control handle must be pulled to the fully closed position and the master switch moved to off.

CAUTION

If the thrust indicator free stream pressure selector, on the copilot's flight instrument panel, is moved to the EMERG OFF position in flight, and the heating control panel CAUTION light illuminates, pull out the COMB fan circuit breaker. For subsequent system operation on the ground, circuit breaker must be reset.

Emergency operation.

If the automatic control of the heater air mixing valve malfunctions, the mixing valve can be controlled manually to regulate the temperature of the air being fed to the cargo compartment outlets. Temperature control is accomplished by moving the control selector as follows:

1. Position at MAN HOT for approximately 30 seconds to move the mixing valve and close the heater bypass duct.

2. Position at MAN COLD for 10 seconds, then to OFF. This partially opens the heater bypass duct to admit cold air and reduce the temperature of the heated air fed to the cargo compartment outlets.

3. Repeated adjustment in this manner, varying the number of seconds at MAN COLD, will modulate the heat supply until the desired temperature is obtained.

Operation of cargo compartment vent air exhaust valve.

When the system is switched off in the air, the cargo compartment vent air exhaust valve remains open. The valve only closes when the system is in ground mode. To prevent rain or moisture entering the valve when the aircraft is on the ground, the master switch should be switched on for a few seconds before shutting down the engine. This action will motor the valve to ground mode and it will close. With the master switch ON, insure engine rpm are sufficient to charge both generators.

FLIGHT COMPARTMENT VENTILATING SYSTEM.

The flight compartment ventilating system utilizes the ducting and outlets of the heating system with the heater in a deenergized condition. For hot day use two cooling louvers are installed, one on each side of the flight compartment, to provide additional fresh air for the pilot and copilot. Each louver is installed at the aft end of a short ram air intake, forward of the windshield. The direction and amount of ventilating air flow can be adjusted by turning the spherical louver and rotating its shutter knob. An adjustable air exhaust louver is installed in the rear of the canopy to the right of the aircraft centerline. Maximum ventilating air is provided when the hot day louvers and the cockpit air control handle are at the fully open position.

OPERATION.

Ground and flight operation of the flight compartment ventilating system is covered in the following paragraphs.

Ground operation.

1. Heater circuit breaker - Pull out.

2. Fan circuit breaker - Set.

3. Cockpit air control handle - Push in (open).

4. Cockpit air selector handle - GROUND.

5. Master switch - Up (on).

6. Hot day louvers - Open for maximum ventilating air, if required.

Note

On transition from Ground to Flight operation of the ventilating system, only actions 4 and 5 of the following paragraph are required.

Flight operation.

1. Heater circuit breaker - Pull out.

2. Fan circuit breaker - Set.

3. Cockpit air control handle - Push in (open).

4. Cockpit air selector handle - FLIGHT.

5. Master switch - Down (off).

WARNING

In the event of fire the cockpit air control handle must be pulled to the fully closed position.

CARGO COMPARTMENT VENTILATING SYSTEM.

The cargo compartment ventilating system utilizes the ducting and outlets of the heating system with the heater in a deenergized condition. For hot day use in flight, cold fresh air can be admitted to the cargo compartment through ducting connected to the ventilating ram air intake in the leading edge of the right wing, and to three louvers in the cargo compartment roof. Two of these louvers are ahead of the forward air exhaust outlet, and the third louver is just aft of the wing rear spar. The amount of fresh air admitted through the louvers is controlled by manually operated butterfly-type valves, one just aft of the forward louvers and one at the rear louver; both are marked HOT DAY VENTILATION ON-OFF. For hot day ventilation in flight, the cargo compartment air control handle must be pulled fully out (close) to shut off the normal ventilating system and allow the maximum amount of cold fresh air to be directed to the three roof louvers, where the flow of air can be manually controlled. On the ground, fresh air ventilation can be supplied through the hot day louvers provided the right engine is operating; the propeller slipstream produces a ram air effect at the ventilating ram air intake.

Operation.

1. Heater and fans circuit breakers - Set.

2. Cargo compartment air control handle - Push in (open).

3. Master switch - Up (on).

4. Start switch - Do not depress.

5. Amber CAUTION light - Should illuminate and remain on to indicate that the fans are energized during ground operation, and should go out at airspeeds above 85 knots IAS to indicate that the fans are deenergized and the air selector valves are in their flight operating positions.

CAUTION

If the thrust indicator free stream pressure selector, on the copilot's flight instrument panel, is moved to the EMERG OFF position in flight, and the heating control panel CAUTION light illuminates, pull out the COMB fan circuit breaker. For subsequent operation on the ground, circuit breaker must be reset.

Hot day ventilation operation.

1. Cargo compartment air control handle - Pull out (close).

2. Hot day duct valves - Open.

Note

This operation can be used on the ground to supply fresh air ventilation, provided the right engine is operating.

ANTI-ICING AND DEICING SYSTEM.

The ice protection facilities consist of windshield anti-icing, heater and ventilating air intake anti-icing, and pitot head anti-icing; propeller deicing, and wing and tail deicing.

WINDSHIELD ANTI-ICING.

Both the pilot's and copilot's windshields are constructed of polyvinyl butyral sandwich panels. The laminations are heated electrically by current that passes through a transparent conductive coating between the sheets. In addition to providing anti-icing, heating of the panels prevents misting and also raises their birdproof qualities.

Note

Maximum "bird proofing" qualities of the windshield are obtained when the vinyl interlayer is maintained in the temperature range of 68° to 130°F. The windshield heat system maintains a temperature of 105 ± 5°F, and the windshield is therefore at its maximum strength with the heat on.

Single phase AC power for each windshield panel is derived from individual windshield inverters powered from the secondary bus; the circuits being protected by 70-ampere circuit breakers. The associated DC relay circuits are protected by 5-ampere circuit breakers. Operation of the windshield heat is controlled by the windshield heat switch on the center switch panel. The switch, marked WINDSCREEN HEAT, has three positions: NORM, OFF, and EMERG. The switch should be set to NORM at least three minutes prior to take-off. Should the pilot's windshield power supply fail, switching to EMERG will transfer power to the pilot's panel from the copilot's panel, which will then cool. A warning light for each windshield inverter, marked FAIL, PILOT'S and CO-PILOT'S, is located adjacent to the control switch and will illuminate if its respective inverter fails.

CAUTION

If inverter failure is the cause of the defect, the appropriate circuit breaker should be pulled and no attempt must be made to reactivate the inverter, or further damage to the system may result.

HEATER INTAKE ANTI-ICING.

The inlets for the flight compartment heater combustion and ventilation air intakes, and the cargo compartment heater combustion air intake, are electrically anti-iced. The cargo compartment heater ventilation air intake is not anti-iced. Below the INTAKE ANTI-ICING marking on both the cockpit heating and cargo compartment heating sections of the heating control panel, are provided a 5-ampere toggle-type circuit breaker control and a 25-ampere push-to-reset circuit breaker. The toggle-type circuit breaker marked CONT controls the heater intake anti-icing circuit and the push-to-reset circuit breaker marked HEATER protects the circuit. The anti-icing elements are powered from the secondary bus.

PITOT HEAD ANTI-ICING.

Electrical anti-icing is provided for the four thrust-indicating pitot heads, and two pitot heads supplying the flight instruments. A switch marked PITOT is located on the deicing switch panel (figure 4-5). The switch also controls a heater at each stall warning lift transducer. Power for the flight instrument pitot heads and lift transducers is taken from the emergency bus through two 15-ampere circuit breakers, and for the thrust indicating pitot heads from the secondary bus through two 10-ampere circuit breakers.

PROPELLER DEICING.

An alcohol deicing system is provided for each propeller. Each system consists of an 8.4 gallon tank, an electrically operated shutoff valve, an electrically operated pump and the necessary piping to a slinger ring and cuffs. Both systems are controlled by a switch marked PROP on the deicing switch panel (figure 4-5). Power for each system is derived from the emergency bus via the left and right hydraulic and engine oil emergency shutoff switches respectively. When energized, the pump supplies fluid under pressure to the slinger ring, and is distributed to the leading edge of the propeller blades by centrifugal force. The shutoff valve is solenoid operated and remains open while the pump circuit is energized.

Note

The rate of flow of each propeller deicing system is 1.27 gallons per hour, and will provide protection for 6.5 hours of continuous operation. However, as the alcohol deicing system is only used intermittently, the supply is sufficient for the endurance of the aircraft.

WING AND TAIL DEICING SYSTEM.

The system, (figure 4-4) is of the inflatable rubber-boot type, deicing being provided at the horizontal stabilizer leading edges and the wing leading edges outboard of the landing lights. Included in the system are two engine-driven air pumps, two combination units, distributor valves, an electronic timer, and the control switches on the deicing panel. System pressure and suction is indicated by two gages, marked DEICING, and PRESS and SUCT respectively, located on the copilot's pedestal. Refer to Section V for instrument markings. Electrical power for the system is taken from the secondary bus via two circuit breakers, AUTO and MANUAL, labeled DEICING WING & TAIL.

The deicer boots are arranged in sections. Two sections at the stabilizer, one left, one right; and two sections, an inboard and an outboard, at each wing. Each section is further divided into an inner and outer boot. A distributor valve serves each wing-boot section; one distributor valve is provided to serve both tailboot sections. The distributor valve has a pressure inlet port, a suction outlet port and a dump port. Two additional ports "A" and "B" are connected to related "A" (inner) and "B" (outer) boot ports. Pressure and suction is alternated through the "A" and "B" ports by movement of a solenoid-operated servo valve. The distributor valves are each connected to a common pressure manifold and a common suction manifold; pressure and suction being applied by either or both engine-driven air pumps. The suction side of each pump is connected direct to the suction manifold; suction being indicated at all times on the gage. The pressure side delivery is routed through the combustion unit from which pressure is dumped when the system is inactive or, when in use, is regulated to the pressure manifold to maintain 15 psi. Both pumps will provide satisfactory operation up to 20,000 feet. In the event of engine or pump failure, the remaining pump will provide satisfactory operation up to 15,000 feet.

An electronic timer is provided for automatic operation of the system; a separate circuitry being provided to bypass the timer for manual operation. The normal cycle of the timer is 1-minute for excessive icing (29 seconds on, 31 seconds off) and 4 minutes for light to moderate icing (29 seconds on, 211 seconds off). When the system is switched on, there is an initial tube warm-up delay of 20 seconds, then the cycle commences with a 5-second period during which the solenoids of the combination units are energized to close the dump valves and pressurize the system. Thereafter, six contacts are energized successively, each for a period of 4 seconds during which the appropriate distributor-valve solenoids are in turn energized

wing and tail deicing system

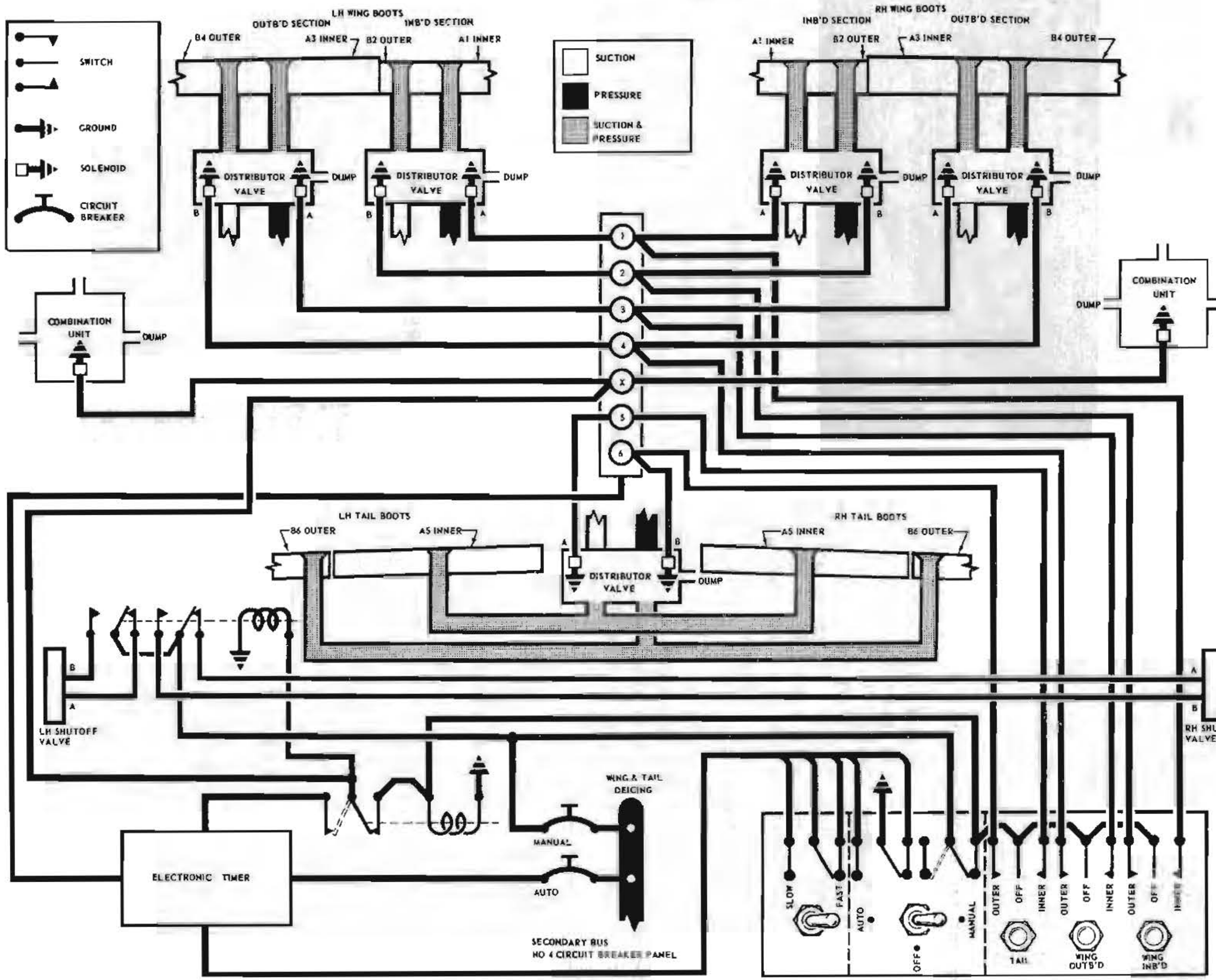


Figure 4-4 Wing and Tail Deicing System

4-1-22

to fully inflate their respective boots. The boots are inflated and deflated once per cycle, in symmetrical pairs, consecutively from the inboard inner wing-boots to the outer tail-boots (see figure 4-4). Suction is applied to hold the boots flush with the leading edge during the intervening periods of the cycle. During the balance of the cycling time (31 or 211 seconds), the dump valves are open and system pressure is unloaded.

Note

If the system is switched OFF during a cycle, the timer will zero for commencement of another cycle.

Wing and tail deicing switches.

Under WING & TAIL, a mode switch has three positions marked AUTO, OFF, and MAN; the function being self-explanatory (figure 4-5). A related two-position switch marked FAST-SLOW selects respectively the 1-minute or 4-minute cycle, and is operative only in the AUTO mode. Three BOOTS switches, INBD, OUTBD, and TAIL, have positions marked INNER-OFF-OUTER, and are for manual operation of the boots either when a particular icing condition makes manual mode preferable or in the event of failure of the automatic function. When manual mode is selected, the system remains loaded at 15 psi and the boot switches bypass the timer to route power direct to the distributor-valve solenoids; the boot remaining inflated while the switch is held selected.

Normal operation.

1. WING & TAIL DEICING circuit breakers - Set.

2. Mode switch - AUTO.

3. System pressure and suction indicators - Check 15 psi and 4 in. Hg respectively.

4. Cycling switch - FAST or SLOW, as required.

Note

With the system operating automatically, the build-up and shedding of ice should be closely observed, bearing in mind the fact that the characteristics of the icing condition may require a change in the manner of system operation. The wing inspection lights are provided for observations during night operation.

Manual operation.

Should a failure in the timer, or characteristic of the icing condition require manual mode of operation, proceed as follows:

1. Mode switch - MAN.

deicing switch panel

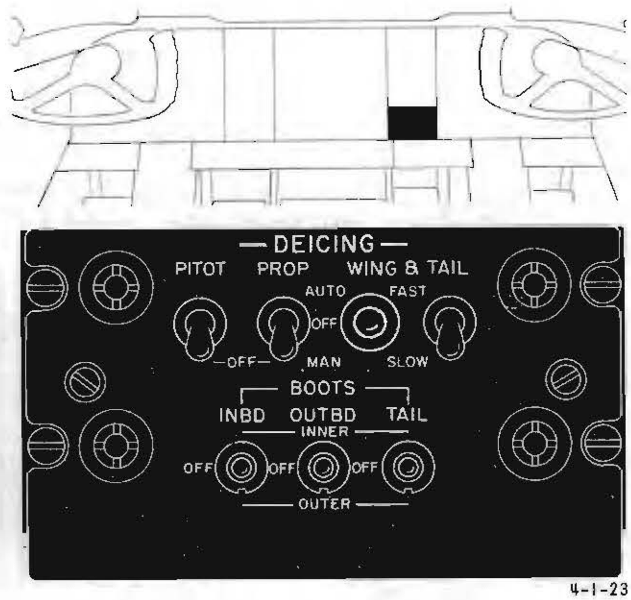


Figure 4-5 Deicing Switch Panel

2. System pressure and suction - Check.

3. BOOTS switches - Commencing with the INBD switch, hold each switch in turn first to the INNER position and then the OUTER position for a period of 4 seconds each approximately.

4. Repeat the cycle as necessary.

Note

For wing and tail deicing procedures refer to cold weather operation in Section IX.

ENGINE PREHEAT SYSTEM.

An engine preheat system is provided to permit heating each engine and its accessory compartment to a reasonable temperature prior to starting the engines in still air temperatures of 0°F (-18°C) and below. The system consists of flexible piping which can be connected to an engine preheat outlet in the tee-duct at the discharge end of the cargo compartment heater and to the snout of the engine covers. The cargo compartment emergency exit door must be open to allow the flexible pipe to be connected to the engine preheat outlet. Air flow for ground operation of the cargo compartment heater is supplied by a high-capacity fan in the combustion air bypass duct, and one in the ventilating air bypass duct. To obtain maximum flow of heated air through the engine preheat outlet, the cargo compartment air control must be pulled to its closed position. The engine preheat flexible piping can be secured to the snout on the left side of the engine covers for engine preheating, and/or to the preheat access at nacelle station 57.50, marked ACCESSORY COMPT PREHEAT CONNECT, for engine accessory compartment preheating. The preheat access adapter cover on each nacelle is secured by four quick-release fasteners; and has a spring-steel insert marked FIRE ACCESS which can be pushed in to allow fire extinguishing agent to be sprayed into the accessory compartment.

OPERATION.

1. Flexible piping - Connect between engine preheat outlet and engine cover as appropriate.

Note

> When the flexible piping is connected to the engine preheat outlet it actuates a cargo compartment air control microswitch to permit operation of the cargo compartment heater.

2. Flight compartment canopy cover, cargo compartment heater forward air exhaust cover and left wing air intake cover - Remove.

3. Cargo compartment heater - Start as for ground operation, then pull the cargo compartment air control to the closed (out) position.

Note

> Secure cover on engine preheat outlet when preheat system is not in use, and push the cargo compartment air control to its open (in) position.

4. Cockpit heater inlet and exhaust cover - Remove to permit ground operation of the flight compartment heater during preheating of the engine.

5. Engine preheat should be applied to one engine and its accessory compartment at the same time. Connect the preheat flexible piping to the preheat outlet, and to the engine cover snout and engine accessory compartment preheat access adapter. Maintain application of preheat until the cylinder head temperature gage indicates above 0°C, then transfer the flexible piping to the cold engine and its accessory compartment. Remove the engine cover and oil cooler air exhaust cover from the preheated engine, and start the engine using the hot fuel prime system if installed. Allow the engine to warm up at 1000 rpm and carry out boil-off procedure detailed in Section IX. Remove the flexible piping, engine cover, and oil cooler air exhaust cover from the engine being preheated when its cylinder head temperature gage indicates above 0°C, and proceed as for the operating engine. Select the hot fuel prime switch to OFF after both engines are operating.

WINTERIZATION COVERS.

Fifteen winterization covers are provided, twelve are installed externally and three internally. A lightweight folding ladder is provided for use when installing the external covers; the ladder length is 12 feet 1.7 inches when unfolded, and 7 feet 5.8 inches when folded.

External covers.

Engine Covers. Two engine covers, one for each engine, are stenciled ENGINE COVER SD5525-1, with TOP at the appropriate position to facilitate installation. Elastic cord assemblies with attachment rings are provided at the aft edge of each cover which are held secure to the nacelles by appropriately located ball-lok pins. Before installing an engine cover insure that the propeller blades are at the 2, 6, and 10 o'clock positions. The blade cuffs of the cover are secured to the propeller by means of elastic cord assemblies with ring and hook attachments. Insure that the heating duct snout of the cover is at approximately the 4 o'clock position.

Cargo Compartment Heater Intake and Exhaust Covers.

a. Two covers, one for each cargo compartment heater air intake in the leading edge of the wing center section, are stenciled SD5605-1 COVER, AIR INTAKE LE CS WING and can be secured in position by means of two button fasteners. Each cover has a warning streamer. Remove left cover before preheating the engines.

b. A shaped cover stenciled SD5606-1 COVER, AIR EXHAUST, CABIN HEATER can be slipped onto the cargo compartment heater combustion air exhaust and secured in position by means of four button fasteners. The cover has a warning streamer. Remove this cover before preheating engines.

c. A shaped cover stenciled SD5607-1 COVER AIR EXHAUST, CABIN HEATER can be slipped onto the cargo compartment heater ventilating air exhaust and secured in position by means of two button fasteners. The cover has a warning streamer.

Landing Gear Covers.

a. Two covers, one for each main landing gear opening, are stenciled SD5609-1 COVER, OPENING, MAIN LG and FORWARD. Each cover can be secured in position by means of eight ball-lok pins, twenty button fasteners, and an elastic cord lacing at the rear panel.

b. A cover for the nose landing gear opening is stenciled SD5611-1 COVER, OPENING, NOSE LG and can be secured in position by means of fourteen button fasteners. Remove this cover before operating the APU, if installed.

Cockpit Heater Inlet and Exhaust Cover. A cover for the flight compartment heater air intake and exhaust outlet is stenciled SD5610-1 COVER INLET AND EXHAUST, COCKPIT HEATER and can be secured in position by means of two button fas-

winterization equipment general arrangement

1. ENGINE PREHEAT OUTLET
2. SD5525-1 COVER, ENGINE
3. SD5606-1 COVER, AIR EXHAUST, CABIN HEATER
4. SD5638-1 COVER, AIR EXHAUST, OIL COOLER
5. SD5605-1 COVER, AIR INTAKE, LE CS WING
6. LADDER, FOLDING, LT WT
7. SD5607-1 COVER, AIR EXHAUST, CABIN HEATER
8. HOT FUEL PRIME UNIT (IN NACELLE)
9. SD5609-1 COVER, OPENING, MAIN LG
10. FIRE ACCESS AND PREHEAT ACCESS CONNECTION
11. PIPING, FLEXIBLE, ENGINE ACCESS. COMPT. PREHEAT
12. SD5611-1 COVER, OPENING, NOSE LG
12A. CANOPY COVER
13. DELETED
14. PIPING, FLEXIBLE, ENGINE PREHEAT FROM APU EXHAUST
15. APU EXHAUST PIPE

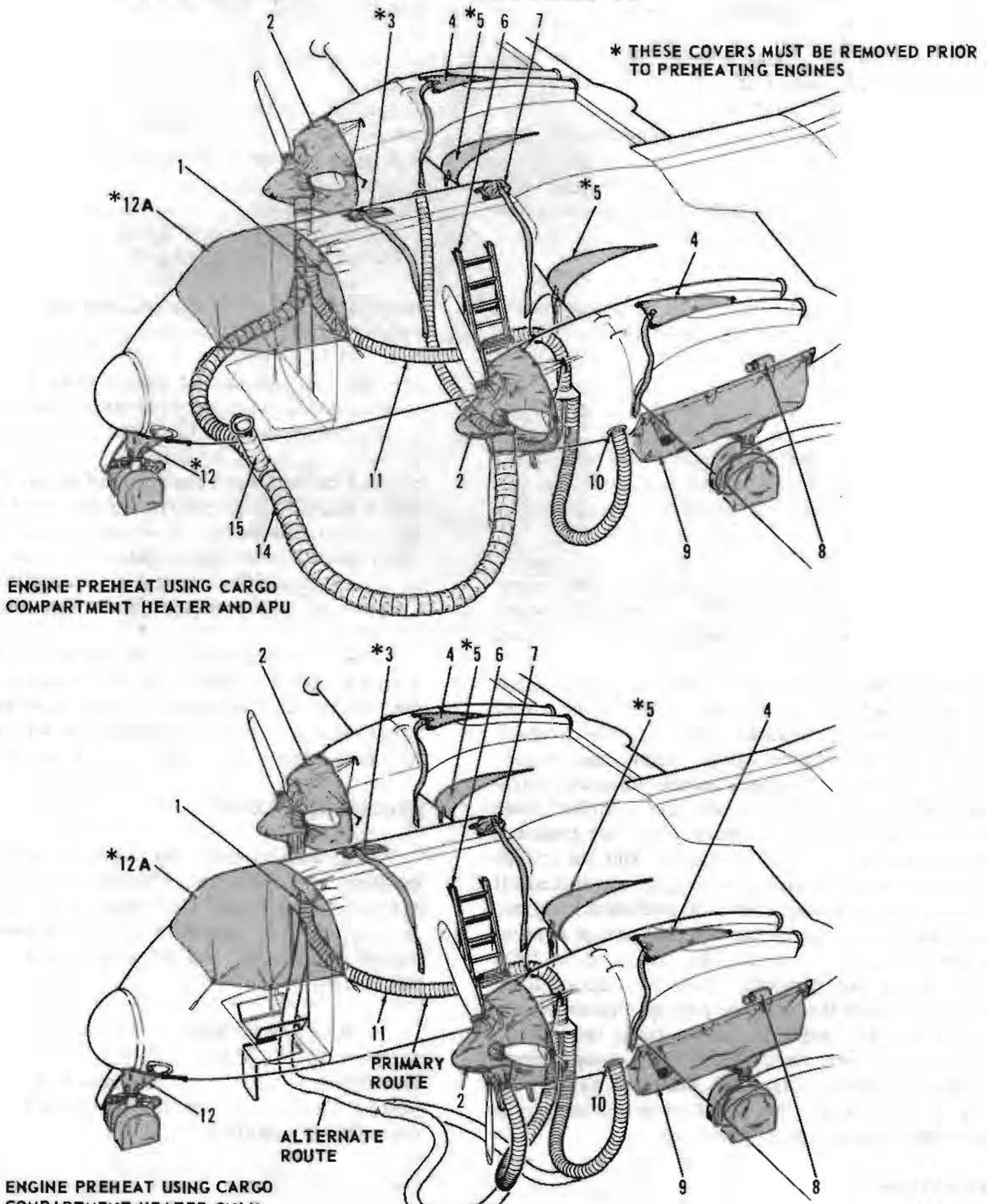


Figure 4-6 Winterization Equipment General Arrangement

teners at the fuselage nose and to the heater exhaust on the right side of the fuselage nose. The cover has a warning streamer. Remove this cover before operating flight compartment heater during preheating of the engines.

Oil Cooler Air Exhaust Covers. Two covers, one for each oil cooler air exhaust, are stenciled SD5638-1 COVER ASSY, OIL COOLER and can be secured in position by means of seven button fasteners. A warning streamer is attached to each cover adjacent to a stenciled instruction reading HANG WARNING STREAMER SD2892-9 OVER LEADING EDGE OF WING. Remove appropriate cover before starting the engine.

Internal covers.

Three covers colored sky-green are provided to block off the hot day ventilation louvers when the aircraft is being operated in winter climates. The covers are secured in position by means of the twelve existing attachment bolts at each louver.

ENGINE PREHEAT SYSTEM (Using APU Exhaust Heat).

On aircraft equipped with a gas turbine auxiliary power unit, an engine preheat system utilizing the APU exhaust heat is provided to permit heating both engines to a reasonable temperature prior to starting in still air temperatures of 0°F (-18°C) and below. The system (figure 4-6) comprises an exhaust pipe which can be connected to the APU exhaust outlet adapter on the left side of the fuselage nose, and a flexible duct assembly connected between the exhaust pipe tee-junction and the snout of each engine cover. Near the upper end of the exhaust pipe is a stub pipe which is engaged with the APU exhaust outlet adapter so that the lower tee end of the exhaust pipe is below the level of the fuselage. A chain is attached to the tee end of the exhaust pipe and the free end can be hooked onto an eyebolt marked APU EXHAUST PIPE SUPPORT on the fuselage left side above the battery location marking. The adapter ends of the flexible duct assemblies attach to the left and right ends of the tee-junction, and the other end connects into the respective engine cover snout. The exhaust pipe has two manually controlled butterfly-type valves, one at each end, and both are marked HOT and COLD at the closed and open position respectively. The upper valve controls the amount of cold ambient air entering the pipe to mix with the APU hot exhaust gases. The lower valve directs the hot gases to atmosphere when the valve is at the COLD position, or to the engine covers when the valve is at the HOT position. A bimetal thermometer with a range from 150° to 750°F (65.5° to 398.9°C) protrudes into the exhaust pipe just above the tee-junction and shows the temperature of the hot gases in the pipe.

Operation.

1. Remove APU exhaust outlet cover.

2. Securely install exhaust pipe on APU exhaust outlet adapter, hook chain to exhaust pipe support eyebolt.

3. Connect flexible duct assembly between exhaust pipe tee-junction and the respective engine cover snout.

4. Insure engine cover snout is securely laced to its flexible duct assembly.

5. Set exhaust pipe upper and lower valves to COLD position.

6. Remove nose gear well cover.

7. Start APU.

8. After one minute adjust exhaust pipe upper valve to give 250°F (121.1°C) maximum temperature.

9. Set exhaust pipe lower valve to HOT position to direct hot gases to engine cover snouts.

ENGINE ACCESSORY COMPARTMENT PREHEAT SYSTEM.

The engine accessory compartment preheat system utilizes cargo compartment heater hot air feed through an engine preheat outlet and a flexible duct assembly to each engine accessory compartment. The engine preheat outlet is on the tee-duct at the discharge end of the cargo compartment heater. The engine accessory compartment preheat connection is on the left side of each engine nacelle at station 57.50, and is marked ACCESSORY COMPT PREHEAT CONNECT. The preheat connection has a cover secured by four quick-release fasteners; and has a spring-steel insert marked FIRE ACCESS which can be pushed in to allow fire extinguishing agent to be sprayed into the accessory compartment. The flexible duct assembly has three ducts joined together at a Y-junction; the duct from the column of the junction is led into the fuselage and attaches to the engine preheat outlet of the cargo compartment heater, and the ducts from the arms of the junction attach one to each engine accessory compartment preheat connection. Air flow for ground operation of the cargo compartment heater is supplied by a high-capacity fan in the combustion air bypass duct, and one in the ventilating air bypass duct. To obtain maximum flow of heated air through the engine preheat outlet, the cargo compartment air control must be pulled to its closed position.

Operation.

1. Remove engine accessory compartment preheat connection cover from each nacelle, and attach appropriate flexible duct.

2. Pass the flexible duct from the Y-junction column into the fuselage through the opened cargo compartment emergency exit.

3. Remove engine preheat outlet cover and attach the flexible duct to the adapter.

4. Remove appropriate external covers from heater inlet and exhaust ducts.

5. Pull the cargo compartment air control to its closed position.

6. Initiate cargo compartment heater ground operation.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

The electronic equipment that may be installed in the aircraft is discussed in the following paragraphs. A brief description of each system, its capability, location, and operating instructions is included.

WARNING

This aircraft contains various combinations of navigational receivers, course indicators and radio magnetic indicators. Before flight, pilots must determine the type of navigation equipment installed and operational; the operation of controls and switches used to select navigation displays; the function of each RMI, bearing pointer and course indicator and the means of monitoring identification signals of NAVAIDS being used.

DESCRIPTION AND DATA.

Purpose and use.

The radio equipment that may be provided in the aircraft is listed in figure 4-7. The configurations vary according to the theater of operations and the production series.

TYPE	DESIGNATION	USE	RANGE DISTANCE AT SPECIFIC ALTITUDE	LOCATION OF CONTROLS	REMARKS
UHF COMMAND COMMUNICATIONS	Radio set AN/ARC-55B or -51X	Two-way voice communications in the frequency range of 225.0 to 399.9 mc voice reception on preset guard frequency	Line of sight 50 miles at 3000 ft (approximately)	Sliding Console	
VHF COMMAND COMMUNICATIONS	Radio Set AN/ARC-73, or -73A	Two-way voice communications. Reception in the frequency range of 108.00 to 151.95 mc (control panel 614U-5), or 116.00 to 151.95 mc (control panel 614U-6). Transmission in the frequency range or 116.00 to 149.95 mc (with either control panel).	Line of sight 50 miles at 3000 ft (approximately)	Sliding console	Complete provision made, set not installed
VHF STANDBY TRANSMITTER	Radio Transmitter T-366A/ARC	Emergency transmission in the frequency range of 116.0 to 132.0 mc. Used in conjunction with the omni radio receiver to provide two-way vhf communications in an emergency	Line of sight 50 miles at 3000 ft (approximately)	Sliding console	

Figure 4-7 (Sheet 1 of 3) Communication and Associated Electronic Equipment

TYPE	DESIGNATION	USE	RANGE DISTANCE AT SPECIFIC ALTITUDE	LOCATION OF CONTROLS	REMARKS
HF RADIO COMMUNICATIONS	Radio Set AN/ARC-59	Two-way voice communications in the frequency range of 2.0 to 18.5 mc	Indefinite	Sliding console	
HF-SSB RADIO COMMUNICATIONS	Radio Set AN/ARC-102	Two-way voice communications in the frequency range of 2.0 to 30.0 mc	Indefinite	Sliding console	
FM LIAISON COMMUNICATIONS	Radio Set AN/ARC-44	Two-way voice communications in the frequency range of 24.0 to 51.9 mc, and intercrew communications.	Line of sight up to 50 miles	Sliding console	AN/ARC-44 dynamotor (DY-107()/AR) supplies power for operation of signal distribution panels (SB-329/AR)
FM AUXILIARY COMMUNICATIONS	Radio Receiver AN/ARR-46 or -49	Liaison auxiliary receiver	Line of sight up to 50 miles	Sliding console	Operates in conjunction with AN/ARC-44 (when installed)
INTER-COMMUNICATIONS	Intercommunication Set C-1611A AIC	Intercrew communications	Within aircraft	Sliding console	Permits selective control of the facilities
VOR/ILS LOCALIZER RECEIVER	Radio Receiving Set AN/ARN-30D, or -30E	VOR and ILS localizer navigational aid and Vhf voice reception in the frequency range of 108.0 to 126.9 mc	Line of sight 50 miles at 3000 ft (approximately)	Sliding console	
LF NAVIGATION RECEIVER (ADF)	Direction Finder Set AN/ARN-59	Radio range and broadcast reception: automatic direction finding in the frequency range of 0.19 to 1.75 mc	200 miles at 3000 ft, depending on conditions	Sliding console	
ILS GLIDE SLOPE RECEIVER	Radio Receiving Set AN/ARA-54	Visual indication of ILS glide slope in the frequency range of 329.3 to 335.0 mc	15 miles approximately	Sliding console	
MARKER BEACON RECEIVER	Radio Receiving Set AN/ARN-32, or R-1041/ARN	Aural and visual indication of marker beacon location	Vertical	Sliding console	75 mc pretuned not adjustable

Figure 4-7 (Sheet 2 of 3) Communication and Associated Electronic Equipment

TYPE	DESIGNATION	USE	RANGE DISTANCE AT SPECIFIC ALTITUDE	LOCATION OF CONTROLS	REMARKS
MARKER BEACON AND GLIDE SLOPE RECEIVER	Radio Receiving Set AN/ARN-58	Aural and visual indication of marker beacon location. Visual indication of glide slope in the frequency range of 329.3 to 335.0 mc	Marker beacon vertical; glide slope 15 miles approximately	Sliding console	
IFF IDENTIFICATION	Transponder Set AN/APX-44	Identification; friend or foe, supplemented by selective identification feature	Line of sight 50 miles at 3000 ft (approximately)	Sliding console	
WEATHER RADAR	AN/APN-158	Primarily weather observation and penetration system	Line of sight	Mounted in the engine instrument panel	Additional capability i.e., as ground mapping nav. radar and anti-collision system
TACAN	AN/ARN-21	Provides bearing and distance information	Up to 200 miles line of sight, depending on altitude	Sliding console	XXXX Proposed
RADAR ALTIMETER	AN/APH-22	Indicates terrain clearance of the airplane	Reliable to 5000 feet absolute altitude	Pilot's Instrument Panel	XXXX Proposed

Figure 4-7 (Sheet 3 of 3) Communication and Associated Electronic Equipment

DESCRIPTION AND OPERATION-INTERCOMMUNICATION SYSTEM (SB-329 AR and C-1611A AIC).

The intercommunication system permits voice communication between pilot, copilot and one to three auxiliary stations in the flight or cargo compartments. Audio signals from radio receivers can be monitored at each of the stations. Transmissions through the radio transmitters, however, can be accomplished only at the pilot's and copilot's station. A three position microphone/interphone switch on both the pilot's and copilot's control wheels and pedestals permits transmissions from these positions. The switches at the base of the pedestals are foot-operated. Intercommunication control panels are identified within each aircraft, depending on configuration. The intercommunication system operates from 27.5 volt, DC power supplied by the emergency bus through the FM Power and Keying or Interphone and Control circuit breakers on the electronics circuit breakers panel located on the forward face of the flight compartment rear bulkhead.

Intercommunication system control panel.

Control panels are installed on each side of the sliding console (8 and 9, figure 4-9), in the cargo compartment aft of the flight compartment door, on the roof at the midway point of the cargo compartment, in the flight compartment adjacent to the hydraulic reservoir, and on the roof at the rear of the cargo compartment. The latter two auxiliary stations are only installed in some aircraft. Each station control panel is equipped with monitoring and/or mixer switches, a transmission selector switch and volume control.

MONITORING SWITCHES.

The monitoring switches enable all communication and audio navigational systems to be connected to the intercommunication system. The switches are On-Off pin type (up for ON and down for OFF). Each of the control panels is equipped with switches which provide interconnection with the following communication and audio navigational systems:

Switch 1 - FM liaison radio.

Switch 2 - UHF or HF radio, as selected on UHF-HF select panel on the sliding console (13, figure 4-9).

Switch 3 - VHF command radio or standby VHF receiver as selected on the standby VHF transmitter panel on the sliding console (16, figure 4-9).

Switch MB - Marker beacon receiver.

Switch NAV - VOR, ADF and TACAN.

With the TRANS switch set to INT, transmission to other stations in the aircraft is possible without use of the I/C or INTERCOM switch (hot mic).

TRANSMISSION SELECTOR SWITCH C-1611A/AIC.

The rotary transmission selector switch (TRANS) on the INT panel may be set to transmit within or outside the aircraft. On early model aircraft the selector switch has 4 positions, and on later models, INT and PVT positions were added.

Position 1 - FM liaison Radio.

Position 2 - UHF

Position 3 - VHF command radio or standby VHF transmitter as selected on standby VHF control panel.

Position 4 - HF liaison Radio.

Position INT - Interphone.

Position PVT - Interphone for flight engineer, cargo compartment and cargo ramp stations only (some aircraft).

The following information is applicable to both systems.

Note

Simultaneous transmission on UHF and FM should be kept to an absolute minimum.

Note

The receiver associated with the selected transmitter is also connected to the headset by the TRANS switch, regardless of the setting of the monitor or mixer switch.

Note

Although the auxiliary INT panels in the cargo compartment are equipped with identical TRANS switches, only the INT and PVT positions are operable. The auxiliary INT panel in the flight compartment can be used for external transmissions.

VOLUME CONTROL.

The volume control (VOL) varies the audio level of mixed interphone and receivers, except the ADF receiver(s).

Normal operation.

PILOT AND COPILOT STATIONS.

To operate the intercommunication system, check the FM Power and Keying CKTS (or Interphone and Control CKTS) circuit breakers ON. There are two modes of transmission, press-to-talk and hot mike (mic). In the press-to-talk mode, the pilot or copilot press the microphone switch on the control wheel to I/C, or the foot-operated switch to INTERCOM to transmit to other stations within the aircraft. When using the I/C or INTERCOM switch, the setting on the TRANS switch is not a factor. To receive other stations within the aircraft the monitor INT switch must be selected ON or the TRANS switch selected to INT. For reception of radio communications and audio navigational systems select the appropriate monitor switch to the ON position for that system. Adjust VOL control on INT panel for suitable audio level.

AUXILIARY STATIONS.

To transmit on the intercommunication system, set TRANS switch to INT position then press the microphone button switch. In some aircraft, with the TRANS switch set to PVT and the monitor INT switch ON, the auxiliary stations can transmit and receive each other while monitoring pilot and copilot transmissions. The PVT position permits interphone transmission that does not interfere with pilot and copilot. For reception of radio communications and audio navigational systems select appropriate monitor switch to the ON position. Adjust VOL control on INT panel for suitable audio level.

STANDBY AUDIO OPERATION.

Standby audio operation is provided on aircraft with an FM power switch. In the event that the FM dynamotor or INT panel fails, the FM power switch and all facilities not required should be turned off. The receiver and microphone audio circuits bypass the INT panels and the desired transmitter must be selected by the TRANS (transmit-interphone) switch on the INT panel for Uhf, hf, vhf transmission. Communication through the fm liaison radio set is not possible. During emergency standby-audio operation, only the facility required should be turned on and the volume level adjusted by means of its control panel volume control. Interphone is available between the pilot and copilot only, in the standby-audio mode.

UHF COMMAND RADIO (AN/ARC-55B or AN/ARC-51X).

The UHF command radio provides voice transmission and reception in the frequency range of 225.0 to 399.9 megacycles, with 1750 frequencies available in steps of 0.1 megacycles. Receiver and transmitter tuning is accomplished automatically after a frequency change. A main receiver and a guard receiver are used in the system. The main receiver tunes to any selected frequency; the guard receiver remains tuned to a guard frequency. The UHF command radio system is supplied 27.5 volt DC power from the main DC bus through the UHF POWER circuit breaker on the electronic circuit breaker panel. The control panel located on the sliding console (10, figure 4-9) contains a dual audio volume and sensitivity control, manual frequency selector controls and a master function switch. Primary control of the set is accomplished by use of the function switch. When turned to T/R position, the switch energizes the set to provide normal frequency selection and operation. The T/R + G position energizes the separate guard receiver and provides monitoring of the guard frequency as well as normal transmission and reception. The ADF position is not connected: To put the radio into operation proceed as follows.

1. On INT panel, set monitor 2 switch to ON and set VOL control.

2. Set UHF-HF select switch on sliding console (13, figure 4-9) to UHF position.

3. On UHF control panel, set function switch to T/R + G position. Allow one minute for warmup.

4. Adjust UHF and INT VOL controls to obtain suitable audio level.

5. Adjust SENS control fully counter-clockwise then clockwise until background hissing noise is eliminated. Do not turn SENS control any further than amount required for elimination of hissing sound, otherwise weak incoming signal will not be heard.

6. To transmit, place TRANS switch to position 2.

7. Should transmission be necessary on the guard frequency, set manual frequency selector controls to the guard frequency.

VHF COMMAND RADIO (AN/ARC-73 or 73A).

The VHF communication system consists of a VHF transmitter, a VHF receiver and a control unit. The VHF system provides communication facilities in the frequency range of 116.00 to 149.95 megacycles, with reception possible to 151.95 megacycles. There are 680 crystal controlled channels available for transmission and 720 or 880 (108.00 to 151.95 mc) channels available for reception depending on control panel used. All frequencies may be selected at intervals of 50 kilocycles from the control panel located on the sliding console. The VHF command radio receives 27.5 volt DC power from the main bus through the VHF XMTR and VHF RCVR circuit breakers located on the electronic circuit breaker panel. The control panel (15, figure 4-9) contains a frequency indicator, a power on-off switch, two frequency selector knobs, and a dual control for squelch and volume. The two frequency selector knobs are used to select an operating frequency. The selected frequency appears as a number (in megacycles) in the frequency indicator window. The power ON-OFF switch controls the power to the system. The VOL and SQ controls adjust the receiver volume level and squelch on the receiver. The SCS-DCS/DCD switch is not used in this installation. To put the radio into operation, proceed as follows:

1. On INT panel, set monitor 3 switch ON, and set VOL control.

2. On the standby VHF transmitter control panel (16, figure 4-9) set the frequency selector for standard VHF reception - STD VHF (ARC-73) or TRANS 1 position, as applicable.

3. On VHF control panel (15, figure 4-9) set power switch to ON. Allow 1 minute for warm-up.

4. Select a frequency, using the two frequency selectors.

5. Adjust SQ control fully counter-clockwise until background hissing noise is eliminated. Do not turn SQ control any further than amount required for elimination of hissing sound, otherwise weak incoming signals will not be heard.

6. Adjust VOL control for suitable volume. If necessary, adjust INT panel VOL control to obtain suitable audio level.

7. To transmit, place TRANS switch on INT panel to position 3.

VHF COMMAND STANDBY TRANSMITTER (T-366A/ARC).

The VHF command standby transmitter provides voice transmission on five pre-set channels in the frequency range of 116.0 to 132.0 megacycles. The transmitter receives 27.5 volt DC power from the emergency bus through the EMERG (or STBY) VHF circuit breaker located on the electronic circ it breaker panel. The control panel located on the sliding console (16, figure 4-9) contains a power switch and frequency selector. The power ON-OFF switch controls power to the system. The frequency selector is a six position rotary switch; the first position is labeled TRANS or STD VHF (ARC-73). When set to TRANS position, the standard VHF command radio is connected to the INT panel. When set to any one of the other five positions, the VHF command standby transmitter frequency is selected and a VOR receiver is connected to monitor 3 switch on the INT panel. The transmitter is used in conjunction with the VOR No. 2 receiver to provide standby communications. To put the system into operation, proceed as follows:

1. On INT panel, set monitor 3 switch ON and set VOL control.

2. On VHF standby transmitter control panel, set selector to the desired frequency.

3. On VHF NAV control panel set power control to ON, and set frequency to correspond with transmitter frequency.

4. On VHF NAV control panel adjust SQUELCH AND VOL controls for suitable audio level.

5. To transmit place TRANS switch on INT panel to position 3.

Note

When TRANS switch on INT panel is set to position 3, the VOR No. 2 receiver is connected regardless of monitor 3 switch position.

FM LIAISON RADIO (AN/ARC-44).

The FM liaison radio provides short range two-way voice communications in the frequency range of 24.0 to 51.9 megacycles. The FM system consists of a receiver-transmitter, dynamotor and control panel. The dynamotor unit supplies high voltage DC and 400 cycle-per-second AC power for operation of the receiver-transmitter and INT panels. The control panel located on the sliding console (11, figure 4-9) contains a power switch marked ON-OFF; a volume control marked VOL; two frequency selector controls (knurled knob and wing type) marked FREQ with indicator window; and a selector switch marked REM-LOCAL. The REM-LOCAL switch is used only on installations having two or more FM control panels. On this aircraft the switch should be left in the LOCAL position. The FM system is supplied 27.5 volt DC power from the main bus through the FM power and KEYING CKTS (or INTERPHONE and CONTROL CKTS) circuit breakers located on the electronic circuit breaker panel. To put the radio into operation, proceed as follows.

1. On INT panel set monitor 1 switch ON and set VOL control.

2. Set power switch to ON position. Allow two minutes for warm-up. A 400 cycle signal may be heard in headset, lasting approximately six seconds.

3. Turn VOL control for suitable volume, then adjust INT panel VOL control as desired.

4. On FM squelch control panel (7, figure 4-9)(on some aircraft) select squelch switch to ON and listen for characteristic noise. Operate squelch switch and squelch receiver.

5. To transmit place TRANS switch on INT panel to position 1.

RADAR ALTIMETER (AN/APN-22).

An AN/APN-22 radar altimeter (figure 1-15) is installed to indicate absolute altitude (AGL). Altitude is indicated in feet on an indicator located on the pilot's instrument panel. The radar altimeter is powered by 27.5 V DC and 115 V AC. The 115 V AC is obtained from the TACAN/RADAR ALTIMETER inverter. The equipment is protected by circuit breakers on a power distribution panel located on the bulkhead next to the heating control panel.

WARNING

The terrain clearance indications received from the radar altimeter are unreliable when operating over large depths of snow and ice, since the radar waves will actually penetrate the surface and indicate greater terrain clearances than actually exist.

RADAR ALTIMETER CONTROL.

The only control for the radar altimeter is the on-limit knob. Rotating the on-limit knob moves the preset altitude pointer above zero, turns the radar altimeter on and sets the clearance altitude. A red light on the indicator plus a repeater light on the pilot's instrument panel will glow whenever the aircraft is below the preset altitude. To put the radar altimeter into operation:

1. Turn on the TACAN/RADAR ALTIMETER inverter.

2. Turn the ON-LIMIT control clockwise and set the desired altitude reference. The equipment will start operating approximately three minutes after the control is turned on.

Note

Allow at least 12 minutes warm-up time after starting the equipment to insure final accuracy. If the temperature is below -40°C, 25 minutes should be allowed.

3. Read directly from the single pointer on the indicator face. When the equipment is operating with the aircraft resting on the ground, the height indicator pointer will move to some point slightly above zero and will fluctuate 2 or 3 feet while taxiing.

course indicator (vor / ils only)

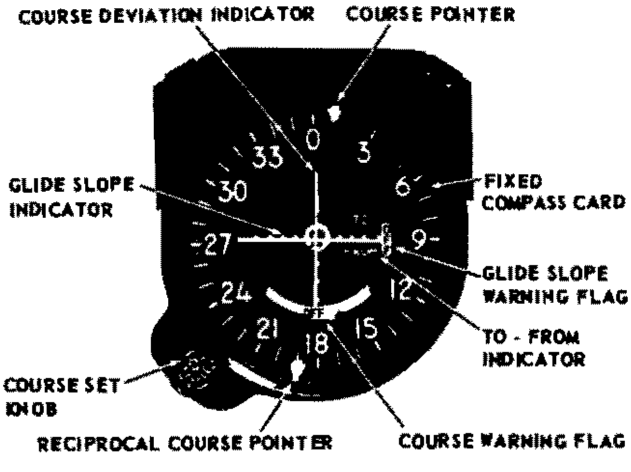


Figure 4-8 Course Indicator (VOR/ILS only)

COURSE INDICATORS.

Two course indicators of a type not usually found in USAF aircraft are installed (figure 4-8), for use with the VOR or ILS navigational receivers. The course deviation indicator (CDI) is pivoted at the top to swing left or right and course deviation is read on the course deviation scale (horizontal dots). Each dot represents approximately 2° of VOR course displacement or 1/2° of ILS localizer displacement. The glide slope indicator (GSI) displays ILS glide slope position relative to the aircraft. It is pivoted at the left to swing up or down and glide slope deviation is read on the glide slope deviation scale (vertical dots). A full scale GSI shows that the aircraft is at least 1/2° from the ILS glide slope. The course and glide slope warning flags indicate that the instrument is not receiving signals suitable for navigation. The TO-FROM indicator indicates whether the course selected, if intercepted and flown, will lead to or from the station. The compass card is fixed and the course set knob is used to set the course pointer to the desired course. Power for the course indicator is from the VOR receiver through a 5-ampere circuit breaker labeled VOR No. 2. The glide slope indicator power is from the glide slope receiver through the 5-ampere marker beacon circuit breaker and the one ampere glide slope fuse.

An additional USAF type course indicator is installed on the pilot's flight instrument panel to display only TACAN course information. This instrument and its use is fully explained in AFM 51-37.

WARNING

The glide slope indicator (GSI) of the TACAN course indicator is inoperative at all times and is not connected to the ILS glide slope receiver.

RADIO MAGNETIC INDICATORS (RMI).

Two radio magnetic indicators (figure 1-15) are installed to indicate VOR/ADF magnetic bearings. One is provided for the pilot and one for the copilot. Each indicator consists of a rotating compass card and two bearing pointers. The compass cards are connected to the J-2 compass system. A two-position gyro compass mode switch located on the pilot's instrument panel is marked SLAVE and D.G. In the SLAVE position, the compass system is slaved to magnetic north and the compass card indicates aircraft magnetic heading under the top index. In D.G. position, the compass system functions as a directional gyro indicator and the compass card is set by use of the synchronization knob. In D.G. the card will require periodic resetting to compensate for gyro precession. A two-position switch labeled ADF and VOR is provided on some RMI's and functions only in aircraft having VOR converters. The switch is used to select VOR or ADF bearing information on the Number 1 bearing pointer from either the pilot's VOR or the ADF receiver. In aircraft where the copilot does not have an ADF/VOR switch, his RMI display is a repeat of the pilot's.

Note

In aircraft without VOR converters, VOR bearings are not displayed on the RMI. VOR bearings in these aircraft are determined by the use of the VOR/ILS course indicator.

Power for the RMI is supplied from the 26-volt and 115-volt, 400 cycle AC bus. The circuits are protected by three 2 ampere fuses, marked GYRO COMPASS ØA, ØC and 26V.

Two additional RMI's are installed to display TACAN bearings in aircraft modified with TACAN. One indicator is provided for each pilot.

Note

The VOR/ADF switch is disconnected and has no function in TACAN modified aircraft.

TACAN (AN/ARN-21).

An AN/ARN-21 TACAN navigation system is installed to provide bearing and distance to a selected TACAN station. The system is controlled by means of a TACAN control panel on the sliding console (3, figure 4-9). Bearing information is presented on a radio magnetic indicator on each pilot's flight instrument panel. Course deviation, and to-from information is available only to the pilot on the TACAN course indicator, ID 249. TACAN distance information is presented on a range indicator, ID310, on the pilot's instrument panel. TACAN identification signals can be adjusted by the volume control on the TACAN control panel. The TACAN system is powered by 27-5 V DC and 115 V AC power. The AC power is supplied by the TACAN/RADAR ALTIMETER inverter. The equipment is protected by circuit breakers on a power distribution panel located on the bulkhead next to the heating control panel. A three position (OFF, REC, T/R) power switch selects the mode of operation. With the switch in REC position, only bearing information and station identification is received; with the switch in T/R position, bearing, range and identification are received. The channel selector tunes the equipment to any of 126 channels. The TACAN is operated by setting power switch to T/R. Approximately 90 seconds are required for the equipment to automatically complete a warm-up cycle.

WARNING

The glide slope indicator (GSI) of the TACAN course indicator is inoperative at all times and is not connected to the ILS glide slope receiver.

Note

Because of malfunctioning ground or airborne TACAN equipment, it is possible for the TACAN to lock-on to a false bearing. The error will be ±40 degrees or any multiple of 40 degrees. When using TACAN for instrument departures, navigation or approaches, verify bearing information with other NAV equipment or radar when possible.

TACAN RANGE INDICATOR.

On TACAN modified aircraft, a range indicator is provided on the pilot's flight instrument panel. The range indicator displays line of sight, slant range to a TACAN station. A range warning flag appears when indications are unreliable.

VOR/ILS LOCALIZER RECEIVER (AN/ARN-30D or 30E).

The VOR/ILS receiver provides bearing information to selected VOR stations or localizer information to ILS localizer transmitters, depending on the frequency selected. The receiver is operated by means of a VOR/ILS control panel located on the sliding console (4, figure 4-9). VOR bearing information is displayed on each pilot's radio magnetic indicator in aircraft equipped with VOR converters. On aircraft without VOR converters, bearing information is determined by use of the VOR/ILS course indicator. ILS localizer information is displayed on the VOR/ILS course indicator. Power for the receiver is 27.5 volts DC supplied through the VOR No. 1 or VOR No. 2 circuit breakers from the main or emergency bus. If two receivers are installed, one is on each bus. To operate the receiver proceed as follows:

1. On INT panel, set monitor NAV switch to ON (up); adjust volume control.

2. Turn VOR/ILS panel power switch ON and allow for a 1 minute warm-up.

3. Check course warning flag out of view on the VOR/ILS course indicator.

COURSE INTERCEPTION PROCEDURES WITHOUT VOR CONVERTERS (COURSE INDICATOR ONLY).

To intercept a course you must first determine the radial of the station selected that the aircraft is on. To do this rotate the course set knob until the course deviation indicator centers with a "to" indication on the to-from indicator. The course pointer will then indicate the magnetic bearing to the station and the reciprocal course pointer, which is 180 degrees from the course pointer, indicates the radial (figure 4-8).

INBOUND.

1. Maintain present heading.

2. Center the CDI with a "to" indication on the TO-FROM indicator and leave centered. (The course pointer indicates the bearing to the station.)

3. Locate the desired inbound course on the course indicator compass card.

4. Proceed from the desired inbound course along the card in the nearest direction to the course pointer, then continue in the same direction beyond the course pointer (normally 30 degrees) and read the intercept heading.

5. Turn the aircraft in the nearest direction to and maintain the intercept heading.

6. Reset the course pointer to the desired inbound course.

7. When within 10 degrees of the selected course the CDI will start to move toward center. Interpret its rate of movement to determine the lead point to start the turn to roll out on course.

OUTBOUND.

1. Maintain present heading.

2. Center the CDI with a "from" indication on the to-from indicator and leave centered. (The course pointer will then indicate the radial the aircraft is presently on.)

3. Proceed from the course pointer along the card in the nearest direction to the desired outbound course, then continue in the same direction beyond the desired outbound course (normally 45 degrees) and read the intercept heading.

4. Turn the aircraft in the nearest direction to and maintain the intercept heading.

5. Reset the course pointer to the desired outbound course.

6. When within 10 degrees of the selected course the CDI will start to move toward center. Interpret its rate of movement to determine the lead point to start the turn to roll out on course.

GLIDE SLOPE RECEIVER (R-746/AR) (SOME AIRCRAFT).

This glide slope receiver has a control panel (not shown) with a dual control power switch and frequency selector. The frequency selected is displayed in the selector window. The receiver is supplied 27.5 volts DC power through the GLIDE SLOPE circuit breaker on the electronic circuit breaker panel from the main bus. To operate the receiver, proceed as follows.

1. On GLIDE SLOPE control panel, turn power switch ON(clockwise) and set frequency selector to correspond with the localizer frequency set on VOR/ILS control panel.

2. On the VOR/ILS course indicator, check the GLIDE SLOPE alarm flag out of view.

GLIDE SLOPE RECEIVER (AN/ARA-54) (SOME AIRCRAFT).

This glide slope receiver has a MKR G/S control panel (not shown) with a power ON-OFF switch marked G/S. The receiver is supplied 27.5 volts DC through the GLIDE SLOPE circuit breaker on the electronic circuit breaker panel from the main bus. To operate the set proceed as follows:

1. On MKR G/S control panel, set G/S power switch to ON position.

2. On VOR/ILS control panel, set frequency selector to localizer frequency. This automatically sets glide slope receiver frequency.

3. On VOR/ILS course indicators check the GLIDE SLOPE alarm flag out of view.

GLIDE SLOPE AND MARKER BEACON RECEIVER (AN/ARN-58) (SOME AIRCRAFT).

This glide slope and marker beacon receiver has a MKR G/S control panel (6, figure 4-9) that contains an HI-LO SENS switch and a dual purpose power and volume control for the marker beacon. It also contains an ON-OFF G/S power switch for the G/S receiver. The receiver is supplied with 27.5 volts DC through the G/S & MKR circuit breaker panel from the main bus. To operate the equipment proceed as follows:

1. On MKR G/S control panel, turn G/S switch to ON.

2. On VOR/ILS control panel, set frequency selector to localizer frequency.

3. On GLIDE SLOPE receiver panel (5, figure 4-9) set localizer frequency.

4. On the VOR/ILS course indicators, check the warning flags out of view.

5. To receive the marker beacon, set monitor NAV switch ON.

6. On MKR G/S control panel set SENS switch to HI, turn VOL control clockwise to raise audio level.

7. Press to test MKR indicator light on pilot's flight instrument panel. When aircraft is over marker beacon, MKR indicator light will illuminate and identification signal will be heard in headset.

MARKER BEACON RECEIVER (AN/ARN-32 or R-1041 ARN) (SOME AIRCRAFT).

These marker beacon receivers have a marker beacon control panel (not shown) that contains a HI-LO SENS switch and a dual purpose power and volume control. The receiver is supplied 27.5 volts DC through the MKR BEACON circuit breaker from the main bus. To operate the receiver proceed as follows:

1. On INT panel, set monitor MB switch to ON, turn VOL control clockwise.

2. On MARKER BEACON control panel, turn VOL-OFF control fully clockwise.

3. Place SENS switch to HI.

4. Press-to-test MKR beacon light on pilot's flight instrument panel. When aircraft is flown over marker beacon, the light will come on and audio identification will be heard in headset.

ADF RECEIVER (AN ARN-59).

The ADF receiver provides ADF bearing information to stations in the 0.19 to 1.75 megacycle (or 190 to 1750 kilocycle) range. Operation of the receiver is provided by the ADF REC control panel on the sliding console (14, figure 4-9). Bearing information is displayed on the pilot and copilot radio magnetic indicator. The power supply for the receiver is 27.5 volts DC supplied through ADF No. 1 and ADF No. 2 (if installed) circuit breaker(s) on the electronic circuit breaker panel from the main bus, and 115 V AC through the 1-ampere fuse labeled ADF or ADF 2 (if installed). To operate the receiver proceed as follows:

1. On INT panel, set monitor NAV switch to ON.

2. On ADF REC control panel, turn VOL-OFF control clockwise to apply power to receiver. Allow 30 seconds for warm-up, then adjust volume.

3. Place the function switch in ANT position.

4. Select the desired frequency.

5. Set function switch to COMP position; set BFO switch to ON. To use the receiver for aural-null:

a. Move the function switch to the LOOP position.

b. Rotate the loop with the LOOP L-R control switch.

HF LIAISON RADIO (AN/ARC-59).

The HF liaison radio set provides transmitting and receiving facilities for high frequency communication in the 2.0 to 18.5 megacycle range. Two-way voice communication is possible on any one of 20 channels. Complete tuning is automatically accomplished whenever the desired channel is selected. The control panel located on the sliding console (not shown) provides all the controls necessary for operation and frequency-selection of the transceiver. These include a function selector, BFO control, volume control, frequency selector and power switch. The set is supplied 27.5 volts DC power through the HF POWER, HF XMTR and HF RCVR circuit breakers on the electronic circuit breaker panel from the main bus. To operate the equipment proceed as follows:

1. On INT panel, set monitor 2 (or 4) switch to ON, and set VOL control.

2. On UHF-HF select panel (when installed), switch to HF position.

3. On HF control panel, set power switch to ON position. Allow 10 minutes for warm-up.

4. Set function switch to phone PH position (CW position not connected).

Note

Allow approximately 10 seconds for channel change mechanism to operate.

5. To transmit, place TRANS switch on INT panel to position 2 (or 4).

HF-SSB LIAISON RADIO (AN/ARC-102).

The HF-SSB liaison radio installation provides two-way voice and code communications in the 2 to 30 megacycle frequency range, and is capable of providing communication on any one of 28,000 channels. The control panel on the sliding console (12, figure 4-9) contains all the controls necessary for selection of any of the 28,000 available channels. A six-position (OFF-USB-LSB-AM-DATA-CW) rotary switch is used to turn the set on and off and to select sideband (Upper or Lower) operation or AM Operation. The data and CW positions are not connected. This switch controls the selection of two filters, one of which will pass only the upper sideband signal and the other only the lower sideband signal. When the set is operated in the AM mode, the upper sideband filter is also selected automatically. The operating frequency, selected by use of four knobs on the control panel, is shown in an indicator in the upper center of the control panel. A RF SENS control switch, located on the right side of the panel, controls the radio frequency gain of the transceiver. The set receives 27.5 volts DC power through the HF POWER circuit breaker on the electronic circuit breaker panel from the main bus. To operate the transceiver proceed as follows:

1. On INT panel, set monitor 2 (or 4) switch to ON.

2. On UHF-HF select panel, switch to HF position.

3. On HF-SSB control panel, set function switch to desired mode of operation.

4. Adjust RF SENS control fully counterclockwise, then clockwise until background noise is barely audible.

5. To transmit, place TRANS switch on INT panel to position 2 (or 4) and depress MIC switch to tune transmitter.

CAUTION

Do not transmit when flying aircraft near stall speeds, as this will prevent stick shakers and short-field approach speed indicator from functioning accurately.

IFF (AN/APX-44).

The IFF set provides automatic radar identification of the aircraft in which it is installed, when challenged by surface or airborne radar sets using coded pulse transmissions. Three modes of interrogation are used in the IFF system and the set will reply to any or all of these depending on how the mode switches are set. The IFF set can also be used to send a distress signal or a prearranged intelligence message. The set incorporates a coder group control (SIF) which provides the capability for additional codes. The equipment receives 27.5 volts DC through the main bus to the IFF APX-44 circuit breaker. The IFF set is operated from the XPDR control panel on the sliding console (1, figure 4-9). On the control panel are located six switches: the master selector switch, an audio switch, an I/P-OFF-MIC switch, a function NORMAL - MOD - CIVIL switch, and MODES 2 and 3 switches. The function of these controls are as follows:

Master Selector Switch.

The master selector switch is a five position rotary switch: OFF, STBY, LOW, NORM and EMER. In STBY, all primary power is turned on and the pilot light should come on. If the light does not come on, it is either burned out or power is not reaching the transponder. Allow three to five minutes for warm-up. In LOW, the receiver is partially sensitive and responds only to strong interrogations. In NORM, the receiver provides maximum performance. The receiver operates at full sensitivity in the EMER position. A push button dial stop must be depressed before the selector can be rotated to EMER.

Audio Switch.

The audio switch is inoperative in this installation.

I/P-OFF-MIC Switch.

This is a three position switch spring loaded to OFF from the I/P position. When held in the I/P position, the set transmits double identification pulses and will continue this type of transmission for 30 seconds after the switch is released. When set to the MIC position, the double identification reply is transmitted when the microphone switch, selected to a command radio, is depressed.

CAUTION

Operation in the MIC position is not generally reliable, for under certain conditions no identification signal is generated or signals are inadvertently transmitted.

NORMAL-MOD-CIVIL Function Switch.

In the NORMAL position the SIF feature is inoperative. In the MOD position, the SIF code is connected to the IFF. The CIVIL position is not used.

RADAR AN/APN-158.

Radar set AN/APN-158 is a lightweight, airborne, pulse-modulated radar system that provides a continuous picture of weather conditions in the general sky area ahead of the aircraft. The wave length has been selected for optimum results in depicting severe weather; however, satisfactory ground mapping can be obtained where large contrast gradient exists, such as land and water, large cities, etc. It provides visual indication of targets in a 120 degree arc ahead of the aircraft, and an arc of 15 degrees above and below the horizontal.

For weather operations a contour (CNTR) mode of operations is provided which enables the operator to identify turbulent areas by "blanking out" areas of heavy rainfall within a cloud mass. This is sometimes known as iso-echo or contour effect. The area of greatest turbulence is indicated on the scope by the narrowest bright line encircling the cell as it is displayed, the center of this target will be blanked out indicating that there is heavy rainfall in the cell.

The radar set operates from 27.5 V DC (main bus) and 115 V AC from a radar inverter through circuit breakers on a panel to the right of the main circuit breaker panel. Some aircraft have a separate radar inverter switch located on the sliding console.

WARNING

Do not operate the radar set while personnel or combustible materials are within 18 feet of the antenna reflector. This can have harmful effects on the human body and can ignite combustible materials. Do not operate the set within 50 feet of highly reflective objects. The high level of reflected energy may damage the receiver.

Operation.

The radar is normally left in the STBY mode for ground operations.

1. The starting procedure is as follows:

a. Turn the following controls to the position indicated:

SWITCH	POSITION	LOCATION
Master	Off	Sliding console (2, figure 4-9)
Background	Min (ccw)	Indicator (figure 1-4)
Range	30 miles (ccw)	Indicator
Tilt	Centered (0°)	Sliding console
Gain	Min (ccw)	Sliding console
Red tab	As Desired	Indicator
Dim tab	As Desired	Indicator

b. Turn the master switch to STBY for 3 to 5 minutes for warm-up. There will be no visual or aur l indication when the warm-up time has elapsed.

c. Check the operation of the radar set as follows:

(1) Turn the master switch to OPR - scope face should flash very briefly and just once.

(2) Turn the background control slowly clockwise until a sweep is just discernible and range marks are visible. (Do not use excessive contrast.)

(3) Turn the gain control clockwise until targets can be defined and range, azimuth and relative size can be determined. If bright flashes, consistently bright or dark areas or target blooming occurs, the system is malfunctioning and requires maintenance and should be deenergized immediately. The most serious malfunction is manifested when the entire scope face is fully painted or illuminated and the background control will not reduce it, this occurrence requires the set to be deenergized also.

(4) Turn the tilt control up and down slowly and observe that the target appears and disappears with excessive tilt control.

(5) Set the range switch at 60 miles detent (15 mile range marks) and 150 miles detent (25 mile range marks) and note the proper range marks, targets and scan at each range. Return to 30 miles detent (10 mile range marks). Background and gain should not vary appreciably between range settings.

(6) Turn the red tab and dim tab carefully up and down and note the change in color and brilliance of scope presentation.

(7) Turn master switch to CNTR.

(8) Turn gain control to maximum (cw).

(9) Set tilt as needed to paint clouds on scope. If there is any rainfall in the cloud formations within the range and scan of the radar, the display should indicate by contouring the targets.

Note

Best results will be obtained with CNTR, 60 mile range, and 150 mile range after the set has been in operation approximately 10 minutes.

2. Deenergize the radar as follows:

a. Turn background control to min (ccw).

b. Turn master control switch off.

Note

To prevent inadvertently turning off the set and initiating another 3 to 5 minute time delay, an internal barrier is provided between STBY and OFF. The function switch must be depressed when selecting the OFF position.

Note

The copilot's attitude indicator (figure 1-16) supplies signals for stabilization of the radar antenna when the radar is in DPR or CNTR. Power failure is indicated by the radar gyro power failure indicator.

WARNING

Damage to the swivel or yoke of the radar antenna due to no stabilization results from hard landings if the radar is not on OPR or CNTR.

OPERATION OF ELECTRONICS EQUIPMENT IN CONJUNCTION WITH OTHER ITEMS.

J-2 Compass System. The J-2 compass system provides heading information to the pilot's course indicator (C6A, or ID-998/ASN), for use with the radio navigation system. The magnetic heading is transmitted from the pilot's course indicator to the copilot's radio magnetic indicator (ID-250/ARN) which is also used with the radio navigation system. The J-2 compass system can be used as a free gyro, or a slaved gyro-magnetic compass. The GYRO COMPASS switch on the pilot's flight instrument panel must be set to the SLAVE position to slave the compass card on the pilot's course indicator to the magnetic heading. In the DG position the indicator acts as a directional gyro. During DG operation the indicator will require periodic checking to compensate for precession.

The J-2 compass system is supplied with power from the aircraft inverter (MAIN or STBY) and the inverter instrument transformer. Two inverters are installed and the standby inverter is brought into operation automatically in event of main inverter failure. The instrument transformer is manually switched from main to standby. The J-2 compass system is brought into operation in the preliminary starting procedures.

LIGHTING SYSTEMS.

EXTERIOR LIGHTING SYSTEM.

The exterior lighting system consists of navigation, anti-collision, wing inspection, taxiing and landing lights. Formation lights are provided on some aircraft. The anti-collision lights are powered from the main bus, while the others are powered from the secondary bus. The circuits are controlled by individual switches on the electrical switch panel and overhead console. Circuit protection is afforded by circuit breakers on the EXTERIOR LIGHTS section of the circuit breaker and fuse panel on the forward face of the flight compartment rear bulkhead.

Navigation lights.

The navigation lights are located in the wing tips, red in the left and green in the right, and the white tail position light is located in the trailing edge of the rudder. The lights are controlled by a switch on the electrical switch panel and the circuits are protected by a 5-ampere circuit breaker marked WING & TAIL on the circuit breaker panel.

Navigation lights switch.

The navigation lights two-position toggle switch is on the copilot's side of the electrical switch panel and is marked WING & TAIL with ON and OFF at its up and down positions.

sliding console

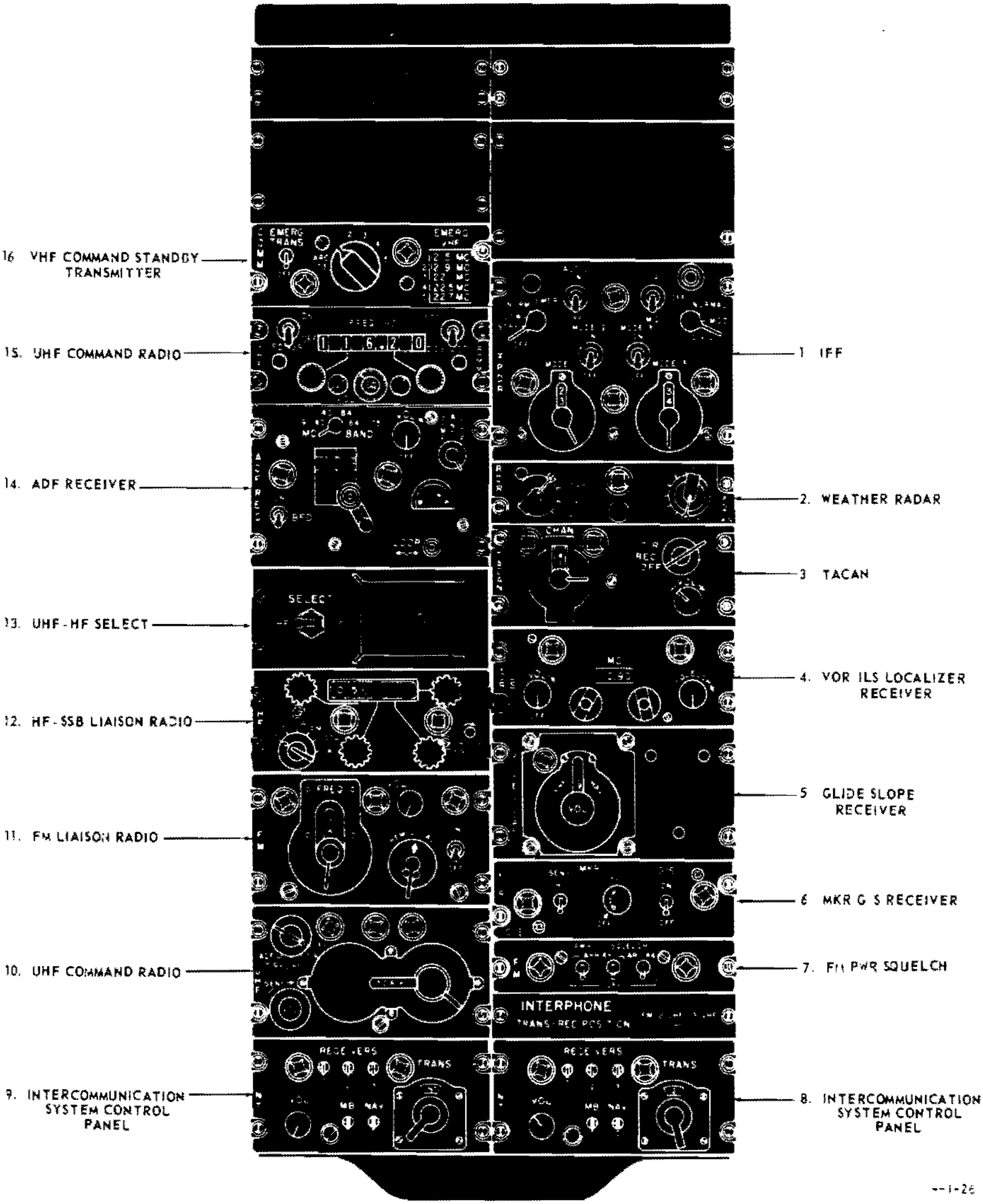


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Figure 4-9 Sliding Console

Anti-collision lights.

The two anti-collision lights are located one on top of the rudder and the other below the fuselage and are powered from the main bus. Both lights are controlled simultaneously by a switch on the electrical switch panel, and the circuits are protected by the two 5-ampere circuit breakers marked ANTI-COLL, UPPER and LOWER on the circuit breaker panel. Each light is rotated by a DC motor within the beacon light housing and, due to blanking between the two lamps in the housing, a rotating beam of lights is emitted at a predetermined angular separation which can be seen at 15° above to 10° below the horizontal plane of the aircraft.

Anti-collision lights switch.

The anti-collision lights two-position toggle switch is on the copilot's side of the electrical switch panel and is marked ANTI-COLL with ON and OFF at its up and down positions.

Wing inspection lights.

The two wing inspection lights are mounted one on the outboard side of each engine nacelle and are directed towards the wing tip. Both lights are controlled simultaneously by a switch on the electrical switch panel, and the circuits are protected by the 5-ampere circuit breaker marked WING INSPECT on the circuit breaker panel.

Wing inspection lights switch.

The wing inspection lights two-position toggle switch is on the copilot's side of the electrical switch panel and is marked WING INSPECT with ON and OFF at its up and down positions.

Taxiing light.

The taxiing light is mounted on the nosewheel door fairing and is directed forward. The light is controlled by a switch on the overhead console and the circuit is protected by a 7-ampere circuit breaker marked TAXI on the circuit breaker panel.

Taxiing light switch.

The taxiing light two-position toggle switch is on the overhead console immediately forward of the wing flap selector lever and is marked TAXI LT with ON at its up position.

Landing lights.

The two 250-watt landing lights are located, one in the leading edge of each wing, outboard of the nacelles and set at a fixed angle. The lights are controlled by two individual switches on the overhead console and the circuits are protected by two 10-ampere circuit breakers marked LANDING LEFT and RIGHT on the circuit breaker panel.

Landing lights switches.

The two landing lights two-position toggle switches are on the overhead console immediately forward of the ignition switch unit and are marked LANDING LTS, LH and RH with ON at the up position.

Formation lights.

Formation lights are provided on some aircraft. Three of the lights are mounted on the top surface of the fuselage; two in tandem forward of the cargo compartment doors and one aft of the cargo compartment doors; and three lights are mounted in the rear upper surface of each outer wing panel. The lights are powered from the secondary bus through the 5-ampere circuit breaker marked FORM on the exterior lights circuit breaker panel, and are controlled by a switch on the electrical switch panel marked LIGHTS.

Formation lights switch.

The formation lights three-position toggle switch is on the copilot's side of the electrical switch panel and is marked FORM with DIM, OFF, and BRT at the up, middle, and down position.

INTERIOR LIGHTING SYSTEM.

The interior-light system consists of flight compartment, utility, magnetic standby compass, cargo compartment, doors unlocked, cargo loading and rear entrance lights. These lights are powered from the battery, emergency or main bus, the circuits being controlled by individual switches on switch panels in the flight compartment and rear cargo compartment. The circuits are protected by circuit breakers marked INTERIOR on the 'lights' section of the circuit breaker and fuse panel on the forward face of the flight compartment bulkhead. In addition, an emergency lighting system for the aircraft exits, is installed.

Flight compartment dome light.

The flight compartment dome light is located on the overhead console, aft of the carburetor heat control levers, and contains a red and a white lamp in the housing. The light is controlled by a guarded switch on the overhead console. The circuit is powered from the battery bus and protected by the 5-ampere circuit breaker marked COCKPIT on the circuit breaker panel.

Flight compartment dome light switch.

The flight compartment dome light three-position toggle switch is at the left of the light on the overhead console and is marked RED, OFF, and WHITE, with a guard which must be displaced before the WHITE position can be selected.

Flight compartment bottom hatch light.

The flight compartment bottom hatch light mounted on the lower forward face of the flight compartment rear bulkhead illuminates the compartment bottom hatch, and is powered from the emergency bus. The light is controlled by a microswitch at the hatch which deenergizes the circuit when the hatch is closed. The circuit is protected by the 5-ampere circuit breaker marked UTILITY on the circuit breaker panel.

Utility lights.

Four utility lights are installed in the flight compartment; one each for the pilot and copilot stowed in brackets on the bulkhead behind each seat, one for the radio rack stowed on the bulkhead at the rack, and one for the cargo doors forward panel stowed near the flight compartment dome light. The lights are fixed to mounting brackets by ball and spring fixtures which engage a groove in a shaft attached to the light assembly. When required, the lights may be pulled from their brackets and a flexible coiled cable permits movement to the desired position. The pilot's and copilot's light may be moved to sockets on either side of the overhead console. The front section of the light assembly can be rotated to four positions to give spotlight or diffused light in either of two colors, red or white for the radio rack light, and red or amber for the remaining lights. A spring catch on the side of the light must be pulled back to change over from red, but the catch is automatically overridden when changing to red. This feature prevents inadvertent selection of white and safeguards night vision. The rear section of each light has an intensity switch marked OFF, DIM, and BRT and also contains a push button for momentary illumination. The light for the cargo doors forward panel is supplied from the battery bus and the circuit is protected by the 5-ampere INTERIOR LIGHTS - COCKPIT circuit breaker (which also protects the flight compartment dome light). The remaining utility lights are supplied from the emergency bus through the 5-ampere INTERIOR LIGHTS - UTILITY circuit breaker. This circuit breaker also protects the flight compartment floor hatch light and the emergency hydraulic selector panel lights.

Magnetic standby compass light.

The magnetic standby compass light is contained in the compass assembly attached to the windshield center post and is powered from the emergency or main bus. The light is controlled by a switch on the center electrical switch panel, and the intensity of the light, when powered from the main bus is controlled by the setting of the SWITCH, EMERG & ROOF switch on the overhead console PANEL LIGHTS panel. The circuit is protected by either of the 5-ampere circuit breakers marked STANDBY COMPASS, and SW EMERG & ROOF on the circuit breaker panel, depending on switch position.

Magnetic standby compass light switch.

The magnetic standby compass light two-position toggle switch is located on the copilot's side of the center electrical switch panel and is marked STBY COMP, with EMERG and NORM at its up and down positions respectively. In the NORM position the light is powered by the main bus and the intensity is controlled by the setting of the switch marked SWITCH, EMERG & ROOF, on the PANEL LIGHTS switch panel on the overhead console. In the EMERG position the light is powered from the battery through the emergency bus switch, and the intensity is dependent on the battery strength.

Cargo compartment dome lights.

The seven cargo compartment dome lights are located in two rows in the cargo compartment roof, four in one row and three in the other, and staggered to provide even distribution of illumination. Each dome light assembly contains a red and a white lamp. The lights are controlled by a guarded switch on the flight compartment rear bulkhead. The circuits are powered from the main bus and are protected by the 15-ampere circuit breaker marked CABIN on the circuit breaker panel.

Cargo compartment dome light switch.

The cargo compartment dome light three-position toggle switch is mounted on a panel on the forward face of the flight compartment rear bulkhead aft of the pilot's seat and is marked RED, OFF, and WHITE, with a guard which must be displaced before the WHITE position can be selected.

Doors unlocked light.

The doors unlocked amber light is located outboard of the take-off check list above the copilot's flight instrument panel. The light will come on if either the flight compartment bottom hatch, passenger doors, cargo door or ramp are not securely closed. The microswitches for the circuit of each door mechanism are powered from the main bus and the intensity of the light is dependent on the setting of the warning lights intensity switch on the center electrical switch panel. The circuit is protected by the 5-ampere circuit breaker marked DOORS WARN on the circuit breaker panel.

Cargo loading light and switch.

The cargo loading light is a spotlight with a white lamp and a mechanically operated red shutter. The light is normally stowed in a mounting in the cargo compartment roof aft of the rear entrance light, and is directed to shine on the cargo loading doors. It can be removed from its mounting and used as a portable light. A two-position slide switch marked ON and OFF is incorporated on the side of the light. The circuit is powered from the main bus and is protected by the 5-ampere circuit breaker marked CARGO on the circuit breaker panel.

Rear entrance light.

The rear entrance light is located in the cargo compartment roof directly above the cargo ramp. The circuit is powered from the main bus and the light is controlled by a switch on the interior lights panel at the aft end of the cargo compartment. A ramp actuated switch automatically extinguishes the lights when the ramp is closed. The circuit is protected by the 5-ampere circuit breaker marked CARGO on the circuit breaker panel.

Rear entrance light switch.

The rear entrance door light two-position toggle switch is on the panel marked INTERIOR LTS mounted at the aft end of the cargo compartment and is marked REAR ENTRANCE and LIGHT at the up (ON) and down (OFF) position respectively. An intensity switch controlling the panel lights is marked PANEL LIGHTS, with OFF and BRIGHT at the ends of its control range.

EMERGENCY LIGHTING SYSTEM.

The emergency lighting system is provided to illuminate the aircraft exits in the event of crash landing or complete electrical failure at night. White lights are beamed at the flight compartment roof hatch, the cargo compartment emergency door, the passenger doors and cargo door. The system also includes a control unit mounted in the left side of the cargo compartment roof aft of the rear spar, and a guarded toggle switch marked EXIT LTS on the cargo compartment lights switch panel on the flight compartment bulkhead. The toggle switch is used for manual operation and testing of the lights. The control unit incorporates an inertia switch which will automatically energize the circuit during crash landing, and a 6.6-volt 4-ampere-hour battery. The battery will power the lights for a minimum period of one hour.

PANEL LIGHTS.

Panel and warning lights are discussed in the following paragraphs.

Passenger warning signs.

The passenger warning signs are located above the doorway of the forward cargo compartment bulkhead facing aft. The NO SMOKING sign and the FASTEN BELTS sign each contain five lamps. The lamps are powered from the main bus and are controlled by individual switches on the flight compartment rear bulkhead. The circuits are protected by the 15-ampere circuit breaker marked CABIN on the INTERIOR LIGHTS section of the circuit breaker panel.

Passenger warning sign switches.

The two passenger warning sign two-position toggle switches are located on a panel mounted on the forward face of the flight compartment rear bulkhead behind the pilot's seat. The up (ON) position of the left and right switches are marked NO SMOKING and FASTEN BELTS respectively, being the indication of the warning sign they control.

Emergency hydraulic selector panel lights.

The two lights on the emergency hydraulic selector panel under the hinged access door in the floor of the flight compartment are powered from the emergency bus and are controlled by a microswitch in the access door opening. When the door is opened the lights will come on provided the emergency bus is energized. The circuit is protected by the 5-ampere circuit breaker marked UTILITY on the circuit breaker panel.

Panel lights intensity switches.

The edge and eyebrow type lighting on all panels is powered from the main bus and, excepting the interior lights control panel at the rear of the cargo compartment, the intensity can be adjusted by means of four rheostats on the overhead console. The circuits are protected by the 5-ampere circuit breakers marked SW EMERG & ROOF on the circuit breaker panel. The four switches are marked PILOT'S & ENGINE; SWITCH, EMERG & ROOF; RADIO CONSOLE; COPILOT'S; and each has a range from OFF to BRT to control the intensity of the lighting of these circuits. The emergency and roof panel lights switch controls the lights on the emergency panel, electrical switch panel, overhead console, and the magnetic standby compass light when it is powered from the emergency bus. The interior lights control panel at the rear of the cargo compartment has an independent switch which controls the intensity of the edge type lighting on that panel.

Warning lights intensity switch.

The warning lights on the various panels are powered from the main bus and are adjusted for intensity by the setting of the two-position toggle switch marked WARN in the section of the electrical switch panel marked LIGHTS. The switch is marked DIM and BRT at the up and down positions respectively.

Pilot's and engine panel lights switch.

The pilot's and engine panel lights intensity switch is located on the electrical switch panel and is marked PILOT'S & ENGINE, with OFF and BRT at the left and right end respectively of its range. The switch controls the eyebrow type lighting of the instrument, engine instrument, voltammeter, pilot's pedestal and fuel gage panels. The switch simultaneously controls the edge type lighting on the de-icing, AC-DC power, elevator trim pedestal, left switch, and fuel control panels.

Copilot's panel lights switch.

The copilot's panel lights intensity switch is located on the electrical switch panel and is marked CO-PILOT'S, with OFF and BRT at the left and right end respectively of its range. The switch controls the eyebrow type lighting of the instruments on the copilot's panel.

OXYGEN SYSTEM.

CONSTANT FLOW SYSTEM.

The oxygen system supplies the pilot, copilot and flight engineer. An oxygen cylinder, a main shutoff valve (marked SUPPLY VALVE - TURN ON FOR OXYGEN) and a charging point (marked OXYGEN CHARGING - CHARGING PRESSURE 1800 ± 50 PSI) and gage are located in the cargo compartment roof left side near the flight compartment bulkhead, access being by way of a zippered panel. A plug-in point for each pilot is provided on the side panel adjacent to his seat; the flight engineer's plug-in point is located in the cargo compartment roof adjacent to the oxygen cylinder installation. Three oxygen masks, are stowed in a container marked OXYGEN MASKS, and are located on the right side of the copilot's seat. A regulator control panel is mounted adjacent to the copilot's plug-in point and contains a system pressure gage, an altitude flow meter and a manual control valve (marked ADJUST TO ALTITUDE). By use of the control valve in conjunction with the altitude flow meter, the copilot is able to adjust the oxygen flow to coincide with the existing flight altitude. The system pressure gages should indicate 1800 ± 50 psi when the system is fully charged. An oxygen duration table is shown in figure 4-10. When oxygen is required, the copilot's regulator control valve must first be closed (fully counterclockwise) before the main shutoff valve is slowly opened. After use, the system must be shut off at the main shutoff valve, then the regulator control valve must be turned fully OFF (counterclockwise).

DILUTER DEMAND SYSTEM.

The oxygen system supplies the pilot, copilot and flight engineer. See figure 4-11. The supply of gaseous oxygen is stored in two interconnected cylinders; at stations 46.00 and 54.00. The cylinders are recharged through a filler valve at station 33.2 and the nose RH access door, and a check valve on each cylinder line. An adjacent oxygen cylinder pressure gage indicates the pressure in the cylinders; the nominal charging pressure is 1800 ± 50 psi. A shut-off valve is provided on the flight compartment floor aft of the copilot's seat, and is turned counterclockwise for oxygen flow from the cylinders to the oxygen regulator pressure demand panel at each of the three crew positions, where the pressure is reduced to a breathable level. An oxygen hose connection for each crewmember is located adjacent to the crewmember's position for connection of Type A13A oxygen masks. When the system is in operation, and with the diluter switch set at NORMAL OXYGEN, air is drawn into the breathing system and is automatically mixed with oxygen from the supply cylinder to give the total needed oxygen up to approximately 30,000 ft, above this altitude 100% oxygen is delivered automatically. Refer to figure 4-12 for duration of oxygen supply at various altitudes with the diluter switch at NORMAL OXYGEN, and at the 100% OXYGEN position.

constant flow oxygen duration chart

OXYGEN DURATION IN HOURS

THREE CREW MEMBERS

CYLINDER: 1-TYPE AN6025 AX646-18 | **CONSTANT FLOW SYSTEM**

GAGE ALTITUDE (FEET)	GAGE PRESSURE - PSI				
	1800	1600	1400	1200	1000
8,000	8.1	7.2	6.4	5.4	4.5
10,000	6.7	5.9	5.3	4.5	3.7
12,000	5.6	5.0	4.5	3.8	3.2
14,000	4.6	4.0	3.6	3.0	2.5
15,000	4.3	3.8	3.4	2.9	2.4
20,000	3.2	2.9	2.6	2.2	1.9
25,000	2.6	2.3	2.1	1.7	1.5
30,000	2.2	1.9	1.7	1.5	1.2

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Figure 4-10 Constant Flow Oxygen Duration Chart

Oxygen Regulator Panels. A panel marked OXYGEN REGULATOR PRESSURE DEMAND, is provided adjacent to each crewmember position. The pilot's and copilot's regulator panel is located at the lower inboard corner of their respective flight instrument panels (figure 4-11), and the flight engineer's regulator panel is on the left aft face of the cargo compartment forward bulkhead. The three regulator panels are identical and each has an eyebrow type light in the center for panel illumination, a gage marked OXYGEN PSI calibrated from 0 to 2000 psi, with a white arc from 0 to 300 (low level) and FULL at 1800 psi. In addition, a blinker indicator marked FLOW which shows that oxygen is flowing on demand to the user's mask, and three individually colored switches for controlling the oxygen supply flow are provided as follows:

1. Supply Switch (Green Color). The supply two-position switch on the right of the panel is marked SUPPLY with ON and OFF at the up and down position respectively. The switch is used to control the supply of oxygen at each panel.

diluter demand oxygen system

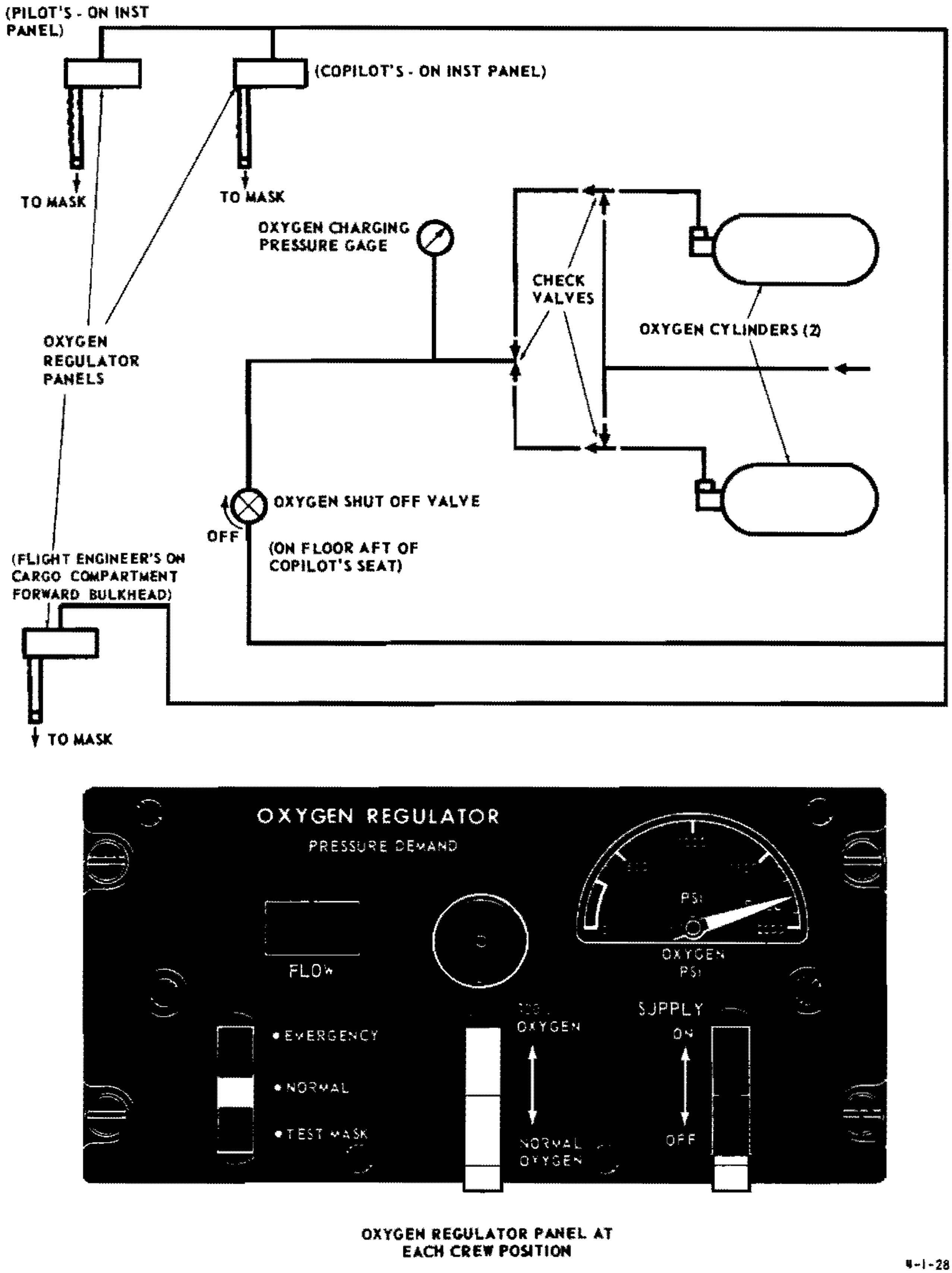

Figure 4-11 Diluter Demand Oxygen System

2. Diluter Switch (Black Color). The diluter two-position switch on the lower center of the panel is marked 100% OXYGEN and NORMAL OXYGEN at the up and down position respectively. With the switch at NORMAL OXYGEN position the oxygen passes through a diluter demand route for normal operation. At 100% OXYGEN position the air-valve of the diluter demand route is closed and pure oxygen only is fed to the user's mask; this position should be selected if any doubt exists regarding the oxygen supply.

Note

When 100% oxygen is used, the oxygen duration will be reduced.

3. Pressure Supply Switch (Red Color). The pressure supply three-position switch on the left of the panel is marked EMERGENCY and NORMAL at the up and center position respectively, and TEST MASK at the down (momentary) position which is selected against a spring tension. The switch should be at NORMAL position for routine operation to allow regulated oxygen pressure to be supplied to the user. At EMERGENCY position a continuous positive pressure of oxygen is supplied to the user regardless of altitude, to prevent hypoxia or unconsciousness. When the switch is held at TEST MASK position, oxygen at positive pressure is supplied to test the user's mask for leaks.

CAUTION

When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to insure no leakage, then continued use of positive pressure under these conditions will result in the rapid depletion of the oxygen supply.

Oxygen Shutoff Valve. The oxygen shutoff valve on the flight compartment floor aft of the copilot's seat is used to stop the flow of oxygen from the cylinders to the three oxygen regulator panels. The valve is marked OXYGEN SHUT OFF VALVE and OFF, and arrowed clockwise.

Cylinder Filler Valve and Pressure Gage. The cylinder filler valve and pressure gage are mounted to the right of the oxygen cylinders. The gage dial is marked OXYGEN CYLINDER PRESSURE and graduated from 0 to 2000 psi. A label below the gage is marked OXYGEN CHARGING, and below the filler valve it is marked CHARGING PRESSURE 1800 ± 50 PSI.

To Turn On Equipment. Before entering the aircraft check the oxygen cylinder pressure gage reading to insure there is sufficient oxygen for the mission. On entering the flight compartment turn the oxygen shutoff valve fully counterclockwise to allow the oxygen to flow to the oxygen regulator panels. When seated in

oxygen duration chart - diluter demand system

OXYGEN DURATION IN HOURS

THREE CREW MEMBERS

CYLINDERS: 2-TYPE AN6025 AX386 — DILUTER DEMAND SYSTEM

ALTITUDE (FEET)	GAGE PRESSURE - PSI				
	1800	1600	1400	1200	1000
8000	0.8 3.3	0.7 2.9	0.6 2.6	0.5 2.2	0.4 1.8
10,000	0.8 3.6	0.7 3.2	0.6 2.8	0.6 2.4	0.5 2.0
12,000	0.9 4.0	0.8 3.6	0.7 3.1	0.6 2.7	0.5 2.2
14,000	1.1 4.4	1.0 3.9	0.9 3.5	0.7 3.0	0.6 2.5
15,000	1.2 4.6	1.1 4.1	0.9 3.6	0.8 3.0	0.7 2.5
20,000	1.5 4.2	1.3 3.8	1.2 3.3	1.0 2.8	0.8 2.4
25,000	2.0 2.4	1.8 2.1	1.6 1.9	1.3 1.6	1.1 1.3
30,000	2.6 2.6	2.4 2.4	2.1 2.1	1.8 1.8	1.5 1.5

NOTE: UPPER FIGURES INDICATE DILUTER SWITCH AT "100% OXYGEN"
LOWER FIGURES INDICATE DILUTER SWITCH AT "NORMAL OXYGEN"

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Figure 4-12 Oxygen Duration Chart (Diluter Demand System)

position place the regulator panel supply switch to ON and check the oxygen supply pressure gage reading is within normal supply limits. Fit and connect mask then check oxygen flow and supply with diluter switch at 100% OXYGEN then at NORMAL OXYGEN with the pressure supply switch at NORMAL. Check supply with the pressure supply switch at EMERGENCY and at TEST MASK.

To Turn Off Equipment. Move regulator panel supply switch to OFF. Before leaving the flight compartment turn the oxygen shutoff valve fully clockwise to OFF, and the regulator panel pressure supply switch to NORMAL.

CARGO LOADING EQUIPMENT.

CARGO COMPARTMENT.

The cargo compartment of the aircraft, which extends from arm 193.0 to arm 538.0 is uniform in height and width and has a volume of 1150 cubic feet. It has two passenger doors at the aft end, one on each side of the cargo compartment, with a removable access ladder which fits into either door opening. A cargo door, aft of the cargo compartment, consists of a large door which hinges upwards from the rear, and a ramp which is an extension of the cargo compartment floor. A heating duct extends along each side of the cargo compartment at floor level. Wall type troop seats, comprising eight units per side, may be installed to accommodate 32 troops or 26 combat equipped troops. With ten aft seat units removed, 14 litters may be installed. On some aircraft the cargo compartment is adapted for 20 litters and 1 troop seat unit. Fixed fittings are provided for the installation of air delivery equipment. For loading instructions refer to T. O. 1C-7A-9.

Cargo compartment floor.

The cargo compartment floor is of aluminum alloy honeycomb sandwich construction. Removable plywood panels, with aluminum alloy skid strips to facilitate cargo handling, are provided for floor protection. The floor supporting structure is a grid with three continuous longitudinal keels which occupy the space between the floor and the outside section. The keels will act as skids in the event of a wheels-up landing. Tie-down rings rated at 5000 pounds are provided in the floor, and studs are installed for the attachment of seats and litter supports.

Cargo compartment floor strength-bulk cargo.

The cargo compartment floor will not withstand the same load over its entire area. The honeycomb panelling is designed to withstand a load of 40 psi at any point; this is an expression of the inherent strength of the panelling, and while the panelling itself will withstand this load, the strength of other parts of the fuselage may be exceeded. For this reason, there are other factors which limit the load which may be placed on the cargo compartment floor. The local footprint pressure of individual load items must not exceed 1000 pounds per square foot, while at the same time a loading of 1200 pounds per running foot must not be exceeded. A "running foot" is measured fore-and-aft, parallel to the longitudinal axis of the aircraft. In other words, a running foot is a one-foot strip the full width of the cargo compartment floor. If bulk cargo will exceed either of these limits, shoring must be used to spread the weight over a larger area.

Cargo compartment floor strength- vehicle loads.

Refer to T. O. 1C-7A-9 for proper aircraft loading or offloading and for take-off, flight and landing. Loads on the vehicle treadways must not exceed 2000 pounds per wheel during loading and offloading. This is also the maximum wheel loading on the treadways forward of arm 397.6 during take-off, flight and landing. On the treadway areas aft of arm 397.6 during take-off, flight and landing, and the remainder of the floor area under all conditions, the loading must not exceed 1000 pounds per wheel.

CAUTION

> These limits are based on a vehicle tire pressure of not more than 40 psi. Before loading a vehicle into the aircraft insure that tire pressures do not exceed this value.

CARGO TIE-DOWN RINGS.

Cargo tie-down rings are installed in the cargo compartment floor, and in the cargo compartment wall at floor level. Each floor tie-down ring fits into a recessed sheet-metal pan, which allows the ring to be clear of the cargo compartment floor. The rings will swivel through 360°, and each ring and its attachment is capable of withstanding a load of 5000 pounds ultimate. The rings are arranged in five rows, each outside row has eight rings, while each of the three center rows has eighteen rings, making a total of seventy rings rated at 5000 pounds ultimate. Four of the recessed pans contain studs to which litter supports may be attached. The wall tie-downs consist of six removable rings, three on each side of the cargo compartment at floor level, and are rated at 10,000 pounds ultimate. A recess in the floor at each ring allows clearance for the tie-down device. All tie-down rings are coded to enable ring positions to be located. Each ring is labeled with a letter and a numeral; the letter indicating the row and the numeral indicating the ring position in the row.

MONORAIL CRANE PROVISION.

A corrugated web structure supporting an extruded carrier member runs the length of the cargo compartment at the roof. It extends from the flight compartment bulkhead to fuselage Frame No.2, just aft of the passenger doors. The structural provisions are for a monorail crane assembly, with a 2000 pound capacity, for loading or offloading of cargo. At present the carrier member is used to provide a guide for the cable of the extraction parachute manual release control.

RAMP EXTENSIONS.

Two ramp extensions, 120 inches long and 15 inches wide, are supplied with each aircraft. When not in use the extensions may be stowed in special racks above the cargo door. The ramps are reversible and both sides have a non-skid surface. One side is provided with edge members for use of wheeled vehicles, while the opposite side has a flat surface to facilitate cargo movement when using rollers etc. Each end of the ramp extensions are provided with a projecting edge lip and two spring-loaded plungers. The edge lip fits into the groove along the aft end of the ramp and the plungers engage with any two holes along the ramp aft face; the holes are spaced every two inches. The ramp extensions should be installed so that the distance between them matches, as closely as possible, the width of the tread of any vehicle to be driven over them. In addition, they should be an equal distance on both sides of the centerline of the aircraft.

Ramp extensions stowage.

Two stowage racks are provided, one for each ramp extension, in the rear fuselage between Frames No. 5 and No. 12. The racks are pivoted at their aft ends, and when lowered rest on integral legs supported by the closed cargo door. The ramp extensions must be stowed in the racks in one position only; an instruction is marked on both sides of the extensions as follows: STOW WITH THIS END FORWARD AND UP, and an arrow shows the side to be uppermost. The extension cannot be hooked to the support rod in any other position. With the racks are raised and locked in the stowed position, the cargo door may be fully opened without interference. The racks themselves must be raised and locked in the stowed position if the extensions are not to be carried. A T-shaped locking handle, secured by a spring clip, is fitted centrally in each rack crossbar. Releasing the clip and pulling the handle forward will allow the support rod to pivot and the hooks may then be disengaged and the rack lowered. The forward part of the rack consists of an end plate welded to a telescopic tube, which is secured by a pip-pin attached to a chain. To install an extension in a stowage rack, the pip-pin is removed and the end-plate moved forward slightly to allow engagement of the two plunger pins, at the end of the ramp extension, with two holes in the plate. Two hooks on the end plate support the rack only when the rack is stowed minus a ramp extension. When a rack is stowed with an extension, the projecting end lip of the extension hooks over the pivoted support rod. When the rack is raised, the locking handle is pushed aft and bears on the end plate or ramp extension, preventing any movement.

CARGO DOOR AND RAMP SYSTEM.

The cargo door and ramp are used primarily for loading and offloading cargo, troops or casualties, or for air delivery operations. The door and ramp may be opened or closed independently by electrical or mechanical actuation.

Note

> The cargo door may be used as an emergency exit, both in the air or on the ground. In the air the door should be opened, while on the ground it may be opened or jettisoned.

Cargo door operation.

The cargo door is attached at its aft end to the rear fuselage by two ball and socket type hinges. The door is raised and lowered by a chain and cable system, driven by a 24-volt motor powered from the main DC bus. The motor is mounted to a frame on the left side of the rear fuselage and its DC electrical power is controlled by a CARGO DOORS MASTER switch on the circuit breaker panel, behind the pilot. With the master switch on, the cargo door may be opened or closed from either of two locations; by the CARGO DOOR, OPEN-OFF-CLOSE switch in the flight compartment on the circuit breaker panel (figure 4-13), or by the CARGO DOOR OPEN-CLOSE switch located in the cargo compartment roof, inboard of the left passenger door (figure 4-14). Limit switches are fitted which cut-out the motor when the cargo door is in the fully open or fully closed position. An amber warning light on the right side of the emergency panel in the flight compartment, marked DOORS UNLOCKED, will illuminate and indicate if the cargo door, ramp, bottom hatch or either passenger door is not fully secured. Manual operation of the cargo door is achieved by means of a handcrank aft of the left passenger door on the side of the fuselage. The handcrank is connected via a torque tube to the motor, and the handle is held by a spring in the manual-disengage position. Pushing the handle to the rear against the spring disengages the motor, and turning the handle clockwise will open the door, counterclockwise will close it.

WARNING

> The cargo door must be visually checked fully open before an air drop, as no indication is given in the flight compartment should the door not be completely open.

Ramp operation.

The ramp is hinged to the aft end of the cargo compartment and is raised or lowered by two screw jacks driven by 24-volt motor through a system of torque tubes, shafts and gears. The motor, powered from the main DC bus, is mounted on the right side of the roof in the rear fuselage. The ramp DC power is controlled by the CARGO DOORS MASTER switch in the flight compartment on the circuit breaker panel. With the master switch on and the aircraft resting on its wheels, the ramp may be lowered or raised from either of two locations; by the RAMP DOOR, OPEN-OFF-CLOSE switch in the flight compartment on the circuit breaker panel (figure 4-13), or by the RAMP DOOR, OPEN-CLOSE switch located in the cargo compartment roof, inboard of the left passenger door (figure 4-14). Limit switches are fitted which cut-out the motor when the ramp is in the fully up or fully down position, when the aircraft is on the ground. When the aircraft is airborne, a weight switch on the nose landing gear limits the ramp lowering position to 15° below the horizontal. The ramp 15° position is required for air drop operations, and is indicated in the flight compartment by the illumination of a green press-to-test light on the circuit breaker panel marked 15° POSITION, RAMP DOOR. A guarded override switch spring-loaded to off, is provided on the same panel, marked OVERRIDE, with switch positions RAMP DOWN and OFF. Raising the guard and selecting and holding the switch to RAMP DOWN will override the 15° limit switch, then

cargo door and ramp switches (forward panel)

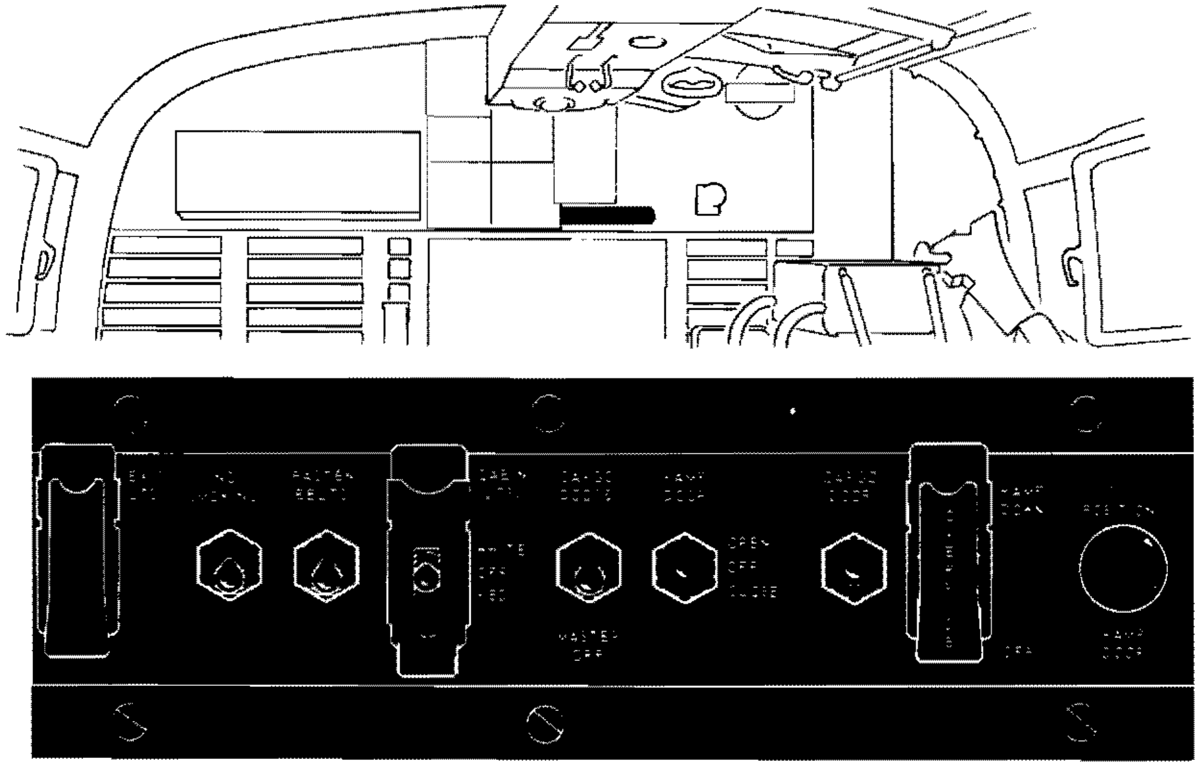


Figure 4-13 Cargo Door and Ramp Switches (forward panel)

cargo door and ramp switches (aft panel)

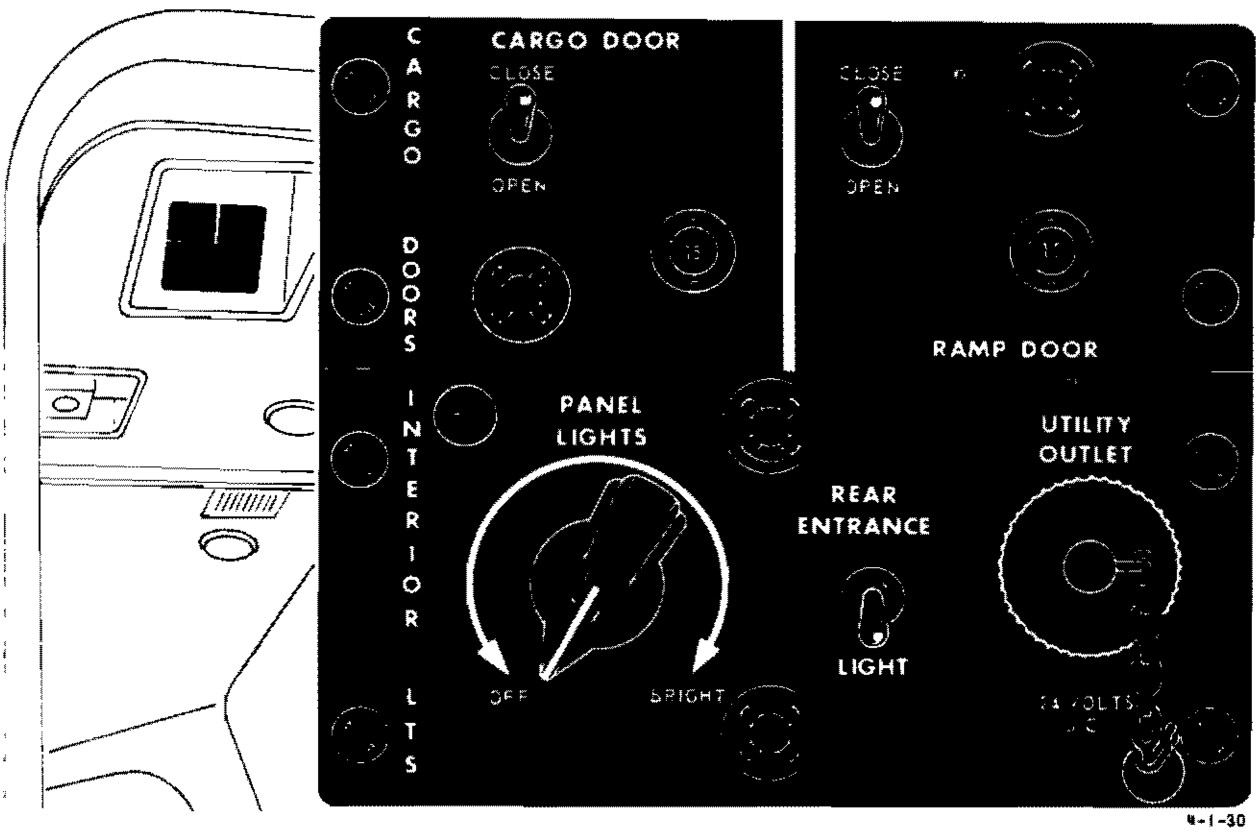


Figure 4-14 Cargo Door and Ramp Switches (aft panel)

selection of the RAMP DOOR, OPEN-OFF-CLOSE switch to OPEN will enable the ramp to be lowered as desired.

Manual operation of the ramp is by means of a detachable handcrank, clipped to the cargo compartment wall aft of the left passenger door and marked STOWAGE RAMP DOOR HANDLE. Before attempting to lower the ramp manually the motor must first be disengaged by means of a knob on the motor. The crank handle may then be positioned in the socket, provided in the cargo compartment roof adjacent to the door switch panel, marked MANUAL CONTROL RAMP DOOR. Turning the handle counterclockwise will lower the ramp, clockwise will raise it.

CARGO DOOR OPERATION.

Procedural steps for operating the cargo door are as follows:

Electrical operation.

The cargo door is opened and closed electrically as follows:

1. If an external power supply is to be used, check that the battery master switch and the generator switches are OFF.

2. Check that the interior of the rear fuselage is clear of obstructions and that the ramp extension stowage racks are locked in their stowed position. Check that the side anchor line is in the stowed position.

3. Pull back on the cargo door manual crank handle to insure that the brake and clutch of the motor are engaged.

4. Select the CARGO DOORS master switch to CARGO DOORS.

5. Select the CARGO DOOR operating switch, on either the fore or the aft panel, to OPEN. Return switch to the center position when doors are fully open.

6. To close the door, select the CARGO DOOR operating switch to CLOSE. Return the switch to the center position when the operation is completed.

7. Select the CARGO DOORS master switch off.

8. Disconnect the external power supply, if used.

Manual operation.

The cargo door is opened and closed manually as follows:

1. Check that the interior of the rear fuselage is clear of obstructions and that the ramp extension stowage racks are locked in their stowed position. Use the aircraft lighting and ramp loading light, if necessary.

2. Push the MANUAL CONTROL CARGO DOOR handle to the rear against the spring until the handle is at 90° to the torque tube.

3. Turn the handle clockwise until the door is open.

4. To close the door, maintain the handle position at 90° to the torque tube, and turn handle counterclockwise.

5. When the manual operation is completed, pull handle fully back to insure engagement of the brake and motor clutch.

RAMP OPERATION

Procedural steps for operating the ramp are given in the following paragraphs.

Electrical operation.

The ramp is opened and closed electrically as follows:

CAUTION

> The ramp is not to be operated when supporting a load.

1. If an external power supply is to be used, check that the battery master switch and the generator switches are OFF.

2. Check the ground clearance below the ramp and remove any obstructions.

CAUTION

> With the aircraft on level ground, with normal payload, the fully open ramp may have a ground clearance of only one inch. The amount of ground clearance depends upon the setting of the limiting switch, which can be adjusted to provide up to six inches clearance.

3. Check that the ramp floor is clear. Use the aircraft lighting and ramp loading light, if necessary.

4. Check that the ramp motor is engaged with the drive. When engaged, the knob on the motor is protruding slightly from the unit and is spring-loaded out.

CAUTION

> Do not engage or disengage while the motor is running.

5. Select the CARGO DOORS master switch to CARGO DOORS.

6. Select the RAMP operating switch, on either the fore or the aft panel, to OPEN. Return switch to the center position when the ramp is in the required position.

7. To raise the ramp, select the RAMP operating switch to CLOSE. Return the switch to the center position when the operation is completed.

8. Select the CARGO DOORS master switch off.

9. Disconnect the external power supply, if used.

Manual operation.

The ramp is opened and closed manually as follows:

1. Check the ground clearance below the ramp and remove any obstructions.

2. Check that the ramp floor is clear. Use the aircraft lighting and ramp loading light, if necessary.

3. Disengage the motor from the drive by pushing in the knob on the motor and turning it approximately 180° until the knob locks in.

4. Remove the RAMP DOOR HANDLE from its STOWAGE and engage it in the MANUAL CONTROL RAMP DOOR socket.

5. Turn the handle counterclockwise until the ramp is in the required position.

6. To raise the ramp, turn the handle clockwise.

7. Reengage the motor by turning the knob approximately 180° until it springs to the out position.

AIR DROP SYSTEM.

The aircraft is equipped for the air dropping of supplies and equipment, rigged on platforms or in containers, by the extraction, gravity or manual ejection methods. Parachutists may also air-drop from the aircraft. Refer to T. O. 1C-7A-9.

PENDULUM SYSTEM.

A pendulum release system is provided for extraction or gravity release of loads. The installation consists of an ejector rack (MK VIII bomb shackle), a pendulum hook at Frame No. 2 and a release clip at the aft end of the ramp. The ejector rack is located at the aft end of the cargo compartment roof between Arm 515 and Frame No. 2. The extraction or release parachute is released from the rack electrically by actuation of the PENDULUM RELEASE switch in the flight compartment (figure 4-15). Power is taken from the emergency bus and a 5-ampere circuit breaker, marked TROOP JUMP on the EXTERIOR LIGHTS section of the circuit breaker panel, is provided.

The extraction or release parachute may be released manually by means of a handle located in the forward part of the cargo compartment roof. For use of the system for air dropping, refer to T.O. 1C-7A-9.

BLACKOUT CURTAINS.

Sixteen blackout curtains are provided for the cargo compartment windows for use during night operations. Each curtain has Velcro tape around the edges and four equally spaced webbing tabs. Each window has Velcro tape cemented around the window frame, and four equally spaced black index marks. The curtains are installed by positioning the curtain tabs to line up with the index marks on the window frame, and pressing the Velcro tape. The curtains are removed by using the webbing tabs to separate the Velcro tape.

TROOP JUMP LIGHTS.

Two troop jump lights are installed on a panel on the aft frame of each passenger door. Each pair of press-to-test lights consists of a GREEN JUMP and a RED CAUTION light, and are controlled from the TROOP JUMP panel on the pilot's instrument panel. Power is taken from the emergency bus, and a 5-ampere circuit breaker, on the EXTERIOR LIGHTS section of the circuit breaker panel, is marked TROOP JUMP.

Troop jump panel.

The TROOP JUMP panel (figure 4-15), located below the fuel control panel in the flight compartment, has a three-position troop jump switch, a red and a green press-to-test light and a dim-bright switch. The panel layout differs slightly between aircraft as shown in figure 4-15. The troop jump switch controls the jump lights in the cargo compartment, and also the lights adjacent to the switch. The dim-bright switch controls the intensity of the jump lights in the cargo compartment. The intensity of the jump lights in the flight compartment is controlled by the WARN lights intensity switch on the LIGHTS panel.

INSTALLATION OF EQUIPMENT.

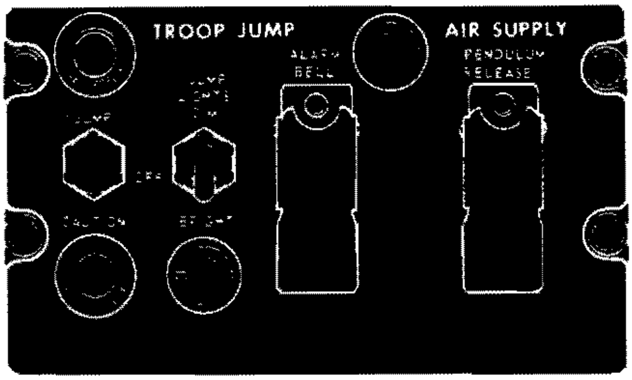
The installation of air dropping equipment is contained in T. O. 1C-7A-9.

MISCELLANEOUS EQUIPMENT.

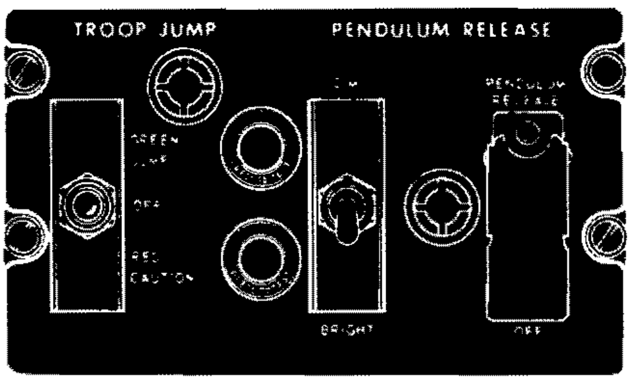
WEIGHT AND BALANCE COMPUTER.

The computer (figure 4-16) provides a simple, compact and accurate method of calculating aircraft weight and balance. It permits the use of a weight/center of gravity graph and loading vectors. The computer gives step-by-step indication of a loading with respect to the aircraft limits, and permits a direct reading of weight, center of gravity, and

troop jump-pendulum release panel



SOME AIRCRAFT



OTHER AIRCRAFT

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Figure 4-15 Troop Jump - Pendulum Release Panel

moment index at any stage without calculation. The moment index, or balance computer index, is a number representing the moment which, when considered in conjunction with the weight, gives the cg position. The effect of each item or group of items added to or removed from the aircraft is registered individually, and a mistake can be readily seen. Adjustments may be made to offset adverse weight or cg trends as they develop. Several loading combinations can be rapidly tried by marking the starting point on the graph. Important locations such as basic, take-off, and landing conditions may also be marked for in-flight reference, with the soft pencil provided inside the computer. The mechanical operation of the computer is such that small errors encountered during actual use will balance out over a complete loading, and in practice high accuracy can be achieved. It is strongly recommended however, that as a check the loaded-in items are finally removed, thus returning to the original basic condition on the graph, and positively confirming an accurate loading.

Description of the computer.

The computer consists of three basic parts, the body, the slide and the cursor. The body is a tube over which the other two parts slide, and has a raised portion at the left end on which the weight/cg graph is attached. The slide is a spring tensioned tube on which the load item vector diagrams are attached. The cursor is also a spring tensioned tube and has a clear plastic face disposed between, and extending over, both the graph and vectors. A removable tag, showing the current basic aircraft condition, (aircraft registration, basic weight, index and cg) is slipped under the face. Slide and cursor must move smoothly over the body. To clean or remove any sticking, wipe the rule thoroughly with a clean damp cloth.

Computer operating instructions.

It is most important to hold the computer correctly. It should be held approximately horizontal in the left hand by gripping the left end of the body at the graph location when operating the rule. All movement of the slide and cursor should be accomplished with the right hand to prevent inadvertent movement of these parts, and subsequent loading errors. Any initial difficulty encountered with this technique will be quickly overcome after a few practice loadings. Position the cursor so that the left cross-hair line (at the countersunk hole) is over the graph at the aircraft current basic weight and center of gravity location. This point is at the intersection of the applicable weight and moment index. Next, position the slide so that the ZERO point of the required item vector is under the right cross-hair line of the cursor. Now move the cursor so that the right cross-hair line moves along the selected vector line the desired distance. It will be noted that the left cross-hair line followed a similar course over the graph. The aircraft's new condition will now be shown under the left cross-hair line and will include the added item. Thus, any desired combination of items or groups of items can be added or removed (in this case reverse the setting and direction moved along the vector line) by repeating this procedure. All graduations on the vector scales are given in pounds so that actual weights rather than standard weights may be used if greater accuracy is required.

Note

> The cg limits given in figure 5-3 are for landing gear down condition. Loadings on this condition which fall within these limits will be satisfactory for flight with landing gear up.

Index value.

To obtain the initial index value after a revision to the basic aircraft condition has been made, move the slide and cursor fully to the left and set the cursor hair-line over the arrow on the body at INDEX. Rotate the slide so that the applicable basic

weight and balance computer

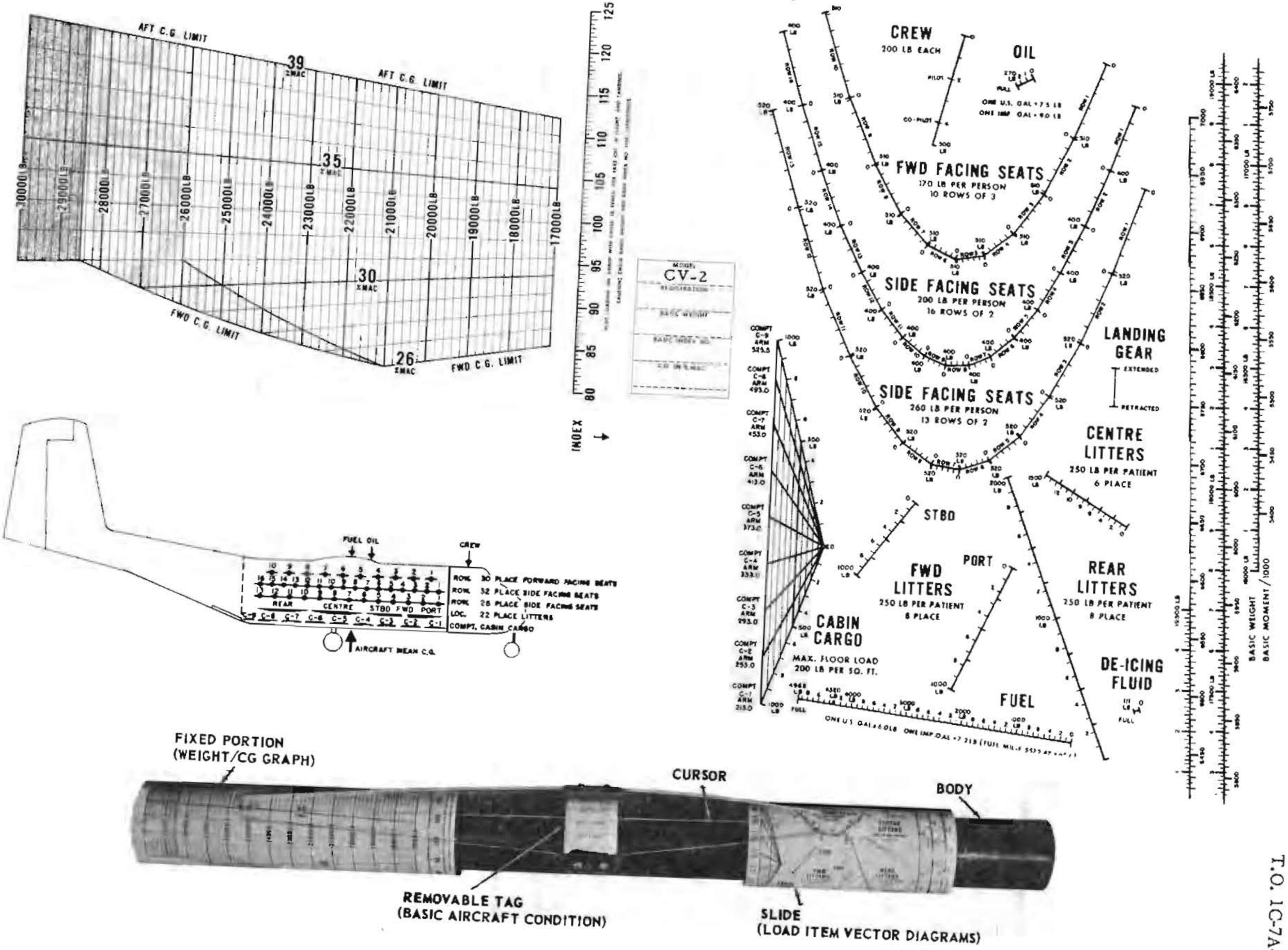

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Figure 4-16 Weight and Balance Computer

weight on the spiral scale (upper graduation) is also under the cursor hair-line. Now rotate the cursor, insuring that the slide does not move, until the hairline is over the applicable basic moment/1000 on the same spiral scale (lower graduation;. The new index value can be read under the cursor hair-line at the index scale together with the center of gravity at the applicable weight. Repeat this procedure as a check and then enter the new condition on the tag.

Stowage of weight and balance computer.

The computer case is secured to the bulkhead behind the pilot by hooking the leather loop of the case over the metal clip provided.

Tie-down device stowage.

Two stowage boxes are provided, one is installed on each side of the forward part of the cargo compartment, for the stowage of the cargo tie-down equipment. The box covers are hinged and are secured by Velcro tape hooks. The following equipment should be stowed in the boxes:

1. Twenty MC-1 tie-down devices.
2. Six MB-1 tie-down devices.
3. One A-2 cargo net.
4. Canvas bag containing twenty conveyor hold-down clamps.

Blackout curtains stowage.

The sixteen blackout curtains for the cargo compartment windows are stowed in a canvas bag, marked BLACKOUT WINDOW CURTAINS, secured to the aft face of the flight compartment bulkhead, on the left side. The bag is secured with Velcro tape.

COMFORT PROVISIONS.

The aircraft is provided with three relief tubes, one each for the pilot and copilot clipped just below their respective seats, and one for passenger use clipped to the side of the cargo compartment just aft of the right passenger door.

DRAFTPROOF DOOR.

A retractable draftproof semi-rigid door separates the cargo compartment from the tail of the aircraft and cargo door. Turning the handle on the lower portion of the upper panel to the door clockwise will release latches and allow springs to fold and retract the door into its stowed position in the roof. A strap and a cable are provided as hand grips to be used for extending the door and for reducing the spring assist during retraction. The draftproof door will automatically retract when the cargo door is jettisoned.

Draftproof door restraining straps.

The draftproof door is secured in its stowed position by attaching the clip ends of two straps (one strap is suspended from a bracket on each side of Frame 3), to their respective special screws provided near the edge of the door bottom panel. Separate the Velcro tape, which holds each strap doubled to itself, and connect the clip to the screw on the door, then press the Velcro tape together again.

PORTABLE OXYGEN EQUIPMENT.

A portable oxygen unit, consisting of an oxygen bottle, sling and a face mask, is located on the rear of the pilot's seat. The unit is mainly for use in the event of a fire in the fuselage, or for use by a crewmember having to go to the rear of the aircraft while at oxygen height.

ALARM BELL SYSTEM.

On some aircraft a guarded spring-loaded toggle switch marked ALARM BELL is located on the TROOP JUMP - AIR SUPPLY panel, below the fuel control panel. On other aircraft the switch is located on the circuit breaker panel on the flight compartment bulkhead. Lifting the guard and holding the switch up will complete the circuit to a bell located on the right cargo compartment wall. The bell is of the vibrator type and will continue ringing until the switch is released. Power is supplied from the emergency bus.

IGNITION ANALYZER.

An electrical connector is located on the forward face of the pilot's bulkhead, and is marked IGNITION ANALYZER. The connector is covered by a dust cap when not in use. A portable airborne-type ignition analyzer unit may be carried in the aircraft and, when operating, is used to detect, locate and classify any malfunction in the ignition system.

WINDSHIELD WIPER SYSTEM.

A windshield wiper system is installed for both the pilot's and copilot's windshield panels. The system consists of two interconnected windshield wipers, one for each panel, driven by a DC motor powered from the secondary bus through a 10-ampere circuit breaker. It is controlled by a rotary switch on the center switch panel.

Windshield wiper switch.

The windshield wiper rotary switch located on the left of the electrical switch panel is marked WIPER. The switch has six marked positions; PARK, OFF, FAST, 3/4, 1/2, and SLOW. To park the wipers, the switch is held momentarily in the PARK position and then released, when it will return to the OFF position.

CAUTION

An excessive load is imposed on the wiper motor if the wipers are operated on a dry windshield, and scratching of the windshield surface may result.

Note

If the switch is held in the PARK position for a prolonged period, the wipers will start to oscillate.

MOORING POINTS.

On some aircraft shackles are installed on the landing gear for the purpose of mooring the aircraft to the ground. On each main landing gear unit a schackle is bolted to the front of the shock strut at the drag strut attachment point. On the nose landing gear a shackle is bolted to the lug on the front of the shock strut.

FUSELAGE STEADY STRUT.

As a safety measure against the aircraft tipping when loading and unloading cargo, an adjustable strut is supplied as part of the ground equipment. When loading items of cargo weighing more than 1500 pounds, the steady strut should be used. The strut consists of a base plate, a locking nut, and a tube assembly incorporating a screw thread. A pin, normally stowed in a clip at the fork end of the strut, is used to attach the strut to the anchor fitting on the center underside of the fuselage, just forward of the passenger doors. Angular adjustment of the base plate may be made up to approximately 15° to suit uneven ground, and the plate can be locked in position by turning the lock nut in the direction indicated by an arrow on the plate. Adjustment for height is made by turning the upper portion of the tube assembly, and should normally be adjusted so that the base plate is approximately 3 inches off the ground. Should the pilot inadvertently taxi the aircraft with the strut in position, the strut will pull away from a light spring retainer clip and release from the aircraft.

HOT FUEL PRIME SYSTEM.

A hot fuel prime system can be installed to facilitate engine starting in ambient temperatures below 32°F (0°C). Below ambient temperatures of 0°F (-18°C) engine preheat may be necessary in addition to hot fuel priming. The hot fuel priming system consists of hot fuel prime units, one in each engine nacelle, which heat the priming fuel enroute to the engines from the selected fuel tank. Each hot fuel prime unit is a compact heater unit, operating similar to the cargo compartment heater, but with the electrical power being supplied from the primary bus through the up position of the hot fuel prime switch on the left electrical switch panel. After the circuit has been powered for a few seconds to allow the heaters to reach operating temperature, the heated fuel is fed to the engine by actuating the engine primer switch as appropriate. When both engines are running smoothly, the hot fuel prime switch should be moved to OFF.

Hot fuel prime switch.

The hot fuel prime toggle switch is adjacent to the battery master switch on the left electrical switch panel and is marked HOT FUEL PRIME and OFF at the up and down position respectively. The switch selects the electrical power to the heater circuit of the hot fuel prime units, and should be moved to the OFF position as soon as both engines have been primed and started through actuation of the engine primer switch.

SECTION V
OPERATING LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION.

This section covers all important limitations that must be observed during normal operation of the aircraft. Certain other limitations that are characteristic only of a specialized phase of operation will be found in their appropriate sections.

Note

For ferry configuration limitations refer to Section VII.

MINIMUM CREW REQUIREMENTS.

The minimum crew required to operate this aircraft is a pilot, copilot, and flight engineer. Additional crew members may be added, as required, at the discretion of the commander.

INSTRUMENT MARKINGS.

Instrument markings are shown in figure 5-1 and give limitations which are not necessarily repeated elsewhere in this manual. Limitations for a specific phase of operation will be found in the text under the appropriate heading.

COLOR CODE CHART.

GREEN	-	NORMAL/AUTO RICH
YELLOW	-	CAUTION
BLUE	-	AUTO LEAN
RED	-	PROHIBITED

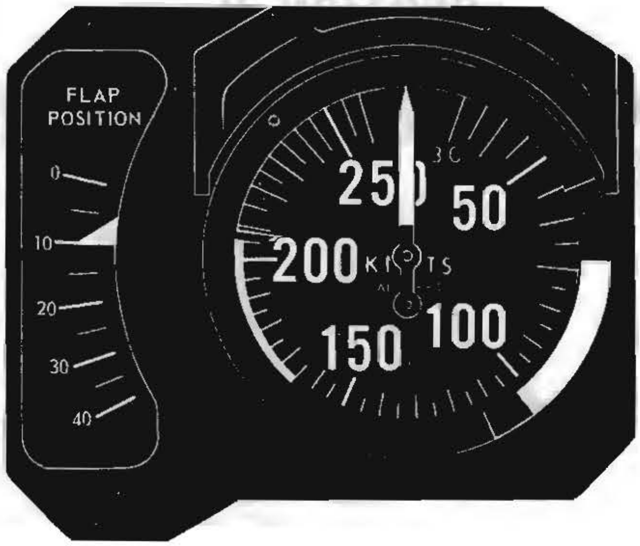
ENGINE AND PROPELLER LIMITATIONS.

1. Cylinder head temperatures:
   a. 80°C minimum for operation above 1200 RPM.
   b. 150°C - 232°C auto lean operation.
   c. 232°C - 260°C auto rich operation.
   d. 80°C minimum for take-off.
   e. 180°C maximum for take-off.
   f. 180°C maximum for engine shutdown.
2. Oil pressure:
   a. Idling 15 PSI minimum.
   b. 1400 RPM - 45 PSI maximum.
   c. 1700 RPM - 55 PSI to 100 PSI.
   d. 1800 RPM - 60 PSI to 100 PSI.
   e. 2550 RPM - 80 PSI to 100 PSI.
   f. 2700 RPM - 80 PSI to 110 PSI.

ENGINE OVERSPEED.

When engine speed exceeds 3100 RPM the aircraft should be landed as soon as possible and the engine

instrument markings



AIRSPEED INDICATOR

73-165 KNOTS
(FLAPS 0 /GEAR UP)

165-208 KNOTS

208 KNOTS

Note

MOVING MARKINGS IN RIM, DENOTING MAXIMUM FLAP SPEEDS AND STALLING SPEEDS. THE WHITE AND YELLOW MARKINGS MOVE TOGETHER

FLAPS EXTENDED SPEED RANGE - FROM MAXIMUM FLAP SPEED TO STALLING SPEED.

MAXIMUM FLAP EXTENSION SPEED

DE-ICING SUCTION

4-8 IN. Hg NORMAL
{4 IN. Hg MINIMUM
{9 IN. Hg MAXIMUM

DE-ICING PRESSURE

14 - 16 PSI NORMAL
{10 PSI MINIMUM
{18 PSI MAXIMUM

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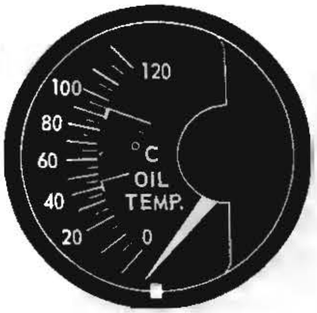
Figure 5-1 (Sheet 1 of 3) Instrument Markings

OIL PRESSURE

45 - 90 PSI. NORMAL RANGE (15 PSI MINIMUM AT IDLE)

45 PSI MINIMUM (AT 1400 RPM);
110 PSI MAXIMUM (AT TAKE-OFF)



OIL TEMPERATURE

60° C - 75° C. NORMAL RANGE

40° C MINIMUM;
93° C MAXIMUM (AT TAKE-OFF OR DURING CLIMB)

CARBURETOR AIR TEMPERATURE

CARBURETOR AIR TEMPERATURE RESTRICTIONS DO NOT APPLY TO FILTER POSITION WITH HEAT NOT APPLIED

-10° C TO 15°C. UNDESIRABLE CONDITION MAY EXIST DEPENDING ON ATMOSPHERIC CONDITIONS

-30° C TO 38° C. BEST OPERATING CONDITION, DEPENDING ON ATMOSPHERIC CONDITIONS (MAXIMUM 38° C. WHEN USING CARBURETOR HEAT)

FUEL PRESSURE

16 - 18 PSI NORMAL RANGE

16 PSI MINIMUM;
18 PSI MAXIMUM

FUEL TANK BOOST PUMP
NORMAL 11 - 17 PSI
HIGH 18 - 21 PSI

FUEL GRADE 115/145

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Figure 5-1 (Sheet 2 of 3) Instrument Markings

TACHOMETER

- 1500 - 2200 RPM AUTO LEAN PERMITTED
- 2200 - 2310 RPM AUTO RICH REQUIRED
- 2510 - 2550 RPM AUTO RICH REQUIRED
- 2310 - 2510 RPM PROHIBITED - EXCEPT PASSING THROUGH
- 2700 RPM MAXIMUM TAKE-OFF (5 MIN LIMIT)

MANIFOLD PRESSURE

- 15 - 33 IN. Hg AUTO LEAN PERMITTED
- 33 - 42.5 IN. Hg AUTO RICH REQUIRED
- 50 IN. Hg MAXIMUM TAKE-OFF AT SEA LEVEL (5 MIN LIMIT)

CAUTION

REDUCE MAXIMUM MANIFOLD PRESSURE 1.0 IN. Hg FOR EACH 10° C BELOW STANDARD CARBURETOR AIR TEMPERATURE

CYLINDER HEAD TEMPERATURE

- BELOW 232° C AUTO LEAN PERMITTED
- 232° C - 260° C AUTO RICH REQUIRED
- 260° C MAXIMUM

SYSTEM HYDRAULIC PRESSURE

3000 PSI MAXIMUM

BRAKE HYDRAULIC PRESSURE

1500 PSI MAXIMUM

FUEL GRADE 115/145

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Figure 5-1 (Sheet 3 of 3) Instrument Markings

inspected. Removal of the engine is mandatory when RPM exceeds 3300.

Note

Momentary overspeed or surge within the 2700 - 3100 RPM range, as a result of abnormally fast throttle movement is permissible without inspecting the engine.

ENGINE OVERBOOST.

1. An overboost condition which requires an engine inspection exists when either or both of the following conditions exist.

a. Overboost above charted manifold pressure requires the following action:

2-5 inches Hg up to 15 seconds - no action.

2-5 inches Hg more than 15 seconds - inspection.

5-10 inches Hg up to 15 seconds - inspection.

5-10 inches Hg over 15 seconds - replace engine.

over 10 inches Hg for any length of time - replace engine.

2. Engine overboost must be recorded in the AFTO 781 and should contain the following information:

a. Engine speed.

b. Manifold pressure.

c. Duration of overboost.

d. Cylinder head temperature.

e. Carburetor air temperature.

f. Oil temperature and pressure.

ENGINE IDLING.

Engines should idle at a speed of 650 ± 25 RPM.

Note

Spark plug fouling will result from prolonged idling below 1000 RPM.

RPM RESTRICTION.

Operation of the engines in the range 2310 to 2510 RPM should be avoided. Climb should be at or below 2300 RPM except where operational conditions require the use of 2550 RPM. Avoiding this RPM range will lessen the possibility of crankshaft failures.

STARTER LIMITATIONS.

30 seconds on, 60 seconds cooling-first attempted start.
30 seconds on, 5 minutes cooling-second attempted start.
30 seconds on, 30 minutes cooling-third attempted start.

REVERSE LIMITATIONS.

Do not exceed 2700 RPM in reverse range.

ALTERNATE GRADE FUEL.

The recommended alternate fuel is MIL-G-5572, Grade 100/130. The engine operating limits do not change when using alternate fuel.

AIRSPEED LIMITATIONS.

The instrument limit markings (figure 5-1), and other speeds noted in this section, show indicated airspeed values. They are applicable to an airspeed indicator without instrument error.

FLAP LOWERING SPEED LIMITATIONS.

To avoid imposing excessive airloads on the aircraft structure, the following speeds must not be exceeded. These speeds are marked on the limiitations label in the flight compartment. The moving yellow radial on the airspeed indicators will constantly indicate the maximum speed for each flap setting.

FLAP SETTING (all Engine Powers)	MAXIMUM AIRSPEED IAS - KNOTS
0 - 15°	105
20°	95
30°	85
40°	80

MANEUVERING AIRSPEED.

Maneuvers which involve full application of rudder or aileron must be confined to speeds below 119 knots IAS.

WARNING

119 knots IAS is the maximum airspeed for penetration of turbulent air.

NORMAL OPERATING AIRSPEED.

The normal operating airspeed limitation below 10,000 feet is 165 knots IAS. Above 10,000 feet the IAS limitation must be reduced by 3 knots for each 1000 feet increase in altitude.

MAXIMUM AIRSPEED.

The maximum airspeed below 10,000 feet is 208 knots IAS. Above 10,000 feet the maximum IAS must be reduced by approximately 1-knot for each 1000 feet increase in altitude.

LANDING GEAR OPERATING AIRSPEED.

The maximum airspeed for extending or retracting the landing gear, or flying with the gear down, is 120 knots IAS.

RAMP AND CARGO DOOR LIMITATIONS.

DOOR OPEN	120 knots IAS
RAMP DOWN 15°	120 knots IAS

PROHIBITED MANEUVERS.

All aerobatic maneuvers are prohibited. Other prohibited maneuvers are:

1. Steep turns above 60° bank angle.

2. Stall turns.

3. Stalls - Except under certain conditions (refer to Section VI).

4. Abrupt maneuvers involving full control deflection at airspeeds above 119 knots IAS.

ACCELERATION LIMITATIONS.

An operating VG diagram is shown in figure 5-2 and applies from sea level to 10,000 feet. The boundary lines show airspeeds and load factors which must not be exceeded under any circumstances. The maneuver speed line is marked at 119 knots IAS, and is the limit airspeed for maneuvers involving full control deflection. At or below this speed it is impossible to exceed the limit load factors, as the aircraft will stall. Above this speed maneuvers may be performed which do not involve full control movements, provided the limit load factors are not exceeded. Further, it must be remembered that turbulent air or gusts impose "g" loading on the aircraft structure even in straight and level flight, and this is additional to any loading the pilot is imposing through maneuvers. For this reason, on a gusty day, the aircraft should be slowed down to maneuver speed and pilot imposed "g" must be kept to a minimum. Refer to Section VI, for thunderstorm penetration. The red area on the VG diagram is the unsafe area, but if entered inadvertently it does not mean that the aircraft will fail structurally at this point. However, operation in this area involves an increasing risks of structural damage.

MAXIMUM ALLOWABLE SINK RATE ON LANDING.

26,000 lb gross weight - 14 feet per second.
28,500 lb gross weight - 13 feet per second.
31,000 lb gross weight - unknown and not recommended.

AIRDROP LIMITATIONS.

Airdrop operations are limited by maximum gross weight, center of gravity limits and floor strength limitations. No unusual flight characteristics will be noted during personnel or equipment drops. By definition, the drop package weight includes the cargo, pallets, parachutes and all associated equipment that is ejected from the aircraft during the flight.

CAUTION

Airdrops in severe turbulence are not recommended because of the possibility of exceeding structural limits.

Multiple package drops may be made so long as the following limitations are observed:

1. The combined drop package weights must not exceed the maximum allowable single package weight for the particular drop condition under consideration.

2. Subsequent to the drop of any one or more of the packages, the position of the packages remaining in the aircraft must not cause the aircraft CG to move outside of the CG envelop shown in figure 5-3.

CENTER OF GRAVITY LIMITATIONS.

When loading the aircraft, particular attention should be paid to keeping the center of gravity within the prescribed limits, shown on Chart E (T. O. 1C-7A-5). With the CG at its forward limit the stalling speed of the aircraft is at its highest value. The stalling speeds given in Section VI are with the CG at its forward limit with power for zero thrust. With the CG at its aft limit there is some deterioration in the stall characteristics, although the actual stalling speed is slightly lower. There is no effect on taxiing with the CG at either the fore or aft limits.

RAMP LOADING LIMITATIONS.

Due to the design and size of the ramp operating motor, the ramp is not to be operated while supporting a load.

The total weight bearing capacity of the ramp in any stationary position is as follows:

Ultimate load - 8000 lb
Load per axle - 4000 lb
Distributed load - 6000 lb

For weights exceeding 1500 lb, the steady strut will be used.

WEIGHT LIMITATIONS.

The maximum permissible weight at which the aircraft can be operated varies, depending on certain weight controlling criteria. The following paragraphs show how the maximum permissible weight is dependent on this criteria.

vg diagram

GROSS WEIGHT 28,500 LB ALTITUDE 0-10,000 FT

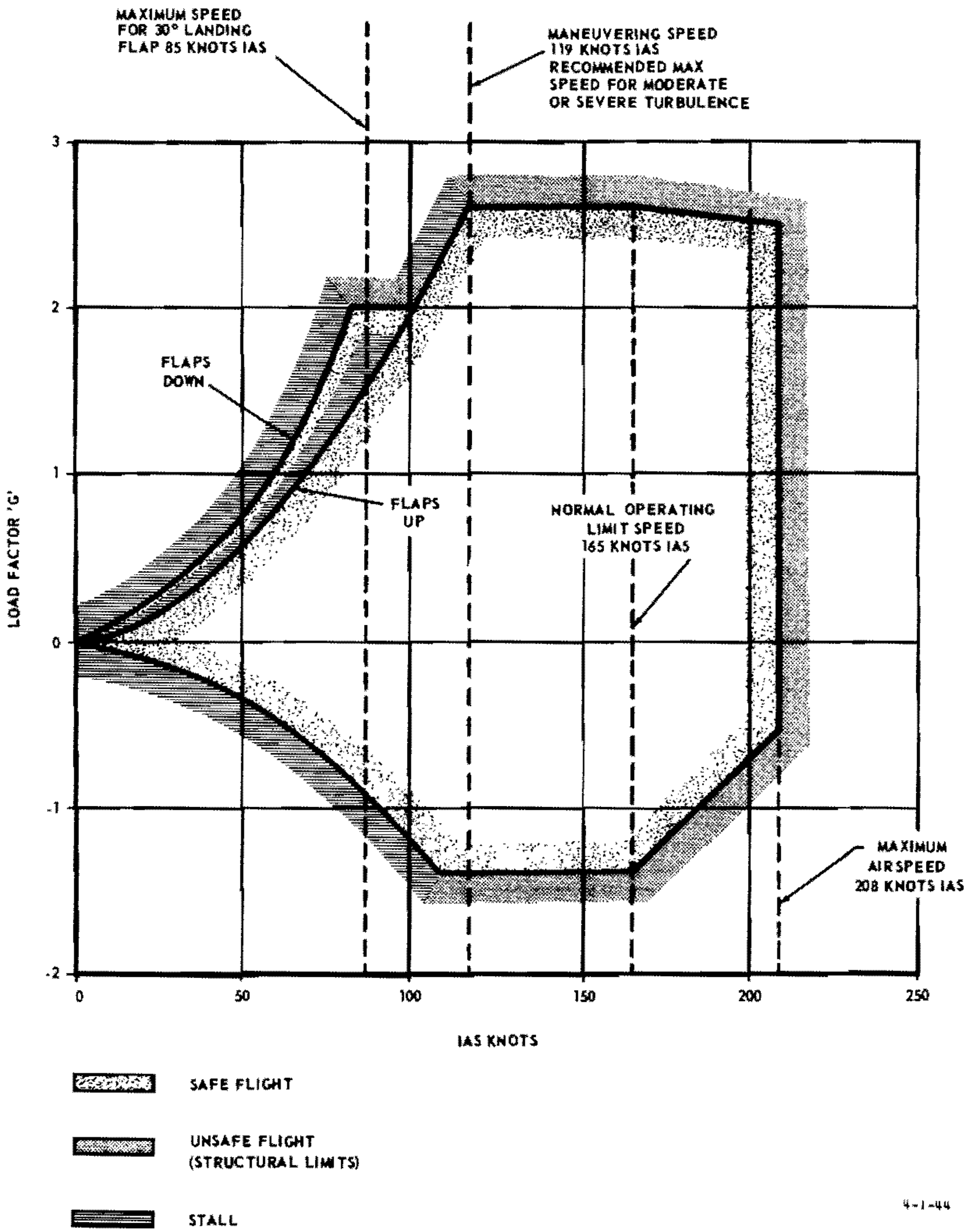
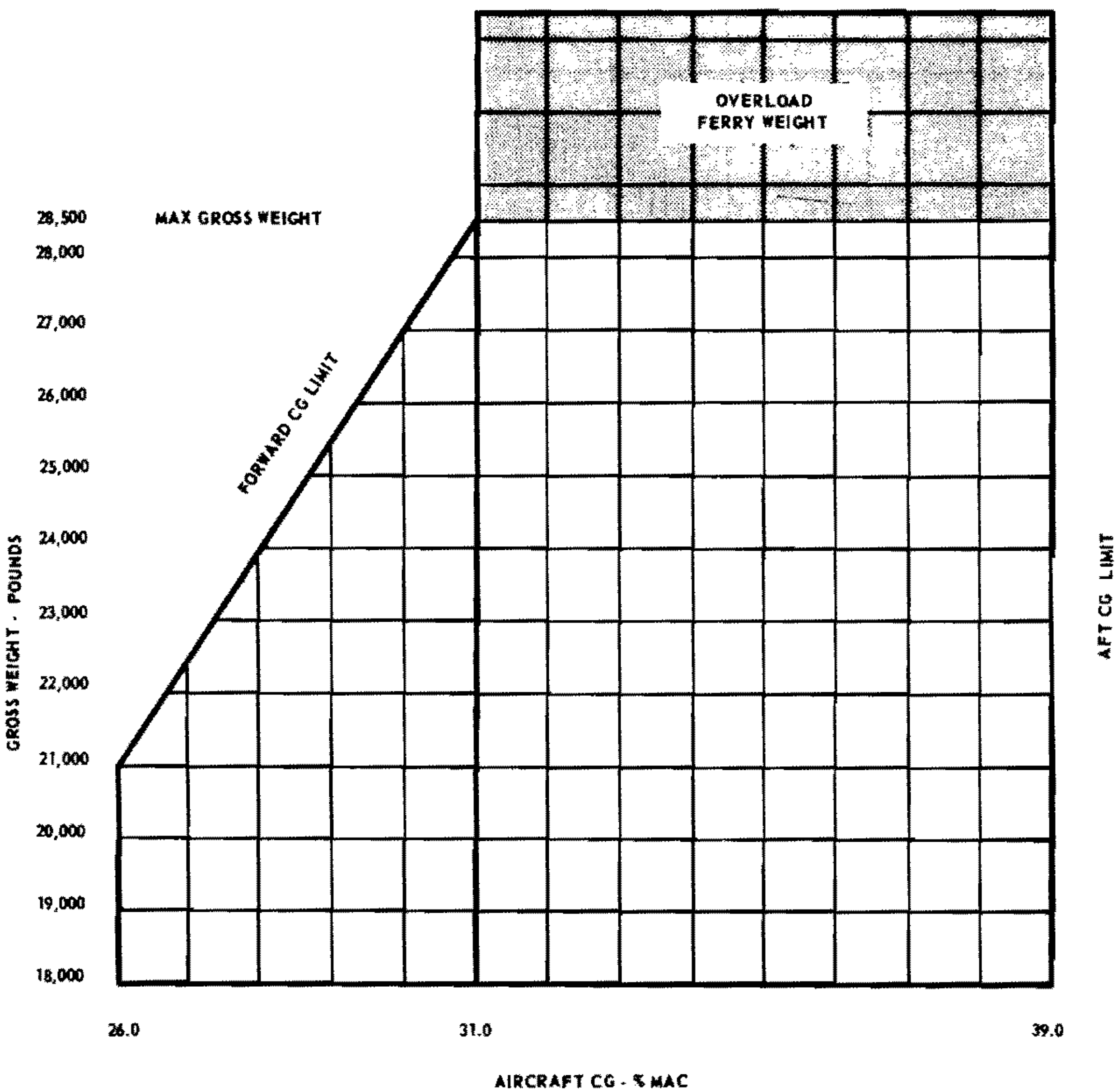


Figure 5-2 VG Diagram

cg limits



NOTE:

THE ABOVE CG LIMITS ARE FOR LANDING GEAR DOWN CONDITION. LOADINGS ON THIS CONDITION WHICH FALL WITHIN THESE LIMITS WILL BE SATISFACTORY FOR FLIGHT WITH THE LANDING GEAR UP.

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Figure 5-3 CG Limits

OPERATING WEIGHT.

The operating weight on which the weight limitations chart (figure 5-5) is based, is 21,000 lb. This assumed value is an approximate weight which includes the average aircraft basic weight plus three crew, full oil, and 780 equipment. Since individual aircraft basic weights vary, it will be necessary to adjust the chart for specific aircraft as shown in the sample problems.

GROSS WEIGHT.

The maximum permissible gross weight is 28,500 lb. At this weight all airworthiness requirements are met with a margin of safety.

Note

Operation above a gross weight of 28,500 pounds is permissible only for ferry operations and requires major air command approval. The maximum gross weight for ferry configuration is 31,000 pound for take-off.

MARGIN OF SAFETY AND LOAD FACTORS.

As an aircraft is loaded to higher weights its ability to windstand additional loads, resulting from turbulent air or maneuvers, decreases proportionately. The amount of additional loading that the aircraft will withstand before failure occurs is termed the margin of safety. If the mission requires excessive maneuvering in turbulent air, a larger margin of safety should be maintained. Load factors are used as an indication of the margin of safety that is available.

PERFORMANCE LIMITATIONS.

In some instances, it may be found necessary to limit the maximum permissible gross weight of the aircraft, not because of structural considerations but because of reduced performance due to the higher weight. (Refer to T. O. 1C-7A-1-1.)

WEIGHT LIMITATIONS CHART EXAMPLES.

To arrive at the weight of fuel and cargo loads, subtract the weight of the crew, plus oil, plus the aircraft basic weight from the aircraft gross weight as shown in the following example:

Gross Weight		28,500 lb
Basic Weight (assumed)	19,594 lb	
Crew (3)	600 lb	
Oil (full)	306 lb	
780 equipment (assumed)	500 lb	
Operating Weight	21,000 lb	21,000 lb
Fuel plus cargo load		7500 lb

Thus as long as any combination of fuel of 1500 lb or more (zero fuel weight) and cabin load does not exceed 7500 lb (in this example), the aircraft is loaded within the normal weight. Since the actual basic weight of each aircraft varies, the operating weight must be interpolated on the chart. To compute the allowable cargo compartment load (ACL) for any fuel load, enter the chart at the fuel weight and proceed vertically upward to the appropriate operating weight line and horizontally to the left margin and read ACL.

ZERO FUEL WEIGHT.

The zero fuel weight is defined as the design maximum weight with no disposable fuel, and determines the maximum weight which can be carried in the fuselage. The zero fuel weight is 27,000 lb maximum, and all weight in excess of this figure up to the maximum gross weight of 28,500 lb must consist of fuel for structural reasons. Fuel must be distributed equally on both sides of the aircraft center line.

GROUND PRESSURE.

The ground pressure of the aircraft's wheels on the runway is given in figure 5-4 below. This data is based on the assumption that the aircraft's tires are inflated to the normal operating pressures.

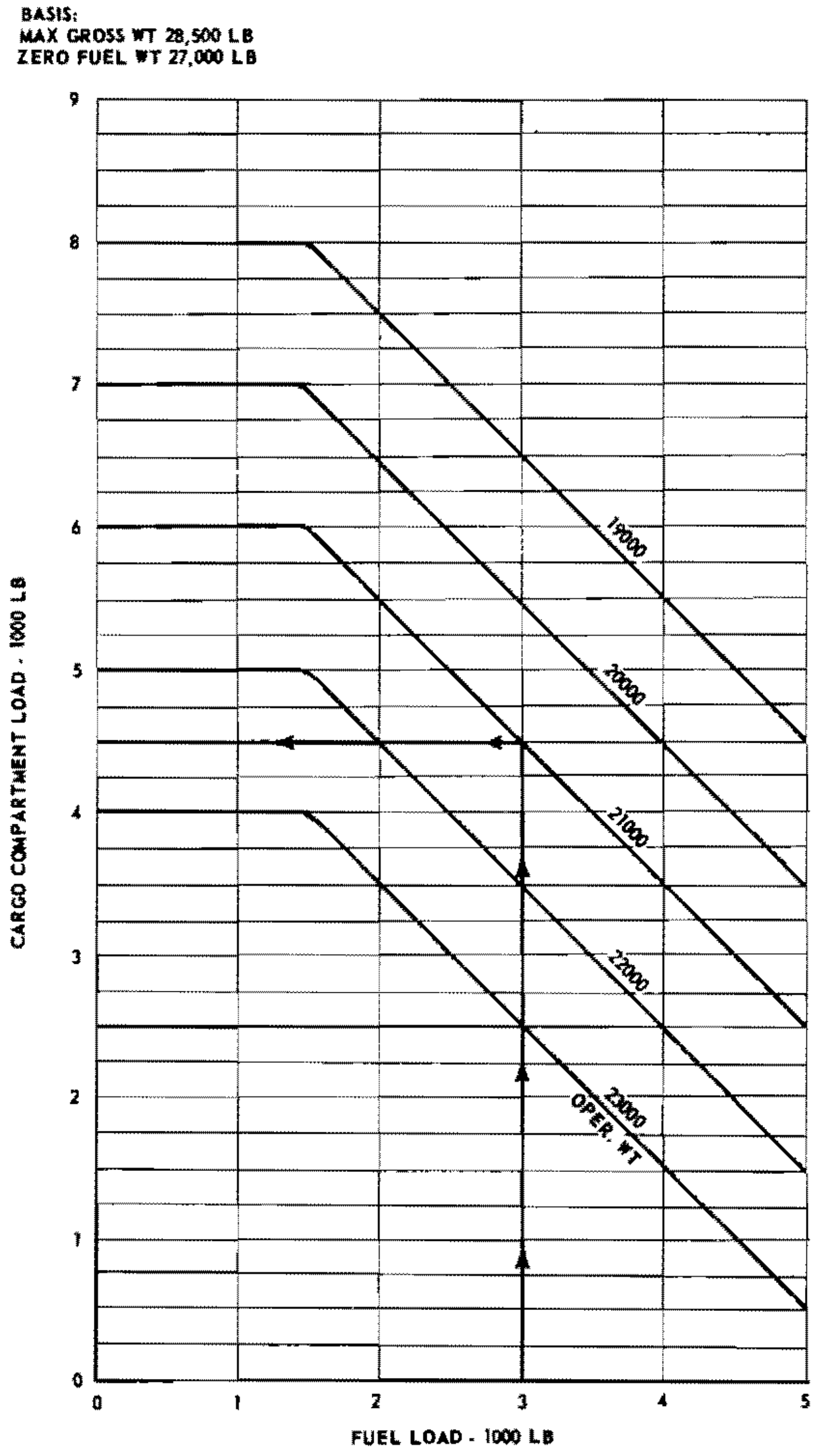
ground pressure data

AIRCRAFT WEIGHT	CENTER OF GRAVITY	GROUND PRESSURE PSI*	
		MAIN WHEEL	NOSE WHEEL
OPERATING WEIGHT 21,000 LB	FWD (26% MAC)	39	46
	AFT (39% MAC)	40	45
GROSS WEIGHT 26,000 LB	FWD (31% MAC)	42.5	48
	AFT (39% MAC)	43	48
GROSS WEIGHT 28,500 LB	FWD (31% MAC)	43.5	48
	AFT (39% MAC)	44	48

*BASED ON TIRE PRESSURES OF 35 TO 40 PSI

Figure 5-4 Ground Pressure Data

weight limitations chart



EXAMPLE

Operating Weight 21,000 lb Fuel Load 3000 lb. Enter chart at the lower margin with the fuel load. Proceed vertically to the oper. wt (interpolate if necessary) and read the allowable cargo compartment load horizontally to the left; 4500 lb ACL. If the required cargo compartment load is known, the chart can be used in reverse to compute the allowable fuel load.

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Figure 5-5 Weight Limitations Chart

SECTION VI
FLIGHT CHARACTERISTICS

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INTRODUCTION.

The aircraft has the following widely diversified mission capabilities: long range ferry, transportation of personnel, cargo, or equipment to remote bases; aerial delivery facilities for personnel, cargo, or equipment airdrops; and short-field take-off and landing characteristics for support and utility operations from small fields and emergency airstrips. In these and other areas of flight operations, including formation and instrument flying, the aircraft has satisfactory flight characteristics.

The aircraft is stable in all configurations. Handling of the aircraft is unaffected when flying with the ramp horizontal and cargo door open. Control is adequate over the entire speed range and the aircraft is controllable down to speeds approaching the stall. Relatively large control surfaces are used to attain this control at low speed. A stall warning system is installed which operates control column shakers at a predetermined margin above the stalling speed in any configuration. The artificial warning system has been incorporated because prestall buffet, in most cases, is not evident.

STALLS.

High lift wings provide very low stalling speeds. As a result, the handling characteristics approaching the actual stall are not identical for all combinations of center of gravity, flap and power settings. However, under all conditions, the initial warning is provided by the artificial two-stage stall warning stick shaker system. Aerodynamic buffet is very slight and can only be felt if the stick shaker stall warning system is inoperative. A low and high intensity stick shaker stall warning system is installed which vibrates both control columns at a predetermined margin above the stalling speed. Should a stall be entered, it is recommended that recovery be made as follows:

1. When a stall is encountered, immediately lower the nose, level the wings, if necessary, and apply power to limit loss of altitude. Avoid diving the aircraft and avoid abrupt or accelerated pull-up after recovery.

2. Heavy gross weight cruise configuration stalls may be accompanied by lightening of rudder and elevator control forces. Recovery should be made by abruptly applying nose down elevator and applying power.

PRACTICE STALLS.

Stall entry and recovery should not be practiced with cargo or passengers aboard. Practice at a minimum altitude of 5000 feet above the ground. Do not delay recovery beyond the point of artificial warning. Avoid abrupt control movements, and avoid any control action that may result in sudden attitude change or in excessive acceleration or buffeting. For practice stall entry, position gear and flaps as desired and set power for zero thrust.

WARNING

A deliberate approach to the stall for training or demonstration purposes will be terminated at the onset of artificial warning, in all flap and power configurations. The aircraft should be loaded to maintain a mean or forward CG when practice stalls are anticipated.

STALL CHARACTERISTICS.

The stall characteristics of the aircraft are safe, since the aircraft will stall straight ahead with little tendency to yaw. With power on, there may be a slight rolling tendency at the point of stall. Aerodynamic indications of an approaching stall are very slight in most configurations, and, in some cases, a stall may occur with no prior aerodynamic warning. Artificial stall warning is provided by an electrically operated stick shaker system. Refer to figure 6-1 for stall speeds.

SPINS.

Intentional spins are prohibited. If a spin is entered inadvertently, normal recovery procedure for a two-engine aircraft is recommended, i.e., close the throttles, apply full opposite rudder and ease the control column forward until the spin stops. If the spin does not stop, apply power to the inner engine.

FLIGHT CONTROLS.

Aileron, elevator, rudder and trim tab control is normal throughout the speed range of the aircraft. The controls are light and effective at all aircraft gross weights, down to the very low speeds at which the aircraft can be flown. The ailerons are effective down to the stall, and lateral control is adequate; larger control movements being required as speed is reduced. With the flaps up, the range of movement of the outer ailerons is 21° up and 16.5° down, while that of the inboard ailerons is only 9.5° up and 5° down. As the flaps are lowered the ailerons droop with the flaps and, in addition, the available range of aileron movement increases. With full flap lowered, the outer ailerons range is 22.5° both up and down; while the range of the inboard ailerons increases considerably, to 20° up and 14.5° down. This has the effect of 'heavying-up' the aileron controls as the flaps are lowered . However, lateral control is augmented by having the increased aileron surface available at low speeds. At high speeds, with the flaps up, the aileron forces are light and comfortable. The hinged tab on the inboard right aileron is actuated by rudder movement and has the effect of increasing the dihedral and raising the low wing in a sideslip. The geared tabs, one on each outboard aileron, reduce the force which the pilot requires to move the aileron control. The trim tab, on the right outboard aileron, is used to trim the aircraft laterally in flight. The elevator is effective throughout the speed range of the aircraft and to below the stall. Two trim tabs and two spring tabs are fitted to the elevator. The trim tabs are used to trim the aircraft longitudinally during all flight conditions. In addition, longitudinal trim is automatically maintained by an interconnect between the flap mechanism and the horizontal stabilizer when the flaps are operated. The horizontal stabilizer angle of incidence is altered during flap operation to compensate for trim changes incurred by flap movement. The spring tabs move by the initial pilot effort at the control column and lighten the elevator loads. The amount the tabs move, for a given pilot force, varies with airspeed so that less assist is given at the higher speeds. The rudder, due to its relatively large area, is particularly effective at very low speeds and also during asymmetric flight. A geared trim tab and a spring tab are fitted to the rudder. The geared trim tab is used to trim the aircraft about the normal axis, particularly during asymmetric flight. In addition, this tab is geared to the rudder control and reduces the force the pilot requires to move the control. The spring tab operates in a similar manner to the spring tab fitted to the elevator.

WARNING

> When operating close to stall speeds with gear extended and flaps full down, such as during short field landings, slipping the aircraft through excessive use of rudder must be avoided. Under these conditions, with the aircraft in a bank, application of top rudder can cause the angle of bank to increase rapidly and uncontrollably unless immediate corrective action is taken to neutralize the rudder and/or increase airspeed.

LEVEL FLIGHT CHARACTERISTICS.

Provided the center of gravity is within the prescribed limits and the aircraft is correctly trimmed, level flight characteristics are smooth and normal throughout the speed range of the aircraft. At 28,500 pounds gross weight with the landing gear extended and 30° flaps, the aircraft can be flown level at 55 knots IAS. When flying the aircraft at slow speeds a large application of the aileron control will be required to maintain wings level. In addition, any lateral displacement should be corrected rapidly, particularly in gusty conditions. If a wing is allowed to drop beyond corrective action of full aileron, power should be increased immediately to regain level flight.

MANEUVERING FLIGHT.

Turn should be entered, sustained and completed with coordinated movements of flight controls. A turn should be entered with sufficient airspeed to insure that an inadvertent stall will not occur. Refer to Stall Speed Chart, figure 6-1. Steep turns, up to 60° bank angle, can be completed without loss of height provided sufficient power and airspeed are attained before entering the turn. Maneuvers which involve full movement of a flight control should be entered at or below an airspeed of 119 knots IAS.

DIVING.

During a dive all flight control pressures increase with airspeed. Use normal recovery methods from a dive and do not exceed the airspeed limitations given in Section V. Avoid abrupt pull-ups at all times.

stall speed chart

STALLING SPEEDS VS ANGLE OF BANK

POWER OFF

MODEL: C-7A
DATE: SEPTEMBER 1967
DATA BASIS: FLIGHT TEST (CONTRACTOR)

CG-FORWARD LIMIT

ANGLE OF BANK			0°	15°	30°	45°	60°
LOAD FACTOR			1.0	1.04	1.15	1.41	2.0
GROSS WEIGHT POUNDS	WING FLAP	LANDING GEAR	STALLING SPEED - CAS KNOTS				
20,000	0°	UP	64.0	65.2	68.6	76.0	90.5
	7°	UP	60.0	61.2	64.5	71.3	85.0
	15°	UP	56.0	57.0	60.0	66.5	79.0
	25°	UP	53.0	54.0	57.0	63.0	75.0
	30°	DOWN	51.8	52.8	55.6	61.5	73.4
	40°	DOWN	49.4	50.4	53.0	58.6	70.0
22,000	0°	UP	67.0	68.4	72.0	79.5	94.6
	7°	UP	62.7	64.0	67.4	74.5	88.6
	15°	UP	58.7	60.0	63.0	69.7	83.0
	25°	UP	55.2	56.3	59.2	65.5	78.0
	30°	DOWN	53.8	54.8	57.7	64.0	76.0
	40°	DOWN	51.7	52.8	55.5	61.5	73.4
24,000	0°	UP	69.5	70.8	74.5	82.5	98.0
	7°	UP	65.2	66.5	70.0	77.5	92.0
	15°	UP	61.0	62.2	65.5	72.5	86.0
	25°	UP	56.8	58.0	61.0	67.5	80.5
	30°	DOWN	55.0	56.0	59.0	65.4	77.7
	40°	DOWN	53.7	54.8	57.6	63.8	76.0
26,000	0°	UP	71.8	73.3	77.0	85.0	101.5
	7°	UP	67.5	68.8	72.5	80.0	95.5
	15°	UP	63.3	64.5	67.8	75.0	89.5
	25°	UP	58.3	59.5	62.5	69.2	82.0
	30°	DOWN	56.1	57.2	60.2	66.5	79.5
	40°	DOWN	55.6	56.6	59.6	66.0	78.5
28,500	0°	UP	74.6	76.0	80.0	88.6	105.5
	7°	UP	70.2	71.5	75.4	83.4	99.0
	15°	UP	65.8	67.0	70.6	78.0	93.0
	25°	UP	60.0	61.1	64.5	71.3	85.0
	30°	DOWN	57.3	58.4	61.5	68.0	81.0
	40°	DOWN	58.0	59.0	62.2	68.9	82.0
31,000	0°	UP	77.8	79.4	83.5	92.5	110.0

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Figure 6-1 Stall Speed Chart

SECTION VII
SYSTEMS OPERATION

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INTRODUCTION.

The descriptions and operating instructions contained in this section are for systems which are peculiar to this aircraft or systems that require emphasis. In some cases the information given overlaps that given in the general description of the system concerned. In other cases, instructions are given which do not appear elsewhere in the manual.

POWER PLANT AND RELATED SYSTEMS.

EXHAUST SYSTEM AND ENGINE COOLING.

The exhaust gases from each engine pass from two groups of four exhaust pipes into augmentor tubes and are directed rearward over the upper surface of the root flaps. An open space exists between the exhaust stacks and the mouth of the augmentor tubes. When the engine is operating, exhaust gas is ejected from the stacks into the augmentors and the force of the exhaust creates a partial vacuum at the mouth of each augmentor, causing air that has entered the engine section around the propeller hubs to rush into the augmentors. This action continuously draws cooling air across the engine, in addition to the normal ram airflow. The augmentor cooling air is automatically proportioned to the power setting at all times, and this is an advantage when climbing with high power and low forward speed. The action of the high velocity exhaust gases through the augmentors gives a jet thrust effect which provides some positive thrust power at low airspeeds and high power settings. The thrust is considered sufficient to eliminate cooling drag.

DETONATION.

Common causes of detonation are: low octane fuel, lean fuel/air mixture, excessive manifold pressure, excessively high carburetor air temperature, excessive cylinder head temperature, advance timing, or operating with only one spark plug firing in a cylinder. Detonation may result in damage to the engine such as overheated, burned, stuck or broken pistons, rings or valves; scored pistons and cylinder; overstressed or broken cylinder hold down studs. When detonation is suspected, the operator should immediately reduce manifold pressure and rpm, enrich the fuel air mixture and reduce carburetor air temperature to the lowest temperature possible within the operating range.

POWER SETTINGS.

It is important to cushion the high inertia loads on the master rod bearings which occur at conditions of high RPM and low manifold pressure. If a large reduction in power is necessary during descent, reduce rpm as well as manifold pressure. It is recommended that for each 100 RPM at least 1 in. Hg manifold pressure be maintained. Operation at high RPM and low manifold pressure should be kept to a minimum.

CARBURETOR TEMPERATURE.

The carburetor air temperature gages register the temperature of the air in the carburetor air intake ducts of the engines. The instrument markings shown in Section V for these gages do not attempt to show a definite temperature at which carburetor heat should be used. Atmospheric conditions conducive to carburetor icing, together with the air temperature, must be taken into account when deciding upon the use of carburetor heat. The following paragraphs discuss icing conditions, and will aid in this decision.

CARBURETOR ICING.

The following atmospheric conditions contribute to carburetor icing:

1. Visible freezing or subfreezing moisture which forms ice in the air intake, and in and on the carburetor metering elements.

2. High atmospheric humidity with a carburetor air intake temperature below +3°C forms ice on the throttle valve at partial throttle opening.

3. High atmospheric humidity with a carburetor air intake temperature below +10°C forms ice in the region between the carburetor and the impeller.

4. Severe low temperature conditions, when the aircraft is exposed for many hours, can lower the fuel temperature to a point where it will cause icing in the internal passages of the carburetor during subsequent operation in a high humidity atmosphere. This condition is not likely to occur when the temperature of the fuel entering the carburetor is at or above 0°C.

Indications of carburetor icing generally appear as follows:

1. Decrease in thrust is evidenced by a drop in manifold pressure and/or thrust indicator readings.

2. Erratic engine operation due to ice on the metering elements.

3. Drop in cylinder head temperature.

4. In some cases jamming of the throttle valve is evidenced by erratic response of manifold pressure to throttle lever positioning.

If carburetor icing conditions are anticipated or suspected, apply carburetor heat to maintain +15°C. The use of carburetor heat for the prevention of ice, and the consequent loss of power in a high-moisture atmosphere, is most effective if applied and maintained in advance of encountering these conditions.

Carburetor heat can be applied with mixture control in AUTO LEAN.

If it is suspected that ice has already formed in the carburetor, move the mixture lever to auto rich and apply full carburetor heat for 30 seconds, but do not exceed +38°C carburetor air temperature. Slowly return the carburetor heat lever toward COLD to see if manifold pressure has been restored to nearly its former indication. Adjust preheat to maintain +15°C carburetor air temperature.

If the temperature of the fuel is well below freezing during icing conditions, a rapid loss of power due to mixture control bleed icing may occur. The use of maximum heat and a lean mixture, if in the cruise range, should restore the normal power condition.

SPARK-PLUG FOULING.

Spark-plug fouling is usually caused by a build-up of lead or carbon deposits which cause shorting at the plugs. Grade 115/145 fuel contains a relatively high lead content and under certain conditions of temperature and pressure the lead will condense out on the spark-plug insulators. In the presence of excess carbon as a reducing agent, the lead may form metallic particles which cause misfiring, or prevent firing, across the plug electrodes. In general, spark-plug fouling involves a build-up of deposits through prolonged operation under a fixed set of conditions. If action is taken to vary these conditions, improved ignition will result. The following preventive measures may be taken:

1. After each ten minutes of ground running, the engine should be run at field barometric manifold pressure for one minute.

2. Cylinder head temperature should be below 180°C prior to the takeoff in order to take advantage of the increased bhp. There will also be less tendency for misfiring with a relatively cool cylinder head temperature during takeoff.

3. During cruising flight a periodic change in engine conditions should be made. This may be done at hourly intervals by either using auto-rich mixture for five minutes, changing manifold pressure by 3 to 5 in. Hg, or changing propeller speed by 100 to 130 RPM. A reduction in power level, followed by an increase, is recommended.

4. If practicable, use cruise power settings during descent.

DEFOULING (CLEANOUT) PROCEDURE

If an unacceptable magneto check occurs and the spark plugs are known or suspected to be in a fouled condition, the following spark plug cleanout procedure is recommended.

1. Mixture - RICH.

2. Propeller - Full increase.

3. Slowly advance throttle levers to obtain field barometric pressure.

4. Retard propeller levers so as to establish 2000 RPM.

5. Reset manifold pressure at field barometric pressure.

6. Maintain this setting (2000 RPM and field barometric pressure) for one minute.

CAUTION

During this time do not allow cylinder head temperature to exceed 260°C.

7. Advance propeller levers to full increase RPM and adjust throttles to obtain field barometric pressure.

8. Recheck magnetos.

Note

Do not repeat more than twice in attempting to clear fouled plugs.

PROPELLER REVERSING.

The reversible pitch propeller is a valuable feature which, when properly used, increases safety and utility of the aircraft. However, it is important to point out the undesirable consequences which result from improper use of this device. When the throttles are placed in the reverse pitch range, the engine continues normal operation, but with this significant exception; the direction of airflow to the engine cooling passages is reversed, the augmentors no longer regulate the airflow through the engine as effectively as in forward thrust operation, and increased temperatures develop around the engine.

The undesirable effects of continued reverse pitch operation does not register immediately on the engine instruments. The cylinder head temperature do not rise alarmingly as the reverse heat capacity permits the bulkier portions of the engine to absorb heat without appreciable temperature increase. The use of propeller reversing to hrake the landing roll does not result in critical temperature conditions. The cooling-off during approach, the forward motion of the aircraft and the relatively short interval of reverse pitch operation serve to keep the temperature below the damaging level. Reverse pitch operation will not damage the engine unless it is sustained over extended periods. It is recommended that reverse thrust be employed for braking and only such other conditions as are absolutely required.

PROPELLER CHECK FOR REVERSE PITCH OPERATION.

Occasionally, propellers do not return to forward pitch after reversing. To insure that the propellers have returned to forward pitch after reverse thrust operation, watch for a surge in rpm as propellers are unreversed, and an indication of positive thrust on the thrust indicators. If there is any doubt that the propellers have returned to forward thrust, immediately depress the propeller feathering button and watch for a drop in rpm. A rise in rpm indicates that the propeller is still in reverse pitch. If rpm begins to rise, the propeller may be returned to forward pitch by waiting until the rpm subsequently begins to fall before returning the feathering button to the neutral position.

FUEL MANAGEMENT.

The fuel system crossfeed may be used to supply both engines from either tank or, during single-engine operation, one engine from either tank. During flight on one engine, fuel should be used alternately from each tank in order to maintain the weight of fuel on each side approximately equal. However, in the event of a fuel malfunction, the aircraft can be trimmed with a full tank on one side and minimum fuel on the other side. Prior to making crossfeed selection the booster pump of the selected tank should be switched to HIGH, the fuel pressure gage on that side should then read approximately 20 psi. The boost pump in the tank not to be used should be turned off.

After the crossfeed selection has been made, if supplying both engines, both fuel pressure gages should read approximately 20 psi. Two minutes should be allowed for the system to rid itself of any trapped air and the booster pump then switched to NORMAL. Whenever crossfeeding fuel, the booster pump of the selected tank should remain in the NORMAL position.

Prior to returning to the normal fuel selection, the booster pump of the tank not being used should be switched to NORMAL. After tank selection has been made, two minutes should be allowed for the system to rid itself of trapped air. At the pilot's discretion, booster pumps may then be switched off.

In addition to using the booster pumps for engine starts, take-offs, climbs, landings and fuel crossfeeding, they should also be used in flight whenever fuel pressure fluctuates within normal operating limits (16 to 18 psi), for flights above 10,000 feet, and in the event of engine-driven fuel pump failure.

WARNING

The booster pump must not be turned on if fuel pressure drops below the low limit while the engine continues to operate normally. A fuel leak may be responsible for the pressure drop. Loss of the main DC bus when a boost pump is being used to replace an inoperative engine driven fuel pump will result in fuel starvation of that engine.

Note

Maximum fuel differential between wings - a full tank (2418 pounds).

LONG RANGE FERRY FUEL AND OIL SYSTEM.

Additional fuel and oil necessary for long range ferry flights may be carried in special tanks installed in the cargo compartment. The package assembly consists of one or two auxiliary fuel tanks, and one auxiliary oil tank. Each fuel tank has a capacity of approximately 480 gallons and the oil tank has a usable capacity of 18 gallons. Each fuel tank is secured in position by tiedown straps. The oil tank is bolted to the floor on the right side of the cargo compartment. A fuel control panel is secured to the left side of the cargo compartment forward of the emergency hatch. A fuel level control valve is incorporated in cell No. 5 of each wing tank.

AUXILIARY FUEL TANKS.

The two auxiliary fuel tanks are constructed of flexible 4-ply rayon tire cord reinforced rubber, with an inner liner of Buna "N" compound. They are 68 inches long and 58 inches in diameter. Inside the tank are two flexible hoses, one a vent hose and the other a fuel hose. A float is attached to the vent hose, and a filler screen assembly is clamped to the fuel hose. The filler assembly will remain on the bottom of the fuel tank during and after refueling.

During operation the tanks are pressurized to a regulated 5 psi, the pressure is supplied by the deicer boot pumps or by a manually operated pump which must be carried aboard the aircraft. This pressure is used to transfer the fuel from the auxiliary fuel tanks to the wing fuel tanks (see figure 7-2). A sight gage, consisting of transparent tubing marked from 50 to 500 gallons, on each fuel tank gives an approximate visual indication of fuel in each tank. The auxiliary tanks are connected by flexible hose directly to the control panel for purposes of refueling, defueling and transfer to the main tanks. Any excess pressure in the tanks can be vented manually to atmosphere through the control panel. An additional pressure relief valve is installed to automatically relieve pressure at 6 psi.

AUXILIARY OIL TANK.

The auxiliary oil tank is clamped in a metal cradle and the cradle is bolted to the cargo compartment floor utilizing 5000 pound cargo tie-down rings at positions D3 and D5, and the lower seat support rail on the right side of the aircraft. The oil tank has a sight gage, marked with a red line indicating the half full condition. The two low oil level amber lights, one for each engine oil tank, are used to indicate when oil transfer should be made. A hand-operated rotary pump and a transfer valve assembly with positions marked OFF, LH, and RH controls oil transfer to the appropriate side engine. The auxiliary oil tank is vented to atmosphere.

FUEL MANAGEMENT PANEL.

The auxiliary fuel management panel (figure 7-1) incorporates a pressure regulator, a pressure gage, and a total of eight valves. The valves are: rear tank selector valve, forward tank selector valve, left and right wing tank shut-off valves, de-icer pressure shut-off valve, vent shut-off valve, pressure relief valve, and refuel vent valve. The two auxiliary tank selector valves have the following positions:

1. OFF.

2. TRANS - Allows fuel to flow from the auxiliary tank to the associated wing tank, i.e., forward auxiliary tank fuel flows to the right wing tank, rear auxiliary tank fuel flows to the left wing tank.

3. XFEED - Allows fuel to flow to both wing tanks from one auxiliary tank (other auxiliary tank OFF).

CAUTION

When cross-feeding fuel from one auxiliary tank to both main tanks insure that the tank selector valve of the empty auxiliary tank is OFF. Loss of air pressure and failure to transfer will result if the selector valve of the empty tank is in any other position.

4. REFUEL - Allows the auxiliary tank to be refueled.

The appropriate wing tank shutoff valve must be open during fuel transfer to the particular wing tank, and closed at all other times.

A short length of transparent flexible tubing is located beneath each fuel selector valve. The tubing allows visual indication of fuel flow, but only when air bubbles are present in the line.

Note

Because fuel is transferred from the auxiliary tanks to the wing tanks, and not directly to the engines, the standard wing tank gages in the flight compartment are used for fuel management.

AIR PRESSURE CONTROL.

Air pressure to the auxiliary tanks is controlled at the auxiliary fuel control panel in the cargo compartment when the wing and tail mode switch (figure 4-5) on the copilot's de-icing panel is on and pressure is available.

1. Deicer Pressure Shutoff Valve - This valve must be ON during fuel transfer to supply air pressure to the auxiliary fuel tanks, and during descent, to preclude collapse of the auxiliary tanks. At all other times the valve must be OFF. When fuel is not being transferred the valve should be OFF.

2. Vent Shutoff Valve - This valve is used to relieve excess air pressure in the auxiliary tanks.

3. Pressure Regulator - This regulator is normally preset on the ground to obtain a 5 psi reading on the pressure gage. It may be adjusted in flight to obtain this pressure, if necessary.

4. Pressure Gage - This gage registers the air pressure delivered to the auxiliary tanks from the pressure regulator.

5. Pressure Relief Valve - This valve will relieve air pressure in excess of 6 psi, to atmosphere.

6. Refuel Vent Valve - This valve has positions marked OFF, FWD, BOTH and REAR. When refueling the auxiliary tanks the valve must be selected to the appropriate tank or tanks being refueled. This will allow the displaced air to escape to atmosphere. At all other times the valve must be OFF.

FUEL LEVEL CONTROL VALVE.

A fuel level control valve is installed in cell No. 5 of each wing tank to prevent overfilling when fuel is transferred from the auxiliary tanks. Before fuel is transferred, the level of fuel in each wing tank must first be lowered below the control valve level, i.e., 1550 pounds (258 gallons).

ferrying system control panels -typical

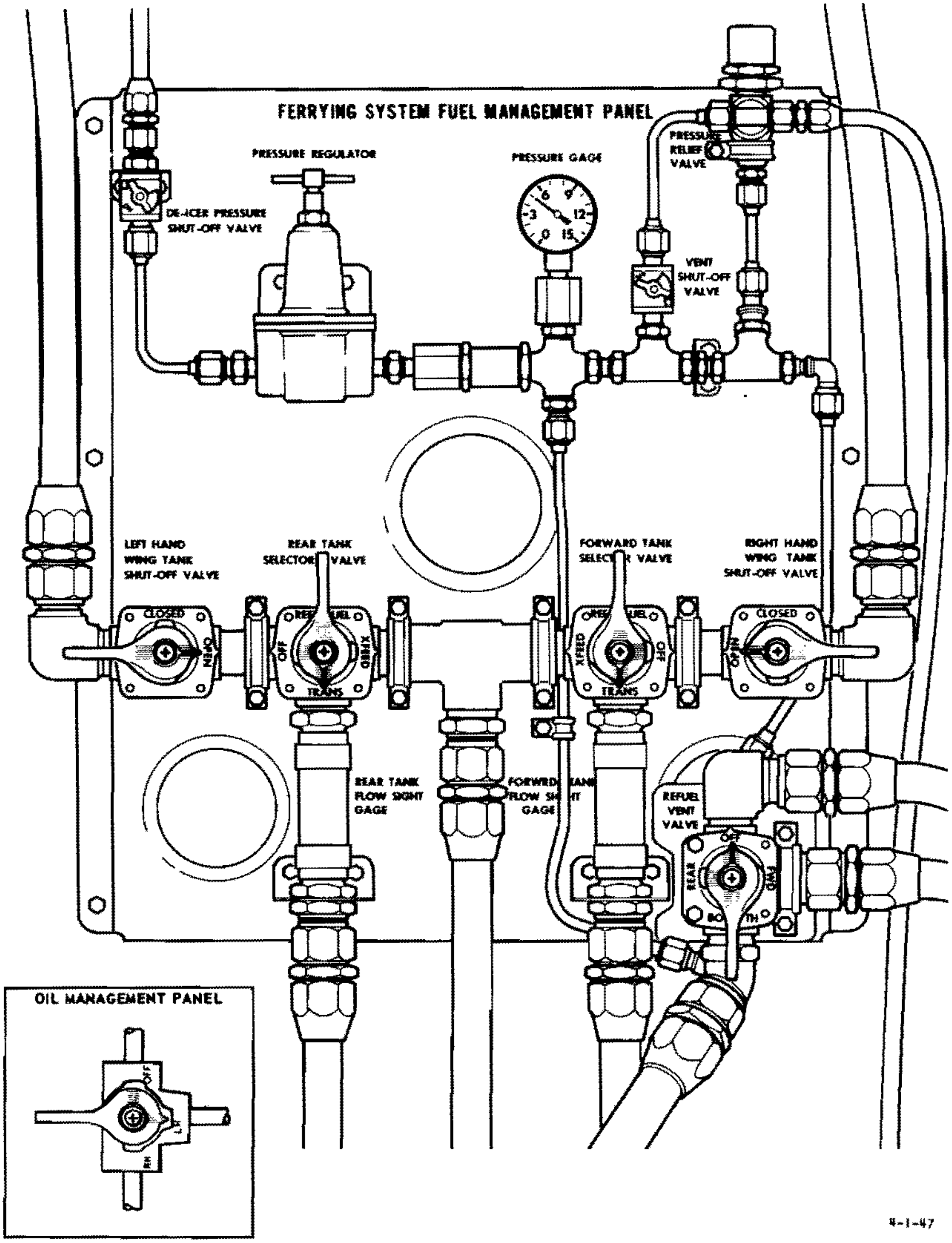


Figure 7-1 Ferrying System Control Panels - Typical

long range ferry fuel system - schematic

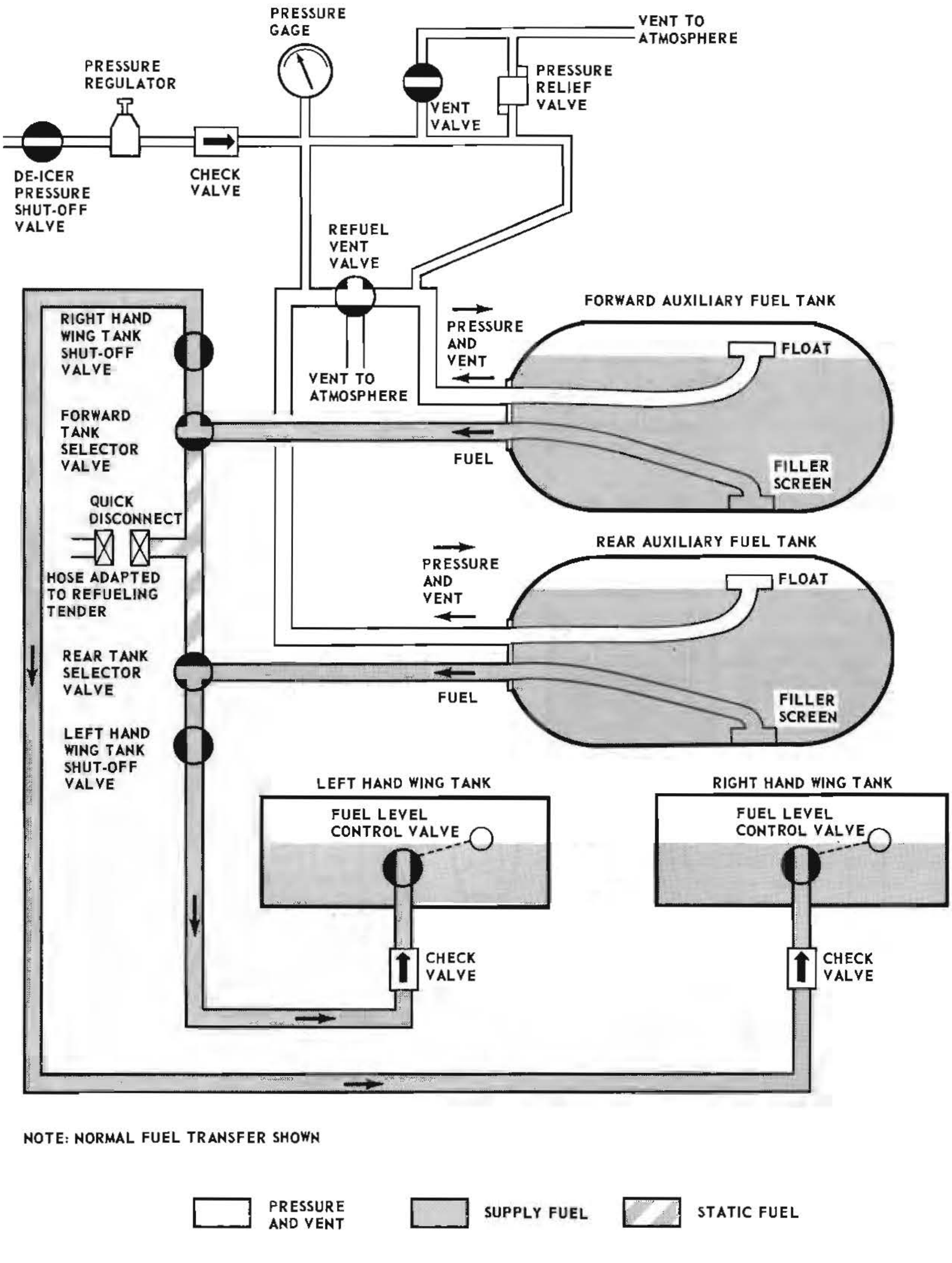


Figure 7-2 Long Range Ferry Fuel System - Schematic

FIRE EXTINGUISHER.

A hand-operated fire extinguisher of sufficient capacity to combat a petroleum fire is attached to the auxiliary oil tank.

REFUELING THE AUXILIARY TANKS.

The auxiliary fuel tanks should be refueled from a pressurized fuel supply to assure complete servicing. The hose is routed from outside through the emergency hatch.

FERRY TANK OPERATION.

The following procedures should be followed when using the long range ferry system. The checks and procedures are additional to those given in Section II.

PREFLIGHT CHECKS.

The following checks should be considered as additional items to the normal interior inspection:

WARNING

Smoking is not allowed in the aircraft at any time when ferry system is installed.

1. Check for any sign of fuel leakage in the ferry system and the cargo compartment.

2. Check the sight gages for approximate quantity of fuel in each auxiliary fuel tank and oil in the auxiliary oil tank.

WARNING

Fuel sight-gages give only approximate quantity readings. Consequently, the refueling operation must be monitored closely so that the actual amount of fuel pumped into the tanks can be verified.

Note

The top of the sight gage, between the vent connection in the tank and the top of the tank, should be full of air with the remainder of the sight gage full of fuel. Tapping the tank with a blunt object will also locate the level of fuel in the tank.

3. Check that the oil transfer valve is OFF.

4. Check all auxiliary fuel tank tie-down straps for security and tension.

5. Check that the air pressure in the auxiliary fuel tanks, is between 1 and 2 psi. Pressure in excess of 2 psi should be vented. When the required pressure is obtained, turn the vent shutoff valve OFF.

6. Check all auxiliary fuel and oil valves are OFF or CLOSED, as applicable.

7. Check propeller, wing and tail deicing mode switches are OFF.

ENGINE START.

1. Start the engines normally, using the wing tanks.

2. Check the deicing suction gage for normal suction of 4 in. Hg.

Note

A deicer pump is operated by each engine, and each pump supplies enough pressure for simultaneous deicing and fuel transfer. The above check, with both engines operating, does not constitute a check of both pumps. Each pump must be checked individually, preferably by checking one pump during engine shutdown and the other during engine start.

TAKE-OFF.

The take-off is made using the normal wing tank selection. The deicing mode switch should be OFF unless wing deicing is required.

INFLIGHT FUEL CONTROL.

For inflight fuel transfer, proceed as follows:

1. Continue to operate on the NORMAL tank selection until the supply of fuel in each wing tank reaches 1000 pounds as indicated on the aircraft fuel gages on the pilot's instrument panel.

2. Select the deicing mode switch to MANUAL. Check deicing pressure.

3. Select right boost pump switch HIGH. Set fuel selector to feed both engines from right tank.

Note

Since accurate fuel gages are not available for auxiliary tanks, engines should be operated from one main tank while the opposite main tank is being filled. This will enable the pilot to determine the amount of fuel transferred and will provide the best means of keeping track of fuel consumption and remaining fuel on board. Transfer fuel from forward auxiliary tank first to obtain the most favorable CG for cruising flight.

4. Select the controls on the ferrying system fuel management panel as follows:

a. Rear tank selector valve - OFF.

b. Forward tank selector valve - TRANS.

c. Left wing tank shutoff valve - OPEN.

d. Vent shutoff valve - OFF.

e. Refuel vent valve - OFF.

f. Deicer pressure shutoff valve - ON.

g. Pressure regulator - Adjusted to 5 psi.

5. When left main tank has filled to 1500 pounds, repeat procedure to fill right tank while operating both engines on the left main tank.

COMPLETION OF FUEL TRANSFER.

When transfer of fuel is completed from either or both auxiliary tanks, prevent buildup of air pressure in the wing tanks by selecting the controls on the fuel management panel as follows:

1. Wing tank shutoff valves - CLOSED.

2. Auxiliary tank selector valves - OFF.

3. Deicer pressure shutoff valve - OFF.

4. Deicing mode switch - OFF (unless required for deicing.)

FUEL CROSSFEED.

To crossfeed fuel from one auxiliary tank to both main tanks, select the controls on the ferrying system fuel management panel as follows:

1. Left and right wing tank shutoff valves - OPEN.

2. Forward tank selector valve - XFEED rear tank selector valve - OFF (if transferring from rear tank).

OR

Rear tank selector valve - XFEED forward tank selector valve - OFF (if transferring from rear tank).

3. When both auxiliary fuel tanks are empty, or ferry fuel ceases to be a requirement, select the switches and controls as directed in completion of fuel transfer.

AIR PRESSURE CONTROL.

While descending from altitude, maintain 2 psi air pressure in the auxiliary tanks to prevent the flexible tanks from collapsing. After landing, select the deicing mode switch to OFF.

INFLIGHT OIL SUPPLY.

The normal engine oil supply is used until a low oil level warning light, illuminates steadily. This indicates that approximately 9 gallons of oil remain in that oil tank. Transfer oil from the auxiliary tank as follows:

1. Auxiliary oil tank valve - Select appropriate tank.

2. Turn the handpump approximately 175 turns until the oil level reaches red line on the auxiliary oil tank sight gage.

3. When the other engine low oil level warning light comes on, transfer the remaining oil in the auxiliary tank to the affected main tank.

Note

Additional oil may be carried aboard the aircraft to reservice the auxiliary oil tank.

OPERATING LIMITS.

When long range ferry tanks are installed in the aircraft the following operating limitations must be observed, in addition to the applicable limitations specified in Section V.

Note

Operation above a gross weight of 28,500 pounds is permissible only for ferry operations and requires Major Air Command approval. The maximum gross weight for ferry configuration is 31,000 pounds for take-off.

WEIGHT.

The gross weight at which the aircraft may be operated with Major Air Command authority is as follows:

1. Gross weight - Ramp weight 31,300 lb.
- Take-off (sea level) 31,000 lb.
- Landing (sea level) 28,500 lb.

Note

Take-off gross weight may be further limited by operational factors such as temperature, altitude and available runway length. The extent of the limitation required may be determined by the responsible authority in the light of performance data contained in T.O. 1C-7A-1-1.

WARNING

Performance data are not available for weights in excess of 31,000 pounds.

2. Zero wing fuel weight - 27,000 lb.

CENTER OF GRAVITY.

At weights above 28,500 pounds the aircraft CG must be maintained between 31% and 39% MAC (wheels down).

TAKE-OFF.

Take-off at a gross weight of 31,000 pounds requires a paved runway of a minimum length of 6000 feet. Take-off is made with 0° flap, and lift-off should be made at 92 knots IAS. On a standard day at sea level take-off roll will be approximately 3000 ft.

EMERGENCY OPERATION.

Minimum Control Speed. The minimum control speed at a gross weight of 31,000 pounds with 0° flap remains the same as at a gross weight of 28,500 pounds with 7° flaps, i.e., 70 knots IAS.

Safe Single Engine Speed. The safe single engine speed at a gross weight of 31,000 pounds with 0° flaps and landing gear up is 92 knots IAS.

Stall Speed. The wing level stall speed at a gross weight of 31,000 pounds with 0° flaps, landing gear up and zero thrust, is 78 knots IAS.

Emergency Procedures - Engine Failure. Should an engine failure occur during take-off or in flight at a gross weight of 31,000 pounds, it is recommended that an emergency landing be made immediately rather than remaining airborne on one engine while burning off fuel to the approved landing weight of 28,500 pounds. The primary consideration in a single engine landing at high gross weight in the aircraft is performance. In view of increased brake energy requirements, runway length should be 6000 feet or more. Single engine rate of climb at maximum power, gear down, flaps up, is approximately 75 fpm at sea level (standard day). The aircraft structure and landing gear are adequate to sustain a carefully executed landing at 31,000 pounds.

WARNING

There is no provision for jettisoning auxiliary tanks or fuel.

Landing. The airspeed should be kept above the safe single engine speed of 92 knots IAS until committed to land; 95 knots IAS is recommended at 31,000 pounds gross weight. The landing gear should be lowered at the pilot's discretion. The flaps should not be lowered until on the final approach and only when landing is assured. Maintain 95 knots IAS on the approach and when landing is assured lower flaps required. Maintain safe single engine airspeed. Cross the threshold at safe single engine airspeed and execute a smooth touchdown. Use aerodynamic braking during initial landing roll and use brakes as sparingly as possible.

Go-Around. The decision to go-around must be made before flaps are lowered. A 31,000 pound aircraft will not maintain altitude at 95 knots with gear and approach flaps extended. Maximum power should be applied and the landing gear retracted. Airspeed should be maintained at 95 knots IAS. When clear of obstacles and the gear is up, power should be reduced to METO. Rate-of-climb will be approximately 130-140 fpm under standard conditions.

Climb Performance. Allowances should be made for non-standard conditions of temperature and humidity, turbulence, and variations in the performance of individual aircraft.

Oil Dilution System. (Refer to Section IX). The oil dilution system provides a method for introducing a controlled quantity of fuel into the engine oil system. The purpose of oil dilution is to lower the viscosity of the oil during cold weather. This makes starting easier, provides an immediate supply of lubricating oil to all moving parts, and also minimizes the risk of bursting flexible hose lines and oil coolers.

WHEEL BRAKES.

The proper use of the wheel brakes is emphasized in order to reduce accidents due to brake failure and cut down maintenance work. To minimize brake and tire wear, the following precautions should be observed:

1. Use extreme care when applying brakes immediately after touchdown, or at any time when there is considerable lift on the wings, to prevent skidding the tires and causing flat spots. A heavy brake pressure can result in locking the wheels more easily if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the aircraft is on the wheels. A wheel once locked in this manner immediately after touchdown will not become unlocked as the load is increased, as long as brake pressure is maintained. Proper braking action cannot be expected until the tires are carrying heavy loads.

2. If maximum braking is required after touchdown, lift should be decreased as much as possible by raising the flaps and lowering the nosewheel to the ground before applying brakes. This procedure will improve braking action by increasing the friction between the tires and the runway.

3. For short landing rolls the most effective braking is obtained by repeated intermittent use of maximum brake for periods not to exceed one full second, followed by a momentary release period.

4. It is recommended that a minimum of 15 minutes elapse between landing, where the landing gear remains extended in the slipstream, and a minimum of 30 minutes between landings where the landing gear has been retracted, to allow for cooling if brakes are used for steering, crosswind taxiing operation, or if a series of landings are performed.

5. The full landing roll should be utilized to take advantage of aerodynamic braking and brakes should be used as little and as lightly as possible.

6. After the brakes have been used excessively for an emergency stop and are in a heated condition,

the aircraft should not be taxied into a crowded parking area or the parking brake set. Peak temperatures occur in the wheel and brake assembly from 5 to 15 minutes after a maximum braking operation.

7. The brakes should not be dragged when taxiing, and should be used as little as possible for turning the aircraft on the ground.

EFFICIENCY OF BRAKES.

Brakes themselves can merely stop the wheels from turning, but stopping the aircraft is dependent upon the friction of the tires on the runway. It has been found that optimum braking occurs with approximately a 15 to 20 percent rolling skid, i.e., the wheel continues to rotate but has approximately 15 to 20 percent slippage on the surface so that the rotational speed is 80 to 85 percent of the speed which the wheel would have were it in free roll. As the amount of skid increases beyond this amount, the coefficient of friction decreases rapidly so that with a 75 percent skid the friction is approximately 60 percent of the optimum and, with a full skid, becomes even lower. There are two reasons for this loss of braking effectiveness with skidding. First, the immediate action is to scuff the rubber, tearing off small pieces which act almost like rollers under the tire. Second, the heat generated starts to melt the rubber and the molten rubber acts as a lubricant. NACA figures have shown that for an incipient skid with an approximate load of 11,000 pounds per wheel, the coefficient of friction on dry concrete is as high as 0.8, whereas the coefficient is in the order of 0.5 or less with a 75 percent skid. Therefore, if one wheel is locked during application of brakes there is a definite tendency for the aircraft to turn away from that wheel and further application of brake pressure will offer no corrective action. Since the coefficient of friction goes down when the wheel begins to skid, it is apparent that a wheel once locked, will never free itself until brake pressure is reduced so that the braking effect on the wheel is less than the turning moment remaining with the reduced frictional force.

SECTION VIII
CREW DUTIES

TABLE OF CONTENTS

INTRODUCTION.

Each flight crew member has duties other than the main duties covered in NORMAL PROCEDURES, Section II. These additional duties are prescribed in this Section.

PILOT.

Insures that a thorough inspection of the aircraft and all equipment is properly conducted. (The checklists for the pilot are covered in detail in Sections II and III.) Plans the mission by analyzing information concerning its nature, the expected weather over the mission route, and special instructions. Prepares or supervises the preparation of the flight plan and clearance. Supervises and coordinates the activities of the crew members during flight planning and preparation. Inspects, or supervises the inspection of the aircraft. Determines that the weight and center of gravity are within prescribed limits. Insures that the troops and passengers have been briefed. Insures inspection of all items of bailout, ditching and survival equipment. Assigns the employment of navigational and communications equipment to the copilot. Coordinates the activities of crew members and airborne personnel in paradrops of cargo or personnel. Insures that required flight logs, records, and maintenance forms are prepared.

COPILOT.

Assists pilot in planning mission by obtaining pertinent weather forecasts, intelligence reports, maps, and other documents. Upon instructions from pilot, assists in plotting the mission route and calculating the route information and fuel requirements. Assists the loadmaster in determining the cargo distribution and in computing the center of gravity of the aircraft. Assists the pilot in insuring that the exterior and interior inspections of the aircraft are completed, and performs additional inspections when instructed to do so by the pilot. Assists the pilot in operating controls and equipment on the ground and in flight. Prepares the flight log and required records and maintenance forms. Operates the communications equipment and assists the pilot in navigating the aircraft.

FLIGHT ENGINEER.

Operates system controls. Controls cabin air to provide proper cabin ventilation and temperature. Reports condition of engines and cargo compartment to the pilot after every take-off. Operates engine and control devices. Continuously monitors tachometers and manifold pressure gages and reports unusual conditions to pilot. Monitors circuit breakers, temperature and pressure indicators and electrical voltage and loads. Observes warning lights and fire detection indicators. Reports abnormal conditions to pilot and recommends corrective action. Computes aircraft weight and balance and performs preflight and postflight inspections. Inspects engines for general condition and for absence of fuel leaks. Ascertains that temperatures have not exceeded limits. Assists the pilot in troubleshooting malfunctions. Visually checks gear down prior to every landing and reports position of the gear to the pilot. In the absence of qualified personnel, supervises the maintenance of the aircraft in general and performs servicing operations. Assigns repair work to ground crew members; reviews work for completeness and accuracy. Instructs subordinates in flight engineer procedures.

LOADMASTER.

The duties in the checklist below will be delegated to the loadmaster by the pilot. The loadmaster will monitor the interphone as directed after the STARTING ENGINES checklist.

LOADMASTER'S CHECKLIST.

PRIOR TO ENTERING

1. Wheel chocks	In place
2. Electrical ground	Connected
3. External power	As required
4. Gear locks	Installed

INITIAL PREFLIGHT

1. Form 781 — Checked

Check the 781, Part II, 781A, 781B, for status of aircraft and aircraft discrepancies.

2. Weight and balance handbook — Checked

Check the last entry in chart C and use in preparation of DD Form 365F.

3. Load adjuster — Checked

CARGO COMPARTMENT

1. Crash axe	Installed
2. Static line retriever	Checked/stowed
3. Anchor cables	Installed/checked
4. Stowage compartments	Checked for proper contents
• 5. Pendulum release system	Checked/as required
6. Tiedown devices	Quantity and condition

Note

Normal 263 equipment includes six chains and devices, twenty 5000 lb straps and twenty conveyor tie-down clamps and one A-2 cargo tie-down net.

7. Seat and seat belts	Check condition/installed, as required
8. Cargo floor/rollers	Checked/rollers installed, as required
9. First aid kits	Checked
10. Entrance doors	Checked
11. Ramp door and controls	Checked
12. Utility light	Secured
13. Ground loading ramps	Checked/secure
14. Fire extinguisher	Checked

15. Relief tube	Checked/secure
16. Steady strut	Checked
17. Headset	Installed

POWER ON

1. Interphone	Checked
2. Troop jump lights	Checked
3. Static line retriever	Checked
4. Pendulum release system	Checked
5. Ramp and door	As required

PRIOR TO LOADING

1. Load planning	Completed
2. Cargo doors and ramp	As required
3. Steady strut	As required
4. Manifests	Checked
5. Cargo inspection	Complete

LOADING

Refer to T.O. 1C-7A-9, AFM 71-4 and other appropriate publications for handling and loading instructions.

AFTER LOADING

1. Steady strut	Removed/stowed
2. Cargo door and ramp	As required
3. Loose equipment	Stowed
4. Cargo	Check for fumes or leaks
5. Load tie-down	Completed/checked
6. Manifests and Form 365F	Submit to pilot

ENGINE START, TAXI AND ENGINE RUNUP

1. Ramp and doors	Closed/as required
2. Monitor cargo compartment for fluid leaks	
3. Observe lower side of wings and engine nacelles for leaks, etc	

BEFORE TAKE-OFF

1. All exits	Secure
2. Tie-downs	Checked
3. Seat belts	Fastened

AFTER TAKE-OFF

1. Wings and nacelles	Scanned
2. Cargo	Checked for security

IN FLIGHT

1. Scan wings, nacelles and report any abnormal indications to the pilot
2. At least once each hour check complete cargo compartment for leaks, securing of passengers, etc

DESCENT

1. Passengers	Briefed
2. Cargo	Checked

BEFORE LANDING

1. Visually check main landing gear	DOWN/index marks aligned
2. Seat belts	Fastened

ENGINE SHUTDOWN

1. Exit clearance	On command of pilot
2. Wheel chocks	In place
3. Gear locks	Installed

OFF-LOADING

1. Cargo door and ramp	As required
2. Steady strut	As required

BEFORE LEAVING AIRCRAFT

1. Cargo compartment	Cleaned
2. Steady strut	Stowed
3. Cargo door and ramp	Closed
4. Equipment	Stowed
5. Form 781	Completed

PASSENGER BRIEFING CHECKLIST.

Prior to blocktime, a crew member will brief passengers on the following items as applicable to the mission being flown.

PRE DEPARTURE

1. Crew, route, times, weather and altitude
2. Seats and safety belts
   a. All passengers should have a seat with a complete seat belt and should be briefed on the use

of the seat belt. Instruct passengers to observe fasten seat belt sign

3. Movement in aircraft

   a. Passengers will be briefed to remain seated with seat belts fastened during take-off, landing taxi operations and at other times when directed by the pilot or other crew members

4. Smoking

   a. Smoking will be at the discretion of the pilot (and the troop commander or jumpmaster when applicable). Smoking will not be permitted until after take-off and will be discontinued during letdown for landing. At no time will smoking be allowed on the ground within 50 feet of the aircraft. Instruct passengers to observe no smoking sign

5. Air sickness

   a. Air sickness bags will be provided for passengers who request them. Passengers will be responsible for removing them from the aircraft after the flight

6. Electronic devices

   a. Passengers having electronic devices such as transistor radios and other private or professional electronics gear will not use them during flight

7. Opening the doors

   a. Doors will not be opened in the air or on the ground by anyone except an authorized crew member

8. Exit after flight

   a. Passengers will remain seated after flight, with seat belt fastened, until directed to leave the aircraft by an authorized crew member

9. Emergency procedures

   a. Use of parachute

      (1) When applicable, the fitting and use of the parachute will be explained

   b. Bail-out (when applicable)

      (1) Signals - 3 short followed by one long

      (2) Exits - Cargo ramp and door and paratroop doors

      (3) Take emergency gear, exposure suits, boots and warm clothing

c. Crash landing

(1) Signals - 6 short followed by one long, one long if just after take-off

(2) Remain seated until aircraft stops

(3) Exits - Left side escape hatch, cargo ramp and door, entrance doors and cockpit escape hatches

(4) Exit quickly without panic; take survival gear and warm clothing

d. Review all ground and air exits

e. Questions

OVER WATER BRIEFING

1. Signals - 6 short followed by one long; don life vests and exposure suits

2. Remain seated until aircraft stops; there may be two separate impacts

3. Exit routes - Left side escape hatch, entrance doors and cargo door

4. Inflate life vests and enter assigned rafts which will be released from the cargo compartment

ARRIVAL BRIEFING

1. Time

2. Observation of no smoking sign

3. Observation of seat belt sign

4. Remain seated

SECTION IX
ALL WEATHER OPERATION

TABLE OF CONTENTS.

INTRODUCTION.

This section contains only those procedures that differ from or are in addition to the normal operating instructions covered in Section II, except for some repetition necessary for emphasis, clarity, or continuity of thought.

INSTRUMENT FLIGHT PROCEDURES.

The aircraft may be provided with navigational equipment and instrumentation for using VOR, TACAN, ADF, GCA and ILS navigational aids. It is the responsibility of the pilot to ensure that each crew member is thoroughly briefed on the exact procedures he is expected to follow during all phases of aircraft operation. If required to land under IFR conditions, additional fuel allowance must be made for letdown and holding procedures, and the maximum range is reduced accordingly. The aircraft has satisfactory instrument flight characteristics in all phases of operation. Steep turns and abrupt maneuvers should be avoided. All turns should be limited to bank angles not exceeding 30°. No special technique due to aircraft configuration or operation is required. The radio and navigational aids provide adequate coverage for practically all conditions of instrument flight.

WARNING

This aircraft contains various combinations of navigational receivers, course indicators and radio magnetic indicators. Before flight, pilot's must determine the type of navigation equipment installed and operational; the operation of controls and switches used to select navigation displays; the function of each RMI, bearing pointer and course indicator and the means of monitoring identification signals of navigation aids being used.

PRE-FLIGHT AND GROUND CHECKS.

Perform the preflight Inspections, as outlined in the normal operating procedures in Section II.

INSTRUMENT TAKE-OFF AND CLIMB.

Preparation for an instrument take-off begins long before aligning the aircraft with the take-off runway. Be thoroughly familiar with the departure route, altitude restrictions, communication and navigation aid frequencies, prior to take-off. Insure that the aircraft can conform to the climb gradient specified on published departures.

1. Before take-off:

a. Communication and navigation aid frequencies, IFF, departure course, should be set prior to taking the runway.

b. Precipitation, low ceilings or visibility or night take-offs may require exclusive reference to the flight instruments soon after lift off. Plan to have an instrument cross-check in progress at or shortly after lift off.

c. Perform the before take-off checklist; align the miniature aircraft on both attitude indicators with the horizon bar and when cleared, taxi into take-off position.

d. Align the aircraft; recheck the heading indications, attitude indicator and navigation and communication frequencies. Perform the line-up checklist.

CAUTION

Attitude indicators without an attitude warning flag should not be used for instrument flight until 15 minutes after electric power has been applied.

Note

The rotating beacon should be turned off during flight in clouds or fog to prevent distracting reflections that could cause spatial disorientation.

e. Turn on anti-icing and deicing systems as required and use carburetor heat as necessary.

2. Take-off:

a. Use the normal take-off procedures outlined in Section II. It is recommended that radar monitoring be used when available, in the event that return to the airfield becomes necessary. Visual references, if available, should be used to maintain alignment during the take-off roll.

b. At minimum control speed or take-off speed, whichever is greater, raise the nose wheel and smoothly establish a 4-bar width pitch change on the attitude indicator. Hold this attitude and allow the aircraft to fly itself off.

c. When the aircraft is in a definite climb as indicated by the altimeter and vertical velocity indicator, retract the gear and flaps.

d. Maintain a climbing attitude for the perforance required and accomplish the after take-off checklist.

Note

Minor pitch trim changes should be expected during flap retraction and power reduction.

CRUISE.

Conduct instrument cruise flight using the normal operating procedures outlined in Section II. Use anti-icing and deicing equipment as required.

WARNING

When reference to the standby magnetic compass is necessary, the windshield heat switch must be OFF. With windshield heat ON, the cycling of electric power creates erratic magnetic deviation and causes unreliable standby compass indications.

HOLDING.

1. The recommended holding airspeed is 110 knots clean configuration, regardless of gross weight.

2. For extended holding or if fuel is a consideration, RPM should be reduced (refer to T.O. 1C-7A-1-1).

INSTRUMENT APPROACHES.

VOR, TACAN, ADF, radio range, ILS or GCA instrument approaches may be flown. Flight characteristics during instrument approaches do not differ from those encountered during visual flight. Normally 110 knots IAS is used for all maneuvering until final approach airspeeds are established. Final approach speeds and configuration will be established at or prior to final approach fix or glide slope. Descent and before landing checklists will be accomplished in accordance with Section II and will be performed as depicted in figures 9-1 and 9-2.

Note

Instrument approach patterns will vary and will not necessarily be flown as illustrated in figures 9-1 and 9-2.

CIRCLING APPROACH.

If a circling approach is required, maintain 110 knots IAS until turning to base leg and proceed with a normal landing procedure.

MISSED APPROACHES.

In the event of a missed approach, immediately apply required power and simultaneously establish a climb attitude. Retract the landing gear and flaps as required when a definite climb is shown on the vertical velocity indicator and altimeter. Accelerate to climb speed and maintain until reaching desired missed-approach altitude. Execute the appropriate missed-approach procedure.

ICING CONDITIONS.

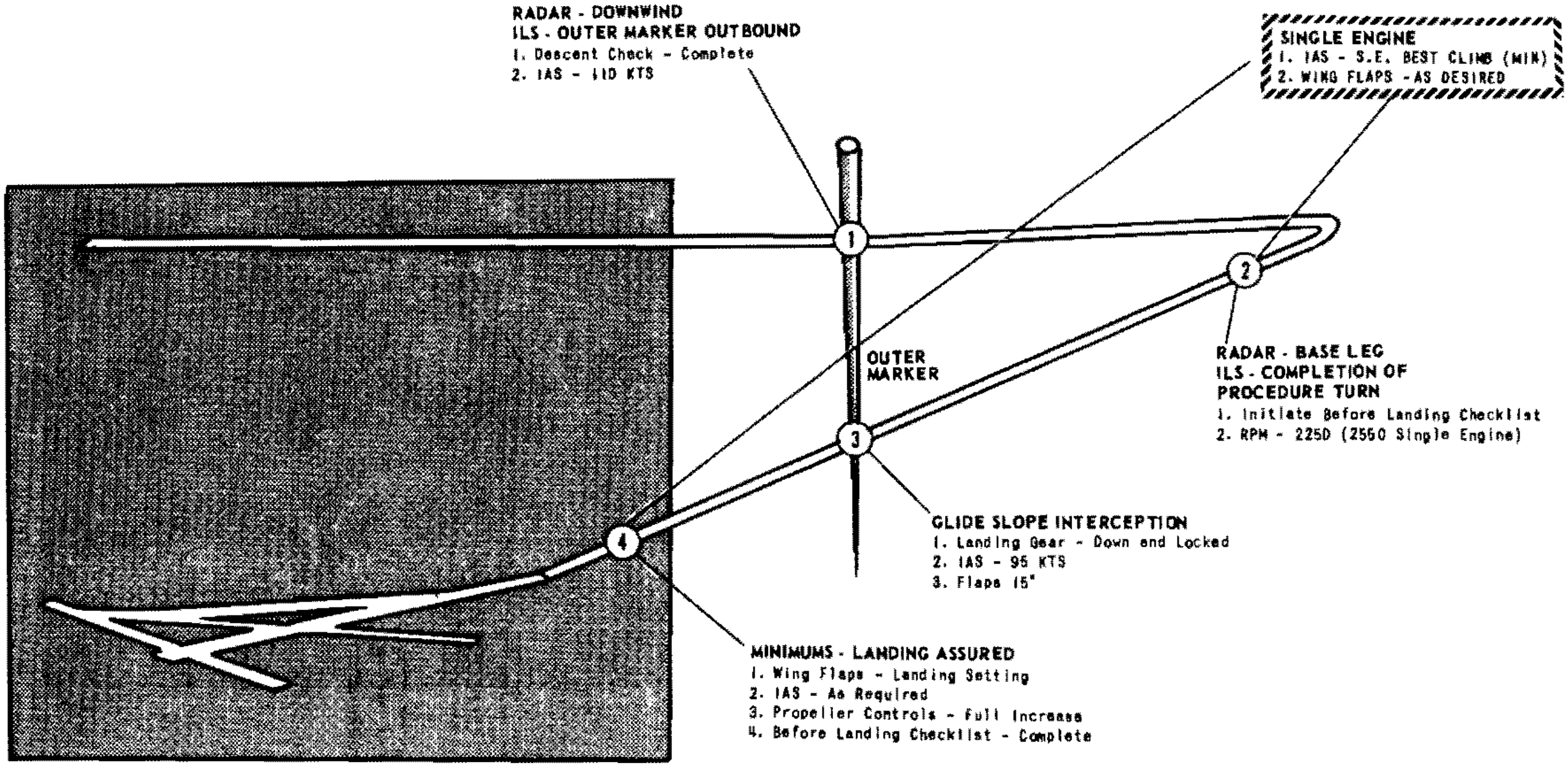
Avoid icing conditions whenever possible. The biggest danger caused by ice accumulation is the reduced aerodynamic efficiency. Specifically, ice accumulation may have the following effects: Higher take-off, landing, and stall speeds; reduced rate of climb; increased power requirements, thus increasing fuel consumption and decreasing range and endurance; impaired control response; and reduced engine power. If a buildup takes place on the nose section it may create erratic effects at the static ports and cause unreliable airspeed indications, even though the ports themselves are not iced.

WARNING

Do not fly into known or forecast moderate or heavy icing conditions.

Altitude should be changed, when possible, to altitudes where icing conditions are not encountered. The aircraft is equipped with wing and tail deicers, propeller anti-icing, carburetor heat, pitot heaters, windshield anti-icers, and heater intake anti-icers. If icing conditions cannot be avoided, the following procedure should be followed:

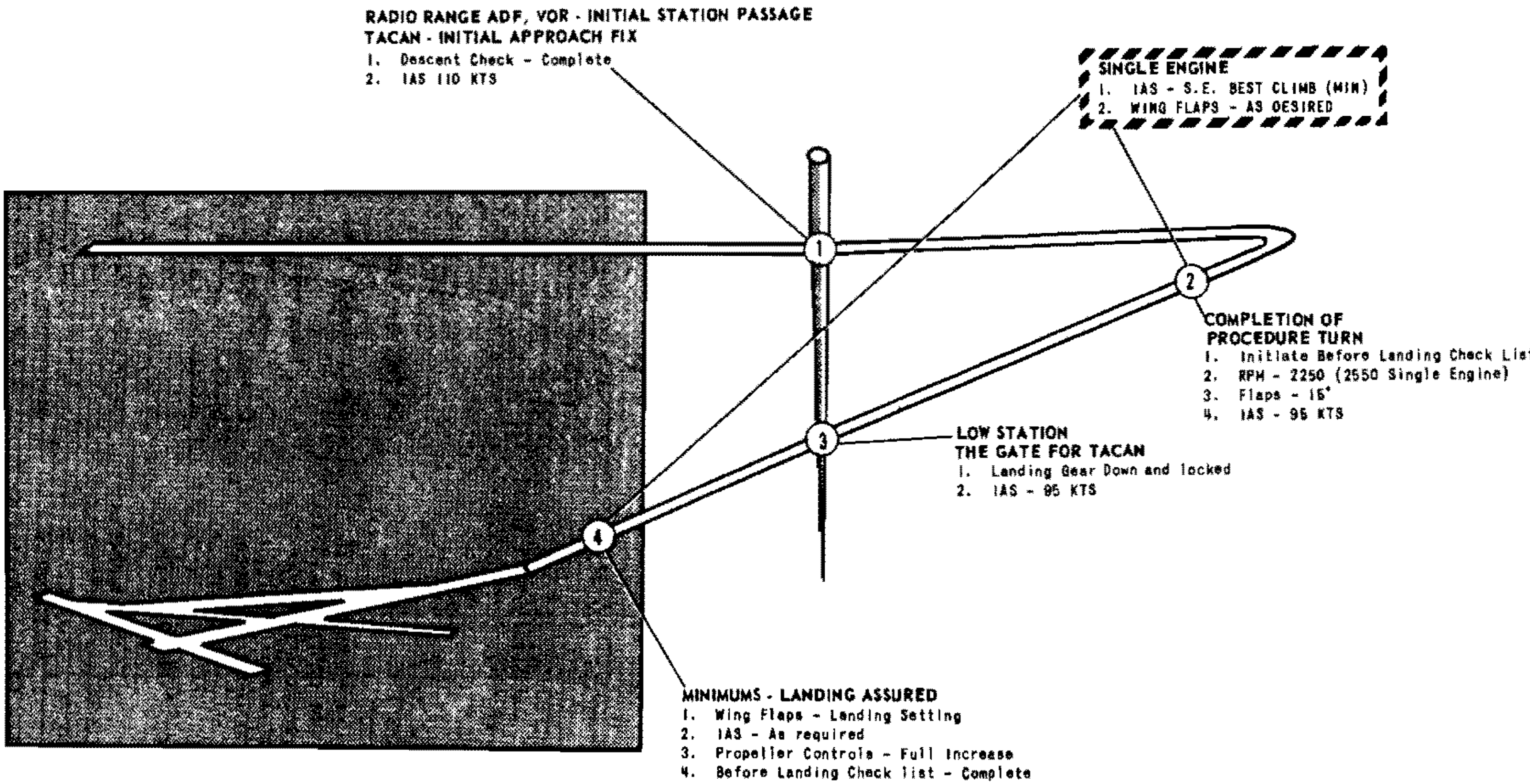
radar or ils approach-typical



NOTE
This is a typical diagram not meant to show the intended flight path. It does indicate a chronological order for the items to be performed. These items may be performed before, but in no case later than the point indicated on the diagram.

Figure 9-1 Radar or ILS Approach - Typical

radio range, adf, vor or tacan approach - typical



NOTE

This is a typical diagram, not meant to show the intended flight path. It does indicate a chronological order for the items to be performed. These items may be performed before, but in no case later than the point indicated on the diagram.

Figure 9-2 Radio Range, ADF, VOR or TACAN Approach - Typical

4-1-65

1. Select the least severe icing altitude, consistent with mission objectives, traffic, or combat conditions. Consideration should be given to outside air temperature, nature of clouds, type of icing (rime, clear) anticipated or being encountered, and duration of icing.

2. The wing and tail deicers should be used with care. In heavy icing conditions, use of the system at the first sign of ice may allow an ice buildup to begin at the inflated contour of the boots. The boots are then unable to reach and break the accumulated ice and they become useless. The system is designed for deicing, not anti-icing. A moderate accumulation of ice should be allowed to develop before the system is operated. The slow boot cycle is effective in all but the most severe icing conditions, i.e., ice buildup greater than 1/4 inch per minute.

3. Pitot heat, and heater intake anti-icing, should be on when visible moisture is present or when icing conditions are anticipated. The circuit for each stall warning lift-transducer vane anti-icer is routed via the pitot heater switch. Windshield heat should be on for the duration of the flight. Windshield wipers will keep the windshields clear. Propeller anti-icing should be used continually at any time icing is encountered. Appreciable accumulation of ice on the propeller can cause engine vibration. If ice has accumulated, exercising the propeller levers will assist in throwing off the ice. Propeller icing is more likely to occur at the lower RPM settings.

4. Carburetor icing may occur in moisture or precipitation at ambient temperatures above the icing range. When carburetor icing is suspected, carburetor heat should be applied as necessary to maintain +15°C carburetor air temperature. If icing conditions are anticipated, apply carburetor heat 15 minutes before entering the icing area.

5. Delay extension of flaps and landing gear until absolutely necessary to avoid excessive ice accumulation on the flaps and landing gear.

CAUTION

If possible avoid flight in freezing rain. If freezing rain is unavoidable, do not operate the aircraft at low airspeeds with corresponding higher angles of attack, as there is a possibility of ice accretion on areas that are not anti-iced.

TURBULENCE AND THUNDERSTORMS.

Thunderstorms and areas of moderate turbulence should be avoided where possible and should only be penetrated intentionally if it is impossible to go around them. When flying under conditions of low visibility, clear passage around or between thunderstorms can usually be identified with radar. The aircraft has adequate control response in turbulent conditions. The optimum thunderstorm penetration speed of 110 knots IAS should be set up prior to entering the storm zone and the aircraft should be flown with regard to the VG limitations.

WARNING

When flying in heavy rain, the alternate air induction system may be required to avoid engines drowning out.

APPROACHING THE STORM.

Select an altitude below 10,000 feet above ground level and proceed as follows:

1. Check that all passengers and crew are seated, check security of cargo and that all safety belts and harnesses are correctly fastened and tight.

2. Turn pitot heater switch on.

3. Turn heater intake anti-icing switches on.

4. Turn windshield heat switch to normal.

5. Set propeller levers - 2200 RPM.

6. Select alternate air source.

7. Set throttles to maintain 110 knots IAS (optimum penetration speed).

8. Set communications equipment as required and reduce volume of any radio equipment badly affected by static.

9. Turn flight compartment lights full bright to minimize blinding effect of lightning.

WARNING

Do not lower landing gear or wing flaps.

IN THE STORM.

Proceed as follows:

1. Maintain the original power setting and pitch attitude throughout the storm. If these are maintained, airspeed indicator fluctuations can be disregarded. Maintain level attitude by reference to the attitude indicator.

2. Maintain the original heading. Do not make any turns unless absolutely necessary.

3. Do not correct for airspeed indicator fluctuations, since doing so may result in extreme aircraft attitudes, with a danger of stalling.

4. Use as little elevator control as possible to minimize the stresses imposed on the aircraft.

WARNING

The altimeter may be unreliable due to differential barometric pressure within a thunderstorm. An indicated gain or loss of several hundred feet is not uncommon, and should be allowed for in determining minimum safe altitude.

Note

Altitudes between 10,000 and 20,000 feet are usually the most turbulent areas in a thunderstorm.

NIGHT FLYING.

Conduct night operations in accordance with normal operating procedures given in Section II. Set exterior lights and interior lights as required. For night take-offs, either taxi or landing lights may be used.

Note

To avoid spatial disorientation, it is recommended that the anti-collision light be turned off during flight in clouds.

COLD WEATHER PROCEDURES.

Extreme cold can have adverse effects on aircraft materials. Rubber, plastic, and fabric materials stiffen and may crack, craze, or even shatter when loads are applied. Oils and lubricants congeal. Adjoining metals contract differentially, and could result in adverse variations in tolerances. Moisture, usually from condensation or melted ice, freezes in critical areas. Tire, landing gear strut, fire extinguisher bottle, and accumulator air pressures decrease with a temperature decrease. Extreme diligence on the part of both ground and flight crews is required to insure successful cold-weather operation. The procedures and precautions outlined here pertain to operating unhangared aircraft in cold weather and are in addition to the normal procedures given in Section II.

Note

Cold weather is generally considered 0°C (32°F) and below.

BEFORE ENTERING THE AIRCRAFT.

Perform a normal preflight inspection of the aircraft as outlined in Section II. In particular, check the following:

1. Check for removal of snow, ice and frost on the wings, fuselage, stabilizer, all flight control surfaces, hinges, fuel and oil vents and drains, static ports, pitot heads, heater vents, carburetor, and oil cooler air intakes.

CAUTION

Do not attempt to scrape or chip ice from flight surfaces or fuselage, Exercise care to prevent personnel injury from slipping and falling.

2. Preheat engines, if required. Preheat is required if temperatures are below 0°F (-18°C) even though oil dilution was accomplished at shutdown. Preheat should not be considered adequate unless oil will flow from the oil tank sump drains.

Note

If an engine is too stiff to start, the starter clutch will slip.

CAUTION

Insure that moisture from melted ice is not allowed to remain in critical areas where it may refreeze.

3. After removal of wheel covers, check the landing gear struts, actuating cylinders, locking mechanism, wheels and brakes for freedom from ice, snow or slush.

4. Check that the tires are not frozen to the ground.

BEFORE STARTING ENGINES.

1. Check that heat has been applied to the cargo compartment and the flight compartment.

2. Check passenger doors, cargo door, emergency exits and flight compartment windows to see that they open easily.

3. Check that the parking brake handle is in the OFF position. If the handle is found to have been left ON, the brakes may be frozen. Notify the ground crew and, if necessary, direct that heat be applied to the brake discs and cylinders.

WARNING

If isopropyl alcohol has been used to remove frost from the aircraft, check the interior of the aircraft for alcohol leaks and fumes. This condition may create a fire hazard.

4. Prior to starting engines remove all protective covers.

STARTING ENGINES.

Except as noted in the following paragraphs, make cold weather starts using the procedures described in Section II.

Note

If sufficient heat has been applied to the engine, and the starter clutch slips during starting, a hydraulic lock probably exists. Remove spark plugs from the bottom cylinders, let cylinders drain and pull propeller through by hand. Reinstall plugs and attempt another start.

It may be necessary to run the engine on prime alone for longer periods than normal if it will not run smoothly in auto-rich initially.

If possible, the engine should be kept running on the first starting attempt. Ice may form on the spark plugs within a few seconds if the engine fires and then stops. If the engine has not started after two or three attempts, several spark plugs should be removed and examined for ice. If icing has occurred, the front plugs should be removed and heated to dry the electrodes before making another starting attempt.

If the oil pressure does not register within 30 seconds after starting, the engine should be shut down and the cause investigated.

Note

The oil pressure may be abnormally high immediately upon starting. As the oil temperature increases, the pressure should drop to normal. Do not increase engine speed above 1000 RPM until oil temperature and pressure are within limits.

Carburetor heat may be used as soon as the engine is firing regularly to improve vaporization and combustion. Return the lever to COLD when the engine is operating normally.

WARM UP.

If the weather is extremely cold, oil may congeal in the oil cooler. The first indication of this will be a very high oil temperature with a decrease in oil pressure. As the congealed oil is forced into the system, a sudden drop in temperature and a large increase in pressure will occur. A careful check should be maintained on oil pressure and temperature and sufficient time allowed for a thorough engine warm up. If oil pressure registers and then drops below normal after a few minutes of operation, the engine should be shut down and checked.

The wing flaps should be operated through one complete cycle while being observed by a ground crew member. Check the flap position indicators to make certain the flaps reach their extreme positions without hindrance from undetected snow or ice. Stop the flaps at various positions to determine if the control and position indicators are in operating condition.

OIL DILUTION BOIL-OFF.

Boil-off is the action of raising the engine operating temperature, and maintaining it at a sufficiently high level, to vaporize the fuel that was introduced into the oil during the oil dilution procedure. The vapor leaves the engine through the engine drain and breather box vent. Adequate boil-off is essential to avoid the possibility of oil venting from the engine or oil tank breather. If insufficient boil-off has been allowed, insufficient engine lubrication will result. In addition the high engine temperatures associated with take-off will rapidly vaporize the fuel in the oil and, if this action is too rapid, the vapor may not separate from the oil fast enough and froth will form in the engine crankcase. This results in an overpressurization of the system, forcing oil out of the engine drain and breather box vent, and can only be stopped by reducing engine power. Should this occur, the oil level should be checked and a complete boil-off procedure should be carried out. Figure 9-3 lists the time required to boil-off the excess fuel, commencing when the oil temperature reaches 45°C. The oil temperature should, and normally will, continue to increase from this temperature, but must not exceed 75°C. If the previous oil dilution period was for

ANTICIPATED TEMPERATURE °F	°C	DILUTION PERCENT	MINUTES TO DILUTE AT 1400 RPM	MINUTES TO BOIL-OFF-OIL TEMP 55 TO 75° C	HOT FUEL PRIME	PREHEAT (UNTIL CYL HD TEMP IS ABOVE 0°C)
32 TO 0	0 TO -18	6	1	NONE	YES	NONE
0 TO -20	-18 TO -29	17	2	25	YES	YES+
-20 TO -35	-29 TO -37	20	2 1/4	30	YES	YES+
-35 TO -50	-37 TO -46	25	2 1/4	35	YES	YES+
-50 TO -65	-46 TO -53	30	3	40	YES	YES+

+ INCLUDING AIR PUMP

Figure 9-3 Oil Dilution and Boil-off Table less than one minute, no boil-off procedure is required. If the dilution period was for more than one minute, carry out the following procedure:

1. Fit the restrictors to the augmentor tubes to decrease the cooling effect of the tubes.

2. Start the engines in accordance with Section II.

3. Warm-up at 1000 RPM; maintain this setting for at least 10 minutes. Continue running if necessary, until the oil temperature reaches 5°C.

4. Advance throttles to 1200 RPM; maintain this setting for at least 5 minutes, or until the oil temperature reaches 20°C.

5. Advance throttles to 1400 RPM, maintain this setting for at least 5 minutes, or until oil temperature reaches 40°C. Increase manifold pressure to 28 in. Hg while maintaining 1400 RPM with the propeller levers.

6. Advance propellers to 1600 RPM and maintain 28 in. Hg until the oil temperature reaches 45°C, and commence boil-off time check.

Note

> A cylinder head temperature of 200°C, and an oil temperature of 75°C, must not be exceeded during the warm-up and boil-off procedure.

TAXIING.

1. Turn pitot heater switch ON.

2. Direct the ground crew to check that the tires are not frozen to the ground prior to taxiing.

3. Check that wheels are rotating. Use nose wheel steering, differential braking, and differential power for best directional control.

4. Insure all instruments have warmed up sufficiently. Check for sluggish operations during taxiing.

5. Taxiing will cause the engines to cool, a sudden increase in power may result in engine back firing. On reaching the take-off position, insure that engines are warm and that power is increased gradually.

ENGINE RUNUP.

Select an area that has the best available surface for braking and conduct the engine and propeller checks outlined in Section II. Avoid parking aircraft close together or near obstructions when performing engine runup.

Note

> Surfaces covered with loose snow generally provide better braking than surfaces covered with compact snow.

When runup must be conducted on snow-covered surfaces, do not attempt to make power checks until the aircraft is lined up on the runway and ready for take-off.

BEFORE TAKE-OFF.

1. Turn windshield heat switch to normal.

2. Set carburetor air induction switch as required.

3. Set carburetor hot air levers as required.

Note

> Carburetor heat may be used during the take-off to assist in the vaporization of fuel, to reduce rough running and to avoid loss of power. Do not allow the temperature to exceed the maximum permissible of +30°C, to prevent detonation; otherwise a loss of power will result during the climb.

TAKE-OFF.

WARNING

> Do not attempt a take-off with snow, ice or frost accumulations on the wing and tail surfaces.

Runway conditions permitting, slowly advance power to 30 in. Hg and assure that the engines are running smoothly prior to releasing brakes. If a crosswind take-off is necessary on an ice surface, use asymmetric engine power to maintain direction, remembering that the take-off distance will be increased.

CAUTION

> For take-off in colder than standard conditions, avoid over-powering the engine beyond its rating. Reduce maximum manifold pressure 1 in. Hg for each 10°C below standard carburetor air temperature.

AFTER TAKE-OFF.

After take-off from a slush-covered surface and after reaching a safe altitude, the landing gear and flaps should be exercised through a few complete cycles to prevent their freezing in the retracted position.

DURING FLIGHT.

At very low temperatures, low cylinder head and carburetor air temperatures may cause rough running. This condition may be corrected by applying carburetor heat; if this is not sufficient the mixture lever should be placed in AUTO RICH.

DESCENT.

If a temperature inversion is expected during a descent, a close watch must be kept on engine temperatures, even when using a high power setting. If necessary, the landing gear may be lowered, so that higher power settings may be used. Carburetor heat should be used as necessary.

APPROACH AND LANDING.

Glide approaches should not be made under cold weather conditions. Normal powered approaches are recommended to maintain normal engine temperatures. Use carburetor heat as necessary. If the landing surface is slush covered, the flaps should be retracted as soon as possible after touchdown. Maintain directional control by use of rudder and differential brakes and if the surface is icy or a crosswind exists, maintain directional control by use of asymmetric engine reverse power. If reverse thrust is used at slow speeds on snow or slush-covered surfaces, complete loss of visibility may occur. Use windshield heat and pitot heat during landing. Turn on windshield wipers if needed. Make the turn-off slowly to avoid skidding.

CAUTION

Careful use of the brakes is required when landing on an ice covered surface.

ENGINE SHUTDOWN.

If a subsequent cold weather start is anticipated, oil dilution should be completed prior to engine shutdown. The extent of dilution depends entirely on the anticipated temperature during the period of shutdown. (Refer to figure 9-3.) A check must be made to insure that the oil tank level is 3 gallons below the full mark. The engines must be idled until the oil temperature is below 40°C (or stopped and cooled, then restarted) before the dilution procedure is commenced.

Note

Do not attempt oil dilution at oil temperatures above 45°C.

OIL DILUTION.

Proceed as follows for each engine.

1. Turn fuel tank selector switch to normal.

2. Turn fuel booster pump switches off.

3. Turn autofeathering switch off.

4. Adjust the throttle to 1400 RPM. Propeller levers should be at full increase RPM and oil temperature at 40°C.

5. Turn the appropriate engine oil dilution switch on for the required time (refer to figure 9-3).

Note

The time quoted is the elapsed time from selecting dilution to selecting idle cut-off. After selecting idle cut-off, the propeller will continue to rotate for approximately 10 seconds, during which time the dilution switch should be retained in the ON position.

6. Position the mixture lever to IDLE CUT-OFF when the required time has elapsed.

Note

Do not start the engines or add oil to the system after dilution is completed. Do not allow the oil pressure to drop below 45 psi during the dilution procedure.

BEFORE LEAVING THE AIRCRAFT.

Insure that a postflight inspection is accomplished, giving special attention to the following:

1. Drain condensation from fuel and oil system sumps and drains.

2. Remove all ice from vents, drains, and breathers.

3. Clean landing gear shock struts of dirt and ice with a clean cloth soaked with hydraulic fluid.

4. Install all exterior protective covers and shields.

5. If the aircraft is to remain outside for a period of more than four hours at below-freezing temperatures, remove the battery and store it in a heated room.

6. Close all doors and hatches.

7. Insure that the aircraft is tied down and chocked.

HOT WEATHER PROCEDURES.

Hot weather operation as distinguished from desert operation generally means operation in a hot, humid atmosphere. High humidity usually results in the condensation of moisture throughout the aircraft. Possible results include malfunctioning of electrical equipment, fogging of instruments, rusting of steel parts, and the growth of fungi in vital areas of the aircraft. Further results may be pollution of lubricants and hydraulic fluids, and deterioration of nonmetallic materials. The procedures essential to operations under such conditions are given in the following paragraphs.

BEFORE ENTERING THE AIRCRAFT.

Perform a normal preflight inspection, as outlined in Section II. Give special attention to the following:

1. Plan the flight thoroughly. Include the determination of range, take-off distance, and other data for existing conditions, using performance data charts in T. O. 1C-7A-1-1.

2. Cool the flight compartment and cargo compartment with portable coolers, if available.

3. Check for freedom of corrosion or fungus at joints, hinge points, and similar locations.

4. Check for hydraulic leaks, as heat and moisture may cause seals and packings to swell.

5. Inspect the shock struts and actuators for cleanliness. Use a cloth moistened in hydraulic fluid to clean. Inspect the tires for proper inflation.

6. Remove all protective covers and shields.

BEFORE STARTING ENGINES.

Perform the normal preflight inspection, as outlined in Section II; giving special attention to instruments, equipment and controls. If they are moisture coated, wipe dry with a clean soft cloth.

TAXIING INSTRUCTIONS.

Taxi the aircraft as directed in Section II. Use brakes as little as possible, to avoid overheating.

Note

> If temperatures approach the maximum limit during prolonged ground operation, the throttle should be advanced to increase airflow through the coolers and engine.

TAKE-OFF.

Execute normal take-off and climb, as outlined in Section II.

Note

> Take-off run is considerably increased, and rate of climb decreased, in high temperatures. Refer to the appropriate charts in T. O. 1C-7A-1-1.

CRUISE.

Follow normal procedures for the operation of the aircraft, as outlined in Section II.

LANDING.

Execute normal approach and landing, as outlined in Section II.

Note

> For a given indicated airspeed, the true airspeed increases as atmospheric temperature rises. Therefore, on very hot days, anticipate a longer landing roll.

STOPPING ENGINES.

Make a normal engine shutdown as outlined in Section II. As soon as the aircraft is parked, chock wheels and release brakes to avoid possible damage to brake components from excessive heat generated while taxiing.

BEFORE LEAVING THE AIRCRAFT.

Make a normal postflight inspection as outlined in Section II, and:

1. Install appropriate protective covers for protection from the sun.

2. When weather conditions permit, leave flight compartment windows and cargo compartment doors open to ventilate the aircraft.

DESERT PROCEDURES.

Desert operation generally means operation in a very hot, dry, dusty and often windy atmosphere. Under such conditions, sand and dust will accumulate in vital areas of the aircraft, such as hinge points, bearings, landing gear shock struts, and engine cowling and air intakes. Severe damage to the affected parts may be caused by the dust and sand. Position the aircraft so that propwash will not subject other aircraft, personnel, and ground equipment to blowing sand or dust. The necessary operations under such conditions are given in the following paragraph.

BEFORE ENTERING THE AIRCRAFT.

Perform a normal preflight inspection as outlined in Section II. Give special attention to the following:

1. Plan the flight thoroughly. Include the determination of range, take-off distance, and other data for the existing conditions, using the charts in T. O. 1C-7A-1-1.

2. Cool the flight compartment and cargo compartment with portable coolers, if available.

3. Inspect all control surface hinges and actuating linkage for freedom of sand and dust.

4. Inspect tires for proper inflation.

5. Inspect shock strut extensions and actuators for freedom of sand or dust, particularly in the area next to the cylinder seals. Insure that the shock strut extensions are clean.

6. Remove all protective covers and shields.

BEFORE STARTING ENGINES.

Continue the normal preflight inspection of the aircraft, as outlined in Section II. Give special attention to the following:

1. Inspect for sand or dust deposits on instrument panels and switches, and on and around flight and engine controls.

2. Operate all controls through at least two full cycles to insure unrestricted operation.

TAXIING INSTRUCTIONS.

Taxi the aircraft as directed in Section II, using care to avoid blowing sand or dust on other aircraft, personnel, or equipment. Use the brakes as little as possible, to avoid overheating. The use of reverse thrust may blow sand and dust into the air directly in front of the engine/air intakes. In deep sand, use differential power, rather than nose wheel steering, for directional control. Minimize ground operation to avoid excessive engine temperatures and gravel erosion of the propellers. Use carburetor air filtering as required.

TAKE-OFF.

Execute normal take-off and climb, as outlined in Section II. Avoid take-off during sand or dust storms, if possible. Take-off run is considerably increased and rate of climb decreased in high atmospheric temperatures. Refer to the appropriate charts in T. O. 1C-7A-1-1.

CRUISE.

Follow normal procedures for the operation of the aircraft, as outlined in Section II. Avoid flying through dust or sand storms, when possible. Use carburetor air filtering as required.

LANDING.

Execute a normal approach and landing, as outlined in Section II. For a given indicated airspeed, the true airspeed increases as atmospheric temperature rises. Therefore, on very hot days, anticipate a longer landing roll. Use carburetor air filtering as required.

STOPPING ENGINES.

Park the aircraft as soon as possible to prevent excessive cylinder head temperatures. Make a normal engine shutdown as outlined in Section II. As soon as the aircraft is parked, chock the wheels and release the brakes to avoid damage to brake components due to excessive heat generated while taxiing.

BEFORE LEAVING THE AIRCRAFT.

Make a normal before leaving the aircraft inspection, as outlined in Section II, giving special attention to the following:

1. Install all protective covers and shields.

2. Except when sand and dust are blowing, leave flight compartment windows and cargo compartment doors open to ventilate the aircraft.

ALPHABETICAL INDEX

Asterisk indicates illustration

A

B

C

D

G