



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 11, 2014

AIRWORTHINESS

Group Chairman's Factual Report

DCA13MA121

**Attachment 6 – N93PC Airplane Flight Manual and Supplements
(135 pages)**



DHC-3 OTTER

AIRPLANE FLIGHT

MANUAL

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VIKING

Revision 14 – Mar. 1, 1966

AMENDMENTS

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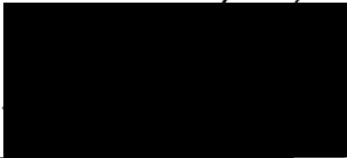
Date: 18 October, 1985

To: Distribution

Subject: Reissue of Approval Page for PSM 1-3-1, DHC-3 Otter
Flight Manual

The attached approval page reissue dated 26 August, 1985 includes D.O.T. aircraft type approval No. 27 in its approval statement.

Remove and destroy the previously issued approval page dated 4 June, 1984 from the front of the manual and insert the attached new page.


for/J. Kirkham,
Manager,
Technical Publications,
Customer Support Department.

DHC-3

OTTER

FLIGHT MANUAL

THIS AIRCRAFT MUST BE OPERATED IN COMPLIANCE WITH THE LIMITATIONS CONTAINED IN CHAPTER IV OF THIS MANUAL.

THIS MANUAL IS LISTED AS AN APPROVED DOCUMENT IN D.O.T. AIRCRAFT TYPE APPROVAL NO. 27 AND F.A.A. AIRCRAFT SPECIFICATION NO. A-815.

THE PRESENT ISSUE DATE OF THIS MANUAL IS JULY 1953

Approved: 

for Director, Airworthiness Branch
Department of Transport

Date:

26 August 53

DHC-3 OTTER
FLIGHT MANUAL

July. 1953.

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IDENTIFICATION DATA

AIRCRAFT NATIONALITY:- Canadian

REGISTRATION NUMBER:-

NAME AND ADDRESS OF
MANUFACTURER:- The De Havilland Aircraft
of Canada Limited.
Downsview. Ontario.

PLACE AND DATE OF
CONSTRUCTION:- 1953
Downsview Ontario, Canada.

AIRCRAFT TYPE NUMBER:- DHC-3

AIRFRAME SERIAL NUMBER:-

NUMBER OF ENGINES:- 1 (one)

ENGINE TYPE:- Pratt and Whitney Wasp
R-1340 S1H1-G or S3H1-G
geared, nine cylinder, air
cooled, supercharged radial.

NUMBER OF PROPELLERS:- 1 (one)

PROPELLER TYPE:- Hamilton - Standard
Blade - 6631A-9
Hub - 3D40-277
Governor - 1A2-G5
Three-bladed, constant-speed
counterweight type.

AIRCRAFT TYPE APPROVAL
NUMBER:- 27 - Dated 27 November 1952

APPROVAL BASIS:- ICAO Annex 8, 2nd Edition
Category D

APPROVAL AGENCY:- Department of Transport
Ottawa, CANADA

CHAPTER I

DESCRIPTION OF AIRCRAFT

1.1 GENERAL

The DHC-3 "OTTER" airplane is an all-metal, high wing monoplane powered by a single Pratt and Whitney "Wasp" engine driving a Hamilton Standard constant-speed propeller. The aircraft has been designed to carry a pilot and from six to eleven passengers. It may also be used for liaison duties, ambulance and rescue operations, for forestry, border and coast patrols, for spraying, dusting, aerial surveying and for photographic operations or cargo transportation. The non retractable landing gear may be replaced by a twin floats installation, an amphibious floats installation, a ski installation or by a combination wheel-ski installation.

Through partitions the aircraft is divided into a cockpit, a cabin and a baggage compartment.

1.2 DIMENSIONS. General over-all dimensions of the airplane are:

Length	41 feet, 10 inches
Wing Span.....	58 feet, 0 inches
Height (to top of rudder- tailwheel on ground).....	12 feet, 6.6 inches

1.3 GROSS WEIGHT. The maximum gross weight of the aircraft is 8000 pounds for the landplane and amphibian, 7967 lb for the seaplane.1.4 ENGINE

The airplane is powered by a Pratt and Whitney "Wasp" R-1340, model S1H1-G or S3H1-G geared nine cylinder, air-cooled, radial, supercharged engine rated at 600 BHP. The two engine models are similar in every respect with the exception of the super-charger ratio which is 12:1 for the S1H1 engine, 10:1 for the S3H1 engine, resulting in rated altitudes of 6,200 feet and 3,000 feet respectively.

The supercharger is of the direct-connected, engine driven centrifugal type and is not under the control of the pilot.

1.4.1 EXHAUST AUGMENTOR TUBES. The two exhaust augmentor tubes on both sides of the fuselage, just below the cockpit doors, (marked "NO STEP") are a special design feature of the aircraft.

In these four exhaust augmentor tubes, the exhaust gases produce suction strong enough to pull cooling air around the engine and from behind the engine accessories compartment while at the same time providing a measurable amount of thrust in cruising flight. The engine is thus effectively cooled during steep climbs when the forward air speed is low and engine output near its maximum.

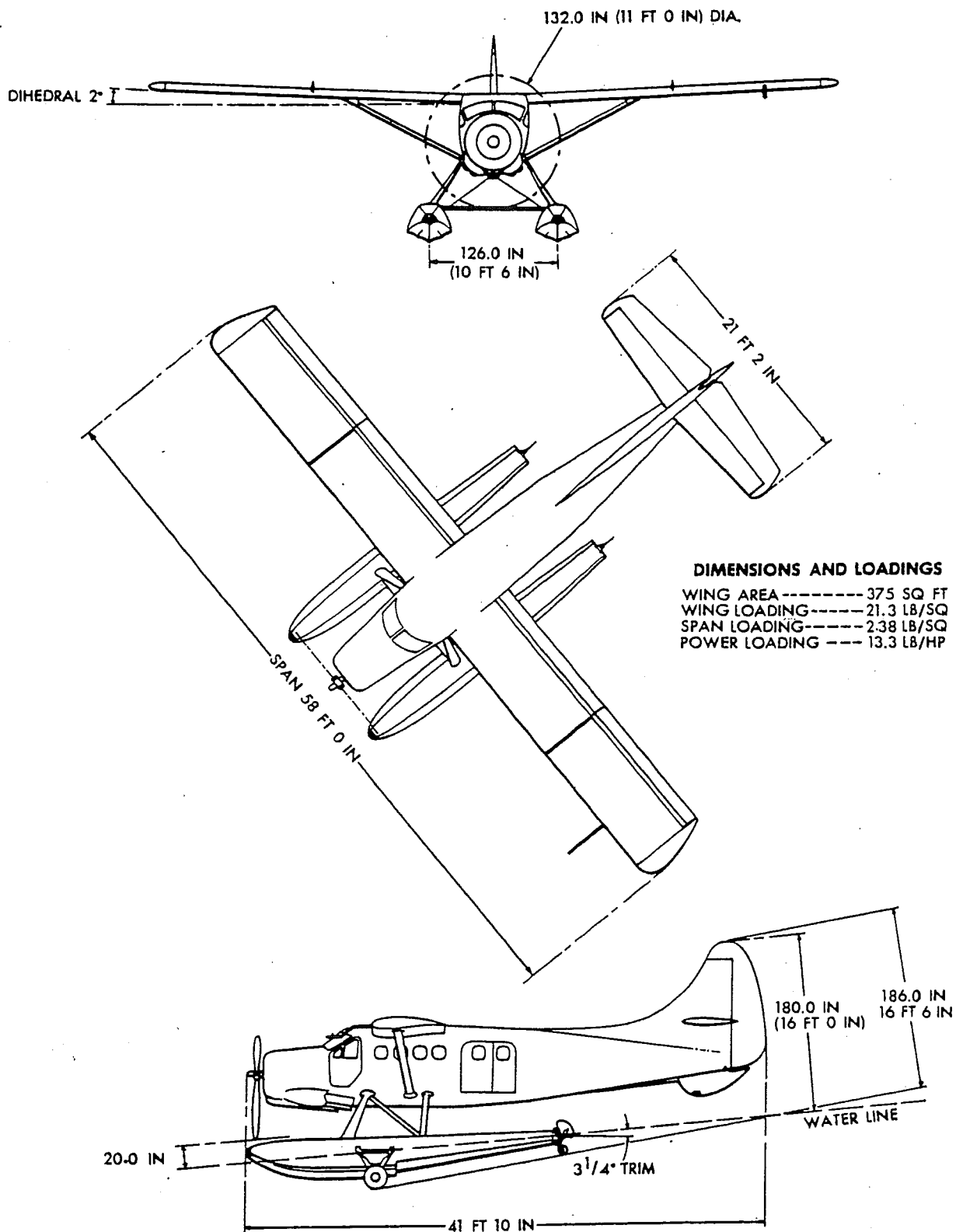


FIG. 1-1 THREE VIEW DIMENSIONAL DIAGRAM: SEAPLANE

May 1955

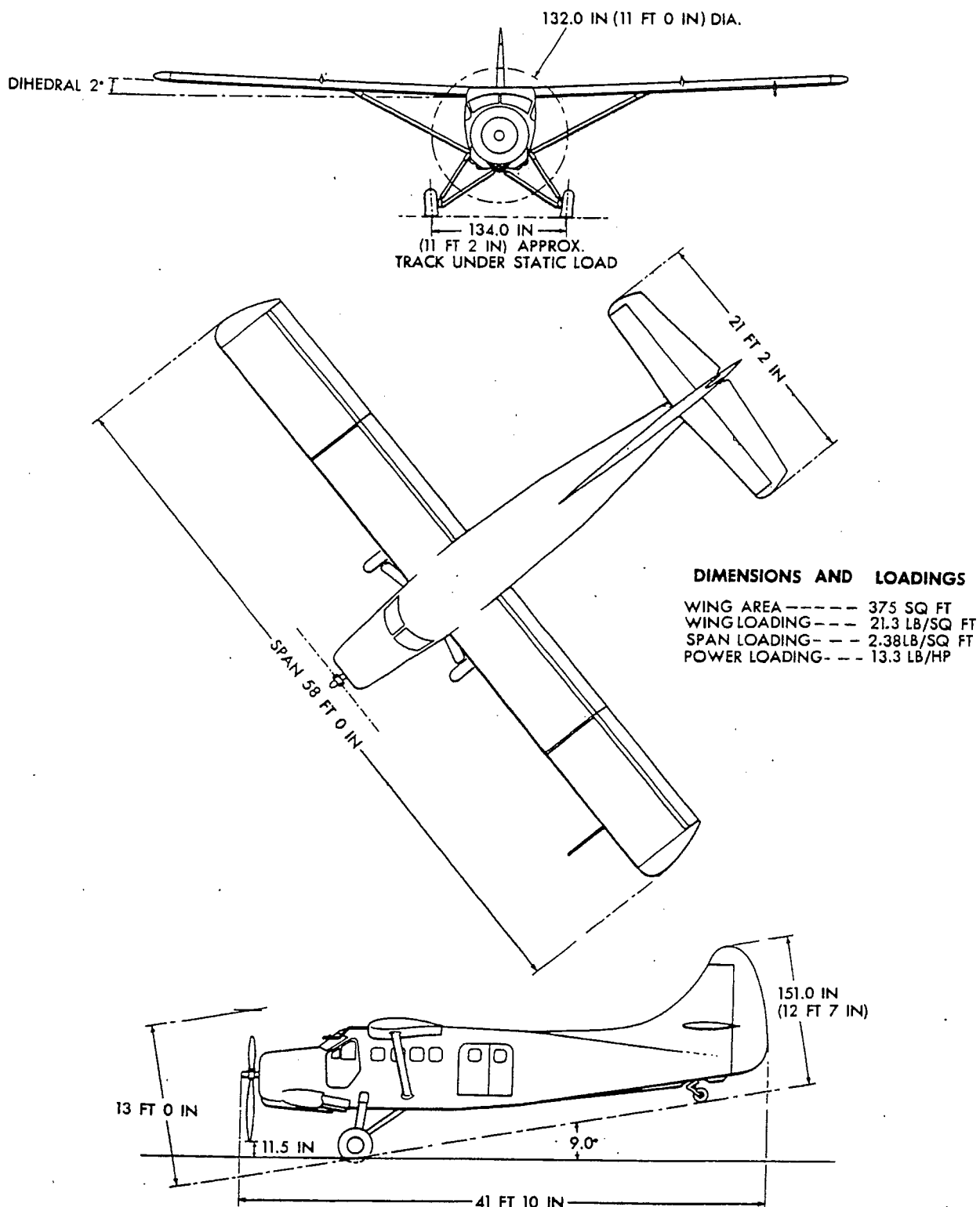


FIG. 1-2 THREE VIEW DIMENSIONAL DIAGRAM: LANDPLANE

May 1955

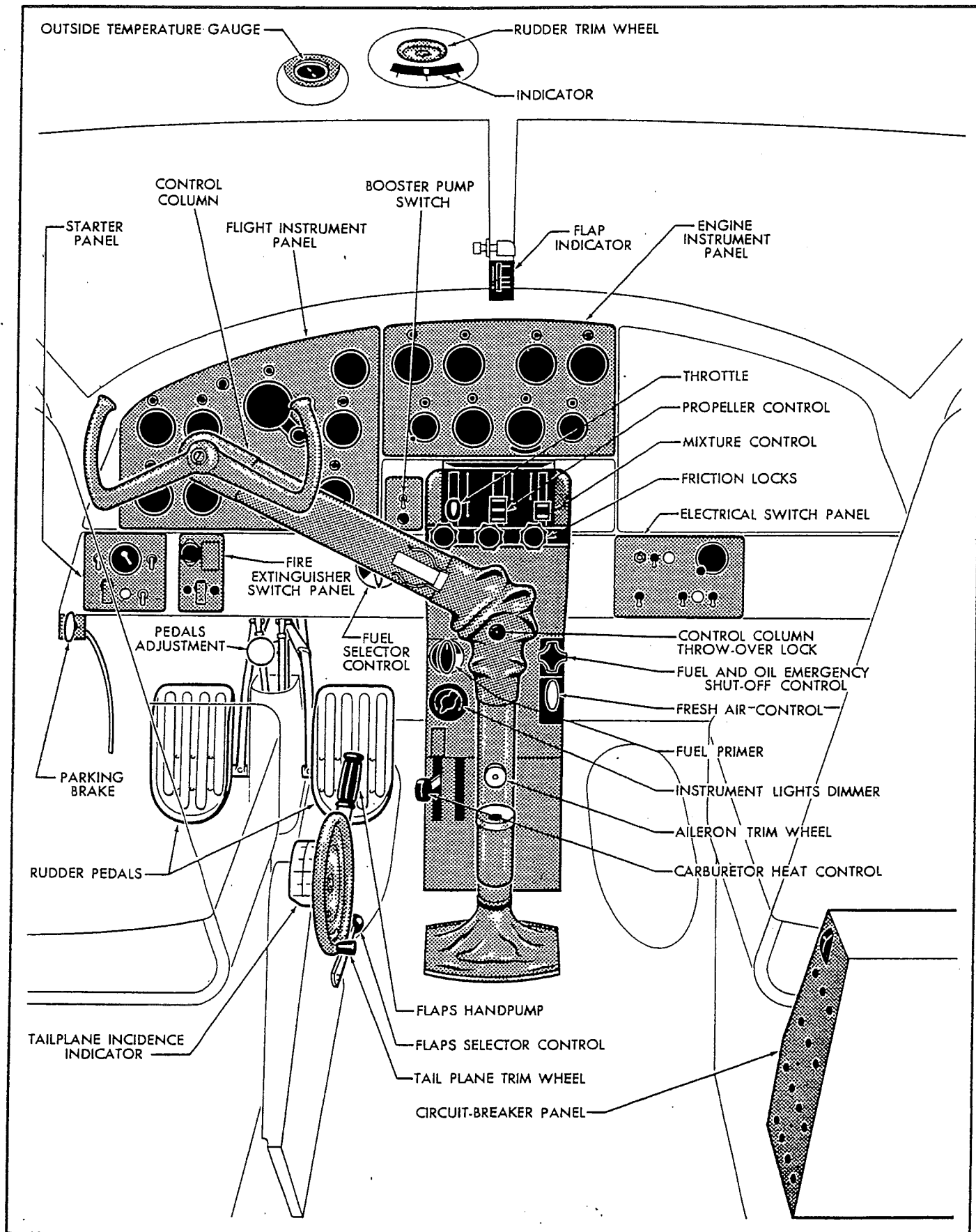


FIG. 1-3 INSTRUMENT PANELS AND FLIGHT CONTROLS

1.5 ENGINE CONTROLS

1.5.1 **THROTTLE.** The throttle control lever at the left of a quadrant at the top of the pedestal slides in a gate marked CLOSED and OPEN. The lever is connected by a flexible cable and conduit control to the carburettor throttle valve.

A friction control below the throttle lever prevents throttle creep when rotated clockwise.

1.5.2 **MIXTURE CONTROL.** The fuel air mixture ratio is manually determined through the mixture control lever at the right of the quadrant. Reading from the rear to the front, positions marked on the quadrant gate are: IDLE CUT-OFF, FULL LEAN, and FULL RICH.

A friction control knob below the control lever prevents the control from creeping and permits to set any intermediate position, when tightened clockwise.

1.5.3 **ENGINE INSTRUMENTS.** Conventional engine instruments are mounted on a panel above the engine controls quadrant.

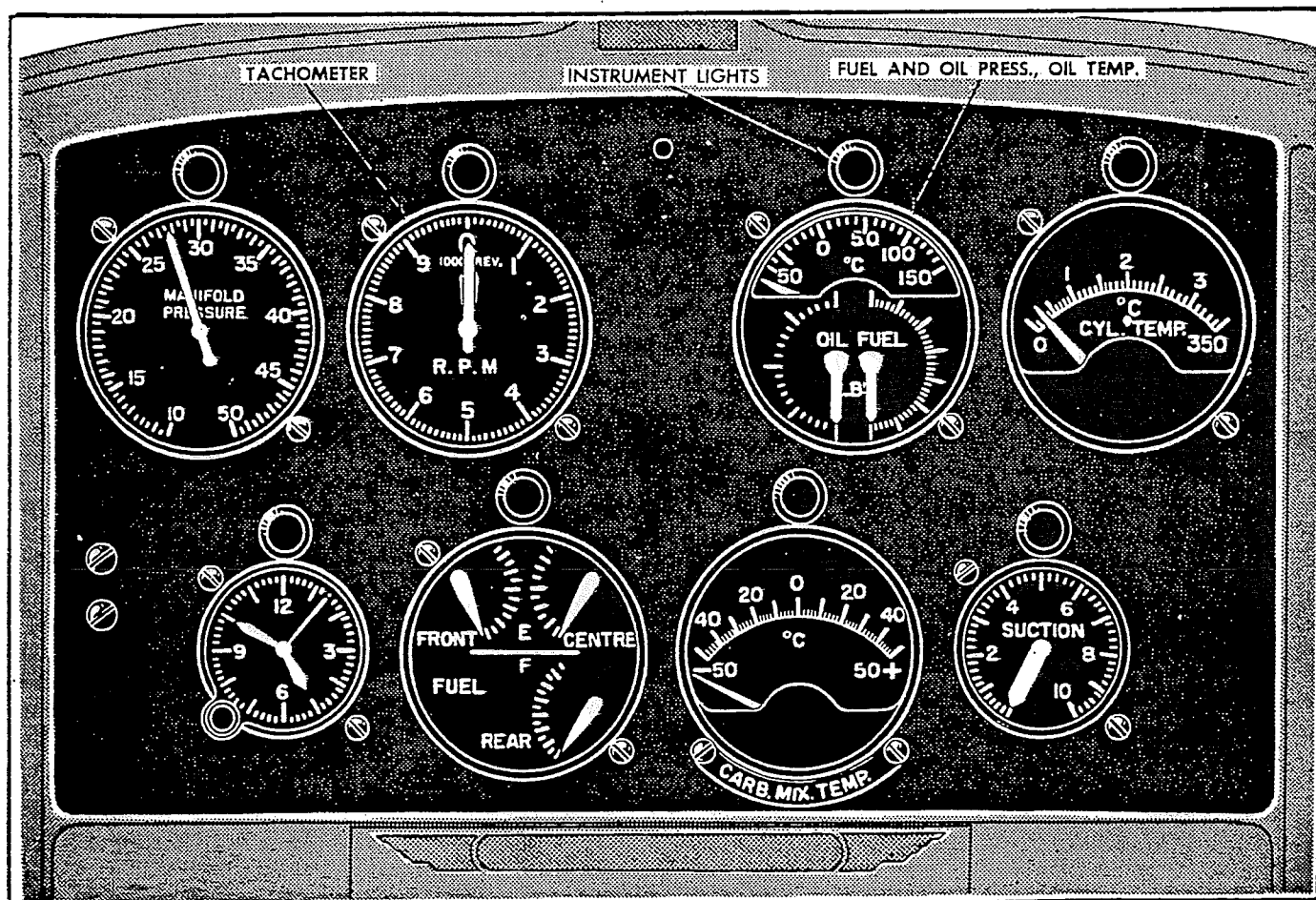


FIG. 1-4 ENGINE INSTRUMENT PANEL

They consist of:

Tachometer	Carburettor Mixture Temp. Gage
Manifold Pressure Gage	Oil Pressure Gage
Cylinder Head Temperature Gage	Oil Temperature Gage
Fuel Pressure Gage	

The tachometer indicator is operated by an electrical generator driven by the engine.

A triple indicator fuel contents gage and a clock are also located on the engine instrument panel.

- 1.5.4 ENGINE IGNITION SWITCH. The engine ignition switch is located on the starter panel below the pilot's flight instrument panel. The switch is marked "OFF", "R", "L" and "BOTH".
- 1.5.5 CARBURETTOR HOT AIR CONTROL. The carburettor hot air control lever is located on the left side of the base of the pedestal and is mechanically linked to a barrel valve in the carburettor air intake.

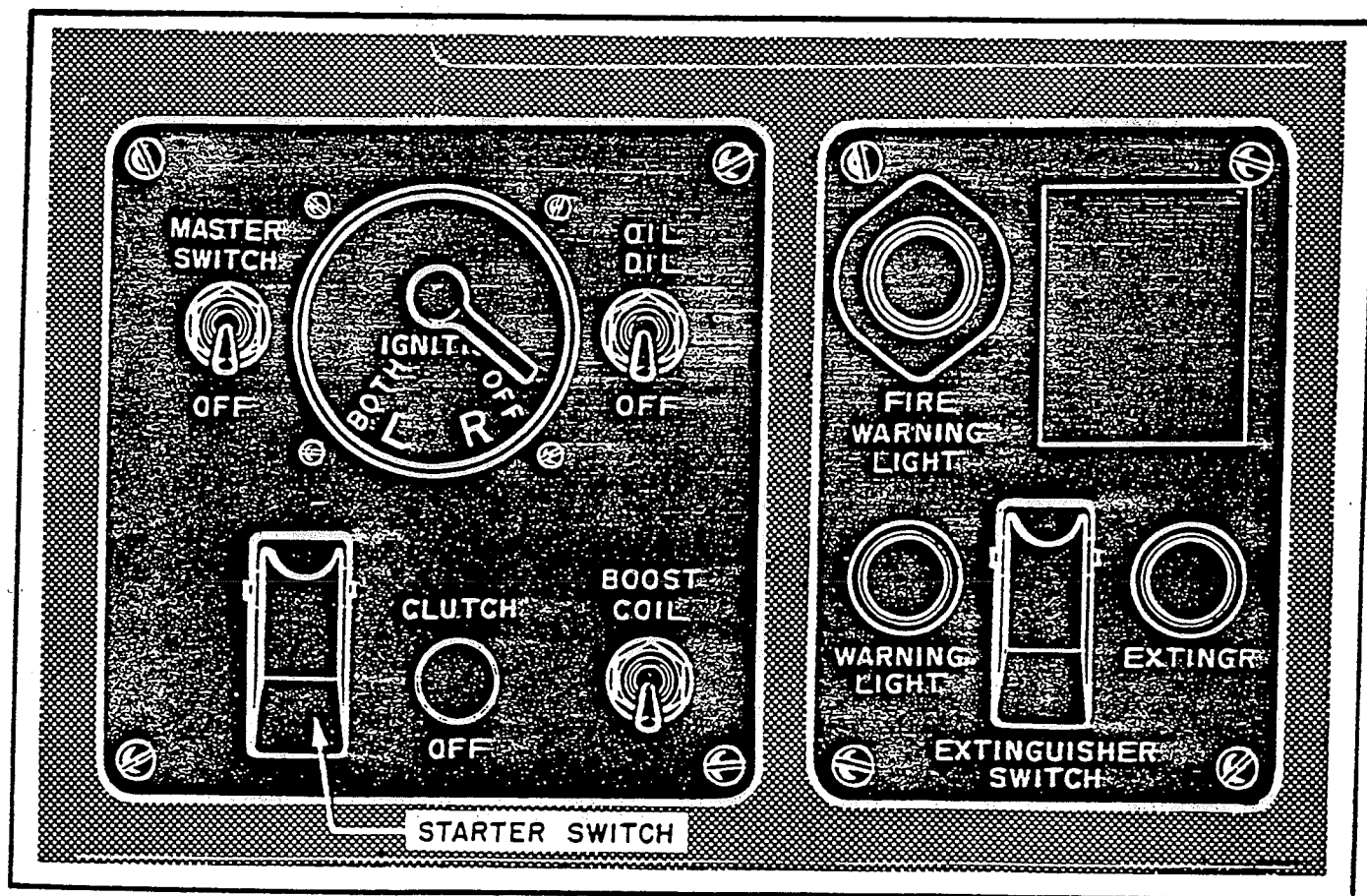


FIG. 1-5 STARTER AND FIRE EXTINGUISHER PANEL

When the lever is in the COLD position, cold ram air enters the carburettor through the shielded air intake. As the lever is moved downwards towards the HOT position, the barrel valve progressively closes the ram air intake while it opens another duct. This second carburettor air duct allows heated air from the inside of a heat exchanger muff which surrounds a section of the engine exhaust collector, to mix with the cold ram air before delivery to the carburettor. Thus, intermediate positions of the lever between fully up and fully down give varying carburettor air intake temperatures. With the carburettor air control lever in the HOT position, the ram air intake is fully closed and hot air from the heat exchanger muff only is ducted to the carburettor. The resulting mixture temperature is indicated on the carburettor mixture temperature gage.

- 1.5.6 PRIMER. The hand-operated cylinder primer pump injects fuel into cylinders numbers 1, 2, 3, 8 and 9. It is located on the left side of the pedestal, below the engine controls quadrant. To unlock the primer, the pump handle is to be pushed in and rotated anti-clockwise. After use the primer pump handle must be relocked by pushing in and rotating clockwise in order to prevent engine flooding and a fire risk when the booster pump is switched on. (Refer to paragraph 2.4.1).
 - 1.5.7 STARTER. The engine is started by an electrical, direct-cranking starter or by an electrical inertia direct-cranking starter with hand cranking facilities. Hand cranking is done from inside the cockpit by means of a handcrank and extension normally secured to the pedestal.
 - 1.5.8 STARTER SWITCH. The starter switch for the electrical direct-cranking starter motor and the two starter switches required for the electrical inertia starter are located on the starter panel below the flight instrument panel. The switch or switches are spring-loaded to the OFF position.
 - 1.5.9 HAND STARTING CONTROLS. When hand cranking, the starter commutator brushes must be released from the commutator in order to reduce the frictional loads which are involved. This is accomplished by the operation of the starter brush release lever at the right side of the pedestal according to instructions on a placard.
- When starting the engine by hand crank, the starter is engaged at its maximum speed to the engine by operating the Starter Clutch Control.
- 1.5.10 BOOST COIL SWITCH. A boost coil switch is located on the starter panel. This switch is also spring-loaded to the OFF position.

1.6 PROPELLER

The engine drives either a Hamilton Standard, three bladed, constant speed, counterweight type propeller or a Hamilton Standard, three bladed, hydromatic, non-feathering propeller.

- 1.6.1 PROPELLER CONTROL. The engine rpm are determined by the setting of the propeller control lever located on the quadrant on top of the pedestal. The control lever is connected to the propeller governor by a flexible cable and slides in a gate marked HIGH PITCH, DECREASE RPM and INCREASE RPM. The propeller governor automatically maintains any selected rpm within the operating range of the propeller, regardless of variation in air loads or flight attitudes. A friction control below the propeller control lever prevents the lever from creeping when rotated clockwise.

a. Counterweight Propeller. The governor hydraulically moves the propeller blades to lower angles by engine oil supplied by an engine-driven pump; when the governor allows oil to drain from the propeller, counterweights progressively move the blades to higher angles.

b. Hydromatic Propeller. The governor maintains the propeller blades within the constant speed range by supplying oil at engine pressure to the outboard end of the propeller actuating piston which, together with the centrifugal twisting moment acting on the blades, tends to move the blades towards low pitch. To balance the effect of both these forces, engine oil is boosted in pressure by the engine driven propeller governor and is passed to the inboard end of the propeller actuating piston to move the blades towards high pitch. The propeller pitch can be changed by re-selection of the propeller control lever which varies the load on the governor fly-weights and allows the governor pilot valve to take up a new position to maintain the propeller at the new selected constant speed setting.

1.7 OIL SYSTEM

The oil tank, which is of 9 Imp. gal. (10.8 U.S. gal., 40.5 liters) capacity is located under the cockpit floor. Servicing of the oil tank is done through a filler neck on the left side of the fuselage.

The oil cooler with an integral surge relief valve and a thermostatic bypass valve is located behind the firewall, and has its own air-flow system.

1.7.1 OIL SPECIFICATIONS AND GRADES.

See Paragraph 4.4.2.

- 1.7.2 OIL DILUTION. When a start in cold weather is anticipated, the oil may be diluted with gasoline before stopping the engine. The oil dilution valve is operated by a solenoid which is controlled by a spring-loaded switch on the starter panel. For dilution percentages and times see Chapter 6, paragraph 6.3.

Oil dilution should not be used intermittently during the season, but should be continued once it has been started because of oil filter sludging.

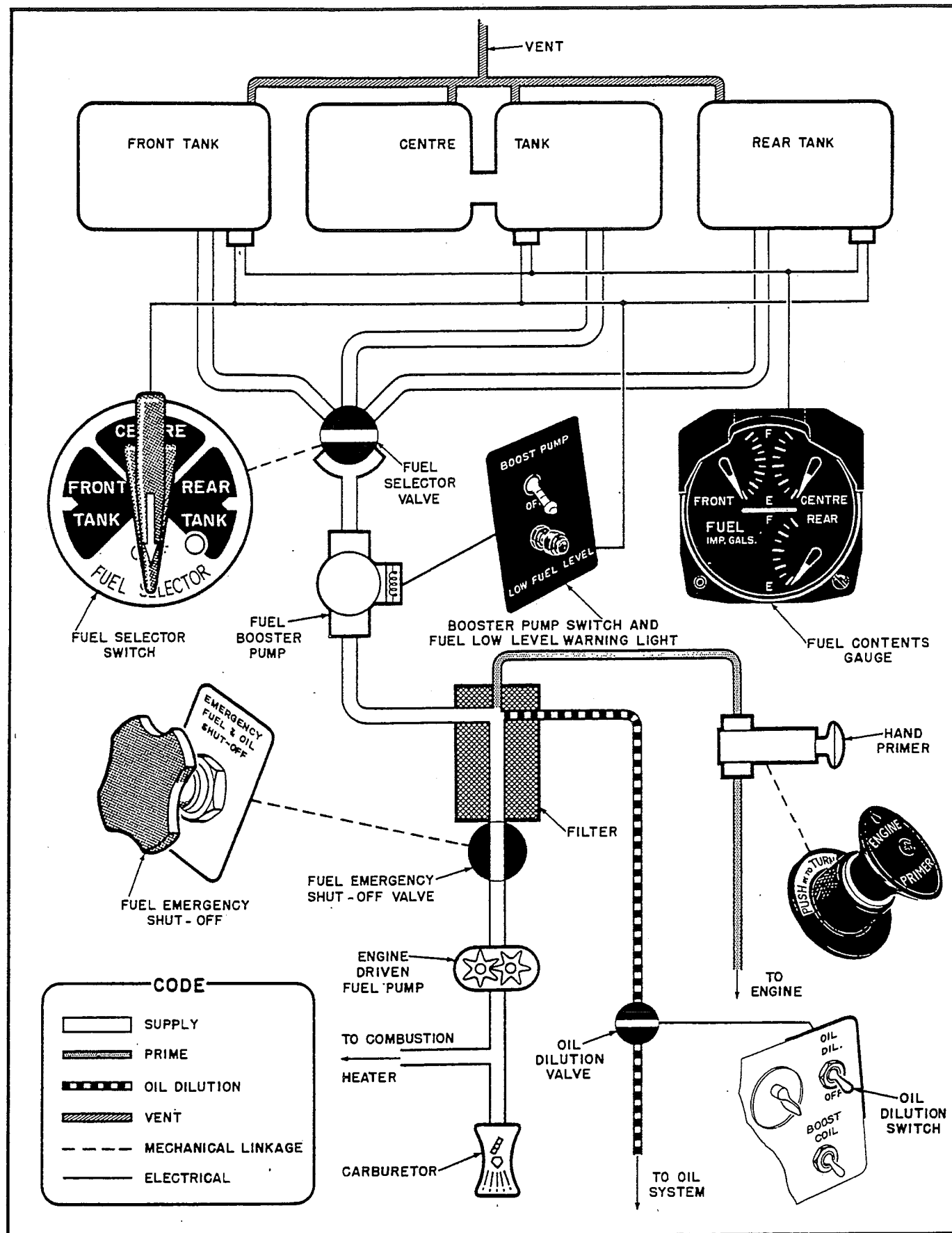


FIG. 1-6 FUEL SYSTEM: SCHEMATIC

1.8 FUEL SYSTEM

Fuel is contained in three flexible bag-type tanks beneath the forward portion of the cabin floor. The tanks are buttoned with fasteners to the underside of the floor, to stringers and the skin of the fuselage.

The tank capacity is as follows:

	<u>Imp. Gal.</u>	<u>U.S. gal</u>	<u>Liters</u>
Front	51	62	233
Center	85	103	389
Rear	42	51	192

The center tank consists of two interconnected cells. Each of the three tanks is used separately, the fuel flow to the engine being controlled by the fuel selector valve. An electrically-operated booster pump ensures that an adequate fuel flow is maintained in the event of failure of the engine driven pump.

- 1.8.1 **FUEL SELECTOR HANDLE.** The fuel selector handle, located below the bottom right corner of the pilots instrument panel, can be positioned to FRONT TANK, CENTRE TANK, REAR TANK or OFF. When the engine is not operating, the selector handle must be selected to OFF to prevent drainage of the fuel supply line into the tank.
- 1.8.2 **FUEL BOOSTER PUMP SWITCH.** The fuel booster pump switch is located on a panel to the left of the engine controls quadrant.
- 1.8.3 **FUEL PRESSURE GAGE.** A combined fuel pressure, oil pressure and oil temperature gage is located on the engine instrument panel above the engine controls quadrant.
- 1.8.4 **FUEL CONTENTS GAGE.** The triple indicator fuel contents gage, graduated either in Imperial or U.S. gallons, will indicate only when the FUEL CONTENTS circuit-breaker is set. This switch is located on the junction box circuit-breaker panel, behind the copilot's seat.

NOTE

Calibration in red applies to aircraft in the tail-down position.

- 1.8.5 **FUEL LOW LEVEL WARNING LIGHT.** A warning light gives an indication of low fuel level in the tank from which the engine is operating. The light becomes illuminated when fuel for approximately 15 minutes of cruising remains in the tank.

NOTE

The fuel low level warning light will indicate a low fuel level in any one of the three fuel tanks, depending upon which tank is selected.

- 1.8.6 FUEL AND OIL SHUT-OFF CONTROL. The shut-off control handle stops the supply of both fuel and oil to the engine in case of emergency. It is located on the right side of the pedestal, below the engine controls quadrant.

1.9 ELECTRICAL SYSTEM

Electrical energy is supplied by a direct current 50 amp. 28-30 volt generator in conjunction with a 24 volt 24 amp-hr. storage battery.

Installations of generators of 80 to 100 amp. and batteries up to 35 amp-hr. have been made.

All circuits of the electrical system are protected by manual reset-type circuit-breakers on the junction box panel behind the co-pilot's seat or on the electrical switch panel on the co-pilot's sub-panel.

The battery is inside the baggage compartment on a shelf in the rear right-hand corner.

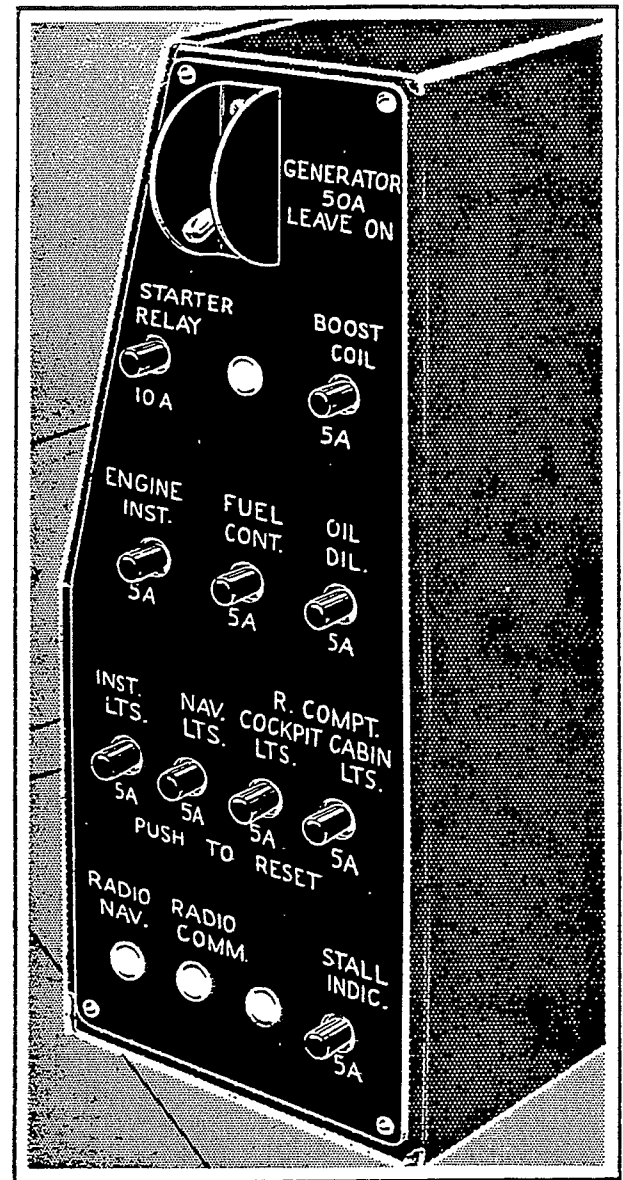


FIG. 1-7 JUNCTION BOX AND CIRCUIT BREAKER PANEL

- 1.9.1 ELECTRICALLY OPERATED EQUIPMENT. The following equipment and controls are supplied by the electrical system.

Engine Starter
Booster Coil
Fuel Booster Pump
Oil Dilution System
Pitot Head Heater
Engine Fire Ext. System
Instrument & Warning Lights
Interior Lights

Navigation Lights
Landing Light
Heater Installation
Anchor Lights (seaplane)
Radio
Communication Equipment
other than Radio (Optional
Equipment)

- 1.9.2 EXTERNAL POWER RECEPTACLE. For starting the engine or for electrical ground checks, an external power source may be connected to an external power receptacle fitted to the right side of the fuselage, aft of the cabin door. Access is gained through a spring-loaded hinge panel. When external power is connected, the aircraft battery is isolated if the battery master switch is in the OFF position.

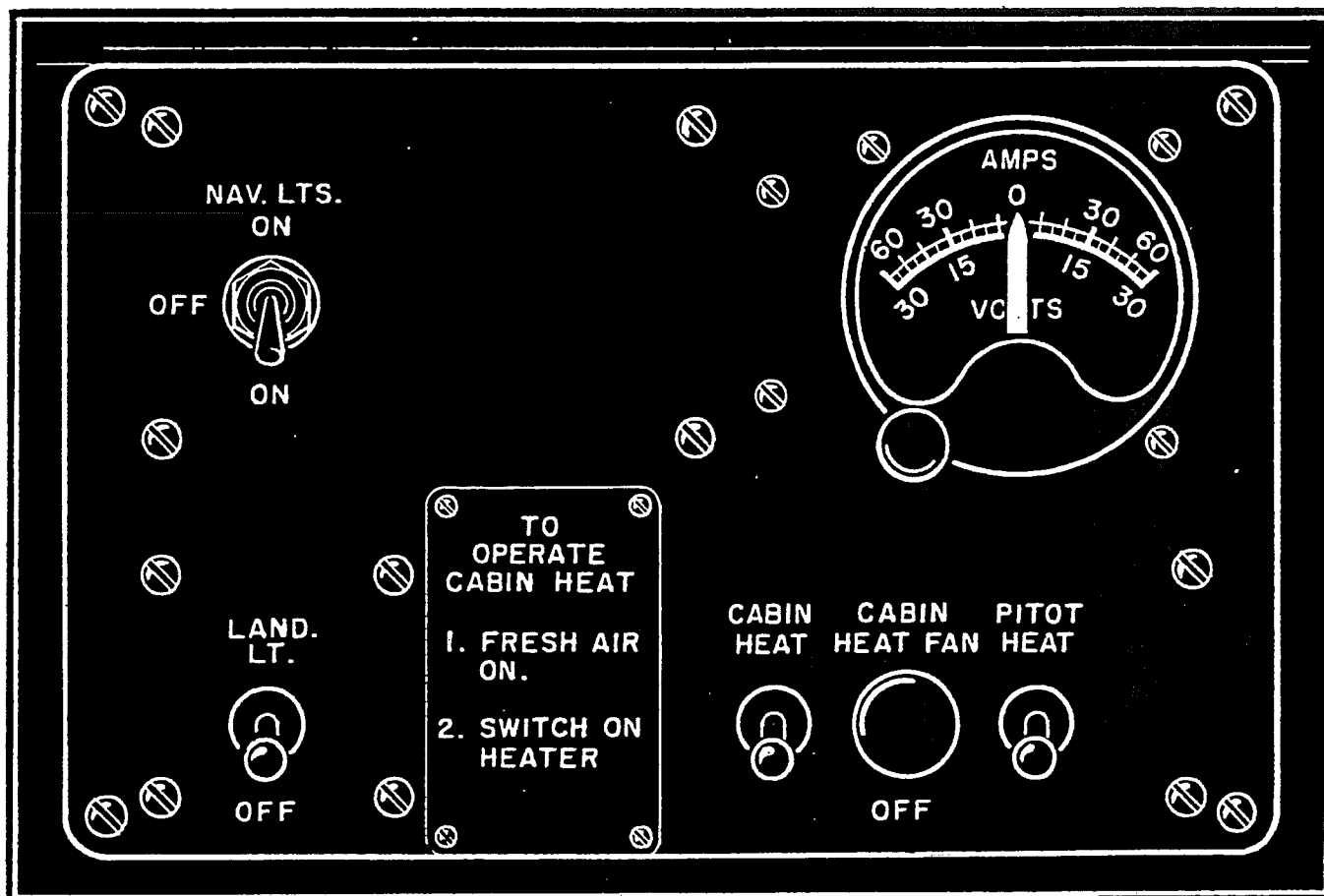


FIG. 1-8 ELECTRICAL SWITCH PANEL

- 1.9.3 BATTERY MASTER SWITCH. The battery master switch on the starter panel, is of the double-pole, single-throw type and serves also as the generator field switch.
- 1.9.4 ELECTRICAL SYSTEM INDICATOR. A volt-ammeter is on the electrical switch panel.

The instrument constantly shows the number of amps. being delivered to the system and the battery.

When pressing the button on the left side of the instrument, the generator output voltage is indicated.

1.10 FLIGHT CONTROLS

All control surfaces are mass-balanced and are conventionally operated by a control column and rudder pedals.

The handwheel portion of the control column may be "thrown-over" for use by a co-pilot, in conjunction with the installation of rudder pedals on the right side of the cockpit.

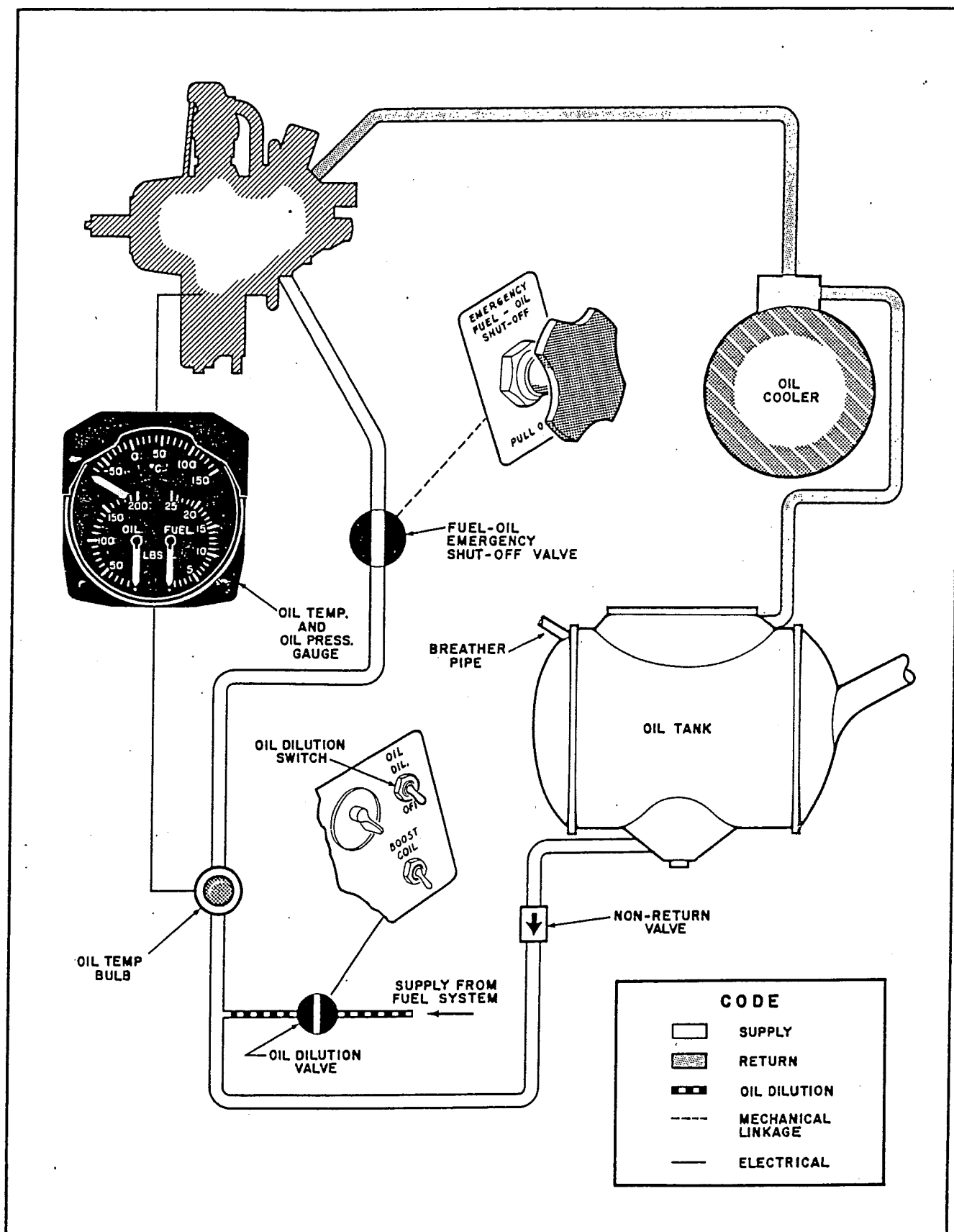


FIG. 1-9 OIL SYSTEM: SCHEMATIC

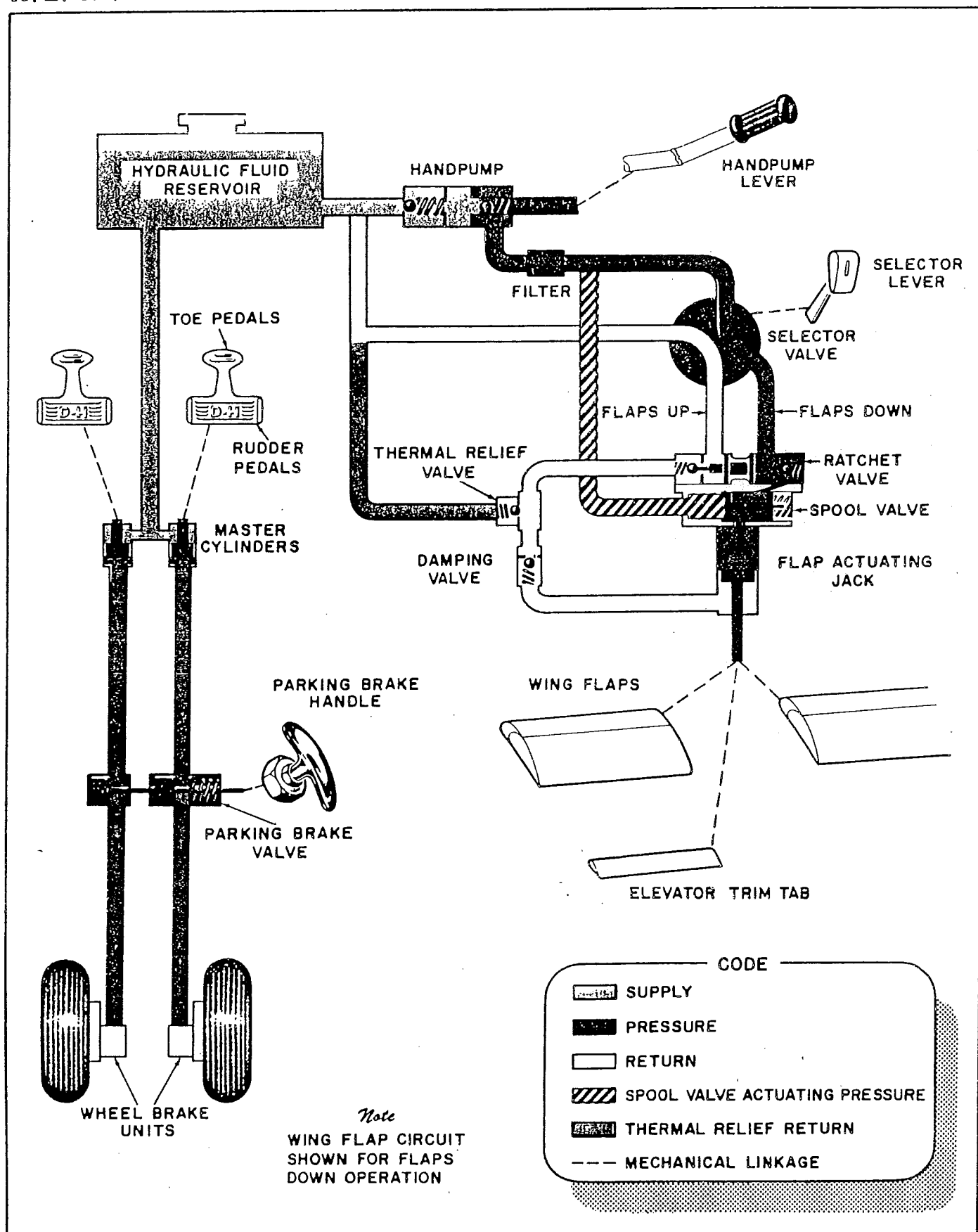


FIG. 1-10 HYDRAULIC SYSTEM - SCHEMATIC

- 1.10.1 WING FLAPS. The wing flaps are of the full-span, double-slotted type. The outboard trailing edge portions of the flaps are operated independently as ailerons.
- 1.10.2 VARIABLE INCIDENCE TAILPLANE. The incidence of the tailplane may be adjusted in flight by rotating the TAILPLANE TRIM handwheel at the right side of the pilot's seat. The handwheel operates in the natural sense and its pointer moves over a label marked NOSE DOWN, TAKE OFF SETTING and NOSE UP. The area marked TAKE OFF SETTING is edged in green. The neutral position of the tailplane trim is marked 0 with further markings to 2 in the NOSE DOWN direction and to 5 in the NOSE UP direction.
- 1.10.3 RUDDER TRIM TAB. The rudder trim tab is actuated by a handwheel in the cockpit roof. The handwheel assembly incorporates a position indicator which moves over a scale marked L and R indicating the direction and amount of trim applied.
- 1.10.4 AILERON TRIM. The aileron trim which is adjusted by means of a handwheel on the control column varies the tension left or right of the aileron control cable in flight.
Fixed trim tabs on each aileron are provided for adjustment on the ground by qualified servicing personnel.
- 1.10.5 RUDDER PEDALS ADJUSTMENT. The pilot's rudder pedals may be adjusted for leg reach. By pulling the adjusting knob, the pedals can be moved to the desired position, and secured in that position by releasing the adjusting knob.
- 1.11 WING FLAPS HYDRAULIC SYSTEM. The wing flaps are operated hydraulically by a flap actuating jack assembly, located in the fuselage roof between the front and rear wing attachment lugs. Hydraulic fluid, contained in a separate reservoir located aft of the firewall on the left-hand side, is pumped into the flap actuating jack assembly by means of a handpump located beneath the pilot's seat. Wing flaps are selected UP or DOWN with a selector lever and after they are pumped to the desired position with the handpump, they are automatically locked by a hydraulic ratchet valve which is part of the flap actuating jack assembly. The wing flaps are mechanically connected to the trim tab on the left elevator so that actuation of the wing flaps automatically deflects the trim tab to maintain the longitudinal trim.
 - 1.11.1 WING FLAPS HANDPUMP LEVER. The handpump lever is in line with the right-hand side of the pilot's seat and is operated in a fore-and-aft movement.
 - 1.11.2 WING FLAPS SELECTOR LEVER. The wing flaps selector lever is mounted on the tailplane trim pedestal, to the right of the pilot's seat. CRUISE, LAND, or intermediate positions of the wing flaps are obtained by moving the wing flaps selector lever to up or down position and then pumping the flaps to the desired position, as shown on the wing flaps position indicator

NOTE

When the wing flaps have been pumped to the desired position, the wing flaps selector lever should immediately be moved to its neutral position, to provide an additional lock on flap motion.

- 1.11.3 WING FLAPS POSITION INDICATOR. The wing flaps position indicator is located on the vertical frame member of the windshield, and is marked UP, CRUISE, CLIMB, TAKE-OFF, LAND and DOWN.

NOTE

Regardless of wing flaps position the TAILPLANE TRIM handwheel should be positioned so that its indicator registers against TAKE OFF SETTING, for take-off. This setting gives satisfactory elevator control forces for all weights and CG positions for which the aircraft is approved. After getting used to the aircraft the pilot may, if desired, trim either side of TAKE OFF SETTING position depending on CG, i.e. Nose down for aft CG: Nose up for forward CG.

1.12 LANDING GEAR

The main wheel units and the tailwheel units are not retractable. For water-based operation the wheel units can be removed and replaced by two floats which are attached to the fuselage by struts.

The main wheels and tailwheel may be replaced by skis for winter operations in the bush.

- 1.12.1 BRAKE SYSTEM. The disc type wheel brakes are hydraulically operated through independent, integrally mounted master cylinders. They are applied by depressing the toe portions of the rudder pedals. For parking, the brakes have to be applied by toe pressure and then locked in that position by pulling out the PARKING BRAKE handle at the extreme left lower edge of the starter panel.

To release the parking brakes, push the parking brake handle fully in. Do not apply pressure on the toe brake pedals before releasing the parking brake, and do not "pump" the toe brake pedals while the parking brake is "ON".

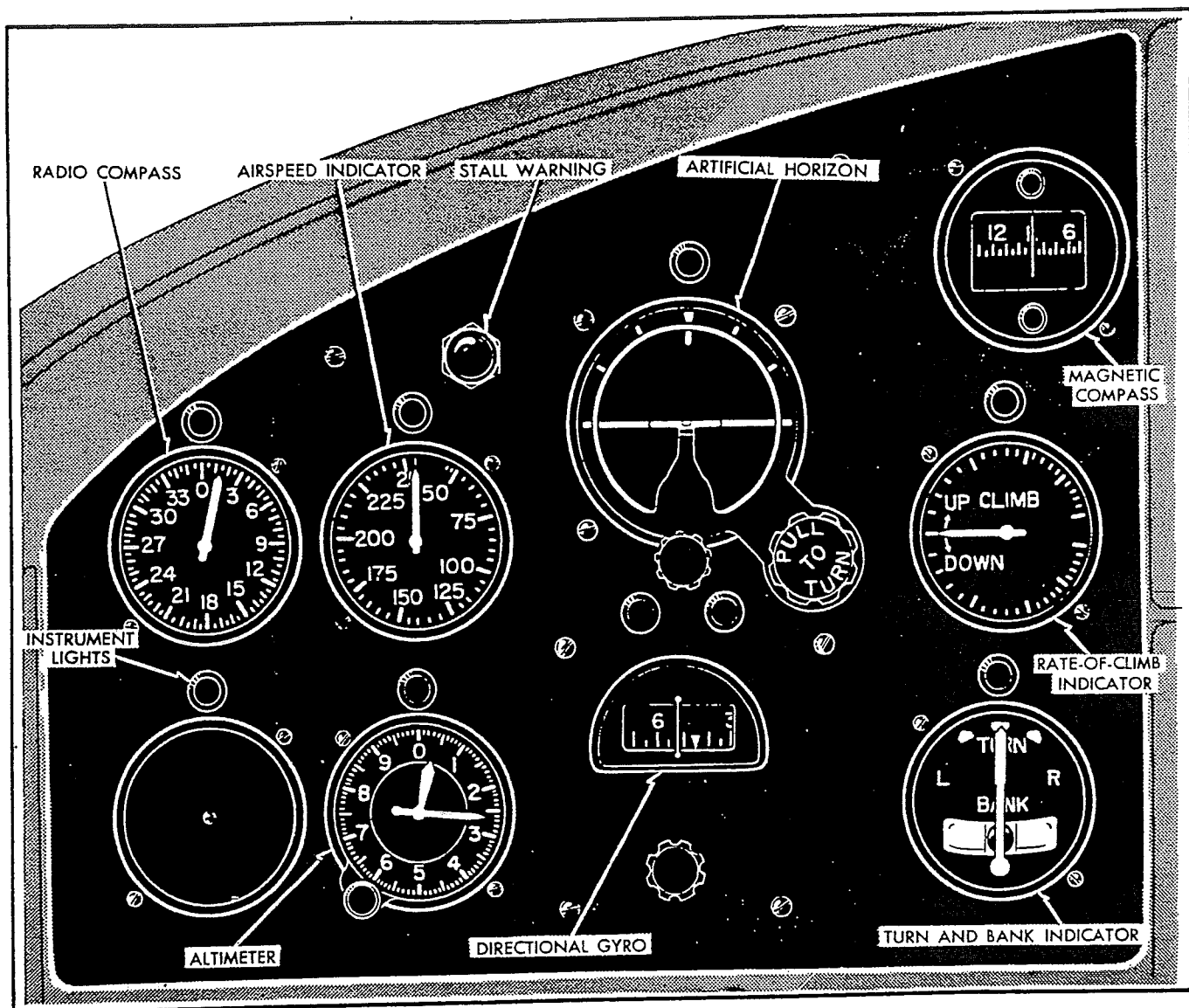


FIG. 1-11 FLIGHT INSTRUMENT PANEL

1.13 INSTRUMENTS

A shock-mounted flight instrument panel is provided for the pilot and incorporates the following flight instruments:

Airspeed Indicator	Rate-of-Climb Indicator
Altimeter	Turn-and-Bank Indicator
Artificial Horizon	Magnetic Compass
Directional Gyro	Radio Compass
Space provision for another flight or Navigation Instrument.	

1.13.1 PITOT-STATIC OPERATED INSTRUMENTS comprise:

Airspeed Indicator	Altimeter
--------------------	-----------

Rate-of-Climb Indicator

- 1.13.2 VACUUM-OPERATED INSTRUMENTS. The engine driven vacuum pump provides suction to operate:

Directional Gyro

Artificial Horizon

Turn-and-Bank Indicator

- 1.13.3 ARTIFICIAL HORIZON. The artificial horizon is operated by the vacuum system and gives bank, dive and climb indications. A knob at the bottom of the instrument dial adjusts the vertical position of the miniature airplane for fore-and-aft attitudes of the airplane. A caging knob permits to lock the instrument in the upright position and provides a rapid means for resetting if the operating limits of the instrument are exceeded.

The operating limits are set to permit 60° climbs and glides, and 100° right or left banks before the limit stops are reached.

- 1.13.4 SUCTION GAGE. The suction gage is located on the engine instruments panel. The gage is calibrated from zero to 10 in. Hg.
- 1.13.5 OUTSIDE AIR TEMPERATURE GAGE. The outside air temperature gage is located in the cockpit roof. It is of the direct-reading bulb type. Its dial is graduated in degrees Fahrenheit and Centigrade.

1.14 EMERGENCY EQUIPMENT

- 1.14.1 ENGINE FIRE EXTINGUISHER SYSTEM. The engine fire extinguisher system is controlled from the fire extinguisher panel below the flight instrument panel. The system incorporates a fire extinguisher bottle, flame switch, and a length of fuse wire located in the engine compartment. In the event of fire, a red warning light on the extinguisher panel is illuminated, and the EXTINGUISHER SWITCH must be switched on to discharge the bottle after the engine is shut down. Both the warning light and the extinguisher circuits are protected by push-to-reset button type circuit-breakers on the fire extinguisher panel.
- 1.14.2 HAND-OPERATED FIRE EXTINGUISHER. A hand-operated fire extinguisher in a quick release clip is attached to a bracket to the left and rear of the pilot's seat.
- 1.14.3 FIRST-AID KIT. A first-aid kit is stowed in a bag located on the right-hand cabin side between the passenger door and the rear cabin bulkhead, aft and above the door lock. A second first aid kit may be installed behind the pilot's seat in the cockpit.

1.15 MISCELLANEOUS EQUIPMENT

- 1.15.1 HATCH. A 27-inch diameter hatch has been provided in the rear cabin floor just aft of the rear cabin bulkhead normally closed by lids screwed to the floor and outer skin of the fuselage. A trap door may be installed.

1.15.2 SEATS

The cabin side seats may be folded flat against the wall, flush with the base of the heater duct. The rear seats hinge up against the rear cabin bulkhead. All seats have padded backs, buoyant seat cushions and lap safety belts.

Provision has been made for six litters or a combination of seats and litters to be installed for ambulance and rescue operations.

1.15.3 CARGO TIE-DOWN RINGS

Fourteen cargo tie-down rings, eight of which are permanently installed are supplied with each aircraft.

Eighteen receptacles to receive the six removable cargo tie-down rings permit to secure any type of cargo. An additional number of receptacles (up to fourteen) may be provided.

1.15.4 RELIEF TUBES

Relief tubes may be installed in the cockpit on the right-hand side of the pedestal and in the cabin. The relief tube for the cabin is located in the baggage compartment.

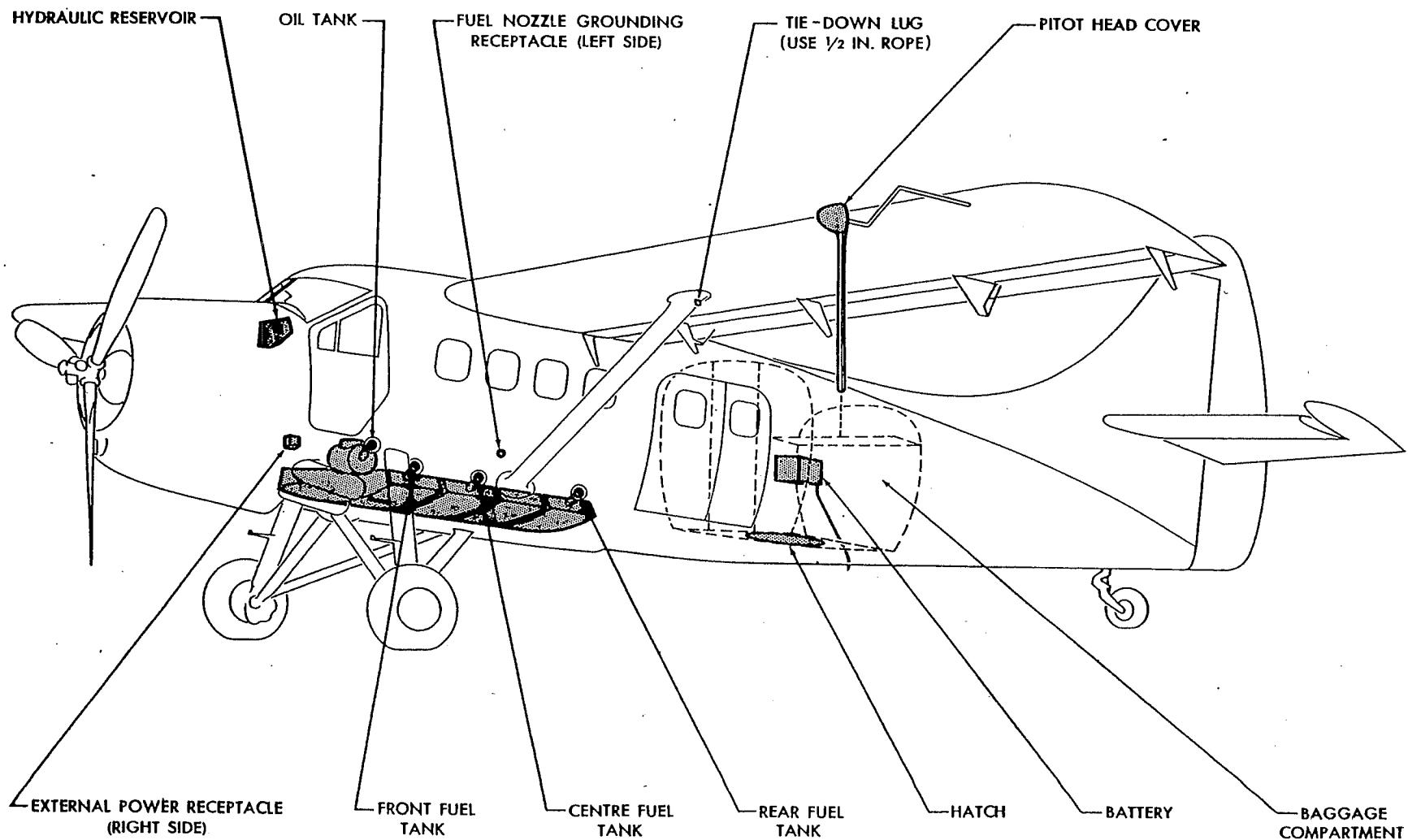
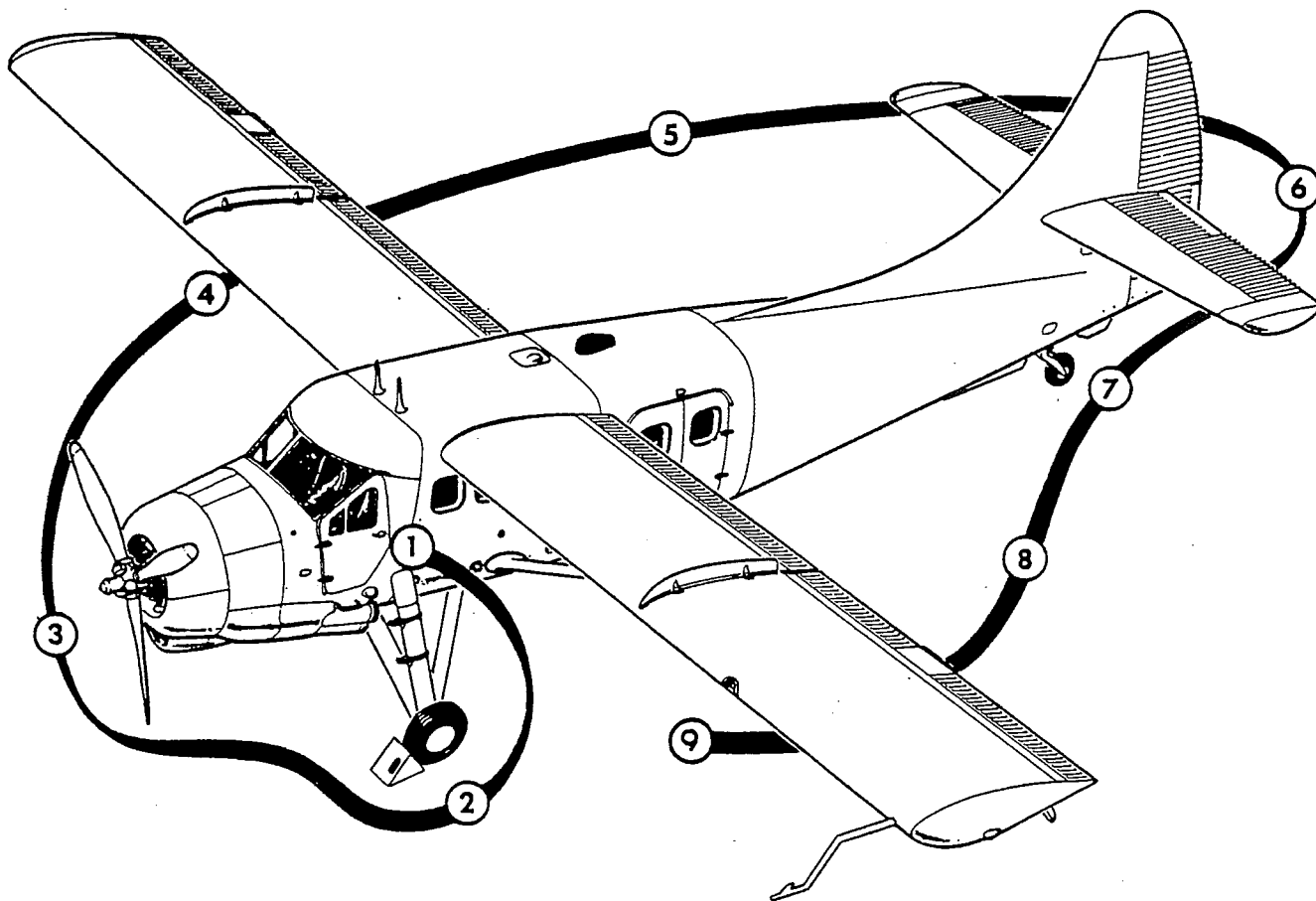


FIG. P-12 GENERAL ARRANGEMENT AND SERVICING POINTS



Starting at the cockpit door, port side, make the following checks:

- 1 COCKPIT AND SERVICING POINTS.** Ignition and Master switches off. Fuel filler caps, oil tank access panel and hydraulic reservoir caps secure.
- 2 LANDING GEAR.** Wheels chocked. Landing gear and fairings for damage. Grounding chain for security and contact. Tires for cuts, bruises, slippage and proper inflation. Brake pipes and hose for fluid leaks. When combination wheel-skis are installed: tire inflation increased to 40 psi, actuator shaft with skis in lowered position 1.0 to 1.5 inches extended.
- 3 POWER PLANT SECTION.** Propeller blades for nicks, governor unit for oil leak. Cowls and fairings for damage and security. Carburetor and oil cooler intakes clear. Exhaust augmentor tubes for condition.
- 4 STARBOARD WING.** All hinges clear. Aileron trim tab neutral. Wing tip and navigation light assembly for dents or damage.
- 5 STARBOARD FUSELAGE SIDE.** Fuselage side for dents or wrinkles. Underside for fuel leaks. Cabin access ladder stowed and secure. Cabin entrance door closed. Wing and fuselage aerials, lead-ins and loop housing for damage.
- 6 EMPENNAGE.** All hinges clear. Access panels secure. Tailplane incidence and rudder trim tab neutral. Control surfaces for wrinkles, dents and damage. Lower rudder hinge assembly (bracket, bolt and control rod) for condition. Servo-tabs for operation. Navigation light assembly for damage.
- 7 TAILWHEEL ASSEMBLY.** Tailwheel tire for proper inflation, cuts, bruises and slippage. Check shock strut for inflation and leaks.
- 8 PORT FUSELAGE SIDE.** Fuselage side for damage or wrinkles. Underside for fuel leaks. Hand fire-extinguisher in rear cargo door secure. Cargo doors closed. Wing and fuselage aerials and lead-ins for damage.
- 9 PORT WING.** All hinges clear. Aileron trim tab neutral. Wing tip and navigation light assembly for damage. Landing light assembly for damage. Pitot head cover removed.

FIG. 1-13 EXTERIOR INSPECTION DIAGRAM

CHAPTER II

NORMAL OPERATING PROCEDURES

2.1 BEFORE ENTERING AIRCRAFT

Visually inspect:

- a. Wings and fuselage.
- b. Control surfaces and hinges - clear.
- c. Tires - for pressure, slippage marks and cuts.
- d. Hydraulic brake lines - for leaks.
- e. Oil tank access cover - closed.
- f. Propeller - for nicks and hydraulic leaks.
- g. Pitot head cover - removed.

Check:

- a. Chocks in place.
- b. Fuel tank caps - secure.
- c. Stowage of cargo and luggage.
- d. Load distribution and CG position.

2.2 ON ENTERING AIRCRAFT

- a. Ignition switch - OFF
- b. Controls - unlocked.
- c. Parking brake - set.
- d. Flight controls - correct, free and full movement.
- e. Trim tabs - as required.
- f. Control column throw-over lock - securely engaged.
- g. All switches - OFF (Except generator switch on Junction Box which is to be left ON at all times).
- h. Battery master switch - OFF (ON if, in an emergency, external power is not used).
- j. External power - connected.

WARNING

When external power is connected, the electric system of the aircraft is alive, irrespective of the position of the master or any other switches. Hence, operation of the starter switch will turn over engine and propeller.

- k. Fuel quantities - check.
- l. Fuel selector control - fullest tank.
- m. Altimeter - set.

- n. Clock - set.
- p. Stowage of hand operated fire extinguisher - check.
- q. Pilot's seat, if necessary - adjust.
- r. Safety belt and shoulder harness, if provided - fasten.
- s. Flash light - check.
- t. Communication equipment - test (if external power is not available make this test during engine warm-up).

When night flying is anticipated, make the following checks with the help of an outside observer:

- a. Landing light.
- b. Navigation lights, identification lights if fitted.
- c. Check panel lights, interior lights.
- d. Flashlight on board.

CAUTION

Do not leave landing light on for more than 10 seconds in any two minute period when aircraft is on the ground, or else heat may fuse the landing light in the ON position.

2.3 BEFORE STARTING THE ENGINE

- a. Fire guard - posted and propeller area - clear.
- b. Throttle - 1/4 in. to 1/2 in. open.
- c. Propeller control.
 - 1. Counterweight propeller - HIGH PITCH.
 - 2. Hydromatic propeller - FULL INCREASE RPM..
- d. Mixture control - FULL RICH.
- e. Carburettor hot air control - COLD.
- f. Ignition switch - OFF.
- g. Have ground crew turn propeller over four revolutions to check for hydraulic lock. If ground crew is not available, check by starting the engine with ignition switch "OFF" through at least six blades and watch for tendency to stall during propeller rotation.

CAUTION

If an hydraulic lock is suspected, do not attempt to clear by rocking the propeller either manually or through the starter. Have lower cylinders drained by removal of spark plugs.

2.4 STARTING ENGINE

2.4.1 NORMAL ENGINE START

- a. Propeller area - clear.
- b. Battery master switch - ON.

- c. Booster pump - ON.
- d. Prime cylinders: four or five strokes of the primer for a cold engine; zero to three strokes for a warm engine. Pull slowly to a full charge; push rapidly to atomize the fuel.
- e. Booster pump - OFF.

CAUTION

After priming make sure primer valve has been shut-off completely, or booster pump will inject raw fuel into cylinders.

Electrical Inertia Starter

- f. Ignition switch - BOTH.
- g. Energize starter with starter switch held to STARTER position until starter whine ceases to rise in pitch. Release switch.
- h. Simultaneously: hold clutch engagement switch to CLUTCH position, Ignition Booster switch to BOOST COIL until engine is firing evenly.

NOTE

A hot engine may be cranked directly for starting by energizing the starter and clutch together.

Direct Cranking Starter Motor

- f. Ignition switch - BOTH.
- g. Simultaneously: Starter switch STARTER, Ignition Booster switch - BOOST COIL. Release STARTER switch as soon as engine fires.

NOTE

Do not operate the starter for more than 30 seconds of continuous cranking. Allow 1 minute cooling period before the starter is operated again.

- j. External supply disconnected.
- h. External supply disconnected.

CAUTION

1. As soon as engine fires, throttle back to about 500 to 800 rpm.
2. Do not use throttle to catch a "dying" engine.
3. If oil pressure does not register on gage within 30 seconds stop engine and investigate.

2.4.2 FAILURE IN STARTING

- a. Ignition switch - OFF.
- b. Disengage starter clutch, if necessary, by rocking propeller by hand between 1/4 and 1/2 revolution.
- c. Attempt another start, repeating original procedure with less priming.

2.4.3 FAILURE IN STARTING DUE TO OVERPRIMING

- a. Ignition switch - OFF.
- b. Throttle - OPEN.
- c. Clear excess fuel from induction system by turning propeller forward by hand for 4 or 5 revolutions.

CAUTION

Insure propeller is turned in a forward direction. Turning the propeller backwards will return the excess fuel into the induction system and, consequently, hamper starting and create a fire hazard.

2.5 ENGINE WARM-UP

- a. Start warm-up at 1000 rpm.
- b. After oil temperature has reached 40°C (100°F) adjust to smoothest engine speed between 1200 to 1400 rpm. Mixture control FULL RICH.
- c. Propeller control.
 1. Counterweight propeller - Advance to full INCREASE RPM, as soon as oil pressure reaches 50 psi.
 2. Hydromatic propeller - Leave at full INCREASE RPM.

NOTE

Never rush engine warm-up.

While the engine is warming up, make the following ground tests:

- a. Fuel system - Check all filled tank feeds by rotating fuel selector control.
- b. Electrical system - Check ammeter to insure that generator cuts in for charging between 1350-1450 rpm.
- c. Test flaps and handpump operation.
- d. Instruments - Check that readings are in the correct ranges.
- e. Check radio equipment, if not done on entering aircraft.

2.6 ENGINE GROUND TESTS

Prior to making any engine performance tests or taxiing the aircraft, the engine must be warmed up until the oil temperature shows a definite increase over 40°C and the oil pressure remains steady when the throttle is advanced.

Before each flight the following engine checks should be made, when fuel selector control is to the fullest tank.

2.6.1 PROPELLER PITCH CHANGE CHECK

- a. Move from full INCREASE RPM at 1650 rpm to full DECREASE RPM.
- b. Note drop to approximately 1000 rpm (counterweight propeller), or to approximately 1200 rpm (hydromatic propeller), then return propeller control to full INCREASE RPM.

2.6.2 MIXTURE CONTROL

- a. Pull Mixture Lever back. Watch for flick of rpm.

2.6.3 CARBURETTOR HEAT

- a. Move control down to HOT position and check for rise in carburettor mixture temperature.

2.6.4 IGNITION CHECK

- a. At 1600 rpm check magnetos by switching to "L" and "R" alternately. The drop in rpm when running on one magneto should normally be 50 to 70 rpm and should not exceed 130 rpm.

NOTE

1. Return ignition switch to BOTH between "L" and "R" checks to allow the engine to regain its normal rpm.
2. If magneto drop exceeds 130 rpm recheck at 2200 rpm.

CAUTION

Conduct these checks quickly as possible to prevent severe backfire. ~~DELETED~~ on the ignition is switched on.

2.6.5 POWER CHECK

- a. Control column - fully back - parking brake - ON.
- b. Propeller control - Full INCREASE RPM.
- c. Open throttle until the manifold pressure is equal to the field barometric pressure.
- d. Check for rpm that engine normally gives. Engines vary in this respect but give values in the range from 2000 to 2200 rpm.
- e. Fuel pressure 4 to 6 psi.
- f. Oil temperature 40 to 75°C.

2.6.6 IDLE SPEED CHECK

- a. Check idling at 300 - 500 rpm.

2.6.7 IGNITION SWITCH CHECK

- a. Check ignition switch by setting throttle at 600-700 rpm and turn ig-

Ignition switch OFF momentarily. Engine must stop firing.

NOTE

Ignition switch check should be conducted as rapidly as possible to prevent severe backfiring when the ignition switch is turned to BOTH again.

WARNING

If the engine does not stop firing, shut it down. Warn all personnel to keep clear of propeller area. Have switch and magneto ground lead checked.

2.7 TAXIING

2.7.1 LANDPLANE:

- a. Wing flaps - CRUISE to improve directional control.
- b. Mixture control - FULL RICH.
- c. Propeller control - Full INCREASE RPM
- d. Have chocks removed, release parking brake.
- e. As soon as airplane is rolling, apply brakes evenly and firmly to test for correct functioning.

CAUTION

Test brakes before permitting speed to build up while taxiing.

- f. Run the engine at 1000 rpm minimum whenever possible, to prevent plug fouling.

2.7.2 SEAPLANE:

The forward CG limit on floats at 7967 lb was set by consideration of safe water handling characteristics. When turning from downwind into wind in rough water the nose of the float on the outside of the turn tends to submerge. This tendency is proportional to the rate of turn, engine power and wind velocity. Thus in high winds it may be advisable to reduce the rate of turn, the power, or both.

2.8 PRE-FLIGHT AIRCRAFT CHECK

- a. All doors properly closed and UNLOCKED.
- b. Tailplane trim - TAKE OFF SETTING.
- c. Wing flaps - TAKE-OFF position.
- d. Directional gyro and artificial horizon - set and uncaged.
- e. All instruments in correct ranges.
- f. In cold weather, or when icing conditions are expected, pitot head heater ON.
- g. Stall Warning Light - Push to check lighting.
- h. Fasten seat-belts.

2.9 TAKE-OFF

2.9.1 LANDPLANE

- a. Adjust throttle, mixture and propeller friction controls to prevent creep.
- b. Open throttle smoothly to maximum permissible take-off power. See Figure 4-2.
- c. Counteract any tendency of aircraft to swing (usually to the left).

- d. Allow airplane to fly itself off in a tail-down attitude at approximately 55 mph IAS.
- e. Reduce throttle (by approximately 2 in. Hg.) and rpm (approximately 50 rpm) when a safe speed and height have been attained.

CAUTION

- 1. Never take off with Lean Mixture.
- 2. Take-off with Carburettor Heat only under severe carburettor icing conditions.

2.9.2 SEAPLANE:

There is no tendency of the properly loaded seaplane to porpoise, even in rough water.

NOTE

Any tendency of the seaplane to porpoise on take-off is an indication that the airplane is loaded an appreciable amount aft of the rear CG limit.

2.10 CLIMB

2.10.1 INITIAL CLIMB

To achieve the maximum angle of climb on take-off climb at 64 mph using take-off power and TAKE-OFF flap.

2.10.2 CONTINUOUS CLIMB

At an altitude of approximately 500 feet above the airfield, reduce power to maximum continuous power (or less, depending on condition).
For maximum angle of climb: Flap setting 15°, Airspeed 67 mph.
For maximum rate of climb: Flap setting 0°, Airspeed 90 mph.

NOTE

The engine manufacturer recommends a climb power of 400 bhp for maximum engine life:- See Pilot's Check Charts.

2.11 CRUISING

2.11.1 Flaps to CRUISE Setting.

NOTE

Not retracting the flaps fully, will cause a reduction in speed of 3 to 4 mph.

2.11.2 Recommended power settings are given in the Appendix.

2.11.3 MIXTURE CONTROL

To obtain best lean mixture power setting when operating in level flight:

- a. Set desired manifold pressure and rpm.
- b. Adjust carburettor heat control as necessary to maintain +4°C to +10°C carburettor air temperature.
- c. Lean out mixture by pulling mixture lever back until second flick of the tachometer needle indicates loss of power.
- d. Advance mixture lever 1/2 inch on the quadrant.

WARNING

When highly leaded fuel grades are used, operate engine at slightly higher cruise power settings and apply rated power for one minute after approximately each hour of cruising and PRIOR to landing approach.

Refer to paragraph 6.1 in Chapter VI.

2.11.4 FUEL MANAGEMENT

For favourable CG travel:

- a. Empty front tank first, when loaded CG forward.
- b. Empty rear tank first, when loaded CG aft.
- c. Empty front tank first, when lightly loaded.

2.11.5 AIRSPEED CORRECTION

To correct IAS to Calibrated Airspeed:

- add +3 mph to all cruising speeds.
- add +2 mph with flaps at TAKE-OFF.
- add +1 mph with flaps at LANDING.

2.12 DESCENT

2.12.1 CRUISING DESCENT

When flying conditions permit a slow descent:

- a. Adjust throttle and/or propeller to maintain level flight cruise power.
- b. Keep check on carburettor air temperature and adjust preheat so as to maintain recommended +4°C to +10°C.

NOTE

Part throttle operation is extremely conducive to the formation of carburettor ice. Ensure safety, especially in instrument weather, by using preheat.

2.12.2 NORMAL DESCENT

- a. Reduce air speed to 90 mph IAS.
- b. Propeller control gradually to full INCREASE RPM.
- c. Follow immediately with mixture control by same increments to FULLY RICH.
- d. Instruments - Check for desired and correct ranges.
- e. Fuel selector control to fullest tank.

CAUTION

Before starting any descent, always place mixture control in RICH. An engine cut-out may occur at retarded throttle settings if mixture is not in RICH position.

2.12.3 ENGINE CUT-OUT

In the event of an engine cut-out, which especially might occur at high altitudes with engine at full throttle, low rpm and mixture in NORMAL, take steps as follows:

- a. Mixture control - RICH.
- b. Propeller control - DECREASE RPM.
- c. Booster pump - ON.
- d. Throttle as required.
- e. Nose down.

2.13 APPROACH TO FIELD

2.13.1 GENERAL

- a. Mixture control - fully RICH.
- b. Fuel selector to fullest tank.
- c. Propeller control - fully INCREASE RPM 2000 rpm.
- d. Carburettor heat - as required.

2.13.2 STEEP APPROACH

- a. Wing flaps at LANDING.
- b. Airspeed 68 mph IAS.

The rate of descent will be approximately 700 feet per minute.

2.13.3 FLAT APPROACH with a dead engine or under forced landing conditions:

- a. Flaps UP.
- b. Airspeed 85 mph IAS.

Gliding without power at that speed will result in a gradient of 10% which corresponds with an angle of 5.7°.

CAUTION

If it is necessary to do a landing approach on the middle tank after the low level warning light has come on, the aircraft should be flown level or nose high.

2.13.4 SIDE SLIPPING

The aircraft may be side slipped.

The air speed should not drop below 80 mph (70 mph with flaps at LANDING) prior to side slipping. Recovery should be effected above 250 feet from the ground.

2.14 LANDING

2.14.1 LANDPLANE

- a. Maintain an approach speed of: 80 mph with flaps at TAKE-OFF position.
75 mph IAS with flaps at LANDING position.

NOTE

Add 5 mph to the above speeds for gusty conditions.

- b. Establish a constant glide and hold it. Add power to decrease rate of descent.
c. Trim tailplane.

NOTE

With power off, a distinct nose-down attitude will result.

- d. Level off by using smooth and continuously increasing back pressure on the stick.
e. Touch down in the three-point attitude.
f. Use rudder for directional control.
g. Take advantage of runway length to save brakes, yet try them soon after touch-down.

2.14.2 SEAPLANE

(A) GLASSY WATER LANDING

- a. Set flaps to CLIMB position.
b. Trim at 60 mph IAS and approach at 65 mph by forward pressure on the stick.
c. Use power to maintain a 200 fpm rate of descent.
d. On contact with water - close throttle.

(B) EXTREME FORWARD C.G. LANDING

When landing with CG full forward (Sta. 132) at corresponding maximum permissible weight (6,600 lb), TAKE-OFF flap setting is recommended to maintain a good nose up attitude.

NOTE

Any tendency of the seaplane to porpoise on take-off is an indication that the airplane is loaded an appreciable amount aft of the rear CG limit.

2.14.3 CROSS WIND LANDING

Owing to the low landing speed of the aircraft with full flaps, cross-wind landings should be made by experienced pilots only and not be attempted

if the lateral component of the wind velocity is more than 17 mph (landplane). In gusty air reduced flap settings may be preferred by the pilot.

2.15 GO-AROUND AND BAULKED LANDING

Decide early in approach whether it is necessary to go-around.

- a. Throttle to Take-off Power.
- b. Trim tailplane and keep nose down to attain safe flying speed.
- c. When safe airspeed and altitude are reached, retract in two steps - RETRIMMING IN THE INTERVAL.

2.16 AFTER THE LANDING

- a. Clear runway.
- b. Raise flaps to UP position.
- c. Tailplane trim wheel to NEUTRAL.

2.17 POST FLIGHT ENGINE CHECKS (Last flight of day only)

- a. Set parking brakes.

2.17.1 IGNITION SAFETY CHECK

- a. Engine at idling speed - 1000 rpm.
- b. Switch off ignition - Engine should stop firing completely.
- c. Ignition ON as soon as possible to prevent backfiring.

2.17.2 FUEL-AIR MIXTURE CHECK

- a. Throttle to 1700 rpm.
- b. Mixture control FULL RICH.
- c. Retard mixture control to NORMAL.
- d. Observe change in rpm.
- e. Return to FULL RICH.

NOTE

Any increase of over 25 rpm indicates that the mixture is too rich. A decrease over 75 rpm indicates too lean a mixture.

2.17.3 IDLE MIXTURE STRENGTH AND IDLE SPEED CHECK

- a. Close throttle and check idle speed - 300 to 500 rpm.
- b. Move mixture control slowly toward IDLE CUT-OFF.

- c. Carefully observe any change in rpm and manifold pressure.
- d. When engine speed is down to 300 rpm during leaning procedure return to FULL RICH.

NOTE

If a momentary rise of not more than 20 rpm is observed before normal drop-off, the mixture strength is correct. A greater rise in rpm indicates that the mixture is too rich, while no rise at all is a sign of the mixture being too lean.

2.17.4 POWER CHECK

- a. Control column full back.
- b. Open throttle to 2000 rpm.
- c. Check manifold pressure 30 in. Hg.

2.17.5 IGNITION SYSTEM CHECK

- a. Control column full back.
- b. Open throttle to 1700 rpm.
- c. Check magnetos "L" and "R".

NOTE

When running on one magneto, the drop in rpm should not exceed 100 rpm.

2.18 STOPPING THE ENGINE

(When a cold weather start is anticipated, dilute engine oil according to instructions and information given in paragraph 6.3).

To stop engine, proceed as follows:

- a. Idle until cylinder head temperature is less than 200°C (approximately 400°F).
- b. Propeller control
 - 1. Counterweight propeller - HIGH PITCH.
 - 2. Hydromatic propeller - Retard slowly towards HIGH PITCH whilst observing the manifold pressure gauge. When manifold pressure ceased to increase, arrest propeller control movement.

CAUTION

With the counterweight propeller, the propeller control must remain at the HIGH PITCH position during the engine shut down and remain in that

position so that the oil in the propeller cylinder is returned to the engine oil system. If the engine were started with the counterweight propeller control in the full INCREASE RPM position, the immediate demand for oil to change the propeller pitch might critically decrease the available oil pressure necessary for engine lubrication during the start.

- c. Mixture control to IDLE CUT-OFF.
- d. When engine has stopped, turn ignition and battery switches OFF.
- e. Close throttle.
- f. Fuel selector to OFF position.

2.18.1 ENGINE FAILS TO STOP

If IDLE CUT-OFF does not stop engine:

- a. Close throttle.
- b. Turn ignition OFF.
- c. Slowly open throttle.

2.19 BEFORE LEAVING AIRPLANE

- a. Have wheels chocked.
- b. Release parking brakes.

CAUTION

Do not leave parking brakes set. There is a possibility of seizure, if brakes are overheated due to hard taxiing.

- c. Cage gyros.
- d. Lock controls.
- e. All switches OFF, with the exception of the generator switch to be left ON.
- f. Carburettor hot air control to COLD.
- g. Tailplane trim to zero, if not done while taxiing.
- h. Have airplane tied down with protective covers placed in position.
- j. REPORT ANY UNSATISFACTORY CONDITIONS.

CHAPTER III

EMERGENCY PROCEDURES

3.1 ENGINE FAILURE

3.1.1 ENGINE FAILURE DURING TAKE-OFF RUN

Remaining runway is sufficient for a pull-up:

- a. Apply brakes - control column fully back all the time.
- b. Fuel and oil emergency shut-off. PULL SHARPLY (to break wire lock)
- c. Mixture control - IDLE CUT-OFF.
- d. Fuel selector valve - OFF.
- e. Ignition - OFF.
- f. Master switch - OFF.

Space ahead is insufficient

- a. Take steps as above.
- b. Attempt to turn the aircraft by momentarily releasing the wheel brake on the outside of the intended turn and counteracting the ground looping tendency thus created by instant and coarse application of the full rudder with the same foot.

3.1.2 ENGINE FAILURE AFTER TAKE-OFF

- a. Lower nose immediately to maintain airspeed above stalling speed.
- b. Fuel and oil emergency shut-off lever CLOSED.
- c. Propeller control - HIGH PITCH.
- d. Ignition - OFF.
- e. Master switch - OFF.
- f. Fuel selector - OFF.
- g. Throttle - CLOSED.
- h. Warn passengers to brace feet against supports and protect heads with arm across forehead, gripping any solid fixture within reach with the same hand.
- i. KEEP STRAIGHT AHEAD.
CHANGE DIRECTION ONLY ENOUGH TO AVOID OBSTACLES.
USE RUDDER ONLY.

CAUTION

Always maintain enough airspeed to assure full control of aircraft to point of touch-down.
Coarse use of ailerons near the stall airspeeds precipitates wing dropping.

CAUTION

It is better to ride an aircraft with a dead engine safely to a crash landing straight ahead, than to make an attempt at turning back to the field. These attempts have in many instances ended with an uncontrolled roll into the ground.

3.1.3 ENGINE FAILURE ABOVE 800 FT AFTER TAKE-OFF

- a. Nose down.
- b. Flaps - CRUISE.
- c. Propeller control - HIGH PITCH.
- d. Maintain airspeed of 85 mph (glide gradient is 10%).
- e. Decide whether to ride aircraft safely to ground for a crash landing or whether to make an attempt at landing on the field.
- f. Proceed as described in DEAD ENGINE LANDING.

3.1.4 ENGINE FAILURE DURING FLIGHT

If sufficient altitude is available

Attempt re-start by taking steps as follows:

- a. Airspeed - 85 mph.
- b. Fuel selector - Fullest tank.
- c. Mixture control - FULL RICH.
- d. Propeller control - Full INCREASE RPM.
- e. Throttle - 1/3 open.
- f. Ignition switch - BOTH.
- g. Booster pump switch - BOOST PUMP.

NOTE

If the propeller is windmilling, the engine can be started without operating the STARTER switch.

If re-start fails:

- a. Shut engine down.
- b. Maintain maximum glide speed of 85 mph with flaps at CRUISE position.
- c. Make a dead engine landing.

3.2 DEAD ENGINE LANDING

- a. Fuel and oil emergency shut-off valve - CLOSED.
- b. Fuel selector control - OFF.
- c. Propeller control - HIGH PITCH.
- d. Mixture control - IDLE CUT-OFF.
- e. Throttle - CLOSED.

Close to ground:

- a. Ignition switch - OFF.
- b. Order occupants to brace themselves.
- c. Flaps to LANDING position.
- d. Touch-down tail first, as nearly into the wind as circumstances permit.
- e. Leave airplane immediately.

3.2.1 IN CASE THE AIRCRAFT NOSES OVER:

- a. Discharge fire extinguisher as soon as turn-over movement begins.
- b. Warn passenger(s) to wait for being released from their safety belts, if there is no fire.
- c. Leave aircraft immediately.

3.3 PROPELLER FAILURE

Failure of the constant speed governor may result in a runaway propeller. When such failure occurs, the propeller goes to full low pitch and the engine speed may exceed the maximum permissible rpm. (Refer to paragraph 4.2).

At first evidence of a runaway propeller:

- a. Throttle back.
- b. Manipulate propeller control in attempt to bring propeller within limits.

3.3.1 PROPELLER FAILURE DURING TAKE-OFF

Abandon take-off as follows:

- a. Apply brakes.
- b. Fuel and oil emergency shut-off - PULL SHARPLY.
- c. Mixture control - IDLE CUT-OFF.
- d. Fuel selector valve - OFF.
- e. Ignition - OFF.
- f. Master switch - OFF.
- g. When speed is low and remaining space insufficient, attempt to turn aircraft through one-sided braking and counteraction with rudder.

3.3.2 PROPELLER FAILURE AFTER TAKE-OFF

- a. Throttle back slightly while keeping nose down.
- b. Manipulate propeller control in attempt to bring propeller within limits.
- c. If unsuccessful, decide whether to return to field or climb to decrease engine speed.

3.3.3 PROPELLER FAILURE DURING FLIGHT

Runaway propeller

- a. Throttle back.
- b. Manipulate propeller control.
- c. Pull aircraft into climb to decrease engine speed and increase load on propeller.

Oil supply break-down

- a. Check oil pressure.
- b. Keep RPM to a minimum and make an emergency landing with limited power on.

3.4 ENGINE FIRE

3.4.1 ENGINE FIRE ON THE GROUND

When an engine fire occurs during starting, it cannot be established at once and with certainty, whether the fire is in the induction system only, or whether it is of a more serious nature. With any type of oil or fuel fire, other than induction fire, the effect of opening the throttle wide to have the fire sucked through the engine, may increase the engine fire to disastrous severity.

NOTE

An air induction system fire will not necessarily give an indication on the fire warning light.

Thus in any case of engine fire on the ground, the engine should be stopped as quickly as possible taking the following steps:

- a. Mixture control to IDLE CUT-OFF.
- b. PULL sharply Oil and Fuel Emergency Shut-off.

Wait until engine speed has slowed down, only then:

- a. Ignition - OFF.
- b. Master switch - OFF.

As soon as the engine has stopped:

- a. Discharge engine fire extinguisher.
- b. Make sure flame switch fuse is replaced, fire switch reset and a fully charged fire extinguisher bottle fitted.

If fire does not go out:

- a. Have extreme bottom panel opened.
- b. Have portable fire extinguisher discharged upwards through opening.
- c. Release brakes.
- d. Leave aircraft.
- e. Stand by to push aircraft away from aircraft or building in neighborhood if endangered.

NOTE

After an engine has been on fire, no attempt must be made at re-starting until the engine has been examined.

An exception, however, can be made; in the case of an intake fire which has been successfully sucked in without the fire extinguisher having been used.

3.4.2 ENGINE FIRE IN THE AIR

As soon as the fire warning light comes on:

- a. Stop engine immediately proceeding in accordance with placard near fire warning light.
- b. Operate Emergency Shut-off.
- c. Propeller to DECREASE RPM.
- d. Throttle closed.
- e. Mixture at IDLE CUT-OFF.
- f. Wait for engine to slow down.
- g. Operate fire extinguisher.
- h. Maintain maximum glide speed of 85 mph with flaps at CRUISING.
- j. Radio state of emergency and position.
- k. Instruct other occupants of aircraft for crash landing.
- l. Make a dead engine landing.

Should the fire show no sign of abating and the height be insufficient, or no parachutes be carried to permit abandoning the aircraft:

- a. Side-slip the aircraft into a crash landing, preferably into soft ground, sand or shallow water using wing and tail to absorb impact.

If parachutes are carried and the height is sufficient for a parachute descent.

- a. Abandon aircraft rather than attempt a crash landing as there is little chance of saving the aircraft with an engine on fire after crash landing but a great risk that the fire may spread rapidly excluding a bail-out at too low altitudes.

CAUTION

Do not attempt to re-start the engine in mid air after the fire extinguisher has been used successfully, as the fire is liable to recur on re-starting when the extinguisher is exhausted.

3.4.3 ACCIDENTAL OPERATION OF THE FIRE EXTINGUISHER

If the fire extinguisher has been accidentally discharged:

- a. Continue flight with throttle at least 2/3 open.
- b. After two to three minutes return to normal flight conditions.

Throttle opening minimises engine corrosion and spark plug fouling, as the methyl bromide is rapidly dispersed, its boiling point being close to 4°C.

- c. Report use of the engine fire extinguisher after landing to ensure engine check and replenishing of the extinguisher.

3.4.4 FUSELAGE FIRE

A fuselage fire is usually indicated by smoke which will immediately warn passengers and/or crew.

- a. Use fire extinguisher, to the left of the pilot, if the source of the fire can be located and is accessible.

If the source of the fuselage fire cannot be located, or is not accessible:

- a. Shut-off all electrical switches EXCEPT IGNITION.
- b. Close all windows, pull ventilators and cabin air extractor, if fitted.

When the fire has been extinguished, yet its source could not clearly be established:

- a. Leave all switches EXCEPT IGNITION in the OFF position.
- b. Land at nearest airfield for investigation.

3.5 DITCHING

Any high-wing monoplane should only be ditched as a last resort. Even in the exceptional case where the pilot succeeds in ditching his airplane under most favourable conditions, there is the almost certain possibility that the aircraft will submerge to the cabin roof in a very short time.

If, however, the aircraft has to be ditched, proceed as follows:

- a. Keep approach speed sufficient for control down to the impact with the water.
- b. Instruct other occupants of the aircraft.
- c. Approach against the wind.
- d. Have rear cargo door pushed open and upholstery panel covering escape hatch removed.
- e. Ditch on the falling side of a wave crest or swell top.
- f. Touch down tail first to prevent the tail from striking a wave crest or swell top which might cause the aircraft to nose in or dive under.

Other occupants of the aircraft should be instructed as follows:

- a. Loosen collars and ties, parachute harness if worn.
- b. Hold on to life preserver cushions.
- c. Be prepared for a double impact when first the tail, and then the engine strike the water.
- d. Not to move until the aircraft has come to rest.
- e. Help each other through the escape hatch or door as quickly as possible.

CHAPTER IV

OPERATING LIMITS

4.1 GENERAL REMARKS

The aircraft must be operated according to the following limitations and instructions.

Instrument readings by means of which operating limitations can be observed, will be found on page 51, figure 4-2. The instrument markings show there should be given close attention since they contain operational limits information which is not necessarily repeated in the following text.

- 4.1.1 The aircraft has been classified in the Normal Category D of International Airworthiness Standards in accordance with the Type Approval.

ALL ACROBATIC MANOEUVRES, INCLUDING SPINS, ARE PROHIBITED

Stalls are permitted for demonstration purposes only.

4.2 ENGINE LIMITATIONS

Refer to: Engine Operating Limits (Table on page 45)
Pilot's Check Charts (Tables on pages 46 and 47)
Procedure Checks (Table on page 48)
Instrument Markings (Figure 4-2 on page 51)

NOTE

Minimum fuel pressure should be 5 1/4 psi
when combustion heater is operated.

CAUTION

If engine over-speeding occurs, land at nearest airfield and have engine and propeller inspected before further flights. If the engine has exceeded 2,640 RPM for more than 30 seconds, an engine change is indicated.

4.3 PROPELLER LIMITATIONS

Provided that the engine is operated within engine limitations, the propeller will be within its safe limits. Excessive run-up on the ground is to be avoided.

4.4 FUEL AND OIL GRADES AND SPECIFICATIONS, RESIDUAL FUEL QUANTITIES

4.4.1 FUEL

Recommended fuel: Fuel Grade 80/87

Alternate fuel grades with lower or higher lead contents:

Fuel Grade 91/98 (Commercial)
 Fuel Grade 91/96 (Military)
 Fuel Grade 100/130 (Military)

These fuel grades are permissible only when fuel grade 80/87 is not available if the following engine limitations are observed:

CAUTION

* If low octane fuel grade 80 is used in an emergency, a manifold pressure of:

33.5 in.Hg. for the S1H1 Engine
 35 in.Hg. for the S3H1 Engine

must NOT be exceeded.

* If fuel grade 100/130 is used, comply with instructions given in Chapter II, paragraph 2.11.2 to minimize possible engine damage due to high lead content.

Fuel Specifications:	Canadian	3-GP-25a
	U.S.A.	MIL-F-5572
	British	DED 2485

Residual Fuel Quantities

Fuel remaining in tanks when the quantity indicator of the fuel contents gage has reached zero, cannot be used safely in flight.

4.4.2 OIL

Oil Specifications and Grades:

<u>Canadian</u>	<u>U.S.A.</u>	<u>British</u>
3-GP-80	MIL-O-6082(1080)	DED 2472A/0
3-GP-100	MIL-O-6082(1100)	DED 2472B/0
3-GP-120	MIL-O-6082(1120)	DED 2472C/0

ENGINE OPERATING LIMITS

a) Temperatures	°C.	°F.
1. OIL		
MIN. Oil Inlet Temperature for Take-Off	40°	100°
Desired Oil Inlet Temperature	60°-75°	140°-165°
MAX. Oil Inlet Temperature	95°	200°
2. CYLINDER HEAD		
MAX. Cylinder Temperature, 1 hr ..	260°	500°
MAX. Cylinder Temperature continuous	232°	450°
MAX. Cylinder Temperature continuous cruising (lean)	232°	450°
Desired Cylinder Temperature continuous cruising (lean)	204° or less	400° or less
3. CARBURETTOR MIXTURE		
Desired Mixture Temperature	+4° to +10°	40° to 50°
b) Pressures	lbs. per sq. in.	kg/cm ²
1. OIL		
MIN. at idling speeds	10	0.7
MIN. at cruising speeds	50	3.5
Desired	70-90	4.9 to 6.3
2. FUEL*		
MIN. (400 rpm or less)	2	.14
MIN. (all speeds above 1200 rpm) ..	4	.28
Desired for cruising	5 1/2	.38
MAX.	6	.42

* Minimum fuel pressure should be 5 1/4 psi when combustion heater is operated.

PILOT'S CHECK CHART - WASP SIH1-G ENGINE

OIL - Grade 100 or 120

Operating Conditions			Engine Settings			Operational Limits (Recommended)					
Rating	BHP	Altitude Feet	Max. Engine RPM	Max. Manifold Press. in. hg.	Mixture Control	Oil Inlet Temp. °C (Temp. °F)		Oil Press. psi		Max. Cyl. Head Temp. °C (Temp. °F)	Carb. Air Temp. °C (Temp. °F)
						Mtn.	Max.	Min.	Max.		
Take-off	600	6200 crit SL	2250 2250	35.0 36.5	Full Rich	40° (100°)	85° (185°)	70	90	260° (500°)	+4°C to +10°C (40° to 50°) max.
Normal Rated	550	8000 crit SL	2200 2200	33.0 35.0	Full Rich	40° (100°)	85° (185°)	70	90	260° (500°) 1 hour	+4°C to 10°C (40° to 50°) max.
Max. Overspeed (30 sec. max.)			2640 max.	Over 12	Full Rich	40° (100°)	85° (185°)				

RECOMMENDED LIMITS OF CONTINUOUS CRUISE

Max. recom. lean oper	400	10,300 crit. SL	2000 2000	26.5 30.0	Rich best power.	40° (100°)	85° (185°)	60	232° (450°)	+4°C to +10°C (40° to 50°)
Max. Economy	400 or less		*	*	Lean best power	40° (100°)	85° (185°)	60	232° (450°)	+4°C to +10°C (40° to 50°)

* For Recommended Operational Cruise Settings see Chart on Page XI in Appendix.

Jan 1954

Fuel Pressure: 4-6 psiA.L.3

PILOT'S CHECK CHART - WASP S3H1-G ENGINE

FUEL Grade 80/87 or 91/98

OIL - Grade 100 or 120

Operating Conditions			Engine Settings			Operational Limits (Recommended)					
Rating	BHP	Altitude Feet	Max. Engine RPM	Max. Manifold Press. in. hg.	Mixture Control	Oil Inlet Temp °C (Temp °F) Min. Max.		Oil Press. psi Min. Max.		Max. Cyl. Head Temp °C (Temp °F)	Carb. Air Temp °C (Temp °F)
Take-off	600	3000 crit SL	2250 2250	35.0 36.0	Full Rich	40° (100°)	85° (185°)	70	90	260° (500°)	+4° to +10° (40° to 50°) max.
Normal Rated	550	5000 crit SL	2200 2200	32.5 33.5	Full Rich	40° (100°)	85° (185°) 1 hour	70	90	260° (500°)	+4° to 10° (40° to 50°) max.
Max. Overspeed(30 sec. max.)			2640	Over 12	Full Rich	40° (100°)	85° (185°)				

RECOMMENDED LIMITS OF CONTINUOUS CRUISE

Max. recom. lean oper.	400	10,300 crit. SL	2000 2000	26.0 29.0	Rich best power	40° (100°)	85° (185°)	60		232° (450°)	+4° to +10° (40° to 50°)
Max. economy	400 or less		*	*	Lean best power	40° (100°)	85° (185°)	60		232° (450°)	+4° to +10° (40° to 50°)

* For recommended Operational Cruise Settings see Chart on page IX in Appendix.

Jan 1954

Fuel Pressure: 4-6 psi

A.L. 3

PROCEDURE CHECKS

OPERATION	MIXTURE CONTROL	PROPELLER CONTROL		THROTTLE CONTROL	OIL INLET Temp. °C (Temp. °F) Min. Max.	OIL PRESSURE PSI Min. Max.		MAXIMUM CYL. HEAD Temp. °C. (Temp. °F.)
		Ham. Std. C'Weight	Other					
Start	Full Rich	Low rpm then high	High rpm	1/10 to 1/4 open		Pressure to show almost immediately		
Warm-Up	Full Rich	High rpm	High rpm	for 1000 rpm	85° (185°)			232° (450°)
Ground check	Full Rich	High rpm	High rpm	See text	40° 85° (100°) (185°)	60 90		232° (450°)
Glide and Approach	Full Rich	Set for 2000	Set for 2000	As needed	40° 85° (100°) (185°)	60 80		232° (450°)
Stop	Idle Cut- off or Full lean	Low rpm	High rpm			Idle 10		200° (400°)

NOTES

Best climb and continuous level flight operation is obtained by maintaining +4°C to +10°C (approximately 40° to 50° F.) carburettor air temperature.

- (1) Above 5000 feet altitude lean mixture to minimum required for smooth operation.
- (2) Limit of carburettor air temperature applies only when preheat is used.

4.5 AIRSPEED LIMITS

- 4.5.1 MAXIMUM PERMISSIBLE DIVING SPEED
- | | |
|------------|------------------------|
| Landplane) | 192 mph (309 km/hr)IAS |
| Skiplane) | |
| Seaplane | 183 mph (294 km/hr)IAS |

WARNING

Max. permissible diving speed is the never-exceed speed. Higher airspeeds reduce safety margins to unauthorized levels.

- 4.5.2 NORMAL OPERATING LIMIT SPEED
- | | |
|------------|------------------------|
| Landplane) | 144 mph (232 km/hr)IAS |
| Skiplane) | |
| Seaplane | 134 mph (216 km/hr)IAS |

Normal cruising flight operations should be confined to speeds below this value.

The range of speed between normal operating limit speed and the maximum permissible diving speed should be intentionally entered only with due regard to the prevailing flight and atmospheric conditions, in particular turbulence.

- 4.5.3 MANOEUVERING SPEED 126 mph (203 km/hr)IAS

Manoeuvres which involve an approach to stall conditions, or full application of rudder or aileron control, should be confined to speeds below this value.

- 4.5.4 MAXIMUM SPEED FOR LOWERING FLAPS 94 mph (151 km/hr)IAS

For AIRSPEED LIMITATIONS as marked on Airspeed Indicator refer to figure 4-2 on page 51.

4.6 ACCELERATION LIMITS

Limit load factors are the maximum values to which the airframe may safely be subjected in flight.

These values for various speeds are given in the Flight Envelope figure 4-1, page 50.

When flying in very rough air, or if it is necessary to perform forcible manoeuvres including full application of aileron and rudder, the airspeed should not be permitted to exceed the manoeuvring speed of 126 mph (203 km/hr)IAS.

In tight turns, flight load factors may reach the limit loads, and may also increase the danger of an unintentional stall as indicated below.

Angle of Bank

Load Factor

Stalling Speed
mph IAS

0°	1.0	65
50°	1.5	85
60°	2.0	100
66°	2.5	110
70°	3.0	120
73°	3.5	130

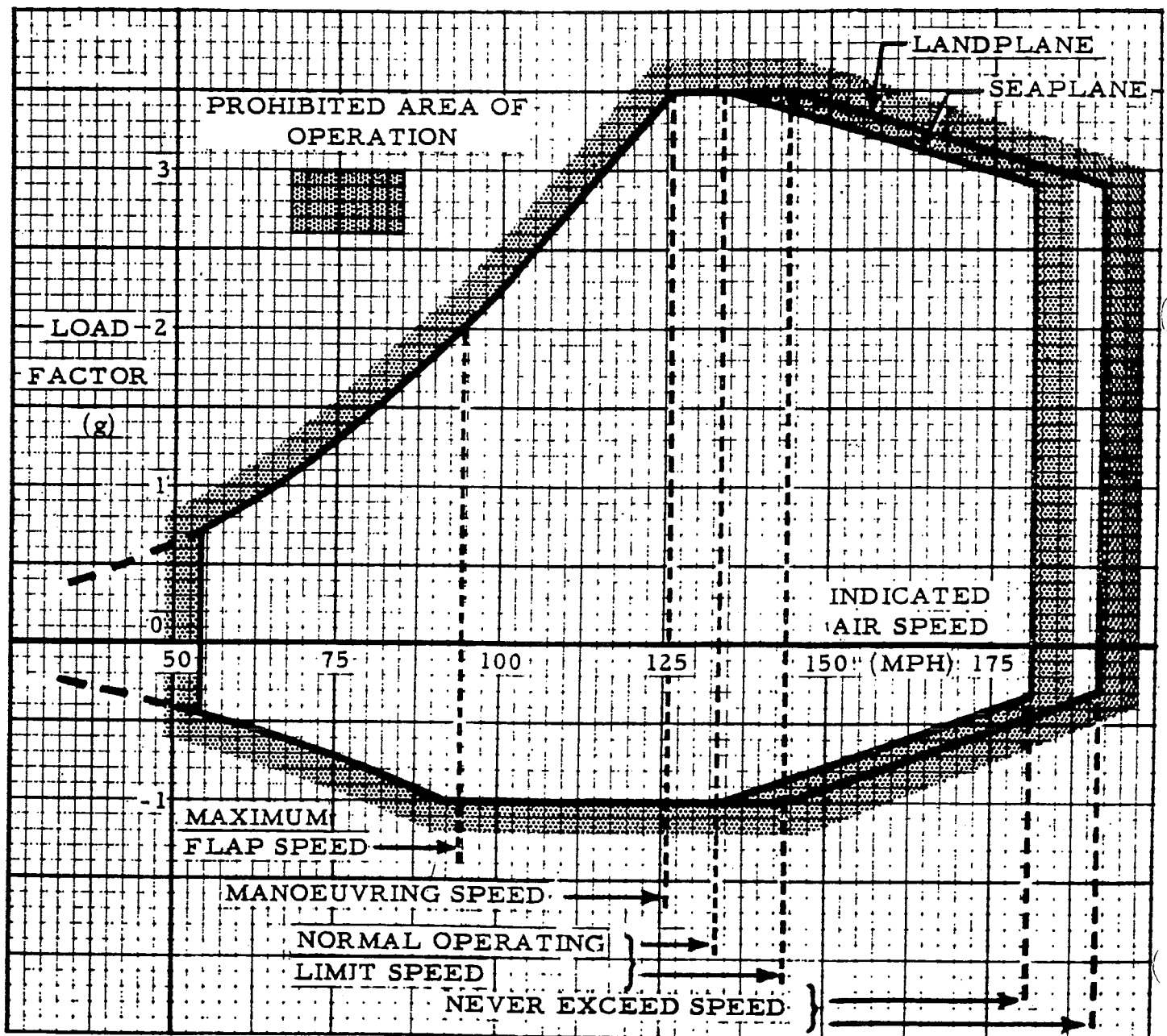
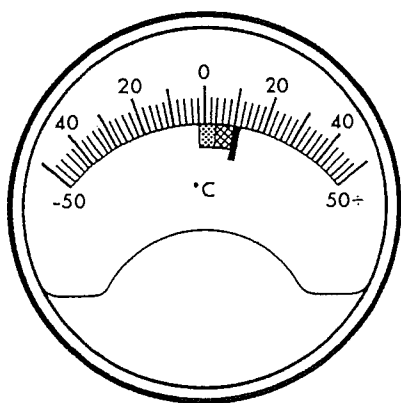
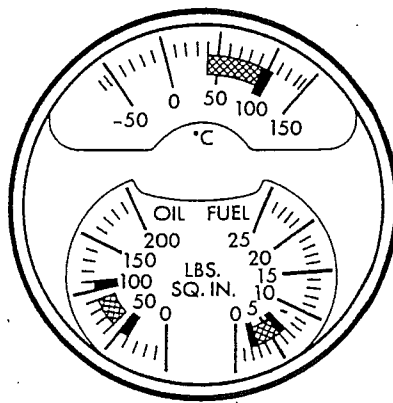


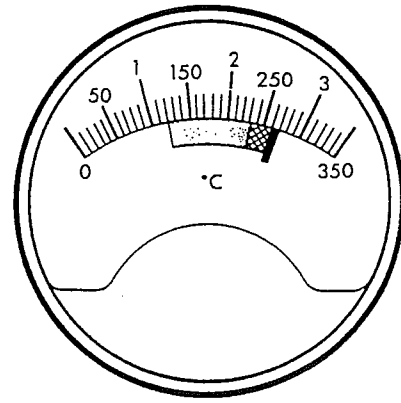
FIG. 4.1 FLIGHT ENVELOPE



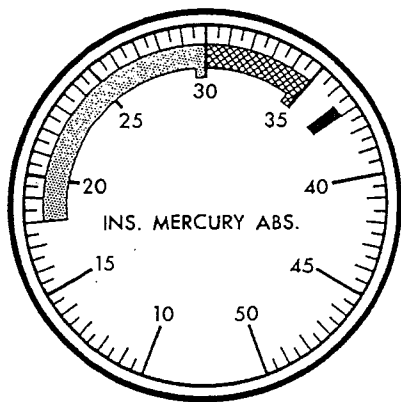
CARB. MIX. TEMP.



FUEL AND OIL PRESS., OIL TEMP.



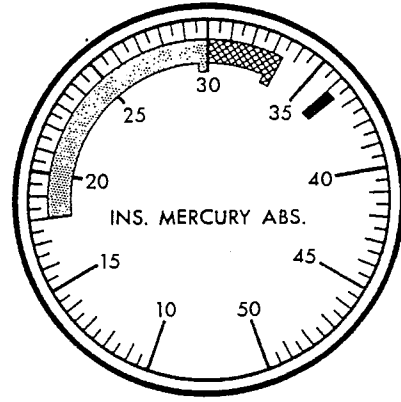
CYLINDER HEAD TEMP.



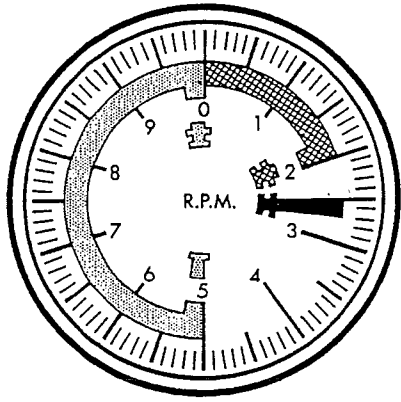
MANIFOLD PRESS.
SIH1 ENGINE

CAUTION

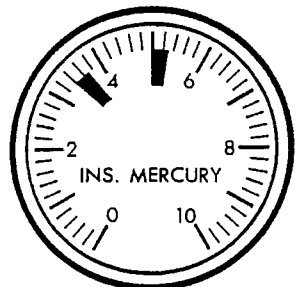
AT AMBIENT TEMPERATURES BELOW STANDARD ALTITUDE TEMPERATURE (15°C (59°F) AT S.L.) WITH CARBURETOR AIR AT COLD, OVER-BOOSTING AND DETONATION ARE POSSIBLE AT MAP SETTINGS BELOW THE NORMAL MAXIMUM PERMISSIBLE. THEREFORE, TAKE-OFF MAP MUST BE REDUCED BY 2% PER 11°C (20°F) BELOW STANDARD, IF ENGINE LIFE IS TO BE PRESERVED.



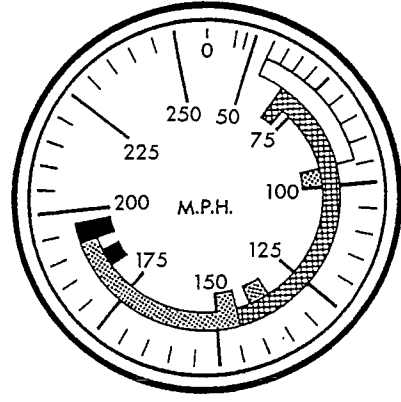
MANIFOLD PRESS.
S3H1 ENGINE



TACHOMETER



SUCTION



AIRSPEED

POWER LIMITS BASED ON FUEL GRADE 80/87-91/98

- | | |
|---|---|
|  RED—DANGER WARNING. MINIMUM AND/OR MAXIMUM LIMITATIONS. |  YELLOW—CAUTION. DANGER MAY EXIST UNDER CERTAIN CONDITIONS. |
|  GREEN. REGION FOR CONTINUOUS OPERATION. WHEN USED IN CONJUNCTION WITH BLUE MARKINGS, GREEN INDICATES RANGE REQUIRING "RICH" OPERATION. |  BLUE. "LEAN" OPERATION IS PERMITTED. |
| |  BLANK SPACE. REGION THAT SHOULD BE AVOIDED OR IN WHICH OPERATION IS LIMITED. |

FIG. 4-2 INSTRUMENT LIMIT MARKINGS

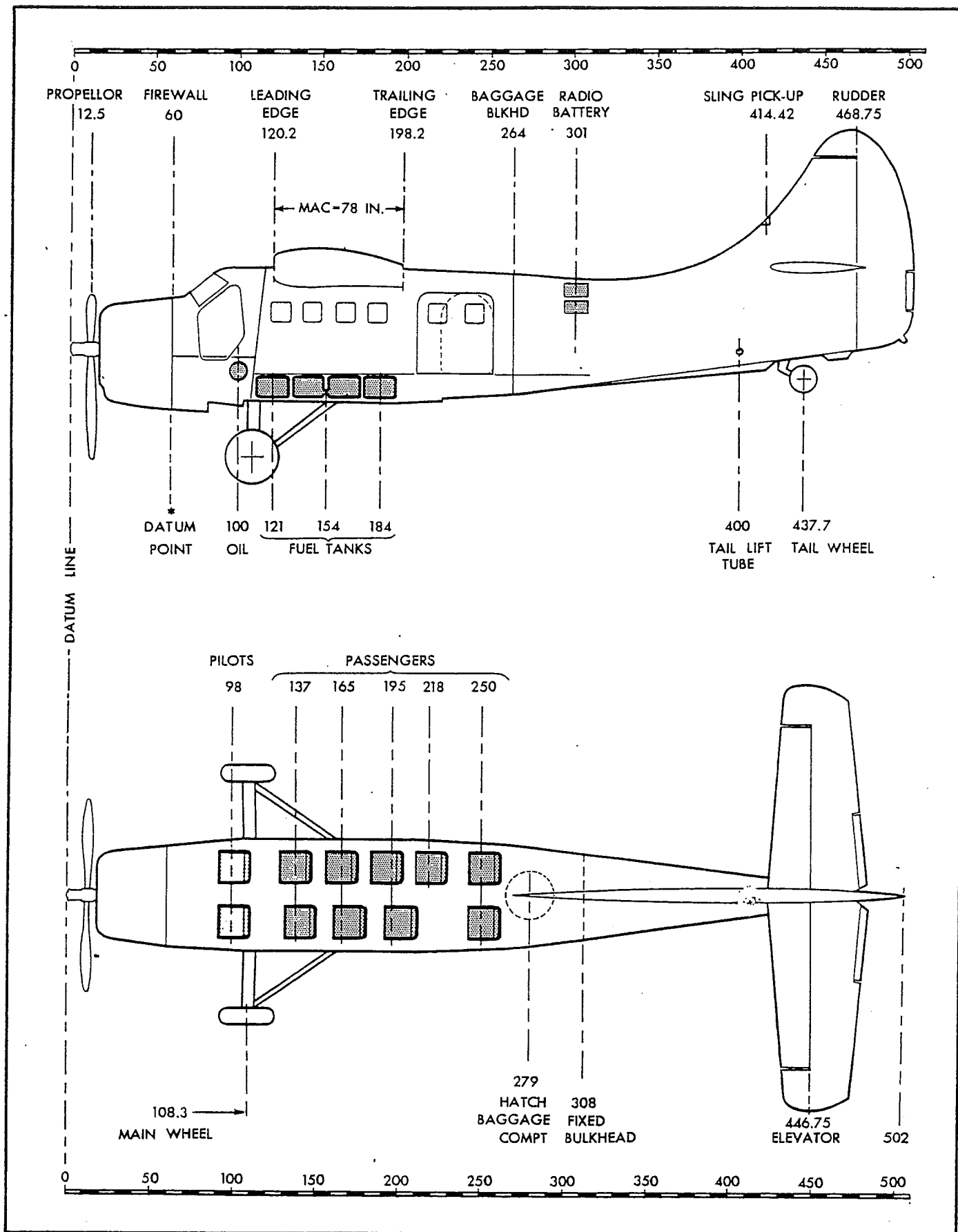


FIG. 4-3 BALANCE DIAGRAM

4.7 WEIGHT AND BALANCE LIMITATIONS

4.7.1 GENERAL

At the maximum gross weight of 8000 lb (landplane) or 7967 lb (seaplane), the aircraft complies with the general performance and strength criteria.

In the interest of airworthiness it is important that the weight and balance limits for the airplane be adhered to in accordance with the recommendations and information given in the following paragraphs, tables and diagrams.

4.7.2 WEIGHT DEFINITIONS

The Tare Weight is the weight of the aircraft with the minimum equipment essential to airworthiness, e.g. pilot's seat, flight and engine instruments, battery and the like.

Hence equipment changes in the field will not normally change the tare weight figure.

The tare weight will be appropriate to the configuration, i.e. the landplane, skiplane and seaplane values will differ.

The Basic Weight includes all other installed equipment both fixed and removable, e.g. radio, exterior finish (paint), furnishings and such equipment as is defined by the item ticked off in the Weight and Balance Report under the heading "Equipment Check List" and "Basic Weight Change Record".

The Operational Load comprises crew and parachutes, oil and fuel, and payload weights.

The Payload consists only of passenger(s), baggage and cargo. Maximum values of payload vs. range for various basic weights are given in the Appendix page VIII.

The All-Up Weight (A.U.W.) is the sum of basic weight plus operational load and in order to remain within approved limits, must not exceed 8000 lb for the landplane, 7967 lb for the seaplane.

4.7.3 FUEL ALLOWANCES

It should be noted that fuel allowances are included for 10 minutes warm-up, take-off and climb to 5,000 ft. altitude, and reserve fuel for 45 minutes flying time at cruising power. (See PAYLOAD vs. CRUISING RANGE chart, page VIII of the Appendix).

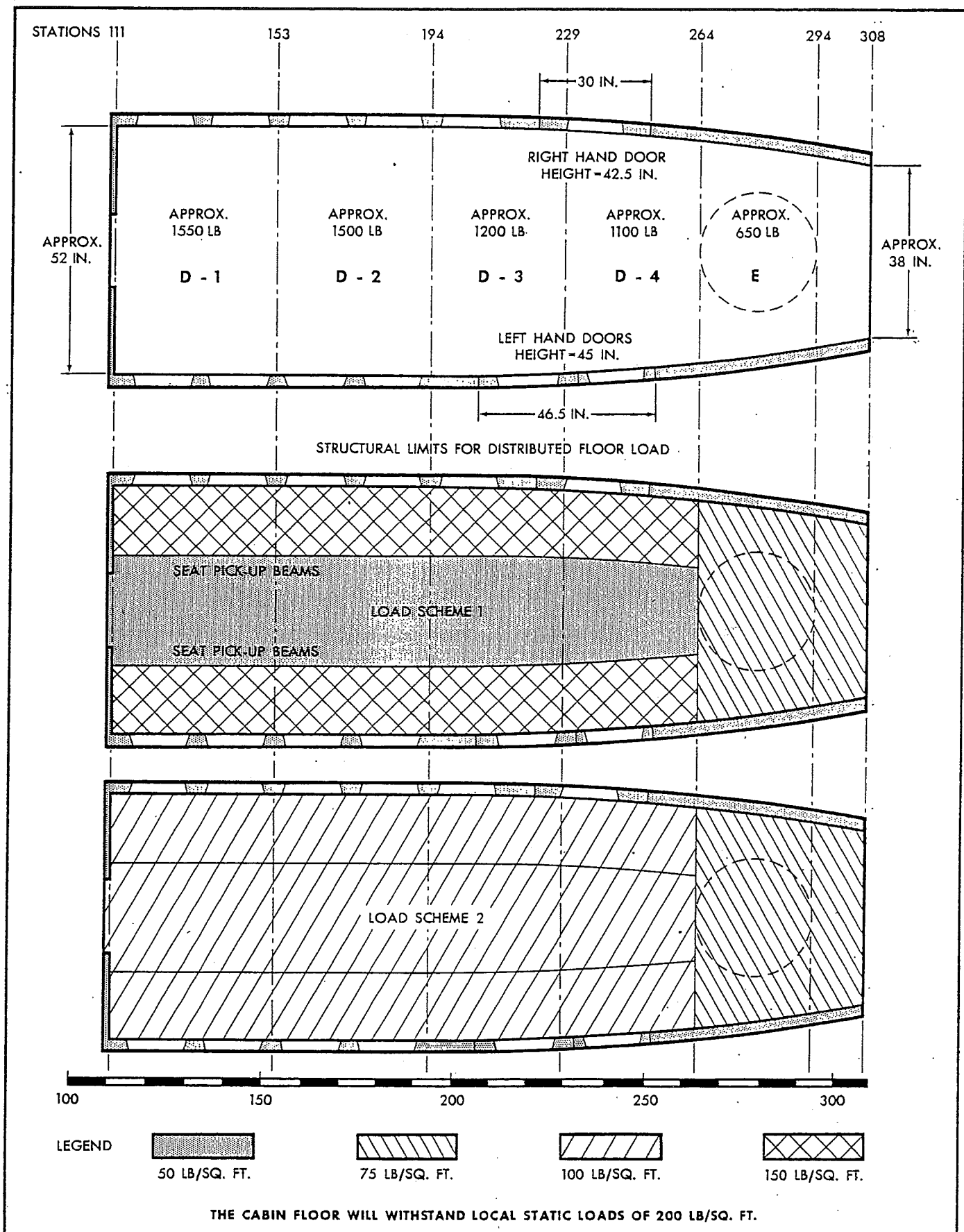


FIG. 4-4 PERMISSIBLE FLOOR LOADING DIAGRAM.

4.7.4 WEIGHT AND BALANCE REPORT

This report defines the equipment that was in the aircraft "As Weighed" and "In Basic Weight" and gives weights, arms and moments as well as the Tare and Basic Weights and Basic Moment. It may be found in the envelope on the inside of the rear cover of this Flight Manual.

If the equipment is changed, the Basic Weight changes too. Changes should be recorded in the "Basic Weight Change Record", which record must be kept up-to-date at all times.

The "Equipment Check List" should be ticked off.

If the configuration of the aircraft is altered at any time, e.g. changing from floats to skis, such alteration must be duly recorded in the "Basic Weight Change Record".

The obligation that all changes must be recorded, applies also to modifications of all sorts; e.g. repair of damages suffered in the field, in which case all parts removed from, or added to, the aircraft must be separately weighed and their Moment Arms measured so that the "Weight and Balance Report" may be properly brought up to date.

The Balance Diagram (figure 4-3) may be used to determine the Arms of any equipment not yet listed.

4.7.5 PREPARATION FOR FLIGHT

The A.U. W. and Total Moment (i.e. C.G. position) should be checked for conditions at the beginning and at the end of the flight by using the current Basic Weight found in the "Basic Weight Change Record", and the Operational Load Diagram.

The A.U. W. maximum must not exceed: Landplane 8000 lb
Seaplane 7967 lb

The sum total of all moment values must remain within the safe moment limits given for different All-up Weights in the Safe Moment Table.

WARNING

C.G. position of the loaded aircraft must be checked and verified prior to take-off, and appropriate trim settings should be used; otherwise abnormal stick forces and positions may result.

To establish conditions at the beginning of the flight, use A.U. W. To arrive at conditions prevailing at end of flight, subtract from A.U.W and total moment the aggregate moments of fuel and oil consumed during flight, to establish whether such change in weights and moments may cause the C.G. position to fall beyond permitted limits.

FREIGHT LOADS AND MOMENTS for compartments in figure 4-5.

Weight Pounds	MOMENT/100				
	COMPARTMENT				
	D-1	D-2	D-3	D-4	E
	Station 111 to Station 153	Station 153 to Station 194	Station 194 to Station 229	Station 229 to Station 264	Station 264 to Station 294
	Arm = 132.0	Arm = 173.0	Arm = 211.0	Arm = 246.0	Arm = 279.0
50	66	87	106	123	140
100	132	173	211	246	279
150	198	260	317	369	419
200	264	346	422	492	558
250	330	433	528	615	698
300	396	519	633	738	837
350	462	606	739	861	977
400	528	692	844	984	1116
450	594	779	950	1107	1256
500	660	865	1055	1230	1395
550	726	952	1161	1353	1535
600	792	1038	1266	1476	1674
650	858	1125	1372	1599	1814
700	924	1211	1477	1722	
750	990	1298	1583	1845	
800	1056	1384	1688	1968	
850	1122	1471	1794	2091	
900	1188	1557	1899	2214	
950	1254	1644	2005	2337	
1000	1320	1730	2110	2460	
1050	1386	1817	2216	2583	
1100	1452	1903	2321	2706	
1150	1518	1990	2427		
1200	1584	2076	2532		
1250	1650	2163			
1300	1716	2249			
1350	1782	2336			
1400	1848	2422			
1450	1914	2509			
1500	1980	2595			
1550	2046				

The following table shows the forward and aft safe moment limits for the landplane and skiplane, and for the seaplane and amphibian.

Gross Weight Lb	Landplane & Skiplane MOM/100				Seaplane & Amphibian MOM/100	
	Forward Limit Landplane & Skiplane	Aft Limit			Forward Limit	Aft Limit
		Landplane		Skiplane		
		Col A	Col B (See Note)			
4500	5936	6813	6848	6813		
4600	6067	6964	7000	6964		
4700	6199	7116	7152	7116		
4800	6331	7267	7305	7267		
4900	6463	7419	7457	7419		
5000	6595	7570	7609	7570	6595	7415
5100	6727	7721	7761	7721	6726	7563
5200	6859	7873	7913	7873	6859	7712
5300	6991	8024	8066	8024	6991	7860
5400	7123	8176	8218	8176	7123	8008
5500	7255	8327	8370	8327	7255	8157
5600	7386	8478	8522	8478	7386	8305
5700	7518	8630	8674	8630	7518	8453
5800	7650	8781	8826	8781	7650	8601
5900	7782	8933	8979	8933	7782	8750
6000	7914	9084	9131	9084	7914	8898
6100	8046	9235	9283	9235	8046	9046
6200	8178	9387	9435	9387	8178	9195
6300	8310	9538	9587	9538	8310	9343
6400	8442	9690	9740	9690	8442	9491
6500	8574	9841	9892	9841	8574	9640
6600	8705	9992	10044	9992	8705	9788
6700	8863	10144	10196	10144	8863	9936
6800	9022	10295	10348	10295	9022	10084
6900	9182	10447	10500	10447	9182	10233
7000	9342	10598	10653	10598	9342	10381
7100	9503	10749	10805	10749	9503	10529
7200	9665	10901	10957	10901	9665	10678
7300	9828	11052	11109	11052	9828	10826
7400	9991	11204	11261	11204	9991	10974
7500	10156	11355	11414	11355	10156	11123
7600	10321	11506	11566	11506	10321	11271
7700	10457	11628	11718	11628	10502	11418
7800	10592	11748	11870	11748	10684	11566
7900	10728	11868	12022	11868	10867	11714
8000	10864	11987	12174	11987	*11051	*11862
7967					11006	11813
*Amphibian Only						

*Amphibian Only

NOTE

COL B under AFT LIMIT applies only to Landplanes with Mod. 3/746 "Introduction of redesigned stall bars" incorporated.

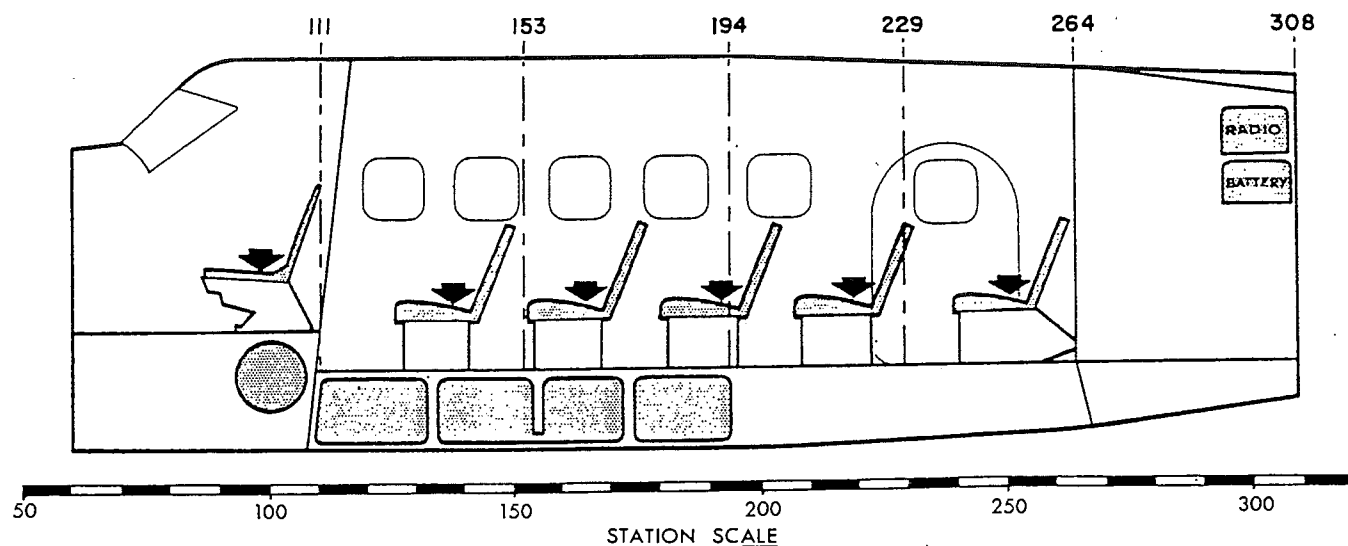
BASIC WEIGHT OF AIRCRAFT LB *

*(INSERT ACTUAL WEIGHT AND BASIC MOMENT GIVEN IN
WEIGHT AND BALANCE REPORT TO BE FOUND IN ENVELOPE
ON INSIDE OF REAR COVER)

BASIC MOMENT *

STD. WEIGHT OF PILOT(S) OR PASSENGER(S) . 170 LB

MEAN ARM IN INS.	98		137	165	195	218		250	279	
MOMENT/100	170		235	285	330	371		425	SEE BELOW	
FREIGHT COMPT.NO.	↑	D-1	↑	↑	↑	↑	↑	↑	E	SEE FREIGHT MOMENT TABLE



OIL		
CAP. 9 IMP. GALS.		ARM= 100 IN
GALS.	LBS.	MOM/100
5	45	45
9	81	81

1) ADD TO BASIC WEIGHT AND TO BASIC MOMENT:

- A) PILOT(S) AND PASSENGER(S)
B) FREIGHT AND BAGGAGE
C) FUEL AND OIL
- WEIGHTS
AND
MOMENTS

2) MAKE SURE:

- A) TAKE-OFF WEIGHT IS LESS THAN MAX ALL-UP WT
B) TOTAL MOMENT VALUE IS WITHIN SAFE MOMENTS LIMITS
C) AVAILABLE TAKE-OFF DISTANCE PERMITS TAKE-OFF AT THIS WEIGHT

3) ADDITIONAL INFORMATION:

FREIGHT MOMENT TABLE
BALANCE DIAGRAM
FLOOR LOAD DISTRIBUTION DIAGRAM

FUEL FRONT TANK		
CAP. 51 IMP. GALS.		ARM= 121 INS.
GALS.	LBS.	MOM/100
10	72	87
20	144	174
30	216	261
40	288	348
50	360	436
51	367	444

FUEL CENTRE TANK		
CAP. 85 IMP. GALS.		ARM= 154 INS.
GALS.	LBS.	MOM/100
10	72	111
20	144	222
30	216	333
40	288	444
50	360	554
60	432	665
70	504	776
80	576	887
85	612	942

NOTE
U.S. GAL.=IMPERIAL X 1.2

FUEL REAR TANK		
CAP. 42 IMP. GALS.		ARM= 184 INS.
GALS.	LBS.	MOM/100
10	72	132
20	144	265
30	216	397
40	288	530
42	302	566

BAGGAGE COMPARTMENT	
ARM= 279 INS.	
WEIGHT	MOM /100
50	140
100	279
150	419
200	558
250	698
300	837
350	977
400	1116
450	1256
500	1395
550	1535
600	1674
650	1814

FIG. 4-5 OPERATIONAL LOADS DIAGRAM

4.7.6 CENTER OF GRAVITY

The CG datum is 60 inches forward of the firewall. See Balance Diagram, figure 4-3 on page 52.

CENTER OF GRAVITY POSITION	GROSS WEIGHT LB	STATION			
		LANDPLANE		SKIPLANE	SEAPLANE
		Mod. 3/746 Incorp.	Mod. 3/746 Not Incorp.		
Extreme	Tare Weight to 6600	131.9	131.9	131.9	131.9
Forward	7600	135.8	135.8	135.8	135.8
	8000	135.8	135.8	135.8	138.1
Extreme	Tare Weight to 7600	152.2	151.4	151.4	148.3
Aft	8000	152.2	149.8	149.8	148.3

For Safe Moment Limits, refer to table on page 56A

4.7.7 CARGO LOAD CONSIDERATIONS

Refer to:

- Balance Diagram
- Operational Load Diagram
- Freight Moments Table
- Safe Moment Limits Table
- Permissible Floor Loads Diagram

4.8 MINIMUM FLIGHT CREW One Pilot

4.9 MISCELLANEOUS

Smoking is authorized for cockpit and cabin.

CHAPTER V

PERFORMANCE DATA AND FLIGHT CHARACTERISTICS

5.1 PERFORMANCE AT 8000 LB GROSS WEIGHT

STANDARD CONDITIONS

STATUTE MILES QUOTED

	Landplane	Seaplane
Max. True Level Speed (600 BHP)	mph (km/hr)	
Sea Level	153 (246)	147 (236)
5,000 ft	160 (257)	153 (246)
True Cruising Speed (400 BHP)	mph (km/hr)	
Sea Level	132 (212)	124 (200)
5,000 ft	138 (222)	129 (208)
True Cruising Speed (325 BHP)	mph (km/hr)	
Sea Level	121 (195)	113 (182)
5,000 ft	127 (204)	117 (188)
Stalling Speed (TAS)	mph (km/hr)	
Flaps Up	73 (117)	73 (117)
Flaps Landing	58 (93)	58 (93)
Take-off over 50 ft Obstacle (ICAO Technique)	ft (metres)	
Flaps "Take-off", Still Air Distance	1630 (497)	2475 (755)
Speed For Best Rate of Climb (IAS)	mph (km/hr)	
	93 (150)	86 (138)
Max. (Initial) Rate of Climb (600 BHP)	fpm (metres/sec)	
(Flaps Up, Sea Level)	850 (4.32)	750 (3.81)
Max. Continuous Rate of Climb (550 BHP)	fpm (metres/sec)	
Sea Level	735 (3.74)	650 (3.30)
5,000 ft	690 (3.51)	605 (3.08)
10,000 ft S1H1-G Engine	560 (2.85)	485 (2.46)
10,000 ft S3H1-G Engine	450 (2.29)	385 (1.96)
Landing over 50 ft Obstacle (Flaps "Landing",	ft (metres)	
Still Air Distance, ICAO Technique)	1225 (374)	1510 (460)
Service Ceiling	ft (metres)	
S1H1-G Engine	18,800 (5740)	17,900 (5460)
S3H1-G Engine	17,400 (5310)	16,400 (5000)
Absolute Ceiling	ft (metres)	
S1H1-G Engine	20,700 (6310)	19,900 (6070)
S3H1-G Engine	19,500 (5950)	18,700 (5700)
Max. Range at 5000 ft	miles (km)	
	960 (1545)	863 (1389)
Cruising Range (325 BHP) at 5000 ft	miles (km)	
	889 (1430)	824 (1327)
Max. Endurance at 5000 ft	hours	
	9.8	8.8
Cruise Power (325 BHP) Endurance at 5000 ft	hours	
	7.0	6.9

For Rates and Gradients of climb under other conditions see Data Charts in Appendix.

NOTES:-

Maximum range and endurance results include allowance for:

- (1) 10 minutes warm up and take-off at maximum continuous power.
- (2) Climb to 5,000 ft. at maximum continuous power.
- (3) Fuel for 45 minutes flight at cruise power (325 BHP) in reserve.
- (4) The specific fuel consumptions given in Cdn. P. & W. specification curve No. C1302 (dated 6-1-54) for the R1340 S3H1-G engine.

For further information consult the Payload vs. Cruising Range Chart and the Cruise Power Chart in the Appendix.

5.2 FLIGHT CHARACTERISTICS

5.2.1 GENERAL

Inherent stability is good about all axes of the aircraft. It will fly hands-off at all speeds within the trim range.

Controls are effective down to low speeds and the aircraft responds well to all changes in trim without being over-sensitive. It is easy to fly and docile.

5.2.2 TAKE-OFF CHARACTERISTICS

The aircraft should be trimmed appropriate to its CG positions in order to retain moderate stick forces.

Empty and with CG forward, the aircraft flies itself off with its tail slightly raised. When loaded CG aft, this tendency may be assisted by trimming.

The aircraft will unstick at airspeeds between 55 to 60 mph.

Flap retracting does not result in a loss of height after take-off. This is best done in steps, re-trimming the aircraft in the intervals.

5.2.3 STALLS

Stalls, in common with all acrobatic manoeuvres are not recommended, except for demonstration and training purposes.

A stall warning light has been fitted to the flight instrument panel which illuminates a red warning light 3 to 5 mph above stalling speed.

If stalls are done the following characteristics obtain: As the stall is approached an increase in yaw occurs. At the point of the stall, Flaps Landing Power On configuration, there is a slight nose up tendency. If yaw is prevented with rudder and the nose up tendency with elevator, an

uncontrolled pitch will occur accompanied by a slight right roll (5° to 10°). In all other configurations, stalls are accompanied by gentle settling of the aircraft followed by a small nose down pitch. Some aileron control remains after the pitch at all times. A slight forward movement of the elevator control will unstall the aircraft.

The height lost, in straight stall with aircraft trimmed at 1.4 times the stalling speed for any flap or power setting, is not greater than 290 ft.

- 5.2.4 With landplane at the extended aft CG limit of 41% M.A.C. (Mod. 3/746 incorporated), the stall characteristics are as follows:

(a) Flaps at LAND position.

The stalls are similar to those described in paragraph 5.2.3. However, with power on, an aerodynamic stall warning in the form of tail buffet and control column shake is produced at 6 to 7 mph above the stall speed.

(b) Flaps at CRUISE position.

1. With power off, the stall warning light becomes illuminated approximately 10 mph above the stall speed and a slight tail buffet occurs approximately 6 mph above the stall speed. The elevator control forces become very heavy when the minimum flight speed is reached, and airspeed fluctuations of 3 or 4 mph may occur. The rate of descent will be approximately 1400 fpm. A considerable amount of right rudder is required to prevent the aircraft from yawing to the left. If this yaw is not prevented and held to zero, there is a tendency to roll to the left which can be controlled with aileron. Recovery from the stall is prompt upon easing the control column forward.

2. With power on, similar effects occur with the control column near to its aft stop, but the rate of descent is reduced to approximately 400 fpm. Application of right rudder is required, as previously stated, to prevent a yaw to the left and its effect on roll. If the control column is moved fully aft to its stop, the extremely heavy elevator force decreases to zero and reverses, but a light forward force applied on the control column will overcome this and result in a rapid recovery from the stall.

5.2.5 STALL SPEEDS

Refer to paragraph 4.6

5.2.6 SPINS

Spins are prohibited. In the event of an accidental spin, apply full opposite rudder, and push control column progressively forward until spin stops.

5.2.7 DIVING

Stick forces necessary for recovery show normal increases and may be relieved by tailplane trimming.

5.2.8 SLOW FLYING

The aircraft is fully controllable at its slow flying air speed of 80 mph with flaps at CRUISE, 70 mph with flaps at LAND.



DeHavilland DHC-3ST Otter Airplane Flight Manual Supplement

TTC-FMS-1

for
Turbine Engine Conversion
and
Optional Bleed-air Heater

Applicable to:

Aircraft Registration No: _____

Aircraft Serial No. _____

This supplement is FAA approved and must be attached to the FAA-approved Airplane Flight Manual when the aircraft has been modified by the installation of a Honeywell TPE-331 engine in accordance with S.T.C. SA09866SC. The information contained in this document supplements or supersedes the Airplane Flight Manual only in those areas listed herein. For limitations, procedures, and performance not contained in this supplement, consult the Airplane Flight Manual.

Approved 

S. Frances Cox, Manager
Special Certification Office, ASW-190
Federal Aviation Administration
Fort Worth, Texas 76193-0190

Original Issue: May 5, 2001

Revision Date: March 10, 2006

Revision C

This document and analysis detailed herein are proprietary to Texas Turbine Conversions, Inc., and may not be copied or used without written permission of Texas Turbine Conversions, Inc.

Table of Revisions

Rev	Description	Pages	Approved By	Date
IR	Initial Release	----	<i>Mark Flora for S. Frances Cox</i>	May 5, 2001
A	Added Seaplane Compatibility List	1-1, 1-4	<i>S. Frances Cox</i>	Jan. 31, 2002
B	Added optional bleed-air heater, Revised fuel system	i,1-2,2-1,2-4,2-6,3-1,3-4,3-5,3-7,3-8,3-9,4-2,4-3,4-5,4-6,4-7,4-8,4-9,4-10,5-1,5-2,5-3,6-2,7-1,7-2,7-4,7-7,7-8,7-10,7-11,7-13,7-14,7-15	<i>S. Frances Cox</i>	Sept. 22, 2003
C	Added optional parallel/series start system descriptions, revised float weights, revised engine temp limits, revised propeller start-lock angle	i, ii,1-2,1-4,2-2,2-5,3-2,4-2,4-3, 4-10,7-5,7-12	 S. Frances Cox, Manager Special Certification Office, ASW-190 Federal Aviation Administration Fort Worth, Texas 76193-0190	MAR 10 2006

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SECTION 1 GENERAL

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DESCRIPTION

The DHC “Otter” airplane is an all-metal, high wing monoplane powered by a single Honeywell (Garrett) TPE331-10 engine driving a Hartzell constant speed, full-feathering, reversing propeller. The aircraft has been designed to carry a pilot and from six to fifteen passengers. It may also be used for liaison duties, ambulance and rescue operations, forestry, border and coastal patrols, spraying, dusting, skydiving, aerial surveying, photographic operations, or cargo transportation. The aircraft is divided through partitions into a cockpit, a cabin and a baggage compartment. An optional bleed-air heater and parallel/series start system may be installed.

DIMENSIONS

General overall dimensions of the airplane are:

Length.....	46 feet, 11 inches
Wing Span.....	58 feet, 0 inches
Height.....	12 feet, 6.6 inches

MAXIMUM WEIGHT

Maximum takeoff weight.....	8000 pounds.
Maximum landing weight.....	8000 pounds.

ENGINE

Manufacturer:.....	Honeywell (Garrett)
Model:	TPE331-10 or TPE331-12JR
Horsepower:.....	Flat rated to 900 shp at 1591 rpm.

PROPELLER

Manufacturer:	Hartzell Propeller
Model:	HC-B4TN-5NL/LT10890N
Blades:	4
Diameter:	109.5”
Type:	Constant-speed, Full-feathering, Reversing, Counter-weighted, and Hydraulically actuated.
Pitch Range:	measured at the 42” blade station
Feathered.....	+81.2°
Reverse.....	-12°

FUEL

Recommended Fuel:	Jet A
Emergency Fuels:	See LIMITATIONS Section.

ENGINE OIL

Recommended Engine Oil:	See LIMITATIONS Section.
Total Oil Capacity:	8 U.S. quarts

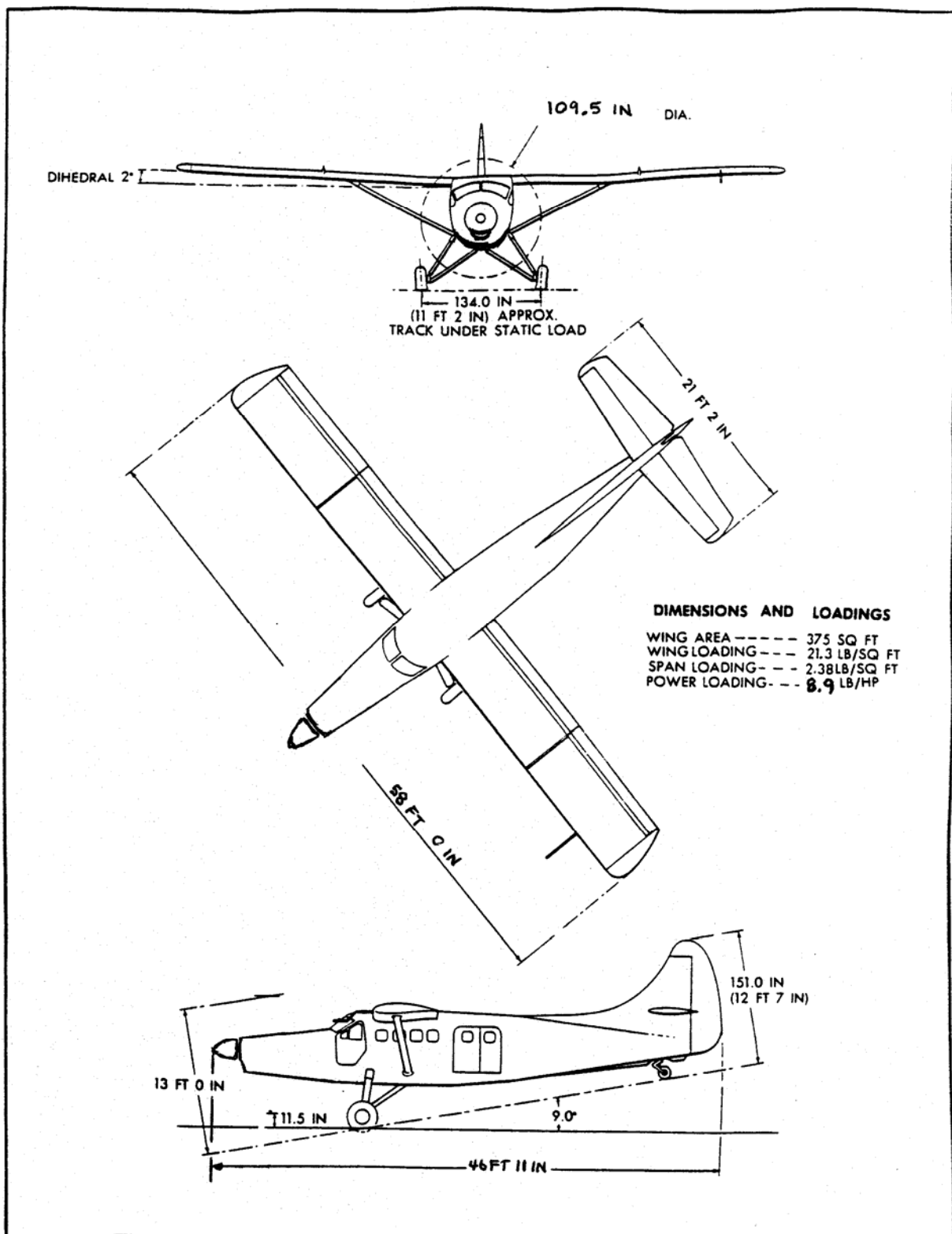


Figure 1-1, Three-view dimensional diagram: Landplane

SEAPLANE COMPATIBILITY

This conversion is compatible with the following approved float installations:

STRAIGHT FLOATS

Model	Length	Width	Installed Weight	Float Displacement	Otter Max Allowable Weight	Approval
EDO 7170	24'8"	10'6"	800 lbs.	7170 lbs.	7967-*8367 lbs.	TC A-815
EDO 7490	25'4.5"	11'0"	850 lbs.	7490 lbs.	8000-*8367 lbs.	TC A-815
EDO 7850	26'2"	12'0"	900 lbs.	7850 lbs.	8000-*8367 lbs.	U.S. STC SA678NW or CDN STC SA01-127
Intaero 8100	26'6"	12'0"	1204 lbs.	8100 lbs.	8000-*8367 lbs.	LSTC O-LSA01-475/D
Wipline 8000	27'6"	12'0"	1211 lbs.	7842 lbs.	8000-*8367 lbs.	U.S. STC SA331CH

AMPHIBIOUS FLOATS

Model	Length	Width	Installed Weight	Displacement	Otter Max Allowable Weight	Approval
EDO 7490	25'4.5"	10'6"	1369 lbs.	7200 lbs.	8000-*8367 lbs.	TC A-815
Wipline 8000	27'6"	12'0"	1504 lbs.	7570 lbs.	8000-*8367 lbs.	U.S. STC SA331CH

* with the Baron STC gross weight increase installed per STC SA00438NY.

SECTION 2 LIMITATIONS

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GENERAL

The following limitations have been written with regard to both the TPE331-10 engine and the TPE331-12JR engine. Either engine is suitable for installation on the Texas Turbine Conversions, Inc. turbine engine modification.

AIRCRAFT CLASSIFICATION

No changes to the aircraft classification

ALL ACROBATIC MANEUVERS, INCLUDING SPINS, ARE PROHIBITED

Stalls are permitted for demonstration purposes only.

POWERPLANT LIMITATIONS (TPE331-10 and TPE331-12JR engines)

Operating Condition	SHP	Torque (%)	Max EGT (degrees C)	RPM (%)	Oil Press. (psig)	Oil Temp. (degrees C)
Starting	---	---	770 (1 sec)	---	---	-40 (min)
Ground Idle	---	---	770	68 (min)	40 (min)	127
Takeoff	900	100	565 (1)	101.0	70-120 (3)	55-110 (4)
Maximum Continuous	900	100	565 (1)	101.0	70-120 (3)	55-110 (4)
Climb	900	100	565 (1)	101.0	70-120 (3)	55-110 (4)
Cruise (96%)	900	100	567 (1)	96 to 101.0	70-120 (3)	55-110 (4)
Landing	---	---	---	93.0 (min)	70-120 (3)	55-110 (4)
Maximum Reverse	---	---	565 (1)	101.0	70-120 (3)	55-110 (4)
Transient	---	104 (5 min)	770 (1 sec)	104 (2)	(6)	127 (5)

Note 1: The maximum permissible temperatures vary as a function of ambient temperature, altitude, and other operating conditions. Takeoff and maximum continuous EGT temperatures are for the ISA standard of 15 C at sea level.

Note 2: Transient operation of propeller output shaft speed above 104 percent, to a maximum of 106 percent is allowable for fuel control overspeed governor test when propeller is on the start locks. DO NOT allow the engine to windmill between 18% and 28 %.

Note 3: Normal operating range above 23,000 ft.: 50-120 psig.

Note 4: Oil temperature limits are for Type II oil. For Type I use: 55-79 C above 776 shp.
55-93 C below 776 shp.

Note 5: All engines except the TPE331-12JR have an oil temperature limit at 776 shp or less of 127 C for five minutes. For the TPE331-12JR the temperature limit at 900 shp or less is limited to 110 C for ten minutes. If either limit is exceeded, a SOAP sample is required within 25 flight hours.

Note 6: Transients above 120 psig can occur during cold weather starting

EGT LIMITS vs. INDICATED OAT:

Cond./Temp	-50 C	-40 C	-30 C	-20 C	-10 C	0 C	+10 C	+20 C	+30 C	+40 C	+50C
Takeoff/Max Cont. (100%)	528	533	537	541	546	554	561	569	578	588	598
Max Cruise (98%)	513	517	521	527	534	542	550	560	571	581	591
Normal Cruise (96%)	516	520	526	534	543	552	562	572	583	594	604

POWERPLANT INSTRUMENT MARKINGS

Engine Parameter	Green Band		Amber Band		Red Line
	low	high	low	high	
Speed- %	96	100	100	101	101
Torque- %	0	100	----	----	101
EGT- C	See Note 1				620
Oil Pressure- psi	70	120	40	70	40 min/ 120 max
Oil Temperature- C (Type II oil) (Type I oil)	55	110	110	127	127
	55	79	79	93	93
Fuel Pressure- psi	20	80	80	90	8 min/ 90 max

Note 1: The maximum permissible EGT limits vary as a function of ambient temperature. See the **EGT LIMITS vs. INDICATED OAT** table for the applicable limit.

ELECTRICAL SYSTEM and IGNITION DUTY CYCLE LIMITATIONS

Maximum continuous generator load is limited to 100 amps.

Ignition Unit Duty Cycle: One Hour (Total) ON in any Two Hour Period

Above 50°F (10°C): The ignition unit may be run up to one hour at a time. Total time “on” shall not exceed one hour without one hour “off”. The one hour “on” may be either continuous or intermittent.

Below 50°F (10°C): The ignition unit may be run as needed without stopping.

FUEL LIMITATIONS

Recommended Fuel: JET-A

Emergency Fuels:

Fuel Type	Garrett** Specification	Class	Freeze Point, C	Equivalent Specification	Grade/Type	Freeze Point, C	Additives***		NATO Code
							Anti-Icing	Anti-Static	
Kerosene Aviation Turbine Fuel	EMS53111	A	-40	ASTM D1655	A	-40	Conditional	Conditional	—
	EMS 51112	A-1	-46	ASTM D1655	A-1	-46	Conditional	Conditional	—
		JP-8	-50	U.S. MIL-T-83133A French Air 34050 British DERD 2494	JP-8 — AVTUR	-50 -50 -50	Mandatory Optional Without	Mandatory Optional Agreement	F-14 F-14 F-15
				British DERD 2451	AVTUR/FS11	-50	Mandatory	Agreement	F-34
Wide-Cut, Aviation Turbine Fuel	EMS 53113	A	-58	U.S. MIL-T-5624K French Air 34078 British DERD 2486	JP-4 — AVTAG	-58 -58 -58	Mandatory Optional Without	Mandatory Optional Agreement	F-40 F-40 F-40
				British DERD 2454	AVTAG/FS11	-58	Mandatory	Without	F-40
		B	-49	ASTM D1655	B	-49	Conditional	Conditional	—
High Flash Kerosene, Aviation Turbine Fuel	EMS 53116	JP-5	-46	U.S. MIL-T-5624K French Air 34048	JP-5 —	-46 -46	Mandatory Optional	Without Optional	F-44 F-42
				British DFED 2498	AVCAT	-46	Without	Without	F-44
				British DERD 2452	AVCAT/FS11	-46	Mandatory	Without	F-44
Gasoline Aviation Type	EMS 53122 (Grade 100LL)			U.S. MIL-G-5572F U.S. MIL-G-5572F	80/87 100/130	-60 -60	Without Without	Without Without	F-12 F-18

*Gasoline may be used for emergency fuel operation. The consumption must not exceed 1000 U.S. gallons of Grade 80/87 on 250 U.S. gallons of Grade 100/130 per 100 hours of operation.

**The use of anti-icing and anti-static additives is approved for TPE331 turboprop engines as follows.

Anti-icing additive - Fuel system icing inhibitor conforming to MIL-I-27686E, or equivalent, is approved for use in homogenous mixtures not to exceed a volumetric concentration of 0.15 percent, except for JP-5 per MIL-T-5624L, which has a 0.20-percent limitation.

Anti-static additive - Electrical conductivity additive conforming to Shell ASA-3 or equivalent is approved for use to increase the conductivity of the fuel up to 300 picosiemens per meter for 300 picohm/meter where 1 picohm = 10^{-12} ohm at 25°C) providing the concentration does not exceed 1 milligram per liter.

***ADDITIVE TERMINOLOGY:

Conditional	-	Permitted, under conditions that the quantities and types of additives are declared by mandatory manufacturer and agreed to by purchaser.
Mandatory	-	Approved additive is required by specification within prescribed concentration limits.
Optional	-	Approved additives may be added within specified concentration.
Agreement	-	Approved additive may be added within specified concentration upon agreement between purchasing authority and the supplier.
Without	-	Not included among approved additives.

Fuel Management

- Do not takeoff with less than 134 lbs (20 U.S. gal.) of fuel in all three tanks.
- Burn from the front tank for takeoff and landing.
- After takeoff, burn fuel from the aft tank forward. Retain as much as possible in the front for landing.
- The electric boost pump must be used for takeoff, landing, fuel tank selection, and operations above 10,000 feet.

NOTE

A placard must be installed above the pilot stating, "For starting, takeoff, landing, flight above 10,000 ft., and when selecting fuel tanks, the boost pump must be turned ON".

OIL SPECIFICATIONS

Recommended Oil: -Type II Oil

Approved Oils:

Type	MIL Spec.	Brand Name
I	*MIL-L-7808D	Texaco SATO 15 Sinclair Turbo S Oil 15 Caltex SATO 15 British Petroleum Aero Turbine Oil 15 Brayco 880 Conojet Continental Conojet Regent SATO 15 Castrol 399
	*MIL-L-7808F	Stauffer Jet I Brayco 880H Hancock Airturb Syn Lube
	MIL-L-7808G	Stauffer Jet I Mobil Avrex-S Turbo 256 Exxon 2389 Brayco 880H
II	MIL-L-23699	Mobil Jet Oil II Exxon (Enco/Esso) 2380 Turbo Oil Chevron Jet Engine Oil No. 5 Stauffer Jet II Cal Tech RPM Jet Engine Oil No. 5 Castrol 205 Castrol 5000 Aeroshell/Royco Turbine Oil 500** Aeroshell/Royco Turbine Oil 560 Mobil 254

*MIL-L-7808D and F oils were qualified at 175F oil inlet temperature. All other listed oils were qualified at 230F oil inlet temperature.

**Approved for all engines certified to 776 shp or less.

PROPELLER LIMITATIONS for HARTZELL HC-B4TN-5NL/LT10890N

Feathered:	+81.2° ±0.5°	Measured at 42" station
Start Locks:	-1.4 to -5.5° ±0.1°	
Flight Idle Blade Angle:	+5.0° ±0.5°	
Max Reverse:	-12° ±0.5°	
Diameter:	109.5" to 103.5"	
Max Takeoff RPM:	100% (1591) rpm	
Max Cont. RPM:	100% (1591) rpm	
Transient RPM:	106% (1686) rpm	
Avoid Stabilized RPM:	Below 68% and between 85% to 92%	

CAUTION:

Stabilized ground operation is prohibited **below 68%** and **between 85% and 92%** .

WEIGHT LIMITS

No changes to the maximum takeoff or landing weights, or the center-of-gravity envelope.

MANEUVER LIMITS

1. Do not intentionally sideslip the aircraft with flaps extended.
2. Do not intentionally sideslip the aircraft below 80 mph with flaps retracted.

BLEED-AIR HEATER LIMITS (if installed)

Bleed-air heater valve must be closed under the following conditions:

1. Before starting the engine
2. In-flight air start

OTHER LIMITATIONS

This aircraft is not approved for flight at night unless an anti-collision lighting system that meets the requirements of FAR 23.1401 has been installed.

SECTION 3 EMERGENCY PROCEDURES

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OPERATING INSTRUCTIONS

The following operating procedures are presented in a form suitable for use by flight crews in the DeHavilland DHC-3ST Turbine Otter only. Procedures contained in this section will show the basic principles of aircraft and powerplant operation. During all operations, observe the operating limitations of the aircraft, propeller, and powerplant.

If the optional parallel/series start system is installed, all emergency procedures are the same except that there is only one master switch installed instead of two. In those procedures referring to the master switches, substitute MASTER SWITCH in place of BOTH MASTER SWITCHES.

The following definitions apply to warnings, cautions, and notes:

- (a) **WARNING:** Operating procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.
- (b) **CAUTION:** Operating procedures, techniques, etc., which could result in damage to equipment if not carefully followed.
- (c) **NOTE:** An operating procedure, techniques, etc., which is considered essential to emphasize.

All boxed items included in the following emergency checklist are considered critical to aircraft and personnel safety and should be committed to memory.

ENGINE FAILURE.

CAUTION

WINDMILLING IN THE SPEED RANGE BETWEEN 18 AND 28 PERCENT MAY RESULT IN ENGINE DAMAGE.

CAUTION

ACTIVATION OF THE STOP CIRCUIT FOLLOWING MANUAL SHUT DOWN OF AN ENGINE EQUIPPED WITH A FUEL PURGE SYSTEM WILL RESULT IN FUEL ACCUMULATION IN THE PLENUM. DO NOT ACTIVATE THE ELECTRICAL SHUT DOWN CIRCUITS UNTIL ENGINE COOLING PRECLUDES COMBUSTION.

NOTE

The engines are equipped with a negative torque sensor system, which, in the event of an engine failure, automatically moves the propeller blades toward the feather position and thus reduces propeller drag.

ENGINE FAILURE DURING TAKEOFF RUN

Remaining runway is sufficient for rollout:

- | | | |
|----|--------------------------------------|---------------------------------------|
| 1. | Brakes | -APPLY with control column fully back |
| 2. | Emergency Fuel Shutoff/Feather Lever | -MOVE TO AFT AND LOCKED POSITION |
| 3. | Firewall Emergency Fuel Shutoff | -PULL |
| 4. | Fuel Selector Valve | -OFF |
| 5. | AUTO/CONT. Ignition Switch | -OFF |
| 6. | Both Master Switches | -OFF |

ENGINE FAILURE IN-FLIGHT (no re-start will be attempted)

1.	Power Lever	-FULL FORWARD
2.	Emergency Fuel Shutoff/Feather Lever	-MOVE TO AFT AND LOCKED POSITION
3.	Firewall Emergency Fuel Shutoff	-PULL
5.	Fuel Selector Valve	-OFF
6.	AUTO/CONT. Ignition Switch	-OFF
7.	Both Master Switches	-OFF

AIRSTART (propeller unfeathered and wind-milling)

CAUTION

DO NOT ENGAGE THE STARTER DURING AN AIR START BECAUSE THE HIGH TORQUE REQUIREMENTS OF A FEATHERED PROPELLER MAY DAMAGE THE STARTER.

ABORT AIR START IMMEDIATELY WHEN:

1. PROPELLER FAILS TO ROTATE
2. RPM DOES NOT REACH 10 PERCENT IN 10 SECONDS
3. EGT IS NOT RISING 10 SECONDS AFTER 10-PERCENT RPM
4. EGT RISES RAPIDLY TOWARD START LIMITS

5. EGT APPROACHES START LIMIT
6. OIL PRESSURE FAILS TO RISE BY 65-PERCENT RPM
7. RPM STOPS INCREASING PRIOR TO PROPELLER GOVERNOR SETTING
8. ANY UNUSUAL NOISE OR VIBRATION OCCURS
9. ENGINE INSTRUMENTS INDICATE ABNORMAL CONDITIONS

If sufficient altitude is available attempt air start as follows:

1. Altitude -Below 20,000 feet
2. Bleed-air heat valve (if installed) -CLOSED
3. Airspeed -90 TO 144 MPH
4. STOP Switch -STOP
5. Emergency Fuel Shutoff/Feather Lever -FULL FORWARD AND LOCKED POSITION
6. Fuel selector -FULLEST TANK
7. Boost Pump Switch -ON with POSITIVE pressure
8. Power Lever -1" FORWARD OF FLIGHT IDLE. This position will reduce drag associated with the propeller.
9. Condition Lever -LOW RPM. This position will reduce overshoot when the engine speed reaches the propeller governor setting. The engine speed will stabilize between the propeller governor stops (94 to 100percent rpm)
10. AUTO/CONT. Ignition Switch -CONT. POSITION
11. FUEL ON/SPR Switch -ON (watch for EGT to rise)
12. FUEL ON/SPR Switch -TOGGLE as necessary to accelerate

If air start fails:

1. STOP Switch -STOP
2. Maintain maximum glide speed of 90 mph with flaps UP
3. Proceed with ENGINE FAILURE IN-FLIGHT CHECKLIST

AIR START FROM FEATHER (requires approximately 1500 ft. min)

CAUTION

DO NOT OPERATE UNFEATHER PUMP WITH THE FEATHER LEVER IN THE FEATHER POSITION AS ALL THE OIL WILL BE PUMPED INTO THE ENGINE SUMP.

1. Altitude -BELOW 20,000 FEET
2. Bleed-air heat valve (if installed) -CLOSED
3. Airspeed -90 to 120 MPH
4. Emergency Fuel Shutoff/Feather Lever -FULL FORWARD AND LOCKED POSITION
5. Power Lever -Approx. 1 inch forward of FLIGHT IDLE
6. Condition Lever -LOW RPM to reduce overshoot
7. Boost Pump -ON with a POSITIVE fuel pressure
8. AUTO/CONT. IGNITION Switch -CONT. positions
9. Unfeathering Pump -ON When the unfeathering pump switch is held on manually, the switch can be released anywhere between 30 and 60 percent rpm

10. Propeller because the pressure from the propeller pump is higher than the unfeather pump.
-ROTATING. As soon as the blades begin to unfeather the propeller should start to rotate. If not, release the unfeathering pump switch and recheck "prior to start" instructions. When all oil has been pumped out of the oil tank, unfeathering is not possible. Slow propeller rotation at high airspeeds might replenish the oil supply for unfeathering.
11. FUEL ON/SPR Switch -ON at 12-15%
12. EGT -RISING, OBSERVE LIMITS.
13. RPM -INCREASING. The engine rpm should continue to increase until reaching the propeller governor setting. If the engine speed dwells (stops increasing) abort the start and investigate the cause.
14. Oil pressure -RISING BY 65-PERCENT RPM. Do not operate the engine without oil pressure.

Once engine has stabilized:

1. Condition lever -AS NECESSARY
2. Boost Pump -OFF
3. AUTO/CONT. Switch -AUTO

ABORTED AIR START

1. Fuel Shutoff and Feather Lever -FULL AFT AND LOCKED POSITION
2. AUTO/CONT. Switch -OFF
3. Boost Pump -OFF

PRECAUTIONARY SHUTDOWN AND INTENTIONAL ENGINE SHUTDOWN WHEN AIR STARTS ARE ANTICIPATED

CAUTION
DO NOT EXCEED WINDMILLING LIMITS.

A normal shutdown should be accomplished when a precautionary or intentional shutdown is to be made, and an air start is desired soon after shutdown. The engine should be shut down with the stop switch and allowed to NTS down to approximately 35 percent rpm and then feathered. This allows the engine to be cooled during the shutdown so that an air start can be made after feathering the propeller.

1. STOP Switch -STOP
2. NTS Action -Check to approximately 35 percent rpm
3. Fuel shutoff and feather lever - FULL AFT AND LOCKED POSITION

If additional engine cooling is desired, restore the feather lever to normal and cause the engine to rotate slowly (about 10 percent rpm) by momentarily actuating the unfeathering pump. Observe wind milling limits.

ABORTED GROUND START

- | | | |
|----|--------------------------------|---------------------------------|
| 1. | Engine STOP Switch | -STOP |
| 2. | Fuel Shutoff and Feather Lever | -PULL for an electrical failure |

PROPELLER FAILURE.

PROPELLER CONTROL MALFUNCTION IN FLIGHT

Indications of a propeller control malfunction may be an inability to govern at the selected speed. If the beta light comes on at low power settings at approach airspeeds, when possible, check the handling of the aircraft by a simulated landing flare at a safe altitude. If power increases, the pilot should be prepared to shut down the engine on landing, as the pilot may not be able to reduce thrust on the engine during flare and after touchdown.

At first evidence of a runaway propeller:

- | | | |
|----|-----------------|-------------------------------|
| 1. | Power Lever | -FLIGHT IDLE |
| 2. | Condition Lever | -MANIPULATE TO REGAIN CONTROL |

CAUTION:

The engine can quickly exceed the rotor speeds and propeller speeds in a matter of seconds. Do not let the propeller or engine exceed the limits in Section 2.

If unsuccessful:

- | | | |
|----|---|-------|
| 1. | STOP Switch | -STOP |
| 2. | Proceed with ENGINE FAILURE IN-FLIGHT CHECKLIST | |

PROPELLER FAILURE DURING TAKEOFF RUN

Abandon take-off as follows:

- | | | |
|----|-------------|--------------|
| 1. | Power Lever | -FLIGHT IDLE |
| 2. | Brakes | -APPLY |
| 3. | STOP Switch | -STOP |

If necessary:

- | | | |
|----|--------------------------------------|-------------------------------|
| 4. | Emergency Fuel Shutoff/Feather Lever | -FULL AFT AND LOCKED POSITION |
| 5. | AUTO/CONT. Ignition Switch | -OFF |
| 6. | Both Master Switches | -OFF |

PROPELLER FAILURE AFTER TAKE-OFF

- | | | |
|----|-----------------|-------------------------------|
| 1. | Power Lever | -REDUCE |
| 2. | Condition Lever | -MANIPULATE TO REGAIN CONTROL |
3. If unsuccessful, decide whether to return to field, climb to decrease engine speed, or shut engine down.

ENGINE FIRE.

ENGINE FIRE ON THE GROUND

1.	STOP Switch	-STOP
2.	Boost Pump	-OFF
3.	Emergency Fuel Shutoff/Feather Lever	-FULL AFT AND LOCKED POSITION
4.	Firewall Emergency Fuel Shutoff	-PULL
5.	Fuel Selector Valve	-OFF
6.	AUTO/CONT. Ignition Switch	-OFF

If fire persists after the engine has stopped:

1. Have portable fire extinguisher discharged through augmentor tube opening

NOTE

After an engine has been on fire, no attempt should be made at re-starting until the engine has been examined.

ENGINE FIRE IN-FLIGHT

1.	STOP Switch	-STOP
3.	Boost Pump	-OFF
4.	Emergency Fuel Shutoff/Feather Lever	-FULL AFT AND LOCKED POSITION
5.	Firewall Emergency Fuel Shutoff	-PULL
6.	Fuel Selector Valve	-OFF
7.	AUTO/CONT. Ignition Switch	-OFF
8.	Bleed-air heat valve (if installed)	-CLOSE

If the fire persists:

1. Maintain maximum glide speed of 90 mph with flaps UP
2. Radio state of emergency and position
3. Instruct other occupants of aircraft for crash landing
4. Conduct ENGINE FAILURE IN-FLIGHT CHECKLIST

FUEL CONTROL MALFUNCTION.

If there is an indication of improper operation of the fuel control, when possible, check the handling of the aircraft by a simulated landing flare at a safe altitude before trying to land. If unusual drag is noted that cannot be eliminated by increasing the power, it may be necessary to feather the engine when the pilot has the runway made.

ENGINE INLET ANTI-ICE AND CONTINUOUS IGNITION.

Engine inlet anti-ice (inlet heat) should be used during all flight in potential icing conditions. These conditions exist when flying in precipitation or visible moisture (including clouds or fog), with OAT of +10C (+50F) or colder.

Select AUTO/CONT Ignition Switch -TO AUTO or CONT as below:

1. During takeoff or approach, during or shortly after operation in icing conditions.
2. When ice is observed shedding from the propeller and/or spinner.
3. Before applying inlet heat, when ice has accumulated.
4. Immediately, any time engine flameout occurs as a possible result of ice ingestion.

NON-RESPONSIVE POWER LEVER.

If a lack of response to the power lever is observed, turn the AUTO/CONT. Ignition switch to CONT. and the ANTI-ICE switch ON. After the engine has cleared and normal operation is observed, which occurs in approximately three minutes, anti-ice and ignition can be turned OFF.

MAIN POWER ELECTRICAL FAILURE

1. Engine Instruments Back-up Switch -BACK-UP
2. Land at nearest suitable airport

BLEED-AIR HEATER DUCT OVERHEAT (if installed)

If the bleed-air heater duct-overheat light is illuminated (red light):

Verify that the bleed-air heat valve has been closed by the automatic duct overheat relay. If the valve is still indicating that it is open after 15 seconds, close the bleed valve manually with the toggle switch located on the bleed-air heater panel.

CAUTION

If there is a main power failure during use of the bleed-air heat system, the valve will remain in the last position selected and cannot be closed until the engine instruments back-up switch is turned ON. The valve will then be powered by the hot battery bus.

NOTE

The toggle switch that controls the bleed-air heat valve is disabled when the automatic duct overheat relay senses a duct overheat. If the automatic system fails, the toggle switch should still be operational.

SUDDEN RISE IN EGT

- | | | |
|----|-------------------------------------|---------|
| 1. | Power Lever | -REDUCE |
| 2. | Bleed-air Heat Valve (if installed) | -CLOSE |

SECTION 4

NORMAL PROCEDURES

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EXTERIOR INSPECTION.

- | | | |
|-----|-----------------------------------|--|
| 1. | Wings and fuselage | -FOR DAMAGE |
| 2. | Control surfaces and hinges | -CLEAR |
| 3. | Tires | -FOR PRESS., SLIPPAGE MARKS & CUTS |
| 4. | Hydraulic brake lines | -FOR LEAKS |
| 5. | Pitot head cover | -REMOVED |
| 6. | Chocks | -SET |
| 7. | Fuel tank caps | -SECURE |
| 8. | Stowage of cargo and luggage | -SECURE |
| 9. | Load distribution and CG position | -WITHIN LIMITS |
| 10. | Engine Air Inlet | -CLEAR and CLEAN. |
| 11. | Engine Inlet Pres and Temp Sensor | -GENERAL CONDITION. |
| 12. | Engine Exhaust | -CLEAR. |
| 13. | Engine Oil Quantity | -PROPER LEVEL. |
| 14. | Propeller | -ROTATION AND CONDITION, NO
UNUSUAL ENGINE NOISE. |
| 15. | Engine Cowling | -SECURE. |
| 16. | Engine Fuel Drains | -CLEAR. |
| 17. | Oil Filter Bypass Indicator | -CHECK. |

NOTE: USE OF EXTERNAL POWER

Engine starts can be made with aircraft battery power or with auxiliary dc electrical power. Use an auxiliary power unit (GPU), if available, when ambient air temperature is 12C (54F) or below. Ensure that the GPU is regulated to 28 V dc and can provide at least 16 V dc, 1000 amperes during the starting cycle.

ON ENTERING AIRCRAFT.

NOTE: If the optional parallel/series start system is installed, all normal procedures are the same except that there is only one master switch installed instead of two. In those procedures referring to the master switches, substitute MASTER SWITCH in place of MASTER SWITCHES.

- | | | |
|----|--------------------------------|---|
| 1. | Controls | -UNLOCKED |
| 2. | Parking brake | -SET |
| 3. | Flight controls | -CORRECT, FREE AND FULL MOVEMENT |
| 4. | Trim tabs | -AS REQUIRED |
| 5. | Control column throw-over lock | -SECURELY ENGAGED |
| 6. | All switches | -OFF |
| 7. | Battery Master Switches | -OFF (ON if, in an emergency, or external
power is not used) |
| 8. | External power | -CONNECTED |

WARNING

WHEN EXTERNAL POWER IS CONNECTED, THE ELECTRIC SYSTEM OF THE AIRCRAFT IS ALIVE, IRRESPECTIVE OF THE POSITION OF THE MASTER OR ANY OTHER SWITCHES. HENCE, OPERATION OF THE STARTER SWITCH WILL TURN OVER ENGINE AND PROPELLER.

- | | | |
|----|-----------------|--------|
| 9. | Fuel quantities | -CHECK |
|----|-----------------|--------|

- | | | |
|-----|--|---------------|
| 10. | Fuel selector control | -FULLEST TANK |
| 11. | Altimeter | -SET |
| 12. | Clock | -SET |
| 13. | Stowage of hand operated fire ext. | -CHECK |
| 14. | Pilot's seat, if necessary | -ADJUST |
| 15. | Safety belt and shoulder harness,
if provided | -FASTEN |
| 16. | Flash light | -CHECK |
| 17. | Communication equipment | -TEST |

When night flying is anticipated, make the following checks with the help of an outside observer:

1. Landing light.
2. Navigation lights, identification lights if fitted.
3. Check panel lights, interior lights
4. Flashlight on board

CAUTION

Do not leave landing light on for more than 10 seconds in any two-minute period when aircraft is on the ground, or else heat may fuse the landing light in the ON position.

BEFORE ENGINE START.

- | | | |
|----|-------------------------------------|--|
| 1. | Bleed-air Heat Valve (if installed) | -CLOSED |
| 2. | Condition Lever | -LOW RPM |
| 3. | Power Lever | -FLIGHT IDLE |
| 4. | Fuel Shutoff and Feather Lever | -FORWARD AND LOCKED |
| 5. | Aircraft Power | -EXT. POWER or MASTER SW. ON (or both) |
| 6. | Bus Voltage | -24V (Battery) 28V(GPU) |
| 7. | Propeller | -CLEAR and ON start locks |

If feathered:

- | | | |
|-----|----------------------------|--|
| a. | Power Lever | -REVERSE. |
| b. | Unfeather Pump | -ON. |
| | | -Observe propeller blade angle until the propeller blades have moved to the locked position. |
| c. | Unfeather Pump | -OFF. |
| d. | Power Lever | -FLIGHT IDLE. |
| 8. | Auto/Cont. Ignition switch | -TEST BOTH POSITIONS, THEN OFF |
| 9. | Fuel Boost Pump | -ON |
| 10. | Stop switch | -STOP POSITION |

NOTE

If indicated EGT is in excess of 200 C, the engine may be cranked without fuel until 15 percent rpm is attained to lower internal temperatures. Add fuel after 15 percent and EGT temperature below 200 C.

ENGINE START SHOULD BE ABORTED WHEN

1. PROPELLER FAILS TO ROTATE
2. RPM DOES NOT REACH 10 PERCENT WITHIN APPROXIMATELY 10 SECONDS
3. EGT IS NOT RISING APPROXIMATELY 5 SECONDS AFTER 10-PERCENT RPM OR APPROXIMATELY 10 SECONDS WHEN COLD SOAKED
4. EGT/ITT RISES RAPIDLY TOWARDS START LIMIT
5. EGT/ITT APPROACHES START LIMIT
6. OIL PRESSURE FAILS TO RISE BY IDLE RPM
7. RPM STOPS INCREASING PRIOR TO IDLE RPM
8. ANY UNUSUAL NOISE OR VIBRATION OCCURS
9. ENGINE INSTRUMENTS INDICATE ABNORMAL CONDITIONS

NOTE

The intervals of time and rpm given for abort are not limits, but are mentioned to provide a relative guide for starting with conditions of the batteries/auxiliary power, starter, ambient temperature, and altitude taken into consideration. These conditions and temperatures of below ISA will have an effect on engine acceleration to 10 percent rpm during the starting cycle. A minimum acceleration rate of **one percent per second** should be obtained to achieve normal starts.

NOTE

Following an aborted start, a second start can be made. Use the start procedure with fuel entered at 15-percent rpm. When EGT rises initially, release fuel enrichment immediately if abort is for excessive turbine temperature.

NORMAL ENGINE START.

- | | | |
|----|--------------------|--|
| 1. | START/GEN Switch | -START (check propeller rotation). |
| 2. | 12-15% engine rpm. | -FUEL/SPR SWITCH TO ON (hold on until light-off or three seconds, whichever comes first) |
| 3. | FUEL ON/SPR Switch | -TOGGLE TO HELP ENGINE ACCELERATE |

CAUTION

DO NOT USE SPR (or FUEL ENRICHMENT) IF EGT APPROACHES THE START TEMPERATURE LIMIT.

NOTE

Use the fuel enrichment switch as follows:

- ON-** at 12-15% and hold three seconds or until light-off, whichever comes first
- OFF-** When EGT rises
- ON-** To assist acceleration
- OFF-** When EGT rises rapidly or approaches the start temperature limit or at 60-percent rpm

- | | | |
|----|-------------------------------|------------------------|
| 4. | EGT Rising. Limit 770C | -CHECK. |
| 5. | Tachometer | -RPM INCREASING. |
| 6. | Oil Pressure | -RISING. |
| 7. | START/GEN switch | -OFF at 55 percent rpm |
| 8. | Starter/Ignition Light | -VERIFY OFF |

QUICK TURNAROUND ENGINE START.

NOTE

A normal engine start can be made at any time after a normal shutdown as long as the electrical power source and wind direction and velocity are satisfactory.

If an engine start is to be made 10 to 45 minutes from the last shutdown, it is recommended that the propeller be turned to both ventilate the engine and reorient the rotating group.

A cooler start can be made by motoring the engine to 15 percent rpm prior to adding fuel.

CLEARING ENGINES.

Clearing an engine of fuel or vapors is accomplished either by motoring the engine with the starter, with the fuel off, or by allowing 3 minutes for fuel to drain from the engine before attempting another start.

BEFORE TAXI.

- | | | |
|----|---|------------------------------|
| 1. | START/GEN Switch | -GEN |
| 2. | Engine Instruments | -CHECK |
| 3. | WARNING Lights | -CHECK |
| 4. | AUTO/CONT. Ignition Switch | -AUTO |
| 5. | Fuel System | -CHECK ALL FILLED TANKS FEED |
| 6. | Electrical System | -CHECK VOLT/AMMETER |
| 7. | Heater Recirculation Fan (if installed) | -AS NECESSARY |
| 8. | Bleed-air Heat Valve (if installed) | -AS NECESSARY |

CAUTION

As the bleed-air heat valve is opened, the engine EGT at ground idle may rise as much as 30 degrees C. Observe EGT limits. Care must be taken when trying to rapidly heat the cabin, because the duct temperatures can easily reach the 250°F ±5°F duct temperature limit.

- | | | |
|------|------------------------------------|--|
| 9. | Test Flaps and Hand-pump Operation | -TEST |
| 10.. | Seat Belts | -FASTEN |
| 11. | Radios- COMM and NAV | -SET |
| 12. | Overspeed Fuel Governor Check | -(PROPELLER START LOCKS WILL
REMAIN ENGAGED FOR THIS CHECK.)
This check should be made every 300 flight
hours for the Woodward and Bendix Fuel
Control Systems), prior to each flight when air
starts are to be intentionally made, if there is any |

indication of malfunction, or when any maintenance or adjustments involving the engine control system have been performed. Ensure that brakes are locked and the area ahead of the aircraft is clear.

CAUTION

DO NOT ALLOW RPM TO EXCEED LIMITS OF SECTION 2

- | | |
|-----------------|---|
| Condition Lever | -HIGH RPM |
| Power Lever | -Advanced to maximum stabilized rpm of 103-105 percent rpm. If the rpm is not within limits, see engine maintenance manual. |
| Power Lever | -RETARD TO GROUND IDLE |
| Condition Lever | -LOW RPM |
13. Unlock Propeller Start Locks -Set COND. lever to "High." Move power lever slowly towards reverse until a positive indication of reverse thrust is observed as a rise in torque. Reset power lever to ground idle.
14. Check Propeller Start Locks -Move power lever slowly towards flight idle until a positive indication of forward thrust is observed as a rise in torque. Reset power lever to ground idle.

TAXI.

CAUTION

IF ENGINE SPEED DECREASES BELOW 64 PERCENT RPM, UNLOAD THE ENGINE BY MOVING THE POWER LEVER TO THE GROUND IDLE POSITION.

CAUTION

IF THE RPM DECAYS TO 55 PERCENT DURING STATIC OR TAXI OPERATION, SHUT DOWN THE ENGINE IMMEDIATELY.

NOTE

If power above flight idle is needed during taxi with the engine speed control in the low position, advance the engine speed control as necessary.

- | | |
|-----------------------------------|--|
| 1. Wing flaps | -CRUISE to improve directional control |
| 2. Chocks | -REMOVE |
| 3. Parking Brake | -RELEASE |
| 4. As soon as airplane is rolling | -APPLY BRAKES TO TEST |

BEFORE TAKEOFF.

- | | |
|------------------|---------------------|
| 1. Doors | -CHECKED FOR CLOSED |
| 2. Elevator trim | -TAKE OFF SETTING |

- | | | |
|-----|---|-------------------------|
| 3. | Wing flaps | -TAKE-OFF POSITION |
| 4. | Directional gyro and artificial horizon | -SET AND UNCAGED |
| 5. | Pitot Heat | -AS NECESSARY |
| 6. | Stall Warning Light | -PUSH TO CHECK LIGHTING |
| 7. | Anti-ice Switch | - OFF |
| 8. | Bleed-air Heat Valve (if installed) | -AS NECESSARY |
| 9. | Boost Pump | - ON |
| 10. | Fuel Selector | -FRONT TANK |
| 11. | Power Lever | -GROUND IDLE |
| 12. | Engine Instruments | -CHECK |
| 13. | Annunciator Lights | -CHECK |

TAKEOFF.

CAUTION

ENGINE SPEED CONTROL LEVER MUST BE IN THE HIGH POSITION OR TORQUE FLUCTUATIONS MAY OCCUR.

- | | | |
|----|-------------------|---|
| 1. | Friction controls | -ADJUST to prevent creep |
| 2. | Condition Lever | -HIGH (should see 96-97 percent RPM) |
| 3. | Power Lever | -ADVANCE (should see 100-101 percent RPM) |

NOTE

Move power lever forward until 100% torque or the maximum EGT for the conditions is reached, whichever comes first. Do not exceed limits in Section 2.

- | | | |
|----|--------------|---|
| 4. | Aircraft Yaw | -COUNTERACT ANY TENDENCY OF AIRCRAFT TO SWING (usually to the right) |
| 5. | Rotation | -Allow airplane to fly itself off in a tail-down attitude at approximately 55 mph IAS |

CLIMB.

For maximum rate of climb:

- | | | |
|----|-----------------|---------------------|
| 1. | Condition Lever | -HIGH |
| 2. | Power Lever | -MAXIMUM CONTINUOUS |

NOTE

Do not exceed limits in Section 2.

INITIAL CLIMB:

-To achieve the maximum angle of climb on take-off climb at 64 mph using take-off power and TAKE-OFF flaps.

CONTINUOUS CLIMB:

-At approximately 500 feet above the airfield, reduce power if desired.

For reduced power or en-route climb:

- | | | |
|----|----------------------|-----------------------|
| 1. | Power Lever | -REDUCE AS REQUIRED |
| 2. | Engine Speed Control | -96 to 98 PERCENT RPM |

CRUISE.

- | | | |
|----|---|-----------------------|
| 1. | Flaps | -UP |
| 2. | Engine Speed Control | -96 to 98 PERCENT RPM |
| 3. | Power Lever | -AS REQUIRED |
| 4. | Boost Pump | -OFF |
| 5. | Heater Recirculation Fan (if installed) | -AS NECESSARY |
| 6. | Bleed-air Heat Valve (if installed) | -AS NECESSARY |

CAUTION

As the bleed-air heat valve is opened, the engine EGT may rise as much as 20 degrees C, depending on flight condition. Observe EGT limits. Care must be taken when trying to rapidly heat the cabin, because the duct temperatures can easily reach the 250°F ±5°F duct temperature limit.

STALLS

CAUTION

When demonstrating stalls with power on and flaps extended, full rudder deflection may be reached before aircraft stalls. Recovery must be initiated prior to full rudder deflection.

BEFORE LANDING.

- | | | |
|----|-------------------------------------|--|
| 1. | Condition Lever | -HIGH |
| 2. | Power Lever | -Retard toward FLIGHT IDLE as required for the proper rate of descent. |
| 3. | Boost Pump | -ON |
| 4. | Fuel Selector | -TO FORWARD TANK |
| 5. | Bleed-air Heat Valve (if installed) | -AS NECESSARY |
| 6. | Instruments | -CHECK |
| 7. | Flaps | -LANDING or as desired |
| 8. | Brakes | -CHECK |

STEEP APPROACH

- | | | |
|----|-------------|------------------------------------|
| 1. | Wing Flaps | -LANDING |
| 2. | Power Lever | -FLIGHT IDLE |
| 3. | Airspeed | -SLOW UNTIL BETA LIGHT ILLUMINATES |
| 4. | Airspeed | -MAINTAIN 68 MPH |

The rate of descent will be approximately 3000 feet per minute.

FLAT APPROACH (with a dead engine or under forced landing conditions)

- | | | |
|----|-----------|------------|
| 1. | Propeller | -FEATHERED |
| 2. | Flaps | -UP |
| 3. | Airspeed | -85 MPH |

Gliding without power at that speed will result in a gradient of 10%, which corresponds with an angle of 5.7 degrees.

CAUTION

IF IT IS NECESSARY TO DO A LANDING APPROACH ON THE CENTER TANK AFTER THE LOW LEVEL WARNING LIGHT HAS COME ON, THE AIRCRAFT SHOULD BE FLOWN LEVEL OR NOSE HIGH WITH THE BOOST PUMP ON.

SIDESLIPS

The aircraft may be sideslipped although the recommended method is with the use of drag through a reduction in the power lever setting. The airspeed must not drop below 80 mph in an intentional sideslipping. Recovery should be initiated above 250 feet from the ground. Side slipping with flaps extended is prohibited.

LANDING.

NORMAL LANDING

No change

CROSS WIND LANDING

Because of the low landing speed of the aircraft with full flaps, crosswind landings should be made by experienced pilots only and not be attempted if the lateral component of the wind velocity is more than 17 mph (landplane). In gusty air, reduced flap settings may be preferred by the pilot.

GO-AROUND AND BALKED LANDING.

Decide early in approach whether it is necessary to go around.

- | | | |
|----|-----------------------------|--|
| 1. | Power Lever | -100% TORQUE or MAX EGT |
| 2. | Elevator trim | -ADJUST TO KEEP NOSE DOWN |
| 3. | At Safe Altitude & Airspeed | -RETRACT FLAPS IN TWO STEP WHILE TRIMMING IN BETWEEN |

AFTER LANDING.

- | | | |
|----|--------------------------|---|
| 1. | Flight Idle Stop Release | -After touch-down, release the flight idle stop and move the power lever back until the beta light comes on and then to the GROUND IDLE position and then REVERSE range as required for deceleration. |
| 2. | Condition Lever | -LOW RPM (Leaving run-way) |
| 3. | Flaps | -UP |
| 4. | Elevator Trim | -NEUTRAL |

NORMAL ENGINE SHUTDOWN ON GROUND.

NOTE: If the optional parallel/series start system is installed, all normal procedures are the same except that there is only one master switch installed instead of two. In those procedures referring to the master switches, substitute MASTER SWITCH in place of MASTER SWITCHES.

NOTE: Engines with a fuel purge system will not totally charge unless a minimum engine rpm of 95 percent is attained during the operational cycle. Partial purge will result in minor smoking from the engine.

1. Power Lever -GROUND IDLE

CAUTION

ACTIVATION OF THE STOP CIRCUIT FOLLOWING MANUAL SHUT DOWN (Moving the emergency fuel shutoff/feather lever aft) OF AN ENGINE EQUIPPED WITH A FUEL PURGE SYSTEM WILL RESULT IN FUEL ACCUMULATION IN THE PLENUM. DO NOT ACTIVATE THE ELECTRICAL SHUT DOWN CIRCUITS UNTIL ENGINE COOLING PRECLUDES COMBUSTION.

NOTE

Engines with a fuel purge system require actuation of the purge circuit for 5 seconds min. or until engine speed decreases below ground idle speed. The rpm should increase with actuation of the STOP circuit, then decrease when the manifold fuel is depleted.

2. Bleed-air Heat Valve (if installed) -CLOSED
3. Engine Stop Switch -STOP
4. Power Lever -REVERSE below 50 percent RPM (to engage propeller blade start locks during shutdown) hold until propeller stops.

NOTE

To Feather Propeller on Shutdown, use normal procedure, except power lever to FLIGHT IDLE in Step 3.

5. Boost Pump -OFF
6. AUTO/CONT. Ignition Switch -OFF

NOTE

Monitor engine coast-down for unusual noises.

@ 0 percent engine speed:

7. Power Lever -FLIGHT IDLE
8. START/GEN Switch -OFF

CAUTION

MOVING THE START/GEN SWITCH TO THE START POSITION WHILE THE ENGINE IS RUNNING CAN CAUSE SEVERE DAMAGE TO THE STARTER/GENERATOR.

9. Heater Recirculation Fan (if installed) -OFF
- 10.. Battery Master Switches -OFF

BEFORE LEAVING AIRPLANE.

- | | | |
|----|---------------|-----------|
| 1. | Wheels | -CHOCKED |
| 2. | Parking brake | -RELEASED |

CAUTION

DO NOT LEAVE PARKING BRAKES SET. THERE IS A POSSIBILITY OF SEIZURE, IF BRAKES ARE OVER-HEATED DUE TO HARD TAXIING.

- | | | |
|----|---|--------------------------------------|
| 3. | Gyros | -CAGE |
| 4. | Controls | -LOCKED |
| 5. | All switches | -OFF |
| 6. | Elevator Trim | -NEUTRAL, if not done while taxiing. |
| 7. | Have airplane tied down with protective covers placed in position | |
| 8. | REPORT ANY UNSATISFACTORY CONDITIONS – | |

SECTION 5 PERFORMANCE

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PERFORMANCE AT 8000 LB GROSS WEIGHT.

The aircraft performance meets or exceeds that of the original aircraft. Refer to the original DeHavilland DHC-3 Otter Flight Manual for determining performance.

NOTE

Use of the Bleed-air Heater System can degrade the climb performance as much as 100 ft/min. The resulting climb performance still meets or exceeds that of the original aircraft. A torque loss of up to 8% can be seen with the bleed-air heater full open versus closed for the same takeoff EGT.

CRUISE POWER SETTINGS.

For turbine engine aircraft, the best fuel efficiency (relative to fuel consumption vs. horsepower) is usually the maximum turbine temperature allowable at the given engine inlet temperature. This is not possible with the engine installed, because the pilot can easily exceed the airframe speed limits. Therefore, it is recommended to set the power lever to the highest allowable speed for the conditions within the operating envelope and reduce the engine speed (with the condition lever) to 96%. The lower engine speed will reduce fuel consumption and the engine noise level.

FLIGHT CHARACTERISTICS.

The flight characteristics are very similar to the original aircraft although the p-factor is opposite to the original due the counter-clockwise rotation of the engine and propeller.

STALL SPEEDS

1. Airspeeds shown are in mph-calibrated airspeed.
2. Power set at zero thrust.
3. Maximum altitude loss during any stall is 350 feet.
4. Stall characteristics are conventional.

CAUTION

When demonstrating stalls with power on and flaps extended, full rudder deflection may be reached before aircraft stalls. Recovery must be initiated prior to full rudder deflection.

Weight (lbs)	Flap Position	Angle of Bank			
		0°	20°	40°	60°
8,000	Up	77	79	88	109
	Climb	57	59	65	81
	Landing	52	54	59	74
7,500	Up	75	77	85	105
	Climb	55	57	63	78
	Landing	50	52	58	71
7,000	Up	72	74	82	102
	Climb	53	55	61	76
	Landing	49	50	56	69
6,500	Up	70	72	80	99
	Climb	52	53	59	73
	Landing	47	49	54	67
6,000	Up	68	70	77	96
	Climb	50	52	57	71
	Landing	46	47	52	65

NOISE

The FAR 36 Appendix G noise level for this aircraft is 81.8 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

SECTION 6 WEIGHT & BALANCE

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WEIGHT AND BALANCE LIMITATIONS.

GENERAL

At the maximum gross weight of 8000 lbs., the aircraft complies with the general performance and strength criteria. In the interest of airworthiness it is important that the weight and balance limits for the airplane be adhered to in accordance with the recommendations and information given in the following paragraphs, tables and diagrams.

WEIGHT DEFINITIONS

No changes to the weight definitions from the previous manual.

FUEL ALLOWANCES

The total fuel consumed, fuel flow, and time-to-empty can be determined using the Electronics International fuel flow gauge after accuracy has been positively identified. Do not use the original DeHavilland fuel flow or endurance data with this installation.

DETERMINING AIRCRAFT WEIGHT AND CG

No changes from the original aircraft techniques.

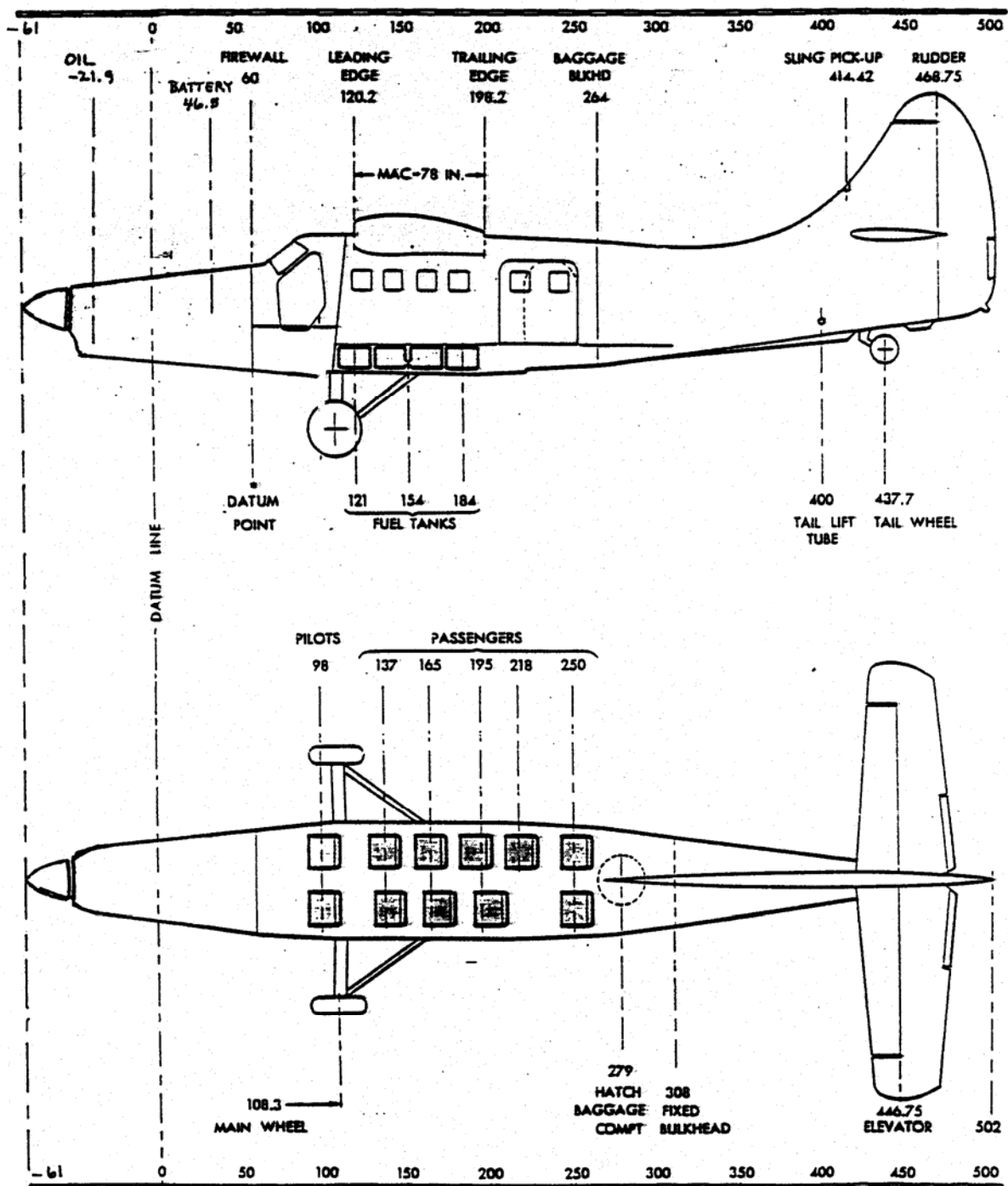


Figure 6-1, Balance Diagram

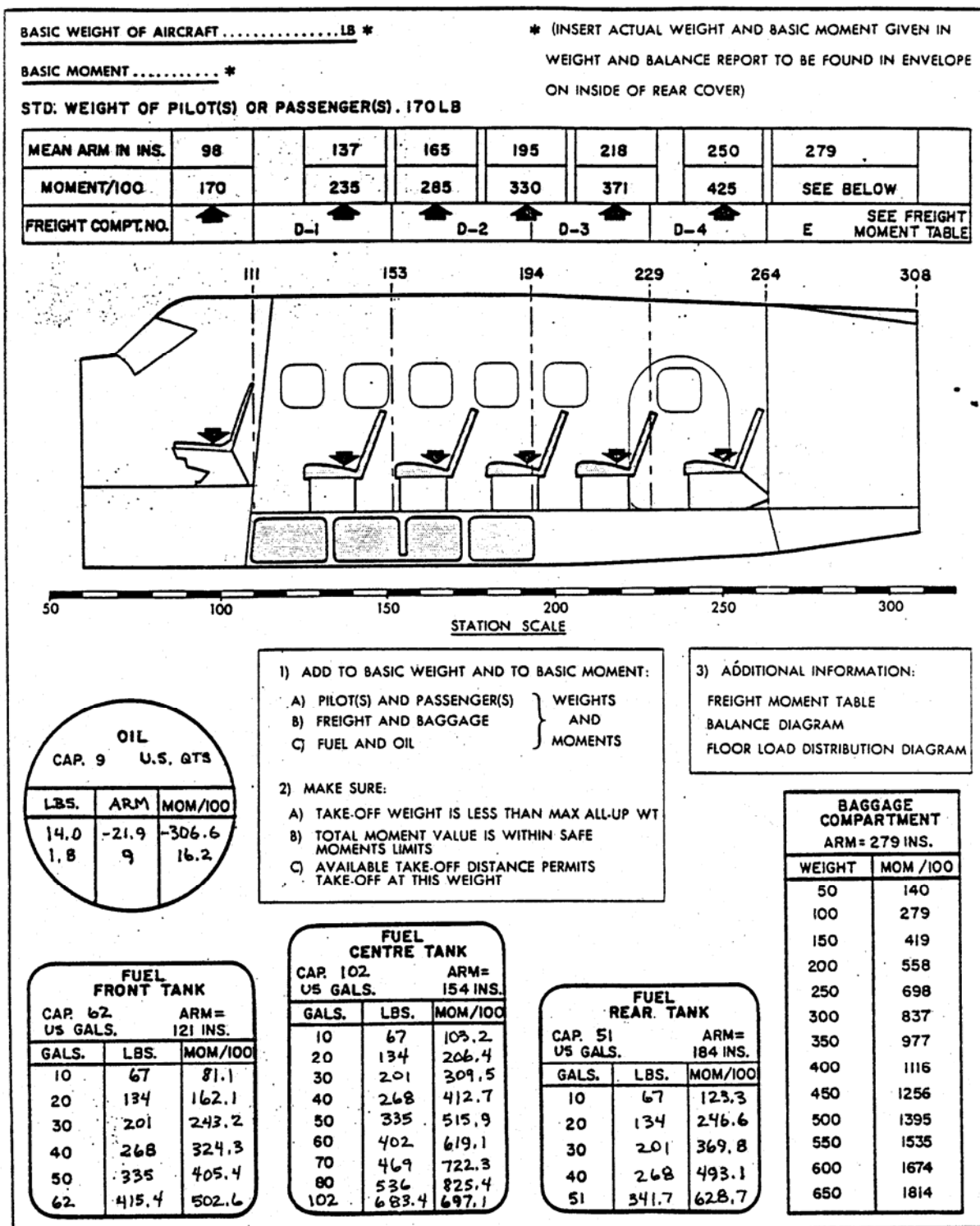


Figure 6-2, Operational Loads Diagram

SECTION 7

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ENGINE RATINGS AND MODES OF OPERATION.

The AlliedSignal (Garrett) TPE331-10 (or -12JR) turboprop engine is a single-shaft turboprop type with a two-stage centrifugal compressor, annular combustion chamber, and a three-stage axial turbine. The engine drives a four-blade constant speed, full-feathering, reversible propeller at 1591 rpm through a 1:26.229 gear reduction. Two controls, an engine speed control (or condition lever) and a power lever, provide all necessary control of the engine and propeller during normal operation.

The engine ratings, power lever, and engine speed control settings areas follows:

Takeoff & Continuous - This rating is the maximum power permissible and corresponds and corresponds to 900 SHP. Takeoff and continuous power limit is determined by either 900 SHP or the maximum allowable exhaust gas temperature (EGT) for the conditions, whichever is reached first.

Normal Cruise- The airframe speed limitations or maximum continuous EGT, which ever is reached first, determine the maximum power allowed in cruise. For slightly quieter cruise operation the engine speed may be reduced to 96% rpm.

Beta Mode- Beta mode operation of the propeller, in which the propeller blades are set at a very low positive angle, is used in the air for fast deceleration and high rates of descent. When operating in the beta mode, the propeller pitch angle is controlled by the position of the power lever instead of the propeller governor. The amount of drag may be varied, as desired, by movement of the power lever. (The propeller will not operate in beta mode at airspeeds above approximately 110 knots IAS). Beta operation is not to be confused with propeller reversing **which is never used in the air**. A blue beta mode indicator light on the instrument panel illuminates whenever the propeller blades are operating in the beta mode. The condition lever should be full forward (100% RPM) when operating in Beta mode.

Reverse- Either full or partial reverse thrust is obtained by lifting the gate and moving the power lever to any position aft of the flight idle stop. A small amount of right torque may be noticeable with full reverse thrust. Reverse thrust is for ground operation only and **is never used in flight**.

EXHAUST AUGMENTOR TUBE:

The exhaust augmentor tube exits the cowling on the lower right-hand side. The exhaust gases passing through the augmentor produce suction strong enough to pull cooling air around the engine and accessories while at the same time providing a measurable amount of thrust in cruising flight. The engine is effectively cooled during steep climbs when the forward airspeed is low and on the ground with little or no ram-air cooling.

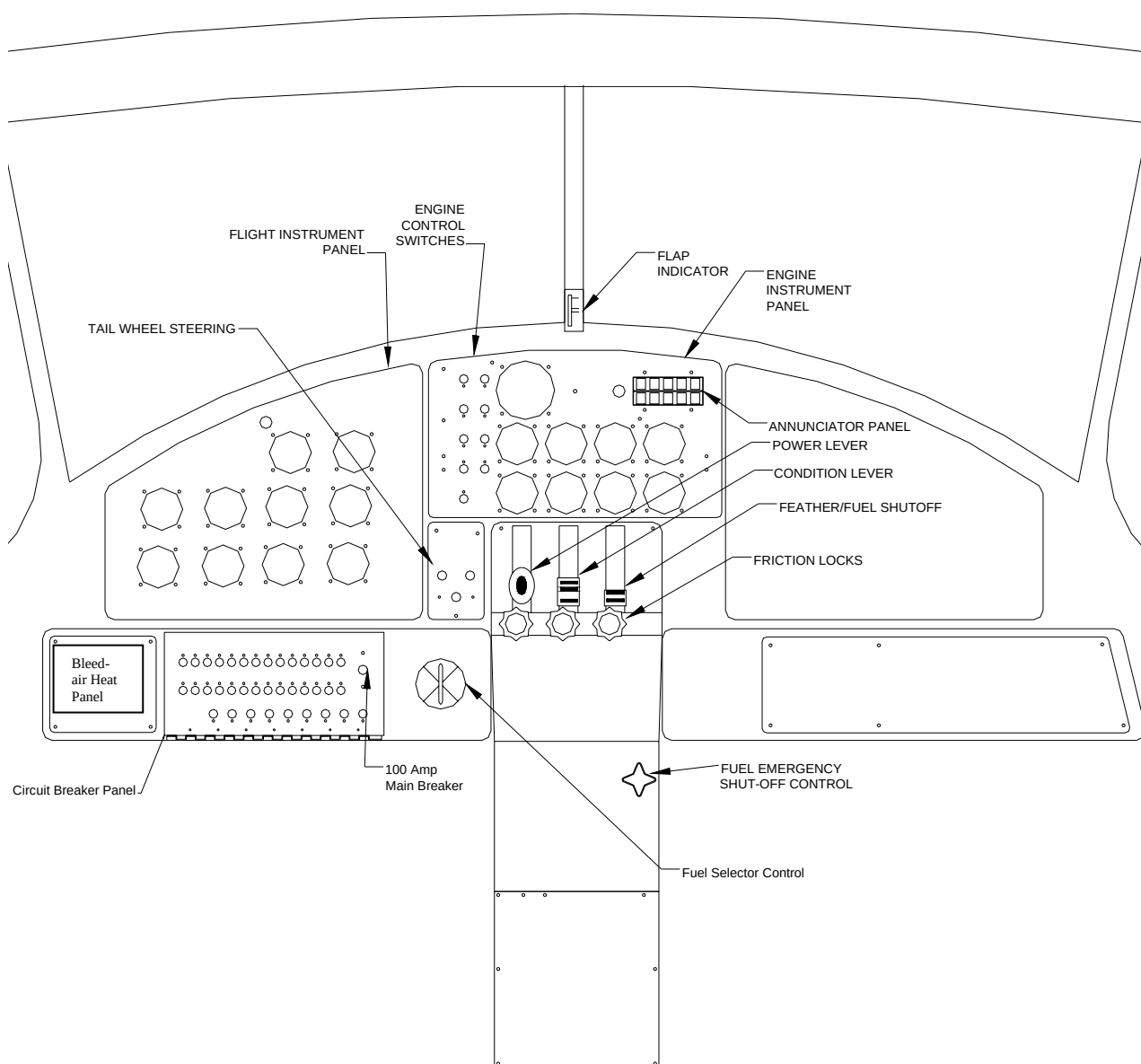


Figure 7-1, Cockpit and Instrument Panel Layout

ENGINE CONTROLS AND INSTRUMENTS.

POWER LEVER. The power lever on the left of the quadrant at the top of the pedestal slides forward and aft between full power and full reverse with a flight idle stop at approximately 40 degrees power lever angle (PLA). The power lever is connected to the engine via control rods.

A friction control below the power lever prevents power lever creep when rotated clockwise.

CONDITION LEVER. The condition lever is linked to the engine fuel control underspeed governor and the propeller governor speed control. Positioning the control full aft sets the fuel control underspeed governor to 68% engine speed (low idle) and the propeller governor to 96% engine speed. Positioning the control full forward sets the fuel control underspeed governor to 97% engine speed (for landing and reverse operation) and the propeller governor to 100% engine speed (for takeoff and climb operation). In-flight cruise adjustment from 100% to 96% rpm is obtained by pulling the condition lever slowly aft to the desired rpm.

CAUTION

Stabilized ground operation is prohibited **below 68% (1081) rpm and between 85% (1352) rpm and 92% (1464) rpm.**

EMERGENCY FUEL SHUTOFF/FEATHER LEVER. The emergency fuel shutoff/feather lever is on the far right side of the pedestal and moves fore and aft between two locked positions:

Locked forward: Fuel valve is able to be electrically opened and the feathering valve is closed (propeller operates normally).

Locked aft: Fuel valve is manually shut off and the feathering valve is opened thus feathering propeller. The fuel valve cannot be opened electrically until the lever is moved back to the forward position.

MASTER SWITCHES. The master switches are two-position switches located on the engine instrument panel. Each of the two aircraft batteries is controlled by a corresponding master switch. The batteries will not charge, nor will the aircraft be supplied power from the battery with the respective master switch in the OFF position. NOTE: There is only one master switch installed on aircraft modified with the optional parallel/series start system.

ENGINE IGNITION SYSTEM. There are two methods of providing ignition to the engine.

The first is through the START/GEN switch located on the engine instrument panel. As the start switch is engaged, the igniters are also energized until the start switch is moved to the OFF position.

The second method uses the AUTO/CONT ignition switch. It is a three-position switch located on the engine instrument panel. In the AUTO mode the ignition will be activated automatically when the torque drops below approximately ten percent. In the CONT mode the ignition will be activated continuously until the switch is moved to the OFF position. In the OFF mode both the automatic and the continuous circuits are disabled.

NOTE

Monitor ignition duty cycles (See Limitations, Section 5.).

BOOST PUMP SWITCH. The boost pump switch activates an electric boost pump to provide positive fuel pressure to the engine driven pumps. It is used during engine start, takeoff, landing, fuel tank selection, and high altitudes where inlet pressures on the engine driven pump may drop below allowable limits. It is not necessary to run the boost pump during normal cruise flight.

FUEL ON/SPR AND STOP SWITCH. The Fuel On/SPR (or Fuel Enrichment) and STOP switch is a three-position switch located on the engine instrument panel. In the spring-loaded Fuel On/SPR mode, the switch opens the fuel valve and activates the start fuel enrichment valve. In the protected STOP mode, the switch electrically closes the fuel valve and activates the EPA fuel purge kit. The center position is the RUN position.

START/GEN SWITCH. The START/GEN switch is a three-position switch located on the engine instrument panel. In the START position the switch accomplishes several tasks:

1. The starter/generator operates as a starter to crank the engine.
2. The oil vent valve is activated.
3. The primaries only solenoid is activated (locking out the secondary fuel nozzles).
4. The ignition system is activated.
5. The fuel anti-ice lockout valve is activated.

In the OFF position both the starter and the generator systems are disabled.

In the GEN position, the reverse current relay closes allowing the starter/generator to operate as a generator for the aircraft electrical system.

ANTI-ICE SWITCH. The anti-ice switch is a two-position switch located on the engine instrument panel. When selected ON, it opens the anti-ice valve allowing compression-heated air to the engine intake duct to prevent ice accumulation. When the anti-icing valve opens, an orange ANTI-ICE indicator light on the instrument panel illuminates.

CAUTION

Observe operating limits of anti-ice system

NOTE

Use of anti-ice when the engine is developing power may result in significant power loss.

NTS SWITCH. The negative torque sensing (NTS) switch is a two-position switch located on the engine instrument panel. It is used to test the NTS system during an engine start sequence.

NTS CHECK SYSTEM: This check can be performed for troubleshooting and failure detection of the negative torque sensing system. The NTS check is accomplished by turning the NTS switch on and observing the NTS indicator light during the engine cranking cycle. The unfeathering pump is also energized with the NTS switch to raise the propeller oil pressure level sufficiently to activate a pressure-sensitive switch, which lights the NTS indicator light. When the starter is energized, the NTS light should turn off momentarily, then turn on after the high initial negative torque decreases. If the set levels of negative torque are exceeded, the indicator light will turn off.

UNFEATHERING PUMP SWITCH. The unfeathering pump switch is a two-position switch located on the engine instrument panel. In the momentary ON position, this switch energizes the unfeathering

pump to unfeather the propeller. The emergency fuel shutoff/feather lever must be in the forward locked position to unfeather the propeller.

ENGINE INSTRUMENTS. Digital and conventional engine instruments are mounted on a panel above the engine controls pedestal. The digital instruments are normally powered from the main bus through the engine instruments circuit breaker. In the event that main power is lost, power can be restored to the engine instruments through the engine instruments BACK-UP switch located on the circuit breaker panel. In BACK-UP, the engine instruments are powered from the hot battery bus.

PERCENT RPM GAUGE. The percent rpm gauge has a digital LCD readout that displays engine rpm from 0-100%. There is also a green and red LED arc around the instrument for visual reference between 92-101% rpm.

EGT GAUGE. The exhaust gas temperature (EGT) gauge has a digital LCD readout that displays the temperature of the exhaust as it exits the engine. There is also a red LED at the top of the instrument that signals that the normal flight absolute maximum engine temperature of 620 degrees C has been reached and to reduce power immediately.

NOTE

It is normal for the red LED light to come on during the start of the engine, since engine temperatures regularly exceed 620 degrees C on the start.

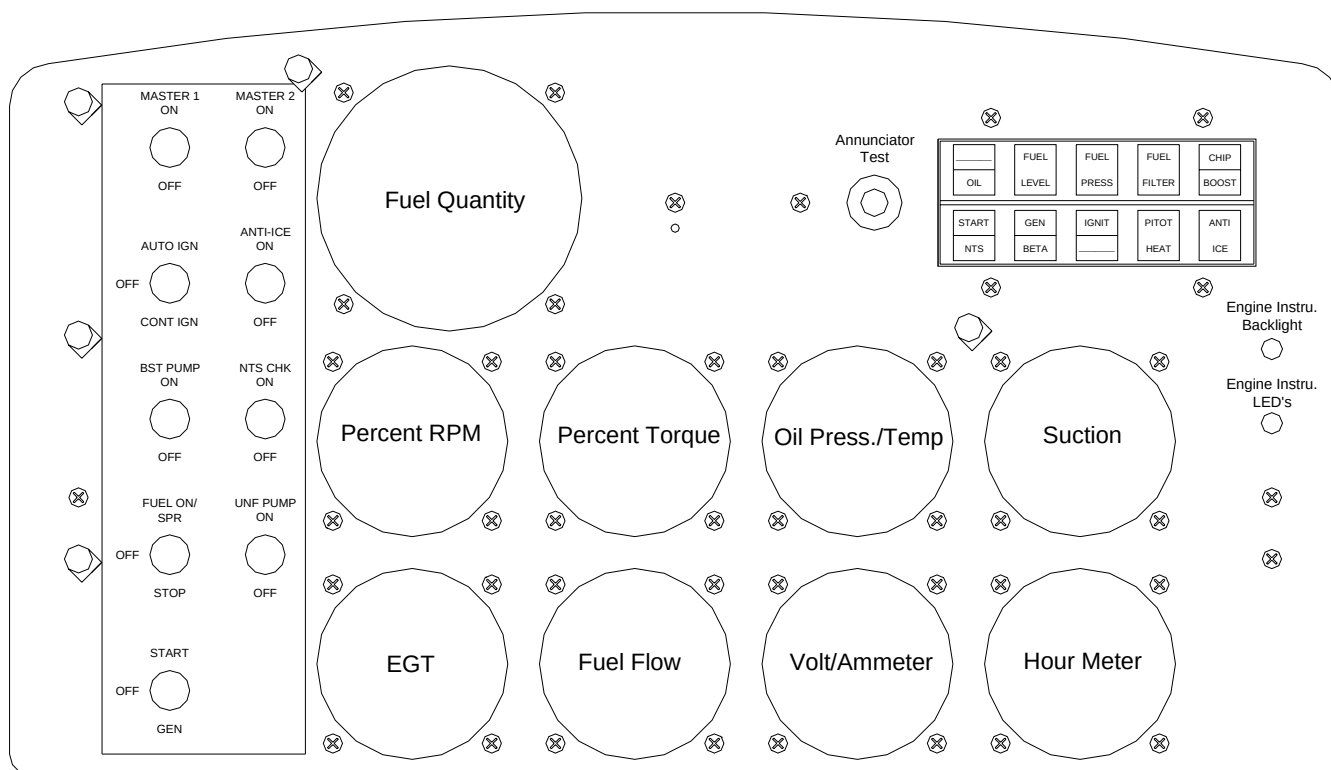


Figure 7-2, Turbine Engine Instrument Panel

TORQUE GAUGE. The torque gauge has a digital LCD readout that displays the engine torque from 10-100%. There is also a green and red LED arc around the instrument for visual reference between 25-101% torque.

FUEL FLOW/FUEL PRESSURE GAUGE. The fuel flow/fuel pressure gauge has a digital LCD readout that displays the fuel flow from 0-100 gal/hr or fuel pressure from 0-100 psi dependent upon the mode selected. It also has the capability to give total fuel burned, fuel remaining, time-to-empty, and GPS interface with the instrument. This instrument also illuminates a FUEL PRESS warning light if the pressure is in a warning area (<10 psi or >80 psi).

OIL PRESSURE/OIL TEMPERATURE GAUGE. The oil pressure/oil temperature gauge has a digital LCD readout that displays oil pressure from 0-120 psi or oil temperature from -40 to 127 degrees C dependent upon the mode selected. There are green, yellow, and red LED arcs on both sides for visual references. This instrument also illuminates an OIL warning light if either the pressure or the temperature is in a warning area.

VOLTMETER/AMMETER. The voltmeter/ammeter gauge has a digital LCD readout that displays bus voltage or total current usage dependent on the mode selected. There are also two LED's on the instrument to indicate DISCHARGE or OVERVOLTAGE.

SUCTION GAUGE The suction gauge shows vacuum applied to the Directional Gyro, Artificial Horizon, and Turn-and-Bank Indicator. The gauge is calibrated from zero to 10 in. Hg.

HOURLY METER The hour meter is used to monitor the engine and airframe time. It begins monitoring the engine/airframe hours as the engine oil pressure exceeds 4 psi upon engine start.

LED DIMMER CONTROL. The LED dimmer control is located on the engine instrument panel and is used to dim the engine instrument LED's for either day or night operation.

ANNUNCIATOR PANEL. The annunciator panel is located on the top, right side of the engine instrument panel. It gives the following indications:

OIL.....	Illuminates if the oil pressure or oil temperature is in a warning area.
FUEL LEVEL.....	Illuminates when there is approximately 15 minutes of fuel remaining in the selected tank.
FUEL PRESS.....	Illuminates if the programmable high/low fuel pressure limit is reached.
FUEL FILTER.....	Illuminates when a specific differential pressure is reached across the fuel filter indicating that the filter is clogged.
CHIP DETR.....	Illuminates when the chip detector magnet attracts a loose piece of metal from the engine indicating a possible failure.
IGNIT.....	Illuminates when the ignition system is activated and remains lighted until the system is de-activated.
START.....	Illuminates when the start relay is closed indicating that the starter is in use.
GEN.....	Illuminates when the reverse current relay is open indicating that the generator is not on line or the generator has failed.
BOOST PUMP.....	Illuminates when the boost pump is in use.
BETA.....	Illuminates when the engine is in the Beta mode of operation.
ANTI-ICE.....	Illuminates when the engine intake anti-ice valve is open.

PITOT HEAT.....	Illuminates when the pitot heat is in use.
NTS.....	Illuminates during the NTS system test (see test instructions).

ANNUNCIATOR PRESS-TO-TEST SWITCH. The press-to-test switch is located on the engine instrument panel and is used to test all of the annunciator lights. When pressed, all lights should light up simultaneously.

PROPELLER.

The engine drives a Hartzell 110" diameter, four-blade, constant-speed, reversing, and full-feathering propeller.

PROPELLER CONTROL. The propeller is controlled in three modes: **Normal, Beta, & Feather**

In the **normal** mode of operation (Power lever at or forward of the flight idle stop and beta light out), the propeller blade angle is controlled by the prop governor. The prop governor adjusts the blade angle to maintain the speed selected by the pilot with the condition lever.

In the **beta** mode of operation (Power lever at or behind the flight idle stop and the beta light on), the propeller blade angle is controlled by the pilot with the power lever and the engine speed is maintained by the underspeed governor on the fuel control unit (FCU). The prop governor serves no function in beta mode.

Feather: If the engine fails, the NTS system will automatically attempt to move the blades toward the feather position. However, the pilot must move the emergency fuel shutoff/feather lever to the full aft and locked position to completely feather the propeller. The emergency fuel shutoff/feather lever shuts the fuel off to the engine and pulls the feathering valve, which dumps the oil from the propeller dome. With no oil pressure, the spring forces in the propeller dome drive the blades to the feather position.

OIL SYSTEM.

The oil tank is integral the engine and has a total capacity of 6 quarts. The oil tank filler neck is located on the lower right side of the engine.

The oil cooler is located just aft of the engine and has an internal thermostat for bypassing oil. The oil cooler is cooled by ram air in flight and by air pulled through it by the augmented exhaust on the ground.

The total **oil system** capacity is 8 quarts.

FUEL SYSTEM.

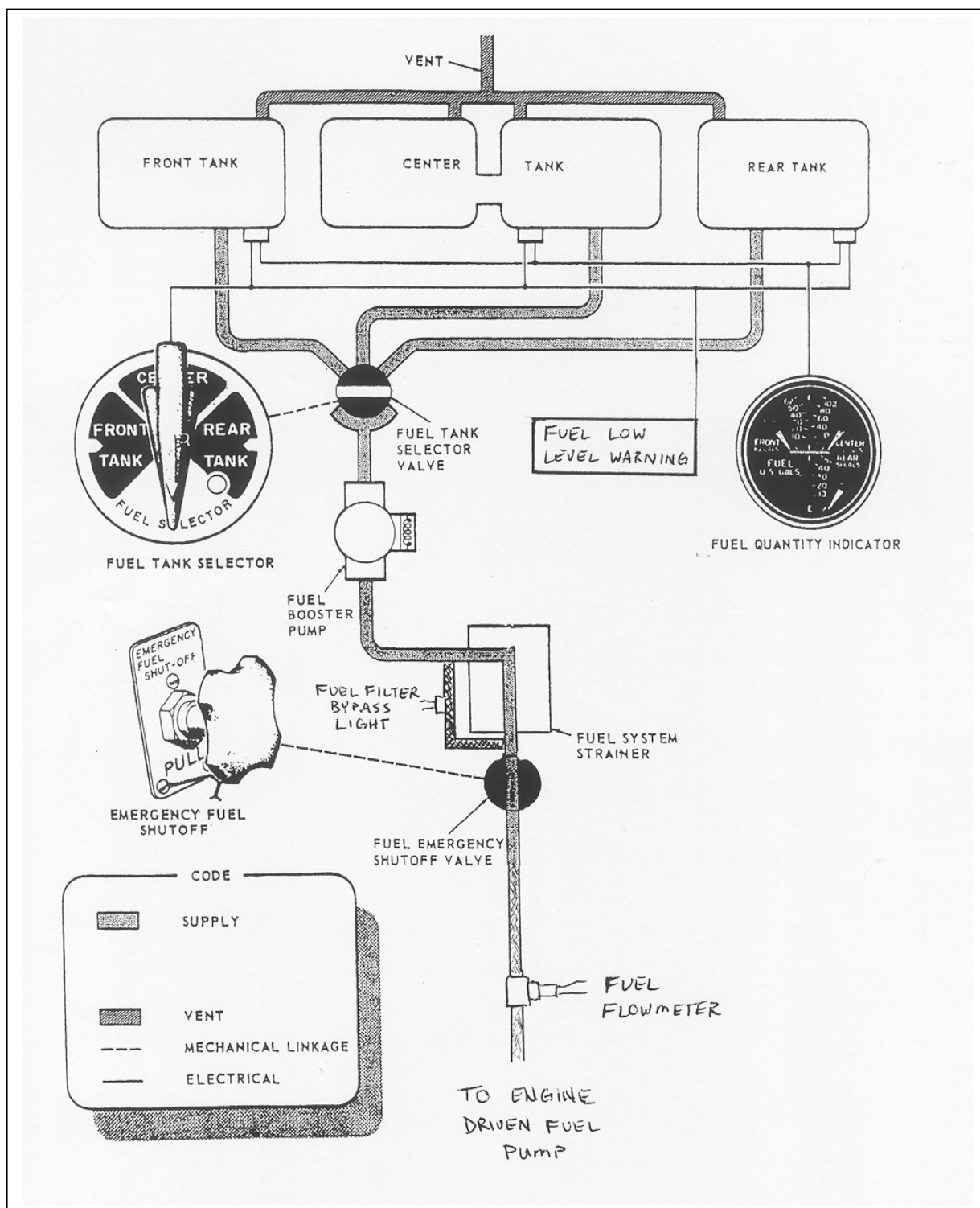


Figure 7-3, Fuel System: Schematic

The fuel system is the same as the original piston Otter fuel system with the exception of a new 25 micron fuel filter that replaces the old screen type and a fuel flowmeter. Fuel is contained in four flexible bag-type tanks beneath the forward portion of the cabin floor. The tanks are buttoned with fasteners to stringers on the underside of the floor and to the skin of the fuselage. The tank capacity is as follows:

	Imp. Gal	U.S. gal	Liters
Front	51	62	233
Center	85	102	389
Aft	42	51	192
TOTAL	178	215	814

NOTE

A placard must be installed above the pilot stating, “**For starting, takeoff, landing, flight above 10,000 ft., and when selecting fuel tanks, the boost pump must be turned ON**”.

FUEL SELECTOR HANDLE. The fuel selector handle, located below the bottom right corner of the pilots instrument panel, can be positioned to FRONT, CENTER, AFT or OFF. When the engine is not operating, the selector handle must be selected to OFF to prevent drainage of the fuel supply line into the tank.

FUEL BOOSTER PUMP SWITCH. The fuel booster pump switch is located on the engine instrument panel. The booster pump incorporated into the fuel system between the tank selector valve and the fuel filter is used to supply fuel pressure for starting the engine and can be operated to supply sufficient fuel pressure to the engine driven fuel pump for takeoff, landing, high altitudes, and when selecting fuel tanks.

FUEL CONTENTS GAGE. The triple indicator fuel contents gage, graduated either in Imperial or U.S. gallons, will indicate only when the FUEL CONTENTS circuit breaker is set. This circuit breaker is located on the main circuit breaker panel below the pilot’s instrument panel.

NOTE

Calibration in **red** applies to aircraft in the tail-down position.

FUEL LOW LEVEL WARNING LIGHT. A red FUEL LEVEL light gives an indication of low fuel level in the tank from which the engine is operating. The light becomes illuminated when fuel for approximately 15 minutes of cruising remains in the tank.

FUEL FILTER BYPASS LIGHT. A red FUEL FILTER light on the annunciator panel is illuminated when the fuel filter senses a potential bypass condition.

EMERGENCY FUEL SHUT-OFF CONTROL. The shut-off control handle stops the supply of fuel to the engine at the firewall in case of emergency. It is located on the right side of the pedestal, below the engine controls quadrant.

ELECTRICAL SYSTEM.

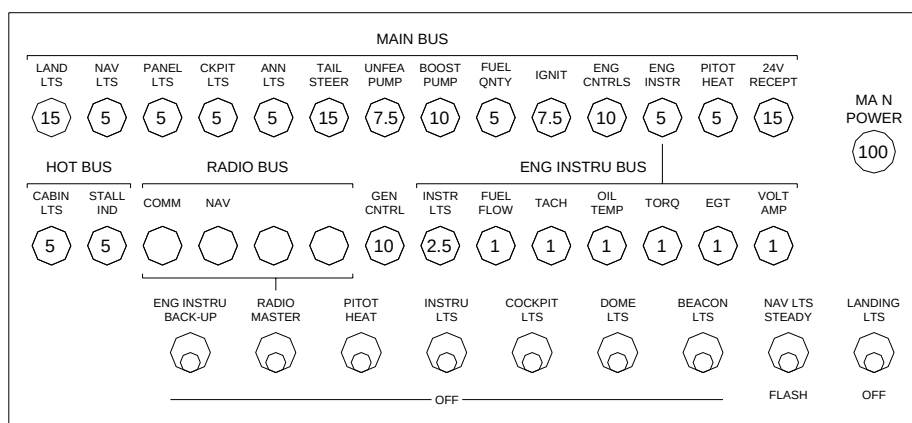
Electrical energy is supplied by a direct current 300 amp, 28-30 volt starter/generator, in conjunction with two 24 volt 43 amp-hr lead-acid batteries connected in parallel. If the optional parallel/series start system is installed, the batteries remain in parallel at all times except during starting from 12-60% where the batteries are switched from parallel (24V) to series (48V) to decrease start time. The 48 volts is isolated from the aircraft buses via relays, so the starter is the only component receiving 48 volts.

The starter/generator is a direct-drive combination unit mounted on the accessory section of the gearbox. It performs starting functions in the start mode and generator functions in the generator mode. The reverse current relay and the START/GEN switch control these modes.

All circuits of the electrical system are protected by manually resetable-type circuit breakers on the lower right panel below the co-pilots instrument panel and on the engine instrument panel.

The batteries are located in a stainless steel battery box mounted in the engine compartment.

CIRCUIT BREAKER PANEL. The circuit breaker panel is located on the sub-panel below the pilot's flight instrument panel. The panel is depicted below:



ELECTRICALLY OPERATED EQUIPMENT. The following equipment and controls are powered by the electrical system.

- | | |
|-----------------------------|--------------------------|
| Engine Starter | Navigation Lights |
| Fuel Booster Pump | Landing Light |
| Pitot Head Heater | Heater Installation |
| Instrument & Warning Lights | COMM & NAV Radios |
| Interior Lights | Unfeathering Pump |
| Engine Instruments | Engine relays and valves |
| Misc. Electronic Equipment | |

EXTERNAL POWER RECEPTACLE. For starting the engine or for electrical ground checks, an external power source may be connected to an external power receptacle fitted to the left side of the fuselage, forward of the pilot's door. When external power is connected, the aircraft's battery is isolated if the battery master switch is in the OFF position.

FLIGHT CONTROLS.

No changes have been made to the flight controls.

WING FLAPS HYDRAULIC SYSTEM.

No changes have been made to the hydraulic system.

LANDING GEAR.

No changes have been made to the landing gear.

INSTRUMENTS.

No changes have been made to the flight instrument panel

VACUUM OPERATED INSTRUMENTS

The engine bleed air moving through an ejector nozzle provides suction to operate:

Directional Gyro Artificial Horizon
Turn-and-Bank Indicator

EMERGENCY EQUIPMENT.

No changes to emergency equipment, except that no engine fire extinguisher system is installed.

BLEED-AIR HEATER (If Installed).

The bleed-air heat system utilizes P3 bleed-air from the engine to heat the cabin. The P3 air travels from the engine to a pilot controlled electric bleed valve. The ejector nozzle design of the bleed valve allows the hot bleed-air to mix with outside ram air to create a temperature suitable for the cabin. Incrementally opening the electric bleed valve increases the mass air flow and heat to the cabin.

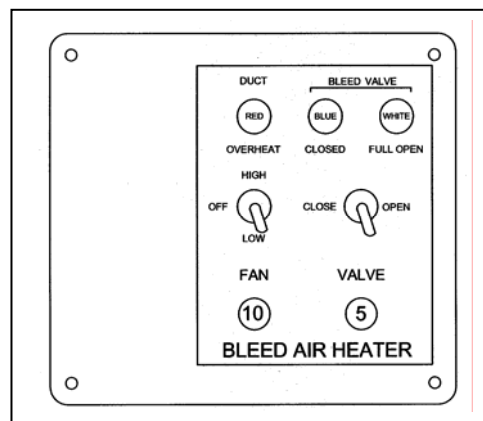


Figure 7-4, Bleed-air Heater Panel

The heater system is provided with an automatic duct overheat detection system. The duct overheat light (red) and the duct overheat relay are activated by a temperature sensor when the duct temperature reaches $250^{\circ}\text{F} \pm 5^{\circ}\text{F}$. The relay automatically drives the bleed valve to a colder position until the overheat condition has ended. When the duct overheat light is illuminated, the heater bleed valve (OPEN/CLOSE) toggle switch is disabled, while the automatic system closes the valve. If the automatic system fails, the pilot should be able to close the valve using the bleed valve toggle switch.

There are two lights to indicate the position of the bleed valve. The blue light indicates that the bleed valve is closed. The white light indicates that the bleed valve is full open. When the valve is in an interim position, neither light will be illuminated.

A recirculation fan is provided to augment the airflow at low bleed rates and to help maintain uniform heating within the cabin and cockpit. It is recommended that the fan be used when the heater is in operation to help prevent duct overheating by re-mixing cabin air. The fan and bleed valve can be operated independently of one another.

CAUTION

If there is a main power failure during use of the bleed-air heat system, the valve will remain in the last position selected and cannot be closed until the engine instruments back-up switch is turned ON. The valve will then be powered by the hot battery bus. If there is a total electrical failure, the valve will remain in the last position selected, which might require an engine shutdown to prevent a duct overheat.

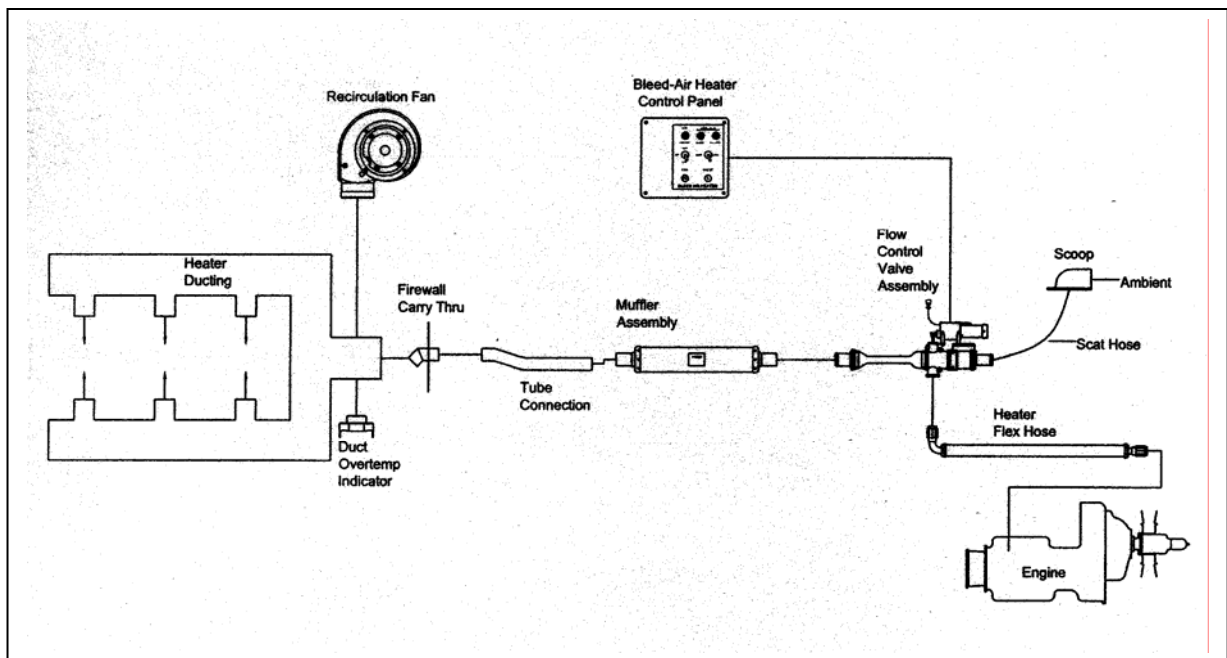


Figure 7-5, Bleed-air Heater Schematic

MISCELLANEOUS EQUIPMENT.

No changes to the miscellaneous equipment.

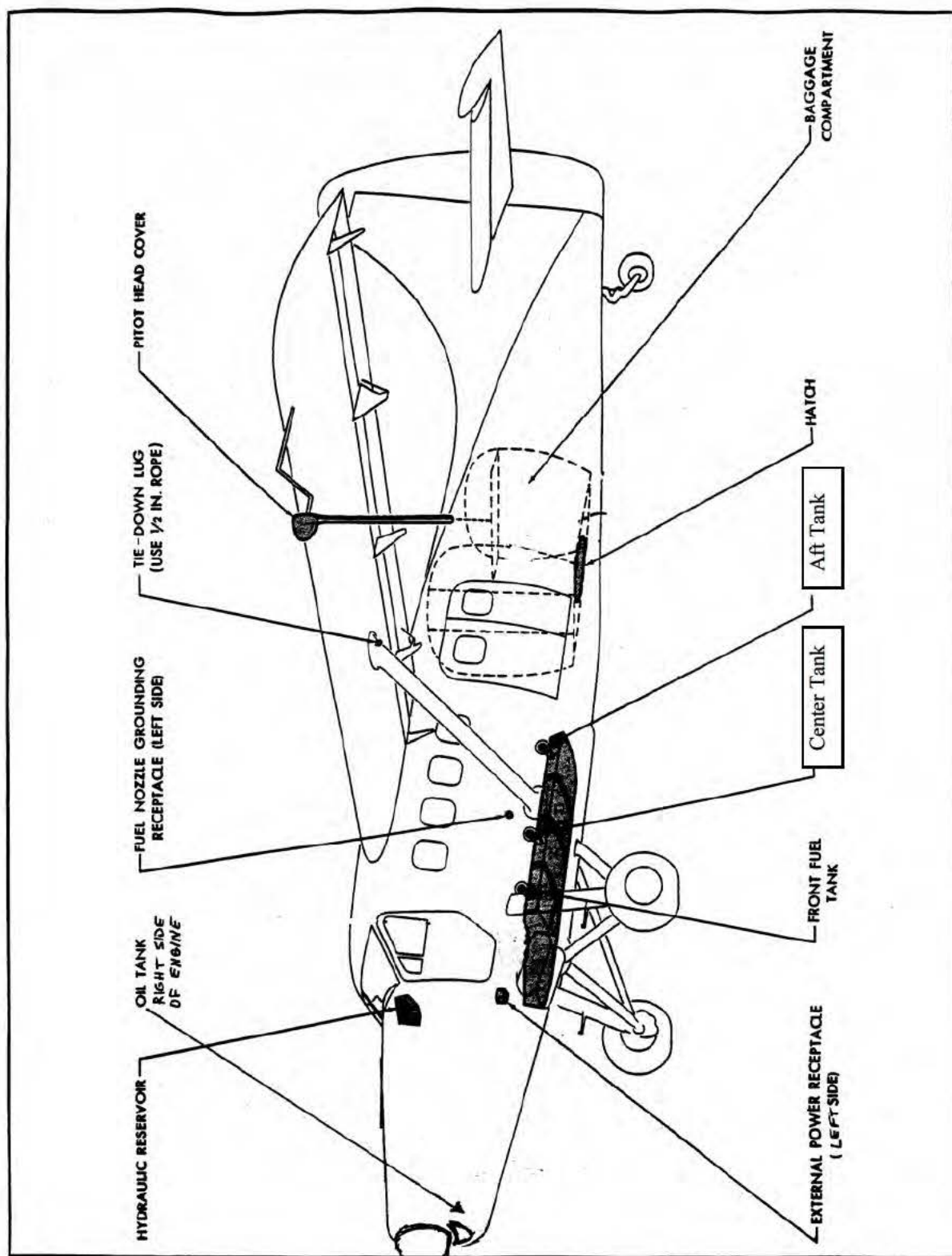


Figure 7-6, General Arrangement and Servicing Points

Kal-Air Repair Ltd
6400 Tronson Rd
Vernon, BC

STC No: SA03-82, Issue 2
deHavilland DHC-3
Extended Range Fuel System

DoT APPROVED
FLIGHT MANUAL SUPPLEMENT No: 615-TEG

for

DeHavilland DHC-3 "Otter"

(Fitted with turbine engine)

This supplement must be attached to the DOT Approved Flight Manual with the installation of the 'Extended Range Fuel System' in accordance with Outback Aviation Drawing No: 1460 Issue 3, or later DoT Approved revision.

Chapters II, III, IV and V of this document comprise of Approved Flight Manual Supplement. Compliance with Chapter IV, 'Operating Limits' of this supplement is mandatory.

The information contained in this document supersedes or supplements the basic Approved Flight Manual No: PSM 1-3-1 and the DOT approved Airplane Flight Supplement applicable to the turbo-prop installation.



DOT Approved: _____

Aircraft Certification Engineer
Transport Canada, Pacific Region

DATE: _____

Kal-Air Repair Ltd
6400 Tronson Rd
Vernon, BC

STC No: SA03-82, Issue 2
deHavilland DHC-3
Extended Range Fuel System

LOG OF AMENDMENTS
to
Flight Manual Supplement No: 615-TE

Issue No:	Date Inserted	Signature	Effective Pages	DOT Approved By/date
1			All	

DoT Approved:
Date: _____

Approved Flight Manual Supplement No: 615-TE

CHAPTER I
DESCRIPTION OF AIRCRAFT

2.2 FUEL SYSTEM

The DHC-3 aircraft may be fitted with two additional under floor fuel cells aft of the existing Rear tank located between stations 204 and 237. These additional cells are plumbed directly into the 'Rear Tank' and effectively increase the usable 'Rear Tank' capacity from 42 to 73 Imp gallons. Since these additional cells are connected to the 'Rear Tank' the cells are filled as the 'Rear Tank' is filled, also when the fuel selector lever is positioned to 'Rear Tank' fuel is drawn from the 'Rear Tank' and these additional cells as if they were one tank. Each added fuel cell is vented to each other and vented to existing fuel vent system. A placard is installed adjacent the "Fuel Contents Gauge" alerting the crew of the increased capacity now available in the 'Rear Tank'.

A sump and quick drain is provisioned in the forward fuel cell.

Revise tank capacity as follows:

	<u>IMP. gal</u>	<u>U.S. gal</u>	<u>Liters</u>
Rear	73	87	331

Approved Flight Manual Supplement No: 615-TE

CHAPTER II

NORMAL OPERATING PROCEDURES

2.1 BEFORE ENTERING AIRCRAFT

Check

- d. Load distribution and CG position

Note: Total rear fuel tank capacity is increased to 73 Imp gallons

- 2 Fuel tank drains: Check for presence of water and correct specification

Note: An additional sump drain has been provisioned

2.2.1 ON ENTERING AIRCRAFT

No change

2.11.4 FUEL MANAGEMENT

No change

CHAPTER III

EMERGENCY PROCEDURES

No change

DoT approved:

Dated: _____

Approved Flight Manual Supplement No: 615-TE

CHAPTER IV OPERATING LIMITS

Placards

Adjacent to the fuel contents gauge:

**REAR TANK
CAPACITY
73 IMP gal**

Adjacent the rear tank filler neck:

73 IMP gal

Fig. 4-3 Balance Diagram

Revise to add following information

Additional Fuel at FS 211 and FS 228

Fig. 4-5 Operational Loads Diagram

Revise Fuel - Rear Tank table as follows:

CAP. 73 IMP GALS	FUEL REAR TANK	ARM= 199
	Sg. 800	
GALS	LBS.	MOM/100
10	80	159
20	160	318
30	240	478
40	320	637
50	400	995
60	480	1194
73	584	1162



JAN 19 2004

CHAPTER V PERFORMANCE DATA AND FLIGHT CHARACTERISTICS

No change

DoT approved:

Dated: _____

Approved Flight Manual Supplement No: 615-TE

CHAPTER V
WEIGHT AND BALANCE DATA

Installation of Kal-Air Repair Ltd Extended Range Fuel System has the following effect on empty weight and center of gravity location.

Item	Weight (lbs)	Arm (inches)	Moment
1. Installation of Extended range Fuel system per Outback Aviation Drawing No: 1460	+34.0	218.4	7425.6
2. Unusable fuel	+4.0	210.6	842.4
Totals	+38.0	217.6	8268.0

Note:

Total fuel capacity of rear tank is 73 Imp gallons or 584 pounds at FS 199.0

SUPPLEMENT # 4

BARON STOL KIT INSTALLATION

ELIGIBLE AIRCRAFT

REG. # S/N

STA # SA 94-114
STC # SA 00287NY

SECTIONS II, III AND IV AND V OF THIS DOCUMENT COMPRISE THE APPROVED FLIGHT MANUAL SUPPLEMENT. COMPLIANCE WITH SECTION IV, & V, OPERATING LIMITATIONS, PERFORMANCE DATA AND FLIGHT CHARACTERISTICS, IS MANDATORY.

THE INFORMATION OR DATA CONTAINED IN THIS DOCUMENT SUPERSEDE OR SUPPLEMENT THAT CONTAINED IN THE BASIC APPROVED AIRCRAFT FLIGHT MANUAL P/N PSM 1-3-1 IN THOSE AREAS LISTED HEREIN. FOR LIMITATIONS, PROCEDURES AND PERFORMANCE NOT CONTAINED IN THIS DOCUMENT, REFER TO THE APPROVED AIRCRAFT FLIGHT MANUAL OR APPROVED FLIGHT MANUAL SUPPLEMENTS.

DOT APPROVED


PACIFIC REGION

DOT APPROVED

MAR 09 2006

REVISION # 2
REVISION DATE: 08/18/2005

LOG OF REVISIONS

REV #	REV.DATE	PAGES AFFECTED	REASON FOR CHANGE
1	09/24/94	1,2,3	AMEND APPROVED FLOAT CONFIGURATATION DATA
2	08/18/05	1,2,3	AMEND THE APPROVED CONFIGURATION DATA

SECTION II - NORMAL PROCEDURES

No change

SECTION III - EMERGENCY PROCEDURES

No change

SECTION IV - OPERATING LIMITS

APPROVED CONFIGURATIONS

- 1/ This installation is compatible with any approved wheel, ski or any approved floats up to 9000 lb displacement.

NOTE:

With 7850 floats installed, avoid intentional slide slips with flaps down.

- 2/ This installation is compatible with any approved engine installation (piston or turbine).

WEIGHT AND BALANCE

Applicable - no change

SECTION V - PERFORMANCE

The performance of this aircraft meets or exceeds the performance described in the basic Flight Manual PSM 1-3-1 or other overriding flight manual supplement when modified with the Baron STOL kit.