

1963 CESSNA

310h

OWNER'S MANUAL



Congratulations

Welcome to the ranks of Cessna owners! Your Cessna has been designed and constructed to give you the most in performance, economy, and comfort. You will find flying it, either for business or pleasure, a pleasant and profitable experience.

This Owner's Manual has been prepared as a guide to help you get the most pleasure and utility from your airplane. It contains information about your Cessna's equipment, operating procedures, and performance; and suggestions for its servicing and care. We urge you to read it from cover to cover, and to refer to it frequently.

Our interest in your flying pleasure has not ceased with your purchase of a Cessna. World-wide, the Cessna Dealer Organization backed by the Cessna Service Department stands ready to serve you. The following services are offered only by your Cessna Dealer:

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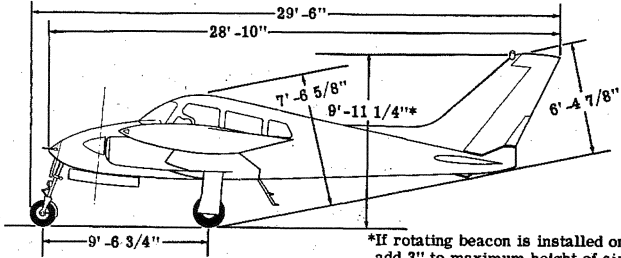
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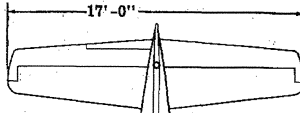
THE LATEST AUTHORITATIVE INFORMATION FOR SERVICING CESSNA AIRPLANES, since Cessna Dealers have all of the Service Manuals and Parts Catalogs, kept current by Service Letters and Service News Letters published by Cessna Aircraft Company.

We urge all Cessna owners to use the Cessna Dealer Organization to the fullest.

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*If rotating beacon is installed on vertical fin, add 3" to maximum height of airplane.



**PRINCIPAL
DIMENSIONS**

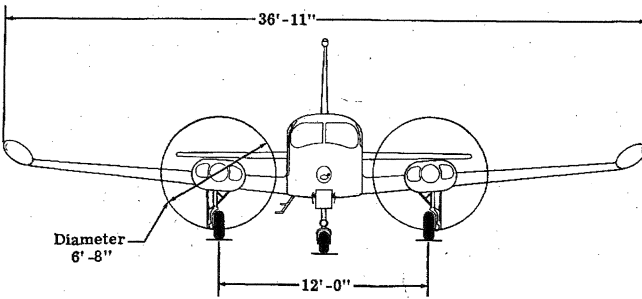
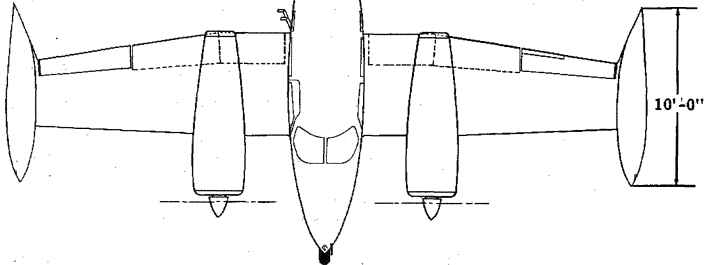


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Description

ONE OF THE FIRST STEPS in obtaining the utmost performance, service, and flying enjoyment from your Cessna is to familiarize yourself with your aircraft's equipment, systems, and controls. This can best be done by reviewing this equipment while sitting in the aircraft. Those items whose function and operation are not obvious are covered herein.

ENGINES

Two horizontally-opposed, six-cylinder, Continental IO-470-D engines, rated at 260 horsepower at 2625 RPM, power your airplane. The engines have wet-sump oil systems, dual magnetos, continuous-flow fuel injection, and jet-augmenter exhaust systems including mufflers.

INDUCTION AIR CONTROL HANDLES

The induction air control handles operate doors in the engine air intakes to select either filtered cold air or air heated by exhaust manifold heaters. If ice should form in induction system, as evidenced by an unexplained drop in manifold pressure, pull the induction air control handle, for the engine involved, full out and lock it in position by rotating it. Do not use an intermediate position.

The alternate air (heated air) doors are spring-loaded closed and their control linkage permits engine suction to open them automatically if

the air filter is blocked, regardless of the position of the induction air control handles.

IGNITION AND STARTING SWITCHES

The two magneto switches, the starting switch and the oil dilution switch (optional equipment-see oil dilution system for further discussion) are incorporated into one unit for each engine. This switch simplifies the starting procedure. The starter is engaged by rotating the switch knob in a clockwise direction. When the switch knob is released, spring action returns the switch to the BOTH position. For normal operation each ignition switch should remain in the BOTH position. Switches should be turned to the L (Left) or R (Right) position for checking only. When engines are stopped, both switches should be OFF (counterclockwise position).

FUEL SYSTEM

Fuel for each engine is supplied by

Description

FUEL QUANTITY DATA (U.S. GALLONS)			
TANK	USABLE FUEL ALL FLIGHT CONDITIONS	UNUSABLE FUEL	TOTAL FUEL VOLUME EACH
LEFT MAIN TANK	50.0 gal.	1.0 gal.	51.0 gal.
RIGHT MAIN TANK	50.0 gal.	1.0 gal.	51.0 gal.
LEFT WING AUXILIARY TANK	15.0 gal.	0.5 gal.	15.5 gal.
RIGHT WING AUXILIARY TANK	15.0 gal.	0.5 gal.	15.5 gal.

a main tank on each wing tip and an optional auxiliary tank in the wing just outboard of each nacelle. Each engine has its own complete fuel system; the two systems are interconnected only by a crossfeed for emergency use. Vapor and excess fuel from the engines are returned to the main fuel tanks. Submerged electric auxiliary pumps in the main fuel tanks supply fuel for priming and starting, and for engine operation if an engine-driven pump fails. The optional auxiliary tanks have no return lines or electric pumps. Refer to page 1-3 for Fuel System Schematic.

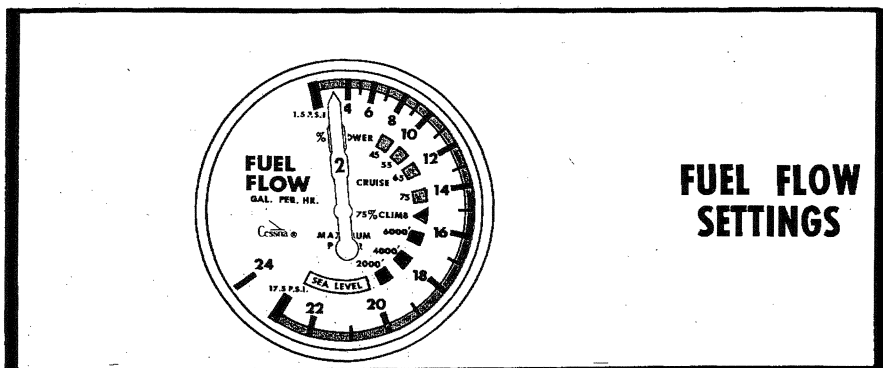
FUEL SELECTOR VALVE HANDLES

Rotary selector valve handles on the cabin floor just back of the engine control pedestal controls the fuel

system. The selector valve placards for standard fuel system are marked LEFT ENGINE OFF, LEFT MAIN and RIGHT MAIN for the left engine selector, and RIGHT ENGINE OFF, RIGHT MAIN and LEFT MAIN for the right engine selector. The crossfeed position of each selector valve is the one marked for the opposite main tank. With optional auxiliary tanks, each selector has a fourth position, marked AUXILIARY which will feed its engine only from its auxiliary tank. The auxiliary tanks cannot be cross-fed.

The fuel selector valve handles form the pointers for the selectors. The ends of the handles are arrow-shaped and point to the position on the selector placard which corresponds to the valve position.

Description



NOTE

The selector valve handles should be turned to **LEFT MAIN** for the left engine and **RIGHT MAIN** for the right engine, during take-off, landing and all normal operation.

AUXILIARY FUEL PUMP SWITCHES

The auxiliary fuel pump switches are three-position switches, marked **ON**, **OFF** and **PRIME**. The **PRIME** position runs the pumps at low speed, providing for priming and starting. The **ON** position also runs the pumps at low speed, as long as the engine-driven pumps are functioning. With the switch in the **ON** position, however, if an engine-driven pump fails, the auxiliary pump on that side will switch to high speed automatically, providing sufficient fuel for all engine operations including emergency take-off. As a safety measure, always take-off and land with the auxiliary pump switches in the **ON** position.

NOTE

Turn auxiliary pumps **OFF** as soon as possible

FUEL QUANTITY INDICATORS

Fuel quantity in each main tank is shown by a dual-reading fuel quantity indicator on the right hand side of the instrument panel. A second dual gage shows the fuel in each optional auxiliary tank. The indicators are electrically-operated, and with the battery switch on, indicate in gallons the amount of fuel remaining.

FUEL FLOW GAGE

The dual fuel flow gage indicates the fuel consumption of each engine by sensing the pressure of the fuel delivered to the injection spray nozzles. Since this pressure is proportional to fuel flow, the gage has been calibrated and marked directly in gallons per hour. Fuel pressures at the minimum and maximum red lines are marked in smaller numerals for calibration reference.

Colored markings have been included to aid in quickly selecting the

proper mixture setting. Fuel flows for sea level maximum rated power are indicated by the white arc marked Sea Level. The blue segments indicate the best-power fuel flow setting for the maximum power available at the altitudes marked, (2625 RPM and full throttle). The blue triangle marked 75% Climb is the best-power fuel flow setting for the recommended climb power of 2450 RPM and 24 inches M. P.

The green segments signify the optimum cruising fuel flows for 45%, 55%, 65% and 75% of maximum rated power. Since the green segments for cruise will give minimum fuel flow for maximum range, they are the lowest fuel flow that should be used for the power indicated. Higher fuel flow settings will increase speed only one or two MPH but will greatly decrease range. Lower fuel flow settings should be avoided since too lean a mixture may cause engine damage.

Since engine power at the same RPM and manifold pressure will change with outside air temperature, the power computer should be used to determine the actual power. The fuel flow may either be adjusted using the green percent power segments, or the fuel flow in gallons per hour per engine may be read from the computer and the fuel flow set to that value.

NOTE

The percent power markings on the fuel flow gage do not indicate the power output of the engines. They indicate only the proper fuel flow for the corresponding power setting.

ELECTRICAL POWER SUPPLY SYSTEM

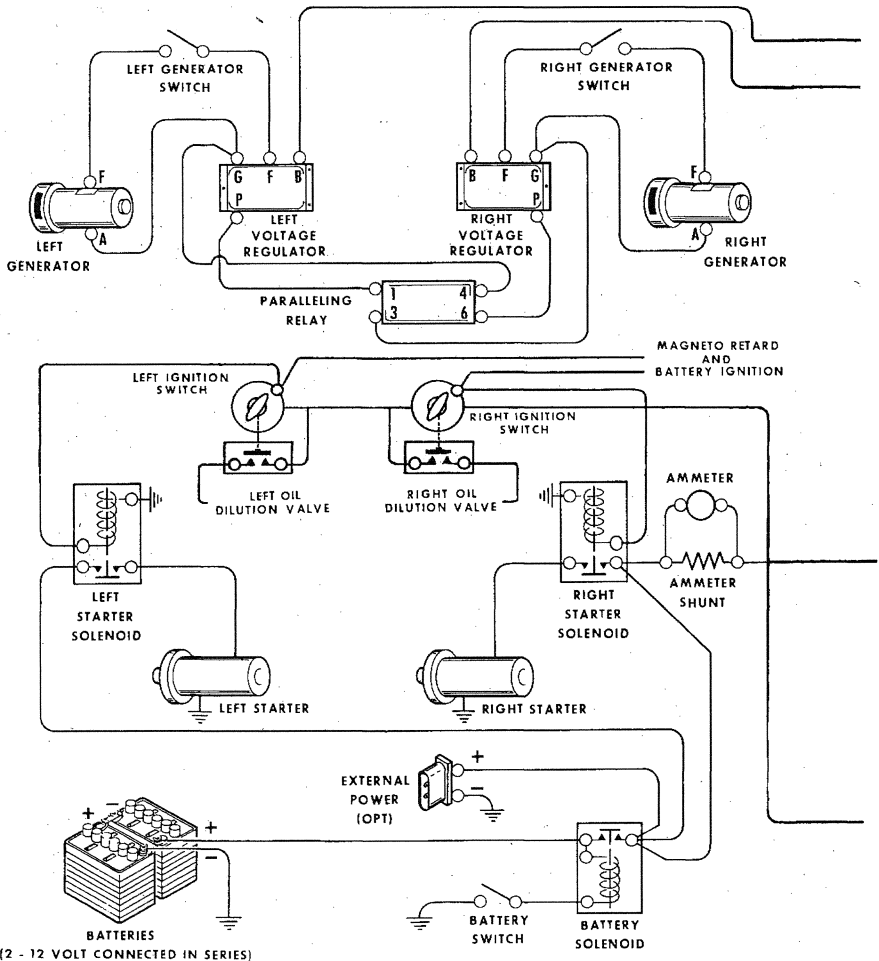
Electrical power is supplied by a 28-volt, negative-ground, direct current system, powered by a 25-ampere engine-driven generator on each engine. A 50-ampere generator system is available as optional equipment. Two 12-volt batteries, connected in series, are located in the left wing just outboard of the engine nacelle, serves as a standby power source, supplying power to the system when the generators are inoperative, or when generator voltage is insufficient to close the reverse-current relays. An optional external power receptacle, which accepts a standard external power plug, can be installed in the left wing under the battery. Refer to pages 1-6 and 1-7 for Electrical Power Distribution Diagram.

BATTERY AND GENERATOR SWITCHES

A battery switch and two generator switches control the electrical power supply system. The switches may be operated individually or all three may be turned off at the same time, by using the hinged bar mounted above them.

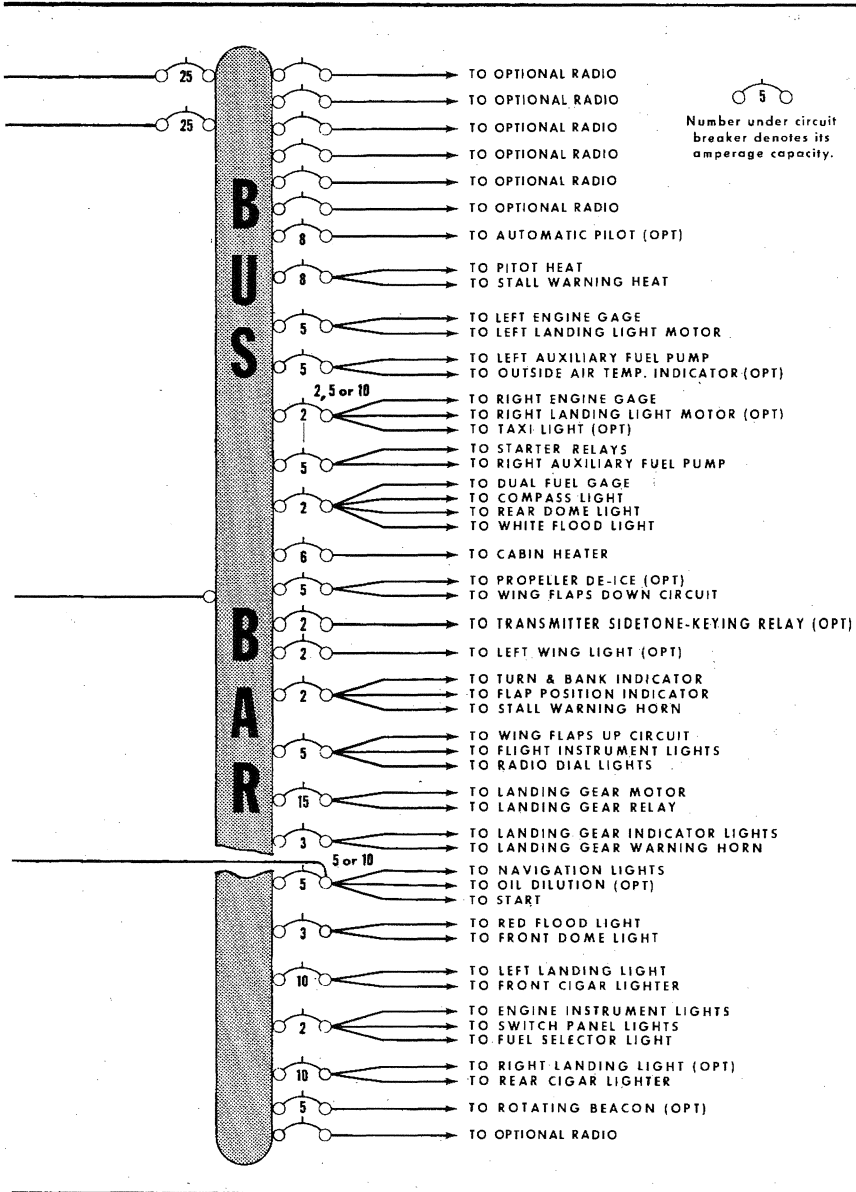
The separate battery and generator switches provide a means of checking for a malfunctioning generator circuit, and permit such a circuit to be cut off. If a generator circuit fails or malfunctions, or when one engine is not running, the switch for that generator should be turned off. Op-

Description



NOTE
 STANDARD 25 - AMPERE SYSTEM IS ILLUSTRATED.
 OPTIONAL 50 - AMPERE SYSTEM DIFFERS ONLY IN
 GENERATOR CONTROL CIRCUIT.

Electrical Power Distribution Diagram



Description

eration should be continued on the functioning generator, using only necessary electrical equipment. If both generator circuits should malfunction, equipment can be operated at short intervals and for a limited amount of time on the battery alone. In either case, a landing should be made as soon as possible to check and repair the circuits.

CIRCUIT BREAKERS

All of the electrical systems in the airplane are protected by "push-to-reset" type circuit breakers located in a circuit breaker panel on the left cabin wall. The panel is covered by a metal door which is hinged along the bottom edge. If your airplane is equipped with optional 50-ampere generators, two additional circuit breakers are mounted on a small panel below and slightly forward of the main panel.

If a circuit is inoperative, wait approximately three minutes for the thermal unit to cool, then press the circuit breaker button to reset the breaker. If resetting the breaker does not restore power, the circuit should be checked for loose connections or defective components. If a circuit breaker pops out a second time, do not try to reset it again, but turn off the controlling switch for that circuit until the fault can be corrected.

LANDING GEAR SYSTEM

The landing gear is of the fully-retractable, tricycle type, incorporating a steerable nosewheel. The

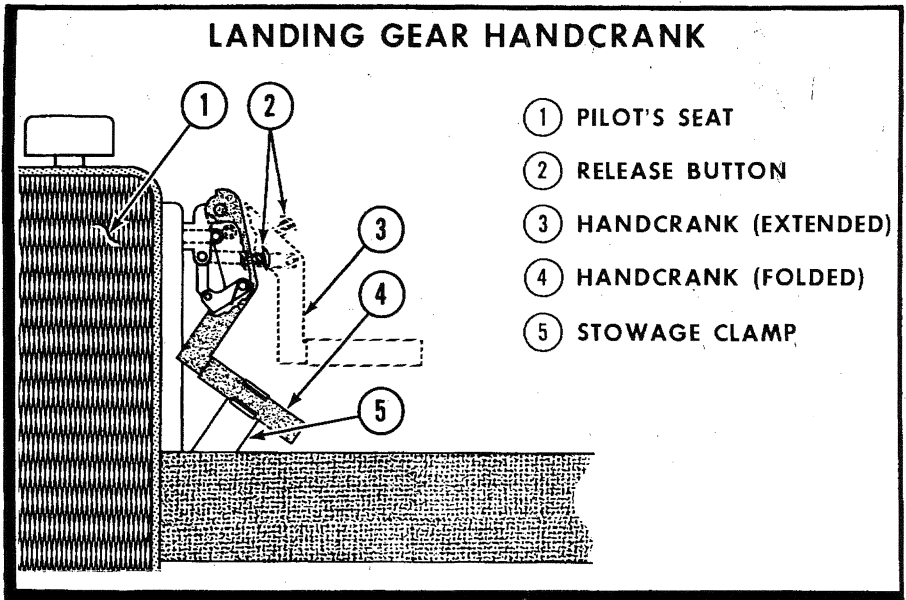
gear retraction system is operated by an electric motor which actuates a gear box mechanism and linkage. To help prevent accidental retraction, an automatic safety switch on the left shock strut prevents retraction as long as the weight of the airplane is sufficient to compress the strut.

Landing gear doors fully enclose the landing gear when retracted, and are opened by mechanical linkage when the gear extends. A two-tread assist step also is mechanically connected to the landing gear linkage, and swings down out of the fuselage when the gear extends, to provide easy access to the right wing walk and cabin door.

Position lights and a warning horn provide visual and audible gear position indications to the pilot. A push-to-reset circuit breaker protects the landing gear motor circuit in the event of an overload, and a hand-crank is used to extend the landing gear if the electrical system is inoperative.

LANDING GEAR SWITCH

The landing gear switch can be identified by its small wheel shaped knob. The knob must be pulled out before the switch can be moved from one position to another. When released, the knob automatically locks in the slot of the selected position. The switch is marked GEAR, and the positions are labeled UP (to raise the landing gear) and DOWN (to lower the landing gear). A center (OFF) position disconnects the electrical circuit. The OFF position need be



used only when lowering the gear with the handcrank.

LANDING GEAR HANDCRANK

The handcrank for manually lowering the landing gear is located just below the right edge of the pilot's seat. Normally, the crank is folded and stowed in a clip beside the seat. To use the crank, pull it out from its storage clip and unfold it until it locks in operating position. To stow the crank, push the lock release button on the crank handle, fold the handle and insert it in the storage clip.

NOTE

The handcrank handle must be

stowed in its clip before the gear will operate electrically. When the handle is placed in operating position, it disengages the landing gear motor from the actuator gear.

The procedure for manually lowering the gear is given in Section IV.

LANDING GEAR POSITION LIGHTS

Two landing gear position lights are mounted one above and the other below the landing gear switch. The lights are push-to-test type with dimming shutters. Clockwise rotation of the lens holder on the lights closes the shutters, permitting only a diffused ring of light to be transmitted through the lens. With the

Description

shutters in the open position (lens holder rotated counterclockwise), illumination of the light is unobstructed. The upper light is red, and is on at all times when the gear is fully retracted. The lower light is green, and illuminates only when the landing gear is fully extended and locked. The green light is connected in series with a down indicator switch on each wheel strut, and remains off until all three gears are down and locked. When neither light is on, the landing gear is in an intermediate position.

LANDING GEAR WARNING HORN

The landing gear warning horn is controlled by the throttles, and will sound an intermittent note if either throttle is retarded below 12 inches of manifold pressure with the gear up. The warning horn is also connected to the UP position of the landing gear switch, and will sound if the switch is placed in the UP position while the airplane is on the ground.

HEATING, VENTILATING, AND DEFROSTING SYSTEM

A cabin heating, ventilating, and windshield defrosting system (page 1-11) is standard equipment in your airplane. The system consists of an air inlet in the nose of the airplane, a ventilating fan, a gasoline combustion-type heater, and ten controllable ventilating and heating outlets.

HEATING AND DEFROSTING

Fresh air is picked up from the

front opening in the nose of the airplane, heated by the heater, and ducted to the front and rear seat occupants. The heated and ventilating air is not recirculated, but exhausts into the slipstream through a cabin air outlet.

The cabin heater depends upon the airplane fuel system for its fuel supply. Fuel pressure is supplied by a diaphragm-type fuel pump mounted on the heater assembly; the main fuel system auxiliary fuel pumps need not be turned on for proper heater operation.

On the ground, the cabin heating system can be used for ventilation by placing the heater switch in the FAN position. The fan provides unheated, fresh air to the cabin through the cabin heat registers. In flight, the fan becomes inoperative and the heating system can be used for ventilation by turning the heater switch to the OFF position and opening the heat registers as desired.

Refer to Section III for heating system operating procedures.

CABIN HEATER SWITCH




The cabin heater and ventilating fan are controlled by a three-position toggle switch labeled CABIN HEAT. Switch positions are HEAT, OFF, and FAN. Placing the switch in the HEAT position starts and maintains heater operation. Placing the switch in the FAN position operates the ventilating fan only.

CABIN AIR TEMP. CONTROL KNOB

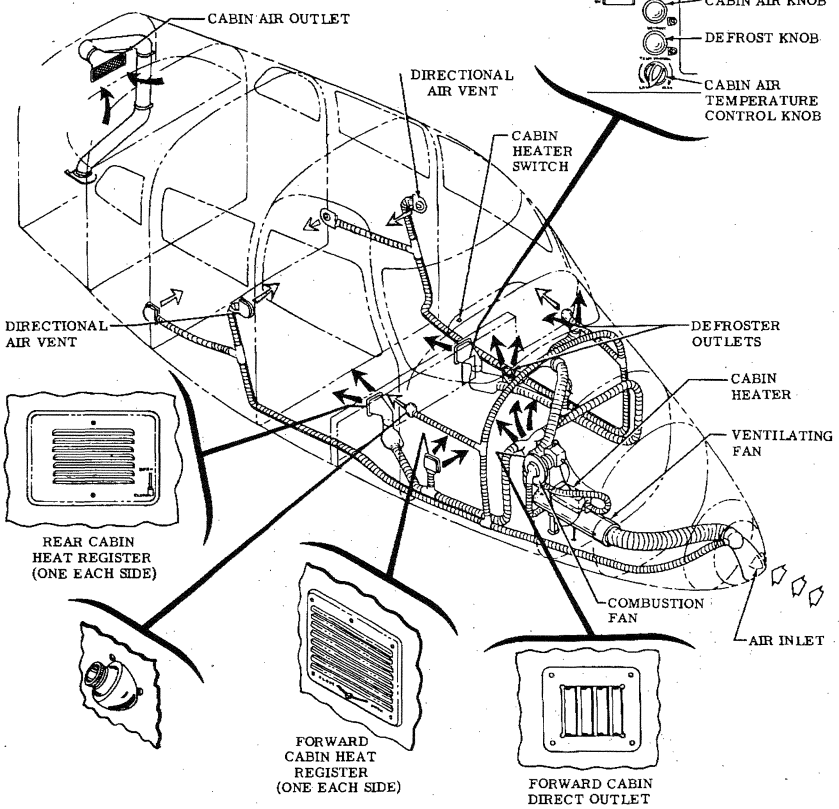
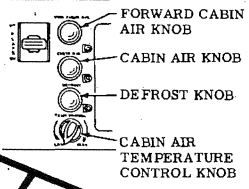
The cabin air temperature control

HEATING, VENTILATING AND DEFROSTING System

CODE

-  FRESH OUTSIDE AIR
-  VENTILATING AIR FROM DIRECTIONAL AIR VENTS
-  HEATED FRESH AIR OR VENTILATING AIR DEPENDING ON SETTING OF CABIN HEATER SWITCH

RIGHT SWITCH & CONTROL PANEL



Description

knob is labeled **TEMP CONTROL**, **OFF** (counterclockwise position), and **MAX** (clockwise position).

Heater output is controlled by adjustment of the cabin air temperature control knob. This knob adjusts a thermostat which in turn controls heated air temperature in a duct located just aft of the heater. When the temperature of the heated air exceeds the setting of the thermostat, the thermostat automatically opens and shuts off the heater. When the heated air cools to the thermostat setting, the heater starts again. Thus the heater continuously cycles on and off to maintain an even air temperature.

The heater also will be cycled by a thermostatic switch in the cabin air duct, which shuts off the heater when the duct temperature reaches approximately 220° F. When duct temperature drops to a normal operating level, the heater will restart automatically. The action of this switch is independent of the cabin thermostat setting, and it is not adjustable in flight.

CABIN AIR KNOB

The airflow to all cabin heat registers (except the forward fast warm up outlet), is controlled by operating a push-pull type knob labeled **CABIN AIR**. When the knob is pulled out, air flows to all heat registers in the cabin except the two defroster outlets. Airflow to the heat registers is completely shut off by pushing the knob all the way in. The knob may be set in any intermediate position to regulate the quantity of air to the cabin.

FORWARD CABIN AIR KNOB

The forward cabin air knob controls a direct warm air outlet which is located on the forward cabin bulkhead. This direct outlet allows fast warm-up when the plane is on the ground. Airflow through the direct outlet is completely shut off by pushing the knob all the way in. The knob may be set at any intermediate position to regulate the quantity of air to the cabin.

CABIN HEAT REGISTERS

The pilot and co-pilot's heat registers are located on each side of the cabin. A rotary type slide valve is incorporated in each register. The registers are marked **OPEN** and **CLOSED** and may be set in any intermediate position to regulate the amount of air coming from the registers.

The rear cabin heat registers are located under each front seat on the aft side of the front spar. Each register is provided with a lever operated, flapper type valve which controls the amount of air coming from the passenger's heat registers. Each flapper valve is **OPEN** when the lever is in the up position and **CLOSED** when in the down position. The valves may be placed in any intermediate position to regulate the amount of air coming from the registers.

DEFROST KNOB

Windshield defrosting and defogging is controlled by operating a push-pull type knob labeled **DEFROST**. When the knob is pulled out, air flows

from the defroster outlets at the base of the windshield. When the knob is pushed all the way in, airflow to the defroster outlets is shut off. The knob may be set in any intermediate position to regulate the defroster airflow.

OVERHEAT WARNING LIGHT

An amber overheat warning light is located on the instrument panel just below the clock, and is labeled **HEATER-OVERHEAT, T & B TEST**. When illuminated, the light indicates that the heater overheat switch has been actuated. This condition occurs only when the temperature of the air in the heater exceeds 325° F. Once the heater overheat switch has been actuated, the heater will not operate until a landing can be made and the switch reset. The overheat switch is mounted on the aft end of the heater, in the nose of the fuselage to the right of the nosewheel well. To reset the overheat switch, press the reset button on the switch.

NOTE

The heater should be inspected thoroughly to determine the reason for the malfunction prior to resetting the overheat switch.

VENTILATING SYSTEM

In addition to the ventilation pro-

vided by the cabin heating system, a separate ventilation system (page 1-11) obtains ram air from the air inlet at the nose of the airplane, and ducts it to four directional vents. The ventilating system functions only in flight, since it depends entirely on ram air pressure. For ground ventilation, the ventilating fan of the heating system should be used.

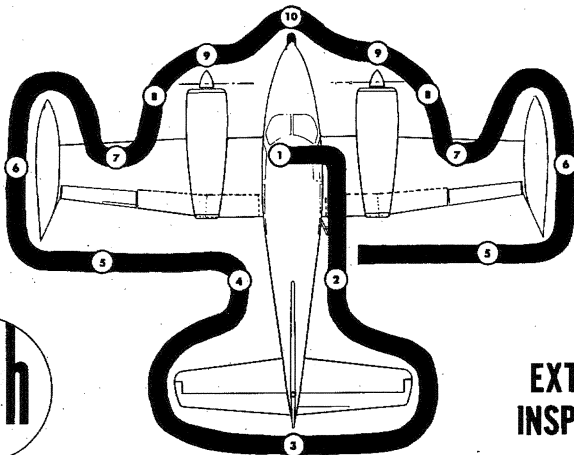
EMERGENCY EXIT

For emergency exit, the left center cabin window can be jettisoned and the baggage door may be forced open. To open the cabin window, pull off the plastic cover over the emergency release ring under the window. Pull the ring to release the window retainers, then push window out. A sharp blow exerted from the inside on the baggage door, near the catch, will force it open.

BAGGAGE AREA

When optional seating arrangements (four place center individual or five place) are installed in your airplane, baggage area is available aft of the seats. The individual seats are folding back type seats which will necessitate all baggage being tied down to prevent possibility of baggage moving forward. On airplanes with the standard three place rear seat, optional fifth and sixth or reclining rear seat, baggage tie down is unnecessary. Optional tie down lugs are available depending on seating and shelf arrangements.

Description



EXTERIOR INSPECTION

- ①
 - a. Remove control lock.
 - b. Momentarily turn on battery switch, and check fuel quantity gages.
 - c. With battery switch "ON" check operation of stall warning transmitter tab and warning horn.
 - d. If a night flight is planned, turn battery switch "ON" and check operation of all lights.
 - e. Check oxygen pressure.
- ②
 - a. Open baggage door and check that oxygen masks and hoses are available.
 - b. Close baggage door and check for security.
 - c. Check static pressure source hole for obstruction.
- ③
 - a. Remove external surface locks, if installed.
 - b. Check general condition of elevator, rudder and trim tab hinges, hinge bolts and actuator rod bolts.
 - c. Remove tie-down.
- ④
 - a. Check static pressure source hole for obstruction.
- ⑤
 - a. Check aileron and tab hinges, and hinge and actuator rod bolts.
- ⑥
 - a. Check main fuel tank filler cap for security. On first flight of day, drain sump.
 - b. Check main fuel tank vent for obstruction.
- ⑦
 - a. Check auxiliary fuel tank filler cap for security.
 - b. Check battery drain and battery compartment cover panel for security (left side only).
 - c. Check auxiliary fuel tank vent for obstruction.
 - d. Check landing light for damage.
 - e. Remove wing tie-down.
 - f. On first flight of day, drain auxiliary fuel tank sump.
- ⑧
 - a. Check oil level (minimum 9 quarts; fill to 12 quarts for extended flight) dip stick secure, generator belt tight, and general condition.
 - b. Check main landing gear strut and tire inflation. Check gear door for security.
 - c. On first flight of the day, drain two ounces of fuel from the strainer.
- ⑨
 - a. Check propeller and spinner for nicks, cracks and security.
 - b. Check oil filler cap for security through cooling air inlet in cowl nose cap.
 - c. Check cowl access doors for security.
- ⑩
 - a. Check nose gear strut and tire inflation, nose gear doors for security.
 - b. Check oxygen cylinder shutoff valve.
 - c. Check taxi light for damage.
 - d. Remove tie-down.
 - e. Check pitot tube opening for obstructions.
 - f. Check windshield for cleanliness.

Repeat steps 5 thru 9 in reversed order to complete the exterior inspection.



Normal Procedures

AFTER FAMILIARIZING YOURSELF with the equipment of your airplane, your primary concern will be its operation. This section lists, in Pilot's Check List form, the normal procedures necessary to operate your airplane efficiently and safely.

This section is condensed to include only normal "day-to-day flying" procedures, and is one of your best sources of normal flying information. It is supplemented by Section III, which contains a narrative description of operating procedures, and Section IV, which describes emergency procedures. This subdivision of information permits quick and easy reference to any flight procedure desired.

All airspeeds mentioned in Sections II, III and IV are indicated air speeds (IAS) unless noted otherwise. Corresponding calibrated airspeeds may be obtained from the airspeed correction table in Section VII.

BEFORE ENTERING THE AIRPLANE.

- (1) Perform an exterior inspection, following the procedure given in the diagram on page 1-14.

BEFORE STARTING ENGINES.

- (1) Adjust and lock seats in a comfortable position, and fasten safety belts.

IMPORTANT

After a seat is moved either forward or aft, it should be tested to see that the latching pins are locked securely.

- (2) Lock cabin door.
- (3) Check controls lock removed.

Normal Procedures

- (4) Check landing gear switch -- DOWN.
- (5) Battery switch -- ON.

NOTE

When using an external power source, do not turn on the battery until external power is disconnected, to avoid a weak battery draining off part of the current being supplied by the external source.

- (6) Generator switches - ON.

NOTE

If 50-ampere generators are installed, turn on one at a time as the engines are started.

- (7) Check circuit breaker panel for faulty circuits.
- (8) Landing gear lights -- push to test (check iris - open).
- (9) Check fuel quantity indicators.
- (10) Check left fuel selector valve handle -- LEFT MAIN; right fuel selector valve handle -- RIGHT MAIN (valves in proper detents).
- (11) Adjust elevator trim tab position indicator to TAKE-OFF range.
- (12) Adjust rudder trim tab position indicator to neutral position.
- (13) Adjust aileron trim tab position indicator to neutral and check tab position visually.
- (14) Set altimeter and clock.
- (15) Turn off all radio switches.
- (16) Release parking brake and test-operate brakes, noting any spongy action or excessive brake pedal travel.
- (17) Check flight controls for free and correct movement.
- (18) Set parking brake.
- (19) For night flying, test-operate all lights except landing lights. Make sure an operating flashlight is aboard.

STARTING ENGINE (Left Engine First).

- (1) Turn ignition switches ON.
- (2) Open throttle approximately 1/2 inch.
- (3) Set propeller pitch lever full forward for HIGH RPM.
- (4) Set mixture lever full forward for FULL RICH.
- (5) Clear the propeller.
- (6) Turn the auxiliary fuel pump switch to PRIME position.

NOTE

Avoid leaving the auxiliary fuel pump switch in either the PRIME or ON position for more than a few seconds unless the engine is running.

- (7) Turn ignition switch to START when fuel flow reaches 2 to 4 gallons per hour.

NOTE

If the engines are warm, turn switch to START, first, then turn auxiliary fuel pump switch to PRIME.

- (8) Release ignition switch as soon as engine fires.
- (9) Turn off auxiliary fuel pump switch when engine runs smoothly.

NOTE

During very hot weather, if there is an indication of vapor in the fuel system (fluctuating fuel flow) with engine running, turn the auxiliary fuel pump switch to ON until system is purged.

- (10) Check for an oil pressure indication within 30 seconds in normal weather and 60 seconds in cold weather. If no indication appears, shut off engine and investigate.
- (11) Disconnect external power source, if used.

WARM-UP AND GROUND TEST (During Taxiing).

- (1) Set both engines at 800 to 1000 RPM.
- (2) For night flight, check landing lights.
- (3) Turn on radios if required.
- (4) Continue the warm-up while taxiing out to the active runway.
- (5) Stop airplane at the run-up location with nosewheel straight, and set parking brake. To avoid propeller tip abrasion, do not run-up engines on loose cinders or gravel.
- (6) Advance throttle to 1700 RPM with control wheel neutral or forward.
- (7) Check engine instruments for operation and indication.
- (8) Check generator operation by turning off each generator switch individually and noting amperage.
- (9) Check magnetos (125 RPM maximum allowable drop with a maximum of 50 RPM difference between magnetos).

Normal Procedures

- (10) Check induction air heat source operation by noting RPM and manifold pressure drop.
- (11) Place each propeller pitch lever in the FEATHER position until engine speed drops to 1200 RPM, then return to full forward position.

NOTE

If propeller operation has been unusually sluggish or erratic, feather propeller twice to 600 RPM in run-up, retarding throttle as necessary to avoid excessive manifold pressure at low RPM. Exercising the propeller in this manner insures optimum propeller governing in flight.

- (12) Check operation of each vacuum pump and amount of suction to the gyros, with the vacuum selector test valve knob.
- (13) Briefly check that the engine idles smoothly at approximately 600 RPM.
- (14) If each engine accelerates smoothly and oil pressure remains steady at some value between 30 and 60 PSI, the engines are warm enough for take-off.

BEFORE TAKE-OFF OR DURING TAXIING.

- (1) Recheck elevator trim tab position indicator for TAKE-OFF range.
- (2) Recheck rudder trim tab position indicator for neutral position.
- (3) Recheck aileron trim tab position indicator for neutral, and check tab visually.
- (4) Turn auxiliary fuel pump switches to ON.
- (5) Check induction air - COLD.
- (6) Check free and correct movement of flight controls.
- (7) Check that the cabin door and the pilot's window are closed and locked.
- (8) Check and set flight instruments and radio as necessary.

NORMAL TAKE-OFF.

- (1) Flaps 0°.
- (2) Apply full throttle smoothly to avoid propeller surging.
- (3) For maximum performance, set mixture for field elevation.

NOTE

Leaning during the take-off roll is normally not necessary; however, should maximum take-off or subsequent engine-

Normal Procedures

out performance be desired, fuel flow should be adjusted to match field elevation.

- (4) Maintain airplane in level attitude in take-off run.
- (5) Keep heels on floor to avoid dragging brakes.
- (6) Apply slight back pressure to raise nosewheel as airplane reaches 88 MPH (minimum single-engine control speed).
- (7) Plan to break ground at 100 MPH (minimum safe single engine speed).
- (8) Apply brakes momentarily to stop wheel rotation.
- (9) Retract landing gear.
- (10) Accelerate to 119 MPH (best single-engine rate-of-climb speed) and climb to a safe single-engine maneuvering altitude.
- (11) Accelerate to 130 MPH (best twin-engine rate-of-climb speed).
- (12) Turn auxiliary fuel pumps OFF individually, checking final fuel flow indications.

NOTE

During very hot weather, if there is an indication of vapor in the fuel system (fluctuating fuel flow) turn the auxiliary fuel pump ON until cruising altitude has been obtained and the system is purged.

CLIMB (Twin Engine).

- (1) In normal operation, if no obstacle is ahead, climb out with flaps retracted at 130 - 140 MPH, with 24 inches of manifold pressure and 2450 RPM.
- (2) Mixture should be adjusted to the blue 75% power climb triangle for economical fuel consumption in cruising climb.
- (3) For maximum rate-of-climb, use full throttle and 2625 RPM at 130 MPH, decreasing climb speed to 120 MPH at 10,000 feet.
- (4) The mixture should be adjusted using the blue altitude markings for maximum climb performance.

CRUISING.

- (1) Select cruising power setting from range charts (see Section VII). Normal cruising power settings are 23 inches and 2300 RPM, and maximum cruising power settings are 24 inches and 2450 RPM.
- (2) After speed is stabilized trim airplane.
- (3) Adjust mixtures as indicated by the range charts or power computer.

Normal Procedures

- (4) Adjust friction knob to prevent engine controls from creeping.

LET-DOWN.

- (1) Reduce power to obtain desired let-down rate at cruising speed.
- (2) Set mixture levers full forward (FULL RICH).
- (3) For steep let-downs, decrease speed to 160 MPH or less and extend flaps 15°. If necessary, for steeper let-downs, reduce speed to 140 MPH and extend landing gear.

NOTE

Avoid steep, power-off let-downs with low fuel.

BEFORE LANDING.

- (1) Check the left fuel selector valve handle - LEFT MAIN and the right fuel selector valve handle - RIGHT MAIN.
- (2) Check mixture levers full forward (FULL RICH).
- (3) Turn on auxiliary fuel pumps.
- (4) Check induction air - COLD.
- (5) Extend flaps to 15° in small increments below 160 MPH.
- (6) Extend landing gear below 140 MPH.
- (7) Check green landing gear position indicator light for illumination.
- (8) Set propeller pitch levers for 2625 RPM (full forward) for maximum power in case of a go-around.
- (9) Lower flaps from 15° to 45° below 140 MPH.
- (10) Approach at approximately 105 MPH with or without power.

NORMAL LANDING.

- (1) Land on main wheels first.
- (2) Lower nosewheel gently to runway after speed is reduced.
- (3) Avoid excessive braking unless obstacle is ahead.

GO-AROUND (Twin Engine).

- (1) Apply full throttle and increase engine speed to 2625 RPM, if necessary.
- (2) Reduce flap setting to 15°.
- (3) Trim airplane for climb.
- (4) Retract flaps as soon as all obstacles are cleared and a safe altitude and airspeed are obtained.

AFTER LANDING.

- (1) Retract flaps.
- (2) Turn off auxiliary fuel pumps.
- (3) Park with nosewheel aligned straight ahead if possible. If gusty wind conditions prevail, caster the nosewheel to the extreme right or left position, to protect the rudder from wind damage.
- (4) Stop engines by putting mixture levers in IDLE CUT-OFF.
- (5) After engines stop, turn ignition switches OFF.
- (6) Turn all switches OFF.
- (7) Set parking brakes.
- (8) Install controls lock, if required.



Operating Details

THIS SECTION GIVES, in narrative form, detailed information on those check list items in Section II that require further explanation.

PREFLIGHT CHECK

The exterior inspection described in Section II is recommended for the first flight of the day. Inspection procedures for subsequent flights are normally limited to brief checks of the tail surface hinges, fuel and oil quantity, and security of fuel and oil filler caps. If the airplane has been in extended storage, has had recent major maintenance, or has been operated from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the flight and trim tab controls should be double-checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspections. Since radio and heater maintenance requires the mechanic to work in the nose compartment, the nose gear doors are often disconnected to allow more room. Therefore, it is important after such maintenance to double-check the security of these doors. If the airplane has been waxed or polished, check the external static pressure source holes

for stoppage.

If the airplane has been exposed to much ground handling in a crowded hangar, it should be checked for dents and scratches on wings, tip tanks, fuselage, and tail surfaces, as well as damage to navigation and landing lights, de-icer boots, and radio antennas. Outside storage for long periods may result in water and obstructions in airspeed system lines, condensation in fuel tanks, and dust and dirt on the intake air filters and engine cooling fins.

If the airplane has been operated from muddy fields or in snow and slush, check the main gear wheel wells and nosewheel mud shield for obstructions and cleanliness. Operation from a gravel or cinder field will require extra attention to propeller tips and abrasion on leading edges of the horizontal tail. Stone damage to the outer six inches of the propeller tips can seriously reduce the fatigue life of the blades.

Airplanes that are operated from rough fields, especially at high altitudes, are subjected to abnormal landing gear abuse. Check frequently all components of the landing gear retracting mechanisms, shock struts,

Operating Details

tires and brakes.

Make sure that the main and optional auxiliary fuel tanks filler caps are tightly sealed to prevent loss of fuel in flight. The main fuel tank vents located on the lower aft end of the tanks and the auxiliary fuel tanks vents located beneath the wings, should be inspected for obstructions, especially after operation from muddy fields.

The interior inspection will vary according to the mission and the optional equipment installed. Prior to high-altitude flights, it is important to check the condition and quantity of oxygen face masks and hoses. The oxygen supply system should be functionally checked to insure that it is in working order. The oxygen pressure gage should indicate between 300 and 1800 PSI depending upon the anticipated requirements.

Satisfactory operation of the pitot tube and stall warning transmitter heating elements is determined by observing a discharge on the ammeter when the pitot heat switch is turned ON. The effectiveness of each element may be verified by cautiously feeling the heat of both devices while the pitot heat switch is ON.

Flights at night and in cold weather involve a careful check of other specific areas that will be discussed in separate sections.

STARTING ENGINES

Since the wing obscures ground crew personnel when they are draining the fuel strainers or connecting the external power source to the airplane, it becomes doubly-important

to clear the airplane properly before starting. Calling out "clear" in loud tones or giving a "thumbs up" hand signal to a responsible ground crew member is best. An answering "clear" or "thumbs up" hand signal from visible ground crew personnel is the required response.

Using an external power supply for starting is recommended in cold weather, or for airplanes that are normally used extensively in instrument or night flying. With the external power source connected, it is preferable to start the airplane with the battery switch OFF. If the battery switch is ON during the engine start, a weak airplane battery will drain off part of the current supplied by the external power source, resulting in less electrical power available for the start. After the external power source is disconnected, the battery switch should be turned ON to supply power to electrical equipment.

If 50-ampere generators are installed, turn on each generator after its engine is started. If both generators are turned on at once before the engines are started, the paralleling system will reduce the output from the operating generator.

Although either engine may be started first and the procedure is identical for both, the left engine is normally started first. The cable from the battery to this engine is much shorter, which permits more electrical power to be delivered to the starter. If battery is low, the left engine should start more readily.

Unlike carburetors, which supply no fuel to the engines until an airflow has been induced by cranking,

Operating Details

the continuous-flow fuel injection system will start spraying fuel in the intake ports as soon as the throttle and mixture controls are opened and the auxiliary pump is turned to prime position. Thus, fuel injection engines need no primer; at the same time, if an auxiliary pump is turned on accidentally while the engine is stopped, with the throttle open and the mixture rich, solid fuel will collect in the intake manifolds, the quantity depending on the amount of throttle opening and the length of time the pump has been operating. If this happens, it is advisable to wait a few minutes until this fuel drains away through the manifold drains before starting the engine. To avoid flooding, be sure you are ready to crank the engine as soon as a steady fuel flow is obtained.

In hot weather with a hot engine, a fluctuating fuel flow slightly lower than normal may be obtained. This is an indication of vaporized fuel and the starter should not be energized until a steady fuel flow indication is obtained. In extremely hot weather, it may be desirable to switch the auxiliary pump to the ON position momentarily to more rapidly dissipate the vapor present.

CAUTION

Do not prime engine excessively during start (especially hot engine), when airplane is tailed into the wind. Due to restricted ventilation in nacelle area during this condition, fuel vapors may accumulate in engine rear nacelle causing a hazardous condition.

Engine mis-starts characterized by weak, intermittent explosions followed by puffs of black smoke from the exhaust are the result of flooding or over-priming. This situation is more apt to develop in hot weather, or when the engines are hot. If it occurs, repeat the starting procedure with the throttle open approximately 1/2, the mixture in idle cut-off and the auxiliary pump off. As the engine fires, move the mixture control to full rich and close the throttle to idle.

If an engine is under-primed, which may occur in cold weather with a cold engine, repeat the starting procedure with the auxiliary fuel pump switch "ON" until the engine fires.

If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the armature windings.

TAXIING

A steerable nosewheel mechanism provides positive control up to 15° left or right, and free turning from 15° to 55° for sharp turns during taxiing. In addition to the nosewheel steering, which is preferred whenever practical, steering may be accomplished with the aid of the rudder, differential power, and differential braking on the main wheels. These aids are listed in the preferred order of use.

NOTE

Auxiliary pumps should be in the OFF position while taxiing.

IMPORTANT

If the airplane is parked with the

Operating Details

nosewheel castered in either direction, initial taxiing should be done with caution. To straighten the nosewheel, use full opposite rudder and differential power, instead of differential braking. After a few feet of forward travel, the nosewheel will steer normally.

At some time early in the taxi run, the brakes should be tested, and any unusual reaction, such as uneven braking, should be noted. If brake operation is not satisfactory, the airplane should be returned to the tie-down location and the malfunction corrected. The operation of the turn-and-bank indicator and directional gyro should also be checked during taxiing.

Most of engine warm-up should be done during taxiing, with just enough power to keep the airplane moving. Engine speed should not exceed 1600 RPM while the oil is cold.

BEFORE TAKE-OFF

Use the Pilot's Check List in the airplane for the "before take-off" check to prevent the possibility of overlooking an important check item.

Most of the warm-up will have been conducted during taxi, and additional warm-up before take-off should be restricted to the checks outlined in Section II.

Full throttle checks on the ground are not recommended unless there is good reason to suspect that the engines are not turning up properly. Do not run up the engines over loose gravel or cinders because of possible stone damage or abrasion to the pro-

PELLER tips.

If the ignition system check produces an engine speed drop in excess of 125 RPM or if the drop in RPM between left and right magneto differs by more than 50 RPM, continue to warm up engine a minute or two longer, before rechecking the system. If there is doubt concerning the operation of the ignition system, checks at higher engine speed may confirm the seriousness of the deficiency. In general, a drop in excess of 125 RPM with a warm engine at 1700 RPM is not considered acceptable.

If instrument flights are contemplated, a careful check should be made of vacuum pump operation by switching the vacuum test selector valve knob to all positions. The minimum and maximum allowable suctions are 4.75 and 5.25 inches of mercury, respectively, on the instruments. (When the ARC CD-4 Course Director is installed, the suction limits at the instruments are 3.8 and 4.2 inches of mercury). The gage readings for both source positions should be higher than the gyro readings. Good generator condition is also important for instrument flight since satisfactory operation of all radio equipment and electrical instruments is essential. The generators are checked by observing the charging rate on the ammeter during an engine run-up to 1700 RPM while the generator on the opposite engine is switched off momentarily.

A simple last minute recheck of important items should include a quick glance to see that the top row of the switches on the left switch panel are

ON, the mixture and propeller pitch levers are forward, all flight controls have free and correct movement, and the fuel selectors are properly positioned.

TAKE-OFF

Since the use of full throttle is not recommended in the static run-up, closely observe full-power engine operation early in the take-off run. Signs of rough engine operation, unequal power between engines, or sluggish engine acceleration are good cause for discontinuing the take-off. If this occurs, you are justified in making a thorough full throttle static run-up before another take-off is attempted.

Normal take-offs are conducted with flaps retracted to provide maximum safety in case of an engine failure after take-off. The distance required to clear a 50-foot obstacle, after an engine failure at 100 MPH with flaps retracted, is approximately 60 percent of the distance required with flaps 15 degrees. The distance to decelerate to a stop from any given speed is also shorter, and there is less chance of tire damage with heavy braking since more weight remains on the main wheels with flaps retracted.

Full throttle operation is recommended on take-off since it is important that a speed well above minimum single-engine control speed (88 MPH) be obtained as rapidly as possible. It is desirable to accelerate the airplane to 100 MPH while still on the ground for additional safety in case of an engine failure.

This safety may have to be compromised slightly where short and rough fields prohibit such high speed before take-off.

In order to obtain maximum engine power for take-off and climb out, adjust the fuel flow during the initial take-off roll to the field elevation blue markings. While the performance increase obtained by leaning will be small at low altitudes, it will become greater as field elevation increases. Consequently, this technique should always be employed when operating from field elevations greater than 5000 feet above sea level. If you are familiar with typical mixture lever positions on the quadrant for best power mixture at various field elevations for your particular airplane, you may preset the mixture controls before take-off. However, these positions will vary between airplanes because of fuel metering and mixture control rigging tolerances.

After take-off it is important to maintain the minimum safe single-engine climb speed (100 MPH). As you accelerate still further to best single-engine rate-of-climb speed (119 MPH), it is good practice to climb rapidly to an altitude at which the airplane is capable of circling the field on one engine.

NOTE

For take-offs at high density altitudes, above the single-engine service ceiling, the allowance must be enough to clear obstacles in single-engine drift-down flight.

After obstruction height is reached,

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power may be reduced and climb speeds may be established as described in Section II.

On long runways, the landing gear should be retracted at the point over the runway where a wheels-down forced landing on that runway would become impractical. However, on short runways it may be preferable to retract the landing gear immediately after reaching 100 MPH.

The use of 15° flaps reduces the ground run and the total distance over a 50-foot obstacle by approximately 13 percent. Minimum-run and soft-field take-offs are performed with flaps 15° by lifting the nose-wheel as the airspeed approaches 65 MPH, so that the airplane will leave the ground in a tail-low attitude. However, the airplane should be immediately leveled off and accelerated to 100 MPH as rapidly as possible.

Obstacle clearance take-offs from soft fields are conducted in the same manner except that a climb at 85 MPH is established after take-off. From hard-surface runways the airplane will climb at a given airspeed over an obstacle in approximately the same total distance using any lift-off speed between 70 and 95 MPH. The best technique is to lift off as the airspeed approaches 85 MPH, and then establish an 85 MPH climb. Performance data for this type of take-off is presented in Section VII.

Crosswind take-offs are performed with a minimum flap setting necessary for the runway length, to minimize the drift angle after take-off. Additional power may be carried on the upwind engine until the rudder

becomes effective. The airplane is accelerated to a slightly higher than normal take-off speed, and then is pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, a coordinated turn is made into the wind to correct for drift.

A take-off with one tip tank full and the opposite tank empty creates a lateral unbalance at take-off speed. This is not recommended since gusty air or premature lift-off could create a serious control problem.

AFTER TAKE-OFF

To set up the airplane in climb configuration, retract the landing gear, adjust power for climb, retract the flaps (if used) at a safe altitude and airspeed, turn off the auxiliary fuel pumps, and adjust the mixture for the power setting selected.

Power reduction will vary according to the requirements of the traffic pattern or surrounding terrain, gross weight, field elevation, temperature, and engine condition. However, a normal "after take-off" power setting is 24 inches of manifold pressure and 2450 RPM.

Before retracting the landing gear, apply the brakes momentarily to stop the main wheels. Centrifugal force caused by the rapidly-rotating wheels expands the diameter of the tires, and if ice or mud has accumulated in the wheel wells, the rotating wheels may rub as they enter.

CLIMB

A cruising climb at 24 inches of

manifold pressure, 2450 RPM (approximately 75% power) and 130 to 140 MPH is recommended for saving time and fuel for the overall trip. In addition, this type of climb provides better engine cooling, less engine wear, and more passenger comfort due to lower noise level. The fuel flow should be leaned to this type of climb to the blue triangle marked for 75% power climb, which is approximately best-power mixture. At this setting, maximum performance for the power selected will be obtained without the high fuel consumption required for cooling at higher powers and lower climb speeds.

If it is necessary to climb rapidly to clear mountains or reach favorable winds at high altitudes, the best rate-of-climb speed should be used with maximum power. This speed varies from 130 MPH at sea level to 120 MPH at 10,000 feet. During maximum-performance climbs the fuel flow should be leaned to the blue markings corresponding to flight altitude to assure maximum power and adequate engine cooling.

If an obstruction ahead requires a steep climb angle, the airplane should be flown at the best angle-of-climb speed with flaps up and maximum power. This speed varies from 101 MPH at sea level to 106 MPH at 15,000 feet.

CRUISE

Tabulated cruising information for normal cruising power and altitudes is presented in Section VII. These charts are based on 100 and 130 gal-

lons of fuel for cruise, normal lean mixture, 5100 pounds gross weight, zero wind, and no fuel reserve. Allowances for warm-up, take-off and climb, headwinds, variations in mixture leaning technique, and fuel reserve should be estimated; and the endurance and range shown in the charts should be modified accordingly. Fuel allowances for take-off and climb are given in the climb charts on page 7-2.

Since the main advantages of the airplane over ground transportation is speed, one should use the high cruising speeds obtainable. However, if a destination is slightly out of reach in one flight at normal cruising speed, it may save time and money to make the trip nonstop at some lower speed. The cruising charts show the long ranges obtainable at lower cruising speeds.

Normal cruising is done between 60% and 70% power. The manifold pressure and RPM settings required to obtain these powers at various altitudes and outside air temperatures can be determined with your Cessna 310 Power Computer. A maximum cruising power of approximately 75% is allowable with 24 inches of manifold pressure and 2450 RPM.

Various percent powers can be obtained with a number of combinations of manifold pressures, engine speeds, altitudes, and outside air temperatures. However, at full throttle and a constant engine speed and a standard air temperature, a specific power may be obtained at only one altitude.

To achieve the level flight performance shown in the cruising charts

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in Section VII, lean the mixtures to give fuel flows shown. This will yield airspeeds slightly below those available at best power mixture. For example, at 75% power at 6500 feet, the cruising speed of this aircraft is 223 MPH with best power mixture and 221 MPH with the recommended normal lean mixture. Since normal lean mixture gives considerably lower fuel consumption and longer range, this technique offers an optimum compromise between speed and fuel consumption for normal cruising flight.

Should maximum speed be desirable for short flights where range and fuel consumption are less important, the mixture should be adjusted to approximately one gph higher than that indicated by the range charts on the power computer. This will yield approximately best power mixture with a resulting airspeed of one to two MPH greater and a fuel flow approximately one gallon per hour greater than those listed in Section VII.

For a given throttle setting, select the lowest engine speed in the green arc range that will give smooth engine operation without evidence of laboring.

Synchronize the propellers by setting one propeller at the desired engine speed, turning the friction control knob to prevent propeller pitch lever creep, and then adjusting the other propeller pitch lever until the tachometer needles are aligned one over the other. If synchronization is slightly off, as indicated by an intermittent "beat", one propeller pitch lever should be adjusted to eliminate this beat. Synchronization is sim-

plified by limiting the adjustments to only one propeller. To avoid slack in controls, the final movement of the lever should be made in a DECREASE RPM direction.

In airplanes equipped with auxiliary fuel tanks, it is important to burn approximately one hour of fuel from the main tanks before switching to auxiliary tanks. This is necessary to provide space for approximately 7 gallons of auxiliary fuel and vapor that are returned through vapor return lines to the main tanks. If sufficient space is not available in the main tanks for this diverted fuel, the tanks may overflow through the vent line. Since part of the fuel from the auxiliary tanks is diverted back to the main tanks instead of being consumed in the engine these tanks will run dry sooner than may be anticipated. However, the main tank endurance will be increased by the returned fuel.

Since the auxiliary fuel tanks are designed for cruising flight, they are not equipped with pumps. Under cruising conditions, failure of an engine-driven fuel pump will not be critical because there will be ample time to switch on the main fuel tank and turn on the auxiliary fuel pump. However, operation near the ground using auxiliary fuel tanks is not recommended because of this limitation.

The induction air system employed on these engines is considered to be non-icing. In addition, the internal location of the induction air inlets should preclude the possibility of impact ice covering the intake air filters. Induction air heat is incorporated, however, to assure satis-

factory operation in the unlikely event that unusual atmospheric conditions should cause intake system icing. The induction air handles should be left in the full cold position for all normal operations. Should intake system icing be encountered, the handles should be pulled to the full heat position.

FLIGHT CHARACTERISTICS

The stability and control characteristics of the airplane are very satisfactory. Control forces are light and adequate control is available throughout the operating speed range. When properly trimmed, the airplane will remain in straight and level flight with little attention from the pilot.

NORMAL STALLS

The stall characteristics of the airplane are conventional in all configurations. Aural warnings are provided by the stall warning horn between 5 and 10 MPH above the stall in all configurations. The stall is also preceded by a mild aerodynamic buffet which increases in severity as the stall is approached. The power-on stall occurs at a very steep angle either with or without flaps, and it is difficult to inadvertently stall the airplane during normal maneuvering. The stall characteristics in all configurations are characterized by a clean drop of the nose accompanied by increased buffet during the stall. The rudder should be used to prevent yaw during the approach to the stall since a rolling tendency will

result if the airplane is allowed to yaw. Recovery is made very quickly with little loss of altitude if the nose is not lowered excessively and full available power is applied to both engines. Landing gear and flap position have little effect on the stall characteristics except that the stalling speed will be lowered in proportion to the degree of flap extension. Power-off stall speeds at maximum gross weight are presented as calibrated airspeeds in the stall speed chart because indicated airspeeds are inaccurate near the stall.

ACCELERATED STALLS

Stalls in accelerated flight are preceded by stall warning horn indications, and by light aerodynamic buffet. The structural limitations of the airplane will be exceeded if accelerated stalls are performed above 167 MPH.

SPINS

Intentional spins are not permitted in this airplane, and due to the excellent stall warning system provided, it is not probable that an inadvertent spin will be encountered. Should a spin occur, however, the following recovery procedure should be employed:

- (1) Cut power on both engines.
- (2) Apply full rudder opposing the direction of rotation.
- (3) Approximately 1/2 turn after applying rudder, push control wheel forward briskly.
- (4) To expedite recovery, add power

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to the engine toward the inside of the direction of turn.

(5) Pull out of dive with smooth steady control pressure.

FLIGHT CONTROLS

Elevator control forces are relatively light in cruising flight at all airplane loadings. Reducing power and extending the flaps and landing gear increases the elevator control forces appreciably thereby enhancing the control feel at low airspeeds. Aileron control forces are light, and aileron control is much more effective than is at first apparent from control feel. This is more pronounced at slow speeds with full wing tip (main) tanks, where the time response to aileron deflection is increased slightly. Rudder forces are comparatively light, and only slight rudder pressure is required when rolling into and out of turns. All trim tabs are effective throughout the speed range of the airplane, the rudder and elevator trim becoming very effective at cruising airspeeds.

LEVEL FLIGHT CHARACTERISTICS UNDER VARIOUS SPEED CONDITIONS

The airplane flight characteristics throughout the level - flight speed range are conventional in all respects. Slow flying is easily accomplished with wing flaps up or down and landing gear up or down.

MANEUVERING FLIGHT

No acrobatic maneuvers are approved in this airplane. The air-

plane is, however, conventional in all respects throughout the maneuvering range encountered in normal flight.

DIVING

Dives should be limited to the maximum diving airspeed marked on the airspeed indicator (254 MPH-CAS). Although trim changes and flight characteristics are conventional, caution should be exercised because the airplane picks up speed rapidly, and if rough air is encountered unexpectedly, it is difficult to slow the airplane down to a safe speed. Pull-outs should be very gentle to avoid excessive stresses in the airplane as well as discomfort to the passengers.

LET-DOWN

Let-downs should be initiated as much as an hour before estimated landing time to permit a gradual rate of descent at cruising speed using enough power to keep the engines warm and the cylinders clear. Since the airplane is so aerodynamically clean it is difficult to descend rapidly without reducing power to very low settings. This results in undesirably low cylinder head temperatures, which in turn lead to spark plug fouling. The optimum engine speed in a let-down is usually the lowest one in the RPM green arc range that will allow cylinder head temperatures to remain in the recommended operating range.

BEFORE LANDING

If fuel has been consumed at uneven rates between the two main tanks because of prolonged single-engine flight, it is desirable to balance the fuel load by operating both engines from the fullest tank. However, if there is sufficient fuel in both tanks, even though they may have unequal quantities, it is important to switch the left and right selector valves to the left and right main tanks respectively for the landing. This will provide an adequate fuel flow to each engine if a full-power go-around is necessary. In airplanes equipped with auxiliary fuel tanks, the selector valves should be switched to main tanks for landing because the auxiliary tanks are not equipped with auxiliary fuel pumps.

Landing gear extension before landing is easily detected by a slight change in airplane trim and a slight "bump" as the gear locks down. Illumination of the gear-down indicator light (green), is further proof that the gear is down and locked. If it is reasonably certain that the gear is down and the gear-down indicator light is still not illuminated, the malfunction could be caused by a burned out light bulb. This can be checked by pushing to test. If the bulb is burned out it can be replaced with the bulb from either the compass light, turn-and-bank test light, or the landing gear up (red) indicator light.

A simple last-minute recheck on final approach should confirm that the top row of switches on the left switch and control panel are ON,

the gear-down indicator light (green) is illuminated, and the propeller pitch levers and mixture levers are full forward.

LANDING

Landings are simple and conventional in every respect. If power is used in landing approaches it should be eased off cautiously near touch-down because the "power-on" stall speed is considerably less than the "power-off" stall speed. An abrupt power reduction at five feet altitude could result in a hard landing if the airplane is near stall speed.

Short-field landings on hard-surface runways are performed with 45° flaps from an 85 to 100 MPH approach, using as little power as practicable. A normal flare-out is made and power is reduced in the flare-out. The landing is made on the main wheels first, and remaining engine power is cut immediately after touch-down. The nose-wheel is quickly lowered to the ground and heavy braking is applied as required. Short field landings on rough or soft runways are done in a similar manner except that the nosewheel is lowered to the runway at a lower speed to prevent excessive nose-gear loads.

Crosswind landings are performed with the least effort by using the crab method. However, either the wing-low, crab, or combination method may be used. Crab the airplane into the wind in a normal approach using a minimum flap setting for the field length. Immediately before touchdown, the airplane is aligned with the flight path by applying down-

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wind rudder. The landing is made in a nearly three-point attitude, and the nosewheel is lowered to the runway immediately after touchdown. A straight course is maintained with the steerable nosewheel and occasional braking if necessary.

AFTER LANDING

Heavy braking in the landing roll is not recommended because skidding the main wheels is probable, with resulting loss of the braking effectiveness and damage to the tires. It is best to leave the flaps fully extended throughout the landing roll to aid in decelerating the airplane. After leaving the active runway, the flaps should be retracted. Be sure the flaps switch is identified before placing it in the UP position. The auxiliary fuel pump switches are turned OFF while taxiing, except in extremely hot weather when auxiliary fuel pumps may be needed to maintain steady fuel flow.

Parking is normally accomplished with the nosewheel aligned straight ahead. This simplifies the steering during subsequent departures from the parking area. However, if gusty wind conditions prevail, the nosewheel should be castered to the extreme right or left position. This forces the rudder against the rudder stop which minimizes buffeting of the rudder in gusty wind.

With the mixture levers in IDLE CUT-OFF, the fuel flow is effectively blocked at the fuel metering body. Thus, it is unnecessary to place the fuel selector valve handles in the OFF position if the airplane is receiving

normal usage. However, if a long period of inactivity is anticipated, the fuel selector valve handles should be turned OFF to preclude any possible fuel seepage that might develop through the metering valve.

NIGHT FLYING

Before starting the engines for a night flight, the rheostats located on the left switch and control panel and on the overhead console panel should be turned on and adjusted to provide enough illumination to check all switches, controls, etc. In addition, the dome light may be used if desired.

Navigation lights are then checked by observing illumination in the small peep holes in the inboard leading edges of the wing tip tanks and reflection from the pavement or ground below the tailight. If a rotating beacon is installed on the airplane it should be checked by observing the reflections on the tip tanks and wings. The retractable landing lights (the right landing light is optional equipment) may be extended and checked momentarily. Returning the landing light switches to OFF turns the lights off but leaves them extended ready for instant use.

Before taxiing, the interior lighting intensity is normally decreased to the minimum at which all the controls and switches are visible. The optional taxi light, if installed, should be turned on prior to taxiing at night. The landing lights, if used during taxiing, should be used intermittently to avoid excessive drain on the battery. Taxiing over loose

gravel should be avoided with the landing lights extended. In the engine run-ups, special attention should be directed to generator operation by individually turning the generator switches OFF and ON and noting the response on the ammeter.

Night take-offs are conventional, although the gear retraction operation is usually delayed slightly to insure that the airplane is well clear of the runway. The landing lights, if used, should be retracted before the airspeed exceeds 160 MPH.

In cruising flight, the interior lighting intensity is usually decreased further for better outside vision.

ENGINE OPERATION IN COLD WEATHER

STARTING

Whenever possible, external power should be used in cold weather, due to the higher cranking power required, coupled with the decreased battery output at low temperatures.

When very cold temperatures are anticipated, oil dilution should be employed before stopping the engines, if external preheat is not available. The starting procedure is normal, although if the engines do not start immediately, it may be necessary to switch the auxiliary fuel pumps to ON for a few seconds.

CAUTION

Do not prime engine excessively during start (especially hot engine), when airplane is tailed into the wind. Due to restricted ventilation in nacelle area during

this condition, fuel vapors may accumulate in engine rear nacelle causing a hazardous condition.

NOTE

Turn auxiliary pumps OFF as soon as possible.

The use of external preheat will considerably improve cold-weather starting and materially reduce the severity of conditions imposed on both the engines and the electrical system. Preheat also will thaw the oil trapped in the oil cooler which will probably be congealed prior to starting in very cold temperatures.

WARM-UP

If the oil pressure gage is extremely slow in indicating pressure, it may be advisable to fill the pressure line to the gage with kerosene. No temperature indication need be apparent on the oil temperature gage prior to take-off if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM if preheat is not used), accelerate the engines several times to higher RPM. If the engines accelerate smoothly and the oil pressure remains normal and steady, the airplane is ready for take-off.

BEFORE TAKE-OFF

The propeller should be operated through several complete cycles to warm the governor and propeller hub. The engines should accelerate smoothly and oil pressure should remain normal and steady.

Operating Details

TAKE-OFF

Take-off procedures are normal in all respects.

CLIMB AND CRUISE

At half-hour intervals, the propellers should be exercised to flush the cold oil from the governors and propeller hubs. Electrical equipment should be managed to assure adequate generator charging throughout the flight, since cold weather adversely affects battery capacity.

LET-DOWN AND LANDING

During let-down, watch engine temperatures closely and carry sufficient power to maintain them above operating minimums.

If erroneous instrument readings are suspected due to water or ice in the static-pressure lines, the static-pressure alternate-source valve should be opened. Since this valve vents to the relatively-low static pressure of the cabin, the air-speed indicator and altimeter will show slightly higher readings than normal. Therefore, the alternate static source should be used primarily as a drain valve to restore the original system.

If the alternate static source must be used for instrument operation, compensation should be made in indicated airspeeds and altitudes. In landing with the alternate source valve open and the pilot's storm window closed, fly at an indicated air-speed 10 MPH faster and altitude 30

feet higher than normal. During landings with the static source valve open and the pilot's storm window open make these allowances 25 MPH and 160 feet.

PITOT AND STALL WARNING HEATER OPERATION

At least five minutes before entering a potential icing condition, turn on the pitot and stall warning heater switch, so these units will be warm enough to prevent formation of ice. Preventing ice is preferable to attempting its removal once it has formed.

HEATER OPERATION FOR HEATING AND DEFROSTING

The heater is operated for heating and windshield defrosting in accordance with the following steps:

- (1) Battery switch - ON.
- (2) Cabin air knob - Full out.
- (3) Defrost knob - Adjust as desired (if windshield defrosting is desired).
- (4) Cabin air temperature control knob - Full clockwise to MAX.
- (5) Cabin heater switch - HEAT.
- (6) Heat registers - (as desired).

NOTE

Warm air should be felt coming out of the cabin heat registers within approximately one minute. If the heater does not start, return the heater switch to the OFF position, and check the circuit

Operating Details

breaker labeled CABIN HEAT. Place the cabin heater switch in the HEAT position and attempt another start. If the heater still does not start, service is required and no further starting attempt should be made.

(7) The cabin air temperature control knob - Adjust as desired (after heater has been operating for one minute).

(8) To shut down the heater, place the cabin heater switch in the OFF position.



Emergency Procedures

ENGINE FAILURE.

ENGINE FAILURE DURING TAKE-OFF BELOW 100 MPH.

- (1) Cut power on operative engine and decelerate to a stop.

NOTE

The airplane can be accelerated from a standing start to 100 MPH on the ground, and then decelerated to a stop with heavy braking within 2849 feet of the starting point of the take-off run at sea level, and within 3698 feet of the starting point at 5000 feet altitude (zero wind, hard surface runway, standard conditions, full gross weight).

ENGINE FAILURE AFTER TAKE-OFF ABOVE 100 MPH WITH ROUGH TERRAIN AHEAD.

- (1) Throttles — FULL FORWARD.
- (2) Propeller pitch levers — FULL INCREASE RPM.
- (3) Landing gear switch — UP.
- (4) Determine the inoperative engine (idle engine same side as idle foot).
- (5) Propeller pitch lever — FEATHER (inoperative engine).
- (6) Climb out at 100 MPH.
- (7) Trim tabs — Adjust for climb with airplane banked 3° — 5° toward operative engine.
- (8) Accelerate to 119 MPH after obstacle is cleared.
- (9) Flaps switch — UP (if extended) in small increments.
- (10) Secure dead engine by turning OFF auxiliary fuel pump switch, generator switch, ignition switches, mixture lever, fuel selector valve handle.
- (11) Fuel selector valve handle (operative engine) — Select tank to maintain lateral balance.

**SUPPLEMENTARY INFORMATION
CONCERNING ENGINE FAILURE
DURING TAKE-OFF.**

The most critical time for an engine to fail in a twin-engine airplane is during a two- or three-second

period late in the take-off run while the airplane is accelerating to a safe engine-out climb speed. A detailed knowledge of recommended single-engine airspeeds in the table below is essential for safe operation of this airplane:

SINGLE-ENGINE AIRSPEED NOMENCLATURE	IAS—MPH
1. Minimum control speed	88
2. Minimum safe single engine speed	100
3. Best single engine angle-of-climb speed	106
4. Best single engine rate-of-climb speed (flaps up)	119

These speeds should be memorized for instant recollection in an emergency, and it is worthwhile to review them mentally, prior to every take-off. The following paragraphs present a detailed discussion of the problems associated with engine failures during take-off.

A multi-engine airplane has an advantage over a single-engine airplane only after the engine-out minimum control speed is reached. This speed is defined as the minimum speed at which controlled flight is maintained with one engine inoperative, and full power operation on the other engine. Under these conditions, full control surface deflection of any one control is normally required to counteract extreme yawing and rolling tendencies of the airplane. This airplane has an engine-out minimum control speed of 88 MPH. Since this speed is so far below the optimum climb speed, it is not suitable for single-engine operation near the ground, especially with the landing

gear and flaps extended and the inoperative propeller windmilling. A more suitable minimum safe single-engine climb speed is 100 MPH, since at this speed altitude can be maintained more easily while the landing gear is being retracted and the propeller is being feathered.

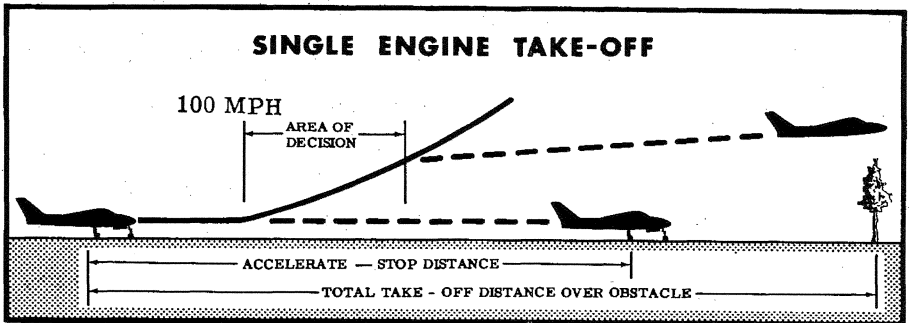
The best angle-of-climb speed for single-engine operation is defined as the speed which gives the greatest increase in altitude in a given distance. This speed becomes important when there are obstacles ahead on take-off, because once the best single-engine angle-of-climb speed is reached, altitude becomes more important than airspeed until the obstacle is cleared. The best single-engine angle-of-climb speed is approximately 109 MPH with flaps up and 102 MPH with flaps 15° for an average single-engine altitude. For convenience, a speed of 106 MPH may be used for any flap setting between 0 - 15°.

The best rate-of-climb speed for single-engine operation is defined as the speed that gives the greatest increase in altitude in the least time. This speed becomes important when there are no obstacles ahead on take-off, or when it is difficult to maintain or gain altitude in single-engine emergencies. The best single-engine rate-of-climb speed is 119 MPH with flaps up, and 109 MPH with flaps 15° at sea level. The flaps-up speed at 119 MPH is of primary importance, because rate-of-climb is appreciably greater with flaps up than with flaps 15°. The variation of flaps-up best rate-of-climb speed with altitude is shown in Section VII. For best climb performance, the wings should be banked approximately 5° toward the operative engine.

Upon engine failure after reaching 100 MPH on take-off, the twin engine pilot has a significant advantage over a single-engine pilot, for he has the choice of stopping or continuing the take-off. This would be similar to the choice facing a single-engine pilot who has suddenly lost slightly more than half of his take-off power.

In this situation, the single-engine pilot would be extremely reluctant to continue the take-off if he had to climb over obstructions. However, if the failure occurred at an altitude as high or higher than surrounding obstructions, he would feel free to maneuver for a landing back at the airport.

Fortunately the airplane accelerates through this area where it is "slow and low" in just a few seconds. However, to make an intelligent decision in this type of an emergency, one must consider the field length, obstruction height, field elevation, air temperature, headwind, and the gross weight. The flight paths illustrated in the figure below indicate that the "area of decision" is bounded by: (1) the point at which 100 MPH is reached and (2) the point where the obstruction altitude is then reached. An engine failure in this area requires an immediate decision. Beyond this area, the airplane, within the limitations of single-engine climb performance shown in Section VII, may be maneuvered to a landing back at the airport.



Emergency Procedures

At sea level, with zero wind and 5100 pounds gross weight, the distance to accelerate to 100 MPH and stop is 2849 feet, while the total unobstructed area required to take-off and climb over a 50-foot obstacle after an engine failure at 100 MPH is 2723 feet. This total distance over an obstacle can be reduced appreciably under more favorable conditions of gross weight, headwind, or obstruction height. However, it is recommended that in most cases it would be better to discontinue the take-off, since any slight mismanagement of single-engine procedure would more than offset the small distance advantage offered by continuing the take-off. The advantage of discontinuing the take-off is even more obvious at a 2500-foot field elevation where the corresponding distances are 3232 feet and 3643 feet, respectively. Still higher field elevations will cause the engine-out take-off distance to lengthen disproportionately until an altitude is reached where a successful take-off is improbable unless the airspeed and height above the runway at engine failure are great enough to allow a slight deceleration and altitude loss while the airplane is being prepared for a single-engine climb.

During single-engine take-off procedures over an obstacle, only one condition presents any considerable advantage, and this is headwind. A decrease of approximately 20% in ground distance required to clear a 50-foot obstacle can be gained for each 10 MPH of headwind. Excessive speed above best single-engine

climb speed at engine failure is not nearly as advantageous as one might expect since deceleration is rapid and ground distance is used up quickly at higher speeds while the airplane is being cleaned up for climb. However, the extra speed is important for controllability.

From a study of the preceding facts, it is apparent that: (1) discontinuing a take-off upon engine failure is advisable under most circumstances; (2) altitude is more valuable to safety after take-off than is airspeed in excess of the best single-engine climb speed since excess airspeed is lost much more rapidly than is altitude; (3) climb or continued level flight at moderate altitude is improbable with the landing gear extended and the propeller windmilling; (4) in no case should the airspeed be allowed to fall below the engine-out best angle-of-climb speed, even though altitude is lost, since this speed will always provide a better chance of climb, or a smaller altitude loss, than any lesser speed. The engine-out best rate-of-climb speed will provide the best chance of climb or the least altitude loss, and is preferable unless there are obstructions which make a steep climb necessary.

Engine failure procedures should be practiced in anticipation of an emergency. This practice should be conducted at a safe altitude, with full power operation on both engines, and should be started at a safe speed of at least 110 MPH. As recovery ability is gained with practice, the starting speed may be lowered in small increments until the feel of the aircraft in emergency condi-

tions is well known. Practice should be continued until: (1) an instinctive corrective reaction is developed, and the corrective procedure is automatic; and (2), airspeed, altitude, and heading can be maintained easily while the airplane is being prepared

for a climb. In order to simulate an engine failure, set both engines at full power operation, and at a chosen speed pull the mixture control of one engine into IDLE CUT-OFF, and proceed with single-engine emergency procedures.

SINGLE-ENGINE CLIMB.

- (1) Throttle - FULL FORWARD.
- (2) Propeller pitch lever - FULL INCREASE RPM.
- (3) Mixture lever - Adjust fuel flow to low side of dial range.
- (4) Landing gear switch - UP (if not previously retracted).
- (5) Wing flaps switch - UP (in small increments, if used).
- (6) Climb at 119 MPH if no obstacles are ahead.
- (7) Climb at 106 MPH with obstacles ahead.

NOTE

For maximum single-engine climb, bank the airplane approximately 5° toward the operating engine. Refer to Section VII for single-engine climb data.

ENGINE FAILURE DURING FLIGHT.

At once:

- (1) Throttles - FULL FORWARD.
- (2) Propeller pitch levers - FULL INCREASE RPM.
- (3) Mixture levers - Adjust fuel flow to low side of dial range.
- (4) Determine inoperative engine (idle engine same side as idle foot).
- (5) Trim rudder for single-engine flight.

Before securing inoperative engine:

- (1) Check fuel flow; if deficient, turn on auxiliary fuel pump.

NOTE

If fuel selector valve handle is on AUXILIARY TANK, switch to MAIN TANK.

- (2) Check fuel quantity and switch to opposite tank if necessary.
- (3) Check oil pressure and oil temperature indications. Shut down engine if oil pressure is low.

Emergency Procedures

- (4) Check ignition switches.

If proper corrective action was taken, engine will restart. If it does not, secure it as follows:

- (1) Mixture lever - IDLE CUT-OFF.
- (2) Propeller lever - FEATHER.
- (3) Turn off auxiliary fuel pump, generator, ignition switches and fuel selector valve.
- (4) To conserve battery power, turn off sufficient electrical equipment to eliminate a negative ammeter reading.
- (5) Select cruise power settings on operative engine.
- (6) Trim airplane 3° - 5° wing-low on the side of the operative engine.
- (7) Land at the nearest suitable airport.

RESTARTING ENGINE IN FLIGHT (After Feathering).

- (1) Check fuel selector valve handle on MAIN.
- (2) Advance throttle until gear warning horn is silent.
- (3) Advance propeller pitch lever forward of feathering detent.
- (4) Set mixture lever full forward for FULL RICH.
- (5) Turn ignition switches ON.
- (6) Turn auxiliary fuel pump switch to PRIME position.
- (7) Turn ignition switch to START when fuel flow reaches 2 to 4 gal/hr.
- (8) Release switch when engine fires.
- (9) In cold weather, turn auxiliary fuel pump switch ON, if required.
- (10) After engine starts, turn off auxiliary fuel pump.

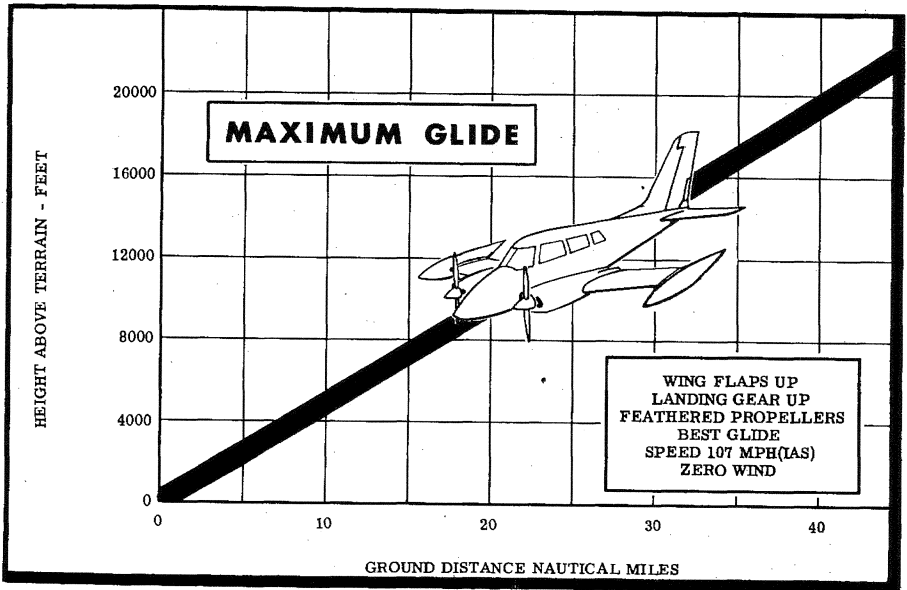
NOTE

If start is unsuccessful, turn ignition and auxiliary fuel pump switch to OFF, retard mixture lever to IDLE CUT-OFF, open throttle fully, and engage starter for several revolutions. Then repeat air start procedure.

- (11) Increase power slowly until cylinder head temperature reaches 200°F.

MAXIMUM GLIDE.

In the event of failure of both engines, maximum gliding distance can be obtained by feathering both propellers, and maintaining 107 MPH with the landing gear and wing flaps up. Refer to the Maximum Glide Diagram on page 4-7 for maximum glide data.



FORCED LANDING (Precautionary Landing With Power).

- (1) Drag over selected field with flaps 15° and 100 MPH airspeed, noting type of terrain and obstructions.
- (2) Plan a wheels-down landing if surface is smooth and hard (pasture, frozen lake, etc).
- (3) Execute a normal short-field landing, keeping nosewheel off ground until speed is decreased.
- (4) If terrain is rough or soft, plan a wheels-up landing as follows:
 - (a) Approach with flaps down 20° at 100 MPH.
 - (b) Turn off all switches except ignition switches.
 - (c) Unlatch cabin door prior to flare-out.

IMPORTANT

Be prepared for moderate tail buffet, pitch change and slight roll as cabin door is opened.

- (d) Reduce power to a minimum during flare-out.
- (e) Prior to contact, turn off ignition switches.

Emergency Procedures

IMPORTANT

If flare-out is sustained with moderate power, cutting power suddenly will result in hard landing. To avoid, reduce power to a minimum in flare-out before turning off ignition switches.

- (f) Land in a slightly tail-low attitude.
- (g) Hold wheel fully back in initial slide to keep nacelles from possibly "digging in" in rough terrain.

NOTE

Airplane will slide straight ahead about 500 feet on smooth sod with very little damage.

FORCED LANDING (Complete Engine Failure).

- (1) Feather propellers and rotate them to a horizontal position with starter if time permits.
- (2) Mixture levers in IDLE CUT-OFF.
- (3) Fuel selector valve handle\$ - OFF.
- (4) All switches OFF except battery switch.
- (5) Approach at 106 MPH.
- (6) If field is smooth and hard, extend landing gear within gliding distance of field.
- (7) Extend flaps as necessary within gliding distance of field.

IMPORTANT

The glide path is extremely steep with flaps and gear down and propellers windmilling.

- (8) Turn battery switch OFF.
- (9) Make a normal landing, keeping nosewheel off ground as long as practical.
- (10) If terrain is rough or soft, plan a wheels-up landing as follows:
 - (a) Approach at 106 MPH with gear and flaps retracted.
 - (b) Extend flaps to 20° within gliding distance of field.
 - (c) Turn battery switch OFF.
 - (d) Unlatch cabin door prior to flare-out.
 - (e) Land in a slightly tail-low attitude.
 - (f) Attempt to hold tail low throughout slide.

SINGLE-ENGINE LANDING.

- (1) Approach at 106 MPH with excess altitude.
- (2) Delay extension of landing gear until within gliding distance of field.
- (3) Avoid use of flaps until landing is assured.
- (4) Decrease speed below 100 MPH only if landing is a certainty.

NOTE

When speed drops below 100 MPH, the airplane is usually committed to land because an immediate climb-out is often difficult at any speed lower than the minimum safe single-engine climb speed.

- (5) Land with some excess speed to allow for gusts, poor technique, etc.
- (6) Maintain enough momentum to turn off the active runway without power because single-engine taxi is difficult at slow speed in certain wind conditions.

GO-AROUND (Single-Engine).

- (1) If absolutely necessary and speed is above 100 MPH, apply full throttle and increase engine speed to 2625 RPM.
- (2) Retract landing gear.
- (3) Reduce flap setting to 15°.
- (4) Climb at 119 MPH (106 MPH with obstacles directly ahead).
- (5) Trim airplane for single-engine climb.
- (6) Retract flaps as soon as all obstacles are cleared and a safe altitude and airspeed are obtained.

SYSTEM EMERGENCY PROCEDURES.

FUEL SYSTEM-EMERGENCY OPERATION.

In the event of an engine-driven fuel pump failure, turn the auxiliary fuel pump switch (on the inoperative side) to ON. This pump will supply sufficient fuel for take-off power; however, mixture control must be reset.

IMPORTANT

If both an engine-driven fuel pump and an auxiliary fuel pump fail on the same side, the failing engine cannot be supplied

Emergency Procedures

with fuel from the opposite main tank since that auxiliary fuel pump will operate on the low pressure setting as long as the corresponding engine fuel pump is operative. The engine with the operative engine-driven fuel pump should be fed from both the right and left main fuel tank to prevent a fuel unbalance from occurring. However, it is impossible to use fuel from the auxiliary fuel tank on the same side as the inoperative engine-driven fuel pump.

Land as soon as practical if fuel flow indication remains below normal.

LANDING GEAR SYSTEM-EMERGENCY OPERATION.

When the landing gear will not extend electrically, it may be extended manually in accordance with the following steps:

- (1) Before proceeding manually, check landing gear circuit breakers with landing gear switch DOWN. If circuit breakers are tripped, allow 3 minutes for them to cool before resetting.
- (2) If circuit breaker is not tripped, put landing gear switch in the OFF (middle) position.
- (3) Raise seat adjustment lever and slide seat forward for easier hand cranking.
- (4) Remove handcrank from stowage clip.
- (5) Extend handcrank until hinged link is straight by rotating crank slightly clockwise to engage extension mechanism gear teeth.
- (6) Crank gear down approximately two turns past the point where the gear-down indicator light (green) comes on (approximately 60 turns of the handcrank).

NOTE

During manual extension of the gear, never release the handcrank to let it turn freely of its own accord.

- (7) Check gear-down indicator light and gear warning horn with throttle retarded.
- (8) Depress button on hinged crank link, and stow the handcrank in the stowage clip.
- (9) Readjust seat to the position desired, for landing.

NOTE

The landing gear should never be retracted with the manual system, as undue loads will be imposed and cause excessive wear on the cranking mechanism. If the gear will not retract electrically, land and have the malfunction corrected.

FLIGHT PROCEDURE WITH OPEN CABIN DOOR.

Airflow over the curved cabin door produces negative pressure over the door surface, resulting in an outward pull that increases with speed. Consequently, if the door should open accidentally in flight because it was not locked, it will float outward enough to disturb the airflow over the tail. This effect is shown by moderate buffeting of the tail. This buffeting attains its maximum with gear up, flaps 20°, and 90 MPH, and occasionally produces a noticeable nose-down pitch and possibly a slight roll as the door pops open. Although these motions are controllable, it is best to avoid this situation close to the ground. Therefore, it is important to make sure the door handle is in the LOCKED position before take-off.

LANDING EMERGENCIES (Except Ditching).

Landing emergencies, including landing with a flat main gear tire, flat nose gear tire, defective main gear, and defective nose gear, and the corrective action to be taken in each condition, are described in the following paragraphs. Under each condition, the landing approach is to be performed using normal throttle, mixture, and propeller pitch lever settings.

LANDING WITH FLAT MAIN GEAR TIRE.

If a blowout occurred during take-off, and the defective main gear tire is identified, proceed as follows:

- (1) Landing gear switch — UP.
- (2) Fuel selector valve handles — Turn to main tank on same side as defective tire. Proceed to destination, to reduce fuel load.

NOTE

Fuel should be used from this tank first to lighten the load on this wing prior to attempting a landing, if in-flight time permits. However, an adequate supply of fuel should be left in this tank so that it may be used during landing.

- (3) Fuel selector valve handles — RIGHT MAIN for right engine, LEFT MAIN for left engine (prior to landing).
- (4) Select a runway with a crosswind from the side opposite the defective tire if a crosswind landing is required.
- (5) Landing gear switch — DOWN (below 140 MPH).
- (6) Check landing gear down indicator light (green) for indication.
- (7) Flaps switch — DOWN. Fully extend flaps to 45°.
- (8) In approach, align airplane with edge of runway opposite the defective tire, allowing room for a mild turn in the landing roll.
- (9) Land slightly gear-low on side of inflated tire and lower nosewheel

Emergency Procedures

to ground immediately, for positive steering.

- (10) Use full aileron in landing roll, to lighten load on defective tire.
- (11) Apply brake only on the inflated tire, to minimize landing roll and maintain directional control.
- (12) Stop airplane to avoid further tire and wheel damage, unless active runway must be cleared for other traffic.

LANDING WITH FLAT NOSE GEAR TIRE.

If a blowout occurred on the nose gear tire during take-off, prepare for a landing as follows:

- (1) Landing gear switch — Leave DOWN.

IMPORTANT

Do not attempt to retract the landing gear if a nose gear tire blowout occurs. The nose gear tire may be distorted enough to bind the nosewheel strut within the wheel well and prevent later gear extension.

- (2) Move disposable load to baggage area and passengers to available rear seat space.
- (3) Flaps switch — DOWN. Extend flaps from 0° to 20° as desired.
- (4) Land in a nose high attitude with or without power.
- (5) Maintain back pressure on control wheel to hold nosewheel off the ground in landing roll.
- (6) Use minimum braking in landing roll.
- (7) Throttles — Retard in landing roll.
- (8) As landing roll speed diminishes, hold control wheel fully aft until airplane is stopped.
- (9) Avoid further tire damage by holding additional taxi to a minimum.

LANDING WITH DEFECTIVE MAIN GEAR.

Attempt to extend the gear manually using the procedure described in paragraph LANDING GEAR SYSTEM — EMERGENCY OPERATION. If a malfunction is then verified by observers in the control tower or another airplane, reduce the fuel load in the tank on the side of the faulty main gear as explained in paragraph LANDING WITH FLAT MAIN GEAR TIRE. When fuel load is reduced, prepare to land as follows:

- (1) Fuel selector valve handles — RIGHT MAIN for right engine and LEFT MAIN for left engine.

Emergency Procedures

- (2) Select a wide, hard surface runway, or if necessary a wide sod runway. Select a runway with crosswind from the side opposite the defective landing gear, if a crosswind landing is necessary.
- (3) Landing gear switch - DOWN.
- (4) Flaps switch - DOWN. Extend flaps to 30°.
- (5) In approach, align airplane with edge of runway opposite the defective landing gear, allowing room for a ground-loop in landing roll.
- (6) Battery switch - OFF.
- (7) Land slightly wing-low toward the operative landing gear and lower the nosewheel immediately, for positive steering.
- (8) Mixture levers - IDLE CUT-OFF (both engines).
- (9) Use full aileron in landing roll to lighten the load on the defective landing gear.
- (10) Apply brake only on the operative landing gear to maintain directional control and minimize the landing roll.
- (11) Fuel selector valve handles - OFF.
- (12) Evacuate the airplane as soon as it stops.

LANDING WITH DEFECTIVE NOSE GEAR.

Attempt to extend the gear manually using the procedure described in paragraph LANDING GEAR SYSTEM - EMERGENCY OPERATION. If a malfunction is then verified by observers in the control tower or other aircraft, prepare for an emergency landing as follows:

SOD RUNWAYS - GEAR RETRACTED.

This procedure will produce a minimum amount of aircraft damage on smooth runways. This procedure is also recommended for short, rough, or uncertain field conditions where passenger safety, rather than minimum aircraft damage, is the prime consideration:

- (1) Select a smooth grass-covered runway, if possible.
- (2) Landing gear switch - "UP".
- (3) Approach at 100 MPH with flaps down only 20 degrees.
- (4) All switches except ignition switches - "OFF".
- (5) Land in a slightly tail low attitude.
- (6) Mixture levers - "IDLE CUT-OFF" (both engines).
- (7) Ignition switches - "OFF".
- (8) Fuel selector valve handles - "OFF".
- (9) Evacuate the airplane as soon as it stops.

Emergency Procedures

SMOOTH HARD SURFACE RUNWAYS - GEAR EXTENDED.

This procedure will produce a minimum amount of aircraft damage on smooth hard surfaced runways of adequate length and width:

- (1) Move disposable load to baggage area, and passengers to available rear seat space.
- (2) Select a smooth hard surface runway.
- (3) Landing gear switch - "DOWN".
- (4) Approach at 100 MPH with flaps down to 20 degrees.
- (5) All switches except ignition switches - "OFF".
- (6) Land in a slightly tail low attitude.
- (7) Mixture levers - "IDLE CUT-OFF" (both engines).
- (8) Ignition switches - "OFF".
- (9) Hold nose off throughout ground roll - Lower gently as speed dissipates.

DITCHING.

- (1) Plan approach into the wind if wind is high and seas are heavy. With heavy swells and light wind, land parallel to swells, being careful not to allow a wing tip to hit first.
- (2) Approach with the landing gear retracted, flaps 45°, and enough power to maintain approximately 300 ft/min. rate of descent at approximately 108 MPH at 4600 pounds, to 114 MPH at 5100 pounds gross weight.
- (3) Maintain a continuous descent until touchdown to avoid flaring and touching down tail-first, pitching forward sharply, and decelerating rapidly. Strive for initial contact at fuselage area below rear cabin section (point of maximum longitudinal curvature of fuselage).

It is expected that the airplane will skip clear of the water once or twice using the optimum technique outlined above. If the final contact is made in the desired level attitude, the nose will submerge completely during two or three seconds of moderately abrupt deceleration, and then the airplane will float for a short time in a nearly level attitude. The length of flotation time will depend on the extent of damage to nose and main gear doors, tip tanks, nacelle firewalls, fuselage bottom and wings. However, it is believed that the airplane would settle rather slowly, especially with empty fuel tanks.



Operating Limitations

OPERATIONS AUTHORIZED.

Your airplane, with standard equipment as certificated under FAA Type Certification No. 3A10, is approved for day and night operation under VFR or IFR.

MANEUVERS—NORMAL CATEGORY.

The airplane exceeds the requirements of the Civil Air Regulations, Part 3, set forth by the United States Government for airworthiness. Spins and aerobatic maneuvers are not permitted in normal category airplanes in compliance with these regulations. In connection with the foregoing, the following gross weight and flight load factors apply:

Maximum Take-off Gross Weight	5100 lbs.
Flight Load Factor*	
Flaps Up	+3.8 -1.52
Flaps Down	+2.0

*The design load factors are 150% of the above and in all cases the structure exceeds design loads.

Your airplane must be operated in accordance with all FAA-approved markings, placards and check lists in the airplane. If there is any information in this section which contradicts the FAA-approved markings, placards and check lists, it is to be disregarded.

AIRSPEED LIMITATIONS (CAS).

Maximum Structural Cruising Speed	210 MPH
(level flight or climb)	
Maximum Speed	
Flaps Extended 15°	160 MPH
Flaps Extended 15° - 45°	140 MPH
Maximum Speed, Gear Extended	140 MPH

Operating Limitations

Maximum Speed, Landing Light Extended	160 MPH
Maximum Speed, Pilot's Window Open	130 MPH
Maneuvering Speed*	168 MPH

*(The maximum speed at which you can use abrupt control travel or fly through extremely turbulent air without exceeding the design load factor.)

AIRSPED INDICATOR INSTRUMENT MARKINGS.

The following table lists the certificated calibrated airspeed (CAS) limitations for the airplane.

Never Exceed (glide or dive, smooth air)	254 MPH (red line)
Caution Range	210-254 MPH (yellow line)
Normal Operation Range	88-210 MPH (green line)
Flap Operating Range (0° -45°)	79-140 MPH (white arc)

ENGINE OPERATION LIMITATIONS.

Maximum Power and Speed	260 BHP at 2625 RPM (for all operations)
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ENGINE INSTRUMENT MARKINGS.

OIL TEMPERATURE GAGES.

Normal Operating Range	80-225° (green arc)
Maximum Temperature	225° (red line)

OIL PRESSURE GAGES.

Idling Pressure	10 PSI (red line)
Normal Operating Range.	30-60 PSI (green arc)
Maximum Pressure	100 PSI (red line)

FUEL FLOW GAGE.

Normal Operating Range	1.5-23 GPH (green arc)
Minimum and Maximum Fuel Flows	1.5 and 23 GPH (red line)

MANIFOLD PRESSURE GAGE.

Normal Operating Range15-24 in. Hg (green arc)
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CYLINDER HEAD TEMPERATURES.

Normal Operating Range 200-460°F (green arc)
Maximum Temperature 460°F (red line)

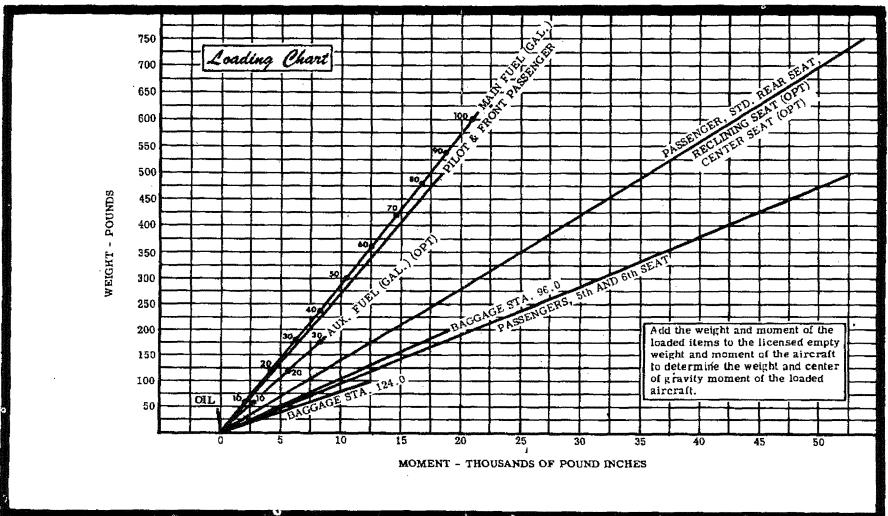
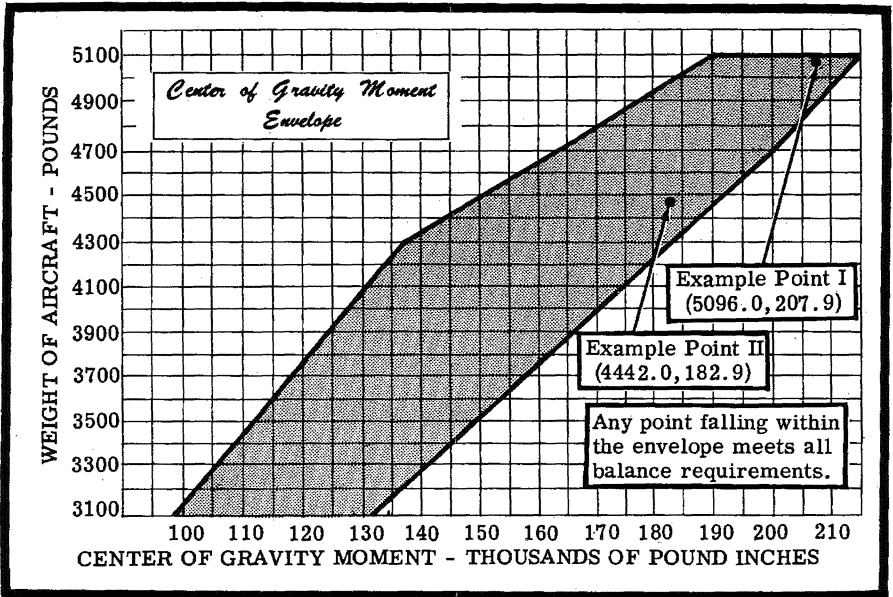
TACHOMETER.

Normal Operating Range 2100-2450 RPM (green arc)
Maximum (Engine rated speed). 2625 RPM (red line)

CENTER OF GRAVITY LIMITATIONS.

The center of gravity moment envelope, located at the end of this section, shows the center of gravity limitations of your airplane. A sample problem is also provided which shows one of the many possible loading arrangements. By using the sample problem as a guide, you can determine if any particular loading configuration is within the balance requirements of your airplane. If the c.g. points, when plotted on the center of gravity moment envelope, fall within the envelope, your airplane meets all balance requirements.

Operating Limitations



SAMPLE PROBLEM

Assume an airplane of the following configuration. Pilot and front seat passenger, three rear seat passengers, 100 gallons fuel in main tanks, 30 gallons of fuel in auxiliary tanks, 24 quarts of oil and 180 pounds of baggage. Assume this airplane has a licensed empty weight of 3241.0 pounds and a moment of 112.5 thousand pound-inches, which include 12 pounds of unusable fuel, 1 pound undrainable oil, and 165 pounds of optional electronic equipment.

	Weight in pounds	Moment in thousands of pound-inches (Obtained from Loading Chart)
AIRCRAFT LICENSED EMPTY WEIGHT	3241.0	112.5
AND MOMENT (From weight and balance sheet)		
OIL (24 qts. x 1.875 lb./qt.)	45.0	-0.2
PILOT AND FRONT SEAT PASSENGER	340.0	12.6
REAR SEAT PASSENGER	510.0	36.2
(Standard rear seat)		
FUEL (MAIN TANKS)	600.0	21.0
(100 gals. x 6 lb./gal.)		
FUEL (AUXILIARY TANKS)	180.0	8.5
(30 gals. x 6 lb./gal.)		
BAGGAGE	<u>180.0</u>	<u>17.3</u>
TOTAL TAKE-OFF WEIGHT	5096.0	207.9 Point I
SUBTRACT TOTAL FUEL LISTED ABOVE	780.0	-29.5
ADD MINIMUM FUEL RESERVE (21 gals.).	<u>126.0</u>	<u>4.5</u>
TOTAL WEIGHT AND MOMENT WITH MINIMUM FUEL RESERVE	4442.0	182.9 Point II

Locate the values of Point I and Point II on the Center of Gravity Moment Envelope. Since the points fall within the envelope, the above loading meets all balance requirements.

WARNING

If either or both points do not fall within the Center of Gravity Moment Envelope, the load must be rearranged before take-off.

The above problem is an example of only one of many different loading configurations. To best utilize the available payload for each airplane, the loading chart should be consulted to determine proper load distribution.



Care of the Airplane

IF YOUR AIRPLANE is to retain that new-plane performance and dependability, certain inspection and maintenance requirements must be followed. It is wise to follow a planned schedule of lubrication and preventive maintenance based on the climatic and flying conditions encountered in your locality.

Keep in touch with your Cessna Dealer, and take advantage of his knowledge and experience. He knows your airplane and how to maintain it. He will remind you when lubrications and oil changes are necessary, and about other seasonal and periodic services.

GROUND HANDLING.

A tow bar is stored in the baggage area of your airplane. When the tow bar is attached to the swivel nose gear, the airplane may be steered by hand and positively controlled in all ground handling operations. Always pull or push horizontally on the tow bar when moving the airplane to keep the weight on the nosewheel for positive steering action. Do not lift on the tow bar.

MOORING YOUR AIRPLANE.

Proper tie-down procedure is your best protection against damage to your parked airplane by gusty or strong winds. To tie down your airplane securely, proceed as follows:

(1) Fasten ropes or chains of at least 700 pounds tensile strength to the wing tie-down fitting located on the underside of each wing, and se-

cure the opposite ends to tie-down rings anchored in the ground.

(2) Caster the nosewheel to the extreme left or right position to protect the rudder from buffeting and wind damage.

(3) Secure a rope or chain to the lug located on the aft side of the nose gear strut directly behind the upper torque link attaching point. Secure the opposite end to a tie-down ring in the ground. An alternate tie-down location on the nose gear strut is around the strut just above the torque links. However, only ropes should be tied to this location and care should be exercised when securing the rope so that the adjustment of the taxi light (if installed) will not be altered.

(4) Tie a rope or chain to the tail skid, and secure the other end to a tie-down ring in the ground.

(5) Install the controls lock on the pilot's control column.

Care of the Airplane

(6) Set the parking brake or use wheel chocks.

STORAGE.

The all-metal construction of your airplane makes outside storage practical. However, inside storage will increase its life just as it does for your car. Cleanliness is important under any condition.

While the airplane is stored, pull the propellers through several revolutions every few days to keep the engine bearings, cylinder walls, and other internal parts oiled. Leave the propellers turned horizontally to prevent rain water from entering the hub mechanism if the airplane is tied down outside. The fuel tanks should be kept full during storage to help prevent moisture condensation and increase fuel tank life. Also keep the tires and struts correctly inflated.

Regular use of your airplane will help keep it in good condition. An airplane left idle for any great length of time is likely to deteriorate more rapidly than if it is flown regularly, and should be carefully checked over before being put back into service after storage.

JACKING.

The airplane is equipped with four jack pads for use when it is desired to raise the entire airplane for landing gear function checks, etc. However, for minor maintenance such as tire changes, an individual wheel may be raised as follows:

(1) To raise the nosewheel, place weights (sandbags, etc.) on each side of the horizontal stabilizer by the fuselage until the tail rests securely on the tail skid. The main wheels should be chocked or the parking brakes set when raising the nosewheel in this fashion.

(2) To raise either main wheel, jacking points are provided on the aft side of each strut. Chock the opposite main wheel and the nosewheel before jacking, as a safety measure.

EXTERIOR CARE.

The painted exterior surfaces of your new Cessna have been finished with high grade synthetic materials selected for their toughness, elasticity, and excellent adhesion. With a minimum of care, they will retain their original beauty for many years.

As with any paint applied to a metal surface, the desired qualities of the paint develop slowly throughout an initial curing period which may be as long as 90 days after the finish is applied. During this curing period, precautions should be taken to avoid damaging the finish or interfering with the curing process. The finish should be cleaned only by washing with clean, cold water and mild soap, followed by a rinse with cold water and drying with cloths or a chamois. Use no polish or wax, which would exclude air from the surface. Do not rub or buff the finish and avoid flying through rain, hail or sleet. Once the finish has cured completely, it may be kept waxed with a good automotive wax. A heavier coating

of wax on the leading edges of the wings and tail and on the nose caps of the fuselage and engine nacelles will help reduce the abrasion encountered in these areas.

Fluids containing dyes, such as fuel and hydraulic oil, accidentally spilled on the painted surface, should be flushed away at once to avoid a permanent stain. Spilled battery electrolyte must be flushed away at once, and the area neutralized with an alkali such as baking soda solution, followed by a thorough rinse with clear water.

An automotive paint cleaner may be used to clean the painted surfaces. Always wash and wax your airplane in a shaded area. **DO NOT USE DETERGENTS TO CLEAN THE AIRPLANE.**

WINDSHIELD AND WINDOWS.

The plastic windshield and windows should be kept clean and waxed at all times. To prevent scratches and crazing, wash them carefully with plenty of soap and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois or sponge may be used, but only to carry water to the surface. Rinse thoroughly, then dry with a clean, moist chamois. Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge so that it attracts dust particles in the air. Wiping with a moist chamois will remove both the dust and this charge.

Remove oil and grease with a cloth moistened with kerosene. Never use gasoline, benzene, alcohol, acetone, carbon tetrachloride, fire extinguisher or anti-ice fluid, lacquer thinner or glass cleaner. These materials

will soften the plastic and may cause it to craze.

After removing dirt and grease, if the surface is not seriously scratched it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the plastic.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the plastic.

PROPELLERS.

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to remove grass and bug stains, coupled with periodic lubrication of the hubs, will assure long, trouble-free service. It is vital that small nicks on the propeller, particularly near the tips and on the leading edges, are dressed out as soon as possible since such nicks produce stress concentrations, and if ignored, shortly may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with carbon tetrachloride or Stoddard solvent.

Lubrication of the propeller hubs requires special greases specified by the manufacturer. Your Cessna Dealer has the proper lubricants. He should be consulted about lubrication, as well as other repair and maintenance work. Civil Air Regu-

Care of the Airplane

lations require that all maintenance except dressing small blade nicks, cleaning, minor spinner repairs and lubrication which does not require disassembly must be done by an FAA-authorized propeller repair station. For this work, too, your Cessna Dealer will be happy to help you.

INTERIOR CARE.

Keeping the inside of your airplane clean is no more difficult than taking care of the rugs and furniture in your home. It is a good idea to occasionally take the dust out of the upholstery with a whisk broom and a vacuum cleaner.

If spots or stains get on the upholstery they should be removed as soon as convenient, before they have a chance to soak and dry. Any good grade of commercial cleaning fluid may be used for cleaning the upholstery. Water, or cleaning materials containing water, should be avoided since the fire-retardant chemicals in the fabrics are water-soluble.

NOTE

Don't use too much fluid as the cushions are padded with foam rubber. Since some volatile solvents attack rubber, the paddings may be damaged if the material is soaked with the cleaner. Follow the manufacturer's instructions closely, and test the fluid on an obscure part of the fabric to be cleaned.

Spots or stains on Royalite trim

parts and panels and leather sidewalls are easily removed using a clean cloth slightly dampened with water. A few light strokes over the area usually removes all dirt. Persistent stains may be removed using a mild soap. The soap should be removed thoroughly with a clean damp cloth and the area dried after cleaning. Never use a volatile solvent on plastic.

SERVICING.

The Servicing Diagram on pages 6-7, 6-8 and 6-9 and the Service Requirements Table outline the normal servicing points, materials and procedures for your airplane. Some of the equipment shown is optional and may not be installed on your airplane. The diagram and table do not include lubrication points or intervals, but are confined to day-to-day items that you may wish to attend to yourself or find necessary to service while on a strange airport. The military specifications listed on the Service Requirements Table are not mandatory, but are intended as guides in choosing satisfactory materials. Products of most reputable manufacturers meet or exceed these specifications. Lubrication information is included in this Owner's Manual for your airplane. Your Cessna Dealer has the correct lubricants and the equipment and trained personnel to do this job properly.

Each item should be serviced at its prescribed interval, and at the same time, all other items requiring more frequent service should receive attention. The intervals shown should

be considered maximums for average service. If your airplane is operated under abnormal conditions, check these items more frequently.

AIRPLANE FILE.

There are miscellaneous data, information and licenses that are a part of the airplane file. The following is a check list for that file. In addition, a periodic check should be made of the latest Civil Air Regulations to insure that all data requirements are met.

A. To be carried in the airplane at all times:

- (1) Aircraft Airworthiness Certificate (Form ACA 1362).
- (2) Aircraft Registration Certificate (Form ACA 500A).
- (3) Airplane Radio Station License (if transmitter installed).
- (4) Weight and Balance Report or latest copy of the Repair and Alteration Form (Form ACA 337).
- (5) Airplane Equipment List.
- (6) Airplane Log Book.
- (7) Engine Log Book.
- (8) Pilot's Check List.

B. To be maintained but not necessarily carried in the airplane at all times:

- (1) A form containing the following information: Model, Registration Number, Factory Serial Number, Date of Manufacture, Engine Numbers, and Key Numbers (duplicate keys are available through your Cessna Dealer).

Most of the items listed are required by the United States Civil Air Regulations. Since the regulations of other nations may require other documents and data, owners of exported airplanes should check with their own aviation officials to determine their individual requirements.

INSPECTION SERVICE AND INSPECTION PERIODS.

With your airplane you will receive an Owner's Service Policy. Coupons attached to the policy entitle you to an initial inspection and the first 100-hour inspection at no charge. If you take delivery from your Dealer, he will perform the initial inspection before delivering the airplane to you. If you pick up the airplane at the factory, plan to take it to your Dealer reasonably soon after you take delivery on it. This will permit him to check it over and to make any minor adjustments that may appear necessary. Also, plan an inspection by your Dealer at 100 hours or 90 days, whichever comes first. This inspection also is performed by your Dealer for you at no charge. While these important inspections will be performed for you by any Cessna Dealer, in most cases you may prefer to have the Dealer from whom you purchase the airplane accomplish this work.

Civil Air Regulations require that all airplanes have a periodic (annual) inspection as prescribed by the administrator, and performed by a person designated by the administrator. In addition, 100-hour periodic

Care of the Airplane

inspections by an "appropriately-rated mechanic" are required if the airplane is flown for hire. The Cessna Aircraft Company recommends the 100-hour periodic inspection for your airplane. The procedure for this 100-hour inspection has been carefully worked out by the factory and is followed by the Cessna Dealer Organization. The complete familiarity of the Cessna Dealer Organization with Cessna equipment and with factory-approved procedures provides the highest type of service possible at lower cost.

Time studies of the 100-hour inspection at the factory and in the field have developed a standard flat-rate charge for this inspection at any Cessna Dealer. Points which the inspection reveals require modification or repairs will be brought to the owner's attention by the Dealer, and quotations or charges will be made accordingly. The inspection charge does not include the oil required for the oil change.

Every effort is made to attract the best mechanics in each community to Cessna service facilities. Many Dealers' mechanics have attended Cessna Aircraft Company schools and have received specialized instruction in maintenance and care of Cessna airplanes. Cessna service instruction activity in the form of service bulletins and letters is constantly being carried on so that when you have your Cessna inspected and serviced by Cessna Dealers' mechanics, the work will be complete and done in accordance with the latest approved methods.

Cessna Dealers carry a full complement of Cessna service parts and have complete repair and service facilities, including such specialized jigs and tools as may be necessary.

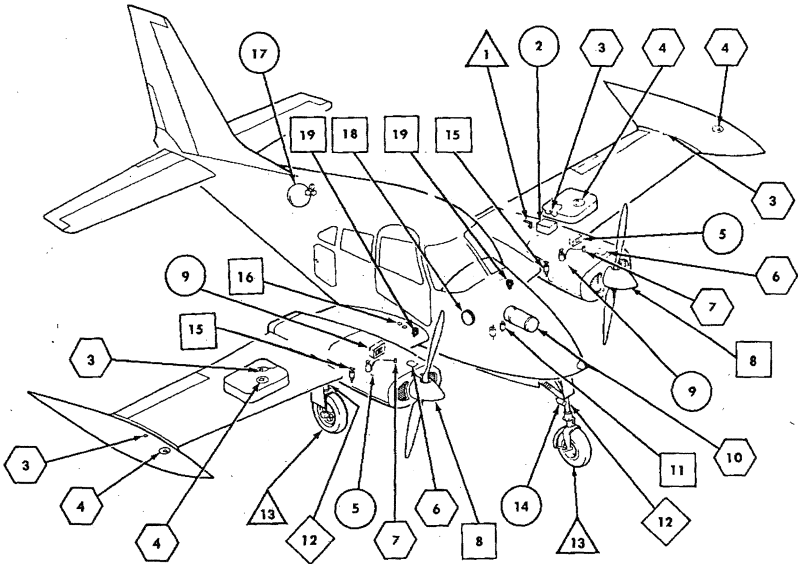
Your Cessna Dealer will be glad to give you current price quotations on all parts that you might need and will be glad to advise you on the practicability of parts replacement versus repairs.

DEALER FOLLOW-UP SYSTEM

Your Cessna Dealer has an owner follow-up system to notify you when he receives information that applies to your Cessna. In addition, if you wish, you may choose to receive similar notification directly from the Cessna Service Department. A subscription card is supplied to you in your airplane file for your use, should you choose to request this service. Your Cessna Dealer will be glad to supply you with details concerning these follow-up programs, and stands ready through his Service Department to supply you with fast, efficient, low cost service.

SERVICING DIAGRAM

NOTE
For quick reference, specifications and quantities of fuel, oil, etc., are contained in a table on the inside back cover.



SERVICING INTERVALS



SERVICE AS REQUIRED.



SERVICE EVERY 25 HOURS.



CHECK OR SERVICED DAILY.



SERVICE EVERY 100 HOURS.



SERVICE EVERY 500 HOURS.

Symbol denotes servicing interval. Number within symbol refers to item to be serviced as shown in adjoining specifications.

Care of the Airplane

For convenience, the items below are segregated into servicing intervals; that is, all items which must be checked or serviced daily are listed, then items requiring 25 hour service are listed etc. The numbered symbol at each item refers to the item as shown in the Servicing Diagram.



DAILY

- ③ **FUEL TANK SUMP DRAIN:**
Drain before first flight each day, and after each refueling.
- ④ **FUEL TANK FILLER:**
Service after each flight. Keep full to retard condensation in tanks.
- ⑥ **ENGINE OIL DIPSTICK AND FILLER CAP:**
Check on preflight and add oil as necessary. Do not operate on less than 9 quarts and fill if an extended flight is planned. The oil capacity is 12 quarts.
- ⑦ **FUEL STRAINER DRAIN:**
Pull handle to drain strainer of about two ounces of fuel before first flight each day and after refueling.
- ⑩ **OXYGEN CYLINDER:**
Check oxygen pressure gage for anticipated requirement before each flight. If no pressure is indicated, check that oxygen cylinder shut-off valve is turned on. Refill whenever pressure drops below 300 PSI. Maximum pressure, 1800 PSI.



25 HOURS

- ② **BATTERY:**
Check electrolyte level every 25 hours (or at least every 30 days), oftener in hot weather. Maintain level of electrolyte even with split ring at bottom of the filler holes by adding distilled water only. Do not overfill.
- ⑤ **INDUCTION AIR FILTER:**
Service every 25 hours, oftener under dusty conditions. Extremely dusty conditions may require daily servicing. Follow instructions stamped on filter frame.

- 9** OIL SUMP DRAIN AND OIL SCREEN:
Change oil and remove and clean screen every 25 hours. Change engine oil at least every four months even though less than 25 hours have accumulated. Reduce these periods for prolonged operation in dusty areas, in cold climates where sludging conditions exist, or where short flights and long idle periods are encountered which cause sludging conditions. Always change oil whenever oil on dipstick appears dirty.
- 14** SHIMMY DAMPENER:
Check fluid level every 25 hours; replenish fluid as necessary.
- 17** DE-ICE RESERVOIR:
Check and refill every 25 hours. Check on preflight if icing is anticipated.



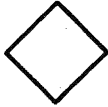
100 HOURS

- 8** PROPELLER:
Grease Hartzell propeller every 100 hours. To prevent entrapping air and high pressure, remove grease fittings adjacent to fitting being greased. Fill each fitting until grease oozes from adjacent fitting hole. Add equal amounts of grease at each clamp to retain propeller balance. Refer to service manual or see your Cessna Dealer for a list of approved grease for Hartzell propellers. McCauley propeller mechanism is sealed and does not require lubrication between overhauls.
- 11** BRAKE MASTER CYLINDERS:
Check fluid level in reservoirs, refill as needed through plugs on cylinder heads.
- 15** VACUUM PUMP AND BREATHER LINE OIL SEPARATOR:
Remove separators flush with Stoddard solvent (Fed. Spec. P-S-661), then dry with compressed air and reinstall.
- 16** FUEL LINE DRAIN PLUGS:
Drain every 100 hours, or whenever water or sediment is found in the strainer. Remove right wing root fairing for access.
- 18** GYRO INSTRUMENTS AIR FILTER:
Replace every 100 hours and when erratic or sluggish responses are noted with normal suction gage readings.

19

SUCTION RELIEF VALVES:

Check suction relief valves breather for dirt or obstructions if suction gage readings appear high. Remove breather and clean with compressed air or wash with Stoddard solvent (Fed. Spec. P-S-661) and reinstall.



500 HOURS

12

SHOCK STRUTS:

Follow filling instructions on strut placard.



AS REQUIRED

1

EXTERNAL POWER RECEPTACLE:

Connect to 24-volt, DC, negative-ground power unit.

13

TIRES:

Maintain 24 PSI pressure in nosewheel, 60 PSI pressure in main wheels. Wash off oil and grease with soap and water.



Operational Data

The OPERATIONAL DATA shown on the following pages are compiled from actual tests with the airplane and engines in good condition, and using average piloting technique and normal lean mixture. This data, when used in conjunction with the "Power, Fuel and Endurance Computer" furnished with your airplane will prove to be a valuable aid when planning your flights. The data will duplicate the information found on the computer; however, the information presented here in tabular form may prove more valuable for quick reference. Inasmuch as the number of variables involved precludes great accuracy, an ample fuel reserve should be provided. The charts make no allowance for wind, navigational error, pilot technique, warm-up, take-off, climb, etc. All of these factors must be considered when estimating fuel reserve.

To realize the maximum usefulness from your airplane, take advantage of the power your engines can develop. For normal cruising, choose a cruising power setting which gives you a fast cruising speed. If your destination is over 700 miles, it may pay you to fly at lower power settings, thereby increasing your range and allowing you to make the trip non-stop with ample fuel reserve. Use the range charts to solve flight planning problems of this nature.

Operational Data

AIRSPED CORRECTION TABLE					
Flaps 0°		Flaps 15°*		Flaps 45°**	
IAS, MPH	CAS, MPH	IAS, MPH	CAS, MPH	IAS, MPH	CAS, MPH
80	82	70	76	70	74
100	101	80	84	80	82
120	120	90	93	90	90
140	139	100	102	100	99
160	159	110	111	110	108
180	179	120	121	120	118
200	200	130	130	130	128
220	220	140	139	140	138
240	240	150	149		
		160	159		

* Maximum Flap Speed 160 MPH (15°) ** Maximum Flap Speed 140 MPH (45°)

STALL SPEED CHART								
MPH								
5100 POUNDS GROSS WEIGHT, IDLE POWER								
CONFIGURATION	ANGLE OF BANK							
	0°		20°		40°		60°	
	IAS	CAS	IAS	CAS	IAS	CAS	IAS	CAS
Gear and Flaps Up	86	88	89	91	99	100	124	124
Gear Down and Flaps 15°	78	82	80	84	91	94	115	116
Gear Down and Flaps 45°	75	79	80	81	90	90	114	112

TAKE-OFF PERFORMANCE**TAKE-OFF DISTANCE WITH 15° FLAPS FROM HARD SURFACE RUNWAY**

GROSS WEIGHT POUNDS	IAS at Obstacle	Head Wind MPH	At Sea Level and 59°F		At 2500 Ft. and 50°F		At 5000 Ft. and 41°F		At 7500 Ft. and 32°F	
			Ground Run	Total Distance over 50 Foot Obstacle	Ground Run	Total Distance over 50 Foot Obstacle	Ground Run	Total Distance over 50 Foot Obstacle	Ground Run	Total Distance over 50 Foot Obstacle
4300 ⁰	84	0	625	1170	740	1310	880	1490	1065	1735
		15	420	870	510	985	615	1120	760	1320
		30	255	610	320	695	400	800	500	950
4700	87	0	750	1335	900	1515	1075	1745	1310	2085
		15	520	1000	630	1140	765	1330	940	1600
		30	325	705	410	815	500	960	640	1170
5100	90	0	920	1545	1100	1790	1330	2130	1620	2640
		15	630	1180	790	1360	980	1620	1190	2020
		30	410	840	510	960	650	1190	825	1510

NOTE: INCREASE DISTANCE 10% FOR EACH 25°F ABOVE STANDARD TEMPERATURE FOR PARTICULAR ALTITUDE.

LANDING CHART

GROSS WEIGHT POUNDS	Approach Speed At 50' -IAS	Distance Feet	Sea Level 59°F	2500' 50°F	5000' 41°F	7500' 32°F
4300	83	Ground Roll	580	620	660	700
		Total Distance Over 50' Obstacle	1620	1730	1835	1950
4700	89	Ground Roll	630	660	720	760
		Total Distance Over 50' Obstacle	1750	1865	1990	2110
5100	100	Ground Roll	690	720	780	825
		Total Distance Over 50' Obstacle	1900	2020	2160	2270

NOTE: WING FLAPS 45°, POWER OFF, HARD SURFACE RUNWAY, ZERO WIND. REDUCE LANDING DISTANCE 10% FOR EACH 6 MPH HEADWIND.

Operational Data

TWIN ENGINE CLIMB DATA

Gross Weight Pounds	At Sea Level and 59° F			At 5000 Ft and 41° F			At 10,000 Ft and 23° F			At 15,000 Ft and 5° F			At 20,000 Ft and -12° F		
	Best Climb IAS mph	Rate of Climb Ft/Min	Gal. Fuel Used	Best Climb IAS mph	Rate of Climb Ft/Min	From S. L. Fuel Used	Best Climb IAS mph	Rate of Climb Ft/Min	From S. L. Fuel Used	Best Climb IAS mph	Rate of Climb Ft/Min	From S. L. Fuel Used	Best Climb IAS mph	Rate of Climb Ft/Min	From S. L. Fuel Used
4300	118	2105	4.0	113	1685	5.9	109	1260	8.2	104	840	10.9	100	420	15.2
4700	123	1900	4.0	119	1500	6.1	115	1100	8.7	110	700	11.9	106	300	16.8
5100	130	1690	4.0	125	1320	6.6	121	935	9.5	116	555	13.5	112	175	20.8

NOTE: FULL THROTTLE, 2625 RPM, MIXTURE AT RECOMMENDED LEANING SCHEDULE, FLAPS AND GEAR UP. FUEL USED INCLUDES WARM-UP AND TAKEOFF ALLOWANCE.

SINGLE ENGINE CLIMB DATA

Gross Weight Pounds	At Sea Level and 59° F		At 2500 Ft and 50° F		At 5000 Ft and 41° F		At 7500 Ft and 32° F		At 10,000 Ft and 23° F	
	Best Climb IAS mph	Rate of Climb Ft/Min	Best Climb IAS mph	Rate of Climb Ft/Min	Best Climb IAS mph	Rate of Climb Ft/Min	Best Climb IAS mph	Rate of Climb Ft/Min	Best Climb IAS mph	Rate of Climb Ft/Min
4300	114	570	112	450	111	330	109	220	108	100
4700	117	475	115	355	114	245	112	130	111	20
5100	119	380	118	260	117	160	115	45	113	-60

NOTE: FLAPS AND GEAR UP, INOPERATIVE PROPELLER FEATHERED, WING BANKED 5° TOWARD OPERATING ENGINE, FULL THROTTLE, 2625 RPM AND MIXTURE AT RECOMMENDED LEANING SCHEDULE. DECREASE RATE OF CLIMB 10 FT/MIN FOR EACH 10° F ABOVE STANDARD TEMPERATURE FOR PARTICULAR ALTITUDE.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 2,500 FT.

RPM	MP	% BHP	TAS	Total Gal./Hr.	Endurance 100 Gal.	Range 100 Gal.	Endurance 130 Gal.	Range 130 Gal.
2450	24	74	213	28.1	3.6	760	4.6	985
	23	70	207	26.3	3.8	785	4.9	1025
	22	66	202	24.9	4.0	810	5.2	1055
	21	62	196	23.3	4.3	840	5.6	1090
2300	24	68	204	25.5	3.9	800	5.1	1045
	23	64	199	24.0	4.2	825	5.4	1075
	22	60	194	22.8	4.4	850	5.7	1105
	21	57	188	21.4	4.7	880	6.1	1145
2200	23	59	192	22.3	4.5	860	5.8	1120
	22	56	187	21.2	4.7	885	6.1	1150
	21	53	182	20.1	5.0	905	6.5	1175
	20	49	176	19.0	5.3	925	6.8	1205
2100	22	52	180	19.7	5.1	915	6.6	1190
	21	49	175	18.7	5.4	935	7.0	1215
	20	45	169	17.7	5.6	955	7.3	1240
	19	42	162	16.7	6.0	970	7.8	1260
	18	39	154	15.8	6.3	975	8.2	1270
	17	36	144	14.8	6.8	970	8.8	1260

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 5100 POUNDS GROSS WEIGHT.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 5,000 FT.

RPM	MP	% BHP	TAS	Total Gal./Hr.	Endurance 100 Gal.	Range 100 Gal.	Endurance 130 Gal.	Range 130 Gal.
2450	24	77	221	29.0	3.4	760	4.5	990
	23	72	214	27.2	3.7	780	4.8	1015
	22	68	209	25.7	3.9	815	5.1	1055
	21	64	203	24.1	4.2	840	5.4	1095
2300	24	70	212	26.5	3.8	800	4.9	1040
	23	66	205	24.7	4.0	830	5.3	1080
	22	62	200	23.5	4.2	855	5.5	1110
	21	58	194	22.1	4.5	880	5.9	1145
2200	23	61	198	23.0	4.4	860	5.6	1120
	22	58	193	21.8	4.6	885	6.0	1155
	21	54	188	20.6	4.8	915	6.3	1185
	20	51	182	19.5	5.1	935	6.7	1215
2100	22	53	186	20.3	4.9	920	6.4	1195
	21	50	181	19.2	5.2	945	6.8	1225
	20	47	175	18.3	5.5	955	7.1	1245
	19	44	168	17.2	5.8	975	7.6	1270
	18	41	161	16.3	6.1	990	8.0	1285
	17	37	151	15.3	6.5	990	8.5	1285

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 5100 POUNDS GROSS WEIGHT.

Operational Data

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 7,500 FT.

RPM	MP	%BHP	TAS	Total Gal/Hr.	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	22	70	216	26.6	3.8	810	4.9	1055
	21	66	210	24.9	4.0	845	5.2	1100
	20	62	205	23.5	4.3	870	5.5	1135
	19	58	198	22.1	4.5	895	5.9	1165
2300	22	64	208	24.2	4.1	860	5.4	1115
	21	60	201	22.6	4.4	890	5.8	1155
	20	57	196	21.5	4.6	915	6.0	1190
	19	54	191	20.3	4.9	940	6.4	1220
2200	22	59	200	22.4	4.5	890	5.8	1160
	21	56	194	21.1	4.7	920	6.2	1195
	20	53	189	20.0	5.0	945	6.5	1225
	19	50	184	19.0	5.3	965	6.8	1255
2100	21	52	187	19.7	5.1	950	6.6	1235
	20	49	181	18.7	5.4	970	7.0	1260
	19	45	175	17.7	5.6	985	7.3	1285
	18	42	167	16.8	6.0	995	7.7	1295
	17	39	157	15.8	6.3	995	8.2	1295
	16	36	141	14.9	6.7	945	8.7	1230

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 5100 POUNDS GROSS WEIGHT.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 10,000 FT.

RPM	MP	% BHP	TAS	Total Gal/Hr.	Endurance 100 Gal	Range 100 Gal.	Endurance 130 Gal.	Range 130 Gal.
2450	20	64	212	24.2	4.1	875	5.4	1140
	19	60	206	22.8	4.4	905	5.7	1175
	18	56	198	21.2	4.7	935	6.1	1215
	17	52	191	19.7	5.1	970	6.6	1260
2300	20	59	203	22.1	4.5	920	5.9	1195
	19	55	197	20.9	4.8	940	6.2	1225
	18	51	191	19.7	5.1	970	6.6	1260
	17	47	182	18.3	5.5	990	7.1	1290
2200	20	54	196	20.6	4.8	950	6.3	1235
	19	51	189	19.5	5.1	970	6.7	1260
	18	48	182	18.4	5.4	990	7.1	1285
	17	44	175	17.3	5.8	1010	7.5	1310
2100	20	50	188	19.2	5.2	930	6.8	1275
	19	47	181	18.2	5.5	995	7.1	1295
	18	44	174	17.2	5.8	1010	7.6	1310
	17	40	164	16.2	6.2	1010	8.0	1315
	16	37	147	15.3	6.5	960	8.5	1245

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 5100 POUNDS GROSS WEIGHT.

Operational Data

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 15,000 FT.								
RPM	MP	% BHP	TAS	Total Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	16	51	196	19.4	5.2	1010	6.7	1315
	15	46	184	18.0	5.6	1025	7.2	1330
	14	42	170	16.7	5.8	1015	7.8	1320
2300	16	46	185	18.1	5.5	1020	7.2	1325
	15	42	170	16.7	6.0	1015	7.8	1320
2200	16	43	175	17.1	5.8	1025	7.6	1330
	15	40	151	15.6	6.4	970	8.3	1260
2100	16	40	156	16.1	6.2	970	8.1	1260

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 5100 POUNDS GROSS WEIGHT.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 20,000 FT.								
RPM	MP	% BHP	TAS	Total Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	13.5	42	151	17.2	5.8	875	7.6	1140

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 5100 POUNDS GORSS WEIGHT.



Optional Equipment Systems

This section contains a description, operating procedures, and performance data (when applicable) for the "major item" optional equipment systems in your airplane. Not all optional equipment is discussed here, rather it is those installations whose complexity and function is such that a detailed coverage is necessary for efficient utilization of the system.

DE-ICING SYSTEM.

The optional de-icing system consists of inflatable rubber de-icer boots cemented to the leading edges of the outer wing panels and horizontal stabilizers. Air for inflation of the boots is supplied by a high-pressure reservoir mounted just aft of the baggage compartment.

Fully-charged, the reservoir provides sufficient air for approximately 148 inflation cycles. A pressure gage on the back of the baggage compartment shelf is calibrated in inflation cycles, to indicate the number of cycles remaining in the reservoir.

An optional left wing light, (used to illuminate ice formations during night operation), is located on the outboard side of the left engine nacelle. The light is controlled by a switch on the upper switch panel.

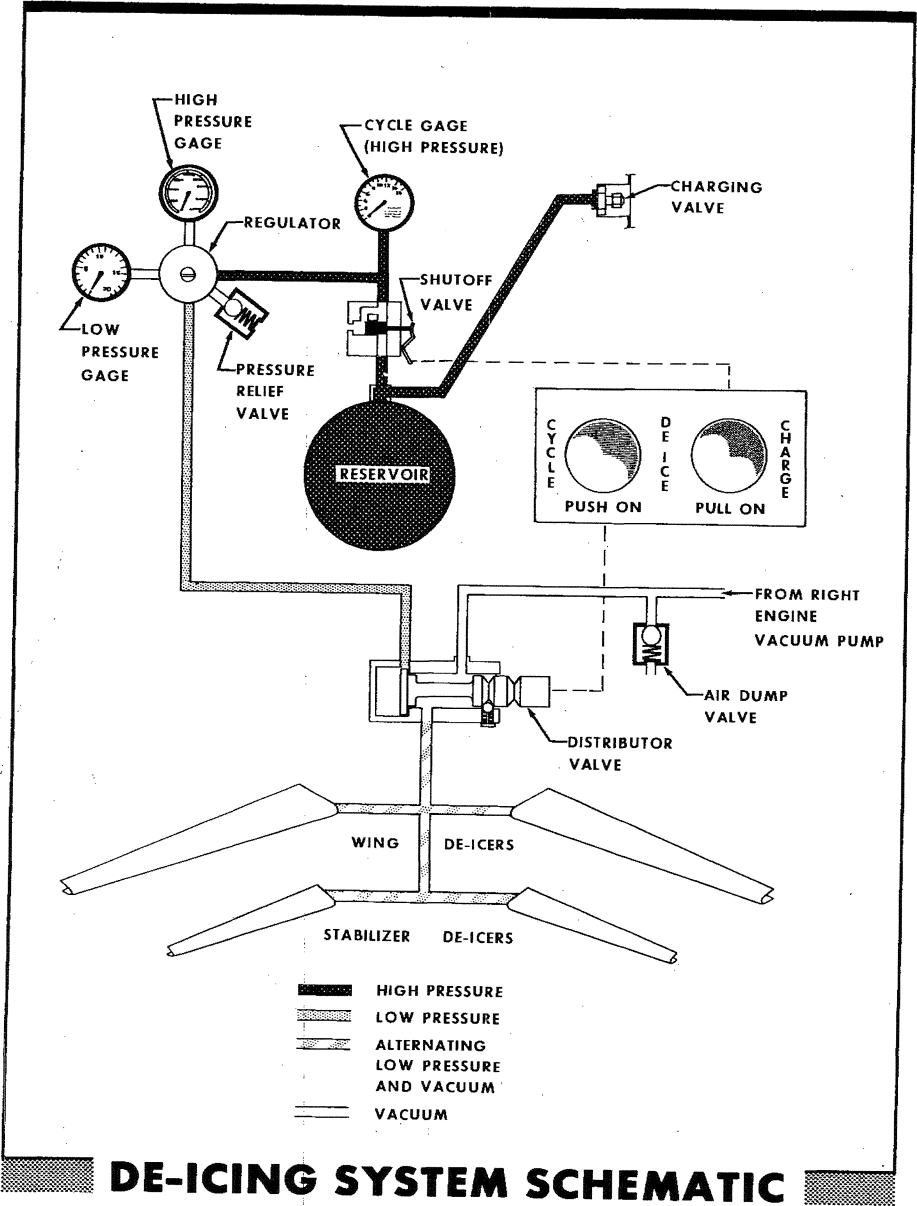
Operation of the de-icing system is entirely manual. A shutoff valve at the reservoir is operated through a flexible push-pull type control by the **CHARGE** knob on the instrument panel. The **CYCLE** knob on the instrument

panel operates the distributor valve behind the panel, through a push-pull rod. When the **CYCLE** knob is pushed in, the distributor valve directs pressure to the boots, inflating them. Then as a preset pressure is reached, the distributor valve returns to its normal position, connecting the boots to the air dump valve and to the right engine vacuum pump, which holds the deflated boots tightly against the leading edge skins. As the distributor valve returns to normal, the **CYCLE** knob pops out.

An adjustable pressure regulator on the reservoir is fitted with both reservoir and regulated pressure gages, both calibrated in psi. The reservoir is charged through a charging valve located behind an access door on the left side of the fuselage.

To increase payload during the summer, the pressure reservoir, its mount and the pressure regulator assembly may be removed as a unit by disconnecting the plumbing and

Optional Equipment Systems



DE-ICING SYSTEM SCHEMATIC

shutoff control and releasing four quick-release fasteners. The weight reduction is approximately 20 pounds.

OPERATING CHECK LIST

BEFORE ENTERING THE AIRPLANE

(1) During the exterior inspection, check the boots for tears, abrasions, and cleanliness. Have boots cleaned and major damage repaired before taking off.

(2) Check charging valve access door secured.

BEFORE STARTING ENGINES

(1) Pull out CHARGE knob, noting that the action of the control is free.

(2) Check the number of cycles remaining in the reservoir, as indicated by the gage on the back of the baggage compartment shelf. Recharge reservoir if necessary.

NOTE

The cycle gage indicates only when the CHARGE knob is pulled out.

(3) Push the CYCLE knob in and check the inflation and deflation of the boots. The CYCLE knob should pop out as deflation begins, and the deflation should be rapid.

NOTE

Deflation of the boots will not be complete with the right engine stopped, since no vacuum will be available.

(4) Push CHARGE knob in, to close the shutoff valve. Escaping air will be heard briefly as the system unloads.

STARTING ENGINES

(1) As the right engine starts, and vacuum becomes available, check the boots visually for complete deflation to the vacuum hold-down condition.

CRUISING

(1) If de-icing is required, pull out the CHARGE knob.

(2) When ice has accumulated 1/2 to 3/4 inches thick on the leading edges, push in CYCLE knob to inflate boots.

(3) Repeat the inflation cycle when ever ice accumulates.

(4) When the de-icing is no longer needed, push the CHARGE knob in.

LET DOWN

(1) Cycle the system as necessary to clear surfaces of ice, when build-up reaches 1/2 to 3/4 inch thickness.

AFTER LANDING

(1) Check boots for damage and cleanliness; remove any accumulations of engine oil or grease.

OPERATING DETAILS

CLIMB

Cycling the boots produces no adverse aerodynamic effects in any attitude within the allowable flight

Optional Equipment Systems

DE-ICING SYSTEM DURATION

RESERVOIR PRESSURE (PSIG)	CYCLES AVAILABLE	ENDURANCE*	
		HOURS	MIN.
100	4		12
200	9		27
300	14		42
400	19		57
500	24	1	12
600	29	1	27
700	34	1	42
800	39	1	57
900	44	2	12
1000	49	2	27
1100	54	2	42
1200	59	2	57
1300	64	3	12
1400	69	3	27
1500	74	3	42
1600	79	3	57
1700	83	4	9
1800	88	4	24
1900	93	4	39
2000	98	4	54
2100	103	5	9
2200	108	5	24
2300	113	5	39
2400	118	5	54
2500	123	6	9
2600	128	6	24
2700	133	6	39
2800	138	6	54
2900	143	7	9
3000	148	7	24

*Endurance calculated for a maximum icing condition and is rated at 1 cycle every 3 minutes.

limitations.

CRUISE

De-icer boots are intended to remove ice after it has accumulated, rather than preventing its formation. Continuously cycling the boots will dissipate the pressure supply prematurely and may cause the ice to grow outside the contour of the inflated boots, preventing its removal. Intermittent operation, removing the ice after it has accumulated, gives best results. (Refer to De-icing System Duration Chart on page 8-4 for the number of cycles available with various reservoir pressures and the useful duration of the system.)

NOTE

Since wing and horizontal stabilizer de-icer boots alone do not provide adequate protection for the entire airplane, known icing conditions should be avoided wherever possible and if icing is encountered, close attention should be paid to the propellers, induction systems and other components subject to icing.

EMERGENCY PROCEDURE

If the distributor valve sticks in the inflation position, the CYCLE knob may be pulled out manually. If the knob pops out again immediately when pushed in, it may be held in manually for the normal 5 to 8 second inflation interval, then released or pulled out to deflate the boots.

If the vacuum supply is lost, the

boots will not deflate completely. However, they still may be operated, and deflation will be sufficiently complete for normal de-icing. No adverse aerodynamic effects will result in any allowable maneuver with partially-deflated de-icer boots.

NOTE

With the left engine feathered, the instrument suction drops briefly as the boots deflate. With the right engine feathered the boots will not deflate to the vacuum hold-down condition. However, the normal elastic properties of the rubber boots prevents the boots from bulging due to the negative air pressure over the wing.

SERVICING

The pressure reservoir should be kept charged with oil free, dry air, nitrogen, or inert gas. Maximum pressure is 3000 psi, giving 148 cycles of the boots. Field servicing facilities normally are equipped to charge the system with 1800 to 2000 psi, giving approximately 98 cycles for a duration of slightly less than 5 hours (see De-icing System Duration Chart on page 8-4).

NOTE

Do not use oxygen or other corrosive or explosive gases in this system. These gases are both dangerous to use and detrimental to the de-icer components.

Charging pressure may be read from

Optional Equipment Systems

the gage on the reservoir by removing the left rear baggage compartment access panel, or cycle readings may be taken from the gage on the rear baggage compartment shelf. Do not exceed 3000 psi, or 148 cycles, the red line on the cycle gage.

NOTE

The charging knob must be pulled on to check reservoir pressure with either gage.

To charge the reservoir, open the charging valve access door on the left side of the fuselage. Remove the cap from the filler valve and attach the filler hose. Back off the upper hex on the filler valve (counterclockwise) to open the internal valve seal and charge the reservoir to the desired pressure. Remove the filler hose, turn the upper hex on the valve clockwise to close the internal seal and replace the valve cap.

PRESSURE REGULATOR

The pressure regulator, on the reservoir behind the baggage compartment, may be adjusted by turning the screw on the regulator body. Correct pressures are as follows:

RESERVOIR PRESSURE(PSIG)	REGULATED PRESSURE(PSIG)
3000	17.00
2500	18.00
2000	19.00
1500	20.25
1000	21.50
750	22.75
500	24.00
250	25.50

With the regulator correctly set, the boot inflation period should be 5 to 8 seconds, after which the CYCLE knob should pop out and deflation begin.

DE-ICER BOOT CARE

De-icer boots have a special, electrically-conductive coating to bleed off static charges which cause radio interference and may perforate the boots. Fueling and other servicing operations should be done carefully, to avoid damaging this conductive coat or tearing the boots.

Keep the boots clean and free from oil and grease, which swell the rubber. Wash the boots with mild soap and water, using benzol or unleaded gasoline, if necessary, to remove stubborn grease. Do not scrub the boots and be sure to wipe off all solvent before it dries.

Small tears and abrasions can be repaired temporarily without removing the boots and the conductive coating can be renewed. Your Cessna dealer has the proper materials and know-how to perform these operations correctly.

RESERVOIR REMOVAL

If the reservoir assembly is removed for the summer months, all lines should be capped to prevent contamination with dirt, and the filler valve should be tagged to indicate that the reservoir is out of the airplane. Seasonal removal of the boots is impractical since they are cemented in place.

PROPELLER DE-ICE SYSTEM

The propeller de-ice system consists of electrical heated boots on the propeller blades. Each boot consists of two heating elements "Outboard" and "inboard", which receive their electrical power through a de-ice timer. To reduce power drain and maintain propeller balance, the timer directs current to the propeller boots in cycles between boot elements and between propellers in the following cycling sequence:

Heating period No. 1. - Outboard halves - right engine blades.

Heating period No. 2. - Inboard halves - right engine blades.

Heating period No. 3. - Outboard halves - left engine blades.

Heating period No. 4. - Inboard halves - left engine blades.

Each heating period lasts for approximately 28 to 34 seconds with a one second interval between cycles, to loosen the ice and free it for removal by centrifugal force.

PROPELLER DE-ICE SWITCH

A propeller de-ice circuit breaker type switch is located on the upper switch panel. The switch has ON and OFF positions and controls operation of the propeller de-ice system. The switch also serves as a circuit breaker to protect the electrical circuits to the de-ice timer.

PROPELLER DE-ICE AMMETER

A propeller de-ice ammeter is located on the lower right hand side

of the instrument panel. The dial of the ammeter is calibrated in amperes with a range of 0 to 30 amperes. The ammeter is used to indicate current draw of the de-ice system and is a visual check on the operation of the system. When the propeller de-ice system is operating, the needle of the ammeter fluctuates between 8 and 12 amperes (green area) each time the de-icer timer directs current to a propeller, indicating normal operation. The purpose of the ammeter is to indicate when the heating elements of a propeller are not drawing the normal amount of current required to de-ice the blades uniformly.

NORMAL OPERATION

To operate the propeller de-ice system, proceed as follows:

- (1) Propeller de-ice circuit breaker - Check in.
- (2) Propeller de-ice switch - ON (up position).
- (3) Ammeter - Check

Periodic fluctuation of the propeller de-ice ammeter pointer indicates normal operation of the de-icing elements of first one propeller and then the other.

NOTE

To check all the heating elements of both propellers and the de-ice timer for normal operation, the system must be left on for approximately 2 to 2 1/2 minutes.

EMERGENCY OPERATION

Abnormal operation of the propeller

Optional Equipment Systems

ler de-ice system is indicated by the circuit breaker on the circuit breaker panel popping out or by the propeller de-ice switch tripping to the OFF position. Failure of the circuit breaker or the switch to stay reset indicates that de-icing is impossible for the propellers.

A reading below 8 amperes on the propeller de-ice ammeter indicates that the blades of the propeller are not being de-iced uniformly.

WARNING

When uneven de-icing of the propeller blades is indicated, it is imperative that the de-icing system be turned off. Uneven de-icing of the blades can result in propeller unbalance and engine failure.

OIL DILUTION SYSTEM

If your airplane is equipped with the optional oil dilution system and very low temperatures are expected, dilute the oil in each engine before stopping the engines. Determine

the dilution time required for the anticipated temperature from the Oil Dilution Table below. With the engines operating at 1000 RPM, and the auxiliary fuel pumps in the ON position press each ignition switch in while in the BOTH position for necessary length of time. Fuel will flow into the oil system of the engine receiving dilution, at the rate of 1 quart every 20 seconds. Diluting the oil in each engine for 80 seconds (4 quarts of fuel) is considered maximum.

While diluting the engine oil, watch the oil pressure closely. A slight, gradual pressure drop is to be expected as the oil is thinned. Stop the engine, however if any sharp fluctuation in pressure is observed; it may be caused by an oil screen becoming clogged with sludge washed down by the fuel.

NOTE

When the dilution system is used for the first time each season, and detergent oil is not used, the oil should be changed and the oil screens cleaned to remove sludge accumulations washed down by

OIL DILUTION TABLE			
	TEMPERATURE		
	0° F	-10° F	-20° F
Dilution Time	20sec.	50 sec.	80 sec.
Fuel Added	1qt.	2.5qt.	4 qt.
MAXIMUM SUMP CAPACITY — 16 qt. MAXIMUM FOR TAKE-OFF — 13 qt.			

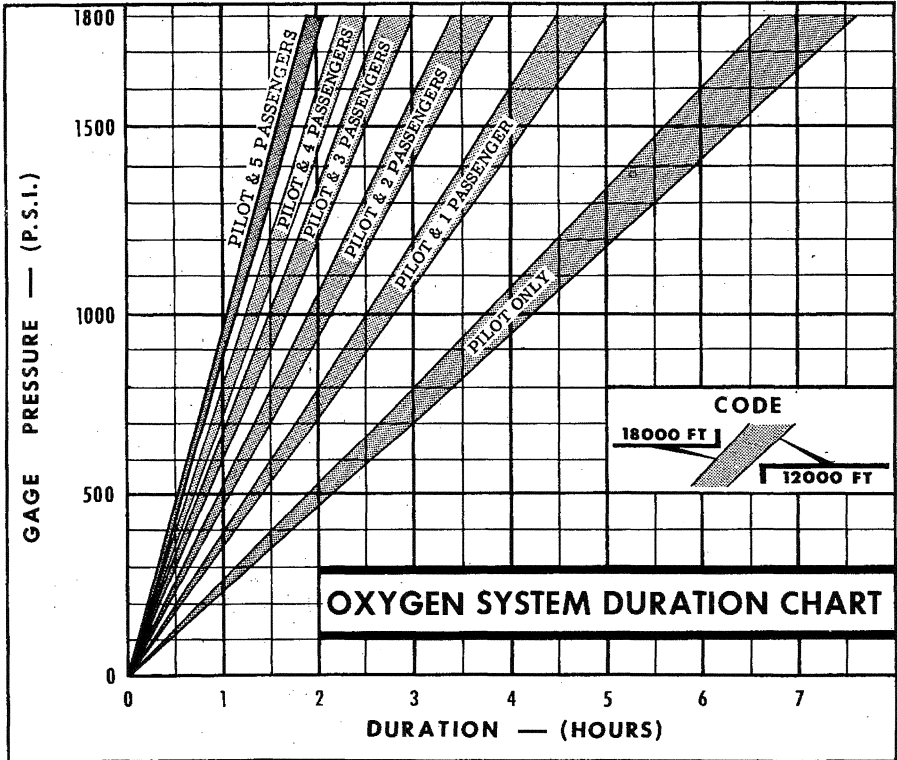
the fuel. Use the full dilution period, drain the oil, clean the screens, refill with new oil and redilute as required for the anticipated temperature before the engine has cooled completely.

On starting and warm-up after diluting the oil, again watch the oil pressure closely for an indication of sludge blocking the oil screens. If the full dilution time was used, starting with full sumps, run the engines long enough to evaporate some of the fuel and lower the sump level

to 13 quarts before take-off. Otherwise, the sumps may overflow when the airplane is nosed up for climb. To avoid progressive dilution of the oil, flights of at least an hour should be made between oil dilutions.

OXYGEN SYSTEM

The optional high pressure, continuous-flow type oxygen system will satisfy the oxygen requirements of the pilot and four passengers for over two hours, starting with a full supply



Optional Equipment Systems

cylinder. The system has automatic regulation and needs no manual adjustment for altitude or number of outlets in use.

The oxygen cylinder located in the nose, incorporates a shut-off valve which is accessible through the nose wheel well. This valve controls the oxygen supply and must be OPEN before take-off if the oxygen system is to be utilized.

Five oxygen outlets are mounted in the overhead light console. The outlet on the extreme left, marked PILOT, contains a larger orifice which delivers approximately twice as much oxygen as the other four outlets. Although intended for the pilot's use this outlet may be used by any person who desired more than the average amount of oxygen.

FACE MASKS

The face masks used with this oxygen system are of the disposable, partial-rebreathing type. They can be reused many times if marked for identification by the user, or may be thrown away after each use. Normal conversation can be carried on while wearing the masks. Each face mask receives oxygen through a rubber hose into a rebreather bag. On exhalation, the first breath exhaled (rich in oxygen, because it never reaches the lungs) passes into the bag, combining with the incoming oxygen. As soon as the bag is filled, the remainder of the exhaled breath (which is low in oxygen, because it has been in the lungs) passes to the atmosphere through the upper sides of the bag. On inhalation, the user

inhales the oxygen-enriched contents of the bag. When the bag is emptied, air is drawn through the upper sides of the bag to satisfy the inhalation volume of the user.

OXYGEN FLOW INDICATORS

An oxygen flow indicator in each face mask hose provides a visual indication that oxygen is flowing to the mask; when oxygen is flowing the indicator spring disappears. The spring is extended when oxygen is not flowing.

OXYGEN PRESSURE GAGE

An oxygen cylinder pressure gage is mounted on the right hand side of the stationary instrument panel. The gage should indicate 1800 PSI when the system is fully charged. It is marked with two green arcs: 0 to 300 PSI and 1550 to 1800 PSI. The lower green arc indicates that the system is nearly exhausted and a lower altitude not requiring oxygen should be sought. The upper green arc is the fully-charged range.

OXYGEN SYSTEM SERVICING

The oxygen cylinder is serviced through an external filler valve located just above the aft end of the nose wheel doors. The Service Requirement Table on the inside back cover lists the correct type of oxygen for refilling the cylinder.

OXYGEN SYSTEM OPERATION

The oxygen system operation is

automatic in that no manual regulation is required to compensate for changes in altitude, or to shut off the oxygen flow when the system is not in use. To operate the system, proceed as follows:

Before Flight:

- (1) Oxygen cylinder shut-off valve - Check open (valve handle rotated full counterclockwise).
- (2) Oxygen pressure gage - Check for sufficient pressure for anticipated requirements of flight (see Oxygen Duration Chart, page 8-9).

During Flight:

- (1) Mask and hose - Select from plastic bag on utility shelf. If mask and hose are not connected, attach by inserting short plastic tube on mask securely into end of rubber

hose.

- (2) Mask - Put on.

IMPORTANT

Permit no smoking when using oxygen. Oil, grease, soap and other fatty materials in contact with oxygen constitute a serious fire hazard. Be sure hands and clothing are oil-free before handling oxygen equipment.

- (3) Hose coupling - Plug in overhead console.
- (4) Oxygen flow indicator - check that indicator spring disappears when hose is inserted into coupling, to insure oxygen is flowing.
- (5) Disconnect mask hoses from overhead console panel when not in use.



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WARRANTY

The Cessna Aircraft Company warrants each new aircraft manufactured by it to be free from defects in material and workmanship under normal use and service, provided, however, that this warranty is limited to making good at the Cessna Aircraft Company's factory any part or parts thereof which shall, within six (6) months after delivery of such aircraft to the original purchaser, be returned to Cessna with transportation charges prepaid, and which upon Cessna's examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and all other obligations or liabilities on the part of Cessna, and Cessna neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale of its aircraft.

This warranty shall not apply to any aircraft which shall have been repaired or altered outside Cessna's factory in any way so as, in Cessna's judgment, to affect the aircraft's stability or reliability, or which aircraft has been subject to misuse, negligence or accident.

SERVICE REQUIREMENTS

	SPECIFICATION		QUANTITY, EACH TANK		
			U. S.	IMP.	METRIC
FUEL	Grade 100-130 Aviation Gasoline (MIL-F-5572A)		*Main 51 Gal.	*Main 42.5 Gal.	*Main 193 Liters
			*Aux. 15.5 Gal.	*Aux. 12.9 Gal.	*Aux. 58.7 Liters
ENGINE OIL	Aviation Grade Straight Mineral Oil (MIL-L-9082)***		**12 Qts.	**10 Qts.	**11.4 Liters
	Above 40° F.	SAE 50 (Grade 1100)			
	Below 40° F.	SAE 30 (Grade 1065)			
SHIMMY DAMPENER BRAKES SHOCK STRUTS	Petroleum Base Hydraulic Fluid (Red) (MIL-H-5606A)		As Required		
OXYGEN CYLINDER	Aviators Breathing Oxygen (Fed. Spec. No. BB-O-925)		As Required Max. Pressure, 1800 PSIG		

*Usable fuel, each main tank: 50 U.S. Gals. (41.6 Imp. Gals., 189.3 Liters)

Usable fuel, each auxiliary tank: 15 U.S. Gals. (12.5 Imp. Gals., 56.8 Liters)

**Minimum for adequate lubrication: 9 U.S. Qts. (7.4 Imp. Qts., 8.5 Liters)

***Detergent oil should not be used during the first 25 hours of operation of the new airplane. This will give the rings a chance to seat and will result in less oil consumption. Detergent oil conforming to Continental Motors Corporation Specification MHS-24 can then be used.

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