OFC

THERE ARE MORE CESSNAS FLYING THAN ANY OTHER MAKE

1959 CESSNA

ACROSS NATIONS

Cessna

AROUND THE WORLD

MODEL 310

OWNER'S MANUAL

WORLD'S LARGEST PRODUCER OF GENERAL AVIATION AIRCRAFT SINCE 1956

Congratulations . . .

■ You are now the owner of a truly outstanding airplane. The Cessna 310C has been engineered to give you the ultimate in performance, styling, durability, flying comfort, and economy for business or pleasure.

■ We share your pride as a Cessna owner and have prepared this Owner's Manual as a guide to acquaint you with your airplane, its equipment, operation and care.

■ Every fine possession is worth caring for, and this is especially true of your Cessna 310C. This book is dedicated to help you obtain the utmost flying enjoyment and service from your airplane with a minimum of care.

Table of Contents

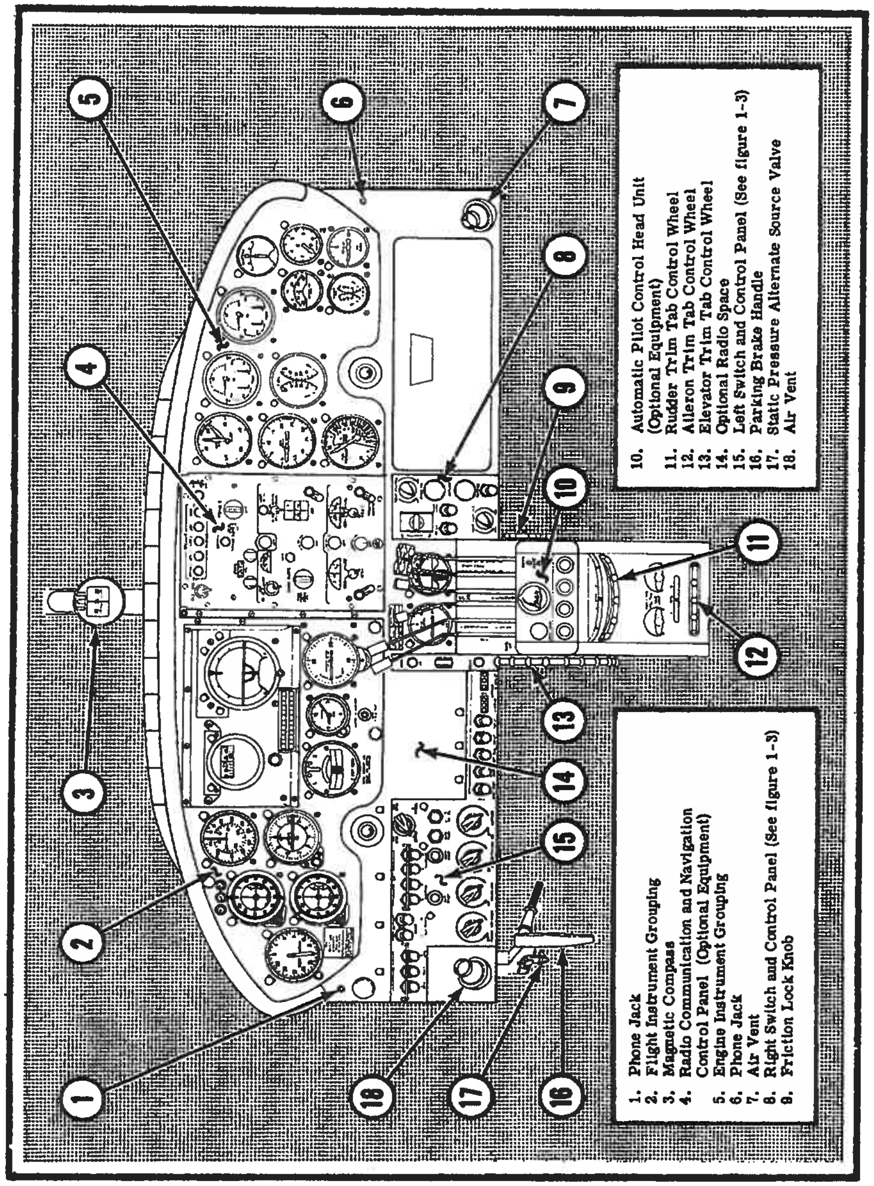


Figure 1-1. Instrument Panel and Control Pedestal

SECTION 1

Description

One of the first steps in obtaining the utmost performance, service, and flying enjoyment from your Cessna is to familiarize yourself with your airplane's equipment, systems, and controls. This section describes location, operation, and function of the various items of equipment, intentionally omitting reference to some items which are obvious.

ENGINES.

Two horizontally-opposed, six-cylinder, Continental IO-470-D engines, rated at 260 horsepower at 2625 RPM, power your 310C. The engines utilize wet sump oil systems, dual magnetos, continuous flow fuel injection, and jet-augmenter exhaust systems including mufflers.

ENGINE CONTROL PEDESTAL.

The throttles, mixture levers, and propeller pitch levers are grouped on the top of the engine control pedestal. They are readily accessible from either the pilot's or copilot's seats. Control lever selections are clearly marked between each group of controls. Numbered index marks are also provided between the mixture levers to facilitate mixture settings. A knurled friction knob (figure 1-1) is provided on the right side of the pedestal, and can be rotated to control friction pressure on the control levers to prevent creeping.

The pedestal also houses the induction air handles and trim tab control wheels, and has provisions for mounting an automatic pilot control head.

Refer to Sections II, III, and IV for further discussion of the use of engine and propeller controls under normal and emergency conditions.

INDUCTION AIR HANDLES.

In the engine air induction system of each engine (figure 1-2), air is admitted at the front of the engine cowling, flows over the engine cylinders, and enters an air intake box. When the induction air handle is pushed full

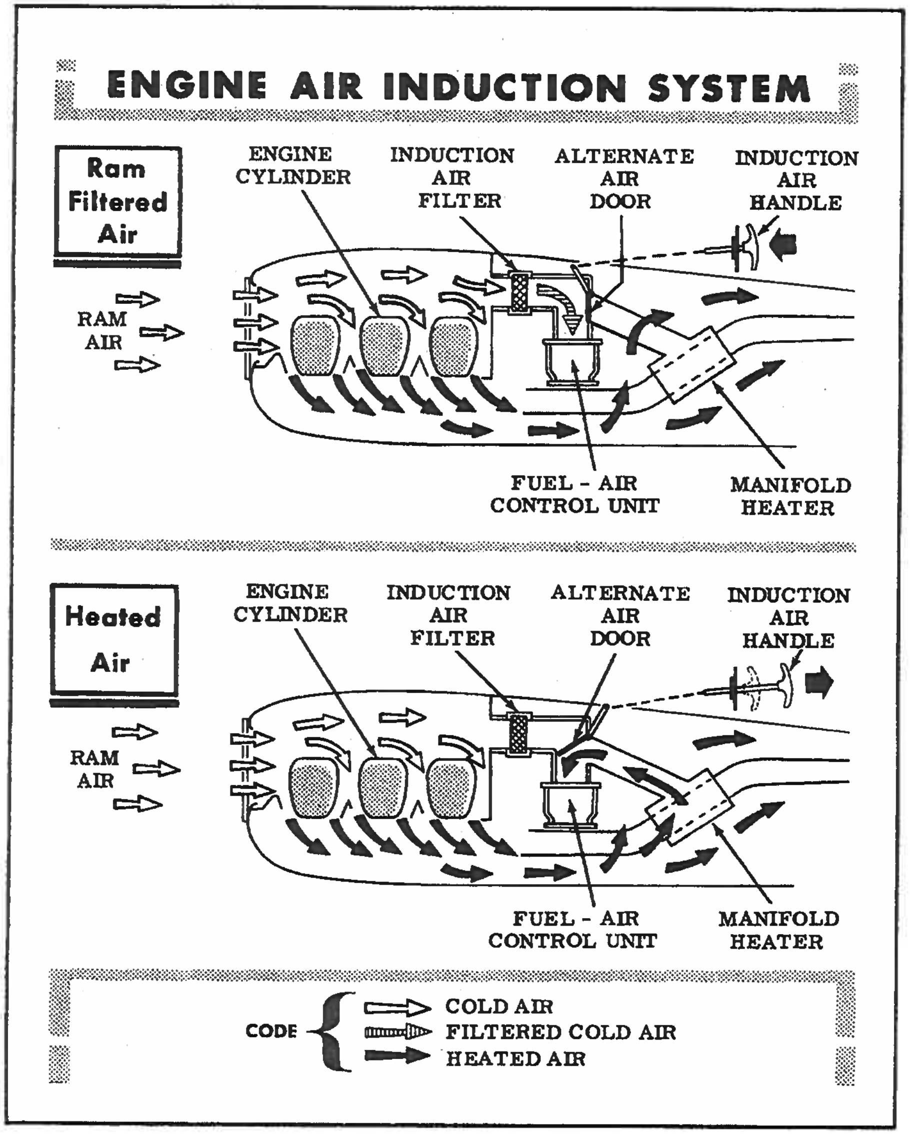


Figure 1-2.

in, this air passes through the air intake box, an air filter, and into the fuel-air control unit and intake manifolds.

Should intake system icing be encountered, as evidenced by an unexplained drop in manifold pressure, the induction air handle should be pulled full out, and locked in this position by rotating the handle. Do not use intermediate positions of the handles. Pulling the handle out mechanically operates an alternate air door in the air intake box. This door closes the passage of normal filtered airflow, and opens to a duct from an exhaust manifold heater. With the door in this position, airflow through the airbox is stopped. Induction air then circulates down through the engine cylinders, around the exhaust manifolds, and into the manifold heater chamber where it is heated. Suction created by the engine draws this heated air through the alternate air door and into the airbox and fuel-air control unit. As an added safety feature, the alternate air door is also spring-loaded, and will open automatically if the air inlet or filter should become obstructed.

IGNITION SWITCHES.

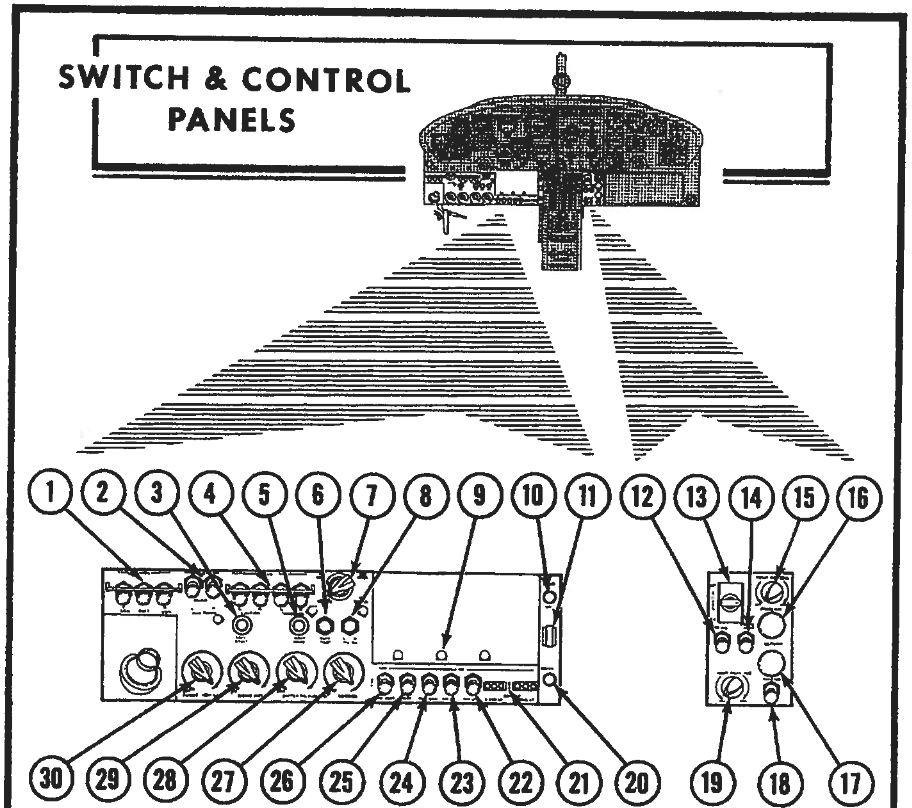
The four ignition switches (figure 1-3) control the dual-magneto ignition system on each engine. The switches have a bar mounted above them which allows them to be turned off simultaneously. The switches may also be turned off individually. All switches should be ON (up position) for normal engine operation. The left and right switches for each engine are provided for checking purposes only. All switches should be OFF (down position) when the engines are not operating.

STARTER BUTTONS.

The starter switches (figure 1-3) are push-buttons mounted in red plastic cups to prevent them from being pressed accidentally. When either starter button is pressed, a solenoid electrically connects the starter of the respective engine to the bus bar. Electrical power for energizing the starter may be supplied by the aircraft battery or an external power source. When starting the engines, the left engine should be started first. The electrical cable from the batteries to this engine is shorter and will permit more electrical power to be delivered to the starter. In the event of low batteries, the left engine should start more readily; then the left engine generator will supply additional power for starting the right engine.

ENGINE COOLING.

Engine cooling air is admitted at the front of the engine cowling and directed around the cylinders to jet-autmenter tubes. The high velocity exhaust gases are released into the jet-autmenter tubes thereby causing a



1. Battery and Generator Switches
2. Auxiliary Fuel Pump Switches
3. Left Starter Button
4. Ignition Switches
5. Right Starter Button
6. Automatic Pilot Power Switch (Opt. Equip.)
7. Vacuum Source Selector Valve Knob
8. Oil Dilution Switch (Opt. Equip.)
9. Post Type Light (Typical)
10. Landing Gear Up Position Light
11. Landing Gear Switch
12. De-Ice Switch (Opt. Equip.)
13. Wing Flaps Switch
14. Left Wing Light Switch (Opt. Equip.)
15. Cabin Air Temperature Control Knob
16. Cabin Air Knob
17. Defrost Knob
18. Propeller Anti-Ice Power Switch (Opt. Equip.)
19. Propeller Anti-Ice Rheostat (Opt. Equip.)
20. Landing Gear Down Position Light
21. Landing Lights Switches (Right Switch Opt.)
22. Taxi Light Switch (Opt. Equip.)
23. Navigation Lights Switch
24. Rotating Beacon Switch (Opt. Equip.)
25. Pitot Heat Switch
26. Cabin Heater Switch
27. Compass Light Rheostat
28. Switch Panel-Fuel Selector Light Rheostat
29. Engine Instrument Lights Rheostat
30. Flight Instrument-Radio Lights Rheostat

Figure 1-3.

pumping action which pulls cooling air around the cylinders and through all parts of the engine compartment. In this cooling system an increase in power causes a corresponding increase in "pumping action," which in conjunction with the forward speed of the airplane, increases the flow of cooling air throughout the engine compartment. This design feature eliminates the need for cowl flaps.

PROPELLERS.

The airplane is equipped with two all-metal, hydraulically-operated, constant speed, full feathering, two-bladed propellers. Propeller operation is controlled by the propeller pitch levers through a mechanical linkage to the engine-driven propeller governor on each engine.

OIL SYSTEM.

In the oil system of each engine, oil is picked up from the sump by an engine-driven oil pump, forced through an oil thermostat, oil cooler, and then through the engine and propeller governor. Oil returns to the sump by gravity flow.

Oil temperature is regulated automatically by the thermostatically controlled oil coolers. The thermostats allow oil to bypass the coolers whenever the oil temperatures are below 170° F.

The oil capacity of each engine is twelve quarts. The last six quarts of oil are considered unusable because, in an extreme nose high climb with a low oil level, it is possible to uncover the oil pick-up line resulting in low oil pressure. Oil should be added if below nine quarts, and should be full if an extended flight is planned.

The oil quantity is easily checked by opening the left rear access door on each engine nacelle, and reading the oil level on the dipstick located just aft of the rear left cylinder of each engine. The dipstick incorporates a spring lock which prevents it from working loose in flight. The dipstick is removed by rotating it until the lock is disengaged, and pulling it out. When replacing the dipstick, make sure that the spring lock is engaged.

The oil filler caps are made accessible by opening the small access door on top of each engine nacelle, and can be removed by rotating them counterclockwise. In replacing the oil filler caps, make sure that they are on firmly and turned clockwise as far as they will go.

An oil drain plug is provided on the underneath side of each engine and is accessible through an access hole in the bottom of the cowl.

OIL SPECIFICATION AND GRADE.

Refer to the Servicing Diagram (figure 6-1) for the recommended oil specification, grades, and servicing intervals.

OIL SYSTEM INSTRUMENTS.

An electrical oil temperature gage and a direct reading oil pressure gage are included in the engine gage unit for each engine. A green arc on each gage dial indicates the normal operating range. Refer to Section V for instrument markings.

OIL DILUTION SYSTEM (OPTIONAL EQUIPMENT).

To permit easier starting in extremely low temperatures, an optional oil dilution system is available. Used just before the engines are shut down, this system injects fuel into the engine oil and reduces its viscosity. When the engines are operated again, the fuel evaporates and is discharged through the engine breathers allowing the oil to resume its normal viscosity.

The oil dilution system consists of two solenoid valves, one mounted on the firewall of each engine, connected to the outlets of the fuel strainers, and to each engine crankcase at an oil passage on the suction side of the engine oil pump. The valves are opened electrically by operation of a single momentary hold-on switch (figure 1-3). The switch is labeled OIL DIL, L (left engine) and R (right engine). When the switch is held to the L and R positions with the auxiliary fuel pumps ON, the oil in each engine is diluted. When the switch is released, it automatically returns to the OFF position.

Detailed operating procedures for the oil dilution system are contained in Section III.

FUEL SYSTEMS.

STANDARD FUEL SYSTEM.

Fuel is supplied to the engines from two main fuel tanks; one located on each wing tip. From each tank, fuel is fed through an electric auxiliary fuel pump, fuel selector valve, fuel strainer, and through the engine-driven fuel pump to the fuel-air control unit. Vapor return lines from the engine-driven fuel pump return unused fuel to the main fuel tanks when the engines are running.

FUEL SPECIFICATION AND GRADE.

Refer to the Servicing Diagram (figure 6-1) for the recommended fuel specification and grade, fuel tank capacity, and fuel tank, strainer and line draining intervals.

AUXILIARY FUEL PUMP SWITCHES.

The auxiliary fuel pump switches (figure 1-3) control the fuel pumps in the main (wing tip) fuel tanks, and are labeled AUX PUMPS, L (left engine) and R (right engine). Switch positions are ON, OFF, and PRIME. The auxiliary fuel pumps have two operating speeds. They will run at slow speed when the switches are in the PRIME position. They will also run at slow speed when the switches are in the ON position and the engine-driven fuel pump is providing a pressure of 5 PSI. If the engine-driven fuel pump pressure drops below 5 PSI, an automatic fuel pressure switch for that engine will actuate and cause the auxiliary fuel pump to operate at high speed. Once the automatic fuel pressure switch has actuated, the auxiliary fuel pump for that engine will run at high speed until the auxiliary fuel pump switch is moved to the OFF position. The pump switch must be in the ON position before the automatic fuel pressure switch will operate the auxiliary fuel pump. As a safety measure, always take-off and land with the pump switches in the ON position.

NOTE

Anytime the auxiliary fuel pump switches are turned to ON or PRIME without the engines running, the mixture levers must be in the ICO (idle cut-off) position to prevent flooding the engine intake manifolds.

FUEL SELECTOR VALVE HANDLES.

Two rotary type fuel selector valve handles (one for each engine) are located on the cabin floor aft of the engine control pedestal. The selector valve handles have three positions labeled for the left engine, LEFT ENGINE OFF, LEFT MAIN and RIGHT MAIN, and for the right engine, RIGHT ENGINE OFF, RIGHT MAIN and LEFT MAIN. The fuel selector valve handle is the pointer for the fuel selector valve, and indicates the setting of the valve by its position above the selector plate.

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 operations.

FUEL QUANTITY INDICATORS.

Fuel quantity in each main tank is shown by a dual-reading fuel quantity indicator mounted on the right side of the instrument panel. The indicator is electrically operated, and with the battery switch ON, indicates in gallons the amount of fuel remaining in each main tank.

FUEL PRESSURE GAGE.

A dual-reading fuel pressure gage is mounted on the right side of the instrument panel. It is calibrated in PSI and marked for recommended pressure settings for various power requirements. The dial, marked in green, is divided into two portions. The upper portion has segments marked for various percentages of power for cruising flight. The lower part of the dial is marked to indicate recommended mixture settings for takeoff and climb power.

Refer to Section V for instrument markings.

FUEL DRAIN VALVES AND PLUGS.

A drain valve is located in the bottom of each fuel strainer, and is accessible through the small door in the bottom of each nacelle. A drain valve is also located on the underside of each main (wing tip) tank and is accessible through a small hole in the lower access plate on each tank. These valves provide a quick method of draining any water or sediment that may have collected in the fuel strainers or main tank sumps.

A special hollow handled screwdriver is stored in the glove compartment to facilitate operation of the fuel strainer and main fuel tank drain valves. The valves may be opened for small quantity fuel draining by engaging the screwdriver with the bottom of the drain valves and pushing up while rotating the screwdriver counterclockwise. Fuel will flow through the hollow handle of the screwdriver. The valves are closed by rotating the screwdriver clockwise and releasing pressure sharply, thus permitting the spring load in the valves to shut off the flow of fuel. Each valve incorporates a detent which will hold it open (when released in the full counterclockwise position) for draining a large quantity of fuel.

Two fuel line drain plugs are accessible by removing the lower right wing fairing. For drain plug and valve draining intervals, refer to the Servicing Diagram (figure 1-6).

AUXILIARY FUEL SYSTEM (OPTIONAL EQUIPMENT).

An auxiliary fuel system may be installed in addition to the standard fuel system to increase the airplane's operating range. The auxiliary system installation includes two additional fuel tanks internally mounted in the wings (one located just outboard of each engine nacelle), a four-position selector valve for each engine (each having an auxiliary tank position), a dual-reading auxiliary tank fuel quantity indicator, and interconnecting

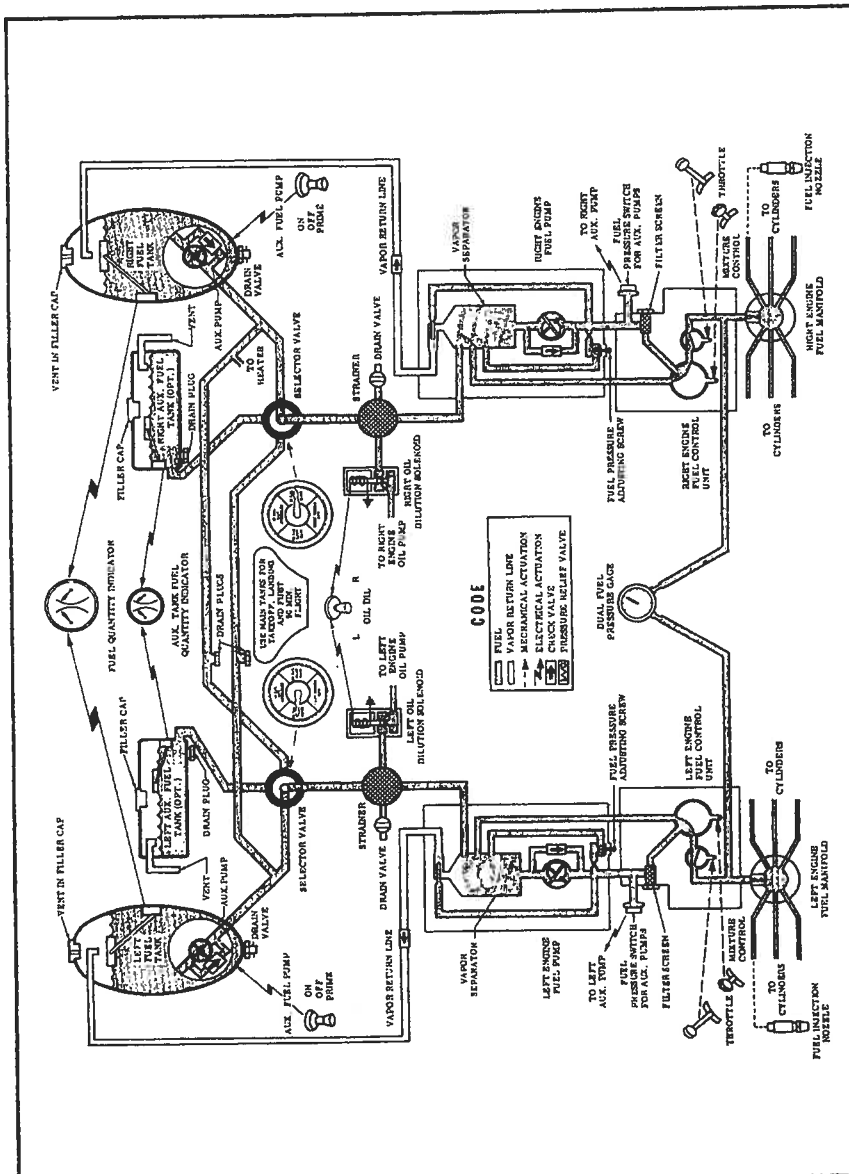


Figure 1-4. Fuel System — With Auxiliary Fuel Tanks

plumbing. Sump drain plugs are provided under each auxiliary fuel tank. The sumps should be drained when the main (wing tip) tanks sumps are drained.

Operation of the auxiliary fuel system differs from the standard system only in that an additional fuel supply selection is possible for each engine, and the auxiliary fuel pumps (in the main tanks) do not provide pressure when auxiliary fuel is being used. Fuel from each auxiliary tank is fed through the fuel selector valve, with the selector in the AUXILIARY position, through the standard fuel strainer, and engine-driven fuel pump to the fuel-air control unit. Auxiliary fuel vapor returns to the main tanks via the standard fuel vapor return lines.

NOTE

Fuel should be used from the main tanks during starting, taxiing, take-off, landing, and operation for the first 60 minutes of flight. Fuel should then be used from the auxiliary tanks until they are emptied. By using fuel from the main tanks first, adequate space will be provided to accommodate fuel returning to the main tanks via the vapor return lines from the vapor separators of the engine-driven fuel pumps when operating on the auxiliary tanks. A period of 3 to 5 seconds will be required to regain power after running the auxiliary tanks dry and switching to the main tanks. Use full rich mixture and have the auxiliary fuel pumps ON when switching fuel tanks.

ELECTRICAL POWER SUPPLY SYSTEM.

Electrical energy is supplied by a 28-volt, direct-current system, powered by two 25-amp engine-driven generators (one mounted on each engine). A 50-amp 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. An external power receptacle can be installed, as optional equipment, in the left wing under the batteries to permit the use of a battery cart for cold weather starting.

BATTERY AND GENERATOR SWITCHES.

A battery switch and two generator switches (figure 1-3) control the electrical power supply system. The switches are grouped together under a hinged bar which allows them to be switched OFF simultaneously or individually.

The separate battery and generator switches are provided as a means of checking for a malfunctioning generator circuit, and to permit such a circuit to be cut off. If a generator circuit is found to be malfunctioning

or when one engine is not running, the generator switch for the affected generator should be turned OFF. Operation should be continued on the functioning generator, using required equipment only. If for some reason both generator circuits should become malfunctioning, equipment can be operated at short intervals and for a limited amount of time on the battery circuit alone. In either case, operation for any length of time is not recommended, and 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 an optional 50-amp generator installation, two additional circuit breakers are provided 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 off, then press the circuit breaker button to reset the breaker. If this does not restore power to the circuit, it should be checked for shorts, defective parts, or loose connections. If a circuit breaker pops out a second time, do not attempt to reset the breaker, but turn off the controlling switch for that circuit and have the malfunction corrected after arriving at your destination.

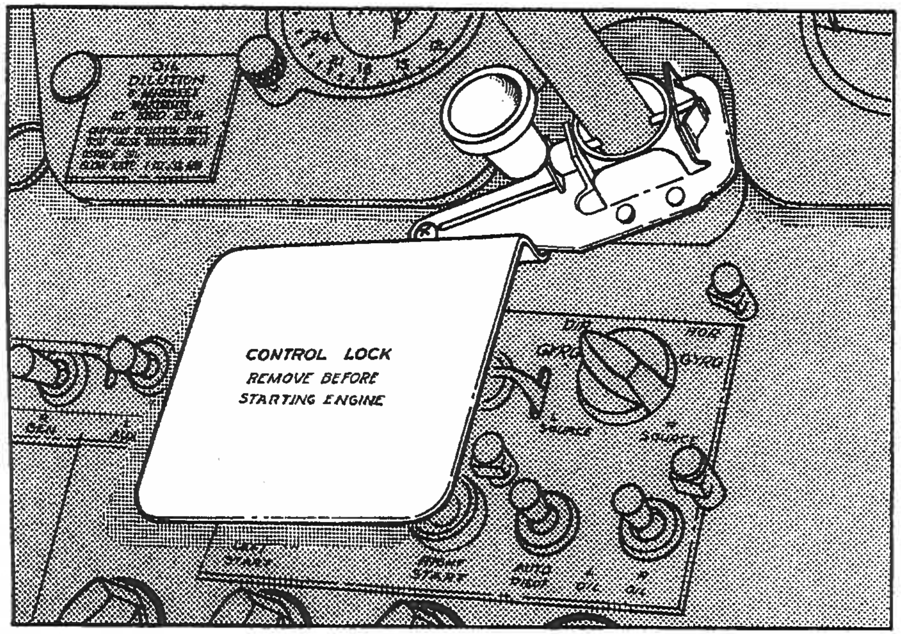
FLIGHT CONTROLS.

Conventional wheel and rudder pedal controls operate the primary flight control surfaces. (The copilot's control wheel and rudder pedals are optional equipment.) Manually-operated trim tab control wheels are provided for the rudder, elevator, and aileron trim tabs. An electrical switch operates the wing flaps.

Refer to Section II, III, and IV for further discussion of the use of flight controls under normal and emergency conditions.

CONTROLS LOCK.

The controls lock assembly is provided to secure the pilot's control column when the airplane is parked outside. The lock assembly incorporates a sliding pin that passes completely through the socket and tube of the pilot's control column. The lock assembly also has a red metal flag which, when the lock is installed, covers the ignition switches and starter buttons making it impossible to start the engines with the controls locked. To install the controls lock:



(1) Slide lock up under pilot's control tube socket.
(2) Align holes in control tube with holes in socket.
(3) Push locking pin of controls lock through aligned holes until pin engages the catch on inboard side of lock.

To remove the controls lock, pull locking pin outboard until controls lock is disengaged. Stow the controls lock in the glove compartment during flight.

TRIM TAB CONTROLS AND INDICATORS.

The aileron, elevator, and rudder trim tabs are operated by tab control wheels (figure 1-1) located on the engine control pedestal. A tab position indicator is incorporated in each system to show tab position as the control wheels are rotated. The aileron tab position indicator is labeled ROLL, with L (roll left) and R (roll right) on their respective sides. The elevator tab position indicator is labeled NOSE DOWN, NOSE UP, and TAKE-OFF. At the take-off marking, there is a small arrow which shows the most satisfactory position for the indicator during normal take-offs. The rudder tab position indicator is labeled NOSE, with L (nose left) and R (nose right) on their respective sides.

WING FLAPS SWITCH.

The wing flaps switch (figure 1-3) electrically controls the wing flaps. The UP and DOWN positions of the switch are momentary hold-on positions; the switch automatically returns to the middle (OFF) position when released. The flaps can be lowered or raised to any position between 0° and 45°, and stopped at any position by allowing the flap switch to return to the OFF position. The flaps will remain in the selected position until the switch is moved to raise or lower them. When the flaps are extended or retracted to their limits, the electric flap actuator motor is automatically turned off by limit switches.

Flap position is shown by a flap position indicator located just above the engine control pedestal. The indicator shows, in degrees, the position of the flaps.

Under normal conditions at 4830 pounds gross weight, the use of 45° flaps will lower the power-off stalling speed approximately 10 MPH (84 MPH to 74 MPH TIAS). This enables a slow, steep approach for short field landings over an obstacle. The flaps can be lowered to 15° at any airspeed below 160 MPH, and to 45° at any speed below 140 MPH, but should never be lowered above these speeds. During take-off, never use more than 15° flap setting.

LANDING GEAR SYSTEM.

The landing gear is of the fully retractable, tricycle type, incorporating a steerable nosewheel. The gear is electrically operated by an electric motor which actuates a gear box mechanism and linkage. Up and down limit switches are provided in the system to automatically stop the motor as the full up or down position is reached. An electrical landing gear switch controls the retraction and extension cycles. An automatic safety switch is provided on the left shock strut which opens the UP circuit whenever the weight of the airplane is on the strut, thus preventing accidental retraction of the landing gear on the ground.

Landing gear doors fully enclose the landing gear when retracted, and are opened by mechanical linkage when the gear is extended. A two tread assist step is also mechanically connected to the landing gear linkage, and extends down out of the fuselage when the gear extends to provide easy access to the right wing walk and cabin door. The landing gear doors, with the exception of the inboard main gear doors, remain open until the gear is retracted. The inboard main gear doors close again after the main gear is extended.

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. A handcrank is provided to extend the landing gear in case of other malfunctions in the landing gear motor.

LANDING GEAR SWITCH.

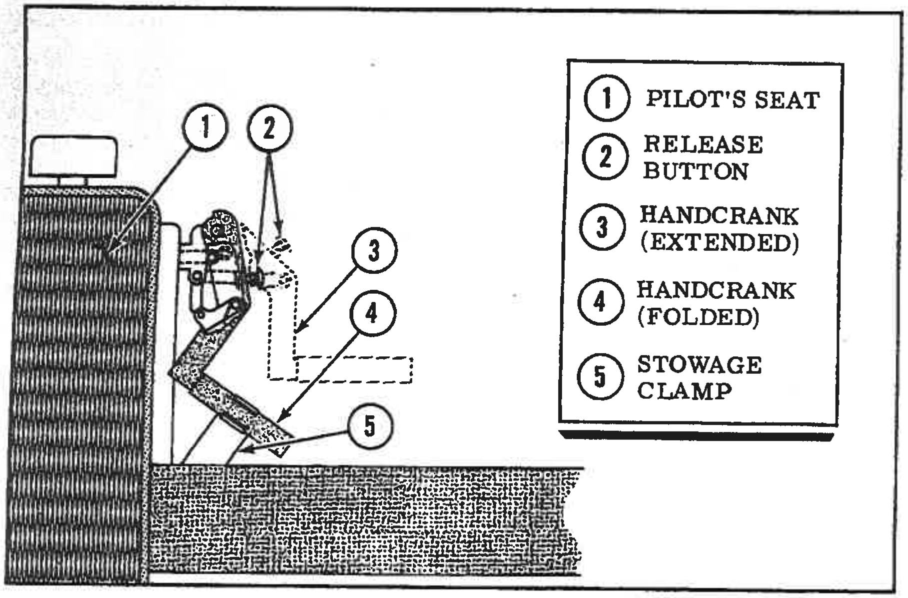
The landing gear switch (figure 1-3) can be identified by its small wheel knob. The switch knob must be pulled out before the switch is moved from one position to another. When released, the knob automatically locks in the slot of the selected position. The switch is marked GEAR, and the positions are labeled UP (to raise the landing gear), and DOWN (to lower the landing gear). A center (OFF) position, for manual lowering of the gear, is provided to disconnect the electrical circuit during cranking operation.

LANDING GEAR HANDCRANK.

A handcrank is located beside the pilot's seat. The crank is normally folded and stowed in a clip beside the seat.

NOTE

The crank must be in stowed position to operate the gear electrically.



The crank is ready for use after pulling it from its storage clip, and unfolding it until it automatically locks in the operating position. The crank is stowed by pushing the lock release button on the crank handle, folding the handle, and inserting it into the storage clip.

Refer to Section IV for the procedure to be used when manually extending the landing gear.

LANDING GEAR POSITION LIGHTS.

Two landing gear position lights (figure 1-3) are provided, one above and the other below the landing gear switch. The lights are the push-to-test type and contain shutters for dimming. 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 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 is series with three down indicator switches, one on each wheel strut. If the landing gear is not fully extended and locked, the green light will not illuminate. When neither light is on, the landing gear is in an intermediate position.

LANDING GEAR WARNING HORN.

The landing gear warning horn is controlled electrically by the throttles, and will sound if either throttle is retarded below 12 inches of manifold pressure with the gear up. A flasher unit in the horn circuit makes the horn sound intermittently. The warning horn is also electrically 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.

STEERING SYSTEM.

The nosewheel is steerable with the rudder pedals up to 15°, either right or left of center, after which it becomes free-swiveling up to a maximum deflection of 55° right or left of center. Using brakes and throttles, this deflection of 55° permits the airplane to be turned in a relatively small radius.

NOTE

Avoid locking a brake and spinning the airplane on one wheel to turn it whenever possible. This action causes tire scuffing and wear.

The steering linkage automatically disconnects from the nosewheel as the wheel is retracted, and the nosewheel is automatically straightened as it goes into the wheel well.

BRAKE SYSTEM.

The hydraulic brakes on the main wheels are conventionally operated by applying toe pressure to the pilot's or the copilot's (optional) rudder pedals. The brakes may also be set by operation of the parking brake handle (figure 1-1) which is mechanically connected to the pilot's rudder pedals. When the brake handle is pulled out, it pulls the pilot's rudder pedals down, thus applying the brakes at the main landing gear wheels. Applying foot pressure to the brake portion of the rudder pedals, as the brake handle is pulled, aids in applying the parking brakes. The parking brake mechanism has a ratchet device which holds the handle in any applied position. Turning the handle in a counterclockwise direction releases this ratchet, allowing the spring-loaded parking brake handle to retract and release the brakes.

FLIGHT INSTRUMENTS AND SYSTEMS.

PITOT-STATIC SYSTEM.

The pitot-static system provides pitot and static pressure to operate the airspeed indicator, and static pressure to operate the rate-of-climb indicator and altimeter. The system is composed of an electrically heated pitot tube mounted on the nose of the fuselage, two external static pressure ports (one located on each side of the fuselage aft of the baggage area), and the associated plumbing necessary to connect the instruments to the source.

NOTE

The static pressure openings should be kept free of polish, wax, and dirt for proper instrument operation.

STATIC PRESSURE ALTERNATE SOURCE VALVE.

A static pressure alternate source valve is installed in the static system for use when the external static sources are malfunctioning. This valve also permits drainage of condensate from the static lines. The static pressure alternate source valve is located adjacent to the parking brake handle, and is opened by pulling the valve lever aft.

Refer to Section III, paragraph COLD WEATHER OPERATION — LET-DOWN AND LANDING for additional information concerning static pressure alternate source valve operation.

PITOT HEATER SWITCH.

The pitot heater switch (figure 1-3) controls the heating elements in both the pitot tube and stall warning transmitter to maintain proper operation of the two systems during icing conditions. The pitot heater and stall warning heater circuits are protected by a single circuit breaker.

VACUUM SYSTEM.

The directional gyro and gyro horizon are vacuum operated. A suction gage, located on the right side of the instrument panel, is included in the vacuum system for checking purposes. Suction gage readings may be obtained from any of four points in the vacuum system with a manually-operated "push-to-turn" vacuum check selector valve knob (figure 1-3). The points of selection are, as marked on the left switch and control panel, DIR GYRO (directional gyro), HOR GYRO (gyro horizon), L SOURCE (left pump), and R SOURCE (right pump). The suction gage indication should be 4.75 to 5.25 inches of mercury when checking either vacuum-driven instrument. When checking the left or right source, the suction gage should indicate between 6.5 and 8.0 inches of mercury.

STALL WARNING SYSTEM.

The stall warning indicator in your airplane is an electric-horn controlled by a transmitter unit in the leading edge of the left wing. This system is in operation whenever the master switch is turned on. The transmitter responds to changes in the airflow over the leading edge of the wing as a stall is approached. Since the same changes in airflow occur with every stall, the unit functions regardless of attitude, altitude, speed, weight, and other factors which affect stalling speeds. Thus, it will warn you of an incipient stall under all conditions. In straight ahead and turning flight, the warning will come 5 to 10 MPH ahead of the stall.

The stall warning transmitter unit incorporates a heater element to prevent ice from hampering its operation. The heater element is controlled by the pitot heater switch. Both the stall warning transmitter heater element and the pitot tube heater element are protected by the same circuit breaker. The stall warning horn is protected by a separate circuit breaker.

HEATING, VENTILATING, AND DEFROSTING SYSTEM.

A cabin heating, ventilation, and windshield defrosting system 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, ducting, and ten controllable ventilating and heating outlets.

HEATING AND DEFROSTING SYSTEM.

Fresh air is picked up from the front opening in the nose of the airplane, is heated by the heater, and is ducted to the front and rear seat occupants. The heated and ventilating air is not recirculated for heater operation, but is exhausted into the slipstream through an exhaust air outlet. Heated air for the front seat occupants enters through four outlets; two registers mounted just forward of the rudder pedals, and two defroster outlets located at the base of the windshield. Heat is supplied to the rear seat passengers through two registers, one located under each of the front seats. Controls are provided to regulate cabin air temperature, and to regulate the flow of air through each cabin air outlet. The heater and ventilating fan are controlled by a toggle switch.

If, at any time during heater operation, the temperature of the heated air stream should exceed 220°F, a duct temperature limit switch, located on the heater shroud, will automatically open, and electrically shut off the fuel metering solenoid valve in the heater. With the fuel supply cut off, combustion will cease, and the heater will cool. When the heater has cooled sufficiently, the duct temperature limit switch will close, fuel will begin flowing, and the heater will automatically restart.

The cabin heater depends upon the airplane fuel system for its fuel supply. Fuel is taken from a tee in the fuel crossfeed line in the right wing. Fuel pressure is supplied by a diaphragm type fuel pump mounted on the heater assembly, therefore, the main fuel system auxiliary fuel pumps do not have to be turned on for proper heater operation.

On the ground, the cabin heating system can be utilized 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 utilized as a ventilating system 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 (figure 1-3) 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 TEMPERATURE CONTROL KNOB.

The cabin air temperature control knob (figure 1-3) is labeled TEMP

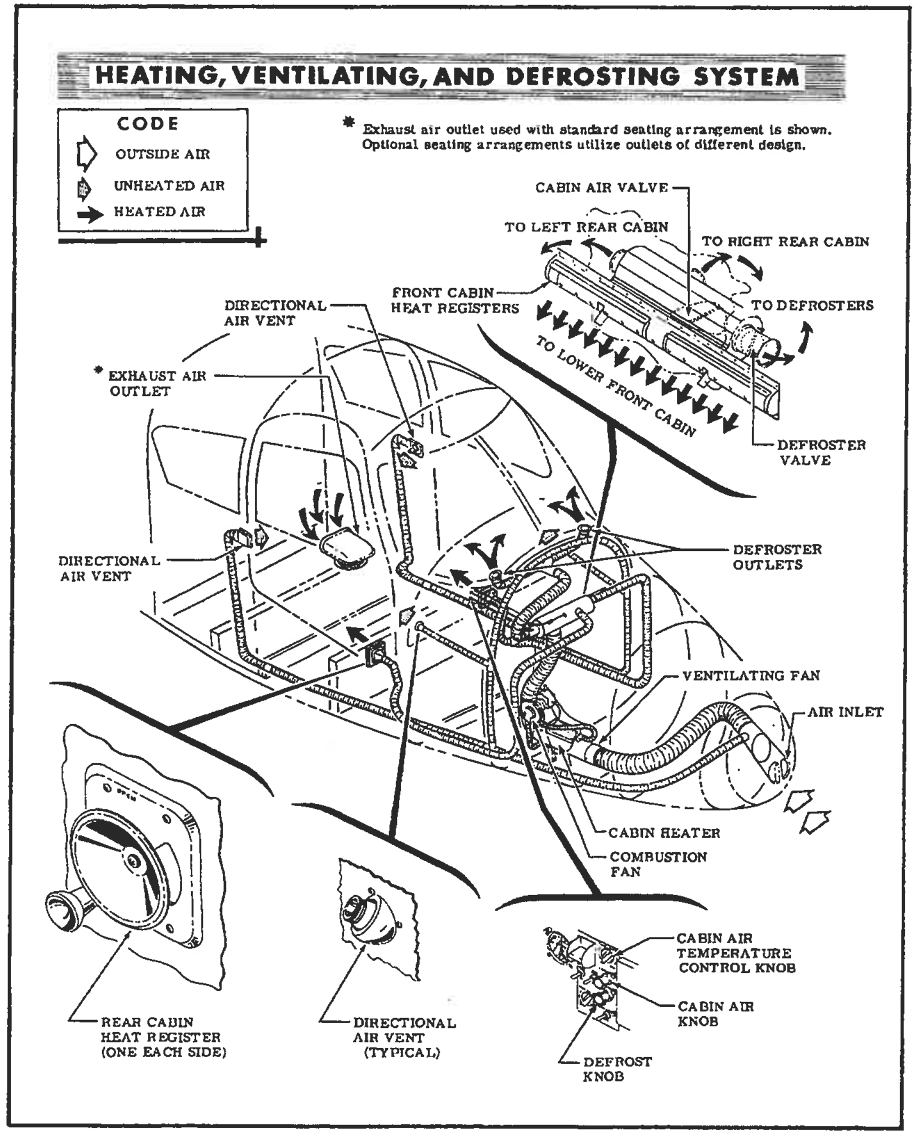


Figure 1-5.

CONTROL, OFF (counterclockwise position), and MAX (clockwise position).

Heater output is controlled by adjustment of the cabin air temperature control knob. This knob, when rotated, 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 electrically shuts off a fuel metering solenoid valve in the heater. Thus, combustion ceases and the heater is allowed to cool until the heated air temperature recedes to within the thermostat setting. The heater is therefore continuously cycling on and off to maintain an even air temperature in the heater ducts and in the cabin.

CABIN AIR KNOB.

The airflow to all cabin heat registers is controlled by operating a push-pull type cabin air knob (figure 1-3) 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.

DEFROST KNOB.

Windshield defrosting and defogging is controlled by operating a push-pull type defrost knob (figure 1-3) labeled DEFROST. When the knob is pulled out, air emits 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 quantity of air used for defrosting or defogging.

FRONT HEAT REGISTERS.

One heat register (figure 1-5) is located just forward of each set of rudder pedals to provide heated air for the pilot and front seat passenger. Each register incorporates a slide valve with a tab for toe operation. The valves are OPEN when the tabs are in the inboard position and CLOSED when the tabs are moved to the outboard position. The valves may be placed in any intermediate position to regulate the quantity of air passing through the registers.

REAR HEAT REGISTERS.

Two adjustable heat registers (figure 1-5) are located on the aft side of the front spar, and provide heat for rear seat passengers. The registers

may be adjusted by hand or foot, and are OPEN when the register control knobs are in the up position. The registers are CLOSED when the knobs are in the down position. Intermediate positions of the knobs may also be selected.

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, that it has opened the heater ignition, fuel control, combustion blower and heater fuel pump electrical circuits, and has closed the warning light circuit. This condition occurs only when the temperature of the air in the heater exceeds 325°F. The heater will not operate until a landing can be made and the overheat switch reset. The overheat switch is mounted on the aft end of the heater which is located 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 provided by the cabin heating system, a separate ventilation system obtains ram air from the air inlet at the nose of the airplane, and ducts it to four air vents. The ventilating system is operative in flight only, since it depends entirely on ram air pressure. For ground ventilation, the ventilating fan of the heating system should be utilized.

AIR VENTS.

Four manually-adjustable air vents (figure 1-5) control the amount of fresh, ventilating air entering the cabin. Two of the air vents are located on the lower corners of the instrument panel for use by the occupants of the front seats. Two additional vents are located, one on each wall, in the rear cabin compartment for use by the rear seat passengers. The volume of air is regulated by turning a knurled ring which circumscribes the air vent opening. The air vents are OPEN when the knurled ring is rotated counterclockwise, and CLOSED when rotated clockwise. Each air vent is mounted in a socket so that it can be positioned to direct air as desired.

LIGHTING EQUIPMENT.

NAVIGATION LIGHTS.

Conventional wing tip and tail navigation lights are standard equipment. A flasher is installed in the circuit, and the lights flash whenever the navigation lights switch (figure 1-3) is ON.

NOTE

> If your airplane is equipped with an optional rotating beacon, the navigation lights will change from flash to steady operation when the beacon is ON.

The wing tip navigation lights may be checked at night for operation by observing the lights through the small peep hole located in the light housing just inboard of each light.

LANDING LIGHTS.

A retractable landing light is mounted in the bottom of the left wing as standard equipment. Provision is made for an identical light under the right wing as optional equipment. Each light is controlled by a separate three-position switch (figure 1-3) labeled L LDG LT (left landing light) and R LDG LT (right landing light). Switch positions are ON, OFF, and RETRACT. When the switches are moved to ON, the landing lights extend and automatically illuminate when fully extended. When in the extended position, the lights may be turned off or on as desired by moving the switches to OFF (middle position) and ON (up position). When the switches are moved to RETRACT (down position), the landing lights will automatically go off, if on, and begin retracting. The landing lights will automatically stop when they reach the fully retracted position.

TAXI LIGHT (OPTIONAL EQUIPMENT).

An optional taxi light may be installed on the nosewheel shock strut to provide illumination of the area just forward of the airplane during night ground operation and taxiing. The taxi light switch (figure 1-3) is labeled TAXI LT.

ROTATING BEACON (OPTIONAL EQUIPMENT).

An optional rotating beacon may be installed on the top of the vertical fin. The light serves as an anti-collision light, and rotates through 360°

at all times when the rotating beacon switch is ON.

NOTE

> The rotating beacon should be turned off during flight through clouds or haze to prevent distracting glare.

The rotating beacon switch (figure 1-3) is labeled ROT BCN.

LEFT WING LIGHT (OPTIONAL EQUIPMENT).

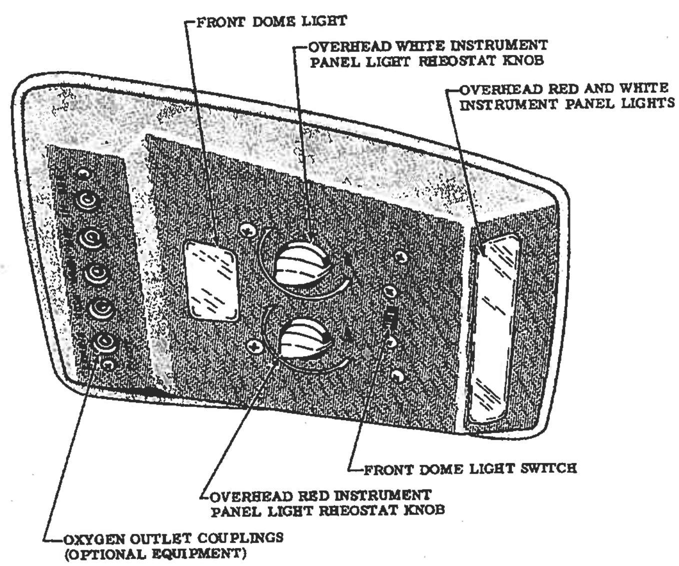
An optional light may be installed on the outboard side of the left engine nacelle to shine on the left wing leading edge. The light is especially useful on night flights during cold weather as it may be turned on to illuminate the wing leading edge so that ice formations may be observed, and corrective action taken. The light is controlled by the left wing light switch (figure 1-3) labeled L WING LIGHT.

INSTRUMENT AND RADIO CONTROL PANEL LIGHTS.

All instruments mounted on the instrument panel are illuminated by post type lights. The control panels for optional radio communication and navigation systems are illuminated by both post type and edge mounted lights depending upon the type of installation in your airplane. The instrument light circuits are controlled by two separate lighting rheostats. Lighting for all flight instruments and radio control panels is controlled by the rheostat (figure 1-3) labeled FLIGHT INST-RADIO, and lighting for all engine instruments and other system instruments is controlled by the rheostat (figure 1-3) labeled ENGINE INST. The rheostats are OFF in the extreme counterclockwise position. As the rheostat knobs are rotated clockwise, the lights are ON, and their intensity is increased. With separate instrument lighting rheostats, the pilot may reduce the intensity of all engine instrument lights, and leave only the flight instrument lights brightened, thus reducing glare to a minimum.

Additional instrument panel lighting is provided by two overhead red lights and one overhead white light mounted in the forward end of the overhead console panel on the cabin ceiling. The two overhead red instrument panel lights are controlled by the left rheostat knob located halfway back on the overhead console panel. The overhead white instrument panel light is controlled by the right rheostat knob on the overhead console panel. The lights are OFF when the knobs are rotated full counterclockwise. As the knobs are rotated clockwise, the lights are ON, and their intensity is increased. The red lights serve as an emergency source of instrument lighting in case of malfunction of the regular instrument lighting circuits. The

OVERHEAD CONSOLE PANEL



white light is extremely useful during night flights in thunderstorms as it may be turned on to reduce the glare and blinding affect of lighting flashes.

SWITCH AND CONTROL PANEL LIGHTS.

The left and right switch and control panels are illuminated by post type lights. The lights are arranged to give maximum illumination with as few lights as possible to keep glare during night operation to a minimum. The lights are controlled by a single rheostat (figure 1-3) labeled SWITCH PNL — FUEL SEL. The lights are OFF when the rheostat knob is rotated full counterclockwise. As the knob is rotated clockwise, the lights are ON, and their intensity is increased.

FUEL SELECTOR VALVE LIGHT.

The fuel selector valve handles and the lower pedestal are illuminated by a light mounted on the forward side of the front spar. The light is con-

trolled by the rheostat (figure 1-3) labeled SWITCH PNL — FUEL SEL. The light is OFF when the rheostat knob is rotated full counterclockwise. As the knob is rotated clockwise, the light is ON, and its intensity is increased.

MAGNETIC COMPASS LIGHT.

The magnetic compass, mounted on the windshield centerstrip, contains an integrally mounted light. The light is controlled by the rheostat (figure 1-3) labeled COMPASS. The light is OFF when the rheostat knob is rotated full counterclockwise. When the knob is rotated clockwise, the light is ON, and its intensity is increased.

DOME LIGHTS.

Three dome lights are mounted in the cabin ceiling to illuminate the entire cabin area. The front dome light is mounted in the overhead console panel. A second dome light is located in the middle of the cabin area. The third light serves as a dome light and baggage area light.

OXYGEN SYSTEM (OPTIONAL EQUIPMENT).

An optional oxygen system may be installed in your airplane to permit flight operations at altitudes where the atmospheric oxygen is insufficient for safe pilot and passenger consumption. The system will automatically supply the demands of a pilot and four passengers for an average of better than two hours (refer to the Oxygen Duration Chart, figure 1-6). System components include a high pressure oxygen cylinder utilizing an external filler valve, a pressure gage, automatic pressure regulator, five continuous flow couplings and connecting lines. Hoses, incorporating flow indicators, and disposable face masks are also provided. Oxygen is stored under a maximum pressure of 1800 PSI in the oxygen cylinder located just aft of the baggage area and is reduced to a breathing pressure by the preset automatic pressure regulator before being routed to the continuous flow couplings located in the overhead console panel in the cabin ceiling. Oxygen is automatically routed through the continuous flow couplings, hoses, and flow indicators to the face masks whenever the hoses are connected to the continuous flow couplings.

Refer to Section III for oxygen system operating procedures.

OXYGEN SYSTEM SERVICING.

Refer to the Servicing Diagram (figure 6-1) for the type of oxygen to be used when servicing the oxygen system.

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, including use of the microphone, 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 air exhaled (which is rich in oxygen, because it never reaches the lungs) is exhaled 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) is exhaled to the atmosphere through the upper sides of the bag. On inhalation, the user inhales the oxygen enriched contents

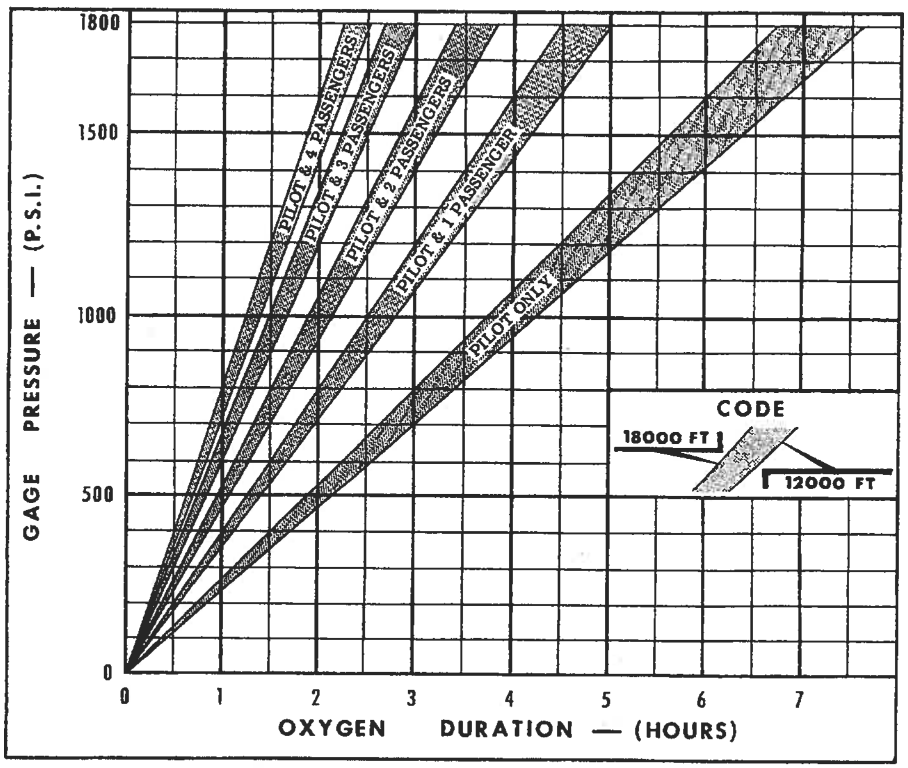


Figure 1-6. Oxygen System Duration Chart

of the bag. When the bag is emptied, air is drawn through the upper sides of the bag to finish satisfying the inhalation volume of the user.

OXYGEN FLOW INDICATORS.

An oxygen flow indicator is provided in each face mask hose. It provides a visual indication that oxygen is flowing to the mask in that a red indicator disappears when oxygen is flowing. The oxygen flow indicators operate in any position.

OXYGEN PRESSURE GAGE.

An oxygen pressure gage is centrally mounted on the aft portion of the utility shelf when the optional oxygen system is installed in your airplane. The gage indicates oxygen cylinder pressure, and should indicate 1800 PSI when the system is fully charged. The gage is marked with two green arcs; 0 to 300 PSI and 1550 to 1850 PSI. The lower green arc indicates that the system is about exhausted and a lower altitude not requiring oxygen should be sought. The upper green arc denotes the fully charged range of the system and no servicing is required.

PROPELLER ANTI-ICE SYSTEM (OPTIONAL EQUIPMENT).

An optional propeller anti-ice system may be installed in your airplane. System components include an anti-ice fluid reservoir, a pump, propeller spinner slinger rings, connecting lines, a main power switch, and a rheostat switch. The reservoir and anti-ice fluid pump are located in the right wing just outboard of the nacelle. The pump is controlled by the two-position, toggle type main power switch (figure 1-3) and the rheostat switch (figure 1-3) wired in series. Both switches are labeled PROP ANTI-ICE. In addition, index markings are provided for the rheostat switch to facilitate switch adjustment. The markings are MIN (minimum pump flow), 1/2, 3/4, and MAX (maximum pump flow), and the switch may be adjusted to any setting between these marks to adjust the speed and flow of the pump. When the pump is operating, anti-ice fluid is pumped through lines to the propeller spinner slinger rings which distribute the fluid to the propeller blades.

NOTE

The pump's maximum output (MAX position) is approximately one quart every four minutes per propeller.

Refer to Section III for propeller anti-ice system operating procedures and endurance.

PROPELLER ANTI-ICE SYSTEM SERVICING.

Refer to the Servicing Diagram (figure 6-1) for the propeller anti-ice fluid specification and reservoir capacity.

DE-ICE SYSTEM (OPTIONAL EQUIPMENT).

A de-icing system for the wings and horizontal stabilizer is available as optional equipment.

MISCELLANEOUS EQUIPMENT.

SEATING ARRANGEMENTS.

Four optional seating arrangements, in addition to the standard seating arrangement, are available for your airplane. The pilot's and copilot's seats are the same for all arrangements. The standard seating arrangement provides a three passenger rear seat with a single panel back which is adjustable to five positions. In addition to the pilot's and copilot's seats, the four optional seating arrangements consist of the following: (1) two reclining rear seats, (2) two adjustable rear seats, just like the pilot's and copilot's seats, (3) one adjustable rear seat on the right side and a lounge on the left side behind the pilot's seat, (4) two adjustable rear seats plus a non-adjustable seat located in the left, aft end of the cabin.

The lounge, adjustable rear seats and the non-adjustable aft seat are attached to the cabin floor with "Wedjit" assemblies which permit them to be removed or installed quickly and easily. To remove a seat or lounge, twist the slotted bolt in the "Wedjit" assembly 90° and lift the seat or lounge from the floor.

To install a seat or lounge, position the attachment points above the "Wedjit" assemblies and push down until each attachment point is securely latched.

PILOT'S AND COPILOT'S SEATS.

The pilot's and copilot's seats are adjustable fore and aft and have three reclining positions. Handles on the lower front of each seat are provided to control adjustments. To move a seat forward or back, pull the left handle up and slide the seat to the desired position, then release the handle and slide the seat to the nearest locking position. To change the seat angle, pull up on the right handle, lean forward or back to the desired position and release the handle. The seat backs fold forward to provide clearance for loading the rear seats. To enter the pilot's seat, step behind the copilot's seat, then through the aisle between the seats.

THREE PASSENGER REAR SEAT.

The standard rear seat accommodates three passengers. The seat back is hinged at the bottom and may be set in any one of five positions by reaching behind the center top of the seat back, pulling on the adjustment handle, and moving the seat back to the desired position. To gain access to the baggage area from within the cabin, pull the adjustment handle forward and fold the back of the seat forward and down.

RECLINING REAR SEATS (OPTIONAL EQUIPMENT).

Two individual reclining rear seats with a removable center arm rest may be installed in your airplane. Each seat can be adjusted to suit the comfort of the occupant. To adjust the seat to a reclining position, press forward on the adjustment handle (located just above the seat cushion on the outside of each seat), lean backward to the position desired, and release the handle. To adjust the seat to an errect position, press the handle forward and lean forward while pushing back on the seat bottom. The reclining seats may be used to accommodate three passengers if the backs are positioned at the same angle and the center arm rest is removed. To remove or install the arm rest, simply withdraw or insert it in the mounting bracket located between the seats. If it is desirable to provide additional hip room for reclining seat passengers, the arm rests, located on each cabin wall, may be removed by pulling them up and out of their mounting brackets.

ADJUSTABLE REAR SEATS (OPTIONAL EQUIPMENT).

Adjustable seats identical to the pilot's and copilot's seats may be installed in the rear seat position of your airplane. Refer to the paragraph concerning the pilot's and copilot's seats for the adjustment procedure for these seats.

LOUNGE (OPTIONAL EQUIPMENT).

A lounge incorporating an adjustable back rest may be installed behind the pilot's seat. The lounge incorporates two safety belts and two pillows, and will accommodate two passengers sitting side-by-side. The lounge will accommodate one passenger in a prone position using a safety belt and the adjustable back rest positioned on the aft end of the lounge. The back rest is adjustable to four positions; vertical, horizontal and two intermediate positions. To adjust the back rest, pull the handle located behind the top of the back rest, move the back rest to the desired position, and release the handle.

NOTE

If a headrest is installed, it must be removed from the adjustable back before it can be lowered to the horizontal position.

HEADREST (OPTIONAL EQUIPMENT).

Headrests are available for use on the lounge and all seats except the three passenger and reclining rear seats. Headrests may be installed and adjusted by simply inserting the two support rods in the holes provided in the top of the seat backs and sliding them up or down to the desired height.

WRITING DESK (OPTIONAL EQUIPMENT).

A leaf-type writing desk, made of walnut, may be installed as an additional item on the back of the pilot's or copilot's seat or the adjustable type rear seats. To use the desk, lift the leaf and swing it to a horizontal position. When not in use, the leaf may be lifted and lowered to the stowed position, flat against the seat back.

CABIN COMPARTMENT CURTAIN (OPTIONAL EQUIPMENT).

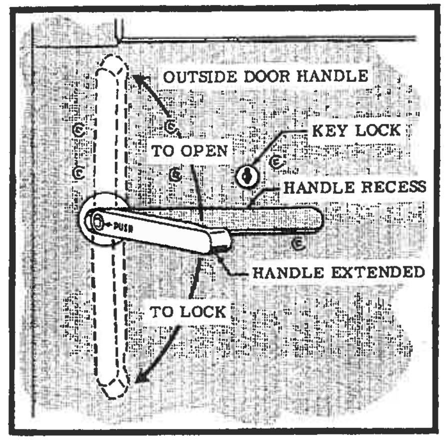
To permit use of the dome light in the passenger area without distracting the pilot, a traverse type curtain may be installed immediately behind the pilot's seats. A tieback strap is provided on the left side of the cabin to secure the curtain when it is not in use.

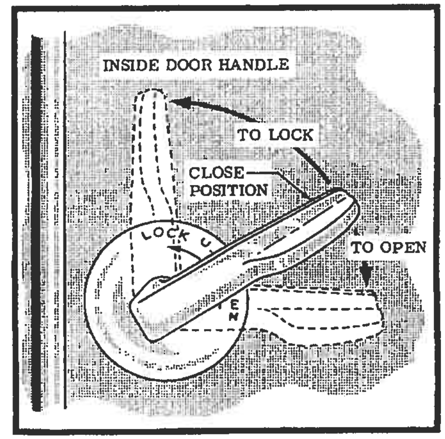
CABIN DOOR.

The large cabin door, on the right side of the airplane, has a flush-type outside door handle, a conventional inside handle, and a door stop. The window in the door does not open. The door lock located above the outside handle, is operated by inserting the same key used for the baggage door. It is unlocked by turning it approximately a half turn.

OUTSIDE DOOR HANDLE.

To operate the outside cabin door handle, first press the aft end of the handle and pull the handle out of its recess. Rotate the handle up and back to open the door. Once the door is opened, return the handle to its recess. Before closing the door from the outside, place the inside door handle in the CLOSE position. Close the door, extend the outside handle, and rotate it down and back about 1/4 turn to lock the door. Then return the handle to its recess.





INSIDE DOOR HANDLE.

To open the cabin door from the inside, pull the inside door handle back and down and push the door out until it engages the stop. To close the door, put the door handle in the CLOSE position, and pull the door closed with the armrest. Make sure the door is fully latched, then push the inside handle up and forward to LOCK.

NOTE

Make sure the door is locked before you take off. It is difficult to lock the door in flight.

EMERGENCY EXIT.

For emergency exit the left rear cabin window may be jettisoned. Pull off the plastic cover over the emergency release ring under the window. Pull the ring to release the window retainers, then push the window out.

BAGGAGE AREA.

Baggage or cargo up to 200 pounds may be stowed in the space back of the rear seat. It may be loaded from the ground through the 22 x 20 inch baggage door on the right side of the fuselage near the wing trailing edge. The door has a push-button latch and a lock operated by the key used for the cabin door.

With the standard seating arrangement, the baggage floor area is approximately 1300 square inches. There is also a small utility shelf back of the baggage area for storing small articles.

In airplanes with three individual rear seats or a single seat and lounge the baggage area is reduced to approximately one half, since the third seat and a portion of the lounge occupy that space.

CARGO TIE-DOWN LUGS (OPTIONAL EQUIPMENT).

The airplane has provisions for the installation of cargo tie-down lugs. If your airplane has a standard rear seat or reclining rear seats, an optional kit is available containing eight tie-down lugs. Four of the lugs attach to the floor of the baggage area behind the rear seats. When additional cargo space is required, the rear seats may be removed, and the four remaining lugs may be installed in the area normally occupied by the rear seats. Two of the lugs attach to the fuselage rear spar, and two attach to the floor approximately 12 inches behind the front spar.

Tie-down lugs are furnished with the seat kit if your airplane is equipped with two adjustable rear seats, an adjustable rear seat and lounge, or two adjustable rear seats and a non-adjustable seat. Six tie-down lugs are furnished with the kit containing two rear seats. The lugs may be installed in the baggage area behind the seats. Four tie-down lugs are furnished with the other two seat kits and may be installed in the baggage area behind the rear seat on the right side of the cabin. Additional cargo tie-down lugs are available as optional equipment if your airplane is equipped with the optional lounge, adjustable rear seats, and non-adjustable aft seat. These lugs fit into the "Wedjit" assemblies used to secure the seats or lounge to the floor.

COAT HANGER HOOKS.

Two coat hanger hooks are positioned on the cabin ceiling over the baggage area so that clothing may be hung up full length out of the passenger area.

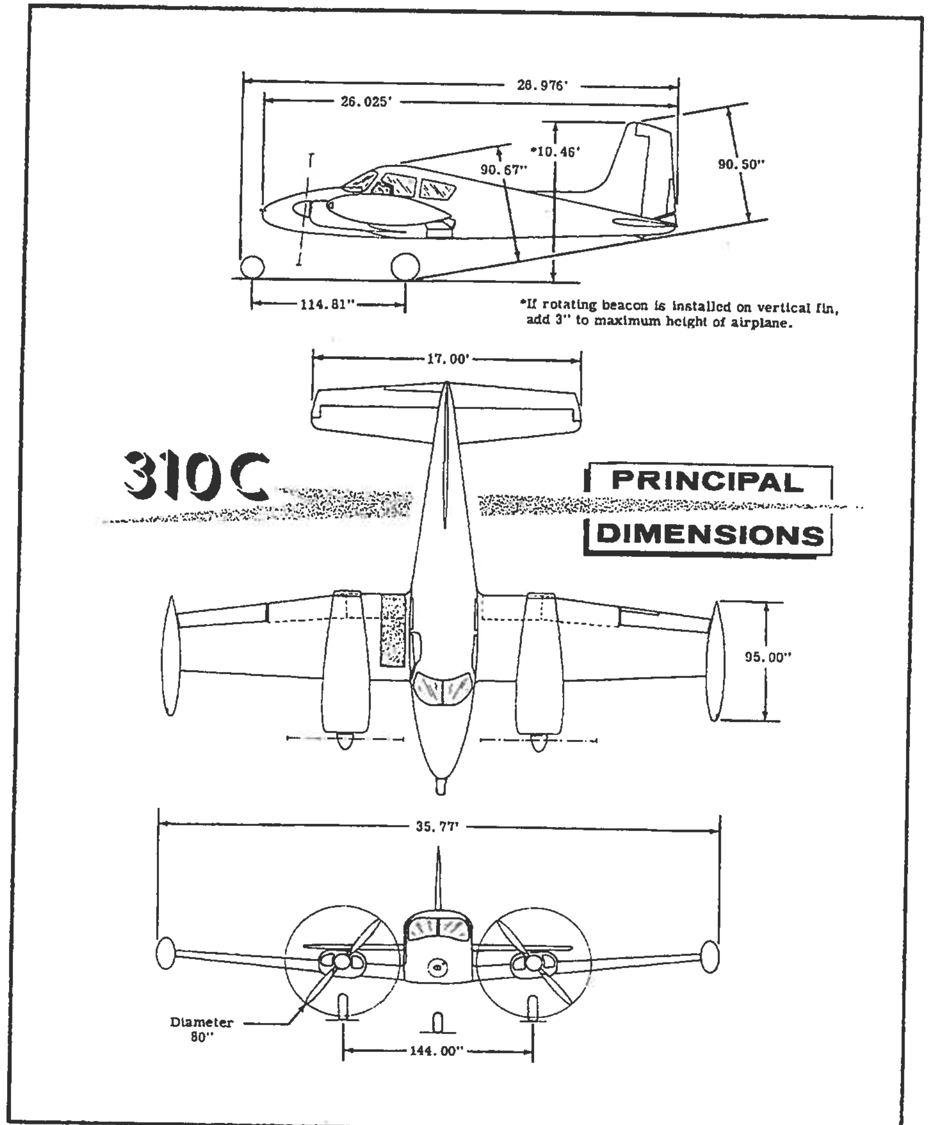
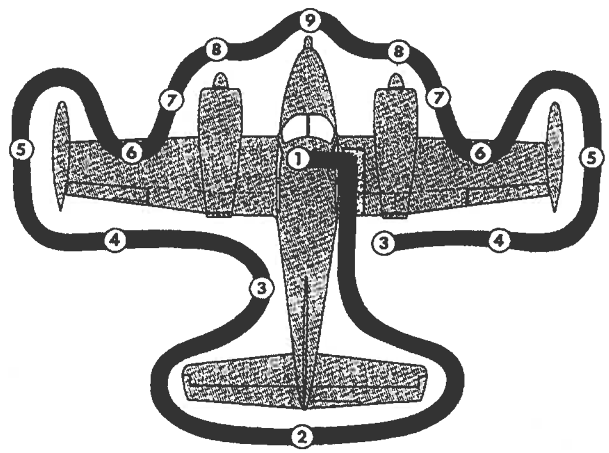


Figure 1-7.



(1) a. Remove controls lock.
b. Momentarily turn on battery switch, and check fuel quantity gages.

(2) 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.

(3) a. Check static pressure source hole for obstruction.
b. Open baggage door (right side only) and check oxygen pressure gage and make sure sufficient oxygen remains for intended flight. Check that oxygen face masks and hoses are available.
c. Close baggage door and check for security.

(4) a. Check aileron and tab hinges, and hinge and actuator rod bolts.

(5) a. Check main fuel tank filler cap and fairing cover for security.

(6) a. Check auxiliary tank filler cap and cover for security.
b. Check battery compartment cover panel for security (left side only).
c. If ice is anticipated, check fluid level in anti-ice reservoir. Check anti-ice reservoir compartment cover panel for security (right side only).
d. Check auxiliary tank vent for obstruction.
e. Check landing light for damage.
f. Remove wing tie-down.

(7) a. Check oil level. Minimum 9 quarts; fill to 12 quarts for extended flight.
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. If water is detected in fuel, drain fuel tank sumps.

(8) 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.

(9) a. Check nose gear strut and tire inflation, nose gear doors for security.
b. Check pitot tube opening for obstructions.
c. Check taxi light for damage.
d. Remove tie-down.

Repeat steps "4" through "8."

Figure 2-1. Exterior Inspection Diagram

Section II

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 airspeeds (IAS) with the exception of the Stall Speed Chart (figure 3-1) which is presented in true indicated airspeeds (TIAS). Corresponding true indicated airspeeds may be obtained from the airspeed correction table in Section VII.

BEFORE ENTERING THE AIRPLANE.

(1) Perform an exterior inspection (see figure 2-1).

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 locking pins are latched securely.

(2) Lock cabin door.
(3) Remove control lock, if used, and stow in glove compartment.
(4) Check landing gear switch "DOWN."
(5) Battery switch "ON."

NOTE

When using an external power source, do not turn battery "ON" 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, do not turn generator switches on until after engines have been 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 engine fuel selector valve handle on "LEFT MAIN," and right engine fuel selector valve handle on "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 all radio switches "OFF."
(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 and check that flashlight is available.

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) Depress starter button when fuel pressure reaches 2 to 2.5 PSI.
(8) Turn auxiliary fuel pump switch "OFF" when engine runs smoothly.

NOTE

If engine fails to start, it is probably loaded since the fuel injector tends to load easily. Repeat starting procedure with throttle open approximately 1/2, mixture lever in idle cut-off, and auxiliary fuel pump "OFF." As engine fires, move mixture lever to full rich and decrease throttle to idle position.

NOTE

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

(9) 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.
(10) Disconnect external power source - if used.

WARM-UP AND GROUND TEST (During Taxiing).

(1) Set both engines at 800 to 1000 RPM.
(2) Turn radio "ON" if required.
(3) Continue the warm-up while taxiing out to the active runway.
(4) 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.
(5) Advance throttle to 1700 RPM with control wheel neutral or forward.
(6) Check engine instruments for operation and indication.
(7) Check generator operation by turning off each generator switch individually and noting amperage.
(8) Check magnetos (125 RPM maximum allowable drop).
(9) Check induction air heat source operation by noting RPM and manifold pressure drop.
(10) Retard propeller pitch levers until engine speed drops to 1000 RPM, then advance 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.

(11) Check operation of each vacuum pump and pressure regulator through

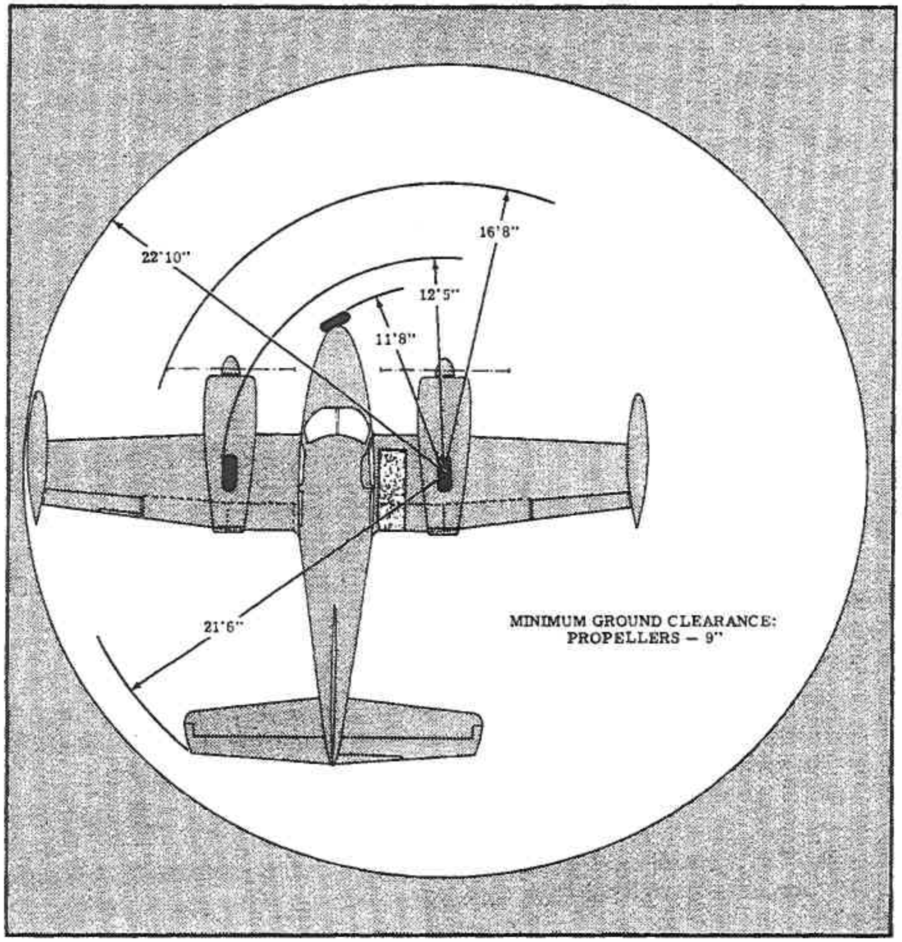


Figure 2-2. Minimum Turning Radius

use of vacuum source selector valve knob.

(12) 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 pumps "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° to 15°.
(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-out performance be desired, fuel pressure 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 approaches 82 MPH (minimum single engine control speed).
(7) After take-off, level off and accelerate to 95 MPH (minimum safe single engine speed).
(8) Apply brakes momentarily to stop wheel rotation.
(9) Retract landing gear.
(10) Accelerate to 111 MPH (best single-engine rate-of-climb speed) and climb to a safe single-engine maneuvering altitude.
(11) Accelerate to 119 MPH (best twin-engine rate-of-climb speed).
(12) Retract flaps after reaching a safe altitude and airspeed.
(13) Turn auxiliary fuel pumps "OFF" individually, checking final fuel pressure indications.

NOTE

During very hot weather, if there is an indication of vapor in the fuel system (fluctuating fuel pressure) 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 high side of cruise power fuel pressure range for economical fuel consumption in cruising climb.
(3) For maximum rate-of-climb, use full throttle and 2625 RPM at 119 MPH, decreasing climb speed to 115 MPH at 10,000 feet.
(4) The mixture should be adjusted to the low side of the take-off and climb dial range 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 to the low side of the dial range for normal operation at the desired power. Check cylinder head temperatures for abnormal change after leaning.
(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 for "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 right engine fuel selector valve handle to "RIGHT

MAIN," and the left engine fuel selector valve handle to "LEFT MAIN."
(2) Check mixture levers full forward for "FULL RICH."
(3) Turn auxiliary fuel pumps "ON."
(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 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 to 30° - 45° below 140 MPH.
(10) Approach at approximately 95 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) Park with nosewheel aligned straight ahead if possible. If gusty wind conditions prevail, caster the nosewheel to the extreme right or left position. This action will protect the rudder from wind damage.
(3) Turn auxiliary fuel pumps "OFF."
(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 control lock, if required.

Notes

Section III

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 subjected to long period storage, recent major maintenance, or operation from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the security of the flight and trim tab controls should be double checked for free and correct movement. The security of all inspection plates on the airplane should be checked following periodic inspections on the airplane. Since maintenance on the radios or heater 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 and polished it is good practice to 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 antennae. 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, it is necessary to check the nosewheel mud shield and main gear wheel wells 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 lift of the propeller blades.

Airplanes that are operated from rough fields, especially at high altitudes, are subjected to abnormal landing gear abuse. A frequent check of all components of the landing gear retracting mechanisms, shock strut and tire inflation, and brake condition is important.

If the airplane is equipped with auxiliary fuel tanks, it is necessary to check that the filler caps are tightly sealed to prevent the loss of fuel in flight. The auxiliary fuel tank vents beneath the wing should also be inspected for obstruction, 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."

Night flights and cold weather flights 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.

The use of an external power source 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, weak airplane batteries 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, they should be turned "OFF" until the engines have been started. If the generator switches are turned

"ON" before the engines have been started, it is possible for the generators to drain off part of the available current, resulting in less electrical power being available for the start.

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 is much shorter to this engine which permits more electrical power to be delivered to the starter. In the event of low batteries the left engine should start more readily.

Since the engines are equipped with a continuous flow fuel injection system, they will flood more easily than conventional lightplane engines. For this reason the starting procedure is arranged to prevent flooding or loading. For example, the auxiliary fuel pump is not operated until immediately before the engine is to be turned over. If by accident the mixture levers are in "FULL RICH" position and the auxiliary fuel pumps are on "PRIME" with the engines not turning over, fuel will flow continuously through the injector nozzles into the intake ports of the cylinder heads in proportion to the amount of throttle opening and length of time. Depending upon the time interval, it is possible to collect as much as one or two pints of solid fuel in the intake manifold. If this happens it is advisable to wait several minutes while the fuel drains through the automatic drain valves located in the intake manifold. Should the auxiliary fuel pumps inadvertently be turned to "ON," the resulting higher fuel pressure would result in even greater fuel flow.

Engine mis-starts, characterized by weak intermittent explosions followed by puffs of black smoke from the exhaust stacks, indicate over-priming or flooding. This is a typical difficulty in hot weather or hot engine starts, and the corrective action is explained in Section II. If the engine is under-primed, which is more likely in cold weather with a cold engine, repeat the starting procedure and switch fuel pumps to "ON" until the engine fires.

If serious engine starting problems persist, it is important to allow the starter motor to cool in frequent intervals since it is possible for excessive heat to damage the wiring on the starter armature.

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.

IMPORTANT

If the airplane is parked with the nosewheel castered in either direction, initial taxiing should be done with caution. To straighten the nosewheel, it is recommended that full opposite rudder and differential power be applied instead of differential braking. After several feet of forward travel, the nosewheel will steer normally.

At some time early in the taxi run, it is recommended that the brakes 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 the engine warm-up should be accomplished during taxiing. Engine speeds should not exceed 1600 RPM while the oil is cold. Taxiing should be accomplished using the minimum power setting necessary to keep the airplane moving.

Taxiing in loose gravel, or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

BEFORE TAKE-OFF.

The pilot is encouraged to 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 because he is usually distracted by other important duties at this time such as appraising the field length, reviewing engine-out emergency procedures, communicating with the tower, setting up navigation radio frequencies, and observing other traffic.

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. Since the engines are closely cowled for efficient in-flight, cooling, precautions should be taken to avoid overheating on the ground. Full throttle checks on the ground are not recommended unless the pilot has good reason to suspect that the engines are not turning up properly. Engine run-ups should not be performed over loose gravel or cinders because of possible stone damage or abrasion to the propeller tips.

If the ignition system check produces an engine speed drop in excess of 125 RPM, the warm-up should be continued a minute or two longer prior to 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 source selector valve knob to all positions. The minumum and maximum allowable suctions are

4.75 and 5.25 inches of mercury, respectively on the instruments, and 6.5 to 8.0 inches of mercury respectively on the left and right sources. The condition of the generators 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 glance to see that the top row of 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 it is important to observe full throttle engine operation early in the take-off run. Any signs of rough engine operation, unequal power between engines, or sluggish engine acceleration is good cause for discontinuing the take-off. If this occurs, the pilot is justified in making a thorough full throttle static run-up before another take-off is attempted.

Full throttle operation is recommended on take-off because it is important that a speed well above minimum single-engine control speed (82 MPH) be obtained as rapidly as possible. It is desirable to accelerate the airplane to 82 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 a high speed before take-off.

In order to obtain maximum engine power for take-off or a possible engine-out emergency during climb out, the mixture controls should be adjusted during the initial take-off roll to the low side of the dial range corresponding to the field elevation. While the performance increase obtained by leaning will be small at low altitudes, it will become greater as the field elevation increases. Consequently, this technique should always be employed when operating from field elevations greater than 5000 feet above sea level. If the pilot is familiar with typical mixture lever positions on the quadrant for best power mixture at various field elevations for his particular airplane, he 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 accelerate to a minimum safe single-engine climb speed (95 MPH) as rapidly as possible in level flight. As the airplane is accelerated still further to best single-engine rate-of-climb speed (111 MPH), it is good practice to climb rapidly to an altitude at which the airplane is capable of circling the field in a single-engine emergency in either level or drift-down flight. After obstruction height is reached, power may be reduced and climb speeds may be established as described in Section II. The landing gear should be retracted at the point over the runway where a wheels down forced landing on that runway would become impractical.

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 nosewheel as the airspeed approaches 60 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 95 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 65 and 85 MPH. The best technique is to lift-off as the airspeed approaches 80 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.

The procedure for placing the airplane in climb configuration is to retract the landing gear, adjust power for climb, retract the flaps 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.

Prior to retracting the landing gear, the toe brakes should be applied momentarily to stop wheel rotation. A rapidly rotating wheel causes the tire to "grow" due to centrifugal force. If an accumulation of mud or ice is present in the wheel well it is possible to get a rubbing action from the rotating wheel as it is retracted into the wheel well.

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 mixture should be leaned in this type of climb to give fuel pressures on the high side of the cruising power dial range 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 119 MPH at sea level to 114 MPH at 15, 000 feet. During maximum performance climbs the mixture should be leaned to give fuel pressures on the low side of the take-off and climb dial range 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 97 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 gallons of fuel for cruise, normal lean mixture, 4830 pounds gross weight, zero wind, and no fuel reserve. Allowances for warm-up, take-off, and climb (see figure 7-3), 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.

Since the main advantage 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 might save time and money to make the trip non-stop at some lower speed. An inspection of these cruising charts shows the long ranges obtainable at lower cruising speeds.

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

To achieve the level flight performance shown in the cruising charts in Section VII, the mixtures should be leaned to give fuel pressures on the low side of the cruise power dial range for the desired power. This should result in normal lean mixtures which will yield airspeeds only slightly below those available at best power mixture but with considerably lower fuel consumption and, consequently, longer range. This leaning technique offers an optimum compromise between speed and range for normal cruising flight.

Should maximum speed be desirable for short flights where range and fuel consumption are less important, the mixture should be leaned to the high side of the cruise power dial range. This will yield approximately best power mixture with a resulting airspeed of one to two MPH greater and a fuel flow approximately two gallons per hour greater than those listed in Section VII.

If maximum range is desired, the mixture should be leaned approximately one PSI below the low edge of the dial range for the power utilized. This should result in airspeeds approximately 5 MPH lower than those listed in Section VII but with an increase of approximately 150 miles in range. At normal cruise power (below 75% power), operation at maximum range mixture is not detrimental to engine life providing that the engines are running smoothly and the cylinder head temperatures are maintained within the recommended (280°F to 460°F) operating range.

It is suggested that for a given throttle setting one should select the lowest engine speed in the green arc range that will give smooth engine operation with no evidence of engine laboring.

Synchronization of the propellers for cruising is accomplished 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 noise "beat," one propeller pitch lever should be adjusted to eliminate this beat. Synchronization is simplified by limiting the adjustments to only one propeller. To avoid a slack in controls, the final movement of levers should be made in a "DECREASE RPM" direction.

In airplanes equipped with auxiliary fuel tanks, it is important to burn approximately 60 minutes of fuel from the main tanks before switching to auxiliary tanks. This is necessary to provide space for approximately 7 gallons of auxiliary tank fuel and vapor that are returned from the injectors 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 filler cap vent hole. Since part of the fuel from the auxiliary tanks is diverted back to the main tanks instead of being consumed in the engine, it is not possible to obtain the normal endurance one would expect from 15 gallons of fuel. However, this endurance is regained when this diverted fuel is used from the main tanks.

Since the auxiliary fuel tanks are designed for cruising flight, they are not equipped with auxiliary fuel pumps. Under cruising conditions,

a failure of an engine-driven fuel pump would not be critical because there would be ample time to switch to the main fuel tanks and turn the auxiliary fuel pumps "ON." However, operation near the ground using auxiliary fuel tanks is not recommended because of this limitation.

The fuel injection system employed on these engines is considered to be non-icing. In addition, the internal location of the induction air inlet should preclude the possibility of impact ice covering the intake air filter. An induction air heat system is incorporated, however, to assure satisfactory operation in the unlikely event that unusual atmospheric conditions should cause intake system icing. The induction air handle should be left in the full "cold" position for all normal operation. Should intake system icing be encountered, the handle 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 mild aerodynamic buffet which increases in severity as the

STALL SPEED CHART
MPH - TIAS
4830 POUNDS GROSS WEIGHT

Configuration	Angle of Bank 0°	20°	40°	60°
Gear and Flaps Up	84	87	96	119
Gear Down and Flaps 15°	80	83	92	113
Gear Down and Flaps 45°	74	77	85	105

Figure 3-1.

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 rudders 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 affected 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 true indicated airspeeds in Figure 3-1 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 163 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 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 with the rudder and elevator trim becoming very effective at cruising airspeeds.

LEVEL FLIGHT CHARACTERISTICS UNDER VARIOUS SPEED CONDITIONS.

The airplane flight characteristics are conventional in all respects throughout the level flight speed range. Slow flying is easily accomplished either with wing flaps up or down or landing gear up or down. No special technique is required other than to realize that the airplane is very clean and, therefore, sensitive to power adjustment.

MANEUVERING FLIGHT.

No acrobatic maneuvers are approved in this airplane. The airplane is, however, conventional in all respects throughout the maneuvering range encountered in normal flight.

DIVING.

Dives should be limited to the maximum diving airspeed (248 MPH) marked on the airspeed indicator. 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 engine warm and the cylinders clear. Since the airplane is so aerodynamically clean, it is difficult to descend rapidly without reducing the engine power to a very low power setting. 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 engine selector valves to the left and right main tanks respectively for the landing. This will allow 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), and the absence of an intermittent sound from the gear warning horn with the throttles retarded below 13 inches of manifold pressure are 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 touchdown 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 80 to 90 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 touchdown. The nosewheel 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. The airplane is crabbed into the wind in a normal approach using a minumum flap setting for the field length. Immediately before touchdown, the airplane is aligned with the flight path by applying downwind 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 of the probability of skidding the main wheels, with resulting loss of 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 pumps switches are normally turned "OFF" while taxiing to the hanger, except in extremely hot weather when auxiliary fuel pumps may be needed to maintain steady fuel pressures.

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, it is recommended that the fuel selector valve handles be turned "OFF" to preclude any possible fuel seepage that might develop through the idle cut-off valve.

NIGHT FLYING.

Before starting the engines for a night flight, sufficient interior illumination is desired to check all switches, controls, etc. Rheostats located on the left switch and control panel and on the overhead console panel should be turned "ON" and adjusted to provide the required lighting intensity. In addition, the dome lights 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 tail light. 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 if desired.

Before taxi, the interior lighting intensity is normally decreased to the point where all controls and switches are discernible. 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 electrical drain on the batteries. 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 turning the generator switches individually "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 even further for better vision outside of the airplane.

ENGINE OPERATION IN COLD WEATHER.

STARTING.

Whenever possible, external power should be utilized due to the higher cranking power required coupled with the decreased battery capacity associated with cold temperatures.

When very cold temperatures are anticipated, oil dilution should be employed prior to engine stoppage if external preheat is not available. The starting procedure is normal, although if immediate starting is not obtained, it may be necessary to switch the auxiliary fuel pumps to the "ON" position for a few seconds.

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 will also thaw the oil trapped in the oil cooler which will probably be congealed prior to starting in very cold temperatures. Engine warm-up should then be held to a minimum to prevent recongealing the oil coolers before the take-off can be completed.

WARM-UP.

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

TAKE-OFF.

Take-off procedures are normal in all respects.

CLIMB AND CRUISE.

Periodically (half-hour intervals) the propellers should be exercised to flush the cold oil from the governor and propeller hub. 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, monitor 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 airspeed 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. When making landings, with the static source valve open and the pilot's storm window closed, increase the indicated airspeed reading by 10 MPH and the indicated altitude by 30 feet. During landings, with the static source valve open and the pilot's storm window open, increase the indicated airspeed reading by 26 MPH and the indicated altitude by 160 feet.

OIL DILUTION SYSTEM OPERATION.

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

OIL DILUTION TABLE			
	TEMPERATURE		
	0° F	-10° F	-20° F
Dilution Time	2 min.	5 min.	8 min.
Fuel Added	1 qt.	2.5 qt.	4 qt.
MAXIMUM SUMP CAPACITY —— 16 qt. MAXIMUM FOR TAKE-OFF —— 13 qt.			

Figure 3-2.

stopping the engines. Determine the dilution time required for the anticipated temperature from the Oil Dilution Table (figure 3-2). With the engines operating at 1000 RPM, and the auxiliary fuel pumps in the "ON" position, hold the oil dilution switch to L (left engine) and R (right engine) for the necessary time. Fuel will flow into the oil pump of the engine receiving dilution at the rate of 1 quart every two minutes. Diluting the oil in each engine for eight minutes (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 being clogged with sludge washed down by the fuel.

NOTE

When the dilution system is used for the first time each season, it is recommended that the oil be changed and the oil screens cleaned to remove sludge accumulations washed down by 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 one hour duration should be conducted between oil dilution operations.

PROPELLER ANTI-ICE SYSTEM OPERATION.

To operate the propeller anti-ice system, proceed as follows:
(1) Anti-ice switch — "ON" (up position).
(2) Anti-ice knob — "MAX" (full clockwise position) for one minute to wet blades just before entering suspected icing conditions.
(3) Anti-ice knob — "MIN" (counterclockwise position) and note sound of ice against the fuselage.

NOTE

A slush sound against the fuselage is desired, and fluid should be added if necessary until the slushing sound is heard. Sharp bangs indicate that the ice is solid, and more fluid is required.

Under average icing conditions, the above procedure will provide approximately one-half hour of anti-icing operation before the fluid is exhausted

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 — "OPEN" (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 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) 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.

OXYGEN SYSTEM OPERATION.

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

Prior to 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, figure 1-7).

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 — Attach in place over face.

IMPORTANT

It is recommended that no smoking be permitted when using the oxygen system.

(3) Select oxygen continuous flow coupling in overhead console panel and insert fitting of mask hose into coupling.

NOTE

The extreme left coupling in the overhead console panel is labeled "PILOT," and is intended for his use. It contains a .023 diameter orifice which meters approximately double the volume of oxygen metered to the four remaining passenger couplings. The passenger couplings contain .016 diameter orifices. However, the pilot's couplings may be used for any of the passengers who desire additional oxygen.

(4) Oxygen flow indicator — Check that red indicator disappears when hose is inserted into coupling to insure that oxygen is flowing.
(5) Disconnect mask hoses from overhead console panel when not in use.

SECTION IV

Emergency Procedures

ENGINE FAILURE.

ENGINE FAILURE DURING TAKE-OFF BELOW 95 MPH.

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

NOTE

The airplane can be accelerated from a standing start to 95 MPH on the ground, and then decelerated to a stop with heavy braking within 2500 feet of the starting point of the take-off run at sea level, and within 3300 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 95 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 95 MPH.
(7) Trim tabs — Adjust for climb with airplane banked 3-5° toward operative engine.
(8) Accelerate to 111 MPH after obstacle is cleared.
(9) Flaps switch — "UP" (in small increments).
(10) Secure dead engine by turning auxiliary fuel pump switch, generator switch, ignition switches, mixture lever, fuel selector valve handle "OFF."
(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 the following recommended single-engine airspeeds is essential for safe operation of this airplane:

SINGLE-ENGINE AIRSPEED NOMENCLATURE	IAS-MPH
1. Minimum control speed	82
2. Minimum safe climb speed	95
3. Best angle-of-climb speed	95
4. Best rate-of-climb speed (flaps up)	111

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

A multi-engine airplane does not have an advantage over a single-engine airplane until the engine-out minimum control speed is reached. This speed is defined as the minimum speed at which controlled flight can be 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 82 MPH. Since this speed is so far below the optimum climb speed, it is not suitable for single-engine flight 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 95 MPH, since altitude can be maintained more easily at this speed 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 after 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 98 MPH with flaps up and 91 MPH with flaps 15° for an average single-engine altitude. For convenience, a speed of 95 MPH may be used for any flap setting between 0-15°, since it is an average speed which also is ident-

ical to the recommended minimum safe single-engine climb speed.

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 111 MPH with flaps up, and 101 MPH with flaps 15° at sea level. The flaps-up speed of 111 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 5° toward the operative engine.

Upon engine failure after reaching 95 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 this airplane accelerates through this area where the airplane is "slow and low" in just a few seconds. However, to make an intelligent decision in this type of emergency, one must consider field length, obstruction height, field elevation, air temperature, headwind, and gross weight. The flight paths illustrated in the figure below indicate that the "area of decision" is bounded by: (1) the point at which 95 MPH is reached and (2) the point where obstruction altitude is 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

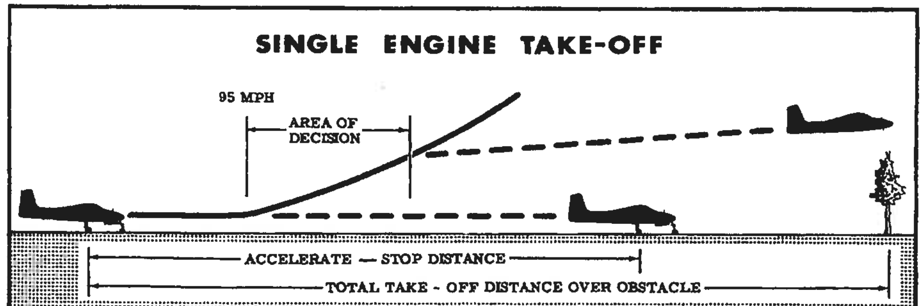


Figure 4-1.

in Section VII, may be maneuvered to a landing back at the airport. At sea level, with zero wind and 4830 pounds gross weight, the distance to accelerate to 95 MPH and stop is 2390 feet, while the total unobstructed area required to take off and climb over a 50 foot obstacle after an engine failure at 95 MPH is 5230 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 apparent that in most cases it would be better to discontinue the take-off since the accelerate stop distance is so much shorter.

Corresponding distances for a 300 foot field elevation under conditions of zero wind and 4830 pounds gross weight are 2800 feet and 6680 feet respectively. With conditions more unfavorable than these, 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 the 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) discontinuation of 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 lower 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.

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 conditions is well known. Practice should be continued until: (1) an instinctive corrective reaction is developed, and the corrective procedure is automatic, (2) airspeed, altitude, and heading can be

easily maintained 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 setting of one engine into the "IDLE CUT-OFF" position, 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 pressure to low side of dial range.
(4) Landing gear switch — "UP" (if not previously retracted).
(5) Wing flaps switch — "UP" (in small increments if not previously retracted).
(6) Climb at 111 MPH if no obstacles are ahead.
(7) Climb at 95 MPH with obstacles ahead.

NOTE

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

ENGINE FAILURE DURING FLIGHT.

(1) Throttles — "FULL FORWARD."
(2) Propeller pitch levers — "FULL INCREASE RPM."
(3) Mixture levers — Adjust fuel pressure to low side of dial range.
(4) Determine inoperative engine (idle engine same side as idle foot).
(5) Trim rudder for single-engine flight.
(6) Check fuel pressure and, if deficient, turn auxiliary fuel pump "ON."

NOTE

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

(7) Check fuel quantity and switch to opposite tank if necessary.
(8) Check oil pressure and oil temperature indications, and shut down engine if oil pressure is low.
(9) Check ignition switches.
(10) If proper corrective action was taken, engine will restart.
(11) If cause of failure was not determined, put mixture lever in "IDLE CUT-OFF."

(12) Feather inoperative propeller.
(13) Secure dead engine by turning auxiliary fuel pump switch, generator switch, ignition switches, and fuel selector valve handle "OFF."
(14) Turn electrical equipment "OFF" as required to eliminate a negative reading on the ammeter, thus preventing unnecessary battery drain.
(15) Select cruise power setting on operative engine.
(16) Trim airplane 3-5° wing low on the side of the operative engine.
(17) Land at the nearest suitable airport.

RESTARTING ENGINE IN FLIGHT (After Feathering).

(1) Check fuel selector valve handle on "MAIN."
(2) Advance throttle forward 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) Depress starter button when fuel pressure reaches 2 to 2.5 PSI.
(8) In cold weather, turn auxiliary fuel pump switch to "ON" position if required.
(9) After engine starts, turn auxiliary fuel pump switch "OFF."

NOTE

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

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

MAXIMUM GLIDE.

In the event of failure of both engines, a 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 (figure 4-2) for maximum glide data.

FORCED LANDING (Precautionary Landing With Power).

(1) Drag over selected field with flaps 15° and 95 MPH airspeed, noting type of terrain and obstructions.

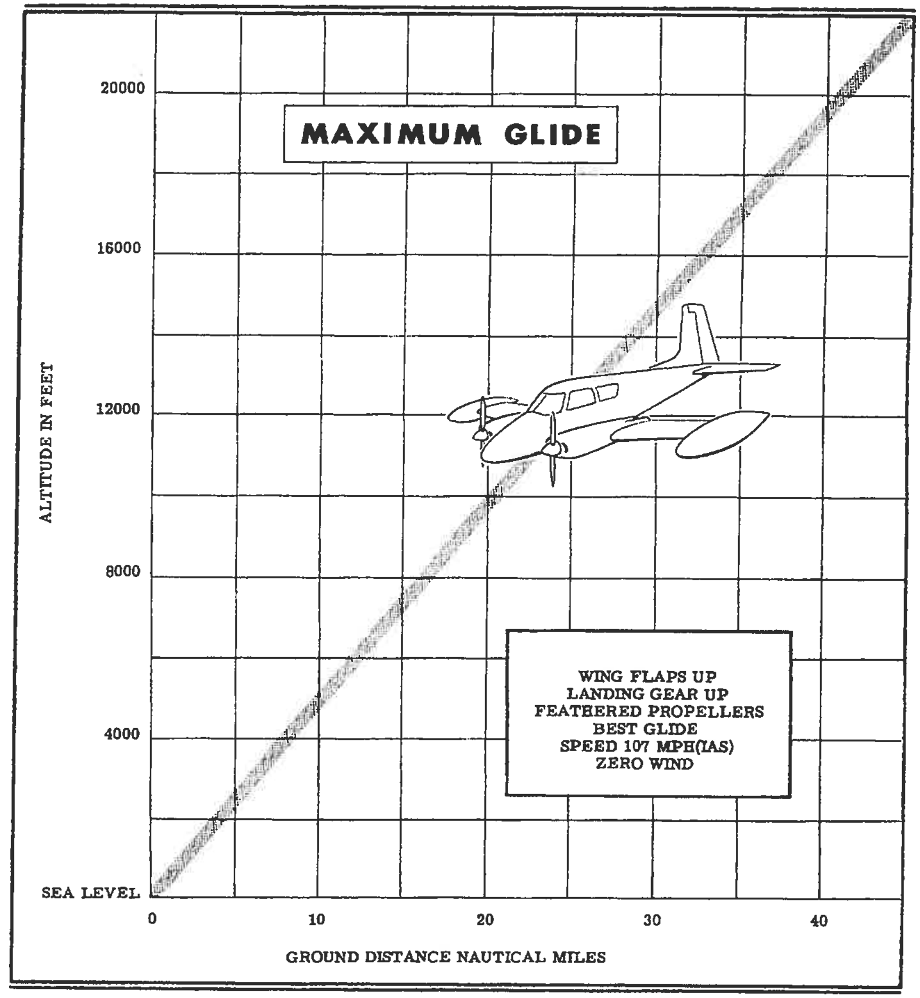


Figure 4-2.

(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 95 MPH.
- (b) Turn all switches "OFF" except ignition switches.
- (c) Unlatch cabin door prior to flare-out.

IMPORTANT

Be prepared for mild tail buffet as cabin door is opened.

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

IMPORTANT

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

- (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 handles "OFF."
(4) All switches "OFF" except battery switch.
(5) Approach at 105 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 105 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 105 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 95 MPH only if landing is a certainty.

NOTE

When speed drops below 95 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 95 MPH, apply full throttle and increase engine speed to 2625 RPM.
(2) Retract landing gear.
(3) Reduce flap setting to 15°.
(4) Climb at 111 MPH (95 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 pumps switch (on the inoperative side) to "ON." This pump will supply sufficient fuel for normal cruising flight but will require that the mixture control be advanced.

IMPORTANT

In the event that both an engine-driven fuel pump and an auxiliary fuel pump fail, fuel may be supplied to the failing engine by feeding it from the tank with the operative auxiliary fuel pump. The engine with the operative engine-driven fuel pump should be fed from the tank containing the inoperative auxiliary fuel pump. This will permit all fuel to be used from the main tanks. 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 pressure 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 need to be reset, 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) Pull upward on the seat right adjustment handle to tilt seat back for easier hand cranking.
(4) Remove hand crank from stowage clip.
(5) Extend hand crank 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 hand crank).

NOTE

During manual extension of the gear, never release the hand crank 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 upright position if desired for landing.

NOTE

The landing gear should never be retracted by use of 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 force that increases with speed. Consequently, if the door should open accidentally in flight because of insecure latching, 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 80 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, checking the door handle before take-off is important.

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. During 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 landing if in-flight time permits. However, an adequate supply of fuel should be left in this tank so that it may be utilized 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 that is opposite from defective tire allowing room for mild turn in landing roll.
(9) Land slightly wing low on side of inflated tire and lower nosewheel 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 because of 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. If retraction is attempted, 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 other aircraft, 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.
(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 required.
(3) Landing gear switch -- "DOWN."
(4) Flaps switch — "DOWN." Extend flaps to 30°.
(5) In approach, align airplane with edge of runway that is opposite from 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 a wheels down landing as follows:
(1) Move disposable load to baggage area, and passengers to available rear seat space.
(2) Select a smooth hard surface or sod runway.
(3) Landing gear switch — "DOWN."

(4) Approach at 95 MPH with flaps down 20°.
(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.
(10) Fuel selector valve handles — "OFF."
(11) Evacuate the airplane as soon as it stops.

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 95 MPH at 3500 lbs., to 108 MPH at 4600 lbs. 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 floatation 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.

Section V

Operating Limitations

OPERATIONS AUTHORIZED.

Your Cessna with standard equipment, as certificated under FAA Type Certificate No. 3A10, is approved for day and night operation under VFR conditions.

MANEUVERS — NORMAL CATEGORY.

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

Maximum Takeoff Weight	4830 lbs.
Maximum Landing Weight	4600 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 (TIAS).

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

Maximum Speed, Landing Light Extended . . . . 160 MPH
Maximum Speed, Pilot's Window Open . . . . 130 MPH
Maneuvering Speed* . . . . 164 MPH

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

AIRSPEED INDICATOR INSTRUMENT MARKINGS.

The following chart lists the certificated true indicated airspeed (TIAS) limitations for the airplane.

Never Exceed (glide or dive, smooth air) . . . . 248 MPH (red line)
Caution Range . . . . .210-248 MPH (yellow line)
Normal Operation Range . . . . 84-210 MPH (green line)
Flap Operating Range (0° -45°) . . . . 74-140 MPH (white arc)

ENGINE OPERATION LIMITATIONS.

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

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 PRESSURE GAGE.

Normal Operating Range . . . . 2-17 PSI (green arc)
Minimum and Maximum Pressures . . . 1.5 and 17.5 PSI (red line)

MANIFOLD PRESSURE GAGE.

Normal Operating Range . . . . .15-24 in. Hg (green arc)

CYLINDER HEAD TEMPERATURES.

Normal Operating Range . . . . 280-460°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 forward and rear c. g. points, when plotted on the center of gravity moment envelope, fall within the envelope, your airplane meets all balance requirements.

WEIGHT LIMITATIONS.

The maximum take-off gross weight for this airplane is 4830 pounds. The maximum landing gross weight is 4600 pounds. After take-off at the gross weight of 4830 pounds, it takes from one and one-half to two hours to use the 38.3 gallons of fuel (230 pounds) required to lighten the airplane to the maximum landing weight of 4600 pounds. If a flight of shorter duration is planned, the airplane should be originally loaded to less than 4830 pounds to permit landing at 4600 pounds or less. Under emergency conditions, landings may be made at weights above 4600 pounds without danger of structural failure and with an adequate margin of safety, if the sink rate of the airplane is held at or below the maximum given for the airplane weight. The maximum allowable sink rate for 4830 pounds gross weight is 540 feet/minute, and for 4600 pounds gross weight is 590 feet/minute. These descent or sink speeds are based on a maximum limit load factor of 3.8 on the landing gear. At 4830 pounds gross weight, the airplane is approved for flight load factors up to 3.8.

Service Ceiling Apprx 21,000 Ft
Single Engine Service Ceiling Apprx 7500 Ft

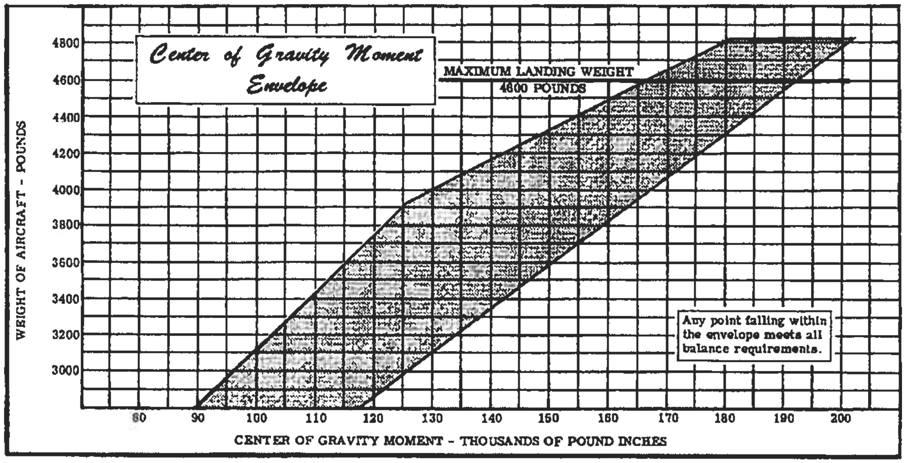


Figure 5-1.

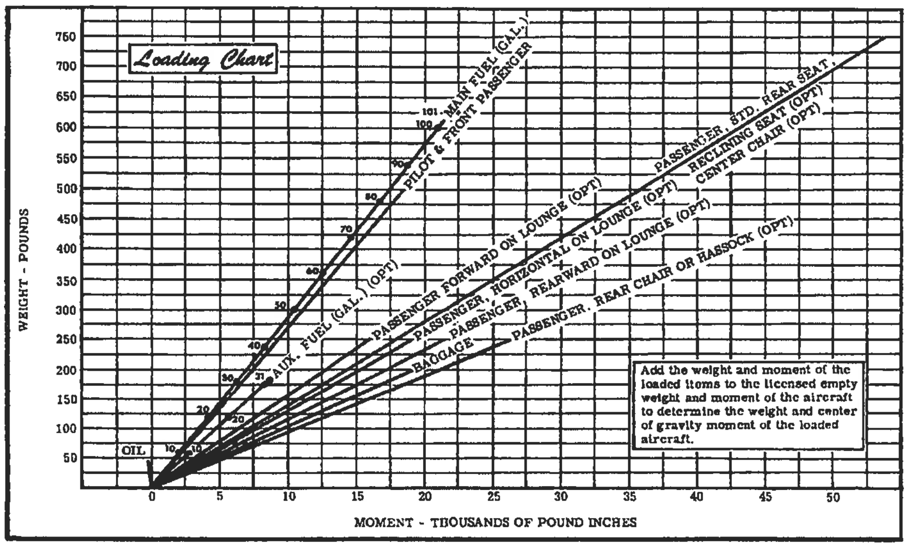


Figure 5-2.

SAMPLE PROBLEM

Example for an airplane with a licensed empty weight of 3125.0 lbs., a moment of 106.0 thousand pound-inches, 24 quarts of oil, a pilot, a front seat passenger, three rear seat passengers, 100 gallons of fuel in the main tanks, and 180 pounds of baggage.

	Weight in pounds	Moment in thousands of pound-inches (Obtained from Loading Chart)	
AIRCRAFT LICENSED EMPTY WEIGHT. . . . AND MOMENT (From weight and balance sheet)	3125.0	106.0	
OIL (24 qts. x 1.875 lb./qt.)	45.0	0.2	
PILOT AND FRONT SEAT PASSENGER. . . .	340.0	12.6	
REAR SEAT PASSENGERS . . . . (Standard rear seat)	510.0	36.2	
FUEL (MAIN TANKS) . . . . (100 gals. x 6 lb./gal.)	600.0	21.0	
BAGGAGE	180.0	19.0	
TOTAL TAKE-OFF WEIGHT	4800.00	195.0	Point I
SUBTRACT TOTAL FUEL . . . . LISTED ABOVE	600.0	21.0	
ADD MINIMUM FUEL RESERVE (21 gals.) . .	126.0	4.5	
TOTAL WEIGHT AND MOMENT WITH . . . . MINIMUM FUEL RESERVE	4326.0	178.5	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.

Figure 5-3.

Notes

SECTION VI

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 secure the opposite ends to tie-down rings suitably 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 skin, and secure the other end to a tie-down ring in the ground.
(5) Install the controls lock at the pilot's control column.
(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.

Flyable storage applies to all aircraft which will not be flown for an indefinite period but which are to be kept ready to fly with the least possible preparation.

Aircraft which are not in daily flight should have the propellers rotated, by hand, five revolutions at least once each week. In damp climates and in storage areas where the daily temperature variation can cause condensation, propeller rotation should be accomplished more frequently. Rotating the propeller an odd number of revolutions, redistributes residual oil on the cylinder walls, crankshaft and gear surfaces and repositions the pistons in the cylinders, thus preventing corrosion. Rotate propellers as follows:

(1) Throttles - IDLE.
(2) Mixtures - IDLE CUT-OFF.
(3) Magneto Switches - OFF.
(4) Propellers - ROTATE CLOCKWISE. Manually rotate propellers five revolutions, standing clear of arc of propeller blades. Leave the propellers turned horizontally to prevent rain water from entering the hub mechanism if the airplane is stored outside.

Keep fuel tanks full to minimize condensation in the fuel tanks. Maintain batteries at full charge to prevent electrolyte from freezing in cold weather. If the aircraft is stored outside, tie-down aircraft in anticipation of high winds. Secure aircraft as follows:

(1) Secure rudder with the rudder gust lock or with a control surface lock over the fin and rudder. If a lock is not available, caster the nose wheel to the full left or right position.
(2) Install control column lock in pilot's control column, if available. If column lock is not available, tie the pilot's control wheel full aft with a seat belt.
(3) Tie ropes or chains to the wing tie-down fittings located on the underside of each wing. Secure the opposite ends of the ropes or chains to ground anchors. Chock the main landing gear tires; do not set the parking brake if a long period of inactivity is anticipated as brake seizing can result.
(4) Secure a rope (no chains or cables) to the upper nose gear trunnion and secure opposite end of rope to a ground anchor. Chock the nose landing gear tire.
(5) Secure the middle of a rope to the tail tie-down fitting. Pull each end of rope at a 45-degree angle and secure to ground anchors at each side of the tail.
(6) After 30 days, the aircraft should be flown for 30 minutes or run engines on the ground until oil temperatures reach operating temperatures.

NOTE

Excessive ground operation is to be avoided so that maximum cylinder head temperatures are not exceeded.

JACKING.

The airplane is equipped with four jack pads for use when it is desired to raise the entire airplane for landing gear functional checks, etc. However, for minor maintenance such as tire changes, the individual wheels may be raised as follows:
(1) To raise the nosewheel, place weights (sandbags, etc.) on each side of the horizontal stabilizer near 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 snythetic 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 some 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.

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

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, benzine, 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 snow or freezing rain is anticipated. Canvas covers may cause the plastic to craze.

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off 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 these nicks produce stress concentrations, and if ignored, shortly will

result in cracks. Never use an alkaline cleaner on the blades; remove grease and oil with 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. Federal Regulations require that all maintenance except dressing out small blade nicks, cleaning, minor repairs to the spinner and lubrication which does not require disassembly be done by a 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.

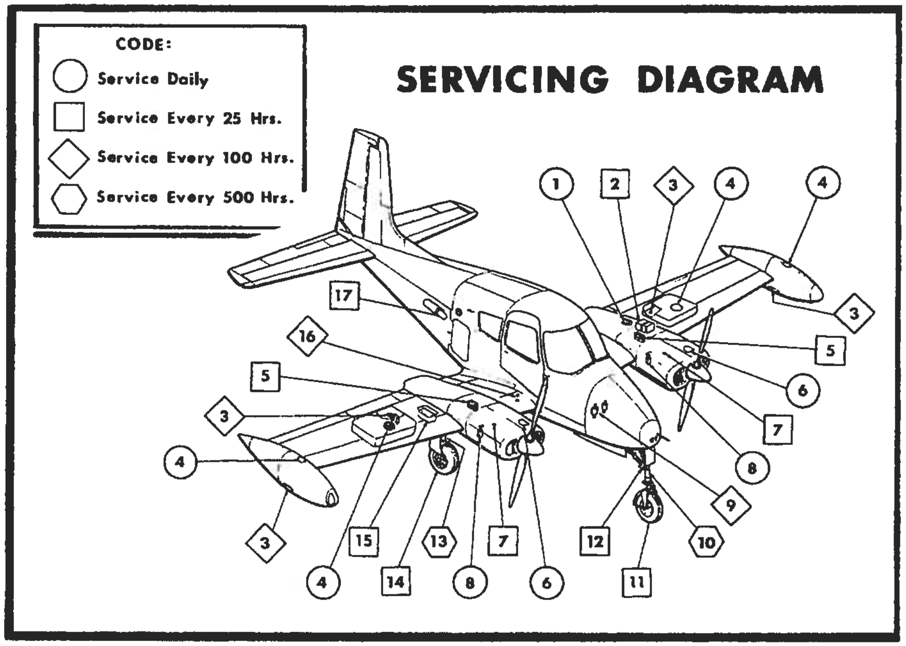
NOTE

Don't use too much fluid as the seat cushions are padded with foam rubber. Since some volatile cleaners attack rubber, these paddings may be damaged if the material gets soaked with the cleaner.

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.

SERVICING.

The Servicing Diagram and Service Requirements Table (figure 6-1) outline the normal servicing points, materials and procedures for your Cessna 310C. 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 which you may wish to attend to yourself or find necessary to service while on a strange airport. Lubrication information is included in the Cessna Model 310 Service Manual. Your Cessna Dealer has the correct lubricants and the equipment and trained personnel to do this job properly.



1···· External Power Receptacle — Connect to 24-volt DC, negative-ground power unit.
2···· Batteries — Check electrolyte level every 25 hours, oftener in warm weather. Add distilled water to level of horizontal baffle plate.
3···· Fuel Tank Sump Drains — Drain when fuel lines are drained.
4···· Fuel Tank Fillers — Service daily and after each flight. Keep full to retard condensation in fuel tanks.
5···· Induction Air Filter — Service every 25 hours, oftener under dusty operating conditions. Operation in extremely dusty conditions may necessitate daily servicing. Follow instructions stamped on filter frame.
6···· Engine Oil Dipstick and Filler — Check on preflight, add oil as necessary.
7···· Oil Sump Drains and Oil Screens — Change oil, remove and clean screens every 25 hours, oftener under severe operating conditions.
8···· Fuel Strainer — Drain before first flight each day and after each refueling.

Figure 6-1.

SERVICE REQUIREMENTS

	SPECIFICATION		QUANTITY, EACH TANK U.S.	IMP.	METRIC
FUEL	Grade 100/130 Aviation Gasoline (MIL-F-5572)		*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-6082)		**12 Qts.	**10 Qts.	**11.4 Liters
	Above 40° F.	SAE 50 (Grade 1100)			
	Below 40° F.	SAE 30 (Grade 1065)			
ANTI-ICE FLUID	Isopropyl Alcohol Anti-Ice Fluid (MIL-F-5566)		4.5 Qts.	3.8 Qts.	4.3 Liters
SHIMMY DAMPENER BRAKES SHOCK STRUTS	Petroleum Base Hydraulic Fluid (Red) (MIL-H-5606)		As Required		
OXYGEN CYLINDER	Aviators Breathing Oxygen (Fed. Spec. No. BB-O-925)		As Required Max. Pressure, 1800 PSI		

* 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: 6 U.S. Qts. (5 Imp. Qts., 5.7 Liters)

9··· Brake Master Cylinders — Check fluid level in reservoirs, refill as needed through plugs on cylinder heads.
10··· Nose Gear Shock Strut — Follow filling instructions on strut placard.
11··· Nose Gear Tire — Maintain 30 PSI pressure. Wash off oil and grease with soap and water.
12··· Shimmy Dampener — Fill through plug on top. Check every 25 hours.
13··· Main Gear Shock Struts — Follow filling instructions on strut placard.
14··· Main Gear Tires — Maintain 40 PSI pressure. Wash off oil and grease with soap and water.
15··· Anti-Ice Reservoir — Check and refill every 25 hours; check on preflight if icing is anticipated.
16··· Fuel Line Drain Plugs — Drain every 100 hours or whenever water or sediment is found in strainers. Remove lower right wing root fairing for access.
17··· Oxygen Cylinder — Check and refill for anticipated requirements before take-off.

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 assigned intervals should be considered maximums for average service. If your airplane is operated under abnormal conditions, you should 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 Federal Aviation Regulations to insure that all data requirements are met.

A. To be carried in the airplane at all times:
   (1) Aircraft Registration Certificate (Form ACA 500A).
   (2) Aircraft Airworthiness Certificate (Form ACA 1362).
   (3) Airplane Radio Station License (if transmitter installed).
   (4) Pilot's Check List.
   (5) Weight and Balance Data.
   (6) Airplane Log Book.
   (7) Two Engine Log Books.

B. To be maintained but not necessarily carried in the airplane at all times:
   (1) Weight and Balance Report or latest copy of the Repair and Alteration Form (Form ACA 337).
   (2) Equipment List.
   (3) A form containing the following information: Model, Registration Number, Factory Serial Number, Date of Manufacture, Engine Number, and Key Numbers (duplicate keys are available through your Cessna dealer).

Most of the items listed are required by the United States Federal 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 delivery of 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 will prefer to have the Dealer from whom you purchase the airplane accomplish this work.

Federal Aviation Regulations require that all aircraft have a periodic inspection as prescribed by the administrator, and performed by a person designated by the administrator. In addition, 100-hour periodic inspections made 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 practicality of parts replacement versus repairs that might from time to time be necessary.

CROSS COUNTRY SERVICE

On your cross country travels make it a point to stop at a Cessna Service Station for your Service requirements. Your Dealer will be glad to supply you with a current copy of the "Dealer Directory" of Cessna Service Stations, or if you wish, you may write to the Service Department, Cessna Aircraft Company, Wichita, Kansas, asking for it and it will be mailed to you promptly.

CESSNA SERVICE PUBLICATIONS

The Cessna Aircraft Company publishes and revises, as necessary, Manuals, Parts Catalogs, Service Letters and Service News Letters. This material goes to all authorized Cessna Service Stations so that they have the latest authoritative information for servicing your Cessna.

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.

SECTION VII

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.

AIRSPEED CORRECTION TABLE

Flaps 0°		Flaps 15°*		Flaps 45°**	
IAS	TIAS	IAS	TIAS	IAS	TIAS
80	85	70	79	70	76
100	103	80	87	80	83
120	122	90	94	90	90
140	142	100	103	100	100
160	160	110	112	110	110
180	180	120	121	120	120
200	200	130	131	130	131
220	220	140	140	140	141
240	239	150	150		
		160	159		

* Maximum flap speed 160 MPH ** Maximum flap speed 140 MPH

Figure 7-1. Airspeed Correction Table

MODEL 310C 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
4000	79	0	530	1060	630	1185	750	1330	905	1525
		15	350	785	425	880	520	995	635	1150
		30	210	545	260	615	325	700	410	820
4400	83	0	650	1210	775	1360	925	1550	1120	1815
		15	445	900	535	1020	650	1170	800	1385
		30	270	630	340	720	420	835	530	1000
4830	86	0	800	1395	960	1590	1150	1850	1400	2230
		15	555	1050	675	1205	825	1410	1015	1715
		30	350	745	440	860	545	1025	690	1265

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

MODEL 310C 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
4000	83	Ground Roll	550	585	620	660
		Total Distance Over 50' Obstacle	1530	1630	1725	1830
4300	86	Ground Roll	585	620	660	700
		Total Distance Over 50' Obstacle	1625	1730	1835	1950
4600	90	Ground Roll	620	650	700	740
		Total Distance Over 50' Obstacle	1720	1830	1950	2070

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

Figure 7-2. Take-Off and Landing Charts

TWIN ENGINE CLIMB DATA

GROSS WEIGHT LBS.	At Sea Level and 59°F			At 5000 Ft and 41°F			At 10000 Ft and 23°F			At 15000 Ft and 5°F			At 20000 Ft and -12°F		
	Best Climb IAS mph	Rate of Climb Ft/Min	Gal. of 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
4000	113	2340	4.0	111	1875	5.7	109	1410	7.6	108	950	9.9	106	405	13.0
4400	116	2060	4.0	114	1630	5.9	112	1200	8.1	111	770	10.9	109	340	15.0
4830	119	1800	4.0	117	1405	6.2	115	1005	8.8	114	605	12.3	112	205	18.2

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

SINGLE ENGINE CLIMB DATA

GROSS WEIGHT LBS.	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 10000 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
4000	107	675	106	545	105	420	104	290	102	160
4400	109	555	108	425	107	295	106	165	104	35
4830	111	440	110	310	109	185	108	60	107	70

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.

Figure 7-3. Climb Data

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 2,500 ft

RPM	MP	%BHP	Fuel Pressure	TAS	Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	24	74	8.1	215	28.1	3.6	765	4.6	990
	23	70	7.5	208	26.3	3.8	790	4.9	1025
	22	66	7.0	203	24.9	4.0	815	5.2	1060
	21	62	6.5	197	23.3	4.3	845	5.6	1100
2300	24	68	7.2	205	25.5	3.9	800	5.1	1045
	23	64	6.7	200	24.0	4.2	835	5.4	1080
	22	60	6.3	194	22.8	4.4	855	5.7	1110
	21	57	5.9	189	21.4	4.7	885	6.1	1150
2200	23	59	6.1	193	22.3	4.5	865	5.8	1120
	22	56	5.8	188	21.2	4.7	885	6.1	1150
	21	53	5.5	183	20.1	5.0	910	6.5	1185
	20	49	5.2	177	19.0	5.2	925	6.8	1205
2100	22	52	5.4	181	19.7	5.1	920	6.6	1195
	21	49	5.1	176	18.7	5.4	940	6.9	1220
	20	45	4.8	170	17.7	5.6	955	7.3	1245
	19	42	4.6	163	16.7	6.0	980	7.8	1270
	18	39	4.3	157	15.8	6.3	990	8.2	1285
	17	36	4.1	147	14.8	6.8	995	8.8	1295

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 4830 POUNDS GROSS WEIGHT.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 5,000 ft

RPM	MP	%BHP	Fuel Pressure	TAS	Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	24	77	8.5	222	29.0	3.4	765	4.5	995
	23	72	7.8	216	27.2	3.7	795	4.8	1030
	22	68	7.3	210	25.7	3.9	815	5.1	1065
	21	64	6.7	204	24.1	4.2	850	5.4	1100
2300	24	70	7.5	213	26.5	3.8	805	4.9	1045
	23	66	6.9	206	24.7	4.0	830	5.3	1085
	22	62	6.5	202	23.5	4.2	855	5.5	1115
	21	58	6.1	196	22.1	4.5	885	5.9	1150
2200	23	61	6.4	199	23.0	4.4	870	5.6	1120
	22	58	6.0	194	21.8	4.6	890	6.0	1160
	21	54	5.6	189	20.6	4.9	920	6.3	1190
	20	51	5.3	184	19.5	5.1	940	6.7	1230
2100	22	53	5.5	188	20.3	4.9	925	6.4	1200
	21	50	5.2	182	19.2	5.2	945	6.8	1235
	20	47	5.0	176	18.3	5.5	965	7.1	1250
	19	44	4.7	170	17.2	5.8	985	7.6	1285
	18	41	4.5	163	16.3	6.1	1000	8.0	1300
	17	37	4.2	155	15.3	6.5	1010	8.5	1315

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 4830 POUNDS GROSS WEIGHT.

Figure 7-4. Cruise Performance

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 7,500 ft

RPM	MP	%BHP	Fuel Pressure	TAS	Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	22	70	7.6	217	26.6	3.8	820	4.9	1060
	21	66	7.0	211	24.9	4.0	845	5.2	1100
	20	62	6.5	206	23.5	4.3	880	5.5	1135
	19	58	6.1	200	22.1	4.5	905	5.9	1175
2300	22	64	6.8	208	24.2	4.1	855	5.4	1120
	21	60	6.3	203	22.6	4.4	895	5.7	1160
	20	57	5.9	198	21.5	4.6	915	6.0	1190
	19	54	5.5	192	20.3	4.9	940	6.4	1225
2200	22	59	6.2	202	22.4	4.5	905	5.8	1170
	21	56	5.8	195	21.1	4.7	920	6.2	1205
	20	53	5.4	190	20.0	5.0	950	6.5	1235
	19	50	5.2	184	19.0	5.3	970	6.8	1255
2100	21	52	5.4	188	19.7	5.1	955	6.6	1240
	20	49	5.1	182	18.7	5.4	980	7.0	1270
	19	45	4.8	176	17.7	5.7	1000	7.3	1290
	18	42	4.6	170	16.8	5.9	1005	7.7	1310
	17	39	4.3	161	15.8	6.3	1015	8.2	1325
	16	36	4.1	150	14.9	6.7	1005	8.7	1305

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 4830 POUNDS GROSS WEIGHT.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 10,000 ft

RPM	MP	%BHP	Fuel Pressure	TAS	Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	20	64	6.8	213	24.2	4.1	875	5.4	1145
	19	60	6.3	207	22.8	4.4	910	5.7	1180
	18	56	5.8	200	21.2	4.7	940	6.1	1225
	17	52	5.4	191	19.7	5.1	970	6.6	1260
2300	20	59	6.1	204	22.1	4.5	920	5.9	1200
	19	55	5.7	198	20.9	4.8	950	6.2	1230
	18	51	5.4	191	19.7	5.1	970	6.6	1265
	17	47	5.0	183	18.3	5.5	1005	7.1	1300
2200	20	54	5.6	197	20.6	4.8	950	6.3	1240
	19	51	5.3	190	19.5	5.1	970	6.7	1270
	18	48	5.0	184	18.4	5.4	995	7.1	1300
	17	44	4.7	176	17.3	5.8	1020	7.5	1325
2100	20	50	5.2	189	19.2	5.2	985	6.8	1280
	19	47	5.0	183	18.2	5.5	1005	7.1	1300
	18	44	4.7	176	17.2	5.8	1020	7.6	1330
	17	40	4.5	167	16.2	6.2	1030	8.0	1340
	16	37	4.2	157	15.3	6.5	1020	8.5	1330

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE, 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 4830 POUNDS GROSS WEIGHT.

Figure 7-5. Cruise Performance

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 15,000 ft

RPM	MP	%BHP	Fuel Pressure	TAS	Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	16	51	5.3	198	19.4	5.2	1025	6.7	1325
	15	46	4.9	188	18.0	5.5	1040	7.2	1355
	14	42	4.6	175	16.7	6.0	1050	7.8	1365
	13	37	4.2	156	15.3	6.5	1015	8.5	1325
2300	16	46	4.9	188	18.1	5.5	1040	7.2	1355
	15	42	4.6	175	16.7	6.0	1050	7.8	1365
	14	39	4.3	162	15.7	6.4	1035	8.3	1340
2200	16	43	4.7	179	17.1	5.8	1045	7.6	1360
	15	40	4.4	165	15.6	6.4	1055	8.3	1370
	14	36	4.1	145	14.8	6.8	980	8.8	1275
2100	16	40	4.4	167	16.1	6.2	1035	8.1	1350
	15	36	4.1	149	15.0	6.7	1000	8.7	1300

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND, NORMAL LEAN MIXTURE. 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 4830 POUNDS GROSS WEIGHT.

CRUISE PERFORMANCE WITH NORMAL LEAN MIXTURE AT 20,000 ft

RPM	MP	%BHP	Fuel Pressure	TAS	Gal/Hr	Endurance 100 Gal	Range 100 Gal	Endurance 130 Gal	Range 130 Gal
2450	13.5	42	4.7	178	17.2	5.8	1035	7.6	1345
	13	40	4.4	168	16.2	6.2	1035	8.0	1345
2300	13.5	38	4.3	155	15.6	6.4	990	8.3	1290

CRUISE PERFORMANCE IS BASED ON STANDARD CONDITIONS, ZERO WIND. NORMAL LEAN MIXTURE. 100 AND 130 GALLONS OF FUEL (NO RESERVE), AND 4830 POUNDS GROSS WEIGHT.

Figure 7-6. Cruise Performance

Alphabetical Index

WARRANTY

- The Cessna Aircraft Company warrants each new airplane, 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 ninety (90) days after delivery of such airplane to the original purchaser, be returned to the Company with transportation charges prepaid, and which upon Company examination shall disclose to the Company 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 the Company, and the Company neither assumes nor authorizes any other person to assume for it any other liability in connection with the sale of its airplanes.

- This warranty shall not apply to any airplane which shall have been repaired or altered outside the Company's factory in any way so as, in its judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident.

CESSNA

"TAKE YOUR CESSNA HOME
FOR SERVICE AT THE SIGN
OF THE CESSNA SHIELD".

CESSNA AIRCRAFT COMPANY

WICHITA, KANSAS