Cessna
SALES AND SERVICE

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CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS

2.10 thru 2.10

Cessna
SALES AND SERVICE

MODEL 177 AND CARDINAL

1968 OWNER'S MANUAL

PERFORMANCE - SPECIFICATIONS

	*Model 177	*Cardinal
GROSS WEIGHT	2350 lbs	2350 lbs
SPEED:		
Top Speed at Sea Level	141 mph	144 mph
Cruise, 75% Power at 9000 ft	130 mph	134 mph
RANGE:		
Cruise, 75% Power at 9000 ft	755 miles	780 miles
48 Gal. No Reserve	5.8 hours	5.8 hours
	130 mph	134 mph
Optimum Range at 10,000 ft	825 miles	855 miles
48 Gal. No Reserve	7.6 hours	7.7 hours
	108 mph	110 mph
RATE OF CLIMB AT SEA LEVEL	670 fpm	670 fpm
SERVICE CEILING	12,700 ft	12,700 ft
TAKE-OFF:		
Ground Run	845 ft	845 ft
Total Distance Over 50-Foot Obstacle	1575 ft	1575 ft
LANDING:		
Landing Roll	400 ft	400 ft
Total Distance Over 50-Foot Obstacle	1135 ft	1135 ft
EMPTY WEIGHT (Approximate)	1340 lbs	1415 lbs
BAGGAGE	120 lbs	120 lbs
WING LOADING: Pounds/Sq Foot	13.6	13.6
POWER LOADING: Pounds/HP	15.7	15.7
FUEL CAPACITY: Total	49 gal.	49 gal.
OIL CAPACITY	8 qts	8 qts
(One additional quart is required when optional oil filter is installed)		
PROPELLER: Fixed Pitch (Diameter)	76 inches	76 inches
ENGINE:		
Lycoming Engine	O-320-E2D	O-320-E2D
150 rated HP at 2700 RPM		

* This manual covers operation of the Model 177/Cardinal which is certificated as Model 177 under FAA Type Certificate No. A13CE

D519-13 McCormick-Armstrong Co. 10M 8/5/67

CONGRATULATIONS.....

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

This Owner's Manual has been prepared as a guide to help you get the most pleasure and utility from your Model 177/Cardinal. It contains information about your Cessna's equipment, operating procedures, and performance; and suggestions for its servicing and care. We urge you to read it from cover to cover, and to refer to it frequently.

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

FACTORY TRAINED PERSONNEL to provide you with courteous expert service.

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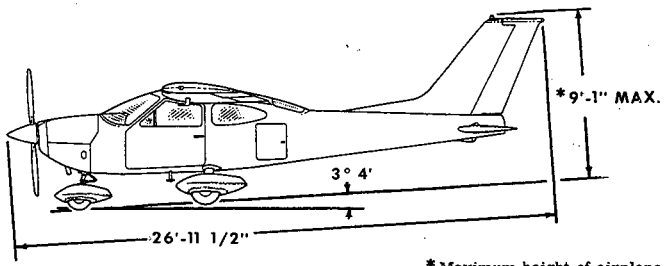
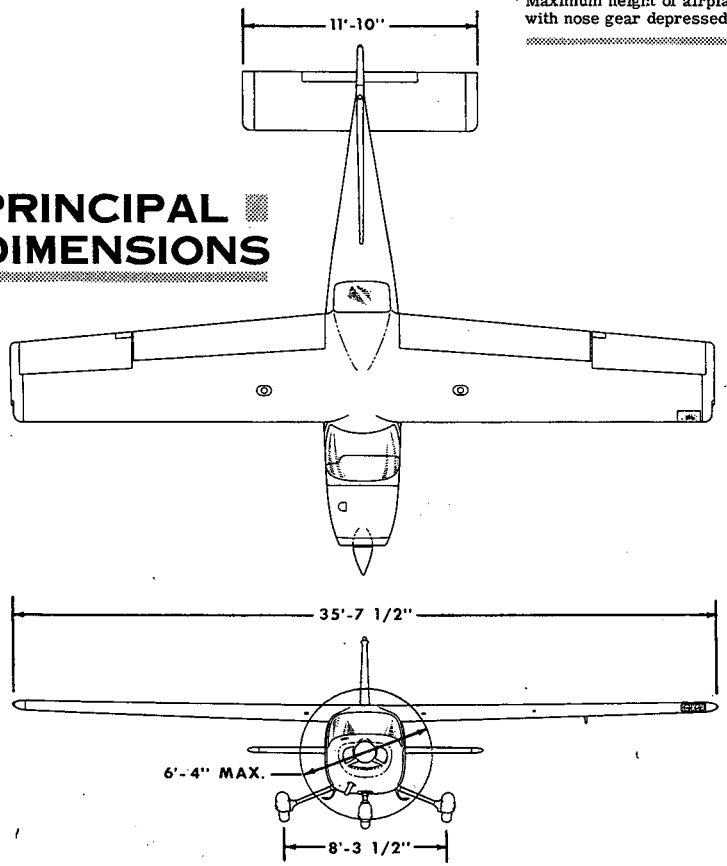


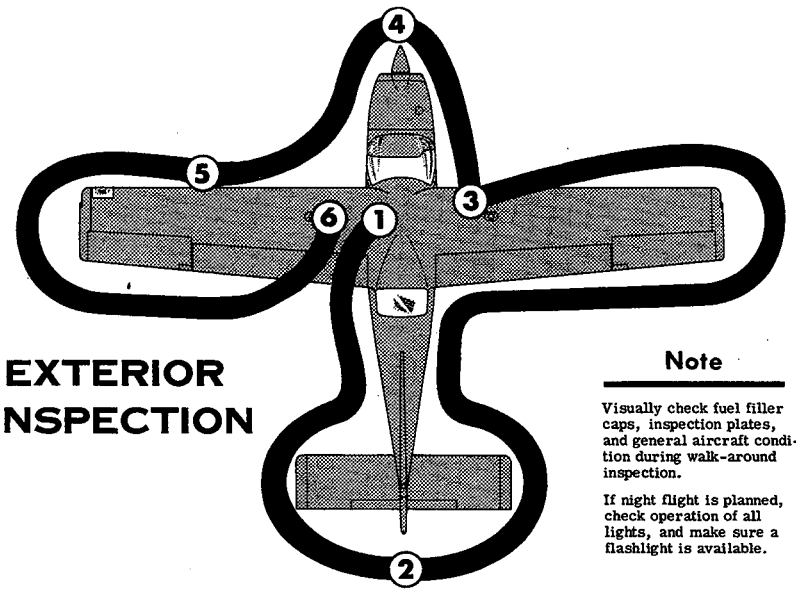
* Maximum height of airplane with nose gear depressed.



PRINCIPAL DIMENSIONS

TABLE OF CONTENTS

This manual describes the operation and performance of both the Cessna Model 177 and the Cardinal. Equipment described as "Optional" denotes that the subject equipment is optional on the Model 177. Much of this equipment is standard on the Cardinal.



EXTERIOR INSPECTION

Note

Visually check fuel filler caps, inspection plates, and general aircraft condition during walk-around inspection.

If night flight is planned, check operation of all lights, and make sure a flashlight is available.

(1) a. Turn master switch "ON" and check fuel quantity indicators, then turn master switch "OFF."
b. Check ignition switch "OFF."
c. Check fuel selector valve handle "BOTH ON."
d. Remove control wheel lock.
e. Check baggage door for security.

(2) a. Remove rudder gust lock, if installed.
b. Disconnect tail tie-down.

(3) a. Check fuel bay vent opening (at wing tip trailing edge) for stoppage.
b. Disconnect wing tie-down.
c. Check main wheel tire for proper inflation.

(4) a. Check oil level. Do not operate with less than six quarts. Fill for extended flight.
b. Before first flight of day and after each refueling, pull out strainer drain knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, there is a possibility that the fuel bay sumps contain water. Thus, the drain plugs in the fuel bay sumps, fuel selector valve, fuel vent line, and fuel reservoir should be removed to check for presence of water.
c. Check propeller and spinner for nicks and security.
d. Check nose wheel strut and tire for proper inflation.
e. Disconnect tie-down rope.
f. Inspect airspeed static source hole on side of fuselage for stoppage (left side only).

(5) a. Check stall warning vent opening for stoppage.
b. Remove pitot tube cover, if installed, and check pitot tube opening for stoppage.

(6) Same as (3).

Figure 1-1.

Section I

OPERATING CHECK LIST

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 can best be done by reviewing this equipment while sitting in the airplane. Those items whose function and operation are not obvious are covered in Section II.

Section I lists, in Pilot's Check List form, the steps necessary to operate your airplane efficiently and safely. It is not a check list in its true form as it is considerably longer, but it does cover briefly all of the points that you should know for a typical flight.

The flight and operational characteristics of your airplane are normal in all respects. There are no "unconventional" characteristics or operations that need to be mastered. All controls respond in the normal way within the entire range of operation. All airspeeds mentioned in Sections I and II are indicated airspeeds. Corresponding calibrated airspeed may be obtained from the Airspeed Correction Table in Section V.

BEFORE ENTERING THE AIRPLANE.

(1) Make an exterior inspection in accordance with figure 1-1.

BEFORE STARTING THE ENGINE.

(1) Seats and Seat Belts -- Adjust and lock.
(2) Fuel Selector -- "BOTH ON."
(3) Fuel Shut-Off Valve Knob -- Check safety wired to "ON" position.
(4) Radios and Flashing Beacon -- "OFF."
(5) Brakes -- Test and set.

STARTING THE ENGINE.

(1) Mixture -- Rich.
(2) Carburetor Heat -- Cold.
(3) Master Switch -- "ON."
(4) Primer -- 2-6 strokes (depending on temperature; none required when engine is warm). Primer locked.
(5) Throttle -- Open 1/8".
(6) Propeller Area -- Clear.
(7) Ignition Switch -- "START."
(8) Release ignition switch to "BOTH" when engine starts.
(9) Oil Pressure -- Check.
(10) Radios -- Turn on and set.
(11) Altimeter and Clock - Set.

BEFORE TAKE-OFF.

(1) Parking Brake -- Set
(2) Cabin Doors -- Closed and locked.
(3) Flight Controls -- Check.
(4) Trim Tab -- "TAKE-OFF" setting.
(5) Throttle Setting -- 1700 RPM.
(6) Engine Instruments and Ammeter -- Check.
(7) Carburetor Heat -- Check operation.
(8) Magnetos -- Check (RPM drop should not exceed 125 RPM on either magneto or 50 RPM differential between magnetos).
(9) Auxiliary Fuel Pump -- Check operation.

NOTE

Gravity feed will normally supply satisfactory fuel flow if the engine-driven fuel pump should fail. However, if the fuel pressure drops below 2 psi, use the auxiliary fuel pump.

(10) Suction Gage -- Check (4.6 to 5.4 inches of mercury).
(11) Flight Instruments and Radios -- Set.
(12) Wing Flaps -- "UP" to "1/4."
(13) Navigation Lights and Flashing Beacon -- "ON", as required.
(14) Optional Autopilot or Wing Leveler -- "OFF."

TAKE-OFF.

NORMAL TAKE-OFF.

(1) Wing Flaps -- "UP" to "1/4."
(2) Carburetor Heat -- Cold.
(3) Power -- Full throttle (applied smoothly).
(4) Airplane Attitude -- Lift nose wheel at 60 MPH.
(5) Climb Speed -- 90 MPH.
(6) Retract flaps (if extended).

MAXIMUM PERFORMANCE TAKE-OFF.

(1) Wing Flaps -- "1/4."
(2) Carburetor Heat -- Cold.
(3) Brakes -- Apply.
(4) Power -- Full throttle.
(5) Brakes -- Release.
(6) Airplane Attitude -- Slightly tail low.
(7) Climb Speed -- 67 MPH until all obstacles are cleared, then set up climb speed as shown in "MAXIMUM PERFORMANCE CLIMB" paragraph.
(8) Wing Flaps -- Retract after obstacles are cleared.

CLIMB.

NORMAL CLIMB.

(1) Airspeed -- 90 to 100 MPH.
(2) Power -- Full throttle.
(3) Mixture -- Full rich (mixture may be leaned above 5000 feet).

MAXIMUM PERFORMANCE CLIMB.

(1) Airspeed -- 88 MPH at sea level to 85 MPH at 10,000 feet.
(2) Power -- Full throttle.
(3) Mixture -- Full rich (mixture may be leaned above 5000 feet).

CRUISING.

(1) Power -- 2200 to 2700 RPM.

NOTE

Maximum cruise RPM varies with altitude. For details, refer to Section V.

(2) Trim Tab -- Adjust.
(3) Mixture -- Lean when power setting is 75% or less.

LET-DOWN.

(1) Mixture -- Rich.
(2) Power -- As desired.
(3) Carburetor Heat -- As required to prevent carburetor icing.

BEFORE LANDING.

(1) Fuel Selector -- "BOTH ON."
(2) Mixture -- Rich.
(3) Carburetor Heat -- Apply full heat before closing throttle.
(4) Airspeed -- 80 to 90 MPH (flaps up).
(5) Wing Flaps -- As desired ("UP" to "1/4" below 130 MPH, "1/4" to "DN" below 105 MPH).
(6) Airspeed -- 70 to 80 MPH (flaps down).
(7) Trim Tab -- Adjust.

BALKED LANDING (GO-AROUND).

(1) Power -- Full throttle.
(2) Carburetor Heat -- Cold.
(3) Wing Flaps -- Retract to "1/2."
(4) Upon reaching an airspeed of approximately 75 MPH, retract flaps slowly.

NORMAL LANDING.

(1) Touchdown -- Main wheels first.

(2) Landing Roll -- Lower nose wheel gently.
(3) Braking -- Minimum required.

NOTE

For maximum braking effectiveness, retract flaps and hold control wheel fully aft.

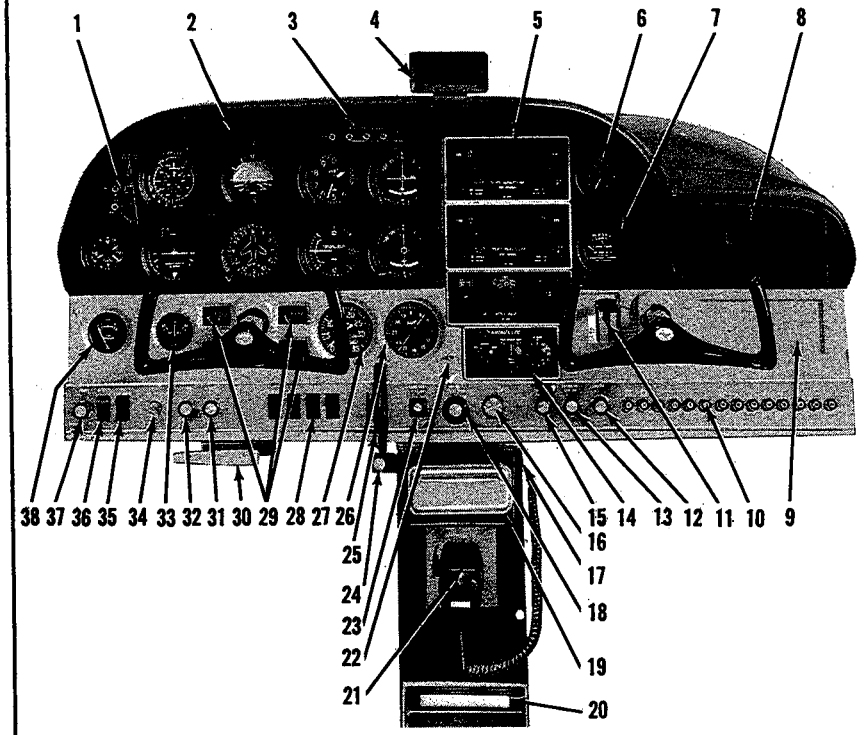
AFTER LANDING.

(1) Wing Flaps -- Up.
(2) Carburetor Heat -- Cold.

SECURE AIRCRAFT.

(1) Mixture -- Idle cut-off (pulled full out).
(2) All Switches -- Off.
(3) Brakes -- Set.
(4) Control Lock -- Installed.

INSTRUMENT PANEL



1. Marker Beacon Lights and Switches (Opt.)
2. Flight Instrument Group
3. Radio Selector Switches (Opt.)
4. Rear View Mirror (Opt.)
5. Radios (Opt.)
6. Suction Gage (Opt.)
7. Carburetor Air Temperature Gage (Opt.)
8. Map Compartment
9. Optional Radio Space
10. Circuit Breakers
11. Wing Flap Switch
12. Cigar Lighter
13. Defroster Knob
14. Autopilot Control Unit (Opt.)
15. Cabin Air/Heat Knob
16. Mixture Control Knob
17. Phone Jack
18. Throttle
19. Ash Tray
20. Courtesy Light
21. Microphone (Opt.)
22. Autopilot-Omni Switch (Opt.)
23. Carburetor Air Heat Control Knob
24. Fuel Shut-Off Valve Knob
25. Stabilator Trim Control Wheel
26. ADF Bearing Indicator (Opt.)
27. Tachometer
28. Electrical Switches
29. Fuel and Oil Gages
30. Parking Brake Handle
31. Radio Dial Lights Rheostat
32. Instrument Lights Rheostat
33. Ammeter
34. Ignition-Starter Switch
35. Auxiliary Fuel Pump Switch
36. Master Switch
37. Primer
38. Fuel Pressure Gage

Figure 2-1.

Section II

DESCRIPTION AND OPERATING DETAILS

The following paragraphs describe the systems and equipment whose function and operation is not obvious when sitting in the airplane. This section also covers in somewhat greater detail some of the items listed in Check List form in Section I that require further explanation.

FUEL SYSTEM.

Fuel is supplied to the engine from two integral fuel bays, one in each wing. Usable fuel in each bay, for all flight conditions, is 24 gallons when completely filled.

The fuel capacity of this aircraft has been designed to provide the owner with a choice of long range capability with partial cabin loading or reduced range with full cabin loading. For example, with full cabin loading, it normally will be necessary to reduce the fuel load to keep the aircraft within approved weight and balance limits. (Refer to Section III for weight and balance control procedures.) A 21 gallon level marker, in the form of a white line just inside the filler neck, is provided to facilitate fueling to reduced fuel loads.

Fuel from each wing fuel bay flows through a selector valve, small reservoir, and fuel shut-off valve to the fuel strainer. From here, it is routed to an engine-driven pump which delivers the fuel under pressure to the carburetor. An electric auxiliary fuel pump parallels the engine-driven pump and is used when fuel pressure drops below 2 psi. It is not necessary to have the auxiliary pump operating during normal take-off and landing, since gravity feed will supply adequate fuel flow to the carburetor with the engine-driven pump inoperative. However, gravity flow is considerably reduced at maximum performance take-off and climb attitudes, and the auxiliary fuel pump would be required if the engine-driven pump should fail during these maneuvers.

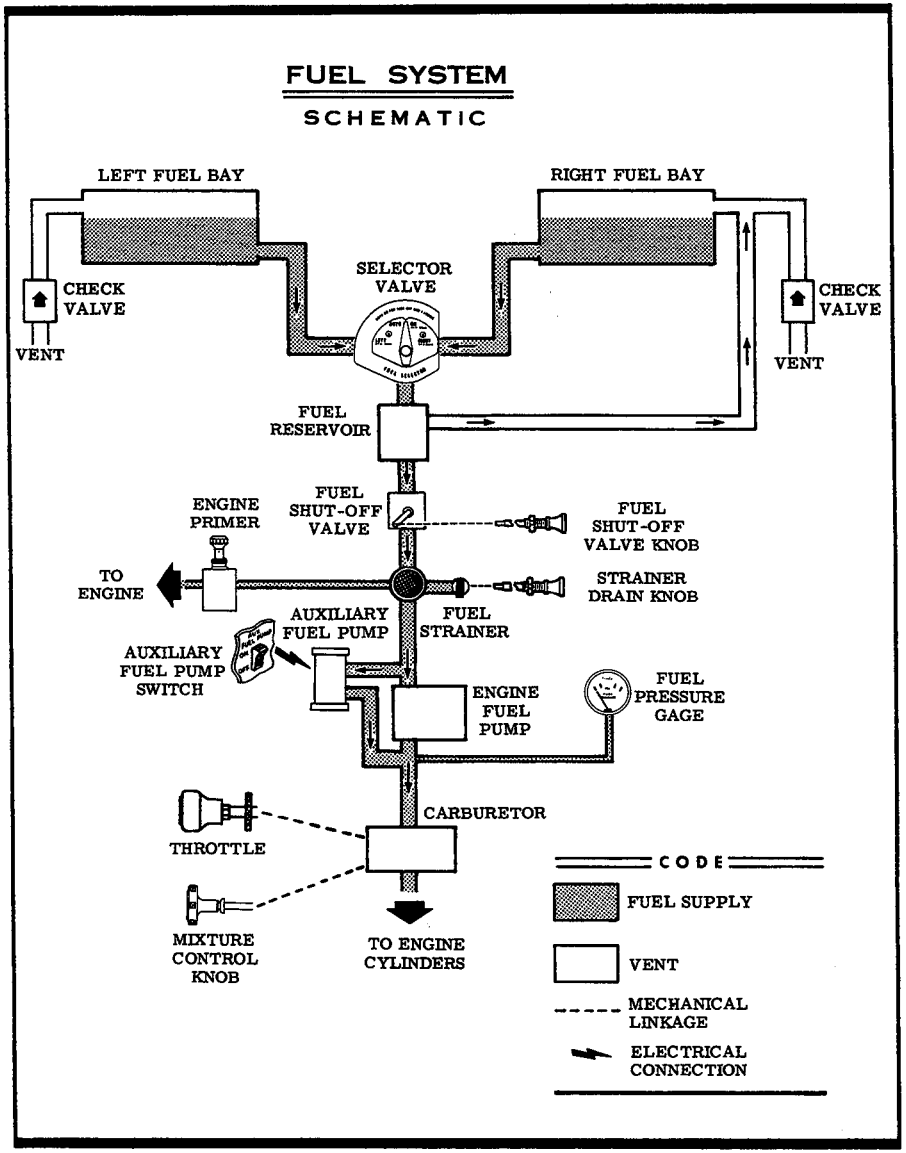


Figure 2-2.

NOTE

Take off with the fuel selector valve handle in the "BOTH ON" position to prevent inadvertent take-off on an empty bay. However, during long range flight with the selector valve handle in the "BOTH ON" position, unequal fuel flow from each bay may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the fuel bay in the "heavy wing." The recommended cruise fuel management procedure for extended flight is to use the left and right bay alternately.

For fuel system servicing information, refer to Lubrication and Servicing Procedures in Section IV.

ELECTRICAL SYSTEM.

Electrical energy is supplied by a 14-volt, direct-current system powered by an engine-driven alternator (see figure 2-3). The 12-volt battery is located aft of the rear cabin wall. Power is supplied to all electrical circuits through a split bus bar, one side containing electronic system circuits and the other side having general electrical system circuits. Both sides of the bus are on at all times except when either an external power source is connected or the starter switch is turned on; then a power contactor is automatically activated to open the circuit to the electronic bus. Isolating the electronic circuits in this manner prevents harmful transient voltages from damaging the semi-conductors in the electronic equipment.

AMMETER.

The ammeter indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the aircraft electrical system. When the engine is operating and the master switch is "ON," the ammeter indicates the charging rate applied to the battery. In the event the alternator is not functioning or the electrical load exceeds the output of the alternator, the ammeter indicates the discharge rate of the battery.

CIRCUIT BREAKERS AND FUSES.

Most of the electrical circuits in the airplane are protected by

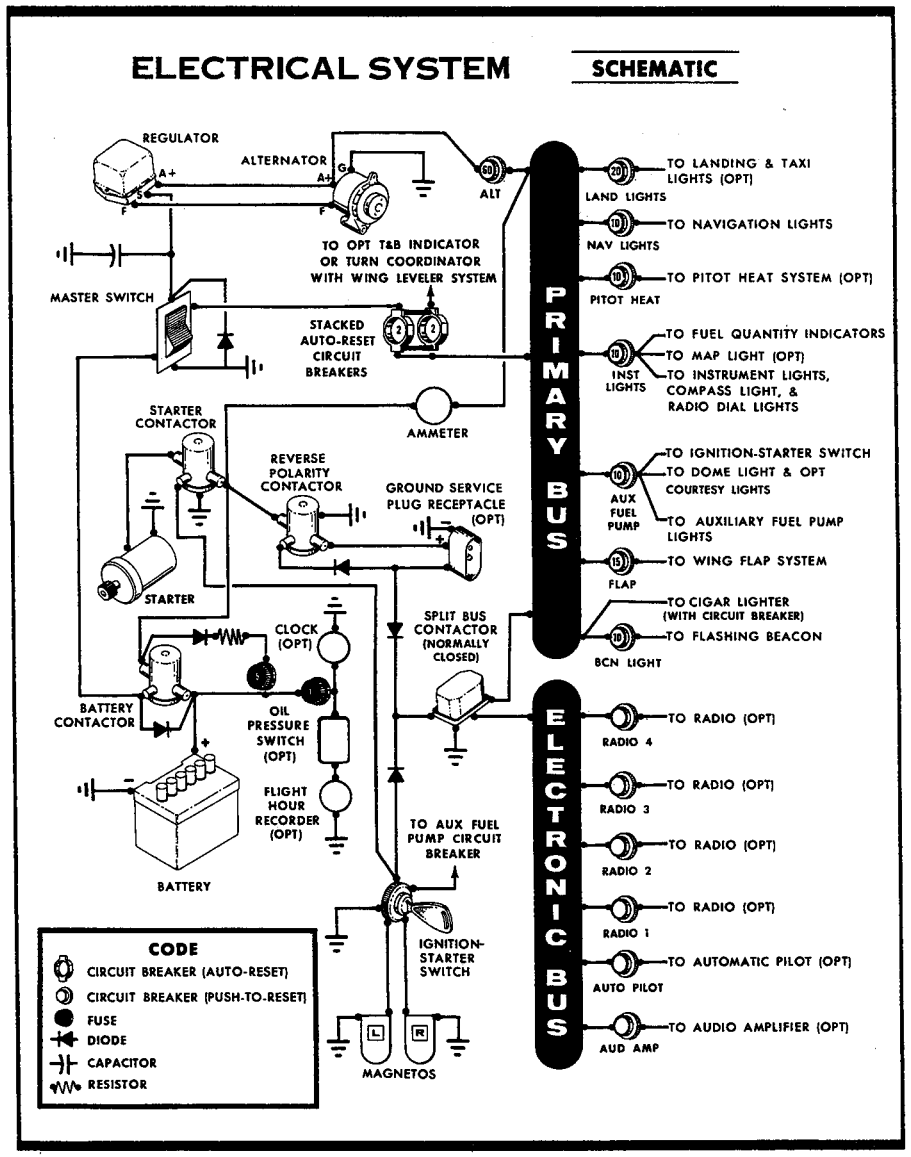


Figure 2-3.

"push-to-reset" circuit breakers mounted on the right side of the instrument panel. Exceptions to this are the battery contactor closing (external power) circuit and optional clock and flight hour recorder circuits which have fuses mounted near the battery. Also, the cigar lighter is protected by a manually-reset type circuit breaker mounted directly on the back of the lighter behind the instrument panel. A pair of automatically-resetting circuit breakers mounted behind the instrument panel protect the alternator field circuit and the optional turn-and-bank indicator or turn coordinator (and wing leveler) circuits.

FLASHING BEACON.

The flashing beacon should not be used when flying through clouds or overcast; the flashing light reflected from water droplets or particles in the atmosphere, particularly at night, can produce vertigo and loss of orientation.

MAP LIGHT (OPT).

A map light may be installed on the bottom of the pilot's control wheel. The light illuminates the lower portion of the cabin just forward of the pilot and is helpful when checking maps and other flight data during night operation. A small knurled rheostat knob just forward of the lower face of the control wheel is used to turn on the light and adjust its intensity.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM.

The volume and blending of heated and cool air from the main cabin heat and ventilating system is controlled by a single push-pull control knob labeled "CABIN AIR/HEAT." When the knob is positioned full in, no air flows into the cabin. As the knob is pulled out to approximately one inch of travel (as noted by a notch on the control shaft) the volume of unheated fresh air entering the cabin is increased. Further actuation of the control knob (past the notch) toward the full out position blends in heated fresh air in increasing amounts.

Front cabin heat and ventilating air from the main heat and ventilating system is supplied by outlet holes spaced across a cabin manifold located just forward of and above the pilot's and copilot's feet. Rear cabin heat

and air is supplied by two ducts from the manifold, one extending down each side of the cabin to an outlet at the front door post at floor level.

Windshield defrost air is supplied from the same manifold which provides cabin air; therefore, the temperature of the defrosting air is the same as cabin air. A push-pull control knob, labeled "DEFROST", regulates the volume of air to the windshield. Pull the knob out as needed for defrosting.

Separate adjustable ventilators supply additional air; two mounted in a console in the forward cabin ceiling supply air to the pilot and copilot, and on the Cardinal, two individual ventilators mounted in the rear cabin ceiling provide air to the rear seat passengers. All ventilators can be swiveled through 360° to direct the flow of air as desired. A separate control knob near each ventilator nozzle can be rotated to regulate the volume of air through the nozzle.

Additional ventilation is available through an openable ventilation window in each cabin door. Each window can be opened at speeds up to 120 MPH by rotating the crank located below the window.

STARTING ENGINE.

Ordinarily the engine starts easily with one or two strokes of the primer in warm temperatures to six strokes in cold weather, with the throttle open approximately 1/8 inch. In extremely cold temperatures, it may be necessary to continue priming while cranking. No priming is required when the engine is warm.

Weak intermittent explosions followed by puffs of black smoke from the exhaust stack indicates overpriming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: Set the mixture control full lean and the throttle full open; then crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all, and additional priming will be necessary. As soon as the cylinders begin to fire, open the throttle slightly to keep it running.

After starting, if the oil gage does not begin to show pressure within 30 seconds in the summertime and about twice that long in very cold

weather, stop the engine and investigate. Lack of oil pressure can cause serious engine damage.

NOTE

Additional details concerning cold weather starting and operation may be found under "COLD WEATHER OPERATION" paragraph in this section.

TAXIING.

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see taxiing diagram, figure 2-4) to maintain directional control and balance.

The carburetor air heat control knob should be pushed full in during all ground operations unless heat is absolutely necessary for smooth engine operation. When the knob is pulled out to the heat position, air entering the engine is not filtered.

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

BEFORE TAKE-OFF.

WARM-UP.

Since the engine is closely cowled for efficient in-flight engine cooling, precautions should be taken to avoid overheating during prolonged engine operation on the ground. Also, long periods of idling at low RPM may cause fouled spark plugs. If the engine accelerates smoothly, the airplane is ready for take-off.

MAGNETO CHECK.

The magneto check should be made at 1700 RPM as follows: Move the ignition switch first to "R" position, and note RPM. Next move switch back to "BOTH" to clear the other set of plugs. Then move switch to "L" position and note RPM. Magneto RPM drop should not exceed 125 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

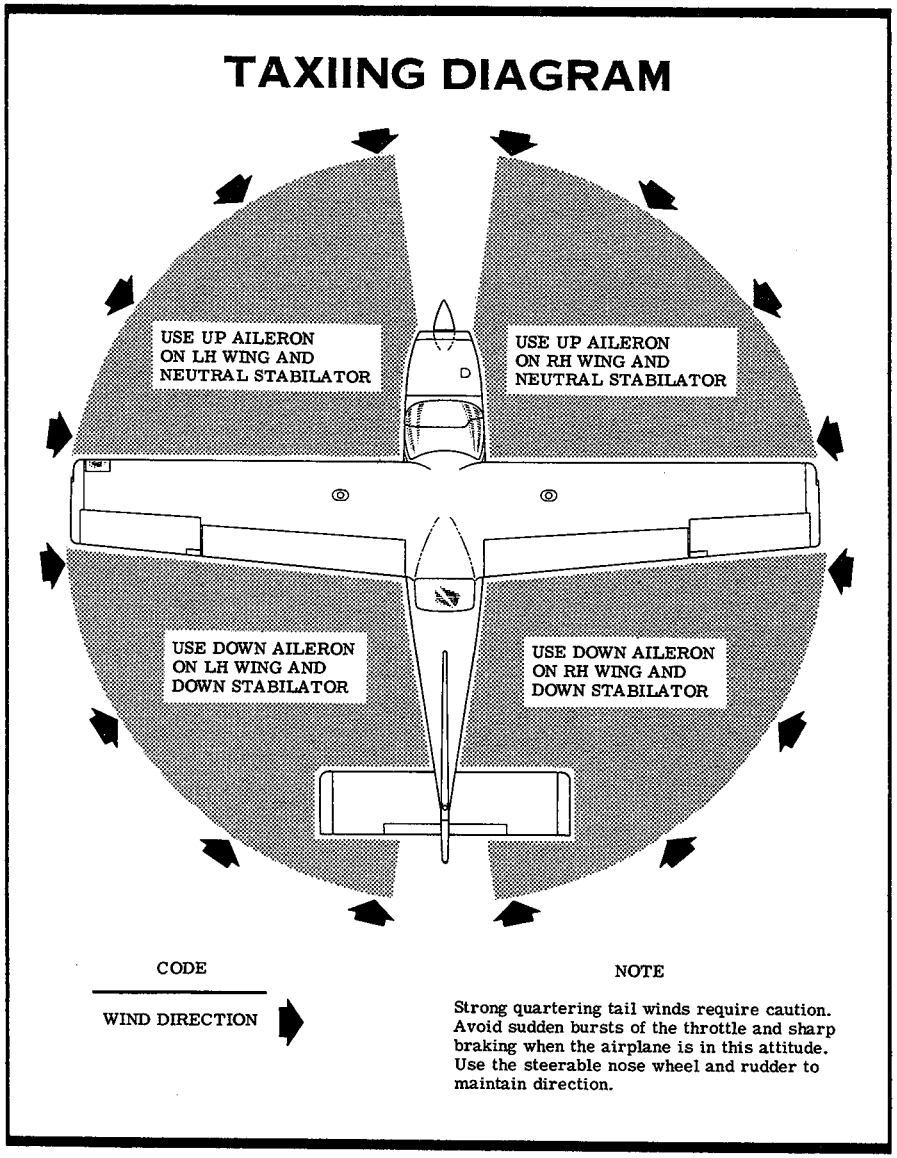


Figure 2-4

An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing is set in advance of the setting specified.

TAKE-OFF.

POWER CHECK.

It is important to check full-throttle engine operation early in the take-off run. Any signs of rough engine operation or sluggish engine acceleration is good cause for discontinuing the take-off. If this occurs, you are justified in making a thorough full-throttle, static runup before another take-off is attempted. The engine should run smoothly and turn approximately 2260 to 2360 RPM with carburetor heat off.

Smooth and uniform throttle application should be used to insure best engine acceleration and to give long engine life. This technique is important under hot weather conditions which may cause a rich mixture that could hinder engine response if the throttle is applied too rapidly.

Full-throttle runups over loose gravel are especially harmful to propeller tips. When take-offs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades, they should be corrected immediately as described in Section IV under propeller care.

Prior to take-off from fields above 5000 feet elevation, the mixture should be leaned to give maximum RPM in a full-throttle, static runup.

WING FLAP SETTINGS.

Normal take-offs are accomplished with the wing flaps set in the "UP" or "1/4" position. The use of "1/4" flaps will shorten the ground run approximately 10%. Soft field take-offs are performed with the flaps in the "1/4" position by lifting the airplane off the ground as soon as practical in a slightly tail-low attitude. However, the airplane should be leveled off immediately to accelerate to a safe climb speed.

If "1/4" flaps are used for take-off, they should not be retracted until

all obstacles are cleared. Obstacle clearance speed with "1/4" flaps is 67 MPH. If no obstructions are ahead, the flaps may be retracted as the airplane accelerates to normal flaps-up climb speeds of 90 to 100 MPH.

Flap settings of "1/2" to "DN" (full down) are not recommended at any time for take-off.

PERFORMANCE CHARTS.

Consult the Take-Off Data chart in Section V for take-off distances under various gross weight, altitude, headwind, temperature, and runway surface conditions.

CROSSWIND TAKE-OFFS.

Take-offs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after take-off. The airplane is accelerated to a speed slightly higher than normal, then pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

CLIMB.

CLIMB DATA.

For detailed data, refer to the Maximum Rate-Of-Climb Data chart in Section V.

CLIMB SPEEDS.

Normal climbs are performed at 90 to 100 MPH with flaps up and full throttle for best engine cooling. The mixture should be full rich below 5000 feet and may be leaned above 5000 feet for smoother engine operation. The maximum rate-of-climb speeds range from 88 MPH at sea level to 85 MPH at 10,000 feet. If an obstacle dictates the use of a steep climb angle, the best angle-of-climb speed should be used with flaps up and full throttle. These speeds vary from 71 MPH at sea level to 79 MPH at 10,000 feet.

NOTE

Steep climbs at these low speeds should be of short duration to improve engine cooling.

GO-AROUND CLIMB.

In a balked landing (go-around) climb, apply full throttle smoothly, remove carburetor heat, and reduce wing flaps promptly to the "1/2" position.

Upon reaching an airspeed of approximately 75 MPH, flaps should be slowly retracted to the full up position. If obstacles are immediately ahead during the go-around, the wing flaps should be left in the "1/2" position until obstacles are cleared.

CRUISE.

Normal cruising is done between 65% and 75% power. The power settings required to obtain these powers at various altitudes and outside air temperatures can be determined by using your Cessna Power Computer or the OPERATIONAL DATA, Section V.

Cruising can be done most efficiently at high altitudes because of lower air density and, therefore, higher true airspeeds for the same power. This is illustrated in figure 2-5, which shows performance at 75% power at various altitudes.

All figures are based on lean mixture, 48 gallons of fuel (no reserve), zero wind, standard atmospheric conditions, and 2350 pounds gross weight.

OPTIMUM CRUISE PERFORMANCE

ALTITUDE	RPM	TRUE AIRSPEED	RANGE
Sea Level	2470	125	720
5000 ft.	2580	130	750
9000 ft.	Full Throttle	134	780

Figure 2-5.

To achieve the lean mixture fuel consumption figures shown in Section V, the mixture should be leaned as follows: pull mixture control out until engine speed peaks and begins to fall off, then enrichen slightly back to peak RPM.

Carburetor ice, as evidenced by an unexplained drop in RPM, can be removed by application of full carburetor heat. Upon regaining the original RPM (with heat off), use the minimum amount of heat (by trial and error) to prevent ice from forming. Since heated air causes a richer mixture, readjust the mixture setting when carburetor heat is used continuously in cruising flight.

STALLS.

The stall characteristics are conventional and aural warning is provided by a stall warning horn which sounds between 5 and 10 MPH above the stall in all configurations.

Power-off stall speeds at maximum gross weight and aft c.g. position are presented on page 5-2 as calibrated airspeeds since indicated airspeeds are unreliable near the stall.

LANDING.

Normal landings are made power-off with any flap setting. Slips are prohibited in full flap approaches because of a downward pitch encountered under certain combinations of airspeed, sideslip angle and center of gravity loadings.

Landings should be made on the main wheels first to reduce the landing speed and subsequent need for braking in the landing roll. The nose wheel is lowered to the runway gently after the speed has diminished to avoid unnecessary nose gear loads. This procedure is especially important in rough or soft field landings.

Full down stabilator (control wheel positioned full forward) should not be used during the ground roll. This reduces the weight on the main wheels which causes poor braking and increases the possibility of sliding the tires.

SHORT FIELD LANDINGS.

For a short field landing, make a power-off approach at approximately 66 MPH with full flaps, and land on the main wheels first. Immediately after touchdown, retract the flaps and hold the control wheel back while applying maximum possible brake pressure without sliding the tires.

CROSSWIND LANDINGS.

When landing in a strong crosswind, use the minimum flap setting required for the field length. Although the crab or combination method of drift correction may be used, the wing-low method gives the best control. Hold a straight course with the steerable nose wheel and occasional braking if necessary.

The maximum allowable crosswind velocity is dependent upon pilot capability rather than airplane limitations. With average pilot technique, direct crosswinds of 15 MPH can be handled with safety.

COLD WEATHER OPERATION.

STARTING.

Prior to starting on a cold morning, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy. In extremely cold (0°F and lower) weather, the use of an external preheater and an external power source are recommended whenever possible to obtain positive starting and to reduce wear and abuse to the engine and the electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of the master switch is important. Refer to Section VI, paragraph GROUND SERVICE PLUG RECEPTACLE, for operating details.

Cold weather starting procedures are as follows:

With Preheat:

(1) With ignition switch "OFF" and throttle closed, prime the engine four to eight strokes as the propeller is being turned over by hand.

NOTE

Use heavy strokes of the primer for best atomization of fuel. After priming, push primer all the way in and turn to the locked position to avoid the possibility of the engine drawing fuel through the primer.

(2) Propeller Area -- Clear.
(3) Master Switch -- "ON."
(4) Throttle -- Open 1/8".
(5) Ignition Switch -- "START."
(6) Release ignition switch to "BOTH" when engine starts.
(7) Oil Pressure -- Check.

Without Preheat:

(1) Prime the engine six to ten strokes while the propeller is being turned by hand with the throttle closed. Leave the primer charged and ready for a stroke.
(2) Propeller Area -- Clear.
(3) Master Switch -- "ON."
(4) Pump throttle rapidly to full open twice. Return to 1/8 inch open position.
(5) Ignition Switch -- "START."
(6) Release ignition switch to "BOTH" when engine starts.
(7) Continue to prime the engine until it is running smoothly, or alternately, pump the throttle rapidly over the first 1/4 of total travel.
(8) Oil Pressure -- Check.
(9) Pull carburetor heat knob full on after the engine has started. Leave on until the engine is running smoothly.
(10) Lock primer.

NOTE

If the engine does not start during the first few attempts, or if engine firing diminishes in strength, it is probable that the spark plugs have been frosted over. Preheat must be used before another start is attempted.

IMPORTANT

Pumping the throttle may cause raw fuel to accumulate in the intake air duct, creating a fire hazard in the event of a backfire. If this occurs, maintain a cranking action to suck the flames into the engine. An outside attendant with a fire extinguisher is advised for cold starts without preheat.

During cold weather operations, no indication will 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), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for take-off.

FLIGHT OPERATIONS.

Take-off is made normally with carburetor heat off. Avoid excessive leaning in cruise.

Carburetor heat may be used to overcome any occasional engine roughness.

When operating in sub-zero temperature, avoid using partial carburetor heat. Partial heat may increase the carburetor air temperature to the 32° to 70°F range, where icing is critical under certain atmospheric conditions.

Refer to Section VI for cold weather equipment.

HOT WEATHER OPERATION.

The general warm temperature starting information on page 2-6 is appropriate. Avoid prolonged engine operation on the ground.

Section III

OPERATING LIMITATIONS

OPERATIONS AUTHORIZED.

Your Cessna exceeds the requirements for airworthiness as set forth by the United States Government, and is certificated under FAA Type Certificate No. A13CE.

With standard equipment, the airplane is approved for day and night operations under VFR. Additional optional equipment is available to increase its utility and to make it authorized for use under IFR day and night. An owner of a properly equipped Cessna is eligible to obtain approval for its operation on single-engine scheduled airline service under VFR. Your Cessna Dealer will be happy to assist you in selecting equipment best suited to your needs.

MANEUVERS-NORMAL CATEGORY.

This airplane is certificated in both the normal and utility category. The normal category is applicable to airplanes intended for non-aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls) and turns in which the angle of bank is not more than 60°. In connection with the foregoing, the following gross weight and flight load factors apply:

Gross Weight	2350 lbs	
Flight Load Factor *Flaps Up	+3.8	-1.52
Flight Load Factor *Flaps Down	+3.5	

*The design load factors are 150% of the above, and in all cases, the structure meets or 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.

MANEUVERS-UTILITY CATEGORY.

This airplane is not designed for purely aerobatic flight. However, in the acquisition of various certificates such as commercial pilot, instrument pilot and flight instructor, certain maneuvers are required by the FAA. All of these maneuvers are permitted in this airplane when operated in the utility category. In connection with the utility category, the following gross weight and flight load factors apply, with maximum entry speeds for maneuvers as shown:

Gross Weight	2200 lbs	
Flight Maneuvering Load Factor, Flaps Up	+4.4	-1.76
Flight Maneuvering Load Factor, Flaps Down	+3.5	

In the utility category, the baggage compartment and rear seat must not be occupied. No aerobatic maneuvers are approved except those listed below:

MANEUVER	MAXIMUM ENTRY SPEED
Chandelles	113 mph (98 knots)
Lazy Eights	113 mph (98 knots)
Steep Turns	113 mph (98 knots)
Stalls (Except Whip Stalls)	Slow Deceleration
Spins	Slow Deceleration

NOTE

For spin recovery, apply full opposite rudder followed by neutral stabilator. When airplane rotation has stopped, use moderate back pressure on stabilator to avoid excessive loads while recovering from the resulting dive. Intentional spins with flaps extended are prohibited.

Aerobatics that may impose high inverted loads should not be attempted. The important thing to bear in mind in flight maneuvers is that the airplane is clean in aerodynamic design and will build up speed quickly with the nose down. Proper speed control is an essential requirement for execution of any maneuver, and care should always be exercised to avoid excessive speed which in turn can impose excessive loads. In the execution of all maneuvers, avoid abrupt use of controls.

AIRSPEED LIMITATIONS.

The following are the certificated calibrated airspeed limits for your Cessna:

Maximum (Glide or dive, smooth air)	185 MPH (red line)
Caution Range	145-185 MPH (yellow arc)
Normal Range	64-145 MPH (green arc)
Maximum Speed, Flaps Extended	
Flaps "1/4"	130 MPH
Flaps "1/4" to "DN"	105 MPH
Flap Operating Range	53-105 MPH (white arc)
Maneuvering Speed*	113 MPH

*The maximum speed at which you can use abrupt control travel without exceeding the design load factor.

ENGINE OPERATION LIMITATIONS.

Power and Speed	150 BHP at 2700 RPM

ENGINE INSTRUMENT MARKINGS.

OIL TEMPERATURE GAGE.

Normal Operating Range	Green Arc
Maximum Allowable	245°F (red line)

OIL PRESSURE GAGE.

Minimum Idling	25 psi (red line)
Normal Operating Range	60-90 psi (green arc)
Maximum	100 psi (red line)

FUEL PRESSURE GAGE.

Minimum	2 psi (red line)
Normal Operating Range	2-8 psi (green arc)
Maximum	8 psi (red line)

FUEL QUANTITY INDICATORS.

Empty (0.5 gallons unusable each tank)	E (red line)

TACHOMETER.

Normal Operating Range:	
At sea level	2200-2500 (inner green arc)

At 5000 feet . . . . . 2200-2600 (middle green arc)
At 10,000 feet . . . . . 2200-2700 (outer green arc)
Maximum Allowable . . . . . 2700 (red line)

CARBURETOR AIR TEMPERATURE GAGE (OPT).

Icing Range . . . . . -15° to 5°C (yellow arc)

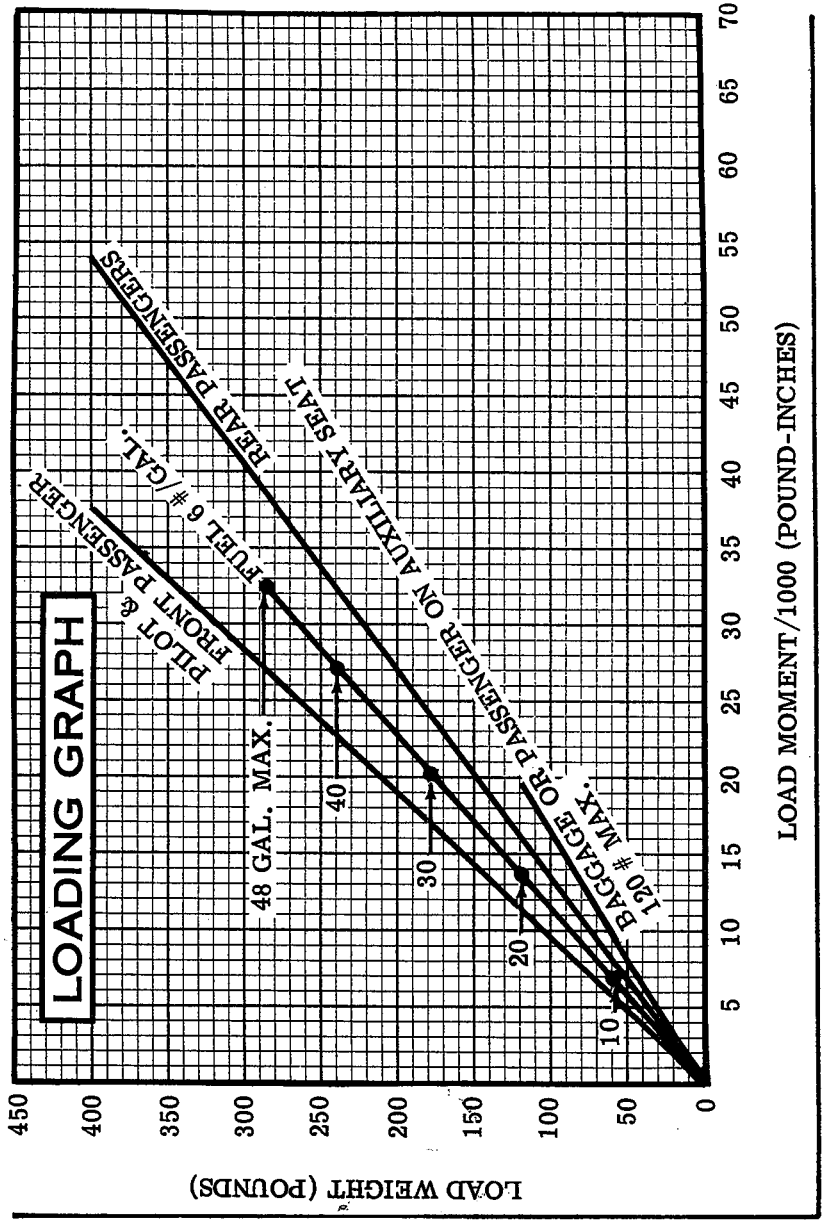
WEIGHT AND BALANCE.

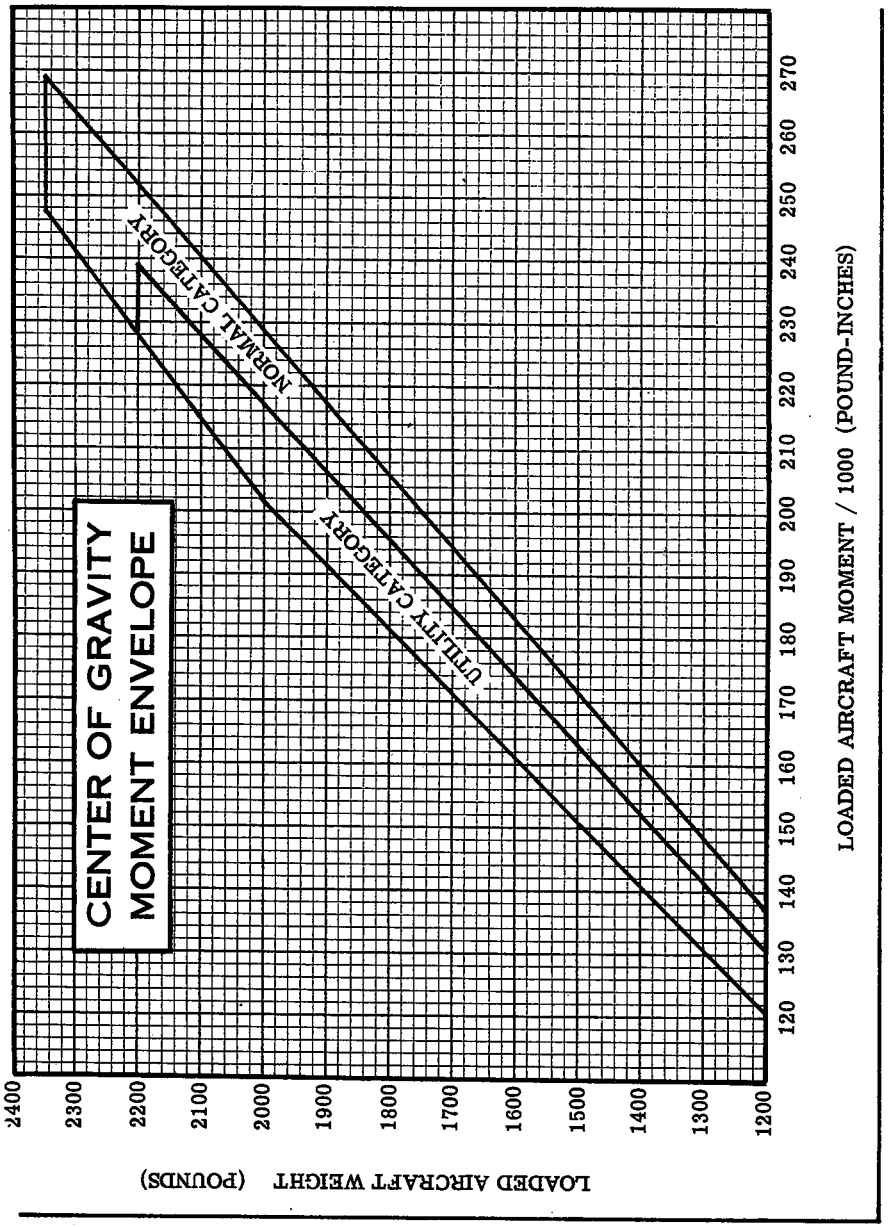
The following information will enable you to operate your Cessna within the prescribed weight and center of gravity limitations. To figure the weight and balance for your particular airplane, use the Sample Problem, Loading Graph, and Center of Gravity Moment Envelope as follows:

Take the licensed Empty Weight and Moment/1000 from the Weight and Balance Data sheet, plus any changes noted on forms FAA-337, carried in your airplane, and write them down in the proper columns. Using the Loading Graph, determine the moment/1000 of each item to be carried. Total the weights and moments/1000 and use the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)
1. Licensed Empty Weight (Sample Airplane) . . .	1409	148.2	Oct 1941	
2. Oil (8 qts. - Full oil may be assumed for all flights).	15	0.7	15	0.7
3. Fuel (Partial Fuel - 35 gal. at 6 lbs./gallon) . . (Total Capacity 48 gallons)	210	23.5		
4. Pilot and Front Passenger	340	31.6		
5. Rear Passengers	340	45.6		
6. Baggage (or Passenger on Auxiliary Seat) . . .	36	5.8		
7. TOTAL WEIGHT AND MOMENT	2350	255.4		

8. Locate this point (2350 at 255.4) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.





Section IV

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 preventative maintenance based on 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.

The airplane is most easily and safely maneuvered by hand with the tow-bar attached to the nose wheel.

NOTE

When using the tow-bar, never exceed the turning angle of 45°, either side of center, or damage to the gear will result.

MOORING YOUR AIRPLANE.

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

(1) Set the parking brake and install the control wheel lock.
(2) Install a surface control lock over the fin and rudder.

(3) Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing and tail tie-down fittings and secure each rope to a ramp tie-down.
(4) Tie a rope (no chains or cables) to the nose gear strut and secure to a ramp tie-down.
(5) Install a pitot tube cover.

WINDSHIELD - WINDOWS.

The plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner sparingly with soft cloths, and rub with moderate pressure until all dirt, oil scum and big stains are removed. Allow the cleaner to dry, then wipe it off with soft flannel cloths.

If a windshield cleaner is not available, the plastic can be cleaned with soft cloths moistened with Stoddard solvent to remove oil and grease.

NOTE

Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, fire extinguisher or anti-ice fluid, lacquer thinner or glass cleaner to clean the plastic. These materials will attack the plastic and may cause it to craze.

Follow by carefully washing with a mild detergent and plenty of water. Rinse thoroughly, then dry with a clean moist chamois. Do not rub the plastic with a dry cloth since this builds up an electrostatic charge which attracts dust. Waxing with a good commercial wax will finish the cleaning job. A thin, even coat of wax, polished out by hand with clean soft flannel cloths, will fill in minor scratches and help prevent further scratching.

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

PAINTED SURFACES.

The painted exterior surfaces of your new Cessna have a durable, long lasting finish and, under normal conditions, require no polishing or buffing. Approximately 15 days are required for the paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the airplane. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by someone experienced in handling uncured paint. Any Cessna Dealer can accomplish this work.

Generally, the painted surfaces can be kept bright by washing with water and mild soap, followed by a rinse with water and drying with cloths or a chamois. Harsh or abrasive soaps or detergents which cause corrosion or make scratches should never be used. Remove stubborn oil and grease with a cloth moistened with Stoddard solvent.

Waxing is unnecessary to keep the painted surfaces bright. However, if desired, the airplane may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the engine nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

ALUMINUM SURFACES.

The clad aluminum surfaces of your Cessna may be washed with clear water to remove dirt; oil and grease may be removed with gasoline, naptha, carbon tetrachloride or other non-alkaline solvents. Dulled aluminum surfaces may be cleaned effectively with an aircraft aluminum polish.

After cleaning, and periodically thereafter, waxing with a good automotive wax will preserve the bright appearance and retard corrosion. Regular waxing is especially recommended for airplanes operated in salt water areas as a protection against corrosion.

PROPELLER CARE.

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off grass and bug stains 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, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with carbon tetrachloride or Stoddard solvent.

INTERIOR CARE.

To remove dust and loose dirt from the upholstery and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off stickly materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

Soiled upholstery and carpet may be cleaned with foam-type detergent, used according to the manufacturer's instructions. To minimize wetting the fabric, keep the foam as dry as possible and remove it with a vacuum cleaner.

The plastic trim, headliner, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with Stoddard solvent. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

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 180 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 purchased the airplane accomplish this work.

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

AIRCRAFT FILE.

There are miscellaneous data, information and licenses that are a part of the aircraft 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 displayed in the aircraft at all times:

(1) Aircraft Airworthiness Certificate (Form FAA-1362B).
(2) Aircraft Registration Certificate (Form FAA-500A).
(3) Aircraft Radio Station License (Form FCC-404, if transmitter installed).

B. To be carried in the aircraft at all times:

(1) Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, Form FAA-337, if applicable).
(2) Aircraft Equipment List.

C. To be made available upon request:

(1) Aircraft Log Book.
(2) Engine Log Book.

NOTE

Cessna recommends that these items, plus the Owner's Manual, "Cessna Flight Guide" (Flight Computer), and Service Policies, be carried in the aircraft at all times.

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

LUBRICATION AND SERVICING PROCEDURES

Specific servicing information is provided here for items requiring daily attention. A Servicing Intervals Check List is included to inform the pilot when to have other items checked and serviced.

DAILY

FUEL BAY FILLERS:

Service after each flight with 80/87 minimum grade fuel. Fill each bay to top of filler for a total capacity of 24.5 gallons in each bay. A 21-gallon level marker, in the form of a white line just inside filler neck, is provided to facilitate fueling to reduced fuel loads.

FUEL STRAINER:

Before the first flight of the day and after each refueling, pull out fuel strainer drain knob for about four seconds, to clear fuel strainer of possible water and sediment. Release drain knob, then check that strainer drain is closed after draining. If water is observed, there is a possibility that the fuel bay sumps contain water. Thus, the drain plugs in the fuel bay sumps, fuel selector valve, fuel vent line, and fuel reservoir should be removed to check for presence of water.

OIL DIPSTICK:

Check oil level before each flight. Do not operate on less than 6 quarts. To minimize loss of oil through breather, fill to 7 quart level for normal flights of less than 3 hours. For extended flight, fill to 8 quarts. If an optional oil filter is installed, one additional quart is required when the filter element is changed.

OIL FILLER:

When preflight check shows low oil level, service with aviation grade engine oil; SAE 50 above 60°F, SAE 10W30 or SAE 30 at temperatures from 0° to 70°F, and SAE 10W30 or SAE 20 at temperatures below 10°F. (Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting and lubrication during warm-up in cold weather.) Detergent or dispersant oil, conforming to Lycoming Specification No. 301E, must be used. Your Cessna Dealer can supply approved brands of oil.

NOTE

To promote faster ring seating and improved oil control, your Cessna was delivered from the factory with straight mineral oil (non-detergent). This "break-in" oil should be used only for the first 50 hours of operation, or until oil consumption has stabilized, at which time it must be replaced with detergent oil.

SERVICING INTERVALS CHECK LIST

FIRST 25 HOURS

ENGINE OIL AND OIL FILTER -- After the first 25 hours of operation, drain the engine oil and clean both the oil suction strainer and oil pressure screen. If an optional oil filter is installed, change filter element at this time. Refill the sump with straight mineral oil (non-detergent) and use until a total of 50 hours have accumulated or oil consumption has stabilized, then change to detergent oil.

EACH 50 HOURS

BATTERY -- Check and service. Check oftener (at least every 30 days) if operating in hot weather.

ENGINE OIL AND OIL FILTER -- On airplanes not equipped with an optional oil filter, change engine oil and clean both the oil suction strainer and oil pressure screen. On airplanes which have an optional oil filter, the oil change interval may be extended to 100-hour intervals providing the oil filter element is changed at 50-hour intervals. Change engine oil at least every four months even though less than 50 hours have accumulated. Reduce periods for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

CARBURETOR AIR FILTER -- Clean or replace. Under extremely dusty conditions, daily maintenance of the filter is recommended.

EACH 100 HOURS

SPARK PLUGS -- Clean, test and regap.

BRAKE MASTER CYLINDERS -- Check and fill.

SHIMMY DAMPENER -- Check and fill.

FUEL STRAINER -- Disassemble and clean.

FUEL BAY SUMP DRAINS -- Drain water and sediment.

FUEL SELECTOR VALVE DRAIN PLUG -- Drain water and sediment.

FUEL VENT LINE DRAIN PLUG -- Drain water and sediment.

FUEL RESERVOIR DRAIN PLUG -- Drain water and sediment.

AUXILIARY FUEL PUMP FILTER -- Remove and clean.

SUCTION RELIEF VALVE INLET FILTER (OPT.) -- Clean. Replace at engine overhaul period.

SERVICING INTERVALS CHECK LIST (Continued)

EACH 500 HOURS

VACUUM SYSTEM AIR FILTER (OPT.) -- Replace filter element. Replace sooner if suction gage reading drops to 4.6 in. Hg.
WHEEL BEARINGS -- Lubricate at first 100 hours and at 500 hours thereafter. Reduce lubrication interval to 100 hours when operating in dusty or sea coast areas, during periods of extensive taxiing, or when numerous take-offs and landings are made.

AS REQUIRED

NOSE GEAR SHOCK STRUT -- Keep filled with fluid and inflated to 50 psi.

OWNER FOLLOW-UP SYSTEM

Your Cessna Dealer has an owner follow-up system to notify you when he receives information that applies to your Cessna. In addition, if you wish, you may choose to receive similar notification directly from the Cessna Service Department. A subscription card is supplied in your aircraft 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.

PUBLICATIONS

Included in your aircraft file are various manuals which describe the operation of the equipment in your aircraft. These manuals, plus many other supplies that are applicable to your aircraft, are available from your Cessna Dealer, and, for your convenience, are listed below.

- OWNER'S MANUALS FOR YOUR
  AIRCRAFT
  ELECTRONICS - 300 SERIES
  AUTOPILOT - NAV-O-MATIC 300 AND 400
- SERVICE MANUALS AND PARTS CATALOGS FOR YOUR
  AIRCRAFT
  ENGINE AND ACCESSORIES
  ELECTRONICS - 300 SERIES
  AUTOPILOT - NAV-O-MATIC 300 AND 400
  WING LEVELER
- COMPUTERS
- SALES AND SERVICE DEALER DIRECTORY

Your Cessna Dealer has a current catalog of all Customer Services Supplies that are available, many of which he keeps on hand. Supplies which are not in stock, he will be happy to order for you.

Section V

OPERATIONAL DATA

The operational data shown on the following pages are compiled from actual tests with the airplane and engine in good condition and using average piloting technique. You will find this data a valuable aid when planning your flights.

A power setting selected from the range chart usually will be more efficient than a random setting, since it will permit you to estimate your fuel consumption more accurately. You will find that using the chart and your Power Computer will pay dividends in overall efficiency.

Cruise and range performance shown in the chart on page 5-4 are based on flight test using a McCauley 1C172/TM7653 propeller. Other conditions of the tests are shown in the chart headings. Allowances for fuel reserve, headwinds, take-offs, and climb, and variations in mixture leaning technique should be made and are in addition to those shown on the chart. Other indeterminate variables such as carburetor metering-characteristics, engine and propeller conditions, and turbulence of the atmosphere may account for variations of 10% or more in maximum range.

Remember that the charts contained herein are based on standard day conditions. For more precise power, fuel consumption, and endurance information, consult the Cessna Flight Guide (Power Computer) supplied with your aircraft. With the Flight Guide, you can easily take into account temperature variations from standard at any flight altitude.

AIRSPEED CORRECTION TABLE

FLAPS UP										
IAS-MPH	60	70	80	90	100	110	120	130	140	145
CAS-MPH	61	71	81	90	100	110	119	129	138	143
FLAPS 1/4										
IAS-MPH	60	70	80	90	100	110	120	130	—	—
CAS-MPH	63	72	82	91	101	110	120	129	—	—
FULL FLAPS										
IAS-MPH	50	60	70	80	90	100	105	—	—	—
CAS-MPH	54	63	73	82	91	101	105	—	—	—

Figure 5-1.

POWER OFF STALLING SPEEDS MPH - CAS

GROSS WEIGHT 2350 LBS / CONDITION	ANGLE OF BANK 0°	20°	40°	60°
FLAPS UP	64	66	73	91
FLAPS 1/4	60	62	69	85
FULL FLAPS	53	55	61	75

Figure 5-2.

TAKE-OFF DATA

TAKE-OFF DISTANCE FROM HARD SURFACE RUNWAY WITH FLAPS 1/4

GROSS WEIGHT POUNDS	IAS AT 50' MPH	HEAD WIND KNOTS	AT SEA LEVEL & 59°F GROUND RUN	AT SEA LEVEL & 59°F TOTAL TO CLEAR 50 FT OBS	AT 2500 FT. & 50°F GROUND RUN	AT 2500 FT. & 50°F TOTAL TO CLEAR 50 FT OBS	AT 5000 FT. & 41°F GROUND RUN	AT 5000 FT. & 41°F TOTAL TO CLEAR 50 FT OBS	AT 7500 FT. & 32°F GROUND RUN	AT 7500 FT. & 32°F TOTAL TO CLEAR 50 FT OBS
2350	67	0	845	1575	1025	2000	1260	2740	1575	4680
		10	585	1190	720	1530	900	2145	1140	3765
		20	370	850	465	1115	595	1600	770	2915
2000	62	0	580	1060	695	1280	850	1610	1050	2150
		10	385	775	475	955	585	1215	740	1650
		20	230	530	290	665	370	865	475	1205
1700	57	0	400	745	475	885	580	1070	710	1340
		10	255	535	315	640	385	785	485	1000
		20	145	350	180	430	230	535	295	695

NOTES:
1. Increase distance 10% for each 20°F above standard temperature for particular altitude.
2. For operation on a dry, grass runway, increase distances (both "ground run" and "total to clear 50 ft. obstacle") by 7% of the "total to clear 50 ft. obstacle" figure.

MAXIMUM RATE-OF-CLIMB DATA

GROSS WEIGHT POUNDS	AT SEA LEVEL & 59°F IAS MPH	AT SEA LEVEL & 59°F RATE OF CLIMB FT/MIN	AT SEA LEVEL & 59°F GAL. OF FUEL USED	AT 5000 FT & 41°F IAS MPH	AT 5000 FT & 41°F RATE OF CLIMB FT/MIN	AT 5000 FT & 41°F FROM S.L. FUEL USED	AT 10,000 FT & 23°F IAS MPH	AT 10,000 FT & 23°F RATE OF CLIMB FT/MIN	AT 10,000 FT & 23°F FROM S.L. FUEL USED	AT 15,000 FT & 5°F IAS MPH	AT 15,000 FT & 5°F RATE OF CLIMB FT/MIN	AT 15,000 FT & 5°F FROM S.L. FUEL USED
2350	88	670	1.0	87	445	2.9	85	225	5.3	84	0	---
2000	86	825	1.0	85	585	2.5	83	350	4.1	82	110	7.1
1700	84	960	1.0	83	710	2.2	81	460	3.5	80	210	5.5

NOTES:
1. Flaps up, full throttle and mixture leaned for smooth operation above 5000 ft.
2. Fuel used includes warm up and take-off allowance.
3. For hot weather, decrease rate of climb 20 ft./min. for each 10°F above standard day temperature for particular altitude.

Figure 5-3.

CRUISE & RANGE PERFORMANCE

CARDINAL

Gross Weight- 2350 Lbs.
Standard Conditions
Zero Wind Lean Mixture
48 Gal. of Fuel (No Reserve)

NOTE: Maximum cruise is normally limited to 75% power. Cruise speeds for the standard Model 177 are 3 to 4 MPH less than shown below for the Cardinal configuration.

ALT.	RPM	% BHP	TAS MPH	GAL / HOUR	ENDR. HOURS	RANGE MILES
2500	2700	89	138	9.9	4.8	670
	2600	81	132	8.9	5.4	710
	2500	73	126	8.1	5.9	750
	2400	65	119	7.3	6.6	785
	2300	58	112	6.6	7.3	815
	2200	52	104	6.0	7.9	825
	2100	46	94	5.7	8.5	795
5000	2700	84	137	9.3	5.2	710
	2600	76	131	8.4	5.7	745
	2500	69	125	7.6	6.3	785
	2400	61	118	6.9	7.0	820
	2300	55	110	6.3	7.6	840
	2200	48	100	5.8	8.2	820
7500	2700	79	136	8.7	5.5	745
	2600	71	130	7.9	6.1	785
	2500	64	123	7.2	6.7	820
	2400	57	115	6.5	7.4	845
	2300	51	105	6.0	8.0	840
10000	2650	70	131	7.8	6.2	805
	2600	67	127	7.4	6.5	825
	2500	60	120	6.8	7.1	850
	2400	54	110	6.2	7.7	855
	2300	48	98	5.8	8.3	810
12500	2600	62	124	7.0	6.9	855
	2500	56	115	6.4	7.5	865
	2400	50	103	5.9	8.1	830

Figure 5-4.

LANDING DISTANCE TABLE

LANDING DISTANCE WITH FULL FLAPS, POWER OFF, AND NO WIND ON HARD SURFACE RUNWAY

GROSS WEIGHT POUNDS	IAS AT 50' MPH	AT SEA LEVEL & 59°F		AT 2500 FT. & 50°F		AT 5000 FT. & 41°F		AT 7500 FT. & 32°F	
		GROUND ROLL	TOTAL TO CLEAR 50 FT. OBS.	GROUND ROLL	TOTAL TO CLEAR 50 FT. OBS.	GROUND ROLL	TOTAL TO CLEAR 50 FT. OBS.	GROUND ROLL	TOTAL TO CLEAR 50 FT. OBS.
2350	66	400	1135	420	1195	445	1265	470	1335

NOTES:
1. Reduce landing distance 10% for each 4 knots of headwind.
2. For operation on a dry, grass runway, increase distances (both "ground roll" and "total to clear 50 ft. obstacle") by 20% of the "total to clear 50 ft. obstacle" figure.

Figure 5-5.

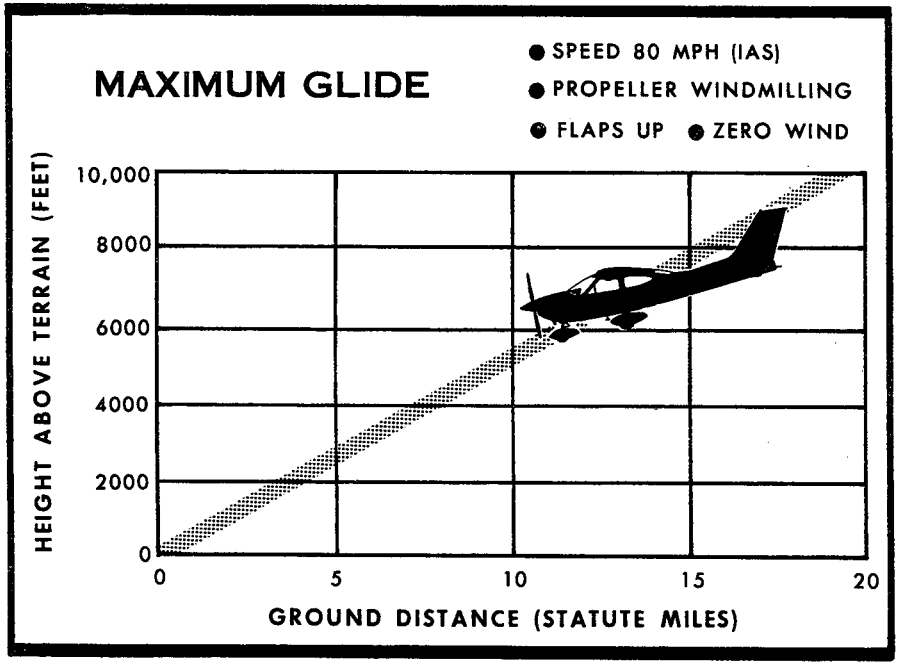


Figure 5-6.

Section VI

OPTIONAL SYSTEMS

This section contains a description, operating procedures, and performance data (when applicable) for some of the optional equipment which may be installed in your Cessna. Owner's Manual Supplements are provided to cover operation of other optional equipment systems when installed in your airplane. Contact your Cessna Dealer for a complete list of available optional equipment.

COLD WEATHER EQUIPMENT

WINTERIZATION KIT.

For continuous operation in temperatures consistently below 20°F, the Cessna winterization kit should be installed to improve engine operation. The kit consists of two baffles to cover the side inlets of the cowling nose cap, and an additional baffle to partially cover the nose cap opening around the carburetor air filter.

GROUND SERVICE PLUG RECEPTACLE.

A ground service plug receptacle may be installed to permit the use of an external power source for cold weather starting and during lengthy maintenance work on the airplane electrical system (with the exception of electronic equipment).

NOTE

Electrical power for the airplane electrical circuits is provided through a split bus bar having all elec-

tronic circuits on one side of the bus and other electrical circuits on the other side of the bus. When an external power source is connected, a contactor automatically opens the circuit to the electronic portion of the split bus bar as a protection against damage to the semi-conductors in the electronic equipment by transient voltages from the power source. Therefore, the external power source can not be used as a source of power when checking electronic components.

Just before connecting an external power source (generator type or battery cart), the master switch should be turned "ON."

The ground service plug receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is correctly connected to the airplane. If the plug is accidentally connected backwards, no power will flow to the airplane's electrical system, thereby preventing any damage to electrical equipment.

The battery and external power circuits have been designed to completely eliminate the need to "jumper" across the battery contactor to close it for charging a completely "dead" battery. A special fused circuit in the external power system supplies the needed "jumper" across the contacts so that with a "dead" battery and an external power source applied, turning the master switch "ON" will close the battery contactor.

STATIC PRESSURE ALTERNATE SOURCE VALVE.

A static pressure alternate source valve may be installed below the left side of the instrument panel in the static system for use when the external static source is malfunctioning. This valve also permits draining condensate from the static lines.

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, thereby supplying static pressure from the cabin. Cabin pressures will vary, however, with open cabin ventilators or windows. The most adverse combinations will result in airspeed and altimeter variations of no more than 6 MPH and 80 feet, respectively.

RADIO SELECTOR SWITCHES

RADIO SELECTOR SWITCH OPERATION.

Operation of the radio equipment is normal as covered in the respective radio manuals. When more than one radio is installed, an audio switching system is necessary. The operation of this switching system is described below.

TRANSMITTER SELECTOR SWITCH.

The transmitter selector switch (figure 6-1) is labeled "TRANS," and has two positions. When two transmitters are installed, it is necessary to switch the micorphone to the radio unit the pilot desires to use for transmission. This is accomplished by placing the transmitter selector switch in the position corresponding to the radio unit which is to be used. The up position selects the upper transmitter and the down position selects the lower transmitter.

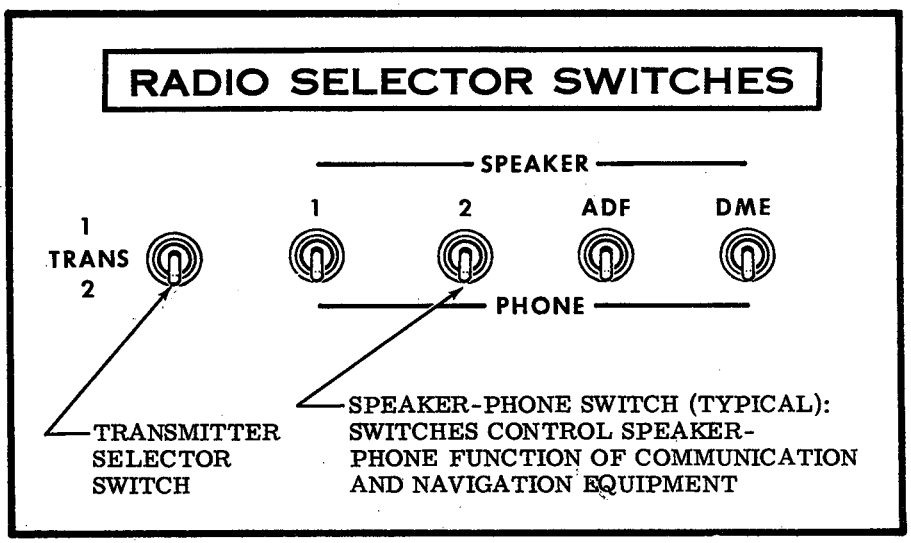


Figure 6-1.

SPEAKER-PHONE SWITCHES.

The speaker-phone switches (figure 6-1) determine whether the output of the receiver in use is fed to the headphones or through the audio amplifier to the speaker. Place the switch for the desired receiving system either in the up position for speaker operation or in the down position for headphones.

AUTOPILOT-OMNI SWITCH.

When a Nav-O-Matic autopilot is installed with two compatible omni receivers, an autopilot-omni switch is utilized. This switch selects the omni receiver to be used for the omni course sensing function of the autopilot. The switch is mounted just to the left of the autopilot control unit located at the bottom of the radio stack in the center of the instrument panel. The switch positions, labeled "OMNI 1" and "OMNI 2", correspond to the omni receivers in the radio panel stack.

TRUE AIRSPEED INDICATOR

A true airspeed indicator is available to replace the standard airspeed indicator in your airplane. The true airspeed indicator has a calibrated rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer.

TO OBTAIN TRUE AIRSPEED, rotate ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Then read true airspeed on rotatable ring opposite airspeed needle.

NOTE

Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, set barometric scale on altimeter to "29.92" and read pressure altitude on altimeter. Be sure to return altimeter barometric scale to original barometric setting after pressure altitude has been obtained.

WING LEVELER

A wing leveler may be installed to augment the lateral and directional stability of the airplane. The system uses the Turn Coordinator for roll and yaw sensing. Vacuum pressure, from the engine-driven vacuum pump, is routed from the Turn Coordinator to cylinder-piston servo units attached to the aileron and rudder control systems. As the airplane deviates from a wing level attitude or a given direction, vacuum pressure in the servo units is increased or relieved as needed to actuate the ailerons and rudder to oppose the deviations. The rudder action effectively corrects adverse yaw induced by the ailerons.

The wing leveler system has manual roll trim capabilities which may be used to compensate for asymmetrical loading of fuel and passengers, and to optimize system performance in climb, cruise and let-down.

OPERATING CHECK LIST

TAKE-OFF.

(1) "WING LVLR" Control Knob -- Check in off position (full in).

CLIMB.

(1) Adjust stabilator trim for climb.
(2) "WING LVLR" Control Knob -- Pull control knob "ON."
(3) "ROLL TRIM" Control Knob -- Adjust for wings level attitude.

CRUISE.

(1) Adjust power and stabilator trim for level flight.
(2) "ROLL TRIM" Control knob -- Adjust as desired.

DESCENT.

(1) Adjust power and stabilator trim for desired speed and rate of descent.
(2) "ROLL TRIM" Control knob -- Adjust as desired.

LANDING.

(1) Before landing, push "WING LVLR" control knob full in to the off position.

EMERGENCY PROCEDURES

If a malfunction should occur, the system is easily overpowered with pressure on the control wheel. The system should then be turned off. In the event of partial or complete vacuum failure, the stability augmentation system will automatically become inoperative.

OPERATING NOTES

(1) The wing leveler system may be overpowered at any time without damage or wear. However, for extended periods of maneuvering it may be desirable to turn the system off.

(2) It is recommended that the system not be engaged during take-off and landing. Although the system can be easily overpowered, servo forces could significantly alter the manual "feel" of the aileron control, especially should a malfunction occur.

FUEL BAY QUICK-DRAIN VALVE KIT

Two fuel bay quick-drain valves and a fuel sampler cup are available as a kit to facilitate daily draining and inspection of fuel in the fuel bays for the presence of water and sediment. The valves replace existing fuel bay drain plugs located at the lower inboard area of the wing. The fuel sampler cup, which may be stowed in the map compartment, is used to drain the valves. The sampler cup has a probe in the center of the cup. When the probe is inserted into the hole in the bottom of the drain valve and pushed upward, fuel flows into the cup to facilitate visual inspection of the fuel. As the cup is removed, the drain valve seats, stopping the flow of fuel.

ALPHABETICAL INDEX

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WARRANTY

The Cessna Aircraft Company ("Cessna") warrants each new aircraft manufactured by it, and all new aircraft equipment and accessories, including Cessna-Crafted Electronics (as herein defined), and all new service parts for such aircraft, aircraft equipment and accessories sold by it, to be free from defects in material and workmanship under normal use and service for a period of six (6) months after delivery to the original retail purchaser or first user in the case of aircraft, aircraft equipment and accessories (except Cessna-Crafted Electronics as herein defined) and service parts therefor, and for a period of one (1) year after such delivery in the case of Cessna-Crafted Electronics (which term includes all communication, navigation and autopilot systems bearing the name "Cessna", beginning at the connection to the aircraft electrical system (bus bar) and including "black boxes", antennas, microphones, speakers and other components and associated wiring but excluding gyro instruments used in connection with autopilot and navigation systems) and service parts therefor.

Cessna's obligation under this warranty is limited to repairing or replacing, at its option, any part or parts which, within the applicable six (6) or twelve (12) months period as above set forth, shall be returned transportation charges prepaid to Cessna at Wichita, Kansas, or to any Cessna appointed or Cessna Distributor appointed dealer authorized by such appointment to sell the aircraft, equipment, accessories and service parts of the type involved and which upon examination shall disclose to Cessna's satisfaction to have been thus defective. (A new warranty period is not established for replacements. Replacements are warranted for the remainder of the applicable six (6) or twelve (12) months original warranty period). The repair or replacement of defective parts under this warranty will be made by Cessna or the dealer without charge for parts, or labor for removal, installation and/or actual repair of such defective parts. (Locations of such dealers will be furnished by Cessna on request).

The provisions of this warranty do not apply to any aircraft, equipment, accessories (including Cessna-Crafted Electronics) or service parts therefor manufactured or sold by Cessna which have been subject to misuse, negligence, or accident, or which shall have been repaired or altered outside of Cessna's factory in any way so as in the judgment of Cessna to affect adversely its performance, stability and reliability, nor to normal maintenance services (such as engine tune up, cleaning, control rigging, brake and other mechanical adjustments, maintenance inspections, etc.) and the replacement of service items (such as spark plugs, brake linings, filters, hoses, belts, tires, etc.) made in connection with such services or required as maintenance, nor to normal deterioration of soft trim and appearance items (such as paint, upholstery, rubber-like items, etc.) due to wear and exposure.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED IN FACT OR BY LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION OR LIABILITY ON THE PART OF CESSNA TO ANYONE OF ANY NATURE WHATSOEVER BY REASON OF THE MANUFACTURE AND/OR SALE OR THE USE OF SUCH AIRCRAFT PRODUCTS, INCLUDING LIABILITY FOR CONSEQUENTIAL OR SPECIAL DAMAGES, AND CESSNA NEITHER ASSUMES NOR AUTHORIZES ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION OR LIABILITY IN CONNECTION WITH SUCH AIRCRAFT PRODUCTS.

SERVICING REQUIREMENTS

FUEL:

AVIATION GRADE -- 80/87 MINIMUM GRADE
TOTAL CAPACITY EACH BAY -- 24.5 GALLONS (24 GALLONS USABLE)
(FILL TO SUIT CABIN LOADING CONDITIONS)

ENGINE OIL:

AVIATION GRADE: -- SAE 50 ABOVE 60°F
SAE 10W30 OR SAE 30 BETWEEN 0° and 70°F
SAE 10W30 OR SAE 20 BELOW 10°F
(MULTI-VISCOSITY OIL WITH A RANGE OF SAE 10W30 IS RECOMMENDED FOR IMPROVED STARTING AND LUBRICATION DURING WARM-UP IN COLD WEATHER. DETERGENT OR DISPERSANT OIL, CONFORMING TO LYCOMING SPECIFICATION NO. 301E, MUST BE USED.
CAPACITY OF ENGINE SUMP -- 8 QUARTS
(DO NOT OPERATE ON LESS THAN 6 QUARTS. TO MINIMIZE LOSS OF OIL THROUGH BREATHER, FILL TO 7 QUART LEVEL FOR NORMAL FLIGHTS OF LESS THAN 3 HOURS. FOR EXTENDED FLIGHT, FILL TO 8 QUARTS. IF AN OPTIONAL OIL FILTER IS INSTALLED, ONE ADDITIONAL QUART IS REQUIRED WHEN THE FILTER ELEMENT IS CHANGED.

HYDRAULIC FLUID:

MIL-H-5606 HYDRAULIC FLUID

TIRE PRESSURES:

NOSE WHEEL----------30 PSI ON 5.00X5 TIRE
30 PSI ON 6.00X6 TIRE
MAIN WHEELS----------30 PSI ON 6.00X6 TIRES

NOSE GEAR SHOCK STRUT:

KEEP FILLED WITH FLUID AND INFLATED TO 50 PSI.