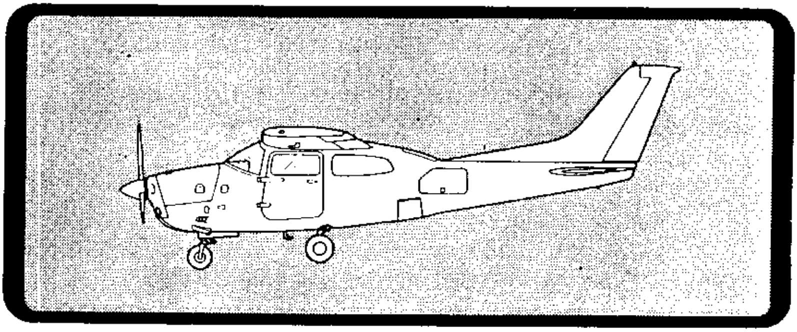
PILOT'S OPERATING HANDBOOK

Cessna®



CENTURION

1977 MODEL 210M

Serial No. 210 61773

Registration No. VH- MDZ

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR PART 3

CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

D1094-3-13
(RGI-100-8/98)

CHANGE 3

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES; DISPOSE OF SUPERSEDED PAGES.

NOTE: This handbook will be kept current by Service Letters published by Cessna Aircraft Company. These are distributed to Cessna Dealers and to those who subscribe through the Owner Follow-Up System. If you are not receiving subscription service, you will want to keep in touch with your Cessna Dealer for information concerning the change status of the handbook. Subsequent changes should be examined immediately after receipt; the handbook should not be used for operational purposes until it has been updated to a current status. On a changed page, the portion of the text or illustration affected by the change is indicated by a vertical line in the outer margin of the page.

Dates of issue for original and changed pages are:

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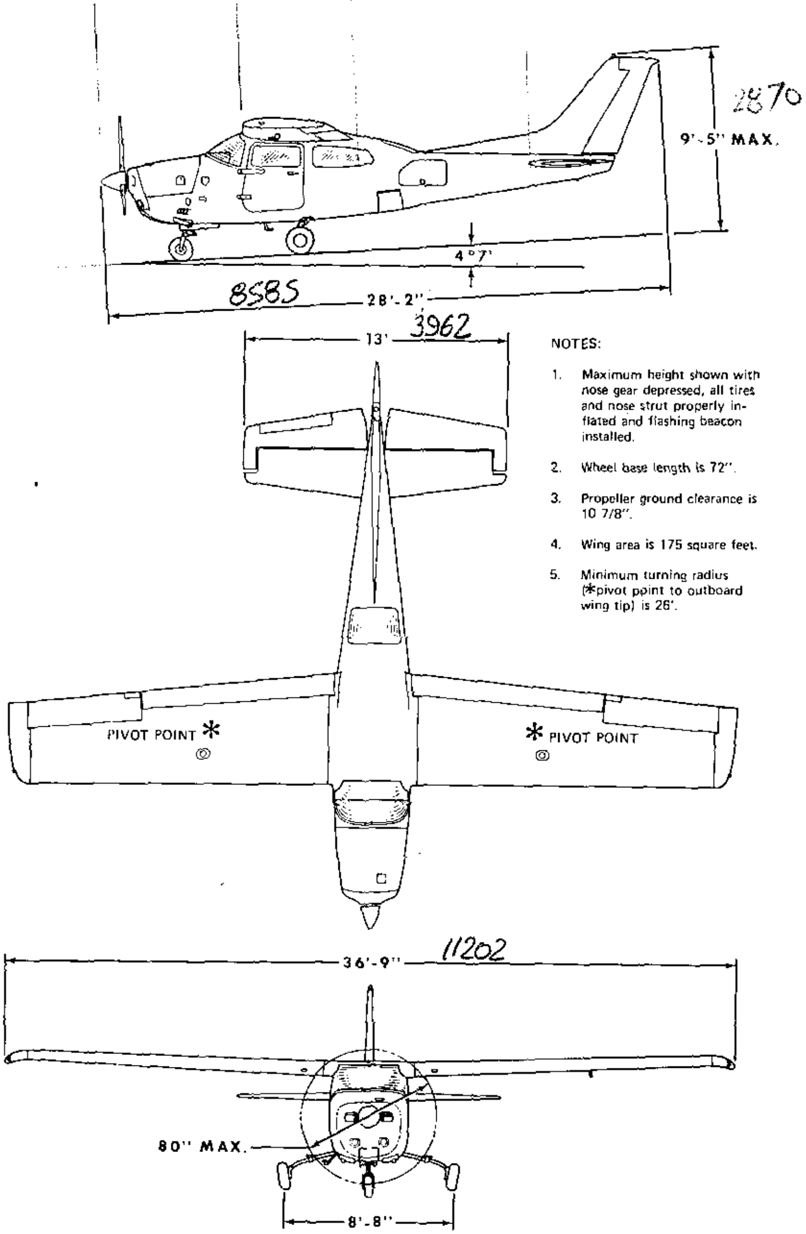
THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 356, CONSISTING OF THE FOLLOWING. THIS TOTAL INCLUDES THE SUPPLEMENTS PROVIDED IN SECTION 9 WHICH COVER OPTIONAL SYSTEMS AVAILABLE IN THE AIRPLANE.

Page No.	#Change No.
Title	3
A	3
i thru iii	0
iv Blank	0
1-1 thru 1-8	0
2-1	0
2-2 Blank	0
2-3 thru 2-11	0
2-12 Blank	0
3-1 thru 3-11	0
3-12 Blank	0
3-13 thru 3-21	0
3-22 Blank	0
4-1 thru 4-11	0
4-12 Blank	0
4-13 thru 4-22	0
5-1	0
5-2 Blank	0
5-3 thru 5-14	0
5-15	3
5-16 thru 5-25	0
5-26 Blank	0
6-1	0
6-2 Blank	0
6-3 thru 6-13	0
6-14 Blank	0
6-15 thru 6-29	0
6-30 Blank	0
7-1 thru 7-47	0
7-48 Blank	0
8-1	0
8-2 Blank	0
8-3 thru 8-14	0
9-1	0
9-2	2
9-3	0
9-4 Blank	0
Supplements (164 Pages) (Refer to Section 9 Table of Contents for Optional Systems Supplements)	2

Zero in this column indicates an original page.

TABLE OF CONTENTS



NOTES:

1. Maximum height shown with nose gear depressed, all tires and nose strut properly inflated and flashing beacon installed.
2. Wheel base length is 72".
3. Propeller ground clearance is 10 7/8".
4. Wing area is 175 square feet.
5. Minimum turning radius (*pivot point to outboard wing tip) is 26'.

Figure 1-1. Three View

SECTION 1
GENERAL

TABLE OF CONTENTS

CABIN AND ENTRY DIMENSIONS

Detailed dimensions of the cabin interior and entry door openings are illustrated in Section 6.

BAGGAGE SPACE AND ENTRY DIMENSIONS

Dimensions of the baggage area and baggage door opening are illustrated in detail in Section 6.

SPECIFIC LOADINGS

Wing Loading: 21.7 lbs./sq. ft.
Power Loading: 12.7 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS — Knots Calibrated Airspeed is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.

KIAS — Knots Indicated Airspeed is the speed shown on the airspeed indicator and expressed in knots.

KTAS — Knots True Airspeed is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.

V_A — Maneuvering Speed is the maximum speed at which you may use abrupt control travel.

V_{FE} — Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

V_{LE} — Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended.

V_{LO} — Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{S_O}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.
V_X	Best Angle-of-Climb Speed is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	Best Rate-of-Climb Speed is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

OAT	Outside Air Temperature is the free air static temperature. It is expressed in either degrees Celsius (formerly Centigrade) or degrees Fahrenheit.
Standard Temperature	Standard Temperature is 15°C at sea level pressure altitude and decreases by 2°C for each 1000 feet of altitude.
Pressure Altitude	Pressure Altitude is the altitude read from an altimeter when the altimeter's barometric scale has been set to 29.92 inches of mercury (1013 mb).

ENGINE POWER TERMINOLOGY

BHP	Brake Horsepower is the power developed by the engine. Percent power values in this handbook are based on the maximum continuous power rating.
RPM	Revolutions Per Minute is engine speed.
MP	Manifold Pressure is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).

INTRODUCTION

This handbook contains 9 sections, and includes the material required to be furnished to the pilot by CAR Part 3. It also contains supplemental data supplied by Cessna Aircraft Company.

Section 1 provides basic data and information of general interest. It also contains definitions or explanations of symbols, abbreviations, and terminology commonly used.

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.
Engine Manufacturer: Teledyne Continental.
Engine Model Number: IO-520-L.
Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, fuel-injected, six-cylinder engine with 520 cu. in. displacement.
Horsepower Rating and Engine Speed:
Maximum Power (5 minutes - takeoff): 300 rated BHP at 2850 RPM.
Maximum Continuous Power: 285 rated BHP at 2700 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: D3A32C88/82NC-2.
Number of Blades: 3.
Propeller Diameter, Maximum: 80 inches.
Minimum: 78.5 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 11.5° and a high pitch setting of 28.1° (30 inch station).

FUEL

Approved Fuel Grades (and Colors):
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).
Total Capacity: 90 gallons.
Total Capacity Each Tank: 45 gallons.
Total Usable: 89 gallons.

OIL

Oil Grade (Specification):

MIL-L-6082 Aviation Grade Straight Mineral Oil: Use to replenish supply during first 25 hours and at the first 25-hour oil change. Continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.

NOTE

The airplane was delivered from the factory with a corrosion preventive aircraft engine oil. This oil should be drained after the first 25 hours of operation.

Continental Motors Specification MHS-24A, Ashless Dispersant Oil: This oil must be used after first 50 hours or oil consumption has stabilized.

Recommended Viscosity For Temperature Range:

SAE 50 above 4°C (40°F).

SAE 10W30 or SAE 30 below 4°C (40°F).

NOTE

Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather.

Oil Capacity:

Sump: 10 Quarts.

Total: 11 Quarts (if oil filter installed).

MAXIMUM CERTIFICATED WEIGHTS

Takeoff: 3800 lbs.

Landing: 3800 lbs.

Weight in Baggage Compartment:

Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110): 120 lbs.

Baggage - On and aft of wheel well (Station 110 to 152): 120 lbs.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight,	Centurion:	2175 lbs.
	Centurion II:	2248 lbs.
Maximum Useful Load,	Centurion:	1625 lbs.
	Centurion II:	1552 lbs.

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity	Demonstrated Crosswind Velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.
Usable Fuel	Usable Fuel is the fuel available for flight planning.
Unusable Fuel	Unusable Fuel is the quantity of fuel that can not be safely used in flight.
PPH	Pounds Per Hour is the amount of fuel (in pounds) consumed per hour.
NMPG	Nautical Miles Per Gallon is the distance (in nautical miles) which can be expected per gallon of fuel consumed at a specific engine power setting and/or flight configuration.
g	g is acceleration due to gravity.

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum	Reference Datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	Station is a location along the airplane fuselage given in terms of the distance from the reference datum.
Arm	Arm is the horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
Moment	Moment is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	Center of Gravity is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	Center of Gravity Arm is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.

C. G. Limits	Center of Gravity Limits are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	Standard Empty Weight is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	Basic Empty Weight is the standard empty weight plus the weight of optional equipment.
Useful Load	Useful Load is the difference between takeoff weight and the basic empty weight.
Gross (Loaded) Weight	Gross (Loaded) Weight is the loaded weight of the airplane.
Maximum Takeoff Weight	Maximum Takeoff Weight is the maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	Maximum Landing Weight is the maximum weight approved for the landing touchdown.
Tare	Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

SECTION 2
LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section have been approved by the Federal Aviation Administration. When applicable, limitations associated with optional systems or equipment are included in Section 9.

NOTE

The airspeeds listed in the Airspeed Limitations chart (figure 2-1) and the Airspeed Indicator Markings chart (figure 2-2) are based on Airspeed Calibration data shown in Section 5 with the normal static source. If the alternate static source is being used, ample margins should be observed to allow for the airspeed calibration variations between the normal and alternate static sources as shown in Section 5.

Your Cessna is certificated under FAA Type Certificate No. 3A21 as Cessna Model No. 210M.

AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in figure 2-1.

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	195	199	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	165	168	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed: 3800 Pounds 3150 Pounds 2500 Pounds	 117 107 95	 119 109 96	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed: To 10° Flaps 10° - 30° Flaps	 138 105	 140 105	Do not exceed these speeds with the given flap settings.
V_{LO}	Maximum Landing Gear Operating Speed	138	140	Do not extend or retract landing gear above this speed.
V_{LE}	Maximum Landing Gear Extended Speed	138	140	Do not exceed this speed with landing gear extended.
	Maximum Window Open Speed	195	199	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their color code significance are shown in figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	55 - 105	Full Flap Operating Range. Lower limit is maximum weight V_{S_O} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	68 - 168	Normal Operating Range. Lower limit is maximum weight V_S at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	168 - 199	Operations must be conducted with caution and only in smooth air.
Red Line	199	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.
Engine Model Number: IO-520-L.
Engine Operating Limits for Takeoff and Continuous Operations:
    Maximum Power,
        5 Minutes - Takeoff: 300 BHP.
        Continuous: 285 BHP.
    Maximum Engine Speed,
        5 Minutes - Takeoff: 2850 RPM.
        Continuous: 2700 RPM.
    Maximum Cylinder Head Temperature: 238°C (460°F).
    Maximum Oil Temperature: 116°C (240°F).
    Oil Pressure, Minimum: 10 psi.
        Maximum: 100 psi.
    Fuel Pressure, Minimum: 3.5 psi.
        Maximum: 19.5 psi (151 lbs/hr).
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: D3A32C88/82NC-2.
Propeller Diameter, Maximum: 80 inches.
    Minimum: 78.5 inches.
Propeller Blade Angle at 30 Inch Station, Low: 11.5°
    High: 28.1°

POWER PLANT INSTRUMENT MARKINGS

Power plant instrument markings and their color code significance are shown in figure 2-3.

INSTRUMENT	RED LINE	GREEN ARC	YELLOW ARC	RED LINE
	MINIMUM LIMIT	NORMAL OPERATING	CAUTION RANGE	MAXIMUM LIMIT
Tachometer	---	2200 - 2550 RPM	2700 - 2850 RPM	2850 RPM
Manifold Pressure	---	15-25 in. Hg	---	---
Oil Temperature	---	100° - 240°F	---	240°F
Cylinder Head Temperature	---	200° - 460°F	---	460°F
Fuel Flow (Pressure)	(3.5 psi)	42 - 102 lbs/hr	---	151 lbs/hr (19.5 psi)
Oil Pressure	10 psi	30 - 60 psi	---	100 psi

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

Maximum Takeoff Weight: 3800 lbs.
Maximum Landing Weight: 3800 lbs.
Weight in Baggage Compartment:
- Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110): 120 lbs.
- Baggage - On and aft of wheel well (Station 110 to 152): 120 lbs.

CENTER OF GRAVITY LIMITS

Center of Gravity Range with Landing Gear Extended:
- Forward: 37.0 inches aft of datum at 3000 lbs. or less, with straight line variation to 42.5 inches aft of datum at 3800 lbs.
- Aft: 53.0 inches aft of datum at all weights.

Moment Change Due To Retracting Landing Gear: +3207 lb. -ins.
Reference Datum: Lower portion of front face of firewall.

MANEUVER LIMITS

This airplane is certificated in the normal category. The normal category is applicable to aircraft intended for non-aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and turns in which the angle of bank is not more than 60°.

Aerobatic maneuvers, including spins, are not approved.

FLIGHT LOAD FACTOR LIMITS

Flight Load Factors:
*Flaps Up: +3.8g, -1.52g
*Flaps Down: +2.0g

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

KINDS OF OPERATION LIMITS

The airplane is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

2 Standard Tanks: 45 U.S. gallons each.
Total Fuel: 90 U.S. gallons.
Usable Fuel (all flight conditions): 89 U.S. gallons.
Unusable Fuel: 1 U.S. gallon.

NOTE

Takeoff and land on fuller tank.

Approved Fuel Grades (and Colors):
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).

PLACARDS

The following information is displayed in the form of composite or individual placards.

(1) In full view of the pilot: (The "DAY-NIGHT-VFR-IFR" entry, shown on the example below, will vary as the airplane is equipped.)

This airplane must be operated as a normal category airplane in compliance with the operating limitations as stated in the form of placards, markings, and manuals.

——— MAXIMUMS ———

MANEUVERING SPEED (IAS)		119 knots
GEAR EXTENSION SPEED (IAS)		140 knots
GROSS WEIGHT		3800 lbs.
FLIGHT LOAD FACTOR	Flaps Up	+3.8, -1.52
	Flaps Down	+2.0

No acrobatic maneuvers, including spins, approved. Altitude loss in a stall recovery - 300 ft. Flight into known icing conditions prohibited. This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY - NIGHT - VFR - IFR

(2) On control lock:

Control lock - remove before starting engine.

(3) On fuel selector valve plate (at appropriate locations):

OFF LEFT ON - 44.5 gal. RIGHT ON - 44.5 gal. Takeoff and land on fuller tank.

(4) Near fuel selector valve plate:

When switching from dry tank, turn auxiliary fuel pump ON momentarily.

(5) Aft of fuel tank cap:

Service this airplane with 100/130 min. aviation grade gasoline. Total capacity 45.0 gal.

(6) Forward of fuel tank cap:

For 32 gal. fuel load fill to bottom of filler neck extension.

(7) On baggage compartment door:

Maximum baggage 120 lbs. Refer to Weight and Balance Data for baggage/cargo loading.

(8) On hand pump cover:

MANUAL GEAR EXTENSION

1. Select gear down.
2. Pull handle forward.
3. Pump vertically.

(9) In front of pilot on lower instrument panel:

ALTERNATE STATIC AIR
PULL ↓ ON

(10) Above fuel flow and manifold pressure gage:

FUEL FLOW AT FULL THROTTLE

	2700 RPM	2850 RPM
S. L.	138 LBS/HR	144 LBS/HR
4000 FT	126 LBS/HR	132 LBS/HR
8000 FT	114 LBS/HR	120 LBS/HR

MAX. POWER SETTING

TAKEOFF (5 MIN. ONLY) . . . . 2850 RPM
MAX. CONTINUOUS POWER . . . . . . 2700 RPM

(11) On lower surface of right hand wing just outboard of fuselage (all models with oxygen):

OXYGEN FILLER DOOR

(12) On flap control indicator:

0° to 10°	(Partial flap range with blue color code and 140 knot callout; also, mechanical detent at 10°.)
10° - 20° - Full	(Indices at these positions with white color code and 105 knot callout; also, mechanical detent at 20°.)

(13) On inside nose wheel doors, strut doors and main wheel doors:

WARNING

Before working in wheel well area pull hydraulic pump circuit breaker off.

WARNING

Severe icing may result from environmental conditions outside those for which the aircraft is certified.

Flight in freezing rain, freezing drizzle or mixed icing conditions (super cooled liquid water and ice crystals) may result in:

- Ice build-up on protected surfaces and exceed the capability of the ice protection system, or
- May result in ice forming aft of the protected surfaces.

This ice may not be shed using the ice protection systems, and may seriously degrade the performance and controllability of the aircraft.

During flight, severe icing conditions that exceed those for which the aircraft is certified shall be determined by the visual cues described below. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions. The cues are:

- Unusually extensive ice accumulation on the airframe and windscreen in areas not normally observed to collect ice, and/or
- Accumulation of ice on the lower surface of the wing aft of the protected area.

Since the auto-pilot, when installed and operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the auto-pilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or auto-pilot trim warnings are encountered while the aircraft is in icing conditions.

All wing icing inspection lights must be operative prior to flight into known or forecast icing conditions at night. **This direction supersedes any relief provided by any Minimum Equipment List.**

SECTION 3
EMERGENCY PROCEDURES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Page

AMPLIFIED PROCEDURES

INTRODUCTION

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered. However, should an emergency arise the basic guidelines described in this section should be considered and applied as necessary to correct the problem. Emergency procedures associated with the ELT and other optional systems can be found in Section 9.

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:
- Wing Flaps Up . . . . 85 KIAS
- Wing Flaps Down . . . . 80 KIAS

Maneuvering Speed:
- 3800 Lbs . . . . 119 KIAS
- 3150 Lbs . . . . 109 KIAS
- 2500 Lbs . . . . 96 KIAS

Maximum Glide:
- 3800 Lbs . . . . 85 KIAS
- 3400 Lbs . . . . 80 KIAS
- 3000 Lbs . . . . 75 KIAS

Precautionary Landing With Engine Power . . . . 75 KIAS

Landing Without Engine Power:
- Wing Flaps Up . . . . 90 KIAS
- Wing Flaps Down . . . . 80 KIAS

OPERATIONAL CHECKLISTS

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF RUN

(1) Throttle -- IDLE.
(2) Brakes -- APPLY.
(3) Wing Flaps -- RETRACT.
(4) Mixture -- IDLE CUT-OFF.
(5) Ignition Switch -- OFF.
(6) Master Switch -- OFF.

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

(1) Airspeed -- 85 KIAS.
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Selector Valve -- OFF.
(4) Ignition Switch -- OFF.
(5) Wing Flaps -- AS REQUIRED (30° recommended).
(6) Master Switch -- OFF.

ENGINE FAILURE DURING FLIGHT

(1) Airspeed -- 85 KIAS.
(2) Fuel Quantity -- CHECK.
(3) Fuel Selector Valve -- FULLER TANK.
(4) Mixture -- RICH.
(5) Auxiliary Fuel Pump -- ON for 3-5 seconds with throttle 1/2 open; then OFF.
(6) Ignition Switch -- BOTH (or START if propeller is stopped).
(7) Throttle -- SLOWLY ADVANCE.

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

(1) Airspeed -- 90 KIAS (flaps UP).
80 KIAS (flaps DOWN).
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Selector Valve -- OFF.
(4) Ignition Switch -- OFF.
(5) Landing Gear -- DOWN (UP if terrain is rough or soft).
(6) Wing Flaps -- AS REQUIRED (30° recommended).
(7) Master Switch -- OFF.
(8) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(9) Touchdown -- SLIGHTLY TAIL LOW.
(10) Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

(1) Airspeed -- 85 KIAS.
(2) Wing Flaps -- 10°.
(3) Selected Field -- FLY OVER, noting terrain and obstructions then retract flaps upon reaching a safe altitude and airspeed.
(4) Radio and Electrical Switches -- OFF.
(5) Landing Gear -- DOWN (UP if terrain is rough or soft).
(6) Wing Flaps -- 30° (on final approach).

(7) Airspeed -- 75 KIAS.
(8) Master Switch -- OFF.
(9) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(10) Touchdown -- SLIGHTLY TAIL LOW.
(11) Ignition Switch -- OFF.
(12) Brakes -- APPLY HEAVILY.

DITCHING

(1) Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions.
(2) Heavy Objects (in baggage area) -- SECURE or JETTISON.
(3) Landing Gear -- UP.
(4) Wing Flaps -- 30°.
(5) Power -- ESTABLISH 300 FT/MIN DESCENT at 75 KIAS.
(6) Approach -- High Winds, Heavy Seas -- INTO THE WIND.
Light Winds, Heavy Swells -- PARALLEL TO SWELLS.

NOTE

If no power is available, approach at 85 KIAS with flaps up or at 80 KIAS with 10° flaps.

(7) Cabin Doors -- UNLATCH.
(8) Touchdown -- LEVEL ATTITUDE AT 300 FT/MIN DESCENT.
(9) Face -- CUSHION at touchdown with folded coat.
(10) Airplane -- EVACUATE through cabin doors. If necessary, open vent window and flood cabin to equalize pressure so doors can be opened.
(11) Life Vests and Raft -- INFLATE.

FIRES

DURING START ON GROUND

(1) Ignition Switch -- START (continue cranking to obtain start).
(2) Auxiliary Fuel Pump -- OFF.

If engine starts:

(3) Power -- 1700 RPM for a few minutes.
(4) Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

(3) Ignition Switch -- START (continue cranking).
(4) Throttle -- FULL OPEN.
(5) Mixture -- IDLE CUT-OFF.
(6) Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
(7) Engine -- SECURE.
  a. Ignition Switch -- OFF.
  b. Master Switch -- OFF.
  c. Fuel Selector Valve -- OFF.
(8) Fire -- EXTINGUISH using fire extinguisher, wool blanket or dirt.

NOTE

If sufficient ground personnel are available (and fire is on ground and not too dangerous) move airplane away from the fire by pushing rearward on the leading edge of the horizontal tail.

(9) Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

ENGINE FIRE IN FLIGHT

(1) Mixture -- IDLE CUT-OFF.
(2) Fuel Selector Valve -- OFF.
(3) Master Switch -- OFF.
(4) Cabin Heat and Air -- OFF (except overhead vents).
(5) Airspeed -- 120 KIAS (if fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture).
(6) Forced Landing -- EXECUTE (as described in Landing Without Engine Power).

ELECTRICAL FIRE IN FLIGHT

(1) Master Switch -- OFF.
(2) Avionics Power Switch -- OFF.
(3) All Other Switches (except ignition switch) -- OFF.
(4) Vents/Cabin Air/Heat -- CLOSED.
(5) Fire Extinguisher -- ACTIVATE (if available).

WARNING

If an oxygen system is available, occupants should use oxygen masks until smoke and discharged dry powder clears. After discharging an extinguisher within a closed cabin, ventilate the cabin.

If fire appears out and electrical power is necessary for continuance of flight:

(6) Master Switch -- ON.
(7) Circuit Breakers -- CHECK for faulty circuit; do not reset.
(8) Radio Switches -- OFF.
(9) Avionics Power Switch -- ON.
(10) Radio and Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.
(11) Vents/Cabin Air/Heat -- OPEN when it is ascertained that fire is completely extinguished.

CABIN FIRE

(1) Master Switch -- OFF.
(2) Vents/Cabin Air/Heat -- CLOSED (to avoid drafts).
(3) Fire Extinguisher -- ACTIVATE (if available).

WARNING

If an oxygen system is available, occupants should use oxygen masks until smoke and discharged dry powder clears. After discharging an extinguisher within a closed cabin, ventilate the cabin.

(4) Land the airplane as soon as possible to inspect for damage.

WING FIRE

(1) Navigation Light Switch -- OFF.
(2) Pitot Heat Switch (if installed) -- OFF.
(3) Strobe Light Switch (if installed) -- OFF.

NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin, and land as soon as possible.

ICING

INADVERTENT ICING ENCOUNTER

(1) Turn pitot heat switch ON (if installed).
(2) Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.

(3) Pull cabin heat control full out and rotate defrost knob clockwise to obtain maximum windshield defroster effectiveness.
(4) Increase engine speed to minimize ice build-up on propeller blades. If excessive vibration is noted, momentarily reduce engine speed to 2200 RPM with propeller control, and then rapidly move the control full forward.

NOTE

Cycling the RPM flexes the propeller blades and high RPM increases centrifugal force, causing ice to shed more readily.

(5) Watch for signs of induction air filter ice and regain manifold pressure by increasing the throttle setting.

NOTE

If ice accumulates on the intake filter (causing the alternate air valve to open), a decrease of 1 to 2 inches of full throttle manifold pressure will be experienced.

(6) If icing conditions are unavoidable, plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
(7) With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for a significantly higher power requirement, approach speed, stall speed and landing roll.
(8) Open the window and if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
(9) Use a 10° to 20° landing flap setting for ice accumulations of 1 inch or less. With heavier ice accumulations, approach with flaps retracted to ensure adequate elevator effectiveness in the approach and landing.
(10) Approach at 85 to 95 KIAS with 20° flaps, and 95 to 105 KIAS with 0° to 10° flaps, depending upon the amount of ice accumulation. If ice accumulation is unusually large, decelerate to the planned approach speed while in the approach configuration (landing gear and flaps down) at a high enough altitude which would permit recovery in the event that a stall buffet is encountered.
(11) Land on the main wheels first, avoiding the slow and high type of flare-out.
(12) Missed approaches should be avoided whenever possible because of severely reduced climb capability. However, if a go-around is mandatory, make the decision much earlier in the approach than normal. Apply maximum power and maintain 95 KIAS while retracting

the flaps slowly in 10° increments. Retract the landing gear after immediate obstacles are cleared.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

(1) Alternate Static Source Valve -- PULL ON.
(2) Airspeed -- Climb 2 knots faster and approach 7 knots faster than normal or consult appropriate table in Section 5.
(3) Altitude -- Cruise 150 feet higher and approach 70 feet higher than normal.

LANDING GEAR MALFUNCTION PROCEDURES

LANDING GEAR FAILS TO RETRACT

(1) Master Switch -- ON.
(2) Landing Gear Handle -- CHECK (handle full up).
(3) Landing Gear and Gear Pump Circuit Breakers -- IN.
(4) Gear Up Light -- CHECK.
(5) Landing Gear Handle -- RECYCLE.
(6) Gear Motor -- CHECK operation (ammeter and noise).

LANDING GEAR FAILS TO EXTEND

(1) Landing Gear Handle -- DOWN.
(2) Emergency Hand Pump -- EXTEND HANDLE, and PUMP (perpendicular to handle until resistance becomes heavy -- about 86 cycles).

NOTE

It takes about 70 cycles (140 strokes) to extend the gear (light on) and about 16 more (until resistance becomes heavy) to close the gear doors.

(3) Gear Down Light -- ON.
(4) Pump Handle -- STOW.

GEAR UP LANDING

(1) Landing Gear Handle -- UP.
(2) Landing Gear and Gear Pump Circuit Breakers -- IN.
(3) Runway -- SELECT longest hard surface or smooth sod runway available.

(4) Wing Flaps -- 30° (on final approach).
(5) Airspeed -- 75 KIAS.
(6) Master Switch -- OFF.
(7) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(8) Touchdown -- SLIGHTLY TAIL LOW.
(9) Mixture -- IDLE CUT-OFF.
(10) Ignition Switch -- OFF.
(11) Fuel Selector Valve -- OFF.
(12) Airplane -- EVACUATE.

LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

(1) Before Landing Check -- COMPLETE.
(2) Approach -- NORMAL (full flap).
(3) Landing Gear and Gear Pump Circuit Breakers -- IN.
(4) Landing -- TAIL LOW as smoothly as possible.
(5) Braking -- MINIMUM necessary.
(6) Taxi -- SLOWLY.
(7) Engine -- SHUTDOWN before inspecting gear.

LANDING WITH A DEFECTIVE NOSE GEAR (Or Flat Nose Tire)

(1) Moveable Load -- TRANSFER to baggage area.
(2) Passenger -- MOVE to rear seat.
(3) Before Landing Checklist -- COMPLETE.
(4) Runway -- HARD SURFACE or SMOOTH SOD.

NOTE

If sod runway is rough or soft, plan a wheels-up landing.

(5) Wing Flaps -- 30°.
(6) Master Switch -- OFF.
(7) Cabin Doors -- UNLATCH prior to touchdown.
(8) Land -- SLIGHTLY TAIL LOW.
(9) Mixture -- IDLE CUT-OFF.
(10) Ignition Switch -- OFF.
(11) Fuel Selector Valve -- OFF.
(12) Elevator Control -- HOLD NOSE OFF GROUND as long as possible.
(13) Airplane -- EVACUATE as soon as it stops.

LANDING WITH A FLAT MAIN TIRE

(1) Approach -- NORMAL (full flap).
(2) Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.

(3) Directional Control -- MAINTAIN using brake on good wheel as required.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

(1) Master Switch -- OFF (both sides).
(2) Master Switch -- ON.
(3) Over-Voltage Light -- OFF.

If over-voltage light illuminates again:

(4) Flight -- TERMINATE as soon as practical.

AMMETER SHOWS DISCHARGE

(1) Alternator -- OFF.
(2) Nonessential Electrical Equipment -- OFF.
(3) Flight -- TERMINATE as soon as practical.

AMPLIFIED PROCEDURES

ENGINE FAILURE

If an engine failure occurs during the takeoff run, the most important thing to do is stop the airplane on the remaining runway. Those extra items on the checklist will provide added safety during a failure of this type.

Prompt lowering of the nose to maintain airspeed and establish a glide attitude is the first response to an engine failure after takeoff. In most cases, the landing should be planned straight ahead with only small changes in direction to avoid obstructions. Altitude and airspeed are seldom sufficient to execute a 180° gliding turn necessary to return to the runway. The checklist procedures assume that adequate time exists to secure the fuel and ignition systems prior to touchdown.

After an engine failure in flight, the best glide speed as shown in figure 3-1 should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in the checklist. If the engine cannot be restarted, a forced landing without power must be completed.

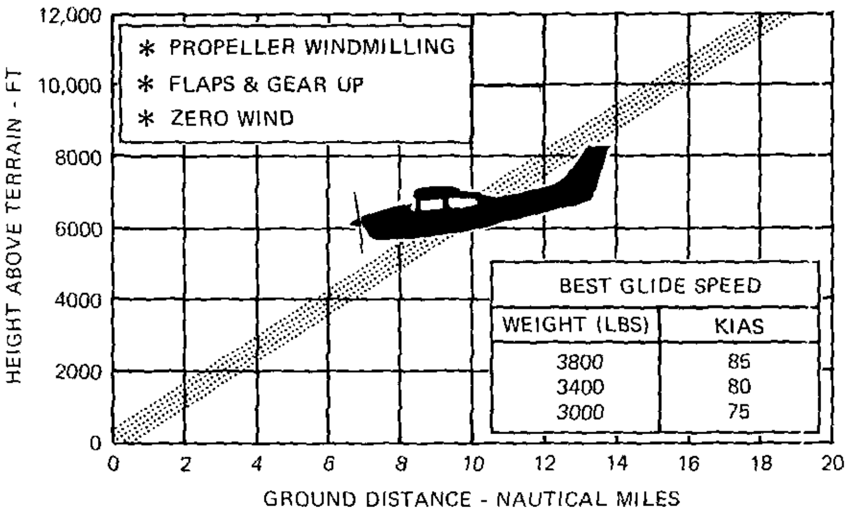


Figure 3-1. Maximum Glide

FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is *imminent, select a suitable field* and prepare for the landing as discussed in the checklist for engine-off emergency landings.

Before attempting an "off airport" landing with engine power available, one should drag the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as discussed under the Precautionary Landing With Engine Power checklist.

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions. Avoid a landing flare because of difficulty in judging height over a water surface.

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight (with an airspeed of approximately 80 KIAS, and flaps set to 20°) by using throttle and trim tab controls. Then do not change the trim tab setting and control the glide angle by adjusting power exclusively.

At flareout, the nose-down moment resulting from power reduction is an adverse factor and the airplane may hit on the nose wheel. Consequently, at flareout the trim tab should be set at full nose-up position and the power adjusted so that the airplane will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

FIRES

Improper starting procedures such as excessive use of the auxiliary fuel pump during a cold weather start can cause a backfire which could ignite fuel that has accumulated in the intake duct. In this event, follow the prescribed checklist.

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing. Do not attempt to restart the engine.

The initial indication of an electrical fire is usually the odor of burning insulation. The checklist for this problem should result in elimination of the fire.

EMERGENCY OPERATION IN CLOUDS
(Vacuum System Failure)

In the event of a vacuum system failure during flight in marginal weather, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator or the turn and bank indicator if he inadvertently flies into clouds. The following instructions assume that only the electrically-powered turn coordinator or the turn and bank indicator is operative, and that the pilot is not completely proficient in instrument flying.

EXECUTING A 180° TURN IN CLOUDS

Upon inadvertently entering the clouds, an immediate plan should be made to turn back as follows:

(1) Note the time of the minute hand and observe the position of the sweep second hand on the clock.
(2) When the sweep second hand indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
(3) Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
(4) If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
(5) Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by keeping the hands off the control wheel as much as possible and steering only with rudder.

EMERGENCY DESCENT THROUGH CLOUDS

If conditions preclude reestablishment of VFR flight by a 180° turn, a descent through a cloud deck to VFR conditions may be appropriate. If possible, obtain radio clearance for an emergency descent through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, keep hands off the control wheel and steer a straight course with rudder control by monitoring the turn coordinator. Occasionally check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

(1) Extend landing gear.

(2) Reduce power to set up a 500 to 800 ft/min rate of descent.
(3) Adjust mixture for smooth operation.
(4) Adjust the elevator and rudder trim control wheels for a stabilized descent at 105 KIAS.
(5) Keep hands off the control wheel.
(6) Monitor turn coordinator and make corrections by rudder alone.
(7) Adjust rudder trim to relieve unbalanced rudder force.
(8) Check trend of compass card movement and make cautious corrections with rudder to stop turn.
(9) Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

(1) Close the throttle and place propeller control in high RPM.
(2) Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
(3) Cautiously apply elevator back pressure to slowly reduce the indicated airspeed to 105 KIAS.
(4) Adjust the elevator trim control to maintain a 105 KIAS glide.
(5) Keep hands off the control wheel, using rudder control to hold a straight heading. Adjust the rudder trim to relieve unbalanced rudder force.
(6) Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
(7) Upon breaking out of clouds, resume normal cruising flight.

FLIGHT IN ICING CONDITIONS

Flight into icing conditions is prohibited. An inadvertent encounter with these conditions can best be handled using the checklist procedures. The best procedure, of course, is to turn back or change altitude to escape icing conditions.

STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and rate-of-climb) are suspected, the alternate static source valve should be pulled on, thereby supplying static pressure to these instruments from the cabin.

NOTE

In an emergency on airplanes not equipped with an alternate static source, cabin pressure can be supplied to the static pressure instruments by breaking the glass in the face of the rate-of-climb indicator.

Cabin pressures will be affected by open ventilators or windows and varying airspeeds, and this will affect the readings.

With windows closed, maximum airspeed and altimeter variation from normal occurs with the vents closed and reaches 8 knots and 150 feet respectively at maximum cruise (instruments read high). During approach, with vents closed, typical variations are 7 knots and 70 feet respectively (reads high). Opening the vents tends to reduce these variations by one third.

With windows open, variations up to 15 knots and 100 feet occur near stall (reads low) and up to 15 knots and 225 feet at maximum cruise (reads high). During approach, typical variations are 4 knots and 40 feet (reads high).

With the alternate static source on, fly the airplane at airspeeds and altitudes which compensate for the variations from normal indications. For more exact airspeed correction, refer to the Airspeed Calibration - Alternate Static Source table in Section 5, appropriate to the vent/window configuration.

SPINS

Intentional spins are prohibited in this airplane. Should an inadvertent spin occur, the following recovery technique may be used:

(1) RETARD THROTTLE TO IDLE POSITION.
(2) PLACE AILERONS IN NEUTRAL POSITION.
(3) APPLY AND HOLD FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
(4) JUST AFTER THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL BRISKLY FORWARD FAR ENOUGH TO BREAK THE STALL. Full down elevator may be required at aft center of gravity loadings to assure optimum recoveries.
(5) HOLD THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
(6) AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

If disorientation precludes a visual determination of the direction of rotation, the symbolic airplane in the turn coordinator or the needle of the turn and bank indicator may be referred to for this information.

ROUGH ENGINE OPERATION OR LOSS OF POWER

SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from BOTH to either L or R position. An obvious power loss in single ignition operation is evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the recommended lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the BOTH position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION

A sudden engine roughness or misfiring is usually evidence of magneto problems. Switching from BOTH to either L or R ignition switch position will identify which magneto is malfunctioning. Select different power settings and enrichen the mixture to determine if continued operation on BOTH magnetos is practicable. If not, switch to the good magneto and proceed to the nearest airport for repairs.

ENGINE-DRIVEN FUEL PUMP FAILURE

Failure of the engine-driven fuel pump will be evidenced by a sudden reduction in the fuel flow indication prior to a loss of power, while operating from a fuel tank containing adequate fuel.

In the event of an engine-driven fuel pump failure during takeoff, immediately hold the left half of the auxiliary fuel pump switch in the HI position until the airplane is well clear of obstacles. Upon reaching a safe altitude, and reducing the power to a cruise setting, release the HI side of the switch. The ON position will then provide sufficient fuel flow to maintain engine operation while maneuvering for a landing.

If an engine-driven fuel pump failure occurs during cruising flight, apply full rich mixture and hold the left half of the auxiliary fuel pump switch in the HI position to re-establish fuel flow. Then the normal ON position (the right half of the fuel pump switch) may be used to sustain level flight. If necessary, additional fuel flow is obtainable by holding the left half of the pump switch in the HI position.

LOW OIL PRESSURE

If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in this line will prevent a sudden loss of oil from the engine sump. However, a landing at the nearest airport would be advisable to inspect the source of trouble.

If a total loss of oil pressure is accompanied by a rise in oil temperature, there is a good reason to suspect an engine failure is imminent. Reduce engine power immediately and select a suitable forced landing field. Use only the minimum power required to reach the desired touchdown spot.

LANDING GEAR MALFUNCTION PROCEDURES

In the event of possible landing gear retraction or extension malfunctions, there are several general checks that should be made prior to initiating the steps outlined in the following paragraphs.

In analyzing a landing gear malfunction, first check that the master switch is ON and the LDG GEAR and GEAR PUMP circuit breakers are in; reset if necessary. Also, check both landing gear position indicator lights for operation by "pressing-to-test" the light units and rotating them at the same time to check for open dimming shutters. A burned-out bulb can be replaced in flight by using the bulb from the remaining gear position indicator light.

RETRACTION MALFUNCTIONS

If the landing gear fails to retract normally or an intermittent GEAR UP indicator light is present, check the indicator light for proper operation and attempt to recycle the landing gear. Place the landing gear handle in the GEAR DOWN position. When the GEAR DOWN light comes on, reposition the gear handle in the GEAR UP position for another retraction attempt. If the GEAR UP light still fails to illuminate, the flight may be continued to an airport having maintenance facilities, if practical. If gear motor operation is audible after a period of one minute following gear handle retraction actuation, pull the GEAR PUMP circuit breaker switch to prevent the electric motor from overheating. In this event, remember to re-engage the circuit breaker switch just prior to landing. Intermittent gear motor operation may also be detected by momentary fluctuations of the ammeter needle.

EXTENSION MALFUNCTIONS

Normal landing gear extension time is approximately 13 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and master switch and repeat the normal extension procedures at a reduced airspeed of 100 KIAS. If efforts to extend and lock the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completely lost) by use of the emergency hand pump. The hand pump is located between the front seats.

A checklist is provided for step-by-step instructions for a manual gear extension.

If gear motor operation is audible after a period of one minute following gear handle extension actuation, pull the GEAR PUMP circuit breaker to prevent the electric motor from overheating. In this event, remember to re-engage the circuit breaker just prior to landing.

GEAR UP LANDING

If the landing gear remains retracted or is only partially extended, and all efforts to fully extend it (including manual extension) have failed, plan a wheels up landing. In preparation for landing, reposition the landing gear handle to UP and push the LDG GEAR and GEAR PUMP circuit breakers in to allow the landing gear to swing into the gear wells at touchdown. Then proceed in accordance with the checklist.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and over-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is the most likely cause of alternator failures, although other factors could cause the problem. A damaged or improperly adjusted voltage regulator can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge.

The paragraphs below describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than four needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate. Electronic components in the electrical system could be adversely affected by higher than normal voltage if a faulty regulator setting is causing the overcharging. To preclude these possibilities, an over-voltage sensor will automatically shut down the alternator, and the over-voltage warning light will illuminate if the charge voltage reaches approximately 30 to 31 volts. Assuming that the malfunction was only momentary, an attempt should be made to reactivate the alternator system. To do this, turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the warning light will go off. If the light comes on again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. If the emergency occurs at night, power must be conserved for later operation of the landing gear and wing flaps and possible use of the landing lights during landing.

INSUFFICIENT RATE OF CHARGE

If the ammeter indicates a continuous discharge rate in flight, the alternator is not supplying power to the system and should be shut down since the alternator field circuit may be placing an unnecessary load on the system. All nonessential equipment should be turned OFF and the flight terminated as soon as practical.

SECTION 4
NORMAL PROCEDURES

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

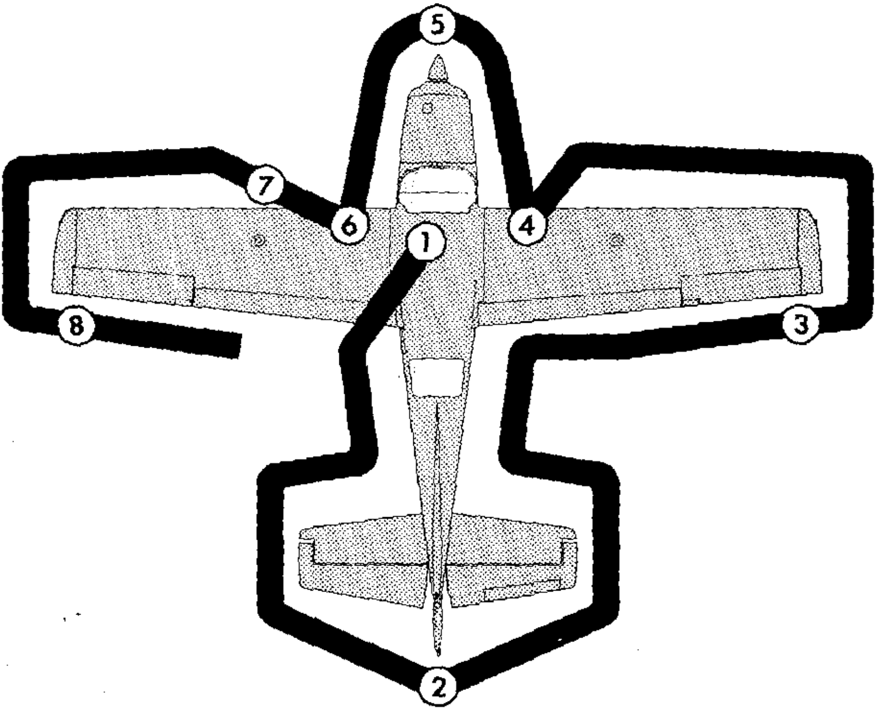
INTRODUCTION

Section 4 provides checklist and amplified procedures for the conduct of normal operation. Normal procedures associated with Optional Systems can be found in Section 9.

SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 3800 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance and climb performance, the speed appropriate to the particular weight must be used.

Takeoff:	
Normal Climb Out	80-90 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	72 KIAS
Enroute Climb, Flaps and Gear Up:	
Normal	100-110 KIAS
Best Rate of Climb, Sea Level	97 KIAS
Best Rate of Climb, 10,000 Feet	90 KIAS
Best Angle of Climb, Sea Level	75 KIAS
Best Angle of Climb, 10,000 Feet	80 KIAS
Landing Approach:	
Normal Approach, Flaps Up	80-90 KIAS
Normal Approach, Flaps 30°	70-80 KIAS
Short Field Approach, Flaps 30°	71 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	70 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
3800 Lbs	119 KIAS
3150 Lbs	109 KIAS
2500 Lbs	96 KIAS
Maximum Demonstrated Crosswind Velocity:	
Takeoff or Landing	21 KNOTS



NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

(1) CABIN

(1) Landing Gear Handle -- DOWN.
(2) Control Wheel Lock -- REMOVE.
(3) Ignition Switch -- OFF.
(4) Master Switch -- ON.
(5) Fuel Quantity Indicators -- CHECK QUANTITY.
(6) Master Switch -- OFF.
(7) Fuel Selector Valve -- ON fuller tank.
(8) Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
(9) Baggage Door -- CHECK for security.

(2) EMPENNAGE

(1) Rudder Gust Lock -- REMOVE.
(2) Tail Tie-Down -- DISCONNECT.
(3) Control Surfaces -- CHECK freedom of movement and security.

(3) RIGHT WING Trailing Edge

(1) Aileron -- CHECK for freedom of movement and security.
(2) Fuel Tank Vent at Wing Tip Trailing Edge -- CHECK for stoppage.

(4) RIGHT WING

(1) Wing Tie-Down -- DISCONNECT.
(2) Main Wheel Tire -- CHECK for proper inflation.
(3) Cabin Step -- CHECK for security and cleanliness, and retraction well for cleanliness.
(4) Before first flight of day and after each refueling, use sampler cup and drain small quantity of fuel from fuel tank sump quick-drain valve to check for water, sediment, and proper fuel grade.
(5) Fuel Quantity -- CHECK VISUALLY for desired level.
(6) Fuel Filler Cap -- SECURE and vent unobstructed.

(5) NOSE

(1) Propeller and Spinner -- CHECK for nicks, security and oil leaks.
(2) Landing and Taxi Lights -- CHECK for condition and cleanliness.

(3) Nose Wheel Strut and Tire -- CHECK for proper inflation.
(4) Nose Tie-Down -- DISCONNECT.
(5) Engine Oil Level -- CHECK, do not operate with less than seven quarts. Fill to 10 quarts for extended flight.
(6) Before first flight of the day and after each refueling, pull out strainer knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, the fuel system may contain additional water, and further draining of the system at the strainer, fuel tank sumps, and fuel reservoir drain valves will be necessary.

(6) LEFT WING

(1) Main Wheel Tire -- CHECK for proper inflation.
(2) Before first flight of day and after each refueling, use sampler cup and drain small quantity of fuel from fuel tank sump quick-drain valve to check for water, sediment and proper fuel grade.
(3) Fuel Quantity -- CHECK VISUALLY for desired level.
(4) Fuel Filler Cap -- SECURE and vent unobstructed.

(7) LEFT WING Leading Edge

(1) Pitot Tube Cover -- REMOVE and check opening for stoppage.
(2) Stall Warning Vane -- CHECK for freedom of movement while master switch is momentarily turned on (horn should sound when vane is pushed upward).
(3) Wing Tie-Down -- DISCONNECT.

(8) LEFT WING Trailing Edge

(1) Fuel Tank Vent at Wing Tip Trailing Edge -- CHECK for stoppage.
(2) Aileron -- CHECK for freedom of movement and security.

BEFORE STARTING ENGINE

(1) Preflight Inspection -- COMPLETE.
(2) Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
(3) Brakes -- TEST and SET.
(4) Cowl Flaps -- OPEN (move lever out of locking hole to reposition).
(5) Avionics Power Switch, Electrical Equipment, Autopilot (if installed) -- OFF.

CAUTION

The avionics power switch must be OFF during engine start to prevent possible damage to avionics.

(6) Landing Gear Handle -- DOWN.
(7) Master Switch -- ON.
(8) Landing Gear Lights and Horn -- PRESS TO TEST.
(9) Circuit Breakers -- CHECK IN.
(10) Fuel Selector Valve -- FULLER TANK.

STARTING ENGINE

(1) Mixture -- RICH.
(2) Propeller -- HIGH RPM.
(3) Throttle -- CLOSED.
(4) Auxiliary Fuel Pump Switch -- ON.
(5) Throttle -- ADVANCE to obtain 50-60 lbs/hr fuel flow; then RETURN to IDLE POSITION.
(6) Auxiliary Fuel Pump Switch -- OFF.
(7) Propeller Area -- CLEAR.
(8) Ignition Switch -- START.
(9) Throttle -- ADVANCE slowly.
(10) Ignition Switch -- RELEASE when engine starts.

NOTE

The engine should start in two to three revolutions. If it does not continue running, start again at step 3. If the engine does not start, leave auxiliary fuel pump switch off, set mixture to idle cut-off, open throttle, and crank until engine fires (or for approximately 15 seconds). If still unsuccessful, start again using the normal starting procedure after allowing the starter motor to cool.

(11) Throttle -- RESET to desired idle speed.
(12) Oil Pressure -- CHECK.

BEFORE TAKEOFF

(1) Parking Brake -- SET.
(2) Cabin Doors and Windows -- CLOSED and LOCKED.
(3) Cowl Flaps -- FULL OPEN.
(4) Flight Controls -- FREE and CORRECT.
(5) Flight Instruments -- CHECK.
(6) Fuel Selector Valve -- FULLER TANK.
(7) Mixture -- RICH (below 3000 feet).
(8) Elevator and Rudder Trim -- TAKEOFF.

(9) Throttle -- 1700 RPM.

a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
b. Propeller -- CYCLE from high to low RPM; return to high RPM (full forward).
c. Engine Instruments and Ammeter -- CHECK.
d. Suction Gage -- CHECK in green arc.

(10) Avionics Power Switch -- ON.
(11) Radios -- SET.
(12) Autopilot (if installed) -- OFF.
(13) Flashing Beacon, Navigation Lights and/or Strobe Lights -- ON as required.
(14) Throttle Friction Lock -- ADJUST.
(15) Parking Brake -- RELEASE.

TAKEOFF

NORMAL TAKEOFF

(1) Wing Flaps -- 0°- 10° (10° preferred).
(2) Power -- FULL THROTTLE and 2850 RPM.
(3) Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
(4) Elevator Control -- LIFT NOSE WHEEL at 60 to 70 KIAS.
(5) Climb Speed -- 80-90 KIAS.
(6) Brakes -- APPLY momentarily when airborne.
(7) Landing Gear -- RETRACT in climb out.
(8) Wing Flaps -- RETRACT.

SHORT FIELD TAKEOFF

(1) Wing Flaps -- 10°.
(2) Brakes -- APPLY.
(3) Power -- FULL THROTTLE and 2850 RPM.
(4) Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
(5) Brakes -- RELEASE.
(6) Elevator Control -- SLIGHTLY TAIL-LOW.
(7) Climb Speed -- 72 KIAS until all obstacles are cleared.
(8) Landing Gear -- RETRACT after obstacles are cleared.
(9) Wing Flaps -- RETRACT after reaching 80 KIAS.

NOTE

Do not reduce power until wing flaps and landing gear have been retracted.

ENROUTE CLIMB

NORMAL CLIMB

(1) Airspeed -- 100-110 KIAS.
(2) Power -- 25 INCHES Hg and 2550 RPM.
(3) Mixture -- LEAN to 108 lbs./hr.
(4) Cowl Flaps -- OPEN as required.

MAXIMUM PERFORMANCE CLIMB

(1) Airspeed -- 97 KIAS at sea level to 90 KIAS at 10,000 feet.
(2) Power -- FULL THROTTLE and 2700 RPM.
(3) Mixture -- LEAN per fuel flow placard.
(4) Cowl Flaps -- FULL OPEN.

CRUISE

(1) Power -- 15-25 INCHES Hg, 2200-2550 RPM (no more than 75%).
(2) Elevator and Rudder Trim -- ADJUST.
(3) Mixture -- LEAN per Cessna Power Computer or the data in Section 5.
(4) Cowl Flaps -- CLOSED (open if required).

DESCENT

(1) Power -- AS DESIRED.
(2) Mixture -- ADJUST for smooth operation (full rich for idle power).
(3) Cowl Flaps -- CLOSED.

BEFORE LANDING

(1) Seats, Belts, Shoulder Harnesses -- SECURE.
(2) Fuel Selector Valve -- FULLER TANK.
(3) Landing Gear -- EXTEND (below 140 KIAS).
(4) Landing Gear -- CHECK (observe main gear down and green indicator light on).
(5) Mixture -- RICH.
(6) Propeller -- HIGH RPM.
(7) Wing Flaps -- AS DESIRED (0° to 10° below 140 KIAS, 10° to 30° below 105 KIAS).
(8) Autopilot (if installed) -- OFF.
(9) Elevator Trim -- ADJUST.

LANDING

NORMAL LANDING

(1) Airspeed --80-90 KIAS (flaps UP).
(2) Wing Flaps -- AS DESIRED (flaps down preferred).
(3) Airspeed -- 70-80 KIAS (flaps DOWN).
(4) Elevator Trim -- ADJUST.
(5) Touchdown -- MAIN WHEELS FIRST.
(6) Landing Roll -- LOWER NOSE WHEEL GENTLY.
(7) Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

(1) Wing Flaps -- FULL DOWN.
(2) Airspeed -- 71 KIAS.
(3) Elevator Trim -- ADJUST.
(4) Power -- REDUCE to idle after clearing obstacle.
(5) Touchdown -- MAIN WHEELS FIRST.
(6) Brakes -- APPLY HEAVILY.
(7) Wing Flaps -- RETRACT.

BALKED LANDING

(1) Power -- FULL THROTTLE and 2850 RPM.
(2) Wing Flaps -- RETRACT to 20° (immediately).
(3) Climb Speed -- 70 KIAS (until obstacles are cleared).
(4) Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
(5) Wing Flaps -- RETRACT slowly (after reaching safe altitude and 75-80 KIAS).
(6) Cowl Flaps -- OPEN.

AFTER LANDING

(1) Wing Flaps -- RETRACT.
(2) Cowl Flaps -- OPEN.

SECURING AIRPLANE

(1) Parking Brake -- SET.
(2) Avionics Power Switch, Electrical Equipment -- OFF.

(3) Mixture -- IDLE CUT-OFF (pulled full out).
(4) Ignition Switch -- OFF.
(5) Master Switch -- OFF.
(6) Control Lock -- INSTALL.

NORMAL PROCEDURES

THE FOLLOWING WEATHER CONDITIONS MAY BE CONDUCTIVE TO SEVERE TO IN-FLIGHT ICING:

- Visible rain at temperatures below 0 degrees Celsius ambient air temperature;
- Droplets that splash or splatter on impact at temperatures below 0 degrees Celsius ambient air temperature.

PROCEDURES FOR EXITING A SEVERE ICING ENVIRONMENT:

(These procedures are applicable to all flight phase from take-off to landing.)

Monitor the ambient air temperature.
While severe icing may form at temperatures as cold as –18 degrees Celsius, increas vigilance is warranted at temperatures around freezing when visible moisture is pres

AMPLIFIED PROCEDURES

STARTING ENGINE

Proper fuel management and throttle adjustments are the determining factors in securing an easy start from your continuous-flow fuel-injection engine. The procedure outlined below should be followed closely as it is effective under nearly all operating conditions.

Conventional full rich mixture and high RPM propeller settings are used for starting; the throttle, however, should be fully closed initially. When ready to start, place the auxiliary fuel pump switch in the ON position and advance the throttle to obtain 50-60 lbs/hr fuel flow. Then, promptly return the throttle to idle and turn off the auxiliary fuel pump. Place the ignition switch in the START position. While cranking, slowly advance the throttle until the engine starts. Slow throttle advancement is essential since the engine will start readily when the correct fuel/air ratio is obtained. When the engine has started, reset the throttle to the desired idle speed.

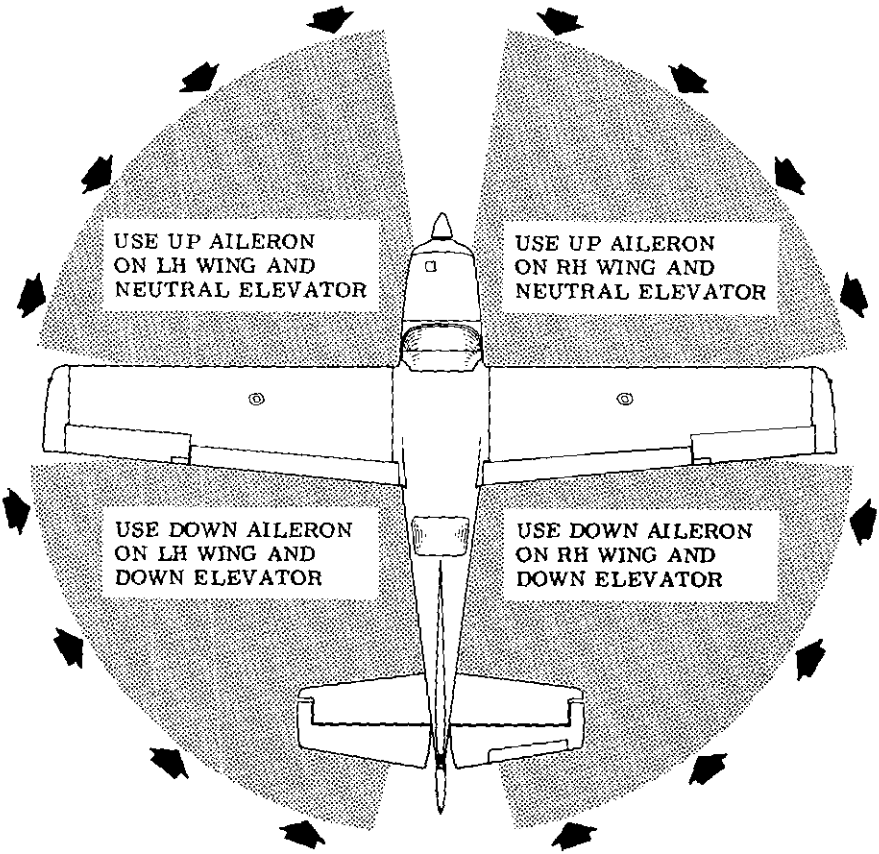
When the engine is hot or outside air temperatures are high, the engine may die after running several seconds because the mixture became either too lean due to fuel vapor, or too rich due to excessive prime fuel. The following procedure will prevent over-priming and alleviate fuel vapor in the system:

(1) Set the throttle 1/3 to 1/2 open.
(2) When the ignition switch is in the BOTH position and you are ready to engage the starter, place the right half of the auxiliary fuel pump switch in the ON position until the indicated fuel flow comes up to 25 to 35 lbs/hr; then turn the switch off.

NOTE

During a restart after a brief shutdown in extremely hot weather, the presence of fuel vapor may require the use of the auxiliary fuel pump switch in the ON position for up to 1 minute or more before the vapor is cleared sufficiently to obtain 25 to 35 lbs/hr for starting. If the above procedure does not obtain sufficient fuel flow, fully depress and hold the left half of the switch in the HI position to obtain additional fuel pump capability.

(3) Without hesitation, engage the starter and the engine should start in 3 to 5 revolutions. Adjust throttle for 1200 to 1400 RPM.



CODE	
WIND DIRECTION	➡

NOTE

Strong quartering tail winds require caution. Avoid sudden bursts of the throttle and sharp braking when the airplane is in this attitude. Use the steerable nose wheel and rudder to maintain direction.

Figure 4-2. Taxiing Diagram

(4) If there is fuel vapor in the lines, it will pass into the injector nozzles in 2 to 3 seconds and the engine will gradually slow down and stop. When engine speed starts to decrease, hold the left half of the auxiliary fuel pump switch in the HI position for approximately one second to clear out the vapor. Intermittent use of the HI position of the switch is necessary since prolonged use of the HI position after vapor is cleared will flood out the engine during a starting operation.
(5) Let the engine run at 1200 to 1400 RPM until the vapor is eliminated and the engine idles normally.

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

After starting, if the oil pressure gage does not begin to show pressure within 30 seconds in normal temperatures and 60 seconds in very cold weather, shut off the engine and investigate. Lack of oil pressure can cause serious engine damage.

TAXIING

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips. Refer to figure 4-2 for additional taxiing instructions.

BEFORE TAKEOFF

WARM-UP

Since the engine is 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 engine is not turning up properly.

MAGNETO CHECK

The magneto check should be made at 1700 RPM as follows. Move 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 the L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 150 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.

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.

ALTERNATOR CHECK

Prior to flights where verification of proper alternator and voltage regulator operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the landing light during the engine run-up (1700 RPM). The ammeter will remain within a needle width of the initial indication if the alternator and voltage regulator are operating properly.

TAKEOFF

POWER CHECK

It is important to check full-throttle engine operation early in the takeoff run. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff.

Full throttle runups over loose gravel are especially harmful to propeller tips. When takeoffs 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.

After full throttle is applied, adjust the throttle friction lock clockwise to prevent the throttle from creeping back from a maximum power position. Similar friction lock adjustments should be made as required in other flight conditions to maintain a fixed throttle setting.

For maximum engine power, the mixture should be adjusted during the initial takeoff roll to the fuel flow corresponding to the field elevation. (Refer to Maximum Performance Takeoff and Climb Settings placard located adjacent to fuel flow indicator.) The power increase is significant above 3000 feet and this procedure always should be employed for field elevations greater than 5000 feet above sea level.

WING FLAP SETTINGS

Using 10° flaps reduces the ground run and total distance over the obstacle by approximately 10 percent. Soft field takeoffs are performed with 10° flaps by lifting the nose wheel off the ground as soon as practical and leaving the ground in a slightly tail-low attitude. However, the airplane should be leveled off immediately to accelerate to a safe climb speed. Flap settings greater than 10° are not approved for takeoff.

SHORT FIELD TAKEOFF

If an obstruction dictates the use of a steep climb angle, after liftoff accelerate to and climb out at an obstacle clearance speed of 72 KIAS with 10° flaps and gear extended. This speed provides the best overall climb speed to clear obstacles when taking into account the turbulence often found near ground level. The takeoff performance data in Section 5 is based on this speed and configuration.

CROSSWIND TAKEOFF

Takeoffs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. The airplane is accelerated to a speed 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.

LANDING GEAR RETRACTION

Landing gear retraction normally is started after reaching the point over the runway where a wheels-down, forced landing on that runway would become impractical. Since the landing gear swings downward approximately two feet as it starts the retraction cycle, damage can result by retracting it before obtaining at least that much ground clearance.

Before retracting the landing gear, the brakes should be applied momentarily to stop wheel rotation. Centrifugal force caused by the rapidly-spinning wheel expands the diameter of the tire. If there is an accumulation of mud or ice in the wheel wells, the rotating wheel may rub as it is retracted into the wheel well.

ENROUTE CLIMB

A cruising climb at 25 inches of manifold pressure, 2550 RPM (approximately 75% power) and 100-110 KIAS is normally recommended. This type of climb provides an optimum combination of performance, visibility ahead, and passenger comfort (due to lower noise level).

Cruising climbs should be conducted at 108 lbs/hr up to 4000 feet and at the fuel flow shown on the Normal Climb Chart in Section 5 for higher altitudes.

If it is necessary to climb rapidly to clear mountains or reach favorable weather or winds at high altitudes, the best rate-of-climb speed should be used with maximum continuous power. This speed is 97 KIAS at sea level, decreasing to 90 KIAS at an altitude of 10,000 feet. The mixture should be leaned as shown by the Maximum Performance Takeoff and Climb Settings placard located adjacent to the fuel flow indicator.

If an obstruction dictates the use of a steep climb angle, climb with flaps retracted and maximum continuous power at 75 KIAS at sea level, to 80 KIAS at 10,000 ft.

CRUISE

Normal cruising is performed between 55% and 75% power. The corresponding power settings and fuel consumption for various altitudes can be determined by using your Cessna Power Computer or the data in Section 5.

NOTE

Cruising should be done at 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This is to ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The Cruise Performance Table, figure 4-3, illustrates the advantage of higher altitude on both true airspeed and nautical miles per gallon. In addition, the beneficial effect of lower cruise power on nautical miles per

	75% POWER		65% POWER		55% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
3000 Feet	165	10.5	157	11.5	146	12.5
6500 Feet	171	10.9	162	11.9	150	12.8
10,000 Feet	---	---	167	12.3	154	13.2
Standard Conditions						Zero Wind

Figure 4-3. Cruise Performance Table

gallon at a given altitude can be observed. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip. The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

For reduced noise levels, it is desirable to select the lowest RPM in the green arc range for a given percent power that will provide smooth engine operation. The cowl flaps should be opened, if necessary, to maintain the cylinder head temperature at approximately two-thirds of the normal operating range (green arc).

For best fuel economy at 65% power or less, the engine should be operated at six pounds per hour leaner than shown in this handbook and on the power computer. This will result in approximately 6% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

The fuel injection system employed on this engine is considered to be non-icing. In the event that unusual conditions cause the intake air filter to become clogged or iced over, an alternate intake air valve opens automatically. Due to a one to two inch decrease in manifold pressure and a significant increase in intake air temperature when the filter is blocked, power at full throttle decreases approximately 10%.

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at 75% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by a desired increment based on figure 4-4.

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilots Operating Handbook and Power Computer)	25°F Rich of Peak EGT
BEST ECONOMY (65% Power or Less)	Peak EGT

Figure 4-4. EGT Table

Continuous operation at peak EGT is authorized only at 65% power or less. This best economy mixture setting results in approximately 6% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

NOTE

Operation on the lean side of peak EGT is not approved.

When leaning the mixture, if a distinct peak is not obtained, use the corresponding maximum EGT as a reference point for enrichening the mixture to the desired cruise setting. Any change in altitude or power will require a recheck of the EGT indication.

STALLS

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

Power-off stall speeds at maximum weight for both forward and aft C. G. position are presented in Section 5.

BEFORE LANDING

In view of the relatively low drag of the extended landing gear and the high allowable gear-down speed (140 KIAS), the landing gear should be extended before entering the traffic pattern. This practice will allow more time to confirm that the landing gear is down and locked. As a further precaution, leave the landing gear extended in go-around procedures or traffic patterns for touch-and-go landing.

Landing gear extension can be detected by illumination of the gear down indicator light (green), absence of a gear warning horn with the throttle retarded below 12 inches of manifold pressure, and visual inspection of the main gear position. Should the gear indicator light fail to illuminate, the light should be checked for a burned-out bulb by pushing to test. A burned-out bulb can be replaced in flight with the landing gear up (amber) indicator light.

LANDING

NORMAL LANDING

Normal landing approaches can be made with power-on or power-off with any flap setting desired. Use of flaps down is normally preferred to minimize touchdown speed and subsequent need for braking. For a given flap setting, surface winds and turbulence are usually the primary factors in determining the most comfortable approach speed.

Actual touchdown should be made with power off and 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 after the speed has diminished to avoid unnecessary nose gear load. This procedure is especially important in rough or soft field landings.

SHORT FIELD LANDING

For short field landings, make a power approach at 71 KIAS with full flaps. After all approach obstacles are cleared, progressively reduce power. Maintain 71 KIAS approach speed by lowering the nose of the airplane. Touchdown should be made with the throttle closed, and on the main wheels first. Immediately after touchdown, lower the nose gear and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, retract the flaps, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

At light operating weights, during ground roll with full flaps, hold the control wheel full back to ensure maximum weight on the main wheels for braking. Under these conditions, full nose down elevator (control wheel full forward) will raise the main wheels off the ground.

CROSSWIND LANDING

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. After touchdown, hold a straight course with the steerable nose wheel and occasional braking if necessary.

BALKED LANDING

In a balked landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. If obstacles must be cleared during the go-around climb, leave the wing flaps at 20° and maintain a safe climb speed. Above 3000 feet altitude, the mixture should be leaned per fuel flow placard to obtain maximum power. After all obstacles are cleared and a safe altitude and airspeed are obtained, the wing flaps may be retracted.

COLD WEATHER OPERATION

The use of an external pre-heater and an external power source is recommended whenever possible 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 7, paragraph Ground Service Plug Receptacle, for operating details.

In very cold weather, no oil temperature indication need be apparent before takeoff. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), the engine is ready for takeoff if it accelerates smoothly and the oil pressure is normal and steady.

During let-down, observe engine temperatures closely and carry sufficient power to maintain them in the recommended operating range.

NOISE ABATEMENT

Increased emphasis on improving the quality of our environment requires renewed effort on the part of all pilots to minimize the effect of airplane noise on the public.

We, as pilots, can demonstrate our concern for environmental improvement, by application of the following suggested procedures, and thereby tend to build public support for aviation:

(1) Pilots operating aircraft under VFR over outdoor assemblies of persons, recreational and park areas, and other noise-sensitive areas should make every effort to fly not less than 2000 feet above the surface, weather permitting, even though flight at a lower level may be consistent with the provisions of government regulations.
(2) During departure from or approach to an airport, climb after takeoff and descent for landing should be made so as to avoid prolonged flight at low altitude near noise-sensitive areas.

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgement, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

Performance data charts on the following pages are presented so that you may know what to expect from the airplane under various conditions, and also, to facilitate the planning of flights in detail and with reasonable accuracy. The data in the charts has been computed from actual flight tests with the airplane and engine in good condition and using average piloting techniques.

It should be noted that the performance information presented in the range and endurance profile charts allows for 45 minutes reserve fuel based on 45% power. Fuel flow data for cruise is based on the recommended lean mixture setting. Some indeterminate variables such as mixture leaning technique, fuel metering characteristics, engine and propeller condition, and air turbulence may account for variations of 10% or more in range and endurance. Therefore, it is important to utilize all available information to estimate the fuel required for the particular flight.

USE OF PERFORMANCE CHARTS

Performance data is presented in tabular or graphical form to illustrate the effect of different variables. Sufficiently detailed information is provided in the tables so that conservative values can be selected and used to determine the particular performance figure with reasonable accuracy.

SAMPLE PROBLEM

The following sample flight problem utilizes information from the various charts to determine the predicted performance data for a typical flight. The following information is known:

AIRPLANE CONFIGURATION	
Takeoff weight	3750 Pounds
Usable fuel	534 Pounds
TAKEOFF CONDITIONS	
Field pressure altitude	1500 Feet
Temperature	28°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	3500 Feet
CRUISE CONDITIONS	
Total distance	860 Nautical Miles
Pressure altitude	7500 Feet
Temperature	16°C (16°C above standard)
Expected wind enroute	10 Knot Headwind
LANDING CONDITIONS	
Field pressure altitude	2000 Feet
Temperature	25°C
Field length	3000 Feet

TAKEOFF

The takeoff distance chart, figure 5-4, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 3800 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1675 Feet
Total distance to clear a 50-foot obstacle	2785 Feet

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 4 of the takeoff chart. The correction for a 12 knot headwind is:

$$\frac{12 \text{ Knots}}{10 \text{ Knots}} \times 10\% = 12\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind	1675
Decrease in ground roll (1675 feet × 12%)	201
Corrected ground roll	1474 Feet
Total distance to clear a 50-foot obstacle, zero wind	2785
Decrease in total distance (2785 feet × 12%)	334
Corrected total distance to clear a 50-foot obstacle	2451 Feet

CRUISE

The cruising altitude should be selected based on a consideration of trip length, winds aloft, and the airplane's performance. A cruising altitude and the expected wind enroute have been given for this sample problem. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics presented in figure 5-7, the range profile chart presented in figure 5-8, and the endurance profile chart presented in figure 5-9.

The relationship between power and range is illustrated by the range profile chart. Considerable fuel savings and longer range result when lower power settings are used.

The range profile chart indicates that use of 65% power at 7500 feet yields a predicted range of 930 nautical miles with no wind. The endurance profile chart shows a corresponding 5.8 hours. Using this information, the estimated distance can be determined for the expected 10 knot headwind at 7500 feet as follows:.

Range, zero wind	930
Decrease in range due to wind (5.8 hours × 10 knot headwind)	58
Corrected range	872 Nautical Miles

This indicates that the trip can be made without a fuel stop using approximately 65% power.

The cruise performance chart for 8000 feet pressure altitude is entered using 20° C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The power setting chosen is 2550 RPM and 21 inches of manifold pressure, which results in the following:

Power	65%
True airspeed	168 Knots
Cruise fuel flow	82 PPH

The power computer may be used to determine power and fuel consumption more accurately during the flight.

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 shows that a normal climb from 2000 feet to 8000 feet at a weight of 3800 pounds requires 21 pounds of fuel. The corresponding distance during the climb is 22 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance, by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

$$\frac{16°C}{10°C} \times 10\% = 16\% \text{ Increase}$$

With this factor included, the fuel estimate would be calculated as follows:

Fuel to climb, standard temperature	21
Increase due to non-standard temperature (21 × 16%)	3
Corrected fuel to climb	24 Pounds

Using a similar procedure for the distance during climb results in 26 nautical miles.

The resultant cruise distance is:

Total distance	860
Climb distance	-26
Cruise distance	834 Nautical Miles

With an expected 10 knot headwind, the ground speed for cruise is predicted to be:

$$\begin{array}{r} 168 \\ \underline{-10} \\ 158 \end{array} \text{ Knots}$$

Therefore, the time required for the cruise portion of the trip is:

$$\frac{834 \text{ Nautical Miles}}{158 \text{ Knots}} = 5.3 \text{ Hours}$$

The fuel required for cruise is:

5.3 hours × 82 pounds/hour = 435 Pounds

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	12
Climb	24
Cruise	435
Total fuel required	471 Pounds

This will leave a fuel reserve of:

$$\begin{array}{r} 534 \\ \underline{-471} \\ 63 \end{array} \text{ Pounds}$$

Once the flight is underway, ground speed checks will provide a more accurate basis for estimating the time enroute and the corresponding fuel required to complete the trip with ample reserve.

LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-10 presents landing distance information for the short field technique. The distances corresponding to 2000 feet pressure altitude and a temperature of 30°C are as follows:

Ground roll	865 Feet
Total distance to clear a 50-foot obstacle	1650 Feet

A correction for the effect of wind may be made, based on Note 2 of the landing chart using the same procedure as outlined for takeoff.

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

FLAPS UP							
KIAS	60	80	100	120	140	160	180
KCAS	62	79	99	118	138	157	177
FLAPS 10°							
KIAS	60	70	80	90	100	120	140
KCAS	60	70	80	89	99	118	138
FLAPS 30°							
KIAS	50	60	70	80	90	100	105
KCAS	56	65	74	83	92	101	105

Figure 5-1. Airspeed Calibration (Sheet 1 of 2)

AIRSPEED CALIBRATION

ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	61	82	103	125	146	168	189
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	61	72	83	94	105	126	148
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	105
ALTERNATE KIAS	57	68	79	89	99	109	114

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	58	78	101	123	144	165	186
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	59	69	80	91	101	123	144
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	105
ALTERNATE KIAS	52	66	77	86	96	106	111

WINDOWS OPEN

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	43	72	101	130	152	175	197
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	47	61	74	88	101	129	156
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	105
ALTERNATE KIAS	40	57	71	84	96	107	113

Figure 5-1. Airspeed Calibration (Sheet 2 of 2)

TEMPERATURE CONVERSION CHART

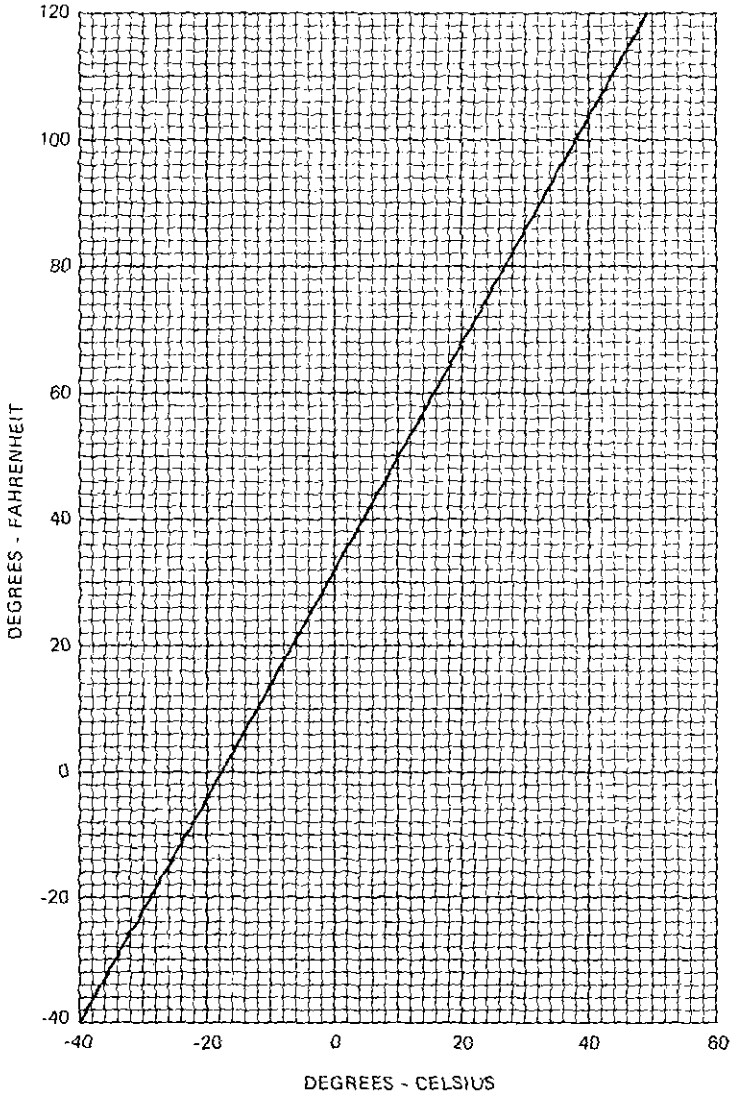


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off
Gear Up or Down

NOTES:
1. Maximum altitude loss during a stall recovery may be as much as 300 feet.
2. KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3800	UP	64	65	69	70	76	77	91	92
	10°	64	64	69	69	76	76	91	91
	30°	50	56	54	60	59	67	71	79

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3800	UP	68	69	73	74	81	82	96	98
	10°	68	68	73	73	81	81	96	96
	30°	55	61	59	66	65	73	78	86

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE

MAXIMUM WEIGHT 3800 LBS

SHORT FIELD

CONDITIONS:
Flaps 10°
2850 RPM and Full Throttle Prior to Brake Release
Mixture Set at Placard Fuel Flow
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind

MIXTURE SETTING	
PRESS ALT	PPH
S.L.	144
2000	138
4000	132
6000	126
8000	120

NOTES:
1. Short field technique as specified in Section 4.
2. Landing gear extended until takeoff obstacle is cleared.
3. Where distance value has been deleted, climb performance after lift-off is less than 150 fpm. Rate of climb is based on landing gear extended and flaps 10° at takeoff speed.
4. Decrease distances 10% for each 10 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2.5 knots.
5. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
3800	66	72	S.L.	1120	1820	1205	1960	1295	2105	1390	2265	1495	2440
			1000	1225	2005	1320	2155	1420	2320	1525	2505	1640	2705
			2000	1345	2210	1445	2380	1555	2570	1675	2785	1800	3020
			3000	1475	2450	1585	2645	1710	2865	1840	3110	1980	3390
			4000	1620	2725	1745	2955	1880	3210	2025	3505	2180	3840
			5000	1785	3055	1925	3325	2075	3630	2235	3990	2410	4415
			6000	1970	3455	2125	3780	2290	4160	2470	4615	2665	5185
			7000	2180	3950	2350	4365	2540	4860	2740	5485	---	---
			8000	2415	4595	2610	5155	---	---	---	---	---	---

Figure 5-4. Takeoff Distance (Sheet 1 of 2)

RATE OF CLIMB

MAXIMUM

CONDITIONS:
Flaps Up
Gear Up
2700 RPM
Full Throttle
Mixture Set at Placard Fuel Flow
Cowl Flaps Open

MIXTURE SETTING	
PRESS ALT	PPH
S.L.	138
4000	126
8000	114
12,000	102

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
3800	S.L.	97	1020	930	835	745
	2000	95	895	810	720	635
	4000	94	775	690	610	525
	6000	93	655	575	495	415
	8000	91	535	460	380	300
	10,000	90	420	345	270	---
	12,000	89	310	235	160	---
3500	S.L.	95	1155	1060	965	865
	2000	94	1025	935	840	750
	4000	93	895	810	720	635
	6000	91	770	685	605	520
	8000	90	645	565	485	405
	10,000	89	520	445	370	---
	12,000	87	405	325	250	---
3200	S.L.	94	1310	1210	1110	1010
	2000	92	1165	1070	975	880
	4000	91	1030	940	850	760
	6000	90	895	810	725	640
	8000	88	765	685	605	520
	10,000	87	635	555	480	---
	12,000	86	510	435	355	---

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Gear Up
2700 RPM
Full Throttle
Mixture Set at Placard Fuel Flow
Cowl Flaps Open
Standard Temperature

MIXTURE SETTING	
PRESS ALT	PPH
S.L.	138
4000	126
8000	114
12,000	102

NOTES:
1. Add 12 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
3. Distances shown are based on zero wind.

76 lph

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED POUNDS	DISTANCE NM
3800	S.L.	97	860	0	0	0
	2000	95	760	2	6	4
	4000	94	660	5	12	9
	6000	93	565	9	18	14
	8000	91	465	13	26	21
	10,000	90	365	18	35	29
	12,000	89	265	24	47	41
3500	S.L.	95	990	0	0	0
	2000	94	885	2	5	3
	4000	93	780	5	10	7
	6000	91	675	7	16	12
	8000	90	570	11	22	17
	10,000	89	465	15	29	24
	12,000	87	360	20	38	32
3200	S.L.	94	1135	0	0	0
	2000	92	1020	2	4	3
	4000	91	910	4	9	6
	6000	90	800	6	14	10
	8000	88	685	9	19	14
	10,000	87	575	12	25	20
	12,000	86	465	16	32	26

Figure 5-6. Time, Fuel, and Distance to Climb (Sheet 1 of 2)

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Gear Up
2550 RPM
25 Inches Hg or Full Throttle
Cowl Flaps Open
Standard Temperature

MIXTURE SETTING	
PRESS ALT	PPH
S.L.	138
4000	126
8000	114
12,000	102

NOTES:
1. Add 12 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
3. Distances shown are based on zero wind.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED POUNDS	DISTANCE NM
3800	S.L.	97	860	0	0	0
	2000	95	760	2	6	4
	4000	94	660	5	12	9
	6000	93	565	9	18	14
	8000	91	465	13	26	21
	10,000	90	365	18	35	29
	12,000	89	265	24	47	41
3500	S.L.	95	990	0	0	0
	2000	94	885	2	5	3
	4000	93	780	5	10	7
	6000	91	675	7	16	12
	8000	90	570	11	22	17
	10,000	89	465	15	29	24
	12,000	87	360	20	38	32
3200	S.L.	94	1135	0	0	0
	2000	92	1020	2	4	3
	4000	91	910	4	9	6
	6000	90	800	6	14	10
	8000	88	685	9	19	14
	10,000	87	575	12	25	20
	12,000	86	465	16	32	26

Figure 5-6. Time, Fuel, and Distance to Climb (Sheet 1 of 2)

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 100 KIAS

CONDITIONS:
Flaps Up
Gear Up
2550 RPM
25 Inches Hg or Full Throttle
Cowl Flaps Open
Standard Temperature

MIXTURE SETTING	
PRESS ALT	PPH
S.L. to 4000	108
8000	96
12,000	84

NOTES:
1. Add 12 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
3. Distances shown are based on zero wind.

WEIGHT LBS	PRESS ALT FT	RATE OF CLIMB FPM	FROM SEA LEVEL		
			TIME MIN	FUEL USED POUNDS	DISTANCE NM
3800	S.L.	580	0	0	0
	2000	580	3	6	6
	4000	570	7	12	12
	6000	470	11	19	19
	8000	365	16	27	28
	10,000	265	22	37	40
	12,000	165	32	51	59
3500	S.L.	685	0	0	0
	2000	685	3	5	5
	4000	675	6	11	10
	6000	565	9	16	16
	8000	455	13	23	23
	10,000	350	18	31	33
	12,000	240	25	41	46
3200	S.L.	800	0	0	0
	2000	800	2	4	4
	4000	795	5	9	8
	6000	675	8	14	13
	8000	560	11	19	19
	10,000	445	15	25	27
	12,000	325	20	33	37

Figure 5-6. Time, Fuel, and Distance to Climb (Sheet 2 of 2)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 65% power or less operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2550	25	---	---	---	78	166	98	76	168	95
	24	77	162	96	74	163	93	71	165	90
	23	72	158	91	70	160	88	67	161	85
	22	68	155	85	65	156	82	63	157	80
2500	25	78	163	98	76	164	95	73	166	92
	24	74	160	93	72	161	90	69	163	87
	23	70	156	88	68	158	85	65	159	82
	22	66	153	83	64	154	80	62	155	78
2400	25	73	159	92	71	161	89	68	162	86
	24	69	156	87	67	157	84	65	159	82
	23	66	153	83	63	154	80	61	155	77
	22	62	149	78	59	150	75	57	151	73
2300	25	69	155	86	66	157	84	64	158	81
	24	65	152	82	63	153	79	61	154	77
	23	61	149	77	59	150	75	57	150	73
	22	58	145	73	56	146	71	54	146	69
2200	25	64	151	80	61	152	77	59	153	75
	24	60	147	76	58	148	74	56	149	71
	23	57	144	72	55	145	70	53	145	68
	22	53	140	68	51	140	66	50	140	64
	21	50	136	64	48	135	62	46	134	60
	20	46	130	60	45	130	58	43	129	57

Figure 5-7. Cruise Performance (Sheet 1 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> NOTE
> For best fuel economy at 65% power or less operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2550	24	79	166	99	76	168	95	73	169	92
	23	74	163	93	72	164	90	69	166	87
	22	70	159	88	67	161	85	65	162	82
	21	66	155	83	63	157	80	61	158	77
2500	25	---	---	---	78	169	97	75	171	94
	24	76	164	96	74	166	92	71	168	89
	23	72	161	90	70	163	87	67	164	85
	22	68	157	85	65	159	82	63	160	80
2400	25	75	163	94	72	165	91	70	166	88
	24	71	160	89	69	162	86	66	163	83
	23	67	157	85	65	158	82	63	159	79
	22	63	153	80	61	154	77	59	155	75
2300	25	70	160	88	68	161	85	66	162	83
	24	67	156	84	64	158	81	62	159	79
	23	63	153	80	61	154	77	59	155	74
	22	59	149	75	57	150	73	55	150	71
2200	25	65	155	82	63	156	79	61	157	77
	24	62	152	78	59	153	75	57	153	73
	23	58	148	74	56	149	71	54	149	69
	22	55	144	70	53	145	68	51	144	66
	21	51	140	66	50	140	64	48	139	62
	20	48	135	62	46	134	60	45	133	59
	19	44	129	58	43	128	56	41	126	55

Figure 5-7. Cruise Performance (Sheet 2 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 65% power or less operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2550	24	---	---	---	78	173	97	75	174	94
	23	76	167	96	74	169	92	71	171	89
	22	72	164	90	69	166	87	67	167	84
	21	68	160	85	65	162	82	63	163	80
2500	24	78	169	98	75	171	95	73	172	91
	23	74	166	93	71	167	90	69	169	87
	22	70	162	88	67	164	85	65	165	82
	21	66	158	83	63	160	80	61	160	77
2400	24	73	165	91	70	166	88	68	167	85
	23	69	161	87	67	163	84	64	164	81
	22	65	158	82	63	159	79	61	160	77
	21	61	154	77	59	155	75	57	155	73
2300	24	68	161	86	66	162	83	64	163	80
	23	65	158	82	62	159	79	60	159	76
	22	61	154	77	59	155	75	57	155	72
	21	57	150	73	55	150	71	53	150	68
2200	24	63	156	80	61	157	77	59	158	75
	23	60	152	76	58	153	73	56	154	71
	22	57	149	72	54	149	70	53	149	67
	21	53	144	68	51	144	66	49	143	64
	20	50	139	64	48	138	62	46	137	60
	19	46	133	60	44	132	58	43	131	57

Figure 5-7. Cruise Performance (Sheet 3 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> NOTE
> For best fuel economy at 65% power or less operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2550	22	74	169	93	71	171	90	69	172	87
	21	70	165	88	67	167	85	65	168	82
	20	66	161	82	63	162	80	61	163	77
	19	61	157	77	59	157	75	57	157	72
2500	22	72	167	90	69	169	87	67	170	84
	21	68	163	85	65	164	82	63	165	79
	20	63	159	80	61	160	77	59	160	75
	19	59	154	75	57	155	72	55	154	70
2400	22	67	163	84	65	164	81	62	165	79
	21	63	159	80	61	160	77	59	160	74
	20	59	154	75	57	155	73	55	155	70
	19	55	150	70	53	149	68	51	148	66
2300	22	63	158	79	61	159	77	59	160	74
	21	59	154	75	57	155	72	55	155	70
	20	55	150	71	53	150	68	52	149	66
	19	52	144	66	50	143	64	48	142	62
2200	22	58	153	74	56	154	71	54	153	69
	21	55	149	70	53	149	68	51	148	66
	20	51	144	66	49	143	64	48	142	62
	19	48	138	62	46	137	60	44	135	58
	18	44	131	58	43	130	56	41	128	55

Figure 5-7. Cruise Performance (Sheet 4 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> NOTE
> For best fuel economy at 65% power or less operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE -5°C			20°C ABOVE STANDARD TEMP 15°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2550	20	68	166	85	65	167	82	63	168	79
	19	63	162	80	61	162	77	59	162	74
	18	59	156	74	56	157	72	55	156	70
	17	54	150	69	52	149	67	50	148	65
2500	20	65	164	82	63	165	80	61	165	77
	19	61	159	77	59	160	75	57	160	72
	18	57	154	72	55	154	70	53	153	68
	17	52	147	67	50	146	65	49	145	63
2400	20	61	159	77	59	160	75	57	160	72
	19	57	154	73	55	154	70	53	153	68
	18	53	149	68	51	148	66	49	147	64
	17	49	142	63	47	140	61	45	139	59
2300	20	57	154	73	55	154	70	53	153	68
	19	53	149	68	51	148	66	50	147	64
	18	50	143	64	48	141	62	46	140	60
	17	46	136	60	44	134	58	42	132	56
2200	20	53	148	68	51	148	66	49	146	64
	19	49	143	64	48	141	62	46	140	60
	18	46	136	60	44	135	58	43	133	56

Figure 5-7. Cruise Performance (Sheet 5 of 6)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 65% power or less operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2550	18	61	162	77	58	162	74	56	161	72
	17	56	155	71	54	155	69	52	153	67
	16	51	148	66	50	147	64	48	145	62
	15	47	139	61	45	137	59	43	135	57
2500	18	59	159	74	57	159	72	55	158	70
	17	54	153	69	52	151	67	50	150	65
	16	50	145	64	48	143	62	46	142	60
	15	45	136	59	43	134	57	42	131	55
2400	18	55	154	70	53	153	68	51	151	66
	17	51	147	65	49	145	63	47	144	61
	16	47	139	61	45	137	59	43	135	57
2300	18	51	148	66	49	146	64	48	145	62
	17	47	140	62	46	139	60	44	137	58
	16	43	132	57	42	130	55	40	126	54
2200	18	48	141	62	46	139	60	44	137	58
	17	44	134	58	42	131	56	41	128	54

Figure 5-7. Cruise Performance (Sheet 6 of 6)

RANGE PROFILE
45 MINUTES RESERVE
534 LBS. USABLE FUEL

CONDITIONS:
3800 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 44 lbs.

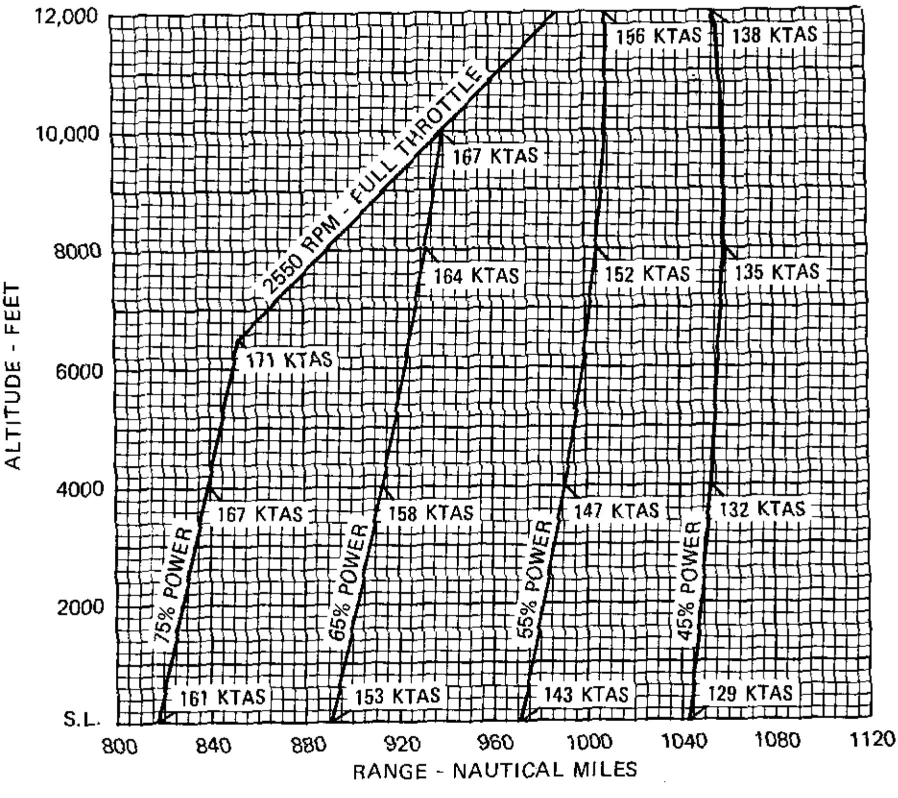


Figure 5-8. Range Profile

ENDURANCE PROFILE
45 MINUTES RESERVE
534 LBS. USABLE FUEL

CONDITIONS:
3800 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 44 lbs.

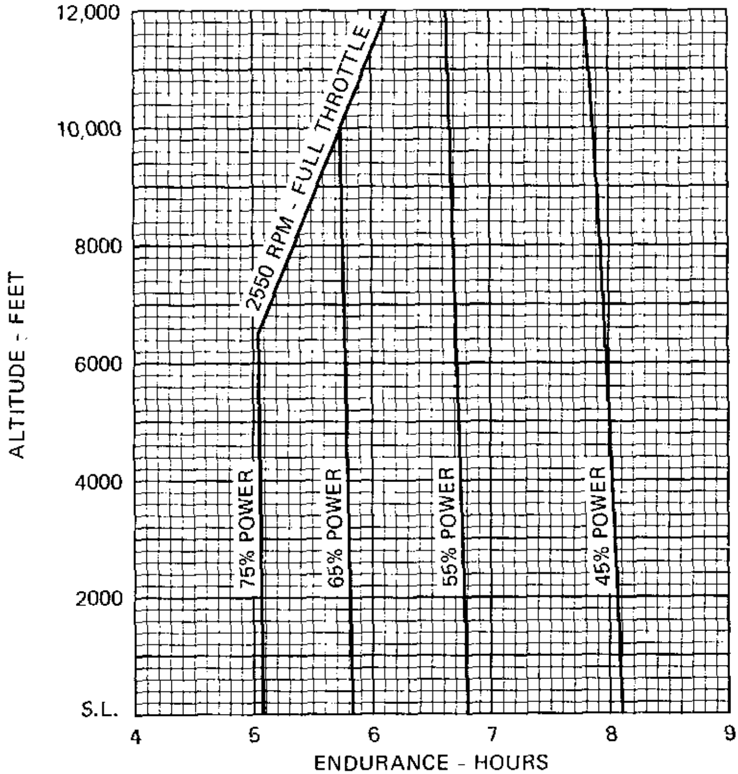


Figure 5-9. Endurance Profile

LANDING DISTANCE

SHORT FIELD

CONDITIONS:
Flaps 30°
Power Off
Maximum Braking
Paved, Level, Dry Runway
Zero Wind

NOTES:
1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 10 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2.5 knots.
3. For operation on a dry, grass runway, increase distances by 40% of the "ground roll" figure.

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
3800	71	S.L.	725	1440	750	1480	780	1520	805	1560	830	1600
		1000	750	1480	780	1520	805	1560	835	1605	860	1645
		2000	780	1525	810	1565	835	1605	865	1650	895	1695
		3000	810	1565	840	1610	870	1660	900	1705	930	1750
		4000	840	1615	870	1660	900	1705	930	1750	965	1800
		5000	870	1660	905	1710	935	1755	965	1805	1000	1855
		6000	905	1710	940	1765	970	1810	1005	1860	1035	1910
		7000	940	1765	975	1815	1010	1870	1045	1920	1075	1970
		8000	975	1815	1010	1870	1050	1930	1085	1980	1120	2035

Figure 5-10. Landing Distance

Cessna Centurion 210M

POWER SETTINGS **CRUISE** @ 1724 kg (3800 lb)

		50 % POWER				**65% POWER**				**75% POWER**			
Mixture		65 lb/hr				82 lb/hr				94 lb/hr			
Fuel Burnt		42 lph				52 lph				60 lph			
Density Alt	***SAP "Hg***	RPM	MP	TAS	SAR nm/l	RPM	MP	TAS	SAR nm/l	RPM	MP	TAS	SAR nm/l
2000	***28***	2200	21.7	138	3.28	2400	23.5	155	2.96	2550	24.3	164	2.73
4000	***26***	2200	21.0	140	3.33	2400	23.0	158	3.03	2550	23.7	167	2.78
6000	***24***	2200	20.7	142	3.36	2400	22.5	161	3.09	2550	23.3	170	2.83
8000	***22***	2200	20.3	142	3.42	2400	22.0	164	3.15	-----	----	----	----
10000	***20***	2200	19.7	145	3.45	2550	20.0	167	3.21	-----	----	----	----

POWER SETTINGS **CLIMB** @ 1724 kg (3800 lb)

	Max Performance Climb						**Cruise Climb**					
Density Altitude	RPM	MP	IAS	ROC	FFR	Grad % / ft/nm	RPM	MP	IAS	ROC	FFR	Grad Ft/nm
2000	2700	FT	95	820	138	8.52/517	2550	25	100	580	108	348
4000	2700	FT	94	660	126	6.93/421	2550	25	100	570	108	342
6000	2700	FT	93	560	120	5.94/361	2550	FT	100	470	102	282
8000	2700	FT	91	465	114	5.04/306	2550	FT	100	365	96	219
10000	2700	FT	90	365	108	4.00/250	2550	FT	100	265	90	166

POWER SETTINGS **HOLDING** @ 1724 kg (3800 lb)

Density Altitude	RPM	MP	TAS	FFR	
2000	2200	20.0	130	58	Endurance
4000	2200	19.7	131	58	82/58 = 1.4
6000	2200	19.3	133	59	Start, taxi & take-off
8000	2200	18.7	135	59	Allowance
10000					12 lb – 2 usg – 8 litres

Take-off and landing distance information

Density altitude	SAT (deg C)	1724 kg	1588 kg	1452 kg	Climb weight limit	Landing distance required	Climb weight limit
MSL	15	620m	507m	411m	1724 kg	475m	1724 kg
1000	13	672m	548m	443m	1724 kg	471m	1724 kg
2000	11	731m	593m	479m	1724 kg	480m	1724 kg
3000	9	799m	645m	518m	1724 kg	490m	**1724 kg**
4000	7	880m	704m	562m	1724 kg	502m	1660 kg
4300	6.4	908m	724m	577m	**1724 kg**	506m	1640 kg
5000	5	972m	770m	612m	1640 kg	514m	1610 kg
			HEADWIND	-10% per 10 knot		-10% per 10 knot	
			TAILWIND	+10% per 2.5 knot		+10% per 2.5 knot (10 kt max)	
			SHORT DRY GRASS (up to 100mm)	+10% (conservative – refer POH)		+22% (slightly conservative – refer POH)	
			LONG DRY GRASS (up to 200mm)	+20% (refer FSA Perform Article)		+25% (refer FSA Perform Article)	
			WET GRASS (up to 200mm)	+30% (refer FSA Perform Article)		Up to 60% if grass very short - slippery	
			CONFIGURATION	10 deg flap mixture – for max power		30 deg flap mixture – for max power	
			SLOPE	+10% per 2% up slope		+10% per 2% down slope	

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST

TABLE OF CONTENTS

INTRODUCTION

This section describes the procedure for establishing the basic empty weight and moment of the airplane. Sample forms are provided for reference. Procedures for calculating the weight and moment for various operations are also provided. A comprehensive list of all Cessna equipment available for this airplane is included at the back of this section.

It should be noted that specific information regarding the weight, arm, moment and installed equipment list for this airplane can only be found in the appropriate weight and balance records carried in the airplane.

AIRPLANE WEIGHING PROCEDURES

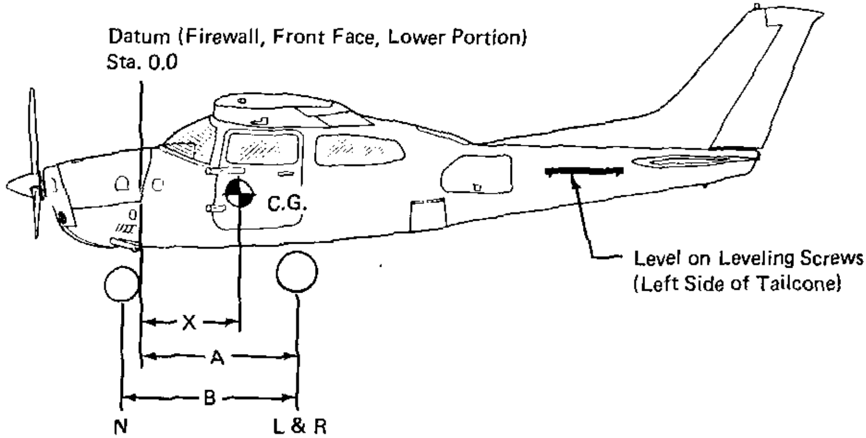
(1) Preparation:
a. Inflate tires to recommended operating pressures.
b. Remove the fuel tank sump quick-drain fittings and fuel reservoir quick-drain fittings to drain all fuel.
c. Remove oil sump drain plug to drain all oil.
d. Move sliding seats to the most forward position.
e. Raise flaps to the fully retracted position.
f. Place all control surfaces in neutral position.

(2) Leveling:
a. Place scales under each wheel (minimum scale capacity, 1000 pounds).
b. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level (see Figure 6-1).

(3) Weighing:
a. With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.

(4) Measuring:
a. Obtain measurement A by measuring horizontally (along the airplane center line) from a line stretched between the main wheel centers to a plumb bob dropped from the firewall.
b. Obtain measurement B by measuring horizontally and parallel to the airplane center line, from center of nose wheel axle, left side, to a plumb bob dropped from the line between the main wheel centers. Repeat on right side and average the measurements.

(5) Using weights from (3) and measurements from (4) the airplane weight and C. G. can be determined.



Scale Position	Scale Reading	Tare	Symbol	Net Weight
Left Wheel			L	
Right Wheel			R	
Nose Wheel			N	
Sum of Net Weights (As Weighed)			W	

$$X = ARM = (A) - \frac{(N) \times (B)}{W} \; ; \; X = (\quad) - \frac{(\quad) \times (\quad)}{(\quad)} = (\quad) \text{ IN.}$$

Item	Weight (Lbs.)	X C.G. Arm (In.) =	Moment/1000 (Lbs.-In.)
Airplane Weight (From Item 5, page 6-3)			
Add Oil: No Oil Filter (10 Qts at 7.5 Lbs/Gal)		-12.5	
With Oil Filter (11 Qts at 7.5 Lbs/Gal)		-12.5	
Add: Unusable Fuel (1 Gal at 6 Lbs/Gal)	6	23	0.1
Equipment Changes			
Airplane Basic Empty Weight			

Figure 6-1. Sample Airplane Weighing

SAMPLE WEIGHT AND BALANCE RECORD

(Continuous History of Changes in Structure or Equipment Affecting Weight and Balance)

AIRPLANE MODEL	SERIAL NUMBER	PAGE NUMBER

DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING BASIC EMPTY WEIGHT	
				ADDED (+)			REMOVED (-)				
	In	Out		Wt. (lb.)	Arm (In.)	Moment /1000	Wt. (lb.)	Arm (In.)	Moment /1000	Wt. (lb.)	Moment /1000

Figure 6-2. Sample Weight and Balance Record

(6) Basic Empty Weight may be determined by completing Figure 6-1.

WEIGHT AND BALANCE

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

Take the basic empty weight and moment from appropriate weight and balance records carried in your airplane, and enter them in the column titled YOUR AIRPLANE on the Sample Loading Problem.

NOTE

In addition to the basic empty weight and moment noted on these records, the C.G. arm (fuselage station) is also shown, but need not be used on the Sample Loading Problem. The moment which is shown must be divided by 1000 and this value used as the moment/1000 on the loading problem.

Use the Loading Graph to determine the moment/1000 for each additional item to be carried, then list these on the loading problem.

NOTE

Loading Graph information for the pilot, passengers and baggage is based on seats positioned for average occupants and baggage loaded in the center of the baggage areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft C.G. range limitation (seat travel or baggage area limitation). Additional moment calculations, based on the actual weight and C.G. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph.

Total the weights and moments/1000 and plot these values on the Center of Gravity Moment Envelope to determine whether the point falls within the envelope, and if the loading is acceptable.

LOADING ARRANGEMENTS

* Pilot or passenger center of gravity on adjustable seats positioned for average occupant. Numbers in parentheses indicate forward and aft limits of occupant center of gravity range.

**Baggage area center of gravity.

NOTE:
The aft baggage wall (approximate station 152) can be used as a convenient interior reference point for determining the location of baggage area fuselage station.

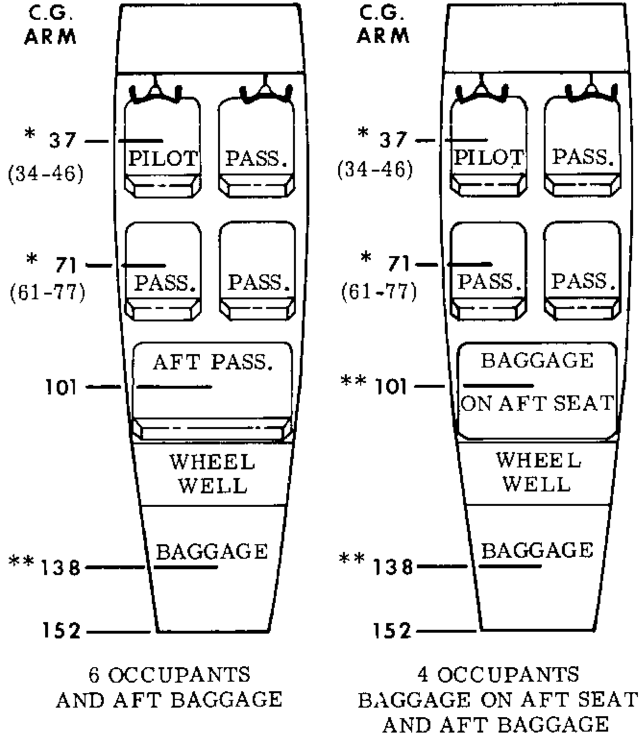


Figure 6-3. Loading Arrangements

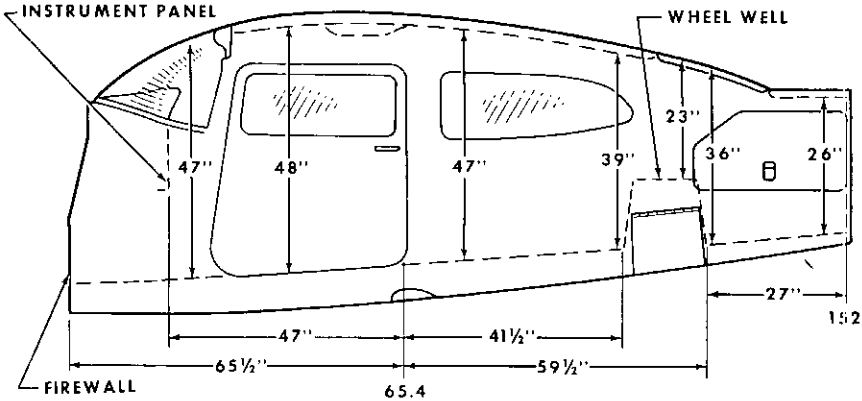
BAGGAGE TIE-DOWN

A nylon baggage net having six tie-down straps is provided to secure baggage in the area aft of the wheel well and on the backs of the fifth and sixth seats when they are used for stowing baggage.

When using the baggage net to secure baggage stowed aft of the wheel well, only four of the net tie-down straps are usually used. They are fastened to the two tie-down rings located on the forward edge of the wheel well and two rings at the bottom edge of the rear cabin window. If the fifth and sixth seats are not occupied, the seat backs may be folded forward to create more baggage area. If this area is used, all six tie-down straps must be used. Tie the front straps of the net to the front legs of the fifth and sixth seats and the remaining four straps to the tie-down rings provided.

Weight and balance calculations for baggage forward of the wheel well and stowed on the backs of the fifth and sixth seats can be figured on the AFT PASSENGERS line of the Loading Graph. Note that the baggage load in this area is limited to 120 pounds. A separate line is provided for computing weight and balance of baggage in the baggage area aft of the wheel well.

CABIN HEIGHT MEASUREMENTS



DOOR OPENING DIMENSIONS

	WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (REAR)
CABIN DOOR	31"	36"	40"	38½"
BAGGAGE DOOR	19"	28½"	8½"	14¾"

WIDTH
• LWR WINDOW LINE
* CABIN FLOOR

CABIN WIDTH MEASUREMENTS

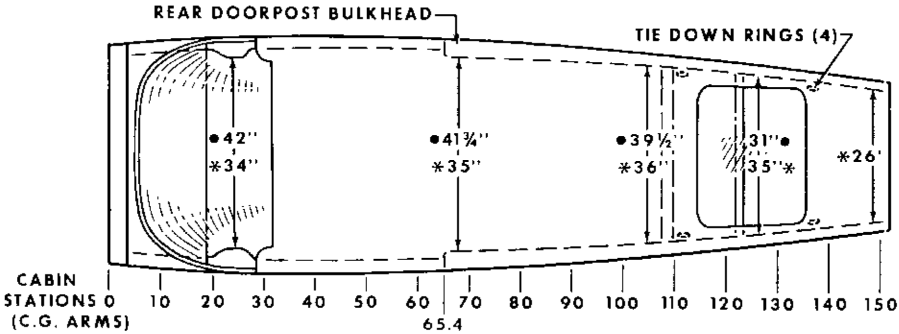
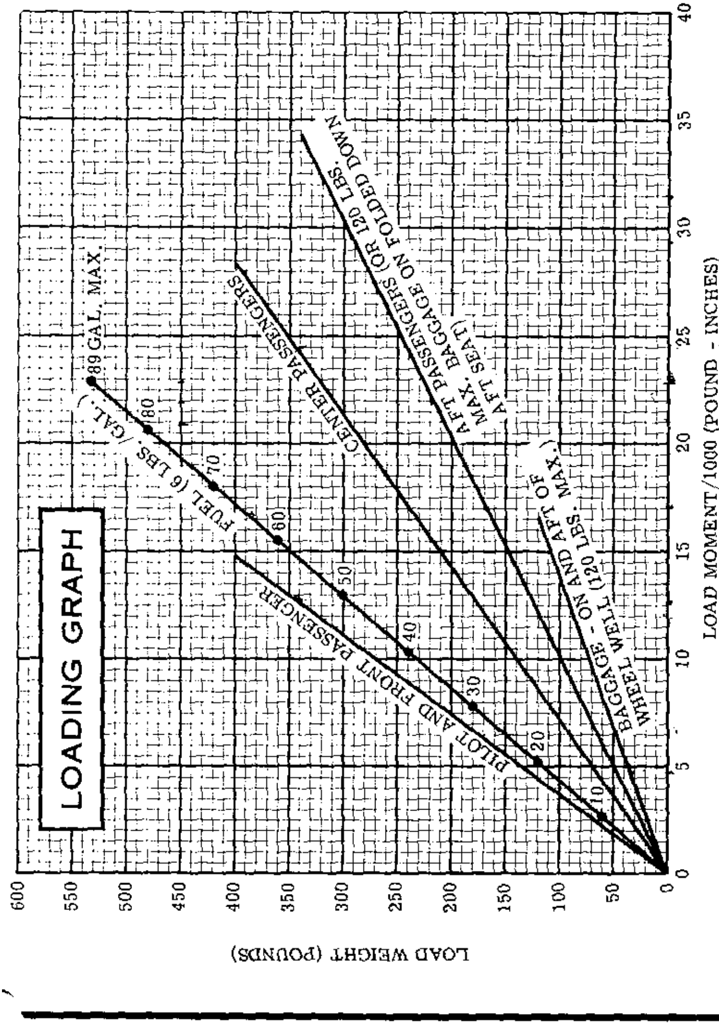


Figure 6-4. Internal Cabin Dimensions

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil)	2276	92.9		
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (89 Gal. Maximum)				
Reduced Fuel (64 Gal.)	384	16.5		
3. Pilot and Front Passenger (Station 34 to 46) . .	340	12.6		
4. Center Passengers (Station 61 to 77)	340	24.1		
5. Aft Passengers	340	34.3		
6. Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110) (120 lbs. max.) . . .				
7. Baggage - On and aft of wheel well (Station 110 to 152) (120 lbs. max.)	120	16.6		
8. TOTAL WEIGHT AND MOMENT	3800	197.0		
9. Locate this point (3800 at 197.0) on the Center of Gravity Moment Envelope. Since this loading falls within the shaded area of the moment envelope, proceed with steps 10, 11 and 12. If the computed loading point falls within the clear area of the moment envelope, no further steps are required and the loading is assumed satisfactory for take-off and landing.				
10. Estimated Fuel Burn-Off (Climb and Cruise) (38 gallons at 6 lbs./gal.)	-228	-9.8		
11. Subtract step 10 from step 8 for estimated airplane landing weight	3572	187.2		
12. Locate this point (3572 at 187.2) on the Center of Gravity Moment Envelope. Since this point falls within the overall envelope, the loading may be assumed acceptable for landing.				

Figure 6-5. Sample Loading Problem



NOTE: Lines representing adjustable seats show the pilot or passenger center of gravity on adjustable seats positioned for an average occupant. Refer to the Loading Arrangements diagram for forward and aft limits of occupant c.g. range.

Figure 6-6. Loading Graph

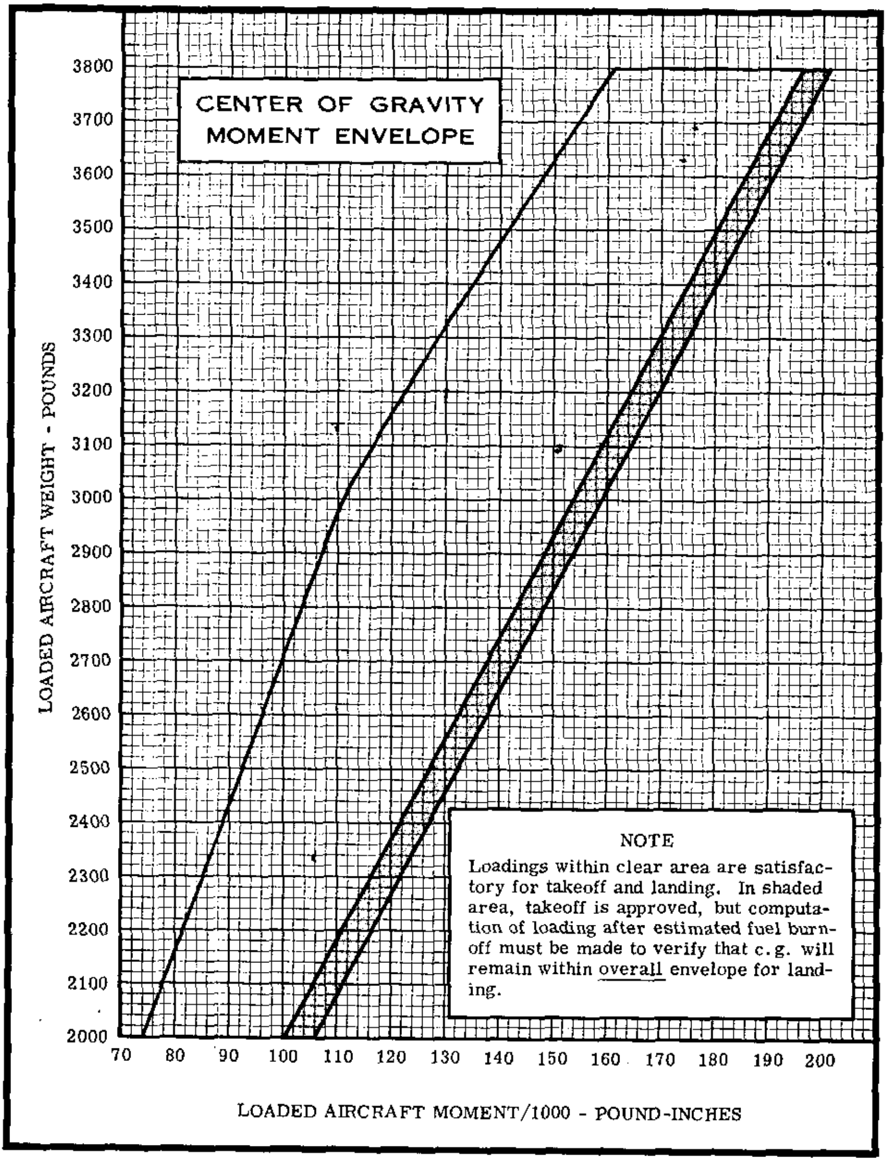
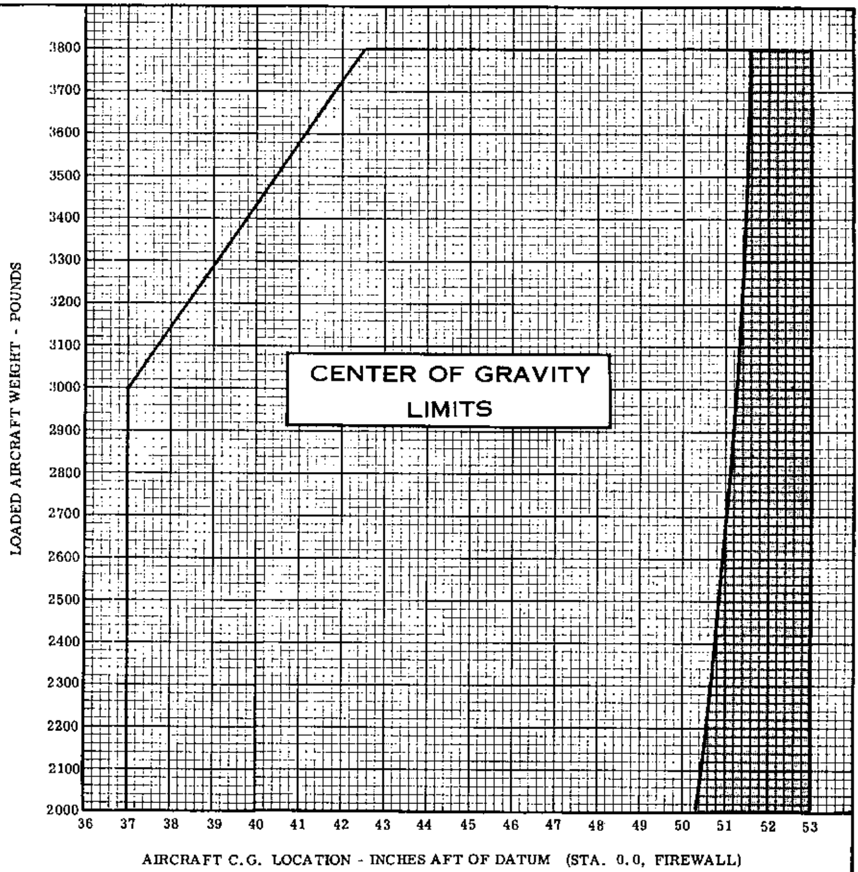


Figure 6-7. Center of Gravity Moment Envelope



NOTE: Loadings within clear area are satisfactory for takeoff and landing. In shaded area, takeoff is approved, but computation of loading after estimated fuel burnoff must be made to verify that c.g. will remain within overall envelope for landing.

Figure 6-8. Center of Gravity Limits

6.2 - AEROPLANE WEIGHT

Aeroplane Type : CESSNA 210M

Registration Marking : VH- RDZ

Issue	Date	Date of Expiry
3	[illegible]	Indefinite

Aeroplane Weight and Centre of Gravity Data :

Item	Weight kg	Arm mm aft of datum	Index Unit kg mm	Cabin Configuration
Empty	1049	1013	1063211	6 Seats
Basic	1057	1008	1065501	6 Seats

NOTE : The above weight(s) include

Empty: Unusable Fuel and Undrainable Eng. Oil.

Basic: Unusable Fuel and Full Engine Oil.

APPROVED BY

P. A. DENHOLM

D.O.T. WEIGHT CONTROL AUTH.

AS2

9-8-85.

SECTION 6 - LOADING DATA

6. 1 - GENERAL

This Section contains basic weight and centre of gravity information necessary to ensure correct loading of the aeroplane and comprises Aeroplane Weight and Loading System pages. Both of these documents, separately approved by the Director-General or an aircraft weight control design signatory, are to be carried in the Flight Manual at all times.

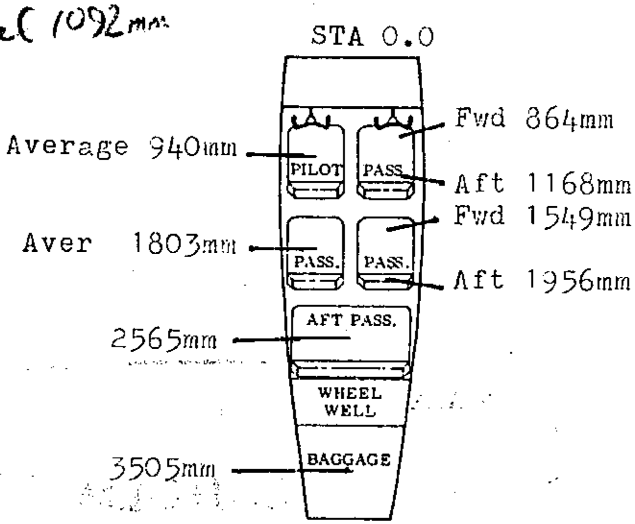
Loading System VH.MDZ Issue 3.

Sample Loading.	KG	Moment kgmm / 1000
Basic Weight	1057	1065.5
Pilot.Pax. Seat Aver.	154	144.7
Centre Pax. " "	154	277.7
Aft Pax.	77	197.5
Baggage.	10	35.0
Zero Fuel	1452	1720.4
Full Fuel	239	261.0
Loaded Aircraft	1691	1981.4

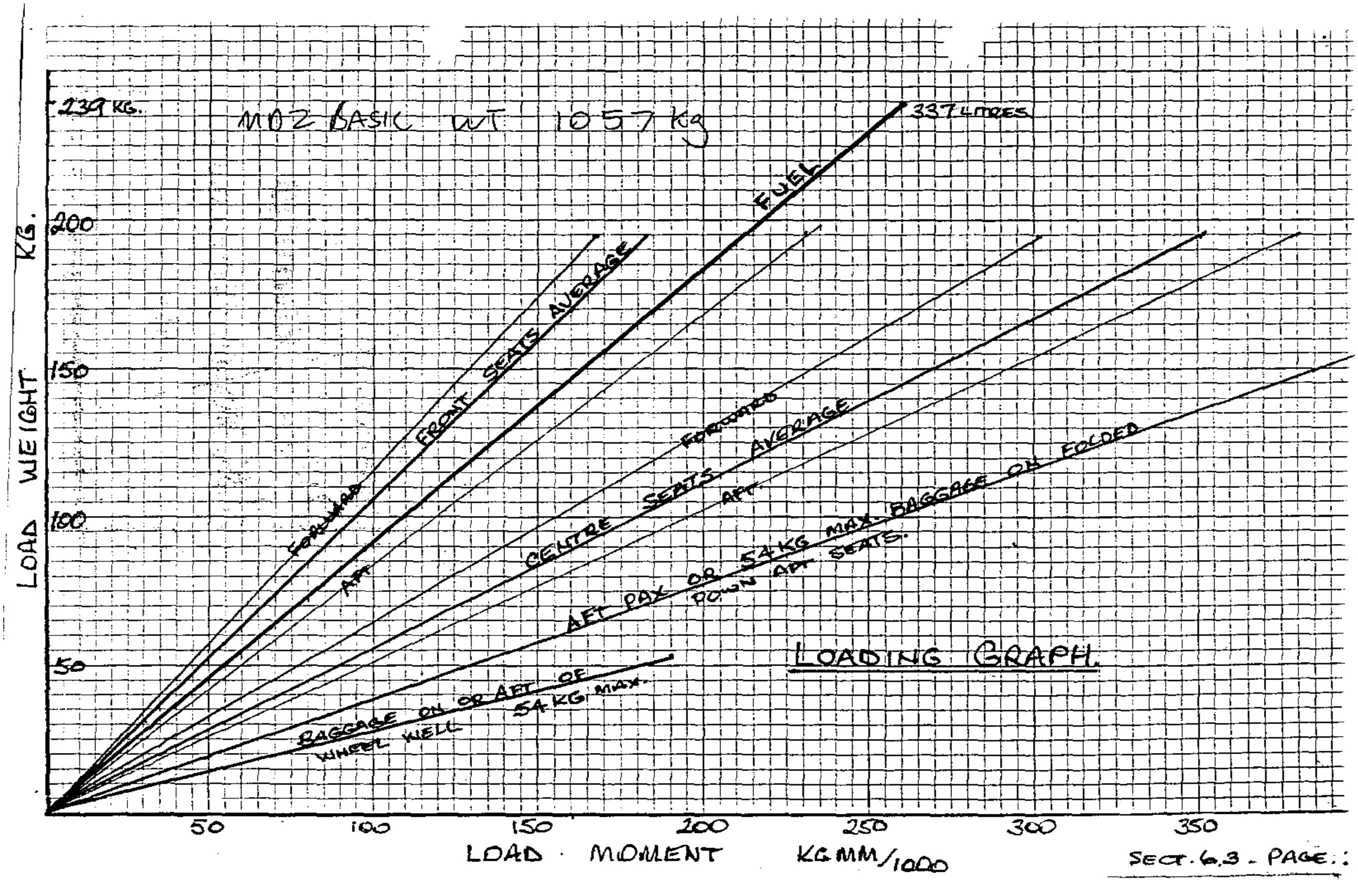
When plotted on the CofG Moment Envelope, it is found to fall within the clear area of the envelope.

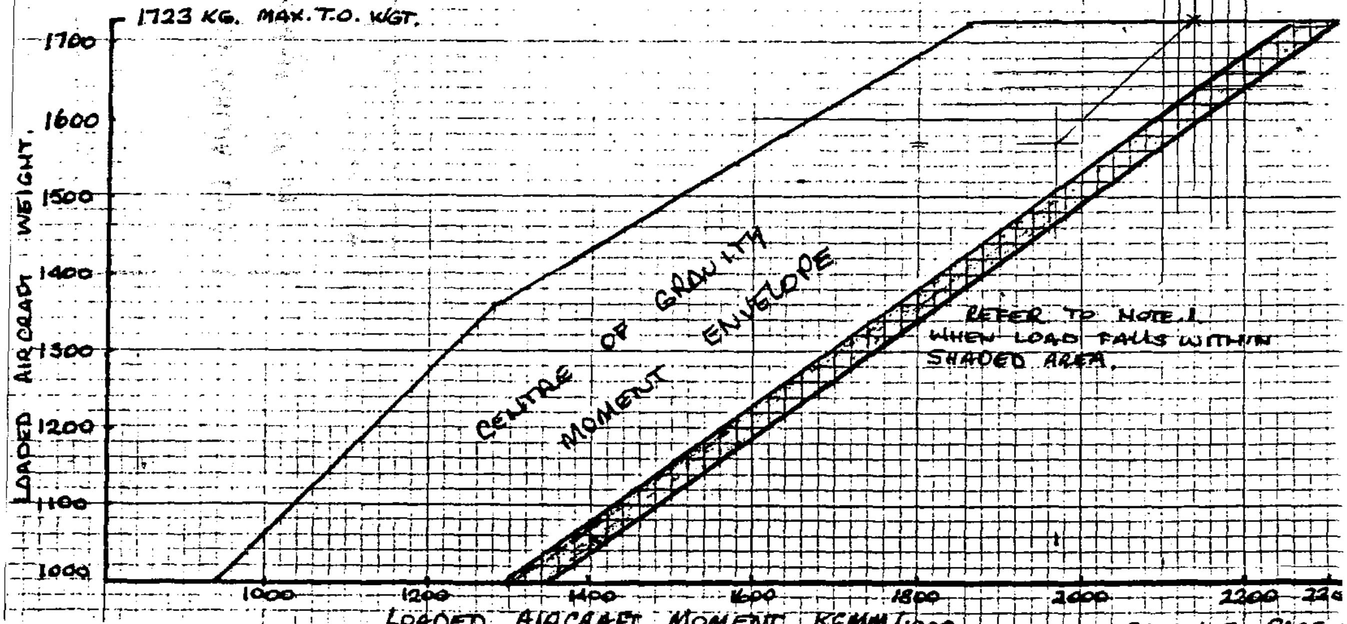
Cabin Stations

Fuel 1092mm



◆ Fuel Arm 1092mm


MO2 BASIC WT 1057 Kg
239 KG.
337 LITRES
LOADING GRAPH.
LOAD WEIGHT KG.
LOAD MOMENT KGMM/1000
200
150
100
50
50
100
150
200
250
300
350
FUEL
FORWARD
FRONT SEATS AVERAGE
AFT
FORWARD
CENTRE SEATS AVERAGE
AFT
AFT PAX OR 54 KG MAX. BAGGAGE ON FOLDED
DOWN AFT SEATS.
BAGGAGE ON OR AFT OF
WHEEL WELL
54 KG MAX.


1723 KG. MAX. T.O. WGT.
LOADED AIRCRAFT WEIGHT.
1700
1600
1500
1400
1300
1200
1100
1000
CENTRE OF GRAVITY MOMENT ENVELOPE
REFER TO NOTE 1 WHEN LOAD FALLS WITHIN SHADED AREA.
1000
1200
1400
1600
1800
2000
2200
LOADED AIRCRAFT MOMENT KGMM/1000

6.3 - LOADING SYSTEM

Aircraft type; Cessna 210M
Registration VH.MDZ

Issue 3 Dated 9.8.85

This aircraft is to be loaded to within the limitations as detailed in the Flight Manual.

The Loading System VH.MDZ Issue 3 comprises a Loading Graph and CofG Moment Envelope, and is to be used to determin that the aircraft is correctly loaded.

The individual weights and moments are plotted on the Loading Graph, added together to obtain a Zero Fuel weight and moment. This Zero Fuel weight and moment then plotted on the CofG Moment Envelope.
The Fuel weight and moment is then added to give the Loaded Aircraft weight and moment. This is then plotted on the CofG Moment Envelope.

Note.1. When the load falls within the clear area of the CofG Moment Envelope, loading is satisfactory for Take-off and Landing.
When the load falls within the shaded area, Take-off is approved, but computation of load after estimated burn-off is to be made to verify that the CofG will remain within the overall envelope.

Note.2. The position of the front and centre adjustable seats can adversly affect the CofG, therefore calculate moment on actual seat position.

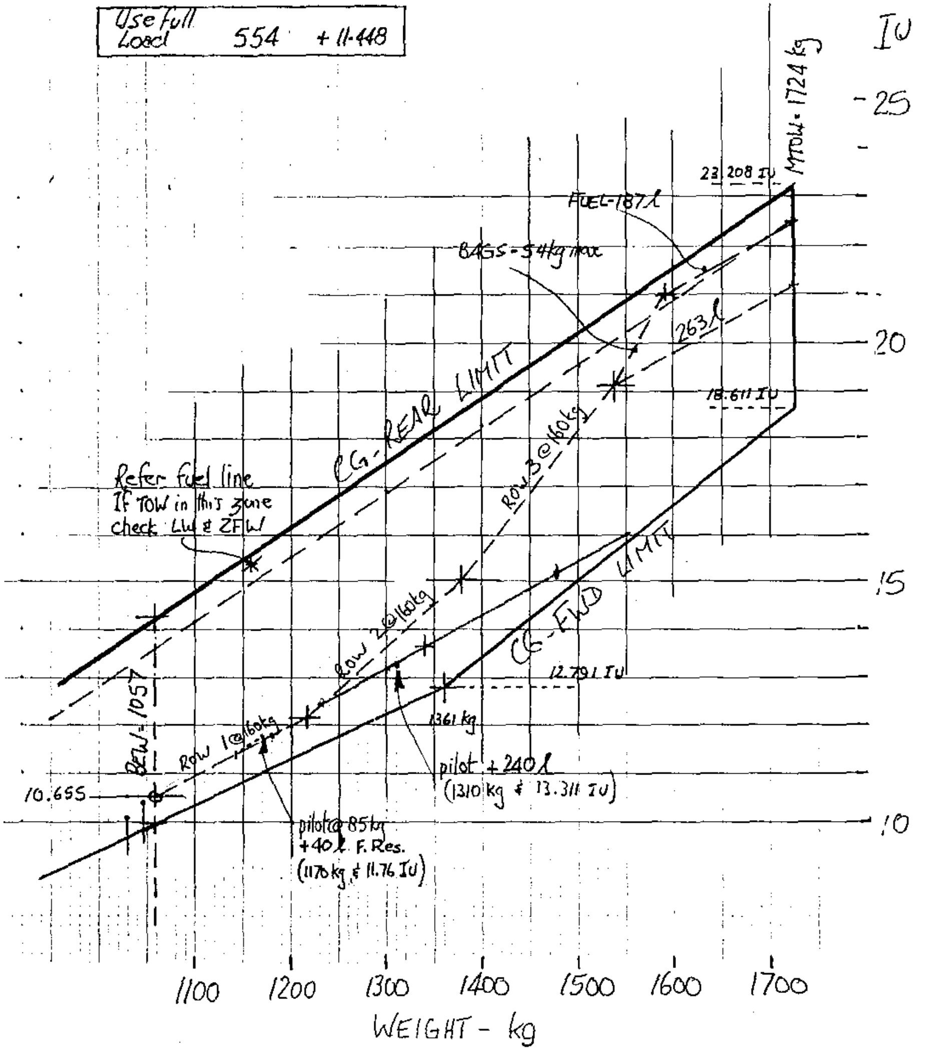
C-210M — MDZ

FUEL (max) = 336 ℓ (242 kg)

$IU = kg.mm \times 10^{-5}$

	KG	I.U
ROW 1	160	1.504
ROW 2	160	2.880
ROW 3	160	4.104 (max bags on seat - 54kg)
FUEL	242	2.643
BAGS	54	1.899
Usefull Load	554	+ 11.448

BEW (6 seats) 1057kg & 10.655 IU
" (4 seats) 1047kg & 10.390 IU
" (2 seats) 1031kg & 10.093 IU



SHEET NOS. 6-16 TO 6-29 INC.

✓ = IN , O = OUT

REF NO: FEL/MDZ/2
DATE: 21/11/77

FIXED EQUIPMENT LIST

The following equipment list is a comprehensive list of all Cessna equipment available for this airplane. A separate equipment list of items installed in your specific airplane is provided in your aircraft file. The following list and the specific list for your airplane have a similar order of listing.

This equipment list provides the following information:

An item number gives the identification number for the item. Each number is prefixed with a letter which identifies the descriptive grouping (example: A. Powerplant & Accessories) under which it is listed. Suffix letters identify the equipment as a required item, a standard item or an optional item. Suffix letters are as follows:

- -R = required items of equipment for FAA certification
- -S = standard equipment items
- -O = optional equipment items replacing required or standard items
- -A = optional equipment items which are in addition to required or standard items

A reference drawing column provides the drawing number for the item.

NOTE

If additional equipment is to be installed, it must be done in accordance with the reference drawing, accessory kit instructions, or a separate FAA approval.

Columns showing weight (in pounds) and arm (in inches) provide the weight and center of gravity location for the equipment.

NOTE

Unless otherwise indicated, true values (not net change values) for the weight and arm are shown. Positive arms are distances aft of the airplane datum; negative arms are distances forward of the datum.

NOTE

Asterisks (*) after the item weight and arm indicate complete assembly installations. Some major components of the assembly are listed on the lines immediately following. The summation of these major components does not necessarily equal the complete assembly installation.

S. C. RIGBY, 33 CRAYFORD CRES, MT. PRITCHARD 2170
D.O.T. AIRCRAFT WEIGHT CONTROL AUTHORITY AN11

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, CONTINENTAL IO-520-L SPEC 4	1250601	455.4*	-17.5*
	TWO MAGNETOS WITH IMPULSE COUPLINGS	SLICK 662	12.9	-12.5
	OIL COOLER MOUNTING PROVISIONS	EQ5968	2.3	-32.5
	OIL COOLER, HARRISON 8526732	TCM 626189	5.3	-32.5
	TWELVE 18MM X 3/4 20-3A SPARK PLUGS	SL 350	3.0	-19.5
	STARTER, 24 VOLT PRESTOLITE	TCM 639171	17.8	-5.0
A05-R	FILTER, ENGINE AIR INDUCTION	1250704	1.0	-9.5
A09-R	ALTERNATOR, 28 VOLT 60 AMP HR	C611503-0201	11.5	-6.0
A17-O	OIL COOLER, NON-CONGEALING-MODINE REPLACES A01-R OIL COOLER AND CHANGES ENGINE DESIGNATION TO IO-520-L SPEC 3 (NET CHANGE)	TCM 639171	2.3	-32.5
A21-A	FILTER, FULL FLOW ENGINE OIL	0750606-9	4.5*	-5.0*
	ENGINE ADAPTER ASSY	1250922-1	2.0	-5.3
	FILTER CAN ASSEMBLY, AC 6436992	C294505-0101	1.8	-4.8
	FILTER ELEMENT KIT, AC 6435683	C294505-0102	0.3	-4.8
A33-R	PROPELLER, 3 BLADE MCCAULEYD3A32C88/82NC-2	C161006-0105	68.5	-44.0
A37-R	PROP GOVERNOR (WOODWARD 210462 OR	C161040-0108	3.0	-35.5
	MCCAULEY C290-D4/T4)	C161032-0102	3.0	-35.5
A41-R	SPINNER, PROPELLER	1250419	3.5	-44.5
A61-A	VACUUM SYSTEM, ENGINE DRIVEN PUMP	1201052	5.6*	1.1*
	VACUUM PUMP (AV. OF 4 TYPES)	C431003	2.8	-3.7
	RELIEF VALVE	C482001-0501	0.6	2.3
	MISC HOSES, CLAMPS & ETC.		1.8	4.6
A70-A	PRIMING SYSTEM, MANIFOLD 2 POINT	1201138	1.3	4.1
	B. LANDING GEAR & ACCESSORIES			
B01-R-1	WHEEL, BRAKE & TIRE ASSY, 600X6 MAIN (2)	1241156-134	40.4*	61.5*
	WHEEL ASSY, CLEVELAND 40-75B (EACH)	C163001-0301	6.2	61.5
	BRAKE ASSY, CLEVELAND 30-52 (LEFT)	C163030-0304	2.8	61.5
	BRAKE ASSY, CLEVELAND 30-52 (RIGHT)	C163030-0303	2.8	61.5
	TIRE, 8 PLY RATED (EACH)	C262003-0208	9.2	61.5
	TUBE (EACH)	C262023-0102	1.8	61.5
B01-R-2	WHEEL, BRAKE& TIRE ASSY, 600X6 MAIN (2)	C16301680115	41.0*	61.5*
	WHEEL ASSY, MCCAULEY	C163004-0102	7.1	61.5
	BRAKE ASSY (LEFT)	C163032-0206	3.0	61.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	BRAKE ASSY (RIGHT)	C163032-0205	3.0	61.5
	TIRE, 8 PLY RATED (EACH)	C262003-0208	9.2	61.5
	TUBE (EACH)	C262023-0102	1.8	61.5
B04-R-1	WHEEL AND TIRE ASSY 500X5 NOSE (CLEVELAND)	1241156-104	9.0*	-7.4*
	WHEEL ASSY, CLEVELAND 40-77	1241156-12	2.8	-7.4
	TIRE, 6 PLY RATED	C262003-0202	5.0	-7.4
	TUBE	C262023-0101	1.2	-7.4
B04-R-2	WHEEL AND TIRE ASSY, 500X5 NOSE (MCCAULEY)	C163018B0103	8.3*	-7.4*
	WHEEL ASSY	C163005-0201	2.4	-7.4
	TIRE, 6 PLY RATED	C262003-0202	4.7	-7.4
	TUBE	C262023-0101	1.2	-7.4
	C. ELECTRICAL SYSTEMS			
C01-R	BATTERY, 24 VOLT, 17 AMP HR	0870060	27.5	3.0
C04-R	REGULATOR, 28 VOLT ALTERNATOR	C611002-0105	0.5	3.0
C07-A	GROUND SERVICE PLUG RECEPTACLE	1270652	2.0	-4.5
C19-O	HEATING SYSTEM, STALL SENSOR & PITOT HEAD (NET CHANGE)	1201035	0.5	36.5
C22-A	LIGHT INSTL., INSTRUMENT POST (SET OF 18)	1213770	0.5	18.5
C25-A	LIGHT INSTALLATION, CONTROL WHEEL MAP	0760020	0.1	22.5
C31-A	COURTESY LIGHTS, WING UNDERSIDE (SET OF 2)	1221103	0.5	51.4
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF 2)	1221201	NEGL	--
C43-A	LIGHT INSTALLATION, OMNIFLASH BEACON	1201049	1.6*	226.0*
	BEACON LIGHT IN FIN TIP	C621001	0.4	253.0
	FLASHER POWER SUPPLY (IN FIN TIP)	C594502-0101	0.7	253.1
C46-A	LIGHT INSTL, WING TIP STROBE	1201129	3.6*	38.9*
	FLASHING POWER SUPPLY	C622004-0101	2.3	39.9
	STROBE LIGHTS IN WING TIP (SET OF 2)	C622003-0104	0.2	38.7
C49-S	LIGHTS, COWL MOUNTED LANDING & TAXI	1213401	2.0*	-28.5*
	LIGHT BULBS (SET OF 2)	GE 4591	1.0	-31.5
C61-A	LIGHT INSTALLATION, ICE DETECTOR (WING)	1201100	0.6	9.6
	D. INSTRUMENTS			
D01-R	INDICATOR, AIRSPEED	C661064-0208	1.0	17.0
D01-O	TRUE AIR SPEED INDICATOR	1201108	1.0	17.0
D04-A	INSTRUMENT AIR ALTERNATE STATIC SOURCE	1201032	0.3	15.5

FELMDZ /2
1/11/77

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, CONTINENTAL IO-520-L SPEC 4	1250601	455.4*	-17.5*
	TWO MAGNETOS WITH IMPULSE COUPLINGS	SLICK 662	12.9	-12.5
	OIL COOLER MOUNTING PROVISIONS	EQ5968	2.3	-32.5
	OIL COOLER, HARRISON 8526732	TCM 626189	5.3	-32.5
	TWELVE 18MM X 3/4 20-3A SPARK PLUGS	SL 350	3.0	-19.5
	STARTER, 24 VOLT PRESTOLITE	TCM 639171	17.8	-5.0
A05-R	FILTER, ENGINE AIR INDUCTION	1250704	1.0	-9.5
A09-R	ALTERNATOR, 28 VOLT 60 AMP HR	C611503-0201	11.5	-6.0
A17-O	OIL COOLER, NON-CONGEALING-MODINE REPLACES A01-R OIL COOLER AND CHANGES ENGINE DESIGNATION TO IO-520-L SPEC 3 (NET CHANGE)	TCM 639171	2.3	-32.5
A21-A	FILTER, FULL FLOW ENGINE OIL	0750606-9	4.5*	-5.0*
	ENGINE ADAPTER ASSY	1250922-1	2.0	-5.3
	FILTER CAN ASSEMBLY, AC 6436952	C294505-0101	1.8	-4.8
	FILTER ELEMENT KIT, AC 6435683	C294505-0102	0.3	-4.8
A33-R	PROPELLER, 3 BLADE MCCAULEYD3A32C88/82NC-2	C161006-0105	68.5	-44.0
A37-R	PROP GOVERNOR (WOODWARD 210462 OR	C161040-0108	3.0	-35.5
	MCCAULEY C290-D4/T4)	C161032-0102	3.0	-35.5
A41-R	SPINNER, PROPELLER	1250419	3.5	-44.5
A61-A	VACUUM SYSTEM, ENGINE DRIVEN PUMP	1201052	5.6*	1.1*
	VACUUM PUMP (AV. OF 4 TYPES)	C431003	2.8	-3.7
	RELIEF VALVE	C482001-0501	0.6	2.3
	MISC HOSES, CLAMPS & ETC.		1.8	4.6
A70-A	PRIMING SYSTEM, MANIFOLD 2 POINT	1201138	1.3	4.1
	B. LANDING GEAR & ACCESSORIES			
B01-R-1	WHEEL, BRAKE & TIRE ASSY, 600X6 MAIN (2)	1241156-134	40.4*	61.5*
	WHEEL ASSY, CLEVELAND 40-75B (EACH)	C163001-0301	6.2	61.5
	BRAKE ASSY, CLEVELAND 30-52 (LEFT)	C163030-0304	2.8	61.5
	BRAKE ASSY, CLEVELAND 30-52 (RIGHT)	C163030-0303	2.8	61.5
	TIRE, 8 PLY RATED (EACH)	C262003-0208	9.2	61.5
	TUBE (EACH)	C262023-0102	1.8	61.5
B01-R-2	WHEEL, BRAKE& TIRE ASSY, 600X6 MAIN (2)	C16301680115	41.0*	61.5*
	WHEEL ASSY, MCCAULEY	C163004-0102	7.1	61.5
	BRAKE ASSY (LEFT)	C163032-0206	3.0	61.5

FEL/MDZ/2 (21/11/77)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ADI GYRO	44670-0000	3.5	14.5
	HSI GYRO	44690-0000	4.8	14.0
	MISC GYRO ITEM		0.8	10.0
D67-A	HOURMETER INSTALLATION	1200744	0.5	9.8
D82-S	GAGE, OUTSIDE AIR TEMPERATURE	C668507-0101	0.1	26.5
D85-R	TACHOMETER, RECORDING	C668020-0107	1.0	16.5
D88-S	INDICATOR, TURN COORDINATOR	C661003-0505	1.3	16.8
D88-O-1	INDICATOR, TURN COORDINATOR (FOR USE WITH NAV-O-MATIC 200A AND 300A)	42320-0028	1.9	15.0
D88-O-2	INDICATOR, TURN AND BANK	S-1303-2	2.0	16.0
D91-S	RATE OF CLIMB INDICATOR	C661080-0101	1.0	17.0
	E. CABIN ACCOMMODATIONS			
E01-A	ARM RESTS (2) 1ST ROW REMOVABLE INBOARD	1214121-2	1.5	37.0
E02-A	ARM RESTS (2) 2ND ROW REMOVABLE INBOARD	1214121-2	1.5	71.0
E05-R	SEAT, PILOT,INFINATE VERTICAL ADJUSTING	1214113-1	18.5	44.0
E05-O	SEAT, PILOT ARTICULATING VERTICAL ADJUST WITH LUMBAR SUPPORT	1214113-21	24.1	39.5
E07-S	SEAT, CO-PILOT FIXED HEIGHT CUSHION	1214113-3	18.5	44.0
E07-O	SEAT, CO-PILOT ARTICULATING VERTICAL ADJUSTING	1214113-2	23.3	39.5
E07-O-1	SEAT, CO-PILOT FIXED HEIGHT, ARTICULATING CUSHION, LUMBAR SUPPORT	1214113-22	19.3	44.0
E07-O-2	SEAT, CO-PILOT VERTICAL ADJUSTING, ARTICULATING CUSHION	1214113-2	23.3	39.5
E07-O-3	SEAT CO-PILOT VERTICAL ADJUSTING, ARTICULATING CUSHION W/LUMBAR SUPPORT	1214113-20	24.1	39.5
E09-S	SEATS, TWO 2ND ROW INDIVIDUAL	1214114	35.3	73.0
E11-S	SEAT, TWO PLACE 3RD ROW BENCH	1214115	22.6	104.5
	NOTE THE ABOVE SEATING IS ALSO OFFERED WITH LEATHER COVER PER CES-1156, NET WEIGHT AND ARM CHANGE IS 6LBS @ 73.1 IN			
E15-R	SEAT BELT ASSY, PILOT	S2275-103	1.0	37.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S2275-201	0.6	37.0
E19-A	INERTIA REEL INSTALLATION -1ST ROW SEAT BELT & SHOULDER HARNESS NET CHANGE	1201057	0.6	145.3
E23-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S2275-3	1.6	37.0

FEL/MD Z/2 (21/11/77)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E27-S	BELT ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S-1746-25	2.0	71.0
E27-O-1	BELT & SHOULDER HARNESS ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S2275-5	3.2	71.0
E29-S	BELT ASSY, 3RD ROW OCCUPANTS (SET OF 2)	S-1746-17	2.0	101.0
E29-O-1	BELT & HARNESS ASSY 3RD ROW (SET OF 2)	S2275-6	3.2	101.0
E37-A	OPENABLE WINDOW, RH CABIN DOOR, NET CHANGE	0701065-5	2.3	47.0
E47-A	OXYGEN SYSTEM, 74 CU. FT. CAPACITY	1200246-2	58.3*	57.1*
	4 BOTTLES (EMPTY), 3 VALVES 1 REGULATOR	C166001	45.2	56.4
	OXYGEN MASKS-1PILOT & 5 PASSENGERS	C166005	1.5	67.2
	74 CUFT OXYGEN (1800 PSI) @ 0.0832 LBS PER CU FT		6.2	56.4
E49-A	BEVERAGE CUP HOLDERS, RETRACTABLE (2)	1201124	0.1	16.0
E50-A	HEADREST, FRONT ROW (EACH)	1215073	0.9	48.0
E51-A	HEADREST, 2ND ROW (EACH)	1215073	0.9	82.0
E52-A	HEADREST, 3RD ROW (EACH)	1215073	0.9	112.0
E53-A	MIRROR, REAR VIEW	1201041	0.3	17.0
E59-A	APPROACH PLATE HOLDER	0715046-1	0.1	22.0
E65-S	BAGGAGE TIE DOWN NET	1215042-1	0.7	138.0
E75-A	STRETCHER INSTL., CUSTOM-AIR (BOXED)(USE ACTUAL INSTALLED WEIGHT & ARM CHANGE)	0700164-8	- -	- -
E85-A	CONTROLS INSTALLATION, DUAL	1260004-6	9.1	12.9
	RIGHT SIDE WHEEL, PEDAL & TOE BRAKES	1260455-2		
E87-A	ELEVATOR ELECTRIC TRIM INSTALLATION	1260671-1	4.1*	216.7*
	VOLTAGE REGULATOR (HOPKINS 4285A)	C611003-0101	0.2	215.2
	DRIVE ACTUATOR ASSY	1260153-1	3.3	220.0
E89-O	CONTROL WHEEL, ALL PURPOSE (NET CHANGE)	0760020-21	NEGL	- -
E93-R	CABIN HEATING AND ENGINE EXHAUST SYSTEM	1250500	16.0	-11.0
	F. PLACARDS & WARNING			
F01-R	PLACARD, OPERATIONAL LIMITATIONS VFR, DAY	1205104-7	NEGL	- -
F01-O-1	PLACARD, OPERATIONAL LIMITATIONS VFR, DAY-NIGHT	1205104-8	NEGL	- -
F01-O-2	PLACARD, OPERATIONAL LIMITATIONS IFR, DAY-NIGHT	1205104-9	NEGL	- -
F07-R	STALL & GEAR WARNING BLACKBOX (REQUIRES ITEM H61-R FOR AUDIBLE OPERATION)	1270733-2	0.5	41.0
F10-S	PILOTS CHECK LIST (STOWED)	1205224-1	- -	- -

FEL/MDZ/ 2 (21/11/77)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	G. AUXILIARY EQUIPMENT			
G04-A	TOW HOOK (INSTALLED ARM SHOWN)	0712643	0.5	231.0
G07-A	HOISTING RINGS, AIRPLANE	1200190	1.0	38.5
G13-A	CORROSION PROOFING, INTERNAL	1260100	8.0	70.0
G16-A	STATIC DISCHARGERS INSTALLATION (SET OF 10	1201131	0.4	130.5
G19-A	STABILIZER ABRASION BOOTS	0500041-2	1.5	202.0
G22-S	TOW BAR, AIRPLANE (STOWED)	0501019	1.6	138.0
G25-S	PAINT, OVERALL EXTERIOR	1204029	11.9*	93.0*
	OVERALL WHITE BASE (104690 SQ IN)		11.4	91.5
	COLORED STRIPE		0.5	130.7
G28-S	JACK PADS, STOWED (INSTALLED ARM SHOWN	1200028	0.2	54.9
G31-O	CONTROL CABLES, CORROSION RESISTANT (NET CHANGE)	1260475	NEGL	- -
G55-A	FIRE EXTINGUISHER, HAND TYPE 1lb C.B. 'PRESTO'.	1201029	~~3.0~~ 2.0	~~10.5~~ 30.0
G76-A	DEICE SYSTEM, WING AND STABILIZER (REQUIRES VACUUM SYSTEM INSTALLATION)	1201030-5	22.4	52.6
G79-A	DEICE SYSTEM, 3 BLADE PROPELLER	1201072-1	4.4	-25.1
G82-A	WINDSHIELD ANTI-ICE SYSTEM	1201060-1	2.1*	9.2*
	REMOVABLE HEATING PANEL (INSTALLED ARM SHOWN)	1513460-5	1.9	9.0
G88-A	WINTERIZATION KIT INSTALLATION-ENGINE	1200702	0.9*	-27.6*
	BREATHER TUBE INSULATION	1200101-200	0.5	-22.0
	COWL INLET AIR COVERS (INSTALLED) (2)	1200702-48 -5	0.3	-36.7
	H. AVIONICS & AUTOPILOTS			
H01-A-1	CESSNA 300 ADF 546E	3910159-10	7.6*	26.4*
	R-546E RECEIVER (WITH BFO)	41240-0101	3.1	12.5
	IN-346A INDICATOR	40980-1001	0.9	16.0
	ADF PARTIAL 300 MOUNT AND CABLES	3930147	1.7	18.2
	LOOP ANTENNA INSTALLATION	41000-1001	1.4	50.0
	SENSE ANTENNA INSTALLATION	3960115-2	0.3	131.8
H01-A-2	CESSNA 400 ADF (446A) WITH BFO	3910160-8	8.0*	25.7*
	R-446A RECEIVER (WITH DUAL TUNERS)	43090-1128	3.5	12.5
	IN-346A INDICATOR	40980-1001	0.9	16.0
	ADF PARTIAL 400 MOUNT AND CABLES	3930147	1.7	18.2
	LOOP ANTENNA INSTALLATION	41000-1001	1.4	50.0
	SENSE ANTENNA INSTALLATION	3960115-2	0.3	131.8

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H01-A-3	DUAL CESSNA 300 ADF'S	3910159-17	15.3*	26.4*
	R-546E RECEIVERS (2)	41240-0101	6.2	12.5
	IN-346A INDICATORS (2)	40980-1001	1.8	16.0
	ADF MOUNTING PROVISIONS (2)		3.4	18.2
	LOOP ANTENNAS (2)	41000-1001	2.8	50.0
	SENSE ANTENNAS (2)	3960115	0.6	131.8
	SWITCH INSTALLATION, 2ND ADF	3970129-1	0.1	17.5
H01-A-4	DUAL CESSNA 400 ADF	3910160-14	16.1*	25.7*
	R-446A RECEIVERS (2)	43090-1128	7.0	12.5
	IN-346A INDICATORS (2)	40980-1001	1.8	16.0
	ADF MOUNTING PROVISIONS (2)		3.4	18.2
	LOOP ANTENNAS (2)	41000-1001	2.8	50.0
	SENSE ANTENNA (2)	3960115	0.6	131.8
	SWITCH INSTALLATION 2ND ADF	3970129-1	0.1	17.5
H02-A-1	CESSNA 300 ADF 546E		6.7*	27.8*
	(USED WITH SYSTEMS THAT INCLUDE HSI)			
	R-546E RECEIVER (BFO)	41240-0101	3.1	12.5
	ADF PARTIAL 300 MOUNT AND CABLES	3930147	1.7	18.2
	LOOP ANTENNA INSTL	41000-1001	1.4	50.0
	SENSE ATNENNA INSTL	3960115-2	0.3	131.8
H02-A-2	CESSNA 400 ADF (446A) WITH BFO		7.1*	26.9*
	(USED WITH SYSTEMS THAT INCLUDE HSI)			
	R-446A RECEIVER (WITH DUAL TUNERS)	43090-1128	3.5	12.5
	ADF PARTIAL 400 MOUNT AND CABLES	3930147	1.7	18.2
	LOOP ANTENNA INSTL	41000-1001	1.4	50.0
	SENSE ANTENNA INSTL	3960115-2	0.3	131.8
H02-A-3	DUAL CESSNA 300 ADF'S		14.4*	27.0*
	(USED WITH SYSTEMS THAT INCLUDE HSI)			
	R-546E RECEIVERS (2)	41240-0101	6.2	12.5
	IN-346A INDICATOR	40980-1001	0.9	16.0
	ADF MOUNTING PROVISIONS (2)		3.4	18.2
	LOOP ANTENNAS (2)	41000-1001	2.8	50.0
	SENSE ANTENNAS (2)	3960115	0.6	131.8
	SWITCH INSTALLATION, 2ND ADF	3970129-1	0.1	17.5
H02-A-4	DUAL CESSNA 400 ADF'S		15.2*	26.2*
	(USED WITH SYSTEMS THAT INCLUDE HSI)			
	R-446A RECEIVERS (2)	41240-0101	7.0	12.5
	IN-346A INDICATOR	40980-1001	0.9	16.0
	ADF MOUNTING PROVISIONS (2)		3.4	18.2
	LOOP ANTENNAS (2)	41000-1001	2.8	50.0
	SENSE ANTENNAS (2)	3960115	0.6	131.8
	SWITCH INSTALLATION, 2ND ADF	3970129-1	0.1	17.5

FEL/MDZ/2 (21/11/77)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H04-A-1	NARCO DME 190	3910166-10	6.1*	12.2*
	ANTENNA	UDA-3	0.2	36.0
	TRANSCEIVER & MOUNT	3312-400	5.5	11.4
H04-A-2	CESSNA 400 DME WITH 300 & 400 NAV/COM SYSTEMS (24 VOLT ONLY)	3910167	16.3*	122.0*
	RT-476 CONTROL UNIT	44020-1100	1.6	14.0
	RTA-476A REMOTE TRANSCEIVER UNIT	44000	8.5	173.4
	ANTENNA	42940	0.2	36.0
H05-A-1	CESSNA 400 R-NAV SYSTEM	3910168	6.4*	12.6*
	RN-478 AREA NAV COMPUTER	44100-1100	3.8	12.0
	COMPUTER MOUNT	44091	1.3	12.0
	IN442AR VOR/LOC INDICATOR OR	43910-1000	1.3	15.0
	IN443AR VOR/ILS INDICATOR	43910-2000	1.3	15.0
H05-A-2	CESSNA 400 R-NAV WITH HSI INSTALLED INSTALLATION COMPONENTS SAME AS H05-A-1 WITH THE FOLLOWING HSI ITEMS DELETED	3910168	2.7*	-32.5*
	CONVERTER INSTL	3940189-1	-1.9	46.0
	CONVERTER CABLE ASSY		-1.8	44.9
H07-A	CESSNA GLIDESLOPE R-443B REQUIRES OPTION H1 (ITEM H67-A) IF NOT PREVIOUSLY INSTALLED	3910157-9	4.4*	42.8*
	R-443B RECEIVER	42100-0000	2.1	48.0
	ANTENNA, UPPER WINDSHIELD MOUNTED	396119-5	0.3	29.3
H10-A	PANTRONICS PT10-A HF TRANSCEIVER 1ST UNIT REQUIRES OPTION H1 (ITEM H67-A) IF NOT PREVIOUSLY INSTALLED	3910156-29	24.0*	58.0*
	PT10-A TRANSCEIVER CONTROL	C582103-0101	4.2	12.3
	PT10-PS-28 REMOTE POWER SUPPLY IN WING	C582103-0301	8.5	42.0
	DX10-RL-28 ANTENNA LOAD BOX	C589502-0201	4.5	157.1
	MICROPHONE INSTL	1270708-701	0.3	17.4
	HEADPHONE INSTL	1270708-704	0.2	12.6
	RADIO COOLING	3930152-2	1.0	11.9
	NOISE FILTER	3940148-1	0.1	-2.0
	WIRING CABLE ASSEMBLIES	3950129-26	2.5	51.3
	HF ANTENNA INSTL	3960117-1	0.4	173.4
	AUDIO CONTROL SYSTEM	3970130	1.9	13.0
H11-A-1	PANTRONICS PT10-A HF TRANSCEIVER 2ND & 3RD REQUIRES OPTION H1 (ITEM H67-A) IF NOT PREVIOUSLY INSTALLED	3910156-30,-31	20.6*	65.5*
	PT10-A TRANSCEIVER CONTROL	C582103-0101	4.2	12.3
	PT10-PS-28 REMOTE POWER SUPPLY IN WING	C582103-0301	8.5	42.0
	DX10-RL-28 ANTENNA LOAD BOX	C589502-0201	4.5	157.1

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	WIRING & CABLE ASSEMBLIES	3950129	2.5	51.3
	H.F. ANTENNA INSTL	3960117-1	0.4	173.4
H11-A-2	SUNAIR ASB 125 SINGLE SIDE BAND HF TRANS-CEIVER 2ND & 3RD UNIT	3910158-19,-20	23.7*	114.9*
	ANTENNA LOAD BOX	99816	4.9	157.1
	TRANSCEIVER	99681	5.3	11.7
	POWER SUPPLY & SHOCK MOUNT	99916	9.2	164.7
	HF ANTENNA INSTL.	3960117-1	0.4	173.4
	WIRING & CABLE ASSEMBLIES	3950129	3.4	78.5
H13-A-1	CESSNA 400 MARKER BEACON (402A)	3910164-10	2.5*	97.5*
	R-402A RECEIVER	42410-5128	0.7	11.5
	ANTENNA INSTALLATION (FLUSH MTD TAIL)	3960126-2	0.9	201.0
H13-A-2	BENDIX GM 247A MARKER BEACON INSTALLATION		4.5*	80.5*
	BENDIX MARKER BEACON RECEIVER	GM-247A	1.6	43.0
	ANTENNA INSTALLATION	3960126-2	0.9	201.0
H16-A-1	CESSNA 300 TRANSPONDER (359A) LOW ALTITUDE	3910127-22	3.6*	13.4*
	RT-359A TRANSCEIVER	41420-1128	2.7	11.5
	A-109A ANTENNA	41530-0001	0.2	36.0
H16-A-2	CESSNA 400 TRANSPONDER (459A)	3910128-16	3.7*	13.4*
	RT-459A TRANSCEIVER	41470-1128	2.7	11.5
	A-109A ANTENNA	41530-0001	0.2	36.0
H22-A-1	CESSNA 300 NAV/COM 308C 1ST UNIT VOR/LOC	3910151-32	16.3*	32.5*
	RT 308C RECEIVER-TRANSMITTER	42450-1114	6.4	11.0
	IN-514B REMOTE INDICATOR VOR/LOC	45010-1000	0.6	16.9
	NOTE-- 1ST UNIT INSTL COMPONENTS ARE AS LISTED--			
	MICROPHONE INSTALLATION HAND HELD	1270708-701	0.3	17.4
	HEADPHONE INSTALLATION	1270708-704	0.2	12.6
	RADIO COOLING	3930152	1.0	11.9
	1ST UNIT MISC INSTL ITEMS		1.2	11.0
	NOISE FILTER, ALTERNATOR	3940148-1	0.1	-2.0
	VHF COM ANTENNA CABLE, LH ANTENNA	3950129-8	0.6	40.5
	VHF OMNI ANTENNA CABLE (FOR NAVIGATION)	3950129-10	0.8	136.4
	VHF OMNI ANTENNA INSTL	3960102-6	0.6	255.0
	VHF COMMUNICATION ANTENNA, L.H.	3960113-1	0.5	50.7
	AUDIO CONTROL SYSTEM	3970130	1.9	13.0
	VOLTAGE REGULATOR INSTL	3940192-1	2.0	40.0
H22-A-2	CESSNA 300 NAV/COM 328T 1ST UNIT VOR/LOC	3910150-44	16.8*	31.9*
	RT 328T RECEIVER-TRANSMITTER	43340-1124	6.9	11.0
	IN-514B VOR/LOC INDICATOR	45010-1000	0.6	16.9
	INSTL COMPONENTS SAME AS H22-A-1			
H22-A-3	CESSNA 300 NAV/COM 328T, 1ST UNIT VOR/ILS	3910152-29	16.9*	31.8*

FEL/MOZ/2
(21/11/77)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	RT 328T RECEIVER-TRANSMITTER	43340-1124	6.9	11.0
	IN-525B VOR/ILS INDICATOR	45010-2000	0.7	16.9
	INSTL COMPONENTS SAME AS H22-A-1			
H22-A-6	CESSNA 400 NAV/COM 428A 1ST UNIT VOR/LOC	3910169-9	16.5*	28.6*
	RT-428A RECEIVER TRANSCEIVER	43330-1128	6.9	10.0
	IN-442B VOR/LOC INDICATOR	41640-1011	2.3	15.0
	NOTE-- 1ST UNIT INSTL COMPCNENTS ARE AS LISTED--			
	MICROPHONE INSTALLATION HAND HELD	1270708-701	0.3	17.4
	HEADPHONE INSTALLATION	1270708-704	0.2	12.6
	RADIO COOLING	3930152	1.0	11.9
	1ST UNIT MISC INSTL ITEMS		0.9	11.5
	NOISE FILTER, ALTERNATOR	3940148-1	0.1	-2.0
	VHF COM ANTENNA CABLE, LH ANTENNA	3950129-8	0.6	40.5
	VHF OMNI ANTENNA CABLE (FOR NAVIGATION)	3950129-10	0.8	136.4
	VHF OMNI ANTENNA INSTL	3960102-6	0.6	255.0
	VHF COMMUNICATION ANTENNA, L.H.	3960113-1	0.5	50.7
	AUDIO CONTROL SYSTEM	3970130	1.9	13.0
H22-A-7	CESSNA 400 NAV/COM 428A 1ST UNIT VOR/ILS	3910169-11	16.5*	28.6*
	RT 428A RECEIVER TRANSMITTER	43330-1128	6.9	10.0
	IN-443A VOR/ILS INDICATOR	41640-2011	2.3	15.0
	INSTL COMPONENTS SAME A H22-A-6			
H24-A-1	CESSNA 300 NAV/COM 328T 1ST UNIT (USED WITH RNAV OR SYSTEMS THAT INCLUDE HSI)		16.2*	32.4*
	RT-328T RECEIVER TRANSMITTER	43340-1124	6.9	11.0
	INSTL. COMPONENTS SAME AS H22-A-1			
H24-A-2	CESSNA 400 NAV/COM 428A 1ST UNIT (USED WITH RNAV OR SYSTEMS THAT INCLUDE HSI)		14.2*	30.8*
	RT-428A RECEIVER TRANSMITTER	43330-1128	6.9	10.0
	INSTL. COMPONENTS SAME AS H22-A-6			
H24-A-3	CESSNA 300 NAV/COM 308C 1ST UNIT (USED WITH SYSTEMS THAT INCLUDE HSI)		15.7*	33.1*
	RT-308C RECEIVER TRANSMITTER	42450-1114	6.4	11.0
	INSTL. COMPONENTS SAME AS H22-A-1			
H25-A-1	CESSNA 300 NAV/COM 308C 2ND UNIT VOR/LOC	3910151-33	11.5*	18.9*
	RT 308C RECEIVER-TRANSMITTER 160 CH NAV	42450-1114	6.4	11.0
	IN-514B VOR/LOC INDICATOR	45010-1000	0.6	16.9
	2ND UNIT MOUNTING & CABLES	3930169-12	1.7	16.9
	41010 VOLTAGE CONVERTER INSTL	3940192-2	2.0	40.0
	S2212-1 OMNI ANTENNA COUPLER	3960111-1	0.2	5.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	VHF COM ANTENNA, RH WING TOP	3960113-2	0.5	50.7
H25-A-2	CESSNA 300 NAV/COM 328T VOR/LOC 2ND UNIT	3910150-45	12.0*	18.6*
	RT 328T RECEIVER-TRANSMITTER	43340-1124	6.9	11.0
	IN-514B VOR/LOC INDICATOR	45010-1000	0.6	16.9
	2ND UNIT MOUNTING & CABLES	3930169-12	1.7	16.9
	41010 VOLTAGE CONVERTER INSTL	3940192-2	2.0	40.0
	S2212-1 OMNI ANTENNA COUPLER	3960111-1	0.2	5.0
	VHF COM ANTENNA, RH WING TOP	3960113-2	0.5	50.7
H25-A-4	CESSNA 400 NAV/COM 428A VOR/LOC 2ND UNIT	3910169-10	11.6*	14.2*
	RT-428A RECEIVER TRANSMITTER	43330-1128	6.9	10.0
	IN-442A VOR/LOC INDICATOR	41640-1000	2.1	15.0
	400 NAV/COM PARTIAL	3930149-2	0.9	11.5
	VHF COM ANTENNA CABLE INSTL	3950129-9	0.6	40.5
	S2212-1 OMNI ANTENNA COUPLER	3960111-1	0.2	5.0
	VHF COM ANTENNA, RH WING TOP	3960113-2	0.5	50.7
H27-A-1	CESSNA 300 NAV/COM 328T 2ND UNIT (USED WITH RNAV)		11.4*	18.7*
	RT-328T RECEIVER TRANSMITTER		6.9	11.0
	2ND UNIT MOUNTING AND CABLES	3930169-12	1.7	16.9
	41010 VOLTAGE CONVERTER INSTL	3940192-2	2.0	40.0
	S2212-1 OMNI ANTENNA COUPLER	3960111-1	0.2	5.0
	VHF COM ANTENNA, RH WING TOP	3960113-2	0.5	50.7
H27-A-2	CESSNA 400 NAV/COM 428A 2ND UNIT (USED WITH RNAV)		9.5*	14.0*
	RT-428A RECEIVER TRANSMITTER	43330-1128	6.9	10.0
	400 NAV/COM PARTIAL	3930149-2	0.9	11.5
	VHF COM ANTENNA CABLE INSTL	3950129-9	0.6	40.5
	S2212-1 OMNI ANTENNA COUPLER	3960111-1	0.2	5.0
	VHF COM ANTENNA, RH WING TOP	3960113-2	0.5	50.7
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	1270472-1	2.1*	159.4*
	TRANSMITTER	C589510-0209	1.8	160.1
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA)	1270472-2	1.9*	159.0*
	TRANSMITTER	C589510-0212	1.6	160.1
H31-A-1	NAV-O-MATIC 200A	3910162-16	7.7*	43.2*
	CONTROLLER AND MOUNT	3930144-7	1.6	13.5
	D88-O-1 TURN COORDINATOR (NET CHANGE)	42320-0028	0.6	11.1
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
H31-A-2	NAV-O-MATIC 300A INSTALLATION	3910163-16	21.2*	15.3*
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
	CONTROLLER AMPLIFIER (C-395A)	3930145-7	1.8	13.5
	D64-A-3 GYRO INSTALLATION	1201048-3	6.3	14.0

FEL/MDZ/2
21/11/77)

EL/MDZ/2
21/11/77

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
	D88-O-1 TURN COORDINATOR (NET CHANGE)	42320-0028	0.6	11.1
H31-A-3	CESSNA 400 AUTOPILOT, NON SLAVED GYROS	1200202-5	32.2*	62.5*
	AILERON ROLL ACTUATOR (PA-500A)	35070-1028	3.2	57.2
	ELEVATOR PITCH ACTUATOR (PA-500A)	35070-1128	3.2	154.0
	CONTROLLER (C-420A)	41540-1128	1.4	16.5
	COMPUTER-AMPLIFIER (CA-520B)	35910-1528	5.5	159.0
	D64-A-4 NON-SLAVED GYRO SYSTEM	1201048-4	6.5	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
H31-A-4	CESSNA 400 AUTOPILOT, SLAVED GYROS		34.9*	59.9*
	AILERON ROLL ACTUATOR (PA-500A)	35070-1028	3.2	57.7
	ELEVATOR PITCH ACTUATOR (PA-500A)	35070-1128	3.2	154.0
	CONTROLLER (C-420A)	41540-1128	1.4	16.5
	COMPUTER-AMPLIFIER (CA-520B)	35910-1528	5.5	159.0
	D64-A-5 GYRO SYSTEM, SLAVED	1201048-5	9.2	18.5
H31-A-6	CESSNA 400B NAV-O-MATIC, NON-SLAVED HEADING INDICATOR	390177-1	45.6*	85.6*
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37960-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	173.0
	ALTITUDE SENSOR	44400-0000	2.3	157.3
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	D64-A-4 GYRO, NON-SLAVED	1201048-4	6.5	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
H31-A-7	CESSNA 400B NAV-O-MATIC, SLAVED HEADING INDICATOR	3910177-3	49.6*	84.0*
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37960-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	173.0
	ALTITUDE SENSOR	44400-0000	2.3	157.3
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	D64-A-5 GYRO SYSTEM, SLAVED DIR. GYRO	1201077-2	6.2	13.6
	VACUUM SYSTEM (A61-A)	1201052	5.6	1.1
	GYRO SLAVING SYSTEM, INCLUDING CABLES		4.3	40.1
H31-A-8	CESSNA 400B NAV-O-MATIC WITH HSI	3910177-5	51.2*	82.0*
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37970-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	173.0
	ALTITUDE SENSOR	44400-0000	2.3	157.3

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(21/11/77)

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	C31-A COURTESY ENTRANCE LIGHTS	1221103	0.5	51.4
	C40-A NAVIGATION LIGHT DETECTORS	1221201	NEGL	--
	C43-A FLASHING BEACON	1201049	1.6	226.0
	D01-O TRUE AIRSPEED IND. (NET CHANGE)	1201108	0.0	--
	D04-A ALTERNATE STATIC AIR SOURCE	1201032	0.3	15.5
	D49-A ECONOMY MIXTURE INDICATOR (EGT)	1200677	0.7	0.9
	D64-A-1 GYRO INSTALLATION	1201048-1	6.0	14.0
	E07-S CO-PILOT SEAT DELEATED	1214113	-18.5	44.0
	E07-O CO-PILOT SEAT, VERTICAL ADJUST ADDED	1214113-3	23.3	39.5
	E65-A DUAL FLIGHT CONTROLS	1260004	9.1	12.9
	E89-O ALL PURPOSE CONTROL WHEEL EXCH	0760020	0.0	--
	H01-A-1 CESSNA 300 ADF (R-546E)	3910159-10	7.6	26.4
	H16-A-2 CESSNA 300 TRANSPONDER RT-359A	3910127-22	3.6	13.4
	H22-A-2 CESSNA 300 NAV/COM VOR/LOC	3910150-44	16.8	31.9
	H28-A-1 E.L.T. INSTALLATION	1270472-1	2.1	159.4
	H31-A-1 200A NAV-O-MATIC AUTO PILOT	3910162-16	7.7	43.2
	H67-A RH WING RADIO COMPARTMENT	1221222-14	3.3	45.7
J04-A	NAV-PAC RADIO OPTION, AVAILABLE ON CENTURION II SERIES ONLY	3910161-10	19.0*	34.6*
	H07-A CESSNA 400 GLIDESLOPE (R443B)	3910157-9	4.4	48.5
	H13-A-1 CESSNA 400 MARKER BEACON	3910164-10	2.5	97.5
	H22-A-2 DELETE 328T VOR/LOC 1ST UNIT	3910150-44	-16.8	31.9
	H22-A-3 ADD 328T VOR/ILS 1ST UNIT	3910152-29	16.9	31.8
	H25-A-2 ADD 328T VOR/LOC 2ND UNIT	3910150-45	12.0	18.6
	(A.W.A. VAN-X) DME:	REX DWG.		
	VAN-X INTERROGATOR & MTG. STRUCTURE.	RA-B-1643	6.8	161.0
	PWC-150 VOLTAGE CONVERTER.		1.5	166.0
	VIN-X INDICATOR.		1.5	13.0
	VCN-X CONTROL UNIT.		1.2	13.0
	VIN-6 ANTENNA.		1.6	151.0
	LOOM ETC.		2.0	94.5
	(PHILLIPS) STEREO CASSETTE PLAYER - MUSIC:	REX DWG.		
	CASSETTE PLAYER & MOUNT.	RA-C-1644	3.3	14.0
	(2) SPEAKERS.		4.0	110.0
	P528A VOLTAGE CONVERTER.		1.5	46.0

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

This section provides description and operation of the airplane and its systems. Some equipment described herein is optional and may not be installed in the airplane. Refer to Section 9, Supplements, for details of other optional systems and equipment.

AIRFRAME

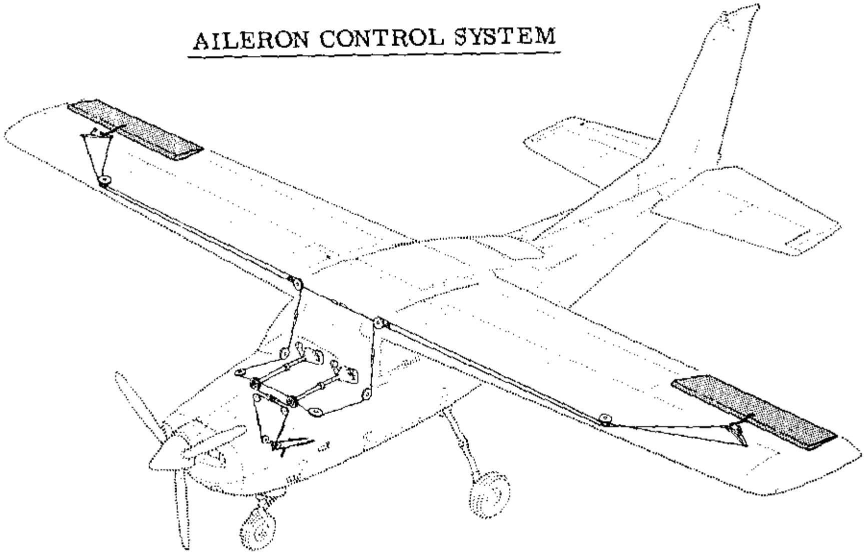
The Centurion is an all-metal, six-place, high-wing, single-engine airplane equipped with retractable tricycle landing gear, and designed for general utility purposes.

The construction of the fuselage is a conventional formed sheet metal bulkhead and skin design referred to as semi-monocoque. Incorporated into the fuselage structure are two large cabin door openings and a baggage door opening. Major items of structure include a forward carry-through spar and a forged aluminum main carry-through spar to which the wings are attached. The lower aft portion of the fuselage center section contains the forgings and structure for the retractable main landing gear.

The full cantilever wings have integral fuel tanks and are constructed of a forward spar, main spar, conventional formed sheet metal ribs and aluminum skin. The integral fuel tanks are formed by the forward spar, two sealing ribs, and an aft fuel tank spar forward of the main spar. The Frise type ailerons and single-slot type flaps are of conventional formed sheet metal ribs and smooth aluminum skin construction. The ailerons are equipped with ground adjustable trim tabs on the inboard end of the trailing edge, and balance weights in the leading edges.

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a forward and aft spar, formed sheet metal ribs and reinforcements, four skin panels, formed leading edge skins, and a dorsal. The rudder is constructed of a forward and aft spar, formed sheet metal ribs and reinforcements, and a wrap-around skin panel. The top of the rudder incorporates a leading edge extension which contains a balance weight. The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, center upper skin panel, and two left and two right wrap-around skin panels which also form the leading edges. The

AILERON CONTROL SYSTEM



RUDDER AND RUDDER TRIM
CONTROL SYSTEMS

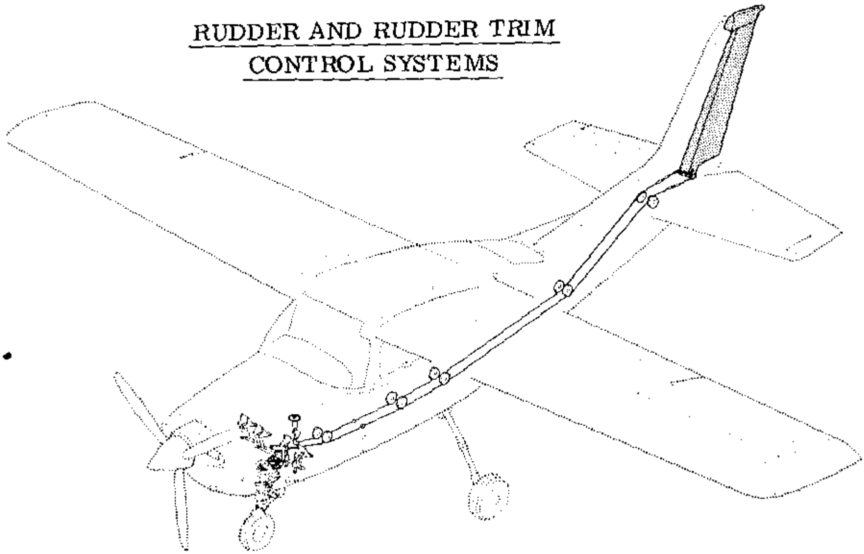
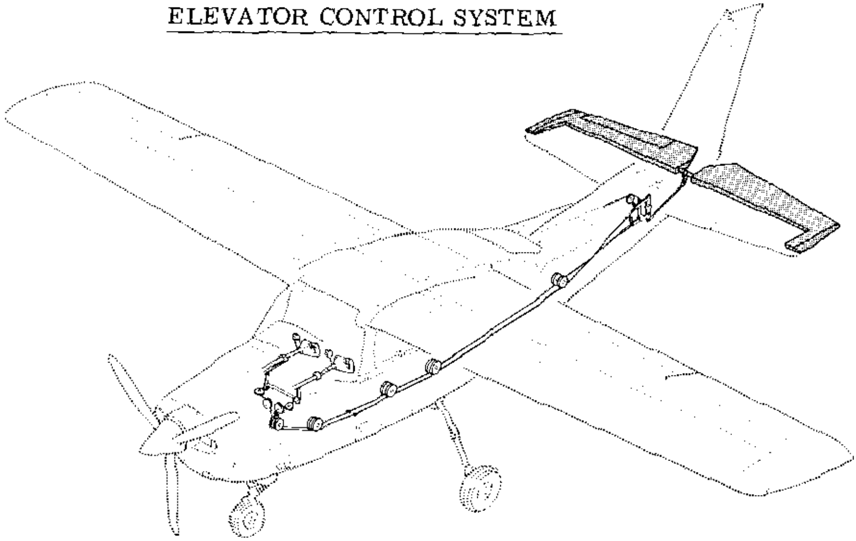


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM CONTROL SYSTEM

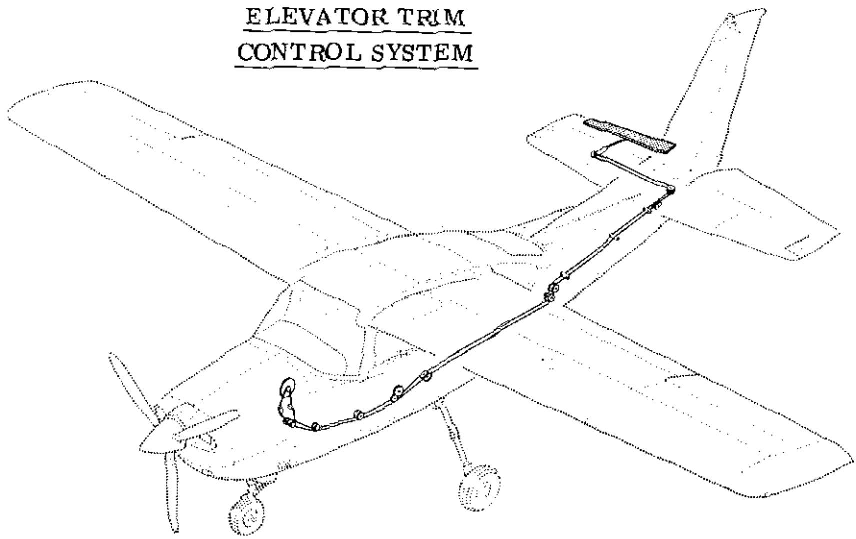


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

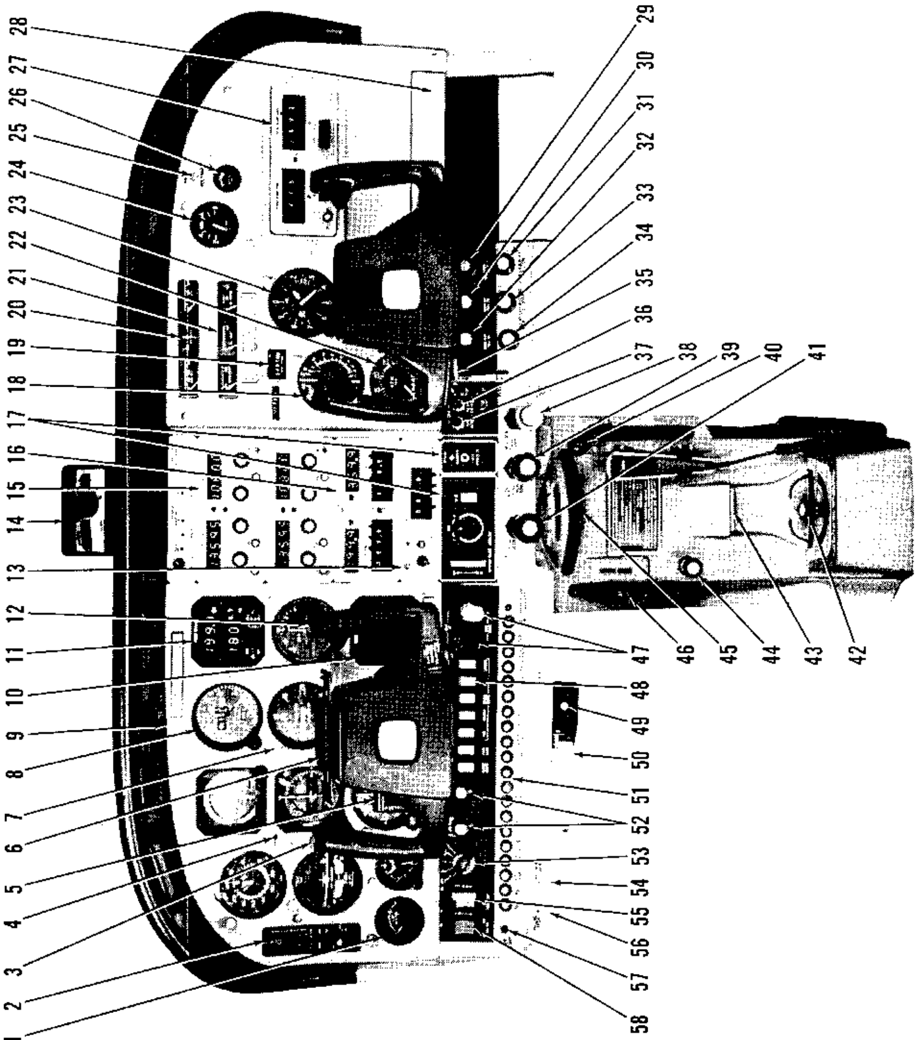


Figure 7-2. Instrument Panel (Sheet 1 of 2)

1. Economy Mixture Indicator
2. *Marker Beacon Indicator* Lights and Switches
3. Electric Elevator Trim Switch
4. Area Navigation Indicator Light
5. Autopilot and Electric Elevator Trim Disengage Switches
6. Approach Plate Holder
7. Flight Instrument Group
8. Encoding Altimeter
9. Approach Plate Light and Switch
10. IFCS Mode Selector
11. DME
12. IFCS Pitch Synchronizer and Go-Around Switches
13. Transponder
14. Rear View Mirror
15. Radios
16. Area Navigation Radio
17. Autopilot Control and Accessory Units
18. Manifold Pressure/Fuel Flow Indicator
19. Flight Hour Recorder
20. Fuel Quantity Indicators and Ammeter
21. Cylinder Head Temperature, Oil Temperature and Oil Pressure Gages
22. Tachometer
23. Secondary Altimeter
24. Suction Gage
25. Over-Voltage Warning Light
26. Propeller Anti-Ice Ammeter
27. ADF Radio
28. Map Compartment
29. Defrost Control Knob
30. Cabin Air Control Knob
31. Auxiliary Cabin Air Control Knob
32. Cabin Heat Control Knob
33. Stowable Rudder Pedal Control Knob
34. Cigar Lighter
35. Wing Flap Switch and Indicator
36. Wing De-Ice Switch and Light
37. Windshield Anti-Ice Switch
38. Mixture Control Knob
39. Propeller Control Knob
40. Cowl Flap Control Lever
41. Throttle (With Friction Lock)
42. Fuel Selector Valve Handle
43. Fuel Selector Light
44. Primer
45. Rudder Trim Control Wheel and Position Indicator
46. Elevator Trim Control Wheel and Position Indicator
47. Landing Gear Control Handle and Position Lights
48. Electrical Switches
49. Alternate Static Source Valve
50. Parking Brake Handle
51. General Electrical Circuit Breakers
52. Radio and Instrument Panel Light Rheostat Control Knobs
53. Ignition Switch
54. Auxiliary Mike Jack
55. *Auxiliary Fuel Pump Switch*
56. Phone Jack
57. *Ice Detector Light Switch*
58. Master Switch

Figure 7-2. Instrument Panel (Sheet 2 of 2) horizontal stabilizer also contains the elevator trim tab actuator. Construction of the elevator consists of a forward and aft spar, ribs, torque tube and bellcrank, left upper and lower skin panels, a formed one-piece left trailing edge, right upper and lower skin panels, and right inboard and outboard formed trailing edges. The elevator trim tab consists of a bracket assembly, hinge half, and a wrap-around skin panel. Both elevator tip leading edge extensions incorporate balance weights.

FLIGHT CONTROLS

The airplane's flight control system consists of conventional aileron, elevator and rudder control surfaces (see figure 7-1). The control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons and elevator, and rudder/brake pedals for the rudder. The elevator control system is equipped with a downspring, and an aileron-rudder interconnect is incorporated to provide improved stability in flight.

Stowable right-hand rudder pedals may be installed. The pedals fold forward and stow against the firewall, thereby permitting the front passenger to extend his feet forward for greater comfort. When the pedals are stowed, the toe brakes will still operate. A push-pull control on the instrument panel actuates the pedal unlocking mechanism. The pedals are stowed by squeezing the double buttons of the control knob and pulling the knob out to release the pedals; the pedals can then be pushed forward against the firewall where they are retained by spring clips within a bracket. The pedals are restored to their operating positions by pushing the control knob full in, inserting the toe of the shoe underneath each pedal, and pulling each pedal aft until it snaps into position. The pedals are again ready for flight use by the right front passenger.

TRIM SYSTEMS

Manually-operated rudder and elevator trim is provided (see figure 7-1). Rudder trimming is accomplished through a bungee connected to the rudder control system and a trim control wheel mounted on the control pedestal. Rudder trimming is accomplished by rotating the horizontally mounted trim control wheel either left or right to the desired trim position. Rotating the trim wheel to the right will trim nose-right; conversely, rotating it to the left will trim nose-left. Elevator trimming is accomplished through the elevator trim tab by utilizing the vertically mounted trim control wheel. Forward rotation of the trim wheel will trim nose-down; conversely, aft rotation will trim nose-up. The airplane may also be equipped with an electric elevator trim system. For details concerning this system, refer to Section 9, Supplements.

INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and arranged vertically. The airspeed indicator and altimeter are located to the left and right of the gyros respectively. The remainder of the flight instruments are located around the basic "T". Avionics equipment is stacked approximately on the center line of the panel, with the right side of the panel containing the wing flap switch and indicator, manifold pressure/fuel flow indicator, tachometer, map compartment, and space for additional instruments and avionics equipment. The engine instrument cluster, fuel quantity indicators, and suction gage are on the right side of the avionics stack near the top of the panel. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches, controls, and circuit breakers necessary to operate the airplane. The left side of the panel contains the master switch, auxiliary fuel pump switch, ignition switch, light intensity controls, landing gear position handle and indicator lights, electrical switches, and circuit breakers for general electrical equipment. The center area contains the throttle, propeller control, and mixture control. The right side of the panel contains the cabin heat control knob, cabin air control knob, defroster control knob, auxiliary cabin air control knob and cigar lighter. A pedestal, extending from the edge of the switch and control panel to the floorboard, contains the elevator and rudder trim control wheels, cowl flap control lever, engine primer, and microphone bracket. The fuel selector valve handle is located at the base of the pedestal. A parking brake handle is mounted under the switch and control panel, in front of the pilot. An alternate static source valve control knob may also be installed beneath the switch and control panel.

For details concerning the instruments, switches, circuit breakers, and controls on this panel, refer in this section to the description of the systems to which these items are related.

GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 14.5° each side of center. By applying either left or right brake, the degree of turn may be increased up to 35° each side of center.

Moving the airplane by hand is most easily accomplished by attaching a tow bar to the nose gear strut. If a tow bar is not available, or pushing is required, use the main landing gear struts as push points. Do not use the vertical or horizontal tail surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 35° either side of center or structural damage to the nose gear could result.

The minimum turning radius of the airplane, using differential braking and nose wheel steering during taxi, is approximately 26 feet. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down at a tailcone bulkhead just forward of the horizontal stabilizer to raise the nose wheel off the ground.

WING FLAP SYSTEM

The wing flaps are of the large span, single-slot type (see figure 7-3), and are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slotted panel that provides mechanical stops at the 10° and 20° positions. For flap settings greater than 10°, move the switch lever to the right to clear the stop and position it as desired. A scale and pointer on the left side of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by an 8-ampere circuit breaker, labeled FLAP, on the left side of the instrument panel.

LANDING GEAR SYSTEM

The landing gear is a retractable, tricycle type with a steerable nose wheel and two main wheels. Shock absorption is provided by the tubular spring-steel main landing gear struts and the air/oil nose gear shock strut. Each main wheel is equipped with a hydraulically actuated disc-type brake on the inboard side of the wheel.

Landing gear extension and retraction, wheel well door operation, and

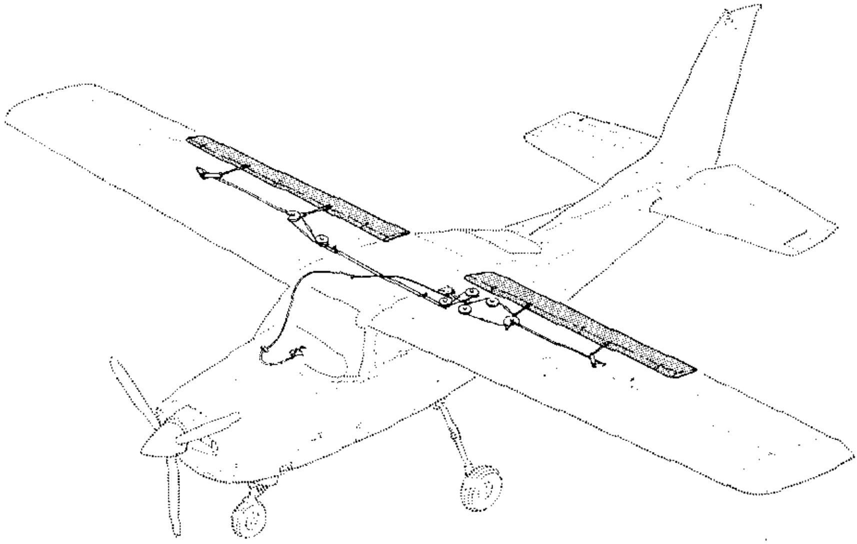


Figure 7-3. Wing Flap System

up and down lock operation is accomplished by hydraulic actuators powered by an electrically-driven hydraulic power pack (see figure 7-7). The power pack assembly is housed within the control pedestal. Hydraulic system fluid level may be checked by utilizing the dipstick/filler cap, on the power pack, behind a snap-out cover panel on the right side of the control pedestal. The system should be checked at 25-hour intervals. If the fluid level is at or below the ADD line on the dipstick, hydraulic fluid (MIL-H-5606) should be added.

Power pack operation is initiated by a landing gear position handle, and is turned off by a pressure switch. Two position-indicator lights are provided to show landing gear position. The landing gear system is also equipped with a nose gear safety switch, an emergency extension hand pump, and a gear-up warning system.

LANDING GEAR POSITION HANDLE

The landing gear position handle, mounted to the left of the engine controls, has two positions (up for gear up and down for gear down) which give a mechanical indication of the gear position selected. From either position, the handle must be pulled out to clear a detent before it can be repositioned. Positioning the handle in the up or down position will start the electrically-driven hydraulic power pack and select the direction of gear travel. Operation of the landing gear system will not begin until repositioning of the handle is completed.

LANDING GEAR POSITION INDICATOR LIGHTS

Two position indicator lights, mounted adjacent to the landing gear handle, indicate that the gear is either up or down and locked. The lights are the press-to-test type. The gear-down indicator light (green) has two positions; with the light pushed in half way (throttle retarded and master switch on) the gear warning system should be heard intermittently on the airplane speaker, and with the light pushed full in, it should illuminate. The gear-up indicator light (amber) has only one test position; with the light pushed full in, it should illuminate. The indicator lights contain dimming shutters for night operation.

LANDING GEAR OPERATION

To retract or extend the landing gear, pull out on the gear handle and move it to the desired position. After the handle is positioned, the electrically-driven hydraulic power pack will create pressure in the system and the landing gear will be actuated to the selected position.

CAUTION

> If for any reason the hydraulic pump continues to run after gear cycle completion (up or down), the 30-amp circuit breaker switch labeled GEAR PUMP should be pulled out. This will shut off the hydraulic pump motor and prevent damage to the pump and motor. Refer to Section 3 for complete emergency procedures.

During a normal cycle, the gear locks up or down and the position-indicator light (amber for up and green for down) comes on. When the light illuminates, hydraulic pressure is switched from the gear actuators to the door actuators to close the gear doors. When the doors are closed, pressure will continue to build until a pressure switch in the door closing system turns off the hydraulic pump. The gear doors are held in the closed position by hydraulic pressure.

A landing gear safety switch, actuated by the nose gear strut, electrically prevents inadvertent retraction whenever the nose gear strut is compressed by the weight of the airplane. A switch type circuit breaker, mounted on the left switch and control panel, should be used for safety during maintenance. With the switch pulled out, landing gear operation cannot occur. After maintenance is completed, and prior to flight, the switch should be pushed back in.

For inspection purposes, the landing gear doors may be opened and closed while the airplane is on the ground with the engine stopped. Operate the doors with the landing gear handle in the down position. To open the doors, turn off the master switch, pull out the GEAR PUMP circuit breaker switch, and operate the hand pump until the doors open. To close the doors, check that the landing gear handle is down, push the GEAR PUMP circuit breaker switch in, and turn on the master switch.

WARNING

Safety placards are installed on each wheel well door to warn against any maintenance in the wheel well areas with the circuit breaker switch pushed in.

NOTE

The position of the master switch for gear door operation is easily remembered by the following rule:

OPEN circuit = OPEN doors
CLOSED circuit = CLOSED doors

EMERGENCY HAND PUMP

A hand-operated hydraulic pump, located between the two front seats, is provided for extension of the landing gear in the event of a hydraulic system failure. To utilize the pump, extend the handle forward and pump vertically. For complete emergency procedures, refer to Section 3.

For practice manual gear extensions, pull out the GEAR PUMP circuit breaker before placing the landing gear handle in the GEAR DOWN position. After the practice manual extension is completed, push the circuit breaker in to restore normal gear operation.

LANDING GEAR WARNING SYSTEM

The airplane is equipped with a landing gear warning system designed to help prevent the pilot from inadvertently making a wheels-up landing.

The system consists of a throttle actuated switch which is electrically connected to a dual warning unit. The warning unit is connected to the airplane speaker.

When the throttle is retarded, below approximately 12 inches of manifold pressure (master switch on), the throttle linkage will actuate a switch which is electrically connected to the gear warning portion of a dual warning unit. If the landing gear is retracted (or not down and locked), an intermittent tone will be heard on the airplane speaker. The system may be checked for correct operation before flight by retarding the throttle to idle and depressing the green gear-down position indicator light half way in. With the indicator light depressed as described, an intermittent tone should be heard on the airplane speaker.

RETRACTABLE CABIN ENTRY STEP

The airplane is equipped with a retractable cabin entry step located on the right side of the fuselage below the cabin door. The step cycles directly with the landing gear, and is spring loaded to the extended position. A cable attached to the nose gear hydraulic actuator thru-bolt retracts the step as the nose gear is retracted.

BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. Access to the baggage compartment is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin. A baggage net with six tie-down straps is provided for securing baggage and is attached by tying the straps to tie-down rings provided in the airplane. When loading the airplane, children should not be placed or permitted in the baggage compartment, and any material that might be hazardous to the airplane or occupants should not be placed anywhere in the airplane. For baggage area and door dimensions, refer to Section 6.

SEATS

The seating arrangement consists of four separate adjustable seats and a one-piece fixed seat. The pilot's seat is a six-way adjustable seat, and the front and center passengers seats are four-way adjustable. The front passenger's seat is also available in the six-way adjustable configuration. The two aft passengers utilize a one-piece fixed seat.

The six-way adjustable pilot's seat may be moved forward or aft, adjusted for height, and the seat back angle is infinitely adjustable. Position the seat by lifting the tubular handle, under the center of the seat bottom, and slide the seat into position; then release the handle and check that the seat is locked in place. Raise or lower the seat by rotating a large crank under the right corner of the seat. Seat back angle is adjustable by rotating a small crank under the left corner of the seat. The seat bottom angle will change as the seat back angle changes, providing proper support. The seat back will also fold full forward. If the front passenger's seat is six-way adjustable, it will function the same as the pilot's seat except the height adjusting and back reclining cranks will be opposite the respective adjustment cranks of the pilot's seat.

The four-way adjustable front and center passenger's seats may be moved forward and aft, and the seat back angle is infinitely adjustable. Position the seat by lifting up on the tubular handle under the center of the seat bottom of the front passenger's seat, or the handle under the inboard corner of the center passenger's seats, and slide the seat into position; then release the handle and check that the seat is locked in place. The seat back angle of either front or center passenger seats may be adjusted by rotating a crank under the outboard corner of the seat. The seat bottom angle will change as the seat back angle changes, providing proper support. The seat backs will also fold full forward.

The aft passenger's seats consist of a fixed position one-piece seat bottom and a one-piece fold-down seat back. If the seat is not to be occupied, a camming action permits the seat back to fold down completely flat, providing more space for baggage. To fold down the seat back, grasp the top edge and rotate it downward.

Headrests are available for any of the seat configurations. To adjust the headrest, apply enough pressure to it to raise or lower it to the desired level. The headrest may be removed at any time by raising it until it disengages from the top of the seat back.

SEAT BELTS AND SHOULDER HARNESSES

All seat positions are equipped with seat belts (see figure 7-4). The pilot's and front passenger's seats are also equipped with separate shoulder harnesses; separate shoulder harnesses are available for the remaining seat positions. Integrated seat belt/shoulder harnesses with inertia reels can be furnished for the pilot's and front passenger's seat positions if desired.

SEAT BELTS

The seat belts used with the pilot, front passenger, and center passenger seats are attached to fittings on the floorboard. The buckle half is inboard of each seat and the link half is outboard of each seat. The belts for the aft seat are attached to the seat frame, with the link halves on the left and right sides of the seat bottom, and the buckles at the center of the seat bottom.

To use the seat belts for the front and center seats, position the seat as desired, and then lengthen the link half of the belt as needed by grasping the sides of the link and pulling against the belt. Insert and lock the belt link into the buckle. Tighten the belt to a snug fit. Seat belts for the aft seat are used in the same manner as the belts for the front and center seats. To release the seat belts, grasp the top of the buckle opposite the link and pull upward.

SHOULDER HARNESSES

Each front seat shoulder harness is attached to a rear doorpost above the window line and is stowed behind a stowage sheath above the cabin door. To stow the harness, fold it and place it behind the sheath. When shoulder harnesses are furnished for the remaining seats, they are attached above and aft of the side windows. Each harness is stowed behind a stowage sheath above the side windows.

To use the shoulder harness, fasten and adjust the seat belt first. Lengthen the harness as required by pulling on the connecting link on the end of the harness and the narrow release strap. Snap the connecting link firmly onto the retaining stud on the seat belt link half. Then adjust to length. A properly adjusted harness will permit the occupant to lean forward enough to sit completely erect, but prevent excessive forward movement and contact with objects during sudden deceleration. Also, the pilot will want the freedom to reach all controls easily.

Removing the shoulder harness is accomplished by pulling upward on the narrow release strap, and removing the harness connecting link from the stud on the seat belt link. In an emergency, the shoulder harness may be removed by releasing the seat belt first and allowing the harness, still attached to the link half of the seat belt, to drop to the side of the seat.

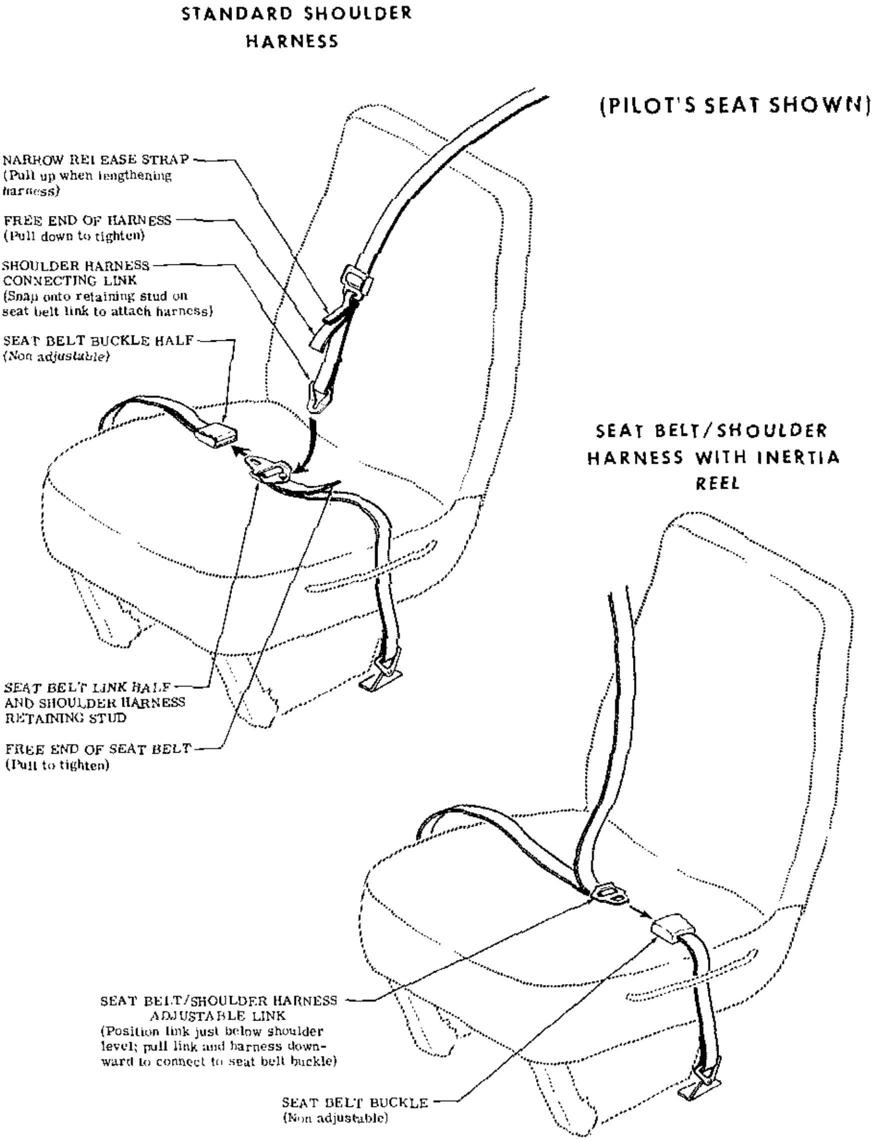


Figure 7-4. Seat Belts and Shoulder Harnesses

INTEGRATED SEAT BELT/SHOULDER HARNESSES WITH INERTIA REELS

Integrated seat belt/shoulder harnesses with inertia reels are available for the pilot and front seat passenger. The seat belt/shoulder harnesses extend from inertia reels located in the cabin top structure, through the overhead console marked PILOT and COPILOT, to attach points inboard of the two front seats. A separate seat belt half and buckle is located outboard of the seats. Inertia reels allow complete freedom of body movement. However, in the event of a sudden deceleration, they will lock automatically to protect the occupants.

To use the seat belt/shoulder harness, position the adjustable metal link on the harness just below shoulder level, pull the link and harness downward, and insert the link in the seat belt buckle. Adjust belt tension across the lap by pulling upward on the shoulder harness. Removal is accomplished by releasing the seat belt buckle, which will allow the inertia reel to pull the harness inboard of the seat.

ENTRANCE DOORS AND CABIN WINDOWS

Entry to, and exit from the airplane is accomplished through either of two entry doors, one on each side of the cabin at the front seat positions (refer to Section 6 for cabin and cabin door dimensions). The doors incorporate a recessed exterior door handle, a conventional interior door handle, a key-operated door lock (left door only), a door stop mechanism, and an openable window in the left door. An openable right door window is also available.

To open the doors from outside the airplane, utilize the recessed door handle near the aft edge of each door. Depress the forward end of the handle to rotate it out of its recess, and then pull outboard. To close or open the doors from inside the airplane, use the conventional door handle and arm rest. The inside door handle is a three-position handle having a placard at its base with the positions OPEN, CLOSE, and LOCK shown on it. The handle is spring-loaded to the CLOSE (up) position. When the door has been pulled shut and latched, lock it by rotating the door handle forward to the LOCK position. Both cabin doors should be locked prior to flight, and should not be opened intentionally during flight.

NOTE

Accidental opening of a cabin door in flight due to improper closing does not constitute a need to land the airplane. The best procedure is to set up the airplane in a trimmed condition at approximately 85 knots, momentarily shove the door outward slightly, and forcefully close and lock the door.

Exit from the airplane is accomplished by rotating the door handle full aft to the OPEN position and pushing the door open. To lock the airplane, lock the right cabin door with the inside handle, close the left cabin door, and using the ignition key, lock the door.

The left cabin door is equipped with an openable window which is held in the closed position by a lock button equipped over-center latch on the lower edge of the window frame. To open the window, depress the lock button and rotate the latch upward. The window is equipped with a spring-loaded retaining arm which will help rotate the window outward and hold it there. An openable window is also available for the right door, and functions in the same manner as the left window. If required, either window may be opened at any speed up to 199 knots. The aft side windows, and rear window are of the fixed type and cannot be opened.

CONTROL LOCKS

A control lock is provided to lock the ailerons and elevator control surfaces in a neutral position and prevent damage to these systems by wind buffeting while the airplane is parked. The lock consists of a shaped steel rod with a red metal flag attached to it. The flag is labeled CONTROL LOCK, REMOVE BEFORE STARTING ENGINE. To install the control lock, align the hole on the right side of the pilot's control wheel shaft with the hole in the right side of the shaft collar on the instrument panel and insert the rod into the aligned holes. Proper installation of the lock will place the red flag over the ignition switch. In areas where high or gusty winds occur, a control surface lock should be installed over the vertical stabilizer and rudder. The control lock and any other type of locking device should be removed prior to starting the engine.

ENGINE

The airplane is powered by a horizontally-opposed, six-cylinder, overhead-valve, air-cooled, fuel injection engine with a wet sump oil system. The engine is a Continental Model IO-520-L and is rated at 300 horsepower at 2850 RPM for five minutes and 285 horsepower at 2700 RPM continuous. Major accessories include a propeller governor on the front of the engine and dual magnetos, starter, and belt-driven alternator on the rear of the engine. Provisions are also made for a vacuum pump and a full flow oil filter.

ENGINE CONTROLS

Engine manifold pressure is controlled by a throttle located on the lower center portion of the instrument panel. The throttle operates in a conventional manner; in the full forward position, the throttle is open, and in the full aft position, it is closed. A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it. The throttle linkage is designed to mechanically actuate a microswitch electrically connected to the landing gear warning system. The switch will cause a warning tone to sound anytime the throttle is retarded with the landing gear retracted, with less than approximately 12 inches of manifold pressure.

The mixture control, mounted above the right corner of the control pedestal, is a red knob with raised points around the circumference and is equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cut-off position. For small adjustments, the control may be moved forward by rotating the knob clockwise, and aft by rotating the knob counterclockwise. For rapid or large adjustments, the knob may be moved forward or aft by depressing the lock button in the end of the control, and then positioning the control as desired.

ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: oil pressure gage, oil temperature gage, cylinder head temperature gage, tachometer, and manifold pressure/fuel flow indicator. An economy mixture (EGT) indicator is also available.

The oil pressure gage, located on the right side of the instrument panel, is operated by oil pressure. A direct pressure oil line from the engine delivers oil at engine operating pressure to the oil pressure gage. Gage markings indicate that minimum idling pressure is 10 PSI (red line), the normal operating range is 30 to 60 PSI (green arc), and maximum pressure is 100 PSI (red line).

Oil temperature is indicated by a gage adjacent to the oil pressure gage. The gage is operated by an electrical-resistance type temperature sensor which receives power from the airplane electrical system. Oil temperature limitations are the normal operating range (green arc) which is 38°C (100°F) to 116°C (240°F), and the maximum (red line) which is 116°C (240°F).

The cylinder head temperature gage, under the left fuel quantity indicator, is operated by an electrical-resistance type temperature sensor on the engine which receives power from the airplane electrical system. Temperature limitations are the normal operating range (green arc) which is 93°C (200°F) to 238°C (460°F) and the maximum (red line) which is 238°C (460°F).

The engine-driven mechanical tachometer is located on the lower right side of the instrument panel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours and tenths. Instrument markings include a normal operating range (green arc) of 2200 to 2550 RPM, a five minute maximum power range (yellow arc) of 2700 to 2850 RPM, and a maximum (red line) of 2850 RPM.

The manifold pressure gage is the left half of a dual-indicating instrument mounted above the tachometer. The gage is direct reading and indicates induction air manifold pressure in inches of mercury. It has a normal operating range (green arc) of 15 to 25 inches of mercury.

The fuel flow indicator is the right half of a dual-indicating instrument mounted above the tachometer. The indicator is a fuel pressure gage calibrated to indicate the approximate pounds per hour of fuel being metered to the engine. The normal operating range (green arc) is from 42 to 102 pounds per hour, the minimum (red line) is 3.5 PSI, and the maximum (red line) is 151 pounds per hour (19.5 PSI).

An economy mixture (EGT) indicator is available for the airplane and is located on the lower left corner of the instrument panel. A thermocouple probe in the left exhaust collector assembly measures exhaust gas temperature and transmits it to the indicator. The indicator serves as a visual aid to the pilot in adjusting cruise mixture. Exhaust gas temperature varies with fuel-to-air ratio, power, and RPM. However, the difference between the peak EGT and the EGT at the cruise mixture setting is essentially constant and this provides a useful leaning aid. The indicator is equipped with a manually positioned peak EGT reference pointer.

NEW ENGINE BREAK-IN AND OPERATION

The engine underwent a run-in at the factory and is ready for the full range of use. It is, however, suggested that cruising be accomplished at 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the rings.

The airplane is delivered from the factory with corrosion preventive oil in the engine. If, during the first 25 hours, oil must be added, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082.

ENGINE OIL SYSTEM

Oil for engine lubrication and propeller governor operation is supplied from a sump on the bottom of the engine. The capacity of the engine sump is 10 quarts (one additional quart is contained in the engine oil filter, if installed). Oil is drawn from the sump through a filter screen on the end of a pickup tube to the engine-driven oil pump. Oil from the pump passes through a pressure screen (full flow oil filter, if installed), a pressure relief valve at the rear of the right oil gallery, and a thermostatically controlled oil cooler. Oil from the cooler is then circulated to the left gallery and propeller governor. The engine parts are then lubricated by oil from the galleries. After lubricating the engine, the oil returns to the sump by gravity. If a full flow oil filter is installed, the filter adapter is equipped with a bypass valve which will cause lubricating oil to bypass the filter in the event the filter becomes plugged, or the oil temperature is extremely cold.

An oil dipstick is located at the rear of the engine on the left side, and an oil filler tube is on top of the crankcase near the front of the engine. The dipstick and oil filler are accessible through doors on the engine cowling. The engine should not be operated on less than 7 quarts of oil. To minimize loss of oil through the breather, fill to 8 quarts for normal flights of less than three hours. For extended flight, fill to 10 quarts (dipstick indication only). For engine oil grade and specifications, refer to Section 8 of this handbook.

The oil cooler may be replaced by a non-congealing oil cooler for operations in temperatures consistently below -7°C(20°F). The non-congealing oil cooler provides improved oil flow at low temperatures. Once installed, the non-congealing oil cooler is approved for permanent use in both hot and cold weather.

IGNITION-STARTER SYSTEM

Engine ignition is provided by two engine-driven magnetos and two spark plugs in each cylinder. The right magneto fires the lower left and upper right spark plugs, and the left magneto fires the lower right and upper left spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel-air mixture with dual ignition.

Ignition and starter operation is controlled by a rotary type switch located on the left switch and control panel. The switch is labeled clockwise, OFF, R, L, BOTH, and START. The engine should be operated on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. When the switch is rotated to the spring-loaded START position, (with the master switch in the ON position), the starter contactor is energized and the starter will crank the engine. When the switch is released, it will automatically return to the BOTH position.

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through the left intake in the front of the engine cowling. Aft of the engine cylinders is an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox at the rear of the engine. The airbox has a spring-loaded alternate air door. If the air induction filter should become blocked, suction created by the engine will open the door and draw unfiltered air from inside the upper cowl area. An open alternate air door will result in an approximate 10% power loss at full throttle. After passing through the airbox, induction air enters a fuel/air control unit behind the engine, and is then ducted to the engine cylinders through intake manifold tubes.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler on each side of the engine. The left muffler is constructed with a shroud around the outside which forms a heating chamber for cabin heater air.

FUEL INJECTION SYSTEM

The engine is equipped with a fuel injection system. The system is comprised of an engine-driven fuel pump, fuel/air control unit, fuel manifold, fuel flow indicator, and air-bleed type injector nozzles.

Fuel is delivered by the engine-driven fuel pump to the fuel/air control unit behind the engine. The fuel/air control unit correctly proportions the fuel flow to the induction air flow. After passing through the control unit, induction air is delivered to the cylinders through intake manifold tubes, and metered fuel is delivered to a fuel manifold. The fuel manifold, through spring tension on a diaphragm and valve, evenly distributes the fuel to an air-bleed type injector nozzle in the intake valve chamber of each cylinder. A pressure line is also attached to the fuel manifold, and is connected to a fuel flow indicator on the instrument panel.

COOLING SYSTEM

Ram air for engine cooling enters through two intake openings in the front of the engine cowling. The cooling air is directed around the cylinders and other areas of the engine by baffling, and is then exhausted through cowl flaps on the lower aft edge of the cowling. The cowl flaps are mechanically operated from the cabin by means of a cowl flap lever on the right side of the control pedestal. The pedestal is labeled COWL FLAP, OPEN, CLOSED. During takeoff and high power operation, the cowl flap lever should be placed in the OPEN position for maximum cooling. This is accomplished by moving the lever to the right to clear a detent, then moving the lever up to the OPEN position. Anytime the lever is repositioned, it must first be moved to the right. While in cruise flight, cowl flaps should be adjusted to keep the cylinder head temperature at approximately two-thirds of the normal operating range (green arc). During extended let-downs, it may be necessary to completely close the cowl flaps by pushing the cowl flap lever down to the CLOSED position.

A winterization kit is available for the airplane. It consists of two baffles for the engine cowling air intake openings, a placard to be installed on the instrument panel, and insulation for the crankcase breather line. This equipment should be installed for operations in temperatures consistently below -7°C (20°F). Once installed, crankcase breather line insulation is approved for permanent installation regardless of temperature.

PROPELLER

The airplane has an all-metal, three-bladed, constant-speed, governor-regulated propeller. A setting introduced into the governor with the propeller control establishes the propeller speed, and thus the engine speed to be maintained. The governor then controls flow of engine oil, boosted to high pressure by the governing pump, to or from a piston in the propeller hub. Oil pressure acting on the piston twists the blades toward high pitch (low RPM). When oil pressure to the piston in the propeller hub is relieved, centrifugal force, assisted by an internal spring, twists the blades toward low pitch (high RPM).

A control knob on the lower center portion of the instrument panel is used to set the propeller and control engine RPM as desired for various flight conditions. The knob is labeled PROP PITCH PUSH INCR RPM. When the control knob is pushed in, blade pitch will decrease, giving a higher RPM. When the control knob is pulled out, the blade pitch increases, thereby decreasing RPM. The propeller control knob is equipped with a vernier feature which allows slow or fine RPM adjustments by rotating the knob clockwise to increase RPM, and counterclockwise to decrease it. To make rapid or large adjustments, depress the button on the end of the control knob and reposition the control as desired.

FUEL SYSTEM

The fuel system (see figure 7-5) consists of two vented integral fuel tanks (one in each wing), two fuel reservoir tanks, a fuel selector valve, auxiliary fuel pump, fuel strainer, engine-driven fuel pump, fuel/air control unit, fuel manifold, and fuel injection nozzles.

NOTE

Unusable fuel is at a minimum due to the design of the fuel system. However, when the fuel tanks are 1/4 full or less, prolonged uncoordinated flight such as slips or skids can uncover the fuel tank outlets, causing fuel starvation and engine stoppage. Therefore, with low fuel reserves, do not allow the airplane to remain in uncoordinated flight for periods in excess of one minute.

Fuel flows by gravity from the two integral tanks to two reservoir tanks, and from the reservoir tanks to a three-position selector valve labeled LEFT ON, RIGHT ON, and OFF. With the selector valve in the LEFT ON or RIGHT ON position, fuel from either the left or right tank flows through a bypass in the auxiliary fuel pump (when it is not in operation), and through a strainer to an engine-driven fuel pump. The engine-driven fuel pump delivers the fuel to the fuel/air control unit where it is metered and directed to a manifold which distributes it to each cylinder.

NOTE

Fuel cannot be used from both fuel tanks simultaneously.

Vapor and excess fuel from the engine-driven fuel pump and fuel/air control unit are returned by way of the selector valve to the reservoir tank of the wing fuel tank system being used.

The airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by filling each tank to the bottom edge of the fuel filler collar, thus giving a reduced fuel load of 195 pounds in each tank (192 pounds usable in all flight conditions).

245 L Total 122 L Per Side.

Fuel system venting is essential to system operation. Blockage of the venting system will result in a decreasing fuel flow and eventual engine stoppage. Venting is accomplished by vent lines, one from each fuel tank, which are equipped with check valves. The fuel filler caps are equipped with vacuum operated vents which open, allowing air into the tanks, should the fuel tank vent lines become blocked.

Fuel quantity is measured by four electrically-operated capacitance type fuel quantity transmitters (two in each tank) and indicated by two

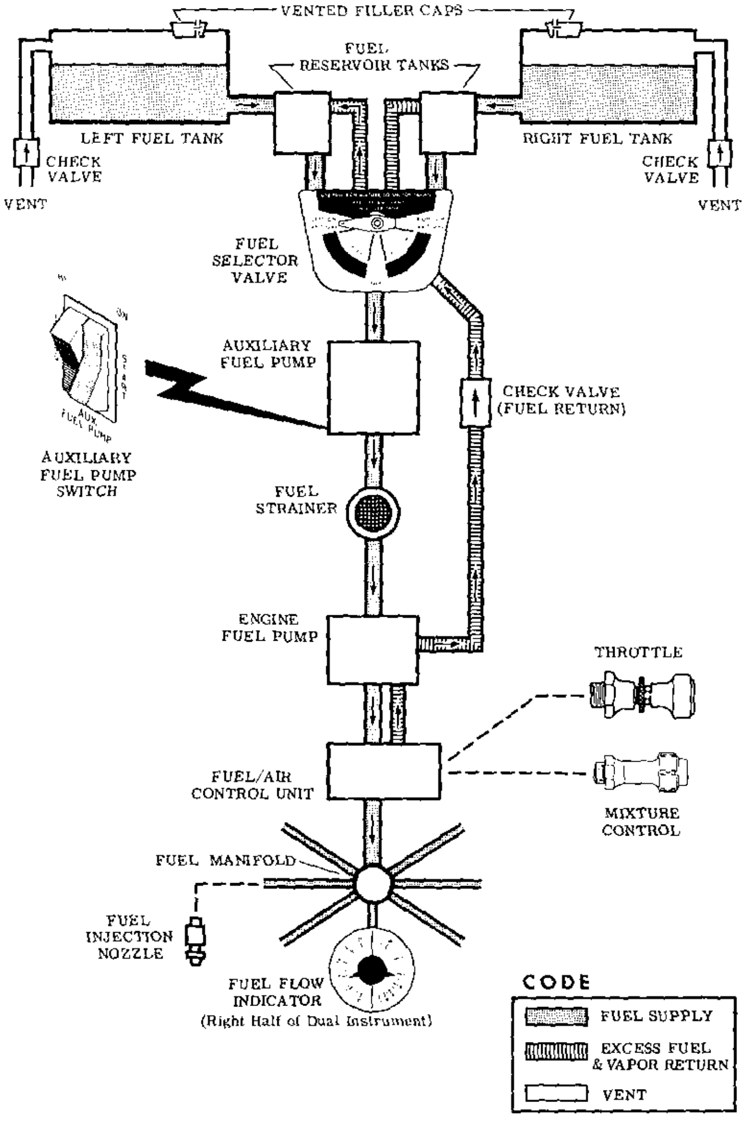


Figure 7-5. Fuel System

FUEL QUANTITY DATA (U.S. GALLONS)			
TANKS	TOTAL USABLE FUEL ALL FLIGHT CONDITIONS	TOTAL UNUSABLE FUEL	TOTAL FUEL VOLUME
STANDARD (45 Gal. Each)	89	1	90

Figure 7-6. Fuel Quantity Data

electrically-operated fuel quantity indicators on the right side of the instrument panel. The indicators are marked in gallons (top scale) and pounds (bottom scale) with a red line indicating an empty tank. When an indicator shows an empty tank, approximately 0.5 gallon remains in the tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips, or unusual attitudes. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature and oil temperature gages for operation. If these gages are not indicating, an electrical malfunction has occurred.

The auxiliary fuel pump switch is located on the left side of the instrument panel and is a yellow and red split-rocker type switch. The yellow right half of the switch is labeled START, and its upper ON position is used for normal starting, minor vapor purging and continued engine operation in the event of an engine-driven fuel pump failure. With the right half of the switch in the ON position, the pump operates at one of two flow rates that are dependent upon the setting of the throttle. With the throttle open to a cruise setting, the pump operates at a high enough capacity to supply sufficient fuel flow to maintain flight with an inoperative engine-driven fuel pump. When the throttle is moved toward the closed position (as during letdown, landing, and taxiing), the fuel pump flow rate is automatically reduced, preventing an excessively rich mixture during these periods of reduced engine speed.

NOTE

If the engine-driven fuel pump is functioning and the auxiliary fuel pump switch is placed in the ON position, an excessively rich fuel/air ratio is produced unless the mixture is leaned. Therefore, this switch should be turned off during takeoff.

NOTE

If the auxiliary fuel pump switch is accidentally placed in the ON position with the master switch on and the engine stopped, the intake manifolds will be flooded.

The red left half of the switch is labeled EMERG, and its upper HI position is used in the event of an engine-driven fuel pump failure during takeoff or high power operation. The HI position may also be used for extreme vapor purging. Maximum fuel flow is produced when the left half of the switch is held in the spring-loaded HI position. In this position, an interlock within the switch automatically trips the right half of the switch to the ON position. When the spring-loaded left half of the switch is released, the right half will remain in the ON position until manually returned to the off position.

If it is desired to completely exhaust a fuel tank quantity in flight, the auxiliary fuel pump will be needed to assist in restarting the engine when fuel exhaustion occurs. Therefore, it is recommended that proper operation of the auxiliary fuel pump be verified prior to running a fuel tank dry by turning the auxiliary fuel pump ON momentarily and checking for a slight rise in fuel flow indication.

To ensure a prompt engine restart in flight after running a fuel tank dry, immediately switch to the tank containing fuel at the first indication of fuel pressure fluctuation and/or power loss. Then place the right half of the auxiliary fuel pump switch in the ON position momentarily (3 to 5 seconds) with the throttle at least 1/2 open. Excessive use of the ON position at high altitude and full rich mixture can cause flooding of the engine as indicated by a short (1 to 2 seconds) period of power followed by a loss of power. This can later be detected by a fuel flow indication accompanied by a lack of power. If flooding does occur, turn off the auxiliary fuel pump switch, and normal propeller windmilling should start the engine in 1 to 2 seconds.

If the propeller should stop (possible at very low airspeeds) before the tank containing fuel is selected, place the auxiliary fuel pump switch in the ON position and advance the throttle promptly until the fuel flow indicator registers approximately 1/2 way into the green arc for 1 to 2 seconds duration. Then retard the throttle, turn off the auxiliary fuel pump, and use the starter to turn the engine over until a start is obtained.

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before the first flight of every day and after each refueling, by using the sampler cup provided to drain fuel from the wing tank sumps, and by utilizing the fuel strainer drain under an access panel on the left side of the engine cowling. Quick-drain valves are also provided for the fuel reservoir tanks. The valves are located under plug buttons in the belly skin of the airplane, and are used to facilitate purging of the fuel system in the event water is discovered during the preflight fuel system inspection. The fuel tanks should be filled after each flight to prevent condensation.

HYDRAULIC SYSTEM

Hydraulic power (see figure 7-7) is supplied by an electrically-driven hydraulic power pack located behind the control pedestal. The power pack's only function is to supply hydraulic power for operation of the retractable landing gear. This is accomplished by applying hydraulic pressure to actuator cylinders which open and close the wheel well doors, operate the gear up and down locks, and extend or retract the gear. The electrical portion of the power pack is protected by a 30-amp push-pull type circuit breaker switch on the switch and control panel.

The hydraulic power pack is turned on, and the direction of actuation is selected by the landing gear handle when it is placed in either the gear-up or gear-down position. When the gear has fully extended or retracted and locked, a series of electrical switches will illuminate one of two indicator lights on the instrument panel to show gear position. Hydraulic pressure is then switched from the gear actuators to the door actuators to close the gear doors. As soon as the doors reach the closed position, a hydraulic pressure switch in the door closing system will automatically turn off the power pack.

The hydraulic system includes an emergency hand pump to permit manual extension of the landing gear in the event of hydraulic power pack failure. The hand pump is located on the cabin floor between the front seats.

During normal operations, the landing gear should require from 12 to 13 seconds to fully extend or retract. For malfunctions of the hydraulic and landing gear systems, refer to Section 3 of this handbook.

BRAKE SYSTEM

The airplane has a single-disc, hydraulically-actuated dual brake on each main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot's rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot's) or right (copilot's) set of rudder pedals, which are interconnected. When the airplane is parked, both main wheel brakes may be set by utilizing the parking brake which is operated by a handle under the left side of the instrument panel.

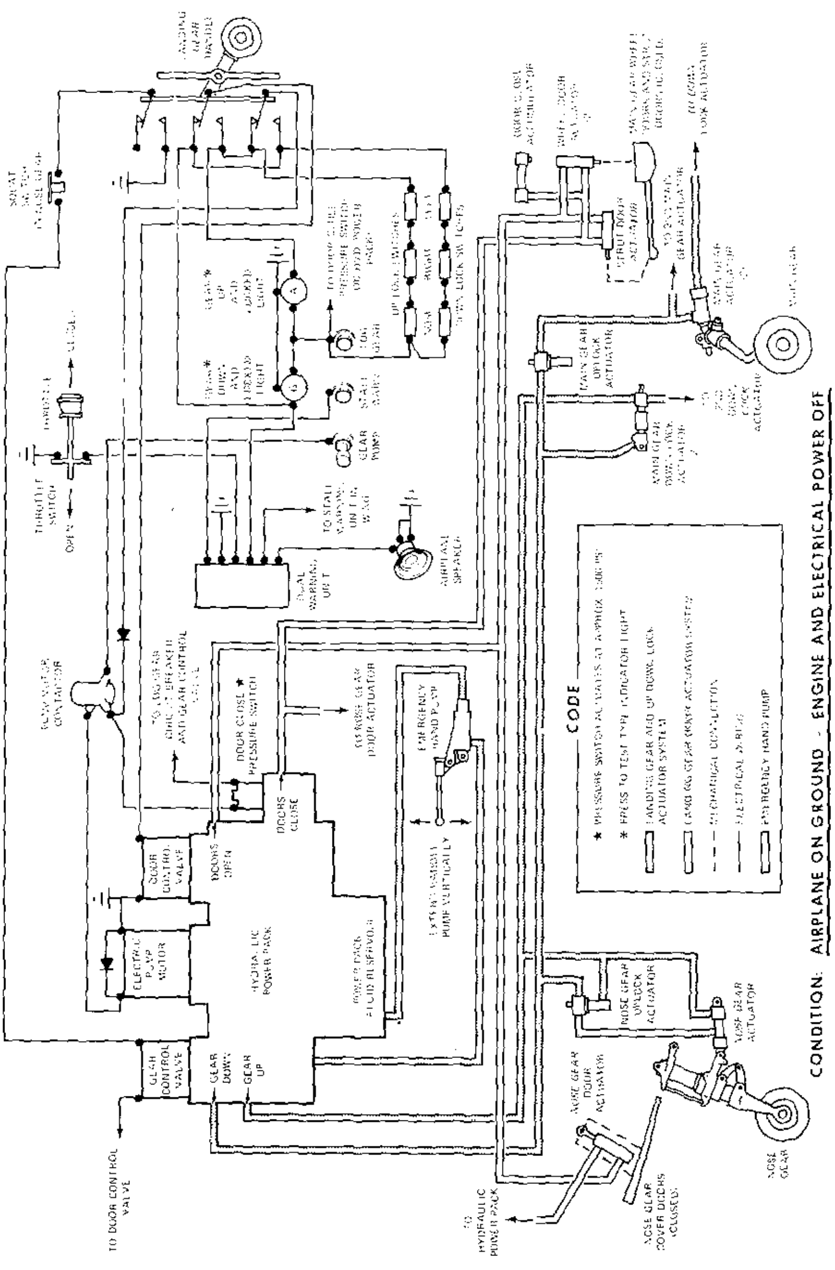


Figure 7-7. Hydraulic System

For maximum brake life, keep the brake system properly maintained, and minimize brake usage during taxi operations and landings.

Some of the symptoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

ELECTRICAL SYSTEM

Electrical energy (see figure 7-8) is supplied by a 28-volt, direct-current system powered by an engine-driven, 60-amp alternator and a 24-volt, 17-amp hour battery which is located on the upper left forward portion of the firewall. Power is supplied to most general electrical and all avionics circuits through the primary bus bar and the avionics bus bar, which are interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on.

CAUTION

Prior to starting the engine or applying an external power source, the avionics power switch, labeled AVN PWR, should be turned off to prevent any harmful transient voltage from damaging the avionics equipment.

MASTER SWITCH

The master switch is a split-rocker type switch labeled MASTER, and is ON in the up position and OFF in the down position. The right half of the switch, labeled BAT, controls electrical power to the airplane through the primary bus bar. The left half, labeled ALT, controls the alternator.

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned ON separately to check equipment while on the ground. To check or use

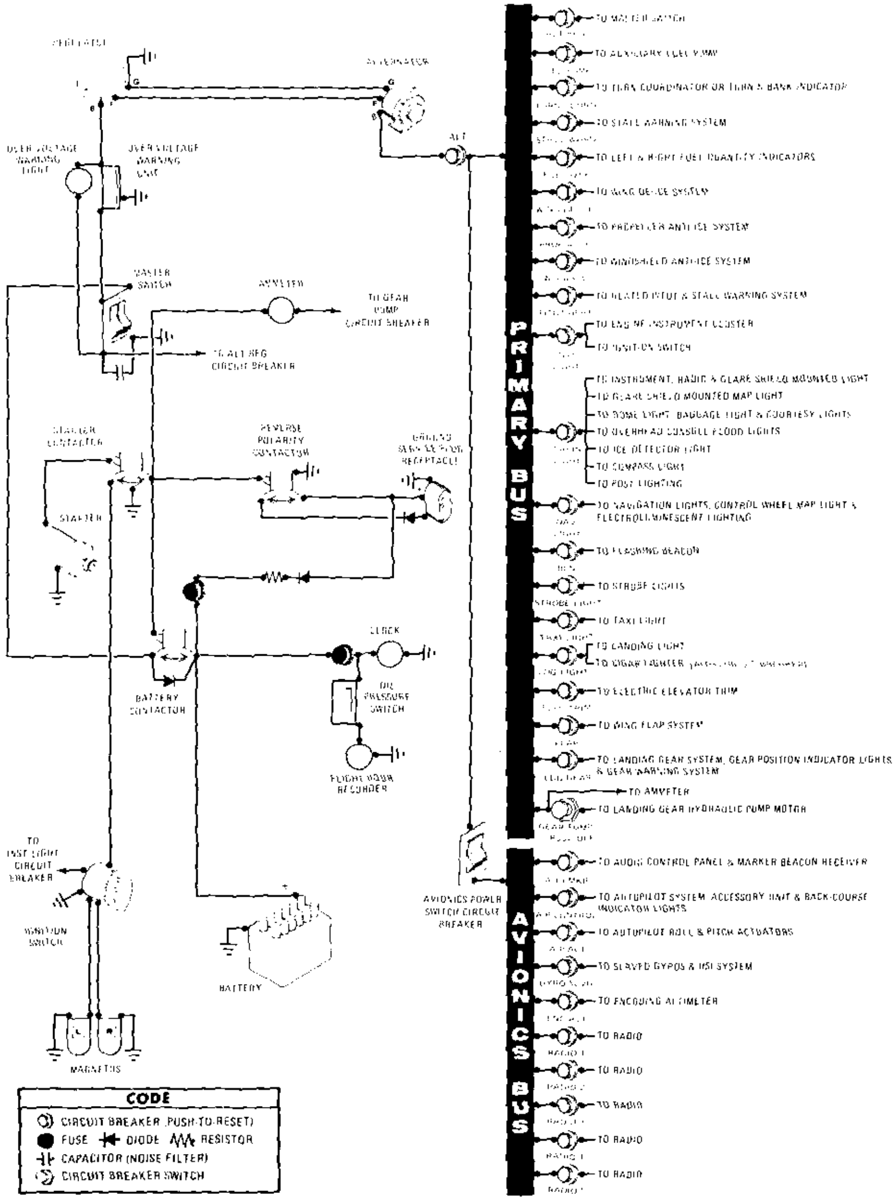


Figure 7-8. Electrical System

avionics equipment or radios while on the ground, the avionics power (AVN PWR) switch must also be turned on. The ALT side of the switch, when placed in the OFF position, removes the alternator from the electrical system. With this switch in the OFF position, the entire electrical load is placed on the battery. Continued operation with the alternator switch in the OFF position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AVIONICS POWER SWITCH

Electrical power from the airplane primary bus to the avionics bus is controlled by the rocker-type circuit breaker-switch labeled AVN PWR. The switch is located on the right side of the avionics circuit breaker panel and is ON in the up position and OFF in the down position. With the AVN PWR switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch. However, the master switch is the primary electrical control, and will remove power to the avionics equipment when turned off, even though the AVN PWR switch is still in the ON position. The AVN PWR switch can be utilized in place of the individual equipment switches, and should be placed in the OFF position prior to starting the engine.

AMMETER

The ammeter indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the airplane electrical system. When the engine is operating and the master switch is turned 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 battery discharge rate.

OVER-VOLTAGE SENSOR AND WARNING LIGHT

The airplane is equipped with an automatic over-voltage protection system consisting of an over-voltage sensor behind the instrument panel and a red warning light, labeled HIGH VOLTAGE, near the suction gage.

In the event an over-voltage condition occurs, the over-voltage sensor automatically removes alternator field current and shuts down the alternator. The red warning light will then turn on, indicating to the pilot that the alternator is not operating and the battery is supplying all electrical power.

The over-voltage sensor may be reset by turning the master switch off and back on again. If the warning light does not illuminate, normal alternator charging has resumed; however, if the light does illuminate again, a malfunction has occurred, and the flight should be terminated as soon as practical.

The warning light may be tested by momentarily turning off the ALT portion of the master switch and leaving the BAT portion turned on.

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" circuit breakers mounted on the lower left side of the instrument panel. A switch type circuit breaker on this panel protects the landing gear system hydraulic pump motor. All the avionics circuits are protected by circuit breakers mounted on a circuit breaker panel between the left forward doorpost and the instrument panel. The avionics connected to this circuit breaker panel are also protected by a rocker-type circuit breaker-switch labeled AVN PWR. The cigar lighter is protected by the LDG LIGHT circuit breaker and a manually-reset type circuit breaker on the back of the lighter. Electrical circuits which are not protected by circuit breakers are the battery contactor closing (external power) circuit, the clock circuit, and flight hour recorder circuit which are protected by fuses mounted adjacent to the battery. The control wheel map light is protected by the NAV LIGHT circuit breaker and a fuse behind the instrument panel.

GROUND SERVICE PLUG RECEPTACLE

A ground service plug receptacle may be installed to permit the use of an external power source (generator type or battery cart) for cold weather starting and during lengthy maintenance work on the airplane electrical system. The receptacle is located under a cover plate, on the lower left side of the cowling.

NOTE

If no avionics equipment is to be used or worked on, the avionics power switch should be turned off. If maintenence is required on the avionics equipment, it is advisable to utilize a battery cart external power source to prevent damage to the avionics equipment by transient voltage. Do not crank or start the engine with the avionics power switch turned on.

Just before connecting an external power source (generator type or battery cart), the master switch should be turned on, and the avionics power (AVN PWR) switch turned off.

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 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 on the master switch will close the battery contactor.

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and tail stinger, and dual landing lights are installed in the cowl nose cap. Additional lighting is available and includes a strobe light on each wing tip, a flashing beacon on top of the vertical stabilizer, and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are operated by a switch located on the left rear door post. All exterior lights, except the courtesy lights, are controlled by rocker type switches on the left switch and control panel. The switches are ON in the up position and OFF in the down position.

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.

The two high intensity strobe lights will enhance anti-collision protection. However, the lights should be turned off when taxiing in the vicinity of other aircraft, or during night flight through clouds, fog or haze.

INTERIOR LIGHTING

Instrument and control panel lighting is provided by electroluminescent, flood, and integral lighting, with post lighting also available. All light intensity is controlled by one dual rheostat, with concentric control knobs, and one single rheostat, labeled LWR PANEL, ENG-RADIO, and INSTRUMENTS respectively. Both the dual and single rheostat controls rotate clockwise from dim to bright, and are located on the left switch and control panel. If the airplane is equipped with 400 Series avionics, the ENG-RADIO control knob controls the light intensity of the incandescent digital readouts incorporated in the 400 Series avionics equipment. For daylight operation, the control knob should be rotated full counterclockwise to produce maximum light intensity for the digital readouts only. Clockwise rotation of the ENG-RADIO control knob will provide normal variable light intensity for nighttime usage. If post lighting is installed, a rocker-type selector switch next to the INSTRUMENTS rheostat control is used to select either post lighting or flood lighting. The switch is labeled POST LIGHT-FLOOD LIGHTS.

Switches and controls on the lower part of the instrument panel and the marker beacon control panel are lighted by electroluminescent panels which do not require light bulbs for illumination. To utilize this lighting, turn on the NAV LIGHTS switch and adjust light intensity with the small (inner) control knob of the concentric control knobs labeled LWR PANEL, ENG-RADIO. Electroluminescent lighting is not affected by the selection of post or flood lighting.

Instrument panel flood lighting consists of four red flood lights on the underside of the anti-glare shield, and two red flood lights in the forward part of the overhead console. To use flood lighting, place the POST LIGHTS-FLOOD LIGHTS selector switch (if installed) in the FLOOD LIGHTS position and adjust light intensity with the INSTRUMENTS rheostat control knob.

The instrument panel may be equipped with post lights which are mounted at the edge of each instrument or control and provide direct lighting. The lights are operated by placing the POST LIGHTS-FLOOD LIGHTS selector switch in the POST LIGHTS position and adjusting light intensity with the INSTRUMENTS rheostat control knob. Switching to post lights will automatically turn off flood lighting.

The engine instrument cluster, radio equipment, and magnetic compass have integral lighting and operate independently of post or flood lighting. The light intensity of instrument cluster and radio equipment lighting is controlled by the large (outer) control knob of the concentric control knobs labeled LWR PANEL, ENG-RADIO. Magnetic compass lighting intensity is controlled by the INSTRUMENTS rheostat control knob.

The airplane is equipped with a dome light aft of the overhead console, and a baggage compartment light above the baggage area. The lights are operated by a slide-type switch, adjacent to the dome light.

The control pedestal has two integral lights and, if the airplane is equipped with oxygen, the overhead console is illuminated by post lights. Pedestal and console light intensity is controlled by the large (outer) control knob of the concentric control knobs labeled LWR PANEL, ENG-RADIO.

Map lighting is provided by overhead console map lights and an anti-glare shield mounted map light. The airplane may also be equipped with a control wheel map light. The overhead console map lights operate in conjunction with instrument panel flood lighting and consist of two openings just aft of the red instrument panel flood lights. The map light openings have sliding covers controlled by small round knobs which uncover the openings when moved toward each other. The covers should be kept closed unless the map lights are required. A map light and toggle switch, mounted in front of the pilot on the underside of the anti-glare shield, is used for illuminating approach plates or other charts when using a control wheel mounted approach plate holder. The switch is labeled MAP LIGHT ON, OFF and light intensity is controlled by the INSTRUMENTS control knob. A map light mounted on the bottom of the pilot's control wheel illuminates the lower portion of the cabin in front of the pilot, and is used for checking maps and other flight data during night operation. The light is utilized by turning on the NAV LIGHTS switch, and adjusting light intensity with the rheostat control knob on the bottom of the control wheel.

The most probable cause of a light failure is a burned out bulb; however, in the event any of the lighting systems fail to illuminate when turned on, check the appropriate circuit breaker. If the circuit breaker has opened (white button popped out), and there is no obvious indication of a short circuit (smoke or odor), turn off the light switch of the affected lights, reset the breaker, and turn the switch on again. If the breaker opens again, do not reset it.

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated to any degree desired by manipulation of the push-pull CABIN HEAT and CABIN AIR control knobs (see figure 7-9). When partial cabin heat is desired, blending warm and cold air will result in improved ventilation and heat distribution throughout the cabin. Additional outside air for summer ventilation is provided through the heat and vent system by operation of the push-pull AUX CABIN AIR knob. All three control knobs are the double button type with locks to permit intermediate settings.

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extend-

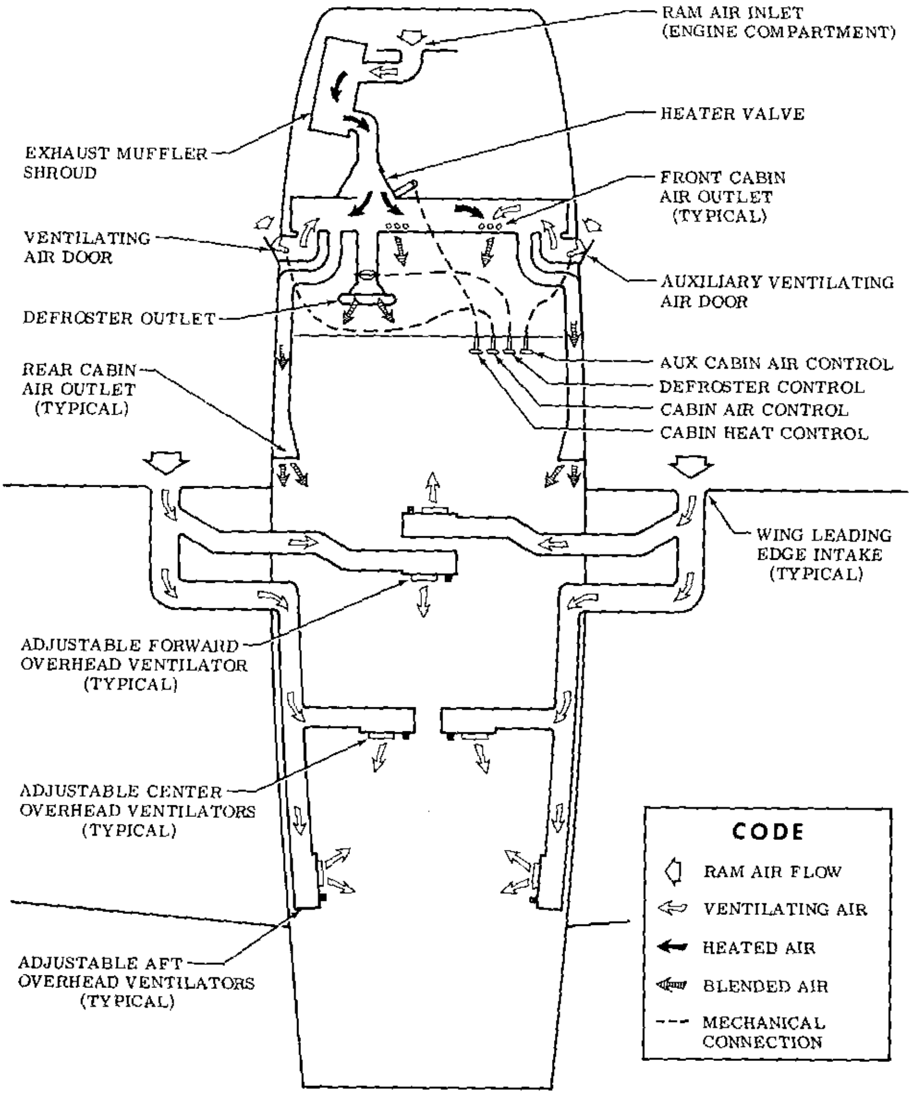


Figure 7-9. Cabin Heating, Ventilating, and Defrosting System

ing down each side of the cabin to an outlet at the front door post at floor level.

Windshield defrost air is supplied by a duct from the cabin manifold to an outlet on top of the anti-glare shield; therefore, the temperature of the defrosting air is the same as heated cabin air. A rotary type control knob labeled DEFROST regulates the volume of air to the windshield. Clockwise rotation of the knob increases defroster air flow.

Additional cabin air is supplied by two fully adjustable ventilators mounted in the forward and aft overhead consoles, and one ventilator in each console located above the rear side windows. Each ventilator outlet can be adjusted in any desired direction by moving the entire outlet to direct the airflow up or down, and by moving a tab, protruding from the center of the outlet, left or right to obtain left or right air flow. The outlets may be closed off completely, or partially closed according to the amount of airflow desired, by rotating an adjustment wheel adjacent to the outlet.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, rate-of-climb indicator and altimeter. The system is composed of a pitot tube mounted on the lower surface of the left wing, two external static ports, one on each side of the fuselage below the rear corners of the aft side windows, and the associated plumbing necessary to connect the instruments to the sources.

The airplane may also be equipped with a pitot heat system. The system consists of a heating element in the pitot tube, a rocker-type switch labeled PITOT HEAT on the lower left side of the instrument panel, an 8-amp circuit breaker on the lower left side of the instrument panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

A static pressure alternate source valve may be installed on the right side of the parking brake, and can be used if the external static source is malfunctioning. This valve supplies static pressure from inside the cabin instead of the external static ports.

If erroneous instrument readings are suspected due to water or ice in the pressure lines going to the standard external static pressure source, the alternate static source valve should be pulled on.

Pressures within the cabin will vary with open cabin ventilators and windows. Refer to Sections 3 and 5 for the effect of varying cabin pressures on airspeed and altimeter readings.

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings include the white arc (55 to 105 knots), green arc (68 to 168 knots), yellow arc (168 to 199 knots), and a red line (199 knots).

If a true airspeed indicator is installed, it is equipped with a rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator, first rotate the ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude has been obtained. Having set the ring to correct for altitude and temperature, then read the airspeed shown on the rotatable ring by the indicator pointer. For best accuracy, this indication should be corrected to calibrated airspeed by referring to the Airspeed Calibration chart in Section 5. Knowing the calibrated airspeed, read true airspeed on the ring opposite the calibrated airspeed.

RATE-OF-CLIMB INDICATOR

The rate-of-climb indicator depicts airplane rate of climb or descent in feet per minute. The pointer is actuated by atmospheric pressure changes resulting from changes of altitude as supplied by the static source.

ALTIMETER

Airplane altitude is depicted by a barometric type altimeter. A knob near the lower left portion of the indicator provides adjustment of the instrument's barometric scale to the current altimeter setting.

VACUUM SYSTEM AND INSTRUMENTS

An engine-driven vacuum system (see figure 7-10) is available and provides the suction necessary to operate the attitude indicator and directional indicator. The system consists of a vacuum pump on the engine, a vacuum relief valve and vacuum system air filter on the aft side of the

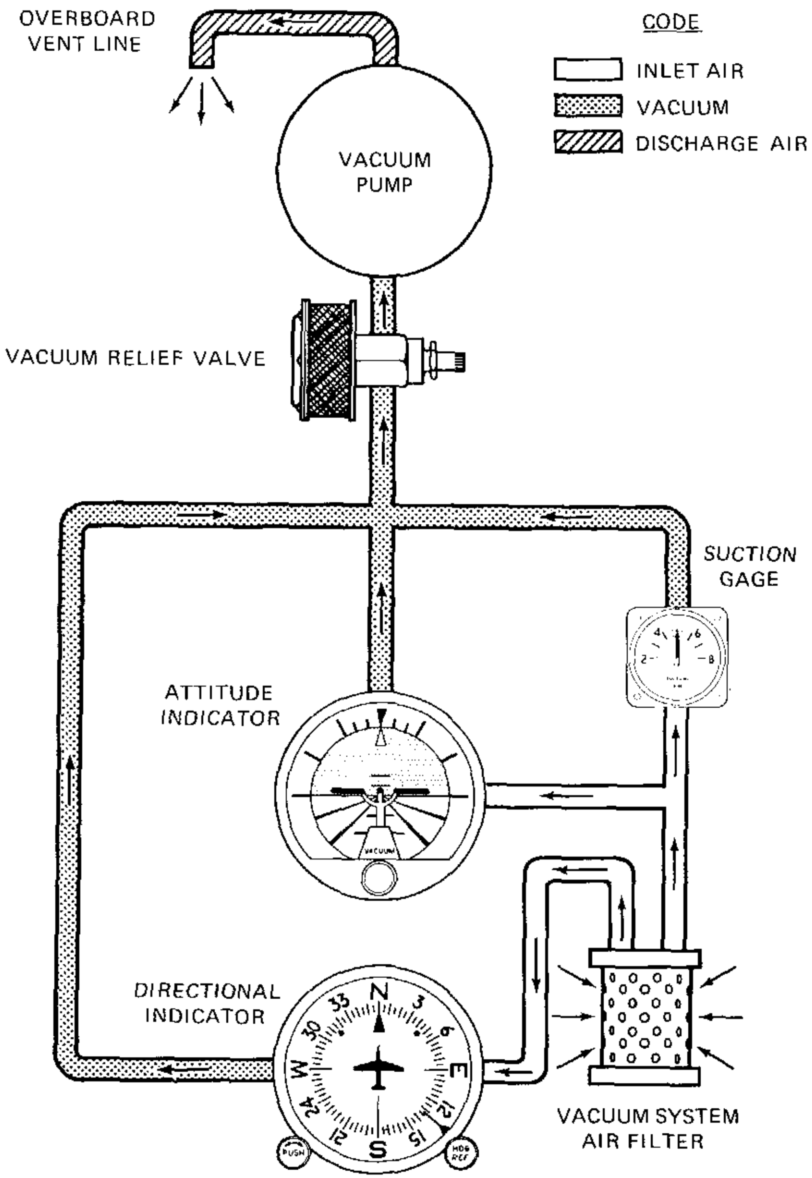


Figure 7-10. Vacuum System

firewall below the instrument panel, vacuum operated instruments on the left side of the instrument panel, and a suction gage on the right side of the panel.

ATTITUDE INDICATOR

An attitude indicator is available and gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which has index marks at 10°, 20°, 30°, 60°, and 90° either side of the center mark. Pitch and roll attitudes are presented by a miniature airplane in relation to the horizon bar. A knob at the bottom of the instrument is provided for in-flight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

DIRECTIONAL INDICATOR

A directional indicator is available and displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession.

SUCTION GAGE

A suction gage is located on the upper right side of the instrument panel when the airplane is equipped with a vacuum system. Suction available for operation of the attitude indicator and directional indicator is shown by this gage, which is calibrated in inches of mercury. The desired suction range is 4.6 to 5.4 inches of mercury. A suction reading below this range may indicate a system malfunction or improper adjustment, and in this case, the indicators should not be considered reliable.

STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit in the leading edge of the left wing. The unit is electrically connected to a dual warning unit located above the right cabin door behind the headliner. The vane in the wing unit senses the change in airflow over the wing, and operates the dual warning unit, which produces a continuous tone over the airplane speaker between 5 and 10 knots above the stall in all configurations.

If the airplane has a heated stall warning system, the vane-type unit in the wing is equipped with a heating element. The heated stall warning system is operated by the PITOT HEAT switch, and is protected by the PITOT HEAT circuit breaker.

The stall warning system should be checked during the preflight inspection by momentarily turning on the master switch and actuating the vane in the wing. The system is operational if a continuous tone is heard on the airplane speaker as the vane is pushed upward.

AVIONICS SUPPORT EQUIPMENT

The airplane may, at the owner's discretion, be equipped with various types of avionics support equipment such as an audio control panel, microphone-headsets, and static dischargers. The following paragraphs discuss these items.

AUDIO CONTROL PANEL

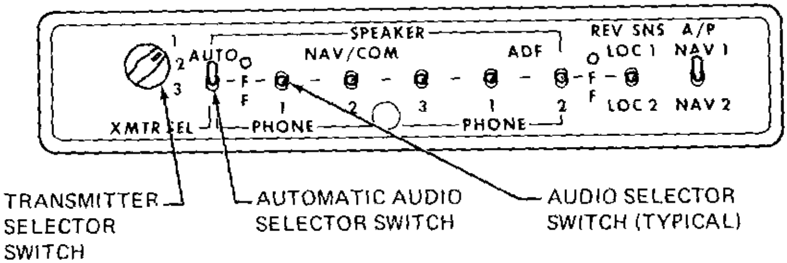
Operation of radio equipment is covered in Section 9 of this handbook. When one or more radios are installed, a transmitter/audio switching system is provided (see figure 7-11). The operation of this switching system is described in the following paragraphs.

TRANSMITTER SELECTOR SWITCH

A rotary type transmitter selector switch, labeled XMTR SEL, is provided to connect the microphone to the transmitter the pilot desires to use. To select a transmitter, rotate the switch to the number corresponding to that transmitter. The numbers 1, 2 and 3 on the right side of the switch correspond to the top, second and third transceivers in the avionics stack.

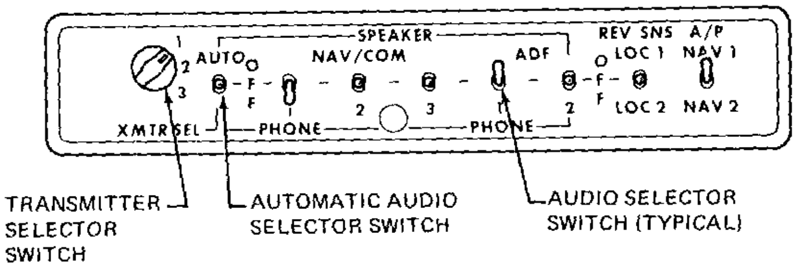
An audio amplifier is required for speaker operation, and is automatically selected, along with the transmitter, by the transmitter selector switch. As an example, if the number 1 transmitter is selected, the audio amplifier in the associated NAV/COM receiver is also selected, and functions as the amplifier for ALL speaker audio. In the event the audio amplifier in use fails, as evidenced by loss of all speaker audio, select another transmitter. This should re-establish speaker audio. Headset audio is not affected by audio amplifier operation.

AUTOMATIC AUDIO SELECTION



As illustrated, the number 1 transmitter is selected, the AUTO selector switch is in the SPEAKER position, and the NAV/COM 1, 2 and 3 and ADF 1 and 2 audio selector switches are in the OFF position. With the switches set as shown, the pilot will transmit on the number 1 transmitter and hear the number 1 NAV/COM receiver through the airplane speaker.

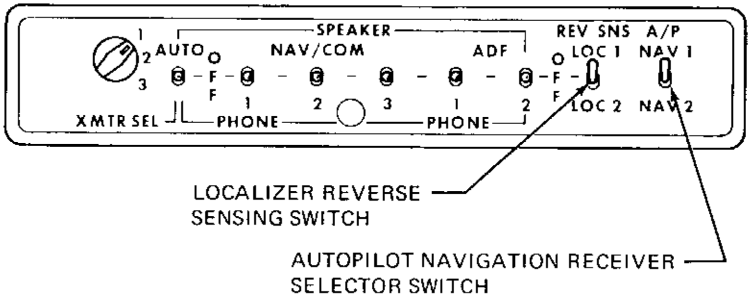
INDIVIDUAL AUDIO SELECTION



As illustrated, the number 1 transmitter is selected, the AUTO selector switch is in the OFF position, the number 1 NAV/COM receiver is in the PHONE position, and the number 1 ADF is in the SPEAKER position. With the switches set as shown, the pilot will transmit on the number 1 transmitter and hear the number 1 NAV/COM receiver on a headset, while the passengers are listening to the ADF audio through the airplane speaker. If another audio selector switch is placed in either the PHONE or SPEAKER position, it will be heard simultaneously with either the number 1 NAV/COM or number 1 ADF respectively.

Figure 7-11. Audio Control Panel (Sheet 1 of 2)

BACK - COURSE AND AUTOPILOT RECEIVER SWITCHES



With the REV SNS and A/P switches positioned as illustrated, course sensing information to the Course Deviation Indicator connected to the number 1 Navigation Receiver will be reversed, allowing normal course tracking during a back-course localizer approach, and the autopilot will be coupled to the number 1 Navigation Receiver and associated CDI. CDI reverse sensing is indicated by an amber light, labeled BC, on the face of the CDI. Glide slope indications are unaffected by the REV SNS and A/P switches.

Figure 7-11. Audio Control Panel (Sheet 2 of 2)

AUTOMATIC AUDIO SELECTOR SWITCH

A toggle switch, labeled AUTO, can be used to automatically match the appropriate NAV/COM receiver audio to the transmitter being selected. To utilize this automatic feature, leave all NAV/COM receiver switches in the OFF (center) position, and place the AUTO selector switch in either the SPEAKER or PHONE position, as desired. Once the AUTO selector switch is positioned, the pilot may then select any transmitter and its associated NAV/COM receiver audio simultaneously with the transmitter selector switch. If automatic audio selection is not desired, the AUTO selector switch should be placed in the OFF (center) position.

NOTE

Using Cessna 300 or 400 Series Radios, sidetone (monitoring of the operator's own audio transmission) can be heard in the headset by placing the AUTO selector switch in the PHONE position. No sidetone will be heard with the AUTO selector switch in either the SPEAKER (speaker operation) or OFF (center) position.

AUDIO SELECTOR SWITCHES

The audio selector switches, labeled NAV/COM 1, 2 and 3 and ADF 1 and 2, allow the pilot to initially pre-tune all NAV/COM and ADF receivers, and then individually select and listen to any receiver or combination of receivers. To listen to a specific receiver, first check that the AUTO selector switch is in the OFF (center) position, then place the audio selector switch corresponding to that receiver in either the SPEAKER (up) or PHONE (down) position. To turn off the audio of the selected receiver, place that switch in the OFF (center) position. If desired, the audio selector switches can be positioned to permit the pilot to listen to one receiver on a headset while the passengers listen to another receiver on the airplane speaker.

The ADF 1 and 2 switches may be used anytime ADF audio is desired. If the pilot wants only ADF audio, for station identification or other reasons, the AUTO selector switch (if in use) and all other audio selector switches should be in the OFF position. If simultaneous ADF and NAV/COM audio is acceptable to the pilot, no change in the existing switch positions is required. Place the ADF 1 or 2 switch in either the SPEAKER or PHONE position and adjust radio volume as desired.

NOTE

If the NAV/COM audio selector switch corresponding to the selected transmitter is in the PHONE position with the AUTO selector switch in the SPEAKER position, all audio selector switches placed in the PHONE position will automatically be connected to both the airplane speaker and any headsets in use.

LOCALIZER REVERSE SENSING (BACK-COURSE) SWITCH

When installed, the localizer reverse sensing switch, labeled REV SNS LOC 1, LOC 2, allows the pilot to reverse localizer needle indications on the selected Course Deviation Indicator (CDI) when the navigation receiver connected to that CDI is set to a localizer frequency. This switch is used for back-course operation only and will allow the pilot to fly a front course outbound or back course inbound, using normal course tracking techniques. When the REV SNS switch is moved from the center OFF position to either LOC 1 or LOC 2 position, an amber light, labeled BC, on the face of the CDI will illuminate, indicating to the pilot that the CDI localizer needle indications are reversed.

CAUTION

When a 400B autopilot is installed with this switch, selection of LOC 1 or LOC 2 will always reverse localizer signals to the autopilot computer for back course operation. Glide slope indications are not affected.

AUTOPILOT NAVIGATION RECEIVER SELECTOR SWITCH

An autopilot navigation receiver selector switch, labeled A/P NAV 1, NAV 2, is installed when a Cessna 400 or 400B Autopilot system is installed. The switch allows the pilot to select the desired navigation receiver for autopilot operation. Since the switch does not have a center OFF position, placing the switch in either position will automatically select the associated navigation information for the autopilot.

MICROPHONE-HEADSET

The microphone-headset combination consists of the microphone and headset combined in a single unit and a microphone keying switch located on the left side of the pilot's control wheel. The microphone-headset permits the pilot to conduct radio communications without interrupting other control operations to handle a hand-held microphone. Also, passengers need not listen to all communications. The microphone and headset jacks are located near the lower left corner of the instrument panel.

STATIC DISCHARGERS

If frequent IFR flights are planned, installation of wick-type static dischargers is recommended to improve radio communications during flight through dust or various forms of precipitation (rain, snow or ice crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, elevator, propeller tips, and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

Installation of static dischargers reduces interference from precipitation static, but it is possible to encounter severe precipitation static conditions which might cause the loss of radio signals, even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent loss of dependable radio signals. If avoidance is impractical, minimize airspeed and anticipate temporary loss of radio signals while in these areas.

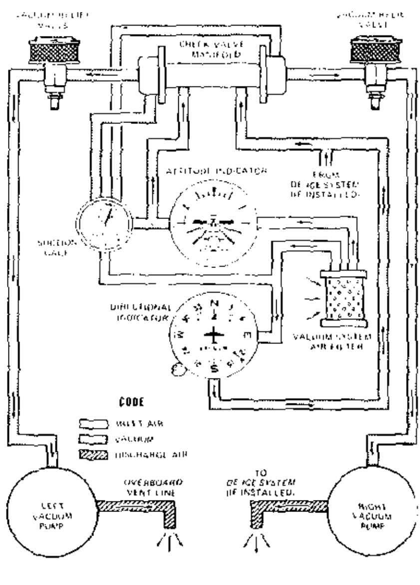
Dual Vacuum Pump Installation

1973-1976 Models 210L/T210L
1977-1978 Models 210M/T210M
1978 Model P210N

If your airplane has a wing and stabilizer de-ice system and IFR operations are conducted, a dual vacuum pump installation is REQUIRED. For details concerning airplane serial applicability and installation kit part numbers, refer to Service Letter SE82-13, Supplement No. 1.

When only a single vacuum pump system is installed, a pump malfunction would disable the directional and attitude indicators, and, if installed, the wing and stabilizer de-ice system. If an autopilot was installed and operating, it too could be affected and should be turned off. The dual pump system provides additional reliability for the gyro-operated flight instruments and certain functions of the autopilot. Also, with this installation, the wing and stabilizer de-ice boots are operated by the right vacuum pump, and only in the event of a failure of the right pump would the de-ice boots be inoperative. A placard is required near the suction gage if a wing and stabilizer de-ice system is installed and reads, "DUAL VACUUM SYSTEM INSTALLED. IF RIGHT PUMP FAILS, DE-ICE BOOTS WILL NOT OPERATE."

Components included in the dual vacuum pump installation are dual vacuum pumps on the rear of the engine, two vacuum relief valves, a system air filter, and a check valve manifold. A replacement suction gage is provided in the installation kit and incorporates two red warning buttons, marked L and R, which extend visibly in the event either or both vacuum sources fail. During the preflight inspection (before engine start), the suction gage warning buttons should be extended; before takeoff, a check should be made to verify that the suction gage reads in the green arc range and the warning buttons are retracted. A periodic check of the suction gage during cruise flight will alert the pilot of any impending vacuum system failure.



SECTION 8
AIRPLANE HANDLING, SERVICE & MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

This section contains factory-recommended procedures for proper ground handling and routine care and servicing of your Cessna. It also identifies certain inspection and maintenance requirements which must be followed if your airplane is to retain that new-plane performance and dependability. It is wise to follow a planned schedule of lubrication and preventive 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.

IDENTIFICATION PLATE

All correspondence regarding your airplane should include the SERIAL NUMBER. The Serial Number, Model Number, Production Certificate Number (PC) and Type Certificate Number (TC) can be found on the Identification Plate, located on the lower part of the left forward doorpost. Located adjacent to the Identification Plate is a Finish and Trim Plate which contains a code describing the interior color scheme and exterior paint combination of the airplane. The code may be used in conjunction with an applicable Parts Catalog if finish and trim information is needed.

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, in the form of Service Letters, directly from the Cessna Customer Services Department. A subscription form is supplied in your Customer Care Program book 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

Various publications and flight operation aids are furnished in the airplane when delivered from the factory. These items are listed below.

- CUSTOMER CARE PROGRAM BOOK
- PILOT'S OPERATING HANDBOOK/SUPPLEMENTS FOR YOUR
  AIRPLANE
  AVIONICS AND AUTOPILOT
- PILOT'S CHECKLISTS
- POWER COMPUTER
- SALES AND SERVICE DEALER DIRECTORY
- DO'S AND DON'TS ENGINE BOOKLET

The following additional publications, plus many other supplies that are applicable to your airplane, are available from your Cessna Dealer.

- SERVICE MANUALS AND PARTS CATALOGS FOR YOUR
  AIRPLANE
  ENGINE AND ACCESSORIES
  AVIONICS AND AUTOPILOT

Your Cessna Dealer has a Customer Care Supplies Catalog covering all available items, many of which he keeps on hand. He will be happy to place an order for any item which is not in stock.

AIRPLANE FILE

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

A. To be displayed in airplane at all times:

(1) Aircraft Airworthiness Certificate (FAA Form 8100-2).
(2) Aircraft Registration Certificate (FAA Form 8050-3).
(3) Aircraft Radio Station License, if transmitter installed (FCC Form 556).

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

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

C. To be made available upon request:

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

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 airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

Cessna recommends that these items, plus the Pilot's Operating Handbook, Pilot's Checklists, Power Computer, Customer Care Program book and Customer Care Card, be carried in the airplane at all times.

AIRPLANE INSPECTION PERIODS

FAA REQUIRED INSPECTIONS

As required by Federal Aviation Regulations, all civil aircraft of U. S. registry must undergo a complete inspection (annual) each twelve calendar months. In addition to the required ANNUAL inspection, aircraft operated commercially (for hire) must have a complete inspection every 100 hours of operation.

The FAA may require other inspections by the issuance of airworthiness directives applicable to the airplane, engine, propeller and components. It is the responsibility of the owner/operator to ensure compliance with all applicable airworthiness directives and, when the inspections are repetitive, to take appropriate steps to prevent inadvertent noncompliance.

In lieu of the 100 HOUR and ANNUAL inspection requirements, an airplane may be inspected in accordance with a progressive inspection schedule, which allows the work load to be divided into smaller operations that can be accomplished in shorter time periods.

The CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisfies the complete airplane inspection requirements of both the 100 HOUR and ANNUAL inspections as applicable to Cessna airplanes. The program assists the owner in his responsibility to comply with all FAA inspection requirements while ensuring timely replacement of life-limited parts and adherence to factory-recommended inspection intervals and maintenance procedures.

CESSNA PROGRESSIVE CARE

The Cessna Progressive Care Program has been designed to help you realize maximum utilization of your airplane at a minimum cost and downtime. Under this program, your airplane is inspected and maintained in four operations at 50-hour intervals during a 200-hour period. The operations are recycled each 200 hours and are recorded in a specially provided Aircraft Inspection Log as each operation is conducted.

The Cessna Aircraft Company recommends Progressive Care for airplanes that are being flown 200 hours or more per year, and the 100-hour inspection for all other airplanes. The procedures for the Progressive Care Program and the 100-hour inspection have been carefully worked out by the factory and are followed by the Cessna Dealer Organization. The complete familiarity of Cessna Dealers with Cessna equipment and factory-approved procedures provides the highest level of service possible at lower cost to Cessna owners.

Regardless of the inspection method selected by the owner, he should keep in mind that FAR Part 43 and FAR Part 91 establishes the requirement that properly certified agencies or personnel accomplish all required FAA inspections and most of the manufacturer recommended inspections.

CESSNA CUSTOMER CARE PROGRAM

Specific benefits and provisions of the CESSNA WARRANTY plus other important benefits for you are contained in your CUSTOMER CARE PROGRAM book supplied with your airplane. You will want to thoroughly review your Customer Care Program book and keep it in your airplane at all times.

Coupons attached to the Program book entitle you to an initial inspection and either a Progressive Care Operation No. 1 or the first 100-hour inspection within the first 6 months of ownership at no charge to you. If you take delivery from your Dealer, the initial inspection will have been performed before delivery of the airplane to you. If you pick up your airplane at the factory, plan to take it to your Dealer reasonably soon after you take delivery, so the initial inspection may be performed allowing the Dealer to make any minor adjustments which may be necessary.

You will also want to return to your Dealer either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100-hour inspection depending on which program you choose to establish for your airplane. 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.

PILOT CONDUCTED PREVENTIVE MAINTENANCE

A certified pilot who owns or operates an airplane not used as an air carrier is authorized by FAR Part 43 to perform limited maintenance on his airplane. Refer to FAR Part 43 for a list of the specific maintenance operations which are allowed.

NOTE

Pilots operating airplanes of other than U.S. registry should refer to the regulations of the country of certification for information on preventive maintenance that may be performed by pilots.

A Service Manual should be obtained prior to performing any preventive maintenance to ensure that proper procedures are followed. Your Cessna Dealer should be contacted for further information or for required maintenance which must be accomplished by appropriately licensed personnel.

ALTERATIONS OR REPAIRS

It is essential that the FAA be contacted prior to any alterations on the airplane to ensure that airworthiness of the airplane is not violated. Alterations or repairs to the airplane must be accomplished by licensed personnel.

GROUND HANDLING

TOWING

The airplane is most easily and safely maneuvered by hand with the tow-bar attached to the nose wheel. When towing with a vehicle, do not exceed the nose gear turning angle of 35° either side of center, or damage to the gear will result. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire or deflated strut will also increase tail height.

PARKING

When parking the airplane, head into the wind and set the parking brakes. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated.

Close the cowl flaps, install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

TIE-DOWN

Proper tie-down procedure is the best precaution against damage to the parked airplane by gusty or strong winds. To tie-down the 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 torque link and secure to a ramp tie-down.
(5) Install a pitot tube cover.

JACKING

When a requirement exists to jack the entire airplane off the ground, or when wing jack points are used in the jacking operation, refer to the Service Manual for specific procedures and equipment required.

Individual main gear may be jacked by using the jack pad which is incorporated in the main landing gear strut step assembly. When using the individual gear strut jack pad, flexibility of the gear strut will cause the main wheel to slide inboard as the wheel is raised, tilting the jack. The jack must then be lowered for a second jacking operation. Do not jack both main wheels simultaneously using the individual main gear jack pads.

If nose gear maintenance is required, the nose wheel may be raised off the ground by pressing down on a tailcone bulkhead, just forward of the horizontal stabilizer, and allowing the tail to rest on the tail tie-down ring.

NOTE

Do not apply pressure on the elevator or outboard stabilizer surfaces. When pushing on the tailcone, always apply pressure at a bulkhead to avoid buckling the skin.

To assist in raising and holding the nose wheel off the ground, weight down the tail by placing sand-bags, or suitable weights, on each side of the horizontal stabilizer, next to the fuselage. If ground anchors are

SERVICING

In addition to the PREFLIGHT INSPECTION covered in Section 4, COMPLETE servicing, inspection, and test requirements for your airplane are detailed in the Service Manual. The Service Manual outlines all items which require attention at 50, 100, and 200 hour intervals plus those items which require servicing, inspection, and/or testing at special intervals.

Since Cessna Dealers conduct all service, inspection, and test procedures in accordance with applicable Service Manuals, it is recommended that you contact your Cessna Dealer concerning these requirements and begin scheduling your airplane for service at the recommended intervals.

Cessna Progressive Care ensures that these requirements are accomplished at the required intervals to comply with the 100-hour or ANNUAL inspection as previously covered.

Depending on various flight operations, your local Government Aviation Agency may require additional service, inspections, or tests. For these regulatory requirements, owners should check with local aviation officials where the airplane is being operated.

For quick and ready reference, quantities, materials, and specifications for frequently used service items are as follows.

ENGINE OIL

GRADE -- Aviation Grade SAE 50 Above 4°C(40°F).
Aviation Grade SAE 10W30 or SAE 30 Below 4°C(40°F).
Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather. Ashless dispersant oil, conforming to Continental Motors Specification MHS-24A, must be used.

NOTE

Your Cessna was delivered from the factory with a corrosion preventive aircraft engine oil. If oil must be added during the first 25 hours, use only aviation grade straight mineral oil conforming to Specification No. MIL-L-6082.

CAPACITY OF ENGINE SUMP -- 10 Quarts.
Do not operate on less than 7 quarts. To minimize loss of oil through breather, fill to 8 quart level for normal flights of less than 3 hours. For extended flight, fill to 10 quarts. These quantities refer to oil

dipstick level readings. During oil and oil filter changes, one additional quart is required when the filter element is changed.

OIL AND OIL FILTER CHANGE--
After the first 25 hours of operation, drain engine oil sump and clean the oil pressure screen. If an oil filter is installed, change the filter element at this time. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to dispersant oil. On airplanes not equipped with an oil filter, drain the engine oil sump and clean the oil pressure screen each 50 hours thereafter. On airplanes which have an 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 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

FUEL

APPROVED FUEL GRADES (AND COLORS) --
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).
CAPACITY EACH TANK -- 45 Gallons.
REDUCED CAPACITY EACH TANK (INDICATED BY SMALL HOLES INSIDE FILLER NECK) -- 32.5 Gallons.

LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 50 PSI on 5.00-5, 6-Ply Rated Tire.
MAIN WHEEL TIRE PRESSURE -- 55 PSI on 6.00-6, 8-Ply Rated Tires.
NOSE GEAR SHOCK STRUT --
Keep filled with MIL-H-5606 hydraulic fluid and inflated with air to 90 PSI. Do not over-inflate.
HYDRAULIC FLUID RESERVOIR -- Check and service with MIL-H-5606 hydraulic fluid. At first 25 hours, first 50 hours, and each 100 hours thereafter, clean the filter on the right side of the reservoir.

OXYGEN

AVIATOR'S BREATHING OXYGEN -- Spec. No. MIL-O-27210.
MAXIMUM PRESSURE (cylinder temperature stabilized after filling) --
1800 PSI at 21°C(70°F).
Refer to Oxygen Supplement (Section 9) for filling pressures.

CLEANING AND CARE

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 bug 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 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.

When the airplane is parked outside in cold climates and it is necessary to remove ice before flight, care should be taken to protect the painted surfaces during ice removal with chemical liquids. A 50-50 solution of isopropyl alcohol and water will satisfactorily remove ice accumulations without damaging the paint. A solution with more than 50% alcohol is harmful and should be avoided. While applying the de-icing solution, keep it away from the windshield and cabin windows since the alcohol will attack the plastic and may cause it to craze.

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. Small nicks on the propeller, particularly near the tips and on the leading edges, should be 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.

LANDING GEAR CARE

Cessna Dealer's mechanics have been trained in the proper adjustment and rigging procedures on the airplane hydraulic system. To assure trouble-free gear operation, have your Cessna Dealer check the gear regularly and make any necessary adjustments. Only properly trained mechanics should attempt to repair or adjust the landing gear.

ENGINE CARE

The engine may be cleaned with Stoddard solvent, or equivalent, then dried thoroughly.

CAUTION

Particular care should be given to electrical equipment before cleaning. Cleaning fluids should not be allowed to enter magnetos, starter, alternator and the like. Protect these components before saturating the engine with solvents. All other openings should also be covered before cleaning the engine assembly. Caustic cleaning solutions should be used cautiously and should always be properly neutralized after their use.

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 sticky 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.

If your airplane is equipped with leather seating, cleaning of the seats is accomplished using a soft cloth or sponge dipped in mild soap suds. The soap suds, used sparingly, will remove traces of dirt and grease. The soap should be removed with a clean damp cloth.

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.