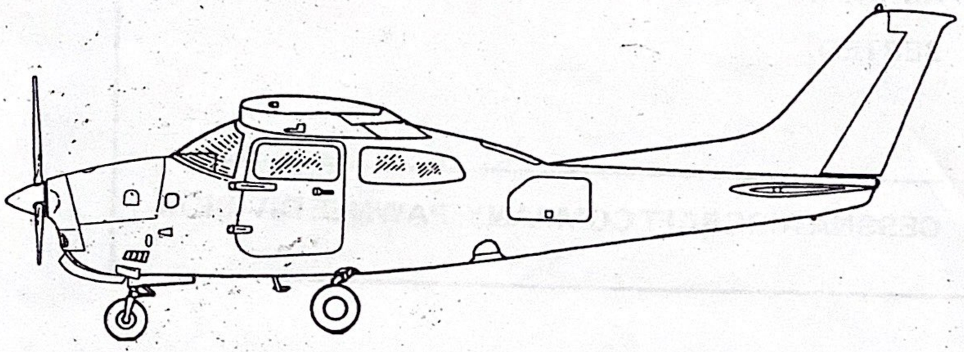
PILOT'S OPERATING HANDBOOK
and
FAA APPROVED AIRPLANE FLIGHT MANUAL



CESSNA AIRCRAFT COMPANY

1980 MODEL T210N

THIS DOCUMENT MUST BE
CARRIED IN THE AIRPLANE
AT ALL TIMES.

Serial No. 21063828

Registration No. 2306D

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY CAR PART 3 AND CONSTITUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL.

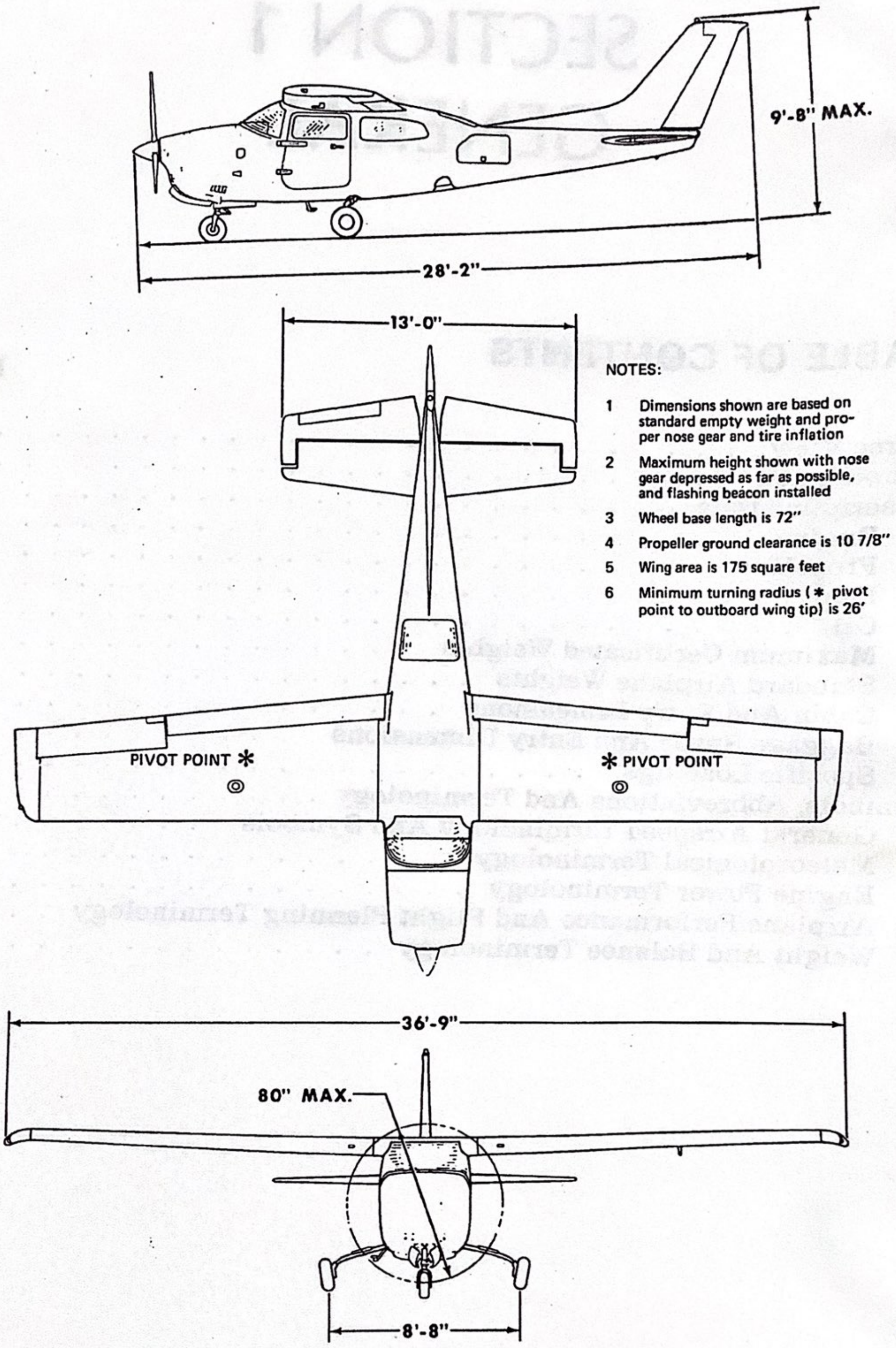
CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

Member of GAMA

1 OCTOBER 1979

PERFORMANCE - SPECIFICATIONS

SPEED:		
Maximum at 17,000 Ft		204 KNOTS
Cruise, 80% Power at 20,000 Ft		196 KNOTS
Cruise, 80% Power at 10,000 Ft		180 KNOTS
CRUISE: Recommended lean mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve.		
80% Power at 20,000 Ft	Range	755 NM
534 Pounds Usable Fuel	Time	4.1 HRS
80% Power at 10,000 Ft	Range	725 NM
534 Pounds Usable Fuel	Time	4.1 HRS
Maximum Range at 20,000 Ft	Range	940 NM
534 Pounds Usable Fuel	Time	7.0 HRS
Maximum Range at 10,000 Ft	Range	960 NM
534 Pounds Usable Fuel	Time	7.4 HRS
RATE OF CLIMB AT SEA LEVEL		930 FPM
SERVICE CEILING		27,000 FT
TAKEOFF PERFORMANCE:		
Ground Roll		1300 FT
Total Distance Over 50-Ft Obstacle		2160 FT
LANDING PERFORMANCE:		
Ground Roll		765 FT
Total Distance Over 50-Ft Obstacle		1500 FT
STALL SPEED (CAS):		
Flaps Up, Power Off		67 KNOTS
Flaps Down, Power Off		58 KNOTS
MAXIMUM WEIGHT:		
Ramp		4016 LBS
Takeoff		4000 LBS
Landing		3800 LBS
STANDARD EMPTY WEIGHT:		
Turbo Centurion		2221 LBS
Turbo Centurion II		2286 LBS
MAXIMUM USEFUL LOAD:		
Turbo Centurion		1795 LBS
Turbo Centurion II		1730 LBS
BAGGAGE ALLOWANCE: Maximum With 4 People		240 LBS
WING LOADING: Pounds/Sq Ft		22.9
POWER LOADING: Pounds/HP		12.9
FUEL CAPACITY: Total		90 GAL.
OIL CAPACITY		11 QTS
ENGINE: Teledyne Continental, Turbocharged Fuel Injection		TSIO-520-R
310 BHP at 2700 RPM (5-Minute Takeoff Rating)		
285 BHP at 2600 RPM (Maximum Continuous Rating)		
PROPELLER: 3-Bladed Constant Speed, Diameter		80 IN.



NOTES:

1 Dimensions shown are based on standard empty weight and proper nose gear and tire inflation

2 Maximum height shown with nose gear depressed as far as possible, and flashing beacon installed

3 Wheel base length is 72"

4 Propeller ground clearance is 10 7/8"

5 Wing area is 175 square feet

6 Minimum turning radius (* pivot point to outboard wing tip) is 26'

Figure 1-1. Three View

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: TSIO-520-R.
Engine Type: Turbocharged, 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): 310 rated BHP at 36.5 inches Hg and 2700 RPM.
  Maximum Continuous Power: 285 rated BHP at 35 inches Hg and 2600 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: D3A34C402/90DFA-10.
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 12.4° and a high pitch setting of 28.5° (30 inch station).

FUEL

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

NOTE

> Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply. Additive concentrations shall not exceed 1% for isopropyl alcohol or .15% for ethylene glycol monomethyl ether. Refer to Section 8 for

additional information.

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-24 (and all revisions thereto), Ashless Dispersant Oil: This oil **must be used** after first 50 hours or oil consumption has stabilized.

Recommended Viscosity for Temperature Range:
All temperatures, use SAE 20W-50 or
Above 4°C (40°F), use SAE 50
Below 4°C (40°F), use SAE 30

NOTE

Multi-viscosity oil with a range of SAE 20W-50 is recommended for improved starting and turbocharger controller operation in cold weather.

Oil Capacity:
Sump: 10 Quarts.
Total: 11 Quarts (with oil filter).

MAXIMUM CERTIFICATED WEIGHTS

Ramp: 4016 lbs.
Takeoff: 4000 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 wheel well (Station 110 to 124): 50 lbs.
Baggage - On and aft of wheel well (Station 110 to 152): 200 lbs.

NOTE

The maximum allowable combined weight capacity for baggage forward, on and aft of the wheel well is 240 pounds.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Turbo Centurion: 2221 lbs.
Turbo Centurion II: 2286 lbs.
Maximum Useful Load, Turbo Centurion: 1795 lbs.
Turbo Centurion II: 1730 lbs.

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: 22.9 lbs./sq. ft.
Power Loading: 12.9 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	**Manuevering Speed** is the maximum speed at which you may use abrupt control travel.

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	198	203	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:			
	4000 Pounds	129	130	Do not make full or abrupt control movements above this speed.
	3350 Pounds	118	119	
	2700 Pounds	105	106	
V_{FE}	Maximum Flap Extended Speed:			
	To 10° Flaps	158	160	Do not exceed these speeds with the given flap settings.
	10° - 20° Flaps	130	130	
	20° - 30° Flaps	116	115	
V_{LO}	Maximum Landing Gear Operating Speed	163	165	Do not extend or retract landing gear above this speed.
V_{LE}	Maximum Landing Gear Extended Speed	198	203	Do not exceed this speed with landing gear extended.
	Maximum Window Open Speed	198	203	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	58 - 115	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	74 - 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 - 203	Operations must be conducted with caution and only in smooth air.
Red Line	203	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.
Engine Model Number: TSIO-520-R.
Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Power, 5 Minutes - Takeoff: 310 BHP rating.
Continuous: 285 BHP rating.
Maximum Engine Speed, 5 Minutes - Takeoff: 2700 RPM.
Continuous: 2600 RPM.
Maximum Manifold Pressure, 5 Minutes - Takeoff: 36.5 inches Hg.
Continuous: 35 inches Hg.

NOTE

For manifold pressure limitations above 17,000 feet, refer to the Minimum Fuel Flows placard in this section.

Maximum Cylinder Head Temperature: 460°F (238°C).
Maximum Oil Temperature: 240°F (116°C).
Oil Pressure, Minimum: 10 psi.
Maximum: 100 psi.
Fuel Pressure, Minimum: 3.0 psi.
Maximum: 19.5 psi (186 lbs/hr).

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: D3A34C402/90DFA-10.
Propeller Diameter, Maximum: 80 inches.
Minimum: 78.5 inches.
Propeller Blade Angle at 30 Inch Station, Low: 12.4°.
High: 28.5°.
Propeller Operating Limits: Avoid continuous operation between 1850 and 2150 RPM above 24 inches manifold pressure.

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	WHITE ARC	RED LINE
	MINIMUM LIMIT	NORMAL OPERATING	CAUTION RANGE	NORMAL CLIMB RANGE	MAXIMUM LIMIT
Tachometer	---	2200 - 2500 RPM	2600 - 2700 RPM	---	2700 RPM
Manifold Pressure	---	15 - 30 in. Hg	35 - 36.5 in. Hg	---	36.5 in. Hg
Oil Temperature	---	100°- 240°F	---	---	240°F
Cylinder Head Temperature	---	200° - 460°F	---	---	460°F
Fuel Flow (Pressure)	(3.0 psi)	36 - 120 lbs/hr	---	120 - 162 lbs/hr	186 lbs/hr (19.5 psi)
Oil Pressure	10 psi	30 - 60 psi	---	---	100 psi
Fuel Quantity	E (.5 Gal Unusable Each Tank)	---	---	---	---
Suction	---	4.6 - 5.4 in. Hg	---	---	---

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

Maximum Ramp Weight: 4016 lbs.
Maximum Takeoff Weight: 4000 lbs.
Maximum Landing Weight: 3800 lbs.
Maximum Weight in Baggage Compartment:
  Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110): 120 lbs.
  Baggage - On wheel well (Station 110 to 124): 50 lbs.
  Baggage - On and aft of wheel well (Station 110 to 152): 200 lbs.

NOTE

The maximum allowable combined weight capacity for baggage forward, on and aft of the wheel well is 240 pounds.

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 43.9 inches aft of datum at 4000 lbs.
  Aft: 52.0 inches aft of datum at 4000 lbs., with straight line variation to 53.0 inches aft of datum at 3800 lbs., and 53.0 inches aft of datum at 3800 lbs. or less.
Moment Change Due To Retracting Landing Gear: +2907 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.

Takeoff and land on fuller tank.

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

OTHER LIMITATIONS

FLAP LIMITATIONS

Approved Takeoff Range: 0° to 20°.
Approved Landing Range: 0° to 30°.

PLACARDS

The following information must be 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.)

> The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
>
> No acrobatic maneuvers, including spins, approved.
>
> 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 (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:

WHEN SWITCHING FROM DRY TANK, TURN AUXILIARY FUEL PUMP ON MOMENTARILY.

5. Aft of fuel tank caps:

SERVICE THIS AIRPLANE WITH 100LL/100 MIN AVIATION GRADE GASOLINE. TOTAL CAPACITY 45.0 GAL.

6. Forward of fuel tank caps:

CAPACITY 33.5 GALLONS TO
BOTTOM OF FILLER NECK EXTENSION.

7. On baggage compartment door:

MAXIMUM BAGGAGE 200 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 FWD.
3. PUMP VERTICALLY.

CAUTION:
DO NOT PUMP WITH
GEAR UP SELECTED

9. Near the engine power instruments:

MINIMUM FUEL FLOWS

T.O.: 2700 RPM
36.5 IN. MP., 186 LBS/HR

MAX. CONTINUOUS POWER: 2600 RPM

ALT-FT/1000	SL-17	18	20	22	24	26	28	30
MP. IN. HG	35	34	32	30	28	26	24	22
FUEL FLOW-LBS/HR	162	156	144	132	120	108	102	96

AVOID CONTINUOUS OPERATION BETWEEN 1850 AND 2150 RPM ABOVE 24 IN. M.P.

10. On flap control indicator:

0°- 10°	(Partial flap range with dark blue color code and 160 knot callout; also, mechanical detent at 10°.)
10°- 20°	(Indices at these positions with light blue color code and 130 knot callout; also, mechanical detent at 20°.)
20°- FULL	(Indices at these positions with white color code and 115 knot callout.)

11. On inside nose wheel doors:

WARNING

BEFORE WORKING IN WHEEL WELL AREA PULL HYDRAULIC PUMP CIRCUIT BREAKER OFF.

12. Near landing gear lever:

MAX SPEED IAS
GEAR OPER 165 KTS
GEAR DOWN 203 KTS

13. A calibration card is provided to indicate the accuracy of the magnetic compass in 30° increments.

14. On oil filler cap:

OIL
10 QTS

15. Near airspeed indicator:

MANEUVER SPEED
130 KIAS

16. On nose gear strut:

WARNING

RELEASE AIR AND FLUID PRESSURE BEFORE REMOVING ANY PART OF THIS ASSEMBLY.

17. In full view of the pilot:

MAJOR FUEL FLOW FLUCTUATIONS/POWER SURGES
1. AUX FUEL PUMP - ON, ADJUST MIXTURE.
2. SELECT OPPOSITE TANK.
3. WHEN FUEL FLOW STEADY, RESUME NORMAL OPERATIONS.
SEE P.O.H. FOR EXPANDED INSTRUCTIONS.

18. Forward of each fuel tank filler cap in line with fwd arrow.

FUEL CAP FWD ▲ ARROW ALIGNMENT
CAP MUST NOT ROTATE DURING CLOSING

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 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:	
4000 Lbs	130 KIAS
3350 Lbs	119 KIAS
2700 Lbs	106 KIAS
Maximum Glide:	
4000 Lbs	88 KIAS
3350 Lbs	80 KIAS
2700 Lbs	72 KIAS
Precautionary Landing With Engine Power, Flaps Down	75 KIAS
Landing Without Engine Power:	
Wing Flaps Up	90 KIAS
Wing Flaps Down	80 KIAS
Emergency Descent:	
Smooth Air	203 KIAS
Rough Air:	
4000 Lbs	130 KIAS
3350 Lbs	119 KIAS
2700 Lbs	106 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 (RESTART PROCEDURES)

1. Airspeed -- 85 KIAS.
2. Auxiliary Fuel Pump -- ON.
3. Fuel Selector Valve -- OPPOSITE TANK (if it contains fuel).
4. Throttle -- HALF OPEN.
5. Auxiliary Fuel Pump -- OFF.

NOTE

If the fuel flow indication immediately drops to zero, signifying an engine-driven fuel pump failure, return the auxiliary fuel pump switch to ON.

6. Mixture -- LEAN from full rich until restart occurs.

NOTE

If propeller is windmilling, engine will restart automatically within a few seconds. If propeller has stopped (possible at low speeds), turn ignition switch to START, advance throttle slowly from idle, and (at higher altitudes) lean the mixture from full rich

7. Mixture -- ADJUST as required as power is restored.
8. Throttle -- ADJUST power as required.
9. Fuel Selector Valve -- AS DESIRED after fuel flow is stabilized.

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. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
8. Master Switch -- OFF when landing is assured.
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. 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. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
9. Avionics Power and Master Switches -- OFF when landing is assured.
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 and SQUAWK 7700 if transponder is installed.
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 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 Emergency Landing Without Engine Power).

ELECTRICAL FIRE IN FLIGHT

1. Master Switch -- OFF.
2. Standby Generator Switch (if installed) -- OFF.
3. Avionics Power Switch -- OFF.
4. All Other Switches (except ignition switch) -- OFF.
5. Vents/Cabin Air/Heat -- CLOSED.
6. 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:

7. Master Switch -- ON.
8. Circuit Breakers -- CHECK for faulty circuit; do not reset.
9. Radio Switches -- OFF.
10. Avionics Power Switch -- ON.
11. Radio and Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.
12. 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.
4. Radar (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 and defrost controls full out 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 the 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 up to 10 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 5 knots faster and approach 7 knots faster than normal or consult appropriate table in Section 5.
3. Altitude -- Cruise 160 feet higher and approach 70 feet higher than normal.

EXCESSIVE FUEL VAPOR

FUEL FLOW STABILIZATION PROCEDURES
(If Fuel Flow Fluctuations Of 5 Lbs/Hr Or More Or Power Surges Occur)

1. Auxiliary Fuel Pump -- ON.

2. Mixture -- RESET as required.
3. Fuel Selector Valve -- SELECT OPPOSITE TANK if vapor symptoms continue.

NOTE

If the opposite tank cannot be used because of a lack of fuel, then retarding the throttle quickly to 10 inches or less of manifold pressure for 30 seconds will also aid in eliminating vapor in the system. To restore power, switch auxiliary fuel pump OFF, advance the throttle (slowly at higher altitudes) and adjust the mixture as required to aid power restoration.

4. Auxiliary Fuel Pump -- OFF after fuel flow has stabilized.
5. Mixture -- RESET as required.
6. Fuel Selector Valve -- AS DESIRED after fuel flow has stabilized for one minute, provided there is fuel in the other tank.

LANDING GEAR MALFUNCTION PROCEDURES

LANDING GEAR FAILS TO RETRACT

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

LANDING GEAR FAILS TO EXTEND

1. Landing Gear Lever -- DOWN.
2. Emergency Hand Pump -- EXTEND HANDLE, and PUMP (perpendicular to handle until resistance becomes heavy -- about 35 cycles).
3. Gear Down Light -- ON.
4. Pump Handle -- STOW.

GEAR UP LANDING

1. Landing Gear Lever -- 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. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
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. Movable 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. Cabin Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
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

5. Airspeed -- 75 KIAS.
6. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
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. Movable 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. Cabin Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
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

AMMETER SHOWS EXCESSIVE RATE OF CHARGE (Full Scale Deflection)

1. Alternator -- OFF.
2. Alternator Circuit Breaker -- PULL.
3. Standby Generator Switch (if installed) -- ON.
4. Nonessential Electrical Equipment -- OFF.
5. Flight -- TERMINATE as soon as practical.

LOW-VOLTAGE LIGHT ILLUMINATES DURING FLIGHT (Ammeter Indicates Discharge)

NOTE

Illumination of the low-voltage light may occur during low RPM conditions with an electrical load on the system such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system.

1. Avionics Power Switch -- OFF.
2. Alternator Circuit Breaker -- CHECK IN.
3. Master Switch -- OFF (both sides).
4. Master Switch -- ON.
5. Low-Voltage Light -- CHECK OFF.
6. Avionics Power Switch -- ON.

If low-voltage light illuminates again:

7. Alternator -- OFF.
8. Standby Generator Switch (if installed) -- ON.
9. Nonessential Radio and Electrical Equipment -- OFF.
10. Flight -- TERMINATE as soon as practical.

EMERGENCY DESCENT PROCEDURES

SMOOTH AIR

1. Seat Belts and Shoulder Harnesses -- SECURE.

2. **Throttle -- IDLE.**
3. **Propeller -- HIGH RPM.**
4. **Mixture -- FULL RICH**
5. **Landing Gear -- EXTEND.**
6. **Wing Flaps -- UP.**
7. **Airspeed:**
    a. **During landing gear extension -- 165 KIAS.**
    b. **After landing gear is fully extended -- 203 KIAS.**

ROUGH AIR

1. **Seat Belts and Shoulder Harnesses -- SECURE.**
2. **Throttle -- IDLE.**
3. **Propeller -- HIGH RPM.**
4. **Mixture -- FULL RICH.**
5. **Landing Gear -- EXTEND.**
6. **Wing Flaps -- UP.**
7. **Weights and Airspeeds:**
    4000 Lbs -- 130 KIAS.
    3350 Lbs -- 119 KIAS.
    2700 Lbs -- 106 KIAS

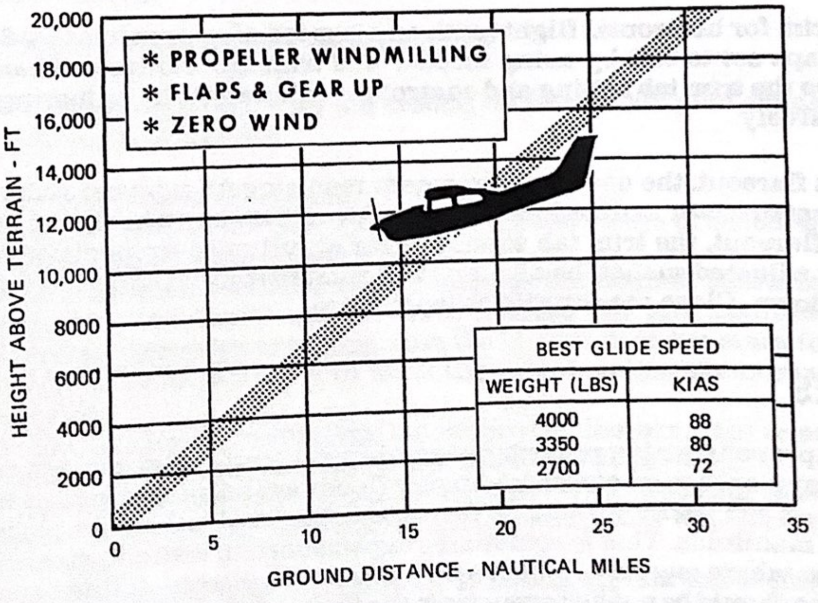
AMPLIFIED PROCEDURES

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 after 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.



BEST GLIDE SPEED

WEIGHT (LBS)	KIAS
4000	88
3350	80
2700	72

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 under the Emergency Landing Without Engine Power checklist.

Before attempting an "off airport" landing with engine power available, one should fly over 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 and squawk 7700 if a transponder is installed. Avoid a landing flare because of difficulty in judging height over a water surface.

In a forced landing situation, do not turn off the avionics power and master switches until a landing is assured. Premature deactivation of the switches will disable the encoding altimeter and airplane electrical systems.

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 involving the excessive use of auxiliary fuel pump operation can cause engine flooding and subsequent collection of fuel on the parking ramp as the excess fuel drains overboard from the intake manifolds. This is sometimes experienced in difficult starts in cold weather where engine pre-heat service is not available. If this occurs, the airplane should be pushed away from the fuel puddle before another engine start is attempted. Otherwise, there is a possibility of raw fuel accumulations in the exhaust system igniting during an engine start, causing a long flame from the tailpipe, and possibly igniting the collected fuel on the pavement. If a fire occurs, proceed according to the 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 complete vacuum system failure during flight, 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. If an autopilot is installed, it too can be affected and should be turned off. Refer to Section 9, Supplements, for additional details concerning autopilot operation. 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 compass heading.
2. Note the time of the minute hand and observe the position of the sweep second hand on the clock.
3. 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.
4. Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
5. If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
6. Maintain altitude and airspeed by cautious application of elevator control. Avoid overcontrolling by keeping 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 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.
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 control wheel back pressure to slowly reduce the 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.

INADVERTENT FLIGHT INTO 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 vertical speed) are suspected, the alternate static source valve should be pulled on, thereby supplying static pressure to these instruments from the cabin.

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 10 knots and 160 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 18 knots and 130 feet occur near stall (reads low) and up to 14 knots and 220 feet at maximum cruise (reads high). During approach, typical variations are 3 knots and 30 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 alternate static source airspeed calibration 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 all obstacles. Upon reaching a safe altitude, reduce the power settings to give cruise power. Then release the HI side of the switch, allowing the right side of the switch to remain in the ON position for level flight.

This ON position provides a reduced fuel flow which results in lean mixtures at two portions of the manifold pressure range. For example, at 2500 RPM excessively lean mixtures with resulting roughness and/or power drop off are experienced at approximately 22 inches (just before the throttle switch activates) and again at 28 or more inches of manifold pressure.

To avoid these areas of rough engine operation. select 2200 RPM and sufficient manifold pressure within the green arc range for the flight condition at hand. If more power is required, use progressively more RPM and select a manifold pressure where smooth engine operation and normal airspeed can be obtained.

The landing approach should be planned so that approximately 15 inches of manifold pressure can be used. If the throttle is brought back to idle position, the mixture becomes very rich. This could cause a sluggish power response if the throttle had to be advanced rapidly during landing.

EXCESSIVE FUEL VAPOR INDICATIONS

Excessive fuel vapor indications are most likely to appear during climb and the first hour of cruise on each tank, especially when operating at higher altitudes or in unusually warm temperatures.

Indications of excessive fuel vapor accumulation are fuel flow gage fluctuations greater than 5 lbs/hr. This condition with leaner mixtures or with larger fluctuations may result in power surges, and if not corrected, may cause power loss.

To eliminate vapor and stabilize fuel flows, turn the auxiliary fuel pump on and reset the mixture as required. If vapor symptoms persist, select the opposite fuel tank. When fuel flows stabilize, turn off the auxiliary fuel pump and reset the mixture as desired.

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 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

Normal landing gear retraction time is approximately 8 seconds. 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 lever in the GEAR DOWN position. When the GEAR DOWN light illuminates, reposition the gear lever 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 lever retraction 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. Intermittent gear motor operation may also be detected by momentary fluctuations of the ammeter needle.

EXTENSION MALFUNCTIONS

Normal landing gear extension time is approximately 6 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. The landing gear lever must be in the down position with the detent engaged. If efforts to extend and lock

Electronic components in the electrical system could be adversely affected by higher than normal voltage. The alternator control unit includes an over-voltage sensor which normally will automatically shut down the alternator if the charge voltage reaches approximately 31.5 volts. If the over-voltage sensor malfunctions or is improperly adjusted, as evidenced by an excessive rate of charge shown on the ammeter, the alternator should be turned off, the alternator circuit breaker pulled, nonessential electrical equipment turned off and the flight terminated as soon as practical. If the standby generator is installed, it should be turned on for the remainder of the flight.

INSUFFICIENT RATE OF CHARGE

NOTE

> Illumination of the low-voltage light and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system.

If the over-voltage sensor should shut down the alternator or if the alternator circuit breaker should trip, a discharge rate will be shown on the ammeter followed by illumination of the low-voltage warning light. Since this may be a "nuisance" trip-out, an attempt should be made to reactivate the alternator system. To do this, turn the avionics power switch off, check that the alternator circuit breaker is in, then 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 low-voltage light will go off. The avionics power switch may then be turned back on. If the light illuminates 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 standby generator is installed, it should be turned on for the remainder of the flight. In any case, battery power must be conserved for later operation of the landing gear and wing flaps and, if the emergency occurs at night, for possible use of the landing lights during landing.

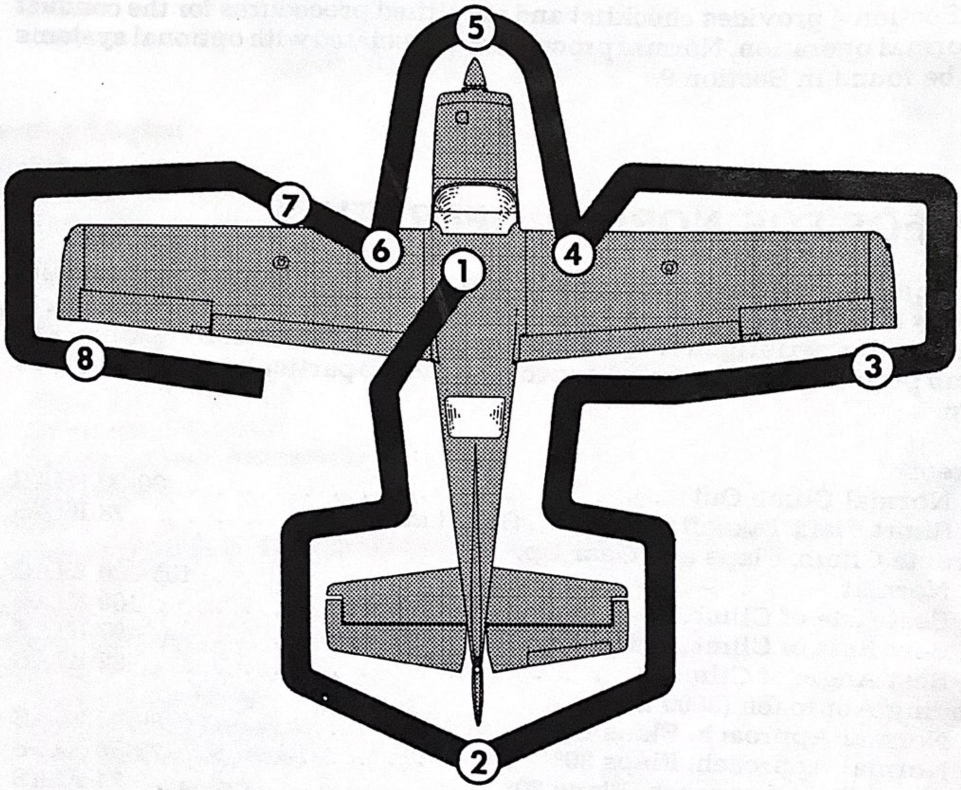
INTRODUCTION

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 4000 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	78 KIAS
Enroute Climb, Flaps and Gear Up:	
Normal	105-120 KIAS
Best Rate of Climb, Sea Level to 17,000 Feet	100 KIAS
Best Rate of Climb, 24,000 Feet	97 KIAS
Best Angle of Climb	82 KIAS
Landing Approach (3800 Lbs):	
Normal Approach, Flaps Up	80-90 KIAS
Normal Approach, Flaps 30°	70-80 KIAS
Short Field Approach, Flaps 30°	74 KIAS
Balked Landing (3800 Lbs):	
Maximum Power, Flaps 20°	70 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
4000 Lbs	130 KIAS
3350 Lbs	119 KIAS
2700 Lbs	106 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. Prior to flight, check that pitot heater (if installed) is warm to touch within 30 seconds with battery and pitot heat switches on. 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. Pilot's Operating Handbook -- AVAILABLE IN THE AIRPLANE.
2. Landing Gear Lever -- DOWN.
3. Control Wheel Lock -- REMOVE.
4. Ignition Switch -- OFF.
5. Radar (if installed) -- OFF.
6. Avionics Power Switch -- OFF.
7. Standby Generator Switch (if installed) -- OFF.
8. Master Switch -- ON.

WARNING

When turning on the master switch, using an external power source, or pulling the propeller through by hand, treat the propeller as if the ignition switch were on. Do not stand, nor allow anyone else to stand, within the arc of the propeller, since a loose or broken wire, or a component malfunction, could cause the propeller to rotate.

9. Fuel Quantity Indicators -- CHECK QUANTITY.
10. Fuel Selector Valve -- ON fuller tank.
11. Master Switch -- OFF.
12. Oxygen Supply Pressure (if installed) -- CHECK.
13. Oxygen Masks (if installed) -- AVAILABLE.
14. Trim Controls -- NEUTRAL.
15. Suction Gage Warning Buttons (if installed) -- CHECK both extended .
16. Static Pressure Alternate Source Valve -- OFF.
17. Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
18. 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. Aileron Gap Seal -- CHECK security and fit.
3. 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. Retractable Cabin Step (if installed) -- CHECK for security and cleanliness, and retraction well for cleanliness.
4. Before first flight of the 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.
7. Radome (if weather radar is installed) -- CHECK for condition and security.

⑤ NOSE

1. Propeller and Spinner -- CHECK for nicks, security and oil leaks.
2. Air Inlets -- CHECK, engine induction air (right) and heater air (left) and oil cooler air (left, if air conditioner is installed) for restrictions.
3. Landing and Taxi Lights -- CHECK for condition and cleanliness.
4. Nose Gear Doors -- CHECK for security.
5. Nose Wheel Strut and Tire -- CHECK for proper inflation.
6. Nose Tie-Down -- DISCONNECT.
7. Engine Oil Level -- CHECK, do not operate with less than seven quarts. Fill to 10 quarts for extended flight.
8. Before first flight of the day and after each refueling, pull out strainer drain knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, 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 the 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.
3. Aileron Gap Seal -- CHECK security and fit.

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 and Radar (if installed) -- OFF.

CAUTION

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

6. Landing Gear Lever -- 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 or three revolutions. If it does not continue running, start again at step 3 above. 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.
13. Low-Voltage Light -- OFF (at approximately 800 RPM).
14. Flashing Beacon and Navigation Lights -- ON as required.
15. Avionics Power Switch -- ON.
16. Radios -- ON.

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.
8. Auxiliary Fuel Pump Switch -- OFF.
9. Elevator and Rudder Trim -- TAKEOFF.
10. 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 and low-vacuum warning buttons retracted (if installed).
11. Throttle -- 1000 RPM.
12. Radios -- SET.
13. Autopilot (if installed) -- OFF.
14. Air Conditioner (if installed) -- OFF.
15. Strobe Lights -- ON as desired.
16. Throttle Friction Lock -- ADJUST.
17. Parking Brake - RELEASE.

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps -- 0°- 10° (10° preferred).

2. Power -- 36.5 INCHES Hg and 2700 RPM (5 minute limitation).
3. Mixture -- ADJUST to 186 lbs/hr.
4. Elevator Control -- LIFT NOSE WHEEL at 65 to 70 KIAS.

NOTE

When the nose wheel is lifted, the gear motor may run 2-3 seconds to restore hydraulic pressure.

5. Climb Speed -- 80-90 KIAS.
6. Brakes -- APPLY momentarily when airborne.
7. Landing Gear -- RETRACT in climb out.
8. Wing Flaps -- RETRACT after reaching 85 KIAS.

SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Brakes -- APPLY.
3. Power -- 36.5 INCHES Hg and 2700 RPM (5 minute limitation).
4. Mixture -- ADJUST to 186 lbs/hr.
5. Brakes -- RELEASE.
6. Elevator Control -- LIFT NOSE WHEEL AT 65 KIAS.
7. Climb Speed -- 78 KIAS until all obstacles are cleared.
8. Landing Gear -- RETRACT after obstacles are cleared.
9. Wing Flaps -- RETRACT after reaching 85 KIAS.

NOTE

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

ENROUTE CLIMB

NORMAL CLIMB

1. Airspeed -- 105-120 KIAS.
2. Power -- 30 INCHES Hg and 2500 RPM.
3. Mixture -- LEAN to 120 lbs/hr.

NOTE

On hot days, it may be necessary to utilize the auxiliary fuel pump to maintain 120 lbs/hr fuel flow.

4. Cowl Flaps -- OPEN as required (full open on warm days).

NOTE

On hot days, turn on auxiliary fuel pump momentarily if switching tanks in climb.

MAXIMUM PERFORMANCE CLIMB

1. Airspeed -- 100 KIAS.
2. Power -- 35 INCHES Hg and 2600 RPM.
3. Mixture -- ADJUST to 162 lbs/ hr.

NOTE

See power and fuel flow placard for maximum continuous power manifold pressure and fuel flow above 17,000 feet. Refer to Section 5 for airspeed above 17,000 feet.

NOTE

On hot days at higher altitudes, be alert for fuel vapor indications. If fuel flow fluctuations are observed or if desired fuel flows cannot be maintained, turn the auxiliary fuel pump ON and reset the mixture as required. If symptoms persist, select the opposite fuel tank.

4. Cowl Flaps -- FULL OPEN.

NOTE

On hot days, turn auxiliary fuel pump ON momentarily if switching tanks in climb.

CRUISE

1. Power -- 15-30 INCHES Hg, 2200-2500 RPM.
2. Elevator and Rudder Trim -- ADJUST.
3. Mixture -- LEAN for cruise fuel flow using the EGT gage (if installed), a Cessna Power Computer, or the data in Section 5.

NOTE

In hot weather at high altitudes, be alert for fuel vapor indications. If fuel flow fluctuations or an unexplained drop in fuel flow are observed, place the auxiliary fuel pump switch in the ON position and reset mixture control as desired. If vapor symptoms persist, select the opposite fuel tank. When fuel flows remain steady, the auxiliary fuel pump may be turned off and the mixture reset as desired.

4. Cowl Flaps -- CLOSED (open as required on hot days or at high altitude).

NOTE

On hot days, turn auxiliary fuel pump ON momentarily if switching tanks within first 30 minutes of cruise.

DESCENT

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

BEFORE LANDING

1. Seats, Belts, Shoulder Harnesses -- SECURE.
2. Fuel Selector Valve -- FULLER TANK.
3. Landing Gear -- EXTEND (below 165 KIAS).
4. Landing Gear -- CHECK (observe main gear down and green indicator light on).
5. Auxiliary Fuel Pump -- OFF.
6. Mixture -- RICH.
7. Propeller -- HIGH RPM.
8. Wing Flaps -- AS DESIRED (0° to 10° below 160 KIAS, 10° to 20° below 130 KIAS, and 20° to 30 ° below 115 KIAS).
9. Autopilot (if installed) -- OFF.
10. Elevator Trim -- ADJUST.
11. Air Conditioner (if installed) -- OFF.

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 -- 74 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 -- 36.5 INCHES Hg and 2700 RPM.
2. Wing Flaps -- RETRACT to 20° (immediately).
3. Climb Speed -- 70 KIAS (until obstacles are cleared).
4. Wing Flaps -- RETRACT SLOWLY (after reaching safe altitude and 75 KIAS).
5. Cowl Flaps -- OPEN.

AFTER LANDING

1. Wing Flaps -- RETRACT.
2. Cowl Flaps -- OPEN.
3. Radar (if installed) -- OFF.

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.

AMPLIFIED PROCEDURES

STARTING ENGINE

Proper fuel management and throttle adjustments are the determining factors in securing an easy start from your turbocharged 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.

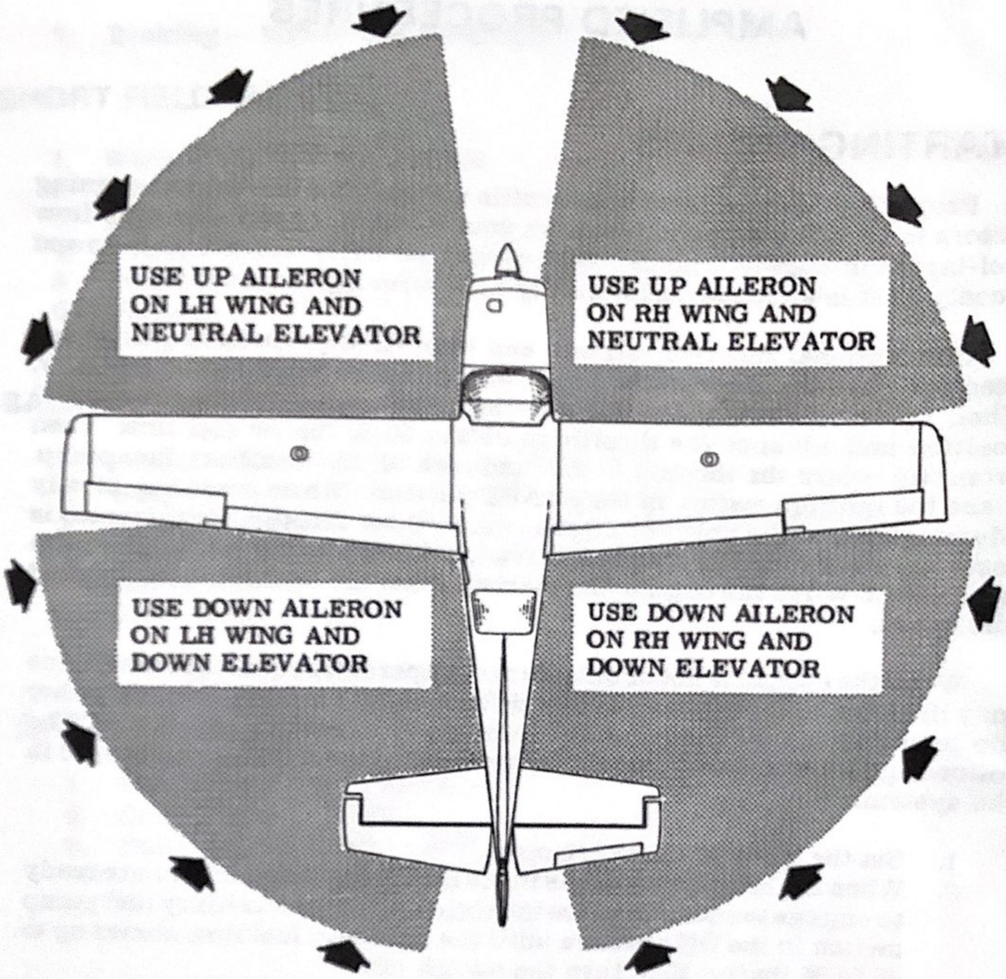
When the engine is hot or outside air temperatures are high, the engine may die after running several seconds because the mixture became either too lean due to fuel vapor, or too rich due to excessive prime fuel. The following procedure will prevent over-priming and alleviate fuel vapor in the system:

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 power 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 alternator control unit 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 runup (1700 RPM). The ammeter will remain within a needle width of the initial indication if the alternator and alternator control unit are operating properly.

TAKEOFF

POWER CHECK

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

Full power 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.

On the first flight of the day, when the throttle is advanced for takeoff, manifold pressure will normally exceed 36.5 inches Hg and fuel flows will exceed 186 lbs/hr if the throttle is opened fully. On any takeoff, the manifold pressure should be monitored and the throttle set to provide 36.5 inches Hg; then, for maximum engine power, the mixture should be adjusted during the initial takeoff roll to 186 lbs/hr. With a heat-soaked engine on a hot day, it may be necessary to use the auxiliary fuel pump to obtain the recommended takeoff fuel flow.

After the throttle is advanced to 36.5 inches Hg, adjust the throttle friction lock clockwise to prevent the throttle from creeping from a maximum power position. Similar friction lock adjustments should be made as required in other flight conditions to maintain a fixed throttle setting.

WING FLAP SETTINGS

For normal takeoffs, use of 10° flaps is preferred since it results in easier nose wheel lift-off and lower initial climb attitude, as well as a 10% reduction in ground run and total distance over an obstacle compared to takeoff with flaps up. Compared to 20° flaps, use of 10° flaps facilitates transition to normal climb without significantly increasing total takeoff distance over an obstacle.

The use of 20° flaps is reserved for minimum ground runs or takeoffs from soft or rough fields, since it will allow safe use of slower takeoff speeds, resulting in shortening the ground run approximately 10% compared to 10° flaps. However, most of the advantage is lost in the climb to the obstacle.

Flap settings greater than 20° 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 78 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.

Minimum ground run takeoffs are accomplished using 20° 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. If 20° of flaps are used on soft or rough fields with obstacles ahead, it is normally preferable to leave them extended rather than partially retract them in the climb to the obstacle. With 20° flaps, use an obstacle clearance speed of 74 KIAS. After clearing the obstacle, and reaching a safe altitude, the flaps may be retracted slowly as the airplane accelerates to the normal climb-out speed.

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. With the ailerons partially deflected into the wind, the airplane is accelerated to a speed higher than normal, and 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

Power settings for climb must be limited to 35 inches of manifold pressure and 2600 RPM up to 17,000 feet with decreasing manifold pressure above 17,000 feet as noted on the power and fuel flow placard.

A cruising climb at 30 inches of manifold pressure, 2500 RPM, 120 lbs/hr fuel flow, and 105 to 120 KIAS is normally recommended to provide an optimum combination of performance, visibility ahead, engine cooling, economy and passenger comfort (due to lower noise level). However, use of higher power may be desirable on hot days near maximum weight to increase climb performance. In this event, establish 2600 RPM and consult the power and fuel flow placard for manifold pressure and fuel flow setting combinations.

NOTE

> During warm weather, if there is an indication of vapor in the fuel system (fluctuating fuel flow) or if the desired fuel flow cannot be maintained with the mixture control in the full rich position, turn on the auxiliary fuel pump and reset the mixture as required until cruising altitude has been obtained and the system is purged (usually 5 to 15 minutes after establishing cruising flight). If vapor symptoms persist, select the opposite tank. When fuel flow remains steady, the auxiliary fuel pump may be turned off and the mixture reset as desired.

If it is necessary to climb rapidly to clear mountains or reach favorable winds or better weather at high altitudes, the best rate-of-climb speed should be used with maximum continuous power. This speed is 100 KIAS from sea level to 17,000 feet, decreasing to 97 KIAS at 24,000 feet.

If an obstruction dictates the use of a steep climb angle, climb with flaps retracted and maximum continuous power at 82 KIAS.

CRUISE

Normal cruising is performed between 60% and 80% of the maximum continuous power rating. The power settings and corresponding 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 70% to 80% 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 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).

	80% POWER		70% POWER		60% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
5000 Feet	171	9.8	162	10.6	150	11.4
10,000 Feet	180	10.3	169	11.0	156	11.8
15,000 Feet	188	10.7	176	11.5	162	12.3
20,000 Feet	196	11.2	183	12.0	167	12.7
Standard Conditions						Zero Wind

Figure 4-3. Cruise Performance Table

For best fuel economy at 70% 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 5% 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 for the most efficient use of either normal or alternate air, depending on the amount of filter blockage. Due to the lower intake pressure available through the alternate air valve or a partially blocked filter, manifold pressure can decrease up to 10 in. Hg from a cruise power setting. This pressure should be recovered by increased throttle setting or higher RPM as necessary to maintain the desired power. Maximum continuous manifold pressure (35 in. Hg) is available up to 14,000 feet under hot day conditions using the alternate air source with a fully blocked filter.

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 approximately 80% 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 data in figure 4-4.

Continuous operation at peak EGT is authorized only at 70% power or less. This best economy mixture setting results in approximately 5% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilot's Operating Handbook and Power Computer)	50°F Rich of Peak EGT
BEST ECONOMY (70% Power or Less)	Peak EGT

Figure 4-4. EGT Table

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. Altitude loss during a stall recovery may be as much as 300 feet from a wings-level stall and even greater from a turning stall.

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

DESCENT

Descent should be initiated far enough in advance of estimated landing to allow a gradual rate of descent at cruising speed. Just prior to beginning the descent, check that the auxiliary fuel pump has been turned off. Descent should be at approximately 500 FPM for passenger comfort, using enough power to keep the engine warm. The optimum engine RPM in a descent is usually the lowest RPM in the green arc range that will allow cylinder head temperature to remain in the recommended operating range and provide smooth engine operation. If a steep descent is required, the landing gear can be extended at speeds as high as 165 KIAS after which the speed can be increased as desired in smooth air up to 203 KIAS.

The airplane is equipped with a specially marked altimeter to attract the pilot's attention and prevent misreading the altimeter. A striped warning segment on the face of the altimeter is exposed at all altitudes below 10,000 feet to indicate low altitude.

BEFORE LANDING

In view of the relatively low drag of the extended landing gear and the high allowable gear operating speed (165 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 15 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 74 KIAS with full flaps. After all approach obstacles are cleared, progressively reduce power. Maintain 74 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. After all obstacles are cleared and a safe altitude and airspeed are obtained, the wing flaps should 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.

For quick, smooth engine starts in very cold temperature, use six trokes of the manual primer (if installed) before cranking, with an additional one or two strokes as the engine starts.

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.

NOTE

> The waste gate controller will not respond quickly to variations in manifold pressure when oil temperature is near the lower limit of the green arc. Therefore, under these conditions, throttle motions should be made slowly and care should be exercised to prevent exceeding the 36.5 inches Hg manifold pressure limit. In addition, the fuel flow indications may exceed 186 lbs/hr on takeoff if the mixture isn't leaned to compensate.

The turbocharged engine installation has been designed such that a winterization kit is not required. With the cowl flaps fully closed, engine emperature will be normal (in the lower green arc range) in outside air temperatures as low as 20° to 30°C below standard. When colder surface

5
PERFORMANCE

temperatures are encountered, the normal air temperature inversion will result in warmer temperatures at cruise altitudes above 5000 feet.

If low altitude cruise in very cold temperatures results in engine temperature below the green arc, increasing cruise altitude or cruise power will increase engine temperature into the green arc. Cylinder head temperatures will increase approximately 50°F as cruise altitudes increase from 5000 to 24,000 feet.

During descent, observe engine temperatures closely and carry sufficient power to maintain them in the recommended green arc 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 judgment, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

The certificated noise level for the Model T210N at 4000 pounds maximum weight is 77.4 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

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 at the specified cruise 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	3950 Pounds
Usable fuel	534 Pounds
TAKEOFF CONDITIONS	
Field pressure altitude	3500 Feet
Temperature	24°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	4000 Feet

CRUISE CONDITIONS

Total distance	720 Nautical Miles
Pressure altitude	11,500 Feet
Temperature	8°C
Expected wind enroute	10 Knot Headwind

LANDING CONDITIONS

Field pressure altitude	3000 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 4000 pounds, pressure altitude of 4000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1920 Feet
Total distance to clear a 50-foot obstacle	3200 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 2 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	1920
Decrease in ground roll (1920 feet × 12%)	230
Corrected ground roll	1690 Feet
Total distance to clear a 50-foot obstacle, zero wind	3200
Decrease in total distance (3200 feet × 12%)	384
Corrected total distance to clear a 50-foot obstacle	2816 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. For this sample problem, a cruise power of approximately 70% will be used.

The cruise performance chart for 12,000 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 2300 RPM and 30 inches of manifold pressure which results in the following:

Power	70%
True airspeed	174 Knots
Cruise fuel flow	91 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, the time, fuel, and distance to climb may be determined from figure 5-6 for a normal climb using the data for 4000 pounds. The difference between the values shown in the table for 4000 feet and 12,000 feet results in the following:

Time	15 Minutes
Fuel	30 Pounds
Distance	30 Nautical Miles

The above 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 7°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:

$$\frac{16^\circ C}{7^\circ C} \times 10\% = 23\% \text{ Increase}$$

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

Fuel to climb, standard temperature	30
Increase due to non-standard temperature (30 × 23%)	7
Corrected fuel to climb	37 Pounds

Using a similar procedure for time and distance during a climb, the following results are obtained:

Time to climb	18 Minutes
Distance to climb	37 Nautical Miles

The distances shown on the climb chart are for zero wind. A correction for the effect of wind may be made as follows:

Distance with no wind	37
Decrease in distance due to wind (18/60 ×10 knot headwind)	3
Corrected Distance to Climb	34 Nautical Miles

The resultant cruise distance is:

Total distance	720
Climb distance	-34
Cruise distance	686 Nautical Miles

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

174
-10
164 Knots

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

$$\frac{686 \text{ Nautical Miles}}{164 \text{ Knots}} = 4.2 \text{ Hours}$$

The fuel required for cruise is:

$$4.2 \text{ hours} \times 91 \text{ pounds/hour} = 382 \text{ Pounds}$$

A 45-minute reserve requires:

$$\frac{45}{60} \times 91 \text{ pounds/hour} = 68 \text{ Pounds}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	16
Climb	37
Cruise	382
Reserve	68
Total fuel required	503 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 3000 feet pressure altitude and a temperature of 30°C are as follows:

Ground roll	900 Feet
Total distance to clear a 50-foot obstacle	1705 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.

DEMONSTRATED OPERATING TEMPERATURE

Satisfactory engine cooling has been demonstrated for this airplane with an outside air temperature 23°C above standard. This is not to be considered as an operating limitation. Reference should be made to Section 2 for engine operating limitations.

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

CONDITIONS:
4000 Pounds
Power required for level flight or maximum power during descent.

FLAPS UP								
KIAS	60	80	100	120	140	160	180	200
KCAS	60	80	99	119	139	158	177	196
FLAPS 10°								
KIAS	60	70	80	90	100	120	140	160
KCAS	60	70	80	90	99	119	138	158
FLAPS 20°								
KIAS	60	70	80	90	100	110	120	130
KCAS	63	72	81	91	100	110	120	130
FLAPS 30°								
KIAS	50	60	70	80	90	100	110	115
KCAS	59	66	74	82	91	100	111	116

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	59	83	105	127	148	170	192
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	60	73	85	96	107	128	147
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	110
ALTERNATE KIAS	60	69	78	87	98	109	122

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	58	81	103	126	147	168	189
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	58	70	82	92	104	125	145
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	110
ALTERNATE KIAS	57	66	75	84	95	105	117

WINDOWS OPEN

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	42	73	102	129	152	174	194
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	40	57	73	87	103	130	153
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	110
ALTERNATE KIAS	45	58	70	82	95	107	122

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

STALL SPEEDS

CONDITIONS:
Power Off
Gear Up or Down

NOTES:
1. Altitude loss during a stall recovery may be as much as 300 feet from a wings-level stall and even greater from a turning stall.
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
4000	UP	68	67	73	72	81	80	96	95
	10°	62	63	67	68	74	75	88	89
	20°	58	60	62	64	69	71	82	85
	30°	55	58	59	62	65	69	78	82

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
4000	UP	74	73	80	78	88	87	105	103
	10°	68	68	73	73	81	81	96	96
	20°	63	64	68	69	75	76	89	91
	30°	58	61	62	66	69	73	82	86

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE

MAXIMUM WEIGHT 4000 LBS

SHORT FIELD

CONDITIONS:
Flaps 10°
2700 RPM, 36.5 Inches Hg, and Mixture Set at 186 PPH Prior to Brake Release.
Cowl Flaps Open
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 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
4000	72	78	S.L.	1140	1885	1245	2065	1360	2265	1485	2490	1620	2755
			1000	1215	1995	1325	2185	1445	2400	1580	2650	1730	2930
			2000	1290	2115	1410	2320	1540	2555	1685	2820	1845	3125
			3000	1375	2245	1505	2465	1645	2715	1795	3000	1970	3340
			4000	1465	2380	1605	2620	1755	2890	1920	3200	2100	3570
			5000	1565	2530	1710	2790	1870	3080	2050	3420	2245	3820
			6000	1670	2695	1825	2970	2000	3285	2190	3655	2405	4095
			7000	1785	2865	1950	3165	2140	3510	2345	3915	2575	4400
			8000	1905	3055	2085	3380	2290	3755	2510	4195	2760	4735

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

TAKEOFF DISTANCE

3700 LBS AND 3400 LBS

SHORT FIELD

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

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
3700	69	75	S.L.	950	1565	1035	1705	1125	1865	1230	2045	1340	2245
			1000	1010	1655	1100	1805	1200	1975	1310	2170	1430	2385
			2000	1075	1750	1170	1915	1275	2095	1395	2300	1525	2535
			3000	1145	1855	1245	2030	1360	2225	1485	2445	1625	2700
			4000	1215	1965	1330	2155	1450	2365	1585	2605	1735	2880
			5000	1300	2085	1420	2290	1550	2515	1695	2775	1855	3070
			6000	1385	2215	1515	2435	1655	2675	1810	2955	1980	3280
			7000	1480	2355	1615	2590	1770	2855	1935	3155	2120	3510
			8000	1580	2505	1725	2760	1890	3045	2070	3370	2270	3755
3400	66	72	S.L.	780	1290	850	1405	925	1530	1010	1670	1100	1830
			1000	830	1365	905	1485	985	1620	1075	1770	1170	1940
			2000	885	1440	965	1570	1050	1715	1145	1875	1250	2060
			3000	940	1525	1025	1665	1120	1820	1220	1990	1330	2185
			4000	1000	1615	1095	1765	1190	1930	1300	2115	1420	2325
			5000	1070	1715	1165	1870	1270	2050	1390	2250	1515	2475
			6000	1140	1815	1245	1985	1355	2180	1480	2390	1620	2635
			7000	1215	1930	1325	2110	1450	2315	1585	2550	1730	2815
			8000	1300	2050	1415	2245	1550	2465	1695	2715	1855	3005

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

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Gear Up
2600 RPM
Cowl Flaps Open

PRESS ALT	MP	PPH
S.L. to 17,000	35	162
18,000	34	156
20,000	32	144
22,000	30	132
24,000	28	120

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
4000	S.L.	100	1170	1035	895	755
	4000	100	1080	940	800	655
	8000	100	980	840	695	555
	12,000	100	870	730	590	- - -
	16,000	100	740	605	470	- - -
	20,000	99	485	355	- - -	- - -
	24,000	97	190	70	- - -	- - -
3700	S.L.	99	1310	1165	1020	875
	4000	99	1215	1070	925	775
	8000	99	1115	965	815	670
	12,000	99	1000	855	710	- - -
	16,000	99	865	730	590	- - -
	20,000	97	600	470	- - -	- - -
	24,000	95	295	170	- - -	- - -
3400	S.L.	97	1465	1320	1165	1015
	4000	97	1370	1220	1065	910
	8000	97	1265	1110	955	795
	12,000	97	1150	995	845	- - -
	16,000	97	1010	865	725	- - -
	20,000	96	730	595	- - -	- - -
	24,000	94	405	275	- - -	- - -

Figure 5-5. Maximum Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Gear Up
2600 RPM
Cowl Flaps Open
Standard Temperature

PRESS ALT	MP	PPH
S.L. to 17,000	35	162
18,000	34	156
20,000	32	144
22,000	30	132
24,000	28	120

NOTES:

1. Add 16 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
4000	S.L.	100	930	0	0	0
	4000	100	890	4	12	7
	8000	100	845	9	24	16
	12,000	100	790	14	38	25
	16,000	100	720	19	52	36
	20,000	99	515	26	69	50
	24,000	97	270	37	92	74
3700	S.L.	99	1060	0	0	0
	4000	99	1020	4	10	6
	8000	99	975	8	21	13
	12,000	99	915	12	33	21
	16,000	99	845	17	45	30
	20,000	97	630	22	59	42
	24,000	95	370	30	77	60
3400	S.L.	97	1205	0	0	0
	4000	97	1165	3	9	5
	8000	97	1120	7	19	12
	12,000	97	1060	11	29	18
	16,000	97	985	15	39	26
	20,000	96	760	19	51	36
	24,000	94	485	26	65	50

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

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 110 KIAS

CONDITIONS:
Flaps Up
Gear Up
2500 RPM
30 Inches Hg
120 PPH Fuel Flow
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 16 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 7°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
4000	S.L.	605	0	0	0
	4000	570	7	14	13
	8000	530	14	28	27
	12,000	485	22	44	43
	16,000	430	31	62	63
	20,000	365	41	82	87
3700	S.L.	700	0	0	0
	4000	665	6	12	11
	8000	625	12	24	23
	12,000	580	19	37	37
	16,000	525	26	52	53
	20,000	460	34	68	72
3400	S.L.	810	0	0	0
	4000	775	5	10	9
	8000	735	10	21	20
	12,000	690	16	32	31
	16,000	635	22	44	45
	20,000	565	29	57	61

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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
2500	30	- - -	- - -	- - -	80	167	105	75	166	99
	28	78	161	102	74	161	96	69	160	91
	26	71	156	93	67	155	88	63	154	83
	24	64	149	84	60	148	80	57	146	75
	22	57	140	75	53	139	72	50	136	68
2400	30	80	163	105	76	163	99	71	162	93
	28	74	158	96	69	158	91	65	156	86
	26	67	152	88	63	151	83	59	149	78
	24	60	145	80	57	143	75	53	141	71
	22	54	137	72	51	135	68	48	132	65
2300	30	76	160	99	71	160	94	67	158	88
	28	70	155	92	66	154	87	62	152	82
	26	64	149	84	61	148	80	57	146	76
	24	58	142	77	55	140	73	51	138	69
	22	52	134	69	49	132	66	46	128	62
2200	30	72	157	95	68	156	89	64	154	84
	28	66	151	87	62	150	82	59	148	78
	26	60	145	79	57	143	75	53	141	71
	24	54	137	72	51	135	69	48	133	65
	22	48	129	66	46	127	62	43	123	59

Figure 5-7. Cruise Performance (Sheet 1 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
>
> For best fuel economy at 70% 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
2500	30	---	---	---	81	170	106	76	170	100
	28	79	165	103	74	165	97	70	164	91
	26	72	160	95	68	159	90	64	157	84
	24	65	153	86	62	151	81	58	149	77
	22	58	144	77	55	142	73	51	140	69
2400	30	80	166	105	76	166	99	71	165	93
	28	74	161	97	70	161	92	66	159	86
	26	68	155	89	64	154	84	60	152	79
	24	61	148	81	58	147	77	54	144	73
	22	55	140	73	52	138	70	49	135	66
2300	30	77	163	100	72	163	95	68	161	89
	28	71	158	93	67	158	88	63	156	83
	26	65	152	85	61	151	81	58	149	76
	24	59	145	78	55	143	74	52	141	70
	22	52	137	70	49	135	67	46	131	63
2200	30	73	160	95	68	159	90	64	157	84
	28	67	154	88	63	153	83	59	151	78
	26	61	148	80	57	146	76	54	144	72
	24	55	140	73	52	138	70	49	135	66
	22	49	132	67	46	129	63	44	126	60

Figure 5-7. Cruise Performance (Sheet 2 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy at 70% 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
2500	30	- - -	- - -	- - -	81	174	107	76	173	100
	28	79	169	104	75	168	98	70	167	92
	26	73	163	96	69	163	91	65	161	85
	24	67	157	88	63	155	83	59	153	78
	22	59	148	79	56	146	75	53	144	71
2400	30	81	169	106	76	170	100	72	168	94
	28	75	165	98	71	164	93	66	162	87
	26	69	159	90	65	158	85	61	155	80
	24	62	152	82	59	150	78	55	148	74
	22	56	144	75	53	142	71	50	139	67
2300	30	77	167	101	73	167	96	69	165	90
	28	72	162	94	68	161	89	64	159	84
	26	66	156	87	62	154	82	58	152	77
	24	60	149	79	56	147	75	53	144	71
	22	53	140	72	50	138	68	47	134	64
2200	30	73	163	96	69	162	90	65	160	85
	28	68	158	89	64	156	84	60	154	79
	26	62	151	82	58	149	77	55	147	73
	24	56	144	75	53	142	71	50	138	67
	22	50	135	68	47	132	64	44	128	61

Figure 5-7. Cruise Performance (Sheet 3 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 70% 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
2500	30	- - -	- - -	- - -	81	177	107	76	176	100
	28	80	172	105	75	172	99	71	170	93
	26	74	167	97	70	166	91	65	164	86
	24	68	160	89	64	159	84	60	156	79
	22	60	152	80	57	150	76	53	147	72
2400	30	81	173	106	76	173	100	72	171	94
	28	75	168	99	71	167	93	67	165	87
	26	69	162	91	65	161	86	61	158	81
	24	63	155	83	60	153	79	56	151	74
	22	57	147	76	54	145	72	51	142	68
2300	30	78	170	102	73	170	96	69	168	90
	28	72	165	95	68	164	90	64	162	84
	26	67	159	87	63	157	83	59	155	78
	24	60	152	80	57	150	76	54	147	72
	22	54	143	72	51	141	69	48	137	65
2200	30	73	166	96	69	165	91	65	163	86
	28	68	161	89	64	159	85	60	157	80
	26	63	154	82	59	152	78	55	150	74
	24	57	147	75	54	145	72	50	141	68
	22	51	138	69	48	135	65	45	131	62

Figure 5-7. Cruise Performance (Sheet 4 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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
2500	30	- - -	- - -	- - -	81	181	107	76	180	100
	28	80	176	105	76	175	99	71	173	93
	26	75	171	98	71	170	92	66	167	87
	24	69	164	90	65	162	85	61	160	80
	22	62	155	81	58	153	77	55	150	73
2400	30	81	177	107	77	176	101	72	175	94
	28	76	172	99	71	171	94	67	168	88
	26	70	166	92	66	164	87	62	162	82
	24	64	159	84	60	157	80	57	154	75
	22	58	151	77	55	149	73	51	145	69
2300	30	78	174	103	74	173	97	69	171	91
	28	73	169	96	69	168	90	65	165	85
	26	67	163	88	64	161	84	60	158	79
	24	61	155	81	58	153	77	54	150	73
	22	55	146	73	52	144	70	49	140	66
2200	30	74	170	97	70	169	92	66	166	86
	28	69	164	90	65	163	85	61	160	81
	26	63	158	84	60	156	79	56	153	75
	24	58	150	77	54	148	73	51	144	69
	22	52	141	70	49	138	66	46	134	63

Figure 5-7. Cruise Performance (Sheet 5 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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
2500	30	---	---	---	81	184	107	76	182	100
	28	80	179	105	76	178	99	71	176	93
	26	75	174	98	71	172	93	66	170	87
	24	69	167	90	65	165	85	61	163	81
	22	62	159	82	59	156	78	55	153	73
2400	30	81	180	107	77	179	101	72	177	94
	28	76	175	99	71	173	94	67	171	88
	26	70	169	92	66	167	87	62	164	82
	24	65	162	85	61	160	80	57	157	76
	22	59	154	78	55	152	74	52	148	70
2300	30	79	177	103	74	176	97	70	174	91
	28	73	172	96	69	171	91	65	168	85
	26	68	166	89	64	164	84	60	161	79
	24	62	158	82	58	156	77	55	153	73
	22	56	150	74	53	147	71	49	142	67
2200	28	69	167	91	65	166	86	61	163	81
	26	64	161	84	60	159	80	57	156	75
	24	58	153	77	55	151	73	52	147	70
	22	52	144	70	49	141	67	46	136	63
	20	46	133	63	44	129	60	41	123	57

Figure 5-7. Cruise Performance (Sheet 6 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 14,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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 -33°C			STANDARD TEMPERATURE -13°C			20°C ABOVE STANDARD TEMP 7°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	- - -	- - -	- - -	81	187	107	76	186	100
	28	80	182	105	76	181	99	71	179	93
	26	75	177	99	71	176	93	67	173	88
	24	70	170	91	66	169	86	62	166	81
	22	63	162	83	59	160	78	56	156	74
2400	30	82	184	107	77	183	101	72	181	95
	28	76	178	100	72	177	94	67	174	89
	26	71	172	93	67	170	88	63	167	83
	24	65	165	86	61	163	81	58	160	77
	22	60	157	79	56	155	75	53	151	71
2300	30	79	181	104	74	180	98	70	177	92
	28	74	176	97	70	174	92	66	172	86
	26	68	169	90	65	167	85	61	164	80
	24	63	162	83	59	159	78	55	156	74
	22	57	153	75	53	150	72	50	145	68
2200	28	70	171	92	66	169	87	62	166	82
	26	65	164	85	61	162	81	57	159	76
	24	59	157	78	56	154	74	52	150	70
	22	53	147	71	50	144	68	47	139	64
	20	47	136	64	45	132	61	42	126	58

Figure 5-7. Cruise Performance (Sheet 7 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 16,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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 -37°C			STANDARD TEMPERATURE -17°C			20°C ABOVE STANDARD TEMP 3°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	191	106	76	188	100
	28	80	186	105	76	184	99	71	182	93
	26	75	180	99	71	179	93	67	176	88
	24	70	173	91	66	171	86	62	168	81
	22	63	165	83	60	162	79	56	158	74
2400	30	81	187	107	77	186	101	72	183	94
	28	76	181	100	72	180	94	67	177	88
	26	71	175	93	67	173	88	63	170	83
	24	66	168	86	62	166	81	58	162	77
	22	60	160	79	57	157	75	53	153	71
2300	30	79	184	103	74	183	97	70	180	91
	28	74	179	97	70	177	92	66	174	86
	26	69	172	90	65	170	85	61	167	80
	24	63	165	83	59	162	79	56	158	74
	22	57	156	76	54	153	72	51	148	68
2200	28	70	174	92	66	172	87	62	169	82
	26	65	168	86	62	166	81	58	162	77
	24	60	160	79	56	157	75	53	153	71
	22	54	150	72	51	146	68	48	141	65
	20	48	139	65	45	134	62	42	128	59

Figure 5-7. Cruise Performance (Sheet 8 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 18,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
>
> For best fuel economy at 70% 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 -41°C			STANDARD TEMPERATURE -21°C			20°C ABOVE STANDARD TEMP -1°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	- - -	- - -	- - -	81	194	106	76	191	100
	28	80	189	105	76	187	99	71	185	93
	26	75	183	99	71	181	93	67	179	88
	24	70	176	91	66	174	86	62	171	81
	22	63	168	84	60	165	79	56	160	75
2400	30	81	190	107	77	189	101	72	186	94
	28	76	184	100	72	182	94	67	180	88
	26	71	178	93	67	176	88	63	173	83
	24	66	171	87	62	169	82	58	165	77
	22	61	164	80	57	160	76	54	156	72
2300	30	79	187	103	74	186	97	70	183	91
	28	74	182	97	70	180	91	65	177	86
	26	69	175	91	65	173	86	61	170	81
	24	64	168	84	60	165	79	56	161	75
	22	58	160	77	55	156	73	51	151	65
2200	26	66	171	87	62	169	82	58	165	77
	24	61	163	80	57	160	76	54	156	72
	22	55	153	73	51	149	69	48	144	66
	20	49	142	66	46	137	63	43	130	59

Figure 5-7. Cruise Performance (Sheet 9 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 20,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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 -45°C			STANDARD TEMPERATURE -25°C			20°C ABOVE STANDARD TEMP -5°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	197	105	76	194	99
	28	80	192	105	75	190	99	71	187	93
	26	75	186	98	71	184	93	66	181	87
	24	70	179	91	66	177	86	62	173	81
	22	64	170	84	60	167	79	56	162	75
2400	30	81	193	106	76	191	100	72	189	94
	28	76	187	100	72	185	94	67	182	88
	26	71	181	93	67	179	88	63	175	83
	24	66	174	87	62	171	82	58	167	77
	22	61	166	81	57	163	76	54	158	72
2300	28	74	184	97	69	182	91	65	179	86
	26	69	178	91	65	176	86	61	172	81
	24	64	171	84	60	168	80	57	163	75
	22	59	163	78	55	159	74	52	153	70
2200	24	61	167	81	58	163	76	54	158	72
	22	55	156	74	52	152	70	49	146	66
	20	49	144	67	46	139	63	44	131	60

Figure 5-7. Cruise Performance (Sheet 10 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 22,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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 -49°C			STANDARD TEMPERATURE -29°C			20°C ABOVE STANDARD TEMP -9°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	- - -	- - -	- - -	80	199	104	75	196	98
	28	80	195	104	75	193	98	70	190	92
	26	75	188	98	70	186	92	66	183	87
	24	69	181	91	65	178	86	61	174	81
	22	63	172	83	59	168	79	56	163	74
2400	30	80	195	105	75	193	99	71	190	93
	28	76	190	99	71	188	93	67	184	88
	26	71	183	93	67	181	87	62	176	82
	24	66	176	86	62	173	82	58	168	77
	22	61	168	80	57	164	76	54	158	72
2300	26	69	181	91	65	179	86	61	174	81
	24	65	174	85	61	171	80	57	166	76
	22	59	166	79	56	162	75	53	156	71
	20	54	156	73	51	151	69	48	145	65
2200	24	61	169	81	58	165	77	54	160	73
	22	56	159	74	52	154	70	49	147	67
	20	50	147	67	47	141	64	44	133	61

Figure 5-7. Cruise Performance (Sheet 11 of 12)

CRUISE PERFORMANCE

PRESSURE ALTITUDE 24,000 FEET

CONDITIONS:
4000 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% 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 -53°C			STANDARD TEMPERATURE -33°C			20°C ABOVE STANDARD TEMP -13°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	28	79	197	104	74	195	98	70	192	92
	26	74	191	97	70	188	91	65	184	86
	24	68	183	90	64	180	85	60	174	80
	22	62	173	82	59	169	78	55	163	74
2400	28	75	192	99	71	190	93	66	186	87
	26	70	185	92	66	182	87	62	177	82
	24	65	178	85	61	174	81	57	168	76
	22	60	169	79	57	165	75	53	158	71
2300	26	69	184	91	65	181	86	61	176	81
	24	65	177	85	61	174	81	57	168	76
	22	60	169	79	57	165	75	53	158	71
	20	55	160	74	52	155	70	49	147	66
2200	22	56	160	74	52	155	70	49	148	66
	20	50	148	68	47	142	64	44	133	61

Figure 5-7. Cruise Performance (Sheet 12 of 12)

RANGE PROFILE
45 MINUTES RESERVE
396 LBS. USABLE FUEL

CONDITIONS:
4000 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb and the distance during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

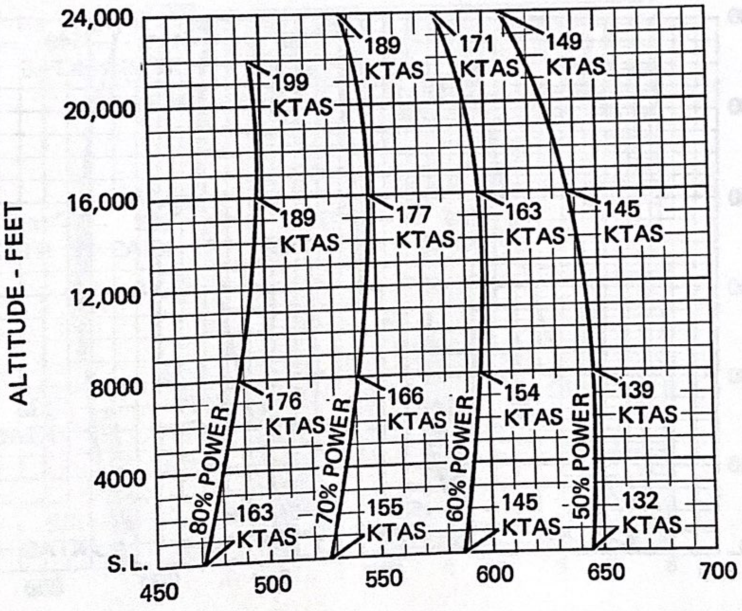


Figure 5-8. Range Profile (Sheet 1 of 2)

RANGE PROFILE
45 MINUTES RESERVE
534 LBS. USABLE FUEL

CONDITIONS:
4000 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb and the distance during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

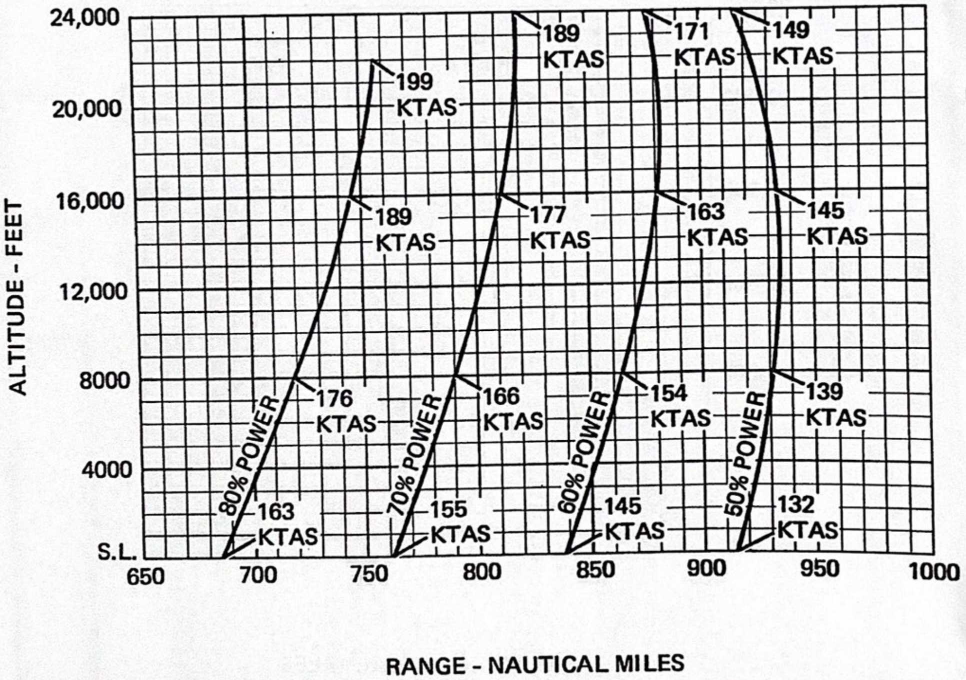


Figure 5-8. Range Profile (Sheet 2 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
396 LBS. USABLE FUEL

CONDITIONS:
4000 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb and the time during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

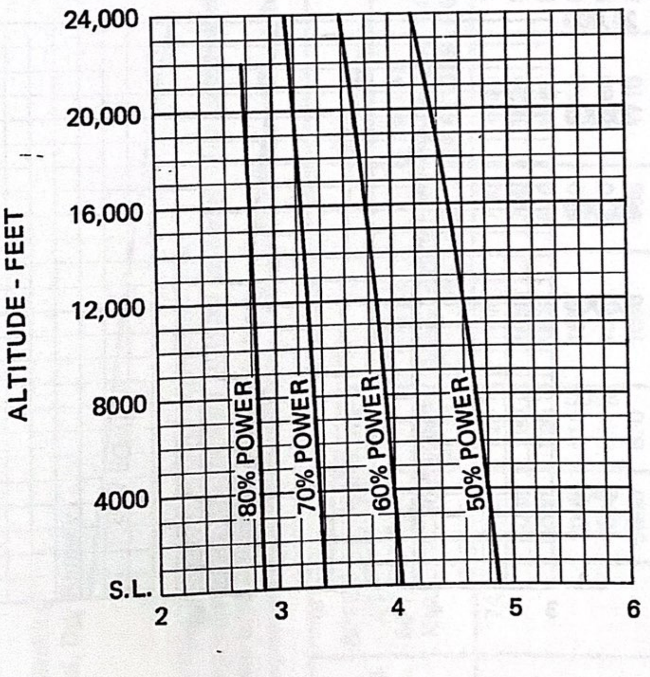


Figure 5-9. Endurance Profile (Sheet 1 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
534 LBS. USABLE FUEL

CONDITIONS:
4000 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb and the time during a normal climb up to 20,000 feet and maximum climb above 20,000 feet.

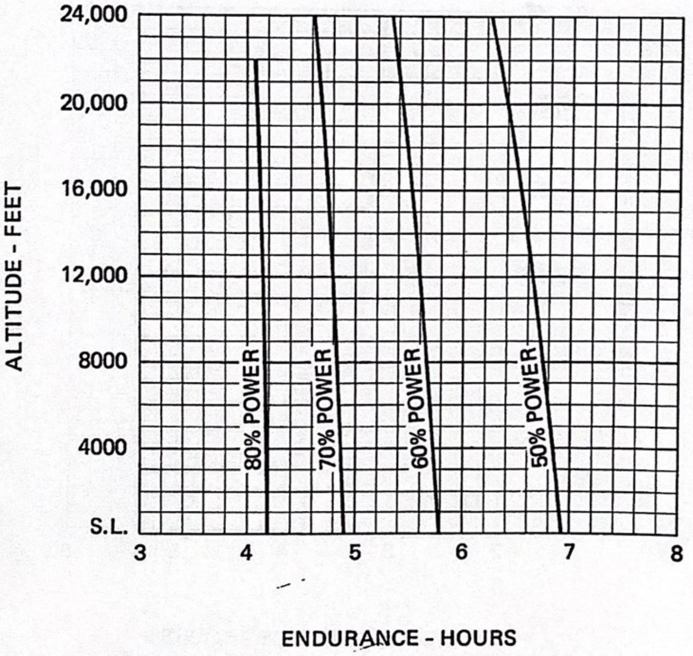


Figure 5-9. Endurance Profile (Sheet 2 of 2)

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	74	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

Aircraft Weight and Balance Revision

Tail Number: **2306D**

Date: 12/19/2019

Prepared by: Steven Gunlock
PAE Aviation and Technical Support Services, LLC
NAS Jacksonville, FL 32212

Work Order No: 2306D-2020-M-0001-0003

Type Certificate Data No:

Aircraft Make: Cessna

Model: T-210N

Serial No: 210-63828

Time:

Registered Owner: Customs and Border Protection

Address: (On File)

Maximum Weight **3800**

CG Range FWD **37.0** AFT **53.0**

	Useful Load:	**EW:**	**EWCG:**	**Moment:**
As Received; Date of Previous Weight and Balance: 12/19/2019	1232	2540.02	45.27	114994.14

Notes:

	Weight	**Arm**	**Moment**
Removed RT-5000 No.1 (P25)	-18.00	173.4	-3121.20
Removed RT-5000 No. 2 (P25)	-18	144.2	-2595.60
Removed Narco ELT-910	-4.3	161	-692.30
Removed Naco ELT-910 Antenna	-.5	106.00	-53.00
			0.00
			0.00
			0.00
			0.00
			0.00
			0.00

☒ As Calculated

☐ As Weighed

Moment 108532.04

Weight 2499.22

New Empty Weight CG

43.43

New Useful Load

1272.80

Signature Steve Gunlock

CRS 3 INSP RX8R084N

Repair Agency or License No: RX8R084N

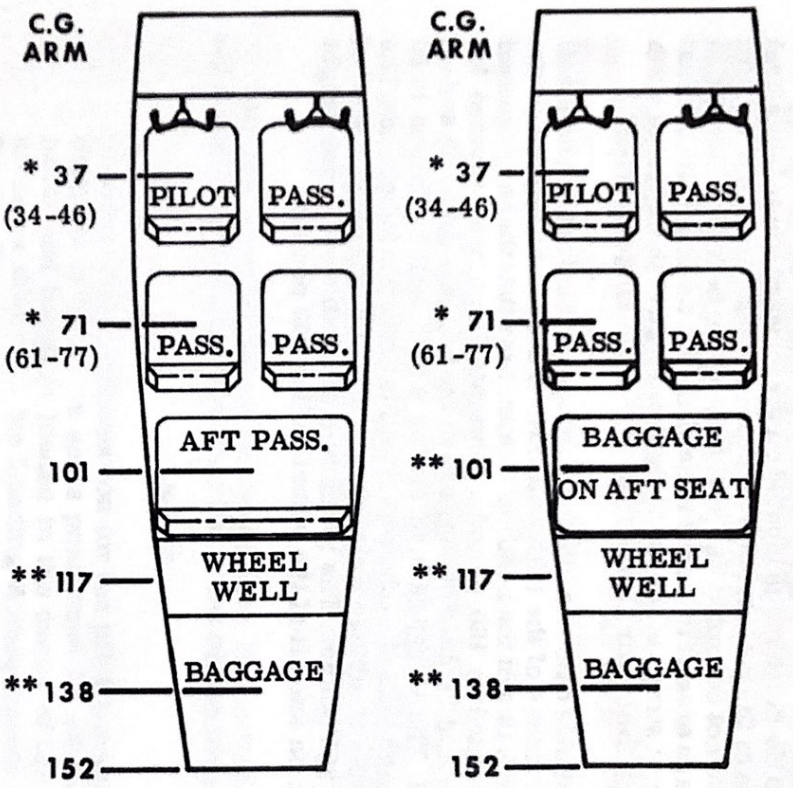
LOADING ARRANGEMENTS

* 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.

NOTES:

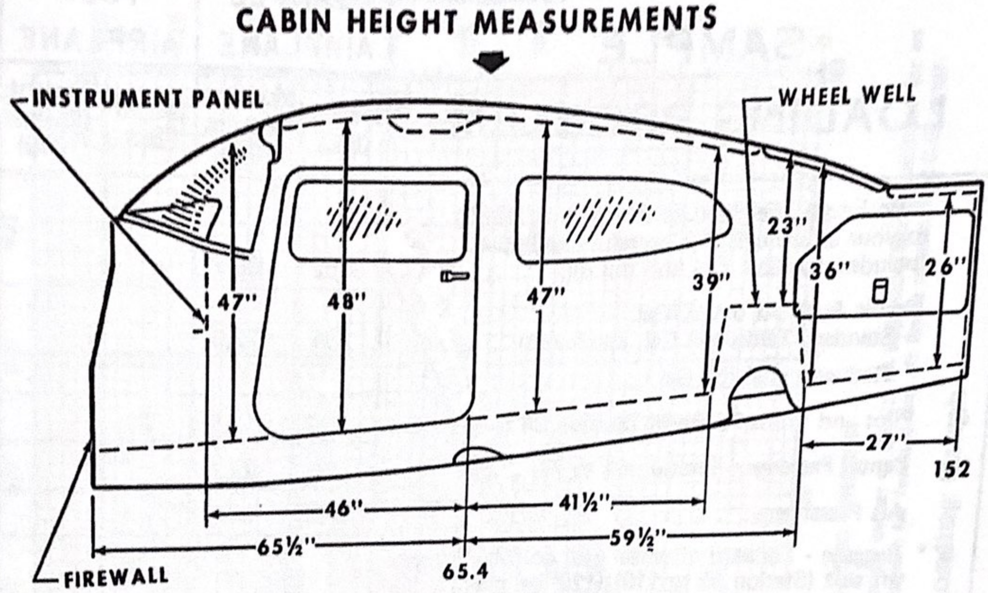
1. The usable fuel C.G. arm is located at station 43. 0.
2. The aft baggage wall (approximate station 152) can be used as a convenient interior reference point for determining the location of baggage area fuselage station.



6 OCCUPANTS
AND AFT BAGGAGE

4 OCCUPANTS
BAGGAGE ON AFT SEAT
AND AFT BAGGAGE

Figure 6-3. Loading Arrangements



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

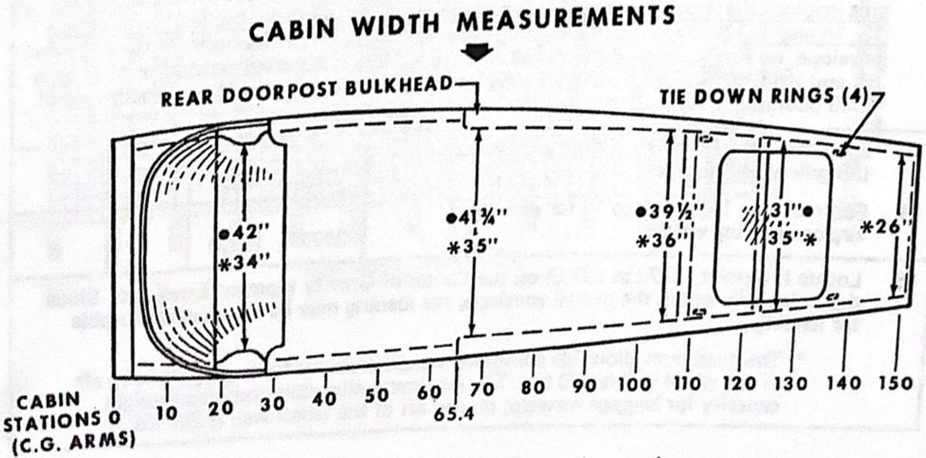
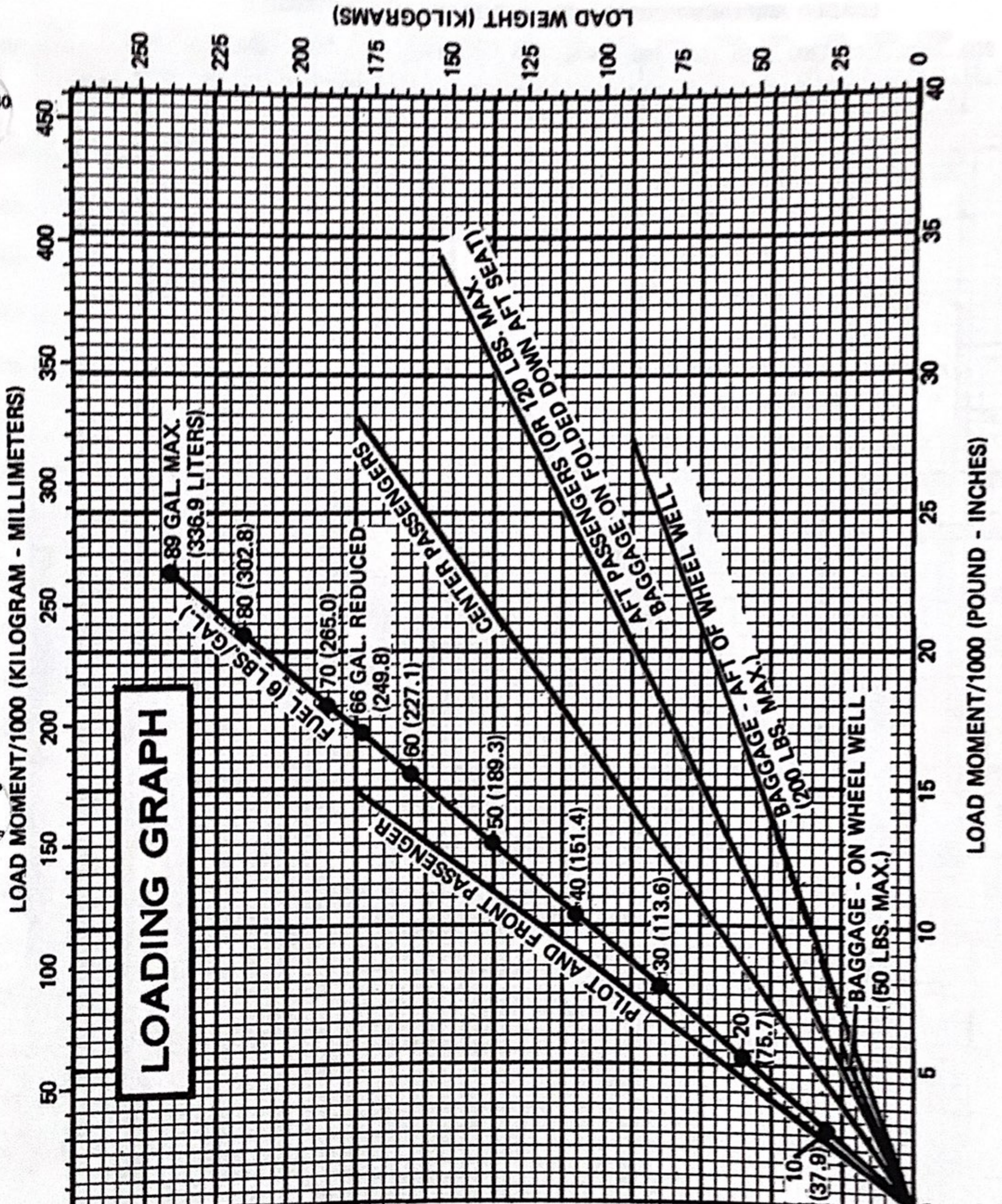


Figure 6-4. Internal Cabin Dimensions

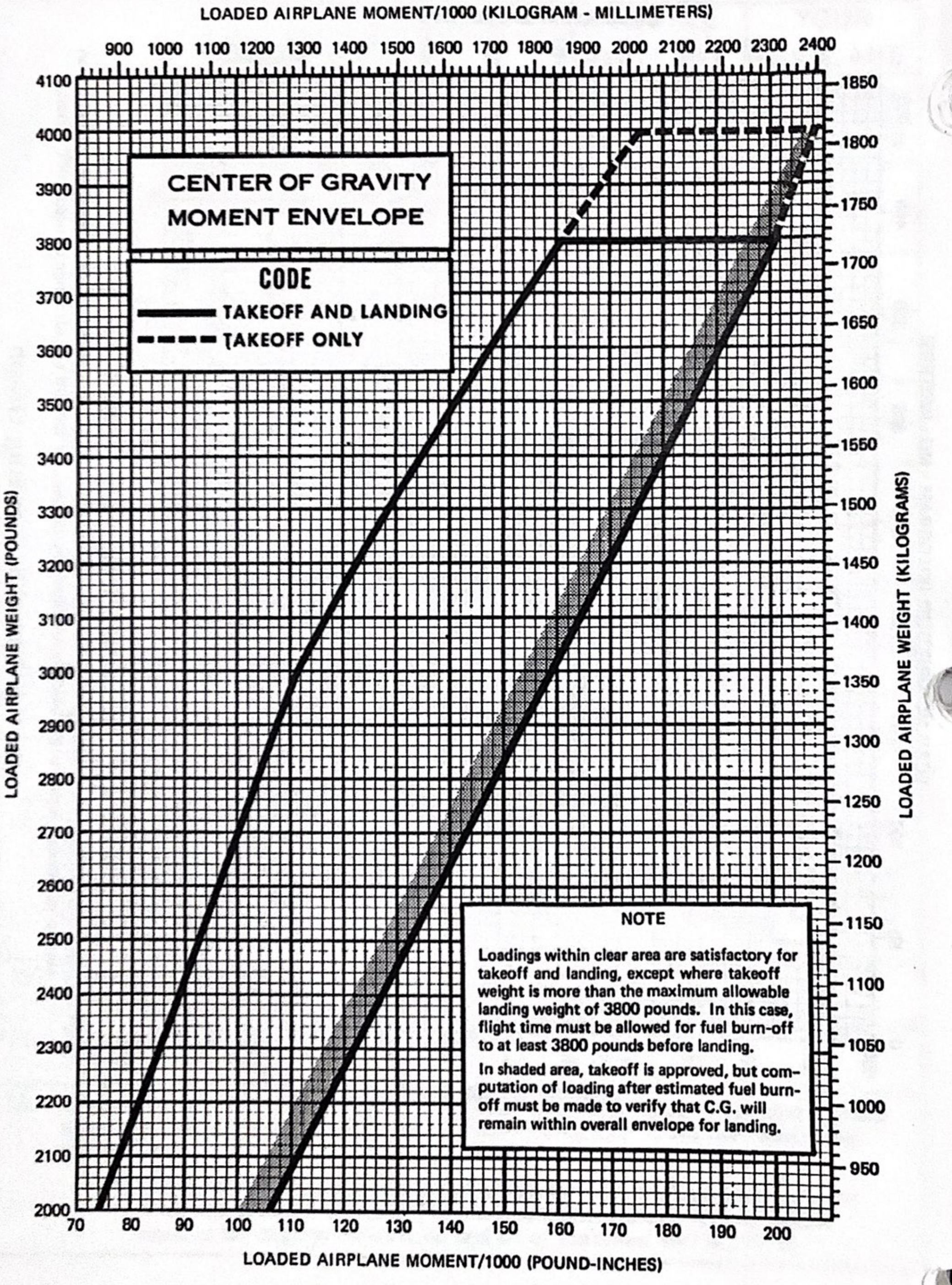
SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil)	2362	99.7		
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (89 Gal. Maximum)	534	23.0		
Reduced Fuel (66 Gal.)				
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 wheel well (Station 110 to 124) (50 lbs. max.)				
8. * Baggage - Aft of wheel well (Station 124 to 152) (200 lbs. max.)	100	13.8		
9. RAMP WEIGHT AND MOMENT	4016	207.5		
10. Fuel allowance for engine start, taxi and runup	-16	-.7		
11. TAKEOFF WEIGHT AND MOMENT (Subtract step 10 from step 9)	4000	206.8		
12. Locate this point (4000 at 206.8) on the Center of Gravity Moment Envelope. Since this loading falls within the shaded area of the moment envelope, proceed with steps 13, 14 and 15. 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 takeoff and landing provided that flight time is allowed for fuel burn-off to a maximum of 3800 pounds before landing.				
13. Estimated Fuel Burn-Off (Climb and Cruise) (38 gallons at 6 lbs./gal.)	-228	-9.8		
14. Subtract step 13 from step 11 for estimated airplane landing weight	3772	197.0		
15. Locate this point (3772 at 197.0) on the Center of Gravity Moment Envelope. Since this point falls within the overall envelope, the loading may be assumed acceptable for landing. * The maximum allowable combined weight capacity for baggage on and aft of the wheel well is 200 lbs. The maximum allowable combined weight capacity for baggage forward, on and aft of the wheel well is 240 lbs.				

Figure 6-5. Sample Loading Problem



NOTES: 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

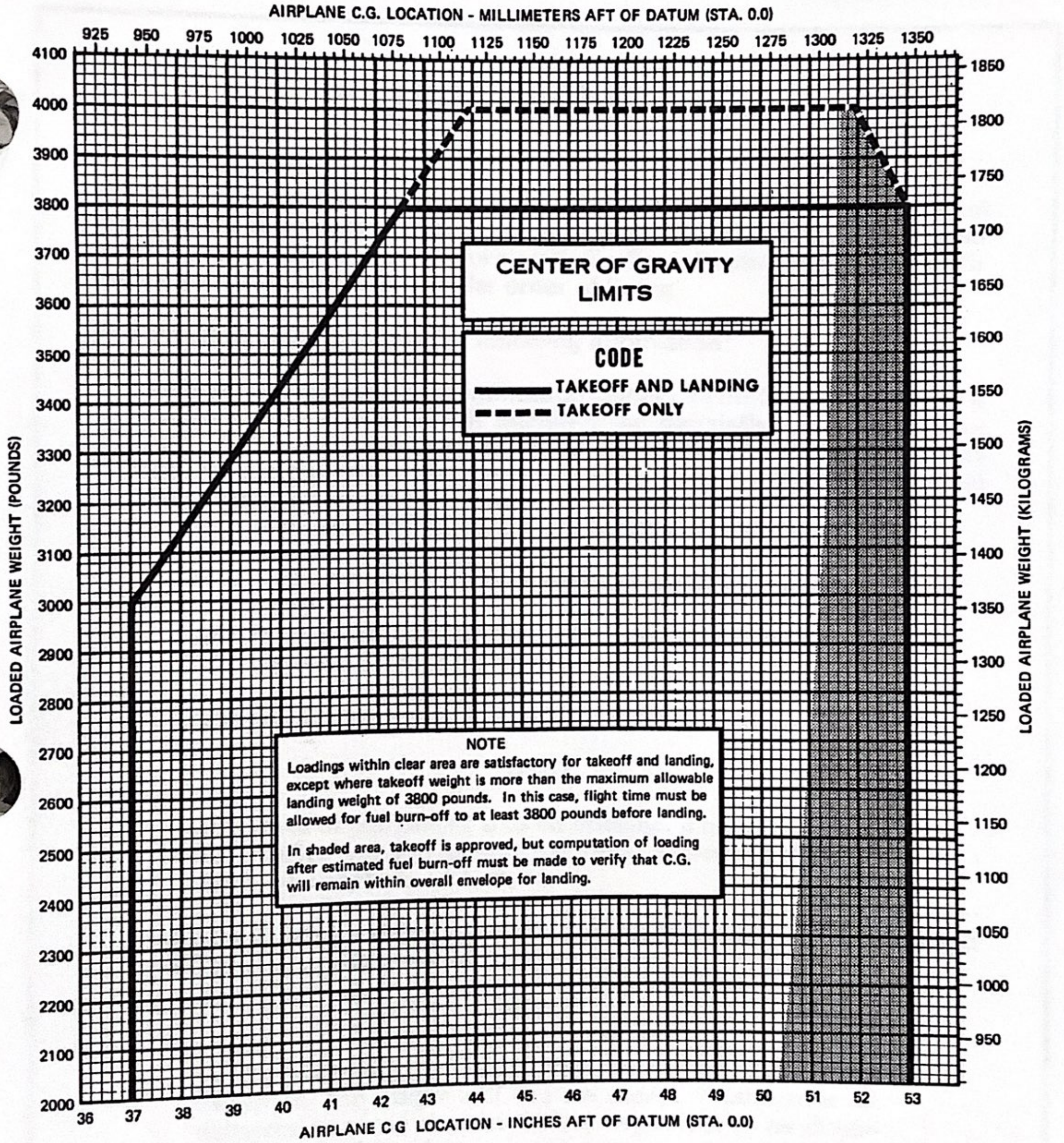


NOTE

Loadings within clear area are satisfactory for takeoff and landing, except where takeoff weight is more than the maximum allowable landing weight of 3800 pounds. In this case, flight time must be allowed for fuel burn-off to at least 3800 pounds before landing.

In shaded area, takeoff is approved, but computation of loading after estimated fuel burn-off must be made to verify that C.G. will remain within overall envelope for landing.

Figure 6-7. Center of Gravity Moment Envelope



NOTE

Loadings within clear area are satisfactory for takeoff and landing, except where takeoff weight is more than the maximum allowable landing weight of 3800 pounds. In this case, flight time must be allowed for fuel burn-off to at least 3800 pounds before landing.

In shaded area, takeoff is approved, but computation of loading after estimated fuel burn-off must be made to verify that C.G. will remain within overall envelope for landing.

Figure 6-8. Center of Gravity Limits

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

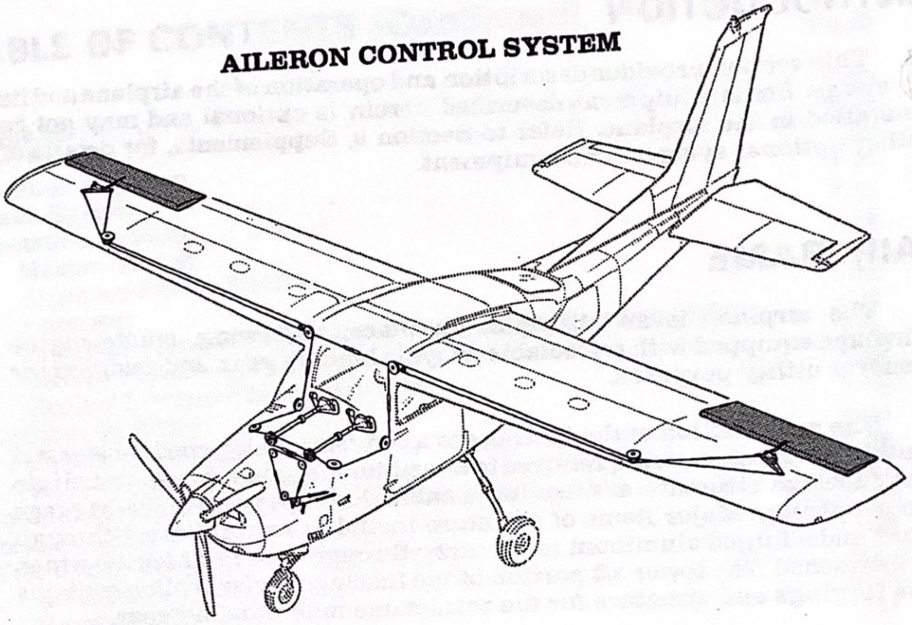
The airplane is an all-metal, six-place, high-wing, single-engine airplane equipped with retractable tricycle landing gear and designed for general utility purposes.

The construction of the fuselage is a conventional formed sheet metal bulkhead and skin design referred to as semimonocoque. 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 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

AILERON CONTROL SYSTEM



RUDDER AND RUDDER TRIM
CONTROL SYSTEMS

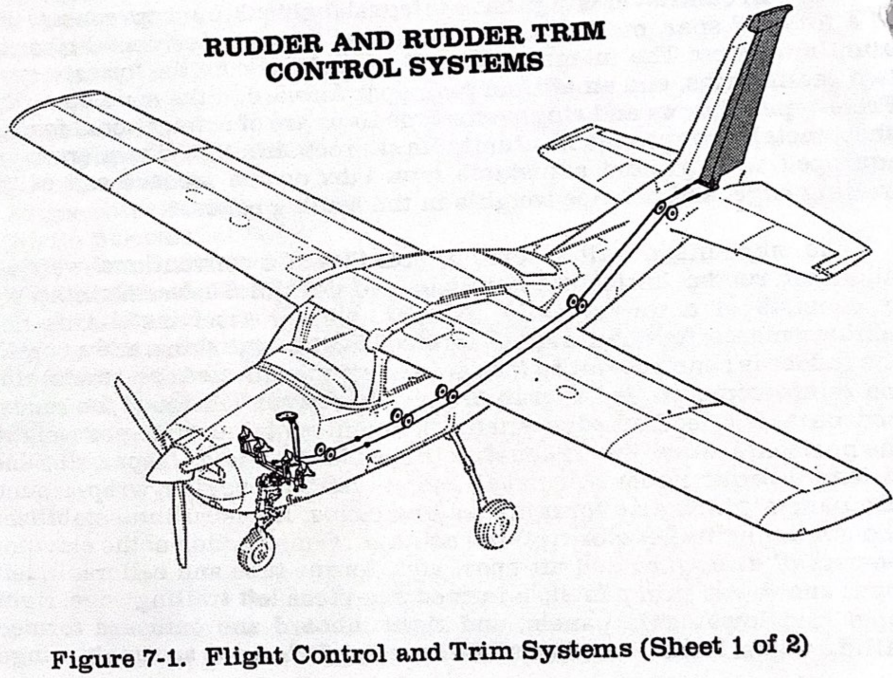
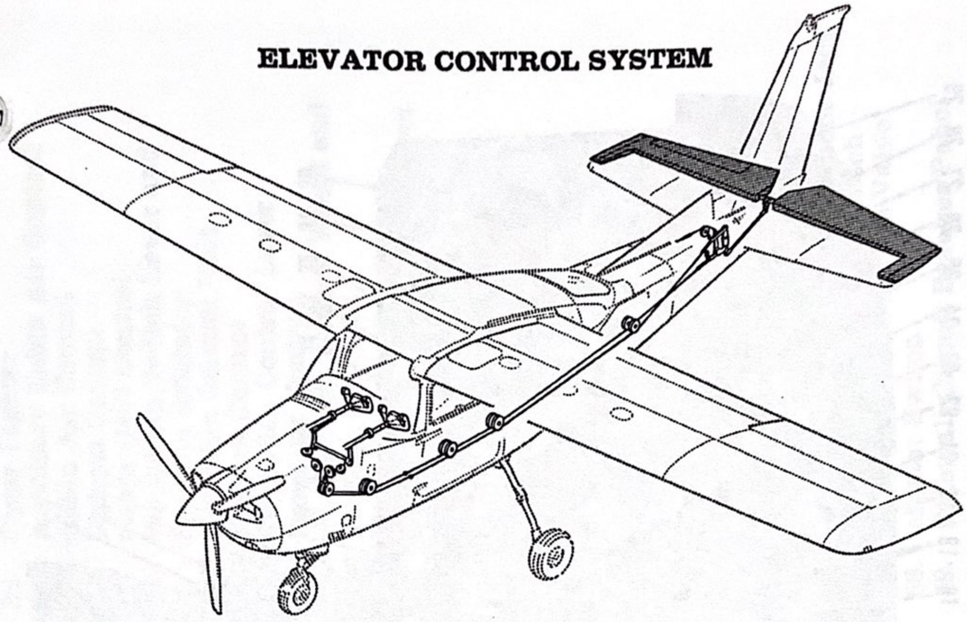
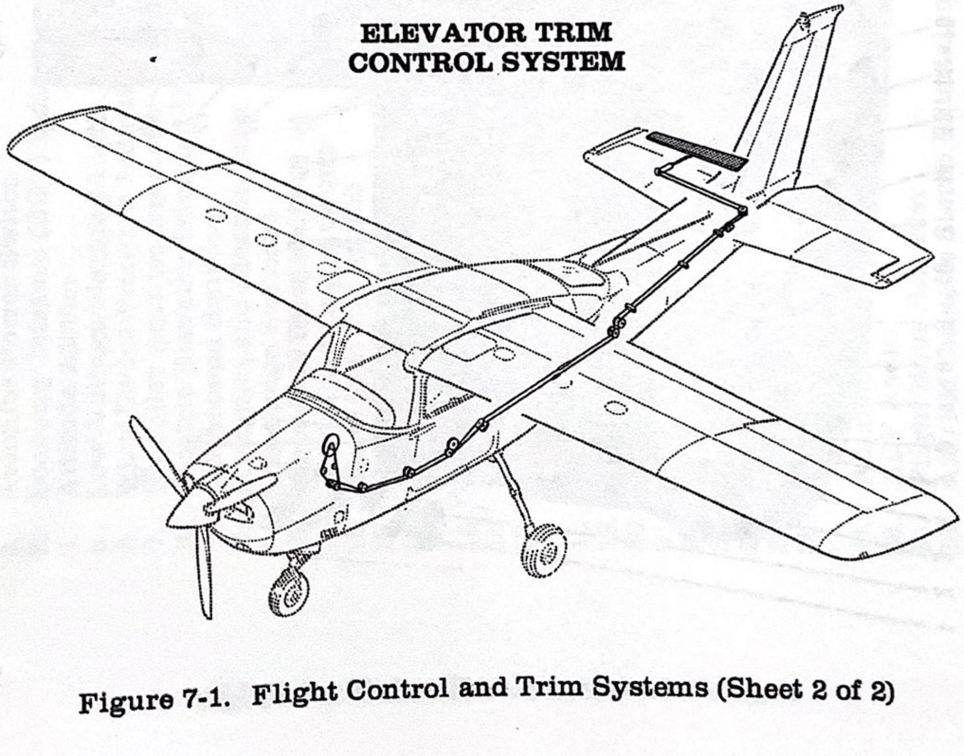


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)



ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM CONTROL SYSTEM

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

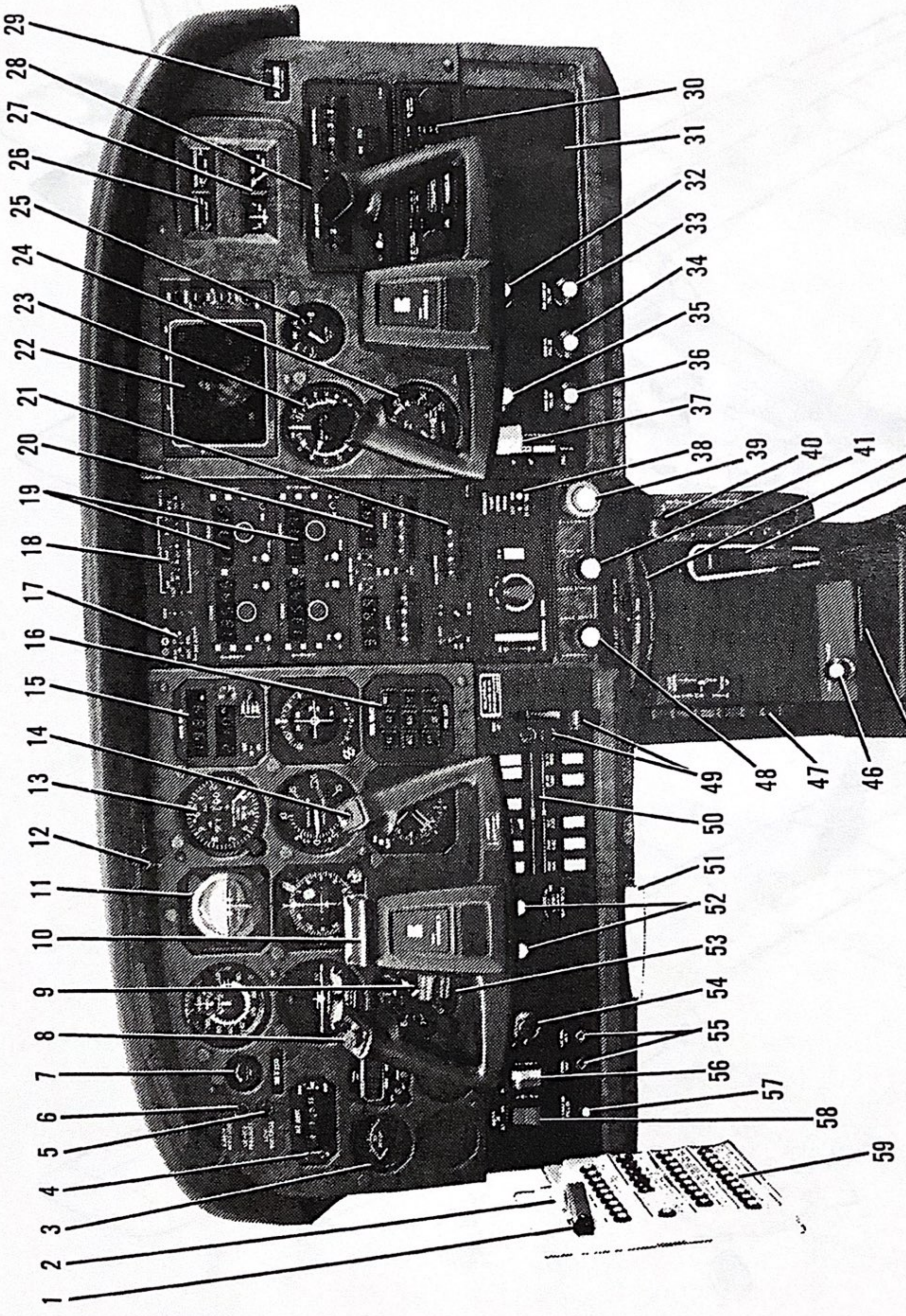


Figure 7-2. Instrument Panel (Sheet 1 of 2)

1. Standby Electric Generator Sw
2. Avionics Power Switch
3. Economy Mixture (EGT) Indicator
4. Altitude Alerter
5. Low-Voltage Warning Light
6. Wing De-Ice Pressure Indicator Light
7. Propeller Anti-Ice Ammeter
8. Electric Elevator Trim and IFCS Go-Around Switches
9. Autopilot and Electric Trim Disengage Switches
10. Approach Plate Holder
11. Flight Instrument Group
12. Map Light and Switch
13. Encoding Altimeter
14. IFCS Pitch Synchronizer and Transponder Remote IDENT Switches
15. DME
16. IFCS Mode Selector
17. Marker Beacon Indicator Lights and Switches
18. Audio Control Panel
19. Nav/Com Radios
20. Area Navigation (RNAV) Radio
21. Transponder
22. Weather Radar
23. Manifold Pressure/Fuel Flow Indicator
24. Tachometer
25. Suction Gage
26. Cylinder Head Temperature and Oil Temperature Gages
27. Ammeter and Oil Pressure Gage
28. ADF Radio
29. Flight Hour Recorder
30. AM/FM Cassette Stereo Entertainment Center
31. Map Compartment
32. Cigar Lighter
33. Auxiliary Cabin Air Control
34. Cabin Air Control
35. Defrost Control
36. Cabin Heat Control
37. Wing Flap Switch Lever and Position Indicator
38. Autopilot Control Unit
39. Mixture Control
40. Cowl Flap Control Lever
41. Propeller Control
42. Rudder Trim Control Wheel and Position Indicator
43. Microphone
44. Fuel Selector Valve Handle and Fuel Quantity Indicators
45. Fuel Selector Light
46. Primer
47. Elevator Trim Control Wheel and Position Indicator
48. Throttle (With Friction Lock)
49. Landing Gear Lever and Position Indicator Lights
50. Electrical Switches
51. Parking Brake Handle
52. Radio and Instrument Panel Lighting Rheostat Controls
53. Secondary Altimeter
54. Ignition Switch
55. Auxiliary Mike Jack and Phone Jack
56. Auxiliary Fuel Pump Switch
57. Alternate Static Source Valve
58. Master Switch
59. Sidewall Circuit Breaker Panel

Figure 7-2. Instrument Panel (Sheet 2 of 2) half, and a wrap-around skin panel. Both elevator tip leading edge extensions incorporate balance weights.

FLIGHT CONTROLS

The airplane's flight control system (see figure 7-1) consists of conventional aileron, elevator and rudder control surfaces. 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 down-spring, and an aileron-rudder interconnect is incorporated to provide improved stability in flight.

Extensions are available for the rudder/brake pedals. They consist of a rudder pedal face, two spacers and two spring clips. To install an extension, place the clip on the bottom of the extension under the bottom of the rudder pedal and snap the top clip over the top of the rudder pedal. Check that the extension is firmly in place. To remove the extensions, reverse the above procedures.

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 manifold pressure/fuel flow indicator, tachometer, weather radar, AM/FM cassette stereo, map compartment, and space for additional instruments and avionics equipment. The engine instrument cluster, 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 and controls necessary to operate the airplane. The left side of the panel contains the master switch, auxiliary fuel pump switch, ignition switch, light intensity controls, electrical switches, landing gear lever and indicator lights, and static pressure alternate source valve control knob. The center area contains the throttle, propeller control, and mixture control. The right side of the panel contains the wing flap switch lever and indicator, cabin heat control knob, cabin air control knob, defroster control knob, auxiliary cabin air control knob and the 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 with the fuel quantity indicators immediately forward of the handle. A parking brake handle is mounted under the switch and control panel in front of the pilot. All circuit breakers for general electrical equipment and avionics are mounted in a circuit breaker panel located on the left cabin sidewall adjacent to the pilot's seat.

For details concerning the instruments, switches, circuit breakers, and controls on this panel, and the circuit breaker 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.

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 10-ampere circuit breaker, labeled FLAP, on the left sidewall circuit breaker 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.

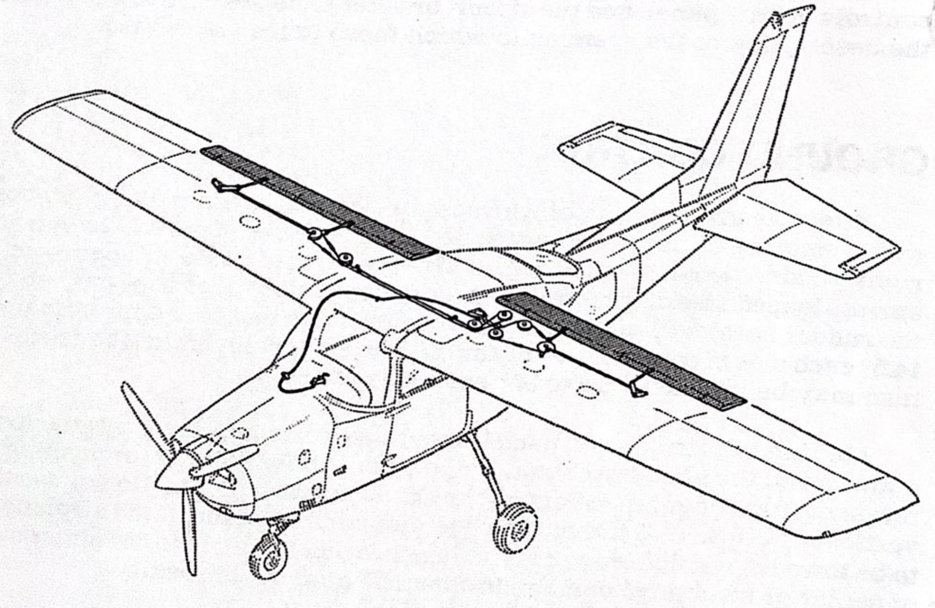


Figure 7-3. Wing Flap System

Each main wheel is equipped with a hydraulically actuated disc-type brake on the inboard side of the wheel.

Landing gear extension, retraction, and down lock operation is accomplished by hydraulic actuators powered by an electrically-driven hydraulic power pack (see figure 7-8). 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. Nose gear wheel and strut door operation is accomplished mechanically.

Power pack operation is initiated by a landing gear lever, 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 LEVER

The landing gear lever, mounted to the left of the engine controls, has two positions (up labeled GEAR UP and down labeled GEAR DOWN) which give a mechanical indication of the gear position selected. From either position, the lever must be pulled out to clear a detent before it can be repositioned. Moving the lever out of the GEAR DOWN detent will start the hydraulic power pack. Positioning the lever in the GEAR UP position will direct hydraulic pressure to retract the landing gear. Operation of the landing gear system to extend the gear will not begin until the landing gear lever is repositioned in the GEAR DOWN detent.

LANDING GEAR POSITION INDICATOR LIGHTS

Two position indicator lights, mounted adjacent to the landing gear lever, 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 lever and move it to the desired position. After the lever 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 "pull-off" type circuit breaker, 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 stops full up or locks down and the position-indicator light (amber for up and green for down) comes on. When the light illuminates, hydraulic pressure will continue to build until a pressure switch turns off the hydraulic pump. The gear is held in the full up position by hydraulic pressure. If the system pressure drops below minimum, the power pack pressure switch will turn the power pack on and return the pressure to maximum except when the nose gear safety (squat) switch is open.

A landing gear safety (squat) switch, actuated by the nose gear strut, electrically prevents inadvertent retraction by the electrically-driven hydraulic power pack whenever the nose gear strut is compressed by the weight of the airplane. When the nose gear is lifted off the runway during takeoff, the squat switch will close, causing the power pack to operate for 1 to 2 seconds which will return system pressure to maximum in the event pressure has dropped.

A "pull-off" type circuit breaker, mounted on the left sidewall circuit breaker panel, should be used for safety during maintenance. With the circuit breaker pulled out, landing gear operation by the gear motor cannot occur. After maintenance is completed, and prior to flight the circuit breaker should be pushed back in.

WARNING

Safety placards are installed in the nose wheel well to warn against any maintenance in this area with the circuit breaker pushed in.

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 or electrical system failure. The landing gear cannot be retracted with the hand pump. 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 lever 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 15 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 may be 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.

8 HANDLING, SERVICE & MAINTENANCE

9 SUPPLEMENTS

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.

Six-way adjustable seats may be equipped with variable lumbar supports located inside the lower seat backs. The firmness of the lower seat back may be controlled by utilizing a button located on the lower inboard side of the seat back. After adjusting the seat back to a comfortable position, move forward on the seat to remove all the weight from the seat back. Hold the button in until the support fully inflates, release the button, and lean back in the seat. If the support is too firm, hold the button in until the desired amount of firmness is obtained.

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 seats are 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

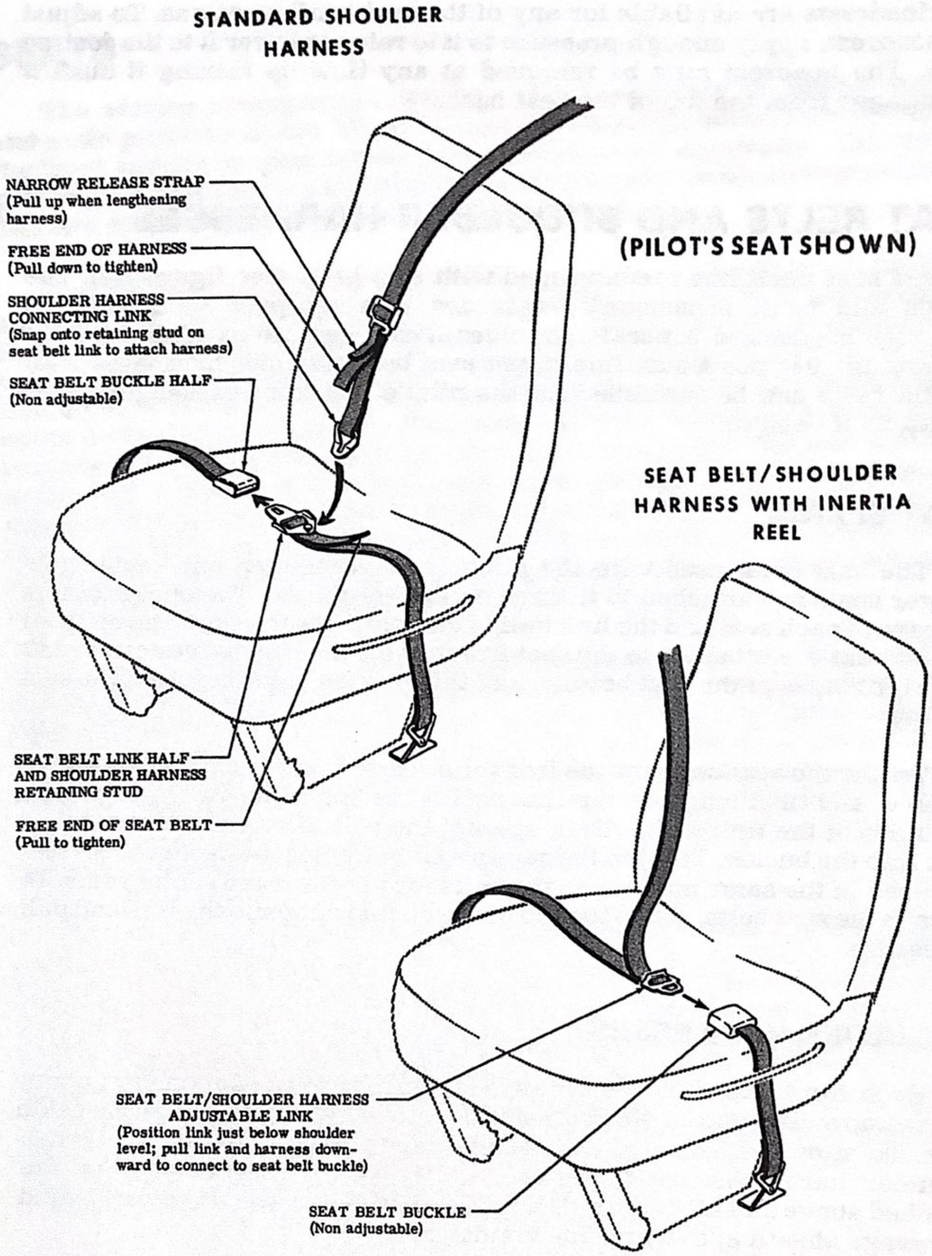


Figure 7-4. Seat Belts and Shoulder Harnesses

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.

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. Grasp the forward end of the handle and 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 (flush with the arm rest). When the handle is rotated to the LOCK position, an over-center action will hold it in that 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 KIAS, 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 entry door is equipped with an openable window which is held in the closed position by a detent-equipped latch on the lower edge of the window frame. To open the window, 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 203 KIAS. 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 aileron and elevator control surfaces to 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. Installation of the lock will secure the ailerons in a neutral position and the elevators in a slightly trailing edge down position. 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, turbocharged, air-cooled, fuel injected engine with a wet sump oil system. The engine is a Continental Model TSIO-520-R and is rated at 310 horsepower at 2700 RPM and 36.5 inches of manifold pressure for five minutes, and 285 horsepower at 2600 RPM and 35 inches of manifold pressure continuous. Major accessories include a propeller governor on the front of the engine and dual magnetos, starter, belt-driven alternator, and full flow oil filter on the rear of the engine. Other major accessories include a turbocharger, connected to the induction air and exhaust systems, and associated components. Provisions are also made for a vacuum pump, and a standby electric generator.

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 15 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 upper 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. Gage markings indicate the normal operating range (green arc) which is 100°F (38°C) to 240°F (116°C), and the maximum (red line) which is 240°F (116°C).

The cylinder head temperature gage, adjacent to the oil temperature gage, is operated by an electrical-resistance type temperature sensor on the engine and is powered by the airplane electrical system. Gage markings indicate the normal operating range (green arc) which is 200°F (93°C) to 460°F (238°C) and the maximum (red line) which is 460°F (238°C).

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 2500 RPM, a five minute maximum power range (yellow arc) of 2600 to 2700 RPM, and a maximum (red line) of 2700 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 30 inches of mercury, a five minute maximum power range (yellow arc) of 35 to 36.5 inches of mercury, and a maximum (red line) of 36.5 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 cruise range (green arc) is from 36 to 120 pounds per hour, the normal climb range (white arc) is from 120 to 162 pounds per hour, the minimum (red line) is 3.0 PSI, and the maximum (red line) is 186 pounds per hour (19.5 PSI).

An economy mixture (EGT) indicator is available for the airplane and is located on the left side of the instrument panel. A thermocouple probe in the exhaust manifold at the inlet to the turbocharger 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 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 70% to 80% 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, propeller governor operation, and turbocharger system control 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). 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 the full flow oil filter to the turbocharger system controls, 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 and turbocharger are then lubricated by oil from the galleries. After lubricating the engine, the oil returns to the sump by gravity, and oil from the turbocharger is returned to the sump by a scavenger pump. The oil 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.

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 a duct in the right intake in the front of the engine cowling. The duct extends down the right side of the engine to an air filter which removes dust and other foreign matter from the induction air. On the aft side of the filter is a duct assembly which contains an alternate air door. If the induction air filter becomes blocked, suction created by the engine will open the door and draw unfiltered air from inside the cowling. An open alternate air door will result in a decrease of up to 10 inches Hg manifold pressure from a cruise power setting. Maximum continuous manifold pressure (35 inches Hg) can be maintained with throttle and/or RPM adjustment up to 14,000 feet under hot day conditions with the alternate air door open. A flexible duct, connected to the duct assembly, directs induction air from the air filter to the compressor section of the turbocharger. At this point, induction air is compressed. The pressurized air is then ducted through a fuel/air control unit and induction manifold to the cylinders.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies into an exhaust manifold which discharges the gas into the turbine section of the turbocharger. After the exhaust gas has passed through the turbine, it is vented overboard through a tailpipe. A waste gate is incorporated into the exhaust manifold, and controls the amount of exhaust gas to the turbine by venting excess gas to the tailpipe through a bypass. A shroud, attached to the left side of the exhaust manifold, forms a heating chamber for cabin heater and windshield defrost 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 letdowns, it may be necessary to completely close the cowl flaps by pushing the cowl flap lever down to the CLOSED position.

TURBOCHARGING SYSTEM

Because the engine is turbocharged, some of its characteristics are different from a normally aspirated engine. The following information describes the system and points out some of the items that are affected by turbocharging. Section 4 contains the normal operating procedures for the turbocharged engine.

The following steps, when combined with the turbocharger system schematic (figure 7-5), provide a better understanding of how the turbocharger system works. The steps follow the induction air as it enters and passes through the engine until it is expelled as exhaust gases.

1. Engine induction air is taken in through an opening in the nose cap, ducted through a filter and into the compressor where it is compressed.
2. The pressurized induction air then passes through the throttle body and induction manifold into the cylinders.
3. The air and fuel are burned and exhausted to the supercharger turbine.
4. The exhaust gases drive the turbine which, in turn, drives the compressor, thus completing the cycle.

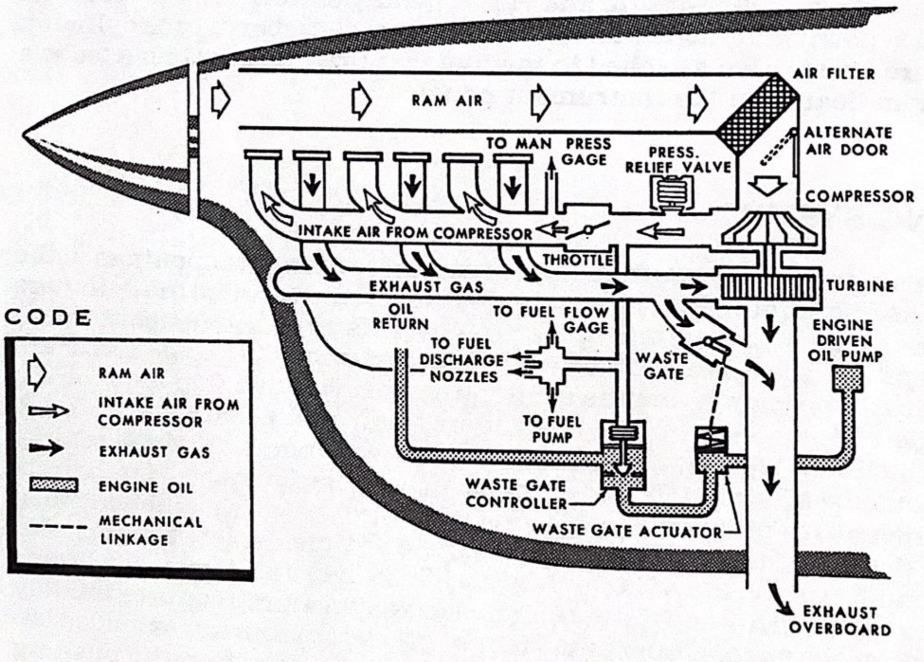


Figure 7-5. Turbocharger System

The compressor has the capability of producing manifold pressures in excess of the 5 minute takeoff maximum of 36.5 inches Hg. In order not to exceed 36.5 inches of manifold pressure, a waste gate is used so that some f the exhaust will bypass the turbine and be vented into the tailpipe.

It can be seen from studying Steps 1 through 4 that anything that affects the flow of induction air into the compressor or the flow of exhaust gases into the turbine will increase or decrease the speed of the turbocharger. This resultant change in flow will have no effect on the engine if the waste gate is still open because the waste gate position is changed to hold compressor discharge pressure constant. A waste gate controller automatically maintains maximum allowable compressor discharge pressure any time the turbine and compressor are capable of producing that pressure.

At high altitude, part throttle, or low RPM, the exhaust flow is not capable of turning the turbine and compressor fast enough to maintain maximum compressor discharge pressure, and the waste gate will close to force all of the exhaust flow through the turbine.

When the waste gate is fully closed, any change in turbocharger speed will mean a change in engine operation. Thus, any increase or decrease in turbine speed will cause an increase or decrease in manifold pressure and fuel flow. If turbine speed increases, the manifold pressure increases; if the turbine speed decreases, the manifold pressure decreases. Since the compression ratio approaches 3 to 1 at high altitude, any change in exhaust flow to the turbine or ram induction air pressure will be magnified proportionally by the compression ratio and the change in flow through the exhaust system.

MANIFOLD PRESSURE VARIATION WITH ENGINE RPM

When the waste gate is open, the turbocharged engine will react the same as a normally aspirated engine when the engine RPM is varied. That is, when the RPM is increased, the manifold pressure will decrease slightly. When the engine RPM is decreased, the manifold pressure will increase slightly.

However, when the waste gate is closed, manifold pressure variation with engine RPM is just the opposite of the normally aspirated engine. An increase in engine RPM will result in an increase in manifold pressure, and a decrease in engine RPM will result in a decrease in manifold pressure.

MANIFOLD PRESSURE VARIATION WITH ALTITUDE

At full throttle, the turbocharger has the capability of maintaining the maximum continuous manifold pressure of 35 inches Hg to well above 17,000 feet depending on engine and atmospheric conditions. However, engine operating limitations establish the maximum manifold pressure that may be used. Manifold pressure should be reduced above 17,000 feet, as noted on the operating placard in the airplane (subtract 1 inch Hg from 35 inches for each 1000 feet above 17,000 feet).

At part throttle, the turbocharger is capable of maintaining cruise climb power of 2500 RPM and 30 inches Hg from sea level to 20,000 feet in standard temperatures, and from sea level to 8000 feet under hot day conditions without changing the throttle position, once the power setting is established after takeoff. Under hot day conditions, this climb power setting is maintained above 8000 feet by advancing the throttle as necessary to maintain 30 inches of manifold pressure in the same manner as a normally aspirated engine during climb.

MANIFOLD PRESSURE VARIATION WITH AIRSPEED

When the waste gate is closed, manifold pressure will vary with variations in airspeed. This is because the compressor side of the turbocharger operates at pressure ratios of up to 3 to 1 and any change in pressure at the compressor inlet is magnified at the compressor outlet with a resulting effect on the exhaust flow and turbine side of the turbocharger.

FUEL FLOW VARIATIONS WITH CHANGES IN MANIFOLD PRESSURE

The engine-driven fuel pump output is regulated by engine speed and compressor discharge pressure. Engine fuel flow is regulated by fuel pump output and the metering effects of the throttle and mixture control. When the waste gate is open, fuel flow will vary directly with manifold pressure, engine speed, mixture, or throttle control position. In this case, manifold pressure is controlled by throttle position and the waste gate controller, while fuel flow varies with throttle movement and manifold pressure.

When the waste gate is closed and manifold pressure changes are due to turbocharger output, as discussed previously, fuel flow will follow manifold pressure even though the throttle position is unchanged. This means that fuel flow adjustments required of the pilot are minimized to (1) small initial adjustments on takeoff or climb-out for the proper rich climb setting, (2) lean-out in cruise, and (3) return to full rich position for approach and landing.

MANIFOLD PRESSURE VARIATION WITH INCREASING OR DECREASING FUEL FLOW

When the waste gate is open, movement of the mixture control has little or no effect on the manifold pressure of the turbocharged engine.

When the waste gate is closed, any change in fuel flow to the engine will have a corresponding change in manifold pressure. That is, increasing the fuel flow will increase the manifold pressure and decreasing the fuel flow will decrease the manifold pressure. This is because an increased fuel flow to the engine increases the mass flow of the exhaust. This turns the turbocharger faster, increasing the induction air flow and raising the manifold pressure.

MOMENTARY OVERSHOOT OF MANIFOLD PRESSURE

Under some circumstances (such as rapid throttle movement, especially with cold oil), it is possible that the engine can be overboosted slightly above the maximum five minute takeoff manifold pressure of 36.5 inches. This would most likely be experienced during the takeoff roll or during a change to full throttle operation in flight. The induction air pressure relief valve will normally limit the overboost to 2 to 3 inches.

A slight overboost of 2 to 3 inches of manifold pressure is not considered detrimental to the engine as long as it is momentary. No corrective action is required when momentary overboost corrects itself and is followed by normal engine operation. However, if overboosting of this nature persists when oil temperature is normal or if the amount of overboost tends to exceed 3 inches or more, the throttle should be retarded to eliminate the overboost and the controller system, including the waste gate and relief valve, should be checked for necessary adjustment or replacement of components.

ALTITUDE OPERATION

Because a turbocharged airplane will climb faster and higher than a normally aspirated airplane, fuel vaporization may be encountered. When fuel flow variations of ±5 lbs/hr or more are observed (as a "nervous" fuel flow needle), or if a full rich mixture setting does not provide the desired fuel flow, placing the auxiliary fuel pump switch in the ON position will control vapor. However, it will also increase fuel flow, making it necessary to adjust the mixture control for the desired fuel flow. The auxiliary fuel pump should be left on for the remainder of the climb. It can be turned off whenever fuel flow will remain steady with it off, and the mixture must be adjusted accordingly. The auxiliary fuel pump should be turned off and the mixture reset prior to descent.

HIGH ALTITUDE ENGINE ACCELERATION

The engine will accelerate normally from idle to full throttle with full rich mixture at any altitude below 20,000 feet. At higher altitudes, it is usually necessary to lean the mixture to get smooth engine acceleration from idle to maximum power. At altitudes above 25,000 feet, and with temperatures above standard, it takes one to two minutes for the turbine to accelerate from idle to maximum RPM although adequate power is available in 20 to 30 seconds.

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 7-6) 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

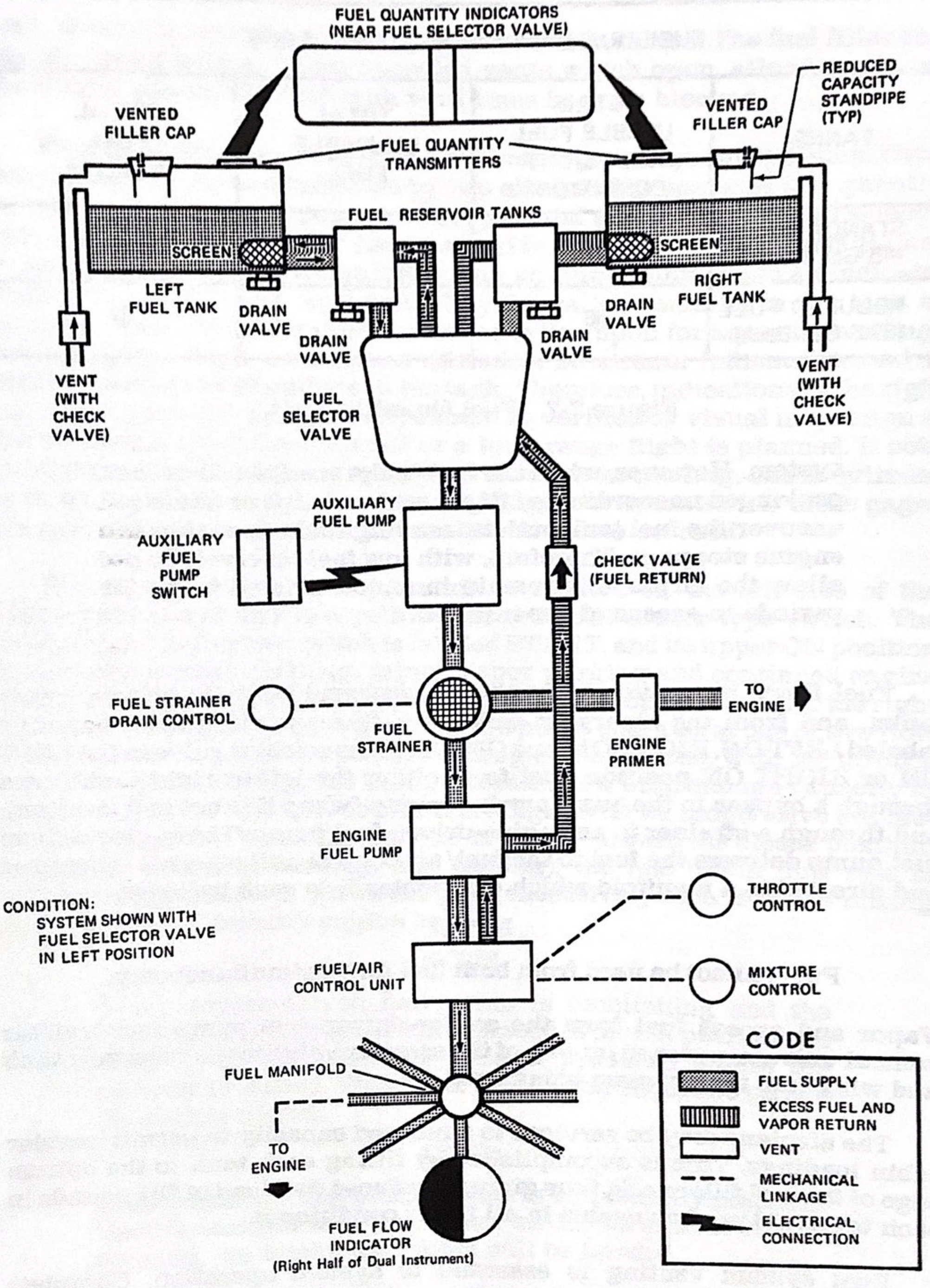


Figure 7-6. Fuel System

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
REDUCED FUEL (33.5 Gal. Each)	66	1	67

Figure 7-7. Fuel Quantity Data

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 and 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 neck, thus giving a reduced fuel load of 201 pounds in each tank (198 pounds usable in all flight conditions).

Fuel system venting is essential to system operation. Complete blockage of the venting system will result in 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 two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity indicators on the lower portion of the pedestal adjacent to the fuel selector valve handle. The indicators are marked in pounds (top scale) and gallons (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. Maximum indicator travel is reached with 41 to 42 gallons in the tank. Therefore, indications at the right end of the scale (40 gallons to F) should be verified by visual inspection of the tanks if a short field takeoff or a long range flight is planned. If both indicator pointers should rapidly move to a zero reading, check cylinder head temperature and oil temperature gages for operation. If these gages are not indicating, an electrical malfunction has occured.

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.

Under hot day-high altitude conditions, or conditions during a climb that are conducive to fuel vapor formation, it may be necessary to utilize the auxiliary fuel pump to attain or stabilize the fuel flow required for the type of climb being performed. In this case, turn the auxiliary fuel pump on and adjust the mixture to the desired fuel flow. If fluctuating fuel flow (greater than 5 lbs./hr.) is observed during climb or cruise at high altitudes on hot days, place the auxiliary fuel pump switch in the ON position to clear the fuel system of vapor. The auxiliary fuel pump may be operated continuously in cruise, if necessary, but should be turned off prior to descent. Each time the auxiliary fuel pump switch is turned on or off, the mixture should be readjusted.

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 minimize condensation.

HYDRAULIC SYSTEM

Hydraulic power (see figure 7-8) 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 extend or retract the gear and operate the gear down locks. The electrical portion of the power pack is protected by a 30-amp "pull-off" type circuit breaker on the circuit breaker panel.

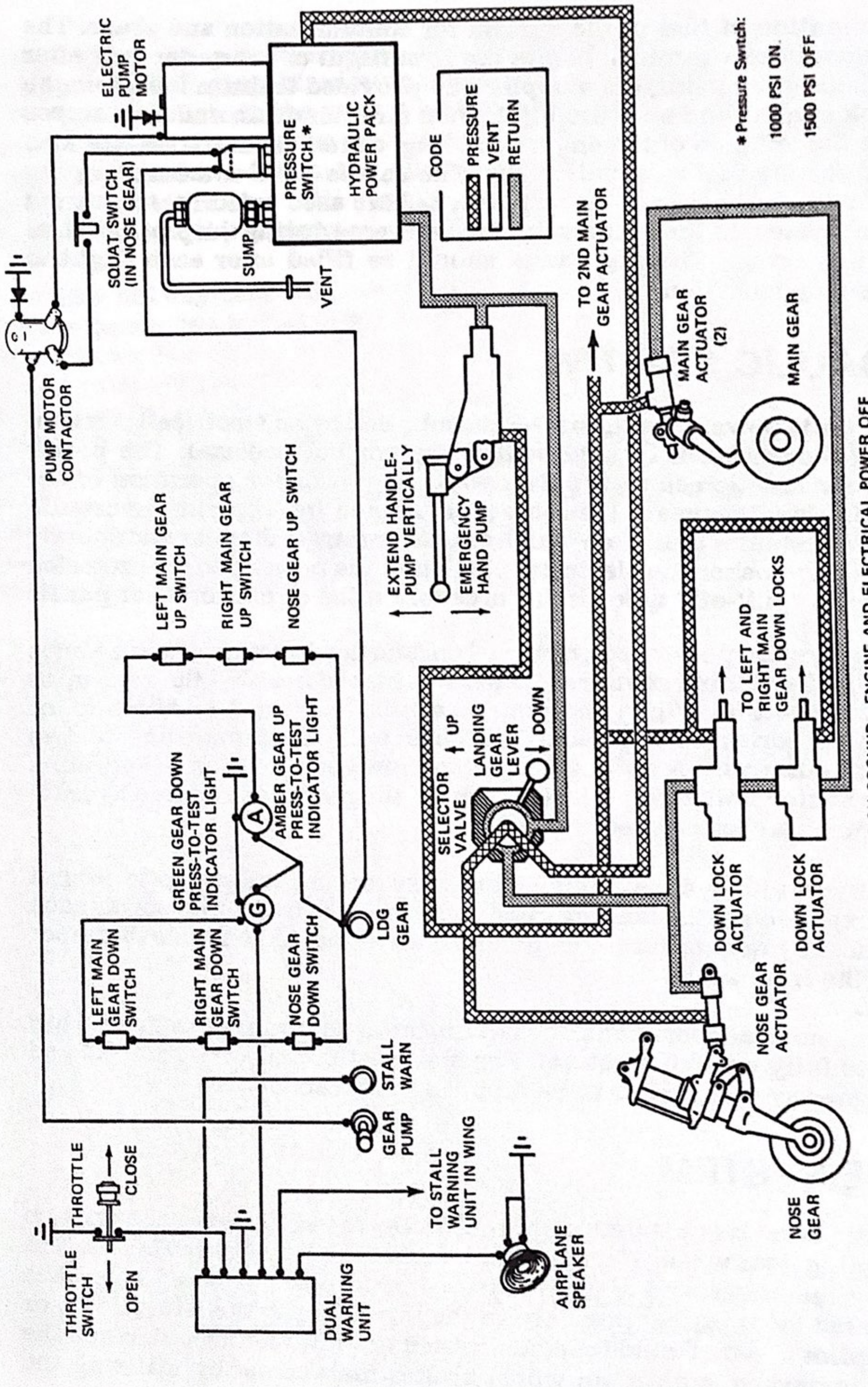
The hydraulic power pack is turned on, and the direction of actuation is selected by the landing gear lever when it is placed in either the gear-up or gear-down position. When the gear has fully extended and locked, or retracted, a series of electrical switches will illuminate one of two indicator lights on the instrument panel to show gear position. A hydraulic pressure switch will automatically turn off the power pack when hydraulic pressure reaches a preset value.

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

During normal operations, the landing gear should require from 6 to 8 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 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



CONDITION: AIRPLANE ON GROUND - ENGINE AND ELECTRICAL POWER OFF

Figure 7-8. Hydraulic System

parking brake which is operated by a handle under the left side of the instrument panel. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down.

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

The airplane is equipped with a 28-volt, direct-current electrical system (see figure 7-9). The system uses a battery located on the forward side, upper left portion, of the firewall, as the source of electrical energy and a belt-driven, 60-amp alternator (or 95-amp, if installed) to maintain the battery's state of charge. 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. A standby electric generator system of approximately seven amperes capacity may be installed. Details of this equipment are presented in Section 9, Supplements.

CAUTION

Prior to turning the master switch on or off, starting the engine or applying an external 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.

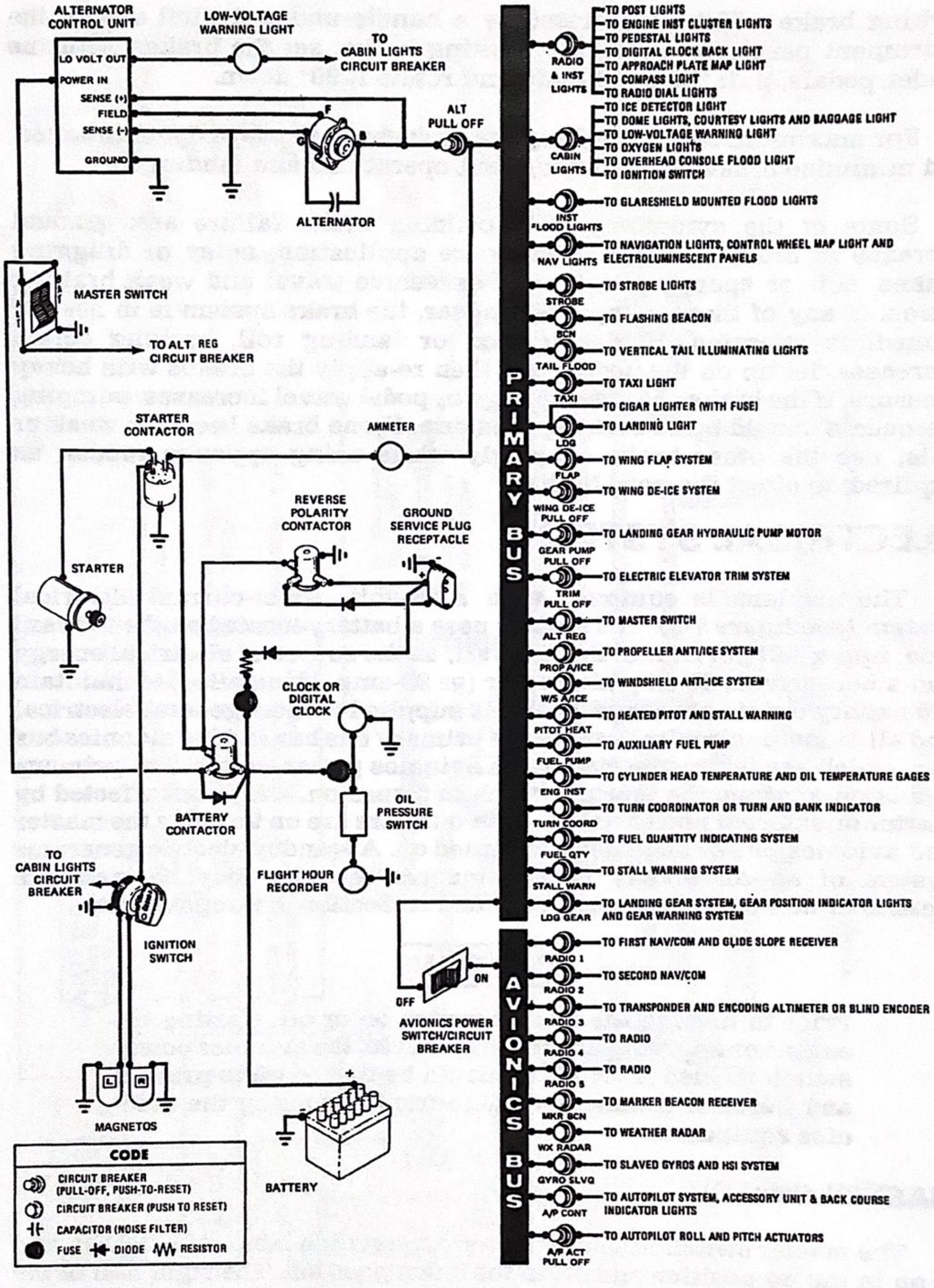


Figure 7-9. Electrical System

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 avionics equipment or radios while on the ground, the avionics power 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 (see figure 7-9) is controlled by a rocker-type circuit breaker-switch labeled AVN PWR. The switch is located on the left sidewall circuit breaker panel and is ON in the forward position and OFF in the aft position. With the switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch or the individual equipment switches. The avionics power switch also functions as a circuit breaker. If an electrical malfunction should occur and cause the circuit breaker to open, electrical power to the avionics equipment will be interrupted and the switch will automatically move to the OFF position. If this occurs, allow the circuit breaker to cool approximately two minutes before placing the switch in the ON position again. If the circuit breaker opens again, do not reset it. The avionics power switch should be placed in the OFF position prior to turning the master switch on or off, starting the engine, or applying an external power source, and may be utilized in place of the individual avionics equipment switches.

AMMETER

The ammeter, located on the upper right side of the instrument panel, indicates the amount 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 the battery discharge rate.

ALTERNATOR CONTROL UNIT AND LOW-VOLTAGE WARNING LIGHT

The airplane is equipped with a combination alternator regulator high-low voltage control unit mounted on the engine side of the firewall and red warning light, labeled LOW VOLTAGE, near the upper left corner of the instrument panel.

In the event an over-voltage condition occurs, the alternator control unit automatically removes alternator field current which shuts down the alternator. The battery will then supply system current as shown by a discharge rate on the ammeter. Under these conditions, depending on electrical system load, the low-voltage warning light will illuminate when system voltage drops below normal. The alternator control unit 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 practicable.

NOTE

Illumination of the low-voltage light and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system.

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

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" type circuit breakers mounted on a single circuit breaker panel on the left cabin sidewall between the forward doorpost and the instrument panel. Five "pull off" type circuit breakers on this panel protect the alternator output, landing gear system hydraulic pump motor, wing and stabilizer de-ice system, electric elevator trim system, and the autopilot pitch and roll actuators. All of the avionics circuits are protected by circuit breakers grouped together in the lower portion of the circuit breaker panel and also by a rocker-type circuit breaker switch labeled AVN PWR. Fuses protect the cigar lighter circuit, the battery contactor closing circuit (when used with external power), and the clock and flight hour recorder circuits.

GROUND SERVICE PLUG RECEPTACLE

A ground service plug receptacle may be installed to permit the use of an external power source for cold weather starting and during lengthy maintenance work on the airplane electrical system. Details of the ground service plug receptacle are presented in Section 9, Supplements.

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, two courtesy lights, one under each wing, just outboard of the cabin door, and vertical tail illumination lights, mounted on the top of each horizontal stabilizer. Details of the strobe light system are presented in Section 9, Supplements. 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.

INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood and integral lighting, with electroluminescent and post lighting also available. Rheostats and control knobs, located on the left switch and control panel, control the intensity of all lighting. The following paragraphs describe the various lighting systems and their controls.

Switches and controls on the lower part of the instrument panel and the marker beacon/audio control panel may be lighted by electroluminescent panels which do not require light bulbs for illumination. To utilize this lighting, turn on the NAV light switch and adjust light intensity with the small (inner) control knob of the concentric control knobs labeled EL PANEL, ENG-RADIO.

Instrument panel flood lighting consists of six red flood lights on the underside of the glare shield, and two red flood lights in the forward part of the overhead console (one if an air conditioner is installed). The lights are utilized by adjusting light intensity with the large (outer) control knob of the concentric control knobs labeled POST, FLOOD. Flood lighting may be used in combination with post lighting by adjusting post light intensity with the small (inner) 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. To operate the post lights, adjust light intensity with the small (inner) control knob of the concentric control knobs labeled POST, FLOOD. To combine post and flood lighting, adjust flood light intensity with the large (outer) control knob.

The engine instrument cluster, radio equipment, magnetic compass, and digital clock have integral lighting and operate independently of post or flood lighting. The light intensity of instrument cluster, magnetic compass, radio equipment, and digital clock lighting is controlled by the large (outer) control knob of the concentric control knobs labeled EL PANEL, ENG-RADIO. If the airplane is equipped with avionics incorporating incandescent digital readouts, the ENG-RADIO (large outer) control knob controls the light intensity of the digital readouts. 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 control knob will provide normal variable light intensity for nighttime operation.

If the airplane is equipped with a Cessna 400B Integrated Flight Control System, individual dimming of both the white and the green Mode Selector panel lamps is provided by the concentric control knobs labeled IFCS, WHITE, GREEN. A push-to-test feature is incorporated into the small (inner) knob to test for proper green mode selector lamp operation.

The control pedestal has two integral lights and, if the airplane is equipped with oxygen or air conditioning, 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 POST, FLOOD.

Map lighting is provided by overhead console map lights and a glare shield mounted map light. The airplane may also be equipped with a control wheel map light. The overhead console map lights (not installed if an air conditioner is installed) 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 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 POST, FLOOD 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 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 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 by manipulation of the push-pull CABIN HEAT and CABIN AIR control knobs (see figure 7-10). 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 extending 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 antiglare shield; therefore, the temperature of the defrosting air is the same as heated cabin air. A push-pull type control knob, labeled DEFROST, regulates the volume of air to the windshield. Pulling out on 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 airflow. 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. An air conditioning system may be installed in the airplane. Details of this system are presented in Section 9, Supplements.

8 HANDLING, SERVICE & MAINTENANCE
9 SUPPLEMENTS

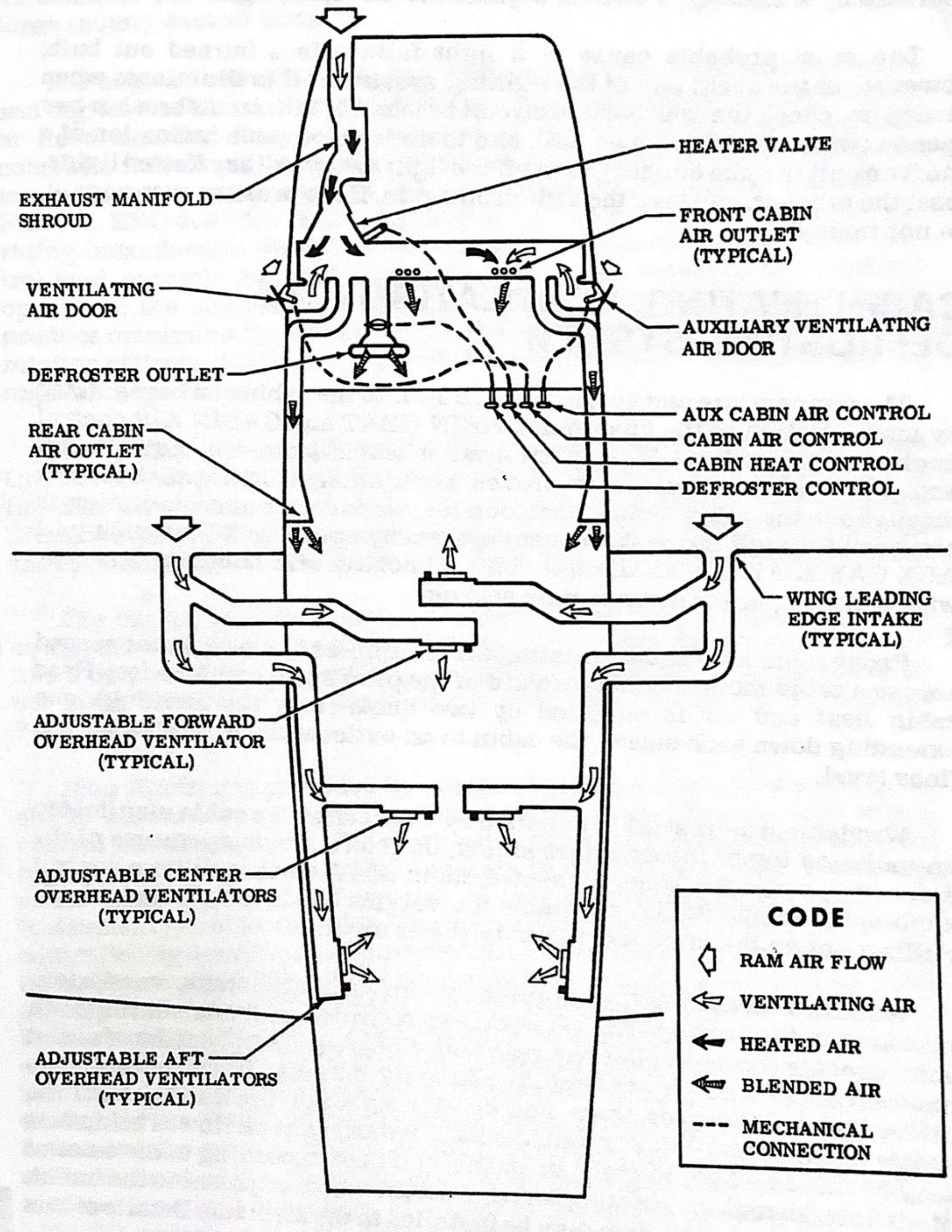


Figure 7-10. Cabin Heating, Ventilating, and Defrosting System

OXYGEN SYSTEM

The airplane is equipped with a partial oxygen system which consists of the outlets, pressure gage, a filler valve, associated plumbing, and an on-off control. If the airplane is equipped with a complete oxygen system, refer to Section 9, Supplements, for complete details and operating instructions.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed 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, a 10-amp circuit breaker on the left sidewall circuit breaker 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 is installed on the left side of the lower instrument panel 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 (in KIAS) include the white arc (58 to 115 knots), green arc (74 to 168 knots), yellow arc (168 to 203 knots), and a red line (203 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, read the true airspeed shown on the rotatable ring by the indicator pointer. For best accuracy, the indicated airspeed 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.

VERTICAL SPEED INDICATOR

The vertical speed 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 SYSTEMS AND INSTRUMENTS

Either of two engine-driven vacuum systems may be installed and provide the suction necessary to operate the attitude and directional indicators. One system (see figure 7-11) consists of a single vacuum pump on the engine, a vacuum relief valve and vacuum system air filter on the aft side of the 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. The other vacuum system (installed per SK210-103) features a dual pump installation on the rear of the engine, two vacuum relief valves, a system air filter, a check valve manifold, vacuum-operated instruments, and a suction gage, equipped with dual warning indicators labeled L and R, on the right side of the instrument panel (see figure 7-11A).

NOTE

Additional reliability is provided by the installation of a dual vacuum pump system. When only a single-pump sys-

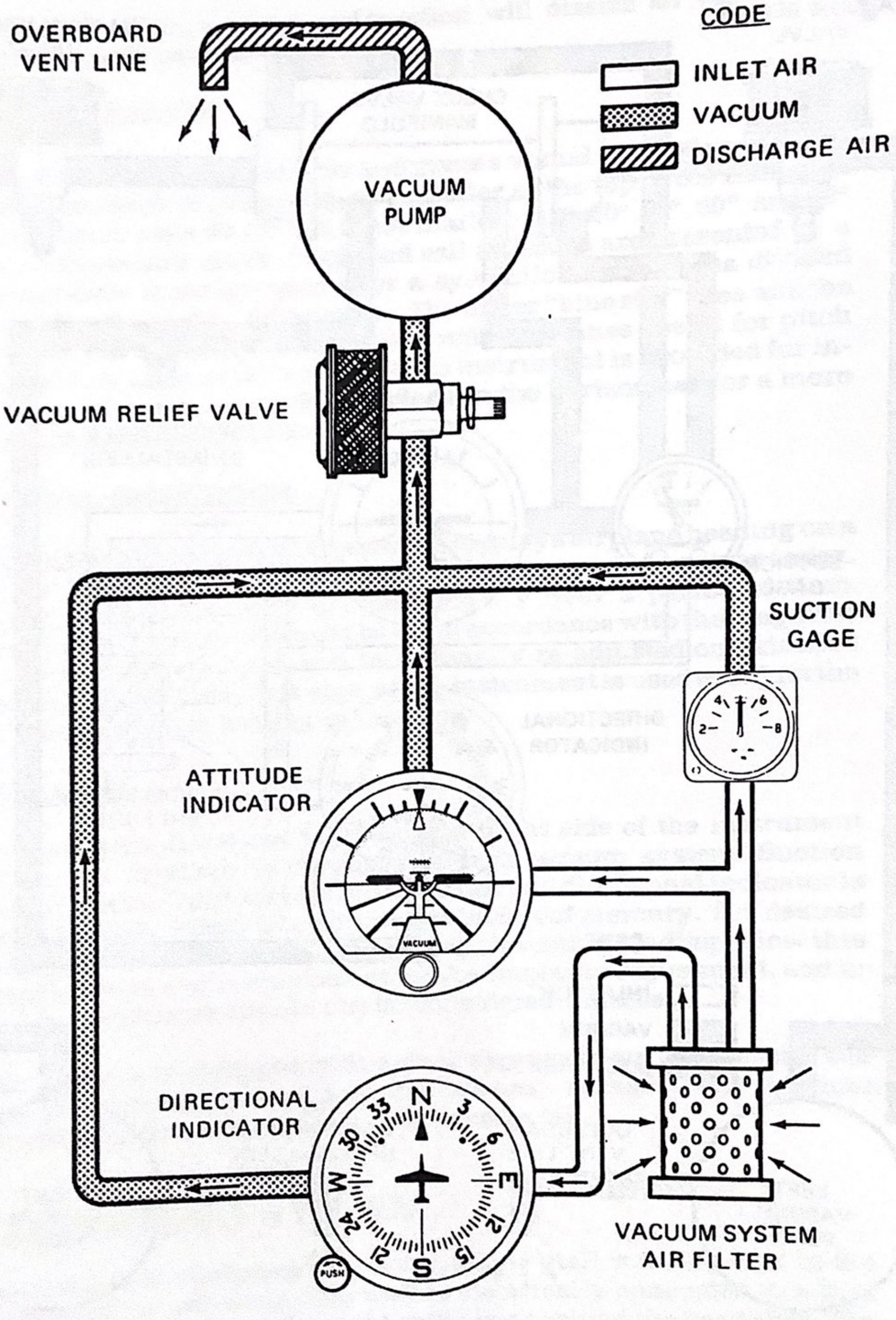


Figure 7-11. Single-Pump Vacuum System

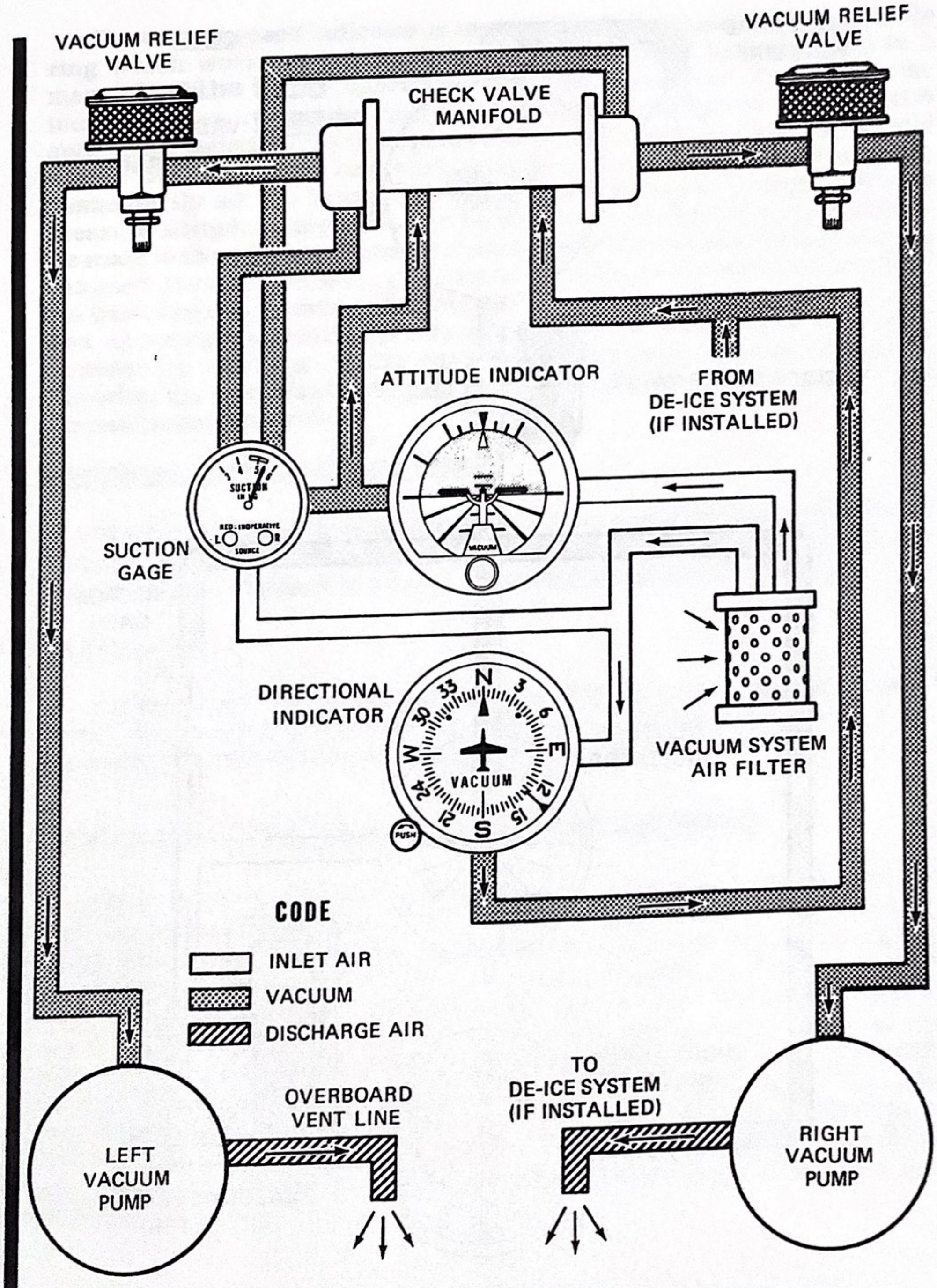


Figure 7-11A. Dual-Pump Vacuum System

tem is installed, a pump malfunction will disable all vacuum-operated equipment.

TTITUDE 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 superimposed over a symbolic horizon area divided into two sections by a white horizon bar. The upper "blue sky" area and the lower "ground" area have arbitrary pitch reference lines useful for pitch attitude control. 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 ompass 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.

If the airplane is equipped with a dual vacuum pump system, the suction gage incorporates two red warning buttons, marked L and R, which extend visibly in the event either or both sources fail.

STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit in the e leading edge of the left wing. The unit is electrically connected to a dual tr warning unit located above the right cabin door behind the headliner. The vane in the wing 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 leading edge is equipped with a heating element. The heated part of the 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

If the airplane is equipped with avionics, various avionics support equipment may also be installed. Equipment available includes two types of audio control panels, microphone-headset installations and control surface static dischargers. The following paragraphs discuss these items. Description and operation of radio equipment is covered in Section 9 of this handbook.

AUDIO CONTROL PANEL

Two types of audio control panels (see figure 7-12) are available for this airplane, depending upon how many transmitters are included. The operational features of both audio control panels are similar and are discussed in the following paragraphs.

TRANSMITTER SELECTOR SWITCH

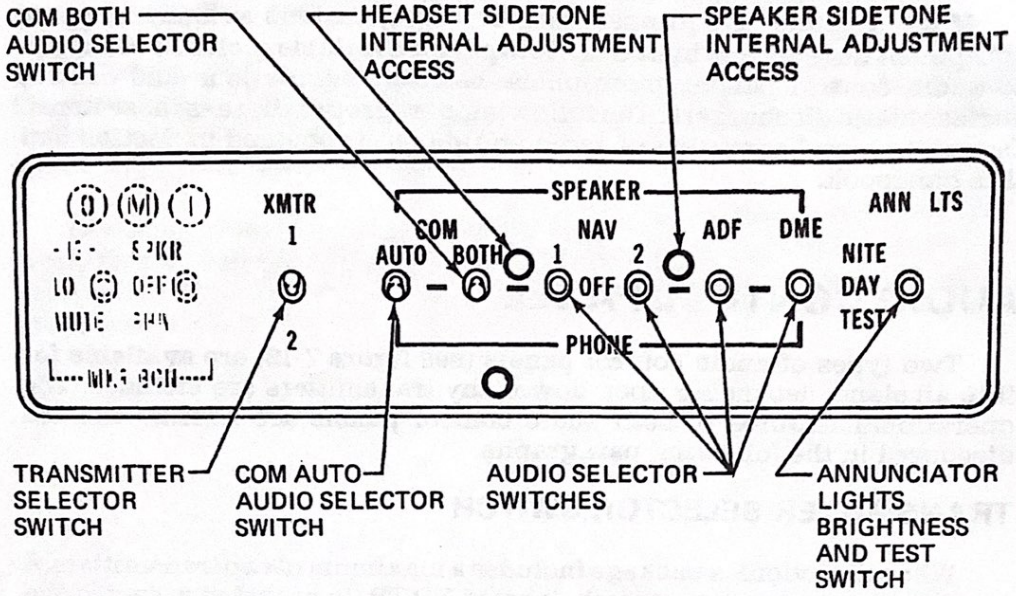
When the avionics package includes a maximum of two transmitters, a two-position toggle-type switch, labeled XMTR, is provided to switch the microphone to the transmitter the pilot desires to use. If the airplane avionics package includes a third transmitter, the transmitter selector switch is a three-position rotary-type switch, labeled XMTR SEL. The numbers 1, 2, or 1, 2 and 3 adjacent to the selector switches correspond to the first, second and third (from top to bottom) transmitters in the avionics stack. To select a transmitter, place the transmitter selector switch in the position number corresponding to the desired transmitter.

The action of selecting a particular transmitter using the transmitter selector switch simultaneously selects the audio amplifier associated with that transmitter to provide speaker audio. For example, if the number one transmitter is selected, the audio amplifier in the number one NAV/COM is also selected and is used for ALL speaker audio. In the event the audio amplifier in use fails, as evidenced by loss of all speaker audio, selecting an alternate transmitter will reestablish speaker audio using the alternate transmitter audio amplifier. Headset audio is not affected by audio amplifier operation.

AUDIO SELECTOR SWITCHES

Both audio control panels (see figure 7-12) incorporate three-position toggle-type audio selector switches for individual control of the audio from systems installed in the airplane. These switches allow receiver audio to be directed to the airplane speaker or to a headset, and heard singly or in combination with other receivers. To hear a particular

USED WITH ONE OR TWO TRANSMITTERS



USED WITH THREE TRANSMITTERS

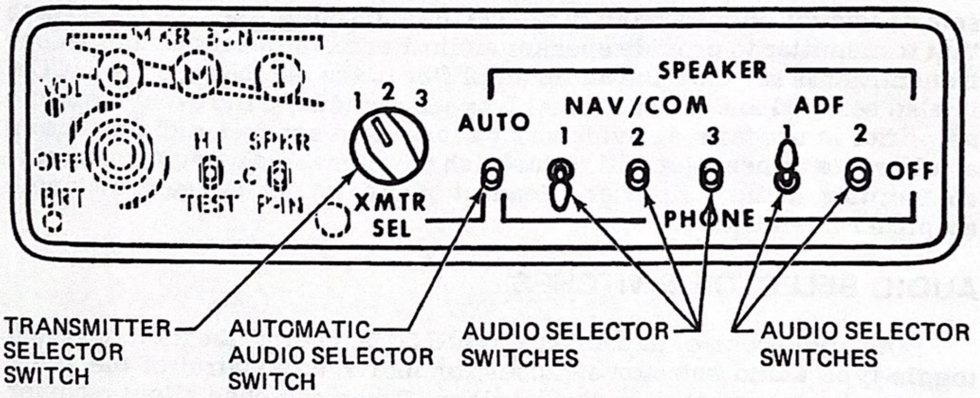


Figure 7-12. Audio Control Panel

receiver on the airplane speaker, place that receiver's audio selector switch in the up (SPEAKER) position. To listen to a receiver over a headset, place that receiver's audio selector switch in the down (PHONE) position. The center (OFF) position turns off all audio from the associated receiver.

NOTE

Volume level is adjusted using the individual receiver volume controls on each radio.

A special feature of the audio control panel used when one or two transmitters are installed is separate control of NAV and COM audio from the NAV/COM radios. With this installation, the audio selector switches labeled NAV, 1 and 2 select audio from the navigation receivers of the NAV/COM radios only. Communication receiver audio is selected by the switches labeled COM, AUTO and BOTH. Description and operation of these switches is described in later paragraphs.

When the audio control panel for three transmitters is installed, audio from both NAV and COM frequencies is combined, and is selected by the audio selector switches labeled NAV/COM, 1, 2 and 3.

COM AUTO AUDIO SELECTOR SWITCH

The audio control panel used with either one or two transmitters incorporates a three-position toggle switch, labeled COM AUTO, which is provided to automatically match the audio of the appropriate NAV/COM communications receiver to the transmitter selected by the transmitter selector switch. When the COM AUTO selector switch is placed in the up (SPEAKER) position, audio from the communications receiver selected by the transmitter selector switch will be heard on the airplane speaker. Switching the transmitter selector switch to the other transmitter automatically switches the other communications receiver audio to the speaker. This automatic audio switching feature may also be utilized when listening on a headset by placing the COM AUTO switch in the down (PHONE) position. If automatic audio selection is not desired, the COM AUTO selector switch should be placed in the center (OFF) position.

COM BOTH AUDIO SELECTOR SWITCH

The audio control panel used with either one or two transmitters incorporates a three-position toggle switch, labeled COM BOTH, which is provided to allow both COM receivers to be monitored at the same time. For example, if the COM AUTO switch is in the SPEAKER position, with the transmitter selector switch in the number one transmitter position, number one communications receiver audio will be heard on the airplane speaker. If it is also desired to monitor the number two communications receiver audio without changing the position of the transmitter selector switch, place the COM BOTH selector switch in the up (SPEAKER) position so that the number two communications receiver audio will be heard in addition to the number one communications receiver audio. This feature can also be used when listening on a headset by placing the COM BOTH audio selector switch in the down (PHONE) position.

NOTE

The combination of placing the COM AUTO switch in the SPEAKER position and the COM BOTH switch in the PHONE position (or vice versa) is not normally recommended as it will cause audio from both communications receivers (and any other navigation receiver with its audio selector switch in the PHONE position) to be heard on both the airplane speaker and the headset simultaneously.

AUTO AUDIO SELECTOR SWITCH

The audio control panel used with three transmitters incorporates a three-position toggle switch, labeled AUTO, which is provided to automatically match the audio of the appropriate NAV/COM receiver to the selected transmitter. To utilize this automatic feature, leave all NAV/COM audio selector switches in the center (OFF) 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 center (OFF) position.

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.

ANNUNCIATOR LIGHTS BRIGHTNESS AND TEST SWITCH

The audio control panel used with either one or two transmitters incorporates a three-position toggle-type switch to control the brightness level of the marker beacon indicator lights (and certain other annunciator lights associated with avionics equipment). When the switch is placed in the center (DAY) position, the indicator lights will show full bright. When this switch is placed in the up (NITE) position, the lights are set to a reduced level for typical night operations and can be further adjusted using the RADIO LT dimming rheostat knob. The down (TEST) position illuminates all lamps (except the ARC light in the NAV indicators) which are controlled by the switch to the full bright level to verify lamp operation.

SIDETONE OPERATION

Cessna radios are equipped with sidetone capability (monitoring of the operator's own voice transmission). While adjusting sidetone, be aware that if the sidetone volume level is set too high, audio feedback (squeal) may result when transmitting.

When the airplane has one or two transmitters, sidetone is provided in both the speaker and headset anytime the COM AUTO selector switch is utilized. Placing the COM AUTO selector switch in the OFF position will eliminate sidetone. Sidetone internal adjustments are available to the pilot through the front of the audio control panel (see figure 7-12). Adjustment can be made by removing the appropriate plug-button from the audio control panel (left button for headset adjustment and right button for speaker adjustment), inserting a small screwdriver into the adjustment potentiometer and rotating it clockwise to increase the sidetone volume level.

When the airplane has three transmitters, sidetone will be heard on either the speaker or a headset as selected with the AUTO selector switch. Sidetone may be eliminated by placing the AUTO selector switch in the OFF position, and utilizing the individual audio selector switches. Adjustment of speaker and headset sidetone volume can only be accomplished by adjusting the sidetone potentiometers located inside the audio control panel.

NOTE

Sidetone is not available on HF Transceivers (Types PT10-A and ASB-125), when installed.

MICROPHONE-HEADSET INSTALLATIONS

Three types of microphone-headset installations are offered. The standard system provided with avionics equipment includes a hand-held microphone and separate headset. The keying switch for this microphone is on the microphone. Two optional microphone-headset installations are also available; these feature a single-unit microphone-headset combination which permits the pilot to conduct radio communications without interrupting other control operations to handle a hand-held microphone. One microphone-headset combination is offered without a padded headset and the other version has a padded headset. The microphone-headset combinations utilize a remote keying switch located on the left grip of the pilot's control wheel. The microphone and headset jacks are located on the left side of the instrument panel. Audio to all three headsets is controlled by the individual audio selector switches and adjusted for volume level by using the selected receiver volume controls.

NOTE

> When transmitting, the pilot should key the microphone, place the microphone as close as possible to the lips and speak directly into it.

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.

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 AND FAA APPROVED AIRPLANE FLIGHT MANUAL
- AVIONICS OPERATION GUIDE
- PILOT'S CHECKLISTS
- POWER COMPUTER
- CUSTOMER CARE 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.

- INFORMATION MANUAL (Contains Pilot's Operating Handbook Information)
- 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.

NOTE

A Pilot's Operating Handbook and FAA Approved Airplane Flight Manual which is lost or destroyed may be replaced by contacting your Cessna Dealer or writing directly to the Customer Services Department, Cessna Aircraft Company, Wichita, Kansas. An affidavit containing the owner's name, airplane serial number and registration number must be included in replacement requests since the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual is identified for specific airplanes only.

AIRPLANE FILE

There are miscellaneous data, information and licenses that are a part f 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 the 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. Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
   2. Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
   3. 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 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 or chain 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.

A jack pad assembly is available to facilitate jacking individual main gear. 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 horizontal 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 available, the tail should be securely tied down.

NOTE

> Ensure that the nose will be held off the ground under all conditions by means of suitable stands or supports under weight supporting bulkheads near the nose of the airplane.

LEVELING

Longitudinal leveling of the airplane is accomplished by placing a level on the leveling screws located on the left side of the tailcone. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level. Corresponding points on either the upper or lower main door sills may be used to level the airplane laterally.

FLYABLE STORAGE

Airplanes placed in non-operational storage for a maximum of 30 days or those which receive only intermittent operational use for the first 25 hours are considered in flyable storage status. Every seventh day during these periods, the propeller should be rotated by hand through five revolutions. This action "limbers" the oil and prevents any accumulation of corrosion on engine cylinder walls.

WARNING

> **For maximum safety, check that the ignition switch is OFF, the throttle is closed, the mixture control is in the idle cut-off position, and the airplane is secured before rotating the propeller by hand. Do not stand within the arc of the propeller blades while turning the propeller.**

After 30 days, the airplane should be flown for 30 minutes or a ground runup should be made just long enough to produce an oil temperature within the lower green arc range. Excessive ground runup should be avoided.

Engine runup also helps to eliminate excessive accumulations of water in the fuel system and other air spaces in the engine. Keep fuel tanks full to minimize condensation in the tanks. Keep the battery fully charged to prevent the electrolyte from freezing in cold weather. If the airplane is to be stored temporarily, or indefinitely, refer to the Service Manual for proper storage procedures.

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 AND VISCOSITY FOR TEMPERATURE RANGE --

All temperatures, use SAE 20W-50 or
Above 4°C (40°F), use SAE 50
Below 4°C (40°F), use SAE 30

Multi-viscosity oil with a range of SAE 20W-50 is recommended for improved starting and turbocharger controller operation in cold weather. Ashless dispersant oil, conforming to Continental Motors Specification MHS-24 (and all revisions thereto), **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 is changed.

OIL AND OIL FILTER CHANGE --

After the first 25 hours of operation, drain engine oil sump and replace filter. 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. Drain the engine oil sump and replace the filter each 50 hours thereafter. The oil change interval may be extended to 100-hour intervals, providing the oil filter 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.

NOTE

During the first 25-hour oil and filter change, a general inspection of the overall engine compartment is required. Items which are not normally checked during a preflight inspection should be given special attention. Hoses, metal lines and fittings should be inspected for signs of oil and fuel leaks, and checked for abrasions, chafing, security, proper routing and support, and evidence of deterioration. Inspect the intake and exhaust systems for cracks, evidence of leakage, and security of attachment. Engine controls and linkages should be checked for freedom of movement through their full range, security of attachment and evidence of wear. Inspect wiring for security, chafing, burning, defective insulation, loose or broken terminals, heat deterioration, and corroded terminals. Check the alternator belt in accordance with Service Manual instructions, and retighten if necessary. A periodic check of these items during subsequent servicing operations is recommended.

FUEL

APPROVED FUEL GRADES (AND COLORS) --

100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).

NOTE

Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply in quantities not to exceed 1% or .15% by volume, respectively, of the total. Refer to Fuel Additives in later paragraphs for additional information.

CAPACITY EACH TANK -- 45 Gallons.
REDUCED CAPACITY EACH TANK (WHEN FILLED TO BOTTOM OF FUEL FILLER NECK EXTENSION) -- 33.5 Gallons.

NOTE

Service the fuel system after each flight, and keep fuel tanks full to minimize condensation in the tanks.

FUEL ADDITIVES --

Strict adherence to recommended preflight draining instructions as called for in Section 4 will eliminate any free water accumulations from the tank sumps. While small amounts of water may still remain in solution in the gasoline, it will normally be consumed and go unnoticed in the operation of the engine.

One exception to this can be encountered when operating under the combined effect of: (1) use of certain fuels, with (2) high humidity conditions on the ground (3) followed by flight at high altitude and low temperature. Under these unusual conditions, small amounts of water in solution can precipitate from the fuel stream and freeze in sufficient quantities to induce partial icing of the engine fuel system.

While these conditions are quite rare and will not normally pose a problem to owners and operators, they do exist in certain areas of the world and consequently must be dealt with, when encountered.

Therefore, to alleviate the possibility of fuel icing occurring under these unusual conditions, it is permissible to add isopropyl alcohol or ethylene glycol monomethyl ether (EGME) compound to the fuel supply.

The introduction of alcohol or EGME compound into the fuel provides two distinct effects: (1) it absorbs the dissolved water from the gasoline and (2) alcohol has a freezing temperature depressant effect.

Alcohol, if used, is to be blended with the fuel in a concentration of 1% by volume. Concentrations greater than 1% are not recommended since they can be detrimental to fuel tank materials.

The manner in which the alcohol is added to the fuel is significant because alcohol is most effective when it is completely dissolved in the fuel. To ensure proper mixing, the following is recommended:

1. **For best results, the alcohol should be added during the fueling operation by pouring the alcohol directly on the fuel stream issuing from the fueling nozzle.**
2. **An alternate method that may be used is to premix the complete alcohol dosage with some fuel in a separate clean container (approximately 2-3 gallon capacity) and then transferring this mixture to the tank prior to the fuel operation.**

Any high quality isopropyl alcohol may be used, such as Anti-Icing Fluid (MIL-F-5566) or Isopropyl Alcohol (Federal Specification TT-I-735a). Figure 8-1 provides alcohol-fuel mixing ratio information.

Ethylene glycol monomethyl ether (EGME) compound, in compliance with MIL-I-27686 or Phillips PFA-55MB, if used, must be carefully mixed with the fuel in concentrations not to exceed .15% by volume. Figure 8-1 provides EGME-fuel mixing ratio information.

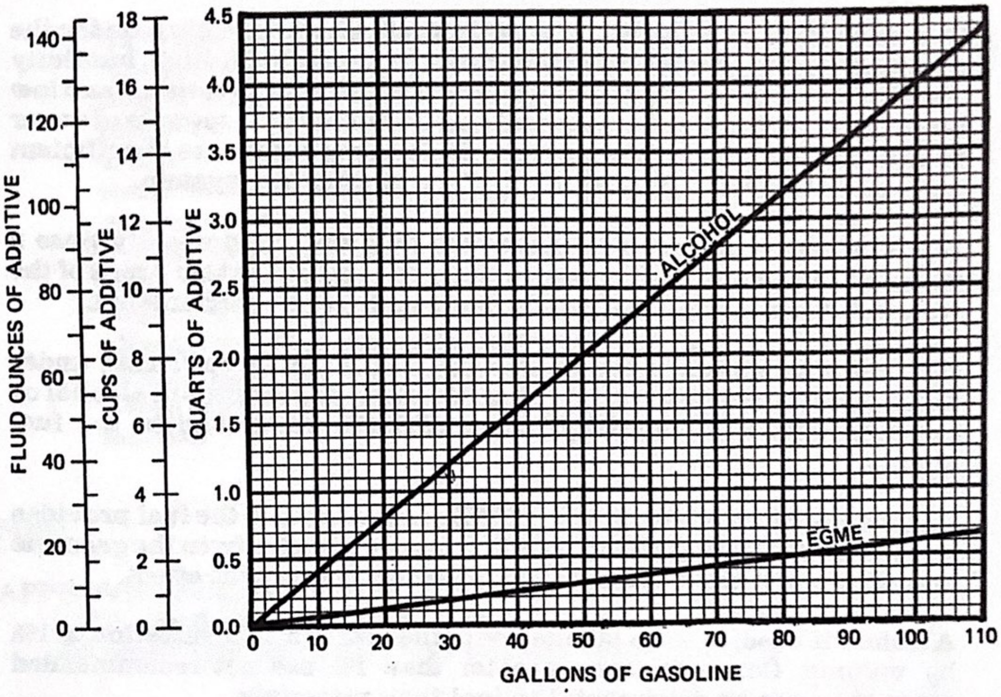


Figure 8-1. Additive Mixing Ratio

CAUTION

Mixing of the EGME compound with the fuel is extremely important because a concentration in excess of that recommended (.15% by volume maximum) will result in detrimental effects to the fuel tanks, such as deterioration of protective primer and sealants and damage to O-rings and seals in the fuel system and engine components. Use only blending equipment that is recommended by the manufacturer to obtain proper proportioning.

CAUTION

Do not allow the concentrated EGME compound to come in contact with the airplane finish as damage can result.

Prolonged storage of the airplane will result in a water buildup in the fuel which "leeches out" the additive. An indication of this is when an excessive amount of water accumulates in the fuel tank sumps. The concentration can be checked using a differential refractometer. It is imperative that the technical manual for the differential refractometer be followed explicitly when checking the additive concentration.

LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 88 PSI on 5.00-5, 10-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 every 25 hours 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, 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 10 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. Isopropyl alcohol will satisfactorily remove ice accumulations without damaging the paint. 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 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.