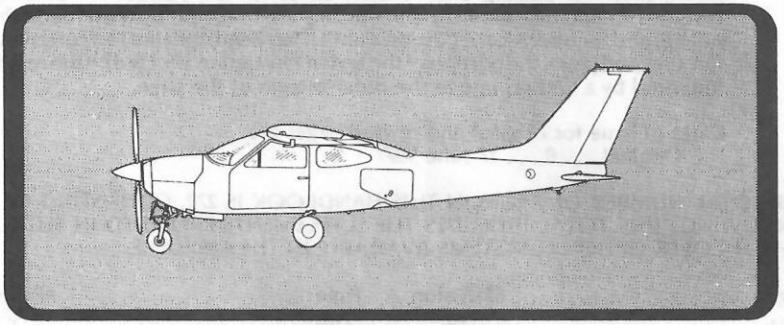
PILOT'S OPERATING HANDBOOK

Cessna®



CARDINAL RG

1978 MODEL 177RG

Serial No._____

Registration No._____

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY FAR PART 23

CESSNA AIRCRAFT COMPANY

WICHITA, KANSAS, USA

D1112-13-RPC-200-4/88

LIST OF EFFECTIVE PAGES

INSERT LATEST REVISED PAGES; DISPOSE OF SUPERSEDED PAGES.

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

Dates of issue for original and revised pages are:
Original . . . 0 . . . 17 June 1977

THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 272, CONSISTING OF THE FOLLOWING. THIS TOTAL INCLUDES THE SUPPLEMENTS PROVIDED IN SECTION 9 WHICH COVER OPTIONAL SYSTEMS AVAILABLE IN THE AIRPLANE.

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CONGRATULATIONS . . . .

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

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

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

- THE CESSNA WARRANTY, which provides coverage for parts and labor, is available at Cessna Dealers worldwide. Specific benefits and provisions of warranty, plus other important benefits for you, are contained in your Customer Care Program book, supplied with your airplane. Warranty service is available to you at authorized Cessna Dealers throughout the world upon presentation of your Customer Care Card which establishes your eligibility under the warranty.
- FACTORY TRAINED PERSONNEL to provide you with courteous expert service.
- FACTORY APPROVED SERVICE EQUIPMENT to provide you efficient and accurate workmanship.
- A STOCK OF GENUINE CESSNA SERVICE PARTS on hand when you need them.
- THE LATEST AUTHORITATIVE INFORMATION FOR SERVICING CESSNA AIRPLANES, since Cessna Dealers have all of the Service Manuals and Parts Catalogs, kept current by Service Letters and Service News Letters, published by Cessna Aircraft Company.

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

A current Cessna Dealer Directory accompanies your new airplane. The Directory is revised frequently, and a current copy can be obtained from your Cessna Dealer. Make your Directory one of your cross-country flight planning aids; a warm welcome awaits you at every Cessna Dealer.

PERFORMANCE - SPECIFICATIONS

SPEED:		
Maximum at Sea Level		156 KNOTS
Cruise, 75% Power at 7000 Ft		148 KNOTS
CRUISE: Recommended lean mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.		
75% Power at 7000 Ft	Range	715 NM
60 Gallons Usable Fuel	Time	4.9 HRS
Maximum Range at 10,000 Ft	Range	895 NM
60 Gallons Usable Fuel	Time	7.5 HRS
RATE OF CLIMB AT SEA LEVEL		925 FPM
SERVICE CEILING		17,100 FT
TAKEOFF PERFORMANCE:		
Ground Roll		890 FT
Total Distance Over 50-Ft Obstacle		1585 FT
LANDING PERFORMANCE:		
Ground Roll		730 FT
Total Distance Over 50-Ft Obstacle		1350 FT
STALL SPEED (CAS):		
Flaps Up, Power Off		57 KNOTS
Flaps Down, Power Off		50 KNOTS
MAXIMUM WEIGHT:		
Ramp		2809 LBS
Takeoff or Landing		2800 LBS
STANDARD EMPTY WEIGHT:		
Cardinal RG		1703 LBS
Cardinal RG II		1761 LBS
MAXIMUM USEFUL LOAD:		
Cardinal RG		1106 LBS
Cardinal RG II		1048 LBS
BAGGAGE ALLOWANCE		120 LBS
WING LOADING: Pounds/Sq Ft		16.1
POWER LOADING: Pounds/HP		14.0
FUEL CAPACITY: Total		61 GAL.
OIL CAPACITY		9 QTS
ENGINE: Avco Lycoming 200 BHP at 2700 RPM		IO-360-A1B6D
PROPELLER: Constant Speed, Diameter		78 IN.

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SECTION 1
GENERAL

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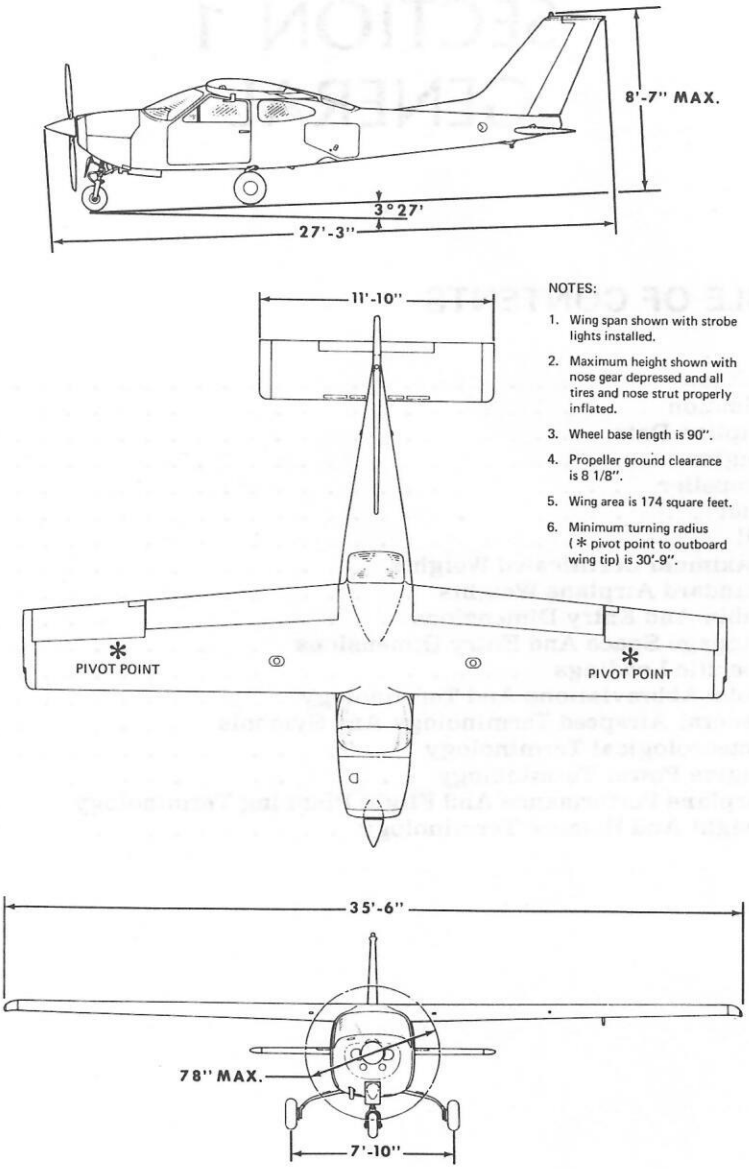

Figure 1-1. Three View

INTRODUCTION

This handbook contains 9 sections, and includes the material required to be furnished to the pilot by FAR Part 23. 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: Avco Lycoming.
Engine Model Number: IO-360-A1B6D.
Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, fuel-injected, four-cylinder engine with 361 cu. in. displacement.
Horsepower Rating and Engine Speed: 200 rated BHP at 2700 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B2D34C207/78TCA-0.
Number of Blades: 2.
Propeller Diameter, Maximum: 78 inches.
Minimum: 76.5 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 12.9° and a high pitch setting of 27.5° (30 inch station).

FUEL

Approved Fuel Grades (and Colors):
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).
Total Capacity: 61 gallons.
Total Capacity Each Tank: 30.5 gallons.
Total Usable: 60 gallons.

NOTE

To ensure desired fuel capacity when refueling, place the

fuel selector valve in either LEFT or RIGHT position to prevent cross-feeding.

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.

MIL-L-22851 Ashless Dispersant Oil: This oil **must be used** after first 50 hours or oil consumption has stabilized.

Recommended Viscosity for Temperature Range:

MIL-L-6082 Aviation Grade Straight Mineral Oil:
SAE 50 above 16°C (60°F).
SAE 40 between -1°C (30°F) and 32°C (90°F).
SAE 30 between -18°C (0°F) and 21°C (70°F).
SAE 20 below -12°C (10°F).

MIL-L-22851 Ashless Dispersant Oil:
SAE 40 or SAE 50 above 16°C (60°F).
SAE 40 between -1°C (30°F) and 32°C (90°F).
SAE 30 or SAE 40 between -18°C (0°F) and 21°C (70°F).
SAE 30 below -12°C (10°F).

Oil Capacity:
Sump: 8 Quarts.
Total: 9 Quarts

MAXIMUM CERTIFICATED WEIGHTS

Takeoff: 2800 lbs.
Landing: 2800 lbs.
Weight in Baggage Compartment:
Baggage Area "A" (on and forward of wheel well) - Station 145 to 172: See note below.
Baggage Area "B" (aft of wheel well) and Hatshelf - Station 172 to 195: See note below.

NOTE

The maximum baggage load, including the hatshelf, is 120

lbs. This load may be distributed as desired between baggage areas, provided 12 lbs. is not exceeded on the hatshelf.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Cardinal RG: 1703 lbs.
Cardinal RG II: 1761 lbs.
Maximum Useful Load, Cardinal RG: 1106 lbs.
Cardinal RG II: 1048 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: 16.1 lbs./sq. ft.
Power Loading: 14.0 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.
V_{FE}	**Maximum Flap Extended Speed** is the highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	**Maximum Landing Gear Extended Speed** is the maximum speed at which an airplane can be safely flown with the landing gear extended.
V_{LO}	**Maximum Landing Gear Operating Speed** is the maximum speed at which the landing gear can be safely extended or retracted.
V_{NO}	**Maximum Structural Cruising Speed** is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	**Never Exceed Speed** is the speed limit that may not be exceeded at any time.
V_S	**Stalling Speed or the minimum steady flight speed** at which the airplane is controllable.
V_{S_o}	**Stalling Speed or the minimum steady flight speed** at which the airplane is controllable in the landing configuration at the most forward center of gravity.
V_X	**Best Angle-of-Climb Speed** is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	**Best Rate-of-Climb Speed** is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

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

inches of mercury (1013 mb).

ENGINE POWER TERMINOLOGY

BHP	**Brake Horsepower** is the power developed by the engine.
RPM	**Revolutions Per Minute** is engine speed.
MP	**Manifold Pressure** is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

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

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum	**Reference Datum** is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.
Station	**Station** is a location along the airplane fuselage given in terms of the distance from the reference datum.
Arm	**Arm** is the horizontal distance from the reference datum to the center of gravity (C.G.) of an item.

Moment	**Moment** is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.)
Center of Gravity (C.G.)	**Center of Gravity** is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.
C.G. Arm	**Center of Gravity Arm** is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	**Center of Gravity Limits** are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	**Standard Empty Weight** is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	**Basic Empty Weight** is the standard empty weight plus the weight of optional equipment.
Useful Load	**Useful Load** is the difference between ramp weight and the basic empty weight.
Maximum Ramp Weight	**Maximum Ramp Weight** is the maximum weight approved for ground maneuver. (It includes the weight of start, taxi and runup fuel.)
Gross (Loaded) Weight	**Gross (Loaded) Weight** is the loaded weight of the airplane.
Maximum Takeoff Weight	**Maximum Takeoff Weight** is the maximum weight approved for the start of the takeoff run.
Maximum Landing Weight	**Maximum Landing Weight** is the maximum weight approved for the landing touchdown.
Tare	**Tare** is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

SECTION 2
LIMITATIONS

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SECTION 2
LIMITATIONS

INTRODUCTION

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

NOTE

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

Your Cessna is certificated under FAA Type Certificate No. A20CE as Cessna Model No. 177RG.

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	169	174	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	139	142	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed: 2800 Pounds 2400 Pounds 2000 Pounds	 113 105 96	 113 105 96	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed: To 10^o Flaps 10^o - 30^o Flaps	 128 95	 130 95	Do not exceed these speeds with the given flap settings.
V_{LO}	Maximum Landing Gear Operating Speed	123	125	Do not extend or retract landing gear above this speed.
V_{LE}	Maximum Landing Gear Extended Speed	123	125	Do not exceed this speed with landing gear extended.
	Maximum Window Open Speed	105	105	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	50 - 95	Full Flap Operating Range. Lower limit is maximum weight V_{S_0} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	59 - 142	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	142 - 174	Operations must be conducted with caution and only in smooth air.
Red Line	174	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Avco Lycoming.
Engine Model Number: IO-360-A1B6D.
Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Power: 200 BHP.
Maximum Engine Speed: 2700 RPM.
Maximum Cylinder Head Temperature: 246°C (475°F).
Maximum Oil Temperature: 118°C (245°F).
Oil Pressure, Minimum: 25 psi.
Maximum: 100 psi.
Fuel Pressure, Maximum: 10.0 psi (19.0 gal/hr).
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B2D34C207/78TCA-0.
Propeller Diameter, Maximum: 78 inches.
Minimum: 76.5 inches.
Propeller Blade Angle at 30 Inch Station, Low: 12.9°.
High: 27.5°.
Propeller Operating Limits: Avoid continuous operation between 1400 and 1750 RPM with less than 10 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 MINIMUM LIMIT	GREEN ARC NORMAL OPERATING	YELLOW ARC CAUTION RANGE	RED LINE MAXIMUM LIMIT
Tachometer	- - -	2100 - 2500 RPM	1400 - 1750 RPM	2700 RPM
Manifold Pressure	- - -	15-25 in. Hg	- - -	- - -
Oil Temperature	- - -	100° - 245°F	- - -	245°F
Cylinder Head Temperature	- - -	200° - 475°F	- - -	475°F
Fuel Flow (Pressure)	- - -	6.0-13.0 gal/hr	- - -	19.0 gal/hr (10.0 psi)
Oil Pressure	25 psi	60-90 psi	- - -	100 psi

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

Maximum Takeoff Weight: 2800 lbs.
Maximum Landing Weight: 2800 lbs.
Maximum Weight in Baggage Compartment:
Baggage Area "A" (on and forward of wheel well) - Station 145 to 172: See note below.
Baggage Area "B" (aft of wheel well) and Hatshelf - Station 172 to 195: See note below.

NOTE

The maximum baggage load, including the hatshelf, is 120 lbs. This load may be distributed as desired between baggage areas, provided 12 lbs. is not exceeded on the hatshelf.

CENTER OF GRAVITY LIMITS

Center of Gravity Range with Landing Gear Extended:
Forward: 101.0 inches aft of datum at 2200 lbs. or less, with straight line variation to 105.8 inches aft of datum at 2800 lbs.
Aft: 114.7 inches aft of datum at all weights.
Moment Change Due To Retracting Landing Gear: +2776 lb. -ins.
Reference Datum: 54.0 inches forward of the front face of the lower portion of the 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 steep 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: 30.5 U.S. gallons each.
Total Fuel: 61 U.S. gallons.
Usable Fuel (all flight conditions): 60 U.S. gallons.
Unusable Fuel: 1 U.S. gallon.

NOTE

Use both tanks for takeoff and landing.

NOTE

To ensure desired fuel capacity when refueling, place the fuel selector valve in either LEFT or RIGHT position to prevent cross-feeding.

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

PLACARDS

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

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

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

MAXIMUMS

GROSS WEIGHT		2800 lbs.
FLIGHT LOAD FACTOR	Flaps Up	+3.8, -1.52
	Flaps Down . . .	+2.0

No acrobatic maneuvers, including spins, approved. Altitude loss in a stall recovery - 190 ft. Flight into known icing conditions prohibited. This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY - NIGHT - VFR - IFR

2. On control lock:

Control lock - remove before starting engine.

3. By fuel valve (at appropriate locations):

Both -- 60 gal.
Left -- 30 gal.
Right -- 30 gal.
Use both for takeoff and landing.
When switching from a dry tank, turn auxiliary pump on and use full rich mixture until power is restored.

4. Aft of fuel tank cap:

Service this airplane with 100LL/100 grade aviation gasoline. Total capacity 30.5 gal. Capacity to line of holes inside filler neck 22 gal.

5. In baggage compartment:

120 lb. maximum baggage including 12 pounds maximum in baggage wall hatshelf. For additional loading instructions see weight and balance data.

6. Next to door ventilation windows:

Do not open window above 105 knots or when using alternate static source.

7. On flap control and indicator:

0° to 10°	(Blue color code and 130 knot callout; also, mechanical detent at 10°.)
10° - 20° - 30°	(Indices at these positions with white color code and 95 knot callout; also, mechanical detent at 20°).

8. At the top of the control pedestal:

MAXIMUM POWER MIXTURE

ALTITUDE	S.L.	4000	8000	12,000
GAL./HR	17	15	13	10

AVOID CONTINUOUS OPERATION BETWEEN 1400 AND 1750 RPM WITH LESS THAN 10" MANIFOLD PRESSURE.

9. On emergency landing gear pump handle cover:

EMERGENCY HAND PUMP
PULL UP

TO EXTEND GEAR MANUALLY

a. Pull out landing gear circuit breaker.
b. Place gear lever in DOWN position.
c. Extend pump handle.
d. Pump approximately 40 pressure strokes.
e. Stop when resistance becomes heavy.
f. Verify gear is down by observing green light.

IMPORTANT

To permit normal gear retraction after hand pump use, push in landing gear circuit breaker.

10. Near the airspeed indicator:

MAX SPEED	KIAS
MANEUVER	113
GEAR OPER	125
GEAR DOWN	125

SECTION 3
EMERGENCY PROCEDURES

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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	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2800 Lbs	113 KIAS
2400 Lbs	105 KIAS
2000 Lbs	96 KIAS
Maximum Glide:	
2800 Lbs	75 KIAS
2400 Lbs	70 KIAS
2000 Lbs	65 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	75 KIAS
Wing Flaps Down	65 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 -- 70 KIAS.
2. Mixture -- IDLE CUT-OFF.
3. Fuel Selector Valve -- OFF.
4. Ignition Switch -- OFF.
5. Wing Flaps -- AS REQUIRED.
6. Master Switch -- OFF.

ENGINE FAILURE DURING FLIGHT

1. Airspeed -- 75 KIAS.
2. Fuel Selector Valve -- BOTH.
3. Mixture -- RICH.
4. Auxiliary Fuel Pump -- ON.
5. Ignition Switch -- BOTH (or START if propeller is stopped).

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Airspeed -- 75 KIAS (flaps UP).
   65 KIAS (flaps DOWN).
2. Mixture -- IDLE CUT-OFF.
3. Fuel Selector Valve -- OFF.
4. Ignition Switch -- OFF.
5. Landing Gear -- DOWN (UP if terrain is rough or soft).
6. Wing Flaps -- AS REQUIRED (30° recommended).
7. Master Switch -- OFF.
8. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
9. Touchdown -- SLIGHTLY TAIL LOW.
10. Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

1. Airspeed -- 65 KIAS.
2. Wing Flaps -- 20°.
3. Selected Field -- FLYOVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
4. Avionics Power Switch and Electrical Switches -- OFF.
5. Landing Gear -- DOWN (UP if terrain is rough or soft).
6. Wing Flaps -- 30° (on final approach).
7. Airspeed -- 65 KIAS
8. Master Switch -- OFF.

9. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
10. Touchdown -- SLIGHTLY TAIL LOW.
11. Ignition Switch -- OFF.
12. Brakes -- APPLY HEAVILY.

DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions.
2. Heavy Objects (in baggage area) -- SECURE OR JETTISON.
3. Landing Gear -- UP.
4. Wing Flaps -- 30°.
5. Power -- ESTABLISH 300 FT/MIN DESCENT AT 60 KIAS.
6. Approach -- High Winds, Heavy Seas -- INTO THE WIND.
   Light Winds, Heavy Swells -- PARALLEL TO SWELLS.

NOTE

If no power is available, approach with 10° flaps at 65 KIAS.

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

FIRES

DURING START ON GROUND

1. Auxiliary Fuel Pump -- OFF.
2. Mixture -- IDLE CUT-OFF.
3. Ignition Switch -- OFF.
4. Parking Brake -- RELEASE.
5. Fire Extinguisher (if installed) -- OBTAIN.
6. Airplane -- EVACUATE.
7. Fire -- EXTINGUISH.

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 stabilator.

8. 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 -- 100 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. Avionics Power Switch -- OFF.
3. All Other Switches (except ignition switch) -- OFF.
4. Vents/Cabin Air/Heat -- CLOSED.
5. Fire Extinguisher -- ACTIVATE (if available).

WARNING

After discharging an extinguisher within a closed cabin, ventilate the cabin.

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

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

CABIN FIRE

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

WARNING

After discharging an extinguisher within a closed cabin, ventilate the cabin.

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

WING FIRE

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

NOTE

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

ICING

INADVERTENT ICING ENCOUNTER

1. Turn pitot heat switch ON (if installed).
2. Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
3. Pull left cabin air, heater and defroster control knobs full out to obtain windshield defroster airflow.
4. Increase RPM to minimize ice build-up on propeller blades.
5. Plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
6. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speeds.
7. Extend wing flaps 10° with ice accumulations of one inch or less. With heavier ice accumulations, approach with flaps retracted to ensure adequate stabilator effectiveness in the approach and landing.
8. Perform a landing approach using a forward slip, if necessary, for improved visibility.

9. Approach at 75-85 KIAS depending upon the amount of ice accumulation.
10. Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

1. Vent Windows -- CLOSED.
2. Alternate Static Source Valve -- PULL ON.
3. Airspeed -- Consult appropriate calibration tables in Section 5.

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 Indicator Circuit Breakers -- IN.
4. Gear Up Light -- CHECK.
5. Landing Gear Lever -- RECYCLE.
6. Gear Motor -- CHECK operation (ammeter).

LANDING GEAR FAILS TO EXTEND

1. Landing Gear Circuit Breaker -- PULL OUT.
2. Landing Gear Lever -- DOWN.
3. Emergency Hand Pump -- LIFT COVER, EXTEND HANDLE, and PUMP (until resistance becomes heavy -- about 40 strokes).
4. Gear Down Light -- ON.
5. Pump Handle -- STOW.
6. Landing Gear Circuit Breaker -- IN.

GEAR UP LANDING

1. Landing Gear Lever -- UP.
2. Landing Gear Circuit Breaker -- IN.
3. Wing Flaps -- 30° (on final approach).
4. Airspeed -- 65 KIAS.
5. Avionics Power Switch -- OFF.
6. Master Switch -- OFF.
7. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
8. Touchdown -- SLIGHTLY TAIL LOW.
9. Ignition Switch -- OFF.
10. Airplane -- EVACUATE.

LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

1. Before Landing Check -- COMPLETE.
2. Approach -- NORMAL full flap.
3. Landing Gear Down Pressure -- MAINTAIN with hand pump.
4. Landing -- TAIL LOW as smoothly as possible.
5. Taxi -- SLOWLY.

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.
5. Emergency Hand Pump -- ACTUATE to maintain gear down pressure, continue through roll-out (defective gear only).
6. Wing Flaps -- 30°.
7. Avionics Power Switch -- OFF.
8. Master Switch -- OFF.
9. Land -- SLIGHTLY TAIL LOW.
10. Mixture -- IDLE CUT-OFF.
11. Ignition Switch -- OFF.
12. Fuel Selector Valve -- OFF.
13. Stabilator Control -- HOLD NOSE OFF GROUND as long as possible.
14. Airplane -- EVACUATE as soon as it stops.

LANDING WITH A FLAT MAIN TIRE

1. Wing Flaps -- AS DESIRED (0°- 10° below 130 KIAS, 10°- 30° below 95 KIAS).
2. Make a normal approach.
3. Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

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

If over-voltage light illuminates again:

6. Flight -- TERMINATE as soon as practical.

AMMETER SHOWS DISCHARGE

1. Alternator -- OFF.
2. Nonessential Radio/Electrical Equipment -- OFF.
3. Flight -- TERMINATE as soon as practical.

AMPLIFIED PROCEDURES

ENGINE FAILURE

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

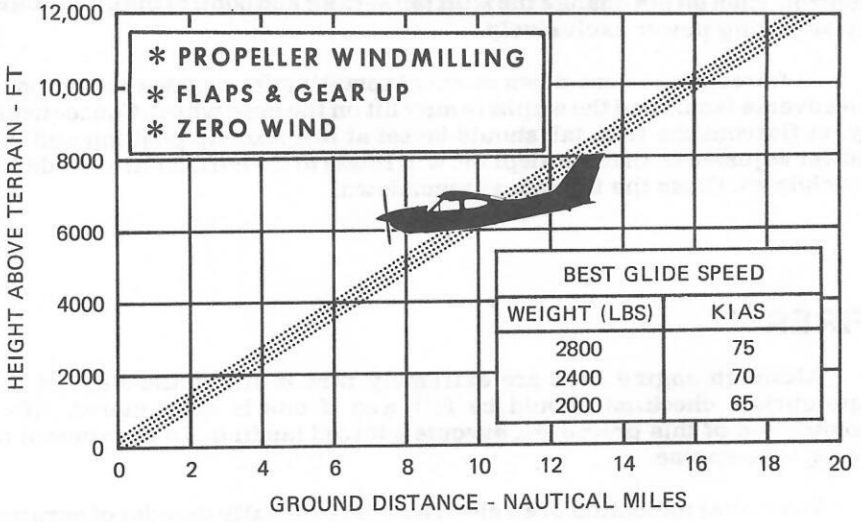


Figure 3-1. Maximum Glide

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. Avoid a landing flare because of difficulty in judging height over a water surface.

LANDING WITHOUT STABILATOR CONTROL

Trim for horizontal flight with an airspeed of approximately 80 KIAS, landing gear extended, and flaps set to 10°, by using throttle and trim tab control. 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

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

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

EMERGENCY OPERATION IN CLOUDS

(Vacuum System Failure)

In the event of a vacuum system failure during flight, the directional indicator and attitude indicator will be disabled, and the pilot will have to rely on the turn coordinator if he inadvertently flies into clouds. The following instructions assume that only the electrically-powered turn coordinator 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 stabilator control. Avoid overcontrolling by keeping the hands off the control wheel as much as possible and steering only with rudder.

EMERGENCY DESCENT THROUGH CLOUDS

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

1. Extend landing gear.

2. Reduce power to set up a 500 to 800 ft/min rate of descent.
3. Apply full rich mixture.
4. Adjust the stabilator and rudder trim control wheels for a stabilized descent at 80 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, if present.
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 stabilator back pressure to slowly reduce the indicated airspeed to 80 KIAS.
4. Adjust the stabilator trim control to maintain an 80 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading. Use rudder trim to relieve unbalanced rudder force, if present.
6. Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
7. Upon breaking out of clouds, resume normal cruising flight.

FLIGHT IN ICING CONDITIONS

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

STATIC SOURCE BLOCKED

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

To avoid the probability of large errors, the vent windows should not be open when using the alternate static source. With the windows closed, the most adverse vent configuration results in minor airspeed and altimeter

variations of less than 5 knots and 50 feet respectively (instruments read higher than normal). However, opening the vent windows will probably result in large errors (airspeed and altimeter readings averaging up to 10 knots and 70 feet lower than normal in the approach speed range and increasing to 13 knots and 110 feet lower than normal at the placarded maximum window open speed of 105 KIAS) depending upon the sealing effectiveness of the baggage curtain.

With the alternate static source on, adjust indicated airspeed during climb or approach, according to the appropriate alternate static source airspeed calibration table in Section 5 to cause the airplane to be flown at the normal operating speeds.

SPINS

Intentional spins are prohibited in this airplane. Should an inadvertent spin occur, the following recovery procedure should 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 WHEEL **BRISKLY** FORWARD FAR ENOUGH TO BREAK THE STALL.
5. **HOLD** THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend 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 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.

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, or a leak has developed in the oil line from the engine to the oil pressure gage. A leak in the line to the gage is not necessarily cause for an immediate precautionary landing because an orifice in the 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 IND circuit breakers are in; reset if necessary. Also, check both landing gear position indicator lights for operation by "pressing-to-test" the light units and rotating them at the same time to check for open dimming shutters. A burned-out bulb can be replaced in flight by using the bulb from the remaining gear position indicator light.

RETRACTION MALFUNCTIONS

If the landing gear fails to retract normally, or an intermittent gear UP indicator light is present, check the gear UP indicator light for proper operation and attempt to recycle the landing gear. Place the landing gear lever in the DWN position. Reposition the gear lever in the UP position for another retraction attempt. If the gear UP indicator light still fails to illuminate, an immediate landing is not necessary. The flight may continue to an airport having maintenance facilities if, after the gear has been apparently retracted, cruise speed appears normal with no abnormal buffeting, and the landing gear motor is not running. However, if the gear motor does not shut off after retraction, or the gear UP light continues to operate intermittently, the landing gear should be extended until maintenance can be obtained.

NOTE

Test for landing gear motor operation as follows: At a safe altitude, cycle landing gear at 70 KIAS with low power and listen for the motor to shut off following the normal sound of gear retraction (approximately 6 seconds). 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 70 KIAS. If efforts to extend and lock the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completely lost) by use of the emergency hand pump. The hand pump is located under a hinged cover between the front seats.

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

GEAR UP LANDING

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

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

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

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than four needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate. Electronic components in the electrical system could be adversely affected by higher than normal voltage if a faulty voltage regulator is causing the overcharging. To preclude these possibilites, an over-voltage sensor will automatically shut down the alternator and the over-voltage warning light will illuminate if the charge voltage reaches approximately 31.5 volts. Assuming that the malfunction was only momentary, an attempt should be made to reactivate the alternator system. To do this, turn the avionics power switch off, 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 warning light will go off. The avionics power switch should then be turned 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 emergency occurs at night, power must be conserved for later operation of the landing gear and wing flaps and possible use of the landing lights during landing.

INSUFFICIENT RATE OF CHARGE

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

terminated as soon as practical. As system voltage deteriorates, the readings in the engine instrument cluster (except oil pressure) will drop proportionally. A complete electrical system failure will cause all readings (excluding oil pressure) to drop to zero.

SECTION 4
NORMAL PROCEDURES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

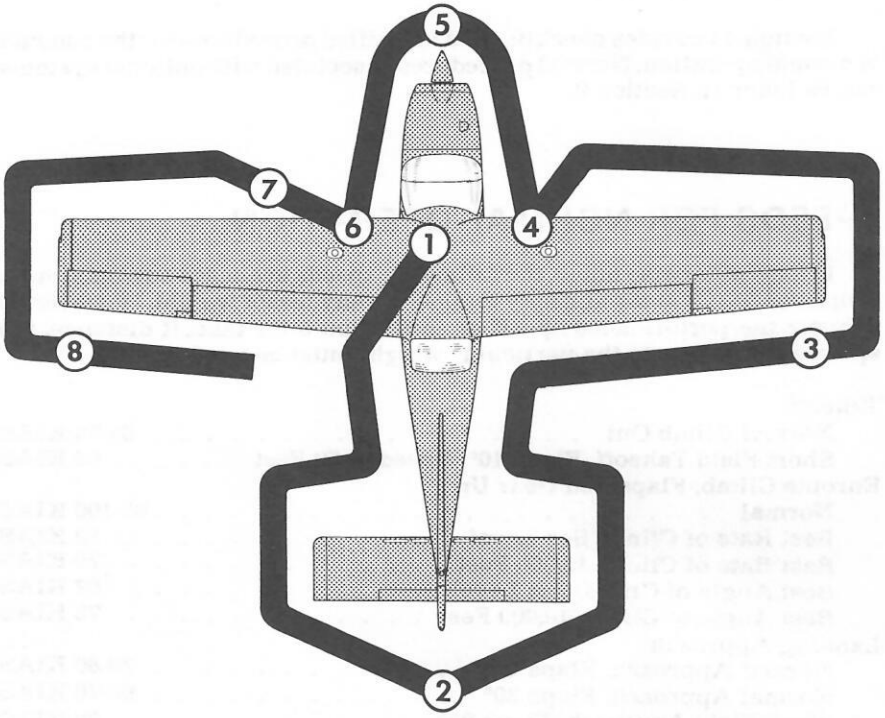
INTRODUCTION

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

SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 2800 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance, the speed appropriate to the particular weight must be used.

Takeoff:	
Normal Climb Out	65-75 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	62 KIAS
Enroute Climb, Flaps and Gear Up:	
Normal	85-100 KIAS
Best Rate of Climb, Sea Level	82 KIAS
Best Rate of Climb, 10,000 Feet	79 KIAS
Best Angle of Climb, Sea Level	67 KIAS
Best Angle of Climb, 10,000 Feet	73 KIAS
Landing Approach:	
Normal Approach, Flaps Up	70-80 KIAS
Normal Approach, Flaps 30°	60-70 KIAS
Short Field Approach, Flaps 30°	63 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	65 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
2800 Lbs	113 KIAS
2400 Lbs	105 KIAS
2000 Lbs	96 KIAS
Maximum Demonstrated Crosswind Velocity:	
Takeoff or Landing	16 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. Landing Gear Lever -- DOWN.
2. Control Wheel Lock -- REMOVE.
3. Avionics Power Switch -- OFF.
4. Ignition Switch -- OFF.
5. Master Switch -- ON.
6. Fuel Quantity Indicators -- CHECK QUANTITY.
7. Landing Gear Position Indicator Light (green) -- ILLUMINATED.
8. Master Switch -- OFF.
9. Fuel Selector Valve -- BOTH.
10. Before the first flight of the day and after each refueling, pull forward on fuel reservoir drain lever (under pilot's seat) for about four seconds to clear fuel system of possible water and sediment. After draining, make sure that reservoir drains are closed. If water is observed in this check, the system may contain additional water. Check the fuel tank sump quick-drain valves for presence of water, and remove the fuel vent line drain plugs (in wing roots just outboard of cabin doors) and the fuel selector valve drain plug to check for presence of water.
11. 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 freedom of movement and security.
2. Fuel Tank Vent Opening (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. 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.

4. Fuel Quantity -- CHECK VISUALLY for desired level.
5. Fuel Filler Cap -- SECURE.

(5) NOSE

1. Engine Oil Level -- CHECK, do not operate with less than six quarts. Fill to eight quarts for extended flight.
2. Propeller and Spinner -- CHECK for nicks, security and oil leaks.
3. Induction Air Filter -- CHECK for restrictions by dust or other foreign matter.
4. Landing and Taxi Lights -- CHECK for condition and cleanliness.
5. Nose Wheel Strut and Tire -- CHECK for proper inflation.
6. Nose Tie-Down -- DISCONNECT.
7. Static Source Openings (both sides of fuselage) -- CHECK for stoppage.

(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.

(7) LEFT WING Leading Edge

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

(8) LEFT WING Trailing Edge

1. Fuel Tank Vent Opening (at wing tip trailing edge) -- CHECK for stoppage.
2. Aileron -- CHECK freedom of movement and security.

BEFORE STARTING ENGINE

1. Preflight Inspection -- COMPLETE.
2. Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
3. Fuel Selector Valve -- BOTH.

4. Avionics Power Switch, Autopilot (if installed), Electrical Equipment -- OFF.

CAUTION

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

5. Brakes -- TEST and SET.
6. Cowl Flaps -- OPEN (move lever out of locking hole to reposition).
7. Landing Gear Lever -- DOWN.
8. Circuit Breakers -- CHECK IN.

STARTING ENGINE

1. Mixture -- IDLE CUT-OFF.
2. Propeller -- HIGH RPM.
3. Throttle -- OPEN 1/4 INCH.
4. Master Switch -- ON.
5. Auxiliary Fuel Pump -- ON.
6. Mixture -- ADVANCE to 3-5 GAL/HR; then RETARD to IDLE CUT-OFF.

NOTE

If engine is warm, omit priming procedure above.

7. Propeller Area -- CLEAR.
8. Ignition Switch -- START (release when engine starts).
9. Mixture -- RICH (ADVANCE smoothly when engine fires).

NOTE

If engine floods, turn off auxiliary fuel pump, place mixture in idle cut-off, open throttle 1/2, and crank engine. When engine fires, advance mixture to full rich and retard throttle promptly.

10. Oil Pressure -- CHECK.
11. Auxiliary Fuel Pump -- OFF.

BEFORE TAKEOFF

1. Parking Brake -- SET.

2. Cabin Doors -- CLOSED and LOCKED.
3. Flight Controls -- FREE and CORRECT.
4. Flight Instruments -- CHECK.
5. Fuel Selector Valve -- BOTH.
6. Mixture -- RICH.
7. Auxiliary Fuel Pump -- CHECK OPERATION (then OFF).
8. Stabilator and Rudder Trim -- TAKEOFF.
9. Throttle -- 1800 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.
   c. Engine Instruments and Ammeter -- CHECK.
   d. Suction Gage -- CHECK.
10. Avionics Power Switch -- ON.
11. Radios -- SET.
12. Autopilot (if installed) -- OFF.
13. Navigation Lights, Flashing Beacon and/or Strobe Lights -- ON as required.
14. Throttle Friction Lock -- ADJUST.
15. Brakes -- RELEASE.

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps -- 0°- 10° (10° preferred).
2. Power -- FULL THROTTLE and 2700 RPM.
3. Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
4. Stabilator Control -- LIFT NOSE WHEEL at 55 KIAS.

NOTE

Lifting the nose wheel will normally allow the gear motor to run 2-3 seconds to restore any pressure loss.

5. Climb Speed -- 65-75 KIAS.
6. Brakes -- APPLY momentarily when airborne.
7. Landing Gear -- RETRACT in climb out.
8. Wing Flaps -- RETRACT (if extended).

SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Brakes -- APPLY.

3. Power -- FULL THROTTLE and 2700 RPM.
4. Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
5. Brakes -- RELEASE.
6. Stabilator Control -- LIFT NOSE WHEEL at 50 KIAS.
7. Climb Speed -- 62 KIAS until all obstacles cleared.
8. Brakes -- APPLY momentarily when airborne.
9. Landing Gear -- RETRACT after obstacles are cleared.
10. Wing Flaps -- RETRACT after reaching 70 KIAS.

NOTE

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

ENROUTE CLIMB

NORMAL CLIMB

1. Airspeed -- 85-100 KIAS.
2. Power -- 25 INCHES Hg or FULL THROTTLE and 2500 RPM.
3. Mixture -- LEANED to 13 GAL/HR (with full throttle, lean 2 GPH less than maximum power mixture placard).
4. Cowl Flaps -- OPEN as required.

MAXIMUM PERFORMANCE CLIMB

1. Airspeed -- 82 KIAS at sea level to 79 KIAS at 10,000 feet.
2. Power -- FULL THROTTLE and 2700 RPM.
3. Mixture -- LEAN per fuel flow placard.
4. Cowl Flaps -- FULL OPEN.

CRUISE

1. Power -- 15-25 INCHES Hg, 2100-2500 RPM (no more than 75% power).
2. Stabilator and Rudder Trim -- ADJUST.
3. Mixture -- LEAN per Cessna Power Computer or the data on page 4-19.
4. Cowl Flaps -- CLOSED.

DESCENT

1. Power -- AS DESIRED.

NOTE

Avoid continuous operation between 1400 and 1750 RPM with less than 10 inches Hg.

2. Mixture -- ADJUST for smooth operation.
3. Cowl Flaps -- CLOSED.
4. Wing Flaps -- AS DESIRED (0°-10° below 130 KIAS, 10°-30° below 95 KIAS).
5. Landing Gear -- AS DESIRED (do not extend above 125 KIAS).

BEFORE LANDING

1. Seats, Belts, Shoulder Harnesses -- SECURE.
2. Fuel Selector Valve -- BOTH.
3. Landing Gear -- EXTEND below 125 KIAS.
4. Mixture -- RICH.
5. Propeller -- HIGH RPM (full in).
6. Autopilot (if installed) -- OFF.

LANDING

NORMAL LANDING

1. Airspeed -- 70-80 KIAS (flaps UP).
2. Wing Flaps -- AS DESIRED (0°- 10° below 130 KIAS, 10°- 30° below 95 KIAS).
3. Airspeed -- 60-70 KIAS (flaps DOWN).
4. Stabilator and Rudder Trim -- ADJUST.
5. Touchdown -- MAIN WHEELS FIRST.
6. Landing Roll -- LOWER NOSE WHEEL GENTLY.
7. Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

1. Airspeed -- 70-80 KIAS (flaps UP).
2. Wing Flaps -- 30° (below 95 KIAS).
3. Airspeed -- MAINTAIN 63 KIAS.
4. Stabilator and Rudder Trim -- ADJUST.
5. Power -- REDUCE TO IDLE as obstacle is cleared.
6. Touchdown -- MAIN WHEELS FIRST.
7. Brakes -- APPLY HEAVILY.
8. Wing Flaps -- RETRACT for maximum brake effectiveness.

BALKED LANDING

1. Power -- FULL THROTTLE and 2700 RPM.
2. Wing Flaps -- RETRACT to 20°.
3. Airspeed -- 65 KIAS.
4. Wing Flaps -- RETRACT slowly.
5. Cowl Flaps -- OPEN.

AFTER LANDING

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

SECURING AIRPLANE

1. Parking Brake -- SET.
2. Avionics Power Switch, Electrical Equipment -- OFF.
3. Mixture -- IDLE CUT-OFF (pulled full out).
4. Ignition and Master Switches -- OFF.
5. Control Lock -- INSTALL.
6. Fuel Selector Valve -- LEFT or RIGHT.

AMPLIFIED PROCEDURES

STARTING ENGINE

In cold weather, the engine compartment temperature drops off rapidly following engine shutdown and the injector nozzle lines remain nearly full of fuel. Cold weather starting procedures are therefore relatively simple with highly predictable results. However, in extremely hot weather, engine compartment temperatures increase rapidly following engine shutdown, and fuel in the lines will vaporize and escape into the intake manifold.

Hot weather starting procedures depend considerably on how soon the next engine start is attempted. Within the first 20 to 30 minutes after shutdown, the fuel manifold is adequately primed and the empty injector nozzle lines will fill before the engine dies. However, after approximately 30 minutes, the vaporized fuel in the manifold will have nearly dissipated and some slight "priming" could be required to refill the nozzle lines and keep the engine running after the initial start. Starting a hot engine is facilitated by advancing the mixture control promptly to 1/3 open when the engine fires, and then smoothly to full rich as power develops.

Should the engine tend to die after starting, turn on auxiliary fuel pump temporarily and adjust throttle as necessary to keep the engine running.

In the event of over-priming or flooding, turn off the auxiliary fuel pump, open the throttle from 1/2 to full open and continue cranking with the mixture full lean. When the engine fires, smoothly advance the mixture control to full rich and retard the throttle to desired idle speed.

If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all, and additional priming will be necessary.

After starting, if the oil pressure gage does not begin to show pressure within 30 seconds in the summertime and about twice that long in very cold weather, stop the engine and investigate. Lack of oil pressure can cause serious engine damage.

NOTE

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

TAXIING

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see Taxiing Diagram, figure 4-2) to maintain directional control and balance. Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

BEFORE TAKEOFF

WARM-UP

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

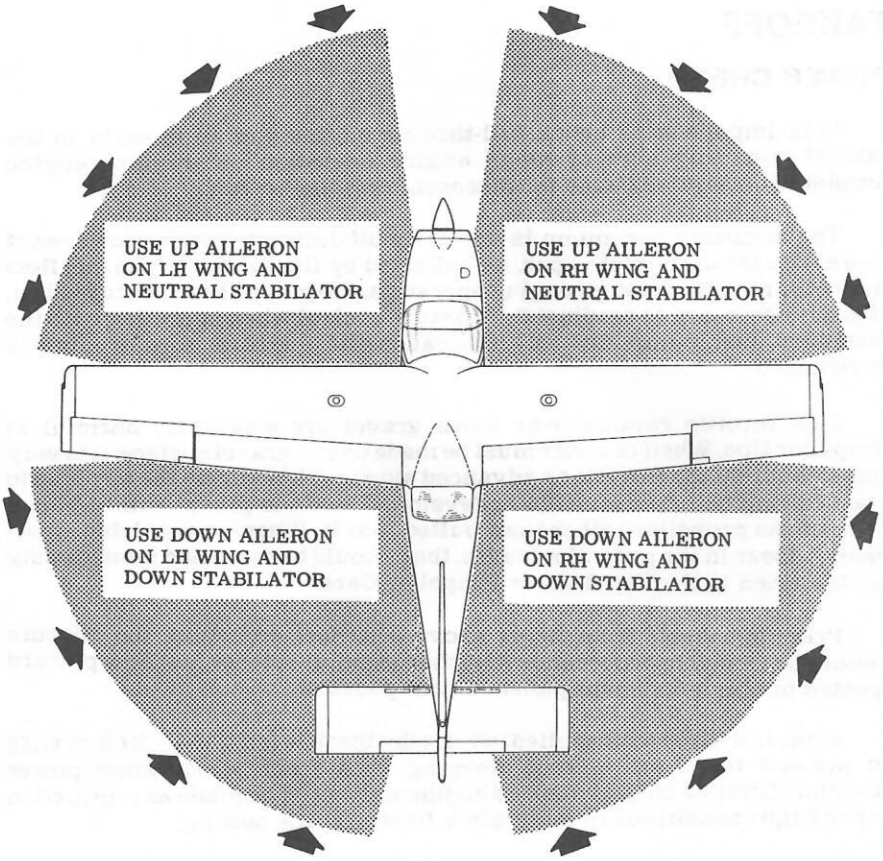
MAGNETO CHECK

The magneto check should be made at 1800 RPM as follows: Move the ignition switch first to R position, and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to L position, note RPM and return the switch to the BOTH position. The RPM drop should not exceed 150 RPM on either magneto or show greater than 50 RPM differential between magnetos. A smooth drop off past normal is usually a sign of a too lean or too rich mixture. If there is a doubt concerning operation of the ignition system, RPM checks at a leaner mixture setting or at higher engine speeds will usually confirm whether a deficiency exists.

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

ALTERNATOR CHECK

Prior to flights where verification of proper alternator and voltage regulator operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the landing light or by operating the wing flaps during the engine runup (1800 RPM). The ammeter will remain within a needle width of the initial reading if the alternator and voltage regulator are operating properly.



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

TAKEOFF

POWER CHECK

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

The auxiliary fuel pump is normally off during takeoffs. However, if there is evidence of fuel vapor, as indicated by fluctuation of the fuel flow indicator needle, or rough engine operation, the pump should be turned on. It is not necessary to readjust the mixture control when operating with the auxiliary fuel pump turned on because the mixture is only slightly enrichened.

Full throttle runups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades, they should be corrected immediately as described in Section 8 under Propeller Care.

Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned in accordance with the maximum power fuel flow placard located on the instrument panel control pedestal.

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

NOTE

Upon lifting the nose gear clear of the runway during the takeoff roll, the squat switch will close. This normally causes the gear motor to run 2-3 seconds, to restore any pressure loss.

WING FLAP SETTINGS

Takeoffs are accomplished with the wing flaps set in the 0° to 10° position. The preferred flap setting for normal takeoff is 10°. This flap setting (in comparison to flaps up) produces an approximate 15% shorter ground run and total takeoff distance over an obstacle. In addition, it provides easier lift-off and increased visibility over the nose in the initial climb-out.

Flap settings greater than 10° are not approved for takeoff.

LANDING GEAR RETRACTION

Since the landing gear swings downward approximately one foot as it starts the retraction cycle, retraction should be avoided until well clear of the runway and after a positive climb is established. This is especially important when attempting a short field takeoff, where a premature lift-off might result in the airplane settling back onto the ground. On long runways the landing gear retraction can be delayed until reaching the point over the runway where a wheels-down forced landing on that runway would be impractical.

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.

CROSSWIND TAKEOFF

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

ENROUTE CLIMB

Normal climbs are performed with landing gear and flaps retracted at airspeeds 5 to 15 knots higher than best rate-of-climb speed, and with reduced power (down to 25 inches of manifold pressure and 2500 RPM) for an optimum combination of performance, visibility and increased passenger comfort due to lower noise level. The mixture may be left full rich as long as the engine is smooth. However, for optimum power and climb economy with 25 inches of manifold pressure and 2500 RPM, set the mixture to 13 GPH. With full throttle and 2500 RPM, set the mixture to 2 GPH less than shown in the maximum power mixture placard.

Best rate of climb is achieved with full throttle and 2700 RPM with the mixture leaned for altitude in accordance with the maximum power fuel flow placard.

If an enroute obstacle dictates the use of a steep climb angle, the best angle of climb speed should be used with landing gear and flaps retracted and maximum power.

CRUISE

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

NOTE

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

The Cruise Performance Table, figure 4-3, illustrates the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers. 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 three-fourths of the normal operating range (green arc).

Cruise performance data in this handbook and on the power computer is based on the recommended lean mixture setting. For best fuel economy at 75% power or less, the engine may be operated at one-half gallon per

	75% POWER		65% POWER		55% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
4000 Feet	144	13.3	135	14.4	126	15.6
7000 Feet	148	13.7	139	14.8	130	16.0
10,000 Feet	- - -	- - -	143	15.2	133	16.4
Standard Conditions						Zero Wind

Figure 4-3. Cruise Performance Table

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilot's Operating Handbook and Power Computer)	25°F Rich of Peak EGT
BEST ECONOMY	Peak EGT

Figure 4-4. EGT Table

hour leaner than shown in this handbook and on the power computer. This will result in approximately 4% greater range than shown in this handbook accompanied by approximately a 2 knot decrease in speed.

The fuel injection system used on this engine is considered to be non-icing. In the event the main intake filter becomes blocked, an alternate intake air door opens automatically, supplying unfiltered air from the lower engine compartment and resulting in a 5% power loss at full throttle.

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

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

As noted in this table, operation at peak EGT provides best fuel economy. This results in approximately 4% greater range than shown in this handbook accompanied by approximately a 2 knot decrease in speed.

When leaning the mixture, under some conditions, engine roughness may occur before peak EGT is reached. In this case, use the EGT corresponding to the onset of roughness as the reference point instead of peak EGT. Any change in altitude or power will require a recheck of 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.

BEFORE LANDING

The landing gear is normally 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, the landing gear may be left extended in go-around procedures or traffic patterns for touch-and-go landings.

Landing gear extension can be detected by illumination of the gear DWN indicator light (green), absence of a gear warning horn with the throttle retarded below approximately 12 inches of manifold pressure, and visual inspection of the main gear position.

LANDING

Normal landing approaches can be made with power on or power off and at any flap setting. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. Slips are permitted with any desired flap setting. Actual touchdown should be made with power off and on the main wheels first. The nose wheel should be lowered smoothly to the runway as speed is diminished.

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

SHORT FIELD LANDING

For a short field landing in smooth air conditions, make an approach at the minimum recommended airspeed with full flaps using enough power to control the glide path. (Slightly higher approach speeds should be used under turbulent air conditions.) After all approach obstacles are cleared, progressively reduce power and maintain the approach speed by lowering the nose of the airplane. Touchdown should be made with power off and on the main wheels first. Immediately after touchdown, lower the nose wheel and apply heavy braking as required. For maximum brake effectiveness, retract the flaps, hold the control wheel full back, and apply maximum brake pressure without sliding the tires.

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, apply full throttle and 2700 RPM smoothly, and reduce wing flaps promptly to 20°. Upon reaching a safe airspeed, flaps should be slowly retracted to the full up position.

If obstacles are immediately ahead during the go-around, the landing gear should be left down and the wing flaps should be left at 20° until obstacles are cleared. At field elevations above 3000 feet, the mixture should be leaned for maximum power.

COLD WEATHER OPERATION

STARTING

Prior to starting on cold mornings, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

NOTE

When pulling the propeller through by hand, treat it as if the ignition switch is turned on. A loose or broken ground wire on either magneto could cause the engine to fire.

In extremely cold (-30°C and lower) weather, the use of an external preheater and an external power source are recommended whenever possible to obtain positive starting and to reduce wear and abuse to the engine and the electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of the master switch is important. Refer to Section 7, paragraph Ground Service Plug Receptacle, for operating details.

Cold weather starting procedures are the same as the normal starting procedures. Use caution to prevent inadvertent forward movement of the airplane during starting when parked on snow or ice.

NOTE

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

During cold weather operations, no indication will be apparent on the

oil temperature gage prior to takeoff if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for takeoff.

HOT WEATHER OPERATION

The general warm temperature starting information in this section is appropriate. Avoid prolonged engine operation on the ground.

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 177RG at 2800 pounds maximum weight is 75.6 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.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

SECTION 5
PERFORMANCE

INTRODUCTION

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

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

USE OF PERFORMANCE CHARTS

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

SAMPLE PROBLEM

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

AIRPLANE CONFIGURATION	
Takeoff weight	2700 Pounds
Usable fuel	60 Gallons
TAKEOFF CONDITIONS	
Field pressure altitude	1500 Feet
Temperature	28°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	3500 Feet

CRUISE CONDITIONS

Total distance	700 Nautical Miles
Pressure altitude	5500 Feet
Temperature	20°C (16°C above standard)
Expected wind enroute	10 Knot Headwind

LANDING CONDITIONS

Field pressure altitude	2000 Feet
Temperature	25°C
Field length	3000 Feet

TAKEOFF

The takeoff distance chart, figure 5-4, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 2800 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1190 Feet
Total distance to clear a 50-foot obstacle	2140 Feet

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

$$\frac{12 \text{ Knots}}{9 \text{ Knots}} \times 10\% = 13\% \text{ Decrease}$$

This results in the following distances, corrected for wind:

Ground roll, zero wind	1190
Decrease in ground roll (1190 feet × 13%)	155
Corrected ground roll	1035 Feet
Total distance to clear a 50-foot obstacle, zero wind	2140
Decrease in total distance (2140 feet × 13%)	278
Corrected total distance to clear 50-foot obstacle	1862 Feet

CRUISE

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

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

The range profile chart indicates that use of 65% power at 5500 feet yields a predicted range of 766 nautical miles with no wind. The endurance profile chart shows a corresponding 5.7 hours. Using this information, the estimated distance can be determined for the expected 10 knot headwind at 5500 feet as follows:

Range, zero wind	766
Decrease in range due to wind (5.7 hours × 10 knot headwind)	57
Corrected range	709 Nautical Miles

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

The cruise performance chart for 6000 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 2400 RPM and 22 inches of manifold pressure which results in the following:

Power	65%
True airspeed	140 Knots
Cruise fuel flow	9.3 GPH

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

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 shows that a normal climb from 2000 feet to 6000 feet requires 1.6

gallons of fuel. The corresponding distance during the climb is 12 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

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

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

Fuel to climb, standard temperature	1.6
Increase due to non-standard temperature (1.6 × 16%)	0.3
Corrected fuel to climb	1.9 Gallons

Using a similar procedure for the distance during climb results in 14 nautical miles.

The resultant cruise distance is:

Total distance	700
Climb distance	-14
Cruise distance	686 Nautical Miles

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

140
-10
130 Knots

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

$$\frac{686 \text{ Nautical Miles}}{130 \text{ Knots}} = 5.3 \text{ Hours}$$

The fuel required for cruise is:

5.3 hours × 9.3 gallons/hour = 49.3 Gallons

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	1.5
Climb	1.9
Cruise	49.3
Total fuel required	52.7 Gallons

This will leave a fuel reserve of:

60.0
-52.7
7.3 Gallons

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

LANDING

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

Ground roll	825 Feet
Total distance to clear a 50-foot obstacle	1480 Feet

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

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

FLAPS UP											
KIAS	- - -	60	70	80	90	100	110	120	130	140	150
KCAS	- - -	62	71	81	91	100	110	119	128	137	147
FLAPS 10°											
KIAS	50	60	70	80	90	100	110	120	130	- - -	- - -
KCAS	52	62	71	81	91	100	110	119	129	- - -	- - -
FLAPS 30°											
KIAS	40	50	60	70	80	90	95	- - -	- - -	- - -	- - -
KCAS	43	52	62	72	81	90	95	- - -	- - -	- - -	- - -

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

AIRSPEED CALIBRATION

ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP												
NORMAL KIAS	- - -	- - -	60	70	80	90	100	110	120	130	140	150
ALTERNATE KIAS	- - -	- - -	61	72	82	92	102	113	123	133	142	152
FLAPS 10°												
NORMAL KIAS	- - -	50	60	70	80	90	100	110	120	130	- - -	- - -
ALTERNATE KIAS	- - -	49	61	72	83	94	104	113	122	131	- - -	- - -
FLAPS 30°												
NORMAL KIAS	40	50	60	70	80	90	95	- - -	- - -	- - -	- - -	- - -
ALTERNATE KIAS	40	52	63	74	84	94	98	- - -	- - -	- - -	- - -	- - -

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP												
NORMAL KIAS	- - -	- - -	60	70	80	90	100	110	120	130	140	150
ALTERNATE KIAS	- - -	- - -	59	70	81	91	101	111	121	131	141	151
FLAPS 10°												
NORMAL KIAS	- - -	50	60	70	80	90	100	110	120	130	- - -	- - -
ALTERNATE KIAS	- - -	48	60	71	82	93	102	111	120	129	- - -	- - -
FLAPS 30°												
NORMAL KIAS	40	50	60	70	80	90	95	- - -	- - -	- - -	- - -	- - -
ALTERNATE KIAS	38	50	62	73	83	92	97	- - -	- - -	- - -	- - -	- - -

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

TEMPERATURE CONVERSION CHART

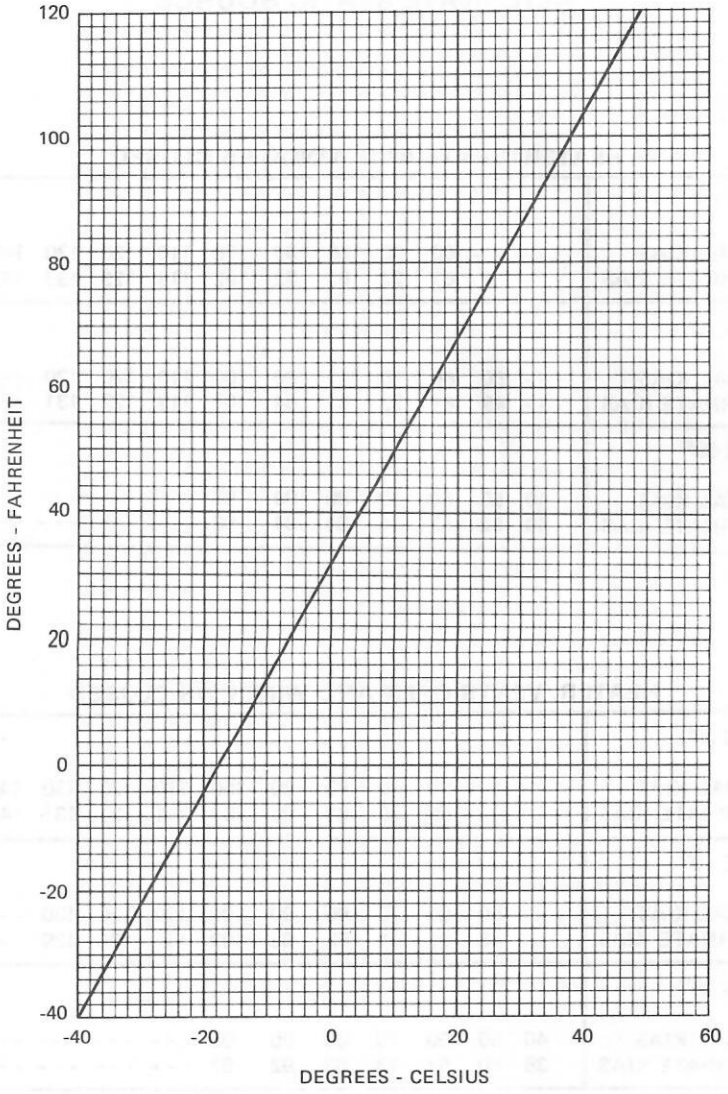


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off
Gear Up or Down

NOTES:
1. Maximum altitude loss during a stall recovery may be as much as 190 feet.
2. KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2800	UP	55	57	59	61	65	68	78	81
	10°	51	53	55	57	61	63	72	75
	30°	48	50	52	54	57	59	68	71

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2800	UP	59	61	63	66	70	73	83	86
	10°	55	57	59	61	65	68	78	81
	30°	50	52	54	56	59	62	71	74

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE
MAXIMUM WEIGHT 2800 LBS

SHORT FIELD

CONDITIONS:
Flaps 10°
2700 RPM, Full Throttle, and Mixture Set at Placard Fuel Flow Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind

MIXTURE SETTING	
PRESS ALT	GPH
S.L.	17
2000	16
4000	15
6000	14
8000	13

NOTES:
1. Short field technique as specified in Section 4.
2. Landing gear extended until takeoff obstacle is cleared.
3. Where distance value has been deleted, climb performance after lift-off is less that 150 fpm. Rate of climb is based on landing gear extended and flaps 10° at takeoff speed.
4. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
5. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2800	58	62	S.L.	795	1420	860	1530	925	1645	995	1765	1065	1900
			1000	870	1555	935	1675	1010	1800	1085	1940	1170	2090
			2000	950	1705	1025	1835	1105	1980	1190	2140	1280	2310
			3000	1040	1875	1125	2025	1210	2185	1305	2365	1405	2565
			4000	1140	2065	1230	2240	1330	2425	1435	2630	1545	2860
			5000	1250	2290	1355	2485	1460	2700	1575	2945	1700	3215
			6000	1380	2550	1490	2780	1610	3030	1740	3315	1880	3645
			7000	1520	2855	1645	3125	1780	3430	1920	3780	---	---
			8000	1680	3225	1815	3550	1970	3925	---	---	---	---

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

TAKEOFF DISTANCE
2600 LBS AND 2400 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
2600	56	60	S.L.	670	1200	720	1290	775	1380	835	1480	895	1590
			1000	730	1310	785	1405	845	1510	910	1620	975	1740
			2000	795	1430	860	1535	925	1650	995	1775	1070	1915
			3000	870	1565	940	1685	1010	1815	1090	1955	1170	2110
			4000	955	1720	1030	1855	1110	2000	1195	2160	1285	2335
			5000	1045	1895	1130	2045	1220	2215	1315	2395	1415	2600
			6000	1150	2095	1240	2270	1340	2460	1445	2675	1560	2910
			7000	1265	2330	1365	2530	1475	2750	1595	3000	1720	3280
			8000	1395	2600	1510	2835	1630	3100	1760	3400	1900	3740
2400	54	57	S.L.	560	1005	600	1075	645	1150	695	1230	745	1320
			1000	605	1090	655	1170	705	1255	755	1345	810	1440
			2000	665	1190	715	1275	770	1370	825	1470	885	1575
			3000	725	1300	780	1395	840	1495	905	1610	970	1730
			4000	790	1420	855	1530	920	1645	990	1770	1065	1905
			5000	865	1560	935	1680	1010	1810	1085	1950	1165	2105
			6000	950	1715	1025	1850	1105	1995	1190	2155	1285	2335
			7000	1045	1895	1130	2045	1215	2215	1310	2400	1415	2605
			8000	1150	2100	1240	2275	1340	2470	1445	2685	1560	2920

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

RATE OF CLIMB

MAXIMUM

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

MIXTURE SETTING	
PRESS ALT	GPH
S. L.	17
4000	15
8000	13
12,000	10

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
2800	S.L.	82	1080	990	905	815
	2000	81	960	875	790	705
	4000	81	840	760	675	595
	6000	80	725	645	565	485
	8000	79	610	530	455	380
	10,000	79	495	420	350	- - -
	12,000	78	385	315	245	- - -

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

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

MIXTURE SETTING	
PRESS ALT	GPH
S.L.	17
4000	15
8000	13
12,000	10

NOTES:
1. Add 1.5 gallons 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	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2800	S.L.	15	82	925	0	0	0
	1000	13	82	875	1	0.3	2
	2000	11	81	830	2	0.6	3
	3000	9	81	780	4	1.0	5
	4000	7	81	730	5	1.3	7
	5000	5	80	685	6	1.6	9
	6000	3	80	635	8	2.0	11
	7000	1	80	585	10	2.4	14
	8000	-1	79	535	11	2.8	17
	9000	-3	79	490	13	3.2	20
	10,000	-5	79	440	16	3.6	23
	11,000	-7	78	390	18	4.1	27
	12,000	-9	78	345	21	4.6	31

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

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 90 KIAS

CONDITIONS:
Flaps Up
Gear Up
2500 RPM
25 Inches Hg or Full Throttle
Cowl Flaps Open
Standard Temperature

MIXTURE SETTING	
PRESS ALT	GPH
S.L. to 4000	13
8000	11
12,000	8

NOTES:
1. Add 1.5 gallons 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	PRESSURE ALTITUDE FT	TEMP °C	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED GALLONS	DISTANCE NM
2800	S.L.	15	550	0	0	0
	1000	13	550	2	0.4	3
	2000	11	550	4	0.8	6
	3000	9	550	5	1.2	8
	4000	7	550	7	1.6	11
	5000	5	500	9	2.0	14
	6000	3	445	11	2.4	18
	7000	1	395	14	2.9	22
	8000	-1	340	17	3.4	27
	9000	-3	295	20	3.9	32
	10,000	-5	245	24	4.6	39
	11,000	-7	200	28	5.2	47
	12,000	-9	150	34	6.1	58

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
2800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 75% power or less, operate at 0.5 GPH 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	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	24	77	140	11.2	75	141	10.7	72	142	10.4
	23	73	137	10.5	71	138	10.1	68	138	9.8
	22	69	133	9.9	67	134	9.6	64	135	9.3
	21	65	130	9.3	62	131	9.0	60	132	8.8
2400	25	78	140	11.2	75	141	10.7	72	142	10.4
	24	73	137	10.5	71	138	10.2	69	139	9.8
	23	69	134	9.9	67	134	9.6	65	135	9.3
	22	65	130	9.4	63	131	9.1	61	132	8.8
2300	25	74	137	10.6	71	138	10.2	69	139	9.9
	24	70	134	10.0	67	135	9.7	65	136	9.4
	23	66	131	9.5	64	132	9.2	62	133	8.9
	22	62	128	9.0	60	128	8.7	58	129	8.4
2200	25	69	134	9.9	67	134	9.6	65	135	9.3
	24	66	131	9.4	63	131	9.1	61	132	8.9
	23	62	128	9.0	60	128	8.7	58	129	8.4
	22	58	125	8.5	56	125	8.2	55	126	8.0
2100	25	66	131	9.4	63	131	9.1	61	132	8.9
	24	62	128	9.0	60	128	8.7	58	129	8.4
	23	59	125	8.5	57	125	8.3	55	126	8.0
	22	55	122	8.1	53	122	7.8	51	123	7.6
	21	52	118	7.7	50	119	7.5	48	120	7.3
	20	48	115	7.3	46	116	7.1	45	116	6.9
	19	45	112	6.9	43	112	6.7	42	112	6.6

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
2800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 75% power or less, operate at 0.5 GPH 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	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	24	---	---	---	77	145	11.0	74	146	10.6
	23	75	141	10.8	73	142	10.4	70	142	10.1
	22	71	137	10.2	69	138	9.8	66	139	9.5
	21	67	134	9.6	64	135	9.3	62	136	9.0
2400	25	---	---	---	77	145	11.1	75	146	10.7
	24	76	141	10.9	73	142	10.5	71	143	10.1
	23	72	138	10.3	69	139	9.9	67	139	9.6
	22	67	134	9.7	65	135	9.3	63	136	9.1
2300	25	76	141	10.9	73	142	10.5	70	143	10.1
	24	72	138	10.3	69	139	9.9	67	140	9.6
	23	68	135	9.7	65	136	9.4	63	136	9.1
	22	64	131	9.2	62	132	8.9	60	133	8.6
2200	25	71	137	10.2	69	138	9.8	66	139	9.5
	24	67	134	9.7	65	135	9.3	63	136	9.1
	23	64	131	9.2	62	132	8.9	60	133	8.6
	22	60	128	8.7	58	129	8.5	56	130	8.2
2100	25	68	134	9.7	65	135	9.4	63	136	9.1
	24	64	131	9.2	62	132	8.9	60	133	8.7
	23	60	128	8.8	58	129	8.5	56	130	8.2
	22	57	125	8.3	55	126	8.0	53	127	7.8
	21	53	122	7.9	51	123	7.6	50	124	7.4
	20	50	119	7.5	48	120	7.3	46	120	7.1
	19	46	115	7.1	45	115	6.9	43	115	6.7

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
2800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 75% power or less, operate at 0.5 GPH 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	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	23	77	145	11.2	75	146	10.7	72	147	10.3
	22	73	142	10.5	71	142	10.1	68	143	9.8
	21	69	138	9.9	66	139	9.5	64	140	9.2
	20	65	134	9.3	62	135	9.0	60	136	8.7
2400	24	78	145	11.3	75	146	10.8	73	147	10.4
	23	74	142	10.6	71	143	10.2	69	144	9.8
	22	69	138	9.9	67	139	9.6	65	140	9.3
	21	65	135	9.4	63	136	9.1	61	137	8.8
2300	24	74	142	10.6	71	143	10.2	69	144	9.8
	23	70	139	10.0	67	140	9.6	65	140	9.3
	22	66	135	9.4	63	136	9.1	61	137	8.8
	21	62	132	8.9	59	133	8.6	57	134	8.4
2200	24	69	138	9.9	67	139	9.6	65	140	9.3
	23	66	135	9.4	63	136	9.1	61	137	8.8
	22	62	132	9.0	60	133	8.7	58	134	8.4
	21	58	129	8.5	56	130	8.2	54	131	8.0
2100	24	66	135	9.5	63	136	9.1	61	137	8.9
	23	62	132	9.0	60	133	8.7	58	134	8.4
	22	59	129	8.5	56	130	8.2	55	131	8.0
	21	55	126	8.1	53	127	7.8	51	128	7.6
	20	51	122	7.6	49	123	7.4	48	123	7.2
	19	48	119	7.2	46	119	7.0	44	119	6.9
	18	44	114	6.8	43	114	6.7	41	113	6.5

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
2800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 75% power or less, operate at 0.5 GPH 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	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	22	75	146	10.8	72	147	10.4	70	148	10.0
	21	71	142	10.2	68	143	9.8	66	144	9.5
	20	67	138	9.6	64	139	9.2	62	140	8.9
	19	62	135	9.0	60	135	8.7	58	136	8.4
2400	22	71	143	10.2	69	144	9.9	66	144	9.5
	21	67	139	9.6	65	140	9.3	62	141	9.0
	20	63	135	9.1	60	136	8.8	58	137	8.5
	19	58	131	8.5	56	132	8.2	54	133	8.0
2300	22	67	139	9.7	65	140	9.3	63	141	9.0
	21	63	136	9.1	61	137	8.8	59	138	8.6
	20	59	132	8.6	57	133	8.3	55	134	8.1
	19	55	128	8.1	53	129	7.9	51	130	7.6
2200	22	64	136	9.2	61	137	8.9	59	138	8.6
	21	60	133	8.7	58	134	8.4	56	135	8.2
	20	56	129	8.2	54	130	8.0	52	131	7.7
	19	53	126	7.8	51	127	7.6	49	127	7.4
2100	22	60	133	8.7	58	134	8.4	56	135	8.2
	21	57	130	8.3	55	130	8.0	53	132	7.8
	20	53	126	7.8	51	127	7.6	49	127	7.4
	19	49	123	7.4	47	123	7.2	46	123	7.0
	18	46	118	7.0	44	118	6.8	42	117	6.7

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
2800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 75% power or less, operate at 0.5 GPH 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	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	20	69	143	9.8	66	144	9.5	64	145	9.2
	19	64	139	9.2	62	140	8.9	60	141	8.6
	18	60	135	8.6	57	136	8.4	55	137	8.1
	17	55	130	8.1	53	132	7.8	51	132	7.6
2400	20	65	139	9.3	62	140	9.0	60	141	8.7
	19	60	135	8.7	58	136	8.4	56	137	8.2
	18	56	131	8.2	54	132	7.9	52	133	7.7
	17	52	127	7.7	50	127	7.4	48	127	7.3
2300	20	61	136	8.8	59	137	8.5	57	138	8.3
	19	57	132	8.3	55	133	8.0	53	134	7.8
	18	53	128	7.8	51	129	7.6	49	129	7.4
	17	49	124	7.4	47	124	7.2	45	123	7.0
2200	20	58	133	8.4	56	134	8.2	54	135	7.9
	19	54	130	8.0	52	131	7.7	50	131	7.5
	18	50	126	7.5	49	126	7.3	47	126	7.1
	17	47	121	7.1	45	121	6.9	43	119	6.7
2100	20	55	130	8.0	52	131	7.7	51	131	7.6
	19	51	126	7.6	49	126	7.4	47	126	7.2
	18	47	122	7.2	45	122	7.0	44	120	6.8

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
2800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 75% power or less, operate at 0.5 GPH 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	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	18	61	139	8.9	59	140	8.6	57	141	8.3
	17	57	135	8.3	55	136	8.0	53	136	7.8
	16	52	130	7.7	50	130	7.5	48	130	7.3
	15	47	124	7.2	46	124	7.0	44	122	6.8
2400	18	58	135	8.4	55	136	8.1	53	137	7.9
	17	53	131	7.8	51	132	7.6	49	132	7.4
	16	49	126	7.4	47	126	7.1	45	125	7.0
2300	18	54	132	8.0	52	133	7.7	51	133	7.5
	17	50	128	7.5	48	128	7.3	47	127	7.1
	16	46	123	7.1	45	122	6.9	43	119	6.7
2200	18	52	130	7.7	50	130	7.5	48	130	7.3
	17	48	125	7.3	46	125	7.1	45	123	6.9
2100	18	49	126	7.3	47	125	7.1	45	124	6.9
	17	45	120	6.9	43	119	6.7	42	116	6.6

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

RANGE PROFILE
45 MINUTES RESERVE
60 GALLONS USABLE FUEL

CONDITIONS:
2800 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 5.2 gallons.

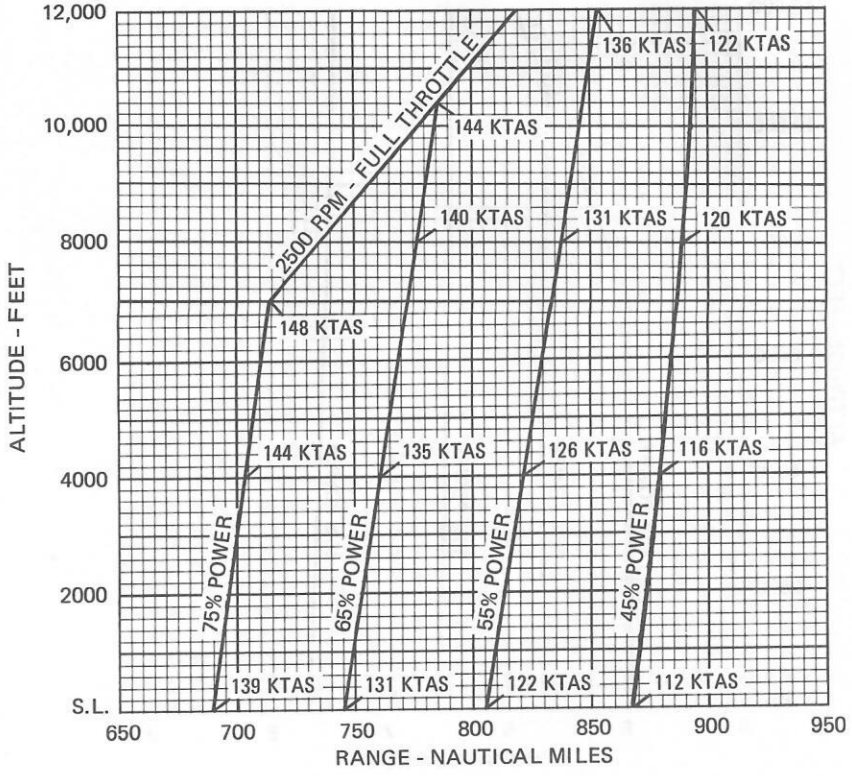


Figure 5-8. Range Profile

ENDURANCE PROFILE
45 MINUTES RESERVE
60 GALLONS USABLE FUEL

CONDITIONS:
2800 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 5.2 gallons.

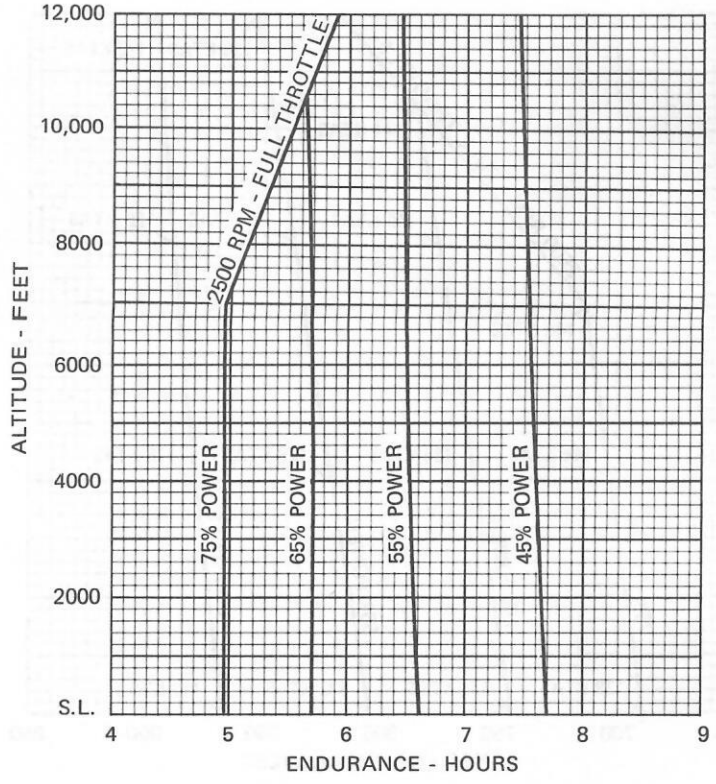


Figure 5-9. Endurance Profile

LANDING DISTANCE

SHORT FIELD

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

NOTES:
1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 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
2800	63	S.L.	690	1295	715	1330	745	1370	770	1405	795	1440
		1000	720	1335	745	1370	770	1405	795	1440	825	1480
		2000	745	1370	770	1405	800	1445	825	1480	855	1520
		3000	770	1405	800	1445	830	1485	855	1520	885	1560
		4000	800	1445	830	1485	860	1530	890	1570	920	1610
		5000	830	1485	860	1530	895	1575	925	1615	955	1655
		6000	865	1535	895	1575	925	1615	960	1665	990	1705
		7000	895	1575	930	1625	960	1665	995	1715	1030	1760
		8000	930	1625	965	1670	1000	1720	1035	1765	1070	1815

Figure 5-10. Landing Distance

SECTION 6
WEIGHT & BALANCE/ EQUIPMENT LIST

TABLE OF CONTENTS

INTRODUCTION

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

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

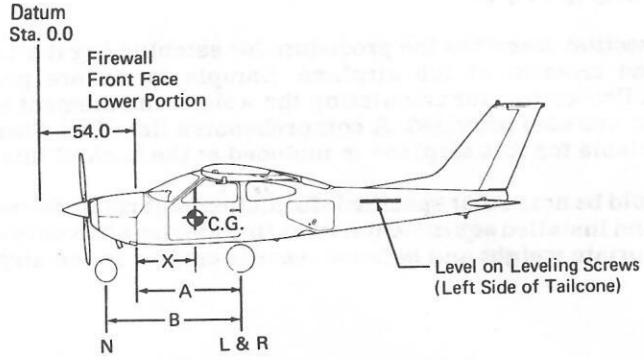
AIRPLANE WEIGHING PROCEDURES

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

2. Leveling:
   a. Place scales under each wheel (minimum scale capacity, 500 pounds nose, 1000 pounds each main).
   b. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level (see figure 6-1).

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

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



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

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

C.G. ARM = 54.0 + X = IN.

Item	Weight (Lbs.) X	C.G. Arm (In.) =	Moment/1000 (Lbs.-In.)
Airplane Weight (From Item 5, page 6-6)			
Add: Oil (9 Qts at 7.5 Lbs/Gal)	17.0	45.0	.765
Add: Unusable Fuel (1 Gal at 6 Lbs/Gal)	6.0	100.0	.600
Equipment Changes			
Airplane Basic Empty Weight			

Figure 6-1. Sample Airplane Weighing

SAMPLE WEIGHT AND BALANCE RECORD

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

AIRPLANE MODEL	SERIAL NUMBER	PAGE NUMBER

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

Figure 6-2. Sample Weight and Balance Record

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

6. Basic Empty Weight may be determined by completing figure 6-1.

WEIGHT AND BALANCE

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

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

NOTE

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

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

NOTE

Loading Graph information for the pilot, passengers, baggage and hatshelf is based on seats positioned for average occupants and baggage or hatshelf items loaded in the center of these areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft C.G. range limitation (seat travel and baggage or hatshelf area limitation). Additional moment calculations, based on the actual weight and C.G. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph. Reduced fuel weights may be measured for use with heavy cabin loadings by filling both tanks to the 22 gallon marker for 43 gallons (258 pounds) usable, or filling one tank

completely with the other tank at 22 gallons for 51.5 gallons (309 pounds) usable. Both tanks may be filled for maximum range, provided maximum takeoff weight is not exceeded.

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

LOADING ARRANGEMENTS

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

** Arm measured to the center of the area shown.

NOTE:

The aft baggage wall (approximate station 188) can be used as a convenient interior reference point for determining the location of baggage area fuselage stations.

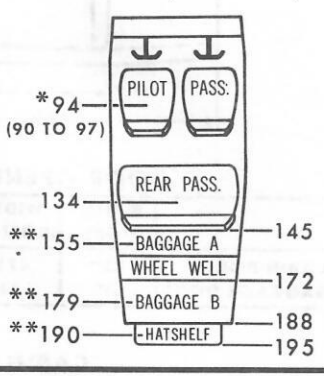
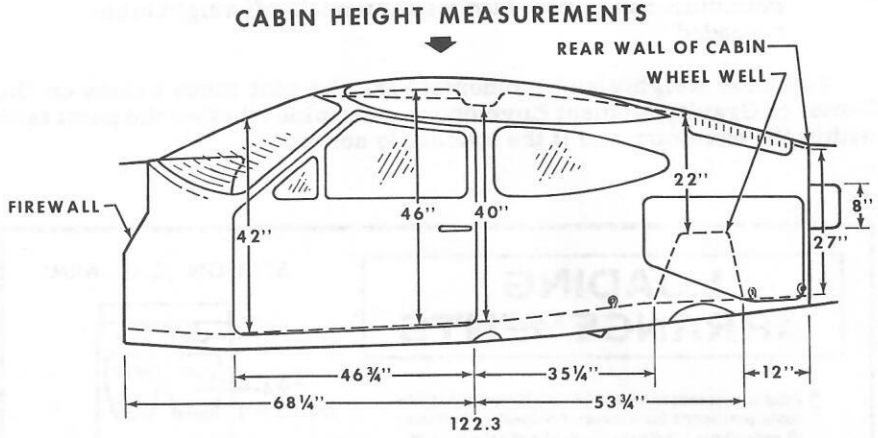


Figure 6-3. Loading Arrangements



DOOR OPENING DIMENSIONS

	WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (CENTER)	HEIGHT (REAR)
CABIN DOOR	23''	47½''	23''	43''	38''
BAGGAGE DOOR	31''	13''	9½''	20''	20''

WIDTH
• LWR. WINDOW LINE
* CABIN FLOOR

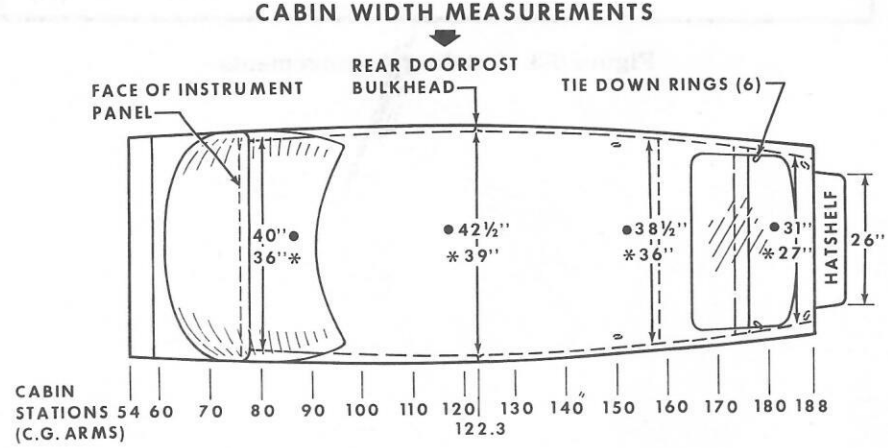
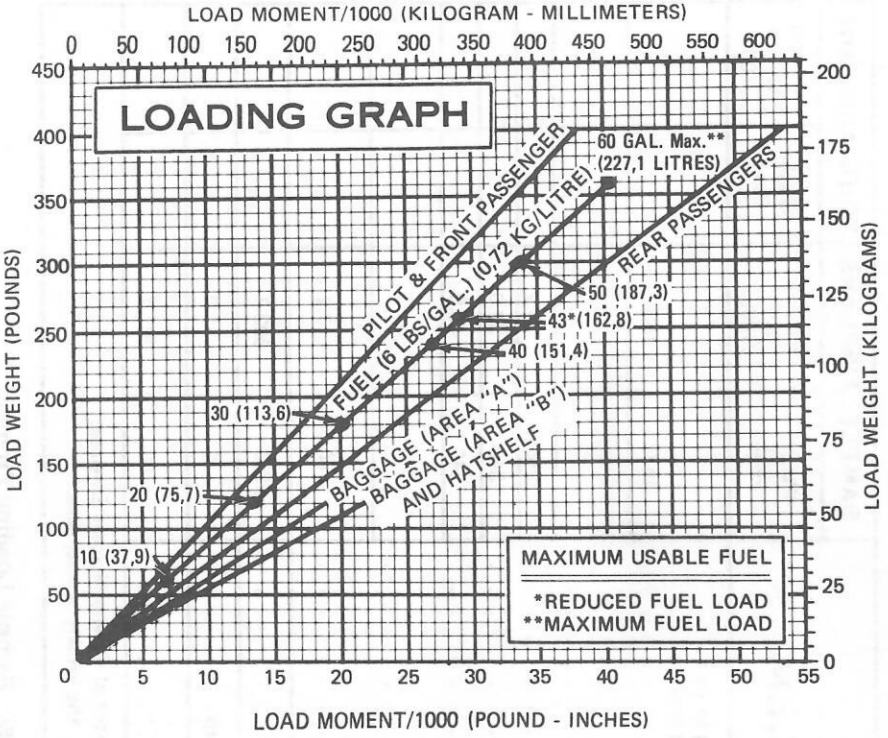


Figure 6-4. Internal Cabin Dimensions

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)	1831	189.2		
2. Usable Fuel (At 6 Lbs./Gal.)				
Standard Tanks (60 Gal. Maximum)				
Reduced Fuel (43 Gal.)	258	28.7		
3. Pilot and Front Passenger (Station 90 to 97)	340	32.0		
4. Rear Passengers	340	45.6		
5. Baggage-Area A (on and forward of wheel well) - Sta. 145 to 172				
6. Baggage-Area B (Aft of wheel well) and Hatshelf - Sta. 172 to 195	40	7.2		
7. RAMP WEIGHT AND MOMENT	2809	302.7		
8. Fuel allowance for engine start, taxi and runup	-9	-1.0		
9. TAKEOFF WEIGHT AND MOMENT (Subtract step 8 from step 7)	2800	301.7		
10. Locate this point (2800 at 301.7) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.				

Figure 6-5. Sample Loading Problem



NOTES

(1) Line representing adjustable seats shows the pilot and front 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.

(2) BAGGAGE (area "A") is located on and forward of the wheel well. BAGGAGE (area "B") is aft of the wheel well. Maximum baggage load, including the hatshelf, is 120 Lbs. (54 Kg). This load may be distributed as desired between baggage areas, provided 12 Lbs. (5.4 Kg) is not exceeded on the hatshelf.

Figure 6-6. Loading Graph

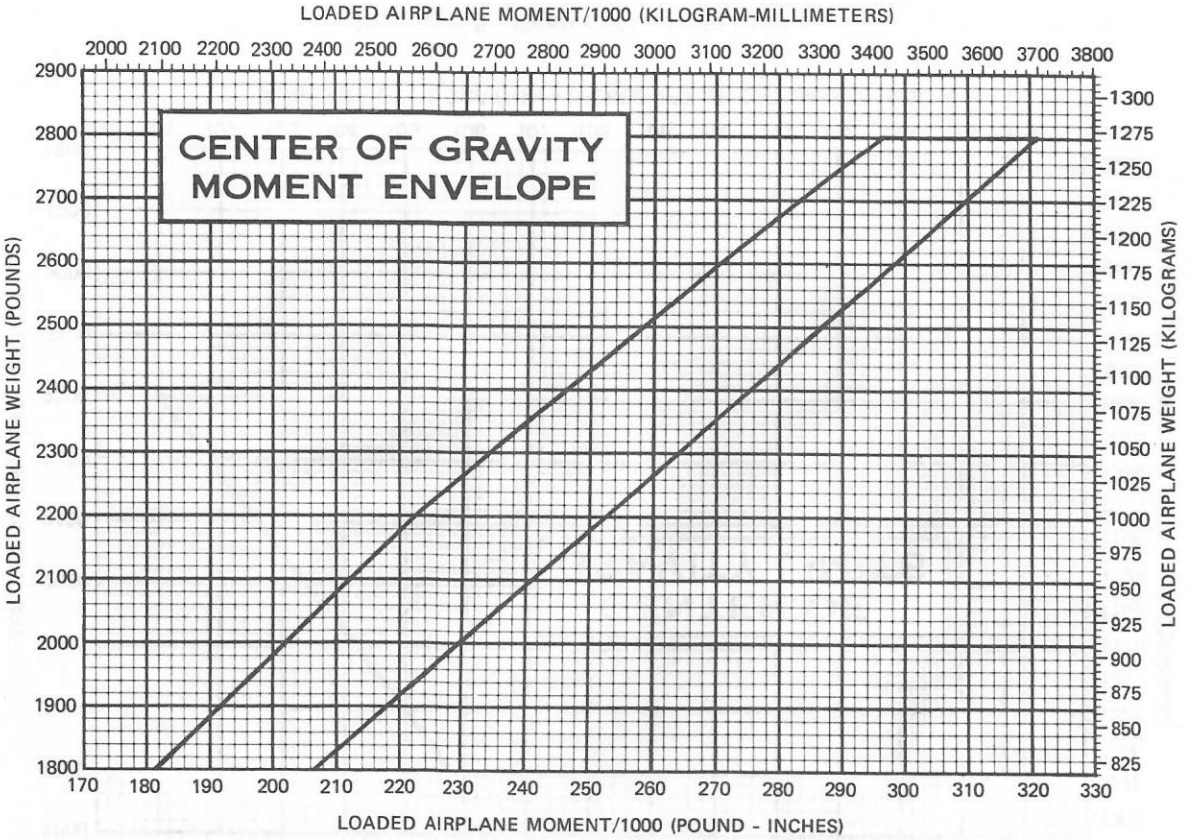


Figure 6-7. Center of Gravity Moment Envelope

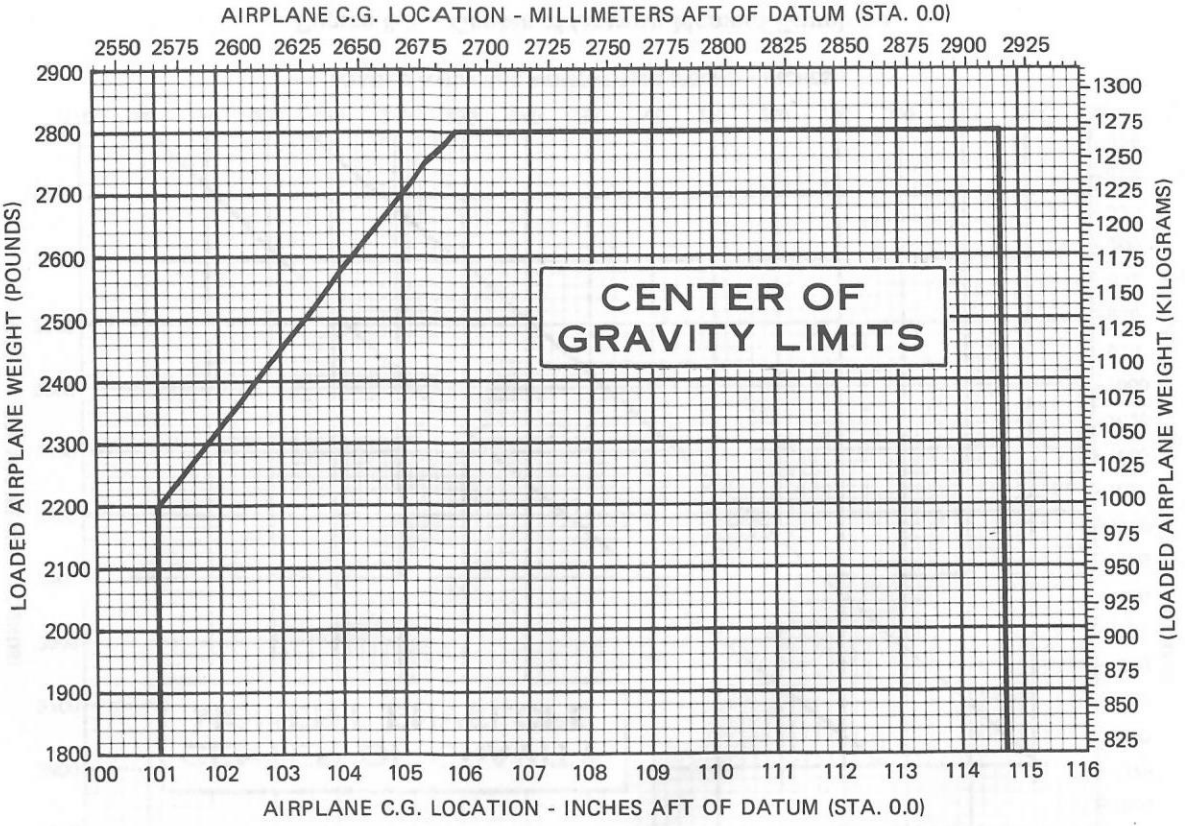


Figure 6-8. Center of Gravity Limits

EQUIPMENT LIST

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

This equipment list provides the following information:

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

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

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

NOTE

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

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

NOTE

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

NOTE

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

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, LYCOMING IO-360-A1B6D (INCLUDES ALL ELECTRIC STARTER, VACUUM PUMP PAD, GOVERNOR PAD, AND OIL FILTER)	2050001	315.5	38.2
A05-R	FILTER, INDUCTION AIR	C294510-0601	1.5	30.0
A09-R	ALTERNATOR, 28 VOLT, 60 AMP	C611503-0102	10.8	30.0
A17-R	OIL COOLER, (STEWART-WARNER 8406E)	2050001	2.5	51.0
	OR (HARRISON 8526250)	2050001	2.5	51.0
A33-R	PROPELLER, CONSTANT SPEED (MCCAULEY B2D34C207/78TCA-0)	C161008-0103	51.3	19.7
A37-R	GOVERNOR, PROPELLER (MCCAULEY C290D3/T12)	C161031-0106	3.0	51.5
A41-R	SPINNER INSTALLATION, PROPELLER	1750050	3.5*	17.9*
	SPINNER DOME	0752637	2.0	15.5
	AFT SPINNER BULKHEAD	1750051-1	1.0	24.2
	FWD SPINNER SPACER BULKHEAD	1750051-4	0.5	14.7
A61-A	VACUUM SYSTEM INSTL, ENGINE-DRIVEN	1713217-10	4.6*	54.8*
	DRY VACUUM PUMP	C431003	2.7	50.5
	FILTER ASSY	1201075-2	0.5	66.2
	VACUUM GAUGE	C668509-0101	0.1	74.0
	VACUUM RELIEF VALVE	C482001-0401	0.5	60.2
	HARDWARE		0.8	56.4
	B. LANDING GEAR & ACCESSORIES			
B01-R-1	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN(TWO) (MCCAULEY)	C16301880203	34.4*	124.8*
	WHEEL ASSY, MCCAULEY (EACH)	C163005-0101	7.6	124.5
	BRAKE ASSY, MCCAULEY C-30018-4 (LEFT)	C163032-0111	1.8	126.9
	BRAKE ASSY, MCCAULEY C-30018-4 (RIGHT)	C163032-0112	1.8	126.9
	TIRE, 6-PLY BLACKWALL (EACH)	C262006-0101	6.6	124.5
	TUBE (EACH)	C262026-0101	1.2	124.5
B01-R-2	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN(TWO) (CLEVELAND)	1241156-137	34.2*	124.8*
	WHEEL ASSY, CLEVELAND 40-113 (EACH)	C163001-0104	7.4	124.5
	BRAKE ASSY, CLEVELAND 30-75 (LEFT)	C163030-0113	1.9	126.9
	BRAKE ASSY, CLEVELAND 30-75 (RIGHT)	C163030-0114	1.9	126.9
	TIRE, 6-PLY BLACKWALL (EACH)	C262006-0101	6.6	124.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	TUBE (EACH)	C262026-0101	1.2	124.5
B04-R-1	WHEEL & TIRE ASSY, 5.00X5 NOSE (MCCAULEY)	C163018B0102	9.3*	33.5*
	WHEEL ASSY, MCCAULEY	C163005-0201	3.0	33.5
	TIRE, 4-PLY	C262003-0102	5.1	33.5
	TUBE	C262023-0101	1.2	33.5
B04-R-2	WHEEL & TIRE ASSY, 5.00X5 NOSE (CLEVELAND)	1241156-102	8.3*	33.5*
	WHEEL ASSY, CLEVELAND 40-77	1241156-12	2.4	33.5
	TIRE, 4-PLY BLACKWALL	C262003-0102	4.7	33.5
	TUBE	C262023-0101	1.2	33.5
	C. ELECTRICAL SYSTEMS			
C01-R-1	BATTERY, 24 VOLT, 14 AMP HR	0870060-1	27.5	209.0
C01-R-2	BATTERY, 24 VOLT, 14 AMP HR	C614001-0101	22.8	209.0
C01-0	BATTERY, 24 VOLT, 17 AMP HR	C614001-0102	24.8	209.0
C04-R	REGULATOR, 28 VOLT ALTERNATOR	C611002-0105	0.6	58.5
C07-A	GROUND SERVICE PLUG RECEPTACLE	2070003-1	3.2	204.5
C19-A	HEATING SYSTEM, PITOT (NET CHANGE	1720099	0.4	117.6
C22-A	INSTRUMENT POST LIGHTS	1701030	0.5	74.0
C23-A	FL PANEL INSTL.	1701030	1.8	72.0
C31-A	LIGHTS, COURTESY (SET OF THREE)	1770005	1.0	109.0
C34-R	PUMP, DUKES ELECTRIC FUEL (C291504-0202)	2016030	2.0	92.0
C37-R	LIGHTS, NAVIGATION (SET OF THREE)	2070032	1.0	139.5
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF TWO)	0701013-1&-2	NEGL	-
C43-R	LIGHT INSTALLATION, OMNIFLASH BEACON	2070027	1.4*	274.2*
	FLASHER POWER SUPPLY	C594502-0102	0.7	267.5
	LIGHT ASSY (ON FIN TIP)	C621001-0102	0.4	297.5
	SWITCH, CIRCUIT BREAKER & WIRING		0.2	126.6
C46-A	LIGHTS, STROBE (WING TIP MOUNTED)	2001013	3.5*	107.5*
	FLASHER POWER SUPPLY (SET OF TWO)	C622008-0102	2.3	109.3
	STROBE LIGHT, WING TIP (SET OF TWO)	C622006-0102	0.3	106.5
C49-S	LIGHTS, LANDING & TAXI (COWL MOUNTED)	1752085	1.4*	29.8*
	LIGHT BULB - G.E. (EACH)	4553	0.5	24.4
	D. INSTRUMENTS			
D01-R	INDICATOR, AIRSPEED	C661064-0202	0.6	72.9
D01-0	INDICATOR, TRUE AIRSPEED	1713375-2	0.7	73.1

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D04-R	STATIC AIR ALTERNATE SOURCE (INSTRUMENT)	2001007	0.5	87.2
D07-R	ALTIMETER, SENSITIVE	C661071-0101	1.0	72.0
D07-D-1	ALTIMETER, SENSITIVE (FEET & MILLIBARS)	C661071-0102	1.0	72.0
D07-D-2	ALTIMETER, SENSITIVE (20 FT. MARKINGS)	C661025-0102	1.0	72.0
D10-A	ALTIMETER, SENSITIVE - SECOND UNIT INSTL. (MAKES DUAL ALTIMETER SYSTEM)	2001015	0.8	71.9
D16-A-1	ENCODING ALTIMETER (REQUIRES RELOCATING REGULAR ALTIMETER)	1701031-1	3.0	69.6
D16-A-2	ENCODING ALTIMETER, FEET & MILLIBARS (REQUIRES RELOCATING REGULAR ALTIMETER)	1701031-2	3.0	69.6
D16-A-3	ALTITUDE ENCODER, BLIND (PANEL INSTL. NOT REQUIRED)	1701033	1.7*	62.0*
	ENCODER ASSEMBLY	C744001-0101	1.3	61.8
D25-S	CLOCK INSTALLATION	1713222-1	0.4*	96.2*
	ELECTRIC CLOCK	C664508-0101	0.3	73.6
D28-R	COMPASS INSTALLATION, MAGNETIC	1713353-2	0.5	83.5
D37-R	GAGE CLUSTER, LEFT FUEL & OIL PRESSURE	C669531-0101	0.5	74.0
D40-R	GAGE CLUSTER, RIGHT FUEL & OIL TEMPERATURE	C669532-0101	0.5	74.0
D43-R	GAGE CLUSTER, CYLINDER HEAD TEMP & AMMETER	C669530-0102	0.5	74.0
D49-A	INDICATOR, ECONOMY MIXTURE	2001009-1	0.6*	66.8*
	TEMPERATURE SENDER	C668501-0210	0.1	42.0
	INDICATOR GAGE	C668501-0211	0.4	74.0
D55-R	GAGE, FUEL FLOW & MANIFOLD PRESSURE	C662037-0106	0.5	73.0
D64-A-1	GYRO INSTALLATION (REQUIRES ITEM A61-A VACUUM SYSTEM)	1713217-9	6.0*	70.7*
	DIRECTIONAL INDICATOR	C661075	2.5	71.9
	ATTITUDE INDICATOR	C661076	2.1	72.1
	HOSES, FITTINGS, SCREWS, CLAMPS	1713217	1.4	66.4
D64-A-2	GYRO INSTALLATION (REQUIRES ITEM H09-A HSI	- -	3.5*	69.8*
	ATTITUDE INDICATOR	C661076	2.1	72.1
	HOSES, FITTINGS, SCREWS, CLAMPS	1713217	1.4	66.4
D64-A-3	GYRO INSTALLATION FOR NAV-O-MATIC 300A (REQUIRES A61-A VACUUM SYSTEM)	1713253-1	6.7*	70.9*
	DIRECTIONAL INDICATOR	40760-0104	3.2	72.0
	ATTITUDE INDICATOR	C661076	2.1	72.0
	HOSES, FITTINGS, SCREWS, CLAMPS	1713253	1.4	66.4
D67-A	HOURMETER INSTL. (C664502-0101)	2001001-3	0.5	64.7
D82-S	GAGE, OUTSIDE AIR TEMP. (C668507-0101)	1713353-2	0.1	85.9
D85-R	TACHOMETER INSTALLATION, ENGINE	2006003	0.9*	70.3*
	RECORDING TACHOMETER INDICATOR	C668020-0110	0.7	73.0
	TACH FLEXIBLE SHAFT (ASES 1605-24)	S-1605-2	0.2	61.0
D88-S	INDICATOR, TURN COORDINATOR (C661003-0505)	2006003	1.3	72.4

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D88-O	TURN COORDINATOR (USED WITH 200A & 300A NAV-O-MATICS)	42320-0028	1.9	71.6
D91-S	INDICATOR, RATE OF CLIMB (C661080-0101)	1700128-1	0.9	72.6
	E. CABIN ACCOMMODATIONS			
E05-R	SEAT, ADJUSTABLE FORE & AFT, PILOT	2014011	15.2	102.0
E05-O	SEAT, VERTICALLY ADJUSTING, PILOT	2014012-12	22.3	99.0
E07-S	SEAT, ADJUSTABLE FORE & AFT, CO-PILOT	2014011	15.2	102.0
E07-O	SEAT, VERTICALLY ADJUSTING, CO-PILOT	2014012-12	22.3	99.0
E09-S	SEAT, REAR (ONE PIECE BACK CUSHION)	2014013	29.4	139.0
E09-O	SEAT, REAR (TWO PIECE BACK CUSHION)	2014014-22	30.0	139.0
E15-R	BELT ASSY, PILOT LAP	S-2275-115	1.0	94.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S-2275-205	0.6	94.0
E19-O	SHOULDER HARNESS INERTIA REEL INSTL., PILOT & CO-PILOT (NET CHANGE)	1701027-2	1.0	155.4
E23-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S-2275-16	1.6	94.0
E27-S	BELT ASSY, REAR OCCUPANT LAP (SET OF TWO)	S-1746-16	2.0	135.0
E27-O	BELT & SHOULDER HARNESS ASSY, REAR OCCUPANT (SET OF TWO)	S-2275-11	3.2	135.0
E33-A	CARPET, BLACK (NET CHANGE)	CES-1207	0.0	- -
E35-A-1	LEATHER SEATING (NET CHANGE)	CES-1207	2.0	120.0
E35-A-2	VINYL SEATING (NET CHANGE)	CES-1207	0.0	- -
E43-A	VENTILATION SYSTEM, REAR SEAT	1706052-1	1.8	124.5
E49-A	CUP HOLDERS, RETRACTABLE (SET OF TWO)	1701023	0.1	74.5
E50-A	HEADRESTS, FRONT (SET OF TWO)	1215073-1	1.4	108.0
E51-A	HEADRESTS, REAR (SET OF TWO)	1215073-1	1.4	148.0
E55-S	SUN VISORS (SET OF TWO)	1701001-1	1.0	93.0
E57-A	WINDOWS, TINTED (SET OF SIX) (NET CHANGE)	1701010-12	0.0	- -
E65-S	BAGGAGE NET	2015009	0.5	180.0
E85-A	CONTROLS INSTALLATION, DUAL	2060001-2	7.3*	70.8*
	CONTROL WHEEL, RIGHT SIDE	0513260-9	1.8	83.0
	RUDDER PEDALS, RIGHT SIDE (SET OF TWO)	1460320-1	1.1	63.1
E89-O	CONTROL WHEEL, ALL PURPOSE, INCLUDES MAP LIGHT AND MIKE SWITCH, NET CHANGE		0.3	82.5
E93-R	HEATING SYSTEM, CABIN (INCLUDES EXHAUST SYSTEM)	2006003 2050001	22.0	45.7
	F. PLACARDS & WARNING			

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
F01-R	PLACARD, OPERATIONAL LIMITATIONS, VFR, DAY & NIGHT	1705037-4	NEGL	- -
F01-O	PLACARD, OPERATIONAL LIMITATIONS, VFR/IFR, DAY & NIGHT	1705037-3	NEGL	- -
F07-R	DUAL WARNING SYS.- GEAR RETRACTION & STALL (REQUIRES ITEM H61-R CABIN SPEAKER)	1270733	0.3	65.0
	G. AUXILIARY EQUIPMENT			
G01-A	LIFT HANDLES, TAILCONE (SET OF TWO)	1712150-1	1.2	252.7
G07-A	RINGS, AIRPLANE HOISTING (NOT FACTORY INSTALLED)	1700122-1	2.4	122.9
G13-A	CORROSION PROOFING, INTERNAL	2001002-1	6.0	140.0
G16-A	STATIC DISCHARGE INSTL. (SET OF TEN)	2001017-1	0.3	226.0
G19-A	STABILIZER ABRASION SHIELD	1701019-1	2.7	276.5
G22-S	TOW BAR (STOWED)	0501019-1	1.6	178.5
G25-S	PAINT, OVERALL EXTERIOR	204008	12.3*	157.4*
	OVERALL WHITE BASE		11.2	157.0
	COLOR STRIPE SCHEME ESTIMATE		0.6	165.0
	WASH PRIME COATING		0.4	157.0
G25-O	PAINT, OVERALL EXTERIOR (MODIFIED POLY-URETHANE) FOR USE WITH ITEM G13-A (INTERNAL CORROSION PROOFING)		12.3*	157.4*
G28-A	JACKING PADS, WING MAIN SPAR (INSTALLED ARM SHOWN)(NOT FACTORY INSTALLED)	1200028-1	0.1	124.1
G31-A	CABLES, CORROSION RESISTANT (NET CHANGE)	2001002-1	0.0	- -
G55-A	FIRE EXTINGUISHER INSTALLATION	1701008-3	3.0*	125.5*
	FIRE EXTINGUISHER	C421001-0101	2.6	125.5
	FIRE EXTINGUISHER BRACKET	C421001-0102	0.3	125.5
G67-A	RUDDER PEDAL EXTENSIONS, REMOVABLE - SET OF 2 (STOWABLE - INSTALLED ARM SHOWN NOT FACTORY INSTALLED)	0701048	2.3	64.5
G88-A	WINTERIZATION KIT INSTALLATION, ENGINE	2052048-13	0.6*	35.4*
	BREATHER TUBE INSULATION		0.2	53.3
	TWO COWL INLET AIR COVERS (INSTALLED)		0.3	25.0
	H. AVIONICS & AUTOPILOTS			

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H01-A-1	CESSNA 300 ADF	3910159-7	7.3*	79.1*
	RECEIVER WITH BFO (R-546E)	41240-0101	2.3	69.5
	INDICATOR (IN-346A)	40980-1001	0.9	71.0
	ADF LOOP ANTENNA & WIRING	3960104-1	2.2	89.1
	ADF SENSE ANTENNA & CABLES	2070000-620	0.2	177.0
	MTG. BOX, WIRING & HDWR.		1.7	71.9
H01-A-2	CESSNA 400 ADF	3910160-2	8.4*	77.8*
	RECEIVER WITH BFO (R-446A)	43090-1114	3.4	69.5
	INDICATOR (IN-346A)	40980-1001	0.9	71.0
	ADF LOOP ANTENNA & WIRING	3960104-1	2.2	89.1
	ADF SENSE ANTENNA & CABLES	2070000-620	0.2	177.0
	MTG. BOX, WIRING & HDWR.		1.7	71.9
H04-A	NARCO DME 190	3910166-5	7.4*	74.7*
	TRANSCEIVER	3930165-1	4.9	68.8
	MOUNTING BOX		0.6	68.4
	DME ANTENNA	3960133-1	0.2	203.9
	RADIO COOLING INSTL. IF NOT PREVIOUSLY INCLUDED	3930152-7	1.4	68.2
H07-A-1	CESSNA 400 GLIDESLOPE (INCLUDES VOR/ILS INDICATOR--EXCHANGE FOR VOR/LOC)	3910157	5.1*	161.2*
	RECEIVER, 40 CHANNEL (R-443B)	42100-0000	2.1	211.7
	MOUNTING, RIGID	36450-0000	0.3	211.7
	ANTENNA ASSEMBLY	1200098	0.2	91.0
	VOR/ILS INDICATOR (IN-386A)(INDICATOR ACTUAL WT IS 2.3 LBS)	46860-2000	0.1	71.5
H07-A-2	CESSNA 400 GLIDESLOPE (INCLUDES AUTOCOURSE INDICATOR--EXCHANGE FOR REGULAR VOR/ILS	3910157	- -	- -
H09-A	CESSNA HSI, NON SLAVED, VOR INDICATOR	3910195-1	6.8*	124.6*
	NET CHANGE (USED WITH H31-A-3)		4.5	70.0
	HSI INDICATOR (IG-832C)	44690-2000	0.9	220.0
	HSI CONVERTER (B-445A)	47240-0000	-2.2	71.5
	OMNI INDICATOR, 300 OR 400 DELETED		3.3	129.1
	WIRING & MISC. ITEMS		20.2*	157.2*
H11-A-1	PANTRONICS HF TRANSCEIVER, SECOND UNIT	3910156-7	3.1	68.5
	TRANSCEIVER (PT10-A)	C582103-0102	0.8	68.5
	MOUNTING BOX		8.5	184.3
	REMOTE POWER SUPPLY (PT-10PS-28)	C582103-0301	4.2	200.8
	ANTENNA LOAD BOX (DX10-RL-28)	C589502-0201	0.3	218.2
	ANTENNA WIRE, 351 IN. LONG	2070000-612	2.5	111.8
	CABLE INSTL.	3950124-6	0.8	190.6
	MISC. HDWR.		22.7*	155.1*
H11-A-2	SUNAIR SSB TRANSCEIVER	3910158		

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	TRANSCEIVER, SINGLE SIDE BAND (ASB-125)	99681	4.5	68.5
	MOUNT		0.8	68.5
	REMOTE POWER SUPPLY (PA-1010A)	99683	8.9	188.3
	ANTENNA COUPLER (CU-110)	99816	4.9	200.8
	ANTENNA WIRE, 351 IN. LONG	2070000-612	0.3	218.2
	CABLE INSTL.	3950124-6	2.5	111.8
	MISC. HDWR.		0.8	190.6
H13-A	CESSNA 400 MARKER BEACON	3910164-3	2.7*	151.8*
	RECEIVER (R-402A)	42410-5128	0.7	204.6
	ANTENNA (L SHAPED ROD)	0770681-1	0.7	200.8
H16-A-1	CESSNA 300 TRANSPONDER	3910127-16	3.5*	69.9*
	RECEIVER-TRANSMITTER (RT-359A)	41420-1128	2.7	68.5
	ANTENNA (A-119)	42940-0000	0.3	83.3
H16-A-2	CESSNA 400 TRANSPONDER	3910128-11	3.6*	70.8*
	RECEIVER-TRANSMITTER (RT-459A)	41470-1128	2.8	68.5
	ANTENNA (A-119)	42940-0000	0.3	83.3
H22-A-1	CESSNA 300 NAV/COM 720 CH COM 1ST UNIT	3910183	14.7*	87.3*
	RECEIVER-TRANSCEIVER (RT-385A)	46660-0000	5.4	68.0
	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	71.5
	H34-A BASIC AVIONICS KIT	3910186	6.2	112.8
	MOUNT, WIRING & MISC HARDWARE		0.9	66.0
H22-A-2	CESSNA 300 NAV/COM 720 CH COM WITH IN-385AC (AUTOMATIC RADIAL CENTERING INDICATOR) EXCHANGE FOR IN-385A, NET CHANGE	3910183	NIL	- -
H22-A-3	CESSNA 400 NAV/COM 720 CH COM 1ST UNIT		14.7*	87.3*
	RECEIVER-TRANSCEIVER (RT-485A	47360-1100	5.4	68.0
	VOR/LOC INDICATOR (IN-385A) 300 TYPE	46860-1000	2.2	71.5
	H34-A BASIC AVIONICS KIT	3910186	6.2	112.8
	MOUNT, WIRING & MISC HARDWARE		0.9	66.0
H25-A-1	CESSNA 300 NAV/COM 720 CH COM 2ND UNIT	3910183	9.6*	72.9*
	RECEIVER-TRANSCEIVER (RT-385A)	46660-0000	5.4	68.0
	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	71.5
	H37-A ANTENNA & OMNI COUPLER KIT	3910185	1.1	105.7
	MOUNT, WIRING & MISC HARDWARE		0.9	66.0
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	0470419	1.8*	197.4*
	TRANSMITTER (D & M DMELT-6)	C589511-0101	1.6	197.7
	ANTENNA	C589511-0109	0.1	195.5
	CABLE & HDWR.		0.1	194.8
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (FOR USE IN CANADA)	0470419	1.8*	197.4*
	TRANSMITTER (D & M DMELT-6C)	C589511-0102	1.6	197.7

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ANTENNA	C589511-0109	0.1	195.5
	CABLE & HDWR.		0.1	194.8
H31-A-1	NAV-O-MATIC 200A AUTOPILOT	3910162-5	8.1*	103.4*
	COMPUTER & MOUNT (ARC 43610-1200)	3930144-2	1.6	67.5
	TURN COORDINATOR (NET CHANGE)	3930144-2	0.6	69.9
	ROLL ACTUATOR INSTL.	1200237-9	4.6	125.7
	RELAY INSTALLATION	3970128-3	0.1	67.0
	CABLES AND HARDWARE		1.2	85.9
H31-A-2	NAV-O-MATIC 300A AUTOPILOT	3910163-5	19.6*	80.5*
	CONTROLLER & MOUNT (ARC 42660-1200)	3930145-2	1.8	67.5
	GYRO INSTALLATION (ITEM D64-A-3)	1713253-1	6.7	70.9
	VACUUM SYSTEM (ITEM A61-A)	1713217-10	4.6	54.8
	TURN COORDINATOR (NET CHANGE)	3930145-2	0.6	69.9
	ROLL ACTUATOR INSTL.	1200237	4.6	125.7
	RELAY INSTALLATION	3970128-3	0.1	67.0
	CABLES AND HARDWARE		1.2	85.9
H31-A-3	NAV-O-MATIC 300A AUTOPILOT WITH HSI		23.2*	94.6*
	CONTROLLER & MOUNT (ARC 42660-1200)	3930145	1.8	67.5
	D64-A-2 GYRO INSTALLATION FOR HSI		3.5	69.8
	A61-A VACUUM-SYSTEM	1713217	4.6	54.8
	D88-O TURN COORDINATOR, NET CHANGE	3930145	0.6	69.9
	H09-A UNSLAVED HSI INSTALLATION		6.8	124.6
	RELAY INSTALLATION	3970128	0.1	67.0
	CABLES AND MISC HARDWARE		1.2	85.9
	ROLL ACTUATOR INSTALLATION	1200237	4.6	125.7
H34-A	BASIC AVIONICS KIT (REQUIRED BY AND AVAILABLE WITH 1ST NAV/COM ONLY)	3910186-5	6.2*	112.8*
	RADIO COOLING	3930152-6	1.3	68.1
	NOISE FILTER, AUDIO (ON ALTERNATOR)	3940148-2	0.1	33.0
	COM ANTENNA CABLE ASSY, RH	3950124-11	0.4	95.0
	OMNI ANTENNA CABLE ASSY	3950124-12	1.0	186.1
	OMNI ANTENNA INSTALLATION	3960102-3	0.6	300.3
	COM ANTENNA, RH	3960113-2	0.5	126.9
	MICROPHONE INSTALLATION, HAND HELD	3970124-3	0.3	75.9
	HEADSET INSTALLATION	3970125-3	0.2	70.5
	AUDIO CONTROL PANEL & WIRING	3970131-1	1.9	66.0
H37-A	ANTENNA AND OMNI COUPLER KIT (REQUIRED AND AVAILABLE WITH 2ND NAV/COM INSTL ONLY)	3910185-4	1.1	105.7
H46-A	ADF ANTI-PRECIP ANTENNA INSTL (NET CHANGE)	3910165	0.5	180.2
H55-A	MICROPHONE-HEADSET COMBINATION (INCLUDES MIKE SWITCH)	2070027-1	0.5	72.4
H56-A	MICROPHONE/HEADSET-PADDED (STOWED ITEM)	C596531-0101	1.2	70.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H61-R	CABIN SPEAKER INSTL. (C596510-0101)	2070027	1.9	111.0
	J. SPECIAL OPTION PACKAGES			
J01-A	CARDINAL RG II EQUIPMENT	2000001-12	58.0*	91.5*
	CONSISTS OF THE FOLLOWING ITEMS			
	A61-A VACUUM SYSTEM INSTL.	1713217-10	4.6	54.8
	C07-A GROUND SERVICE RECEPTACLE	2070003-1	3.2	204.5
	C19-A HEAT SYS, PITOT & STALL WARNING	2070001	0.4	117.6
	C31-A COURTESY LIGHTS	1770005-3	1.0	109.0
	C40-A DETECTORS, NAV LIGHTS	0701013-1&-2	NEGL	-
	D01-O TRUE AIRSPEED IND. (NET CHANGE)	1713375-2	0.1	74.3
	D64-A-1 GYRO INSTALLATION	1713217-9	6.0	70.7
	E85-A DUAL CONTROLS	2060001-2	7.3	70.8
	H01-A-1 CESSNA 300 ADF WITH BFO	3910159-7	7.3	79.1
	H16-A-1 CESSNA 300 TRANSPONDER	3910127-16	3.5	69.9
	H22-A-1 CESSNA 300 NAV/COM, 1ST UNIT	3910183	14.7	87.3
	H28-A-1 EMERGENCY LOCATOR TRANSMITTER	470419	1.8	197.4
	H31-A-1 CESSNA 200A NAV-O-MATIC	3910162-5	8.1	103.4
J04-A	NAV-PAC INSTALLATION (AVAIL W/J01-A ONLY)		17.4*	111.0*
	H07-A-1 CESSNA 400 GLIDESLOPE	3910157	5.1	161.2
	H13-A CESSNA 400 MARKER BEACON	3910164	2.7	151.8
	H25-A CESSNA 300 NAV/COM, 2ND UNIT	3910183	9.6	72.9

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

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

AIRFRAME

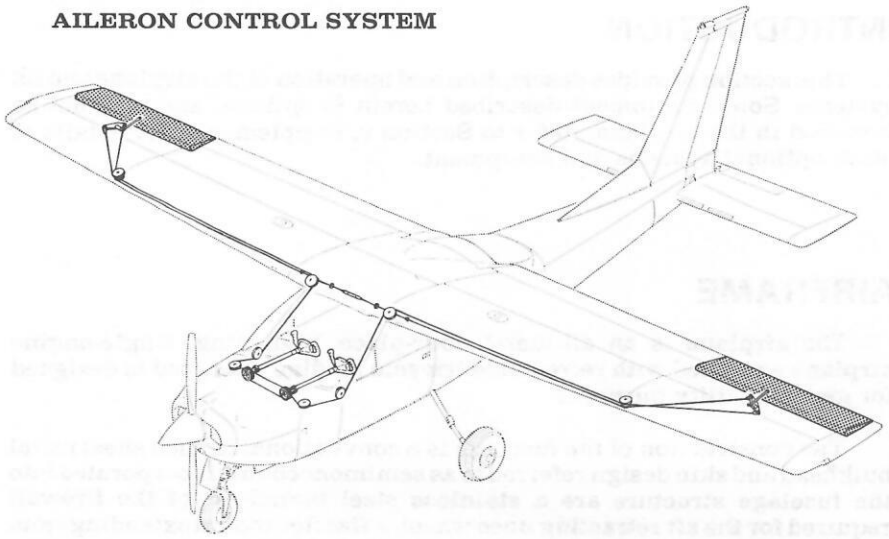
The airplane is an all-metal, four-place, high-wing, single-engine airplane equipped with retractable tricycle landing gear, and is designed for general utility purposes.

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 a stainless steel tunnel aft of the firewall required for the aft retracting nose wheel, a flat floorboard extending from the firewall to the main wheel wells, 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. A reinforced tailskid/tie-down ring is installed on the tailcone for tailcone protection.

The full cantilever, modified laminar flow wings with integral fuel tanks 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-slotted flaps are of the 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 and rudder, and a stabilator. The vertical stabilizer and rudder are of conventional construction consisting of formed sheet metal forward and aft spars, and formed sheet metal ribs covered with aluminum skin. The tip of the rudder is designed with a leading edge overhang which contains a balance weight. The stabilator is a combination of the horizontal stabilizer and elevator, and incorporates a 40% span anti-servo trim tab. The stabilator is constructed of a torque transmitting primary spar, an aft spar, formed sheet metal ribs, and aluminum skin. The stabilator

AILERON CONTROL SYSTEM



RUDDER AND RUDDER TRIM CONTROL SYSTEMS

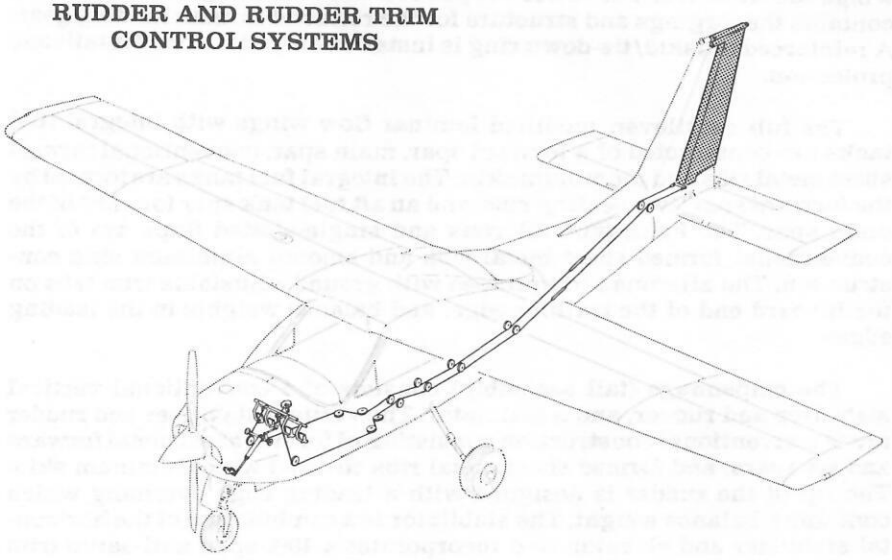


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

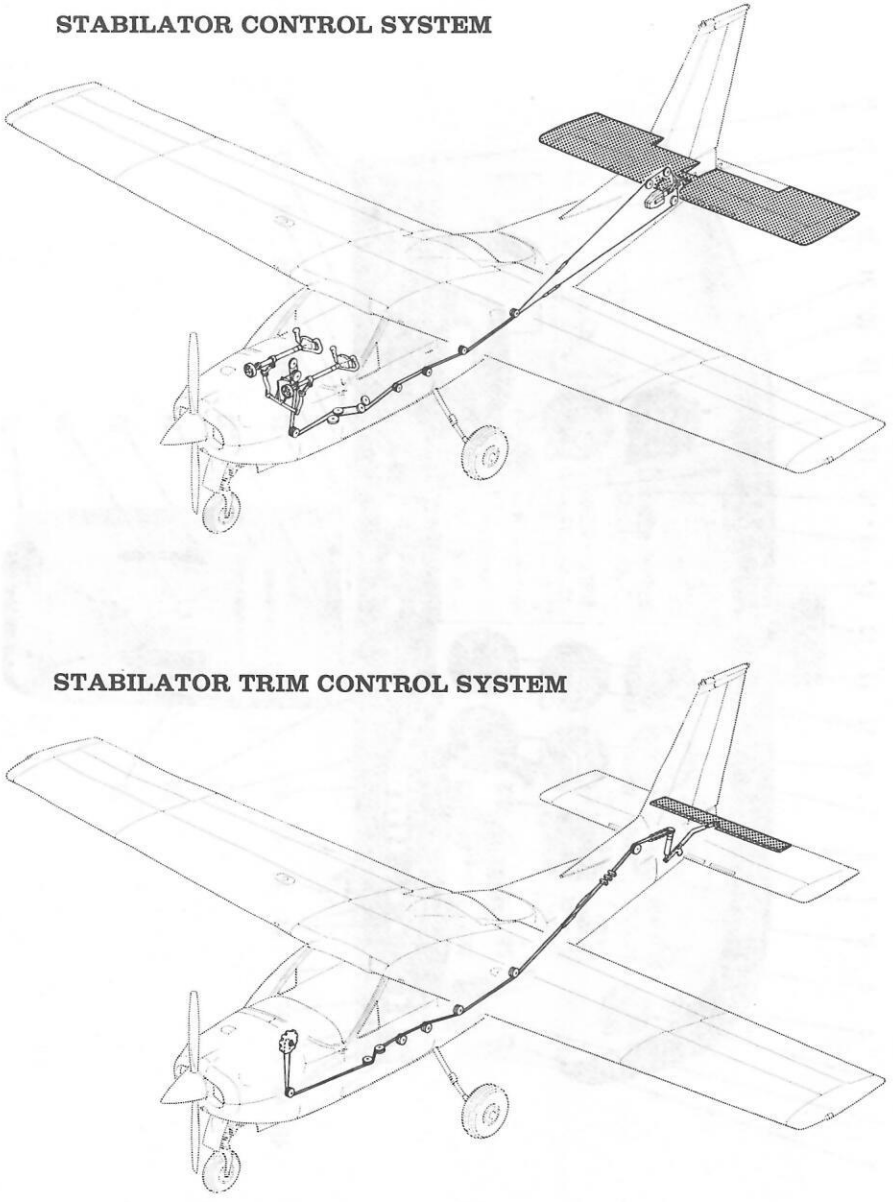


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

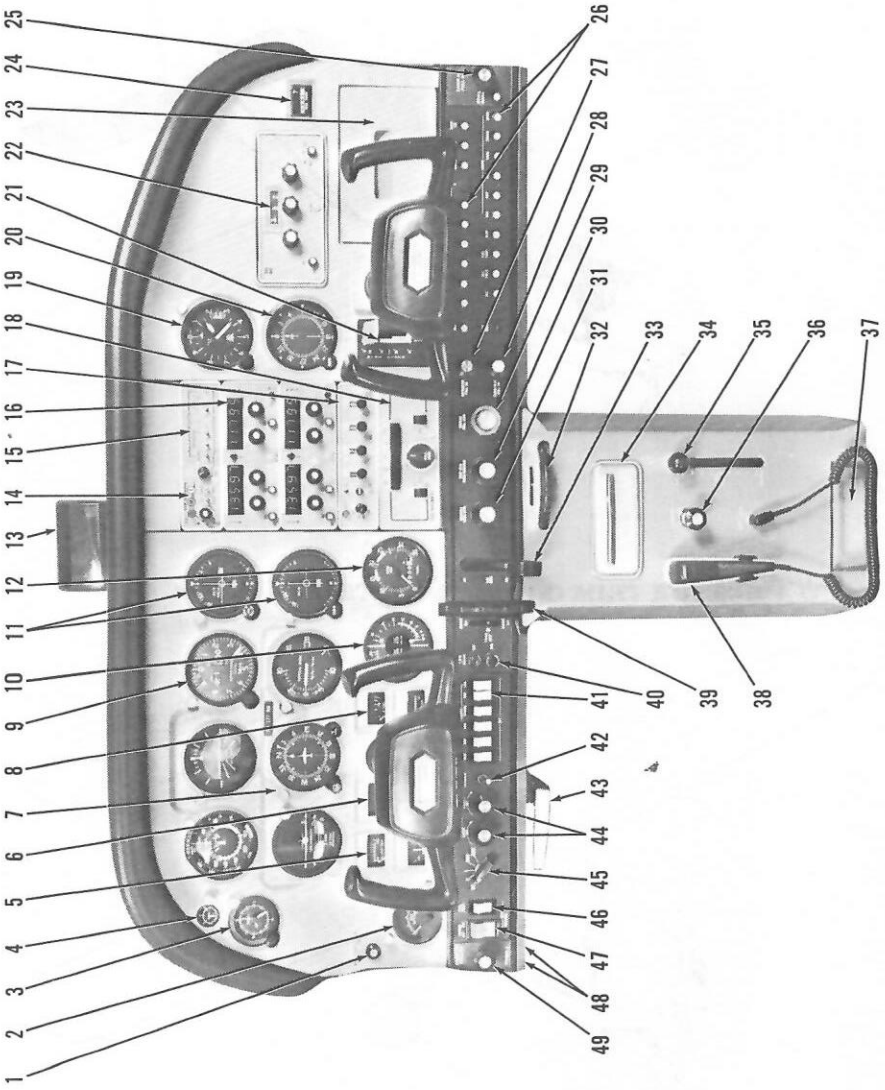


Figure 7-2. Instrument Panel (Sheet 1 of 2)

1. Static Pressure Alternate Source Valve
2. Economy Mixture Indicator
3. Clock
4. Suction Gage
5. Cylinder Head Temperature Gage and Ammeter
6. Left Fuel Quantity Indicator and Oil Pressure Gage
7. Flight Instrument Group
8. Right Fuel Quantity Indicator and Oil Temperature Gage
9. Encoding Altimeter
10. Manifold Pressure/Fuel Flow Indicator
11. Omni Course Indicators
12. Tachometer
13. Rear View Mirror
14. Marker Beacon Indicator Lights and Switches
15. Audio Control Panel
16. Radios
17. Transponder
18. Autopilot Control Unit
19. Secondary Altimeter
20. ADF Bearing Indicator
21. Wing Flap Switch and Position Indicator
22. ADF Radio
23. Map Compartment
24. Flight Hour Recorder
25. Right Cabin Air Control Knob
26. Circuit Breakers
27. Defroster Control Knob
28. Cabin Heat Control Knob
29. Mixture Control Knob
30. Propeller Control Knob
31. Throttle (With Friction Lock)
32. Rudder Trim Control Wheel
33. Landing Gear Lever
34. Ashtray
35. Cowl Flap Control Lever
36. Cigar Lighter
37. Courtesy Light
38. Microphone
39. Stabilator Trim Control Wheel
40. Landing Gear Position Indicator Lights
41. Electrical Switches
42. Avionics Power Switch
43. Parking Brake Handle
44. Instrument and Radio Dial Light Rheostat Control Knobs
45. Ignition Switch
46. Auxiliary Fuel Pump Switch
47. Master Switch
48. Phone and Auxiliary Mike Jacks
49. Left Cabin Air Control Knob

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

contains a beam mounted balance weight attached to the center of the primary spar and extending into the fuselage tailcone. The leading edge contains four inverted slots formed of sheet metal and positioned to place two on each side of the fuselage.

FLIGHT CONTROLS

The airplane's flight control system (see figure 7-1) consists of conventional aileron and rudder control surfaces and a stabilator (combined horizontal stabilizer and elevator). The control surfaces are manually operated through mechanical linkage using a control wheel for the ailerons and stabilator, and rudder/brake pedals for the rudder. 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 stabilator trim is provided. 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. Stabilator trimming is accomplished through the stabilator 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.

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 over the control column. 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". The engine instrument cluster and fuel quantity indicators are arranged around the base of the control wheel shaft. The alternate static source valve

control knob is installed on the left edge of the instrument panel. Avionics equipment is stacked approximately on the centerline of the panel, with the right side of the panel containing the wing flap switch and indicator, map compartment, and space for additional instruments and avionics equipment. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches, controls, and circuit breakers necessary to operate the airplane. The left side of the panel contains the left cabin air control knob, master switch, auxiliary fuel pump switch, ignition switch, panel light intensity controls, avionics power switch, electrical switches for installed equipment and landing gear indicator lights. The center area contains the stabilator trim control wheel, landing gear lever, throttle, propeller control, and mixture control. The right side of the panel contains the defroster control knob, cabin heat control knob, circuit breakers and right cabin air control knob. A pedestal, extending from the edge of the switch and control panel to the floorboard, contains the rudder trim control wheel, an ashtray, a cigar lighter, the cowl flap control lever, and the microphone bracket. A parking brake handle is mounted under the switch and control panel in front of the pilot.

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

GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 15° each side of center. By applying either left or right brake, the degree of turn may be increased up to 39° 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 surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 39° 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 30 feet 9 inches. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down on a tailcone bulkhead just forward of the stabilator to raise the nose wheel off the ground.

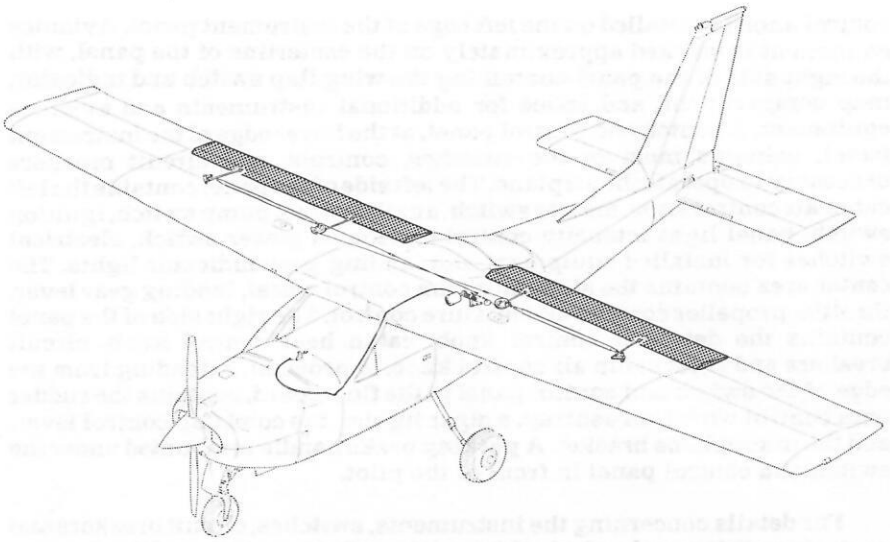


Figure 7-3. Wing Flap System

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 a 15-ampere circuit breaker, labeled FLAP, on the right side of the instrument panel.

LANDING GEAR SYSTEM

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

The landing gear extension and retraction and the main gear down lock operation is accomplished by hydraulic actuators powered by an

electrically-driven hydraulic power pack (see figure 7-7). The power pack is located aft of the rear baggage wall. Fluid level in the power pack should be checked at 25-hour intervals and anytime the emergency hand pump has been used to extend the landing gear. With the baggage wall removed, the fluid level can be checked by removing the filler screw on the right forward corner of the power pack. Hydraulic fluid (MIL-H-5606) should be added to maintain the level to the top of the filler opening. Landing gear system hydraulic pressure is maintained automatically by the power pack and serves as the main gear up lock. If pressure drops below that necessary to retain up lock pressure on the main gear, the power pack will automatically compensate, providing a positive up lock. The nose gear incorporates an over-center mechanical linkage which provides a positive mechanical up and down lock. Mechanically-actuated wheel well doors are provided for the nose gear. They are open when the nose gear is down and closed when it is retracted.

Power pack operation is started and stopped by a pressure switch, and hydraulic pressure is directed by the landing gear lever. Two position indicator lights are provided to show landing gear position. The landing gear system is also equipped with a nose gear safety (squat) 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 for gear up, and down for gear down) which give a mechanical indication of the gear position selected. From either position, the gear lever must be pulled out to clear a detent before it can be repositioned; operation of the landing gear system will not begin until the lever has been repositioned. After the lever has been repositioned, it directs hydraulic pressure within the system to actuate the gear to the selected position.

LANDING GEAR POSITION INDICATOR LIGHTS

Two position indicator lights, adjacent to the stabilator trim control wheel, indicate that the gear is either up or down and locked. Both the gear-up (amber) and gear-down (green) lights are the press-to-test type, incorporating dimming shutters for night operation. If an indicator light bulb should burn out, it can be replaced in flight with the bulb from the remaining indicator light.

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 power pack will create pressure in the system and actuate the landing gear to the

selected position. During a normal cycle, the gear locks up or down and the position indicator light comes on (amber for up and green for down) indicating completion of the cycle. After indicator light illumination, pressure will continue to build until the power pack pressure switch turns the power pack off. If system pressure drops below maximum, 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.

The safety (squat) switch, actuated by the nose gear, electrically prevents inadvertent retraction 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 2 to 3 seconds which will return system pressure to maximum in the event pressure has dropped. A switch type circuit breaker is also provided in the system as a maintenance safety feature. With the switch pulled out, landing gear operation is prevented. After maintenance is completed, and prior to flight, the switch should be pushed back in.

EMERGENCY HAND PUMP

A hand-operated hydraulic pump, located under a cover between the front seats, is provided for manual extension of the landing gear in the event of a hydraulic system failure. The landing gear cannot be retracted with the hand pump. To utilize the pump, raise the cover, extend the handle forward, and pump vertically. For complete emergency procedures, refer to Section 3.

LANDING GEAR WARNING SYSTEM

The airplane is equipped with a landing gear warning system designed to help prevent the pilot from inadvertently making a wheels-up landing. The system consists of a throttle actuated switch which is electrically connected to a dual warning unit. The warning unit is connected to the airplane speaker.

When the throttle is retarded below approximately 12 inches of manifold pressure at low altitude (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.

BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. Mounted to the aft cabin bulkhead, and extending aft of it, is a hatshelf. Access to the baggage

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

SEATS

The seating arrangement consists of two separate adjustable seats for the pilot and front passenger, and a solid or split-backed fixed seat in the rear. The pilot's and front passenger's seats are available in two different designs: four-way and six-way adjustable.

Four-way seats may be moved forward or aft, and the seat back angle changed. To position the seat, lift the lever under the left corner of the seat, slide the seat into position, release the lever, and check that the seat is locked in place. The seat back is spring-loaded to the vertical position. To adjust its position, rotate the knob on the right rear side of the seat and reposition the back. The seat backs will also fold full forward.

The six-way seats 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 lever and check that the seat is locked in place. Raise or lower either seat by rotating a crank under the left corner of the seat. Seat back angle is adjustable by rotating a crank under the right corner of either 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 rear passenger's seats consist of a fixed one-piece seat bottom with either one-piece or individually adjustable seat backs. The one-piece back is adjusted by a lever under the center of the seat bottom between the passengers. Two adjustment levers are provided for the individually adjustable backs. These levers are under the left and right corners of the seat bottom. All seat back configurations are spring-loaded to the vertical position. To adjust either type of seat back, lift the adjustment lever and reposition the back.

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's and front passenger's 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 rear 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 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 rear seats are used in the same manner as the belts for the front 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 rear seat shoulder harnesses are furnished, they are attached adjacent to the lower corners of the rear window. Each rear seat harness is stowed behind a stowage sheath above an aft side window.

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

Removing the shoulder harness is accomplished by pulling upward on

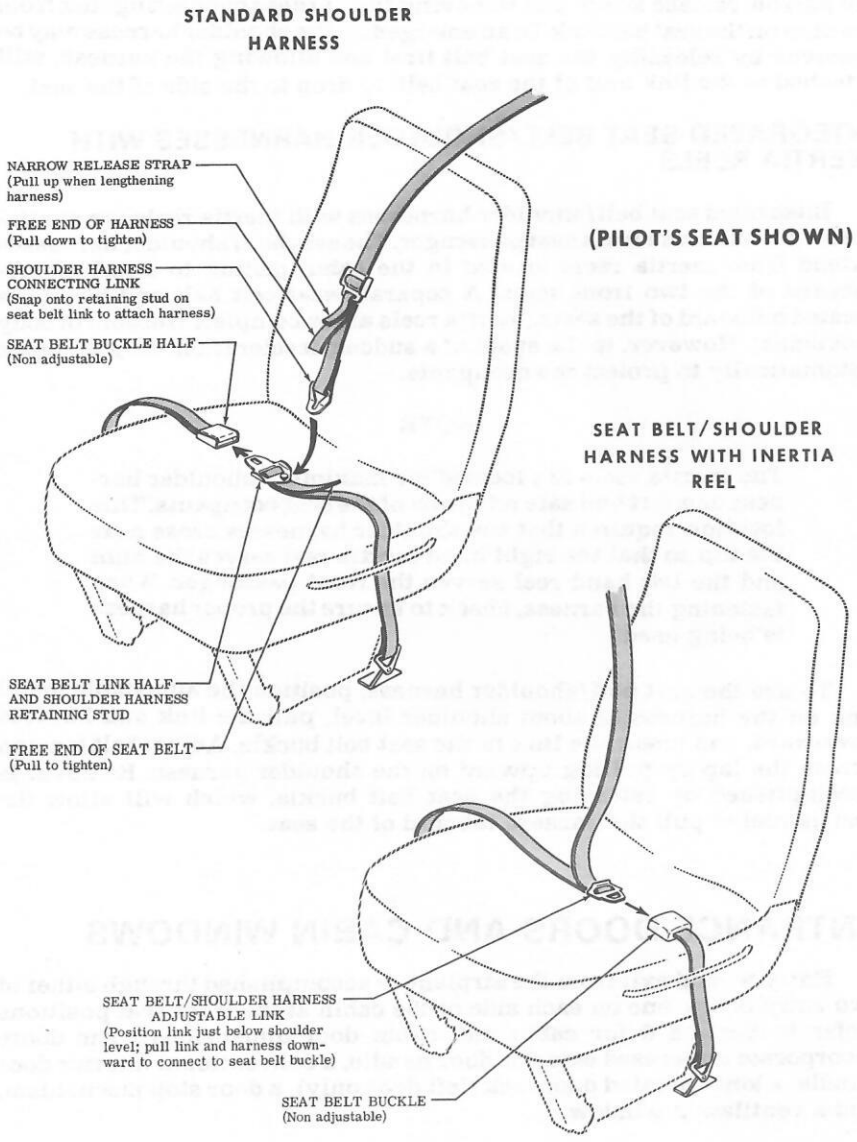


Figure 7-4. Seat Belts and Shoulder Harnesses

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 ceiling 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.

NOTE

The inertia reels are located for maximum shoulder harness comfort and safe retention of the seat occupants. This location requires that the shoulder harnesses cross near the top so that the right hand inertia reel serves the pilot and the left hand reel serves the front passenger. When fastening the harness, check to ensure the proper harness is being used.

To use the seat belt/shoulder harness, position the adjustable metal link on the harness at about 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 a ventilation window.

To open the doors from outside the airplane, utilize the recessed door handle near the aft edge of each door. Depress the forward end of the handle to rotate it out of its recess, and then pull outboard. To close or open the

doors from inside the airplane, use the conventional door handle and arm rest. The inside door handle is a three-position handle having a placard at its base with the positions OPEN, CLOSE, and LOCK shown on it. The handle is spring-loaded to the CLOSE (up) position. When the door has been pulled shut and latched, lock it by rotating the door handle forward to the LOCK position. Both cabin doors should be locked prior to flight, and should not be opened intentionally during flight.

NOTE

Accidental opening of a cabin door in flight due to improper closing does not constitute a need to land the airplane. The best procedure is to set up the airplane in a trimmed condition at approximately 80 knots, momentarily shove the door outward slightly, and forcefully close and lock the door.

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

Both cabin doors are equipped with a crank-operated ventilation window in the lower front corner of the fixed door window. The crank, located below each ventilation window, opens the window when rotated forward and closes it when rotated aft. A placard, listing restrictions and usage, is located adjacent to the crank handle. The windows should not be opened at airspeeds above 105 knots, or when the alternate static source is in use. All other cabin windows are of the fixed type and cannot be opened.

CONTROL LOCKS

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

ENGINE

The airplane is powered by a horizontally-opposed, four-cylinder, overhead-valve, air-cooled, fuel injection engine with a wet sump oil system. The engine is a Lycoming Model IO-360-A1B6D and is rated at 200 horsepower at 2700 RPM. Major accessories mounted on the engine include a direct-drive starter and belt-driven alternator on the front of the engine, and dual magnetos, an engine-driven fuel pump, a full flow oil filter, a propeller governor, and a vacuum pump on the rear of the engine.

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 which is electrically connected to the landing gear warning horn system. The switch will cause the warning horn to sound anytime the throttle is retarded with the landing gear retracted, with less than approximately 12 inches of manifold pressure at low altitude.

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 below and to the left of the pilot's control wheel shaft, 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 25 PSI (red line), the normal operating range is 60 to 90 PSI (green arc), and maximum pressure is 100 PSI (red line).

Oil temperature is indicated by a gage located below and to the right of the pilot's control wheel shaft. The gage is operated by an electrical-resistance type temperature sensor which receives power from the airplane electrical system. Oil temperature limitations are the normal operating range (green arc) which is 38°C (100°F) to 118°C (245°F), and the maximum (red line) which is 118°C (245°F).

The cylinder head temperature gage is located directly to the left of the pilot's control wheel shaft. An electrical-resistance type temperature sensor, which receives power from the airplane electrical system, operates the gage. Temperature limitations are the normal operating range (green arc) which is 93°C (200°F) to 246°C (475°F) and the maximum (red line) which is 246°C (475°F).

The engine-driven mechanical tachometer is located near the lower center portion 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 2100 to 2500 RPM, and a maximum (red line) of 2700 RPM. A yellow arc from 1400 to 1750 RPM is provided to caution the pilot against continuous engine operation at or below 10 inches Hg manifold pressure in the 1400 to 1750 RPM range.

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

The fuel flow indicator is the right half of dual-indicating instrument mounted to the left of the tachometer. The indicator is a fuel pressure gage calibrated to indicate the approximate gallons per hour of fuel being metered to the engine. The normal operating range (green arc) is from 6 to 13 gallons per hour, and the maximum (red line) is 19 gallons per hour (10 PSI).

An economy mixture (EGT) indicator is available for the airplane and is located on the extreme lower left side of the instrument panel. A thermocouple probe in the right rear exhaust riser 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 65% to 75% power until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the rings.

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

ENGINE OIL SYSTEM

Oil for engine lubrication and propeller governor operation is supplied from a sump on the bottom of the engine. The capacity of the engine sump is eight quarts (one additional quart is contained in the engine oil filter). Oil is drawn from the sump through an oil suction strainer into the engine-driven oil pump. From the pump, oil is routed to a bypass valve. If the oil is cold, the bypass valve allows the oil to go directly from the pump to the oil filter. If the oil is hot, the bypass valve routes the oil out of the accessory housing and into a flexible hose leading to the oil cooler. Pressure oil from the cooler returns to the accessory housing where it enters the oil filter. The filtered oil then enters a pressure relief valve which regulates engine oil pressure by allowing excessive oil to return to the pump, while the balance of the pressure oil is circulated to various engine parts for lubrication. Residual oil is returned to the sump by gravity flow. Also, engine oil is routed to the propeller governor to provide control pressures to the propeller.

An oil filler cap/oil dipstick is located at the rear of the engine on the right side. The filler cap/dipstick is accessible through an access door in the engine cowling. The engine should not be operated on less than six quarts of oil. To minimize loss of oil through the breather, fill to seven quarts for normal flights of less than three hours. For extended flight, fill to eight quarts (dipstick indication only). For engine oil grade and specifications, refer to Section 8 of this handbook.

An oil quick-drain valve is available to replace the drain plug in the oil sump drain port, and provides quicker, cleaner draining of the engine oil. To drain the oil with this valve installed, slip a hose over the end of the valve and push upward on the end of the valve until it snaps into the open position. Spring clips will hold the valve open. After draining, use a suitable tool to snap the valve into the extended (closed) position and remove the drain hose.

IGNITION-STARTER SYSTEM

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

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

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through the left intake in the front of the engine cowling. Just inside the intake is an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox at the front of the engine. The airbox has a spring-loaded alternate air door. If the air induction filter should become blocked, suction created by the engine will open the door and draw air from inside the lower cowl area. An open alternate air door will result in an approximate 5% power loss at full throttle. After passing through the airbox, induction air enters a fuel/air control unit under the engine, and is then ducted to the engine cylinders through intake manifold tubes.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler on each side of the engine. A crossover pipe carries exhaust gas from the left muffler to the tailpipe on the right muffler where it is vented overboard. Each muffler is constructed with a shroud around the outside which forms a heating chamber for cabin heater air.

FUEL INJECTION SYSTEM

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

Fuel is delivered by the engine-driven fuel pump to the fuel/air control unit on the bottom of 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 OPEN, COWL FLAPS, 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 three-fourths of the normal operating range (green arc). During extended let-downs, it may be necessary to completely close the cowl flaps by pushing the cowl flap lever down to the CLOSED position.

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

PROPELLER

The airplane has an all-metal, two-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 RPM, PUSH INCREASE. When the control knob is pushed in, blade pitch will decrease, giving a higher RPM. When the control knob is pulled out, the blade pitch increases, thereby decreasing RPM. The propeller control knob is equipped with a vernier feature which allows slow or fine RPM adjustments by rotating the knob clockwise to increase RPM, and counterclockwise to decrease it. To make rapid or large adjustments, depress the button on the end of the control knob and reposition the control as desired.

FUEL SYSTEM

The fuel system (see figure 7-5) consists of two vented integral fuel tanks (one in each wing), two fuel reservoir tanks, a fuel selector valve, auxiliary fuel pump, fuel strainer, engine-driven fuel pump, fuel/air control unit, fuel manifold, and fuel injection nozzles. Refer to figure 7-6 for fuel quantity data.

Fuel flows by gravity from the two integral tanks to two reservoir tanks, and from the reservoir tanks to a four-position selector valve labeled BOTH, LEFT, RIGHT, and OFF. With the selector valve in the BOTH position, fuel from both tanks 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.

The airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by utilizing the marker in the filler neck in each tank. The marker consists of a series of small holes at the bottom of the filler neck. When filled to this level, the tank contains 22 gallons (21.5 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 vent overboard at the wing tip opposite the tank. The vent lines are interconnected, providing back-up ventilation for each tank through the opposite fuel tank vent line. Vent lines connecting the fuel tank vent lines to the reservoir tanks prevent the reservoir tanks from air locking during refueling operations. An empty reservoir tank will result

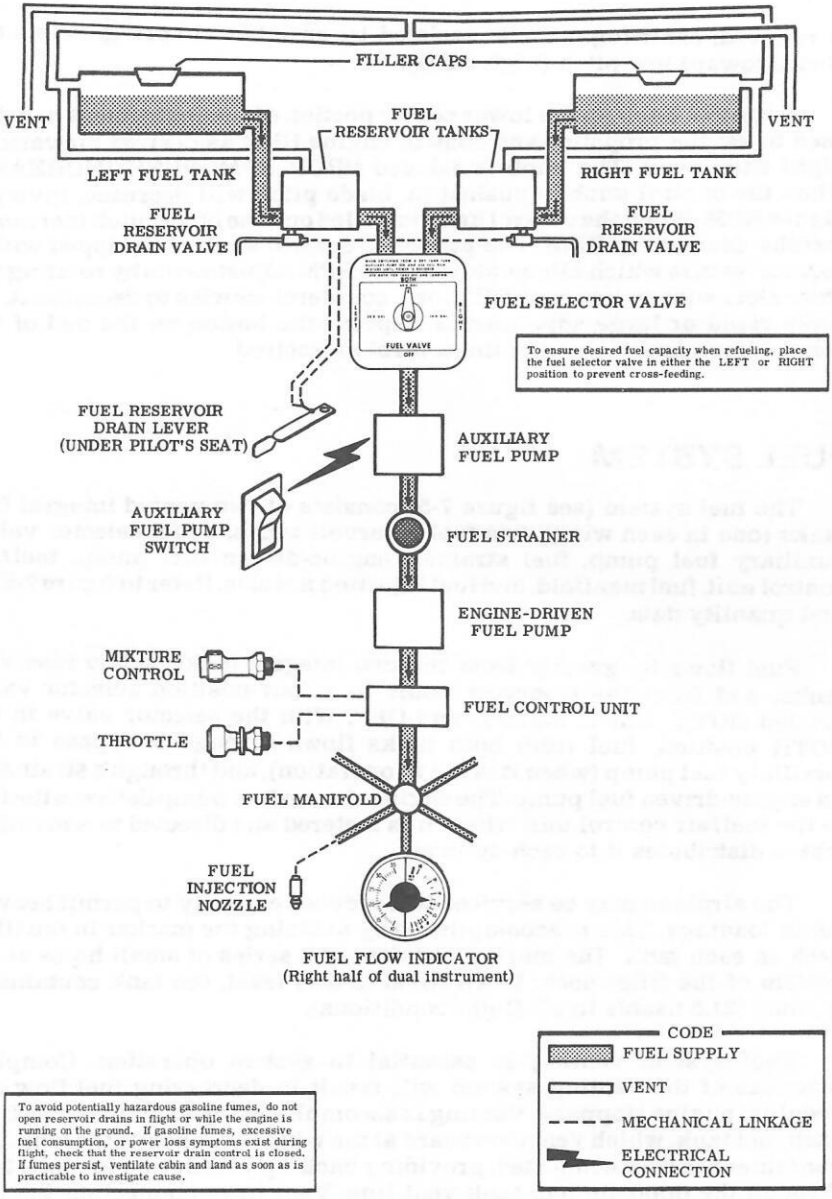


Figure 7-5. Fuel System

FUEL QUANTITY DATA (U.S. GALLONS)			
TANKS	TOTAL USABLE FUEL ALL FLIGHT CONDITIONS	TOTAL UNUSABLE FUEL	TOTAL FUEL VOLUME
STANDARD (30.5 Gal. Each)	60	1	61

Figure 7-6. Fuel Quantity Data

from completely exhausting the fuel in the respective wing tank.

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 left portion of the instrument panel. An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately 0.5 gallon remains in the tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips, or unusual attitudes. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature gage, or oil temperature gage for readings. If these gages are not indicating, an electrical malfunction has occurred.

The auxiliary fuel pump is used primarily for priming the engine before starting. Priming is accomplished through the regular injection system. If the auxiliary fuel pump switch is accidentally placed in the ON position for prolonged periods (with master switch turned on and mixture rich) with the engine stopped, the intake manifolds will be flooded.

The auxiliary fuel pump is also used for vapor suppression in hot weather. Normally, momentary use will be sufficient for vapor suppression; however, continuous operation is permissible if required. Turning on the auxiliary fuel pump with a normally operating engine pump will result in only a very minor enrichment of the mixture.

It is not necessary to have the auxiliary fuel pump operating during normal takeoff and landing, since gravity and the engine-driven pump will supply adequate fuel flow to the fuel injector unit.

In the event of failure of the engine-driven fuel pump, use of the auxiliary fuel pump will provide sufficient fuel to maintain flight at maximum continuous power.

The fuel selector valve handle should be in the BOTH position for takeoff, landing, and power-on maneuvers that involve prolonged slips or skids. During prolonged climb or cruise with the fuel selector in BOTH position, unequal fuel flow from each tank may occur if the airplane is out of trim directionally (slip indicator ball not centered) or if the fuel tank caps are not sealing properly. The resulting heaviness can be alleviated gradually by turning the selector valve to the tank in the "heavy" wing.

To ensure a prompt engine restart after running a fuel tank dry, switch the fuel selector to the opposite tank at the first indication of fuel flow fluctuation or power loss. Then turn on the auxiliary fuel pump and advance the mixture control to full rich. After power and steady fuel flow are restored, turn off the auxiliary fuel pump and lean the mixture, if desirable. Prior to landing, the fuel selector should be returned to the BOTH position.

NOTE

With low fuel (1/16th tank or less) a prolonged powered steep descent (1000 feet or more) should be avoided with more than 10° flaps to prevent the possibility of fuel starvation resulting from uncovering the fuel tank outlets. If starvation should occur, leveling the nose and turning on the auxiliary fuel pump should restore engine power within 30 seconds.

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 actuating the fuel reservoir drain lever under the pilot's seat to drain a quantity of fuel from the reservoir tanks. The fuel tanks should be filled after each flight to prevent condensation.

HYDRAULIC SYSTEM

Hydraulic power (see figure 7-7) is supplied by an electrically-driven hydraulic power pack located aft of the rear baggage compartment wall. 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. The electrical portion of the power pack is protected by a 30-amp push-pull type circuit breaker switch.

The hydraulic power pack is turned on by a pressure switch on the power pack when the landing gear lever is placed in either the UP or DN

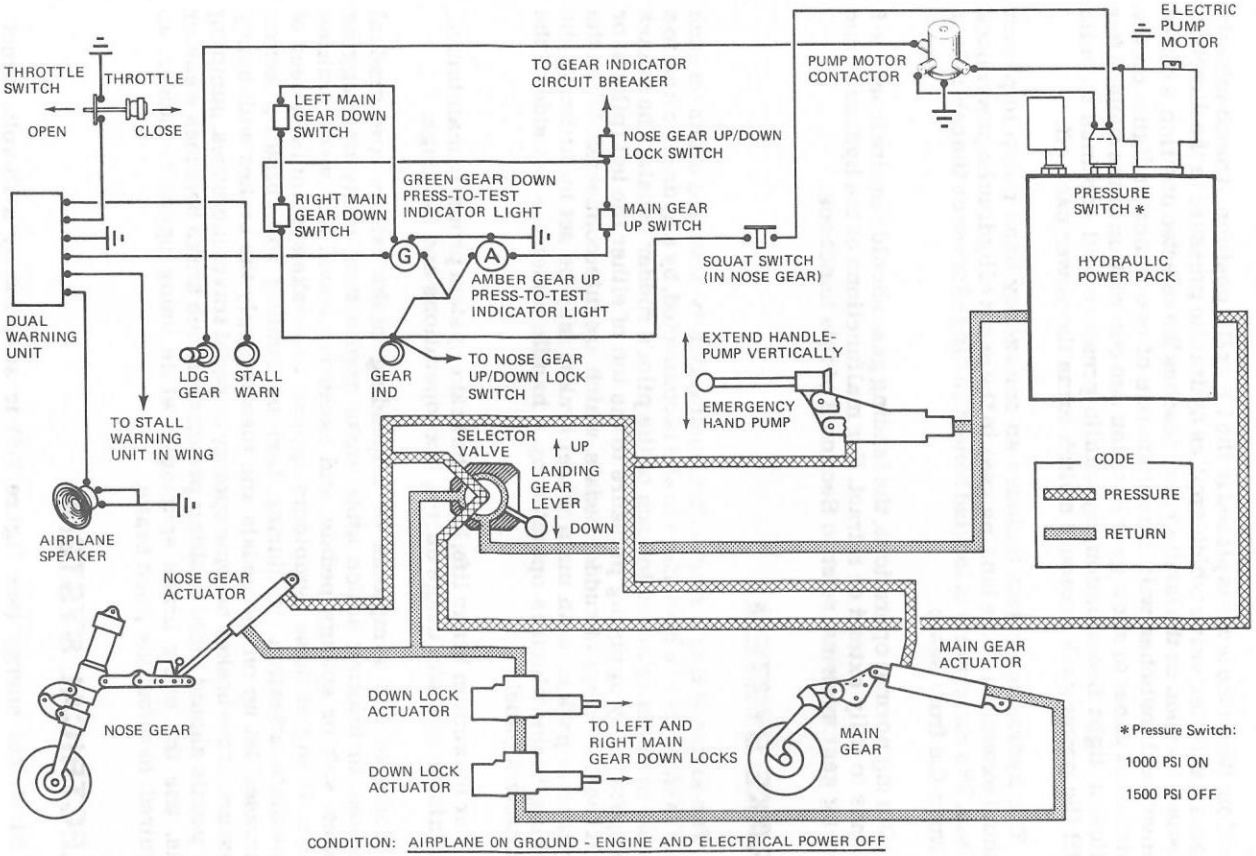


Figure 7-7. Hydraulic System

position. When the lever is placed in the UP or DN position, it mechanically rotates a selector valve which applies hydraulic pressure in the direction selected. As soon as the landing gear reaches the selected position, a series of electrical switches will illuminate one of two indicator lights on the instrument panel to show gear position and completion of the cycle. After indicator light illumination, hydraulic pressure will continue to build until the power pack pressure switch turns the power pack off.

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

During normal operations, the landing gear should require from 5 to 6 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 parking brake which is operated by a handle under the left side of the instrument panel.

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

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

ELECTRICAL SYSTEM

Electrical energy (see figure 7-8) is supplied by a 28-volt, direct-

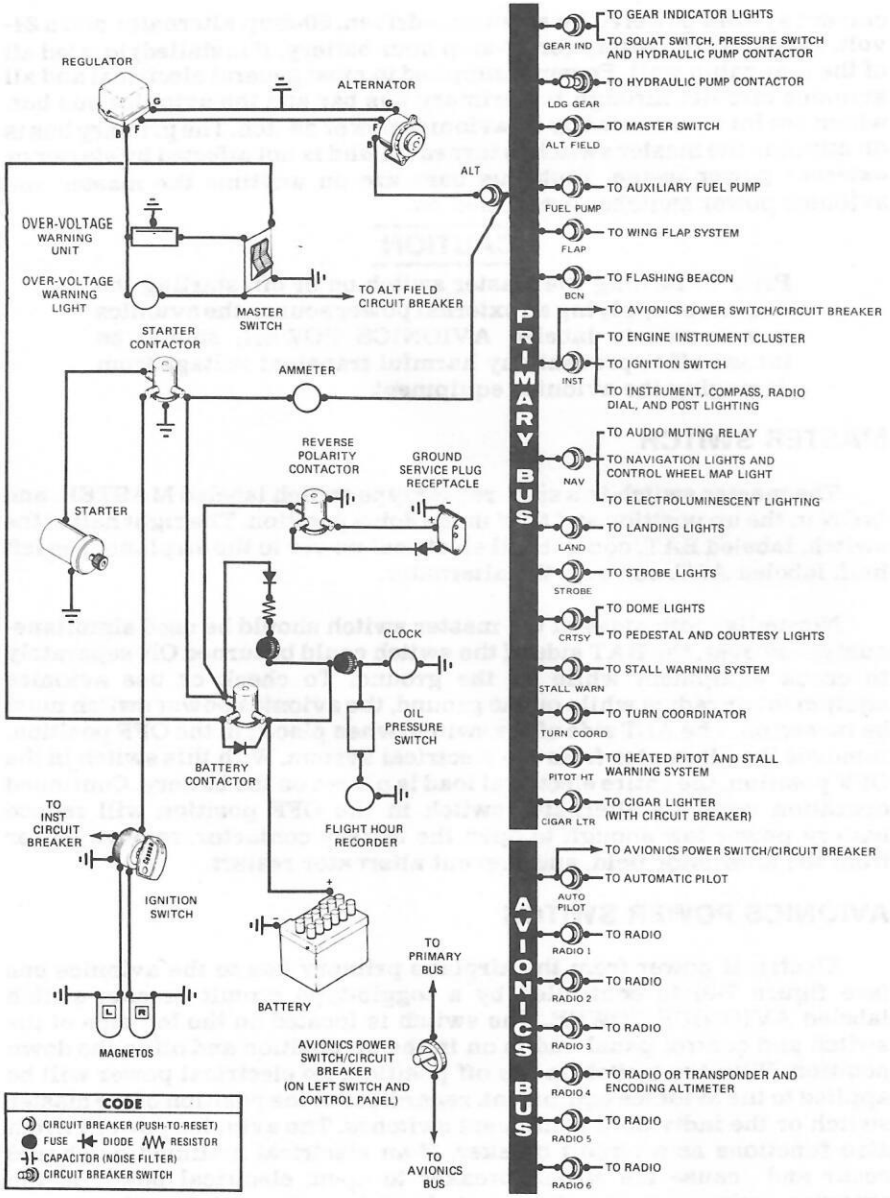


Figure 7-8. Electrical System

current system powered by an engine-driven, 60-amp alternator and a 24-volt, 14-amp hour battery (or 17-amp hour battery, if installed) located aft of the rear cabin wall. Power is supplied to most general electrical and all avionics circuits through the primary bus bar and the avionics bus bar, which are interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on.

CAUTION

Prior to turning the master switch on or off, starting the engine, or applying an external power source, the avionics power switch, labeled AVIONICS POWER, 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 all electrical power to the airplane. The left half, labeled ALT, controls the alternator.

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned ON separately to check equipment while on the ground. To check or use avionics equipment or radios while on the ground, the avionics power switch must 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 7-8) is controlled by a toggle-type circuit breaker-switch labeled AVIONICS POWER. The switch is located on the left side of the switch and control panel and is on in the up position and off in the down 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 toggle will automatically move to the off position. If this occurs, allow the circuit breaker

approximately two minutes to cool before placing the toggle 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 indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the airplane electrical system. When the engine is operating and the master switch is turned on, the ammeter indicates the charging rate applied to the battery. In the event the alternator is not functioning or the electrical load exceeds the output of the alternator, the ammeter indicates the battery discharge rate.

OVER-VOLTAGE SENSOR AND WARNING LIGHT

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

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

The over-voltage sensor may be reset by turning off the avionics power switch and then 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 illuminates again, a malfunction has occurred, and the flight should be terminated as soon as practical. In either case, the avionics power switch may be turned on again if required.

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

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" circuit breakers mounted on the lower right side of the instrument panel. The landing gear circuit is protected by a push-pull type circuit breaker on the right side of the instrument panel. In addition to the individual circuit breakers, a toggle type circuit breaker-switch, labeled AVIONICS POWER, on the left switch and control panel also protects the avionics systems. The cigar lighter is protected by a manually-reset type

circuit breaker on the back of the lighter, and a fuse behind the instrument panel. The control wheel map light (if installed) is protected by the NAV lights circuit breaker and a fuse behind the instrument panel. Electrical circuits which are not protected by circuit breakers are the battery contactor closing (external power) circuit, clock circuit and flight hour recorder circuit. These circuits are protected by fuses mounted adjacent to the battery.

GROUND SERVICE PLUG RECEPTACLE

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

NOTE

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

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

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

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

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and top of

the rudder. Landing and taxi lights are installed in the nose cap, and a flashing beacon is mounted on top of the vertical fin. Additional lighting is available and includes a strobe light on each wing tip and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are operated by a switch located on the left rear doorpost. All exterior lights, except the courtesy lights, are controlled by rocker type switches on the left switch and control panel. The switches are on in the up position and OFF in the down position.

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

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

INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood and integral lighting, with post and electroluminescent lighting also available. All light intensity is rheostat controlled. The lighting intensity in airplanes not equipped with electroluminescent lighting is controlled by two rheostats and control knobs labeled PANEL LIGHTS and ENG-RADIO LIGHTS on the left switch and control panel. If electroluminescent lighting is installed, the rheostat and control knob labeled PANEL LIGHTS is replaced with a dual rheostat and two concentric control knobs. The concentric control knobs remain labeled PANEL LIGHTS. If post lighting is installed, the overhead console will contain a slide-type switch on the left side of the console. The switch is labeled PANEL LTS and its positions are labeled FLOOD, BOTH, and POST. The POST and FLOOD positions will select post or flood lighting respectively, and the BOTH position will select a combination of post and flood lighting.

Switches and controls on the lower part of the instrument 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 PANEL LIGHTS. Electroluminescent lighting is not affected by the selection of post or flood lighting.

Instrument and control panel flood lighting consists of four red flood lights on the underside of the anti-glare shield, and a single red flood light in the forward part of the overhead console. To use flood lighting, place the PANEL LTS selector switch in the FLOOD position and adjust light intensity with the PANEL LIGHTS rheostat control knob.

The instrument panel may be equipped with post lights which are mounted at the edge of each instrument or control and provide direct lighting. The lights are operated by placing the PANEL LTS selector switch in the POST position and adjusting light intensity with the PANEL LIGHTS rheostat control knob. By placing the PANEL LTS selector switch in the BOTH position, the post lights can be used in combination with the standard flood lighting.

The engine instrument cluster, radio equipment, and magnetic compass have integral lighting and operate independently of post or flood lighting. The light intensity of instrument cluster and radio lighting is controlled by the ENG-RADIO LIGHTS rheostat control knob. Magnetic compass lighting intensity is controlled by the PANEL LIGHTS rheostat control knob.

A cabin dome light is located in the aft part of the overhead console, and is operated by a switch adjacent to the light. To turn the light on, move the switch to the right.

The instrument panel control pedestal may be equipped with a courtesy light, mounted at its base, to illuminate the forward cabin floor area. This light is controlled by the courtesy light switch on the left rear doorpost.

A control wheel map light is available and is mounted on the bottom of the pilot's control wheel. The light illuminates the lower portion of the cabin just forward of the pilot and is helpful when checking maps and other flight data during night operations. To operate the light, first turn on the NAV LIGHTS switch; then adjust the map light's intensity with the knurled disk type rheostat control located at the bottom of the control wheel.

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

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated to any degree desired by adjustment of a single CABIN HEAT knob and two

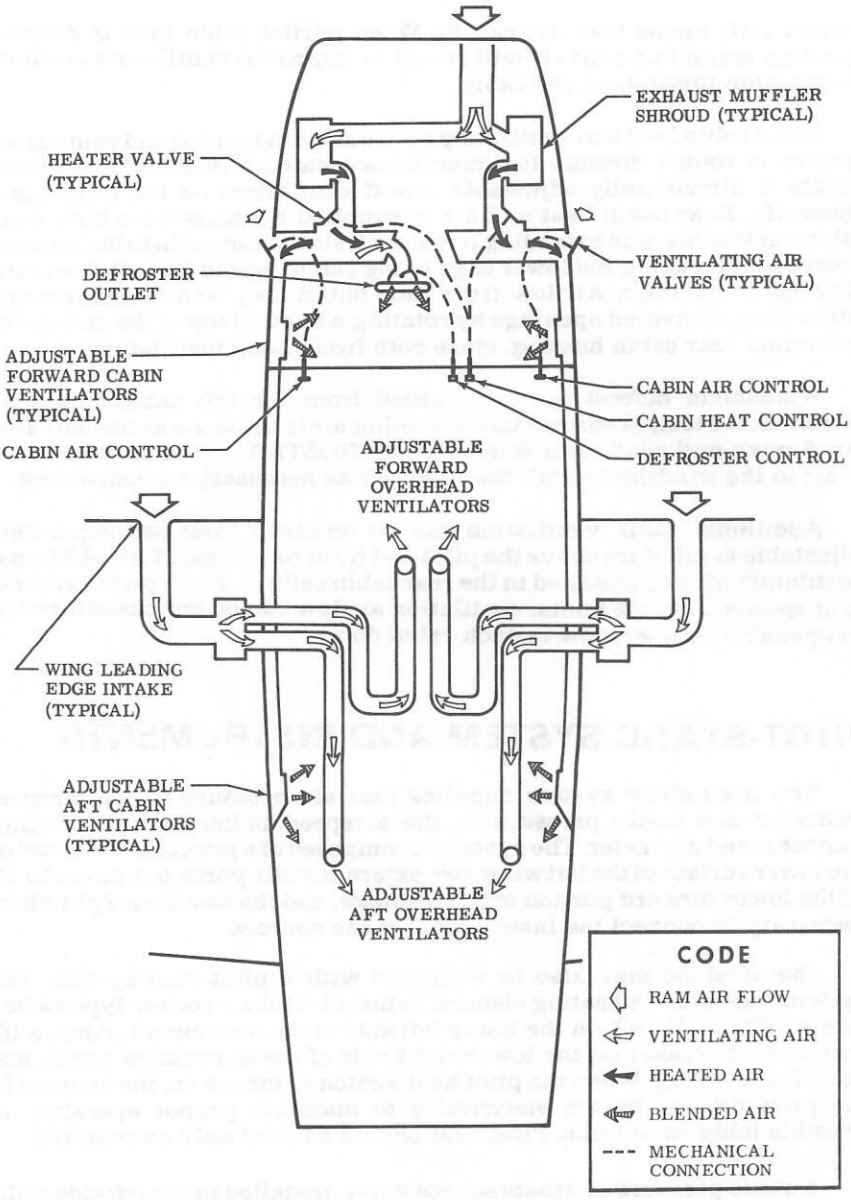


Figure 7-9. Cabin Heating, Ventilating, and Defrosting System

CABIN AIR knobs (see figure 7-9). When partial cabin heat is desired, blending warm and cold air will result in improved ventilation and heat distribution throughout the cabin.

Front cabin heat and ventilating air from the main heat and ventilating system is routed through two manifolds located forward of the rudder pedals to directionally-adjustable, on-off ventilators on the front cabin sidewalls. Rear cabin heat and air is supplied by ducts from both front cabin ventilators, one extending down each side of the cabin to the forward doorpost, then along the lower edge of the cabin door to an outlet near the aft edge of the door. Airflow from each outlet may be directed through either of two louvered openings by rotating a knob on top of the outlet. For maximum rear cabin heating, close both front cabin ventilators.

Windshield defrost air is supplied from the left cabin manifold; therefore, the temperature of the defrosting air is the same as heated cabin air. A push-pull control knob labeled DEFROSTER regulates the volume of air to the windshield. Pull the knob out as necessary for defrosting.

Additional cabin ventilation can be obtained from two separately adjustable ventilators above the pilot and front passenger. Two additional ventilators may be installed in the rear cabin ceiling. While on the ground, or at speeds up to 105 knots, ventilation airflow can be increased through an openable vent window in each cabin door.

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, rate-of-climb indicator and altimeter. The system is composed of a pitot tube mounted on the lower surface of the left wing, two external static ports, one on each side of the lower forward portion of the fuselage, 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 lower right side of the instrument panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

A static pressure alternate source valve, installed in the left side of the instrument panel, can be used if the external static source is malfunctioning. This valve supplies static pressure from inside the rear fuselage

instead of the external static ports. An external condensate drain, located in the alternate source line under the floorboard, is provided for periodic draining of any moisture accumulation.

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

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings include the white arc (50 to 95 knots), green arc (59 to 142 knots), yellow arc (142 to 174 knots), and a red line (174 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 the 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.

RATE-OF-CLIMB INDICATOR

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

ALTIMETER

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

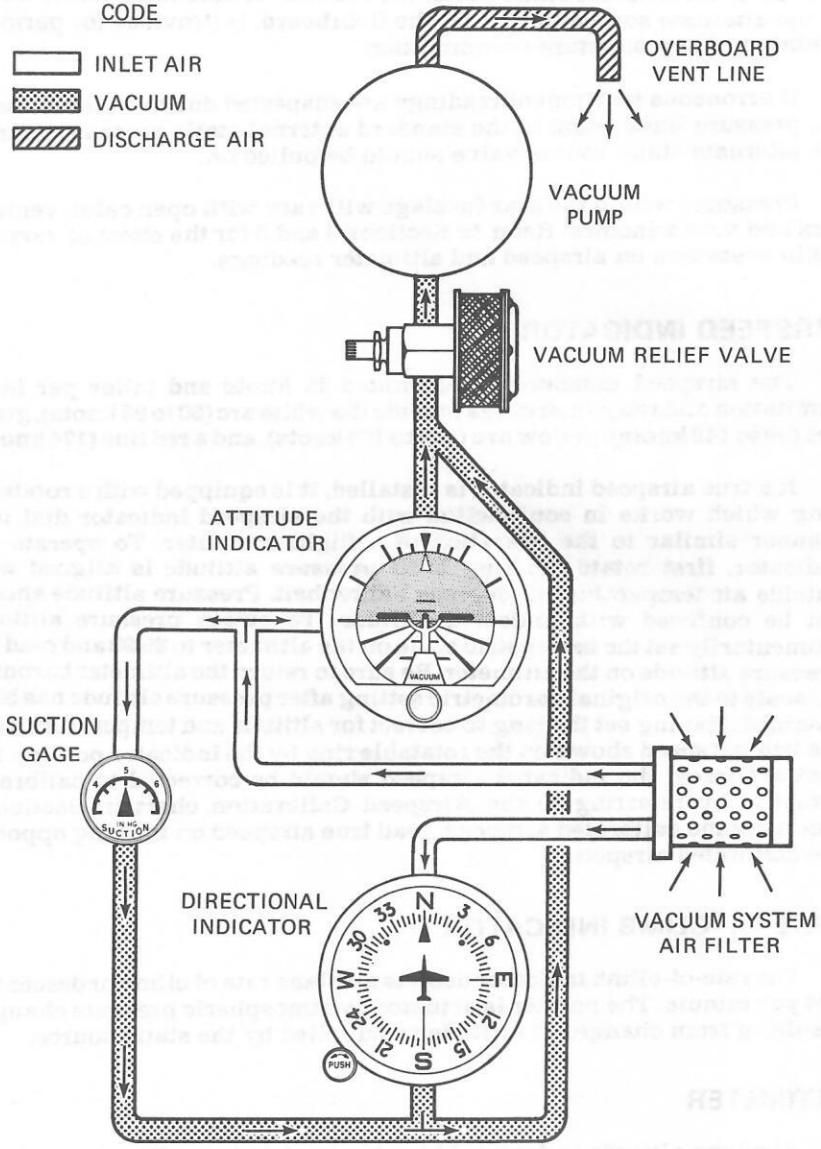


Figure 7-10. Vacuum System

VACUUM SYSTEM AND INSTRUMENTS

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

ATTITUDE INDICATOR

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

DIRECTIONAL INDICATOR

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

SUCTION GAGE

The suction gage, located on the upper left side of the instrument panel when the airplane is equipped with a vacuum system, is calibrated in inches of mercury and indicates suction available for operation of the attitude and directional indicators. The desired suction range is 4.5 to 5.4 inches of mercury. A suction reading below this range may indicate a system malfunction or improper adjustment, and in this case, the indicators should not be considered reliable.

STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit in the leading edge of the left wing. The unit is electrically connected to a dual warning unit near the airplane speaker in the overhead console. The vane in the wing unit senses the change in airflow over the wing, and operates

the dual warning unit, which produces a continuous tone over the airplane speaker, between 5 and 10 knots above the stall in all configurations.

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

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

AVIONICS SUPPORT EQUIPMENT

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

AUDIO CONTROL PANEL

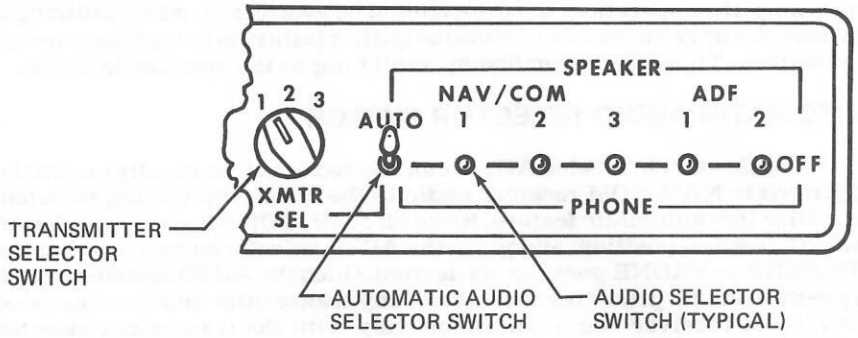
Operation of radio equipment is covered in Section 9 of this handbook. When one or more radios are installed, a transmitter/audio switching system is provided (see figure 7-11). The operation of this switching system is described in the following paragraphs.

TRANSMITTER SELECTOR SWITCH

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

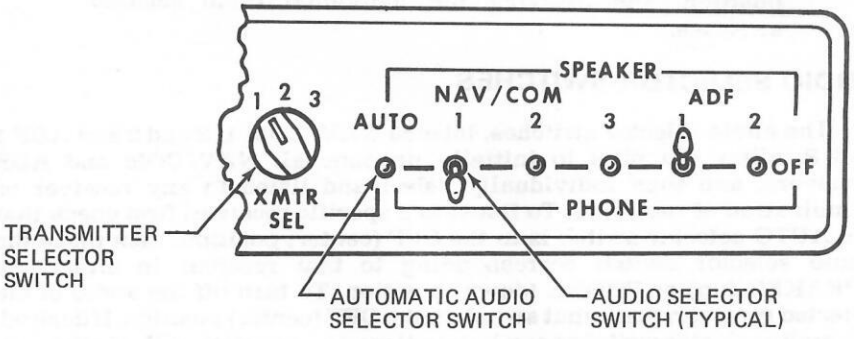
The audio amplifier in the NAV/COM radio is required for speaker and transmitter operation. The amplifier is automatically selected, along with the transmitter, by the transmitter selector switch. As an example, if the number 1 transmitter is selected, the audio amplifier in the associated NAV/COM receiver is also selected, and functions as the amplifier for ALL speaker audio. In the event the audio amplifier in use fails, as evidenced by loss of all speaker audio and transmitting capability of the selected transmitter, select another transmitter. This should re-establish speaker

AUTOMATIC AUDIO SELECTION



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

INDIVIDUAL AUDIO SELECTION



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

Figure 7-11. Audio Control Panel

audio and transmitter operation. Since headset audio is not affected by audio amplifier operation, the pilot should be aware that, while utilizing a headset, the only indication of audio amplifier failure is loss of the selected transmitter. This can be verified by switching to the speaker function.

AUTOMATIC AUDIO SELECTOR SWITCH

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

NOTE

Cessna radios are equipped with sidetone capability (monitoring of the operator's own voice transmission). Sidetone will be heard on either the airplane 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 radio selector switches.

AUDIO SELECTOR SWITCHES

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

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

NOTE

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

MICROPHONE-HEADSET

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

STATIC DISCHARGERS

If frequent IFR flights are planned, installation of wick-type static dischargers is recommended to improve radio communications during flight through dust or various forms of precipitation (rain, snow or ice crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, stabilator, 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.

SECTION 8
AIRPLANE HANDLING, SERVICE & MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

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

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

IDENTIFICATION PLATE

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

OWNER FOLLOW-UP SYSTEM

Your Cessna Dealer has an Owner Follow-Up System to notify you when he receives information that applies to your Cessna. In addition, if you wish, you may choose to receive similar notification, in the form of Service Letters, directly from the Cessna Customer Services Department. A subscription form is supplied in your Customer Care Program book for your use, should you choose to request this service. Your Cessna Dealer will be glad to supply you with details concerning these follow-up programs, and stands ready, through his Service Department, to supply you with fast, efficient, low-cost service.

PUBLICATIONS

Various publications and flight operation aids are furnished in the

airplane when delivered from the factory. These items are listed below.

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

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

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

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

AIRPLANE FILE

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

A. To be displayed in 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. Weight and Balance, and associated papers (latest copy of the Repair and Alteration Form, FAA Form 337, if applicable).
   2. Equipment List.

C. To be made available upon request:
   1. Airplane Log Book.
   2. Engine Log Book.

Most of the items listed are required by the United States Federal Aviation Regulations. Since the Regulations of other nations may require other documents and data, owners of airplanes not registered in the United States should check with their own aviation officials to determine their individual requirements.

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

AIRPLANE INSPECTION PERIODS

FAA REQUIRED INSPECTIONS

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

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

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

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

CESSNA PROGRESSIVE CARE

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

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

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

CESSNA CUSTOMER CARE PROGRAM

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

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

You will also want to return to your Dealer either at 50 hours for your first Progressive Care Operation, or at 100 hours for your first 100-hour inspection depending on which program you choose to establish for your airplane. While these important inspections will be performed for you by any Cessna Dealer, in most cases you will prefer to have the Dealer from whom you purchased the airplane accomplish this work.

PILOT CONDUCTED PREVENTIVE MAINTENANCE

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

NOTE

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

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

ALTERATIONS OR REPAIRS

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

GROUND HANDLING

TOWING

The airplane is most easily and safely maneuvered by hand with the tow-bar attached to the nose wheel. When towing with a vehicle, do not exceed the nose gear turning angle of 39° 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 accumu-

lated 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 strut and secure to a ramp tie-down.
5. Install a pitot tube cover.

JACKING

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

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

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

NOTE

Do not apply pressure on the outboard stabilator 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 stabilator, 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 leveling screws located at stations 213.0 and 238.0 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. A level placed across the front seat rails, at corresponding points, is 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 --

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, and the following oils used as specified for the average ambient air temperature in the operating area.

MIL-L-6082 Aviation Grade Straight Mineral Oil: Use to replenish supply during the 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.

SAE 50 above 16°C (60°F).
SAE 40 between -1°C (30°F) and 32°C (90°F).
SAE 30 between -18°C (0°F) and 21°C (70°F).
SAE 20 below -12°C (10°F).

MIL-L-22851 Ashless Dispersant Oil: This oil **must be used** after the first 50 hours or oil consumption has stabilized.

SAE 40 or SAE 50 above 16°C (60°F).
SAE 40 between -1°C (30°F) and 32°C (90°F).
SAE 30 or SAE 40 between -18°C (0°F) and 21°C (70°F).
SAE 30 below -12°C (10°F).

CAPACITY OF ENGINE SUMP -- 8 Quarts.

Do not operate on less than 6 quarts. To minimize loss of oil through breather, fill to 7 quart level for normal flights of less than 3 hours. For extended flight, fill to 8 quarts. 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 oil cooler, clean the oil suction strainer, and change the 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 oil cooler, clean the oil suction strainer, and change 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.

FUEL

APPROVED FUEL GRADES (AND COLORS) --

100LL Grade Aviation Fuel (Blue).

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

CAPACITY EACH TANK -- 30.5 Gallons.

REDUCED CAPACITY EACH TANK (INDICATED BY SMALL HOLES INSIDE FILLER NECK) -- 22 Gallons.

NOTE

To ensure desired fuel capacity when refueling, place the fuel selector valve in either LEFT or RIGHT position to prevent cross-feeding.

LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 31 PSI on 5.00-5, 4-Ply Rated Tire.

MAIN WHEEL TIRE PRESSURE -- 68 PSI on 15 x 6.00-6, 6-Ply Rated Tires.

NOSE GEAR SHOCK STRUT --

Keep filled with MIL-H-5606 hydraulic fluid and inflated with air to 38 PSI. Do not over-inflate.

HYDRAULIC FLUID RESERVOIR -- Check every 25 hours and service with MIL-H-5606 hydraulic fluid.

CLEANING AND CARE

WINDSHIELD-WINDOWS

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

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

NOTE

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

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

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

PAINTED SURFACES

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

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

Waxing is unnecessary to keep the painted surfaces bright. However, if

desired, the airplane may be waxed with a good automotive wax. A heavier coating of wax on the leading edges of the wings and tail and on the engine nose cap and propeller spinner will help reduce the abrasion encountered in these areas.

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

PROPELLER CARE

Preflight inspection of propeller blades for nicks, and wiping them occasionally with an oily cloth to clean off grass and bug stains will assure long, trouble-free service. Small nicks on the propeller, particularly near the tips and on the leading edges, should be dressed out as soon as possible since these nicks produce stress concentrations, and if ignored, may result in cracks. Never use an alkaline cleaner on the blades; remove grease and dirt with carbon tetrachloride or Stoddard solvent.

LANDING GEAR CARE

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

ENGINE CARE

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

CAUTION

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

INTERIOR CARE

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

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

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

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

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

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

SECTION 9
SUPPLEMENTS
(Optional Systems Description & Operating Procedures)

TABLE OF CONTENTS

INTRODUCTION

This section consists of a series of supplements, each covering a single optional system which may be installed in the airplane. Each supplement contains a brief description, and when applicable, operating limitations, emergency and normal procedures, and performance. Other routinely installed items of optional equipment, whose function and operational procedures do not require detailed instructions, are discussed in Section 7.

SUPPLEMENT

EMERGENCY LOCATOR TRANSMITTER (ELT)

SECTION 1
GENERAL

The ELT consists of a self-contained dual-frequency radio transmitter and battery power supply, and is activated by an impact of 5g or more as may be experienced in a crash landing. The ELT emits an omni-directional signal on the international distress frequencies of 121.5 and 243.0 MHz. (Some ELT units in export aircraft transmit only on 121.5 MHz.) General aviation and commercial aircraft, the FAA, and CAP monitor 121.5 MHz, and 243.0 MHz is monitored by the military. Following a crash landing, the ELT will provide line-of-sight transmission up to 100 miles at 10,000 feet. The ELT supplied in domestic aircraft transmits on both distress frequencies simultaneously at 75 mw rated power output for 48 continuous hours in the temperature range of -40°F to +131°F (-40°C to +55°C). The ELT unit in export aircraft transmits on 121.5 MHz at 25 mw rated power output for 100 continuous hours in the temperature range of -40°F to +131°F (-40°C to +55°C).

The ELT is readily identified as a bright orange unit mounted behind the baggage compartment wall in the tailcone. To gain access to the unit, remove the baggage compartment wall. The ELT is operated by a control panel at the forward facing end of the unit (see figure 1.)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this equipment is installed.

1. FUNCTION SELECTOR SWITCH (3-position toggle switch):

   ON - Activates transmitter instantly. Used for test purposes and if "g" switch is inoperative.

   OFF - Deactivates transmitter. Used during shipping, storage and following rescue.

   AUTO - Activates transmitter only when "g" switch receives 5g or more impact.

2. COVER - Removable for access to battery pack.

3. ANTENNA RECEPTACLE - Connects to antenna mounted on top of tailcone.

Figure 1. ELT Control Panel

SECTION 3
EMERGENCY PROCEDURES

Immediately after a forced landing where emergency assistance is required, the ELT should be utilized as follows.

1. ENSURE ELT ACTIVATION --Turn a radio transceiver ON and select 121.5 MHz. If the ELT can be heard transmitting, it was activated by the "g" switch and is functioning properly. If no emergency tone is audible, gain access to the ELT and place the function selector switch in the ON position.

2. PRIOR TO SIGHTING RESCUE AIRCRAFT -- Conserve airplane battery. Do not activate radio transceiver.

3. AFTER SIGHTING RESCUE AIRCRAFT -- Place ELT function selector switch in the OFF position, preventing radio interference. Attempt contact with rescue aircraft with the radio transceiver set to a frequency of 121.5 MHz. If no contact is established, return the function selector switch to ON immediately.

4. FOLLOWING RESCUE -- Place ELT function selector switch in the OFF position, terminating emergency transmissions.

SECTION 4
NORMAL PROCEDURES

As long as the function selector switch remains in the AUTO position, the ELT automatically activates following an impact of 5g or more over a short period of time.

Following a lightning strike, or an exceptionally hard landing, the ELT may activate although no emergency exists. To check your ELT for inadvertent activation, select 121.5 MHz on your radio transceiver and listen for an emergency tone transmission. If the ELT can be heard transmitting, place the function selector swtich in the OFF position and the tone should cease. Immediately place the function selector switch in the AUTO position to re-set the ELT for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance data when this equipment is installed.

SUPPLEMENT

CESSNA 300 NAV/COM
(720-Channel - Type RT-385A)

SECTION 1
GENERAL

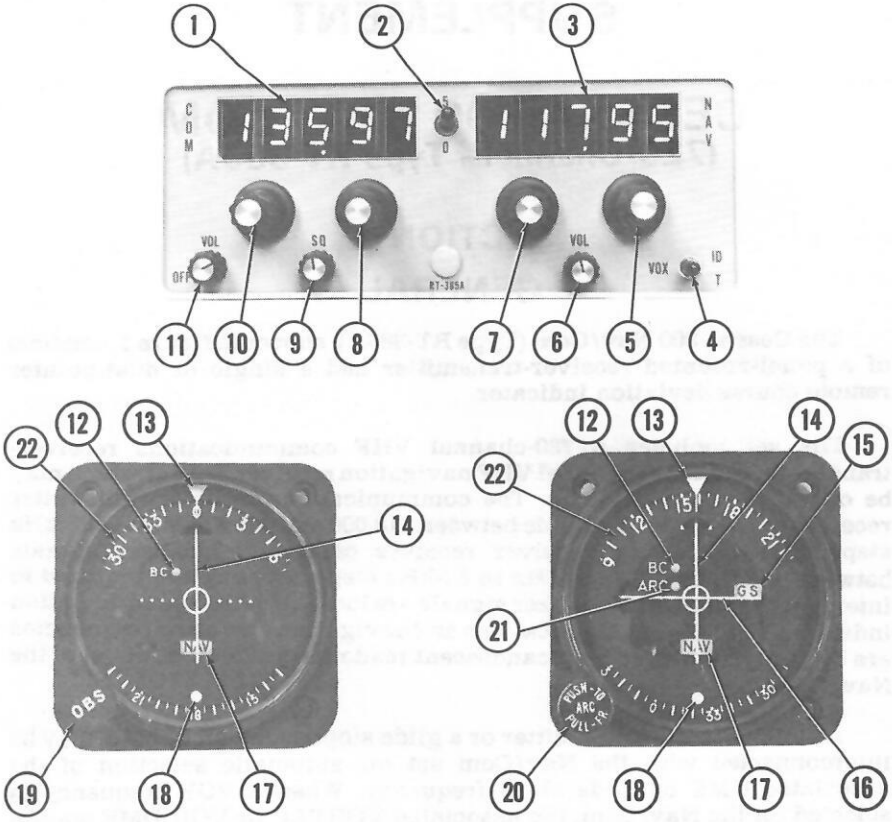
The Cessna 300 Nav/Com (Type RT-385A), shown in figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote course deviation indicator.

The set includes a 720-channel VHF communications receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously. The communications receiver-transmitter receives and transmits signals between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives omni and localizer signals between 108.00 and 117.95 MHz in 50-kHz steps. The circuits required to interpret the omni and localizer signals are located in the course deviation indicator. Both the communications and navigation operating frequencies are digitally displayed by incandescent readouts on the front panel of the Nav/Com.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Nav/Com set for automatic selection of the associated DME or glide slope frequency. When a VOR frequency is selected on the Nav/Com, the associated VORTAC or VOR-DME station frequency will also be selected automatically; likewise, if a localizer frequency is selected, the associated glide slope frequency will be selected automatically.

The course deviation indicator includes either a single-pointer and related NAV flag for VOR/LOC indication only, or dual pointers and related NAV and GS flags for both VOR/LOC and glide slope indications. Both types of course deviation indicators incorporate a back-course lamp (BC) which lights when optional back course (reversed sense) operation is selected. Both types may be provided with Automatic Radial Centering which, depending on how it is selected, will automatically indicate the bearing TO or FROM the VOR station.

All controls for the Nav/Com, except the standard omni bearing selector (OBS) knob or the optional automatic radial centering (ARC) knob located on the course deviation indicator, are mounted on the front panel of



1. COMMUNICATION OPERATING FREQUENCY READOUT (Third-decimal-place is shown by the position of the "5-0" switch).

2. 5-0 SWITCH - Part of Com Receiver-Transmitter Fractional MHz Frequency Selector. In "5" position, enables Com frequency readout to display and Com Fractional MHz Selector to select frequency in .05-MHz steps between .025 and .975 MHz. In "0" position, enables COM frequency readout to display and Com Fractional MHz Selector to select frequency in .05-MHz steps between .000 and .950 MHz.

NOTE

The "5" or "0" may be read as the third decimal digit, which is not displayed in the Com fractional frequency display.

Figure 1. Cessna 300 Nav/Com (Type RT-385A), Operating Controls and Indicators (Sheet 1 of 3)

3. NAVIGATION OPERATING FREQUENCY READOUT.

4. ID-VOX-T SWITCH - With VOR or LOC station selected, in ID position, station identifier signal is audible; in VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the VOR navigational self-test function is selected.

5. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects Nav frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.

6. NAV VOL CONTROL - Adjusts volume of navigation receiver audio.

7. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects NAV frequency in 1-MHz steps between 108 and 117 MHz; simultaneously selects paired glide slope frequency and DME channel.

8. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Depending on position of 5-0 switch, selects COM frequency in .05-MHz steps between .000 and .975 MHz. The 5-0 switch identifies the last digit as either 5 or 0.

9. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.

10. COMMUNICATION RECEIVER-TRANSMITTER MEGAHERTZ SELECTOR - Selects COM frequency in 1-MHz steps between 118 and 135 MHz.

11. COM OFF-VOL CONTROL - Combination on/off switch and volume control; turns on NAV/COM set and controls volume of communications receiver audio.

12. BC LAMP - Amber light illuminates when the autopilot or reverse sense option is installed and the reverse sense switch or autopilot's back-course function is engaged; indicates course deviation pointer is reversed on selected receiver when tuned to a localizer frequency.

13. COURSE INDEX - Indicates selected VOR course.

14. COURSE DEVIATION POINTER - Indicates course deviation from selected omni course or localizer centerline.

15. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.

16. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.

17. NAV/TO-FROM INDICATOR - Operates only with a VOR or localizer signal. Red NAV position (Flag) indicates unusable signal. With usable VOR signal, indicates whether selected course is TO or FROM station. With usable localizer signal, shows TO.

Figure 1. Cessna 300 Nav/Com (Type RT-385A), Operating Controls and Indicators (Sheet 3 of 3)

18. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.

19. OMNI BEARING SELECTOR (OBS) - Rotates course card to select desired course.

20. AUTOMATIC RADIAL CENTERING (ARC - PUSH-TO/PULL-FR) SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, turns OBS course card to center course deviation pointer with a TO flag, then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card to indicate bearing from VOR station, keeping course deviation pointer centered, with a FROM flag. ARC function will not operate on localizer frequencies.

21. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use.

22. COURSE CARD - Indicates selected VOR course under course index.

Figure 1. Cessna 300 Nav/Com (Type RT-385A), Operating Controls and Indicators (Sheet 2 of 3)

the receiver-transmitter. In addition, when two or more radios are installed, aircraft mounted transmitter selector and speaker/phone switches are provided.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware that on many Cessna airplanes equipped with the windshield mounted glide slope antenna, pilots should avoid use of 2700 ± 100 RPM (or 1800 ± 100 RPM with a three bladed propeller) during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the radio will remain operational on the last frequency selected. The frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition.

SECTION 4
NORMAL PROCEDURES

COMMUNICATION RECEIVER-TRANSMITTER OPERATION:

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. XMTR SEL Switch -- SET to desired 300 Nav/Com (on audio control panel).
3. SPEAKER/PHONE (or AUTO) Switch -- SET to desired mode (on audio control panel).
4. 5-0 Fractional MHz Selector Switch -- SELECT desired operating frequency (does not affect navigation frequencies).
5. COM Frequency Selector Switches -- SELECT desired operating frequency.
6. SQ Control -- ROTATE counterclockwise to decrease background noise as required.

7. Mike Button:
   a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected on all models except 152 models by placing the AUTO selector switch in either the SPEAKER or PHONE positions. On 152 models, sidetone is constant in both the SPEAKER and PHONE positions. However, the 152 models have a SIDETONE VOL control that may be used to adjust or suppress speaker sidetone.

   b. To Receive -- RELEASE mike button.

NAVIGATION OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. SPEAKER/PHONE (or AUTO) Switch -- SET to desired mode (on audio control panel).
3. NAV Frequency Selector Knobs -- SELECT desired operating frequency.
4. NAV VOL -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
   a. To Identify Station -- SET to ID to hear navigation station identifier signal.
   b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.
6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
   a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
   b. To Obtain Bearing TO VOR Station -- PUSH (ARC/PUSH-TO) knob to inner (momentary on) position.

NOTE

ARC lamp will illuminate amber while the course card is moving to center with the course deviation pointer. After alignment has been achieved to reflect bearing to VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out.

   c. To Obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

NOTE

ARC lamp will illuminate amber, OBS course card will

turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station.

7. OBS Knob (If Applicable) -- SELECT desired course.

VOR SELF-TEST OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers and NAV/TO-FROM indicator shows FROM.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement. NAV/TO-FROM indicator shows FROM.
6. ID/VOX/T Switch -- RELEASE for normal operation.

NOTE

This test does not fulfill the requirements of FAR 91.25.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 ADF

(Type R-546E)

SECTION 1
GENERAL

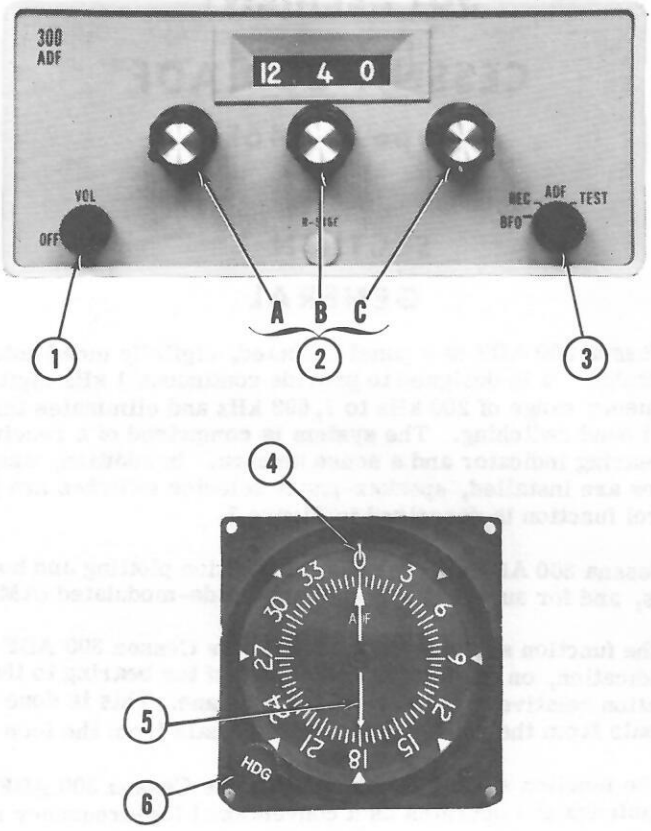
The Cessna 300 ADF is a panel-mounted, digitally tuned automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1, 699 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, loop antenna, bearing indicator and a sense antenna. In addition, when two or more radios are installed, speaker-phone selector switches are provided. Each control function is described in Figure 1.

The Cessna 300 ADF can be used for position plotting and homing procedures, and for aural reception of amplitude-modulated (AM) signals.

With the function selector knob at ADF, the Cessna 300 ADF provides a visual indication, on the bearing indicator, of the bearing to the transmitting station relative to the nose of the airplane. This is done by combining signals from the sense antenna with signals from the loop antenna.

With the function selector knob at REC, the Cessna 300 ADF uses only the sense antenna and operates as a conventional low-frequency receiver.

The Cessna 300 ADF is designed to receive transmission from the following radio facilities: commercial broadcast stations, low-frequency range stations, FAA radio beacons, and ILS compass locators.



1. OFF/VOL CONTROL - Controls primary power and audio output level. Clockwise rotation from OFF position applies primary power to receiver; further clockwise rotation increases audio level.

2. FREQUENCY SELECTORS - Knob (A) selects 100-kHz increments of receiver frequency, knob (B) selects 10-kHz increments, and knob (C) selects 1-kHz increments.

Figure 1. Cessna 300 ADF Operating Controls and Indicators (Sheet 1 of 2)

3. FUNCTION SWITCH:

   BFO: Selects operation as communication receiver using only sense antenna and activates 1000-Hz tone beat frequency oscillator to permit coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

   REC: Selects operation as standard communication receiver using only sense antenna.

   ADF: Set operates as automatic direction finder using loop and sense antennas.

   TEST: Momentary-on position used during ADF operation to test bearing reliability. When held in TEST position, slews indicator pointer clockwise; when released, if bearing is reliable, pointer returns to original bearing position.

4. INDEX (ROTATABLE CARD) - Indicates relative, magnetic, or true heading of aircraft, as selected by HDG control.

5. POINTER - Indicates station bearing in degrees of azimuth, relative to the nose of the aircraft. When heading control is adjusted, indicates relative, magnetic, or true bearing of radio signal.

6. HEADING CONTROL (HDG) - Rotates card to set in relative, magnetic, or true bearing information.

Figure 1. Cessna 300 ADF Operating Controls and Indicators (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE AS A COMMUNICATIONS RECEIVER ONLY:

(1) OFF/VOL Control -- ON.
(2) Function Selector Knob -- REC.
(3) Frequency Selector Knobs -- SELECT operating frequency.
(4) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position as desired.
(5) VOL Control -- ADJUST to desired listening level.

TO OPERATE AS AN AUTOMATIC DIRECTION FINDER:

(1) OFF/VOL Control -- ON.
(2) Frequency Selector Knobs -- SELECT operating frequency.
(3) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
(4) Function Selector Knob -- ADF position and note relative bearing on indicator.
(5) VOL Control -- ADJUST to desired listening level.

TO TEST RELIABILITY OF AUTOMATIC DIRECTION FINDER:

(1) Function Selector Knob -- ADF position and note relative bearing on indicator.
(2) Function Selector Knob -- TEST position and observe that pointer moves away from relative bearing at least 10 to 20 degrees.
(3) Function Selector Knob -- ADF position and observe that pointer returns to same relative bearing as in step (1).

TO OPERATE BFO:

(1) OFF/VOL Control -- ON.
(2) Function Selector Knob -- BFO.
(3) Frequency Selector Knobs -- SELECT operating frequency.
(4) ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
(5) VOL Control -- ADJUST to desired listening level.

NOTE

A 1000-Hz tone is heard in the audio output when a CW signal (Morse Code) is tuned in properly.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 TRANSPONDER

(Type RT-359A)

AND

OPTIONAL ENCODING ALTIMETER

(Type EA-401A)

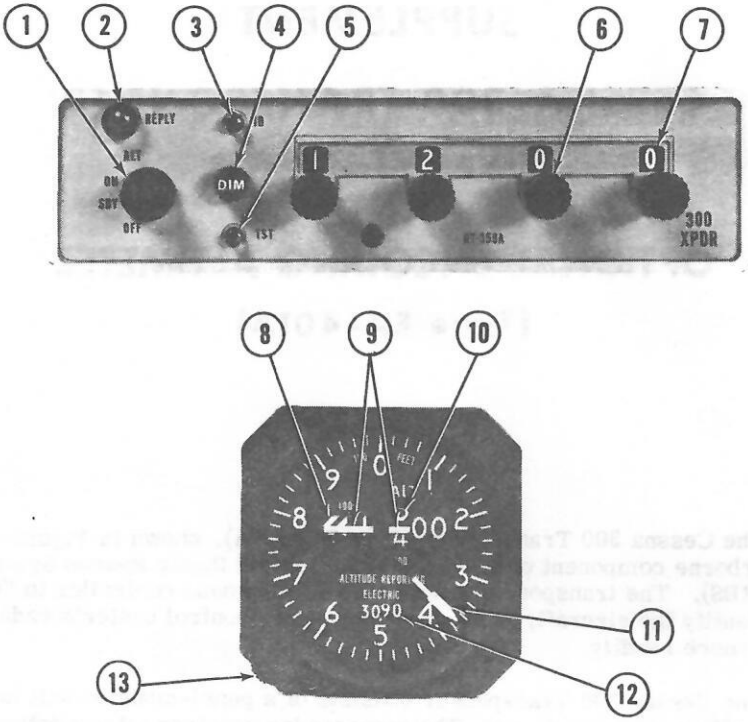
SECTION 1

GENERAL

The Cessna 300 Transponder (Type RT-359A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 300 Transponder consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogating pulse signals on 1030 MHz and transmits coded pulse-train reply signals on 1090 MHz. It is capable of replying to Mode A (aircraft identification) and Mode C (altitude reporting) interrogations on a selective reply basis on any of 4,096 information code selections. When an optional panel-mounted EA-401A Encoding Altimeter (not part of a standard 300 Transponder system) is included in the avionic configuration, the transponder can provide altitude reporting in 100-foot increments between -1000 and +35, 000 feet.

All Cessna 300 Transponder operating controls, with the exception of the optional altitude encoder's altimeter setting knob, are located on the front panel of the unit. The altimeter setting knob is located on the encoding altimeter. Functions of the operating controls are described in Figure 1.



1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode, as follows:
   - OFF - Turns set off.
   - SBY - Turns set on for equipment warm-up.
   - ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   - ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply Lamp will also glow steadily during initial warm-up period.)

Figure 1. Cessna 300 Transponder and Encoding Altimeter (Sheet 1 of 2)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply Lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.

5. SELF-TEST (TST) SWITCH -- When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply Lamp will glow steadily to verify self test operation.)

6. REPLY-CODE SELECTOR KNOBS (4) - Select assigned Mode A reply code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.

8. 1000-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 1000-foot increments between -1000 feet and +35,000 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in the 10,000 foot window.

9. OFF INDICATOR WARNING FLAG - Flag appears across altitude readout when power is removed from the altimeter to indicate that readout is not reliable.

10. 100-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 100-foot increments between 0 feet and 1000 feet.

11. 20-FOOT INDICATOR NEEDLE - Indicates altitude in 20-foot increments between 0 feet and 1000 feet.

12. ALTIMETER SETTING SCALE - DRUM TYPE - Indicates selected altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.

13. ALTIMETER SETTING KNOB - Dials in desired altimeter setting in the range of 27.9 to 31.0 inches of mercury on the standard altimeter or 950 to 1050 millibars on the optional altimeter.

Figure 1. Cessna 300 Transponder and Encoding Altimeter (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT:

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Reply-Code Selector Knobs -- SELECT assigned code.

(2) Function Switch -- ON.
(3) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

(4) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.
(2) Altitude Encoder Altimeter Setting Knob -- SET IN assigned local altimeter setting.
(3) Reply-Code Selector Knobs -- SELECT assigned code.
(4) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the encoding altimeter.

(5) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.
(2) Function Switch -- ON or ALT.

(3) TST Button -- DEPRESS and HOLD (reply lamp should light with full brilliance regardless of DIM control setting).
(4) TST Button -- Release for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 300 TRANSPONDER

(Type RT-359A)

AND

OPTIONAL ALTITUDE ENCODER (BLIND)

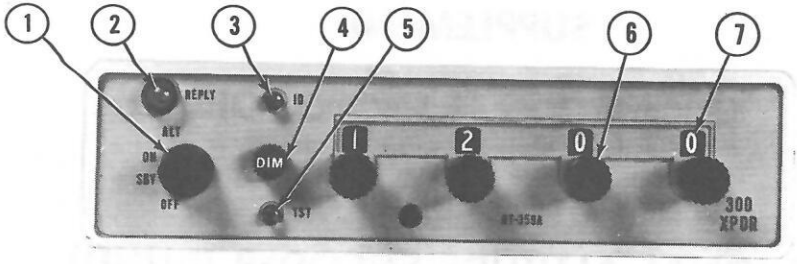
SECTION 1

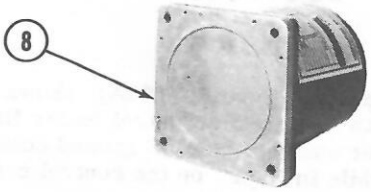
GENERAL

The Cessna 300 Transponder (Type RT-359A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 300 Transponder system consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogation pulse signals on 1030 MHz and transmits pulse-train reply signals on 1090 MHz. The transponder is capable of replying to Mode A (aircraft identification) and also Mode C (altitude reporting) when coupled to an optional altitude encoder system. The transponder is capable of replying on both modes of interrogation on a selective reply basis on any of 4,096 information code selections. The optional altitude encoder system (not part of a standard 300 Transponder system) required for Mode C (altitude reporting) operation consists of a completely independent remote-mounted digitizer that is connected to the static system and supplies encoded altitude information to the transponder. When the altitude encoder system is coupled to the 300 Transponder system, altitude reporting capabilities are available in 100-foot increments between -1000 and +20,000 feet.

All Cessna 300 Transponder operating controls are located on the front panel of the unit. Functions of the operating controls are described in Figure 1.





1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode as follows:

   OFF - Turns set off.
   SBY - Turns set on for equipment warm-up or standby power.
   ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply lamp will also glow steadily during initial warm-up period.)

Figure 1. Cessna 300 Transponder and Altitude Encoder (Blind)
(Sheet 1 of 2)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.

5. SELF-TEST (TST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply lamp will glow steadily to verify self-test operation.)

6. REPLY-CODE SELECTOR KNOBS (4) - Select assigned Mode A reply code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.

8. REMOTE-MOUNTED DIGITIZER - Provides an altitude reporting code range of -1000 feet up to the airplane's maximum service ceiling.

Figure 1. Cessna 300 Transponder and Altitude Encoder (Blind)
(Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, a placard labeled "ALTITUDE ENCODER EQUIPPED" must be installed near the altimeter.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

(1) Function Switch -- ON.
(2) Reply-Code Selector Knobs -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Reply-Code Selector Knobs -- SELECT assigned code.

(2) Function Switch -- ON.
(3) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

(4) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Reply-Code Selector Knobs -- SELECT assigned code.
(2) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the aircraft altimeter.

(3) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.
(2) Function Switch -- ON or ALT.
(3) TST Button -- DEPRESS (reply lamp should light brightly regardless of DIM control setting).
(4) TST Button -- Release for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

DME
(TYPE 190)

SECTION 1
GENERAL

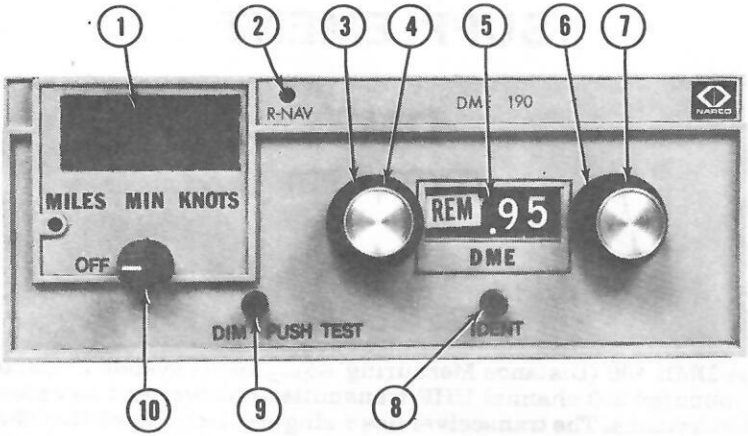
The DME 190 (Distance Measuring Equipment) system consists of a panel mounted 200 channel UHF transmitter-receiver and an externally mounted antenna. The transceiver has a single selector knob that changes the DME's mode of operation to provide the pilot with: distance-to-station, time-to-station, or ground speed readouts. The DME is designed to operate in altitudes up to a maximum of 50,000 feet at ground speeds up to 250 knots and has a maximum slant range of 199.9 nautical miles.

The DME can be channeled independently or by a remote NAV set. When coupled with a remote NAV set, the MHz digits will be covered over by a remote (REM) flag and the DME will utilize the frequency set by the NAV set's channeling knobs. When the DME is not coupled with a remote NAV set, the DME will reflect the channel selected on the DME unit. The transmitter operates in the frequency range of 1041 to 1150 MHz and is paired with 108 to 117.95 MHz to provide automatic DME channeling. The receiver operates in the frequency range of 978 to 1213 MHz and is paired with 108 to 117.95 MHz to provide automatic DME channeling.

All operating controls for the DME are mounted on the front panel of the DME and are described in Figure 1.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.



1. READOUT WINDOW - Displays function readout in nautical miles (distance-to-station), minutes (time-to-station) or knots (ground speed).

2. R-NAV INDICATOR LAMP - The green R-NAV indicator lamp is provided to indicate the DME is coupled to an R-NAV system. Since this DME is not factory installed with an R-NAV system on Cessna airplanes, the R-NAV indicator lamp should never be illuminated. However, if an R-NAV system is coupled to the DME, and when in R-NAV mode, the R-NAV lamp will light which indicates that the distance readout is the "way point" instead of the DME station. The DME can only give distance (MILES) in R-Nav mode.

3. REMOTE CHANNELING SELECTOR - This knob is held stationary by a stop when not coupled to a remote NAV receiver. When coupled to a remote NAV receiver, a stop in the selector is removed and the selector becomes a two position selector. In the first position, the DME will utilize the frequency set by the DME channeling knobs. In the second position, the MHz digits will utilize the frequency set by the NAV unit's channeling knobs.

4. WHOLE MEGAHERTZ SELECTOR KNOB - Selects operating frequency in 1-MHz steps between 108 and 117 MHz.

5. FREQUENCY INDICATOR - Shows operating frequency selected on the DME or displays remote (REM) flag to indicate DME is operating on a frequency selected by a remote NAV receiver.

6. FRACTIONAL MEGAHERTZ SELECTOR KNOB - Selects operating frequency in 50 kHz steps. This knob has two positions, one for the 0 and one for the 5.

7. FRACTIONAL MEGAHERTZ SELECTOR KNOB - Selects operating frequency in tenths of a Megahertz (0-9).

Figure 1. DME 190 Operating Controls (Sheet 1 of 2)

8. IDENT KNOB - Rotation of this control increases or decreases the volume of the received station's Ident signal. An erratic display, accompanied by the presence of two Ident signals, can result if the airplane is flying in an area where two stations using the same frequency are transmitting.

9. DIM/PUSH TEST KNOB -

   DIM: Controls the brilliance of the readout lamp's segments. Rotate the control as desired for proper lamp illumination in the function window (The frequency window is dimmed by the aircraft's radio light dimming control).

   PUSH TEST: This control is used to test the illumination of the readout lamps, with or without being tuned to a station. Press the control, a readout of 188 8 should be seen with the mode selector switch in the MIN or KNOTS position. The decimal point along with 188.8 will light in the MILES mode. When the control is released, and had the DME been channeled to a nearby station, the distance to that station will appear. If the station channeled was not in range, a "bar" readout will be seen (--.- or -- -).

10. MODE SELECTOR SWITCH -

    OFF: Turns the DME OFF.

    MILES: Allows a digital readout to appear in the window which represents slant range (in nautical miles) to or from the channeled station.

    MIN: Allows a digital readout (in minutes) to appear in the window that it will take the airplane to travel the distance to the channeled station. This time is only accurate when flying directly TO the station and after the ground speed has stabilized.

    KNOTS: Allows a digital readout (in knots) to appear in the window that is ground speed and is valid only after the stabilization time (approximately 2 minutes) has elapsed when flying directly TO or FROM the channeled station.

Figure 1. DME 190 Operating Controls (Sheet 2 of 2)

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE:

1. Mode Selector Switch -- SELECT desired DME function.
2. Frequency Selector Knobs -- SELECT desired frequency and allow equipment to warm-up at least 2 minutes.

NOTE

If frequency is set on remote NAV receiver, place remote channeling selector in the REM position.

3. PUSH TEST Control -- PUSH and observe reading of 188.8 in function window.
4. DIM Control -- ADJUST.
5. IDENT CONTROL -- ADJUST audio output in speaker.
6. Mode Selector Functions:

   MILES Position -- Distance-to-Station is slant range in nautical miles.

   MIN Position -- Time-to-Station when flying directly to station.

   KNOTS Position --Ground Speed in knots when flying directly to or from station.

CAUTION

After the DME 190 has been turned OFF, do not turn it on again for 5 seconds to allow the protective circuits to reset.

SECTION 4
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

HF TRANSCEIVER
(TYPE PT10-A)

SECTION 1
GENERAL

The PT10-A HF Transceiver, shown in Figure 1, is a 10-channel AM transmitter-receiver which operates in the frequency range of 2.0 to 18.0 Megahertz. The transceiver is automatically tuned to the operating frequency by a Channel Selector. The operating controls for the unit are mounted on the front panel of the transceiver. The system consists of a transceiver, antenna load box, fixed wire antenna and associated wiring.

The Channel Selector Knob determines the operating frequency of the transmitter and receiver. The frequencies of operation are shown on the frequency chart adjacent to the channel selector.

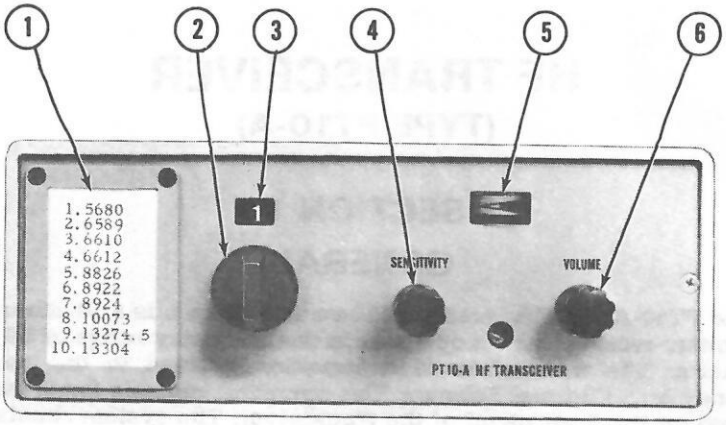
The VOLUME control incorporates the power switch for the transceiver. Clockwise rotation of the volume control turns the set on and increases the volume of audio.

The meter on the face of the transceiver indicates transmitter output.

The system utilizes the airplane microphone, headphone and speaker. When two or more radios are installed, a transmitter selector switch and a speaker-phone switch are provided.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.



1. FREQUENCY CHART - Shows the frequency of the channel in use (frequencies shown may vary and are shown for reference purposes only).

2. CHANNEL SELECTOR - Selects channels 1 thru 10 as listed in the frequency chart.

3. CHANNEL READOUT WINDOW - Displays channel selected in frequency chart.

4. SENSITIVITY CONTROL - Controls the receiver sensitivity for audio gain.

5. ANTENNA TUNING METER - Indicates the energy flowing from the transmitter into the antenna. The optimum power transfer is indicated by the maximum meter reading.

6. ON/OFF VOLUME CONTROL - Turns complete set on and controls volume of audio.

Figure 1. HF Transceiver (Type PT10-A)

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

1. XMTR SEL Switch -- SELECT transceiver (on audio control panel).
2. SPEAKER/PHONE (or AUTO) Switch -- SELECT desired mode (on audio control panel).
3. VOLUME Control -- ON (allow equipment to warm up and adjust audio to comfortable listening level).
4. Frequency Chart -- SELECT desired operating frequency.
5. Channel Selector -- DIAL in frequency selected in step 4.
6. SENSITIVITY Control -- ROTATE clockwise to maximum position.

NOTE

If receiver becomes overloaded by very strong signals, back off SENSITIVITY control until background noise is barely audible.

NOTE

The antenna tuning meter indicates the energy flowing from the airplane's transmitter into the antenna. The optimum power transfer is indicated by the maximum meter reading.

7. Mike Button:
   a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected by placing the AUTO selector switch in either the SPEAKER or PHONE positions.

   b. To Receive -- RELEASE mike button.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

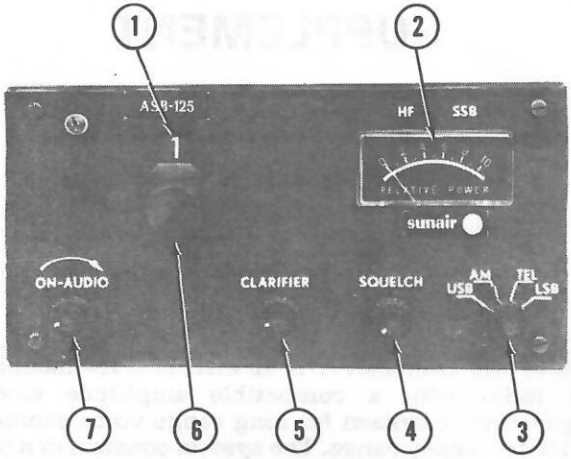
SSB HF TRANSCEIVER
(TYPE ASB-125)

SECTION 1
GENERAL

The ASB-125 HF transceiver is an airborne, 10-channel, single sideband (SSB) radio with a compatible amplitude modulated (AM) transmitting-receiving system for long range voice communications in the 2 to 18 MHz frequency range. The system consists of a panel mounted receiver/exciter, a remote mounted power amplifier/power supply, an antenna coupler and an externally mounted, fixed wire, medium/high frequency antenna.

A channel selector knob determines the operating frequency of the transceiver which has predetermined crystals installed to provide the desired operating frequencies. A mode selector control is provided to supply the type of emission required for the channel, either sideband, AM or telephone for public correspondence. An audio knob, clarifier knob and squelch knob are provided to assist in audio operation during receive. In addition to the aforementioned controls, which are all located on the receiver/exciter, a meter is incorporated to provide antenna loading readouts.

The system utilizes the airplane microphone, headphone and speaker. When two or more radios are installed, a transmitter selector switch and a speaker-phone switch are provided.



1. CHANNEL WINDOW - Displays selected channel.

2. RELATIVE POWER METER - Indicates relative radiated power of the power amplifier/antenna system.

3. MODE SELECTOR CONTROL - Selects one of the desired operating modes:
   - USB - Selects upper sideband operation for long range voice communications.
   - AM - Selects compatible AM operation and full AM reception.
   - TEL - Selects upper sideband with reduced carrier, used for public correspondence telephone and ship-to-shore.
   - LSB - (Optional) Selects lower sideband operation (not legal in U.S., Canada and most other countries).

4. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.

5. CLARIFIER CONTROL - Used to "clarify" single sideband speech during receive while in USB mode only.

6. CHANNEL SELECTOR CONTROL - Selects desired channel. Also selects AM mode if channel frequency is 2003 kHz, 2182 kHz or 2638 kHz.

7. ON - AUDIO CONTROL - Turns set ON and controls receiver audio gain.

Figure 1. SSB HF Transceiver Operating Controls

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware of the two following radio limitations:

1. For sideband operation in the United States, Canada and various other countries, only the upper sideband may be used. Use of lower sideband is prohibited.
2. Only AM transmissions are permitted on frequencies 2003 kHz, 2182 kHz and 2638 kHz. The selection of these channels will automatically select the AM mode of transmission.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

1. XMTR SEL Switch -- SELECT transceiver (on audio control panel).
2. SPEAKER/PHONE (or AUTO) Switch -- SELECT desired mode (on audio control panel).
3. ON-AUDIO Control -- ON (allow equipment to warm up for 5 minutes for sideband or one minute for AM operation and adjust audio to comfortable listening level).
4. Channel Selector Control -- SELECT desired frequency.
5. Mode Selector Control -- SELECT operating mode.
6. Squelch Control -- ADJUST the audio gain counterclockwise for normal noise output, then slowly adjust clockwise until the receiver is silent.
7. Clarifier Control -- ADJUST when upper single sideband RF signal is being received for maximum clarity.

8. Mike Button:
   a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected by placing the AUTO selector switch in either the SPEAKER or PHONE positions.

   b. To Receive -- RELEASE mike button.

NOTE

Voice communications are not available in the LSB mode.

NOTE

Lower sideband (LSB) mode is not legal in the U.S., Canada, and most other countries.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 NAV/COM
(720-Channel - Type RT-485A)

SECTION 1
GENERAL

The Cessna 400 Nav/Com (Type RT-485A), shown in Figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote 300 or 400 Series course deviation indicator.

The set includes a 720-channel VHF communications receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously. The communications receiver-transmitter receives and transmits signals between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives omni and localizer signals between 108.00 and 117.95 MHz in 50 kHz steps. The circuits required to interpret the omni and localizer signals are located in the course deviation indicator. Microprocessor frequency management provides storage for 3 preset NAV and 3 preset COM frequencies in MEMORY. A "keep-alive" voltage prevents loss of the preset frequencies when the Nav/Com is turned off. Both the communications and navigation operating frequencies are digitally displayed by incandescent readouts on the front panel of the Nav/Com.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Nav/Com set for automatic selection of the associated DME or glide slope frequency. When a VOR frequency is selected on the Nav/Com, the associated VORTAC or VOR-DME station frequency will also be selected automatically; likewise, if a localizer frequency is selected, the associated glide slope frequency will be selected automatically.

The 400 Nav/Com may be installed with either 300 or 400 Series course deviation indicators. The 400 Series Nav/Com indicators incorporate Automatic Radial Centering and Course Datum as standard features. The 300 Series course deviation indicators do not incorporate Course Datum but are offered with, or without, Automatic Radial Centering.

Both the 300 and 400 Series course deviation indicators include either a single-pointer and related NAV flag for VOR/LOC indication only, or dual

pointers and related NAV and GS flags for both VOR/LOC and glide slope indications. Both types of indicators incorporate a back-course lamp (BC) which lights when back course (reversed sense) operation is selected. Indicators with Automatic Radial Centering will, when selected, automatically indicate the bearing TO or FROM the VOR station.

All controls for the Nav/Com, except the omni bearing selector (OBS) knob or automatic radial centering (ARC) knob, which is located on the course deviation indicator, are mounted on the front panel of the receiver-transmitter. In addition, when two or more radios are installed, aircraft mounted transmitter selector and speaker/phone switches are provided.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware that on many Cessna airplanes equipped with the windshield mounted glide slope antenna, pilots should avoid use of 2700 ±100 RPM on airplanes equipped with a two-bladed propeller or 1800 ±100 RPM on airplanes equipped with a three-bladed propeller during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed. However, if the frequency readouts fail, the frequency controls should not be moved due to the difficulty of obtaining a known frequency under this condition. The radio will remain operational on the last frequency selected, and the preset frequencies in MEMORY may be selected by pressing the appropriate MEMORY pushbutton.

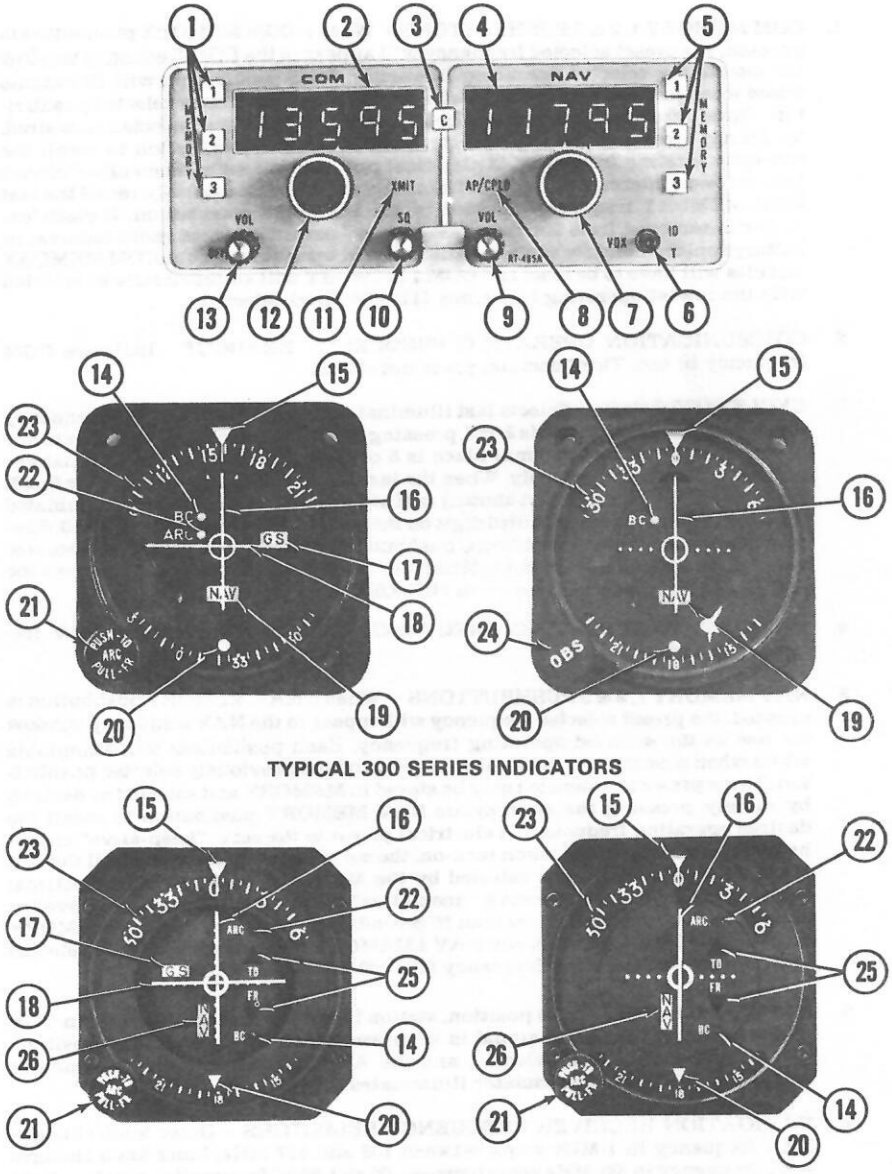


Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 1 of 4)

1. COM MEMORY 1, 2 & 3 PUSHBUTTONS - When a COM MEMORY pushbutton is pressed, the preset selected frequency will appear in the COM frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate COM MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive"circuit has not been interrupted, upon turn-on, the set will automaticaly recall the last COM MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, the COM MEMORY circuits will have to be reset and COM 1 MEMORY will automatically be selected with the lowest operating frequency (118.000 MHz) selected.

2. COMMUNICATION OPERATING FREQUENCY READOUT - Indicates COM frequency in use. Third decimal place not shown.

3. CYCLE BUTTON (C) - Selects last illuminated decimal place on COM frequency in use. If last decimal place is 2 or 7, pressing C pushbutton changes number to 5 or 0, respectively. If last decimal place is 5 or 0, pressing C pushbutton changes number to 7 or 2, respectively. When the last illuminated digit on the set is 2 or 7, the third digit on the set (not shown) will always be 5. When the last illuminated digit on the set is 0 or 5, the third digit on the set (not shown) will always be 0. Also provides test function by holding C pushbutton pressed for more than 1.7 seconds. This lights each COM and NAV MEMORY pushbutton in turn, and displays the corresponding preset frequency in MEMORY.

4. NAVIGATION OPERATING FREQUENCY READOUT - Indicates NAV frequency in use.

5. NAV MEMORY 1, 2 & 3 PUSHBUTTONS - When a NAV MEMORY pushbutton is pressed, the preset selected frequency will appear in the NAV frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate NAV MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last NAV MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, the NAV MEMORY circuits will have to be reset and NAV 1 MEMORY will automatically be selected with the lowest operating frequency (108.000 MHz) selected.

6. ID-VOX-T SWITCH - In ID position, station identifier signal is audible; in VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the self-test function is selected, and the AP/CPLD annunciator illuminates amber and the XMIT annunciator illuminates green.

7. NAVIGATION RECEIVER FREQUENCY SELECTORS - Outer knob changes NAV frequency in 1-MHz steps between 108 and 117 MHz; inner knob changes NAV frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 2 of 4)

8. AUTOPILOT COUPLED ANNUNCIATOR (AP/CPLD) - Illuminates amber when a 400B or 400B IFCS autopilot is coupled to NAV VOR/LOC converter output (non-operational with 200A, 300A, 400, 400A and 400A IFCS autopilots).

9. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio.

10. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.

11. TRANSMIT ANNUNCIATOR (XMIT) - Illuminates green when transmitter output is normal while mike is keyed.

12. COMMUNICATION RECEIVER FREQUENCY SELECTORS - Outer knob changes COM frequency in 1-MHz steps between 118 and 135 MHz; inner knob changes COM frequency in .05 MHz steps between .025 and .975 MHz or between .000 and .950 MHz depending on selection of C button.

13. COM OFF-VOLUME CONTROL (OFF-VOL) - Combination ON/OFF switch and volume control; turns on Nav/Com set and controls volume of COM receiver audio.

14. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed.

15. COURSE INDEX - Indicates selected VOR COURSE.

16. COURSE DEVIATION POINTER - Indicates course deviation from selected omni course or localizer centerline.

17. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.

18. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.

19. NAV/TO-FROM INDICATOR - Operates only with a VOR or localizer signal. Red NAV position (Flag) indicates unusable signal. With usable VOR signal, indicates whether selected VOR course is TO or FROM station. With usable localizer signal, shows TO.

20. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.

21. AUTOMATIC RADIAL CENTERING (ARC) PUSH-TO/PULL-FR SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, rotates OBS course card to center course deviation pointer with a TO flag, then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card to indicate bearing from VOR station, keeping

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 3 of 4)

course deviation pointer centered, with a FROM flag. ARC function will not operate on localizer frequencies.

NOTE

Engaging either Automatic Radial Centering (ARC) functions will alter the airplane's course anytime the autopilot is engaged and coupled to any frequency other than a localizer frequency.

22. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use.

23. COURSE CARD - Indicates selected VOR course under course index.

24. OMNI BEARING SELECTOR (OBS) - Rotates course card to select desired course.

25. TO/FROM INDICATOR (TO/FR) - Operates only with a usable VOR or localizer signal. When white flag is in view, indicates whether selected course is TO or FROM station. With usable localizer signal, shows TO.

26. NAV INDICATOR FLAG - When in view, red NAV position (Flag) indicates the selected VOR or localizer signal is unusable.

Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 4 of 4)

SECTION 4
NORMAL PROCEDURES

PRESETTING NAV/COM FREQUENCIES IN MEMORY:

1. COM OFF/VOL CONTROL -- TURN ON; adjust to desired audio level.
2. MEMORY 1 Pushbutton -- PRESS desired NAV or COM pushbutton 1 momentarily to alert the memory bank of a forthcoming frequency to be stored.
3. FREQUENCY SELECTORS -- MANUALLY ROTATE corresponding NAV or COM frequency selectors (press C pushbutton as required to select the desired third fractional COM digit) until the desired frequency is shown in the operating frequency readout window. The frequency displayed will be automatically transferred into MEMORY 1.

NOTE

Do not press the C pushbutton more than about 2 seconds while selecting fractional frequencies or you will activate the MEMORY test function.

4. MEMORY 2 and 3 Pushbuttons -- REPEAT STEPS 2 and 3 using next desired NAV or COM MEMORY to be stored. Up to 3 NAV and 3 COM frequencies may be stored for automatic recall frequency selection.

NOTE

The operating frequency set in the selected MEMORY position will automatically be changed in the MEMORY bank any time the operating frequency is manually changed.

COMMUNICATION RECEIVER-TRANSMITTER OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. XMTR SEL Switch -- SET to desired 400 Nav/Com (on audio control panel).
3. SPEAKER/PHONE (or AUTO) Switch --.SET to desired mode (on audio control panel).
4. COM Frequency Selection -- SELECT desired operating frequency by either pressing a COM MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by manually selecting the desired operating frequency using the COM frequency selectors and C pushbutton.

5. VOL Control -- ADJUST to desired audio level.
6. SQ Control -- ROTATE counterclockwise to decrease background noise as required.
7. Mike Button:
   a. To Transmit -- DEPRESS and SPEAK into microphone.

NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position.

   b. XMIT Annunciator Light -- CHECK ON (green light illuminated).
   c. To Receive -- RELEASE mike button.

NAVIGATION OPERATION:

1. COM OFF/VOL Control -- TURN ON; adjust to desired audio level.
2. SPEAKER/PHONE (or AUTO) Switch -- SET to desired mode (on audio control panel).
3. NAV Frequency Selection -- SELECT desired operating frequency by either pressing a NAV MEMORY 1, 2 or 3 pushbutton to recall a preset frequency, or by using NAV frequency selectors.
4. NAV VOL Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
   a. To Identify Station -- SET to ID to hear navigation station identifier signal.
   b. To Filter Out Station Identifier Signal -- SET to VOX to include filter in audio circuit.
6. ARC PUSH-TO/PULL-FROM Knob (If Applicable):
   a. To Use As Conventional OBS -- PLACE in center detent and select desired course.
   b. To Obtain Bearing TO VOR Station -- PUSH (ARC/PUSH-TO) knob to inner (Momentary On) position.

NOTE

ARC lamp will illuminate amber while the course card is moving to center the course deviation pointer. After alignment has been achieved to reflect bearing TO VOR, automatic radial centering will automatically shut down, causing the ARC lamp to go out and the ARC knob to return to the center detent position and function as a normal OBS.

c. To obtain Continuous Bearing FROM VOR Station -- PULL (ARC/PULL-FR) knob to outer detent.

NOTE

ARC lamp will illuminate amber, OBS course card will turn to center the course deviation pointer with a FROM flag to indicate bearing from VOR station. This system will continually drive to present the VOR radial the aircraft is on until manually returned to the center detent by the pilot.

7. AP/CPLD Annunciator -- CHECK ON (if 400B Autopilot or 400B IFCS is engaged), amber light illuminated.

NOTE

The AP/CPLD annunciator light is only operational with a 400B Autopilot or 400B IFCS installation.

VOR SELF-TEST OPERATION:

1. COM OFF/VOL Control -- TURN ON.
2. NAV Frequency Selector Switches -- SELECT usable VOR station signal.
3. OBS Knob -- SET for 0° course at course index; course deviation pointer centers or deflects left or right, depending on bearing of signal; NAV/TO-FROM indicator shows TO or FROM.
4. ID/VOX/T Switch -- PRESS to T and HOLD at T; course deviation pointer centers, NAV/TO-FROM indicator shows FROM and AP/CPLD and XMIT annunciators light.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID/VOX/T to T). Course deviation pointer deflects full scale in direction corresponding to course displacement. NAV/TO-FROM indicator shows FROM.
6. ID/VOX/T Switch -- RELEASE for normal operation.

NOTE

This test does not fulfill the requirements of FAR 91.25.

MEMORY TEST OPERATION:

1. C Pushbutton -- PUSH for about 2 seconds. Each COM and NAV

MEMORY pushbutton (1, 2 & 3) will illuminate white, in turn, with the corresponding preset frequency displayed.

NOTE

If the "keep-alive" circuit has not been interrupted, the MEMORY test will always start with the last COM MEMORY selected and cycle through the remaining COM and NAV preset frequencies. The MEMORY test will always stop on the last selected COM and NAV preset frequencies.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 ADF
(Type R-446A)

SECTION 1
GENERAL

The Cessna 400 ADF is an automatic direction finder set which provides continuous, visual bearing indications of the direction from which an RF signal is being received. It can be used for plotting position, for homing, and for aural reception of AM signals between 200 kHz and 1699 kHz. In addition, a crystal-controlled, beat frequency oscillator (BFO) permits coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

The basic units of the Cessna 400 ADF are an R-446A Receiver with dual frequency selectors, a goniometer-indicator (IN-346A), and sense and loop antennas. The receiver and goniometer-indicator are panel-mounted units. The sense and loop antennas are mounted on the external airplane surfaces. Operating controls for the Cessna 400 ADF are mounted on the receiver front panel. The goniometer-indicator presents station bearing in degrees of azimuth. An automatic pointer-stow feature alerts the operator to non-ADF operation by slewing the pointer to the 3:00 o'clock position when the REC mode is selected.

The frequency range of the Cessna 400 ADF is electronically divided into three bands: 200-399 kHz, 400-799 kHz, and 800-1699 kHz. Frequency spacing within each band is in 1-kHz increments. The operating frequency and band are selected by a four-section Minilever switch which displays a digital readout of the frequency selected and supplies a binary code to control the logic circuits within the set. A secondary (standby) operating frequency is selected by another four-section Minilever switch. Frequency control of the ADF is switched to the primary or the secondary operating frequency by a toggle switch. The operating modes (ADF and REC) are selected by individual pushbutton switches. Additional pushbutton switches are used to select the BFO and to test signal reliability during ADF operation. Operating controls for the Cessna 400 ADF are shown and described in Figure 1.

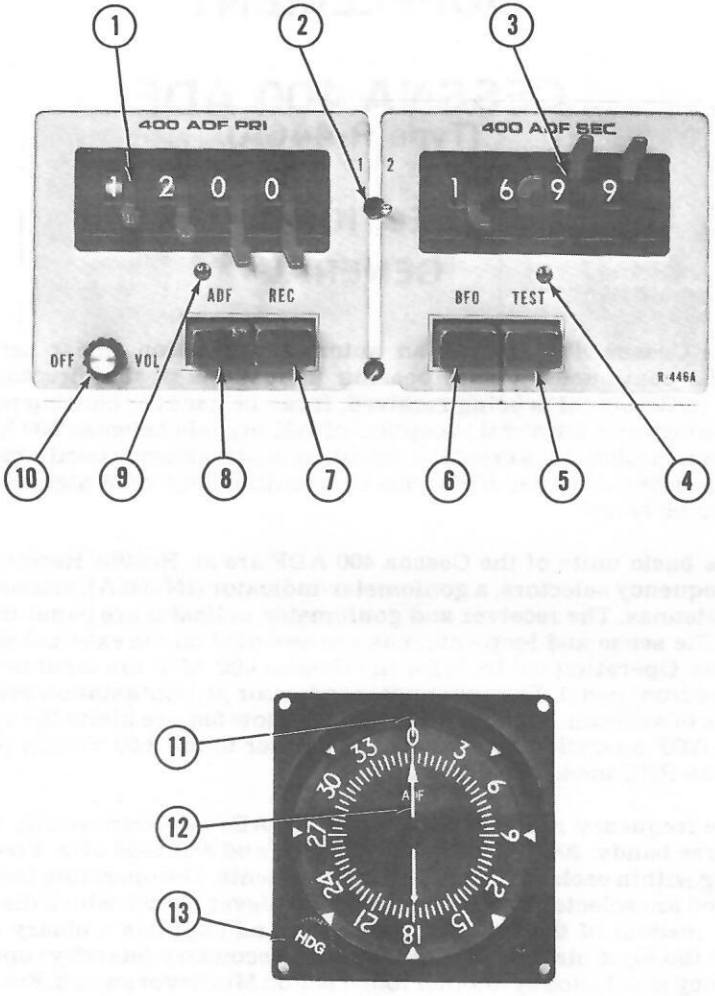


Figure 1. Cessna 400 ADF Operating Controls and Indicator
(Sheet 1 of 2)

1. PRI (PRIMARY FREQUENCY SELECTOR) - Selects and displays "primary" frequency.

2. 1-2 - The "1" position activates "primary" (PRI) frequency. The "2" position activates "secondary" (SEC) frequency.

3. SEC (SECONDARY FREQUENCY SELECTOR) - Selects and displays "secondary" frequency.

4. SECONDARY RESELECT LAMP - Lamp will flash only when "secondary" (SEC) frequency selection is outside of operating range of the receiver and 1-2 switch is in the "2" position.

5. TEST - Momentary-on switch used only with ADF function to test bearing reliability. When held depressed, slews indicator pointer; when released, if bearing is realiable, pointer returns to original position.

6. BFO - Pushed in: Activates beat frequency oscillator tone to permit coded identifier of stations transmitting keyed CW signals (Morse Code) to be heard.

7. REC - Pushed in: Selects receive mode (set operates as a standard communications receiver using sense antenna only).

NOTE

In this position an automatic pointer stow feature will alert the pilot to non-ADF operation by positioning and retaining the pointer at the 3:00 o'clock position when the 400 ADF is in the REC function.

8. ADF - Pushed in: Selects ADF mode (set operates as automatic direction finder using loop and sense antennas).

9. PRIMARY RESELECT LAMP - Lamp will flash only when "primary" (PRI) frequency selection is outside of operating range of the receiver and 1-2 switch is in the "1" position.

10. OFF-VOL - Turns set on or off and adjusts receiver volume.

11. INDEX - Fixed reference line for dial rotation adjustment.

12. POINTER - When HDG control is adjusted, indicates either relative, magnetic, or true bearings of a radio station.

13. HDG - Rotates dial to facilitate relative, magnetic, or true bearing information.

Figure 1. Cessna 400 ADF Operating Controls and Indicator (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE AS A COMMUNICATIONS RECEIVER ONLY:

1. OFF/VOL Control -- ON.
2. REC Pushbutton -- PUSH in.

NOTE

ADF indicator pointer will stow at a 90-degree position to alert the pilot to non-ADF operation.

3. PRI Frequency Selectors -- SELECT desired operating frequency.
4. SEC Frequency Selectors -- SELECT desired operating frequency.
5. 1-2 Selector Switch -- 1 position.

NOTE

1-2 selector switch can be placed in the 2 position for operation on secondary frequency. The re-select lamp will flash only when frequency selection is outside of operating range of the receiver.

6. ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
7. VOL Control -- ADJUST to desired listening level.

TO OPERATE AS AN AUTOMATIC DIRECTION FINDER:

1. OFF/VOL Control -- ON.
2. PRI Frequency Selectors -- SELECT desired operating frequency.
3. SEC Frequency Selectors -- SELECT desired operating frequency.
4. 1-2 Selector Switch -- 1 position.

NOTE

1-2 selector switch can be placed in the 2 position for operation on secondary frequency. The re-select lamp will flash only when frequency selection is outside of operating range of the receiver.

5. ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position as desired.
6. ADF Pushbutton -- PUSH in and note relative bearing on ADF indicator.
7. HDG Control -- SET goniometer-indicator dial so that index indicates 0°, magnetic, or true heading of airplane. Pointer then indicates relative, magnetic, or true bearing to station.
8. VOL Control -- ADJUST to desired listening level.

NOTE

When switching stations, place function pushbutton in the REC position. Then, after station has been selected, place function pushbutton in the ADF position to resume automatic direction finder operation. (This practice prevents the bearing indicator from swinging back and forth as frequency dial is rotated.)

TO TEST RELIABILITY OF AUTOMATIC DIRECTION FINDER:

1. ADF Pushbutton -- PUSH in and note relative bearing on indicator.
2. TEST Pushbutton -- PUSH in and hold TEST button unit indicator pointer slews off indicated bearing at least 10 to 20 degrees.
3. TEST Pushbutton -- RELEASE and OBSERVE that indicator pointer returns to the same relative bearing as in step (1).

TO OPERATE BFO:

1. OFF/VOL Control -- ON.
2. ADF SPEAKER/PHONE Switch -- SELECT speaker or phone position.
3. BFO Pushbutton -- PUSH in.
4. 1-2 Selector Switch -- SELECT 1 position to activate PRI frequency

or 2 to activate SEC frequency that is transmitting keyed CW signals (Morse Code).

5. VOL Control -- ADJUST to desired listening level.

NOTE

A 1000-Hz tone is heard in the audio output when CW signal (Morse Code) is tuned in properly.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 MARKER BEACON
(Type R-402A)

SECTION 1
GENERAL

The system consists of a 75 MHz marker beacon receiver, three indicator lights, a speaker/phone selector switch, a light dimming control, an ON/OFF/VOLUME control, and a 75 MHz marker beacon antenna. In addition, a HI-LO-TEST switch is provided on all airplanes except the 152 series airplanes for sensitivity selection and test selection. On 152 series airplanes, a HI-LO sensitivity selector switch is provided with a separate press-to-test button.

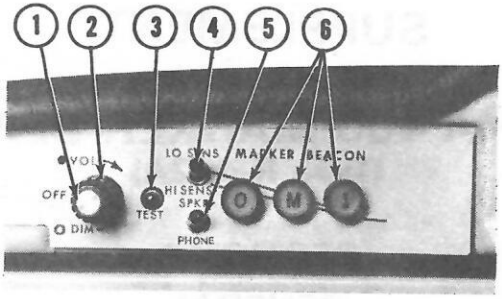
This system provides visual and aural indications of 75 MHz ILS marker beacon signals as the marker is passed. The following table lists the three most currently used marker facilities and their characteristics.

MARKER FACILITIES

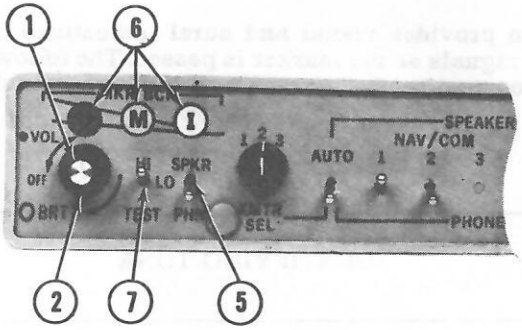
MARKER	IDENTIFYING TONE	LIGHT*
Inner	Continuous 6 dots/sec (300 Hz)	White
Middle	Alternate dots and dashes (1300 Hz)	Amber
Outer	2 dashes/sec (400 Hz)	Blue

* When the identifying tone is keyed, the respective indicating light will blink accordingly.

Operating controls and indicator lights are shown and described in Figure 1.



TYPICAL INSTALLATION
ON ALL 152 MODEL SERIES



TYPICAL INSTALLATION
ON ALL MODELS EXCEPT
152 MODEL SERIES

Figure 1. Cessna 400 Marker Beacon Operating Controls and Indicator Lights (Sheet 1 of 2)

1. OFF/VOLUME CONTROL - The small, inner control turns the set on or off and adjusts the audio listening level. Clockwise rotation turns the set on and increases the audio level.

2. DIM/BRT CONTROL - The large, outer control provides light dimming for the marker lights. Clockwise rotation increases light intensity.

3. TEST SWITCH - (152 Model Series Only) When the press-to-test switch button is depressed, the marker beacon lights will illuminate, indicating the lights are operational (the test position is a lamp test function only).

4. LO/HI SENS SWITCH - (152 Model Series Only) In the LO position (Up), receiver sensitivity is positioned for ILS approaches. In the HI position (Down), receiver sensitivity is positioned for airway flying.

5. SPEAKER/PHONE SWITCH - Selects speaker or phone for aural reception.

6. MARKER BEACON INDICATOR LIGHTS - Indicates passage of outer, middle and inner marker beacons. The OUTER light is blue, the MIDDLE light is amber and the INNER light is white.

7. HI/LO/TEST SWITCH - (All Models Except 152 Model Series) In the HI position (Up), receiver sensitivity is positioned for airway flying. In the LO position (Center), receiver sensitivity is positioned for ILS approaches. In the TEST position (Down), the marker lights will illuminate, indicating the lights are operational (the test position is a lamp test function only).

Figure 1. Cessna 400 Marker Beacon Operating Controls and Indicator Lights (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO OPERATE:

1. OFF/VOL Control -- VOL position and adjust to desired listening level.
2. LO/HI SENS Switch -- SELECT HI position for airway flying or LO position for ILS approaches.
3. SPKR/PHONE Switch -- SELECT speaker or phone audio.
4. TEST Switch -- PRESS and ensure that marker beacon indicator lights are operative.
5. BRT Control -- SELECT BRT (full clockwise). ADJUST as desired when illuminated over marker beacon.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 TRANSPONDER

(Type RT-459A)

AND

OPTIONAL ENCODING ALTIMETER

(Type EA-401A)

SECTION 1

GENERAL

The Cessna 400 Transponder (Type 459A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radar scope more readily.

The 400 Transponder consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogating pulse signals on 1030 MHz and transmits coded pulse-train reply signals on 1090 MHz. It is capable of replying to Mode A (aircraft identification) and Mode C (altitude reporting) interrogations on a selective reply basis on any of 4,096 information code selections. When an optional panel mounted EA-401A Encoding Altimeter (not part of 400 Transponder System) is included in the avionic configuration, the transponder can provide altitude reporting in 100-foot increments between -1000 and +35,000 feet.

All Cessna 400 Transponder operating controls, with the exception of the optional altitude encoder's altimeter setting knob, are located on the front panel of the unit. The altimeter setting knob is located on the encoding altimeter. Functions of the operating controls are described in Figure 1.

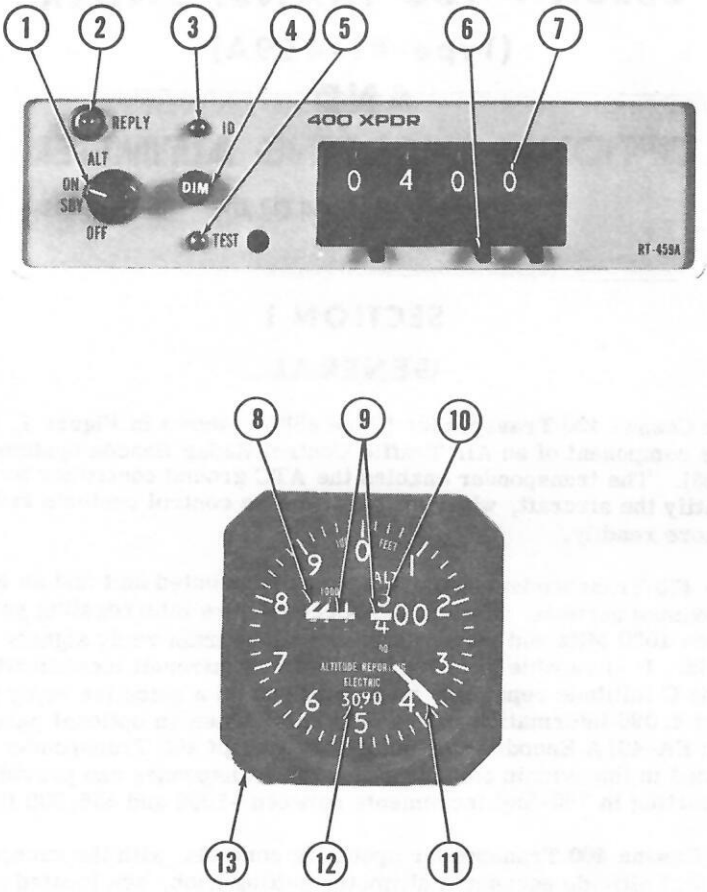


Figure 1. Cessna 400 Transponder and Encoding Altimeter Operating Controls (Sheet 1 of 2)

1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode as follows:
   - OFF - Turns set off.
   - SBY - Turns set on for equipment warm-up or standby power.
   - ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   - ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply Lamp will also glow steadily during initial warm-up period.)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply Lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of Reply Lamp.

5. SELF-TEST (TST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply Lamp will glow steadily to verify self test operation.)

6. REPLY-CODE SELECTOR SWITCHES (4) - Select assigned Mode A Reply Code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A Reply Code.

8. 1000-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 1000-foot increments between -1000 feet and +35,000 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in the 10,000-foot window.

9. OFF INDICATOR WARNING FLAG - Flag appears across altitude readout when power is removed from altimeter to indicate that readout is not reliable.

10. 100-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 100-foot increments between 0 feet and 1000 feet.

11. 20-FOOT INDICATOR NEEDLE - Indicates altitude in 20-foot increments between 0 feet and 1000 feet.

12. ALTIMETER SETTING SCALE - DRUM TYPE - Indicates selected altimeter setting in the range of 28.1 to 30.99 inches of mercury on the standard altimeter or 946 to 1049 millibars on the optional altimeter.

13. ALTIMETER SETTING KNOB - Dials in desired altimeter setting in the range of 27.9 to 31.0 inches of mercury on standard altimeter or 950 to 1050 millibars on the optional altimeter.

Figure 1. Cessna 400 Transponder and Encoding Altimeter Operating Controls (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Reply-Code Selector Switches -- SELECT assigned code.

(2) Function Switch -- ON.
(3) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, REPLY lamp flashes indicating transponder replies to interrogations.

(4) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (REPLY lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Off Indicator Warning Flag -- VERIFY that flag is out of view on encoding altimeter.
(2) Altitude Encoder Altimeter Setting Knob - SET IN assigned local altimeter setting.
(3) Reply-Code Selector Switches -- SELECT assigned code.
(4) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the encoding altimeter.

(5) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.

(2) Function Switch -- ON or ALT.
(3) TST Button -- DEPRESS and HOLD (Reply lamp should light with full brilliance regardless of DIM control setting).
(4) TST Button -- Release for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 TRANSPONDER

(Type RT-459A)

AND

OPTIONAL ALTITUDE ENCODER (BLIND)

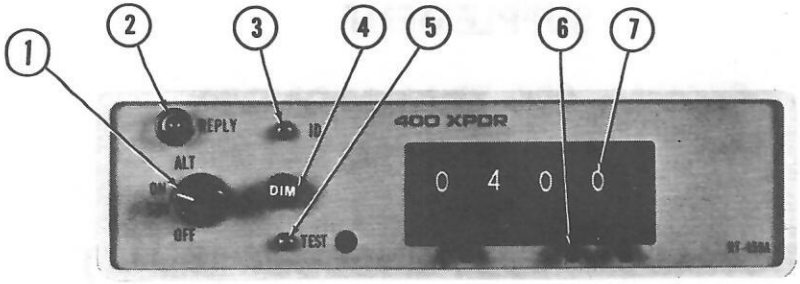
SECTION 1

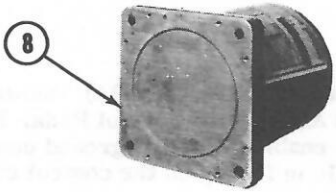
GENERAL

The Cessna 400 Transponder (Type RT-459A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, on the control center's radarscope more readily.

The Cessna 400 Transponder system consists of a panel-mounted unit and an externally-mounted antenna. The transponder receives interrogating pulse signals on 1030 MHz and transmits pulse-train reply signals on 1090 MHz. The transponder is capable of replying to Mode A (aircraft identification) and also to Mode C (altitude reporting) when coupled to an optional altitude encoder system. The transponder is capable of replying on both modes of interrogation on a selective reply basis on any of 4,096 information code selections. The optional altitude encoder system (not part of a standard 400 Transponder system) required for Mode C (altitude reporting) operation, consists of a completely independent remote-mounted digitizer that is connected to the static system and supplies encoded altitude information to the transponder. When the altitude encoder system is coupled to the 400 Transponder system, altitude reporting capabilities are available in 100-foot increments between -1000 feet and the airplane's maximum service ceiling.

All Cessna 400 Transponder operating controls are located on the front panel of the unit. Functions of the operating controls are described in Figure 1.





1. FUNCTION SWITCH - Controls application of power and selects transponder operating mode as follows:

   OFF - Turns set off.
   SBY - Turns set on for equipment warm-up or standby power.
   ON - Turns set on and enables transponder to transmit Mode A (aircraft identification) reply pulses.
   ALT - Turns set on and enables transponder to transmit either Mode A (aircraft identification) reply pulses or Mode C (altitude reporting) pulses selected automatically by the interrogating signal.

2. REPLY LAMP - Lamp flashes to indicate transmission of reply pulses; glows steadily to indicate transmission of IDENT pulse or satisfactory self-test operation. (Reply lamp will also glow steadily during initial warm-up period.)

Figure 1. Cessna 400 Transponder and Altitude Encoder (Blind)
(Sheet 1 of 2)

3. IDENT (ID) SWITCH - When depressed, selects special pulse identifier to be transmitted with transponder reply to effect immediate identification of aircraft on ground controller's display. (Reply lamp will glow steadily during duration of IDENT pulse transmission.)

4. DIMMER (DIM) CONTROL - Allows pilot to control brilliance of reply lamp.

5. SELF-TEST (TST) SWITCH - When depressed, causes transponder to generate a self-interrogating signal to provide a check of transponder operation. (Reply lamp will glow steadily to verify self-test operation.)

6. REPLY-CODE SELECTOR SWITCHES (4) - Select assigned Mode A reply code.

7. REPLY-CODE INDICATORS (4) - Display selected Mode A reply code.

8. REMOTE-MOUNTED DIGITIZER - Provides an altitude reporting code range of -1000 feet up to the airplane's maximum service ceiling.

Figure 1. Cessna 400 Transponder and Altitude Encoder (Blind)
(Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, a placard labeled "ALTITUDE ENCODER EQUIPPED" must be installed near the altimeter.

SECTION 3
EMERGENCY PROCEDURES

TO TRANSMIT AN EMERGENCY SIGNAL:

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code.
(3) ID Switch -- DEPRESS then RELEASE to effect immediate identification of aircraft on ground controller's display.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS (WHEN IN A CONTROLLED ENVIRONMENT):

(1) Function Switch -- ON.
(2) Reply-Code Selector Switches -- SELECT 7700 operating code for 1 minute; then SELECT 7600 operating code for 15 minutes and then REPEAT this procedure at same intervals for remainder of flight.
(3) ID Switch -- DEPRESS then RELEASE at intervals to effect immediate identification of aircraft on ground controller's display.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT IDENTIFICATION) CODES IN FLIGHT:

(1) Reply-Code Selector Switches -- SELECT assigned code.

(2) Function Switch -- ON.
(3) DIM Control -- ADJUST light brilliance of reply lamp.

NOTE

During normal operation with function switch in ON position, reply lamp flashes indicating transponder replies to interrogations.

(4) ID Button -- DEPRESS momentarily when instructed by ground controller to "squawk IDENT" (reply lamp will glow steadily, indicating IDENT operation).

TO TRANSMIT MODE C (ALTITUDE REPORTING) CODES IN FLIGHT:

(1) Reply-Code Selector Switches -- SELECT assigned code.
(2) Function Switch -- ALT.

NOTE

When directed by ground controller to "stop altitude squawk", turn Function Switch to ON for Mode A operation only.

NOTE

Pressure altitude is transmitted by the transponder for altitude squawk and conversion to indicated altitude is done in ATC computers. Altitude squawked will only agree with indicated altitude when the local altimeter setting in use by the ground controller is set in the aircraft altimeter.

(3) DIM Control -- ADJUST light brilliance of reply lamp.

TO SELF-TEST TRANSPONDER OPERATION:

(1) Function Switch -- SBY and wait 30 seconds for equipment to warm-up.
(2) Function Switch -- ON.
(3) TST Button -- DEPRESS (reply lamp should light brightly regardless of DIM control setting).
(4) TST Button -- RELEASE for normal operation.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed. However, the installation of an externally mounted antenna or several related external antennas, will result in a minor reduction in cruise performance.

SUPPLEMENT

CESSNA 400 GLIDE SLOPE

(Type R-443B)

SECTION 1
GENERAL

The Cessna 400 Glide Slope is an airborne navigation receiver which receives and interprets glide slope signals from a ground-based Instrument Landing System (ILS). It is used with the localizer function of a VHF navigation system when making instrument approaches to an airport. The glide slope provides vertical path guidance while the localizer provides horizontal track guidance.

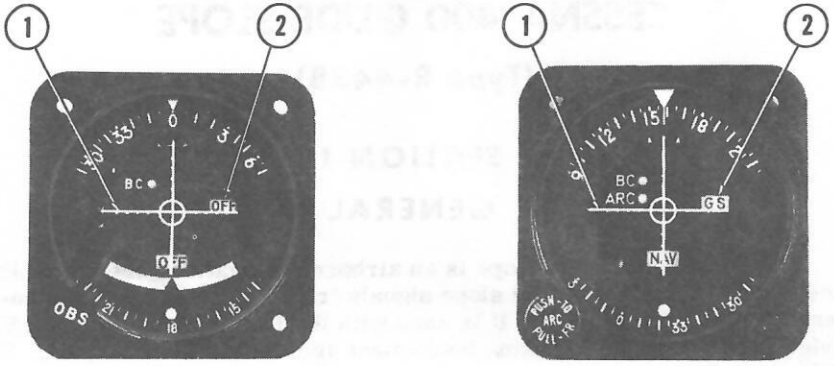
The Cessna 400 Glide Slope system consists of a remote-mounted receiver coupled to an existing navigation system, a panel-mounted indicator and an externally-mounted antenna. The glide slope receiver is designed to receive ILS glide slope signals on any of 40 channels. The channels are spaced 150 kHz apart and cover a frequency range of 329.15 MHz through 335.0 MHz. When a localizer frequency is selected on the NAV receiver, the associated glide slope frequency is selected automatically.

Operation of the Cessna 400 Glide Slope system is controlled by the associated navigation system. The functions and indications of typical 300 series glide slope indicators are pictured and described in Figure 1. The 300 series glide slope indicators shown in Figure 1 depict typical indications for all Cessna-crafted glide slope indicators. However, refer to the 400 Nav/Com or HSI write-ups if they are listed in this section as options for additional glide slope indicators.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the pilot should be aware that on many Cessna airplanes equipped with the windshield mounted glide slope antenna, pilots should avoid use of 2700 ±100 RPM on airplanes equipped with a two-bladed propeller or 1800 ±100 RPM on airplanes equipped with a three-bladed propeller during ILS approaches to avoid oscillations of the glide slope deviation pointer caused by propeller interference.

TYPICAL 300 SERIES GLIDE SLOPE INDICATORS



1. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from normal glide slope.

2. GLIDE SLOPE "OFF" OR "GS" FLAG - When visible, indicates unreliable glide slope signal or improperly operating equipment. The flag disappears when a reliable glide slope signal is being received.

CAUTION

Spurious glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope "OFF" or "GS" flag to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope (ILS BC) is specified on the approach and landing chart.

Figure 1. Typical 300 Series VOR/LOC/ILS Indicator

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this avionic equipment is installed.

SECTION 4
NORMAL PROCEDURES

TO RECEIVE GLIDE SLOPE SIGNALS:

(1) NAV Frequency Select Knobs -- SELECT desired localizer frequency (glide slope frequency is automatically selected).
(2) NAV/COM VOX-ID-T Switch -- SELECT ID position to disconnect filter from audio circuit.
(3) NAV VOL Control -- ADJUST to desired listening level to confirm proper localizer station.

CAUTION

When glide slope "OFF" or "GS" flag is visible, glide slope indications are unusable.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.

SUPPLEMENT

OPTIONAL UNSLAVED HORIZONTAL SITUATION INDICATOR (HSI) (TYPE IG-832C)

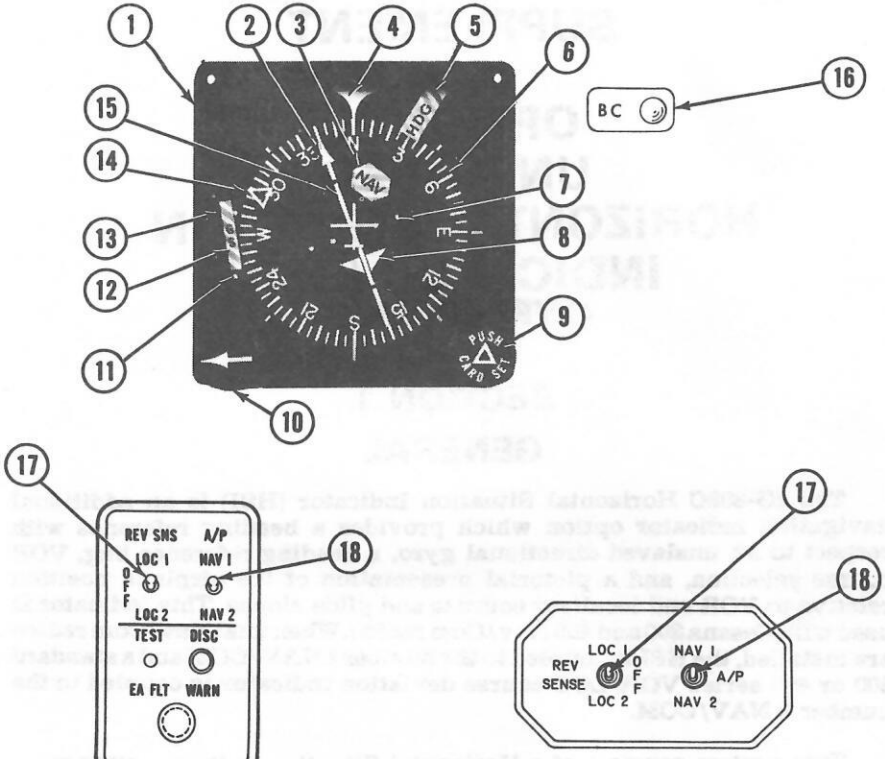
SECTION 1
GENERAL

The IG-832C Horizontal Situation Indicator (HSI) is an additional navigation indicator option which provides a heading reference with respect to an unslaved directional gyro, a heading reference bug, VOR course selection, and a pictorial presentation of the airplane position relative to VOR and localizer courses and glide slopes. This indicator is used with Cessna 300 and 400 Nav/Com radios. When dual Nav/Com radios are installed, the HSI is coupled to the number 1 NAV/COM and a standard 300 or 400 series VOR/LOC course deviation indicator is coupled to the number 2 NAV/COM.

This system consists of a Horizontal Situation Indicator (HSI-Type IG-832C) and a remote mounted VOR/LOC Converter (Type B-445A). The indicator is unslaved and course datum is not available. When the HSI is installed with a 300A, 400A or 400B Autopilot system, a BC light is installed on the instrument panel, adjacent to the HSI, to alert the pilot of back-course operation. Each control and indicator function is described in Figure 1.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this instrument is installed.



USED WITH 400B AUTOPILOT ON 210 SERIES MODELS

USED WITH 400A AUTOPILOT ON 337 SERIES MODELS

1. HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials and localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north when compass card is set to agree with compass.

2. OMNI BEARING POINTER - Indicates selected VOR course or localizer course on compass card (6). The selected VOR radial or localizer heading remains set on the compass card when the compass card (6) is rotated.

3. NAV FLAG - When flag is in view, indicates that the NAV receiver signal being received is not reliable.

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832C) (Sheet 1 of 3)

4. HEADING REFERENCE (LUBBER LINE) - Indicates aircraft magnetic heading on compass card (6).

5. HEADING WARNING FLAG (HDG) - When flag is in view, heading display is invalid due to the heading system power being interrupted or the HSI vacuum powered gyro being low.

6. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (4). Must be set to agree with aircraft compass using Card Set Knob (9).

7. COURSE DEVIATION DOTS - Indicates aircraft displacement from VOR, or localizer beam center. A full scale (2 dots) course deviation bar (15) displacement represents the following deviations from beam center:
   a. VOR = ±10° approx.
   b. LOC = ±2-1/2° approx.

8. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.

9. HEADING SELECTOR AND CARD SET KNOB (PUSH ▲ CARD SET) - When rotated in normal (out) position, positions heading "bug" (14) on compass card (6) to indicate selected heading for reference or for autopilot tracking. When pushed in and rotated, sets compass card (6) to agree with magnetic compass. The omni bearing pointer (2), heading bug (14), and deviation bar (15) rotate with the compass card (6).

NOTE

The compass card (6) must be reset periodically to compensate for precessional errors in the gyro.

10. COURSE SELECTOR ( ) KNOB - When rotated, positions omni bearing pointer (2) on the compass card (6) to select desired VOR radial or localizer course.

11. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.

12. GLIDE SLOPE POINTER - Indicates on glide slope scale (11) aircraft displacement from glide slope beam center.

13. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.

14. HEADING BUG - Indicates selected reference heading relative to compass card (6).

15. COURSE (OMNI) DEVIATION BAR - Bar is center portion of omni bearing pointer and moves laterally to pictorially indicate relationship of aircraft to selected course. It relates in degrees of angular displacement from VOR radials or localizer beam center (see Item 7).

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832C)
(Sheet 2 of 3)

16. BACK-COURSE LIGHT (BC) (Installed in a remote position, as shown, with 300A, 400A and 400B autopilots only.) - The remote amber BC light will illuminate when back-course operation is selected by the REV SNS LOC 1 switch (17) mounted on the left-hand instrument panel or the BC function of 300A autopilot.

CAUTION

When back-course operation is selected, the course (omni) deviation bar (15) on the HSI does not reverse. However, selection of back-course operation will always cause the localizer signal to the autopilot to reverse for back-course operation.

17. BACK COURSE REVERSE SENSE (REV SNS) LOC 1 OR LOC 2 SELECTOR SWITCH - With AP switch ON (on 400A or 400B Autopilot control units) and either LOC 1 or LOC 2 selected, localizer signals to the Cessna 400A or 400B Autopilots will reverse for back-course operation. With autopilot ON or OFF, the course (omni) deviation bar on the HSI will not reverse but the standard CDI pointer will reverse depending on the position of the REV SNS switch.

18. AUTOPILOT (A/P) NAV 1 OR NAV 2 SELECTOR SWITCH - (Installed with 400A and 400B Autopilots only) Selects appropriate signals from the desired navigation receiver to be coupled to the autopilot.

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832C) (Sheet 3 of 3)

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when this instrument is installed.

SECTION 4
NORMAL PROCEDURES

Normal procedures for operation of this system differ little from those required for the more conventional Course Deviation Indicators. However, several small differences are worth noting.

The rectilinear movement of the omni deviation bar in combination with the rotation of the compass card in response to heading changes, provides an intuitive picture of the navigation situation at a glance when turned to an omni station. When tuned to a localizer frequency, the omni bearing pointer must be set to the inboard front course for both front and back-course approaches to retain this pictorial presentation.

When the HSI system is installed with a Cessna 300A (Type AF-395A), Cessna 400A (Type AF-530A) or Cessna 400B (Type IF-550A) Autopilot, a back-course indicator light labeled BC, is mounted adjacent to the HSI and will illuminate amber when the reverse sense (REV SNS) switch (mounted in the upper portion of the pilot's instrument panel on 337 Models or is mounted in the autopilot's accessory unit on 210 Models) is placed in the ON (LOC 1) position to alert the pilot that back-course operation is selected. The HSI needle will not be reversed but the LOC signals to the autopilot will be. Light dimming for the BC light is provided for low ambient light conditions.

For normal procedures with autopilots, refer to the 300A, 400A and 400B Autopilot Supplements in this handbook if they are listed in this section as options.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this instrument is installed.

SUPPLEMENT

CESSNA NAVOMATIC 200A AUTOPILOT
(Type AF-295B)

SECTION 1
GENERAL

The Cessna 200A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, an aileron actuator, and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude.

The 200A Navomatic will also capture and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 200A Navomatic are located on the front panel of the computer-amplifier, shown in Figure 1. The primary function pushbuttons (DIR HOLD, NAV CAPT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

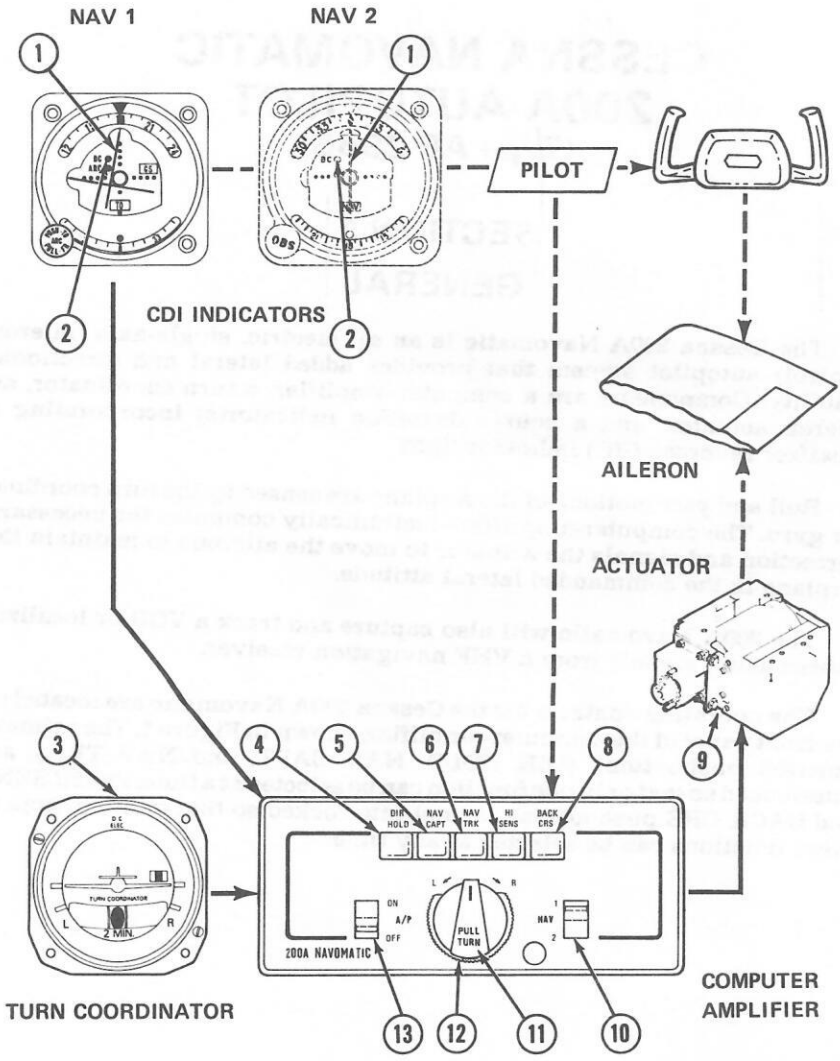


Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

1. COURSE DEVIATION INDICATOR - Provides VOR/LOC navigation inputs to autopilot for intercept and tracking modes.

2. LOCALIZER REVERSED INDICATOR LIGHT - Amber light, labeled BC, illuminates when BACK CRS button is pushed in (engaged) and LOC frequency selected. BC light indicates course indicator needle is reversed on selected receiver (when turned to a localizer frequency). This light is located within the CDI indicator.

3. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.

4. DIR HOLD PUSHBUTTON - Selects direction hold mode. Airplane holds direction it is flying at time button is pushed.

5. NAV CAPT PUSHBUTTON - Selects NAV capture mode. When parallel to desired course, the airplane will turn to a pre-described intercept angle and capture selected VOR or LOC course.

6. NAV TRK PUSHBUTTON - Selects NAV track mode. Airplane tracks selected VOR or LOC course.

7. HI SENS PUSHBUTTON - During NAV CAPT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low sensitivity position (pushbutton out), response to NAV signal is dampened for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.

8. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.

9. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.

10. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.

11. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left, standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.

12. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or weight distribution. (For proper operation, the aircraft's rudder trim, if so equipped, must be manually trimmed before the autopilot is engaged.)

13. A/P SWITCH - Turns autopilot ON or OFF.

Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the following autopilot limitation should be adhered to during airplane operation:

BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.

SECTION 3
EMERGENCY PROCEDURES

TO OVERRIDE THE AUTOPILOT:

1. Airplane Control Wheel -- ROTATE as required to override autopilot.

NOTE

The servo may be overpowered at anytime without damage.

TO TURN OFF AUTOPILOT:

1. A/P ON-OFF Switch -- OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.
2. BACK CRS Button -- OFF (see Caution note under Nav Capture).

NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected.

INFLIGHT WINGS LEVELING:

1. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered on Turn Coordinator).
2. PULL-TURN Knob -- CENTER and PULL out.
3. A/P ON-OFF Switch -- ON.
4. Autopilot TRIM Control -- ADJUST for zero turn rate (wings level indication on Turn Coordinator).

NOTE

For optimum performance in airplanes equipped as floatplanes, use autopilot only in cruise flight or in approach configuration with flaps down no more than 10° and airspeed no lower than 75 KIAS on 172 and R172 Series Models or 85 KIAS on 180, 185, U206 and TU206 Series Models.

COMMAND TURNS:

1. PULL-TURN Knob -- CENTER, PULL out and ROTATE.

DIRECTION HOLD:

1. PULL-TURN Knob -- CENTER and PULL out.
2. Autopilot TRIM Control -- ADJUST for zero turn rate.
3. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered).
4. DIR HOLD Button -- PUSH.
5. PULL-TURN Knob -- PUSH in detent position when airplane is on desired heading.
6. Autopilot TRIM Control -- READJUST for zero turn rate.

NAV CAPTURE (VOR/LOC):

1. PULL-TURN Knob -- CENTER and PULL out.
2. NAV 1-2 Selector Switch -- SELECT desired VOR receiver.
3. Nav Receiver OBS or ARC Knob -- SET desired VOR course (if tracking omni).

NOTE

Optional ARC knob should be in center position and ARC amber warning light should be off.

4. NAV CAPT Button -- PUSH.
5. HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.

6. BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

CAUTION

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed even when the autopilot switch is OFF.

7. PULL-TURN Knob -- Turn airplane parallel to desired course.

NOTE

Airplane must be turned until heading is within ±5° of desired course.

8. PULL TURN Knob -- CENTER and PUSH in. The airplane should then turn toward desired course at 45° ±10° intercept angle (if the CDI needle is in full deflection).

NOTE

If more than 15 miles from the station or more than 3 minutes from intercept, use a manual intercept procedure.

NAV TRACKING (VOR/LOC):

1. NAV TRK Button -- PUSH when CDI centers and airplane is within ±5° of course heading.
2. HI SENS BUTTON -- DISENGAGE for enroute omni tracking (leave ENGAGED for localizer).
3. Autopilot TRIM Control -- READJUST as required to maintain track.

NOTE

Optional ARC function, if installed, should not be used for autopilot operation. If airplane should deviate off course, pull out PULL TURN knob and readjust airplane rudder trim for straight flight on the Turn Coordinator. Push in PULL TURN knob to reintercept course. If deviation persists, progressively make slight adjustments of autopilot TRIM control towards the course as required to maintain track.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.

SUPPLEMENT

CESSNA NAVOMATIC 300A AUTOPILOT
(Type AF-395A)

SECTION 1
GENERAL

The Cessna 300A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, a directional gyro, an aileron actuator and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. Deviations from the selected heading are sensed by the directional gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude or heading.

The 300A Navomatic will also intercept and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 300A Navomatic are located on the front panel of the computer-amplifier and on the directional gyro, shown in Figure 1. The primary function pushbuttons (HDG SEL, NAV INT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

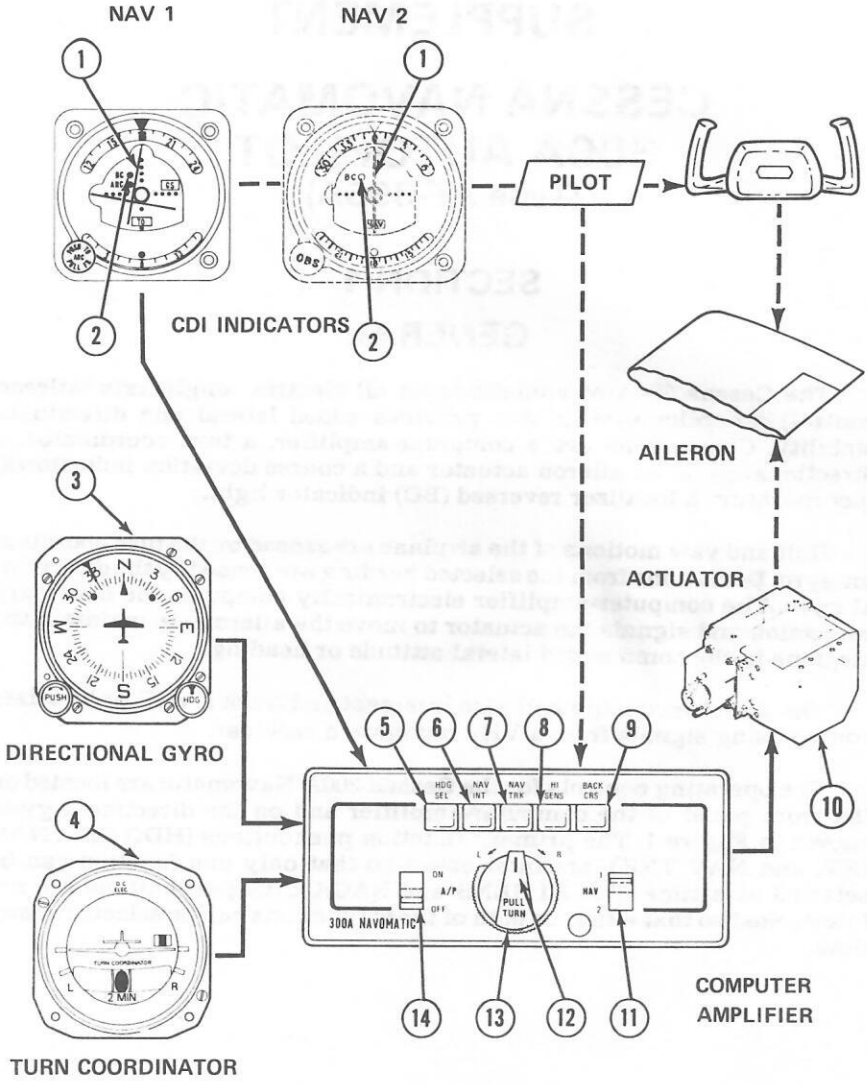


Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

1. COURSE DEVIATION INDICATOR - Provides VOR/LOC navigation inputs to autopilot for intercept and tracking modes.

2. LOCALIZER REVERSED INDICATOR LIGHT - Amber light, labeled BC, illuminates when BACK CRS button is pushed in (engaged) and LOC frequency selected. BC light indicates course indicator needle is reversed on selected receiver (when tuned to a localizer frequency). This light is located within the CDI indicator.

3. DIRECTIONAL GYRO INDICATOR - Provides heading information to the autopilot for heading intercept and hold. Heading bug on indicator is used to select desired heading or VOR/LOC course to be flown.

4. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.

5. HDG SEL PUSHBUTTON - Aircraft will turn to and hold heading selected by the heading "bug" on the directional gyro.

6. NAV INT PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will turn to and intercept selected VOR or LOC course.

7. NAV TRK PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will track selected VOR or LOC course.

8. HI SENS PUSHBUTTON - During NAV INT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low-sensitivity position (pushbutton out), response to NAV signal is dampened for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.

9. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.

10. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.

11. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.

12. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left, standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.

13. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or lateral weight distribution. (For proper operation, the aircraft's rudder trim, if so equipped, must be manually trimmed before the autopilot is engaged.

14. A/P SWITCH - Turns autopilot ON or OFF.

Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators (Sheet 2 of 2)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the following autopilot limitation should be adhered to during airplane operation:

BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.

SECTION 3
EMERGENCY PROCEDURES

TO OVERRIDE THE AUTOPILOT:

1. Airplane Control Wheel -- ROTATE as required to override autopilot.

NOTE

The servo may be overpowered at any time without damage.

TO TURN OFF AUTOPILOT:

1. A/P ON-OFF Switch -- OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.
2. BACK CRS Button -- OFF (see Caution note under Nav Intercept).

NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected.

INFLIGHT WINGS LEVELING:

1. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered on Turn Coordinator).
2. PULL-TURN Knob -- CENTER and PULL out.
3. A/P ON-OFF Switch -- ON.
4. Autopilot TRIM Control -- ADJUST for zero turn rate (wings level indication on Turn Coordinator).

NOTE

For optimum performance in airplanes equipped as floatplanes, use autopilot only in cruise flight or in approach configuration with flaps down no more than 10° and airspeed no lower than 75 KIAS on 172 and R172 Series Models or 85 KIAS on 180, 185, U206 and TU206 Series Models.

COMMAND TURNS:

1. PULL-TURN Knob -- CENTER, PULL out and ROTATE.

HEADING SELECT:

1. Directional Gyro -- SET to airplane magnetic heading.
2. Heading Selector Knob -- ROTATE bug to desired heading.
3. Heading Select Button -- PUSH.
4. PULL-TURN Knob -- CENTER and PUSH.

NOTE

Airplane will turn automatically to selected heading. If airplane fails to hold the precise heading, readjust autopilot TRIM control as required or disengage autopilot and reset manual rudder trim (if installed).

NAV INTERCEPT (VOR/LOC):

1. PULL-TURN Knob -- CENTER and PULL out.
2. NAV 1-2 Selector Switch -- SELECT desired receiver.
3. Nav Receiver OBS or ARC Knob -- SET desired VOR course (if tracking omni).

NOTE

Optional ARC knob should be in center position and ARC warning light should be off.

4. Heading Selector Knob -- ROTATE bug to selected course (VOR or localizer - inbound or outbound as appropriate).
5. Directional Gyro --SET for magnetic heading.
6. NAV INT Button -- PUSH.
7. HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.
8. BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

CAUTION

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed even when the autopilot switch is OFF.

9. PULL-TURN Knob -- PUSH.

NOTE

Airplane will automatically turn to a 45° intercept angle.

NAV TRACKING (VOR/LOC):

1. NAV TRK Button -- PUSH when CDI centers (within one dot) and airplane is within ± 10° of course heading.
2. HI SENS Button -- Disengage for enroute omni tracking (leave engaged for localizer).

NOTE

Optional ARC feature, if installed, should not be used for autopilot operation. If CDI remains steadily off center, readjust autopilot TRIM control as required to maintain track.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this avionic equipment is installed.