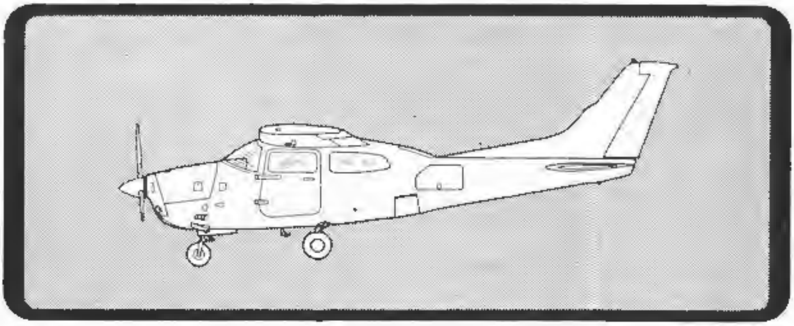
PILOT'S OPERATING HANDBOOK

Cessna®



CENTURION

1978 MODEL 210M

Serial No.____________________

Registration No.________________

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

CESSNA AIRCRAFT COMPANY

WICHITA, KANSAS, USA

D1122-1-13-RPC-200-5/88

REVISION 1

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INSERT LATEST REVISED PAGES; DISPOSE OF SUPERSEDED PAGES.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 . . . 24 August 1977

Revision . . . 1 . . . 1 November 1978

THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 398, 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 . . . . 175 KNOTS
Cruise, 75% Power at 6500 Ft . . . . 171 KNOTS
CRUISE: Recommended lean mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.
75% Power at 6500 Ft . . . . Range 855 NM
534 Pounds Usable Fuel Time 5.1 HRS
Maximum Range at 10,000 Ft . . . . Range 1065 NM
534 Pounds Usable Fuel Time 7.9 HRS
RATE OF CLIMB AT SEA LEVEL . . . . 950 FPM
SERVICE CEILING . . . . 17,300 FT
TAKEOFF PERFORMANCE:
Ground Roll . . . . 1250 FT
Total Distance Over 50-Ft Obstacle . . . . 2030 FT
LANDING PERFORMANCE:
Ground Roll . . . . 765 FT
Total Distance Over 50-Ft Obstacle . . . . 1500 FT
STALL SPEED (CAS):
Flaps Up, Power Off . . . . 65 KNOTS
Flaps Down, Power Off . . . . 56 KNOTS
MAXIMUM WEIGHT:
Ramp . . . . 3812 LBS
Takeoff and Landing . . . . 3800 LBS
STANDARD EMPTY WEIGHT:
Centurion . . . . 2168 LBS
Centurion II . . . . 2238 LBS
MAXIMUM USEFUL LOAD:
Centurion . . . . 1644 LBS
Centurion II . . . . 1574 LBS
BAGGAGE ALLOWANCE: Maximum With 4 People . . . . 240 LBS
WING LOADING: Pounds/Sq Ft 21.7
POWER LOADING: Pounds/HP 12.7
FUEL CAPACITY: Total . . . . 90 GAL.
OIL CAPACITY . . . . 10 QTS
ENGINE: Teledyne Continental, Fuel Injection IO-520-L
300 BHP at 2850 RPM (5-Minute Takeoff Rating)
285 BHP at 2700 RPM (Maximum Continuous Rating)
PROPELLER: 3-Bladed Constant Speed, Diameter . . . . 80 IN.

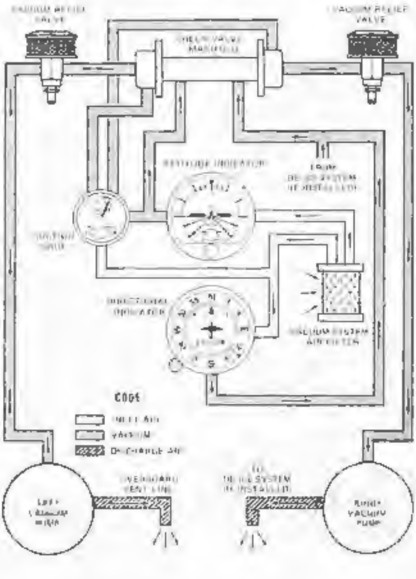
Dual Vacuum Pump Installation

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

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

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

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



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SECTION 1
GENERAL

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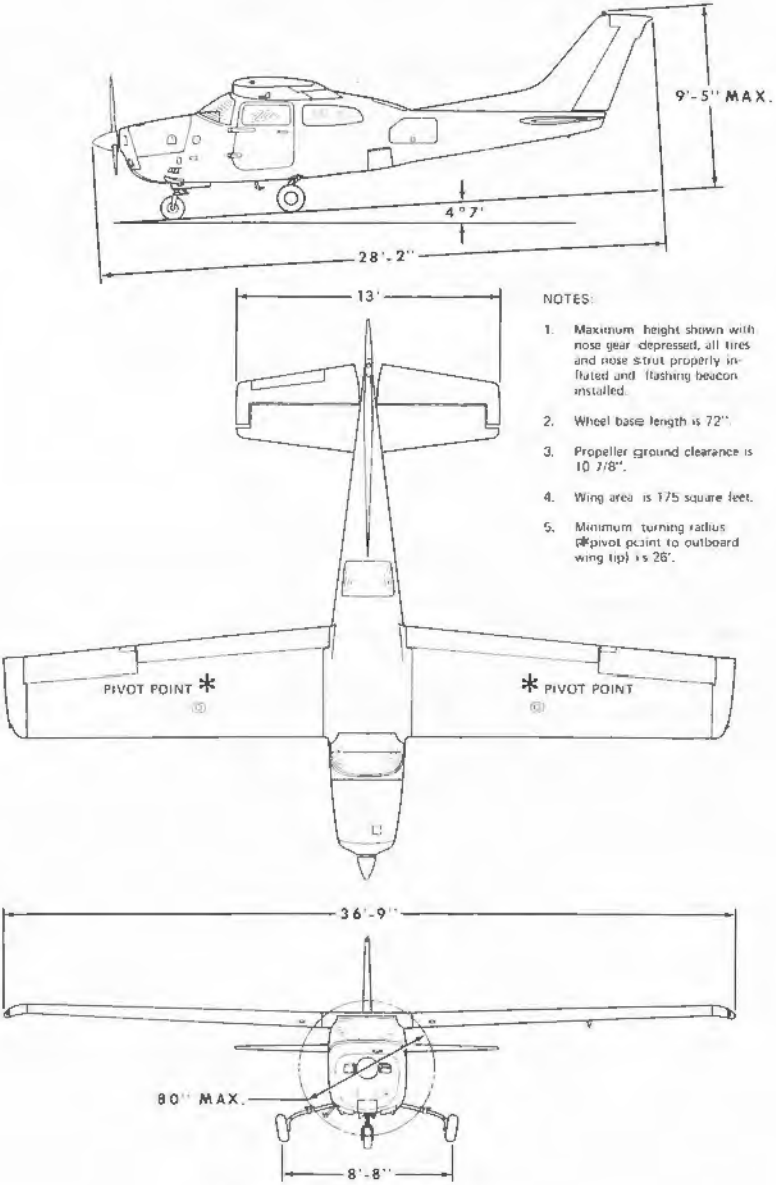

NOTES:

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

Figure 1-1. Three View

INTRODUCTION

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

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

DESCRIPTIVE DATA

ENGINE

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

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: D3A34C404/80VA-0.
Number of Blades: 3.
Propeller Diameter, Maximum: 80 inches.
Minimum: 78.5 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 11.0° and a high pitch setting of 27.0° (30 inch station).

FUEL

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

OIL

Oil Grade (Specification):

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

NOTE

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

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

Recommended Viscosity for Temperature Range:

SAE 50 above 4°C (40°F).
SAE 10W30 or SAE 30 below 4°C (40°F).

NOTE

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

Oil Capacity:

Sump: 10 Quarts.
Total: 11 Quarts (if oil filter installed).

MAXIMUM CERTIFICATED WEIGHTS

Takeoff: 3800 lbs.
Landing: 3800 lbs.
Weight in Baggage Compartment:

Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110): 120 lbs.
Baggage - On and aft of wheel well (Station 110 to 152): 120 lbs.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Centurion: 2168 lbs.
Centurion II: 2238 lbs.
Maximum Useful Load, Centurion: 1644 lbs.
Centurion II: 1574 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: 21.7 lbs./sq. ft.
Power Loading: 12.7 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS	**Knots Calibrated Airspeed** is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.
KIAS	**Knots Indicated Airspeed** is the speed shown on the airspeed indicator and expressed in knots.
KTAS	**Knots True Airspeed** is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.
V_A	**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. Percent power values in this handbook are based on the maximum contiouous power rating.
RPM	**Revolutions Per Minute** is engine speed.
MP	**Manifold Pressure** is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

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

WEIGHT AND BALANCE TERMINOLOGY

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

C.G. Arm	**Center of Gravity Arm** is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits	**Center of Gravity Limits** are the extreme center of gravity locations within which the airplane must be operated at a given weight.
Standard Empty Weight	**Standard Empty Weight** is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.
Basic Empty Weight	**Basic Empty Weight** is the standard empty weight plus the weight of optional equipment.
Useful Load	**Useful Load** is the difference between 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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INTRODUCTION

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

NOTE

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

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

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	194	199	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	164	168	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed: 3800 Pounds 3150 Pounds 2500 Pounds	 117 107 95	 119 108 96	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed: To 10° Flaps 10° - 30° Flaps	 147 115	 150 115	Do not exceed these speeds with the given flap settings.
V_{LO}	Maximum Landing Gear Operating Speed	137	140	Do not extend or retract landing gear above this speed.
V_{LE}	Maximum Landing Gear Extended Speed	194	199	Do not exceed this speed with landing gear extended.
	Maximum Window Open Speed	194	199	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

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

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	55 - 115	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	68 - 168	Normal Operating Range. Lower limit is maximum weight V_S at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	168 - 199	Operations must be conducted with caution and only in smooth air.
Red Line	199	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.
Engine Model Number: IO-520-L.
Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Power, 5 Minutes - Takeoff: 300 BHP.
Continuous: 285 BHP
Maximum Engine Speed, 5 Minutes - Takeoff: 2850 RPM.
Continuous: 2700 RPM.
Maximum Cylinder Head Temperature: 238°C (460°F).
Maximum Oil Temperature: 116°C (240°F).
Oil Pressure, Minimum: 10 psi.
Maximum: 100 psi.
Fuel Pressure, Minimum: 3.5 psi.
Maximum: 19.5 psi (151 lbs/hr).
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: D3A34C404/80VA-0.
Propeller Diameter, Maximum: 80 inches.
Minimum: 78.5 inches.
Propeller Blade Angle at 30 Inch Station, Low: 11.0°.
High: 27.0°.

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	- -	2200 - 2550 RPM	2700 - 2850 RPM	2850 RPM
Manifold Pressure	- - -	15-25 in. Hg	-	- - -
Oil Temperature	- -	100° - 240°F	- - -	240°F
Cylinder Head Temperature	- -	200° - 460°F	- - -	460°F
Fuel Flow (Pressure)	(3.5 psi)	42 - 102 lbs/hr	- - -	151 lbs/hr (19.5 psi)
Oil Pressure	10 psi	30 - 60 psi	- - -	100 psi

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

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

CENTER OF GRAVITY LIMITS

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

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

MANEUVER LIMITS

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

Aerobatic maneuvers, including spins, are not approved.

FLIGHT LOAD FACTOR LIMITS

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

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

KINDS OF OPERATION LIMITS

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

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

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

NOTE

Takeoff and land on fuller tank.

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

PLACARDS

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

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

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

MAXIMUMS

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

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

DAY - NIGHT - VFR - IFR

2. On control lock:

CONTROL LOCK - REMOVE BEFORE STARTING ENGINE.

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

OFF LEFT ON -- 44.5 GAL. RIGHT ON -- 44.5 GAL. TAKEOFF AND LAND ON FULLER TANK.

4. Near fuel selector valve:

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

5. Aft of fuel tank cap:

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

6. Forward of fuel tank cap:

FOR 32 GAL FUEL LOAD FILL TO BOTTOM OF FILLER NECK EXTENSION

7. On baggage compartment door:

MAXIMUM BAGGAGE 120 LBS. REFER TO WEIGHT AND BALANCE DATA FOR BAGGAGE/CARGO LOADING.

8. On hand pump cover:

MANUAL GEAR EXTENSION 1. SELECT GEAR DOWN. 2. PULL HANDLE FORWARD. 3. PUMP VERTICALLY. CAUTION: DO NOT PUMP WITH GEAR UP SELECTED

9. Above fuel flow and manifold pressure gage:

FUEL FLOW AT FULL THROTTLE

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

MAX. POWER SETTING

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

10. On flap control indicator:

0° to 10°	(Partial flap range with blue color code and 150 knot callout; also, mechanical detent at 10°.)
10° - 20° - Full	(Indices at these positions with white color code and 115 knot callout; also, mechanical detent at 20°.)

11. On inside nose wheel doors, strut doors and main wheel doors:

WARNING

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

12. Near landing gear lever:

MAX SPEED IAS	
GEAR OPER	140 KTS
GEAR DOWN	199 KTS

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 . . . . 85 KIAS
- Wing Flaps Down . . . . 80 KIAS

Maneuvering Speed:
- 3800 Lbs . . . . 119 KIAS
- 3150 Lbs . . . . 108 KIAS
- 2500 Lbs . . . . 96 KIAS

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

Precautionary Landing With Engine Power . . . . 75 KIAS

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

OPERATIONAL CHECKLISTS

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF RUN

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

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

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

ENGINE FAILURE DURING FLIGHT

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

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

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

PRECAUTIONARY LANDING WITH ENGINE POWER

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

7. Airspeed -- 75 KIAS.
8. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
9. Avionics Power and Master Switches -- OFF when landing is assured.
10. Touchdown -- SLIGHTLY TAIL LOW.
11. Ignition Switch -- OFF.
12. Brakes -- APPLY HEAVILY.

DITCHING

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

NOTE

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

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

FIRES

DURING START ON GROUND

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

If engine starts:

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

If engine fails to start:

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

NOTE

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

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

ENGINE FIRE IN FLIGHT

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

ELECTRICAL FIRE IN FLIGHT

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

WARNING

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

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

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

CABIN FIRE

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

WARNING

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

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

WING FIRE

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

NOTE

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

ICING

INADVERTENT ICING ENCOUNTER

1. Turn pitot heat switch ON (if installed).
2. Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
3. Pull cabin heat and defrost controls full out to obtain maximum windshield defroster effectiveness.
4. Increase engine speed to minimize ice build-up on propeller blades. If excessive vibration is noted, momentarily reduce engine speed to 2200 RPM with the propeller control, and then rapidly move the control full forward.

NOTE

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

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

NOTE

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

6. If icing conditions are unavoidable, plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
7. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for a significantly higher power requirement, approach speed, stall speed, and landing roll.
8. Open the window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
9. Use a 10° to 20° landing flap setting for ice accumulations of 1 inch or less. With heavier ice accumulations, approach with flaps retracted to ensure adequate elevator effectiveness in the approach and landing.
10. Approach at 85 to 95 KIAS with 20° flaps and 95 to 105 KIAS with 0° to 10° flaps, depending upon the amount of ice accumulation. If ice accumulation is unusually large, decelerate to the planned approach speed while in the approach configuration (landing gear and flaps down) at a high enough altitude which would permit recovery in the event that a stall buffet is encountered.

11. Land on the main wheels first, avoiding the slow and high type of flare-out.
12. Missed approaches should be avoided whenever possible because of severely reduced climb capability. However, if a go-around is mandatory, make the decision much earlier in the approach than normal. Apply maximum power and maintain 95 KIAS while retracting the flaps slowly in 10° increments. Retract the landing gear after immediate obstacles are cleared.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

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

LANDING GEAR MALFUNCTION PROCEDURES

LANDING GEAR FAILS TO RETRACT

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

LANDING GEAR FAILS TO EXTEND

1. Landing Gear Lever -- DOWN.
2. Emergency Hand Pump -- EXTEND HANDLE, and PUMP (perpendicular to handle until resistance becomes heavy -- about 65 cycles).

NOTE

It takes about 55 cycles (110 strokes) to extend the gear (light on) and about 10 more (until resistance becomes heavy) to close the gear doors.

3. Gear Down Light -- ON.

NOTE

If the landing gear still does not extend, attempt another manual extension with the avionics power and master switches turned off to eliminate any possible electrical malfunctions. After extension, turn the avionics power and master switches back on to check that the gear-down indicator light is illuminated.

4. Pump Handle -- STOW

GEAR UP LANDING

1. Landing Gear Lever -- UP.
2. Landing Gear and Gear Pump Circuit Breakers -- IN.
3. Runway -- SELECT longest hard surface or smooth sod runway available.
4. Wing Flaps -- 30° (on final approach).
5. Airspeed -- 75 KIAS.
6. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Touchdown -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel Selector Valve -- OFF.
12. Airplane -- EVACUATE.

LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

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

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

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

NOTE

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

5. Wing Flaps -- 30°.

6. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Land -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel Selector Valve -- OFF.
12. Elevator Control -- HOLD NOSE OFF GROUND as long as possible.
13. Airplane -- EVACUATE as soon as it stops.

LANDING WITH A FLAT MAIN TIRE

1. Approach -- NORMAL (full flap).
2. Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.
3. Directional Control -- MAINTAIN using brake on good wheel as required.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

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.

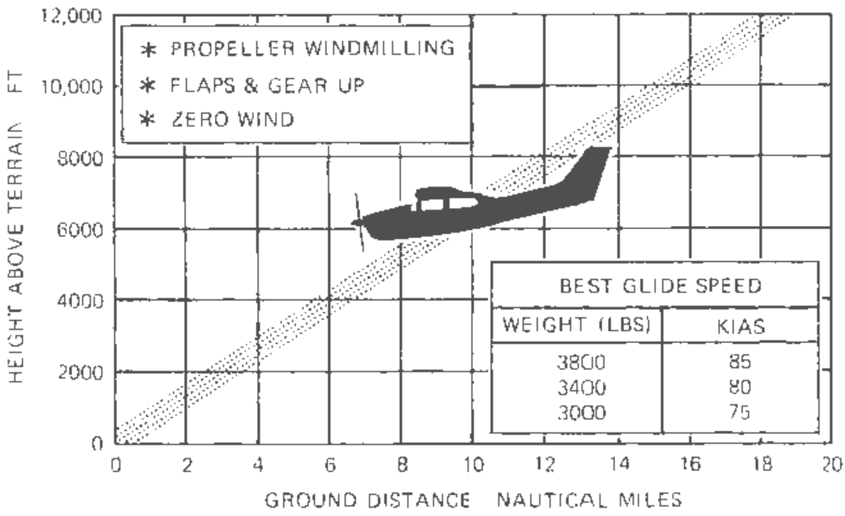
AMPLIFIED PROCEDURES

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.



BEST GLIDE SPEED	
WEIGHT (LBS)	KIAS
3800	85
3400	80
3000	75

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.

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

LANDING WITHOUT ELEVATOR CONTROL

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

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

FIRES

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

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

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

EMERGENCY OPERATION IN CLOUDS

(Vacuum System Failure)

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

EXECUTING A 180° TURN IN CLOUDS

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

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

EMERGENCY DESCENT THROUGH CLOUDS

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

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

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

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

FLIGHT IN ICING CONDITIONS

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

STATIC SOURCE BLOCKED

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

NOTE

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

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

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

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

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

SPINS

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

1. RETARD THROTTLE TO IDLE POSITION.
2. PLACE AILERONS IN NEUTRAL POSITION.
3. APPLY AND HOLD FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.

4. JUST **AFTER** THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL **BRISKLY** FORWARD FAR ENOUGH TO BREAK THE STALL. Full down elevator may be required at aft center of gravity loadings to assure optimum recoveries.
5. **HOLD** THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
6. AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

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

ROUGH ENGINE OPERATION OR LOSS OF POWER

SPARK PLUG FOULING

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

MAGNETO MALFUNCTION

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

ENGINE-DRIVEN FUEL PUMP FAILURE

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

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

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

LOW OIL PRESSURE

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

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

LANDING GEAR MALFUNCTION PROCEDURES

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

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

RETRACTION MALFUNCTIONS

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

EXTENSION MALFUNCTIONS

Normal landing gear extension time is approximately 11 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and master switch and repeat the normal extension procedures at a reduced airspeed of 100 KIAS. The landing gear lever must be in the down position with the detent engaged. If efforts to extend and lock the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completely lost) by use of the emergency hand pump. The hand pump is located between the front seats.

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

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

GEAR UP LANDING

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

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

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

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two 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 possibilities, an over-voltage sensor will automatically shut down the alternator and the over-voltage warning light will illuminate if the charge voltage reaches approximately 30 to 31 volts. Assuming that the malfunction was only momentary, an attempt should be made to reactivate the alternator system. To do this, turn 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 comes on again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. If the emergency occurs at night, power must be conserved for later operation of the landing gear and wing flaps and possible use of the landing lights during landing.

INSUFFICIENT RATE OF CHARGE

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

SECTION 4
NORMAL PROCEDURES

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AMPLIFIED PROCEDURES

INTRODUCTION

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

SPEEDS FOR NORMAL OPERATION

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

Takeoff:
- Normal Climb Out . . . . 80-90 KIAS
- Short Field Takeoff, Flaps 10°, Speed at 50 Feet . . . . 71 KIAS

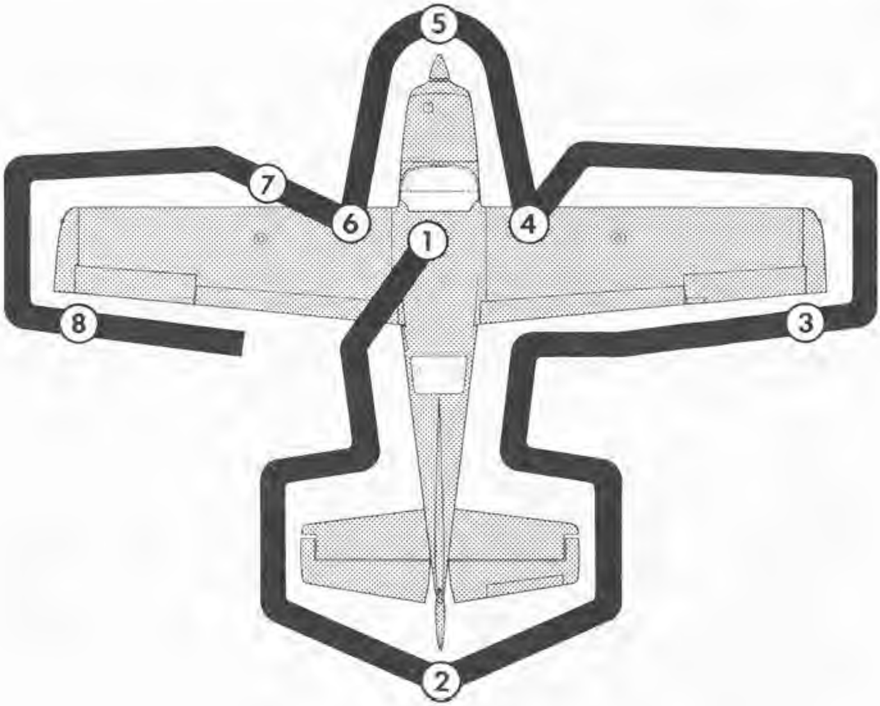
Enroute Climb, Flaps and Gear Up:
- Normal . . . . 100-110 KIAS
- Best Rate of Climb, Sea Level . . . . 97 KIAS
- Best Rate of Climb, 10,000 Feet . . . . 90 KIAS
- Best Angle of Climb, Sea Level . . . . 79 KIAS
- Best Angle of Climb, 10,000 Feet . . . . 80 KIAS

Landing Approach:
- Normal Approach, Flaps Up . . . . 80-90 KIAS
- Normal Approach, Flaps 30° . . . . 70-80 KIAS
- Short Field Approach, Flaps 30° . . . . 71 KIAS

Balked Landing:
- Maximum Power, Flaps 20° . . . . 70 KIAS

Maximum Recommended Turbulent Air Penetration Speed:
- 3800 Lbs . . . . 119 KIAS
- 3150 Lbs . . . . 108 KIAS
- 2500 Lbs . . . . 96 KIAS

Maximum Demonstrated Crosswind Velocity:
- Takeoff or Landing . . . . 21 KNOTS



NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. 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. Ignition Switch -- OFF.
4. Radar (if installed) -- OFF.
5. Avionics Power Switch -- OFF.
6. Master Switch -- ON.
7. Fuel Quantity Indicators -- CHECK QUANTITY.
8. Master Switch -- OFF.
9. Fuel Selector Valve -- ON fuller tank.
10. Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
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 for freedom of movement and security.
2. Fuel Tank Vent at Wing Tip Trailing Edge -- CHECK for stoppage.

(4) RIGHT WING

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

(5) NOSE

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

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

(6) LEFT WING

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

(7) LEFT WING Leading Edge

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

(8) LEFT WING Trailing Edge

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

BEFORE STARTING ENGINE

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

CAUTION

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

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

STARTING ENGINE

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

NOTE

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

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

BEFORE TAKEOFF

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

9. Throttle -- 1700 RPM.
   a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
   b. Propeller -- CYCLE from high to low RPM; return to high RPM (full forward).
   c. Engine Instruments and Ammeter -- CHECK.
   d. Suction Gage -- CHECK in green arc.
10. Avionics Power Switch -- ON.
11. Radios -- SET.
12. Autopilot (if installed) -- OFF.
13. Flashing Beacon, Navigation Lights and/or Strobe Lights -- ON as required.
14. Throttle Friction Lock -- ADJUST.
15. Parking Brake -- RELEASE.

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps -- 0°- 10° (10° preferred).
2. Power -- FULL THROTTLE and 2850 RPM.
3. Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
4. Elevator Control -- LIFT NOSE WHEEL at 60 to 70 KIAS.

NOTE

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

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

SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Brakes -- APPLY.
3. Power -- FULL THROTTLE and 2850 RPM.
4. Mixture -- RICH (lean for field elevation per fuel flow placard above 3000 feet).
5. Brakes -- RELEASE.
6. Elevator Control -- SLIGHTLY TAIL-LOW.
7. Climb Speed -- 71 KIAS until all obstacles are cleared.

8. Landing Gear -- RETRACT after obstacles are cleared.
9. Wing Flaps -- RETRACT after reaching 80 KIAS.

NOTE

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

ENROUTE CLIMB

NORMAL CLIMB

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

MAXIMUM PERFORMANCE CLIMB

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

CRUISE

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

DESCENT

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

BEFORE LANDING

1. Seats, Belts, Shoulder Harnesses -- SECURE.
2. Fuel Selector Valve -- FULLER TANK.
3. Landing Gear -- EXTEND (below 140 KIAS).
4. Landing Gear -- CHECK (observe main gear down and green indicator light on).
5. Mixture -- RICH.
6. Propeller -- HIGH RPM.
7. Wing Flaps -- AS DESIRED (0° to 10° below 150 KIAS, 10° to 30° below 115 KIAS).
8. Autopilot (if installed) -- OFF.
9. Elevator Trim -- ADJUST.

LANDING

NORMAL LANDING

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

SHORT FIELD LANDING

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

BALKED LANDING

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

AFTER LANDING

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

SECURING AIRPLANE

1. Parking Brake -- SET.
2. Avionics Power Switch, Electrical Equipment -- OFF.
3. Mixture -- IDLE CUT-OFF (pulled full out).
4. Ignition Switch -- OFF.
5. Master Switch -- OFF.
6. Control Lock -- INSTALL.

AMPLIFIED PROCEDURES

STARTING ENGINE

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

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

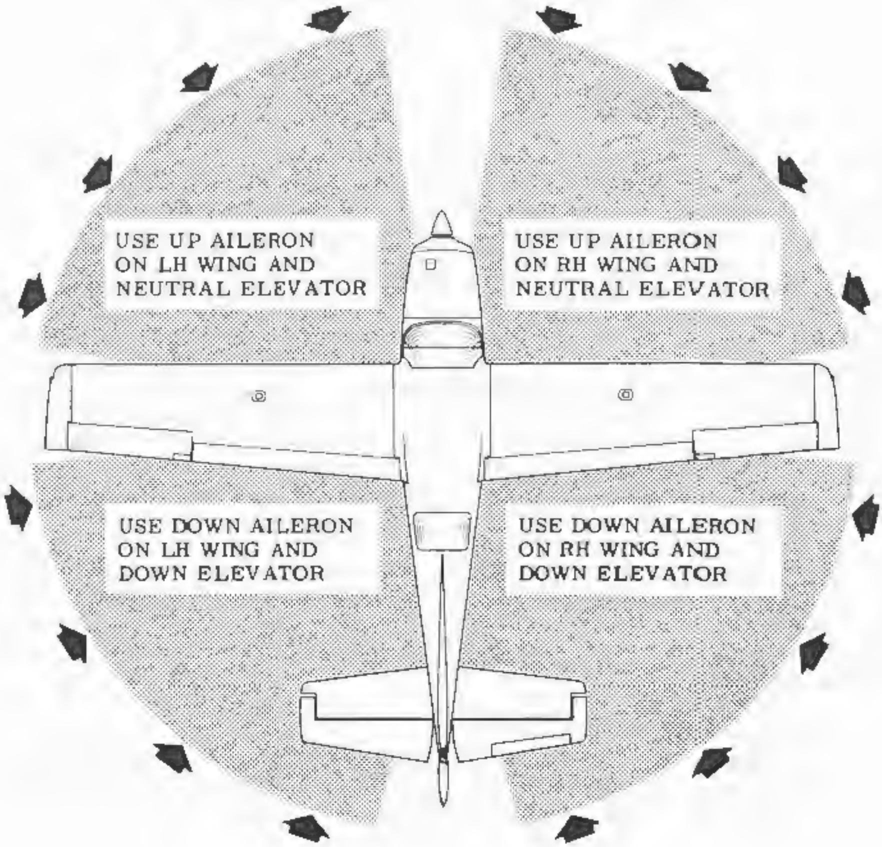
When the engine is hot or outside air temperatures are high, the engine may die after running several seconds because the mixture became either too lean due to fuel vapor, or too rich due to excessive prime fuel. The following procedure will prevent over-priming and alleviate fuel vapor in the system:

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

NOTE

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

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



CODE

WIND DIRECTION ➧

NOTE

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

Figure 4-2. Taxiing Diagram

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

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

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

TAXIING

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

BEFORE TAKEOFF

WARM-UP

Since the engine is closely cowled for efficient in-flight cooling, precautions should be taken to avoid overheating on the ground. Full throttle checks on the ground are not recommended unless the pilot has good reason to suspect that the engine is not turning up properly.

MAGNETO CHECK

The magneto check should be made at 1700 RPM as follows. Move ignition switch first to R position and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to the L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 150 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

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

ALTERNATOR CHECK

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

TAKEOFF

POWER CHECK

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

Full power runups over loose gravel are especially harmful to propeller tips. When takeoffs must be made over a gravel surface, it is very important that the throttle be advanced slowly. This allows the airplane to start rolling before high RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it.

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

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

WING FLAP SETTINGS

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

SHORT FIELD TAKEOFF

If an obstruction dictates the use of a steep climb angle, after liftoff accelerate to and climb out at an obstacle clearance speed of 71 KIAS with 10° flaps and gear extended. This speed provides the best overall climb speed to clear obstacles when taking into account the turbulence often found near ground level. The takeoff performance data in Section 5 is based on this speed and configuration.

CROSSWIND TAKEOFF

Takeoffs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. With the ailerons deflected partially into the wind, the airplane is accelerated to a speed higher than normal, and then pulled off abruptly to prevent possible settling back to the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

LANDING GEAR RETRACTION

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

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

ENROUTE CLIMB

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

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

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

If an obstruction dictates the use of a steep climb angle, climb with flaps retracted and maximum continuous power at 79 KIAS at sea level to 80 KIAS at 10,000 feet.

CRUISE

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

NOTE

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

The Cruise Performance Table, figure 4-3, illustrates the advantage of higher altitude on both true airspeed and nautical miles per gallon. In addition, the beneficial effect of lower cruise power on nautical miles per gallon at a given altitude can be observed. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip. The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

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

For best fuel economy at 65% power or less, the engine should be operated at six pounds per hour leaner than shown in this handbook and on

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

Figure 4-3. Cruise Performance Table

the power computer. This will result in approximately 6% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

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

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

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

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

Figure 4-4. EGT Table

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

NOTE

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

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

STALLS

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

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

BEFORE LANDING

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

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

LANDING

NORMAL LANDING

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

Actual touchdown should be made with power off and on the main wheels first to reduce the landing speed and subsequent need for braking in the landing roll. The nose wheel is lowered to the runway after the speed diminished to avoid unnecessary nose gear load. This procedure is especially important in rough or short field landings.

SHORT FIELD LANDING

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

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

CROSSWIND LANDING

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

BALKED LANDING

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

COLD WEATHER OPERATION

The use of an external pre-heater and an external power source is recommended whenever possible to reduce wear and abuse to the engine and the electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of the master switch is important. Refer to Section 7, paragraph Ground Service Plug Recepticle, for operating details.

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

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

NOISE ABATEMENT

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

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

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

NOTE

The above recommended procedures do not apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's 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 210M at 3800 pounds maximum weight is 79.9 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

INTRODUCTION

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

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

USE OF PERFORMANCE CHARTS

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

SAMPLE PROBLEM

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

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

TAKEOFF

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

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

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

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

This results in the following distances, corrected for wind:

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

CRUISE

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

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

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

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

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

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

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

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

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 shows that a normal climb from 2000 feet to 8000 feet at a weight of 3800 pounds requires 18 pounds of fuel. The corresponding distance during the climb is 18 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	18
Increase due to non-standard temperature (18 × 16%)	3
Corrected fuel to climb	21 Pounds

Using a similar procedure for the distance during climb results in 21 nautical miles.

The resultant cruise distance is:

Total distance	860
Climb distance	-21
Cruise distance	839 Nautical Miles

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

168
-10
158 Knots

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

$$\frac{839 \text{ Nautical Miles}}{158 \text{ Knots}} = 5.3 \text{ Hours}$$

The fuel required for cruise is:

$$5.3 \text{ hours} \times 82 \text{ pounds/hour} = 435 \text{ Pounds}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	12
Climb	21
Cruise	435
Total fuel required	468 Pounds

This will leave a fuel reserve of:

$$\begin{array}{r} 534 \\ -468 \\ \hline 66 \text{ Pounds} \end{array}$$

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

LANDING

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

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

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

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

FLAPS UP								
KIAS	60	80	100	120	140	160	180	190
KCAS	62	80	99	118	137	156	175	185
FLAPS 10°								
KIAS	60	70	80	90	100	120	140	150
KCAS	62	71	80	90	100	119	138	147
FLAPS 30°								
KIAS	50	60	70	80	90	100	110	115
KCAS	59	66	74	83	92	101	110	115

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

AIRSPEED CALIBRATION
ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP								
NORMAL KIAS	60	80	100	120	140	160	180	190
ALTERNATE KIAS	61	82	103	125	146	167	187	198
FLAPS 10°								
NORMAL KIAS	60	70	80	90	100	120	140	150
ALTERNATE KIAS	63	73	83	94	105	126	148	159
FLAPS 30°								
NORMAL KIAS	50	60	70	80	90	100	110	115
ALTERNATE KIAS	60	69	79	89	99	109	119	124

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP								
NORMAL KIAS	60	80	100	120	140	160	180	190
ALTERNATE KIAS	58	78	101	123	144	164	184	195
FLAPS 10°								
NORMAL KIAS	60	70	80	90	100	120	140	150
ALTERNATE KIAS	61	70	80	91	101	123	144	155
FLAPS 30°								
NORMAL KIAS	50	60	70	80	90	100	110	115
ALTERNATE KIAS	55	67	77	86	96	106	116	121

WINDOWS OPEN

FLAPS UP								
NORMAL KIAS	60	80	100	120	140	160	180	190
ALTERNATE KIAS	43	72	101	130	152	174	195	207
FLAPS 10°								
NORMAL KIAS	60	70	80	90	100	120	140	150
ALTERNATE KIAS	49	62	74	88	101	129	156	172
FLAPS 30°								
NORMAL KIAS	50	60	70	80	90	100	110	115
ALTERNATE KIAS	43	58	71	84	96	107	113	124

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

TEMPERATURE CONVERSION CHART

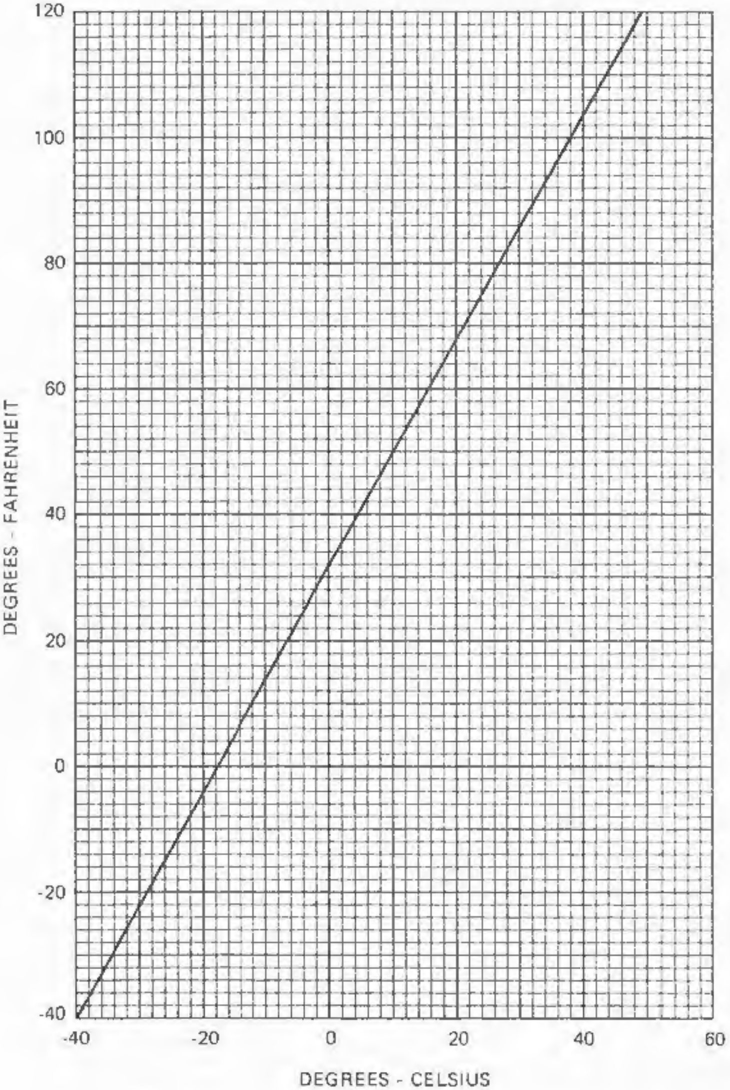


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off
Gear Up or Down

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

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0^o		30^o		45^o		60^o	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3800	UP	64	65	69	70	76	77	91	92
	10^o	62	64	67	69	74	76	88	91
	30^o	46	56	49	60	55	67	65	79

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0^o		30^o		45^o		60^o	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3800	UP	68	69	73	74	81	82	96	98
	10^o	67	68	72	73	80	81	95	96
	30^o	55	61	59	66	65	73	78	86

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE
MAXIMUM WEIGHT 3800 LBS

SHORT FIELD

CONDITIONS:
Flaps 10°
2850 RPM, 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	PPH
S.L.	144
2000	138
4000	132
6000	126
8000	120

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

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
3800	65	71	S.L.	1120	1820	1205	1960	1295	2105	1390	2265	1495	2440
			1000	1225	2005	1320	2155	1420	2320	1525	2505	1640	2705
			2000	1345	2210	1445	2380	1555	2570	1675	2785	1800	3020
			3000	1475	2450	1585	2645	1710	2865	1840	3110	1980	3390
			4000	1620	2725	1745	2955	1880	3210	2025	3505	2180	3840
			5000	1785	3055	1925	3325	2075	3630	2235	3990	2410	4415
			6000	1970	3455	2125	3780	2290	4160	2470	4615	2665	5185
			7000	2180	3950	2350	4365	2540	4860	2740	5485	- - -	- - -
			8000	2415	4595	2610	5155	- - -	- - -	- - -	- - -	- - -	- - -

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

TAKEOFF DISTANCE
3500 LBS AND 3200 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
3500	62	68	S.L.	925	1495	990	1605	1065	1720	1145	1845	1225	1980
			1000	1010	1640	1085	1760	1165	1885	1250	2030	1340	2180
			2000	1105	1800	1185	1930	1275	2080	1370	2235	1470	2410
			3000	1210	1980	1300	2130	1400	2295	1505	2475	1615	2680
			4000	1325	2190	1425	2360	1535	2550	1650	2755	1775	2990
			5000	1460	2430	1570	2625	1690	2845	1820	3090	1960	3365
			6000	1605	2715	1730	2940	1865	3195	2005	3490	2160	3825
			7000	1770	3050	1910	3320	2060	3630	2220	3990	2395	4415
			8000	1960	3460	2115	3790	2280	4175	2460	4640	2655	5215
3200	60	65	S.L.	755	1220	810	1305	865	1395	930	1490	995	1595
			1000	820	1330	880	1425	945	1525	1015	1635	1090	1750
			2000	895	1455	965	1560	1035	1670	1110	1790	1190	1925
			3000	980	1595	1055	1710	1135	1835	1215	1970	1305	2120
			4000	1075	1755	1155	1880	1240	2025	1335	2180	1435	2350
			5000	1180	1935	1270	2080	1365	2240	1470	2415	1580	2610
			6000	1300	2140	1395	2305	1500	2490	1615	2695	1740	2920
			7000	1430	2380	1540	2575	1655	2785	1785	3025	1920	3295
			8000	1575	2665	1700	2885	1830	3140	1970	3425	2125	3755

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	PPH
S.L.	138
4000	126
8000	114
12,000	102

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
3800	S.L	97	1115	1020	925	830
	2000	95	995	900	810	720
	4000	94	870	785	700	615
	6000	92	750	670	585	505
	8000	91	635	555	475	395
	10,000	90	520	440	365	- - -
	12,000	88	405	330	255	- - -
3500	S.L.	95	1255	1160	1060	960
	2000	93	1125	1035	940	845
	4000	92	1000	910	820	730
	6000	91	870	785	705	620
	8000	89	745	665	585	505
	10,000	88	625	550	470	- - -
	12,000	87	505	430	355	- - -
3200	S.L.	93	1415	1315	1215	1110
	2000	92	1275	1185	1085	990
	4000	90	1140	1050	960	865
	6000	89	1010	920	835	750
	8000	87	875	795	710	630
	10,000	86	745	670	590	- - -
	12,000	85	620	545	470	-

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

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

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

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

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED POUNDS	DISTANCE NM
3800	S.L.	97	950	0	0	0
	2000	95	850	2	5	4
	4000	94	755	5	10	8
	6000	92	655	8	16	13
	8000	91	560	11	23	18
	10,000	90	460	15	30	25
	12,000	88	360	20	39	34
3500	S.L.	95	1085	0	0	0
	2000	93	980	2	4	3
	4000	92	880	4	9	7
	6000	91	775	7	14	11
	8000	89	670	9	19	15
	10,000	88	565	13	26	21
	12,000	87	465	17	32	28
3200	S.L.	93	1240	0	0	0
	2000	92	1130	2	4	3
	4000	90	1020	4	8	6
	6000	89	910	6	12	9
	8000	87	800	8	17	13
	10,000	86	690	11	22	17
	12,000	85	580	14	27	23

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

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 100 KIAS

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

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

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

WEIGHT LBS	PRESS ALT FT	RATE OF CLIMB FPM	FROM SEA LEVEL		
			TIME MIN	FUEL USED POUNDS	DISTANCE NM
3800	S.L.	670	0	0	0
	2000	670	3	5	5
	4000	660	6	11	10
	6000	560	9	17	16
	8000	455	13	23	23
	10,000	355	18	31	33
	12,000	255	25	41	46
3500	S.L.	780	0	0	0
	2000	780	3	5	4
	4000	770	5	9	9
	6000	665	8	14	14
	8000	555	11	20	20
	10,000	445	15	26	28
	12,000	340	21	33	38
3200	S.L.	910	0	0	0
	2000	910	2	4	4
	4000	900	4	8	7
	6000	785	7	12	12
	8000	665	10	17	17
	10,000	550	13	22	23
	12,000	435	17	28	31

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

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

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

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

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

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

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

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

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

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

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

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

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

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

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

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

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

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

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

RANGE PROFILE
45 MINUTES RESERVE
534 LBS. USABLE FUEL

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

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

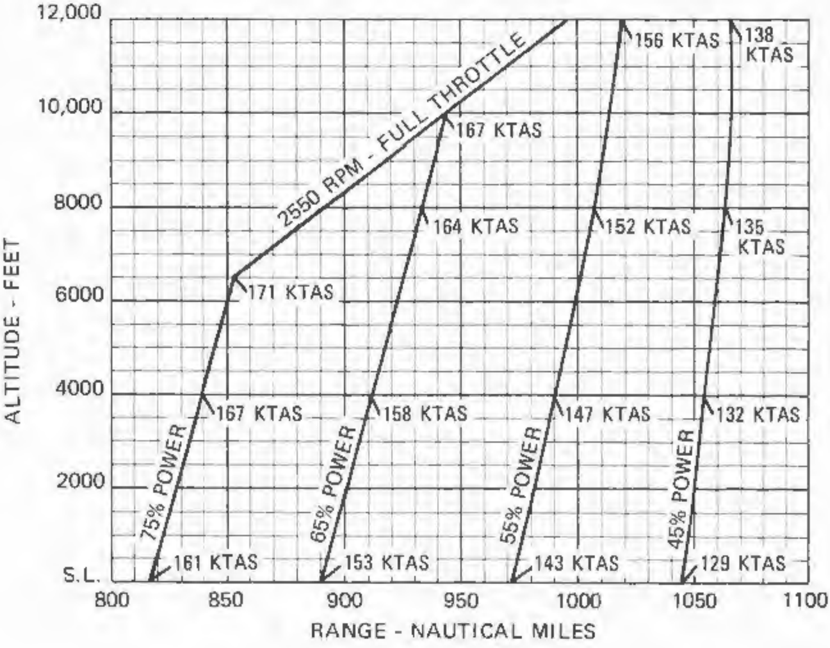


Figure 5-8. Range Profile

ENDURANCE PROFILE
45 MINUTES RESERVE
534 LBS. USABLE FUEL

CONDITIONS:
3800 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

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

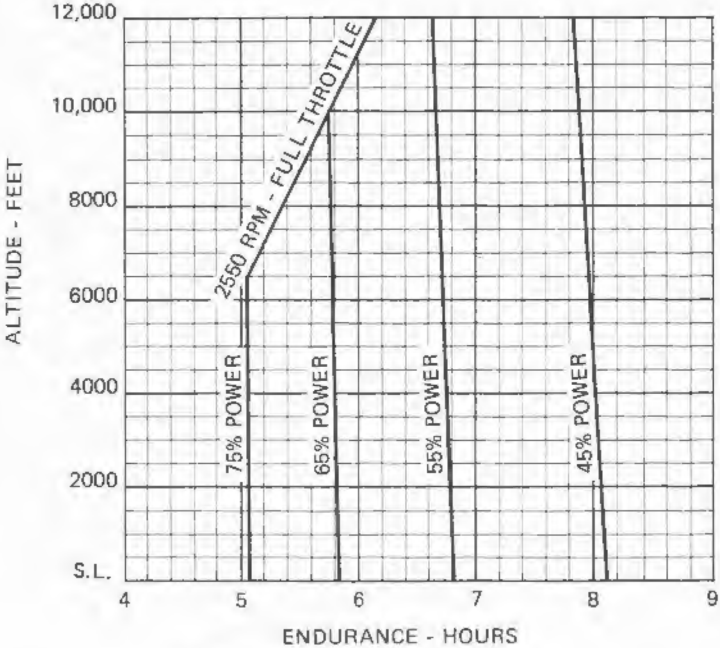


Figure 5-9. Endurance Profile

LANDING DISTANCE

SHORT FIELD

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

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

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

Figure 5-10. Landing Distance

SECTION 6
WEIGHT & BALANCE/ EQUIPMENT LIST

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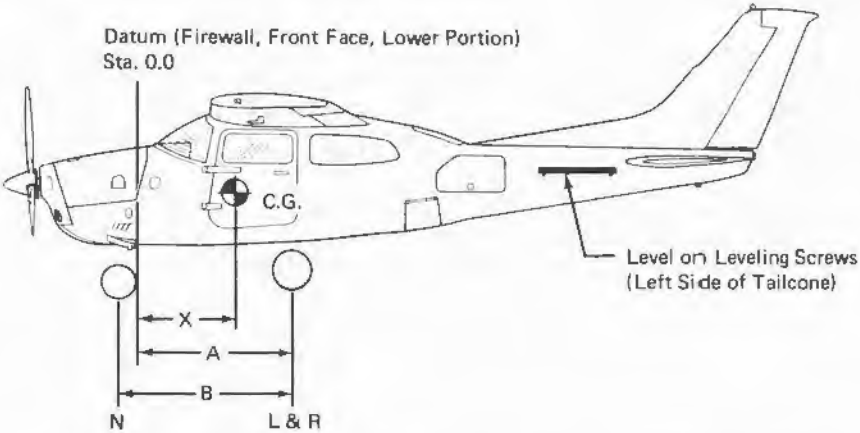
INTRODUCTION

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

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

AIRPLANE WEIGHING PROCEDURES

1. Preparation:
   a. Inflate tires to recommended operating pressures.
   b. Remove the fuel tank sump quick-drain fittings and fuel reservoir quick-drain fittings to drain all fuel.
   c. Remove oil sump drain plug to drain all oil.
   d. Move sliding seats to the most forward position.
   e. Raise flaps to the fully retracted position.
   f. Place all control surfaces in neutral position.
2. Leveling:
   a. Place scales under each wheel (minimum scale capacity, 1000 pounds).
   b. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level (see figure 6-1).
3. Weighing:
   a. With the airplane level and brakes released, record the weight shown on each scale. Deduct the tare, if any, from each reading.
4. Measuring:
   a. Obtain measurement A by measuring horizontally (along the airplane center line) from a line stretched between the main wheel centers to a plumb bob dropped from the firewall.
   b. Obtain measurement B by measuring horizontally and parallel to the airplane center line, from center of nose wheel axle, left side, to a plumb bob dropped from the line between the main wheel centers. Repeat on right side and average the measurements.
5. Using weights from 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.



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

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

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

Figure 6-1. Sample Airplane Weighing

SAMPLE WEIGHT AND BALANCE RECORD

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

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

Figure 6-2. Sample Weight and Balance Record

WEIGHT AND BALANCE

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

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

NOTE

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

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

NOTE

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

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

BAGGAGE TIE-DOWN

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

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

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

LOADING ARRANGEMENTS

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

**Baggage area center of gravity.

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

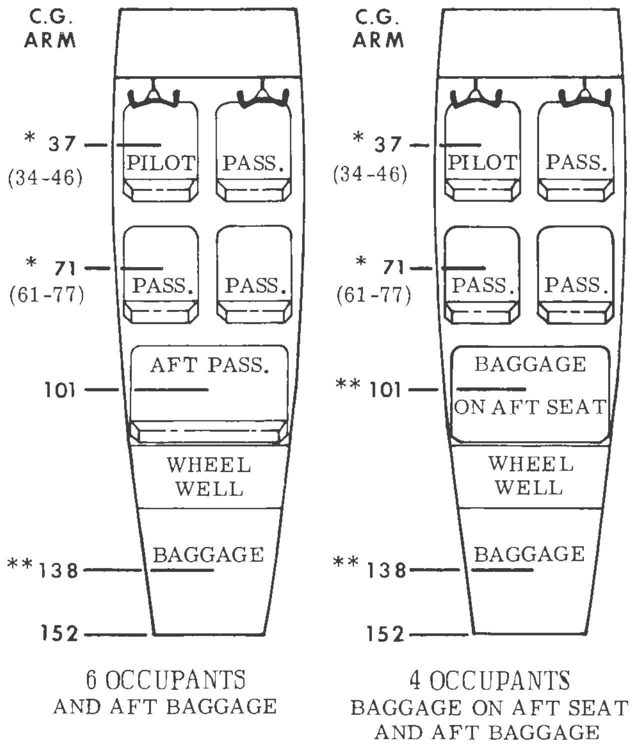
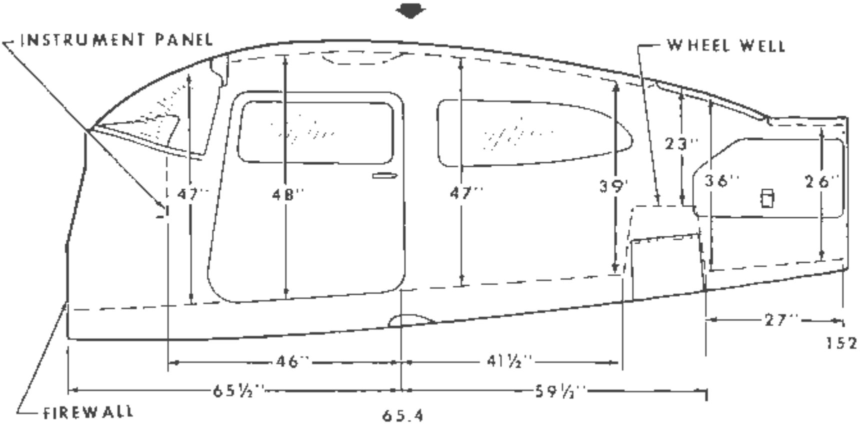


Figure 6-3. Loading Arrangements

CABIN HEIGHT MEASUREMENTS



DOOR OPENING DIMENSIONS

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

═══ WIDTH ═══
● LWR WINDOW LINE
* CABIN FLOOR

CABIN WIDTH MEASUREMENTS

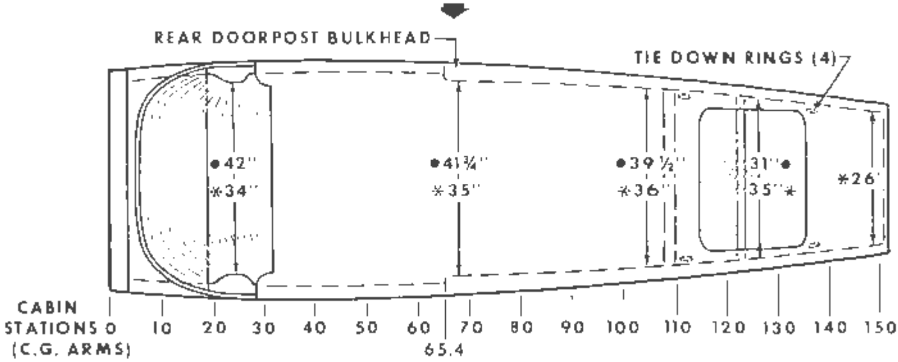
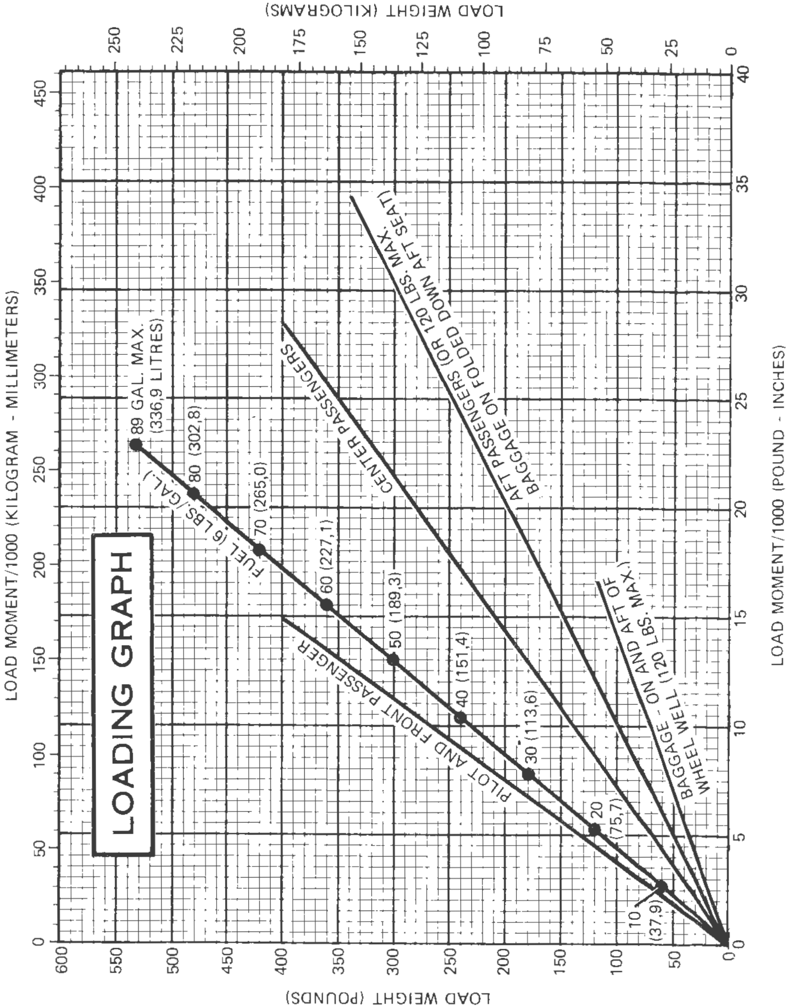


Figure 6-4. Internal Cabin Dimensions

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil) . . .	2288	92.9		
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (89 Gal. Maximum) . .				
Reduced Fuel (64 Gal.) . .	384	16.5		
3. Pilot and Front Passenger (Station 34 to 46) .	340	12.6		
4. Center Passengers (Station 61 to 77)	340	24.1		
5. Aft Passengers	340	34.3		
6. Baggage - Forward of wheel well on folded down aft seat (Station 89 to 110) (120 lbs. max.) .				
7. Baggage - On and aft of wheel well (Station 110 to 152) (120 lbs. max.)	120	16.6		
8. RAMP WEIGHT AND MOMENT	3812	197.0		
9. Fuel allowance for engine start, taxi and runup	-12	.5		
10. TAKEOFF WEIGHT AND MOMENT (Subtract step 9 from step 8)	3800	196.5		
11. Locate this point (3800 at 196.5) on the Center of Gravity Moment Envelope. Since this loading falls within the shaded area of the moment envelope, proceed with steps 12, 13 and 14. If the computed loading point falls within the clear area of the moment envelope, no further steps are required and the loading is assumed satisfactory for take-off and landing.				
12. Estimated Fuel Burn-Off (Climb and Cruise) (38 gallons at 6 lbs./gal.)	-228	9.8		
13. Subtract step 12 from step 10 for estimated airplane landing weight	3572	186.7		
14. Locate this point (3572 at 186.7) on the Center of Gravity Moment Envelope. Since this point falls within the overall envelope, the loading may be assumed acceptable for landing.				

Figure 6-5. Sample Loading Problem



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

Figure 6-6. Loading Graph

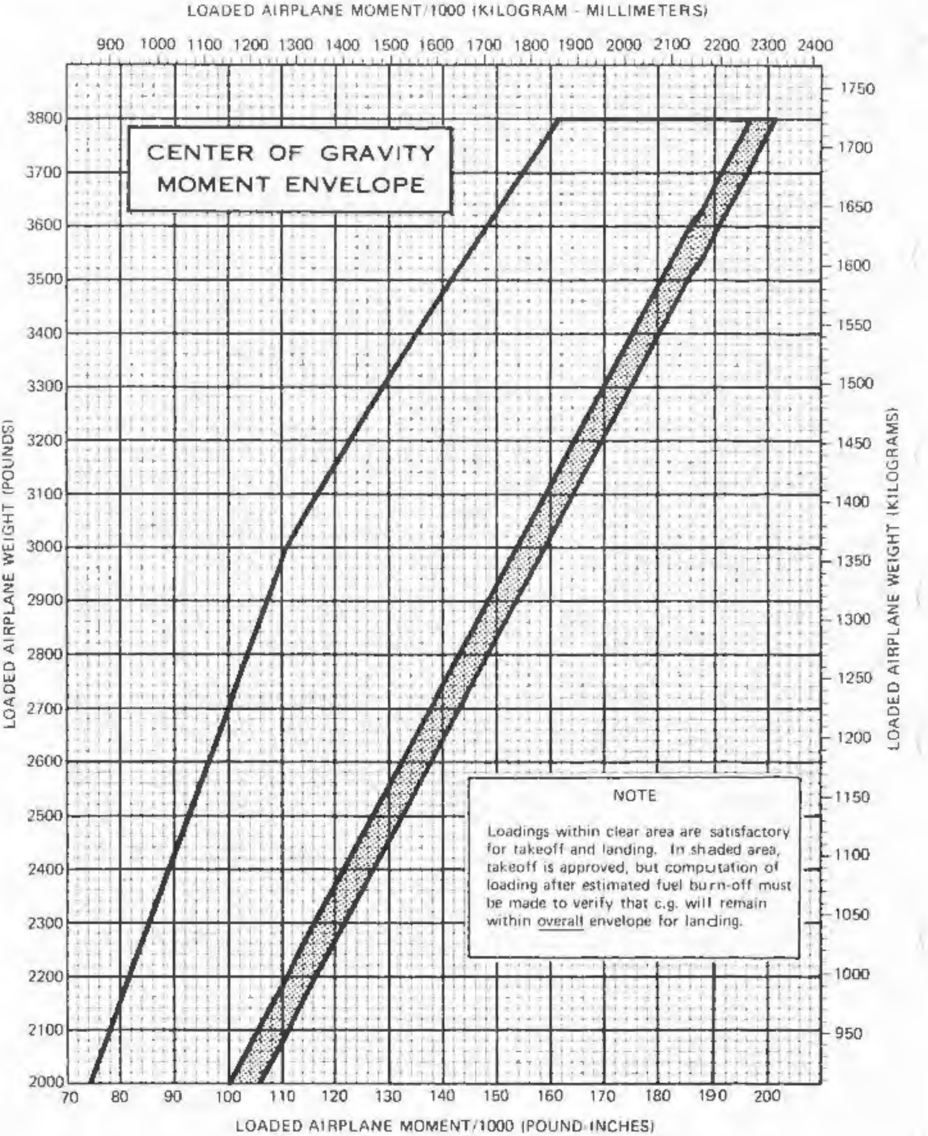


Figure 6-7. Center of Gravity Moment Envelope

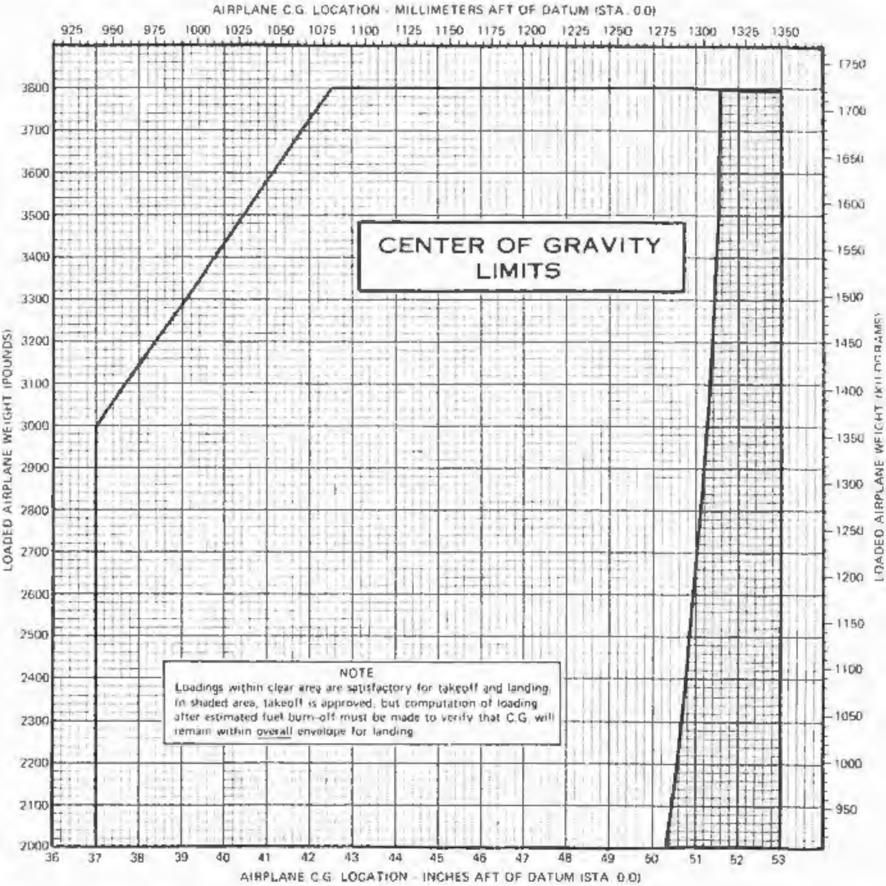


Figure 6-8. Center of Gravity Limits

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, CONTINENTAL IO-520-L SPEC 4	1250601	455.4*	-17.5*
	TWO MAGNETOS WITH IMPULSE COUPLINGS	SLICK 662	12.9	-12.5
	OIL COOLER MOUNTING PROVISIONS	EG5968	2.3	-32.5
	OIL COOLER, HARRISON 8526732	TCM 626139	5.3	-32.5
	TWELVE 18MM X 3/4 2C-3A SPARK PLUGS	SL 350	3.0	-19.5
	STARTER, 24 VOLT PRESTOLITE	TCM 639171	17.8	-5.0
A05-R	FILTER, ENGINE AIR INDUCTION	1250704	1.0	-9.5
A09-R	ALTERNATOR, 28 VOLT, 60 AMP	C611503-0102	11.5	-6.0
A09-O	ALTERNATOR INSTALLATION, NET CHANGE	1601021-2	6.4*	-4.3*
	ALTERNATOR, 95 AMP 28 VOLT	C611505-0101	15.8	-5.5
A17-O	OIL COOLER, NON-CONGEALING-MODINE	TCM 639171	2.3	-32.5
	REPLACES A01-R OIL COOLER AND CHANGES			
	ENGINE DESIGNATION TO IO-520-L SPEC 3			
	(NET CHANGE)			
A21-A	FILTER, FULL FLOW ENGINE OIL	0750606-9	4.5*	-5.0*
	ENGINE ADAPTER ASSY	1250922-1	2.0	-5.3
	FILTER CAN ASSEMBLY, AC 6436992	C294505-0101	1.8	-4.8
	FILTER ELEMENT KIT, AC 6435683	C294505-0102	0.3	-4.8
A33-R	PROPELLER, 3 BLADE MCCAULEY	C161007-0102	73.0	-44.0
	MODEL NO.--D34C4C2/90DFA-10			
A37-R	PROP GOVERNOR (WOODWARD 210462 OR	C161040-0108	3.0	-35.5
	MCCAULEY C290-D4/T4)	C161032-0102	3.0	-35.5
A41-R	SPINNER, PROPELLER	1250419	3.5	-44.5
A61-A	VACUUM SYSTEM, ENGINE DRIVEN PUMP	1201144	5.6*	1.1*
	VACUUM PUMP (AV. OF 4 TYPES)	C431003	2.8	-3.7
	RELIEF VALVE	C482001-0501	0.6	2.3
	MISC HOSES, CLAMPS & ETC.		1.8	4.6
A70-A	PRIMING SYSTEM, MANIFOLD 2 POINT	2101010	1.3	4.1
	B. LANDING GEAR & ACCESSORIES			
B01-R-1	WHEEL, BRAKE & TIRE ASSY, 600X6 MAIN (2)	1241156-134	40.4*	64.4*
	WHEEL ASSY, CLEVELAND 40-75B (EACH)	C163001-0301	6.2	64.0
	BRAKE ASSY, CLEVELAND 30-52 (LEFT)	C163030-0304	2.8	66.5
	BRAKE ASSY, CLEVELAND 30-52 (RIGHT)	C163030-0303	2.8	66.5
	TIRE, 8 PLY RATED (EACH)	C262003-0208	9.2	64.0
	TUBE (EACH)	C262023-0102	1.8	64.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
B01-R-2	WHEEL, BRAKE& TIRE ASSY, 600X6 MAIN (2)	C16301630115	42.2*	64.4*
	WHEEL ASSY, MCCAULEY	C163004-0102	7.1	64.0
	BRAKE ASSY (LEFT)	C163032-0206	3.0	66.5
	BRAKE ASSY (RIGHT)	C163032-0205	3.0	66.5
	TIRE, 8 PLY RATED (EACH)	C262003-0208	9.2	64.0
	TUBE (EACH)	C262023-0102	1.8	64.0
B04-R-1	WHEEL AND TIRE ASSY 500X5 NOSE (CLEVELAND)	C16301880107	9.0*	-7.4*
	WHEEL ASSY, CLEVELAND 40-77	1241156-12	2.8	-7.4
	TIRE, 6 PLY RATED	C262003-0202	5.0	-7.4
	TUBE	C262023-0101	1.2	-7.4
B04-R-2	WHEEL AND TIRE ASSY, 500X5 NOSE (MCCAULEY)	C16301880103	8.3*	-7.4*
	WHEEL ASSY	C163005-0201	2.4	-7.4
	TIRE, 6 PLY RATED	C262003-0202	4.7	-7.4
	TUBE	C262023-0101	1.2	-7.4
	C. ELECTRICAL SYSTEMS			
C01-R-1	BATTERY, 24 VOLT, 14 AMP HR	0870060-1	27.0	3.0
C01-R-2	BATTERY, 24 VOLT, 14 AMP HR	C614001-0101	22.8	3.0
C01-O	BATTERY, 24 VOLT, 17 AMP HR	C614001-0102	24.8	3.0
C04-R	REGULATOR, 28 VOLT ALTERNATOR	C611002-0105	0.5	3.0
C07-A	GROUND SERVICE PLUG RECEPTACLE	1270652	2.0	-4.5
C19-O	HEATING SYSTEM, STALL SENSOR & PITOT HEAD (NET CHANGE)	1201093-1	0.4	43.4
	ICING CONDATION KIT)			
C22-A	LIGHT INSTL., INSTRUMENT POST (SET OF 18)	2101009	0.5	18.5
C23-A	LIGHTS, INSTRUMENT PANEL, ELECTROLUMINES	2101009-5	2.3	17.5
C25-A	LIGHT INSTALLATION, CONTROL WHEEL MAP	1260243	0.1	22.5
C31-A	COURTESY LIGHTS, WING UNDERSIDE (SET OF 2)	1221103	0.5	51.4
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF 2)	1221201	NEGL	- -
C43-A	LIGHT INSTALLATION, OMNIFLASH BEACON	1201049	1.6*	226.0*
	BEACON LIGHT IN FIN TIP	C621001	0.4	253.0
	FLASHER POWER SUPPLY (IN FIN TIP)	C594502-0101	0.7	253.1
C46-A	LIGHT INSTL, WING TIP STROBE	1201129	3.6*	38.9*
	FLASHING POWER SUPPLY	C622004-0101	2.3	39.9
	STROBE LIGHTS IN WING TIP (SET OF 2)	C622003-0104	0.2	38.7
C49-S	LIGHTS, COWL MOUNTED LANDING & TAXI	1213401	2.0*	-28.5*
	LIGHT BULBS (SET OF 2)	GE 4591	1.0	-31.5
C61-A	LIGHT INSTALLATION, ICE DETECTOR (WING)	1201100	0.6	9.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	D. INSTRUMENTS			
D01-R	INDICATOR, AIRSPEED	C661064-0218	1.0	17.0
D01-O	TRUE AIR SPEED INDICATOR	1201108	1.0	17.0
D04-A	INSTRUMENT AIR ALTERNATE STATIC SOURCE	1201032	0.3	15.5
D07-R	ALTIMETER, SENSITIVE	C661071-0101	1.0	16.0
D07-O-1	ALTIMETER, SENSITIVE-FEET & MILLIBARS	C661071-0102	1.0	16.0
D07-O-2	ALTIMETER, SENSITIVE (35,000 FT, 20 FT MARKINGS)	C661025-0102	1.0	16.0
D10-A	ALTIMETER, 2ND INSTRUMENT (R.H. SIDE)	2101013	1.1	15.5
D16-A-1	ALTIMETER, ENCODING (REQUIRES RELOCATION OF REGULAR ALTIMETER)	2101013	3.0	14.0
D16-A-2	ALTIMETER, ENCODING (REQUIRES RELOCATION OF REGULAR ALTIMETER)(FEET & MILLIBARS)	2101013	3.0	14.0
D16-A-3	ALTIMETER, ENCODER, BLIND (INSTRUMENT PANEL MOUNTING NOT REQUIRED)	2101011-1	1.5*	13.6*
	ENCODER	C744001-0101	1.3	15.5
D25-S	ELECTRIC CLOCK	C664508-0101	0.4	16.5
D38-R	GAGE, FUEL QUANTITY, (IN LOWER PEDISTAL)	C669525-0101	0.5	20.0
D41-R	GAGE, CYLINDER HEAD & OIL TEMPERATURE	C669526-0101	0.5	17.2
D43-R	GAGE, AMMETER & OIL PRESSURE	C669527-0101	0.5	17.2
D49-A	INDICATOR,INSTALLATION, ECONOMY MIXTURE	1200677	0.7*	0.9*
	EGT INDICATOR, ALCOR 202-2AY	C668501-0211	0.4	17.3
	THERMOCOUPLE LEAD WIRE (IC)	C668501-0206	0.1	-0.3
	THERMOCOUPLE PROBE, ALCOR 01-005-1A44	C668501-0204	0.1	-18.0
D55-R	GAGE, MANIFOLD PRESSURE & FUEL FLOW	C662037-0201	1.0	16.5
D64-A-1	GYRO INSTL, NON ALTO-PILOT	2101021	6.0*	14.0*
	HEADING INDICATOR	C661075-0101	3.0	14.3
	ATTITUDE INDICATOR	C661076-0103	2.1	15.3
D64-A-2	GYRO INSTALLATION FOR NON-SLAVED HSI		3.0*	13.7*
	ATTITUDE INDICATOR	C661076	2.1	15.3
	MISC ITEMS		0.9	10.0
D64-A-3	GYRO INSTL, CESSNA 300A NAV-O-MATIC	2101001	6.3*	14.0*
	ATTITUDE INDICATOR	C661076-0103	2.1	15.3
	HEADING INDICATOR (DG) (ARC)	40760-0104	3.3	14.3
D64-A-4	GYRO INSTL, CESSNA NAV-O-MATIC 400 AND 400B NON SLAVED HEADING INDICATOR	2101001	6.5*	14.0*
	ATTITUDE INDICATOR	37570-1011	2.3	15.3
	DIRECTIONAL INDICATOR	40760-0104	3.3	14.3
D64-A-5	GYRO INSTALLATION, CESSNA NAV-O-MATIC 400 AND 400B SLAVED HEADING INDICATOR	2101001	6.2*	13.6*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ATTITUDE INDICATOR (HG)	37570-0105	2.1	14.5
	DIRECTIONAL INDICATOR (DG)	44760-0000	3.4	14.0
D64-A-6	GYRO INSTALLATION, CESSNA 400B NAV-O-MATIC WITH HSI	1201077-3	3.1*	13.9*
	HORIZON GYRO	37570-0105	2.3	15.3
	MISC GYRO ITEMS		0.8	9.7
D64-A-7	GYRO INSTALLATION FOR CESSNA 400B IFCS	2101001	9.0*	13.9*
	ADI GYRO	44670-0000	3.5	14.5
	HSI GYRO	44690-0000	4.8	14.0
	MISC GYRO ITEM		0.8	10.0
D64-A-8	GYRO INSTL FOR NON SLAVED HSI SYSTEM USED WITH 400B AUTOPILOT, ITEM H31-A11		3.2*	13.7*
	ATTITUDE INDICATOR	37570-0105	2.3	15.3
D67-A	HOURMETER INSTALLATION	2100010	0.5	9.8
D82-S	GAGE, OUTSIDE AIR TEMPERATURE	C668507-0101	0.1	26.5
D85-R	TACHOMETER, RECORDING	C668020-0107	1.0	16.5
D88-S-1	INDICATOR, TURN COORDINATOR (24 VOLT ONLY)	C661003-0505	1.3	16.8
D88-S-2	INDICATOR, TURN COORDINATOR (12/24 VOLT)	C661003-0506	1.3	16.8
D88-O-1	INDICATOR, TURN COORDINATOR (FOR USE WITH NAV-O-MATIC 200A AND 300A)	42320-0028	1.9	15.0
D88-O-2	INDICATOR, TURN AND BANK	S-1303-2	2.0	16.0
D91-S	RATE OF CLIMB INDICATOR	C661080-0101	1.0	17.0
	E. CABIN ACCOMMODATIONS			
E01-A	ARM RESTS (2) 1ST ROW REMOVABLE INBOARD	1214121-2	1.5	37.0
E02-A	ARM RESTS (2) 2ND ROW REMOVABLE INBOARD	1214121-2	1.5	71.0
E05-R	SEAT, PILOT, INFINATE VERTICAL ADJUSTING	1214128-1	18.5	44.0
E05-O	SEAT, PILOT ARTICULATING VERTICAL ADJUST WITH LUMBAR SUPPORT	1214128-7	24.1	39.5
E07-S	SEAT, CO-PILOT FIXED HEIGHT CUSHION	1214128-3	18.5	44.0
E07-O-1	SEAT, CO-PILOT FIXED HEIGHT, ARTICULATING CUSHION, LUMBAR SUPPORT	1214128-9	19.3	44.0
E07-O-2	SEAT, CO-PILOT VERTICAL ADJUSTING, ARTICULATING CUSHION	1214128-2	23.3	39.5
E07-O-3	SEAT CO-PILOT VERTICAL ADJUSTING, ARTICULATING CUSHION W/LUMBAR SUPPORT	1214128-6	24.1	39.5
E09-S	SEATS, TWO 2ND ROW INDIVIDUAL	1214129-18 -2	35.3	73.0
E11-S	SEAT, TWO PLACE 3RD ROW BENCH	1214130-1	22.6	104.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	NOTE THE ABOVE SEATING IS ALSO OFFERED WITH LEATHER COVER PER CES-1156, NET WEIGHT AND ARM CHANGE IS 6LBS @ 73.1 IN			
E15-R	SEAT BELT ASSY, PILOT	S2275-103	1.0	37.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S2275-201	0.6	37.0
E19-A	INERTIA REEL INSTALLATION -1ST ROW	1201057	0.6	145.3
	SEAT BELT & SHOULDER HARNESS NET CHANGE			
E23-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S2275-3	1.6	37.0
E27-S	BELT ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S-1746-25	2.0	71.0
E27-O-1	BELT & SHOULDER HARNESS ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S2275-5	3.2	71.0
E29-S	BELT ASSY, 3RD ROW OCCUPANTS (SET OF 2)	S-1746	2.0	101.0
E29-O	BELT & HARNESS ASSY 3RD ROW	S-2275	3.2	101.0
E37-A	OPENABLE WINDOW, RH CABIN DOOR, NET CHANGE	0701065-5	2.3	47.0
E47-A	OXYGEN SYSTEM, 74 CU. FT. CAPACITY	1200246-2	58.3*	57.1*
	4 BOTTLES (EMPTY), 3 VALVES 1 REGULATOR	C166001	45.2	56.4
	OXYGEN MASKS-1PILOT & 5 PASSENGERS	C166005	1.5	67.2
	74 CUFT OXYGEN (1800 PSI) @ 0.0832 LBS PER CU FT		6.2	56.4
E49-A-1	BEVERAGE CUP HOLDER, RETRACTABLE, PILOT	1201124-1	0.1	16.0
E49-A-2	BEVERAGE CUP HOLDER, RETRACTABLE, CO-PILOT	1201124-1	NIL	16.0
E50-A	HEADREST, FRONT ROW (EACH)	1215073	0.9	48.0
E51-A	HEADREST, 2ND ROW (EACH)	1215073	0.9	82.0
E52-A	HEADREST, 3RD ROW (EACH)	1215073	0.9	112.0
E53-A	MIRROR, REAR VIEW	1201041	0.3	17.0
E59-A	APPROACH PLATE HOLDER	1515151-1	0.1	22.0
E65-S	BAGGAGE TIE DOWN NET	1215042-1	0.7	138.0
E75-A	STRETCHER INSTL., CUSTOM-AIR (BOXED)(USE ACTUAL INSTALLED WEIGHT & ARM CHANGE) (NOT FACTORY INSTALLED)	0700164-8	- -	- -
E85-A	CONTROLS INSTALLATION, DUAL	1260004-6	8.1	13.7
	RIGHT SIDE WHEEL, PEDAL & TOE BRAKES	- -		
E87-A	ELEVATOR ELECTRIC TRIM INSTALLATION	1260671-1	4.1*	216.7*
	VOLTAGE REGULATOR	C611003-0101	0.2	215.2
	DRIVE ACTUATOR ASSY	1260153-1	3.3	220.0
E89-O	CONTROL WHEEL, ALL PURPOSE (NET CHANGE)	1260243	NEGL	- -
E93-R	CABIN HEATING AND ENGINE EXHAUST SYSTEM	1250500	18.0	-11.0
	F. PLACARDS & WARNING			

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
F01-R	PLACARD, OPERATIONAL LIMITATIONS VFR, DAY	1205104-10	NEGL	- -
F01-O-1	PLACARD, OPERATIONAL LIMITATIONS VFR, DAY-NIGHT	1205104-11	NEGL	- -
F01-O-2	PLACARD, OPERATIONAL LIMITATIONS IFR, DAY-NIGHT	1205104-12	NEGL	- -
F07-R	STALL & GEAR WARNING BLACKBOX (REQUIRES ITEM H61-R FOR AUDIBLE OPERATION)	1270733-2	0.5	41.0
F10-S	PILOTS CHECK LIST (STOWED)	D 6023	- -	- -
	G. AUXILIARY EQUIPMENT			
G04-A	TOW HOOK (INSTALLED ARM SHOWN) (NOT FACTORY INSTALLED)	0712643	0.5	231.0
G07-A	HOISTING RINGS, AIRPLANE (NOT FACTORY INSTALLED)	1200190	1.0	38.5
G13-A	CORROSION PROOFING, INTERNAL	1260100	8.0	70.0
G16-A	STATIC DISCHARGERS INSTALLATION (SET OF 10	1201131	0.4	130.5
G19-A	STABILIZER ABRASION BOOTS	0500041-2	2.7	202.0
G22-S	TOW BAR, AIRPLANE (STOWED)	0501019	1.6	138.0
G22-O	TOW BAR, AIRPLANE, TELESCOPING HANDLE (STOWED ARM SHOWN)		2.0	
G25-S	PAINT, OVERALL EXTERIOR (MODIFIED POLY-URETHANE)	1201032	13.0*	92.7*
	OVERALL BASE WHITE		11.7	91.5
	COLORED STRIPE		1.3	103.7
G28-S	JACK PADS, STOWED (INSTALLED ARM SHOWN	1200028	0.2	54.9
G31-O	CONTROL CABLES, CORROSION RESISTANT (NET CHANGE)	1260475	NEGL	- -
G55-A	FIRE EXTINGUISHER, HAND TYPE	0701014	3.0	35.0
G67-A	EXTENSIONS, RUDDER PEDAL, REMOVABLE, SET OF 2 (STOWABLE - INSTALLED ARM SHOWN, NOT FACTORY INSTALLED)	0701048	2.3	8.0
G76-A	DEICE SYSTEM, WING AND STABILIZER (REQUIRES VACUUM SYSTEM INSTALLATION)	1201030-5	22.4	52.6
G79-A	DEICE SYSTEM, 3 BLADE PROPELLER	1201072-1	4.4	-25.1
G82-A	WINDSHIELD ANTI-ICE SYSTEM	1201060-2	2.1*	9.2*
	REMOVABLE HEATING PANEL (INSTALLED ARM SHOWN)	1513460-5	1.9	9.0
G88-A	WINTERIZATION KIT INSTALLATION-ENGINE	1200702	0.9*	-27.6*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	BREATHER TUBE INSULATION	1200101-200	0.5	-22.0
	COWL INLET AIR COVERS (INSTALLED) (2)	1200702-48 -5	0.3	-36.7
	H. AVIONICS & AUTOPILOTS			
H01-A-1	CESSNA 300 ADF 546E	3910159-10	7.6*	26.4*
	R-546E RECEIVER (WITH BFO)	41240-0101	3.1	12.5
	IN-346A INDICATOR	40980-1001	0.9	16.0
	300 MOUNT & WIRING	3930147	1.7	18.2
	LOOP ANTENNA INSTALLATION	41000-1001	1.4	50.0
	SENSE ANTENNA INSTALLATION	3960115-2	0.3	131.8
H01-A-2	CESSNA 400 ADF (446A) WITH BFO	3910160-8	8.0*	25.7*
	R-446A RECEIVER (WITH DUAL TUNERS)	43090-1128	3.5	12.5
	IN-346A INDICATOR	40980-1001	0.9	16.0
	ADF PARTIAL 400 MOUNT AND CABLES	3930147	1.7	18.2
	LOOP ANTENNA INSTALLATION	41000-1001	1.4	50.0
	SENSE ANTENNA INSTALLATION	3960115-2	0.3	131.8
H01-A-3	DUAL CESSNA 300 ADF'S	3910159-17	15.3*	26.4*
	R-546E RECEIVERS (2)	41240-0101	6.2	12.5
	IN-346A INDICATORS (2)	40980-1001	1.8	16.0
	ADF MOUNTING PROVISIONS (2)		3.4	18.2
	LOOP ANTENNAS (2)	41000-1001	2.8	50.0
	SENSE ANTENNAS (2)	3960115	0.6	131.8
	SWITCH INSTALLATION, 2ND ADF	3970129-1	0.1	17.5
H01-A-4	DUAL CESSNA 400 ADF	3910160-14	16.1*	25.7*
	R-446A RECEIVERS (2)	43090-1128	7.0	12.5
	IN-346A INDICATORS (2)	40980-1001	1.8	16.0
	ADF MOUNTING PROVISIONS (2)		3.4	18.2
	LOOP ANTENNAS (2)	41000-1001	2.8	50.0
	SENSE ANTENNA (2)	3960115	0.6	131.8
	SWITCH INSTALLATION 2ND ADF	3970129-1	0.1	17.5
H03-A	AM-FM STEREO & CASSETTE RECEIVER/PLAYER INSTL. WITH 2 HEADSETS		5.3*	31.7*
	RECEIVER/TAPE PLAYER		2.4	15.0
	HEADSETS (2 USED HERE)(4 MAY BE USED)		2.0	37.0
H04-A	CESSNA 400 DME WITH 300 & 400 NAV/COM	3910167	16.3*	122.0*
	RT-476 CONTROL UNIT	44020-1100	1.6	14.0
	RTA-476A REMOTE TRANSCEIVER UNIT	44000	8.5	173.4
	ANTENNA	42940	0.2	36.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H05-A	CESSNA 400 R-NAV SYSTEM (USED WITH 300 OR 400 SERIES NAV/COM) NET CHANGE	3910168	4.2*	11.1*
	RN-478 AREA NAV COMPUTER	44100-1100	3.8	12.0
	COMPUTER MOUNT	44091	1.3	12.0
	IN-442AR VOR/LOC INDICATOR	43910-1000	1.3	15.0
	REGULAR VOR/LOC INDICATOR DELEATED		-2.2	15.5
H07-A-1	CESSNA 400 GLIDESLOPE WITH IN-386A ILS INDICATOR (IND. WT NET CHANGE)	3910157	4.4*	74.4*
	RECEIVER (R-443B)	42100-0000	2.1	99.3
	ANTENNA INSTALLATION, WINDSHIELD MTD	3960119-5	0.3	29.3
	VOR/ILS INDICATOR (WT NET CHANGE FOR VOR/LOC, ACTUAL WT IS 2.3 LBS.)	46860-2000	0.1	15.5
H07-A-2	CESSNA 400 GLIDESLOPE WITH IN-486AC ILS INDICATOR (IND. WT NET CHANGE)	3970157	4.4*	74.4*
	RECEIVER (R-443B)	42100-0000	2.1	99.3
	ANTENNA INSTALLATION, WINDSHIELD MTD	3960119-5	0.3	29.3
	VOR/ILS INDICATOR (WT NET CHANGE FOR VOR/LOC, ACTUAL WT IS 2.3 LBS.)		0.1	15.5
H09-A-1	NON-SLAVED HSI INSTALLATION (USED WITH H31-A10, 300A AUTOPILOT)		4.3*	43.8*
	NON SLAVED HSI INDICATOR (ID-832C)	44690-2000	4.5	15.0
	HSI CONVERTER	47240-0000	0.9	100.0
	VOR/LOC INDICATOR REPLACED		-2.2	15.5
H09-A-2	SLAVED HSI SYSTEM		5.3*	47.8*
	HSI INDICATOR (IG-832A)	44690-0000	4.7	14.0
	HSI CONVERTER	41790-0000	1.7	100.0
	VOR/LOC INDICATOR REPLACED		-2.2	15.5
H11-A-1	PANTRONICS PT10-A HF TRANSCEIVER 2ND & 3RD	3910156-30,-31	20.6*	81.5*
	PT10-A TRANSCEIVER CONTROL	C582103-0101	4.2	12.3
	PT10-PS-28 REMOTE POWER SUPPLY	C582103-0301	8.5	102.6
	DX10-RL-28 ANTENNA LOAD BOX	C589502-0201	4.5	116.0
	WIRING & CABLE ASSEMBLIES	3950129	2.5	51.3
	H.F. ANTENNA INSTL	3960117-1	0.4	173.4
H11-A-2	SUNAIR ASB 125 SINGLE SIDE BAND HF TRANS-CEIVER 2ND & 3RD UNIT	3910158-19,-20	23.7*	82.3*
	ANTENNA LOAD BOX	99816	4.9	116.0
	TRANSCEIVER	99681	5.3	11.7
	POWER SUPPLY & SHOCK MOUNT	99916	9.2	102.6
	HF ANTENNA INSTL.	3960117-1	0.4	173.4
	WIRING & CABLE ASSEMBLIES	3950129	3.4	78.5
H13-A	CESSNA 400 MARKER BEACON	3910164-10	2.5*	97.5*
	REMOTE RECEIVER, R-402A	42410-5128	0.7	11.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ANTENNA INSTALLATION, FLUSH MTD IN TAIL	3960126-2	0.9	201.0
H15-A	WEATHER RADAR INSTALLATION (BENDIX RD-160)		21.9*	30.6*
	INDICATOR (VIEWING SCREEN, IN-152A)	4000946-5201	5.1	12.2
	RADAR ANTENNA-TRANSCEIVER (ART-161)	4001018-6101	9.3	34.4
	RADOME & WING POD ASSY	1570366	4.5	43.9
	MISC ITEMS, INCLUDING ELECTRICAL CABLES		3.0	30.1
H16-A-1	CESSNA 300 TRANSPONDER (359A) LOW ALTITUDE	3910127-22	3.6*	14.8*
	RT-359A TRANSCEIVER	41420-1128	2.7	11.5
	ANTENNA (A-119)	42940-0000	0.2	60.5
H16-A-2	CESSNA 400 TRANSPONDER (459A)	3910128-16	3.7*	14.8*
	RT-459A TRANSCEIVER	41470-1128	2.7	11.5
	ANTENNA (A-119)	42940-0000	0.2	60.5
H22-A-1	CESSNA 300 NAV/COM 720 CH COM	3910183	14.5*	31.0*
	RECEIVER/TRANSCEIVER (RT-385A)	46660-0000	5.4	12.5
	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	15.5
	H34-A BASIC AVIONICS KIT	3910186-11	5.7	58.9
	MOUNT, WIRING & MISC HARDWARE	1270708-704	1.2	10.7
H22-A-2	CESSNA 400 NAV/COM 1ST UNIT W/300 SERIES	3910183	14.5*	31.0*
	VOR/LOC INDICATOR			
	RECEIVER-TRANSCEIVER (RT-485A)	47360-1100	5.4	12.5
	VOR/ILS INDICATOR (IN-385A)	46360-1000	2.2	15.5
	H37-A BASIC AVIONICS KIT	3910186-11	5.7	58.9
	MOUNT, WIRING & MISC HARDWARE		1.2	10.7
H22-A-3	CESSNA 400 NAV/COM 720 CH COM 1ST UNIT	3910183	14.5*	31.0*
	RECEIVER-TRANSCEIVER (RT-485A)	43340-1124	5.4	12.5
	VOR/LOC INDICATOR (IN-485AC)	46870-1300	2.2	15.5
	H34-A BASIC AVIONICS KIT	3910186-11	5.7	58.9
	MOUNT, WIRING & MISC HARDWARE		1.2	10.7
H25-A-1	CESSNA 300 NAV/COM 720 CH COM 2ND UNIT	3910183	10.1*	16.5*
	RECEIVER-TRANSCEIVER (RT-385A)	46660-0000	5.4	12.5
	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	15.5
	H37-A ANTENNA & COUPLER KIT	3910185	1.3	40.3
	MOUNT, WIRING & MISC ITEMS	3940192-2	1.2	10.7
H25-A-2	CESSNA 400 NAV/COM 2ND UNIT W/300 SERIES	3910183	10.1*	16.5*
	VOR/LOC INDICATOR			
	RECEIVER-TRANSCEIVER (RT-485A)	47360-1100	5.4	12.5
	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	15.5
	H37-A ANTENNA & COUPLER KIT	3910185	1.3	40.3
	MOUNT, WIRING & MISC HARDWARE	3960111-1	1.2	10.7
H25-A-3	CESSNA 400 NAV/COM 2ND UNIT W/400 SERIES	3910183	10.1*	16.5*
	VOR/LOC INDICATOR			
	RECEIVER-TRANSCEIVER (RT-485A)	47360-1100	5.4	12.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	VOR/LOC INDICATOR (IN-485AC)	46870-1300	2.2	15.5
	F37-A ANTENNA & COUPLER KIT	3910185	1.3	40.3
	MOUNT, WIRING & MISC HARDWARE		1.2	10.7
	NOTE--WITH THE 300 SERIES INDICATOR-VOR/ LOC AUTOMATIC RADIAL CENTERING MAY BE EXCHANGED FOR THE STANDARD IND- ICATOR, WT CHANGE IS NEGL.			
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	0470419-15	1.8*	159.0*
	TRANSMITTER D & M DMELT-6	C589511-0101	1.6	160.1
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA)	0470419-16	1.8*	159.0*
	TRANSMITTER (D & M DMELT-6C)	C589511-0102	1.6	160.1
H31-A-1	NAV-O-MATIC 200A	3910162-16	7.7*	43.2*
	CONTROLLER AND MOUNT	3930144-7	1.6	13.5
	C88-C-1 TURN COORDINATOR (NET CHANGE)	42320-0028	0.6	11.1
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
H31-A-2	NAV-O-MATIC 300A INSTALLATION	3910163-16	21.2*	15.3*
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
	CONTROLLER AMPLIFIER (C-395A)	3930145-7	1.8	13.5
	C64-A-3 GYRO INSTALLATION	2101001	6.3	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
	C88-C-1 TURN COORDINATOR (NET CHANGE)	42320-0028	0.6	11.1
H31-A-3	CESSNA 400 AUTOPILOT, NON SLAVED GYROS	1200202-5	32.2*	52.4*
	AILERON ROLL ACTUATOR (PA-500A)	35070-1028	3.2	57.2
	ELEVATOR PITCH ACTUATOR (PA-500A)	35070-1128	3.2	154.0
	CONTROLLER (C-420A)	41540-1128	1.4	16.5
	COMPUTER-AMPLIFIER (CA-520B)	35910-1528	5.5	100.0
	C64-A-4 NON-SLAVED GYRO SYSTEM	2101001	6.5	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
H31-A-4	CESSNA 400 AUTOPILOT, SLAVED GYROS		34.9*	50.6*
	AILERON ROLL ACTUATOR (PA-500A)	35070-1028	3.2	57.7
	ELEVATOR PITCH ACTUATOR (PA-500A)	35070-1128	3.2	154.0
	CONTROLLER (C-420A)	41540-1128	1.4	16.5
	COMPUTER-AMPLIFIER (CA-520B)	35910-1528	5.5	100.0
	C64-A-5 GYRO SYSTEM, SLAVED	2101001	9.2	18.5
H31-A-6	CESSNA 400B NAV-O-MATIC, NON-SLAVED HEADING INDICATOR	390177-1	45.6*	76.3*
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37960-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	100.0

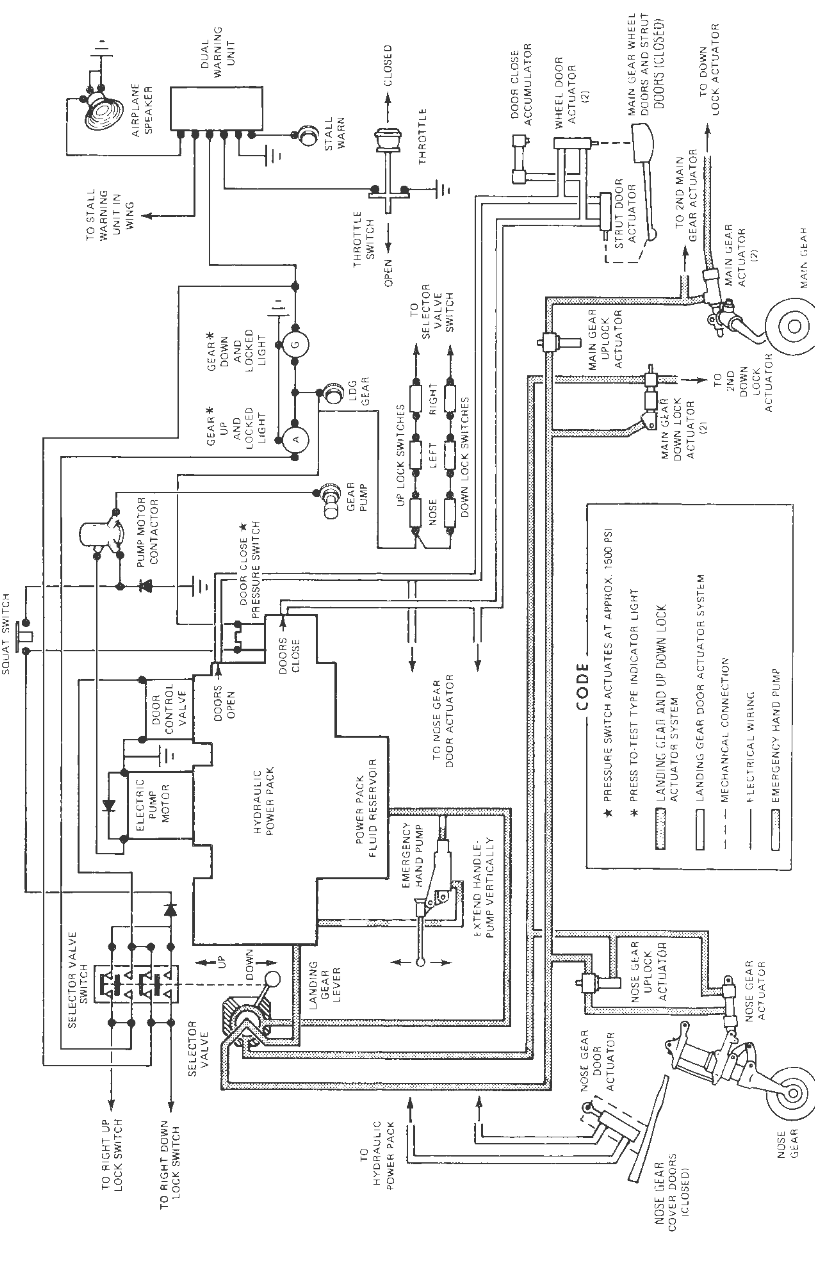
ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ALTITUDE SENSOR	44400-0000	2.3	157.3
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	C64-A-4 GYRO, NON-SLAVED	2101001	6.5	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
H31-A-7	CESSNA 400B NAV-O-MATIC, SLAVED HEADING INDICATOR	3910177-3	49.6*	72.8*
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37960-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	100.0
	ALTITUDE SENSOR	44400-0000	2.3	100.0
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	C64-A-5 GYRO SYSTEM, SLAVED DIR. GYRO	2101001	6.2	13.6
	VACUUM SYSTEM (A61-A)	1201052	5.6	1.1
	GYRO SLAVING SYSTEM, INCLUDING CABLES		4.3	40.1
H31-A-8	CESSNA 400B NAV-O-MATIC WITH HSI (SLAVED)	3910177-5	49.0*	73.7*
	AILERON ROLL ACTUATOR (PA495-2)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37970-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	100.0
	ALTITUDE SENSOR	44400-0000	2.3	100.0
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	VACUUM SYSTEM (A61-A)	1201052	5.6	1.1
	ATTITUDE INDICATOR	37570-1001	2.1	14.5
	GYRO SLAVING SYSTEM, INCLUDING CABLES		4.3	40.1
	FC9-A-2 SLAVED HSI INSTALLATION	44690-0000	5.3	47.8
H31-A-9	CESSNA 400B IFCS W/SLAVED HSI	3910178-1	55.4*	70.3*
	CESSNA 400B IFCS W/ALTITUDE ALERT OPTION		59.4*	66.5*
	CONTROLLER	41090-1128	1.3	16.5
	MODE SELECTOR	42710-0000	2.6	13.0
	PITCH ACTUATOR	45850-3012	4.2	154.7
	ALTITUDE SENSOR	44400-0000	2.3	100.0
	COMPUTER-AMPLIFIER	42680-0007	5.8	100.0
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	ROLL ACTUATOR	45850-2009	4.2	56.2
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
	MISC AUTOPILOT HARDWARE AND WIRING		22.2	78.9
	ATTITUDE INDICATOR	37570-1001	2.1	14.5
	GYRO SLAVING SYSTEM, INCLUDING CABLES		4.3	40.1
	FCS-A-2 SLAVED HSI INSTL.	44690-0000	5.3	47.8
	ALTITUDE ALERT SYSTEM (INCLUDES 801A ENCODING ALTIMETER)	41790-0000	4.0	14.6

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H31-A10	CESSNA 300C AUTOPILOT W/NON SLAVED HSI		19.8*	27.5*
	WING SERVO INSTALLATION	1200237-7	5.1	55.0
	CONTROLLER-AMPLIFIER		1.8	13.5
	D64-A-2 GYRO INSTL		3.0	13.7
	A61-A VACUUM SYSTEM		5.6	1.1
	H09-A-1 HSI INSTL		4.3	43.8
H31-A11	CESSNA 400B AUTOPILOT WITH NON SLAVED HSI INDICATOR		45.8*	79.9*
	AILERON ROLL ACTUATOR (PA495-2)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER		1.4	16.3
	COMPUTER/AMPLIFIER	42680-0007	5.8	100.0
	ALTITUDE SENSOR	44400-0000	2.3	100.0
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	A61-A VACUUM SYSTEM	1201144	5.6	1.1
	D64-A-8 NON SLAVED HSI GYRO INSTL		3.2	13.7
	H09-A-1 NON SLAVED HSI, VOR IND. EXCH.		4.3	43.8
H34-A	BASIC AVIONICS KIT	3910186-11	5.7*	58.8*
	MICROPHONE INSTL., HAND HELD	1270708-701	0.3	17.9
	RADIO COOLING	3930152-2	1.0	12.7
	NOISE FILTER	3940148-1	0.1	-2.0
	VHF COM ANTENNA CABLE	3950129-8	0.6	43.3
	VHF NAV ANTENNA CABLE (OMNI)	3950129-10	0.8	132.6
	VHF OMNI ANTENNA	3960102-6	0.6	250.5
	VHF COM ANTENNA (SPIKE ON RH WING)	3960113-1	0.5	50.7
	AUDIO CONTROL PANEL & WIRING	3970131-1	1.9	12.0
	HEADPHONE INSTALLATION	3910138-4	0.2	14.5
H37-A	ANTENNA & COUPLER KIT	3910185-9		
	OMNI ANTENNA COUPLER	3960111-1	0.2	5.0
	VHF COM ANTENNA (SPIKE ON LH WING)	3960113-2	0.5	50.7
	VHF COM ANTENNA CABLE	3950129	0.6	43.3
H44-A	REVERSE SENSING SWITCH INSTL.	3910154-86	0.2	16.0
H46-A	ADF ANTI-PRECIP SENSE ANTENNA	3910154-71	0.7	140.0
H52-A	FLUSH MOUNTED COM ANTENNA, DUAL NET CHANGE (MOUNTED IN LEADING EDGE OF VTL FIN)	3910154-50	1.3	198.5
H55-A	HEADSET MICROPHONE INSTL	3970112	0.6	16.1
H61-R	GEAR WARNING HORN & CABIN SPEAKER	C596510-0101	1.9	45.8
	J. SPECIAL OPTION PACKAGES			

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
J01-A	CENTURION II KIT	- -	65.8*	31.0*
	A61-A VACUUM SYSTEM (RQD FOR GYROS)	1201052-1	5.6	1.1
	C07-A GROUND SERVICE RECEPTACLE	1270652	2.0	-4.5
	C19-D HEATED PITOT & STALL SENSOR	1201093-1	0.5	36.5
	C22-A INSTRUMENT POST LIGHTS	2101009	0.5	18.5
	C31-A COURTESY ENTRANCE LIGHTS	1221103	0.5	51.4
	C40-A NAVIGATION LIGHT DETECTORS	1221201	NEGL	- -
	C43-A FLASHING BEACON	1201049	1.6	226.0
	D01-D TRUE AIRSPEED IND. (NET CHANGE)	1201108	0.0	- -
	D04-A ALTERNATE STATIC AIR SOURCE	1201032	0.3	15.5
	D49-A ECONOMY MIXTURE INDICATOR (EGT)	1200677	0.7	0.9
	D64-A-1 GYRO INSTALLATION	2101001	6.0	14.0
	E07-S CO-PILOT SEAT DELEATED	1214128-3	-18.5	44.0
	E07-D CO-PILOT SEAT, VERTICAL ADJUST ADDED	1214128-2	23.3	39.5
	E85-A DUAL FLIGHT CONTROLS	1260004	8.1	13.7
	E89-D ALL PURPOSE CONTROL WHEEL EXCH	1260243	0.0	- -
	F01-A-1 CESSNA 300 ADF (R-546E)	3910159-10	7.6	26.4
	F16-A-2 CESSNA 300 TRANSPONDER RT-359A	3910127-22	3.6	14.8
	F22-A-1 CESSNA 300 NAV/COM VOR/LOC	3910183	14.5	31.0
	F28-A-1 E.L.T. INSTALLATION	0470419	1.8	159.4
	F31-A-1 200A NAV-O-MATIC AUTO PILOT	3910162-16	7.7	43.2
J04-A	NAV-PAC INSTALLATION (AVAILABLE W/II KIT)		17.0*	43.4*
	F07-A-1 GLIDESLOPE	3910157	4.4	74.4
	F13-A MARKER BEACON	3910164	2.5	97.5
	F25-A-1 300 NAV COM-2ND UNIT	3910183	10.1	16.5

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

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



CONDITION: **AIRPLANE ON GROUND - ENGINE AND ELECTRICAL POWER OFF**

Figure 7-7. Hydraulic System

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

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

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

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

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a forward and aft spar, formed sheet metal ribs and reinforcements, four skin panels, formed leading edge skins, and a dorsal. The rudder is constructed of a forward and aft spar, formed sheet metal ribs and reinforcements, and a wrap-around skin panel. The top of the rudder incorporates a leading edge extension which contains a balance weight. The horizontal stabilizer is constructed of a forward and aft spar, ribs and stiffeners, center upper skin panel, and two left and two right wrap-around skin panels which also form the leading edges. The horizontal stabilizer also contains the elevator trim tab actuator. Construction of the elevator consists of a forward and aft spar, ribs, torque tube and bellcrank, left upper and lower skin panels, a formed one-piece left trailing edge, right upper and lower skin panels, and right inboard and outboard formed trailing edges. The elevator trim tab consists of a bracket assembly, hinge

AILERON CONTROL SYSTEM

RUDDER AND RUDDER TRIM CONTROL SYSTEMS

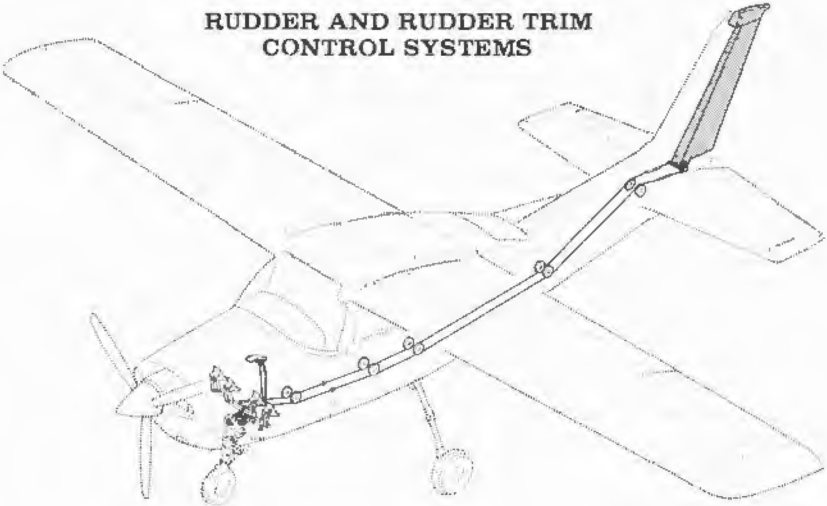
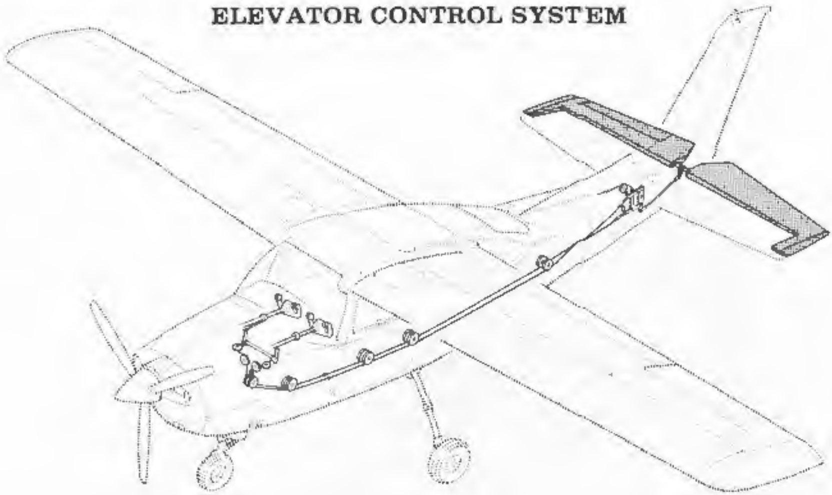


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM CONTROL SYSTEM

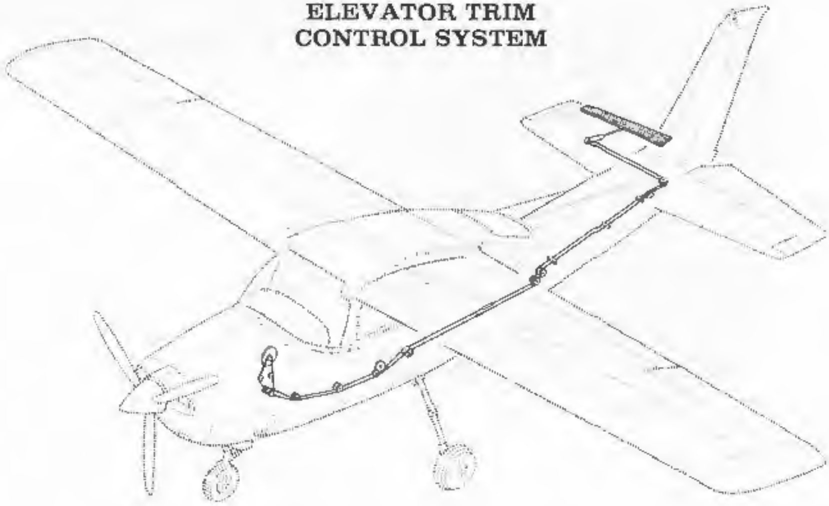


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

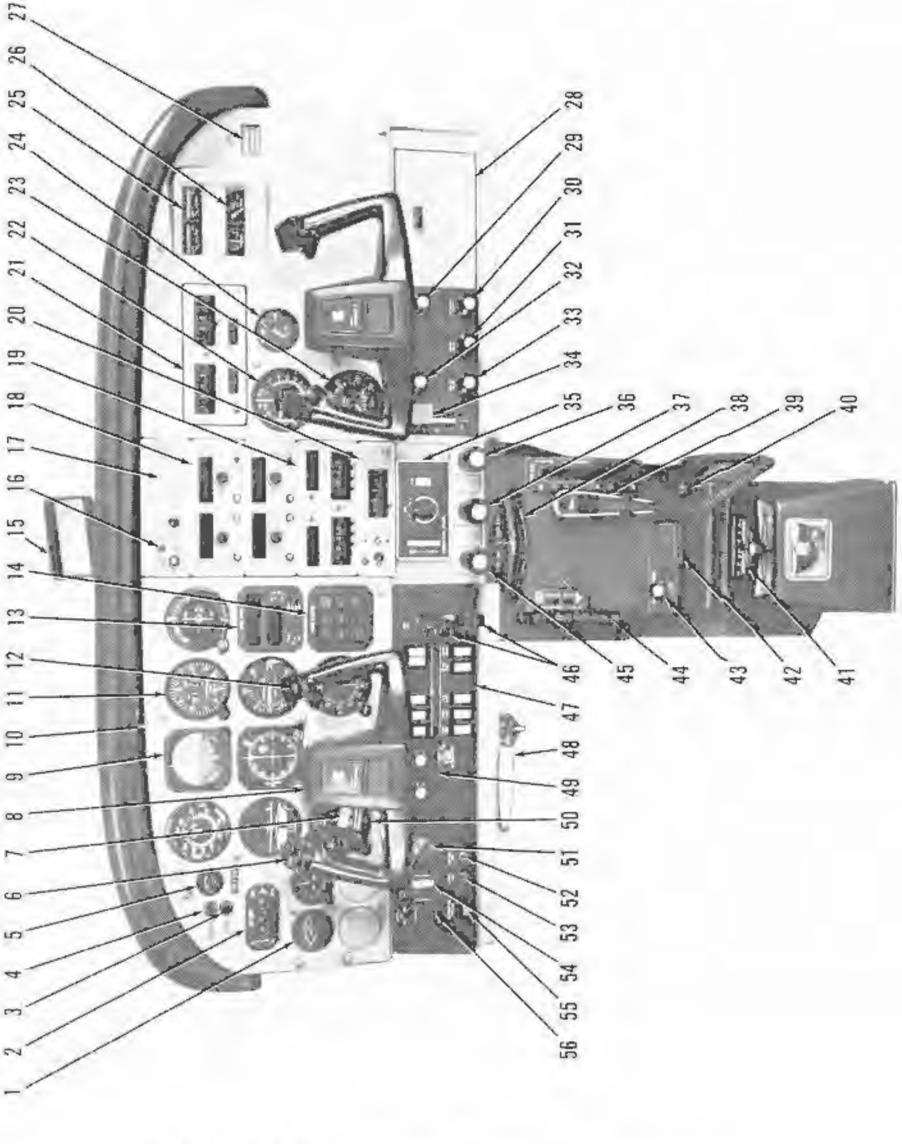


Figure 7-2. Instrument Panel (Sheet 1 of 2)

half, and a wrap-around skin panel. Both elevator tip leading edge extensions incorporate balance weights.

FLIGHT CONTROLS

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

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

TRIM SYSTEMS

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

INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and arranged vertically. The airspeed indicator and altimeter are located to the left and right of the gyros respectively. The remainder of the flight instruments are located around the basic "T". Avionics equipment is stacked approximately on the center line of the panel, with the right side of the panel containing the manifold pressure/fuel flow indicator, tachometer, map compartment, and space for additional instruments and avionics equipment. The engine instrument cluster, and suction gage are on the right side of the avionics stack near the top of the panel. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches and controls necessary to operate the airplane. The left side of the panel contains the master switch, auxiliary fuel pump switch, ignition switch, light intensity controls, electrical switches, landing gear lever and indicator lights, and static pressure alternate source valve control knob. The center area contains the throttle, propeller control, and mixture control. The right side of the panel contains the wing flap switch lever and indicator, cabin heat control knob, cabin air control knob, defroster control knob, auxiliary cabin air control knob, and the cigar lighter. A pedestal, extending from the edge of the switch and control panel to the floorboard, contains the elevator and rudder trim control wheels, cowl flap control lever, engine primer and microphone bracket. The fuel selector valve handle is located at the base of the pedestal with the fuel quantity indicators immediately forward of the handle. A parking brake handle is mounted under the switch and control panel in front of the pilot. All circuit breakers for general electrical equipment and avionics are mounted in a circuit breaker panel located on the left cabin sidewall adjacent to the pilot's seat.

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

GROUND CONTROL

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

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

The minimum turning radius of the airplane, using differential braking and nose wheel steering during taxi, is approximately 26 feet.

WING FLAP SYSTEM

The wing flaps are of the large span, single-slot type (see figure 7-3), and are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slotted panel that provides mechanical stops at the 10° and 20° positions. For flap settings greater than 10°, move the switch lever to the right to clear the stop and position it as desired. A scale and pointer on the left side of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by a 15-ampere circuit breaker, labeled FLAP, on the left sidewall circuit breaker panel.

LANDING GEAR SYSTEM

The landing gear is a retractable, tricycle type with a steerable nose wheel and two main wheels. Shock absorption is provided by the tubular spring-steel main landing gear struts and the air/oil nose gear shock strut.

Figure 7-3. Wing Flap System

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

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

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

LANDING GEAR LEVER

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

LANDING GEAR POSITION INDICATOR LIGHTS

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

LANDING GEAR OPERATION

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

CAUTION

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

During a normal cycle, the gear locks up or down and the position-indicator light (amber for up and green for down) comes on. When the light illuminates, hydraulic pressure is switched from the gear actuators to the door actuators to close the gear doors. When the doors are closed, pressure will continue to build until a pressure switch in the door closing system turns off the hydraulic pump. The gear doors are held in the closed position by hydraulic pressure. If the system pressure drops below minimum, the power pack pressure switch will turn the power pack on and return the pressure to maximum except when the nose gear safety (squat) switch is open.

A landing gear safety (squat) switch, actuated by the nose gear strut, electrically prevents inadvertent retraction by the electrically-driven hydraulic power pack, whenever the nose gear strut is compressed by the weight of the airplane. When the nose gear is lifted off the runway during takeoff, the squat switch will close, causing the power pack to operate for 2 to 3 seconds which will return system pressure to maximum in the event pressure has dropped.

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

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

WARNING

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

NOTE

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

OPEN circuit - OPEN doors
CLOSED circuit = CLOSED doors

CAUTION

Do not operate the hand pump with the GEAR UP position selected by the landing gear lever while the airplane is on the ground, since the squat switch will not prevent gear retraction.

EMERGENCY HAND PUMP

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

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

LANDING GEAR WARNING SYSTEM

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

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

RETRACTABLE CABIN ENTRY STEP

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

BAGGAGE COMPARTMENT

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

SEATS

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

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

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

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

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

SEAT BELTS AND SHOULDER HARNESSES

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

SEAT BELTS

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

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

SHOULDER HARNESSES

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

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

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

INTEGRATED SEAT BELT/SHOULDER HARNESSES WITH INERTIA REELS

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

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

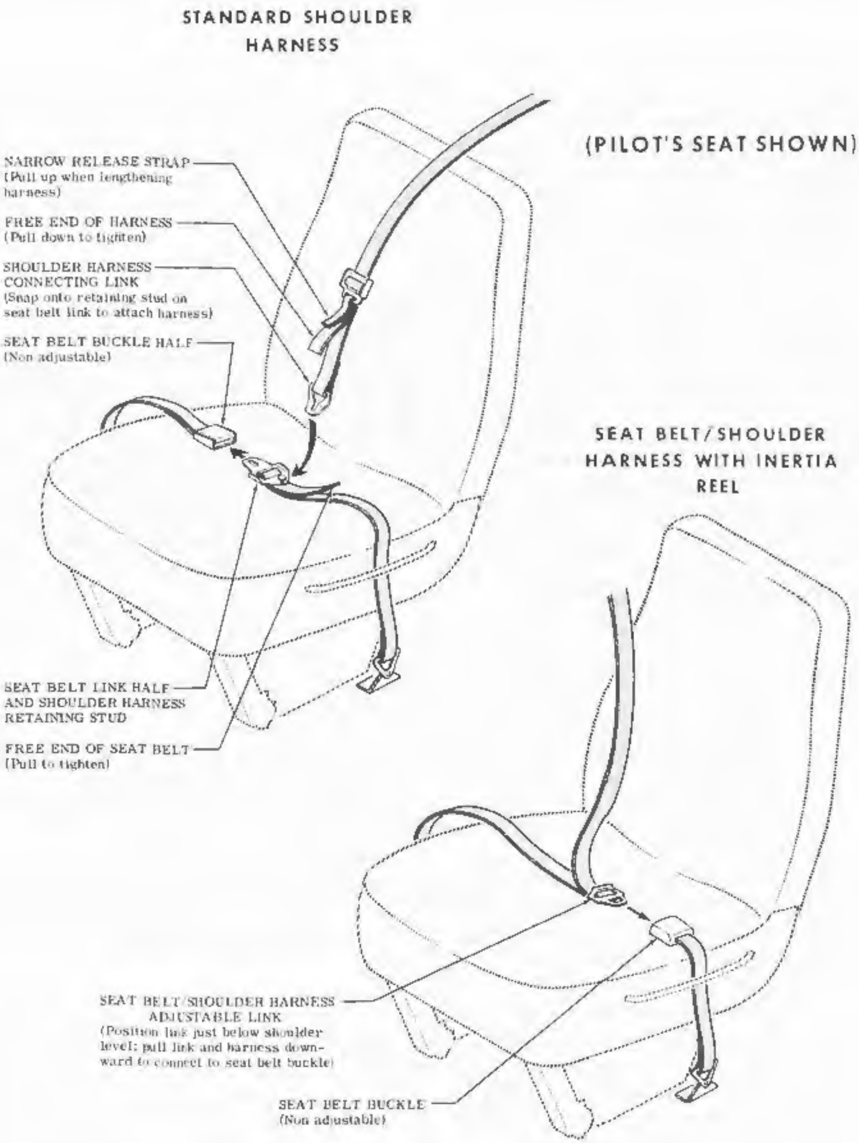


Figure 7-4. Seat Belts and Shoulder Harnesses

ENTRANCE DOORS AND CABIN WINDOWS

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

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

NOTE

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

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

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

CONTROL LOCKS

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

ENGINE

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

ENGINE CONTROLS

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

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

ENGINE INSTRUMENTS

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

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

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

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

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

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

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

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

NEW ENGINE BREAK-IN AND OPERATION

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

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

ENGINE OIL SYSTEM

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

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

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

IGNITION-STARTER SYSTEM

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

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

AIR INDUCTION SYSTEM

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

EXHAUST SYSTEM

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

FUEL INJECTION SYSTEM

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

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

COOLING SYSTEM

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

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

PROPELLER

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

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

FUEL SYSTEM

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

NOTE

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

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

NOTE

Fuel cannot be used from both fuel tanks simultaneously.

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

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

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

Fuel quantity is measured by two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity indicators on the lower portion of the pedestal adjacent to the fuel selector valve handle. The indicators are marked in pounds (top scale) and gallons (bottom scale) with a red line indicating an empty tank. When an indicator shows an empty tank, approximately 0.5 gallon remains in the tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips or unusual attitudes. Maximum indicator travel is reached with 41 to 42 gallons in the tank. Therefore, indications at the right end of the scale (40 gallons to F) should be verified by visual inspection of the tanks if a short field takeoff or a long range flight is planned. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature and oil temperature gages for operation. If these gages are not indicating, an electrical malfunction has occurred.

The auxiliary fuel pump switch is located on the left side of the instrument panel and is a yellow and red split-rocker type switch. The yellow right half of the switch is labeled START, and its upper ON position is used for normal starting, minor vapor purging and continued engine operation in the event of an engine-driven fuel pump failure. With the right half of the switch in the ON position, the pump operates at one of two flow rates that are dependent upon the setting of the throttle. With the throttle open to a cruise setting, the pump operates at a high enough capacity to supply sufficient fuel flow to maintain flight with an inoperative engine-

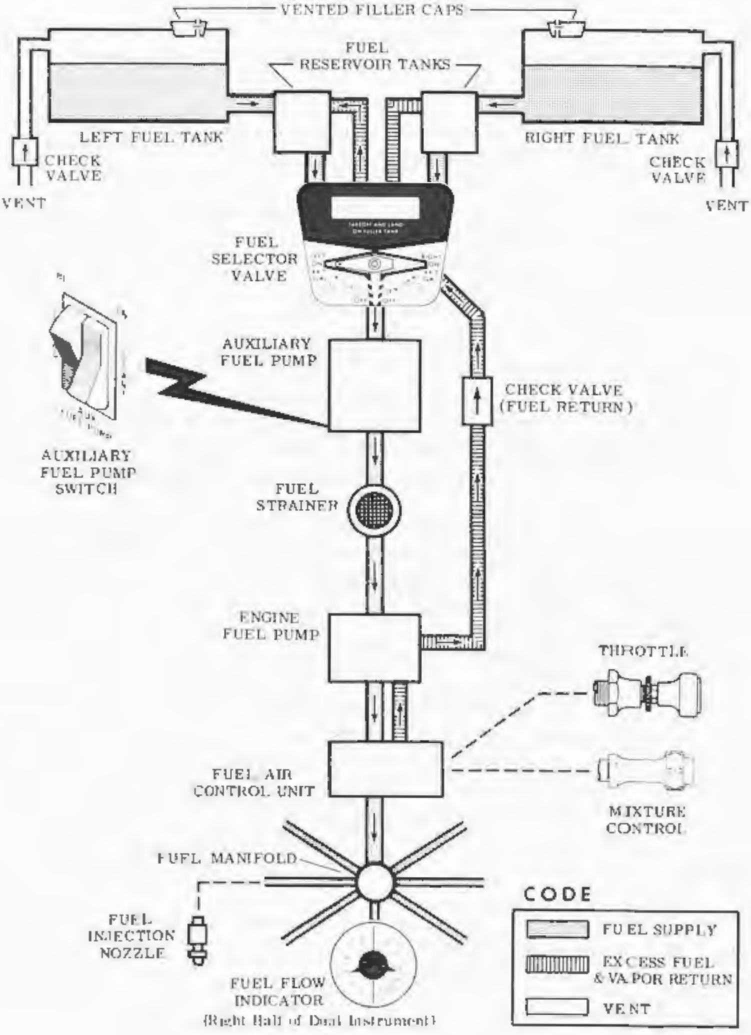


Figure 7-5. Fuel System

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

Figure 7-6. Fuel Quantity Data

driven fuel pump. When the throttle is moved toward the closed position (as during letdown, landing, and taxiing), the fuel pump flow rate is automatically reduced, preventing an excessively rich mixture during these periods of reduced engine speed.

NOTE

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

NOTE

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

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

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

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

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

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

HYDRAULIC SYSTEM

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

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

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

During normal operations, the landing gear should require from 10 to 12 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. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down.

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

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

ELECTRICAL SYSTEM

Electrical energy (see figure 7-8) is supplied by a 28-volt, direct-current system powered by an engine-driven, 60-amp (or 95-amp, if installed) alternator. A 24-volt, 14-amp hour battery (or 17-amp hour battery, if installed) is located on the upper left forward portion of the firewall. Power is supplied to most general electrical and all avionics circuits through the primary bus bar and the avionics bus bar, which are interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on.

CAUTION

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

MASTER SWITCH

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

Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned on separately to check equipment while on the ground. To check or use avionics equipment or radios while on the ground, the avionics power switch must also be turned on. The ALT side of the switch, when placed in the off position, removes the alternator from the electrical system. With this switch in the off position, the entire electrical load is placed on the battery. Continued operation with the alternator switch in the off position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AVIONICS POWER SWITCH

Electrical power from the airplane primary bus to the avionics bus (see figure 7-8) is controlled by a rocker-type circuit breaker-switch labeled AVN PWR. The switch is located on the left sidewall circuit breaker panel and is ON in the forward position and OFF in the aft position. With the switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch or the individual equipment switches. The avionics power switch also functions as a circuit breaker. If an electrical malfunction should occur and cause the circuit breaker to open, electrical power to the avionics equipment will be interrupted and the switch will automatically move to the OFF position. If

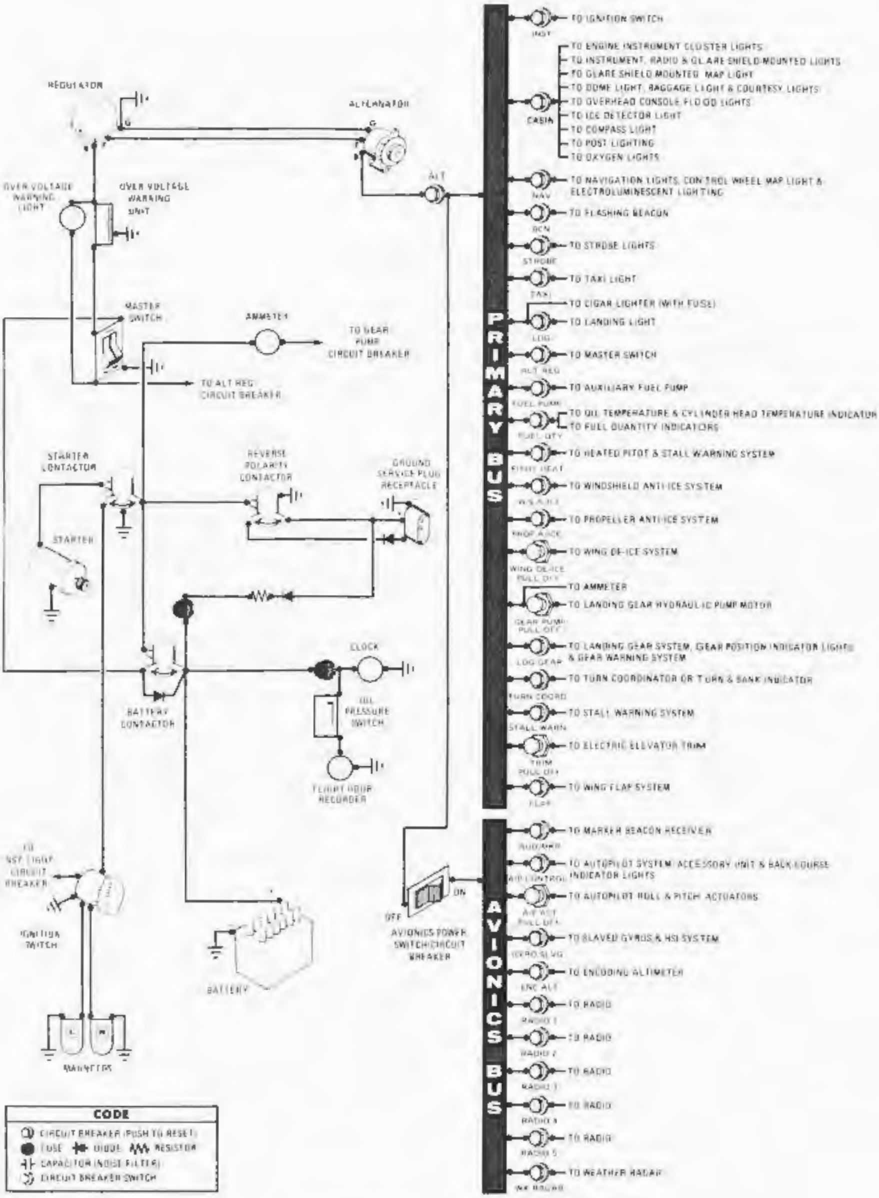


Figure 7-8. Electrical System

this occurs, allow the circuit breaker approximately two minutes to cool before placing the switch in the ON position again. If the circuit breaker opens again, do not reset it. The avionics power switch should be placed in the OFF position prior to turning the master switch on or off, starting the engine, or applying an external power source, and may be utilized in place of the individual avionics equipment switches.

AMMETER

The ammeter 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 airspeed indicator.

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

GROUND SERVICE PLUG RECEPTACLE

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

NOTE

If no avionics equipment is to be used or worked on, the avionics power switch should be turned off. If 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 tail stinger, and dual landing lights are installed in the cowl nose cap. Additional lighting is available and includes a strobe light on each wing tip, a flashing beacon on top of the vertical stabilizer, and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are operated by a switch located on the left rear door post. All exterior lights, except the courtesy lights, are controlled by rocker-type switches on the left switch and control panel. The switches are ON in the up position and off in the down position.

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

The high intensity strobe lights will enhance anti-collision protection. However, the lights should be torned 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 electroluminescent and post lighting also available. Rheostats and control knobs, located on the left switch and control panel, control the intensity of all lighting. The following paragraphs describe the various lighting systems and their controls.

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

Instrument panel flood lighting consists of five red flood lights on the underside of the antiglare shield, and two red flood lights in the forward part of the overhead console. The lights are utilized by adjusting light intensity with the large (outer) control knob of the concentric control knobs labeled POST, FLOOD. Flood lighting may be used in combination with post lighting by adjusting post light intensity with the small (inner) control knob.

The instrument panel may be equipped with post lights which are mounted at the edge of each instrument or control and provide direct lighting. To operate the post lights, adjust light intensity with the small (inner) control knob of the concentric control knobs labeled POST, FLOOD. To combine post and flood lighting, adjust flood light intensity with the large (outer) control knob.

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

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

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

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

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

The most probable cause of a light failure is a burned out bulb;

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

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

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

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extending down each side of the cabin to an outlet at the front door post at floor level.

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

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

PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed

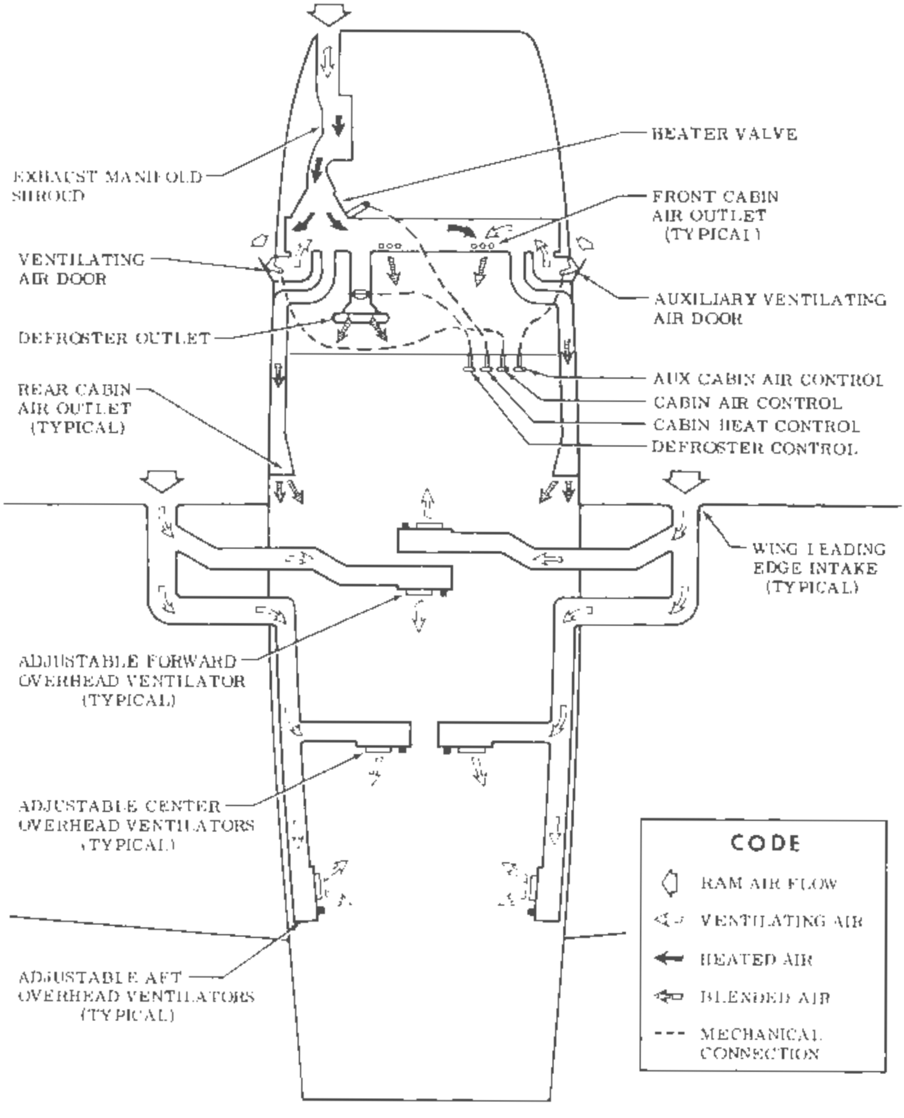


Figure 7-9. Cabin Heating, Ventilating, and Defrosting System

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

The airplane may also be equipped with a pitot heat system. The system consists of a heating element in the pitot tube, a rocker-type switch labeled PITOT HEAT on the left side of the instrument panel, a 10-amp circuit breaker on the left sidewall circuit breaker panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

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

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

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

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings include the white arc (55 to 115 knots), green arc (68 to 168 knots), yellow arc (168 to 199 knots), and a red line (199 knots).

If a true airspeed indicator is installed, it is equipped with a rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer. To operate the indicator, first rotate the ring until **pressure** altitude is aligned with outside air temperature in degrees Fahrenheit. Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, momentarily set the barometric scale on the altimeter to 29.92 and read pressure altitude on the altimeter. Be sure to return the altimeter barometric scale to the original barometric setting after pressure altitude has been obtained. Having set the ring to correct for altitude and temperature, 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.

VACUUM SYSTEM AND INSTRUMENTS

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

ATTITUDE INDICATOR

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

DIRECTIONAL INDICATOR

A directional indicator is available and displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The directional indicator will precess slightly over a period of time. Therefore, the compass card should be set in accordance with the magnetic

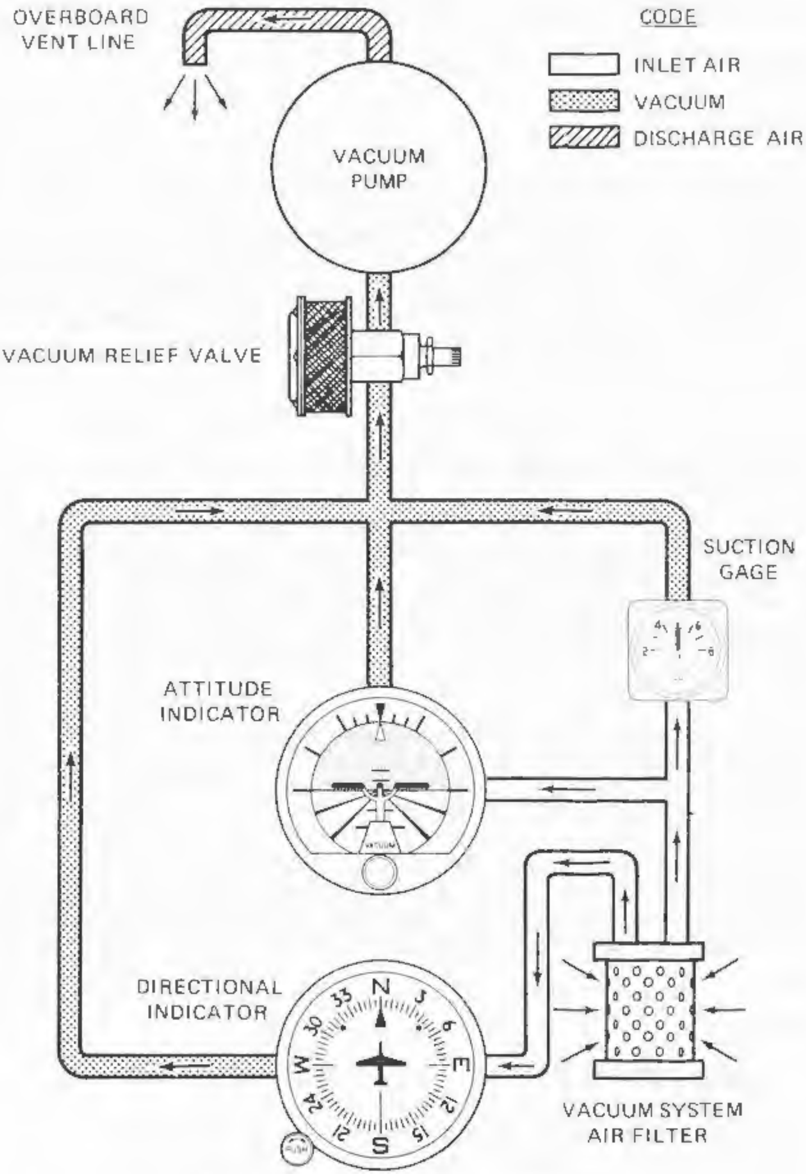


Figure 7-10. Vacuum System

compass just prior to takeoff, and occasionally re-adjusted on extended flights. A knob on the lower left edge of the instrument is used to adjust the compass card to correct for any precession.

SUCTION GAGE

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

STALL WARNING SYSTEM

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

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

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

AVIONICS SUPPORT EQUIPMENT

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 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.

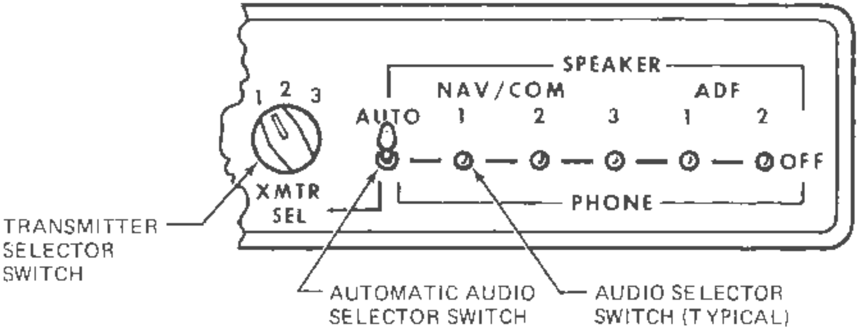
AUTOMATIC AUDIO SELECTOR SWITCH

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

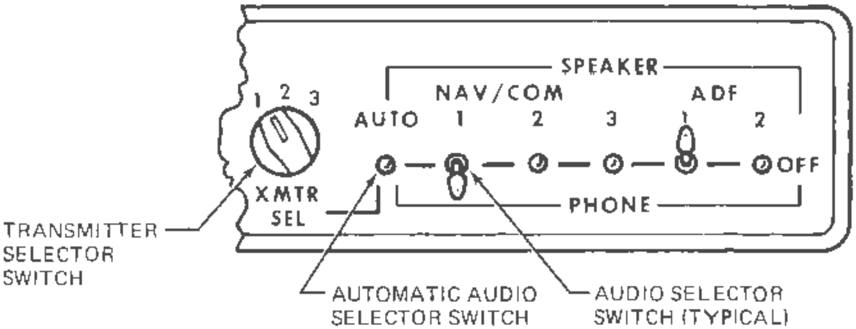
Cessna radios are equipped with sidetone capabililty (monitoring of the operators own voice transmission). Sidetone will be heard on either the airplane speaker or a headset as selected with the AUTO selector switch. Sidetone may be elimated by placing the AUTO selector switch

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

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, elevator, propeller tips, and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

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

SECTION 8
AIRPLANE HANDLING, SERVICE & MAINTENANCE

TABLE OF CONTENTS

INTRODUCTION

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

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

IDENTIFICATION PLATE

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

OWNER FOLLOW-UP SYSTEM

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

PUBLICATIONS

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

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

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

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

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

AIRPLANE FILE

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

A. To be displayed in 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 35° either side of center, or damage to the gear will result. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire or deflated strut will also increase tail height.

PARKING

When parking the airplane, head into the wind and set the parking brakes. Do not set the parking brakes during cold weather when accumulated moisture may freeze the brakes, or when the brakes are overheated. Close the cowl flaps, install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

TIE-DOWN

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

1. Set the parking brake and install the control wheel lock.
2. Install a surface control lock over the fin and rudder.
3. Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing and tail tie-down fittings and secure each rope or chain to a ramp tie-down.
4. Tie a rope (no chains or cables) to the nose gear torque link and secure to a ramp tie-down.
5. Install a pitot tube cover.

JACKING

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

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

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

NOTE

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

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

NOTE

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

LEVELING

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

FLYABLE STORAGE

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

WARNING

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

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

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

SERVICING

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

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

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

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

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

ENGINE OIL

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

NOTE

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

CAPACITY OF ENGINE SUMP -- 10 Quarts.
Do not operate on less than 7 quarts. To minimize loss of oil through breather, fill to 8 quart level for normal flights of less than 3 hours. For extended flight, fill to 10 quarts. These quantities refer to oil dipstick level readings. During oil and oil filter changes, one additional quart is required when the filter is changed.

OIL AND OIL FILTER CHANGE --

After the first 25 hours of operation, drain engine oil sump and clean the oil pressure screen. If an oil filter is installed, change the filter at this time. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to dispersant oil. On airplanes **not** equipped with an oil filter, drain the engine oil sump and clean the oil pressure screen each 50 hours thereafter. On airplanes **which have** an oil filter, the oil change interval may be extended to 100-hour intervals, providing the oil filter is changed at 50-hour intervals. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

FUEL

APPROVED FUEL GRADES (AND COLORS) --

100LL Grade Aviation Fuel (Blue).

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

CAPACITY EACH TANK -- 45 Gallons.

REDUCED CAPACITY EACH TANK (WHEN FILLED TO BOTTOM OF FUEL FILLER NECK) -- 32.5 Gallons.

LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 50 PSI on 5.00-5, 6-Ply Rated Tire.

MAIN WHEEL TIRE PRESSURE -- 55 PSI on 6.00-6, 8-Ply Rated Tires.

NOSE GEAR SHOCK STRUT --

Keep filled with MIL-H-5606 hydraulic fluid and inflated with air to 90 PSI. Do not over-inflate.

HYDRAULIC FLUID RESERVOIR -- Check every 25 hours and service with MIL-H-5606 hydraulic fluid. At first 25 hours, first 50 hours, and each 100 hours thereafter, clean the filter on the right side of the reservoir.

OXYGEN

AVIATOR'S BREATHING OXYGEN -- Spec. No. MIL-O-27210.

MAXIMUM PRESSURE (cylinder temperature stabilized after filling) --

1800 PSI at 21°C (70°F).

Refer to Oxygen Supplement (Section 9) for filling pressures.

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1800 PSI at 21°C (70°F).

Refer to Oxygen Supplement (Section 9) for filling pressures.

CLEANING AND CARE

WINDSHIELD-WINDOWS

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

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

NOTE

> **Never use** gasoline, benzine, alcohol, acetone, carhon 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, polisbed 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 hright 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

TABLE OF CONTENTS (Continued)

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)

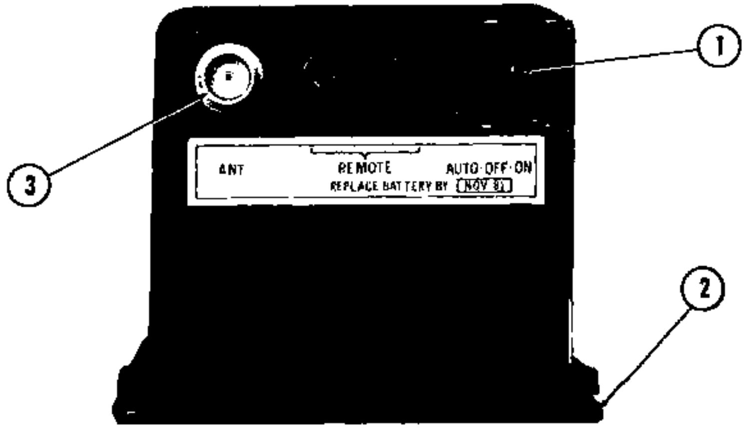
SECTION 1
GENERAL

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

ELECTRIC ELEVATOR TRIM SYSTEM (MODEL 210)

SECTION 1
GENERAL

The electric elevator trim system provides a simple method of relieving pitch control pressures without interrupting other control operations to adjust the manual elevator trim wheel. The system is controlled by a slide-type trim switch on the top of the left control wheel grip, a disengage switch on the left side of the control wheel pad and a switch type circuit breaker on the sidewall circuit breaker panel. Pushing the trim switch to the forward position, labeled DN, moves the elevator trim tab in the "nose down" direction; conversely, pulling the switch aft to the UP position moves the tab in the "nose up" direction. When the switch is released, it automatically returns to the center off position, and elevator trim tab motion stops. The disengage switch, labeled ELEC TRIM DISENGAGE, disables the system when placed in the DISENGAGE position. The elevator trim circuit breaker is provided as a secondary control of all electrical power to the system and can be pulled out in case of system malfunction.

A servo unit (which includes a motor and chain-driven, solenoid-operated clutch) actuates the trim tab to the selected position. When the clutch is not energized (trim switch off) the electric portion of the trim system freewheels so that manual operation is not affected. The electric trim system can be overridden at any time by manually rotating the elevator trim wheel, thus overriding the servo that drives the trim tab.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this trim system is installed. However, the following information is presented on a placard near the bottom of the instrument panel:

Maximum Altitude Loss During Electric Trim Malfunction - 250 ft.

SECTION 3
EMERGENCY PROCEDURES

1. Elevator Trim Disengage Switch -- DISENGAGE.

NOTE

For maximum altitude loss during an electric trim malfunction, refer to placarding on the instrument panel.

2. Elevator Trim Circuit Breaker -- PULL TO DISABLE system for the remainder of the flight.
3. Manual Trim -- AS REQUIRED.

SECTION 4
NORMAL PROCEDURES

To operate the electric elevator trim system, proceed as follows:

1. Master Switch -- ON.
2. Elevator Trim Disengage Switch -- ON.
3. Trim Switch -- ACTUATE as desired.
4. Elevator Trim Position Indicator -- CHECK.

NOTE

To check the operation of the disengage switch, actuate the elevator trim switch with the disengage switch in the DISENGAGE position. Observe that the manual trim wheel and indicator do not rotate when the elevator trim switch is activated.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when this trim system is installed.

SUPPLEMENT

OXYGEN SYSTEM (MODEL 210)

SECTION 1
GENERAL

A six-place oxygen system provides the supplementary oxygen necessary for continuous flight at high altitude. In this system, four oxygen cylinders, located in the fuselage cabin top, supply the oxygen. Cylinder pressure is reduced to an operating pressure of 70 PSI by a pressure regulator/shutoff valve assembly attached to the left front cylinder. An oxygen cylinder filler valve is located on the bottom of the right wing just outboard of the rear door post under a round cover plate. Cylinder pressure is indicated by a pressure gage located in the overhead console above the pilot and front passenger's seats.

Six oxygen outlets are provided; two each in consoles above the front seats and center passenger seats, and one each in two separate consoles near the aft passenger seats. One permanent, microphone equipped mask is provided for the pilot, and five disposable type masks are provided for the passengers. All masks are the partial rebreathing type, equipped with vinyl plastic hoses and flow indicators.

NOTE

The hose provided for the pilot is of a higher flow rate than those for the passengers; it is color-coded with an orange hand adjacent to the plug-in fitting. The passenger hoses are color-coded with a green band. If the airplane owner prefers, he may provide higher flow hoses for all passengers. In any case, it is recommended that the pilot use the larger capacity hose. The pilot's mask is equipped with a microphone to facilitate use of the radio while using oxygen. An adapter cord is furnished with the microphone-equipped mask to mate the mask microphone lead to the auxiliary microphone jack located on the left side of the instrument panel. To connect the oxygen mask microphone, connect the mask lead to the adapter cord and plug the cord into the auxiliary microphone jack. (If an optional microphone-headset combination has been in use, the microphone lead from this equipment is already plugged into the auxiliary microphone jack. It will be necessary to disconnect this lead from the auxiliary microphone jack so that the adapter cord from the oxygen mask microphone can be plugged into the jack.) A switch is incorporated on the left hand control wheel to operate the microphone.

A remote shutoff valve control in the overhead console above the pilot and front passenger's seat is used to shut off the supply of oxygen to the system when not in use. The control is mechanically connected to the shutoff valve at the cylinder. With the exception of the shutoff function, the system is completely automatic and requires no manual regulation for change of altitude.

The oxygen cylinders, when fully charged, contain a total of approximately 74 cubic feet of aviator's breathing oxygen (Spec. No. MIL-O-27210), under a pressure of 1800 PSI at 21°C (70°F). Filling pressures will vary, however, due to ambient temperature in the filling area, and the temperature rise resulting from compression of the oxygen. Because of this, merely filling to 1800 PSI will not result in properly filled cylinders. Fill to pressures indicated on the table below for ambient temperatures.

WARNING

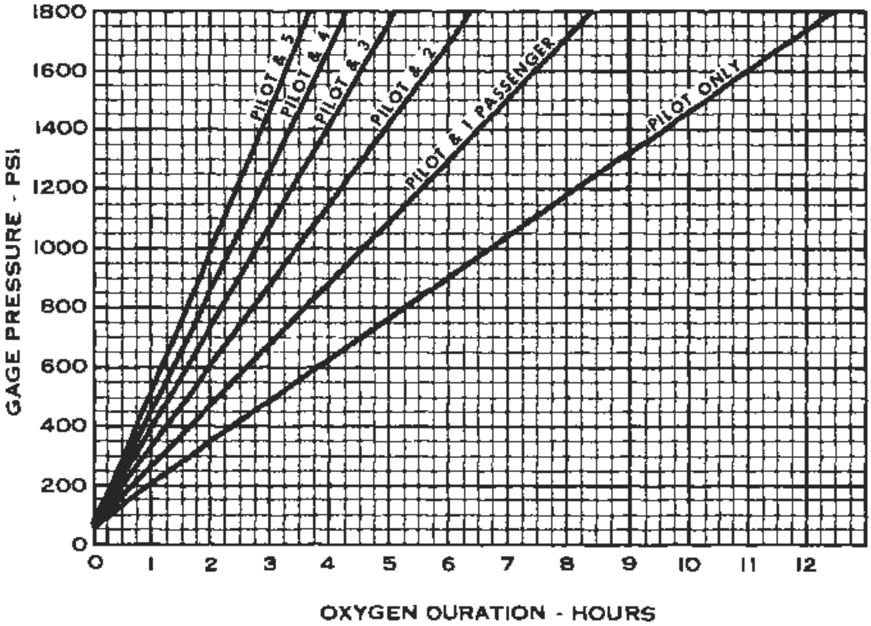
Oil, grease or other lubricants in contact with oxygen create a serious fire hazard, and such contact must be avoided when handling oxygen equipment.

AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG	AMBIENT TEMPERATURE °F	FILLING PRESSURE PSIG
0	1600	50	1825
10	1650	60	1875
20	1700	70	1925
30	1725	80	1975
40	1775	90	2000

Figure 1. Oxygen Filling Pressures

OXYGEN DURATION CHART

(74 CUBIC FEET CAPACITY)



NOTE:
This chart is based on a pilot with an orange color-coded oxygen line fitting and passengers with green color-coded line fittings.

Figure 2. Oxygen Duration Chart

For FAA requirements concerning supplemental oxygen, refer to FAR 91.32. Supplemental oxygen should be used by all occupants when cruising above 12,500 feet. As described in the Cessna booklet "Man At Altitude," it is often advisable to use oxygen at altitudes lower than 12,500 feet under conditions of night flying, fatigue, or periods of physiological or emotional disturbances. Also, the habitual and excessive use of tobacco or alcohol will usually necessitate the use of oxygen at less than 10,000 feet.

The Oxygen Duration Chart (figure 2) should be used in determining the usable duration (in hours) of the oxygen supply in your airplane. The following procedure outlines the method of finding the duration from the chart.

1. Note the available oxygen pressure shown on the pressure gage.
2. Locate this pressure on the scale on the left side of the chart, then go across the chart horizontally to the right until you intersect the line representing the number of persons making the flight. After intersecting the line, drop down vertically to the bottom of the chart and read the duration in hours given on the scale.
3. As an example of the above procedure, 1200 PSI of pressure will safely sustain the pilot only for nearly 8 hours and 10 minutes. The same pressure will sustain the pilot and three passengers for approximately 3 hours and 20 minutes.

NOTE

The Oxygen Duration Chart is based on a standard configuration oxygen system having one orange color-coded hose assembly for the pilot and green color-coded hoses for the passengers. If orange color-coded hoses are provided for pilot and passengers, it will be necessary to compute new oxygen duration figures due to the greater consumption of oxygen with these hoses. This is accomplished by computing the total duration available to the pilot only (from PILOT ONLY line on chart), then dividing this duration by the number of persons (pilot and passengers) using oxygen.

SECTION 2
LIMITATIONS

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

SECTION 3
EMERGENCY PROCEDURES

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

SECTION 4
NORMAL PROCEDURES

Prior to flight, check to be sure that there is an adequate oxygen supply for the trip, by noting the oxygen pressure gage reading, and referring to the Oxygen Duration Chart (figure 2). Also, check that the face masks and hoses are accessible and in good condition.

WARNING

For safety reasons, no smoking should be allowed in the airplane while oxygen is being used.

When ready to use the oxygen system, proceed as follows:

1. Mask and Hose -- SELECT. Adjust mask to face and adjust metallic nose strap for snug mask fit.
2. Delivery Hose -- PLUG INTO OUTLET nearest to the seat you are occupying.

NOTE

When the oxygen system is turned on, oxygen will flow continuously at the proper rate of flow for any altitude without any manual adjustments.

3. Oxygen Supply Control Knob -- ON.
4. Face Mask Hose Flow Indicator -- CHECK. Oxygen is flowing if the indicator is being forced toward the mask.
5. Delivery Hose -- UNPLUG from outlet when discontinuing use of oxygen. This automatically stops the flow of oxygen.
6. Oxygen Supply Control Knob -- OFF when oxygen is no longer required.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

WING AND STABILIZER DE-ICE SYSTEM (MODEL 210)

SECTION 1
GENERAL

Pneumatic de-icing boots, installed on the leading edges of the wings and horizontal stabilizer, provide a measure of protection if unexpected icing conditions are encountered. Controls for the de-icing system consists of a spring-loaded on-off rocker switch on the left switch and control panel, a pressure indicator light on the upper left side of the instrument panel, and a 5-amp circuit breaker switch on the left sidewall circuit breaker panel. The two-position de-icing switch, labeled DE-ICE PRESS, is spring-loaded to the normal off (lower) position. When pushed to the ON (upper) position and released, it will activate one de-icing cycle. Each time a cycle is desired, the switch must be pushed to the ON position and released. The pressure indicator light, labeled DE-ICE PRESSURE, should come on within four seconds after the cycle is initiated and remain on for two to three seconds if the system is operating properly.

De-icing boots have a special electrically-conductive coating to bleed off static electricity which causes radio interference and could perforate the boots. Fueling and other servicing should be done carefully to avoid damage to the conductive coating or tearing of the boot. Keep the boots clean and free from oil and grease which can swell the rubber. Wash them with mild soap and water, using benzol or unleaded gasoline to remove stubborn grease. Do not scrub the boots, and be sure to wipe off all solvent before it dries. Small tears and abrasions can be repaired temporarily and the conductive coating can be renewed, without removing the boots. Your Cessna Dealer has the proper materials and know-how to do this correctly.

An ice detector light is also installed to facilitate the detection of wing ice at night or during reduced visibility. The ice detector light system consists of a light installed on the left side of the cowl deck forward of the windshield which is positioned to illuminate the leading edge of the wing, and a rocker-type switch located on the left switch and control panel.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when the de-ice system is installed; intentional flight into known icing conditions is prohibited, regardless of installed ice protection equipment.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the de-ice system is installed.

SECTION 4
NORMAL PROCEDURES

De-icing boots are intended for removal of ice after it has accumulated rather than prevent its formation. If ice accumulation is slow, best results can be obtained by not using the de-ice system until approximately 1/2 inch of ice has accumulated. Clear the accumulation with one or two cycles of operation. Do not repeat de-icing procedure until ice has again accumulated.

Cycling the de-icing boots procedures no adverse aerodynamic effects in any attitude within the allowable flight limitations. Continual cycling of the de-ice system, however, is not recommended as this may cause ice to form outside the contour of the inflated boots, preventing its removal.

NOTE

> Since wing and horizontal stabilizer de-icer boots alone do not provide adequate protection for the entire airplane, known icing conditions should be avoided whenever possible. If icing is encountered, close attention should be given to the pitot-static system, propeller, induction system and other components subject to icing.

PREFLIGHT INSPECTION

Prior to flight, make an exterior inspection to check the de-icing boots for tears, abrasions, and cleanliness. Boots must be cleaned and damage repaired prior to flight.

DURING ENGINE RUNUP

The system should be checked through several cycles as follows:

1. De-Icing Switch -- ON and release. Check inflation and deflation cycle.
2. Pressure Indicator Light -- CHECK ON within four seconds after the cycle is initiated. The light should remain on for two to three seconds if the system is operating properly.
3. Boots -- CHECK VISUALLY FOR COMPLETE DEFLATION to the vacuum hold-down condition.

IN FLIGHT

Flight into known or forecast icing conditions is prohibited. If unexpected icing conditions are encountered, the following procedure is recommended:

1. Ice Build-up -- MONITOR until approximately 1/2 inch thick on the leading edges.
2. De-Icing Switch -- ON and release. The switch must be actuated again if additional cycles are required.

NOTE

The de-ice system will operate up to a maximum altitude of 14,500 feet; however, at or near this altitude, engine RPM must be a minimum of 2500 RPM.

AFTER LANDING

1. De-Icing Boots -- CHECK for damage and cleanliness. Remove any accumulations of oil or grease.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when the de-ice system is installed.

SUPPLEMENT

PROPELLER ANTI-ICE SYSTEM (MODEL 210)

SECTION 1
GENERAL

The propeller anti-ice system provides a measure of protection if unexpected icing conditions are encountered. The system is operated by a rocker-type switch located on the left switch and control panel. When the switch is placed in the ON position, current flows to an anti-ice timer which supplies electric power in cycles every 20 seconds to elements in the anti-icing boots located on the propeller blades. Operation of the anti-ice system can be checked by monitoring a propeller anti-ice ammeter near the upper left corner of the instrument panel. The system is protected by a circuit breaker, labeled PROP A/ICE, located on the left sidewall circuit breaker panel.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when the propeller anti-ice system is installed; intentional flight into known icing conditions is prohibited, regardless of installed ice protection equipment.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the propeller anti-ice system is installed.

SECTION 4
NORMAL PROCEDURES

Flight into known or forecast icing conditions is prohibited. If unexpected icing conditions are encountered, the following procedure is recommended:

1. Master Switch -- ON.
2. Propeller Anti-Ice Switch -- ON.
3. Propeller Anti-Ice Ammeter -- CHECK in green arc range (14 to 18 amps).

NOTE

To check the heating elements and anti-ice timer for one complete cycle, the system must be left on for approximately 1 minute. Ammeter readings must remain in the green arc except during momentary change.

NOTE

While using the anti-ice system, monitor the airplane ammeter to ensure that the electrical system does not become overloaded. If the total electrical load is high, resulting in a discharge indication, limit the use of other electrical equipment so that the airplane ammeter maintains a slight charge.

CAUTION

If the ammeter indicates unusually high or low amperage during the 20-second cycle of operation, a malfunction has occurred and it is imperative that the system be turned off. Uneven anti-icing may result, causing propeller unbalance and engine roughness.

4. Propeller Anti-Ice Switch -- OFF when anti-icing is no longer required.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when the propeller anti-ice system is installed.

SUPPLEMENT

WINDSHIELD ANTI-ICE SYSTEM (MODEL 210)

SECTION 1
GENERAL

The windshield anti-ice system assures adequate visibility for a landing during flight conditions where ice may form on the windshield. A detachable electrically-heated glass panel, 11.0 inches high by 5.5 inches wide, mounts to the base of the windshield in front of the pilot. Quick disconnects are provided to facilitate ease of installation and removal. When not in use, a padded cover is provided for protection against scratches, breakage, and wiring damage, and the panel may be stowed in the seat pocket on the aft side of the pilot's or copilot's seat back. Windshield anti-icing is controlled by a rocker-type switch, labeled W/S A/ICE, on the left switch and control panel.

The heated glass panel should be installed whenever icing conditions are a possibility on a proposed flight, especially if the freezing level is near or at the surface.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when the windshield anti-ice system is installed; intentional flight into known icing conditions is prohibited regardless of installed ice protection equipment. Prolonged operation of the system without the engine running should be avoided.

SECTION 3
EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the windshield anti-ice system is installed.

SECTION 4
NORMAL PROCEDURES

The anti-ice system should be checked, **prior to engine start**, as follows:

1. Anti-Ice Panel -- INSTALL.
2. Master Switch -- ON.
3. Windshield Anti-Ice Switch -- ON for one minute.
4. Anti-Ice Panel -- CHECK FOR WARMTH (step outside the airplane to feel for warmth in the panel).
5. Windshield Anti-Ice and Master Switches -- OFF.

CAUTION

Inadventent prolonged operation of the heated anti-icing panel without the engine running may cause damage to the panel and crazing of the windshield.

Flight into known or forecast icing conditions is prohibited. If unexpected icing conditions are encountered, the following procedure is recommended:

1. Windshield Anti-Ice Switch -- ON 5 to 10 minutes in advance of its need. The anti-ice system may become ineffective if a large accumulation of ice is allowed to form.
2. Windshield Anti-Ice Switch -- OFF when the possibility of icing no longer exists.

SECTION 5
PERFORMANCE

There is no change to the airplane performance when the windshield anti-ice system is installed.

SUPPLEMENT

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

SECTION 1
GENERAL

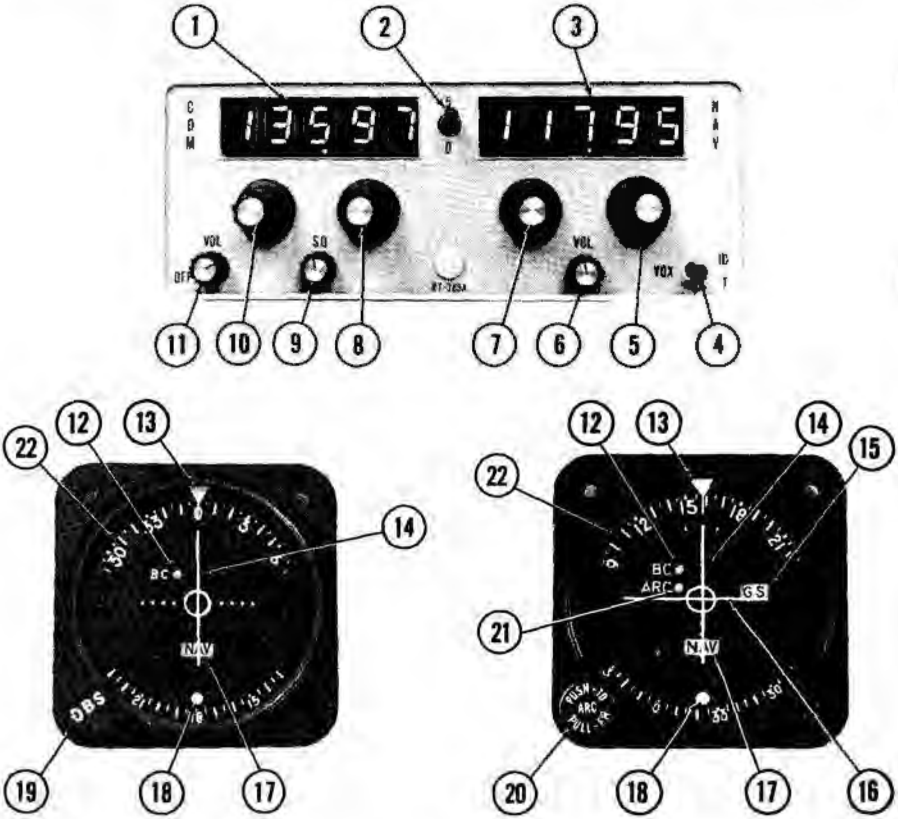
The Cessna 300 Nav/Com (Type RT-385A), shown in figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote course deviation indicator.

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 by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position. Adjustment of sidetone may be accomplished by adjusting the sidetone pot located inside the audio control panel.

   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 NAV/COM
(Type RT-385A)

WITH

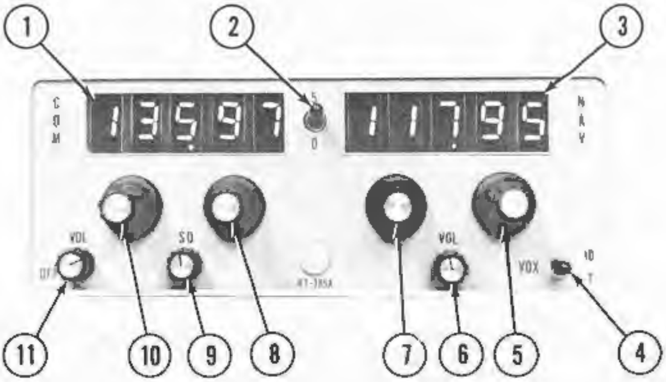
CESSNA 400 AREA NAVIGATION SYSTEM
(Type RN-478A)

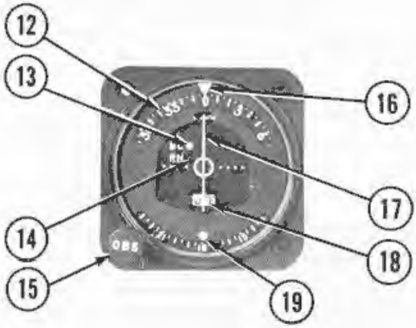
SECTION 1
GENERAL

The Cessna 300 Nav/Com (Type RT-385A) Set with Cessna 400 Area Navigation (RNAV-Type RN-478A) consists of a RT-385A Nav/Com, a R-476A DME system, a RN-478A Area Navigation Computer and a IN-442AR Course Deviation Indicator. The RN-478A includes circuits which combine the VOR navigation information with distance information from the R-476A DME system to provide data for area navigation. Operating information for the communication set and for VOR/localizer navigation is presented in this supplement. Operating information for area navigation and for DME is presented in separate supplements.

The RT-385A Receiver-Transmitter includes a 720-channel VHF communication receiver-transmitter which receives and transmits signals between 118.000 MHz and 135.975 MHz in 25-kHz steps. It also includes a 200-channel VHF navigation receiver which receives VOR and localizer signals between 108.00 MHz and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver can be operated simultaneously.

The VOR or localizer signal from the navigation receiver is applied to the converter circuits in the RN-478A Area Navigation Computer. The





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 Set, 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 center VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the VOR navigational self-test function is selected.

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

6. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio. Clockwise rotation increases audio level.

7. NAVIGATION RECEIVER MEGAHERTZ FREQUENCY 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 MHz FREQUENCY SELECTOR - Depending on position of the 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 MHz FREQUENCY 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 RNAV Computer circuits; controls volume of communication receiver audio.

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

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

14. AREA NAV LAMP (RN) - When green light is illuminated, indicates that RNAV operation is selected.

15. OMNI BEARING SELECTOR (OBS) - Rotates course card (12) to select desired bearing to or from a VOR station or to a selected RNAV waypoint.

16. COURSE INDEX - Indicates selected VOR or RNAV course (bearing).

17. COURSE DEVIATION POINTER - Indicates deviation from selected VOR or RNAV course or localizer centerline.

Figure 1. Cessna 300 Nav/Com Set, Operating Controls and Indicators (Sheet 2 of 3)

18. OFF/TO-FROM INDICATOR - Operates only with VOR or localizer signal. OFF position (flag) indicates unusable signal. With usable VOR signal, when OFF position disappears, indicates whether selected course is TO or FROM station or waypoint. With usable localizer signal, shows TO.

19. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR or RNAV course.

Figure 1. Cessna 300 Nav/Com Set, Operating Controls and Indicators
(Sheet 3 of 3)

converter processes the received navigation signal to provide omni bearing or localizer information for display by the course indicator.

CAUTION

If the RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

The course indicator includes a Course Deviation Indicator (CDI), an Omni Bearing Selector (OBS) and OFF/TO-FROM Indicator Flags. It also includes an RNAV lamp (RN) which lights when area navigation operation is selected, and a back-course lamp (BC) which lights when back-course operation is selected. The IN-442AR is offered as the standard Course Deviation Indicator.

All operating controls and indicators for the Cessna 300 Nav/Com are included on the front panel of the RT-385A Receiver-Transmitter and the associated Course Deviation Indicator. These controls and indicators are shown and described in Figure 1. Operating controls for the RN-478A Area Navigation Computer, which are used for area navigation, and operating controls for the associated Type R-476A DME are shown in the appropriate supplements in this manual.

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 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

COMMUNICATIONS TRANSCEIVER 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 Knobs -- 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 by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position. Adjustment of sidetone may be accomplished by adjusting the sidetone pot located inside the audio control panel.

   b. To Receive -- RELEASE mike button.

NAVIGATION RECEIVER 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 Control -- ADJUST to desired audio level.
5. ID-VOX-T Switch:
   a. To Identify Station -- SET to ID to hear navigation station identifier (Morse Code) signal.
   b. To Filter Out Station Identifier Signal -- SET to VOX (center) position to include filter in audio circuit.
6. OBS Knob -- SELECT desired course.

TO SELF TEST VOR NAVIGATION CIRCUITS:

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 index; CDI pointer centers or deflects left or right, depending on bearing of signal; OFF/TO-FROM indicator shows TO or FROM.
4. ID-VOX-T Switch -- PRESS to T and HOLD at T; CDI pointer should center and OFF/TO-FROM indicator should show FROM.
5. OBS Knob -- TURN to displace course approximately 10° to either side of 0° (while holding ID-VOX-T switch at T); CDI pointer should deflect full scale in direction corresponding to course displacement. OFF/TO-FROM indicator should still show FROM.

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

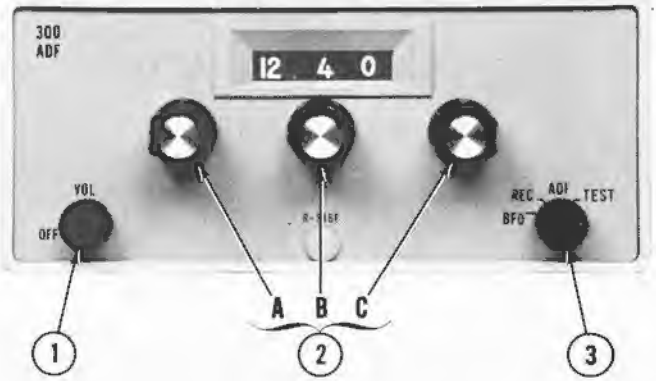
The Cessna 300 ADF is a panel-mounted, digitally tuned automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1,699 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, loop antenna, bearing 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.

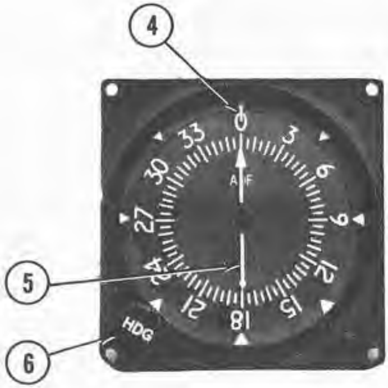
The Cessna 300 ADF can be used for position plotting and homing procedures, and for aural reception of amplitude-modulated (AM) signals.

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)

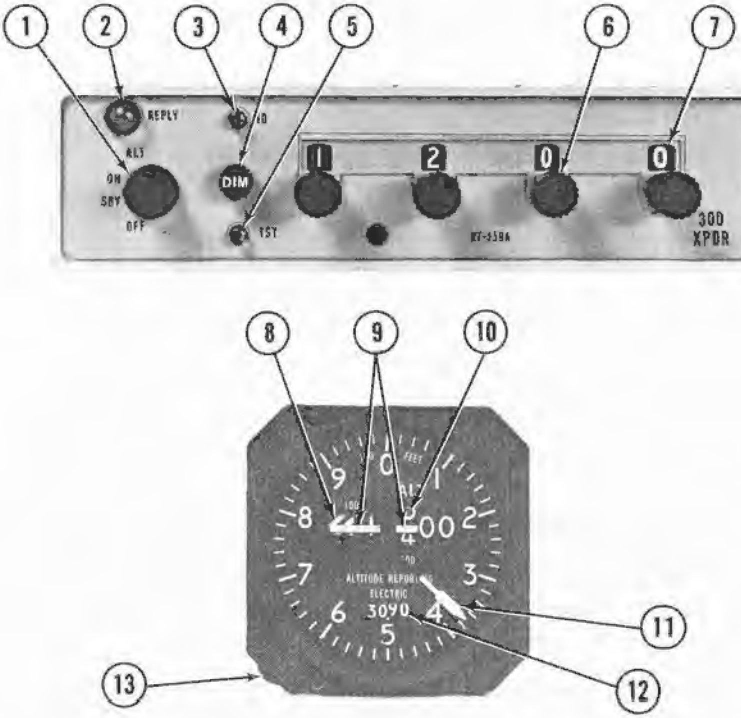
SECTION 1

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)

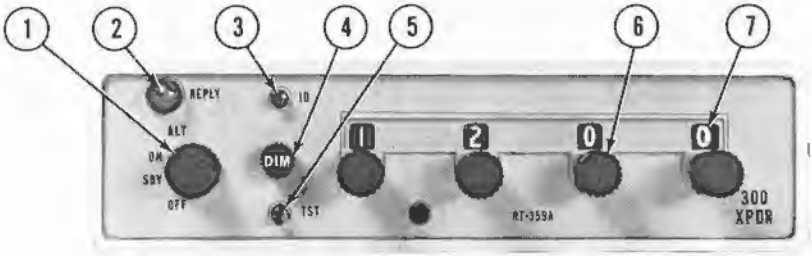
SECTION 1

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

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.

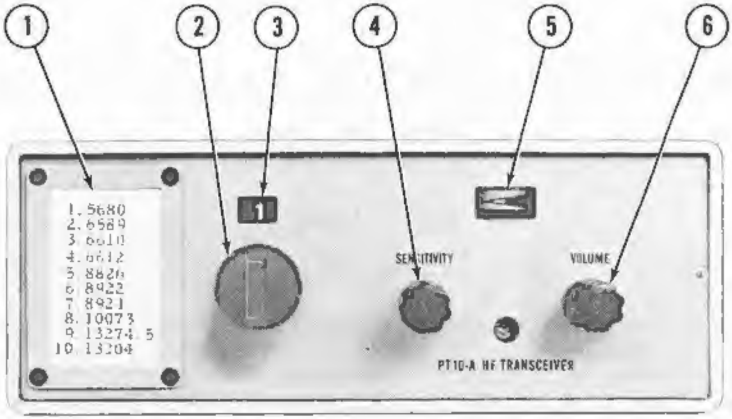
The VOLUME control incorporates the power switch for the transceiver. Clockwise rotation of the volume control turns the set on and increases the volume of audio.

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 pnrposes 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

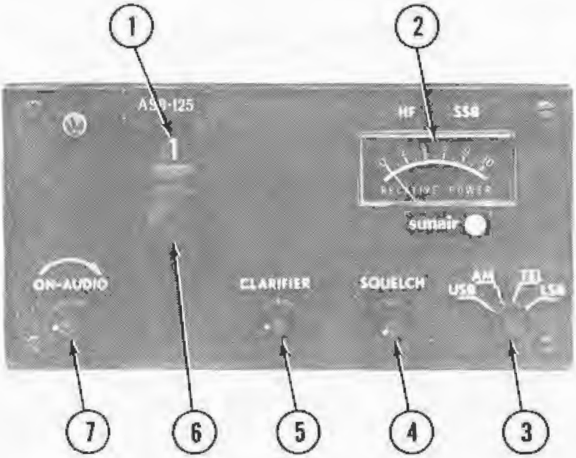
SSB HF TRANSCEIVER
(TYPE ASB-125)

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 a Course Datum synchro as standard features. The 300 Series course deviation indicators do not incorporate a Course Datum synchro but are offered with, or without, Automatic Radial Centering.

NOTE

The Course Datum synchro incorporated in 400 Series course deviation indicators is only operational when coupled to a slaved directional gyro system which is coupled to a 400A or 400B Autopilot or Integrated Flight Control System.

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.

The Cessna 400 Nav/Com incorporates a variable threshold automatic squelch. With this squelch system, you set the threshold level for automatic operation - the further clockwise the lower the threshold - or the more sensitive the set. When the signal is above this level, it is heard even if the noise is very close to the signal. Below this level, the squelch is fully automatic so when the background noise is very low, very weak signals (that are above the noise) are let through. For normal operation of the squelch circuit, just turn the squelch clockwise until noise is heard - then back off slightly until it is quiet, and you will have automatic squelch with the lowest practical threshold. This adjustment should be rechecked periodically during each flight to assure optimum reception.

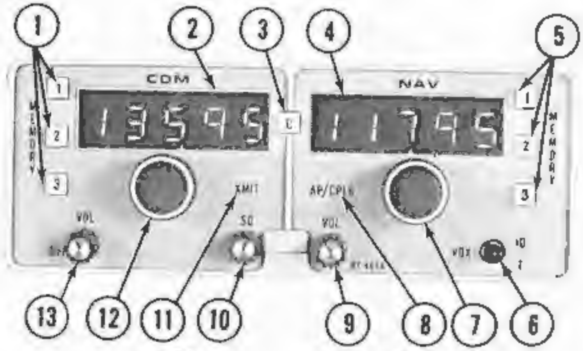
All controls for the Nav/Com, except the omni bearing selector (OBS) knob or automatic radial centering (ARC) knob, which is located on the course deviation indicator, are mounted on the front panel of the receiver-transmitter. The audio control panel used in conjunction with this radio is shown and described in Section 7 of this handbook.

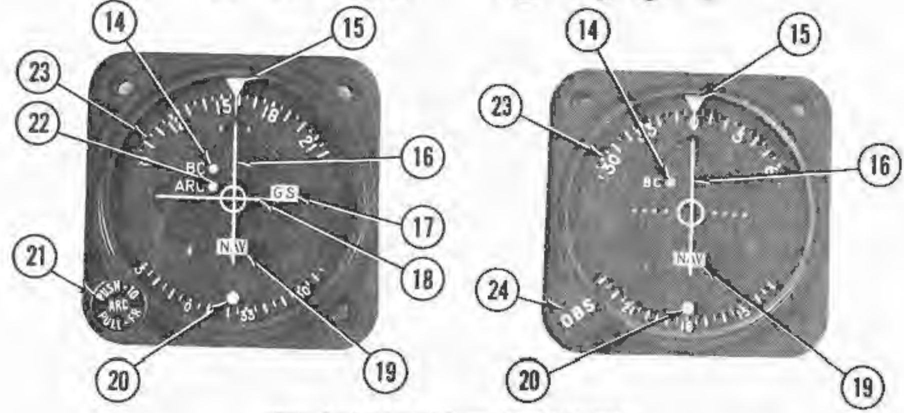
SECTION 2
LIMITATIONS

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

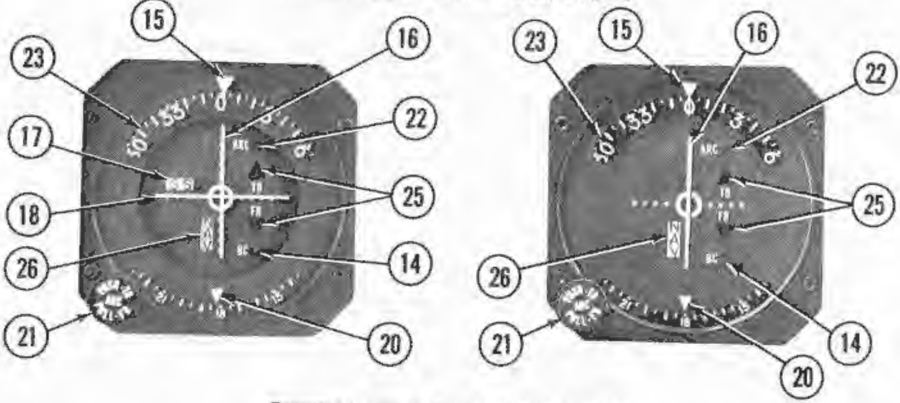
SECTION 3
EMERGENCY PROCEDURES

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





TYPICAL 300 SERIES INDICATORS



TYPICAL 400 SERIES INDICATORS

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 (on audio control panel) -- SET to desired 400 Nav/Com.
3. SPEAKER/PHONE (or AUTO) Switch (on audio control panel) -- SET to desired mode.
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 just eliminate background noise. Adjustment should be checked periodically to assure optimum reception.
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. Adjustment of sidetone may be accomplished by adjusting the sidetone pot located inside the audio control panel.

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

NAVIGATION OPERATION:

NOTE

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.

1. COM OFF /VOL Control -- TURN ON.
2. SPEAKER/PHONE (or AUTO) Switch (on audio control panel) -- SET to desired mode.
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 Light -- CHECK ON (light is only operational if a 400B Autopilot or 400B IFCS is engaged), amber light illuminated.

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 NAV/COM
(Type RT-485A)

WITH

CESSNA 400 AREA NAVIGATION SYSTEM
(Type RN-478A)

SECTION 1
GENERAL

The Cessna 400 Nav/Com (Type RT-485A) Set with Cessna 400 Area Navigation (RNAV-Type RN-478A) consists of a RT-485A Nav/Com, a R-476A DME system, a RN-478A Area Navigation Computer and a Course Deviation Indicator with, or without, the optional Automatic Radial Centering (ARC) feature. The RN-478A includes circuits which combine the VOR navigation information with distance information from the R-476A DME system to provide data for area navigation. Operating information for the communication set and for VOR/localizer navigation is presented in this supplement. Operating information for area navigation and for DME is presented in separate supplements. 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 Switch, Avionics Power Switch, or Master Switch is turned OFF.

The RT-485A Receiver-Transmitter includes a 720-channel VHF communication receiver-transmitter which receives and transmits signals between 118.000 MHz and 135.975 MHz in 25-kHz steps. It also includes a 200-channel VHF navigation receiver which receives VOR and localizer signals between 108.00 MHz and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver can be operated simultaneously.

The VOR or localizer signal from the navigation receiver is applied to the converter circuits in the RN-478A Area Navigation Computer. The converter processes the received navigation signal to provide omni bearing or localizer information for display by the course indicator.

CAUTION

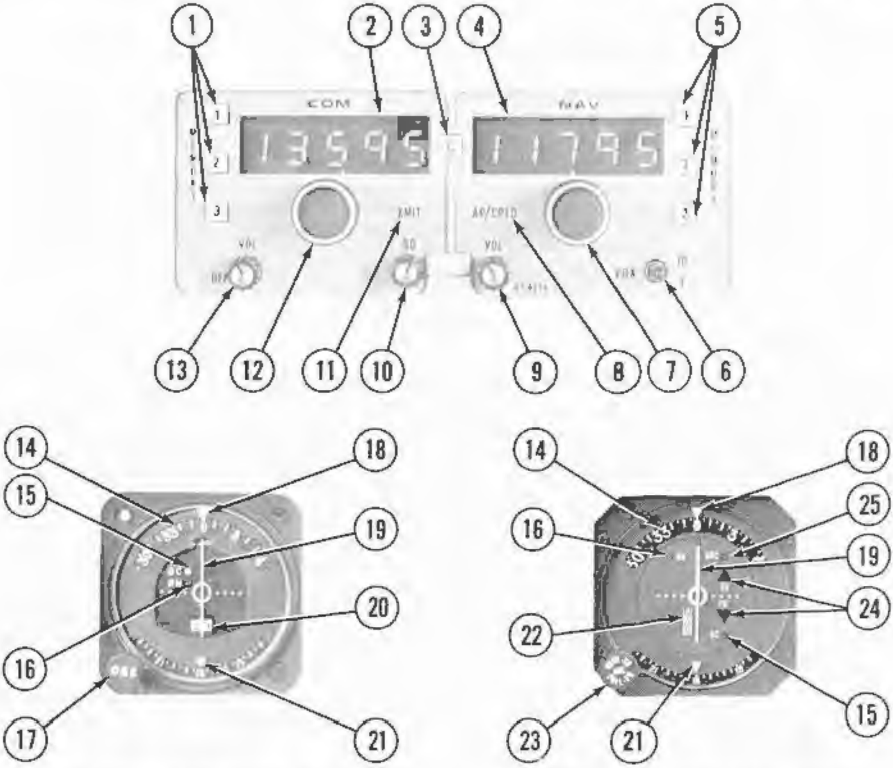
If the RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

The course indicator includes a Course Deviation Indicator (CDI), an Omni Bearing Selector (OBS) or Automatic Radial Centering (ARC) knob, and OFF (or NAV)/To-From Indicator Flags. It also includes an RNAV lamp (RN) which lights when area navigation operation is selected, and a back-course lamp (BC) which lights when back-course operation is selected. The IN-442AR is offered as the standard Course Deviation Indicator and an optional IN-1048AC Course Deviation Indicator is also offered when Automatic Radial Centering (ARC) is desired. When the optional IN-1048AC Course Deviation Indicator is installed, an Automatic Radial Centering lamp (ARC) is incorporated in the CDI to alert the pilot that the Automatic Radial Centering feature has been selected.

All operating controls and indicators for the Cessna 400 Nav/Com are included on the front panel of the RT-485A Receiver-Transmitter and the associated Course Deviation Indicator. These controls and indicators are shown and described in Figure 1. Operating controls for the RN-478A Area Navigation Computer, which are used for area navigation, and operating controls for the associated Type R-476A DME are shown in the appropriate supplements in this manual.

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.



IN-442AR STANDARD CDI
WITHOUT
AUTOMATIC RADIAL CENTERING

IN-104BAC OPTIONAL CDI
WITH
AUTOMATIC RADIAL CENTERING

1. COMM 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 automatically 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.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators (Sheet 1 of 4)

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.

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, 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.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators (Sheet 2 of 4)

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

15. 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.

16. AREA NAV LAMP (RN) - When green light is illuminated, indicates that RNAV operation is selected.

17. OMNI BEARING SELECTOR (OBS) - Rotates course card (12) to select desired bearing to or from a VOR station or to a selected RNAV waypoint.

18. COURSE INDEX - Indicates selected VOR or RNAV course (bearing).

19. COURSE DEVIATION POINTER - Indicates course deviation from selected VOR or RNAV course or localizer centerline.

20. OFF/TO-FROM INDICATOR - Operates only with VOR or localizer signal. OFF position (flag) indicates unusable signal. With usable VOR signal, when OFF position disappears, indicates whether selected course is TO or FROM station or waypoint. With usable localizer signal, shows TO.

21. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR or RNAV course.

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

23. 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 (14) to center course deviation pointer (19) with a TO flag (20 or 24), then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card (14) to indicate bearing from VOR station, keeping course deviation pointer (19) centered, with a FROM flag (20 or 24). 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.

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators (Sheet 3 of 4)

24. 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.

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

Figure 1. Cessna 400 Nav/Com Set, Operating Controls and Indicators
(Sheet 4 of 4)

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.

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 Pushbutton -- 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 anytime 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. Adjustment of sidetone may be accomplished by adjusting the sidetone pot located inside the audio control panel.

   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 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 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 or 400B IFCS autopilot is engaged), amber light illuminated.

NOTE

The AP/CPLD annunciator light is only operational with a 400B or 400B IFCS autopilot 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 AREA NAVIGATION SYSTEM

(Type RN-478A)

SECTION 1

GENERAL

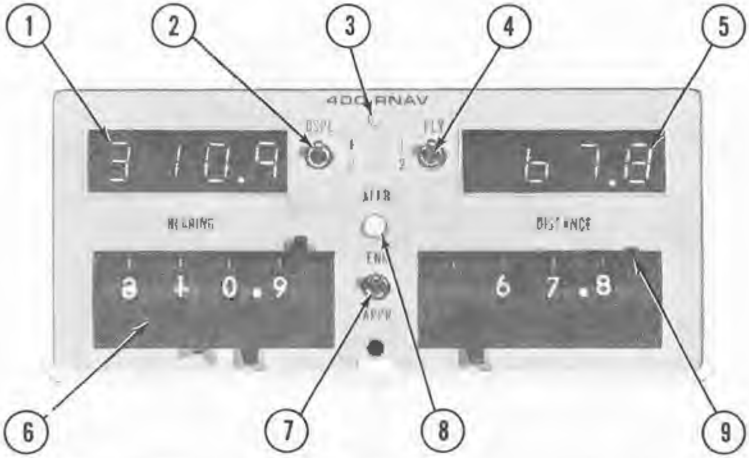
The Cessna 400 Area Navigation System (Type RN-478A) consists of an RN-478A Area NAV Computer (RNAV), a compatible VHF navigation receiver and course deviation indicator, and the Type R-476A distance measuring equipment (DME). The RNAV includes converter circuits which operate with the VHF navigation receiver and produce positional information for display by the course deviation indicator. It also includes computer circuits which combine the bearing information from the navigation set with the distance information from the R-476A DME to establish navigation data for selected waypoints. During RNAV operation, a course scalloping suppressor circuit suppresses the spurious navigation signal phases to provide stable waypoint information which enhances autopilot operation. The 400 RNAV is coupled to the number 2 Nav/Com and includes storage for 3 waypoints.

Ground speed/time-to-station information to the selected VOR (not the waypoint) is available on this system. This capability, along with the course scalloping suppression (radial straightening), may be used to an advantage while tracking inbound or outbound from the VOR station by programming a waypoint directly over the associated VOR (000.0°/000.0 nautical miles) and using RNAV for course smoothing while enroute.

CAUTION

If RNAV set is removed from the airplane or becomes inoperative, the associated VHF navigation indicator will be inoperative.

All operating controls and displays which are part of the RN-478A are shown and described in Figure 1. Other controls required for operation of the Cessna 400 Area Navigation System are included on the VHF navigation receiver and on the R-476A DME control; these controls are shown and described in the respective supplements included for this equipment.



1. BEARING DISPLAY READOUT - Depending on position of DSPL Switch, displays bearing programmed for waypoint 1 or waypoint 2.

2. DISPLAY 1-2 SWITCH (DSPL) - Determines information shown on DISTANCE and BEARING displays: In position 1, distance and bearing programmed for waypoint 1 are displayed; in position 2, distance and bearing programmed for waypoint 2 are displayed.

3. FLY/DISPLAY LAMP - Flashes amber when FLY Switch and DSPL Switch are not set to same number; indicates that waypoint information being displayed is not waypoint information being flown.

4. FLY SWITCH - Determines waypoint being used for navigation. In position 1, waypoint 1 is in use; in position 2, waypoint 2 is in use.

5. DISTANCE DISPLAY READOUT - Depending on position of DSPL Switch, displays distance programmed for waypoint 1 or waypoint 2.

6. BEARING MINILEVER SWITCHES (4) - Select bearing of desired waypoint from VOR/DME station. May be used to store bearing of 3rd waypoint.

7. ENROUTE/APPROACH SWITCH (ENR/APPR) - Controls width of navigation corridor. ENR position provides standard (±5 NM) enroute sensitivity; APPR position provides standard (±1-1/4 NM) approach course sensitivity.

NOTE

Due to unreliable signals, do not operate in the APPR position when computed distance to waypoint exceeds 51 nautical miles.

8. TRANSFER PUSHBUTTON SWITCH (XFER) - Transfers waypoint distance and bearing from minilevers into either waypoint 1 or 2 as selected by DSPL switch position.

9. DISTANCE MINILEVER SWITCHES (4) - Select distance of desired waypoint from VOR/DME station. May be used to store distance of 3rd waypoint.

Figure 1. Cessna 400 Area Nav (Type RN-478A) Computer, Operating Controls and Indicators

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the following RNAV IFR approach limitation should be adhered to during airplane operation.

OPERATING LIMITATION:

1. IFR Approaches -- Follow approved published RNAV instrument procedures.

SECTION 3
EMERGENCY PROCEDURES

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

SECTION 4
NORMAL PROCEDURES

VOR/LOC OPERATION

VOR NAVIGATION CIRCUITS VERIFICATION TESTS:

1. See appropriate Nav/Com supplement.

VOR/LOC NAVIGATION:

As a convenience to the pilot, a separate supplement (Avionic Operation Guide) is supplied to explain the various procedures for using the VHF Navigation Set for VOR and localizer navigation. Refer to the Avionic Operations Guide for flight procedures.

AREA NAVIGATION OPERATION

NOTE

Proper RNAV operation requires valid VOR and DME inputs to the RNAV system. In certain areas, the ground station antenna patterns and transmitter power may be inadequate to provide valid signals to the RNAV. For this reason, intermittent RNAV signal loss may be experienced enroute. Prolonged loss of RNAV signal shall require the pilot to revert to other navigational procedures.

WAYPOINT PROGRAMMING:

1. Using a VFR sectional, enroute instrument chart, instrument approach plate, or enroute RNAV chart -- DETERMINE distance and bearing for desired waypoint(s) from appropriate VOR/DME stations.
2. VHF Navigation Receiver -- ON.
3. DME TEST/ON-OFF Switch -- ON.
4. DME Mode Selector Switch -- RNAV.
5. RNAV DSPL Switch -- 1.

NOTE

When DSPL and FLY switches are not set to the same waypoint number, the display/fly light slowly blinks on and off as a reminder to the pilot that values displayed are not those being used for navigation. This does not affect operation of the unit.

6. BEARING Minilever Switches -- SET to first waypoint bearing.
7. DISTANCE Minilever Switches -- SET to first waypoint distance.
8. XFER Pushbutton Switch -- PUSH in.
   a. First waypoint bearing and distance are placed in memory as waypoint 1.
   b. BEARING Display Readout -- DISPLAYS readout of first waypoint bearing.
   c. DISTANCE Display Readout -- DISPLAYS readout of first waypoint distance.
9. RNAV DSPL Switch -- SET to 2.
10. BEARING Minilever Switches -- SET to second waypoint bearing.
11. DISTANCE Minilever Switches -- SET to second waypoint distance.
12. XFER Pushbutton Switch -- PUSH in.
    a. Second Waypoint Readout -- BEARING and DISTANCE are placed in memory as waypoint 2.
    b. BEARING Display Readout -- DISPLAYS readout of second waypoint bearing.
    c. DISTANCE Display Readout -- DISPLAYS readout of second waypoint distance.
13. BEARING Minilever Switches -- SET to standby waypoint bearing.

14. DISTANCE Minilever Switches -- SET to standby waypoint distance.

NOTE

As first waypoint is reached, it can be replaced with the third "standby" waypoint (already set) before placing the RNAV "DSPL" switch to 2. Then a fourth waypoint, if necessary, can be set with the minilever selectors.

DISPLAY RELIABILITY TESTS:

NOTE

This test must be conducted following the "Waypoint Programming" procedures with the VHF Navigation Receiver and DME TEST/ON-OFF switches still in the ON position.

1. VHF Navigation Receiver Frequency Selector Switches -- SET to VOR frequency.
2. RNAV DSPL and FLY Switches -- DSPL set to 1, FLY set to 2.
   a. Readout -- DISPLAYS first waypoint bearing and distance that was selected in Waypoint Programming.
   b. Fly/Display Lamp (On RNAV Control Head) -- FLASHES.
3. RNAV DSPL and FLY Switches -- DSPL set to 2, FLY set to 1.
   a. Readout -- DISPLAYS second waypoint bearing and distance.
   b. Fly/Display Lamp (On RNAV Control Head) -- FLASHES.
4. RNAV DSPL and FLY Switches -- BOTH SET to same number.
   a. Readout -- DISPLAYS waypoint bearing and distance as selected by DSPL switch.
   b. Fly/Display Lamp (On RNAV Control Head) -- NOT LIGHTED.
5. DME Mode Selector Switch -- SET to RNAV.
   a. Both RN and NM Annunciators on DME -- LIGHTED.
   b. RN Lamp on Course Deviation Indicator -- LIGHTS.
6. VHF Navigation Receiver Frequency Selector Switches -- SET to LOC frequency.
   a. Both RN and NM Annunciators -- LIGHTED.
   b. RN Lamp on Course Deviation Indicator -- LIGHTED.
   c. Course Deviation Indicator OFF(or NAV)/TO-FROM Indicator -- OFF (or NAV) flag in view.
7. DME Mode Selector Switch -- SET to NAV 1, NAV 2, or HOLD.
   a. NM Annunciator on DME -- LIGHTED.
   b. RN Annunciator on DME -- NOT LIGHTED.
   c. RN Lamp on Course Deviation Indicator -- NOT LIGHTED.
   d. Course Indicator OFF(or NAV)/TO-FROM Indicator -- Shows TO if a usable signal is received.

8. DME Mode Selector Switch -- RNAV.
9. DME TEST/ON-OFF Switch -- HOLD to TEST.
   a. DME RN/NM Distance Display -- READOUT is 888.8.
   b. DME KTS/MIN Ground Speed/Time-to-Station Display -- READOUT is 888
   c. RNAV BEARING Display -- READOUT is 888.8.
   d. RNAV DISTANCE Display -- READOUT is 188.8.

AREA NAVIGATION CIRCUITS SELF-TEST:

1. VHF Navigation Receiver -- ON.
2. VHF Navigation Receiver Frequency Selector Switches -- SET to a usable VOR/DME frequency.
3. DME TEST/ON-OFF Switch -- ON.
4. DME Mode Selector Switch -- RNAV.
   a. RN Lamp on Course Deviation Indicator -- LIGHTED.
5. RNAV Computer -- PROGRAMMED to waypoint.
6. DSPL and FLY Switches -- SET both to waypoint to be tested.
   a. BEARING Display -- READOUT is waypoint bearing.
   b. DISTANCE Display -- READOUT is waypoint distance.
   c. Course Indicator -- RN LAMP lights.
7. Course Indicator OBS (or ARC) -- SET to waypoint bearing.
8. VHF Navigation Receiver ID/VOX/T Switch -- HOLD in T position.
   a. Course Deviation Pointer -- CENTERS.
   b. Course Deviation Indicator OFF(or NAV)/TO-FROM Flag -- Shows TO.
   c. DME Distance Display -- READOUT is the same as the RNAV DISTANCE readout.

NOTE

After releasing the navigation receiver test (T) switch, the return to accurate computed bearing and distance data can take up to 60 seconds depending upon airplane position and waypoint.

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

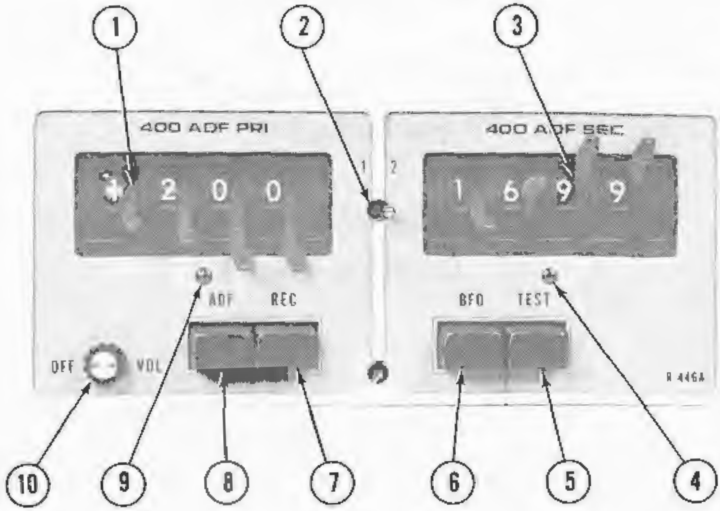
CESSNA 400 ADF
(Type R-446A)

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.



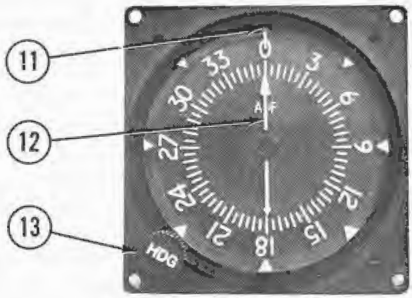


Figure 1. Cessna 400 ADF Operating Controls and Indicator
(Sheet 1 of 2)

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 DME

(TYPE R-476A)

SECTION 1
GENERAL

The Cessna 400 DME (Type R-476A) is the airborne "interrogator" portion of a navigation system which supplies continuous, accurate, slant range distance information from a fixed ground station to an aircraft in flight.

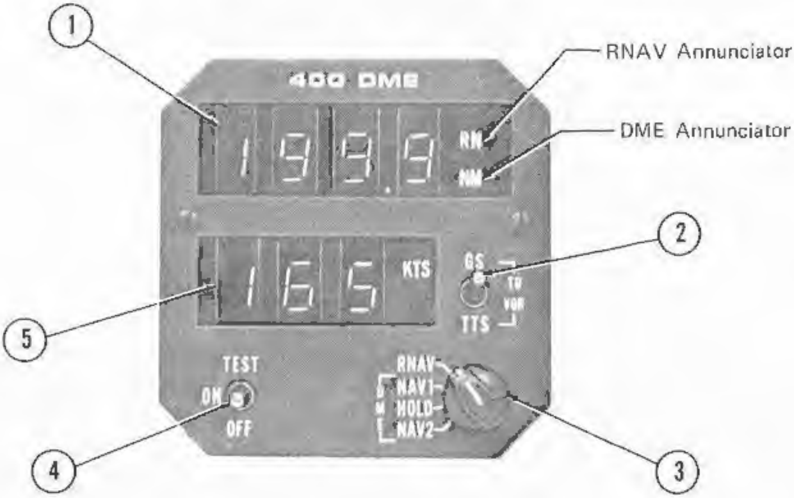
Except for selection of the operating channel, which is selected by the VHF navigation receiver frequency selector switches, the Cessna 400 DME is capable of independent operation. The equipment consists of a panel-mounted C-476A Control Unit which contains all of the operating controls and displays, and a remotely mounted RTA-476A Receiver-Transmitter. The RTA-476A transmits interrogating pulse pairs on 200 channels between 1041 MHz and 1150 MHz; it receives associated ground-to-air replies between 978 MHz and 1213 MHz. The C-476A Control Unit digitally displays distances up to 200 nautical miles and either ground speed or time-to-station information, as selected. All operating controls and displays for the DME are shown in Figure 1, and the functions of each are described.

SECTION 2
LIMITATIONS

There is no change to the airplane emergency procedures 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.



1. DISTANCE DISPLAY - In NAV 1, NAV 2, or HOLD mode, displays distance to selected VOR/DME station in nautical miles; only NM (Nautical Miles) annunciator lights. In RNAV mode, displays distance to selected waypoint in nautical miles; both RN (RNAV) and NM annunciators light.

2. GS/TTS SELECTOR SWITCH - In NAV 1, NAV 2, or HOLD mode, selects display of ground speed (GS) or time-to-station (TTS). In RNAV mode, display shows ground speed component to or from the VOR (not to waypoint) or the time to the VOR station at that indicated ground speed.

3. DME MODE SELECTOR SWITCH - Selects DME operating mode as follows:

   RNAV: Selects area navigation operation; selects display of nautical miles (distance) to selected RNAV waypoint.

   NAV 1: Selects DME operation with No. 1 VHF navigation set; enables channel selection by NAV 1 frequency selector switches.

   HOLD: Selects DME memory circuit; DME remains channeled to station to which it was channeled when HOLD was selected; display of distance continues to be nautical miles to that station. Both the NAV 1 and the NAV 2 sets may be set to new operation frequencies.

CAUTION

In the HOLD mode, there is no annunciation of the VOR/DME station frequency.

   NAV 2: Selects DME operation with No. 2 VHF navigation set; enables channel selection by NAV 2 frequency selector switches.

Figure 1. Cessna 400 DME (Type R-476A) (Sheet 1 of 2)

4. TEST/ON-OFF SWITCH - Controls application of power to DME circuits (turns equipment on or off); selects display lamp test for DME and RNAV displays.

5. GROUND SPEED/TIME DISPLAY - Displays ground speed in knots or time-to-station in minutes, as follows:
   a. With GS/TTS Switch set to GS, displays ground speed component to or from station in knots (aircraft must be flying directly to or from the VOR/DME station for true ground speed indication).

   b. With GS/TTS Switch set to TTS, displays time to VOR/DME station in minutes at the ground speed component indicated.

   c. With GS/TTS in RNAV mode will display ground speed component or time-to-station at that speed to the selected VOR (not the waypoint).

Figure 1. Cessna 400 DME (Type R-476A) (Sheet 2 of 2)

SECTION 4
NORMAL PROCEDURES

DME OPERATION:

1. TEST/ON-OFF Switch -- SET to ON.
2. DME Mode Selector Switch -- SET to NAV 1 or NAV 2.
3. NAV 1 and NAV 2 VHF Navigation Receivers -- ON: SET FREQUENCY selector switches to VOR/DME station frequencies, as required.

NOTE

When the VOR frequency is selected, the appropriate DME frequency is automatically channeled. Therefore, the system does not provide independent operation of the DME for reception of the DME Morse Code identifier.

4. GS/TTS Switch -- SET as desired.
5. TEST/ON-OFF Switch -- HOLD to TEST:
   a. Distance-to-Station Display readout is 188.8.
   b. Knots/Minutes Display readout is 888.
6. TEST/ON-OFF Switch -- RELEASE to ON; display readouts return to normal.

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.

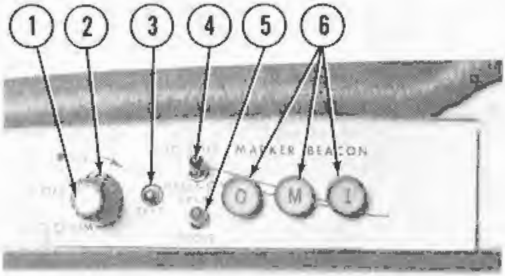
This system provides visual and aural indications of 75 MHz ILS marker beacon signals as the marker is passed. The following table lists the three most currently used marker facilities and their characteristics.

MARKER FACILITIES

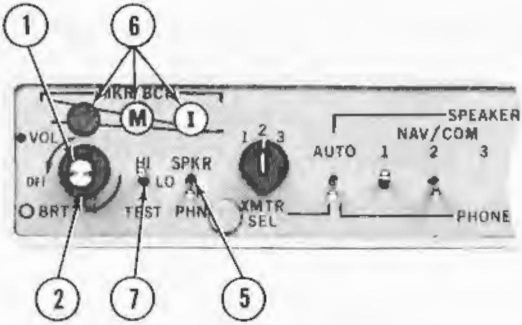
MARKER	IDENTIFYING TONE	LIGHT*
Inner	Continuous 6 dots/sec (300 Hz)	White
Middle	Alternate dots and dashes (1300 Hz)	Amber
Outer	2 dashes/sec (400 Hz)	Blue

* 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.

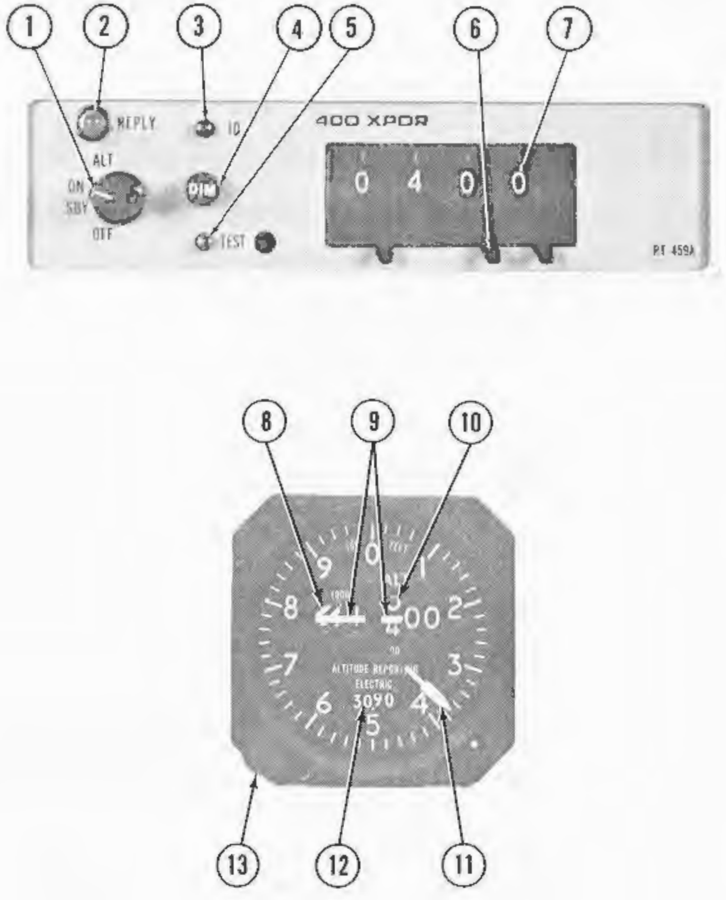


Figure 1. Cessna 400 Transponder and Encoding Altimeter Operating Controls (Sheet 1 of 2)

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 (TEST) 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) TEST Button -- DEPRESS and HOLD (Reply lamp should light with full brilliance regardless of DIM control setting).
(4) TEST 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)

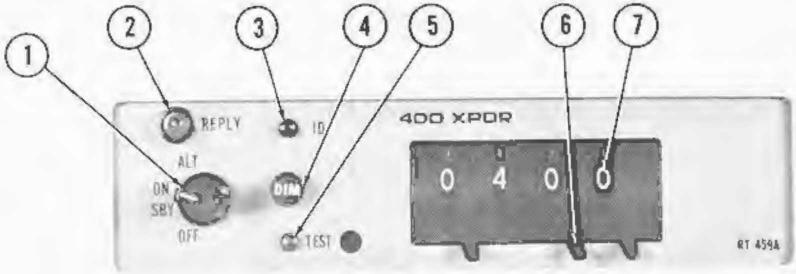
SECTION 1

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 (TEST) 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) TEST Button -- DEPRESS (reply lamp should light brightly regardless of DIM control setting).
(4) TEST 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.

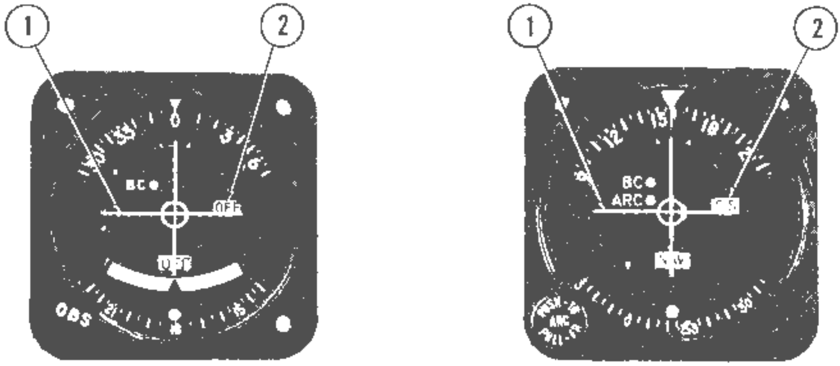
The Cessna 400 Glide Slope system consists of a remote-mounted receiver coupled to an existing navigation system, a panel-mounted indicator and an externally-mounted antenna. The glide slope receiver is designed to receive ILS glide slope signals on any of 40 channels. The channels are spaced 150 kHz 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)

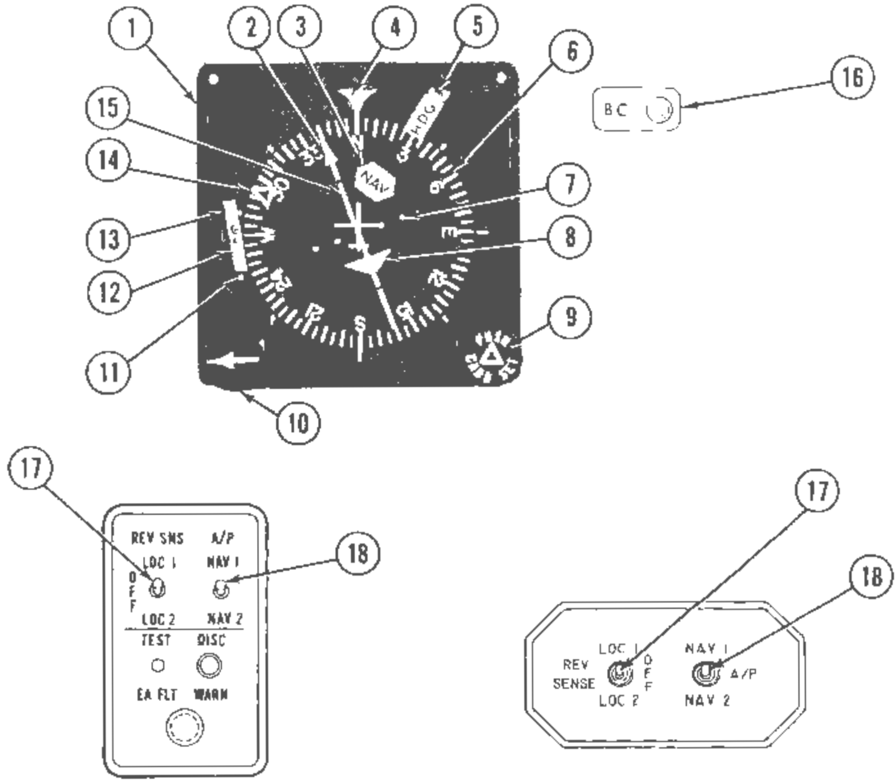
SECTION 1
GENERAL

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 illnminate 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 canse 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 Antopilots 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 <u>must</u> be set to the inboard front course for <u>both</u> 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

OPTIONAL SLAVED HORIZONTAL SITUATION INDICATOR (HSI)

(TYPE IG-832A)

(STANDARD EQUIPMENT ON 400 SERIES IFC SYSTEMS)

SECTION 1

GENERAL

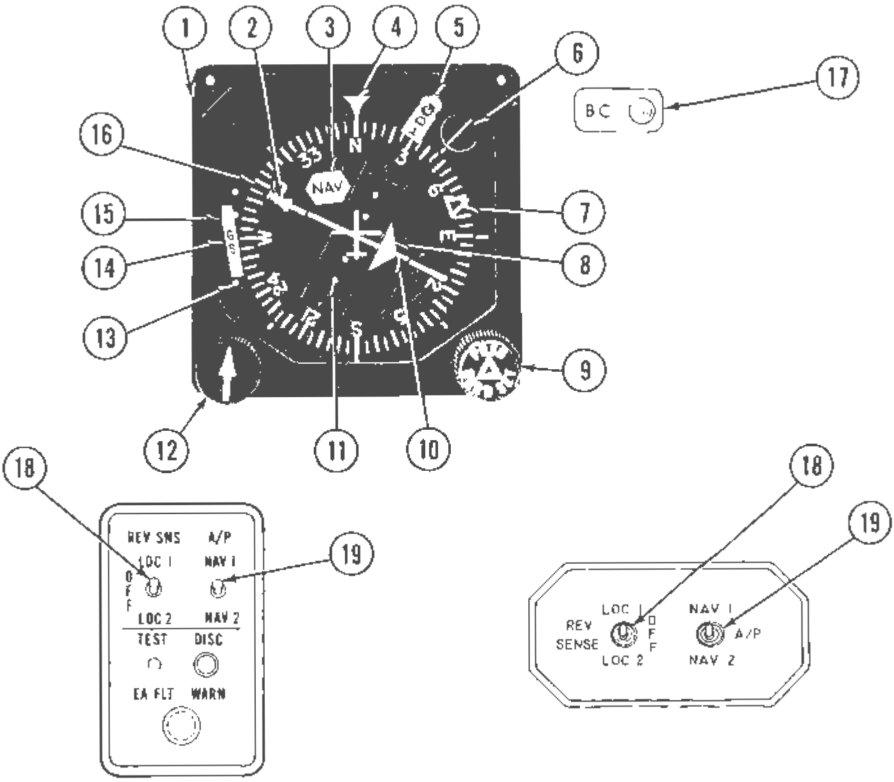
The IG-832A Horizontal Situation Indicator (HSI) is an additional navigation indicator option available with Cessna 300 or 400 Nav/Com radios. When dual Nav/Coms are installed, the HSI is coupled to the first Nav/Com and a standard 300 or 400 series VOR/LOC indicator is coupled to the second Nav/Com.

This system consists of a remote Horizontal Situation Indicator (HSI), a SA-832A remote slaving accessory without course datum or an alternate SA-832B with course datum and a remote VOR/LOC converter which is only installed without a RNAV installation. The HSI features the modified ARINC face presentation, providing a slaved gyro heading display with a built-in slaving indicator and full ILS navigation capability. When the HSI is installed with 400A or 400B series Autopilots, a BC light is installed on the instrument panel, adjacent to the HSI, to alert the pilot of back-course operations. 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.

2. OMNI BEARING POINTER - Indicates selected VOR course or localizer course on compass card (16). The selected VOR radial or localizer heading remains set on the compass card when the compass card (16) 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-832A)
(Sheet 1 of 3)

4. HEADING REFERENCE (LUBBER LINE) - Indicates aircraft magnetic heading on compass card (16).

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 speed being low.

6. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the HSI 45° right index, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of heading indicator error relative to aircraft magnetic heading. The compass CARD SET knob (9) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.

7. HEADING BUG - Indicates selected reference heading relative to the compass card (16).

8. TO/FROM INDICATOR FLAG -- Indicates direction of VOR station relative to selected course.

9. HEADING SELECTOR AND CARD SET KNOB (PUSH ▲ CARD SET) - Positions heading "bug" on compass card (16) by rotating the PUSH ▲ CARD SET knob. Pushing in and rotating the PUSH ▲ CARD SET knob, sets the compass card. The "bug" (7) rotates with the compass card.

10. 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.

11. COURSE DEVIATION DOTS - A course deviation bar displacement of 2 dots represents full scale (VOR = ±10° or LOC = ±2½°) deviation from beam centerline.

12. COURSE SELECTOR (⍿) KNOB - When rotated, positions omni bearing selector (2) on the compass card (16) to select desired VOR radial or localizer course.

13. 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.

14. GLIDE SLOPE POINTER - Indicates on glide slope scale (13) aircraft displacement from glide slope beam center.

15. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.

16. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (4).

Figure 1. Horizontal Situation Indicator (HSI) (Type IG-832A) (Sheet 2 of 3)

17. BC LIGHT (Installed in a remote position, as shown, with 400A and 400B Autopilots only. The BC light is incorporated in the mode selector on 400A and 400B IFC systems.) - Remote amber BC light installed with 400A or 400B Autopilots will illuminate when back-course operation is selected by the REV SNS LOC 1 switch on the left-hand instrument panel. With 400A or 400B IFC systems when back-course operation is selected the BC light incorporated in the MODE SELECTOR will illuminate green.

CAUTION

When back-course operation is selected, the omni deviation bar 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.

18. 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 be reversed for back-course operation. With autopilot ON or OFF, the 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.

19. 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-832A)
(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 tuned to an omni station. When tuned to a localizer frequency, the omni bearing pointer must be set to the inbound front course for both front and back-course approaches to retain this pictorial presentation.

When the HSI system is installed with a Cessna 400A (Type AF-530A) Autopilot 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 upper portion of the pilot's instrument panel on 337 Models or is mounted in the autopilot accessory unit on 210 Models) is placed in the ON (LOC 1) position to alert the pilot that back-course operation is selected. The BC light is incorporated in the MODE SELECTOR on 400A and 400B IFC systems. The HSI needle will not be reversed but the LOC signals to the autopilot will be. Light dimming for both types of BC lighting is provided for low ambient light conditions.

For normal procedures with autopilots, refer to the 400A, 400B, 400A IFCS and 400B IFCS Autopilot Supplements in this handbook if they are listed in this section as options. A description of course datum and autopilot procedures for course datum are incorporated in the appropriate autopilot supplements.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

CESSNA 800 ALTITUDE ENCODING
(Type EA-801A)

WITH

ALTITUDE ALERTING/PRESELECT
(Type AA-801A)

SECTION 1
GENERAL

The Cessna 800 encoding altimeter (Type EA-801A) is an electrically driven instrument that senses airplane altitude and provides the pilot with a visual display of the altitude. It also includes an optical encoder which automatically produces a logic code corresponding to the sensed altitude. This code is supplied to the Air Traffic Control Radar Beacon System transponder in the airplane to generate replies to Mode C (altitude reporting) interrogations from the ground radar. A second altitude information output from the altimeter can be coupled to airplane accessory equipment such as an altitude alerter or an autopilot altitude preselector circuit.

The altitude alerter (Type AA-801A) is an accessory unit used with the Cessna 800 encoding altimeter to supply a preselected altitude capture signal to arm the altitude hold function of the Integrated Flight Control System. It also provides visual and aural warnings as the airplane approaches and then deviates from the selected altitude.

The encoding altimeter is a panel-mounted barometric altimeter with an altitude range of -1000 to +35,000 feet. Altitude is displayed by a dial and a digital readout. The dial is graduated in 10 numerical divisions which represent increments of 100 feet, with subdivision markings for every 20 feet; the dial pointer completes one revolution for every 1000 feet of altitude change. The digital readout displays airplane altitude in increments of hundreds and thousands of feet only. Friction-induced lag and jumping of the display is reduced by the use of a combined aneroid sensor and motor-driven display. Electronic damping circuits in the unit insure that the display follows altitude changes rapidly with no overshoot. When power is removed from the altimeter, a striped warning flag appears across the digital altitude display to indicate a "power-off" condition.

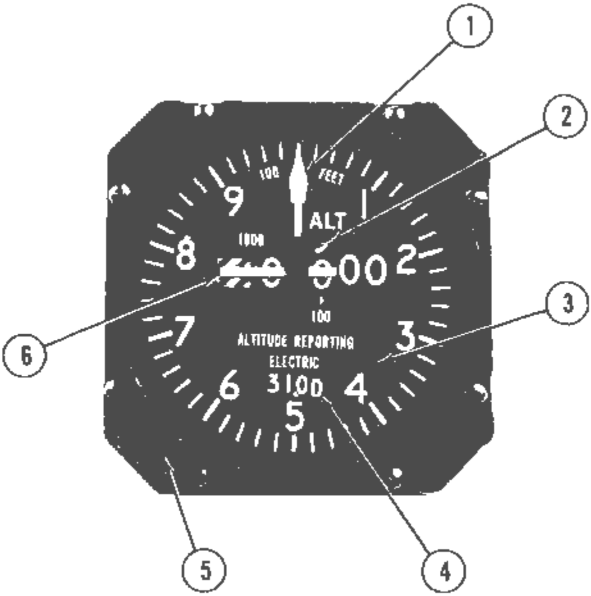
The local altimeter setting is set into the altimeter with a manually operated baroset knob, and is displayed on a four-digit readout, either in inches of mercury or in millibars (as ordered). The altimeter setting does not affect the output of the optical encoder, since the encoder is always referenced to standard pressure (sea level; 29.92 inches of mercury or 1013.2 millibars).

Except for introducing the altimeter setting with the baroset knob, operation of the altimeter is completely automatic. The baroset knob and the display indicators are shown in Figure 1.

The altitude alerter is a panel-mounted unit which includes all of the operating controls and indicators and the preselector logic circuits. Altitude information for use in the altitude alerter is supplied electronically from the encoding altimeter. Three Minilever switches, mounted on the front panel of the unit, are used to select any altitude between 100 and 35,000 feet in 100-foot increments; the selected altitude is displayed on a digital readout. The preselector control and indicators and an ALERT indicator are also included on the front panel of the unit. All controls and indicators for the altitude alerter are shown in Figure 2.

The altitude capture function is selected by a white pushbutton switch (ARM) which energizes the preselector logic circuits. For altitude capture function operation, the Integrated Flight Control System must be turned on but not engaged in a vertical mode (altitude hold or glide slope coupled). When the Minilever switches are set to the desired altitude and the white ARM pushbutton is pushed in, an amber ARMD panel lamp lights to indicate that the function is "armed." When the airplane reaches the selected altitude, the amber ARMD lamp turns off, and a green CPLD panel lamp on the alerter and the altitude hold (ALT) lamp on the flight director mode selector lights to indicate that altitude hold mode is operational. If the Minilever switches are repositioned after the preselector has been armed but before altitude hold is engaged, the logic circuits are reset and must be rearmed by again pushing in the ARM switch.

The alert indicator consists of a three-lamp display and an associated one-second aural tone. The green indicator lamp (ALERT) lights when the airplane altitude is within ±300 feet of the selected altitude. When the airplane enters an altitude band from 300 to 1000 feet above or below the selected altitude, the amber HI ALERT or LO ALERT lamp lights and simultaneously, a one-second tone is heard. The one-second aural annunciator is only activated whenever the amber altitude band is entered, or the green altitude band is departed. There is no audible annunciator when the green band is entered, or when the amber altitude band is departed.



1. ZERO-TO-THOUSAND FOOT ALTITUDE DISPLAY POINTER -Directly indicates airplane altitude between 0 and 1000 feet; for altitudes above 1000 feet, indicates last three digits of altitnde (ones, tens, and hnndreds).

2. ALTITUDE READOUT - Displays altitude above 100 feet on three-section counter in increments of 10,000, 1000, and 100 feet. When altitude is below 10,000 feet, a diagonally striped flag appears in 10,000-foot window.

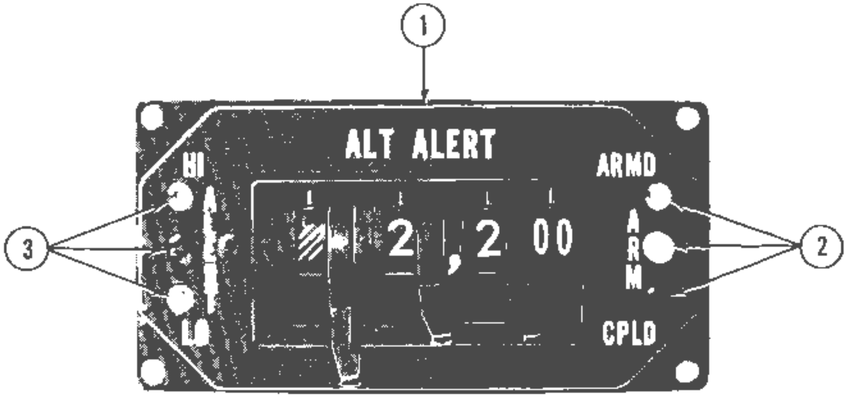
3. ZERO-TO-THOUSAND FOOT ALTITUDE DISPLAY DIAL - Calibrated in 10 numerical graduations which represent increments of 100 feet; the subdivisions of each graduation represent increments of 20 feet.

4. ALTIMETER SETTING READOUT - Displays altimeter setting set into altimeter with baroset knob on a four-digit counter.

5. BAROSET KNOB - Used to set in local altimeter setting; clockwise rotation increases setting, counterclockwise rotation decreases setting.

6. POWER-OFF WARNING FLAG - Appears across altitude readout when power is removed from altimeter to indicate that readout is not reliable.

Figure 1. Cessna 800 Encoding Altimeter Indicator (Type EA-801A)



1. ALTITUDE SELECTOR AND DISPLAY - Minilever switches (3) select desired altitude between 100 and 39,900 feet in 100-foot increments. Digital readout displays selected altitude. Black/white flag in first window, when visible, indicates selected altitude is less than 10,000 feet.

2. ALTITUDE CAPTURE CONTROL AND INDICATORS - Selector switch and two-lamp indicator which operate as follows:

   ARM Pushbutton Switch - Arms altitude capture function of Alerter, provided Integrated Flight Control System is turned on and not already engaged in a vertical mode (altitude hold or glide slope coupled), and altitude selector switches are set to desired altitude.

   ARMD AMBER LAMP - Lights when ARM pushbutton switch is pushed in to indicate that altitude capture function of flight director is engaged; remains lighted until altitude is captured.

   CPLD Green Lamp - Lights when airplane reaches selected altitude and Integrated Flight Control System altitude hold mode is automatically engaged.

3. ALTITUDE ALERT INDICATOR - Three-lamp indicator which operates within a preestablished alert range on either side of the selected altitude, as follows:

   ALERT Green Lamp - Lights when airplane altitude is within about 300 feet of the selected altitude.

   HI ALERT Amber Lamp - Lights when airplane altitude is about 1000 feet above the selected alert altitude during descent or when deviating by about 300 feet above alert altitude after reaching altitude.

   LO ALERT Amber Lamp - Lights when airplane altitude is about 1000 feet below the selected alert altitude during climb or when deviating by about 300 feet below alert altitude after reaching altitude.

NOTE

A one-second aural tone is heard when the airplane enters either amber band from above or below the altitude alert range, or departs from the green band.

Figure 2. Cessna 800 Altitude Alerter Indicator (Type AA-801A)

SECTION 2
LIMITATIONS

There is no change to the airplane performance when this avionic equipment is installed. However, the encoding altimeter used in this installation does have a limitation that requires a standard barometric altimeter be installed as a back-up altimeter.

SECTION 3
EMERGENCY PROCEDURES

ENCODING ALTIMETER FAILURE (WARNING FLAG SHOWING):

1. ENCODING ALT Circuit Breaker -- CHECK IN.
2. If warning flag is still showing, use the standby barometric altimeter.

SECTION 4
NORMAL PROCEDURES

ALTIMETER OPERATION:

1. Baroset Knob -- TURN as necessary to set readout to local altimeter setting.
2. Power-off Warning Flag -- VERIFY that flag is not in view.

WARNING

Do not attempt to use altimeter indication for flight information if warning flag is in view. Flag indicates that power has been removed from altimeter.

3. Altitude Display -- Below 1000 feet read altitude on display pointer and dial. Above 1000 feet, read altitude on altitude readout plus pointer and dial indication for last two digits (for example, for an altitude of 12,630 feet, read 12,600 feet on readout; read 30 feet on pointer and dial).

ALTITUDE ENCODING AND ACCESSORY OPERATION:

Operation of the altitude encoding and accessory information functions of the altimeter is completely automatic as soon as power is applied to the altimeter and the warning flag is out of view. However, for transmission of the altitude information to the ground controller, the MODE C (ALT) function must be selected on the transponder.

ALTITUDE ALERT:

NOTE

The altitude alerter must be used with a properly functioning 800 encoding altimeter for all operation. The altitude preselect function is usable only when the airplane is equipped with the Integrated Flight Control System.

During flight, altitude alert operation of the altitude alerter is automatic within the preestablished alert range. Operation may be verified on the ground as follows:

1. Turn on airplane master and avionics power switches. Altimeter power-off warning flag should disappear.

NOTE

When using the encoding altimeter to simulate altitude inputs, no altitudes below 100 feet shall be used for testing. If the combination of station altitude (near sea level) and pressure presents a below 100 foot situation, then preset lowest obtainable altitude (above 100 feet) on altimeter and perform the upper range of the test specified in steps 5 and 6. Following this test, preset the altitude alerter for 1100 to 1500 feet above the previous preset altitude, and then perform steps 3 and 4 for the lower altitude portion of the test.

2. Set altitude selector switches to slightly more than 1000 feet above altitude indicated on the encoding altimeter. Altitude is displayed on readout.
3. Begin to turn altimeter baroset knob to set altimeter reading to agree with selected altitude. When altitude reading reaches about 1000 feet below selected altitude, a one-second tone is heard and amber LO ALERT lamp lights.
4. Continue to turn baroset knob toward selected altitude. When altitude reading is within about 300 feet of selected altitude, the LO ALERT lamp goes out and the green ALERT lamp lighte.
5. Continue to turn baroset knob for altitude above selected altitude by about 300 feet. Green lamp goes out, one-second tone is heard, and amber HI ALERT lamp lights.
6. Continue to turn baroset knob until altitude reading reaches about

1000 feet above alert range. Just as altitude leaves alert range, the HI ALERT lamp goes out.

7. Turn baroset knob to reset altimeter as required.
8. Turn off power, power-off warning flag appears.

ALTITUDE CAPTURE:

Altitude capture operation may be verified on the ground as follows:

1. Turn on airplane master and avionics power switches. Power-off warning flag on altimeter should disappear.
2. Turn on Integrated Flight Control System and verify that a vertical mode is not selected.
3. Set altitude selector switches to desired altitude; altitude is displayed on readout.
4. Push in ARM pushbutton switch. Amber ARMD lamp lights.
5. Turn altimeter baroset knob to set altimeter reading to displayed alerter altitude. When altimeter reaches approximate selected altitude, ARMD lamp goes out and green CPLD lamp lights. The altitude hold indicator lamp on the flight director mode selector will also light.
6. Turn baroset knob to reset altimeter as required.
7. Turn off power switches. Power-off warning flag appears and all indicator lamps go out.

ALTITUDE CAPTURE OPERATING NOTES:

CAUTION

The altitude alerter used in this system is not designed to identify the MDA (Minimum Descent Altitude) or DA (Decision Height) while making an instrument approach. Therefore, the alerter should never be used during an instrument approach to identify the MDA or DA.

1. If the altitude selector switches are moved to a new position after the ARM pushbutton has been pushed in but before the altitude is captured, the alerter logic is reset and the ARM pushbutton must be pushed again to enable the new altitude.
2. After altitude capture, and altitude hold mode is established; if the airplane leaves the selected altitude, the green CPLD lamp will remain lit. The altitude deviation will be indicated by the altitude ALERT lamps and the discrepancy between the selected altitude displayed on the alerter and the airplane altitude displayed by the altimeter.
3. If the altitude selector switches are set to a different altitude after altitude capture, the Integrated Flight Control System will remain

in the altitude hold mode but the green CPLD lamp will go out to indicate that the altitude displayed is not the altitude at which the airplane is being held.

4. If the altitude hold is manually selected on the flight director mode selector prior to automatic altitude capture, the ARMD lamp will go out, the CPLD lamp will not light, and the capture logic circuits will have to be reset for the next use. The function may be reset after altitude hold is disengaged.

SECTION 5
PERFORMANCE

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

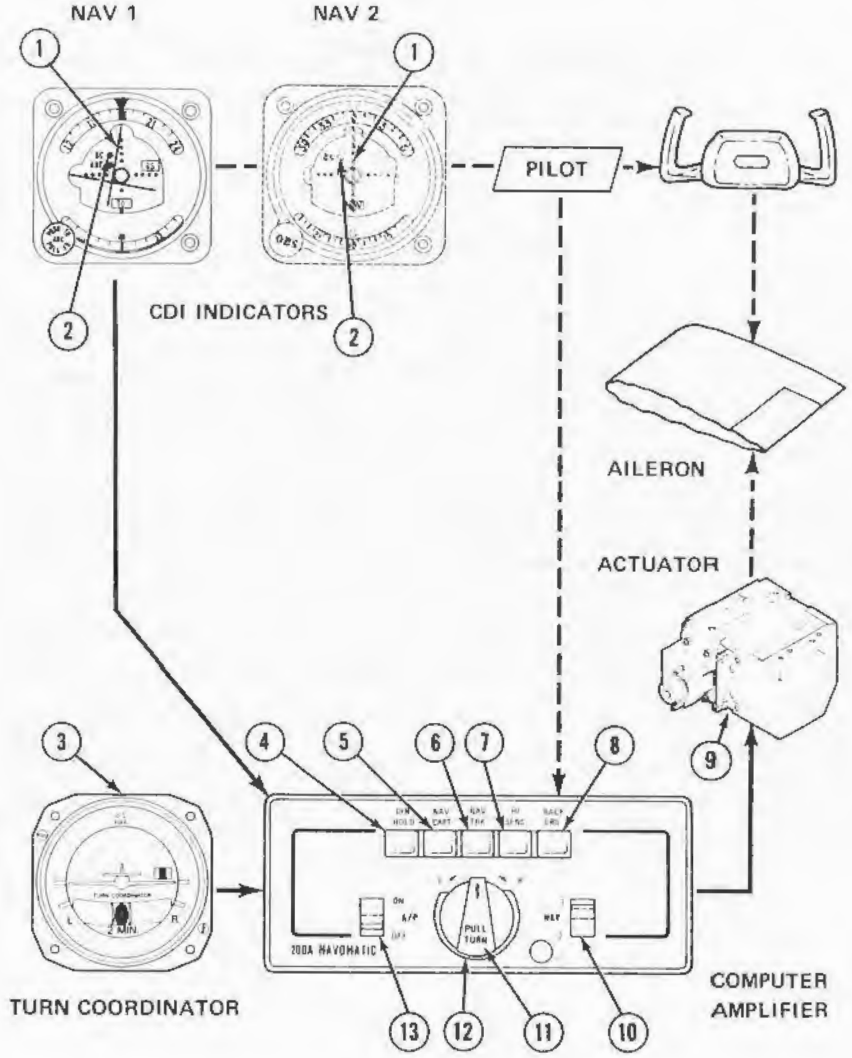


Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

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.

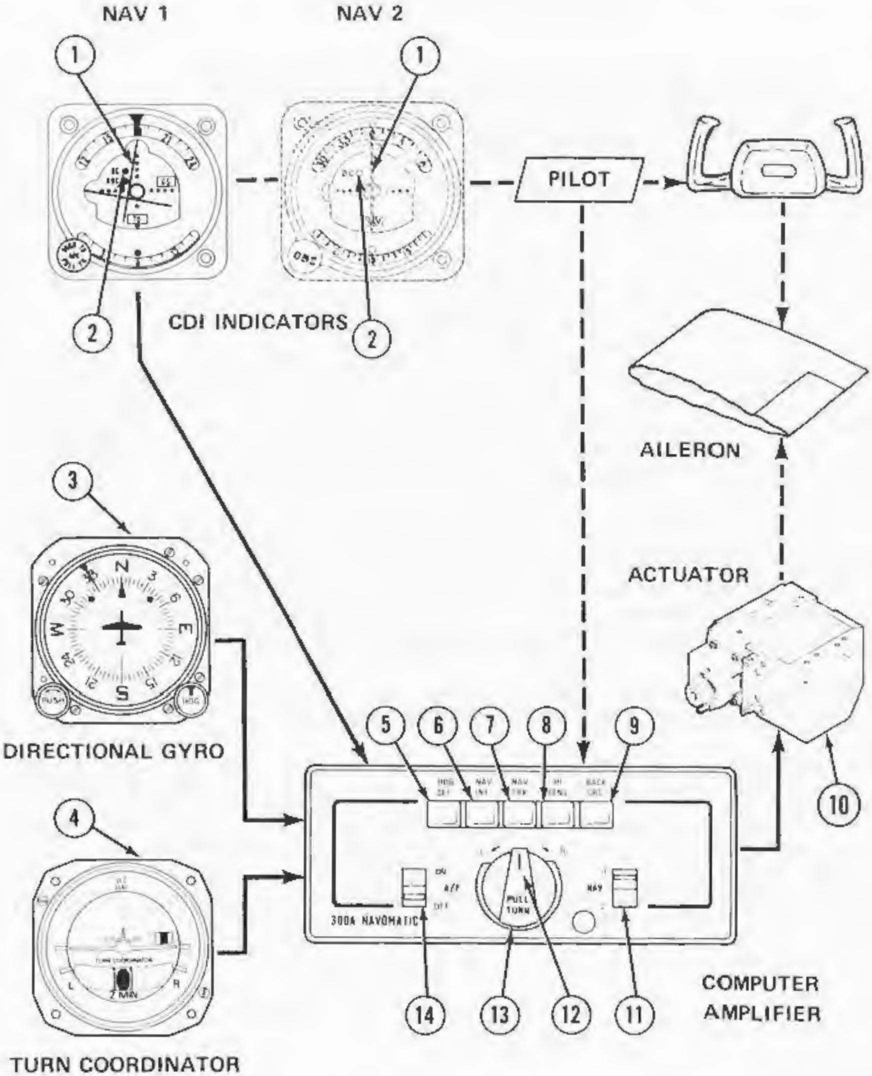


Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators (Sheet 1 of 2)

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.

SUPPLEMENT

CESSNA 400 AUTOPILOT
(Type AF-420A)

SECTION 1
GENERAL

Cessna 400 Autopilot (Type AF-420A) is a two axis automatic flight control system that governs the position of the ailerons and elevators to provide automatic roll and pitch stability as commanded by the selected mode of operation. The system also provides for tracking of any magnetic heading, automatic intercept and tracking of VOR radials and includes manual turn and pitch command, altitude hold, and NAV 1 or NAV 2 receiver selection. There is no ILS coupler in the autopilot system.

The major components in a standard 400 autopilot system consist of a control unit mounted in either the lower center stack of the instrument panel or lower console, a panel-mounted vacuum driven unslaved directional gyro, and an aileron and elevator actuator. On some aircraft an optional slaved compass system is offered consisting of a slaved directional gyro incorporating a built-in slaving indicator that monitors heading displacement error between the flux detector and the slaved DG, a remote mounted flux detector and a slaving accessory unit.

The control unit (flight controller) contains most of the operating controls for the autopilot. In addition, controls for the directional gyro are mounted on the front of the gyro and an A/P NAV 1/NAV 2 selector switch is installed adjacent to the control unit to allow the autopilot to operate in conjunction with either navigation receiver.

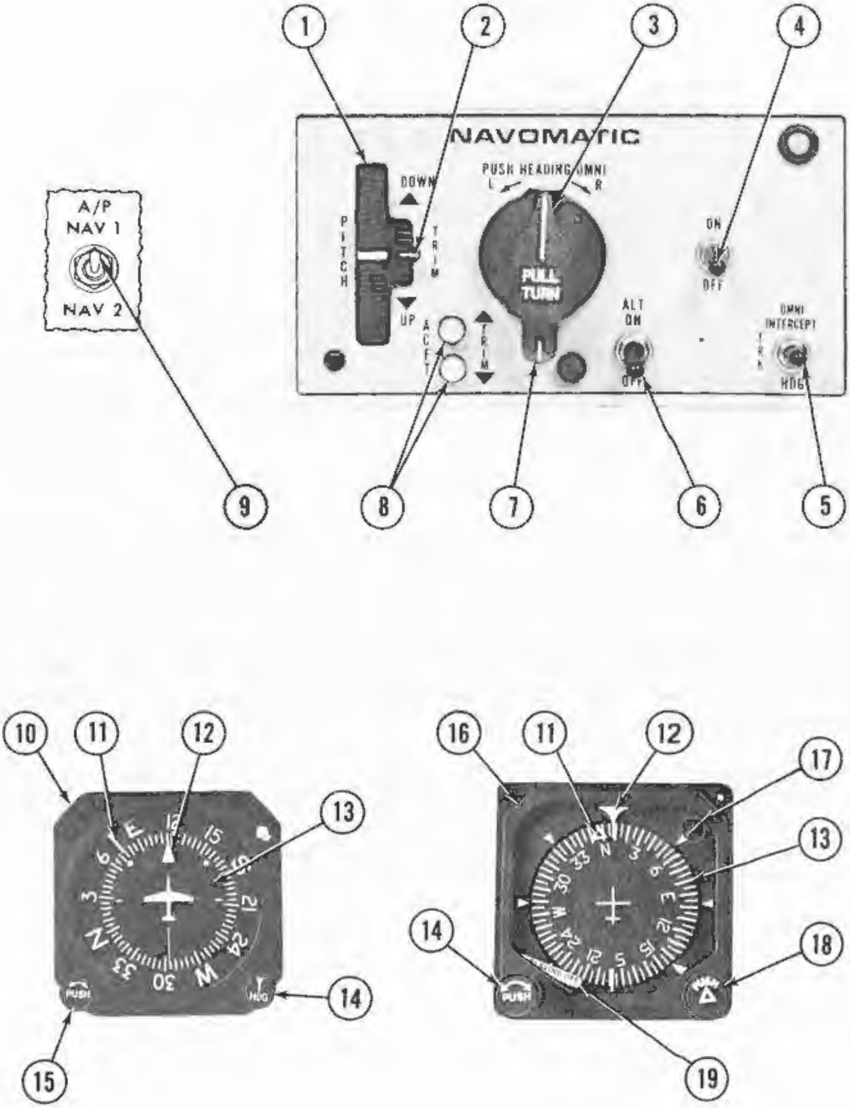


Figure 1. Cessna 400 Autopilot (Type AF-420A) (Sheet 1 of 3)

1. PITCH CONTROL - Controls pitch attitude of airplane. When rotated toward UP, airplane will pitch up. When rotated toward DWN, airplane will pitch down. Pitch attitude depends on displacement of control from DETENT (level flight) position. (Must be coordinated with aircraft elevator trim.)

2. PITCH TRIM - Used only when PITCH control is in detent to trim airplane for level flight.

3. PULL-TURN CONTROL KNOB - When pulled out and turned, airplane can be banked right (R) or left (L). When in detent and pushed in, intercepts and maintains selected heading or VOR radial.

4. ON-OFF SWITCH - Controls primary power to Navomatic 400.

5. FUNCTION SWITCH - Selects mode of operation. In HDG position heading hold circuits are engaged. In OMNI INTERCEPT position, omni coupler is engaged. In TRK position, omni coupler is engaged, but turn rate is limited to that appropriate to two dots course deviation.

6. ALT ON-OFF - When at ALT ON, with PITCH control in detent, maintains the selected altitude. Movement of the PITCH control from level flight detent disengages the altitude hold circuit.

7. LATERAL TRIM - Used when PULL-TURN control knob is pulled out and in detent to trim aircraft for wing level attitude.

8. AIRCRAFT TRIM LIGHTS - These lights illuminate as the pitch actuator corrects toward the selected attitude or when the aircraft is out of trim to a degree that the pitch actuator is not able to correct to the attitude selected by the PITCH control. When the upper light is illuminated, the aircraft elevator trim wheel should be rotated forward for more nose down trim. When the lower light is illuminated, a need for additional nose up trim is indicated.

9. AUTOPILOT (A/P) NAV 1 OR NAV 2 SELECTOR SWITCH - Selects the desired navigation receiver.

10. UNSLAVED DIRECTIONAL GYRO - When properly set to agree with the magnetic compass, the DG will provide a stable visual indication of aircraft heading to the pilot and also provides electrical heading information to the autopilot.

11. HEADING INDEX (BUG) - Displays selected heading relative to the compass card.

12. LUBBER LINE - Provides airplane heading reference index.

13. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (12) on directional gyros.

Figure 1. Cessna 400 Autopilot (Type AF-420A) (Sheet 2 of 3)

14. HEADING SELECTOR KNOB (HDG) - When pushed in, the heading bug (11) may be positioned to the desired magnetic heading by rotating the HDG selector knob. Also used to select VOR course when the autopilot is installed with Nav/Com radios without course datum.

15. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (13) to correspond with the magnetic heading indicated by the compass. The unslaved gyro's (10) compass card (13) must be manually reset periodically to compensate for precessional errors in the gyro. The slaved directional gyro's (16) compass card (13) will automatically realign itself due to the slaving features. However, the slaved DG may be manually reset at any time in order to accelerate precession adjustment.

16. OPTIONAL SLAVED DIRECTIONAL GYRO - When properly set to agree with the magnetic compass, the slaved DG will provide a magnetically stabilized visual indication of aircraft heading and also provides electrical heading information to the autopilot. The slaved DG eliminates the need to manually compensate for precessional errors in the gyro.

17. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the DG 45° right index, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of heading indicator error relative to aircraft magnetic heading. The gyro adjustment knob (15) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.

18. HEADING SELECTOR KNOB (PUSH/▲) - When pushed in the heading bug (11) may be positioned to the desired magnetic heading by rotating the PUSH/▲ selector knob. Also used to select VOR course when an autopilot is installed with Nav/Com radios.

19. SLAVING OFF WARNING FLAG - When out of view, indicates presence of slaving voltage. When in view, indicates absent or low slaving voltage.

Figure 1. Cessna 400 Autopilot (Type AF-420A) (Sheet 3 of 3)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is installed. However, the following autopilot limitations should be adhered to during airplane operation:

OPERATING LIMITATIONS:

1. ON-OFF Switch -- OFF for takeoff and landing.
2. Maximum Airspeed for Autopilot Operation - - REFER to Autopilot Limitations Placard on instrument panel of airplane.
3. Possible Altitude Loss with Autopilot Malfunction -- REFER to Autopilot Limitations Placard on instrument panel of airplane.

SECTION 3
EMERGENCY PROCEDURES

IN CASE OF AUTOPILOT MALFUNCTION:

1. Airplane Control Wheel -- OPERATE as required to manually override the autopilot.

NOTE

The servos may be manually overpowered at any time without damage. However, this practice should be kept to a minimum since slip clutch wear will result from extended periods of manual overpower.

2. Autopilot ON-OFF Switch -- OFF.

NOTE

If electrical malfunction persists, turn aircraft master or avionics power switch OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF AND LANDING:

1. Autopilot ON-OFF Switch -- OFF.

IN-FLIGHT WINGS LEVELING:

1. Airplane Elevator and Rudder Trim -- ADJUST.
2. Avionics Power Switch -- ON.
3. PULL-TURN Knob -- PULL out and center in detent.
4. PITCH Control -- ADJUST to centered position.
5. PITCH TRIM Lever -- ADJUST to centered position.
6. ON-OFF Switch -- ON.
7. Lateral Trim Lever -- ADJUST to level wings.
8. PITCH TRIM Lever -- ADJUST for longitudinal trim.

ALTITUDE HOLD:

1. PITCH Control -- DETENT position.
2. OFF-ALT ON Switch -- ALT ON.

COMMAND TURNS:

1. PULL-TURN Knob -- PULL and ROTATE.

CLIMB OR DESCENT:

1. Aircraft Power and Trim -- ADJUST.
2. PITCH Control Wheel -- Rotate UP or DOWN.
3. Lateral Trim Lever -- ADJUST to level wings.
4. PITCH Trim Lever -- ADJUST if aircraft trim light is illuminated.

NOTE

If trim light remains illuminated readjust the aircraft elevator trim wheel.

HEADING SELECT:

1. PUSH Knob on DG -- SET to aircraft magnetic heading.
2. HDG Knob on DG -- ROTATE "bug" to desired heading.
3. Function Switch -- SET to HDG.
4. PULL-TURN Knob -- PUSH.

NOTE

Airplane will turn automatically to selected heading.

OMNI COUPLING:

1. PULL-TURN Knob -- PULL out.
2. A/P NAV 1/NAV 2 Selector Switch (On Instrument Panel) -- SELECT desired Nav receiver.

3. Nav Indicator OBS (or ARC) Knob -- SET VOR course.
4. HDG Knob DG -- ROTATE "bug" to agree with OBS on CDI.
5. Function Switch -- SET to OMNI INTERCEPT.
6. PULL-TURN Knob -- PUSH.

NOTE

Airplane will automatically intercept at 45° and then track the selected omni course.

7. Function Switch -- SET to TRK for VOR station passage and smoother tracking of omni radials.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

CESSNA 400B NAVOMATIC AUTOPILOT (Type AF-550A)

SECTION 1

GENERAL

Cessna 400B Navomatic Autopilot (Type AF-550A) is a two axis automatic flight control system that governs the positions of the ailerons and elevators to provide automatic roll and pitch stability as commanded by the selected mode of operation. The system also provides for tracking of any magnetic heading, automatic intercept and tracking of VOR radials or ILS localizer and glide slope beams, and includes automatic pitch synchronization and trim, manual turn and pitch command, altitude hold, back course switching, Nav 1 or Nav 2 receiver selection, an automatic autopilot disengage acceleration sensor with an associated autopilot disengagement warning horn and a prior-to-flight test function.

The major components in a standard 400B autopilot system consist of a control unit and accessory unit mounted side-by-side in the lower center stack of the instrument panel, a panel-mounted vacuum driven unslaved directional gyro and an attitude gyro, a remote mounted acceleration sensor with a built in "G" switch, an associated autopilot disengage warning horn, an altitude sensor, an aileron, elevator and elevator trim actuator. In addition, an optional unslaved HSI is offered as replacement for the standard unslaved directional gyro and two optional slaved compass systems consisting of a remote mounted flux detector, a slaving accessory unit (offered without course datum on 300 Series Radios and with, or without, course datum on 400 Series Radios), and either a slaved directional gyro or a slaved Horizontal Situation Indicator (HSI) are offered. Both the optional slaved DG and optional slaved HSI are panel-mounted and incorporate a slaving meter that monitors heading displacement error between the flux detector and the slaved DG or slaved HSI. The HSI, in addition to replacing the standard DG, also replaces the standard Course Deviation Indicator (CDI) normally installed with the navigational receiver.

NOTE

400 Nav/Com radios equipped with course datum aid the

pilot by eliminating the need to set the DG heading bug to the desired VOR or ILS course. When course datum is installed, the autopilot will automatically track the VOR or ILS course selected by the OBS on the CDI or course selector on the slaved HSI.

The control unit (flight controller) and accessory unit contain most of the operating controls for the autopilot. In addition, there are three switches mounted on the pilot's control wheel and two switches mounted in the autopilot accessory unit. The three switches on the pilot's control wheel provide for manual electric trim operation, autopilot disengage and electric trim disengage. An AP NAV 1/NAV 2 switch in the autopilot accessory unit provides for selection of the desired VOR receiver (NAV 1 or NAV 2) and a REV SNS selector switch (LOC 1 or LOC 2), also in the autopilot accessory unit, is provided to select back-course (reverse sensing) operation on the desired navigation receiver. All operating controls necessary to properly operate the 400B autopilot are shown in Figure 1.

An automatic autopilot disengage function (provided by the "G" switch in the acceleration sensor) will automatically disengage the autopilot anytime the airplane pitches down at more than a normal rate from normal flight attitude. The operational capability of the disengage function should be tested before takeoff by pressing the TEST EA FLT button, located on the accessory unit. When the TEST button is pressed with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the autopilot will disengage, the autopilot disconnect horn will sound, and the autopilot disconnect (DISC) warning (WARN) light will illuminate yellow to advise the pilot the autopilot disengage system is operational.

The autopilot will also be automatically disengaged anytime the airplane pitches up or down more than a normal amount from a level flight attitude. In this event, the disconnect horn would sound and the disconnect light would illuminate, advising the pilot that the autopilot has disengaged.

An additional autopilot disengage feature is provided by a thermostatic switch which monitors the operating temperature of the aileron and elevator actuators. If the temperature becomes abnormal in either the roll or pitch actuator, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch automatically resets to close the autopilot interlock circuit. Power can then be reapplied to the actuator by re-engaging the AP/ON-OFF switch.

The autopilot disconnect (DISC) warning (WARN) light, on the accessory unit, will illuminate yellow when the autopilot is disengaged by any means other than the control wheel AUTOPILOT DISENGAGE switch. Whenever the autopilot is disengaged by any means, the autopilot disengage horn will produce a short tone lasting 1 to 2 seconds with decreasing amplitude. The autopilot disconnect warning (WARN) light (yellow) will remain on, until it is cancelled by pressing the control wheel AUTOPILOT DISENGAGE switch.

The back course (REV SNS LOC 1/LOC 2) selector switch, mounted in the autopilot accessory unit, is only used when conducting localizer approaches. With the navigation receiver set to a localizer frequency, positioning the switch to LOC 1 or LOC 2 (back course) will reverse the appropriate signals to provide for back course operation for either autopilot or manual flight. Except when a horizontal situation indicator is installed, selecting back course (REV SNS LOC 1/LOC 2) causes reversal of the Course Deviation Indicator (CDI) indication, whether or not the autopilot is being used.

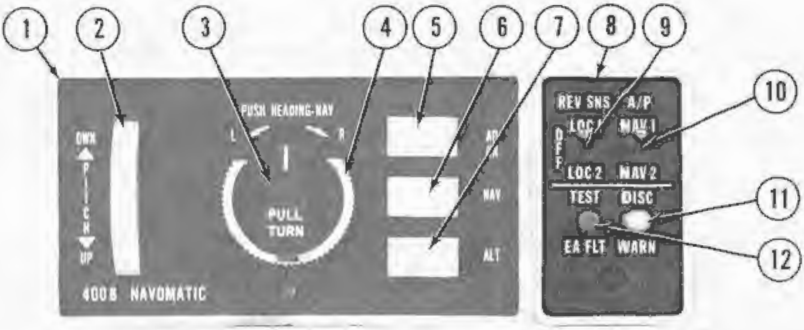
The navigation receiver selector switch (AP NAV 1/NAV 2), installed in the autopilot accessory unit when dual navigation receivers are installed, allows the autopilot to operate in conjunction with either navigation receiver.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is disengaged. However, the following autopilot limitations must be followed during airplane operation with the autopilot engaged.

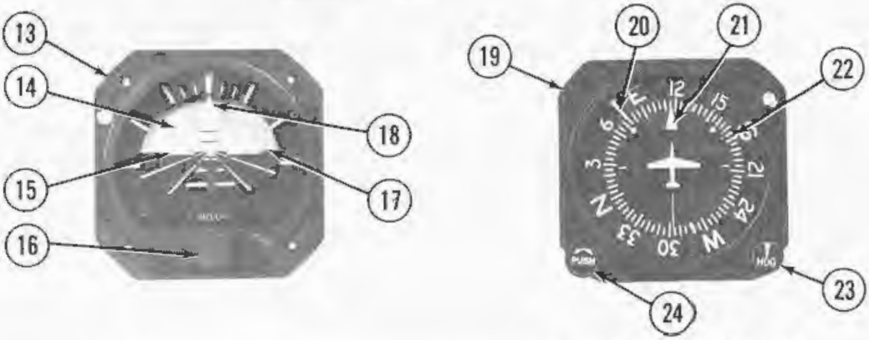
OPERATING LIMITATIONS WITH AUTOPILOT ENGAGED:

1. Maximum Airspeed -- 165 KIAS
   Reduce maximum speed 10 KTS every 3,000 Ft. above FL 180.
2. Maximum Altitude Loss During Malfunction Recovery:
   Cruise -- 300 Ft.
   Approach -- 200 Ft.
3. Maximum Flap Deflection -- 10°.
4. In Altitude Hold Mode:
   Maximum Speed for Flap and Gear Operation -- 115 KIAS.



CONTROL UNIT

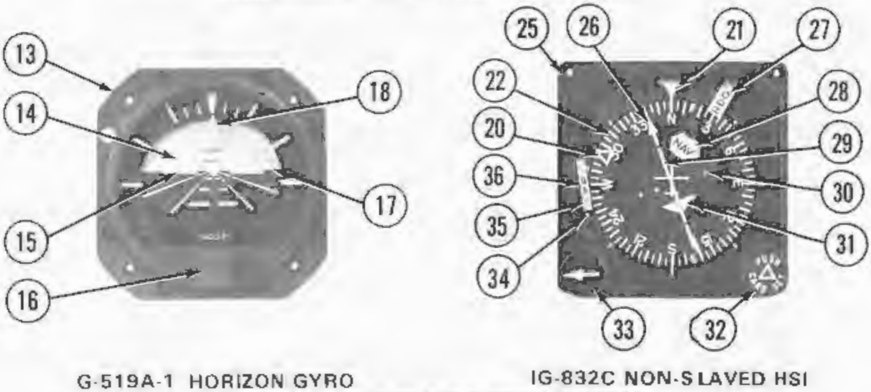
ACCESSORY UNIT



G-519A-1 HORIZON GYRO

G-502A NON-SLAVED DG

STANDARD NON-SLAVED GYRO SYSTEM

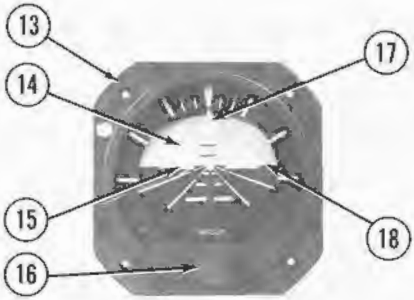


G-519A-1 HORIZON GYRO

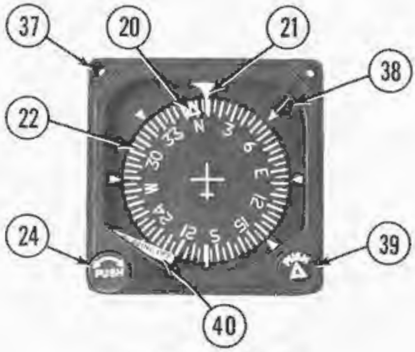
IG-832C NON-SLAVED HSI

OPTIONAL NON-SLAVED GYRO SYSTEM

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)
(Sheet 1 of 6)

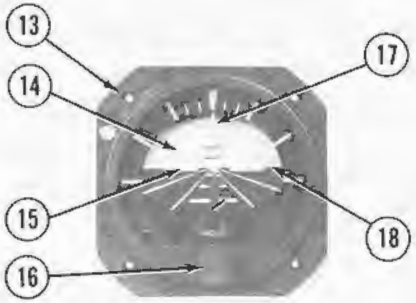


G-519A-1 HORIZON GYRO

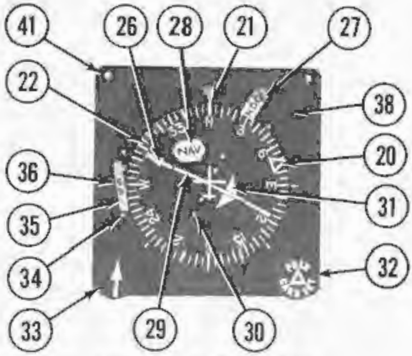


G-504A SLAVED DG

OPTIONAL SLAVED GYRO SYSTEM



G-519A-1 HORIZON GYRO



IG-832A SLAVED HSI

OPTIONAL SLAVED GYRO SYSTEM

CONTROL WHEEL SWITCHES

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A) (Sheet 2 of 6)

1. CONTROL UNIT - Provides the primary switches and controls for operating the autopilot.

2. PITCH CONTROL - Controls pitch attitude of airplane. When rotated toward UP, airplane will pitch up. When rotated toward DWN, airplane will pitch down. Pitch attitude depends on displacement of control from level flight position.

3. PULL-TURN CONTROL KNOB - When pulled out and turned, aircraft will bank right (R) or left (L). When in detent and pushed in intercepts and maintains selected heading (HDG). When pulled out and in detent, acts as wing leveler.

4. LATERAL TRIM CONTROL (TRIM) - When PULL-TURN knob is pulled out and centered, control is used to trim aircraft for wings level attitude.

5. AUTOPILOT ON-OFF SWITCH (AP/ON) - Controls primary power to turn on or off the Navomatic 400B. When the AP/ON switch is turned off, the autopilot disengage horn will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude and autopilot disconnect light will illuminate.

6. NAVIGATION ENGAGE SWITCH (NAV) - When PULL-TURN knob is pushed in, selects automatic VOR radial or localizer intercept and tracking operation.

7. ALTITUDE HOLD ENGAGE SWITCH (ALT) - Selects automatic altitude hold. If aircraft is in anything but level flight, the altitude control will smoothly level the airplane and return it to the altitude existing when ALT hold switch was pressed

8. ACCESSORY UNIT - Provides the pilot with an automatic autopilot disconnect warning light, an autopilot disconnect system self-test button for use prior to flight, a reverse sense (back-course) selector switch and a navigation receiver selector switch.

9. BACK COURSE REVERSE SENSE (REV SNS) LOC 1 OR LOC 2 SELECTOR SWITCH - Used with LOC operation only. With AP switch OFF or ON, and when navigation receiver selected by AP switch (on autopilot accessory unit) is set to a localizer frequency, it reverses normal localizer needle indication on a course deviation indicator (CDI) and causes localizer reversed (BC) light to illuminate. With AP switch ON (on autopilot flight controller), reverses localizer signal to autopilot.

CAUTION

When an optional horizontal situation indicator (HSI) is installed, the omni deviation bar does not reverse. However, with AP SWITCH ON (on autopilot flight controller), selection of either LOC 1 or LOC 2 will always cause the localizer signal to the autopilot to reverse for back-course operation.

10. AUTOPILOT (AP) NAV 1 OR NAV 2 SELECTOR SWITCH - Selects appropriate signals from the desired navigation receiver.

11. AUTOPILOT DISCONNECT WARNING INDICATOR LIGHT (DISC WARN) - Whenever the autopilot is disengaged by any means, other than the control wheel

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A) (Sheet 3 of 6)

AUTOPILOT DISENGAGE switch, the autopilot disconnect (DISC) warning (WARN) light will illuminate yellow and will remain lighted until it is cancelled by pulling aft the control wheel AUTOPILOT DISENGAGE switch. When the autopilot disconnect DISC WARN indicator light is activated, the circuit will also automatically activate an autopilot disengage warning horn that will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude.

12. AUTOPILOT DISCONNECT TEST BUTTON (TEST EA FLT) - When the TEST EA FLT pushbutton is pressed and held with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the AP/ON-OFF switch will automatically disengage, the autopilot disconnect horn will produce a short tone and the yellow autopilot disconnect warning light will illuminate to advise the pilot the "G" switch disengaging function is operational.

13. ATTITUDE GYRO - Provides the pilot with a visual indication of the airplane's pitch and roll attitude with respect to the earth and also provides the autopilot with electrical roll and pitch signals.

14. GYRO HORIZON (ATTITUDE BACKGROUND) - Moves with respect to symbolic aircraft to display actual pitch and roll attitude.

15. SYMBOLIC AIRCRAFT - Serves as a stationary symbol of the aircraft. Aircraft pitch and roll attitudes are displayed by the relationship between the fixed symbolic aircraft and the movable background.

16. SYMBOLIC AIRCRAFT ALIGNMENT KNOB - Provides manual positioning of the symbolic aircraft for level flight under various load conditions.

17. HORIZON LINE - Provides indentification of artificial horizon.

18. ROLL ATTITUDE INDEX - Displays actual roll attitude through movable index and fixed reference marks at 0, 10, 20, 30, 60 and 90 degrees.

19. NON-SLAVED DIRECTIONAL GYRO - Provides a stable visual indication of aircraft heading to the pilot and provides electrical heading information to the autopilot.

20. HEADING BUG - Moved by HDG knob on DG or PUSH Knob on Slaved DG or PUSH CARD SET Knob on HSI's to select desired heading.

21. LUBBER LINE - Indicates aircraft magnetic heading on compass card (22)

22. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (21) on DG's or HSI.

23. HEADING SELECTOR KNOB (HDG) - When pushed in, the heading bug (15) may be positioned to the desired magnetic heading by rotating the HDG selector knob. Also used to select VOR or ILS course when the autopilot is installed with 300 Series Radios or 400 Series Radios without course datum.

24. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in, allows the pilot to manually rotate the gyro compass card (22) to correspond with the magnetic

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A) (Sheet 4 of 6)

heading indicated by the compass. The unslaved directional gyro's (19) compass card (22) must be manually reset periodically to compensate for precessional errors in the gyro. The slaved directional gyro's (37) compass card (22) will automatically realign itself due to the slaving features. However the slaved DG may be manually reset at any time in order to accelerate precession adjustment.

25. NON-SLAVED 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. The unslaved HSI's directional gyro compass card (22) must be manually reset periodically to compensate for precessional errors in the gyro.

26. OMNI BEARING POINTER - Indicates selected VOR course or localizer course on compass card (22). The selected VOR radial or localizer heading remains set on the compass card when the compass card (22) is rotated.

27. HEADING WARNING FLAG (HDG) - When flag is in view, heading display is invalid due to the slaving system power being interrupted or the HSI vacuum powered gyro speed being low.

28. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate.

29. COURSE 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.

30. COURSE DEVIATION DOTS - A course deviation bar displacement of 2 dots represents full scale (VOR = ±10° or LOC = ±2½°) deviation from beam centerline.

31. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.

32. HEADING SELECTOR KNOB (PUSH/CARD SET/) - Positions heading "bug" on compass card (22) by rotating the CARD SET knob. Pushing in and rotating the CARD SET knob sets the compass card. The "bug" (36) rotates with the compass card. Also used to select VOR or ILS course when the autopilot is installed with 300 Series Radios or 400 Series Radios without course datum.

33. COURSE SELECTOR KNOB - Positions omni bearing pointer (26) on the compass card (22) by rotating the course selector knob.

34. 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.

35. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A) (Sheet 5 of 6)

36. GLIDE SLOPE POINTER - Indicates on glide slope scale (34) aircraft displacement from glide slope beam center.

37. OPTIONAL SLAVED DIRECTIONAL GYRO - When properly set to agree with the magnetic compass, the slaved DG will provide a magnetically stabilized visual indication of aircraft heading and also provides electrical heading information to the autopilot. The slaved DG eliminates the need to manually compensate for precessional errors in the gyro since the gyro motor will keep the card aligned with the earth's magnetic field.

38. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the 45° right index on the DG or HSI, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of the heading indicator error relative to aircraft magnetic heading. The slaved HSI's (41) compass CARD SET knob (32) or the slaved DG's gyro adjustment knob (24) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.

39. HEADING SELECTOR KNOB (PUSH/△) - When pushed in the heading bug (20) may be positioned to the desired magnetic heading by rotating the PUSH/△ selector knob. Also used to select VOR or ILS course when autopilot is installed with a 300 Series Radio or 400 Series Radios without course datum.

40. SLAVING OFF WARNING FLAG - When out of view, indicates adequate slaving voltage. When in view, indicates absent or low slaving voltage.

41. SLAVED 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. The slaving feature associated with the HSI's directional gyro compass card (22) eliminates the need to manually compensate for precessional errors in the gyro. However, the slaved DG may be manually reset at any time in order to accelerate precessional adjustment.

42. ELECTRIC TRIM SWITCH - When moved forward to DN position, moves the elevator trim tab in the "nose-down" direction; conversely, pulling the switch aft to the up position, moves the tab in the "nose-up" direction. Electric trim switch is only operational with autopilot AP/ON-OFF switch OFF.

43. ELECTRIC TRIM DISENGAGE SWITCH - When pulled aft to the OFF position, disengages the electric trim system. A secondary disengagement of electric trim is provided by a TRIM/PULL OFF circuit breaker; pull out to remove all electrical power from the electric trim system.

44. AUTOPILOT DISENGAGE SWITCH - When momentarily pulled aft to the OFF position, trips primary AP ON/OFF switch to OFF and removes all electrical power from the system. Autopilot will remain OFF until primary AP ON/OFF switch is turned ON even though the switch is spring loaded to return to ON when released.

Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)
(Sheet 6 of 6)

SECTION 3
EMERGENCY PROCEDURES

IN CASE OF AUTOPILOT MALFUNCTION:

1. Airplane Control Wheel -- OPERATE as required to manually override the autopilot.

NOTE

The servos may be manually overpowered at any time without damage. If pitch axis is overpowered, electric trim will run in opposition to overpowering force. Manually overpowering the autopilot should be kept to a minimum since slip clutch wear will result from extended periods of manual overpower.

2. AUTOPILOT DISENGAGE Switch (on Control Wheel) -- PULL OFF.

NOTE

This action automatically trips autopilot ON-OFF switch OFF. If electrical malfunction still persists, turn avionics power switch OFF and, if necessary, turn the airplane master switch OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF RELIABILITY TESTS:

1. Autopilot Automatic Disconnect Check (with Engine Running and Gyros Erected) -- PERFORM the following checks.
   a. PULL-TURN Knob -- CENTER and PULL OUT.
   b. Autopilot Lateral TRIM Control -- CENTER.
   c. AP ON-OFF Rocker Switch -- ON.

NOTE

The roll servo will engage immediately. The pitch servo will engage after pitch synchronization as evidenced by the autopilot pitch command wheel coming to rest.

d. Airplane Control Wheel -- HOLD to reduce movement.
e. Autopilot Disconnect TEST Prior To EA FLT Button -- PUSH and HOLD.
f. Verify the following:
(1) AP ON-OFF Rocker Switch -- OBSERVE disengage to OFF position.
(2) Autopilot DISC WARN Light -- OBSERVE yellow illumination.
(3) Autopilot Disengage Horn -- OBSERVE 1 to 2 second aural tone.
g. Airplane Control Wheel AUTOPILOT DISENGAGE Switch - PULL to turn off autopilot DISC WARN light.

BEFORE TAKEOFF AND LANDING:

1. AP ON-OFF Rocker Switch -- PUSH OFF.
2. REV SNS LOC 1/LOC 2 Switch (on Autopilot Accessory Unit) -- OFF.

IN-FLIGHT WINGS LEVELING:

1. Airplane Elevator and Rudder Trim -- ADJUST.
2. PULL-TURN Knob -- CENTER and PULL OUT.
3. AP ON-OFF ROCKER SWITCH -- PUSH ON.
4. Lateral TRIM Knob -- ADJUST to level wings.
5. Pitch Command Wheel -- ADJUST as desired.

ALTITUDE HOLD:

1. ALT Rocker Switch -- PUSH to hold altitude.

NOTES

The autopilot ON-OFF switch must be engaged for a short time (maximum of 30 seconds) before the ALT switch can be engaged.

Altitude Hold mode will automatically disengage on a coupled ILS approach when the glide slope is captured.

2. Airplane Rudder Trim -- ADJUST.
3. Lateral TRIM -- ADJUST to level wings.

COMMAND TURNS:

1. PULL-TURN Knob -- PULL OUT and ROTATE as desired.

CLIMB OR DESCENT:

1. ALT Rocker Switch -- DISENGAGE.
2. Pitch Command Wheel -- ROTATE UP or DOWN as desired.
3. Rudder Trim -- ADJUST as required.

HEADING SELECT:

1. PUSH Knob on DG or HSI -- SET to aircraft magnetic heading.
2. HDG Knob on DG or CARD SET Knob on HSI -- ROTATE bug to desired heading.
3. NAV Rocker Switch -- OFF.
4. PULL-TURN Knob -- PUSH IN.

NOTE

Airplane will turn automatically to selected heading.

VOR COUPLING:

1. PULL-TURN Knob -- PULL OUT.
2. AP NAV 1/NAV 2 Selector Switch (on Autopilot Accessory Unit) -- SET to desired VOR receiver.
3. Nav Indicator OBS or Course Selector Knob on HSI -- SET VOR course.
4. HDG Knob on DG or CARD SET Knob on HSI (300 or 400 Nav/Com Radios without Course Datum Only) -- ROTATE bug to agree with OBS.
5. PULL-TURN Knob -- PUSH IN.
6. NAV Rocker Switch -- ON (within 135° of desired heading).

NOTE

Airplane will automatically intercept and then track the selected VOR course.

ILS/LOC APPROACH:

1. Wing Flaps -- SELECT desired 0° to 10° approach setting.

NOTE

Maximum allowable flap deflection is 10° with autopilot engaged. Airspeed should be reduced to 115 KIAS prior to operation of the flaps if operating in the altitude hold mode.

2. Airspeed -- ADJUST to approach speed (95 to 115 KIAS).
3. Rudder Trim -- ADJUST as required.
4. PULL-TURN KNOB -- PULL out and turn airplane to within 30° to 45° of localizer heading.
5. A/P NAV 1/NAV 2 Selector Switch (on Autopilot Accessory Unit) -- SET for NAV 1 receiver.
6. REV SNS LOC 1/LOC 2 Selector Switch (on Autopilot Accessory Unit) -- SELECT only if intercepting localizer front course outbound or back course inbound.

CAUTION

When Rev SNS switch is placed in the LOC 1 or LOC 2 position (on Autopilot Accessory Unit), and a localizer frequency is selected, the CDI on the selected Nav radio will be reversed even when the autopilot switch is OFF.

NOTE

Selection of LOC 1 or LOC 2 will only reverse the vertical needle on a Course Deviation Indicator. When the optional Horizontal Situation Indicator is installed, operation of the HSI needle is unaffected by the selection of LOC 1 or LOC 2. However, selection of LOC 1 or LOC 2 (corresponding to the selected A/P NAV 1/NAV 2 switch position) will always cause the localizer signal to the autopilot to reverse for back-course operation.

7. Nav Indicator OBS or Course Selector Knob on HSI -- SET to localizer front course heading for both front and back course approaches.
8. HDG Knob on DG or CARD SET Knob on HSI (300 or 400 Nav/Com Radios without Course Datum Only) -- ROTATE bug to localizer course (inbound or outbound as appropriate).
9. PULL-TURN Knob -- PUSH.
10. NAV Rocker Switch -- ON for automatic intercept and ILS tracking.
11. HDG Knob on DG or CARD SET Knob on HSI (400 Nav/Com Radios with Course Datum Only) -- ROTATE bug to missed approach heading.
12. ALT Rocker Switch -- ON when at published approach altitude.

NOTE

Autopilot can only capture glide slope from below beam center.

13. ALT Rocker Switch:
    CHECK -- AUTOMATIC DISENGAGEMENT at glide slope capture.
    OFF -- AT FINAL APPROACH FIX if localizer approach only.
14. Autopilot PITCH Command Wheel -- ADJUST for proper descent if localizer approach only.

15. Landing Gear -- EXTEND by outer marker.

NOTE

Airspeed should be reduced to 115 KIAS prior to operation of the gear if operating in the altitude hold mode.

16. AUTOPILOT DISENGAGE SWITCH (on Control Wheel) -- OFF before landing and extending flaps more than 10°, or when executing missed approach.
17. Wing Flaps -- EXTEND as required after landing is assured.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

CESSNA 400B INTEGRATED FLIGHT CONTROL SYSTEM
(Type IF-550A)

SECTION 1
GENERAL

The Cessna 400B Integrated Flight Control System provides a capability of automatic flight control or manual control with precision flight direction command provided by computed information. The complete presentation for the system is displayed on the Flight Director Indicator (FDI), the Mode Selector and the Horizontal Situation Indicator (HSI).

The operation of the manual and the automatic system is basically the same. The difference is whether the pilot decides to follow the Flight Director commands manually or allows the autopilot to fly the airplane.

Precision flight direction information for manual control is provided on the FDI. The FDI includes a symbolic airplane which incorporates pitch and roll command bars. The pilot merely flies the airplane to center the two command bars to follow the calculated flight path determined by the computer. In this way, climbs, descents, or turns are easily and accurately executed.

A Horizontal Situation Indicator (HSI) displays a pictorial presentation of the airplane's position relative to VOR radials, localizer and glide slope beams. The HSI also gives heading reference with respect to magnetic north and provides selection of the desired heading, VOR radials, LOC runway heading, and RNAV course when installed.

For automatic flight, the autopilot ON-OFF switch on the autopilot controller. is activated. Pitch and roll manual command controls are also located on this unit. All other normal modes of flight are controlled from the Mode Selector.

An automatic autopilot disengage function (provided by the "G" switch in the acceleration sensor) will automatically disengage the autopilot anytime the airplane pitches down at more than a normal rate from normal flight attitudes. The operational capability of the disengage function should be tested before takeoff by pressing the TEST-EA FLT button, located on the autopilot accessory unit. When the TEST button is pressed with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the autopilot will disengage, the autopilot disconnect horn will sound, and the yellow autopilot disconnect (DISC) warning (WARN) light will illuminate on the autopilot accessory unit to advise the pilot the autopilot disengage system is operational.

The autopilot will also be automatically disengaged anytime the airplane pitches up or down more than a normal amount from a level flight attitude. In this event, the disconnect horn would sound and the disconnect light would illuminate, advising the pilot that the autopilot has disengaged.

An additional autopilot disengage feature is provided by a thermostatic switch which monitors the operating temperature of the aileron and elevator actuators. If the temperature becomes abnormal in either the roll or pitch actuators, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch automatically resets to close the autopilot interlock circuit. Power can then be reapplied to the actuator by re-engaging the AP/ON-OFF switch.

The autopilot disconnect warning light, on the accessory unit, will illuminate yellow when the autopilot is disengaged by any means other than the control wheel AUTOPILOT DISENGAGE switch. Whenever the autopilot is disengaged by any means, the autopilot disengage horn will produce a short tone lasting 1 to 2 seconds with decreasing amplitude. The autopilot disconnect warning light (yellow) will remain on, until it is cancelled by pressing the control wheel AUTOPILOT DISENGAGE switch.

The pilot's control wheel incorporates five switches for other related autopilot operations. Four of the switches are mounted on the left-hand side of the control wheel and provide for operation of go-around, electric trim, autopilot disengage, and electric trim disengage. The other switch, mounted on the right-hand side of the control wheel, provides for operation of pitch synchronization.

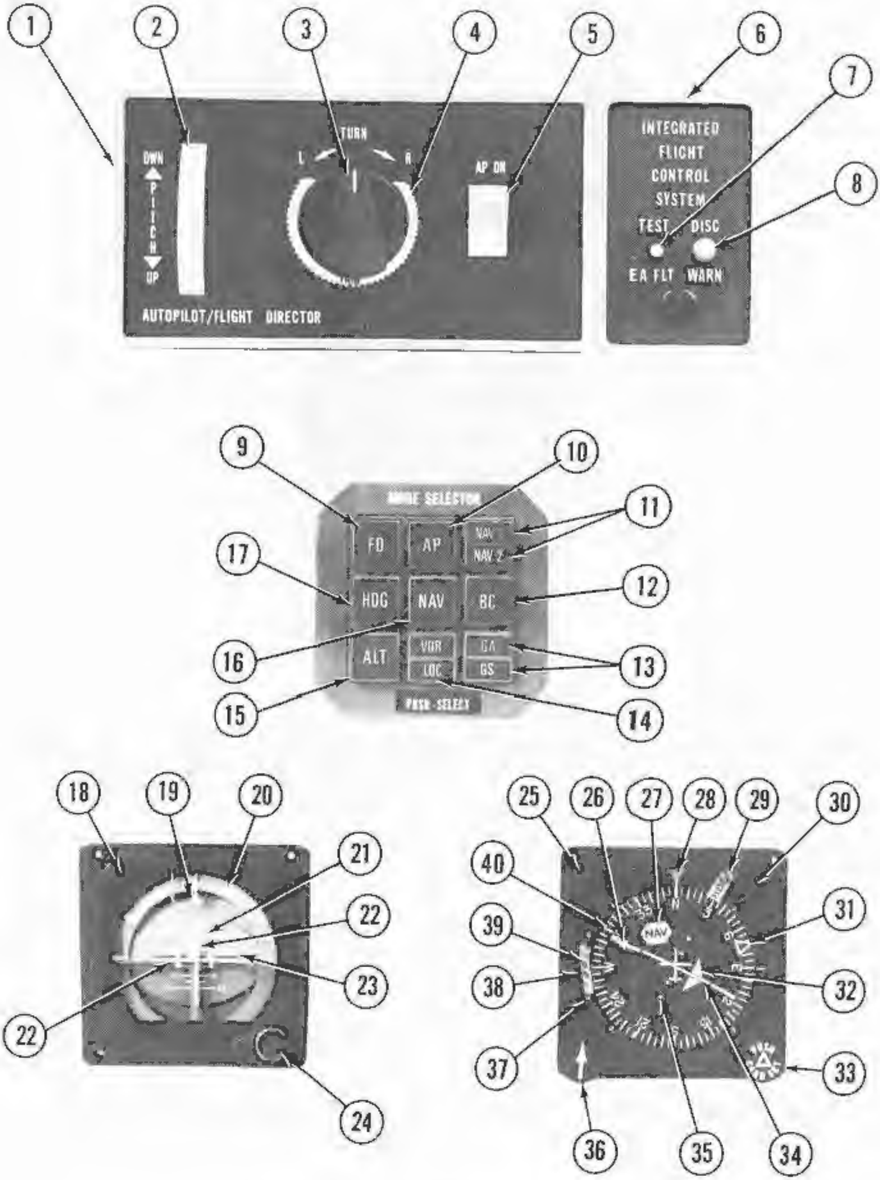
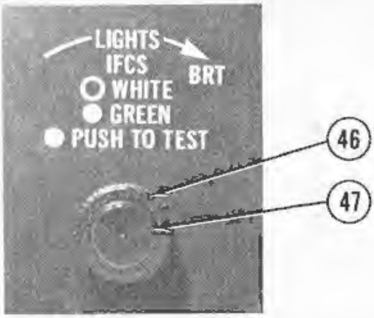


Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 1 of 6)



1. CONTROL UNIT - Provides the autopilot ON-OFF switch and the primary manual controls for operating the autopilot.

2. PITCH CONTROL - Controls pitch attitude of airplane. When rotated toward UP, airplane will pitch up. When rotated toward DWN, airplane will pitch down. Pitch attitude depends on displacement of the control from level flight position.

3. TURN CONTROL KNOB (TURN) - When turned, airplane will bank right (R) or left (L). When turned, disconnects heading (HDG) or navigation (NAV) modes selected on Mode Selector.

4. LATERAL TRIM CONTROL (TRIM) - When TURN knob is centered, (with no lateral modes engaged and the airplane manually trimmed for existing flight conditions), the TRIM control is used to trim for a wings level attitude.

5. AUTOPILOT ON-OFF SWITCH (AP/ON) - Controls primary power to autopilot. AP annunciator on Mode Selector will illuminate green when autopilot is engaged.

6. ACCESSORY UNIT - Provides the pilot with an automatic autopilot disconnect warning light and an autopilot disconnect self-test operation for use prior to flight.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 2 of 6)

7. AUTOPILOT DISCONNECT WARNING INDICATOR LIGHT (DISC WARN) Whenever the autopilot is disengaged by any means, other than the control wheel AUTOPILOT DISENGAGE switch, the autopilot disconnect warning indicator light (DISC WARN) will illuminate yellow and will remain lighted until it is cancelled by pressing the control wheel AUTOPILOT DISENGAGE switch. When the DISC WARN indicator light is activated, the circuit will also automatically activate an autopilot disengage warning horn that will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude.

8. AUTOPILOT DISCONNECT TEST BUTTON (TEST EA FLT) - When the TEST EA FLT pushbutton is pressed and held with the autopilot engaged, the "G" switch in the acceleration sensor is actuated and if the "G" switch is functional, the AP/ON-OFF switch will automatically disengage, the autopilot disconnect horn will produce a short tone and the yellow autopilot disconnect warning (DISC WARN) light will illuminate to advise the pilot the "G" switch disengaging function is operational.

9. FLIGHT DIRECTOR (FD) MODE SELECTOR SWITCH - Engages flight director mode. FD annunciator will illuminate green and command bars (22) on the attitude gyro (FDI) will appear.

10. AUTOPILOT (AP) MODE SELECTOR ANNUNCIATOR LIGHT - AP annunciator will illuminate green when autopilot is engaged.

11. NAV 1/NAV 2 MODE SELECTOR SWITCH - Permits selection of either one of the two Nav receivers to be coupled to the Integrated Flight Control System by pressing the NAV 1/NAV 2 pushbutton. The NAV 1/NAV 2 annunciator will illuminate green to show NAV 1 when engaged. By pressing NAV 1/NAV 2 a second time the alternate NAV 2 receiver will be coupled. NAV 1 will be dropped out and the annunciator light NAV 2 will illuminate green.

12. BACK-COURSE (BC) MODE SELECTOR SWITCH - Used with localizer operation only. With AP switch (on control unit) or FD pushbutton ON and when associated navigation receiver selected by NAV 1/NAV 2 is set to a localizer frequency, it will always reverse localizer signals to the computer for back-course operation which provides the capability to fly the localizer back-course inbound or the front course outbound. BC annunciator on mode selector will illuminate green when engaged. It also reverses normal localizer needle indication on the #2 navigation CDI needle.

13. GO-AROUND (GA) AND GLIDE SLOPE (GS) MODE SELECTOR ANNUNCIATOR LIGHTS - GA annunciator illuminates green when go-around switch on control wheel is pressed; indicates that all modes of operation, including autopilot, except a preset pitch-up and wings-level flight director command, are cancelled. The GA mode may be cancelled by repressing the GA switch, pressing the HDG pushbutton or reengaging the autopilot. During approach, GS annunciator illuminates green when glide slope is captured by IFCS.

14. VOR/LOCALIZER (VOR/LOC) MODE ANNUNCIATOR LIGHTS - When NAV pushbutton is engaged, either the VOR or LOC annunciator will illuminate green to reflect the selected frequency on the selected nav receiver. VOR/LOC light will only illuminate while in NAV mode.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 3 of 6)

15. ALTITUDE HOLD (ALT) MODE SELECTOR SWITCH - Engagement may be accomplished in climb, descent, or level attitude and commands the airplane to maintain pressure altitude existing at the moment of selection. Mode can be used with lateral command modes. In approach mode, altitude hold will automatically disengage when glide slope is captured. The go-around (GA) switch, when engaged, will also disengage altitude hold (ALT). ALT annunciator will illuminate green when engaged.

16. NAVIGATION (NAV) MODE SELECTOR SWITCH - Engagement provides for capture of VOR (omni) or LOC (localizer) track using NAV 1 or NAV 2 mode as selected. The TURN knob must be centered. During NAV-LOC operation, the glide slope (GS) mode will automatically engage only at beam center and only when the beam is approached from below. If the go-around (GA) switch on the airplane control wheel is actuated, the navigation (NAV) mode will automatically be cancelled and all associated annunciator lights will go out. Depending on the frequency selected at the time the NAV mode is activated, the VOR/LOC annunciator will illuminate green to show either VOR or LOC and the NAV mode annunciator will also illuminate green.

17. HEADING (HDG) MODE SELECTOR SWITCH - Engages the heading mode, which commands the airplane to turn to and maintain heading selected on Horizontal Situation Indicator (HSI). A new heading may be selected at anytime and will result in airplane turning to new heading with maximum bank angle of 25°. HDG mode will cancel GA mode and HDG annunciator will illuminate green.

18. FLIGHT DIRECTOR INDICATOR (FDI) - Displays airplane attitude as a conventional attitude gyro and displays commands for flight director operation.

19. FDI ROLL ATTITUDE INDEX - Displays airplane roll attitude read against roll attitude scale.

20. FDI ROLL ATTITUDE SCALE - Movable scale marked at 0, ±10, 20, 30, 60, and 90 degrees.

21. FDI PITCH ATTITUDE SCALE - Moves with respect to the symbolic airplane to present pitch attitude. Scale graduated at 0, ±5, 10, 15, and 20 degrees.

22. FDI COMMAND BARS - Display computed steering commands referenced to dot on symbolic airplane. Command bars are only visible when FD mode is selected on the MODE SELECTOR.

23. FDI SYMBOLIC AIRPLANE - Airplane pitch and roll attitude is displayed by the relationship between the fixed symbolic airplane and the movable background. During flight director operation, the symbolic airplane is flown to align its center dot with the command bars to satisfy the flight director commands.

24. FDI SYMBOLIC AIRPLANE ALIGNMENT KNOB - Provides manual positioning of the symbolic airplane for pitch attitude alignment.

25. HORIZONTAL SITUATION INDICATOR (HSI) - Provides a pictorial presentation of aircraft deviation relative to VOR radials or localizer beams. It also displays glide slope deviations and gives heading reference with respect to magnetic north.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 4 of 6)

26. COURSE BEARING POINTER - Indicates selected VOR course or localizer course on compass card (40). The selected VOR radial or localizer heading remains set on the compass card when the compass card (40) is rotated.

27. NAV FLAG - Flag is in view when the NAV receiver signal is inadequate.

28. LUBBER LINE - Indicates aircraft magnetic heading on compass card (42).

29. HEADING WARNING FLAG (HDG) - When flag is in view, heading display is invalid due to the slaving system power being interrupted or the HSI vacuum powered gyro speed being low.

30. GYRO SLAVING INDICATOR - Displays visual indication of heading indicator and flux detector synchronization. When slaving needle is aligned with the 45° right index on the HSI, it shows that the heading indicator agrees with the aircraft magnetic heading. Off-center pointer deflections show the direction of heading indicator error relative to aircraft magnetic heading. The compass CARD SET knob (33) may be used at any time to more rapidly accomplish synchronization of the heading indicator reading with magnetic heading as indicated by the slaving indicator.

31. HEADING BUG - Indicates selected heading relative to the compass card (40).

32. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.

33. HEADING SELECTOR AND CARD SET KNOB (PUSH/CARD SET/△) - Positions heading "bug" on compass card (40) by rotating the PUSH/CARD SET knob. Pushing in and rotating the PUSH/CARD SET knob sets the compass card. The "bug" (29) rotates with the compass card.

34. COURSE 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.

35. COURSE DEVIATION DOTS - A course deviation bar displacement of 2 dots represents full scale (VOR - ±10° or LOC - ±2½°) deviation from beam centerline.

36. COURSE SELECTOR KNOB - Positions omni bearing pointer (26) on the compass card (40) by rotating the course selector knob.

37. 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.

38. GLIDE SLOPE POINTER - Indicates on glide slope scale (37) aircraft displacement from glide slope beam center.

39. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 5 of 6)

40. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (28) on HSI.

41. GO-AROUND (GA) SWITCH - GA annunciator will illuminate green and all modes of operation, including autopilot, except a preset pitch-up and wings-level flight director command, are then cancelled. The GA mode may be cancelled by repressing the GA switch, engaging the HDG mode selector, or re-engaging the autopilot.

42. ELECTRIC TRIM SWITCH - When moved forward to DN position, moves the elevator trim tab in the "nose down" direction, conversely, pulling the switch aft to the UP position moves the tab in the "nose-up" direction. Electric trim switch is only operational with AP/ON-OFF switch OFF.

43. ELECTRIC TRIM DISENGAGE SWITCH - When pulled aft to the OFF position, disengages the electric trim system. A secondary disengagement of electric trim is provided by a TRIM/PULL OFF circuit breaker; pull out to remove all electrical power from the electric trim system.

44. AUTOPILOT DISENGAGE SWITCH - When momentarily pulled aft to the OFF position, trips primary AP ON/OFF switch to OFF and removes all electrical power from the system. Autopilot will remain OFF until primary AP ON/OFF switch is turned ON even though the switch is spring loaded to return to ON when released. The AUTOPILOT DISENGAGE SWITCH may also be used to turn the AUTOPILOT DISCONNECT light off when the autopilot is in the OFF position.

45. PITCH SYNCHRONIZATION (PITCH SYNC) SWITCH - When the FD mode selector switch is ON and AP is OFF, the command bars will automatically synchronize to the pitch attitude at the time of flight director engagement. If a new pitch attitude is established, align the pitch command bar with the symbolic aircraft by depressing (but do not hold) the PITCH SYNC switch on the control wheel. The pitch command wheel can also be used for this.

46. MODE SELECTOR WHITE LIGHT DIMMING CONTROL - The annunciators in the Mode Selector will be illuminated with white lighting which identifies the function of each switch or mode. Rotate the large knob as desired to adjust the intensity of the white lights.

47. COMBINATION MODE SELECTOR GREEN LIGHT DIMMING CONTROL AND PUSH TEST CONTROL - Rotate the small knob as desired to adjust the intensity of the lights. The small knob is also used to test the mode selector lights. Press the small knob inward to test the green mode selector lights.

Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 6 of 6)

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equipment is disengaged. However, the following autopilot limitations must be followed during airplane operation with the autopilot engaged.

OPERATING LIMITATIONS WITH AUTOPILOT ENGAGED:

1. Maximum Airspeed -- 165 KIAS.
   Reduce maximum speed 10 KTS every 3,000 Ft. above FL 180.
2. Maximum Altitude Loss During Malfunction Recovery:
   Cruise -- 300 Ft.
   Approach -- 200 Ft.
3. Maximum Flap Deflection -- 10°.
4. In Altitude Hold Mode:
   Maximum Speed for Flap and Gear Operation -- 115 KIAS.

SECTION 3
EMERGENCY PROCEDURES

IN CASE OF AUTOPILOT MALFUNCTION:

1. Airplane Control Wheel -- OPERATE as required to manually override the autopilot.

   NOTE

   The servos may be manually overpowered at any time without damage. If pitch axis is overpowered, electric trim will run in opposition to overpowering force. Manually overpowering the autopilot should be kept to a minimum since slip clutch wear will result from extended periods of manual overpower.

2. AUTOPILOT DISENGAGE Switch (on Control Wheel) -- PULL OFF.

   NOTE

   This action automatically trips autopilot ON-OFF switch OFF. If electrical malfunction still persists, turn avionics power switch OFF and, if necessary, also turn the airplane master switch OFF.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF

RELIABILITY TESTS:

1. Autopilot Automatic Disconnect Check (with Engine Running and Gyros Erected) -- PERFORM the following checks.
   a. TURN Knob -- CENTER.
   b. Autopilot Lateral TRIM Control -- CENTER.
   c. AP ON-OFF Rocker Switch -- ON and observe annunciator illuminates green on mode selector.

NOTE

The roll servo will engage immediately. The pitch servo will engage after pitch synchronization as evidenced by the autopilot pitch command wheel coming to rest.

   d. FD Mode Selector Button -- ENGAGE and observe annunciator illuminates green on mode selector.
   e. Airplane Control Wheel -- HOLD to reduce movement.
   f. Autopilot Disconnect TEST Prior To EA FLT Button -- PUSH and HOLD.
   g. Verify the following:
      (1) Flight Director Indicator -- OBSERVE command bars are visible.
      (2) AP ON-OFF Switch -- OBSERVE disengage.
      (3) Autopilot Disconnect Warning Light -- OBSERVE yellow illumination.
      (4) Autopilot Disengage Horn -- OBSERVE 1 to 2 second aural tone.
   h. Airplane Control Wheel AUTOPILOT DISENGAGE Switch -- PULL AFT to turn off Autopilot Disconnect Warning light.
   j. FD Mode Selector Button -- DISENGAGE and observe that command bars recess out of view.

AUTOPILOT MODE

BEFORE TAKEOFF AND LANDING:

1. AP ON-OFF Rocker Switch -- PUSH OFF.
2. MODE SELECTOR Rheostats -- ADJUST illumination intensities.
3. MODE SELECTOR AP Annunciator -- CHECK OFF (green light extinguished).
4. MODE SELECTOR FD Annunciator -- CHECK OFF (green light extinguished).

IN-FLIGHT WING LEVELING:

1. Airplane Elevator and Rudder Trim -- ADJUST.
2. TURN Knob -- CENTERED in detent.
3. AP/ON-OFF ROCKER SWITCH -- ON.
4. MODE SELECTOR AP Annunciator -- CHECK ON (green light illuminated).
5. Lateral Trim Knob -- ADJUST to level wings.
6. PITCH Command Wheel -- ADJUST as desired.

ALTITUDE HOLD:

1. MODE SELECTOR ALT Button -- PUSH.
2. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

NOTE

The autopilot ON-OFF switch must be engaged for a short time (maximum of 30 seconds) before the ALT switch can be engaged.

COMMAND TURNS:

1. TURN Knob -- ROTATE as desired.

CLIMB OR DESCENT:

1. ALT Rocker Switch -- DISENGAGE.
2. Pitch Command Wheel -- ROTATE UP or DOWN as desired.
3. Rudder Trim -- ADJUST as required.

HEADING SELECT:

1. Heading Selector Knob on HSI -- ROTATE bug to desired heading.
2. TURN Knob -- CENTERED in detent.
3. MODE SELECTOR HDG Button -- PUSH.
4. MODE SELECTOR HDG Annunciator -- CHECK ON (green light illuminated).

NOTE

Airplane will turn automatically to selected heading.

VOR COUPLING:

1. TURN Knob -- CENTERED in detent (after turning airplane heading within 135° of desired course).

2. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for desired receiver.
3. HSI Course Selector Knob (or CDI OBS Knob) -- SET desired VOR course.
4. MODE SELECTOR NAV Button -- PUSH.
5. MODE SELECTOR NAV Annunciator -- CHECK ON (green light illuminated).

NOTE

Airplane will automatically intercept at 45° and then track the selected VOR course.

ILS/LOC APPROACH:

1. Wing Flaps -- SELECT desired 0° to 10° approach setting.

NOTE

Maximum allowable flap deflection is 10° with autopilot engaged. Airspeed should be reduced to 115 KIAS prior to operation of the flaps if operating in the altitude hold mode.

2. Airspeed -- ADJUST to approach speed (95 to 115 KIAS).
3. Rudder Trim -- ADJUST as required.
4. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for NAV 1 receiver.
5. MODE SELECTOR NAV 1/NAV 2 Annunciator -- CHECK correct NAV ON (green light illuminated).
6. MODE SELECTOR BC Button -- PUSH for front course outbound or back course inbound.

NOTE

If BC mode is selected, ensure that BC annunciator light illuminates green on the MODE SELECTOR.

7. HSI Course Selector Knob -- SET localizer <u>front</u> course heading for <u>both</u> front and back-course approaches.
8. MODE SELECTOR NAV Button -- PUSH for automatic intercept and ILS tracking (aircraft heading must be within 90° of selected course).
9. MODE SELECTOR NAV Annunciator -- CHECK ON (green light illuminated).
10. Heading Selector Knob on HSI -- ROTATE bug for missed approach heading.
11. MODE SELECTOR ALT Button -- PUSH upon reaching published approach altitude.

12. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

NOTE

As glide slope needle passes down through center position, ALT annunciator will deactivate automatically and GS annunciator will illuminate. Autopilot can only capture glide slope from below beam center. ALT engaged is not required to capture glide slope.

13. MODE SELECTOR ALT Button -- OFF at final approach fix if localizer approach only. Adjust autopilot pitch command wheel for proper descent.
14. Landing Gear -- EXTEND by outer marker.

NOTE

Airspeed should be reduced to 115 KIAS prior to operating the gear if operating in the altitude hold mode.

15. AUTOPILOT DISENGAGE Switch (Control Wheel)-- OFF before landing or extending flaps more than 10°.
16. Wing Flaps -- EXTEND as REQUIRED after landing is assured.

MISSED APPROACH:

1. Control Wheel GA Switch -- PRESS.

NOTE

Autopilot will disengage and an autopilot disengage warning horn will produce a short tone lasting from 1 to 2 seconds with decreasing amplitude. Flight Director will automatically engage to provide a preset pitch up climb attitude and wings level command.

2. Control Wheel/Elevator Trim Switch -- OPERATE as necessary to satisfy command signals.
3. Power and Cowl Flaps -- SET as required for climb.
4. Landing Gear and Wing Flaps -- RETRACT.
5. Rudder Trim -- ADJUST as required.
6. Heading Bug on HSI -- SET for missed approach heading.
7. Control Wheel GA Switch -- PRESS to disengage GA mode.
8. Autopilot ON-OFF Switch -- ON.
9. MODE SELECTOR AP Annunciator -- CHECK ON (green light illuminated).

10. MODE SELECTOR HDG Button -- PUSH.
11. MODE SELECTOR HDG Annunciator -- CHECK ON (green light illuminated).
12. PITCH Command Wheel -- ROTATE for desired climb attitude.

FLIGHT DIRECTOR MODE

BEFORE TAKEOFF AND LANDING:

1. AP ON-OFF Rocker Switch -- PUSH OFF.
2. MODE SELECTOR Rheostats -- ADJUST illumination intensities.
3. MODE SELECTOR AP Annunciator -- CHECK OFF (green light extinguished).
4. MODE SELECTOR FD Annunciator -- CHECK OFF (green light extinguished).

CLIMB:

1. Airplane Climb Attitude -- ESTABLISH.
2. MODE SELECTOR FD Button -- PUSH ON and observe that command bars appear on FD Indicator.
3. MODE SELECTOR FD Annunciator -- CHECK ON (green light illuminated).

NOTE

If pitch command bar is not aligned in pitch with the symbolic aircraft, readjust flight director indicator's symbolic airplane alignment knob.

4. Autopilot Lateral TRIM Knob -- ADJUST as required to center vertical command bar.
5. Airplane Control Wheel/Elevator Trim Switch -- OPERATE to keep dot on symbolic airplane aligned with command bars, satisfying command signal.

NOTE

If climb attitude is changed, press PITCH SYNC button on control wheel to realign pitch command bar with symbolic airplane.

LEVEL FLIGHT:

1. MODE SELECTOR ALT Button -- PUSH.
2. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

3. Control Wheel/Elevator Trim Switch -- OPERATE as necessary to satisfy command signal.

HEADING SELECT:

1. Heading Selector Knob on HSI -- ROTATE bug to desired heading.
2. MODE SELECTOR HDG Button -- PUSH.
3. Control Wheel -- OPERATE as necessary to satisfy command signal.

NOTE

Airplane will not be commanded to bank more than 25° toward the selected heading.

VOR INTERCEPT:

1. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for desired receiver.
2. MODE SELECTOR NAV 1/NAV 2 Annunciator -- CHECK CORRECT NAV ON (green light illuminated).
3. HSI Course Selector Knob (or OBS on CDI) -- SET desired VOR course.
4. MODE SELECTOR NAV Button -- PUSH.
5. MODE SELECTOR NAV Annunciator -- CHECK ON (green light illuminated).
6. Control Wheel -- OPERATE as necessary to satisfy command signal.

NOTE

Vertical command bar will lead airplane to an intercept angle and then a smooth transition to the VOR radial.

ILS/LOC APPROACH:

1. Wing Flaps -- SELECT desired 0° to 10° approach setting.
2. Airspeed -- ADJUST to initial approach speed.
3. MODE SELECTOR NAV 1/NAV 2 Button -- PUSH for NAV 1 receiver.
4. MODE SELECTOR NAV 1/NAV 2 Annunciator -- CHECK correct NAV ON (green light illuminated).
5. MODE SELECTOR BC Button -- PUSH for front course outbound or back course inbound.

NOTE

If BC mode is selected, ensure that BC annunciator light illuminates green on the MODE SELECTOR.

6. HSI Course Selector -- SET localizer front course heading for both front and back-course approaches.
7. MODE SELECTOR NAV Button -- PUSH.
8. MODE SELECTOR NAV Annunciator Light -- CHECK ON (green light illuminated).
9. Heading Selector Knob on HSI -- SET bug for missed approach heading.
10. MODE SELECTOR ALT Button -- PUSH upon reaching published approach altitude.
11. MODE SELECTOR ALT Annunciator -- CHECK ON (green light illuminated).

NOTE

As glide slope needle passes through center position, the ALT annunciator will automatically go out and G S annunciator will illuminate green. Flight director can only capture glide slope from below beam center. ALT engaged is not required to capture glide slope.

12. MODE SELECTOR ALT Button -- OFF at final approach fix if localizer approach only. Use pitch trim wheel to establish proper command attitude.
13. Control Wheel/Elevator Trim Switch -- OPERATE as necessary to satisfy command signals.
14. Landing Gear -- EXTEND by outer marker.
15. Wing Flaps -- EXTEND as required after landing is assured

MISSED APPROACH:

1. Control Wheel GA Switch -- PRESS.

NOTE

Flight Director will disengage on all modes of operation except a preset pitch up climb attitude and wings level command.

2. Control Wheel/Elevator Trim -- OPERATE as necessary to satisfy command signals.
3. Power and Cowl Flaps -- SET as required for climb.
4. Landing Gear and Wing Flaps -- RETRACT.
5. Heading Selector Knob on HSI -- SET bug for missed approach heading.
6. MODE SELECTOR HDG Button -- PUSH.
7. MODE SELECTOR HDG Annunciator -- CHECK ON (green light illuminated).

8. Control Wheel -- OPERATE as necessary to satisfy command signals.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

WEATHER RADAR
(Type RDR-160)

SECTION 1
GENERAL

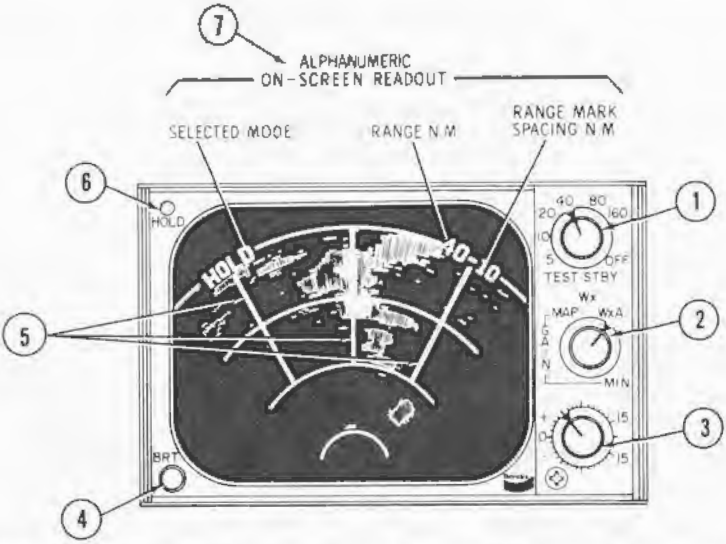
The RDR-160 Weather Radar system consists of a wing pod mounted receiver-transmitter and X-band radar antenna, and a radar indicator that is mounted in the right portion of the instrument panel. All operating controls are mounted on the front panel of the radar indicator and operating controls and functions are described in Figure 1.

The RDR-160 Weather Radar is designed to detect significant enroute weather formations within a range of 160 nautical miles to preclude undesirable penetration of heavy weather and its usually associated turbulence. Internally generated range marks appear as evenly spaced concentric circular arcs on the display to assist in determining distance from weather targets. Reference marks on each side of the zero heading assist in determining bearing of weather targets. A secondary objective of the weather radar system is the gathering and presentation of terrain data.

WARNING

This system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED ALL SAFETY PRECAUTIONS AND INSTRUCTIONS CALLED OUT IN SECTION 4 (NORMAL PROCEDURES) OF THIS SUPPLEMENT.

For expanded information and operational instructions, refer to the RDR-160 Pilot's Manual supplied with your aircraft.



1. FUNCTION SWITCH - Controls application of power and selects mode of operation for testing, warm-up and antenna scanning in the range of 5 nautical miles to 160 nautical miles. Switch positions are as follows:

   OFF - Turns set off.

   STBY - Turns set on to standby for warmup but transmitter, antenna scan and indicator display are inhibited. (Warmup time is approximately 2 minutes.)

   TEST - Applies drive to antenna and activates test circuit and indicator display to determine operability of system.

   5 - Energizes Transmitter. Selects 5 nautical mile range presentation with 1 mile range marks.

   10 - Energizes Transmitter. Selects 10 nautical mile range presentation with 2 mile range marks.

   20 - Energizes Transmitter. Selects 20 nautical mile range presentation with 4 mile range marks.

   40 - Energizes Transmitter. Selects 40 nautical mile range presentation with 10 mile range marks.

   80 - Energizes Transmitter. Selects 80 nautical mile range presentation with 20 mile range marks.

   160 - Energizes Transmitter. Selects 160 nautical mile range presentation with 40 mile range marks.

NOTE

Each time the function switch position is changed, the indicator presentation is automatically erased so that information on the newly selected function may be presented without confusion.

Figure 1. Weather Radar (X-Band Type RDR-160) (Sheet 1 of 3)

2. MODE SELECTOR AND GAIN CONTROL - Selects weather radar and ground mapping modes of operation with manual gain selection for ground mapping. Switch positions are as follows:

   MAP/GAIN (Ground Mapping) - Places indicator in MAP mode and disables contour feature. In the MAP mode, 6 levels of GAIN may be manually selected from MAP (maximum gain) to MIN (minimum gain) during ground mapping mode. All targets will be presented on the indicator in up to 3 different shades, depending on the radar echo strength and the particular click-gain setting used.

   Wx (Weather) - Places weather indicator image gain in a preadjusted level. Contour operation is automatic and constant. Contoured storm cells will appear as dark holes which will be outlined by lighter shades automatically.

   WxA (Weather Alert) - When the Mode Selector is in the WxA position, verification of storm cloud contouring is provided. If a dark hole seen in the Wx mode is a contour or storm cell, its presentation will alternate from darkest shade to brightest shade approximately 1 time per second. If a dark hole remains the same intensity while in the WxA mode, then this area of the display does not represent a contour or storm cell.

3. ANTENNA TILT CONTROL - Electronically adjusts the radar beam to 15 degrees up, or down, with respect to the airplane axis to compensate for differences in airplane attitude.

4. BRT CONTROL - Controls the brightness of the indicator display.

5. BEARING MARKS - To assist in determining relative bearing of return, marks are provided 30° either side of the 0° or forward mark.

6. HOLD SWITCH - The HOLD switch is a push-pushbutton. Pushing the HOLD button in puts the image in the hold mode; pushing the button in again puts the image in the scan mode.

   HOLD (Pushbutton Engaged) - Weather or ground mapping image last presented is retained (frozen) on the indicator display in order to evaluate the significance of storm cell movement. Switching back to scan from Hold mode reveals relative direction and distance of target movement during hold period if airplane heading and speed were not changed. The word "HOLD" will be flashing on the display screen when in the HOLD mode.

   SCAN (Pushbutton Disengaged) - When the HOLD pushbutton is disengaged, presentation is unfrozen and normal scanning updates the picture with each sweep.

Figure 1. Weather Radar (X-Band Type RDR-160) (Sheet 2 of 3)

7. ALPHANUMERIC ON-SCREEN READOUTS - The indicator features alphanumeric readouts of full scale range, range mark spacing, and mode selection. The following Table lists the readouts as a function of switch positions:

Function Switch Position	Range-Range Mks Spacing
TEST	40-10
5	5-1
10	10-2
20	20-4
40	40-10
80	80-20
160	160-40

Mode Selector Switch Position	Mode Readout*
MAP/GAIN	MAP
Wx	Wx
WxA	WxA

*Footnote - When the HOLD switch is energized, the mode readout displays HOLD which flashes at the rate of once per second. Also when TEST is selected on the function switch the word TEST appears at the mode readout location.

Figure 1. Weather Radar (X-Band Type RDR-160) (Sheet 3 of 3)

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

PRIOR TO FLIGHT:

WARNING

The radar system generates microwave radiation and improper use, or exposure, may cause serious bodily injury. DO NOT OPERATE THIS EQUIPMENT UNTIL YOU HAVE READ AND CAREFULLY FOLLOWED THE FOLLOWING SAFETY PRECAUTIONS AND INSTRUCTIONS:

SAFETY PRECAUTIONS AND INSTRUCTIONS TO BE FOLLOWED PRIOR TO RADAR OPERATION:

1. Do not turn on, or operate radar within 15 feet of ground personnel or containers holding flammable or explosive material.
2. Do not turn on, or operate radar during refueling operations.

PREFLIGHT CHECKS PRIOR TO ENERGIZING RADAR:

WARNING

IN ORDER TO PREVENT POSSIBLE SERIOUS BODILY INJURY TO GROUND PERSONNEL OR IGNITION OF

FLAMMABLE OR EXPLOSIVE MATERIALS. THE FOLLOWING TESTS MUST BE ACCOMPLISHED WITH THE FUNCTION SWITCH ALWAYS IN THE "TEST" MODE OF OPERATION.

1. Function Switch -- STBY position and after 30 seconds select TEST position.
2. HOLD Selector Switch -- DISENGAGED (scan mode).
3. Mode Selector Control -- Wx position.
4. BRT Control -- ADJUST to desired brightness.
5. Indicator Display -- CHECK TEST PATTERN with the following:
   a. Four equally spaced range marks should be visible, the word "TEST" and numerals "40-10" should appear in the alphanumeric area of display.
   b. No video noise distortion should appear on the display.
   c. There are two distinct brightness levels appearing on the indicator.
   d. Starting at the lower center of the display, there will either be four or five bands extending outward. The variance in the number of bands is due to the design of the display unit which causes the nearest light shading band (small) to appear on units with a five band display and not appear on units with a four band display. The four and five band displays are as follows:

      Nearest is light shading (appears on five band display only).
      Next (or nearest) is intermediate shading (intermediate shading appears as the nearest band on four band displays).
      Next is dark or contour area.
      Next is intermediate shading.
      Next is light shading.

6. Mode Selector Control -- WxA position and observe that the word "TEST" and numbers "40-10" appear in the alphanumeric area of display. Ensure that the pattern center band alternates between the darkest shade and the brightest shade at about 1 time per second.
7. Mode Selector Control -- MAP (maximum gain) position and observe that the word "TEST" and numbers "40-10" appear in the alphanumeric area display. Note that stroke line (antenna position) moves across the indicator screen through the range marks for the full 90 degrees without jumping.
8. HOLD Selector Switch -- ENGAGE HOLD pushbutton and observe that the word "HOLD" replaces TEST and flashes at the rate of once per second in the alphanumeric area of display. Note that the strobe line disappears.

PREFLIGHT CHECKS WITH RADAR ENERGIZED:

WARNING

IN ORDER TO PREVENT POSSIBLE BODILY INJURY TO GROUND PERSONNEL OR IGNITION OF FLAMMABLE OR EXPLOSIVE MATERIALS, THE AIRPLANE MUST BE TAXIED WITH THE FUNCTION SWITCH IN THE OFF, STBY, OR TEST POSITIONS ONLY TO A "CLEAR-AHEAD" AREA WHERE METAL BUILDINGS, AIRCRAFT, GROUND PERSONNEL, ETC., ARE NOT IN THE LINE-OF-SIGHT OF THE RADAR UNIT. OBSERVE THE SAFETY PRECAUTIONS AND INSTRUCTIONS AT THE START OF SECTION 4 PRIOR TO PERFORMING THE FOLLOWING CHECKS WITH THE RADAR UNIT ENERGIZED.

1. Ensure safety precautions have been observed.
2. Function Switch -- 40 position. Observe that the numbers "40-10" are present in the alphanumeric area of the display.
3. HOLD Selector Switch -- DISENGAGED (scan position).
4. Mode Selector -- Wx position. Observe that letters "Wx" are present in the alphanumeric area of the display.
5. TILT Control +4° to minimize ground return.
6. BRT Control -- ADJUST as required.
7. Antenna Tilt Control -- TILT UP (+ degrees) and DOWN (- degrees) in small increments. Close-in ground targets should appear on the display at low tilt angles and any local moisture laden weather should appear at higher angles.

OPERATIONAL NOTES

ALTITUDE RING DISPLAY

1. Some energy is radiated peripherally from the radar antenna which, under some atmospheric conditions, will create a false return on the radar screen when the display is set on the 5, 10, or 20 mile ranges. The false return will usually be most prominently displayed at approximately 2 miles from the origin when flying at altitudes near 12,000 ft. However, under certain atmospheric conditions, the false return can still be observed at a distance from the origin approximately equivalent to the airplaue's altitude. Care must be taken not to confuse this normal interference return with a weather return. This is best accomplished by using the longer distance displays (40 or more) for early detection of significant weather.

EXTENDING LIFE OF THE MAGNETRON TRANSMITTING TUBE:

1. The RDR-160 weather radar system is designed so that full operation is possible approximately two minutes after turn on. Therefore, the pilot may choose to leave the function switch in OFF rather than STBY if no significant weather is in the immediate area of the aircraft. The life of the magnetron transmitting tube will be extended by leaving the system "OFF" when possible. This in turn will reduce the cost of maintenance.

NORMAL OPERATION

WEATHER DETECTION:

1. Function Switch -- 80 position (allow 2 minutes warm-up).
2. Mode Selector Switch -- SELECT as desired:
   Wx - Weather.
   WxA - Weather Alert.
3. BRT Switch -- ADJUST as required for ambient light conditions.
4. Antenna Tilt Control -- +4° to +6° (approximate minimum angle relative to horizon without ground return).

NOTE

If airplane is climbing or descending, tilt angles must be reduced or increased by approximately the pitch angle indicated on the attitude gyro.

5. Function Switch -- SELECT desired range.
6. HOLD Switch -- ENGAGE if desired to "freeze" display on indicator to track storm movements.
7. Aircraft -- MAINTAIN SPEED and HEADING to assure an accurate picture of relative motion of storm in next step.
8. HOLD Switch -- DISENGAGE HOLD switch to compute storm movement and return antenna to scan mode.

GROUND MAPPING:

NOTE

Ground mapping is a secondary feature of this radar which is only useful after the operator is very familiar with this equipment. More complete discussion of this feature is included in the RDR-160 Pilot's Manual.

1. Function Switch -- SELECT DESIRED RANGE (allow 2 minutes warmup).

2. Mode Selector Switch - MAP. Set GAIN as desired for clearest display.
3. BRT Switch -- ADJUST as required.
4. Antenna Tilt Control -- ADJUST for clearest display.

SECTION 5
PERFORMANCE

There is a slight reduction in cruise speed performance with the radar pod installed which varies from approximately 1 knot at high cruise power at lower altitudes to 3 knots at low cruise power or at very high altitudes. All other performance data is unchanged.

SUPPLEMENT

CASSETTE STEREO PLAYER WITH AM/FM MPX RADIO (TYPE C-114A)

SECTION 1
GENERAL

The Model C-114A Cassette Stereo Player and AM/FM Radio is a compact, fully automatic AM/FM Mpx radio and stereo cassette player mounted in the instrument panel above the glove box. In addition to the player/radio, the system consists of stereo headphones and an externally mounted, fixed-wire antenna. All operating controls for the player/radio and headphones are shown in figure 1.

The AM/FM Mpx Radio will receive AM frequencies between 525 and 1650 kHz or FM frequencies between 88 and 108 MHz. AM or FM reception is selected by an A/F pushbutton located on the front of the set.

The cassette stereo player is equipped with four-track, two-channel stereo cassette type playback with a tape speed of 4.76 cm/sec. Any standard-size monural or stereo cassette may be used in the player. Cassettes are automatically activated when inserted in tape receptacle (with tape play side to the right) with radio ON and A/F switch in either AM or FM position. When cassette is finished or ejected, radio play will automatically resume. Indicator lights denote play status. STEREO indicator light will illuminate red when stereo sound is being received over radio. TAPE indicator light will illuminate green when cassette is inserted. When cassette play ends, STEREO indicator light will illuminate again if radio is receiving stereo transmission.

Headphones are equipped with a headphone volume control box, which has a selector switch for selection of either monural (AM) or stereo (FM or cassette) reception and individual earphone volume controls; and a phono plug which must be attached to one of four phone jacks in the overhead console.

NOTICE

Sound from the player/radio is only available through headphones.

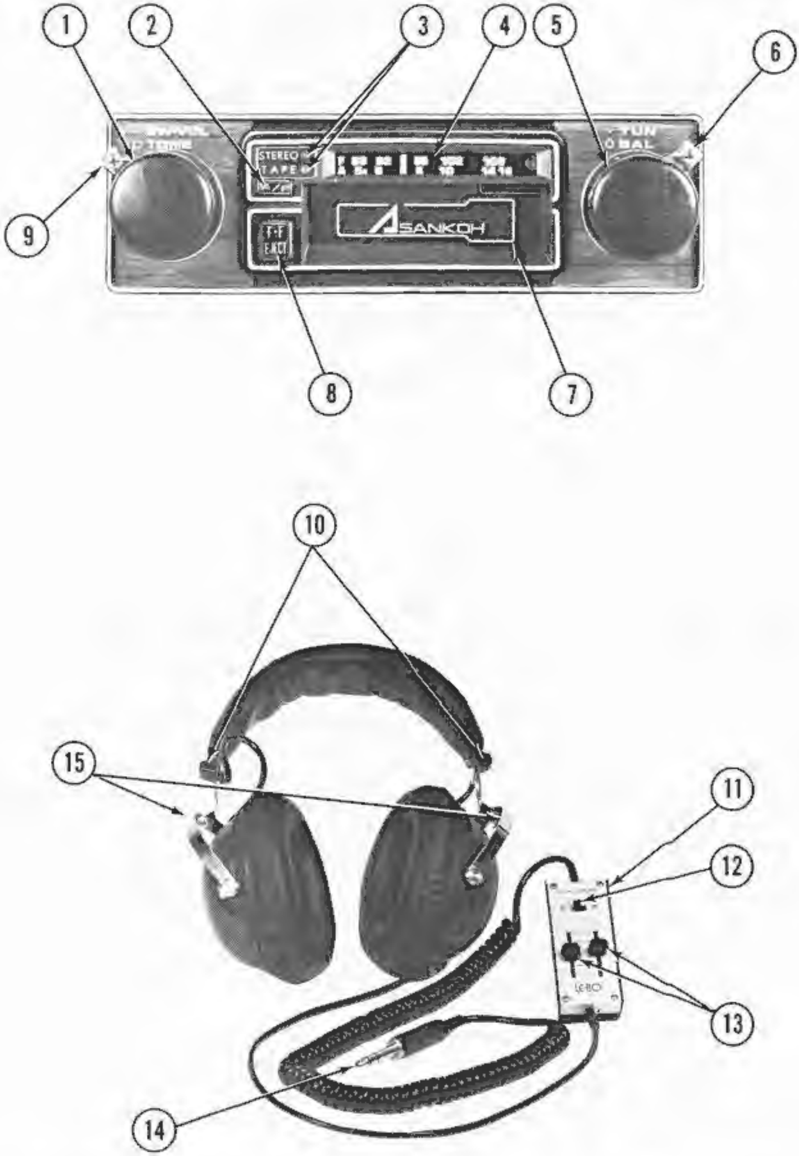


Figure 1. Cassette Player-AM/FM Radio, Operating Controls (Sheet 1 of 3)

1. ON/OFF PUSH SWITCH AND VOLUME CONTROL (SW-VOL) - When pushed in, turns set ON or OFF and when rotated controls volume of audio applied to headphones. Clockwise rotation increases audio level.

2. AM/FM PUSHBUTTON SELECTOR SWITCH (A/F) - Selects AM or FM radio reception: IN for AM and OUT for FM.

3. STEREO AND TAPE PLAY INDICATORS - STEREO indicator light will illuminate red when stereo radio station is received. TAPE play indicator light will illuminate green when cassette is inserted in tape receptacle. When cassette tape ends, TAPE indicator light goes out, radio play on preselectd AM or FM will automatically resume, and STEREO light will illuminate again if radio is receiving FM stereo transmission.

4. AM AND FM RADIO DIAL (A/F) - Indicates selected operating radio frequencies for AM between 525 and 1650 kHz and FM between 88 and 108 MHz.

5. TUNING KNOB (TUN) - ROTATE to tune in desired AM or FM station.

6. PLAYER/RADIO BALANCE CONTROL (BAL) - Speaker balance is adjusted by moving silver lever control either clockwise or counterclockwise as desired.

7. TAPE RECEPTACLE - Insert cassette with tape play side to the right. Top numbered side will play. Either monural or stereo standard cassettes may be used.

8. TAPE EJECT AND FAST FORWARD PUSHBUTTON (F-F/EJECT) - For fast forward (rewind), pushbutton is pushed in slightly. To lock fast forward, pushbutton is pushed in halfway and released. Fast forward is unlocked by pushing button in slightly and releasing. Cassette is ejected by pushing button all the way.

9. PLAYER/RADIO TONE CONTROL (TONE) - TONE is adjusted by moving silver lever control clockwise for treble and counterclockwise for bass.

10. HEADPHONE EXTENSION-ADJUSTMENT LEVERS - Located on both sides of the headphones. Earphone extension is adjusted by moving levers up or down to a comfortable listening position.

11. HEADPHONE VOLUME CONTROL BOX - Located on the headphone cord; contains Monural-Stereo Selector Switch and Earphone Volume Control Levers.

12. MONURAL-STEREO SELECTOR SWITCH - Located on the Headphone VOLUME CONTROL Box; selects mono (AM) or stereo (FM) and Cassette reception for headphones.

13. EARPHONE VOLUME CONTROL LEVERS (LEFT/RIGHT) - CONTROL VOLUME Box; regulate volume of audio to individual earphones. Volume is increased as levers are moved to higher settings.

Figure 1. Cassette Player-AM/FM Radio, Operating Controls (Sheet 2 of 3)

14. HEADPHONE PLUG - Inserts in one of four phone jacks located in overhead console and placarded STEREO HEADPHONES. Jacks are for 1/4-inch stereo plugs only.

CAUTION

To prevent damage to the player/radio, use only 8-ohm headphones with 1/4-inch stereo type plugs.

15. EARPHONE IDENTIFICATION MONOGRAMS (L/R) - Located on left (L) and right (R) earphones. Audio in left, or "cord", earphone is regulated by LEFT lever on Headphone VOLUME CONTROL Box. RIGHT lever regulates audio to "R" earphone.

NOTE

Headphones are usually worn with left (L), or "cord", earphone on left. If earphones are switched, LEFT lever on Headphone VOLUME CONTROL Box will still regulate earphone labeled "L".

Figure 1. Cassette Player-AM/FM Radio, Operating Controls (Sheet 3 of 3)

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

AM/FM RADIO OPERATION:

1. Headphones -- INSERT headphone plug(s) into one of four jacks mounted in the overhead console and placarded STEREO HEADPHONES.
2. Headphone Extension-Adjustment Levers -- ADJUST to comfortable listening position.
3. Stereo-Mono Selector Switch -- SELECT desired monural (AM) or stereo (FM) position on Headphone VOLUME CONTROL Box.
4. Headphone LEFT/RIGHT VOLUME CONTROL Levers -- Select No. 4 position for both LEFT and RIGHT levers on the Headphone VOLUME CONTROL Box.

CAUTION

With headphones plugged in, extended play at full volume should be avoided in order to prevent damage to headphones.

5. ON/OFF Pushbutton Switch and Volume Control -- ROTATE control fully counterclockwise to obtain the minimum audio setting and then PUSH in to activate unit. ROTATE control clockwise to desired setting.

NOTE

Audio can only be heard through headphones.

6. A/F Pushbutton Selector Switch -- SELECT as desired; IN for AM, OUT for FM.
7. Tuning Knob -- SELECT desired frequency.
8. STEREO Indicator Light -- CHECK ON (red light will illuminate) if stereo radio station reception is selected.
9. EARPHONE VOLUME CONTROL LEVERS (LEFT/RIGHT) -- ADJUST to desired audio setting. Volume is increased by moving levers to higher settings, and lowered by moving levers to lower settings.

NOTE

Improper tuning will result in poor tone and excessive noise.

10. Tone Control -- ADJUST to desired audio setting.
11. Balance Control -- ADJUST to desired audio setting.

CASSETTE PLAYER OPERATION:

1. Tape Receptacle -- INSERT CASSETTE with tape play side to right and adjust listening controls on unit and headphones. Player will play top numbered side.

NOTE

When tape runs out and automatically stops, radio play will automatically resume.

CAUTION

To insure the best performance and operation of your cassette player follow these simple rules:

a. Loose cassette tape should not be played.

NOTE

If your tape is loose, rewind it before playing.

b. Do not keep cassette tape in your player long after cassette play is finished.
c. Do not use non-standard cassette tapes. Damage to your player will result.

2. Tape EJECT/Fast Forward Pushbutton:
   a. To Eject Tape -- PUSH IN button all the way to eject cassette at end of play or at any point desired.

b. To Select Fast Forward (Rewind) -- PUSH SLIGHTLY in for fast forward or to lock fast forward position, push button in halfway and release.
c. To Cancel Fast Forward -- RELEASE BUTTON or (if in lock position) PUSH BUTTON in slightly and release.

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.