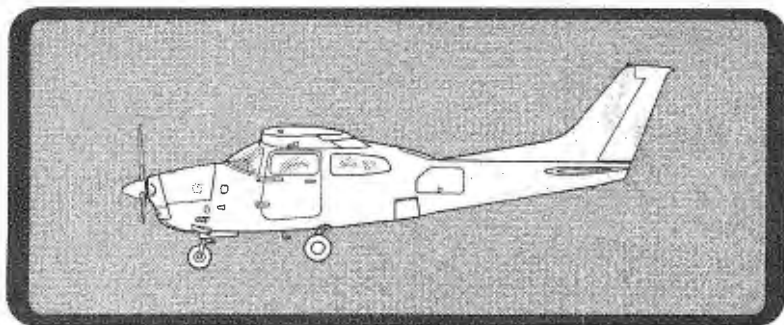


PILOT'S OPERATING HANDBOOK

Cessna®



TURBO CENTURION

1978 MODEL T210M

Serial No. 210-4115

Registration No. N-761YM

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

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CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

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LIST OF EFFECTIVE PAGES

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THE TOTAL NUMBER OF PAGES IN THIS HANDBOOK IS 390, CONSISTING OF THE FOLLOWING. THIS TOTAL INCLUDES THE SUPPLEMENTS PROVIDED IN SECTION 9 WHICH COVER OPTIONAL SYSTEMS AVAILABLE IN THE AIRPLANE.

Page No.	#Revision No.	Page No.	#Revision No.
Title	0	5-32 Blank	0
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i thru iii	0	6-2 Blank	0
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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:

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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

CESSNA
MODEL T210M

PERFORMANCE - SPECIFICATIONS

SPEED:

Maximum at 17,000 Ft	205 KNOTS
Cruise, 80% Power at 20,000 Ft	198 KNOTS
Cruise, 80% Power at 10,000 Ft	181 KNOTS

CRUISE: Recommended lean mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.

80% Power at 20,000 Ft	Range	830 NM
534 Pounds Usable Fuel	Time	4.4 HRS
80% Power at 10,000 Ft	Range	790 NM
534 Pounds Usable Fuel	Time	4.5 HRS
Maximum Range at 20,000 Ft	Range	995 NM
534 Pounds Usable Fuel	Time	7.1 HRS
Maximum Range at 10,000 Ft	Range	990 NM
534 Pounds Usable Fuel	Time	7.4 HRS

RATE OF CLIMB AT SEA LEVEL 1030 FPM

SERVICE CEILING 28,500 FT

TAKEOFF PERFORMANCE:

Ground Roll	1150 FT
Total Distance Over 50-Ft Obstacle	1900 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	3816 LBS
Takeoff and Landing	3800 LBS

STANDARD EMPTY WEIGHT:

Turbo Centurion	2240 LBS
Turbo Centurion II	2306 LBS

MAXIMUM USEFUL LOAD:

Turbo Centurion	1576 LBS
Turbo Centurion II	1510 LBS

BAGGAGE ALLOWANCE: Maximum With 4 People

240 LBS

WING LOADING: Pounds/Sq Ft

21.7

POWER LOADING: Pounds/HP

12.3

FUEL CAPACITY: Total

90 GAL.

OIL CAPACITY

11 QTS

ENGINE: Teledyne Continental, Turbocharged Fuel Injection

TSIO-520-R

310 BHP at 2700 RPM (5-Minute Takeoff Rating)

285 BHP at 2600 RPM (Maximum Continuous Rating)

PROPELLER: 3-Bladed Constant Speed, Diameter 80 IN.

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SECTION 1 GENERAL

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SECTION 1
GENERAL

CESSNA
MODEL T210M

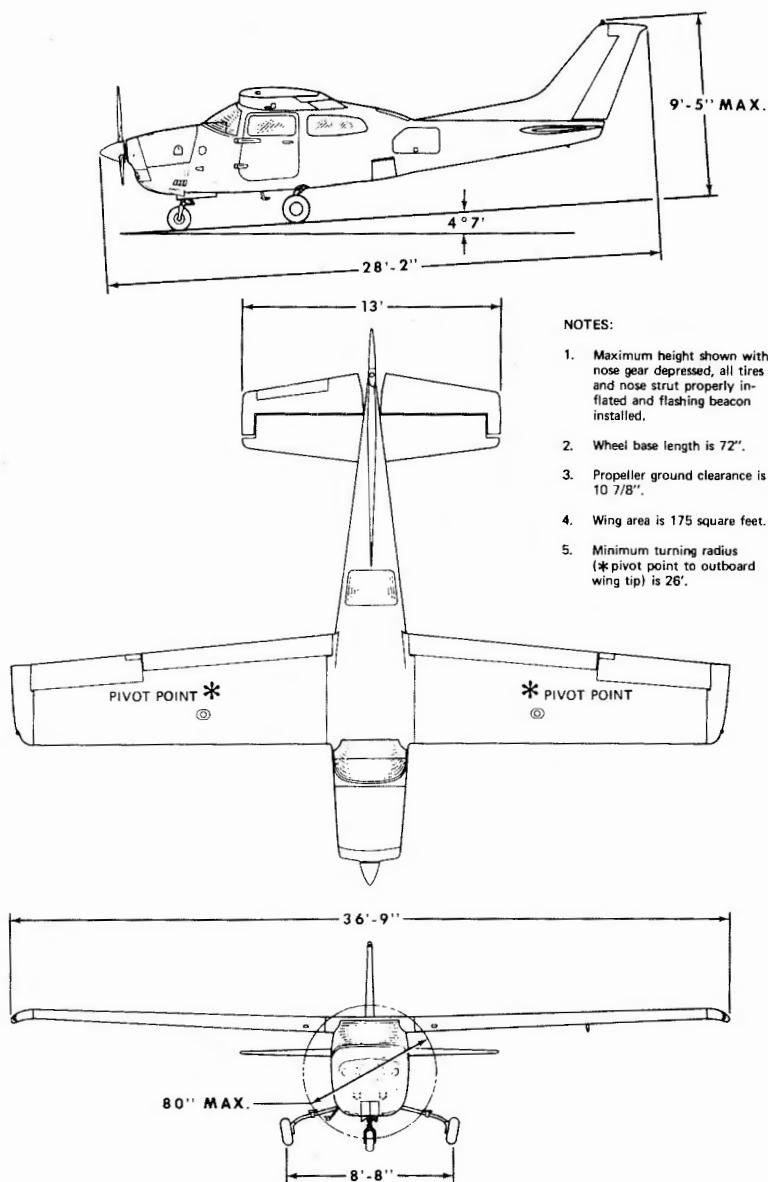


Figure 1-1. Three View

INTRODUCTION

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

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

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.

Engine Manufacturer: Teledyne Continental.

Engine Model Number: TSIO-520-R.

Engine Type: Turbocharged, direct-drive, air-cooled, horizontally-opposed, fuel-injected, six-cylinder engine with 520 cu. in. displacement.

Horsepower Rating and Engine Speed:

Maximum Power (5 minutes - takeoff): 310 rated BHP at 36.5 inches Hg and 2700 RPM.

Maximum Continuous Power: 285 rated BHP at 35 inches Hg and 2600 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.

Propeller Model Number: D3A34C402/90DFA-10.

Number of Blades: 3.

Propeller Diameter, Maximum: 80 inches.

Minimum: 78.5 inches.

Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 12.4° and a high pitch setting of 28.5° (30 inch station).

FUEL

Approved Fuel Grades (and Colors):

100LL Grade Aviation Fuel (Blue).

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

Total Capacity: 90 gallons.

Total Capacity Each Tank: 45 gallons.

Total Usable: 89 gallons.

SECTION 1
GENERAL

CESSNA
MODEL T210M

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 and turbocharger controller operation in cold weather.

Oil Capacity:

Sump: 10 Quarts.

Total: 11 Quarts (with oil filter).

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, Turbo Centurion: 2240 lbs.

Turbo Centurion II: 2306 lbs.

Maximum Useful Load, Turbo Centurion: 1576 lbs.

Turbo Centurion II: 1510 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: 12.3 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

KCAS	Knots Calibrated Airspeed is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level.
KIAS	Knots Indicated Airspeed is the speed shown on the airspeed indicator and expressed in knots.
KTAS	Knots True Airspeed is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.
V_A	Maneuvering Speed is the maximum speed at which you may use abrupt control travel.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}	Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended.
V_{LO}	Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted.

SECTION 1
GENERAL

CESSNA
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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_{So}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.
V_X	Best Angle-of-Climb Speed is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	Best Rate-of-Climb Speed is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

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

ENGINE POWER TERMINOLOGY

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

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.

SECTION 1
GENERAL

CESSNA
MODEL T210M

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. T210M.

AIRSPPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V _{NE}	Never Exceed Speed	195	195	Do not exceed this speed in any operation.
V _{NO}	Maximum Structural Cruising Speed	165	165	Do not exceed this speed except in smooth air, and then only with caution.
V _A	Maneuvering Speed: 3800 Pounds 3200 Pounds 2600 Pounds	118 109 97	119 110 98	Do not make full or abrupt control movements above this speed.
V _{FE}	Maximum Flap Extended Speed: To 10° Flaps 10° - 30° Flaps	149 114	150 115	Do not exceed these speeds with the given flap settings.
V _{LO}	Maximum Landing Gear Operating Speed	139	140	Do not extend or retract landing gear above this speed.
V _{LE}	Maximum Landing Gear Extended Speed	195	195	Do not exceed this speed with landing gear extended.
	Maximum Window Open Speed	195	195	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPPEED 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_{SO} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	68 - 165	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	165 - 195	Operations must be conducted with caution and only in smooth air.
Red Line	195	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.

Engine Model Number: TSIO-520-R.

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum Power, 5 Minutes - Takeoff: 310 BHP.

Continuous: 285 BHP

Maximum Engine Speed, 5 Minutes - Takeoff: 2700 RPM.

Continuous: 2600 RPM.

Maximum Manifold Pressure, 5 Minutes - Takeoff: 36.5 inches Hg.

Continuous: 35 inches Hg.

NOTE

For manifold pressure limitations above 17,000 feet, refer to the Maximum Power Setting and Fuel Flow placard in this section.

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: 3.0 psi.

Maximum: 19.5 psi (186 lbs/hr).

SECTION 2 LIMITATIONS

CESSNA
MODEL T210M

Propeller Manufacturer: McCauley Accessory Division.

Propeller Model Number: D3A34C402/90DFA-10.

Propeller Diameter, Maximum: 80 inches.

Minimum: 78.5 inches.

Propeller Blade Angle at 30 Inch Station, Low: 12.4°.

High: 28.5°.

Propeller Operating Limits: Avoid continuous operation between 1850 and 2150 RPM above 24 inches manifold pressure.

POWER PLANT INSTRUMENT MARKINGS

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

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

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

**SECTION 2
LIMITATIONS**

**CESSNA
MODEL T210M**

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.

SECTION 2
LIMITATIONS

CESSNA
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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. Near the engine power instruments:

MAXIMUM POWER SETTING & FUEL FLOW

T.O. (5 MIN ONLY): 2700 RPM
36.5 IN. MP., 186 LBS/HR

NORMAL CLIMB: 2500 RPM,
30.0 IN. MP., 120 LBS/HR

MAX. CONTINUOUS POWER: 2600 RPM									
ALT-FT/1000	SL-17	18	20	22	24	26	28	30	
MP. IN. HG	35	34	32	30	28	26	24	22	
FUEL FLOW-LBS/HR	162	156	144	132	120	108	102	96	

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

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

OXYGEN FILLER DOOR

11. On flap control indicator:

0°-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°.)

SECTION 2
LIMITATIONS

CESSNA
MODEL T210M

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

WARNING

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

13. Near landing gear lever:

MAX SPEED IAS

GEAR OPER	140 KTS
GEAR DOWN	195 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
3200 Lbs	110 KIAS
2600 Lbs	98 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.

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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.

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EMERGENCY PROCEDURES

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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 up to 10 inches of full throttle manifold pressure will be experienced.

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

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

STATIC SOURCE BLOCKAGE (Erroneous Instrument Reading Suspected)

1. Alternate Static Source Valve -- PULL ON.
2. Airspeed -- Climb 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

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

LANDING WITH A FLAT MAIN TIRE

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

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

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.

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AMPLIFIED PROCEDURES

ENGINE FAILURE

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

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

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

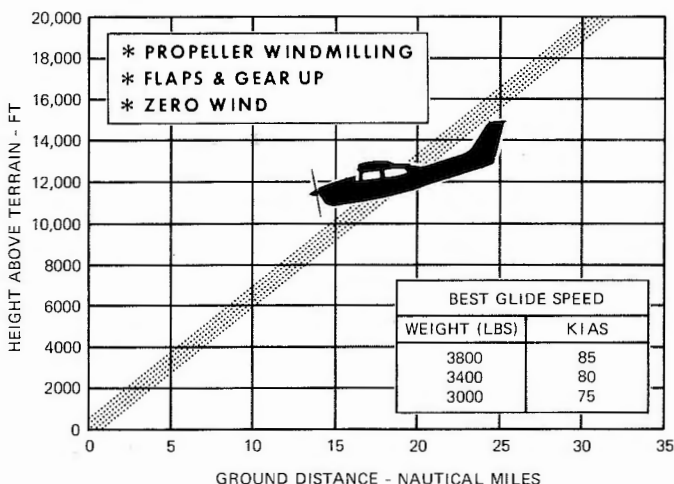


Figure 3-1. Maximum Glide

FORCED LANDINGS

If all attempts to restart the engine fail and a forced landing is imminent, select a suitable field and prepare for the landing as discussed under the Emergency Landing Without Engine Power checklist.

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

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

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

LANDING WITHOUT ELEVATOR CONTROL

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

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

FIRES

Improper starting procedures involving the excessive use of auxiliary fuel pump operation can cause engine flooding and subsequent collection of fuel on the parking ramp as the excess fuel drains overboard from the intake manifolds. This is sometimes experienced in difficult starts in cold weather where engine pre-heat service is not available. If this occurs, the airplane should be pushed away from the fuel puddle before another engine start is attempted. Otherwise, there is a possibility of raw fuel accumulations in the exhaust system igniting during an engine start, causing a long flame from the tailpipe, and possibly igniting the collected fuel on the pavement. If a fire occurs, proceed according to the checklist.

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

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

EMERGENCY OPERATION IN CLOUDS

(Vacuum System Failure)

In the event of a 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 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

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

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

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

1. Close the throttle 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.

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 alternate static source airspeed calibration table in Section 5, appropriate to the vent/window configuration.

SPINS

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

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

NOTE

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

ROUGH ENGINE OPERATION OR LOSS OF POWER

SPARK PLUG FOULING

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

MAGNETO MALFUNCTION

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

ENGINE-DRIVEN FUEL PUMP FAILURE

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

In the event of an engine-driven fuel pump failure during takeoff, immediately hold the left half of the auxiliary fuel pump switch in the HI position until the airplane is well clear of all obstacles. Upon reaching a safe altitude, reduce the power settings to give cruise power. Then release the HI side of the switch, allowing the right side of the switch to remain in the ON position for level flight.

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

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

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

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

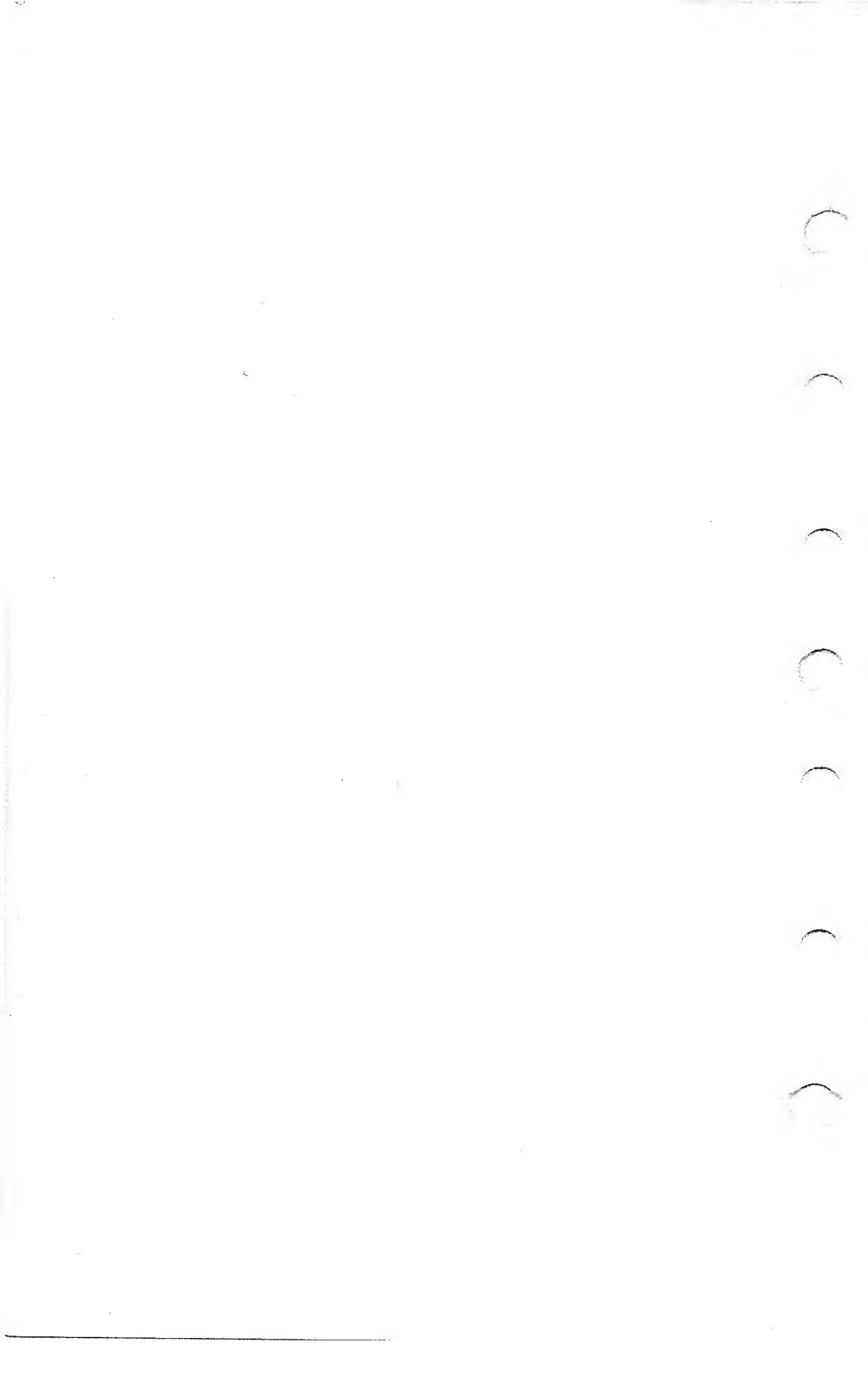
Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and over-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is the most likely cause of alternator failures, 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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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	75 KIAS

Enroute Climb, Flaps and Gear Up:

Normal	100-120 KIAS
Best Rate of Climb, Sea Level to 17,000 Feet	97 KIAS
Best Rate of Climb, 24,000 Feet	93 KIAS
Best Angle of Climb	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:

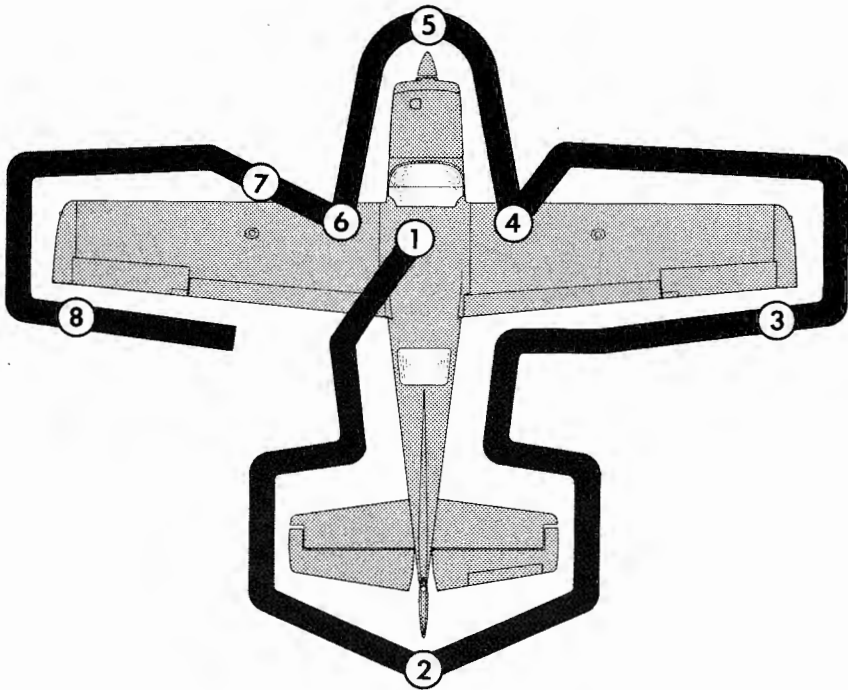
Maximum Power, Flaps 20°	70 KIAS
--------------------------	---------

Maximum Recommended Turbulent Air Penetration Speed:

3800 Lbs	119 KIAS
3200 Lbs	110 KIAS
2600 Lbs	98 KIAS

Maximum Demonstrated Crosswind Velocity:

Takeoff or Landing	21 KNOTS
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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

FIGURE 1

PILOT OPERATING PROCEDURES - PREFLIGHT FUEL SYSTEM QUANTITY CHECK

The following procedures are to be used on certain Cessna 210, P210, and T210 Series airplanes whenever more than 75 gallons of fuel are needed for range and reserve.

1. Verify that the airplane is level laterally and is approximately 4.5 degrees nose up (normal nose strut on a level surface).

NOTE: The airplane turn and bank instrument may be used to check lateral leveling.

2. Visually inspect each fuel tank for fuel level with the upper wing surface when full fuel capacity is intended to be in each tank.

3. Check each fuel cap and seal for security and wing surface for a lack of fuel stains aft of each fuel cap.

NOTE: It is highly recommended that the wing tips and flap trailing edges are checked during flight for evidence of fuel siphoning.

2. Air Inlets -- CHECK, engine induction air (left) and heater air (right) for restrictions.
3. Landing and Taxi Lights -- CHECK for condition and cleanliness.
4. Nose Wheel Strut and Tire -- CHECK for proper inflation.
5. Nose Tie-Down -- DISCONNECT.
6. Engine Oil Level -- CHECK, do not operate with less than seven quarts. Fill to 10 quarts for extended flight.
7. 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 and Autopilot (if installed) -- OFF.

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. Oxygen Supply Pressure (if installed) -- CHECK.
11. Oxygen Masks (if installed) -- AVAILABLE.
12. Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
13. 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

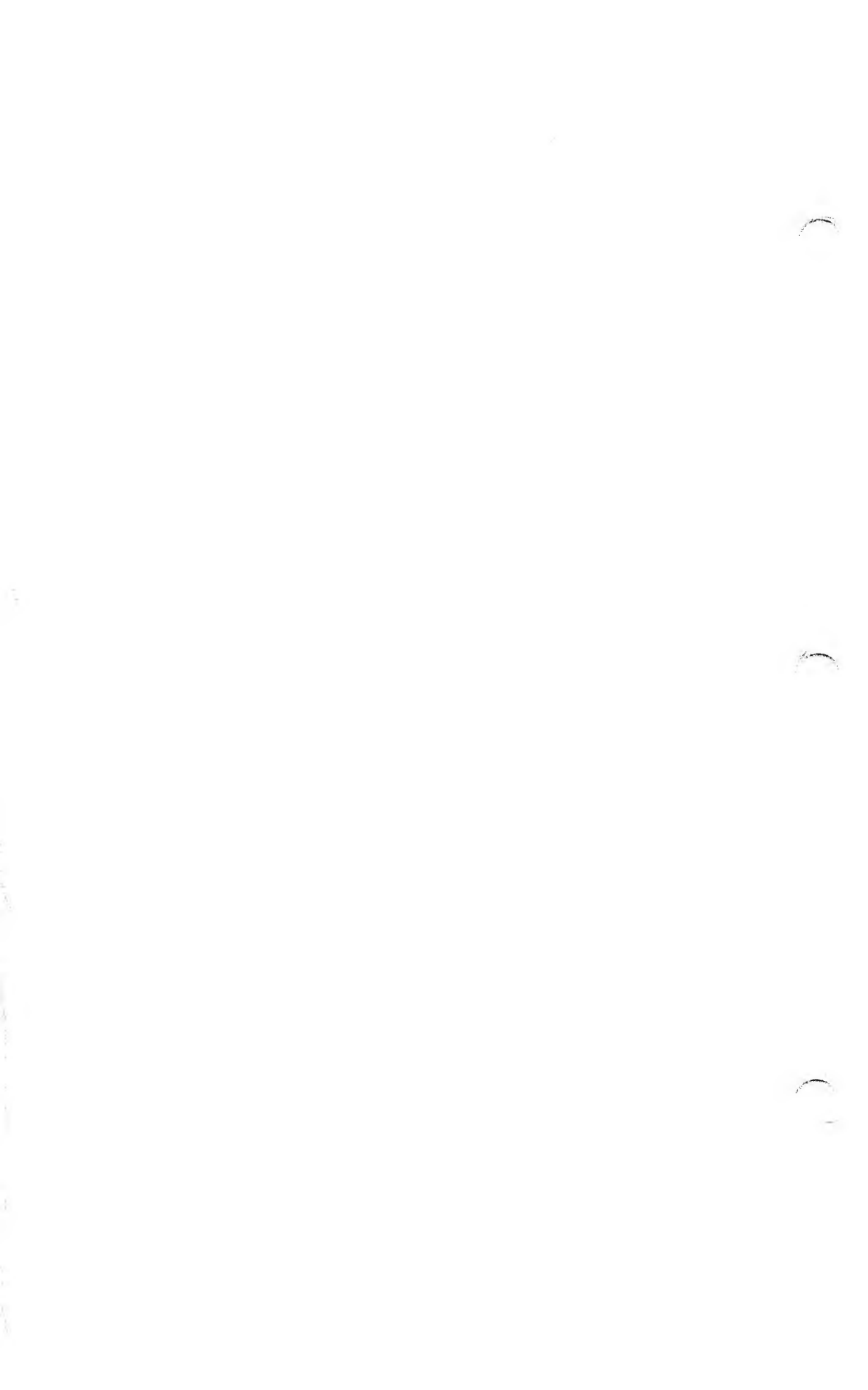
1. Aileron -- CHECK for freedom of movement and security.
2. Fuel Tank Vent at Wing Tip Trailing Edge -- CHECK for stoppage.

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.



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.

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NORMAL PROCEDURES

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4. Flight Controls -- FREE and CORRECT.
5. Flight Instruments -- CHECK.
6. Fuel Selector Valve -- FULLER TANK.
7. Mixture -- RICH.
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 -- 36.5 INCHES Hg and 2700 RPM (5 minute limitation).
3. Mixture -- ADJUST to 178-186 lbs/hr.
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 -- 36.5 INCHES Hg and 2700 RPM (5 minute limitation).
4. Mixture -- ADJUST to 178-186 lbs/hr.

5. Brakes -- RELEASE.
6. Elevator Control -- SLIGHTLY TAIL-LOW.
7. Climb Speed -- 75 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 -- 100-120 KIAS.
2. Power -- 30 INCHES Hg and 2500 RPM.
3. Mixture -- LEAN to 120 lbs/hr.

NOTE

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

4. Cowl Flaps -- OPEN as required.

NOTE

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

MAXIMUM PERFORMANCE CLIMB

1. Airspeed -- 97 KIAS.
2. Power -- 35 INCHES Hg and 2600 RPM.
3. Mixture -- ADJUST to 162 lbs/ hr.

NOTE

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

NOTE

On hot days at higher altitudes, be alert for fuel vapor

SECTION 4 NORMAL PROCEDURES

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indications. If fuel flow fluctuations are observed or if desired fuel flows cannot be maintained, turn the auxiliary fuel pump ON and reset the mixture as required.

4. Cowl Flaps -- FULL OPEN.

NOTE

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

CRUISE

1. Power -- 15-30 INCHES Hg, 2200-2500 RPM.
2. Elevator and Rudder Trim -- ADJUST.
3. Mixture -- LEAN per Cessna Power Computer or the data in Section 5.

NOTE

In hot weather at high altitudes, be alert for fuel vapor indications. If fuel flow fluctuations are observed, place the auxiliary fuel pump switch in the ON position and reset mixture control as desired. The auxiliary fuel pump should be turned off when fuel flows will remain steady.

4. Cowl Flaps -- CLOSED (open if required).

NOTE

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

DESCENT

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

BEFORE LANDING

1. Seats, Belts, Shoulder Harnesses -- SECURE.
2. Fuel Selector Valve -- FULLER TANK.

3. Landing Gear -- EXTEND (below 140 KIAS).
4. Landing Gear -- CHECK (observe main gear down and green indicator light on).
5. Auxiliary Fuel Pump -- OFF
6. Mixture -- RICH.
7. Propeller -- HIGH RPM.
8. Wing Flaps -- AS DESIRED (0° to 10° below 150 KIAS, 10° to 30° below 115 KIAS).
9. Autopilot (if installed) -- OFF.
10. 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 -- 36.5 INCHES Hg and 2700 RPM.
2. Wing Flaps -- RETRACT to 20° (immediately).
3. Climb Speed -- 70 KIAS (until obstacles are cleared).
4. Wing Flaps -- RETRACT SLOWLY (after reaching safe altitude and 75 KIAS).
5. Cowl Flaps -- OPEN.

AFTER LANDING

1. Wing Flaps -- RETRACT.

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EMERGENCY PROCEDURES

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

SECURING AIRPLANE

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

AMPLIFIED PROCEDURES

STARTING ENGINE

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

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

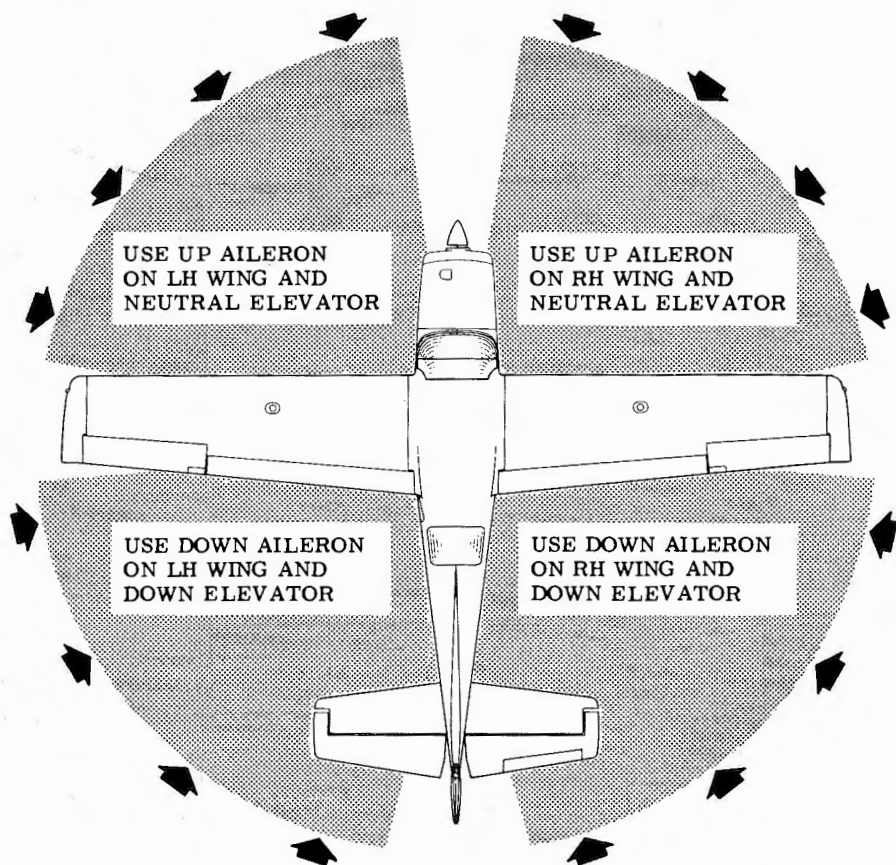
When the engine is hot or outside air temperatures are high, the engine may die after running several seconds because the mixture became either too lean due to fuel vapor, or too rich due to excessive prime fuel. The following procedure will prevent over-priming and alleviate fuel vapor in the system:

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

NOTE

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

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



CODE

WIND DIRECTION



NOTE

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

Figure 4-2. Taxiing Diagram

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

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

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

TAXIING

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

BEFORE TAKEOFF

WARM-UP

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

MAGNETO CHECK

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

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

ALTERNATOR CHECK

Prior to flights where verification of proper alternator and 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.

On the first flight of the day, when the throttle is advanced for takeoff, manifold pressure will normally exceed 36.5 inches Hg and fuel flows will exceed 186 lbs/hr if the throttle is opened fully. On any takeoff, the manifold pressure should be monitored and the throttle set to provide 36.5 inches Hg; then, for maximum engine power, the mixture should be adjusted during the initial takeoff roll to 178-186 lbs/hr.

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

WING FLAP SETTINGS

For normal takeoffs, use of 10° flaps is preferred since it results in

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

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

Flap settings greater than 20° are not approved for takeoff.

SHORT FIELD TAKEOFF

If an obstruction dictates the use of a steep climb angle, after liftoff accelerate to and climb out at an obstacle clearance speed of 75 KIAS with 10° flaps and gear extended. This speed provides the best overall climb speed to clear obstacles when taking into account the turbulence often found near ground level. The takeoff performance data in Section 5 is based on this speed and configuration.

Minimum ground run takeoffs are accomplished using 20° flaps by lifting the nose wheel off the ground as soon as practical and leaving the ground in a slightly tail-low attitude. However, the airplane should be leveled off immediately to accelerate to a safe climb speed. If 20° of flaps are used on soft or rough fields with obstacles ahead, it is normally preferable to leave them extended rather than partially retract them in the climb to the obstacle. With 20° flaps, use an obstacle clearance speed of 70 KIAS. After clearing the obstacle, and reaching a safe altitude, the flaps may be retracted slowly as the airplane accelerates to the normal climb-out speed.

CROSSWIND TAKEOFF

Takeoffs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length, to minimize the drift angle immediately after takeoff. With the ailerons 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

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

A cruising climb at 30 inches of manifold pressure, 2500 RPM, 120 lbs/hr fuel flow, and 100 to 120 KIAS is normally recommended to provide an optimum combination of performance, visibility ahead, engine cooling, economy and passenger comfort (due to lower noise level).

NOTE

During warm weather, if there is an indication of vapor in the fuel system (fluctuating fuel flow) or if the desired fuel flow cannot be maintained with the mixture control in the full rich position, turn on the auxiliary fuel pump and reset the mixture as required until cruising altitude has been obtained and the system is purged (usually 5 to 15 minutes after establishing cruising flight). The auxiliary fuel pump should be turned off when fuel flow will remain steady.

If it is necessary to climb rapidly to clear mountains or reach favorable winds or better weather at high altitudes, the best rate-of-climb speed should be used with maximum continuous power. This speed is 97 KIAS from sea level to 17,000 feet, decreasing to 93 KIAS at 24,000 feet.

If an obstruction dictates the use of a steep climb angle, climb with flaps retracted and maximum continuous power at 80 KIAS.

CRUISE

Normal cruising is performed between 60% and 80% of the maximum continuous power rating. The power settings and corresponding fuel consumption for various altitudes can be determined by using your Cessna Power Computer or the data in Section 5.

NOTE

Cruising should be done at 70% to 80% power until a total of 50 hours has accumulated or oil consumption has stabilized. This is to ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

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

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

ALTITUDE	80% POWER		70% POWER		60% POWER	
	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
5000 Feet	172	9.8	163	10.7	153	11.5
10,000 Feet	181	10.3	171	11.2	159	12.0
15,000 Feet	189	10.8	178	11.6	165	12.5
20,000 Feet	198	11.3	186	12.1	171	12.9
Standard Conditions					Zero Wind	

Figure 4-3. Cruise Performance Table

For best fuel economy at 70% power or less, the engine should be operated at six pounds per hour leaner than shown in this handbook and on the power computer. This will result in approximately 5% greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

The fuel injection system employed on this engine is considered to be non-icing. In the event that unusual conditions cause the intake air filter to become clogged or iced over, an alternate intake air valve opens automatically for the most efficient use of either normal or alternate air, depending on the amount of filter blockage. Due to the lower intake pressure available through the alternate air valve or a partially blocked filter, manifold pressure can decrease up to 10 in. Hg from a cruise power setting. This pressure should be recovered by increased throttle setting or higher RPM as necessary to maintain the desired power. Maximum continuous manifold pressure (35 in. Hg) is available up to 14,000 feet under hot day conditions using the alternate air source with a fully blocked filter.

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at approximately 80% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by a desired increment based on data in figure 4-4.

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

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

Figure 4-4. EGT Table

NOTE

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

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

STALLS

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

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

DESCENT

Descent should be initiated far enough in advance of estimated landing to allow a gradual rate of descent at cruising speed. Just prior to beginning the descent, check that the auxiliary fuel pump has been turned off. Descent should be at approximately 500 FPM for passenger comfort, using enough power to keep the engine warm. The optimum engine RPM in a descent is usually the lowest RPM in the green arc range that will allow cylinder head temperature to remain in the recommended operating range.

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

BEFORE LANDING

In view of the relatively low drag of the extended landing gear and the high allowable gear operating speed (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 15 inches of manifold pressure, and visual inspection of the main gear position. Should the gear indicator light fail to illuminate, the light should be checked for a burned-out bulb by pushing to test. A burned-out bulb can be replaced in flight with the landing gear up (amber) indicator light.

LANDING

NORMAL LANDING

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

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

SHORT FIELD LANDING

For short field landings, make a power approach at 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 bailed landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. After all obstacles are cleared and a safe altitude and airspeed are obtained, the wing flaps should be retracted.

COLD WEATHER OPERATION

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

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

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

NOTE

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

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

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

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

During descent, observe engine temperatures closely and carry sufficient power to maintain them in the recommended 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 T210M at 3800 pounds maximum weight is 75.8 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

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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	3500 Feet
Temperature	24°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	4000 Feet

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CRUISE CONDITIONS

Total distance	780 Nautical Miles
Pressure altitude	11,500 Feet
Temperature	8°C
Expected wind enroute	10 Knot Headwind

LANDING CONDITIONS

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

TAKEOFF

The takeoff distance chart, figure 5-4, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 3800 pounds, pressure altitude of 4000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1695 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 3 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	1695
Decrease in ground roll (1695 feet × 12%)	203
Corrected ground roll	1492 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 70% power at 11,500 feet yields a predicted range of 856 nautical miles with no wind. The endurance profile chart shows a corresponding 5 hours. Using this information, the estimated distance can be determined for the expected 10 knot headwind at 11,500 feet as follows:

Range, zero wind	856
Decrease in range due to wind (5 hours × 10 knot headwind)	50
Corrected range	806 Nautical Miles

This indicates that the trip can be made without a fuel stop using approximately 70% power.

The cruise performance chart for 12,000 feet pressure altitude is entered using 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The power setting chosen is 2300 RPM and 30 inches of manifold pressure which results in the following:

Power	70%
True airspeed	177 Knots
Cruise fuel flow	91 PPH

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

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, the time, fuel, and distance to climb may be determined from figure 5-6 for a

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normal climb using the data for 3800 pounds. The difference between the values shown in the table for 4000 feet and 12,000 feet results in the following:

Time	13 Minutes
Fuel	26 Pounds
Distance	25 Nautical Miles

The above values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 8°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

$$\frac{16^{\circ}\text{C}}{8^{\circ}\text{C}} \times 10\% = 20\% \text{ Increase}$$

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

Fuel to climb, standard temperature	26
Increase due to non-standard temperature (26 × 20%)	<u>5</u>
Corrected fuel to climb	31 Pounds

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

Time to climb	16 Minutes
Distance to climb	30 Nautical Miles

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

Distance with no wind	30
Decrease in distance due to wind (16/60 × 10 knot headwind)	<u>3</u>
Corrected Distance to Climb	27 Nautical Miles

The resultant cruise distance is:

Total distance	780
Climb distance	<u>-27</u>
Cruise distance	753 Nautical Miles

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

$$\begin{array}{r} 177 \\ -10 \\ \hline 167 \text{ Knots} \end{array}$$

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

$$\frac{753 \text{ Nautical Miles}}{167 \text{ Knots}} = 4.5 \text{ Hours}$$

The fuel required for cruise is:

$$4.5 \text{ hours} \times 91 \text{ PPH} = 410 \text{ Pounds}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	16
Climb	31
Cruise	<u>410</u>
Total fuel required	457 Pounds

This will leave a fuel reserve of:

$$\begin{array}{r} 534 \\ -457 \\ \hline 77 \text{ Pounds} \end{array}$$

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 3000 feet pressure altitude and a temperature of 30°C are as follows:

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

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

AIRSPEED CALIBRATION NORMAL STATIC SOURCE

FLAPS UP								
KIAS	60	80	100	120	140	160	180	---
KCAS	61	80	99	119	139	160	180	---
FLAPS 10°								
KIAS	60	70	80	90	100	120	140	150
KCAS	63	71	81	90	100	119	139	149
FLAPS 20°								
KIAS	60	70	80	90	100	110	115	---
KCAS	63	73	82	92	101	110	114	---
FLAPS 30°								
KIAS	50	60	70	80	90	100	110	115
KCAS	56	65	75	84	93	102	110	114

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

AIRSPEED CALIBRATION ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	61	82	103	125	146	168	189
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	61	72	83	94	105	126	148
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	110
ALTERNATE KIAS	57	68	79	89	99	109	118

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	58	78	101	123	144	165	186
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	59	69	80	91	101	123	144
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	110
ALTERNATE KIAS	52	66	77	86	96	106	115

WINDOWS OPEN

FLAPS UP							
NORMAL KIAS	60	80	100	120	140	160	180
ALTERNATE KIAS	43	72	101	130	152	175	197
FLAPS 10°							
NORMAL KIAS	60	70	80	90	100	120	140
ALTERNATE KIAS	47	61	74	88	101	129	156
FLAPS 30°							
NORMAL KIAS	50	60	70	80	90	100	110
ALTERNATE KIAS	40	57	71	84	96	107	118

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

TEMPERATURE CONVERSION CHART

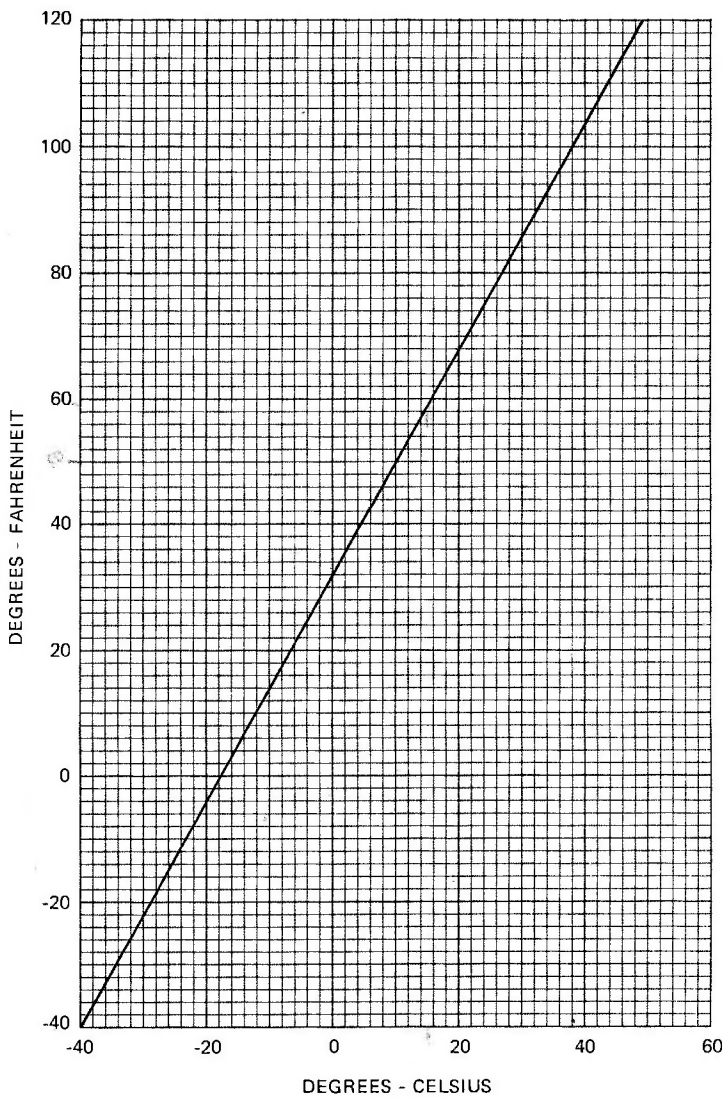


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:

Power Off
Gear Up or Down

NOTES:

- Maximum altitude loss during a stall recovery may be as much as 300 feet.
- KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3800	UP	64	65	69	70	76	77	91	92
	10°	62	64	67	69	74	76	88	91
	20°	56	59	60	63	67	70	79	83
	30°	50	56	54	60	59	67	79	79

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
3800	UP	68	69	73	74	81	82	96	98
	10°	66	68	71	73	78	81	93	96
	20°	62	65	67	70	74	77	88	92
	30°	55	61	59	66	65	73	78	86

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE

MAXIMUM WEIGHT 3800 LBS

SHORT FIELD

CONDITIONS:

Flaps 10°

2700 RPM, 36.5 Inches Hg, and Mixture Set at 178-186 PPH Prior to Brake Release.

Cowl Flaps Open

Paved, Level, Dry Runway

Zero Wind

NOTES:

1. Short field technique as specified in Section 4.
2. Landing gear extended until takeoff obstacle is cleared.
3. 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.
4. 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	68	75	S.L.	1010	1665	1100	1815	1200	1990	1310	2180	1430	2400
			1000	1075	1760	1170	1925	1280	2110	1395	2315	1525	2555
			2000	1145	1865	1250	2040	1360	2235	1485	2460	1625	2715
			3000	1215	1975	1330	2165	1450	2375	1585	2615	1735	2895
			4000	1295	2095	1415	2295	1550	2525	1695	2785	1855	3090
			5000	1385	2225	1510	2440	1650	2690	1810	2970	1980	3295
			6000	1475	2365	1615	2595	1765	2865	1930	3170	2115	3525
			7000	1575	2515	1725	2765	1885	3055	2065	3285	2265	3775
			8000	1685	2675	1845	2950	2020	3260	2210	3620	2425	4050

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	65	72	S.L.	835	1375	910	1500	990	1635	1080	1785	1175	1960
			1000	890	1455	965	1585	1055	1730	1150	1895	1255	2075
			2000	945	1540	1030	1680	1125	1835	1225	2010	1335	2205
			3000	1005	1630	1095	1780	1195	1945	1305	2130	1425	2345
			4000	1070	1725	1170	1885	1275	2065	1390	2265	1520	2495
			5000	1140	1830	1245	2000	1360	2190	1485	2410	1625	2655
			6000	1220	1940	1330	2125	1450	2330	1585	2565	1735	2835
			7000	1300	2060	1420	2260	1550	2480	1695	2735	1855	3025
			8000	1390	2190	1515	2405	1660	2645	1815	2915	1985	3230
3200	62	68	S.L.	680	1125	740	1220	805	1325	875	1445	950	1580
			1000	720	1185	785	1290	855	1405	930	1530	1015	1670
			2000	765	1255	835	1365	910	1485	990	1620	1080	1770
			3000	815	1325	890	1445	970	1575	1055	1720	1150	1880
			4000	870	1400	945	1530	1030	1665	1125	1820	1225	1995
			5000	925	1485	1010	1620	1100	1770	1200	1935	1310	2120
			6000	985	1575	1075	1715	1175	1875	1280	2055	1400	2260
			7000	1055	1670	1150	1825	1255	1995	1370	2185	1495	2405
			8000	1125	1770	1225	1935	1340	2120	1465	2330	1600	2565

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

RATE OF CLIMB

MAXIMUM

CONDITIONS:
Flaps Up
Gear Up
2600 RPM
Cowl Flaps Open

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

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
3800	S.L.	97	1280	1135	995	850
	4000	97	1185	1040	895	750
	8000	97	1090	945	800	655
	12,000	97	980	840	695	---
	16,000	97	860	725	590	---
	20,000	95	595	465	---	---
	24,000	93	295	165	---	---
3500	S.L.	95	1430	1285	1135	985
	4000	95	1335	1185	1035	880
	8000	95	1235	1085	935	780
	12,000	96	1125	975	830	---
	16,000	96	1000	860	720	---
	20,000	94	725	590	---	---
	24,000	92	410	275	---	---
3200	S.L.	93	1605	1455	1295	1135
	4000	94	1505	1345	1190	1025
	8000	94	1405	1250	1090	925
	12,000	94	1290	1135	980	---
	16,000	94	1160	1015	870	---
	20,000	93	870	730	---	---
	24,000	91	540	400	---	---

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:

Flaps Up
Gear Up
2600 RPM
Cowl Flaps Open
Standard Temperature

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

NOTES:

1. Add 16 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
3. Distances shown are based on zero wind.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED POUNDS	DISTANCE NM
3800	S.L.	97	1030	0	0	0
	4000	97	990	4	11	7
	8000	97	950	8	22	14
	12,000	97	900	12	34	22
	16,000	97	835	17	46	31
	20,000	95	625	23	60	43
	24,000	93	380	31	78	61
3500	S.L.	95	1170	0	0	0
	4000	95	1130	3	9	6
	8000	95	1090	7	19	12
	12,000	96	1040	11	29	19
	16,000	96	975	15	40	27
	20,000	94	755	19	52	36
	24,000	92	495	26	66	51
3200	S.L.	94	1335	0	0	0
	4000	94	1295	3	8	5
	8000	94	1255	6	17	10
	12,000	94	1205	9	26	16
	16,000	94	1135	13	35	23
	20,000	93	900	17	45	31
	24,000	91	625	22	57	43

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

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 105 KIAS

CONDITIONS:

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

NOTES:

1. Add 16 pounds of fuel for engine start, taxi and takeoff allowance.
2. Increase time, fuel and distance by 10% for each 8°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.	690	0	0	0
	4000	655	6	12	11
	8000	615	12	25	23
	12,000	570	19	38	36
	16,000	515	26	53	52
	20,000	450	35	70	72
3500	S.L.	800	0	0	0
	4000	765	5	10	9
	8000	725	11	21	19
	12,000	680	16	33	31
	16,000	625	22	45	44
	20,000	555	29	59	60
3200	S.L.	925	0	0	0
	4000	890	4	9	8
	8000	850	9	18	17
	12,000	800	14	28	27
	16,000	745	19	38	38
	20,000	675	25	50	51

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 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	167	105	75	167	99
	28	78	162	102	74	162	96	69	162	91
	26	71	157	93	67	157	88	63	155	83
	24	64	150	84	60	149	80	57	148	75
	22	57	142	75	53	141	72	50	139	68
2400	30	80	163	105	76	164	99	71	163	93
	28	74	158	96	69	159	91	65	157	86
	26	67	153	88	63	152	83	59	151	78
	24	60	146	80	57	145	75	53	143	71
	22	54	139	72	51	137	68	48	135	65
2300	30	76	160	99	71	160	94	67	160	88
	28	70	156	92	66	156	87	62	154	82
	26	64	150	84	61	149	80	57	148	76
	24	58	144	77	55	142	73	51	140	69
	22	52	136	69	49	134	66	46	131	62
2200	30	72	157	95	68	157	89	64	156	84
	28	66	152	87	62	151	82	59	150	78
	26	60	146	79	57	145	75	53	143	71
	24	54	139	72	51	138	69	48	135	65
	22	48	131	66	46	129	62	43	126	59

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:

3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	171	106	76	171	100
	28	79	166	103	74	166	97	70	165	91
	26	72	160	95	68	160	90	64	159	84
	24	65	154	86	62	153	81	58	152	77
	22	58	146	77	55	145	73	51	142	69
2400	30	80	167	105	76	167	99	71	167	93
	28	74	162	97	70	162	92	66	161	86
	26	68	156	89	64	156	84	60	154	79
	24	61	150	81	58	149	77	54	147	73
	22	55	142	73	52	141	70	49	138	66
2300	30	77	164	100	72	164	95	68	163	89
	28	71	159	93	67	159	88	63	157	83
	26	65	154	85	61	153	81	58	151	76
	24	59	147	78	55	146	74	52	143	70
	22	52	139	70	49	137	67	46	134	63
2200	30	73	161	95	68	161	90	64	159	84
	28	67	156	88	63	155	83	59	153	78
	26	61	149	80	57	148	76	54	146	72
	24	55	142	73	52	141	70	49	138	66
	22	49	135	67	46	132	63	44	129	60

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	175	107	76	175	100
	28	79	169	104	75	170	98	70	169	92
	26	73	164	96	69	164	91	65	163	85
	24	67	158	88	63	157	83	59	155	78
	22	59	150	79	56	149	75	53	146	71
2400	30	81	170	106	76	171	100	72	170	94
	28	75	166	98	71	166	93	66	164	87
	26	69	160	90	65	159	85	61	158	80
	24	62	153	82	59	152	78	55	150	74
	22	56	146	75	53	144	71	50	142	67
2300	30	77	168	101	73	168	96	69	166	90
	28	72	163	94	68	163	89	64	161	84
	26	66	157	87	62	156	82	58	154	77
	24	60	150	79	56	149	75	53	147	71
	22	53	142	72	50	141	68	47	138	64
2200	30	73	164	96	69	164	90	65	162	85
	28	68	159	89	64	158	84	60	156	79
	26	62	153	82	58	152	77	55	149	73
	24	56	146	75	53	144	71	50	141	67
	22	50	138	68	47	135	64	44	132	61

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

CRUISE PERFORMANCE
PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	178	107	76	178	100
	28	80	173	105	75	173	99	71	172	93
	26	74	168	97	70	168	91	65	166	86
	24	68	162	89	64	161	84	60	159	79
	22	60	154	80	57	152	76	53	150	72
2400	30	81	174	106	76	174	100	72	173	94
	28	75	169	99	71	169	93	67	167	87
	26	69	164	91	65	162	86	61	161	81
	24	63	157	83	60	156	79	56	153	74
	22	57	150	76	54	148	72	51	145	68
2300	30	78	171	102	73	171	96	69	170	90
	28	72	167	95	68	166	90	64	164	84
	26	67	161	87	63	160	83	59	158	78
	24	60	154	80	57	152	76	54	150	72
	22	54	146	72	51	144	69	48	140	65
2200	30	73	167	96	69	167	91	65	165	86
	28	68	162	89	64	161	85	60	159	80
	26	63	156	82	59	155	78	55	152	74
	24	57	149	75	54	147	72	50	144	68
	22	51	141	69	48	138	65	45	135	62

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE -5°C			20°C ABOVE STANDARD TEMP 15°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	182	107	76	181	100
	28	80	176	105	76	177	99	71	175	93
	26	75	172	98	71	171	92	66	170	87
	24	69	166	90	65	164	85	61	162	80
	22	62	158	81	58	156	77	55	153	73
2400	30	81	177	107	77	178	101	72	176	94
	28	76	173	99	71	172	94	67	171	88
	26	70	167	92	66	166	87	62	164	82
	24	64	160	84	60	159	80	57	157	75
	22	58	153	77	55	151	73	51	148	69
2300	30	78	175	103	74	175	97	69	173	91
	28	73	170	96	69	169	90	65	168	85
	26	67	164	88	64	163	84	60	161	79
	24	61	157	81	58	156	77	54	153	73
	22	55	149	73	52	147	70	49	143	66
2200	30	74	171	97	70	170	92	66	169	86
	28	69	166	90	65	165	85	61	163	81
	26	63	160	84	60	158	79	56	156	75
	24	58	153	77	54	151	73	51	148	69
	22	52	144	70	49	142	66	46	138	63

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:

3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	185	107	76	184	100
	28	80	180	105	76	180	99	71	178	93
	26	75	175	98	71	174	93	66	173	87
	24	69	169	90	65	168	85	61	166	81
	22	62	161	82	59	159	78	55	156	73
2400	30	81	181	107	77	181	101	72	179	94
	28	76	176	99	71	175	94	67	174	88
	26	70	170	92	66	169	87	62	167	82
	24	65	164	85	61	162	80	57	160	76
	22	59	156	78	55	155	74	52	151	70
2300	30	79	179	103	74	178	97	70	177	91
	28	73	174	96	69	173	91	65	171	85
	26	68	167	89	64	166	84	60	164	79
	24	62	161	82	58	159	77	55	156	73
	22	56	152	74	53	150	71	49	146	67
2200	28	69	169	91	65	168	86	61	166	81
	26	64	163	84	60	162	80	57	159	75
	24	58	156	77	55	154	73	52	151	70
	22	52	147	70	49	144	67	46	140	63
	20	46	137	63	44	133	60	41	129	57

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 14,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -33°C			STANDARD TEMPERATURE -13°C			20°C ABOVE STANDARD TEMP 7°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	189	107	76	187	100
	28	80	184	105	76	183	99	71	182	93
	26	75	179	99	71	178	93	67	176	88
	24	70	172	91	66	171	86	62	169	81
	22	63	164	83	59	163	78	56	160	74
2400	30	82	185	107	77	184	101	72	183	95
	28	76	180	100	72	179	94	67	177	89
	26	71	174	93	67	173	88	63	170	83
	24	65	167	86	61	166	81	58	163	77
	22	60	160	79	56	158	75	53	154	71
2300	30	79	182	104	74	182	98	70	180	92
	28	74	177	97	70	176	92	66	174	86
	26	68	171	90	65	170	85	61	167	80
	24	63	164	83	59	162	78	55	159	74
	22	57	156	75	53	153	72	50	150	68
2200	28	70	173	92	66	172	87	62	169	82
	26	65	167	85	61	165	81	57	162	76
	24	59	160	78	56	157	74	52	154	70
	22	53	151	71	50	148	68	47	143	64
	20	47	140	64	45	136	61	42	131	58

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 16,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -37°C			STANDARD TEMPERATURE -17°C			20°C ABOVE STANDARD TEMP 3°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	192	106	76	191	100
	28	80	187	105	76	186	99	71	185	93
	26	75	182	99	71	181	93	67	179	88
	24	70	176	91	66	174	86	62	172	81
	22	63	167	83	60	166	79	56	162	74
2400	30	81	188	107	77	187	101	72	186	94
	28	76	183	100	72	182	94	67	180	88
	26	71	177	93	67	176	88	63	173	83
	24	66	171	86	62	169	81	58	166	77
	22	60	163	79	57	161	75	53	157	71
2300	30	79	186	103	74	185	97	70	183	91
	28	74	180	97	70	179	92	66	177	86
	26	69	174	90	65	173	85	61	170	80
	24	63	167	83	59	165	79	56	162	74
	22	57	159	76	54	157	72	51	152	68
2200	28	70	176	92	66	175	87	62	172	82
	26	65	170	86	62	169	81	58	165	77
	24	60	163	79	56	161	75	53	157	71
	22	54	154	72	51	151	68	48	146	65
	20	48	143	65	45	139	62	42	134	59

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 18,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -41°C			STANDARD TEMPERATURE -21°C			20°C ABOVE STANDARD TEMP -1°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	81	196	106	76	194	100
	28	80	191	105	76	190	99	71	188	93
	26	75	185	99	71	184	93	67	182	88
	24	70	179	91	66	177	86	62	174	81
	22	63	171	84	60	168	79	56	165	75
2400	30	81	192	107	77	191	101	72	189	94
	28	76	186	100	72	185	94	67	183	88
	26	71	180	93	67	179	88	63	176	83
	24	66	174	87	62	172	82	58	169	77
	22	61	167	80	57	164	76	54	160	72
2300	30	79	189	103	74	188	97	70	186	91
	28	74	184	97	70	183	91	65	180	86
	26	69	178	91	65	176	86	61	173	81
	24	64	171	84	60	169	79	56	165	75
	22	58	163	77	55	160	73	51	155	69
2200	26	66	174	87	62	172	82	58	169	77
	24	61	166	80	57	164	76	54	160	72
	22	55	157	73	51	154	69	48	149	66
	20	49	146	66	46	142	63	43	136	59

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 20,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -45°C			STANDARD TEMPERATURE -25°C			20°C ABOVE STANDARD TEMP -5°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	198	105	76	197	99
	28	80	194	105	75	193	99	71	190	93
	26	75	188	98	71	187	93	66	184	87
	24	70	182	91	66	180	86	62	177	81
	22	64	173	84	60	171	79	56	167	75
2400	30	81	195	106	76	194	100	72	192	94
	28	76	189	100	72	188	94	67	185	88
	26	71	183	93	67	182	88	63	179	83
	24	66	177	87	62	175	82	58	171	77
	22	61	170	81	57	167	76	54	162	72
2300	28	74	187	97	69	185	91	65	182	86
	26	69	181	91	65	179	86	61	176	81
	24	64	174	84	60	172	80	57	168	75
	22	59	166	78	55	163	74	52	158	70
2200	24	61	170	81	58	167	76	54	163	72
	22	55	160	74	52	156	70	49	151	66
	20	49	149	67	46	144	63	44	138	60

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 22,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE

For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -49°C			STANDARD TEMPERATURE -29°C			20°C ABOVE STANDARD TEMP -9°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	30	---	---	---	80	202	104	75	199	98
	28	80	197	104	75	196	98	70	193	92
	26	75	191	98	70	190	92	66	186	87
	24	69	184	91	65	182	86	61	178	81
	22	63	175	83	59	173	79	56	168	74
2400	30	80	197	105	75	196	99	71	194	93
	28	76	192	99	71	191	93	67	188	88
	26	71	186	93	67	184	87	62	181	82
	24	66	179	86	62	177	82	58	172	77
	22	61	172	80	57	168	76	54	163	72
2300	26	69	184	91	65	182	86	61	178	81
	24	65	178	85	61	175	80	57	171	76
	22	59	170	79	56	166	75	53	161	71
	20	54	161	73	51	157	69	48	151	65
2200	24	61	173	81	58	170	77	54	165	73
	22	56	163	74	52	159	70	49	154	67
	20	50	151	67	47	147	64	44	140	61

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

CRUISE PERFORMANCE
PRESSURE ALTITUDE 24,000 FEET

CONDITIONS:
3800 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

NOTE
For best fuel economy at 70% power or less, operate at 6 PPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -53°C			STANDARD TEMPERATURE -33°C			20°C ABOVE STANDARD TEMP -13°C		
RPM	MP	% BHP	KTAS	PPH	% BHP	KTAS	PPH	% BHP	KTAS	PPH
2500	28	79	200	104	74	198	98	70	196	92
	26	74	194	97	70	192	91	65	188	86
	24	68	186	90	64	183	85	60	179	80
	22	62	177	82	59	174	78	55	169	74
2400	28	75	195	99	71	193	93	66	190	87
	26	70	188	92	66	186	87	62	182	82
	24	65	181	85	61	178	81	57	173	76
	22	60	173	79	57	170	75	53	164	71
2300	26	69	187	91	65	185	86	61	181	81
	24	65	181	85	61	178	81	57	173	76
	22	60	173	79	57	170	75	53	164	71
	20	55	164	74	52	160	70	49	154	66
2200	22	56	165	74	52	161	70	49	155	66
	20	50	154	68	47	148	64	44	141	61

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

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 climb (as shown in Figure 5-6) for a normal climb up to 20,000 feet and maximum rate of climb above 20,000 feet.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 46 lbs.

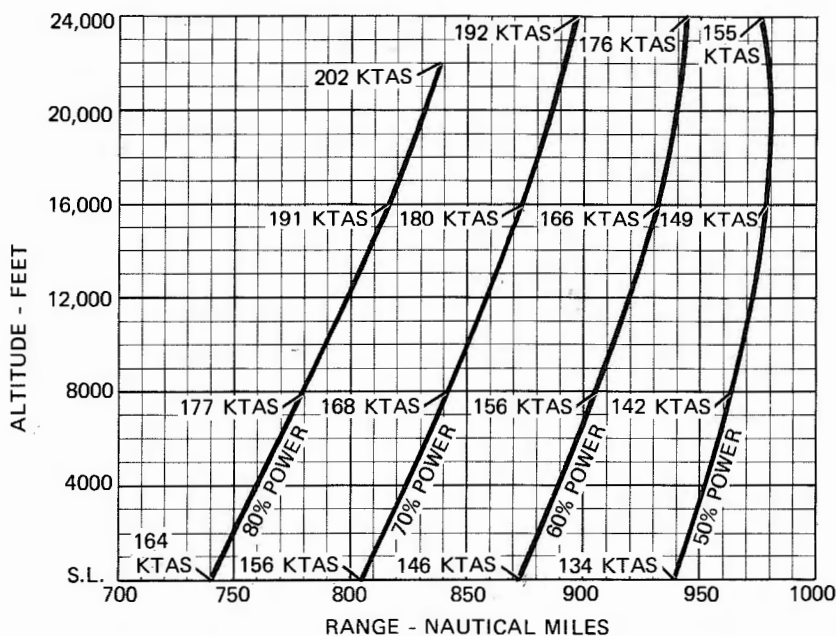


Figure 5-8. Range Profile

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 climb (as shown in Figure 5-6) for a normal climb up to 20,000 feet and maximum rate of climb above 20,000 feet.
- 2. Reserve fuel is based on 45 minutes at 45% BHP and is 46 lbs.

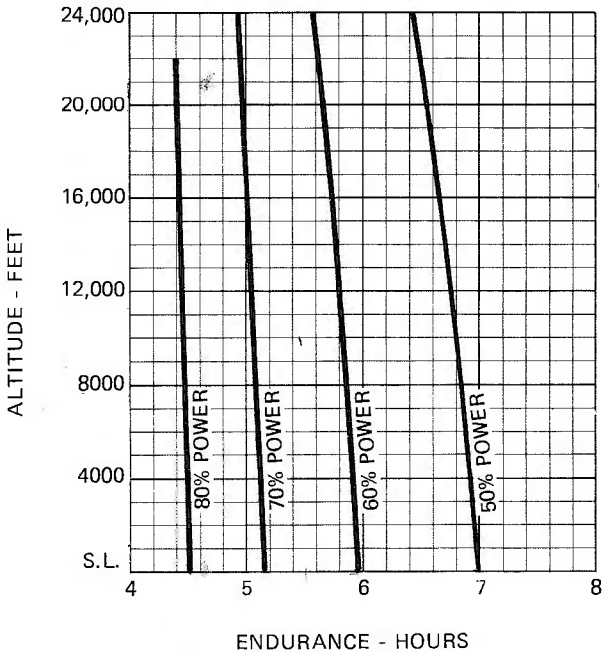


Figure 5-9. Endurance Profile

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

U

C

C

C

C

C

C

Weight and Balance

Reg. No	Model	Serial No.	
N761YM	Cessna T210M	21062625	
	Weight	Arm	Moments
	Pounds	Inches	Inch/Pounds
Prior values:			
Nose Wheel	811	-7.4	-6001.4
Left Main	797	64.4	51326.8
Right Main	792	64.4	51004.8
New Total:	2400	40.138	96330.20

A. New Empty Weight

2400 Pounds

B. New Empty CG

40.138 Inches

C. New Empty Weight CG Moment

96330.20 Inch/Pounds

This new weight and balance information superseads all previous weight and balance data
For aircraft loading, see instructions in Weight and Balance Section of the Aircraft Flight Manual.

Mario Filice

Date: 12/11/2020

A&P 3421289

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.

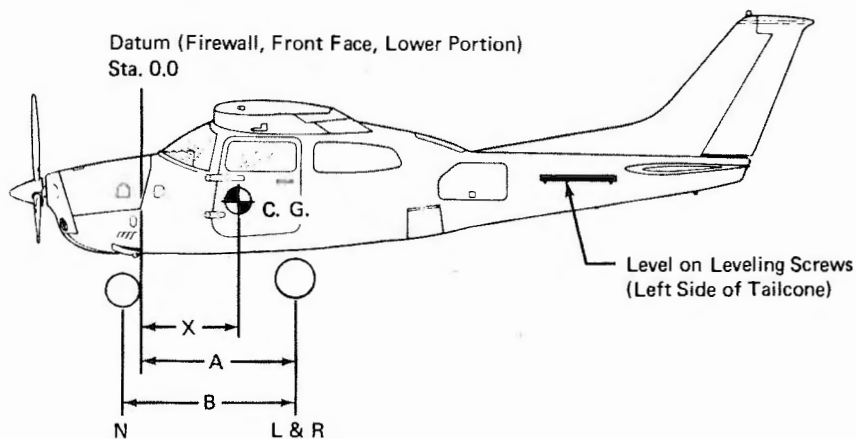
It should be noted that specific information regarding the weight, arm, moment and installed equipment list for this airplane can only be found in the appropriate weight and balance records carried in the airplane.

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.

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

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

Item	Weight (Lbs.)	X C.G. Arm (In.)	Moment/1000 (Lbs.-In.)
Airplane Weight (From Item 5, Page 6-3)			
Add: Oil (11 Qts at 7.5 Lbs/Gal)	21	- 12.5	- 0.3
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

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SECTION 6 WEIGHT & BALANCE/ EQUIPMENT LIST

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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.

C.G.
ARM

* 37
(34-46)

* 71
(61-77)

101

** 138

152

6 OCCUPANTS
AND AFT BAGGAGE

C.G.
ARM

* 37
(34-46)

* 71
(61-77)

** 101

** 138

152

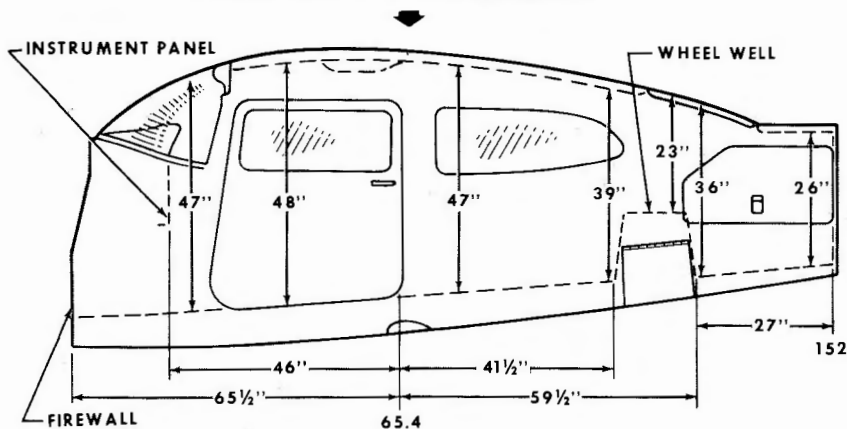
4 OCCUPANTS
BAGGAGE ON AFT SEAT
AND AFT BAGGAGE

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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"	14¼"

— WIDTH —
● LWR WINDOW
LINE
* CABIN FLOOR

CABIN WIDTH MEASUREMENTS

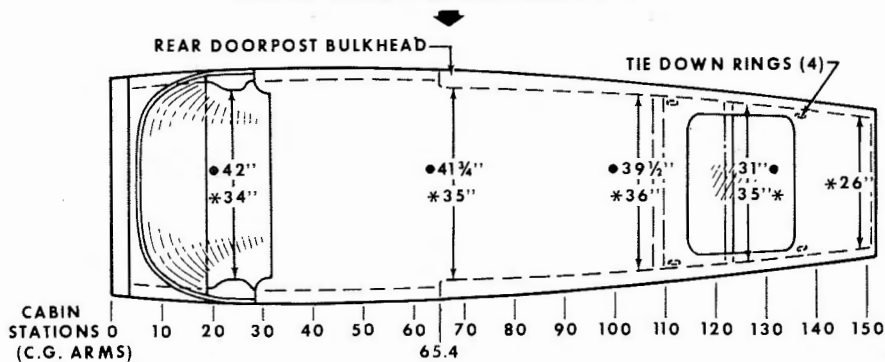


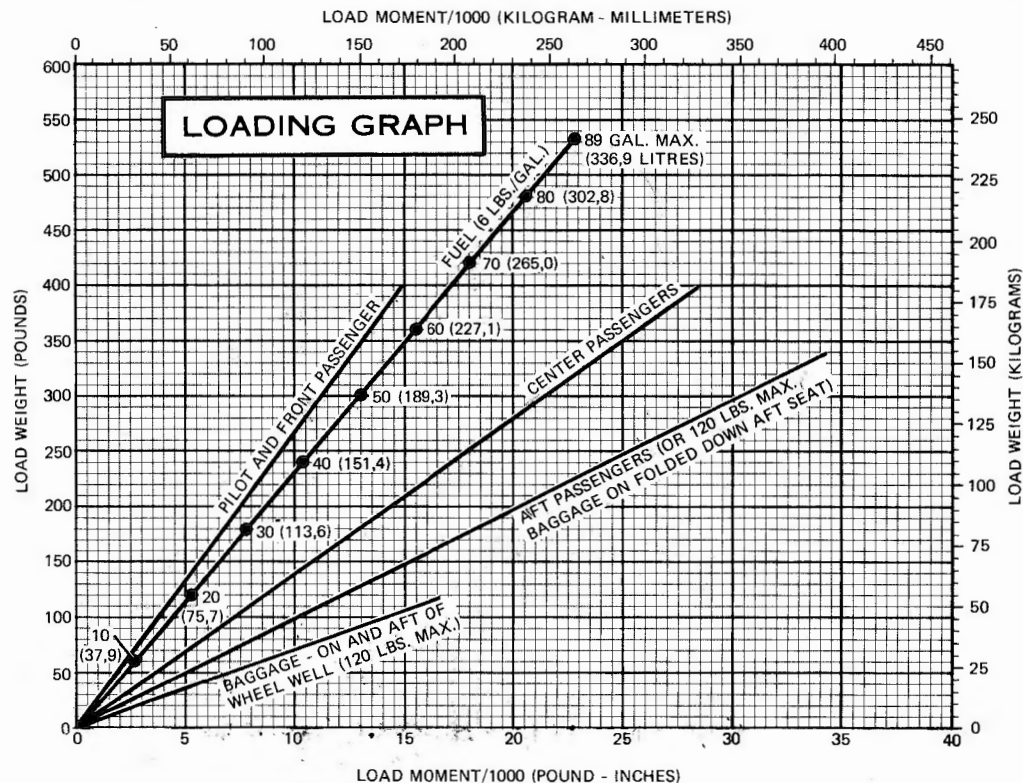
Figure 6-4. Internal Cabin Dimensions

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SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		7614M 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)	2342	99.6	2451.9	98.93
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.)	70	9.7		
8. RAMP WEIGHT AND MOMENT	3816	196.8		
9. Fuel allowance for engine start, taxi and runup	- 16	- .7		
10. TAKEOFF WEIGHT AND MOMENT (Subtract step 9 from step 8)	3800	196.1		
11. Locate this point (3800 at 196.1) 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	186.3		
14. Locate this point (3572 at 186.3) 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

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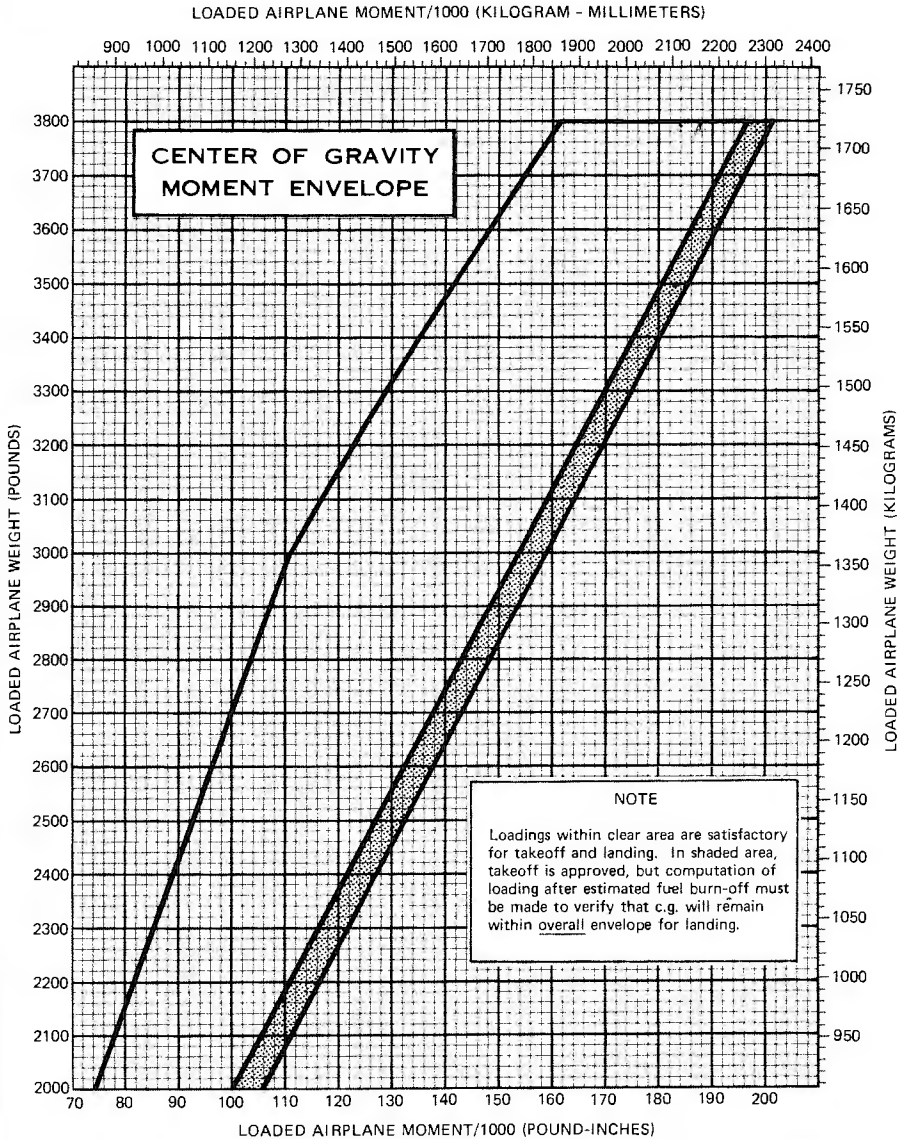


Figure 6-7. Center of Gravity Moment Envelope

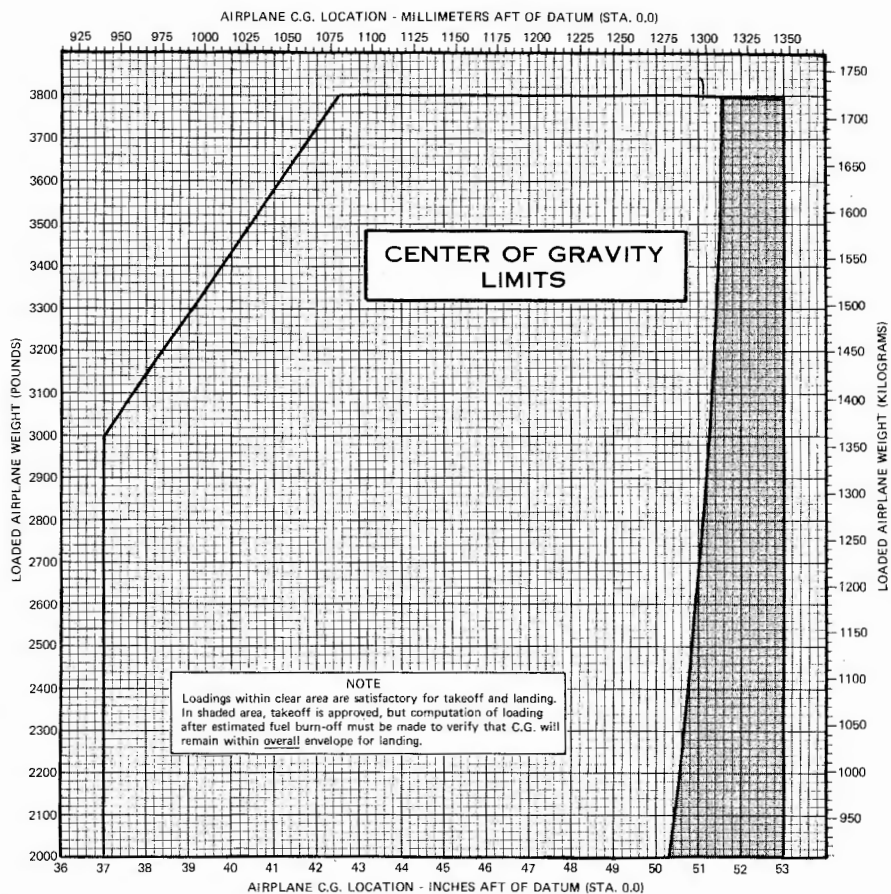
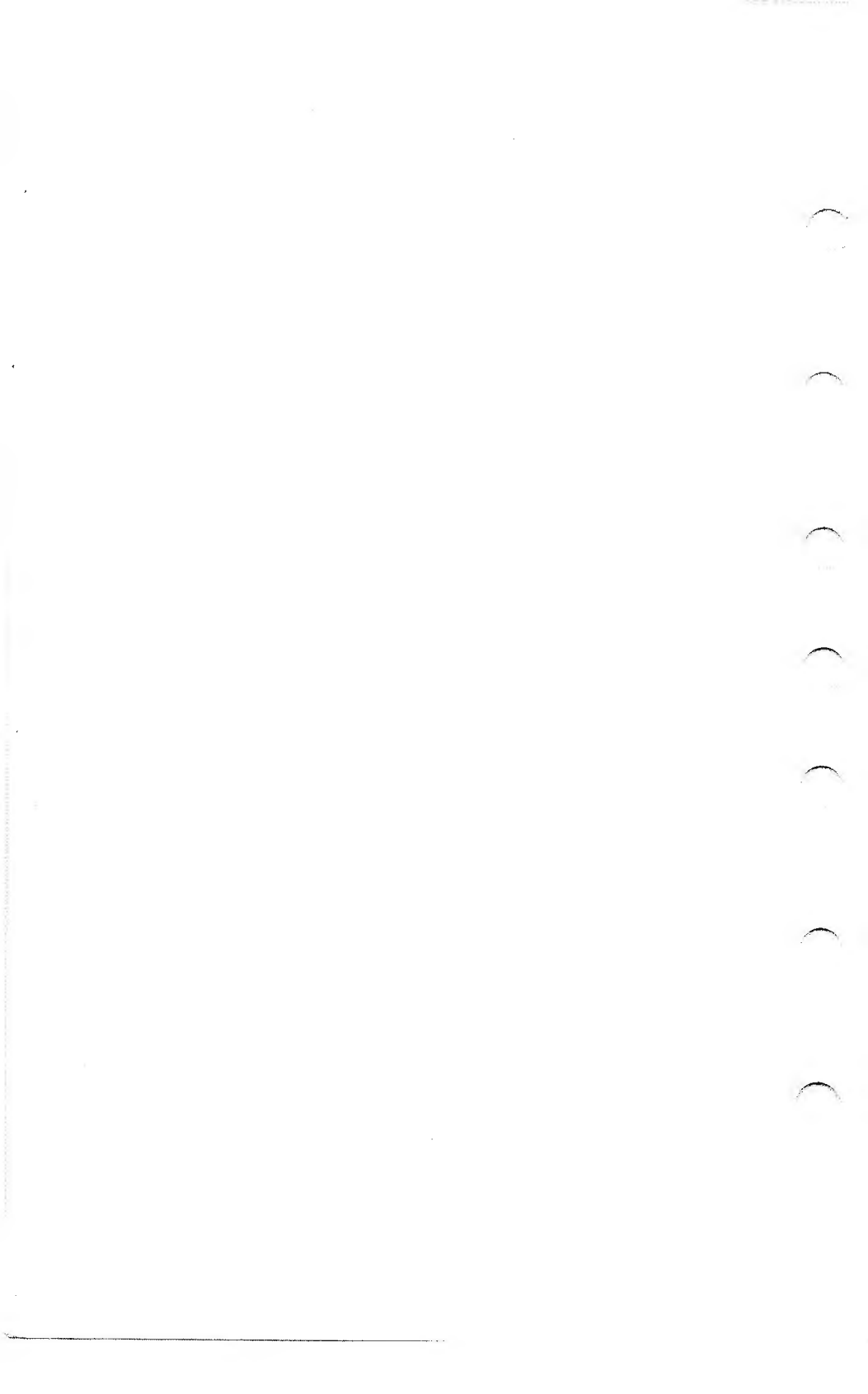


Figure 6-8. Center of Gravity Limits



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.

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 WEIGHT & BALANCE/
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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
A. POWERPLANT & ACCESSORIES				
A01-R	ENGINE, CONTINENTAL TSIO 520-R TWO MAGNETOS WITH IMPULSE COUPLING OIL COOLER MOUNTING PROVISIONS OIL COOLER, NON-CONGEALING MODINE TWELVE 18MM X 3/4 20-2A SPARK PLUGS STARTER, 24 VOLT PRECLITE	1250800 SLICK 662 EQ 5968 TCM 635994 SL 350 C TCM 634433	458.8* 12.9 2.3 6.4 3.1 17.8	-18.0* -12.5 -3.2 -3.2 -19.5 -5.0
A05-R	FILTER ENGINE AIR INDUCTION	1250846	1.0	-4.0
A09-R	ALTERNATOR, 28 VOLT, 60 AMP	G611503-0102	11.5	-6.0
A09-0	ALTERNATOR INSTL, 55 AMP, NET CHANGE	1601021-2	16.4*	-3.5*
A21-S	ALTERNATOR, 55 AMP, 28 VOLT	G611505-0101	15.8	-5.0
	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 C3A34C402/SCDFA-10	C161007-0101	73.0	-44.0
A37-R	GOVERNOR, PROPELLER (WOODWARD G210452 OR MCCAULEY C290-D4/T2)	C161040-0106 C161032-0101	3.0 3.0	-35.5 -35.5
A41-R	SPINNER, PROPELLER	1250419	3.5	-4.5
A45-R	TURBOCHARGER ASSEMBLY	C295001-0101	23.0	-13.0
A49-R	TURBOCHARGER WASTE GATE VALVE ASSEMBLY	C165006-0101	4.0	-26.5
A53-R	TURBOCHARGER CONTROLLER	C165004-0502	2.5	0.0
A57-R	TURBOCHARGER OVERBOOST RELIEF VALVE	C482002-0108	1.5	-7.0
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
A70-A	MISC HOSES, CLAMPS & ETC.		1.8	4.6
	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 4C-75R (EACH)	C163001-0301	6.2	64.0
	BRAKE ASSY, CLEVELAND 3C-52 (LEFT)	C163030-0304	2.8	66.5
	BRAKE ASSY, CLEVELAND 3C-52 (RIGHT)	C163030-0303	2.8	66.5
	TIRE, 8 PLY RATED (EACH)	C262003-0208	6.2	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) WHEEL ASSY, MCCAULEY BRAKE ASSY {LEFT} BRAKE ASSY {RIGHT} TIRE, 8 PLY RATED TUBE {EACH}	C163016B0115 C163004-0102 C163032-0206 C163032-0205 C262003-0208 C262023-0102 C163018B0107	42.2* 7.1 3.0 3.0 9.2 1.8 9.0*	64.4* 64.0 66.5 66.5 64.0 64.0 -7.4*
B04-R-1	WHEEL AND TIRE ASSY 500X5 NCSE (CLEVELAND) WHEEL ASSY, CLEVELAND 40-77 TIRE, 6 PLY RATED TUBE	C163018B0107 1241156-12 C262003-0202 C262023-0101 C163018B0103	2.8 5.0 1.2 2.4 4.7	-7.4 -7.4 -7.4 -7.4 -7.4
B04-R-2	WHEEL AND TIRE ASSY, 500X5 NCSE (MCCAULEY) WHEEL ASSY TIRE, 6 PLY RATED TUBE	C163018B0103 C163005-0201 C262003-0202 C262023-0101	1.2 2.4 4.7 1.2	* -7.4 -7.4 -7.4
C. ELECTRICAL SYSTEMS				
C01-R-1	BATTERY, 24 VOLT, 14 AMP HR	0870060	27.5	3.0
C01-R-2	BATTERY, 24 VOLT, 14 AMP HR	C614001-0101	22.8	3.0
C01-D	BATTERY, 24 VOLT, 17 AMP HR	C614001-0102	24.8	3.0
C04-R	REGULATOR, 28 VOLT ALTERNATOR	C611002-0105	0.9	3.0
C07-A	GROUND SERVICE PLUG RECEPTACLE	1270652	2.0	-4.5
C19-D	HEATING SYSTEM, STALL SENSOR & PITOT HEAD (NET CHANGE)	1201093-1	0.4	43.4
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 UNDER SIDE (SET OF 2)	1221103	0.5	51.4
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF 2)	1221201	NEGL	-
C43-A	LIGHT INSTALLATION, OMNIFLASH BEACON BEACON LIGHT IN FIN TIP FLASHER POWER SUPPLY (IN FIN TIP)	1201049 C621001 0594502-0101	1.6* 0.4 0.7	226.0* 253.0 38.9*
C46-A	LIGHT INSTL, WING TIP STROBE FLASHING POWER SUPPLY	1201129 C622004-0101	3.6* 2.3	38.9* 39.9
C49-S	STROBE LIGHTS IN WING TIP (SET OF 2) LIGHTS, COWL MOUNTED LANDING & TAXI	C622003-0104 1213401	0.2 2.0*	38.7 -28.5*
C61-A	LIGHT BULBS (SET OF 2) LIGHT INSTALLATION, ICE DETECTOR (WING)	GE 4591 1201100	1.0 0.6	-31.5 9.6

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D. INSTRUMENTS				
D01-R	INDICATOR, AIRSPEED	C661064-0219	1.0	17.0
D01-O	TRUE AIR SPEED INDICATOR	1201108	1.0	17.0
D04-S	INSTRUMENT AIR ALTERNATE STATIC SOURCE	1201032	0.3	15.5
D07-R	ALTIMETER, SENSITIVE	C661071-0201	1.0	16.0
D07-O-1	ALTIMETER, SENSITIVE (FEET & MILLIBARS)	C661071-0202	1.0	16.0
D07-O-2	ALTIMETER, SENSITIVE 35,000 FT 20 FT MARKING INTERVALS	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	ALTITUDE ENCODER, BLIND (INSTRUMENT PANEL INSTALLATION NOT REQUIRED)	2101011-1	1.5*	13.6*
D25-S	ELECTRIC CLOCK	C744001-0101	1.3	15.5
D38-R	GAGE, FUEL QUANTITY, (IN LOWER PEDISTAL)	C664508-0101	0.4	16.5
D41-R	GAGE, CYLINDER HEAD & OIL TEMPERATURE	C669525-0101	0.5	20.0
D43-R	GAGE, AMMETER & OIL PRESSURE	C669526-0101	0.5	17.2
D49-A	INDICATOR INSTALLATION, ECONOMY MIXTURE	C669527-0101	0.5	17.2
	EGT INDICATOR, ALCOR 202-2AY	1200577	0.7*	0.9*
	THERMOCOUPLE LEAD WIRE (IC)	C668501-0211	0.4	17.3
	THERMOCOUPLE PROBE, ALCOR 01-005-1A44	C668501-0206	0.1	-0.3
D55-R	GAGE, MANIFOLD PRESSURE AND FUEL FLOW	C668501-0204	0.1	-16.0
D64-A-1	GYRO INSTL, NON AUTO-PILOT	C662037-0205	1.0	16.5
	HEADING INDICATOR	2101001	6.0*	14.0*
	ATTITUDE INDICATOR	C661075-0101	3.0	14.3
D64-A-2	GYRO INSTALLATION FOR NON SLAVED HSI	C661076-0103	2.1	15.3
	ATTITUDE INDICATOR	-	3.0*	13.7*
	MISC ITEMS & HOSES	C661076	2.1	15.3
D64-A-3	GYRO INSTL, CESSNA 300A NAV-O-MATIC	C661076-0103	0.9	10.0
	ATTITUDE INDICATOR	2101001	6.3*	14.0*
	HEADING INDICATOR (DG) (ARC)	C661076-0103	2.1	15.3
D64-A-4	GYRO INSTL, CESSNA NAV-O-MATIC 400 AND 400B NON SLAVED HEADING INDICATOR	40760-0104	3.3	14.3
	ATTITUDE INDICATOR	2101001	6.5*	14.0*
	DIRECTIONAL INDICATOR	37570-0105	2.3	15.3
D64-A-5	GYRO INSTALLATION, CESSNA NAV-O-MATIC 400 AND 400B SLAVED HEADING INDICATOR	40760-0104	3.3	14.3
		2101001	6.2*	13.6*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D64-A-6	ATTITUDE INDICATOR (HG) DIRECTIONAL INDICATOR (DG) GYRO INSTALLATION, CESSNA 400B NAV-O-MATIC WITH HSI HORIZON GYRO MISC GYRO ITEMS	37570-1011 44760-0000 2101001	2.1 3.4 3.1*	14.5 14.0 13.9*
D64-A-7	GYRO INSTALLATION FOR CESSNA 400B IFCS ADI GYRO HSI GYRO MISC GYRO ITEM	37570-0105 2101001 44670-0000 44690-0000	2.3 0.8 9.0* 3.5 4.8 0.8 3.2*	15.3 9.7 13.9* 14.5 14.0 10.0 13.7*
D64-A-8	GYRO INSTL FOR NON SLAVED HSI SYSTEM, USED WITH HC9-A-1 NON SLAVED HSI ATTITUDE INDICATOR	37570-0105 2100010	2.3 0.5	15.3 7.6
D67-A	HOURLY METER INSTALLATION	2100010	0.1	26.5
D82-S	GAGE, OUTSIDE AIR TEMPERATURE	C668507-0101	1.0	16.5
D85-R	TACHOMETER, RECORDING	C668020-0108	1.3	16.8
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	1.9	15.0
D88-O-1	INDICATOR, TURN COORDINATOR (FOR USE WITH NAV-O-MATIC 200A & 3CCA)	42320-0028	2.0	16.0
D88-O-2	INDICATOR, TURN AND BANK	S-1303-2	1.0	17.0
D91-S	RATE OF CLIMB INDICATOR	C661080-0101		
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, INFINITE 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, ARTICULATING	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, ARTIC- ULATING CUSHION	1214128-2	23.3	39.5
E07-O-3	SEAT, CO-PILOT VERTICAL ADJUSTING, ARTIC- ULATING CUSHION W/LUMBAR SUPPORT	1214128-8	24.1	39.5
E09-S	SEATS, TWO 2ND ROW INDIVIDUAL	1214129-1, -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	S-2275-103	1.0	37.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S-2275-201	0.6	37.0
E19-A	INERTIA REEL INSTALLATION -1ST ROW	1201057	0.6	145.3
E23-S	SEAT BELT & SHOULDER HARNESS NET CHANGE			
E27-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S-2275-3	1.6	37.0
E27-O-1	BELT ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S-1746-25	2.0	71.0
	BELT & SHOULDER HARNESS ASSY, 2ND ROW OCCUPANT LAP (SET OF 2)	S-2275-5	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	3.9	47.0
E47-S	PARTIAL OXYGEN SYSTEM	1200246-3	5.4	61.0*
E47-A	OXYGEN SYSTEM, INCLUDES BOTTLES, MASKS AND OXYGEN AT C.C.832 LBS/CU FT	1200246-4	52.9*	56.7*
	OXYGEN MASKS-1 PILOT & 5 PASSENGERS		1.5	67.2
	OXYGEN WT - 74 CU FT @ 1800 PSI		45.2	56.4
	4 BOTTLES (EMPTY), 3 VALVES 1 REGULATOR		0.1	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	1201124-2	NIL	16.0
E50-A	HEADREST, FRONT ROW (EACH)	1215073	0.9	48.0
E51-A	HEADREST, 2ND ROW (EACH)	1215073	0.9	32.0
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)	0700154-8	-	-
E85-A	CONTROLS INSTALLATION, DUAL RIGHT SIDE WHEEL, PEDAL & TOE BRAKES	1260004-6	8.1	13.7
E87-A	ELEVATOR ELECTRIC TRIM INSTALLATION VOLTAGE REGULATOR (HOPKINS 4285A) DRIVE ACTUATOR ASSY	1260671-1 C611003-0101 1260153-1	4.1* 0.2 3.3	216.7* 215.2 220.0
F93-R	CONTROL WHEEL, ALL PURPOSE (NET CHANGE) CABIN HEATING & ENGINE EXHAUST SYSTEM	0760020-21 1250800	N EGL 26.0	- -20.5
	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-D-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	PILOT'S CHECK LIST (STOWED)	- -	- -	- -
G. AUXILIARY EQUIPMENT				
G04-A	TOW HOOK (INSTALLED ARM SHOWN)	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 INSTL. (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)	1200008	2.0	138.0
G25-S	PAINT, OVERALL EXTERIOR (MODIFIED POLY-URETHANE)	1201032	13.0*	92.7*
	OVERALL BASE WHITE		11.7	91.5
	COLOR STRIPE		1.3	103.7
G31-O	CONTROL CABLES, CORROSION RESISTANT (NET CHANGE)	1260475	NEGL	- -
G55-A	FIRE EXTINGUISHER, HAND TYPE	0701014	3.0	35.0
G67-A	PEDAL EXTENSIONS, RUDDER, REMOVABLE - SET OF 2 (STOWABLE, INSTALLED ARM SHOWN) (NOT FACTORY INSTALLED)	0701048-1	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	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
H. AVIONICS & AUTOPILOTS				

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LISTCESSNA
MODEL 1210M

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H01-A-1	CESSNA 300 ADF 546E	3910159-10	7.6*	26.4*
	RECEIVER WITH BFO, R-546E	41240-0101	3.1	12.5
	INDICATOR, IN-346A	40980-1001	0.9	16.0
	LOOP ANTENNA INSTALLATION	41000-1001	1.4	50.0
H01-A-2	SENSE ANTENNA INSTALLATION	3960115-2	0.3	131.8
	ADF PARTIAL 300 MOUNT & CABLES	3930147	1.7	18.2
	CESSNA 400 ADF (446A) WITH BFO	3910160-8	8.0*	25.7*
	RECEIVER (WITH DUAL TUNERS), R-446A	43090-1128	3.5	12.5
H01-A-3	IN-346A INDICATOR	40980-1001	0.9	16.0
	LOOP ANTENNA INSTALLATION	41000-1001	1.4	50.0
	SENSE ANTENNA INSTALLATION	3960115-2	0.3	131.8
	ADF PARTIAL 300 MOUNT & CABLES	3930147	1.7	18.2
H01-A-4	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
H01-A-5	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
	DUAL CESSNA 400 ADF	3910160-14	16.1*	25.7*
H03-A	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
H04-A	SENSE ANTENNA (2)	3960115	0.6	131.8
	SWITCH INSTALLATION 2ND ADF	3970129-1	0.1	17.5
	AM-FM STEREO & CASSETTE RECEIVER/PLAYER		5.3*	31.7*
	INSTR. WITH 2 HEADSETS		2.4	15.0
H05-A	RECEIVER/TAPE PLAYER		2.0	37.0
	HEADSETS (2 USED HERE) (4 MAY BE USED)		16.3*	122.0*
	CESSNA 400 OME WITH 300 & 400 NAV/COM SYSTEMS	3910167		
	CONTROL UNIT, RT-476	44020-1100	1.6	14.0
H07-A-1	REMOTE TRANSCEIVER, RTA-476A	44000	8.5	173.4
	ANTENNA	42940	0.2	36.0
	CESSNA 400 R-NAV SYSTEM (USED WITH 300 OR 400 SERIES NAV/COM) NET CHANGE	3910168	4.2*	11.1*
	RN-476 AREA NAV COMPTER	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 DELETED		-2.2	15.5
	CESSNA 400 GLIDESLOPE WITH IN-386A ILS	3910237-11	4.4*	74.4*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H07-A-2	INDICATOR (IND. WT NET CHANGE)			
	RECEIVER (R-443R)	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
H09-A-1	CESSNA 400 GLIDESLOPE WITH IN-486AC ILS INDICATOR (IND. WT NET CHANGE)	3910237	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-2	NON-SLAVED HSI INSTALLATION (USED WITH F31-AIC, 3CCA AUTOPILOT)		4.3*	43.8*
	NON SLAVED FSI INDICATOR (IG-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 FSI SYSTEM		5.3*	47.8*
	FSI INDICATOR (IG-832A)	44690-0000	4.7	14.0
	FSI 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
	CX10-RL-28 ANTENNA LOAD BOX	C589502-0201	4.5	116.0
H11-A-2	WIRING & CABLE ASSEMBLIES	3950129	2.5	51.3
	HF ANTENNA INSTL	3960117-1	0.4	173.4
	SUN AIR ASB 125 SINGLE SIDE BAND HF TRANS- CEIVER 2ND & 3RD UNIT	3910158-19,-20	23.7*	82.3*
	ANTENNA LOAD BOX			
H13-A	TRANSCEIVER	99816	4.9	116.0
	POWER SUPPLY & SHOCK MOUNT	99681	5.3	11.7
	HF ANTENNA INSTL	99916	9.2	102.6
	WIRING & CABLE ASSEMBLIES	3960117-1	0.4	173.4
H15-A	CESSNA 400 MARKER BEACON	3950129	3.4	78.5
	REMOTE RECEIVER, R-4C2A	3910164-10	2.5*	97.5*
	ANTENNA INSTALLATION, FLLSH MTD IN TAIL	42410-5128	0.7	11.5
	WEATHER RADAR INSTALLATION (BENDIX RD-160)	3960126-2	0.9	201.0
H16-A	INDICATOR (VIEWING SCREEN) (IN-152A)		21.9*	30.6*
	RADAR ANTENNA-TRANSCIEVER (ART-161)	4000946-5201	5.1	12.2
	RADOME & WING POD ASSY	4001018-6101	9.3	34.4
	MISC ITEMS, INCLUDING ELECTRICAL CABLES	1570366	4.5	43.9
	CESSNA 400 TRANSPONDER (459A)	3910128-16	3.7*	14.8*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H22-A-1	RT-455A TRANSCEIVER	41470-1128	2.8	11.5
	ANTENNA	42940-0000	0.2	60.5
	CESSNA 30C NAV/COM 720 CH CCM	3910133	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
H22-A-2	H34-A BASIC AVIONICS KIT	3910186-11	5.7	58.9
	MOUNT, WIRING & MISC HARDWARE	1270708-704	1.2	10.7
	CESSNA 40C NAV/COM 720 CH CCM 1ST UNIT	3910183	14.5*	31.0*
	SERIES INDICATOR			
	RECEIVER-TRANSCEIVER (RT-485A)	45010-1000	5.4	12.5
H22-A-3	VOR/ILS INDICATOR (IN-385A)	46860-1000	2.2	15.5
	H37-A BASIC AVIONICS KIT	3910186-11	5.7	58.9
	MOUNT, WIRING & MISC HARDWARE		1.2	10.7
	CESSNA 40C NAV/COM 720 CH CCM 1ST UNIT	3910152-29		*
	RECEIVER-TRANSCEIVER (RT-485A)	43340-1124	5.4	12.5
H25-A-1	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
	CESSNA 30C NAV/COM 720 CH CCM 2ND UNIT	3910183	10.1*	16.5*
	RECEIVER/TRANSCEIVER (RT-385A)	46660-0000	5.4	12.5
H25-A-2	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	15.5
	H37-A ANTENNA AND COUPLER KIT	3910135-9	1.3	40.3
	MOUNT, WIRING & MISC HARDWARE	3940192-2	1.2	10.7
	CESSNA 40C NAV/COM 720 CH CCM WITH 300	3910150-45	10.1*	16.5*
	SERIES INDICATOR, 2ND UNIT			
H25-A-3	RECEIVER/TRANSCEIVER, RT-485A	43340-1124	5.4	12.5
	VOR/LOC INDICATOR (IN-385A)	46860-1000	2.2	15.5
	H37-A ANTENNA & COUPLER KIT	3910189	1.3	40.3
	MOUNT, WIRING & MISC HARDWARE	3960111-1	1.2	10.7
	CESSNA 40C NAV/COM 720 CH CCM WITH 400		10.1*	16.5*
H28-A-1	SERIES INDICATOR			
	RECEIVER/TRANSCEIVER, RT-485A	43340-1124	5.4	12.5
	VOR/LOC INDICATOR (IN-485AC)	46870-1300	2.2	15.5
	H37-A ANTENNA & COUPLER KIT	3910189	1.3	40.3
	MOUNT, WIRING & MISC HARDWARE		1.2	10.7
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	0470419	1.8*	159.0*
H28-A-2	TRANSMITTER (D & M DMELT-6)	0589511-0101	1.6	160.1
	EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA)	0470419	1.8*	159.0*
H31-A-1	TRANSMITTER (D & M DMELT-6C)	0589511-0102	1.6	160.1
	NAV-O-MATIC 20CA	3910162-16	7.7*	43.2*
	CONTROLLER AND MOUNT	3930144-7	1.6	13.5

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LISTCESSNA
MODEL T210M

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H31-A-2	D8E-0-1 TURN COORDINATOR (NET CHANGE)	42320-0028	0.6	11.1
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
	CESSNA 30CA NAV-O-MATIC INSTALLATION	3910141	19.8*	21.7*
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
	CONTROLLER-AMPLIFIER (C-345A)	3930145-7	1.8	13.5
H31-A-3	D64-A-3 GYRC INSTALLATION	2101001	6.3	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
	CESSNA 400 AUTOPILOT, NON SLAVED GYROS	1200202-5	32.2*	52.4*
	AILERON ROLL ACTUATOR (PA-500A)	35070-1028	3.2	52.2
	ELEVATOR PITCH ACTUATOR (PA-500A)	35070-1128	3.2	154.0
H31-A-4	CONTROLLER (C-42CA)	41540-1128	1.4	16.5
	COMPUTER-AMPLIFIER (CA-52GB)	35910-1528	5.5	100.0
	D64-A-4 NON-SLAVED GYRO SYSTEM	2101001	6.5	14.0
	A61-A VACUUM SYSTEM	1201052	5.6	1.1
	CESSNA 400 AUTOPILOT, SLAVED GYROS	1200202	34.9*	50.6*
H31-A-6	(INCLUDES GYROS BUT NO VACUUM SYSTEM)			
	AILERON ROLL ACTUATOR (PA-500A)	35070-1028	3.2	57.7
	ELEVATOR PITCH ACTUATOR (PA-500A)	35070-1128	3.2	154.0
	CONTROLLER (C-42CA)	41540-1128	1.4	16.5
	COMPUTER-AMPLIFIER (CA-52GB)	35910-1528	5.5	100.0
H31-A-7	D64-A-5 GYRO SYSTEM, INCLUDES SLAVING COMPONENTS	2101001	9.2	18.5
	CESSNA 400B NAV-O-MATIC, NON-SLAVED	3910177-1	45.6*	76.3*
	HEADING INDICATOR			
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
H31-A-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
	D64-A-4 GYRC, NON-SLAVED	2101001	6.5	14.0
H31-A-7	A61-A VACUUM SYSTEM	1201052	5.6	1.1
	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
H31-A-7	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
	D64-A-5 GYRO SYSTEM, SLAVED DIR. GYRC	2101001	6.2	13.6
	VACUUM SYSTEM (A61-A)	1201052	5.6	1.1

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H31-A-8	GYRO SLAVING SYSTEM, INCLUDING CABLES		4.3	40.1
	CESSNA 400B NAV-O-MATIC WITH HSI	3910177-5	51.2*	73.7*
	AILERON ROLL ACTUATOR (PA495-1)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA495-2)	45850-3012	4.2	154.7
	CONTROLLER	37970-1128	1.4	16.3
	COMPUTER-AMPLIFIER	42680-0007	5.8	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
	FSI/CG INDICATOR (IG-832A)	44690-0000	4.8	14.0
	FSI CONVERTER	41790-0000	1.7	46.0
H31-A-9	CESSNA 400B IFCS W/SLAVED HSI	3910178-1	55.4*	70.3*
	CESSNA 400B IFCS W/SLAVED HSI & ALTITUDE		59.4*	66.5*
	ALERT OPTION			
	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	42680-0007	5.8	100.0
	PITCH TRIM ACTUATOR	44430-2835	2.1	220.5
	ROLL ACTUATOR (IN WING)	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
H31-A10	GYRO SLAVING SYSTEM, INCLUDING CABLES		4.3	40.1
	FC5-A-2 SLAVED HSI INSTALLATION	- -	5.3	47.8
	ALTITUDE ALERT SYSTEM (INCLUDES 801A	41790-0000	4.0	14.6
	ENCODING ALTIMETER)			
	CESSNA 300A NAV-O-MATIC WITH NON SLAVED		19.8*	27.5*
	FSI INSTALLATION			
	WING SERVO INSTALLATION	1200237-7	5.1	55.8
	CONTROLLER-AMPLIFIER		1.8	13.5
	DE4-A-2 GYRO INSTL		3.0	13.7
	A61-A VACUUM SYSTEM		5.6	1.1
	FC5-A-1 FSI INSTL		4.3	43.8
	CESSNA 400B AUTOPILOT WITH NON SLAVED HSI		45.8*	79.9*
	INDICATOR			
H31-A11	AILERON ROLL ACTUATOR (PA 495-2)	45850-2009	4.2	56.2
	ELEVATOR PITCH ACTUATOR (PA 495-2)	45850-3012	4.2	154.7
	CONTROLLER		1.4	16.3

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST

CESSNA
MODEL T210M

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	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
	F65-A-1 NON-SLAVED HSI, VOR INDICATOR		4.3	43.8
	EXCHANGED			
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 (CMNI)	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	0.3	14.5
H37-A	ANTENNA & COUPLER KIT	3910185-9	1.3*	40.3*
	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		0.2	16.0
H46-A	ADF ANTI-PRECIP ANTENNA	3910154-71	0.7	140.0
H52-A	FLUSH MOUNTED COM ANTENNA INSTALLATION (MOUNTED IN LEADING EDGE OF VTL FIN)	3910154-50	1.3	198.5
H55-A	HEADSET-MICROPHONE INSTL	3970112	0.6	16.1
H56-A	HEADSET/MICROPHONE, PADDED (STOWED ITEM)	C596531-0101	1.1	14.0
H61-R	GEAR WARNING HORN & CABIN SPEAKER	C596510-0101	1.9	45.8
	J. SPECIAL OPTION PACKAGES			
J01-A	CENTURION II KIT--TURBO	- -	65.6*	31.0*
	A61-A VACUUM SYSTEM (RCD FOR GYROS)	1201144	5.6	1.1
	C07-A GROUND SERVICE RECEPTACLE	1270652	2.0	14.5
	C15-A HEATED PILOT & STALL SENSOR	1201093	0.5	36.0
	C22-A INSTRUMENT POST LIGHTS	2101009	0.5	18.5
	C31-A COURTESY ENTRANCE LIGHTS	1221103	0.5	51.1
	C40-A NAVIGATION LIGHT DETECTORS	1221201	NEGL	-
	C43-A FLASHING BEACON	1201049	1.6	226.0
	D01-A TRUE AIR SPEED IND. (NET CHANGE)	1201108	0.0	-

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
J04-A	D45-A ECONOMY MIXTURE INDICATOR (EGT)	1200677	0.7	0.9
	D64-A-1 GYRO INSTALLATION	2101001	6.0	14.0
	E07-0 VERT. ADJUST RH SEAT NET CHANGE	1214128	4.8	22.2
	E85-A DUAL FLIGHT CONTROLS	1260004	8.1	13.7
	F01-A-1 CESSNA 300 ADF (R-546E)	3910159-10	7.6	26.4
	F16-A CESSNA 400 TRANSPONDER RT-459A	3910128-16	3.7	13.4
	F22-A-1 CESSNA 300 NAV/COM VCR/LCC	3910183	14.5	31.0
	F28-A-1 E.L.T. INSTALLATION	0470419	1.8	155.0
	F31-A-1 200A NAV-O-MATIC AUTO PILOT	3910162-16	7.7	43.2
	NAV/PAC RADIO OPTION, AVAILABLE ON TURR	- -	17.0*	43.4*
	CENTURION II SERIES ONLY			
	F25-A-1 RT-385A 2ND UNIT w/300 IND	3910183	10.1	16.5
	H07-A CESSNA 400 GLIDE SLOPE (R443B)	3910237-11	4.4	74.4
	F13-A CESSNA 400 MARKER BEACON R402A	3910164-10	2.5	97.5

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST

CESSNA
MODEL T210M

SECTION 7

AIRPLANE & SYSTEMS DESCRIPTIONS

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INTRODUCTION

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

AIRFRAME

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

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

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

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

AILERON CONTROL SYSTEM



**RUDDER AND RUDDER TRIM
CONTROL SYSTEMS**

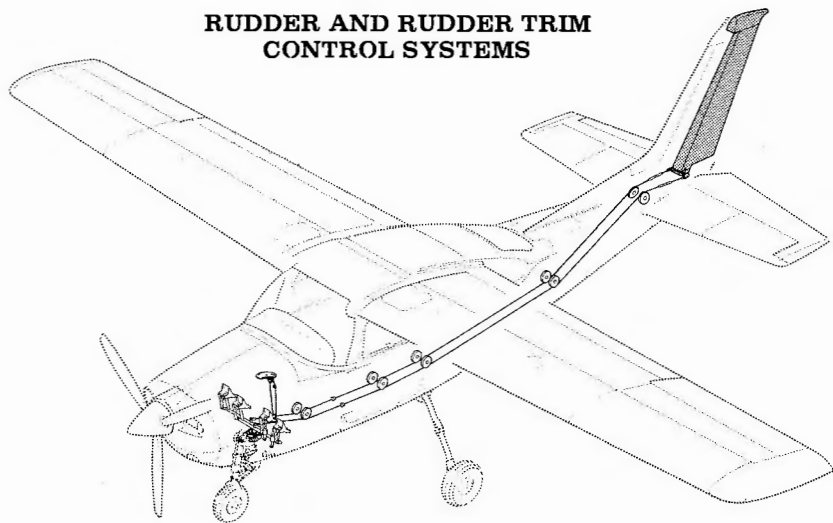
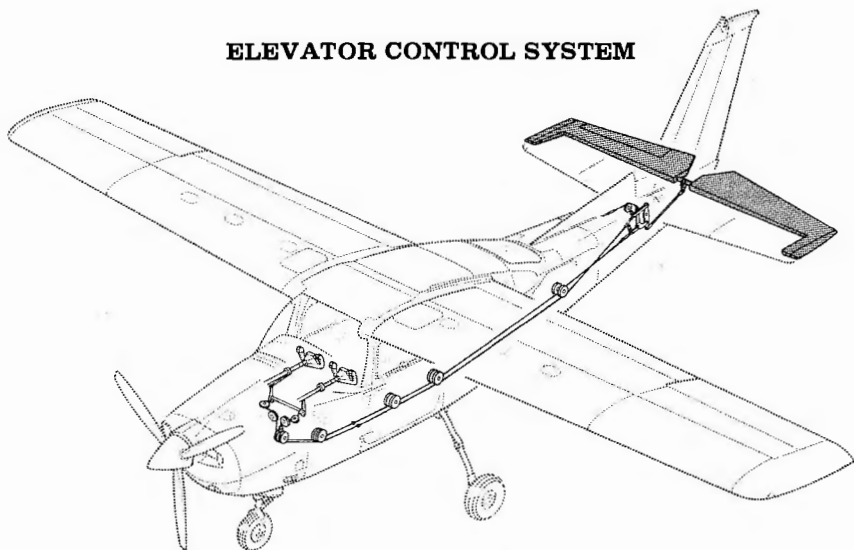


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM CONTROL SYSTEM

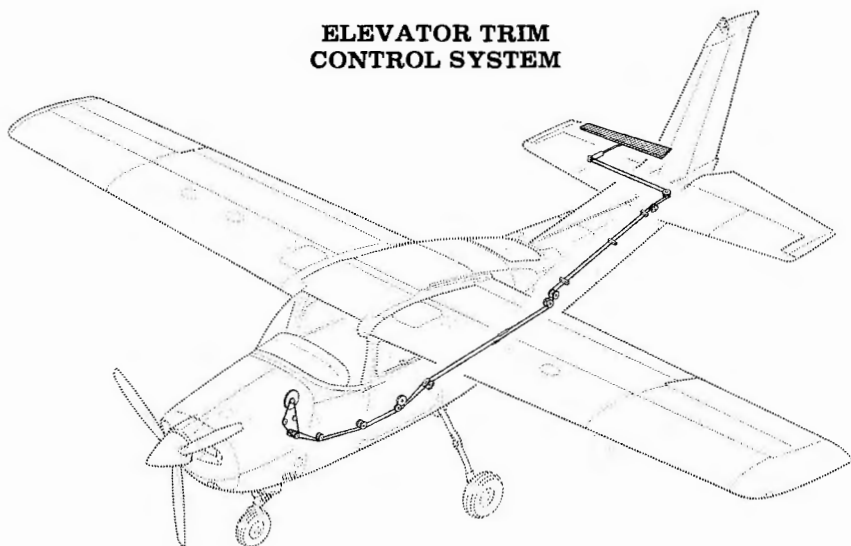


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

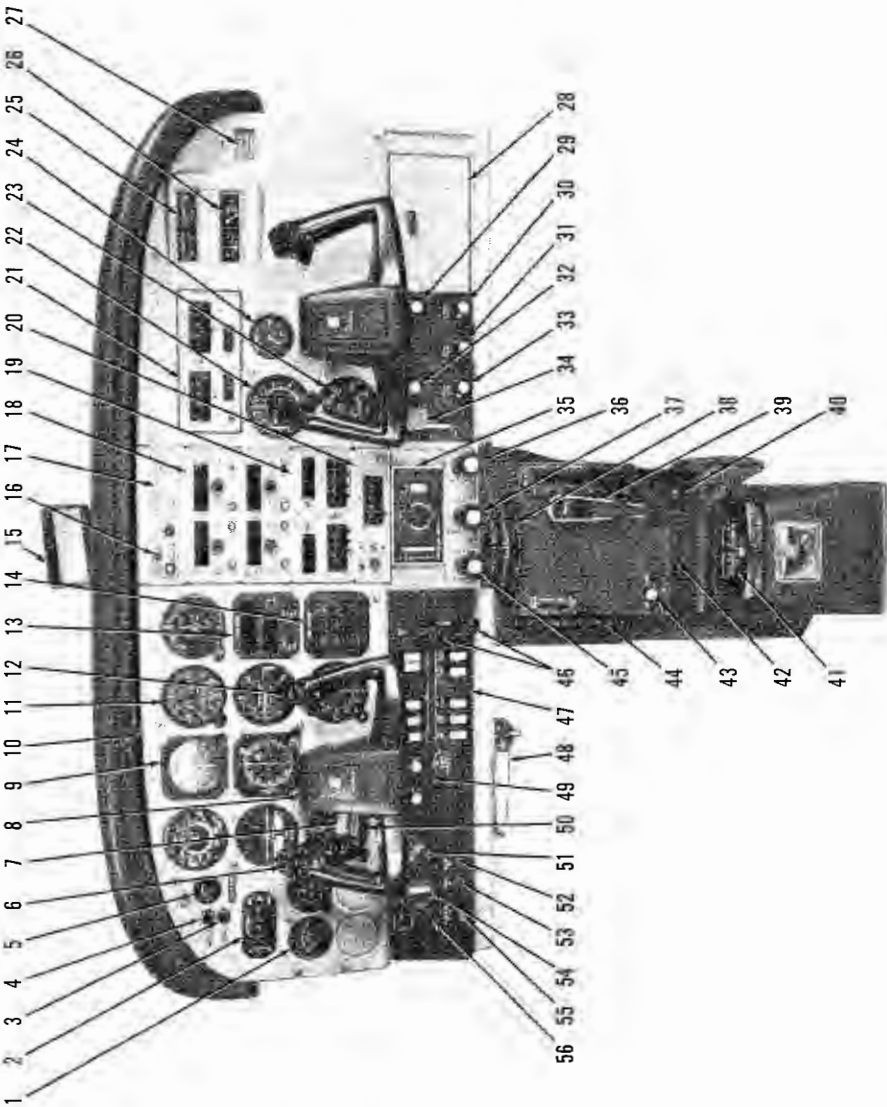


Figure 7-2. Instrument Panel (Sheet 1 of 2)

1. 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)

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

FLIGHT CONTROLS

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

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

TRIM SYSTEMS

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

INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and arranged vertically. The airspeed indicator and altimeter are located to the left and right of the gyros respectively. The remainder of the flight instruments are located around the basic "T". Avionics equipment is stacked approximately on the center line of the panel, with the right side of

the panel containing the manifold pressure/fuel flow indicator, tachometer, map compartment, and space for additional instruments and avionics equipment. The engine instrument cluster, and suction gage are on the right side of the avionics stack near the top of the panel. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches and controls necessary to operate the airplane. The left side of the panel contains the master switch, auxiliary fuel pump switch, ignition switch, light intensity controls, electrical switches, landing gear lever and indicator lights, and static pressure alternate source valve control knob. The center area contains the throttle, propeller control, and mixture control. The right side of the panel contains the wing flap switch lever and indicator, cabin heat control knob, cabin air control knob, defroster control knob, auxiliary cabin air control knob and the cigar lighter. A pedestal, extending from the edge of the switch and control panel to the floorboard, contains the elevator and rudder trim control wheels, cowl flap control lever, engine primer and microphone bracket. The fuel selector valve handle is located at the base of the pedestal with the fuel quantity indicators immediately forward of the handle. A parking brake handle is mounted under the switch and control panel in front of the pilot. All circuit breakers for general electrical equipment and avionics are mounted in a circuit breaker panel located on the left cabin sidewall adjacent to the pilot's seat.

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

GROUND CONTROL

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

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

The minimum turning radius of the airplane, using differential

braking and nose wheel steering during taxi, is approximately 26 feet.

WING FLAP SYSTEM

The wing flaps are of the large span, single-slot type (see figure 7-3), and are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slotted panel that provides mechanical stops at the 10° and 20° positions. For flap settings greater than 10°, move the switch lever to the right to clear the stop and position it as desired. A scale and pointer on the left side of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by an 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 7-8). The power pack assembly is housed within the control pedestal. Hydraulic system fluid level may be checked by utilizing the dipstick/filler cap, on the power pack, behind a snap-out cover panel on the right side of the control pedestal. The system should be checked at 25-hour intervals. If the fluid level is at or below the ADD line on the dipstick, hydraulic fluid (MIL-H-5606) should be added.

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 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 practice manual extension is completed, push the circuit breaker in to restore normal gear operation.

LANDING GEAR WARNING SYSTEM

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

When the throttle is retarded below approximately 15 inches of manifold pressure (master switch on), the throttle linkage will actuate a switch which is electrically connected to the gear warning portion of a dual warning unit. If the landing gear is retracted (or not down and locked), an intermittent tone will be heard on the airplane speaker. The system may be checked for correct operation before flight by retarding the throttle to idle and depressing the green gear-down position indicator light half way in. With the indicator light depressed as described, an intermittent tone

should be heard on the airplane speaker.

RETRACTABLE CABIN ENTRY STEP

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

BAGGAGE COMPARTMENT

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

SEATS

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

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

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

The aft passenger's seats consist of a fixed position one-piece seat bottom and a one-piece fold-down seat back. If the 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 HARNESSSES

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

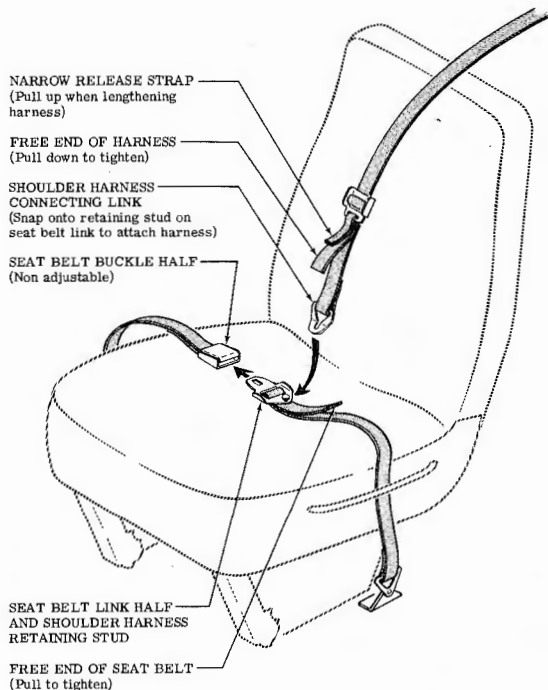
The seat belts used with the pilot, front passenger, and center passenger seats are attached to fittings on the floorboard. The buckle half is inboard of each seat and the link half is outboard of each seat. The belts for the aft seat are attached to the seat frame, with the link halves on the left and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

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CESSNA
MODEL T210M

**STANDARD SHOULDER
 HARNESS**



(PILOT'S SEAT SHOWN)

**SEAT BELT/SHOULDER
 HARNESS WITH INERTIA
 REEL**

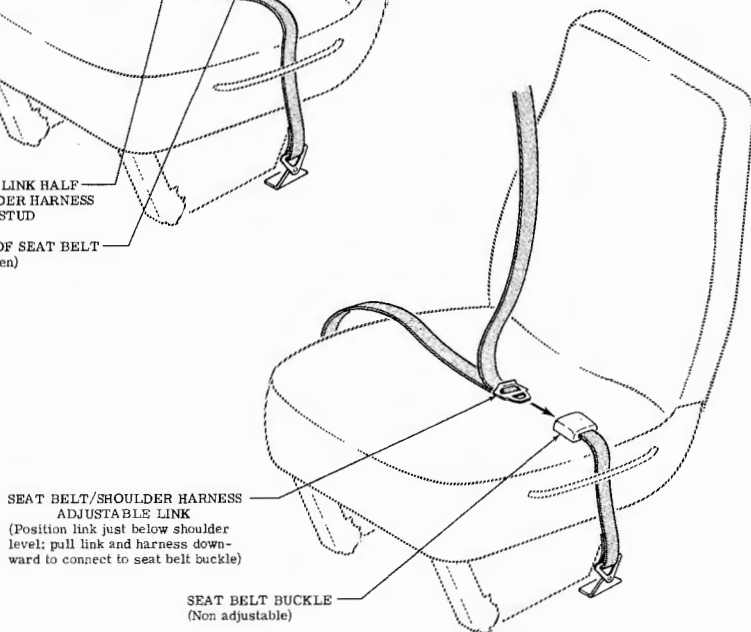


Figure 7-4. Seat Belts and Shoulder Harnesses

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.

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 entry door is equipped with an openable window which is held in the closed position by a detent-equipped latch on the lower edge of the window frame. To open the window, rotate the latch upward. The window is equipped with a spring-loaded retaining arm which will help rotate the window outward and hold it there. An openable window is also available for the right door, and functions in the same manner as the left window. If required, either window may be opened at any speed up to 195 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, turbocharged, air-cooled, fuel injection engine with a wet sump oil system. The engine is a Continental Model TSIO-520-R and is rated at 310 horsepower at 2700 RPM and 36.5 inches of manifold pressure for five minutes, and at 285 horsepower at 2600 RPM and 35 inches of manifold pressure continuous. Major accessories include a propeller governor on the front of the engine and dual magnetos, starter, belt-driven alternator, and full flow oil filter on the rear of the engine. Other major accessories include a turbocharger, connected to the induction air and exhaust systems, and associated components. Provisions are also made for a vacuum pump.

ENGINE CONTROLS

Engine manifold pressure is controlled by a throttle located on the lower center portion of the instrument panel. The throttle operates in a conventional manner; in the full forward position, the throttle is open, and in the full aft position, it is closed. A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it. The throttle linkage is designed to mechanically actuate a microswitch electrically connected to the landing gear warning system. The switch will cause a warning tone to sound anytime the throttle is retarded with the landing gear retracted, with less than approximately 15 inches of manifold pressure.

The mixture control, mounted above the right corner of the control pedestal, is a red knob with raised points around the circumference and is

equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cut-off position. For small adjustments, the control may be moved forward by rotating the knob clockwise, and aft by rotating the knob counterclockwise. For rapid or large adjustments, the knob may be moved forward or aft by depressing the lock button in the end of the control, and then positioning the control as desired.

ENGINE INSTRUMENTS

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

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

Oil temperature is indicated by a gage adjacent to the oil pressure gage. The gage is operated by an electrical-resistance type temperature sensor which receives power from the airplane electrical system. 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 2500 RPM, a five minute maximum power range (yellow arc) of 2600 to 2700 RPM, and a maximum (red line) of 2700 RPM.

The manifold pressure gage is the left half of a dual-indicating instrument mounted above the tachometer. The gage is direct reading and indicates induction air manifold pressure in inches of mercury. It has a normal operating range (green arc) of 15 to 30 inches of mercury, a five minute maximum power range (yellow arc) of 35 to 36.5 inches of mercury,

and a maximum (red line) of 36.5 inches of mercury.

The fuel flow indicator is the right half of a dual-indicating instrument mounted above the tachometer. The indicator is a fuel pressure gage calibrated to indicate the approximate pounds per hour of fuel being metered to the engine. The normal cruise range (green arc) is from 36 to 120 pounds per hour, the normal climb range (white arc) is from 120 to 162 pounds per hour, the minimum (red line) is 3.0 PSI, and the maximum (red line) is 186 pounds per hour (19.5 PSI).

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

NEW ENGINE BREAK-IN AND OPERATION

The engine underwent a run-in at the factory and is ready for the full range of use. It is, however, suggested that cruising be accomplished at 70% to 80% power until a total of 50 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the rings.

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

ENGINE OIL SYSTEM

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

bypass the filter in the event the filter becomes plugged, or the oil temperature is extremely cold.

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

IGNITION-STARTER SYSTEM

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

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

AIR INDUCTION SYSTEM

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

compressed. The pressurized air is then ducted through a fuel/air control unit and induction manifold to the cylinders.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies into an exhaust manifold which discharges the gas into the turbine section of the turbocharger. After the exhaust gas has passed through the turbine, it is vented overboard through a tailpipe. A waste gate is incorporated into the exhaust manifold, and controls the amount of exhaust gas to the turbine by venting excess gas to the tailpipe through a bypass. A shroud, attached to the left side of the exhaust manifold, forms a heating chamber for cabin heater and windshield defrost air.

FUEL INJECTION SYSTEM

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

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

COOLING SYSTEM

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

TURBOCHARGING SYSTEM

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

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

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

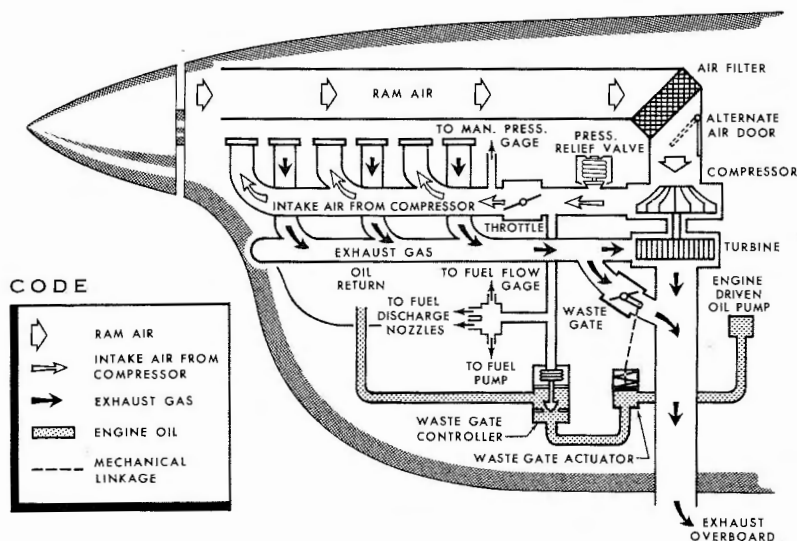


Figure 7-5. Turbocharger System

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

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

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

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

MANIFOLD PRESSURE VARIATION WITH ENGINE RPM

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

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

MANIFOLD PRESSURE VARIATION WITH ALTITUDE

At full throttle, the turbocharger has the capability of maintaining the

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

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

MANIFOLD PRESSURE VARIATION WITH AIRSPEED

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

FUEL FLOW VARIATIONS WITH CHANGES IN MANIFOLD PRESSURE

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

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

MANIFOLD PRESSURE VARIATION WITH INCREASING OR DECREASING FUEL FLOW

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

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

MOMENTARY OVERSHOOT OF MANIFOLD PRESSURE

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

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

ALTITUDE OPERATION

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

HIGH ALTITUDE ENGINE ACCELERATION

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

PROPELLER

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

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

FUEL SYSTEM

The fuel system (see figure 7-7) 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

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

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.

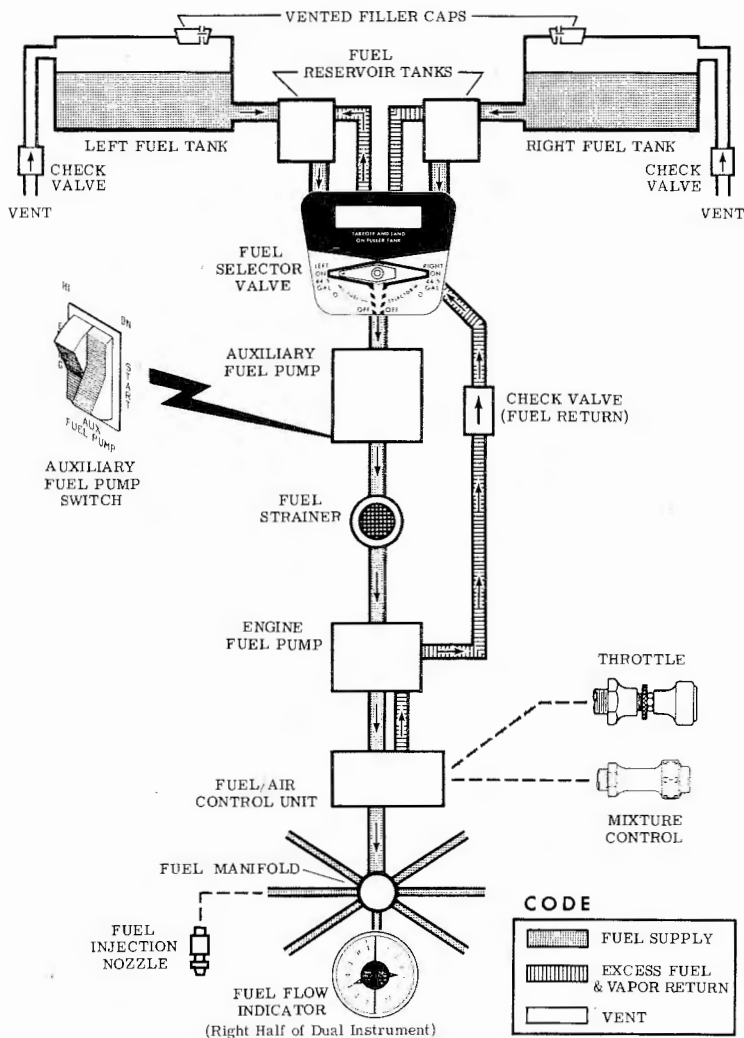


Figure 7-7. Fuel System

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

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

NOTE

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

NOTE

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

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

to the ON position. When the spring-loaded left half of the switch is released, the right half will remain in the ON position until manually returned to the off position.

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

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

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

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

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before the first flight of every day and after each refueling, by using the sampler cup provided to drain fuel from the wing tank sumps, and by utilizing the fuel strainer drain under an access

panel on the left side of the engine cowling. Quick-drain valves are also provided for the fuel reservoir tanks. The valves are located under plug buttons in the belly skin of the airplane, and are used to facilitate purging of the fuel system in the event water is discovered during the preflight fuel system inspection. The fuel tanks should be filled after each flight to prevent condensation.

HYDRAULIC SYSTEM

Hydraulic power (see figure 7-8) is supplied by an electrically-driven hydraulic power pack located behind the control pedestal. The power pack's only function is to supply hydraulic power for operation of the retractable landing gear. This is accomplished by applying hydraulic pressure to actuator cylinders which 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

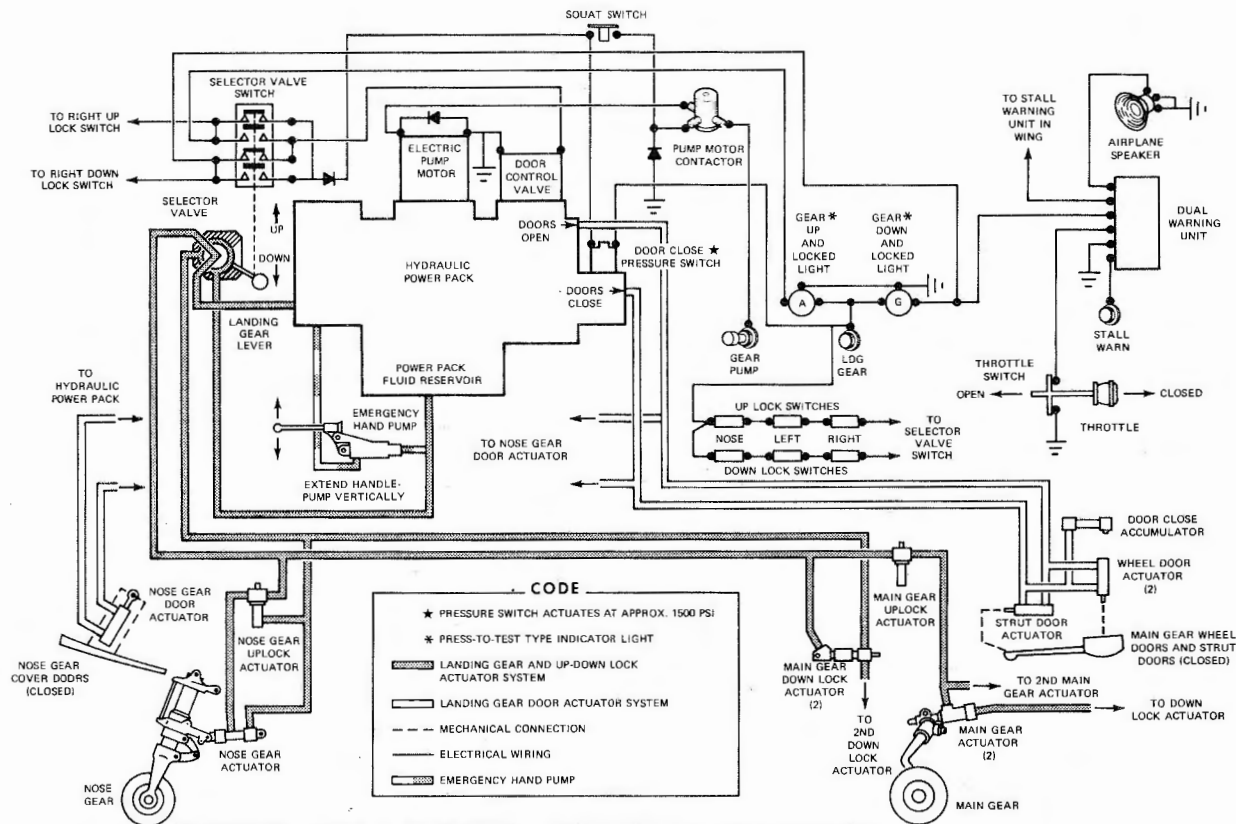


Figure 7-8. Hydraulic System

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

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

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

ELECTRICAL SYSTEM

Electrical energy (see figure 7-9) is supplied by a 28-volt, direct-current system powered by an engine-driven, 60-amp (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 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 simultane-

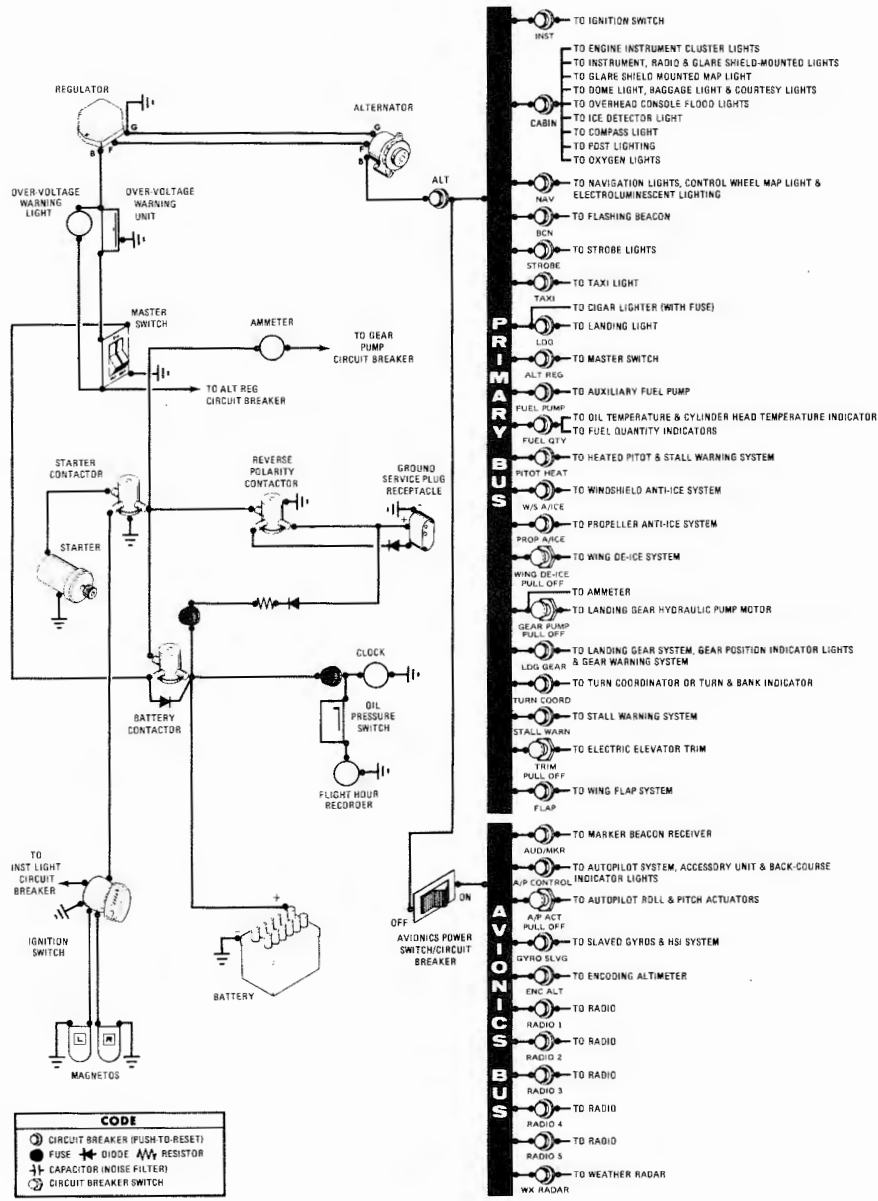


Figure 7-9. Electrical System

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

AVIONICS POWER SWITCH

Electrical power from the airplane primary bus to the avionics bus (see figure 7-9) is controlled by a rocker-type circuit breaker-switch labeled AVN PWR. The switch is located on the left sidewall circuit breaker panel and is ON in the forward position and OFF in the aft position. With the switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch or the individual equipment switches. The avionics power switch also functions as a circuit breaker. If an electrical malfunction should occur and cause the circuit breaker to open, electrical power to the avionics equipment will be interrupted and the switch will automatically move to the OFF position. If this occurs, allow the circuit breaker 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 alter-

nator. 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 cart) for cold weather starting and during lengthy maintenance work on the airplane electrical system. The receptacle is located under a cover plate, on the lower left side of the cowl.

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 turned off when taxiing in the vicinity of other airplanes, or during night flight through clouds, fog or haze.

INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood and integral lighting, with 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.

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

CESSNA
MODEL T210M

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 7-10). When partial cabin heat is desired, blending warm and cold air will result in improved ventilation and heat distribution throughout the cabin. Additional outside air for summer ventilation is provided through the heat and vent system by operation of the push-pull AUX CABIN AIR knob. All three control knobs are the double button type with locks to permit intermediate settings.

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

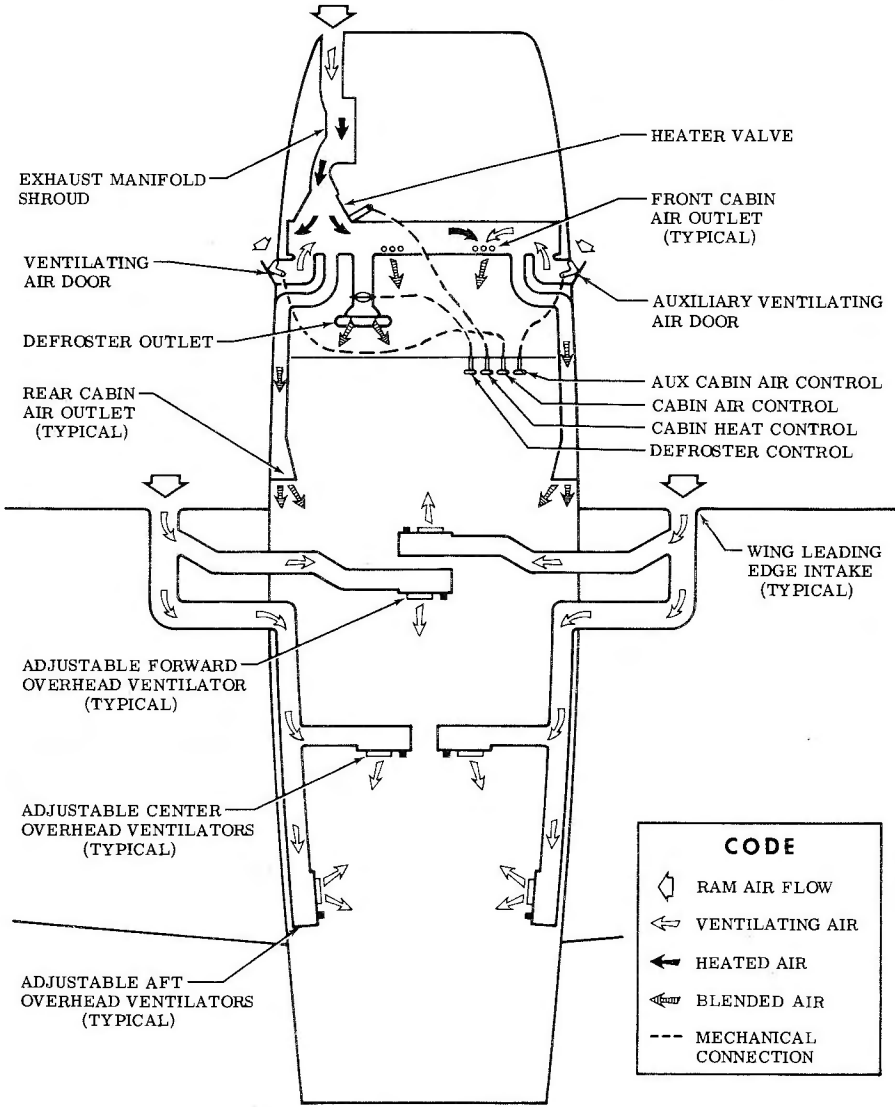


Figure 7-10. Cabin Heating, Ventilating, and Defrosting System

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.

OXYGEN SYSTEM

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

PITOT-STATIC SYSTEM AND INSTRUMENTS

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

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

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

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

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

AIRSPPEED 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 165 knots), yellow arc (165 to 195 knots), and a red line (195 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 7-11) is available and

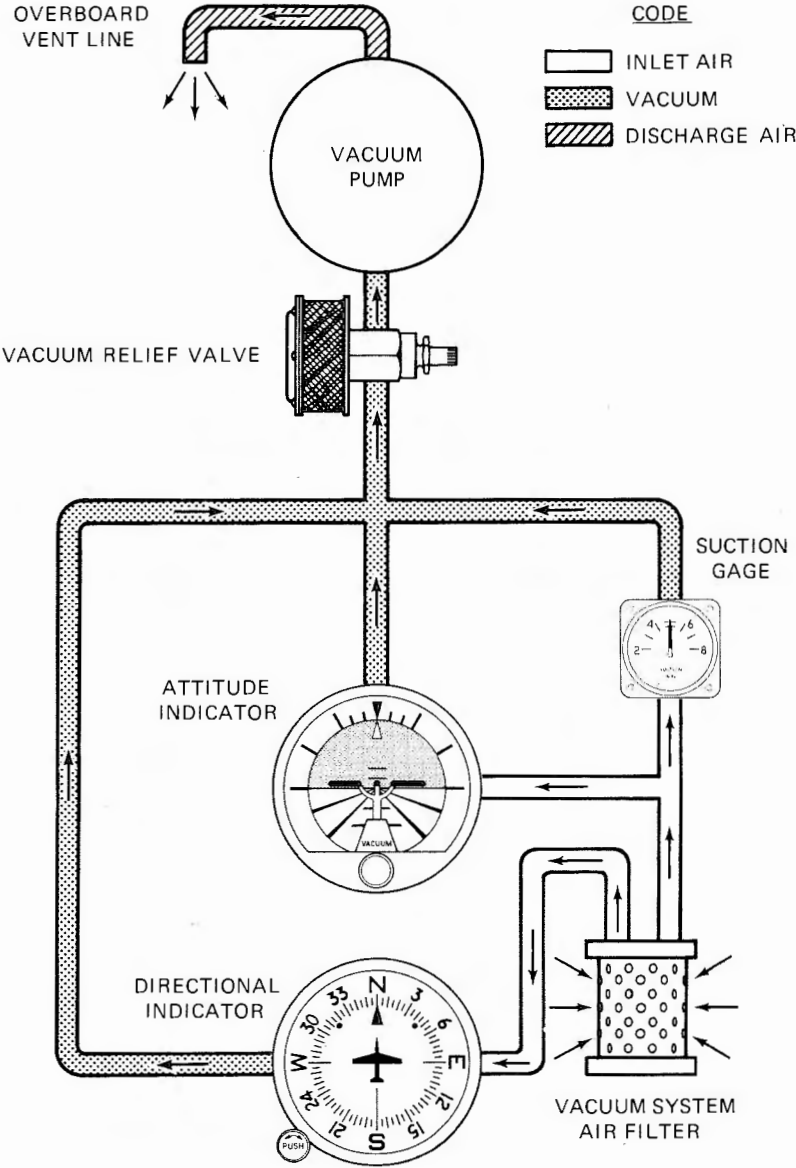


Figure 7-11. Vacuum System

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

SUCTION GAGE

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

STALL WARNING SYSTEM

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

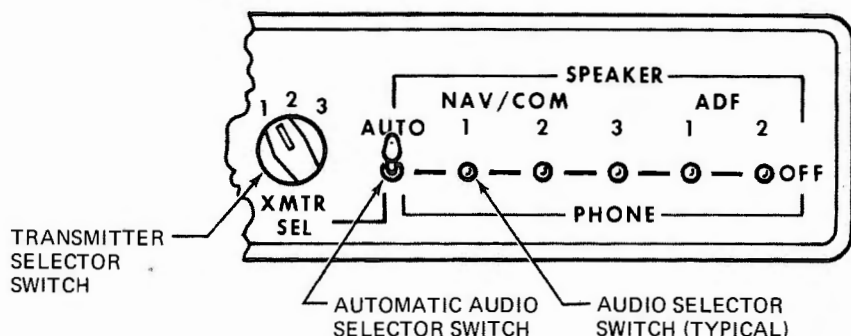
Operation of radio equipment is covered in Section 9 of this handbook. When one or more radios are installed, a transmitter/audio switching system is provided (see figure 7-12). The operation of this switching system is described in the following paragraphs.

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.

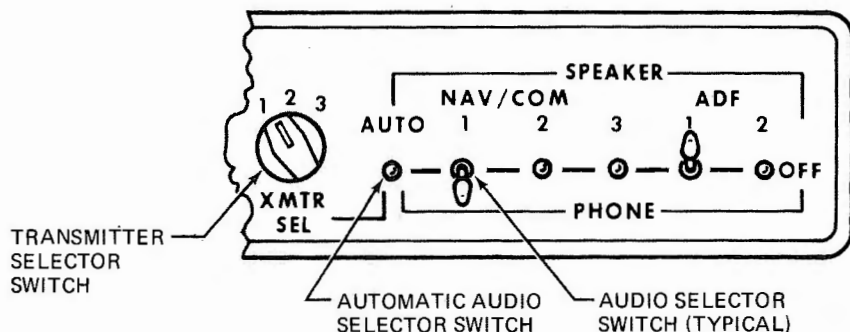
The audio amplifier in the NAV/COM radio is required for speaker and transmitter operation. The amplifier is automatically selected, along with the transmitter, by the transmitter selector switch. As an example, if the number 1 transmitter is selected, the audio amplifier in the associated NAV/COM receiver 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 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 7-12. Audio Control Panel

AUTOMATIC AUDIO SELECTOR SWITCH

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

NOTE

Cessna radios are equipped with sidetone capability (monitoring of the operator's own voice transmission). Sidetone will be heard on either the airplane speaker or a headset as selected with the AUTO selector switch. Sidetone may be eliminated by placing the AUTO selector switch in the OFF position, and utilizing the individual radio selector switches.

AUDIO SELECTOR SWITCHES

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

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

NOTE

If the NAV/COM audio selector switch corresponding to

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

MICROPHONE-HEADSET

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

STATIC DISCHARGERS

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

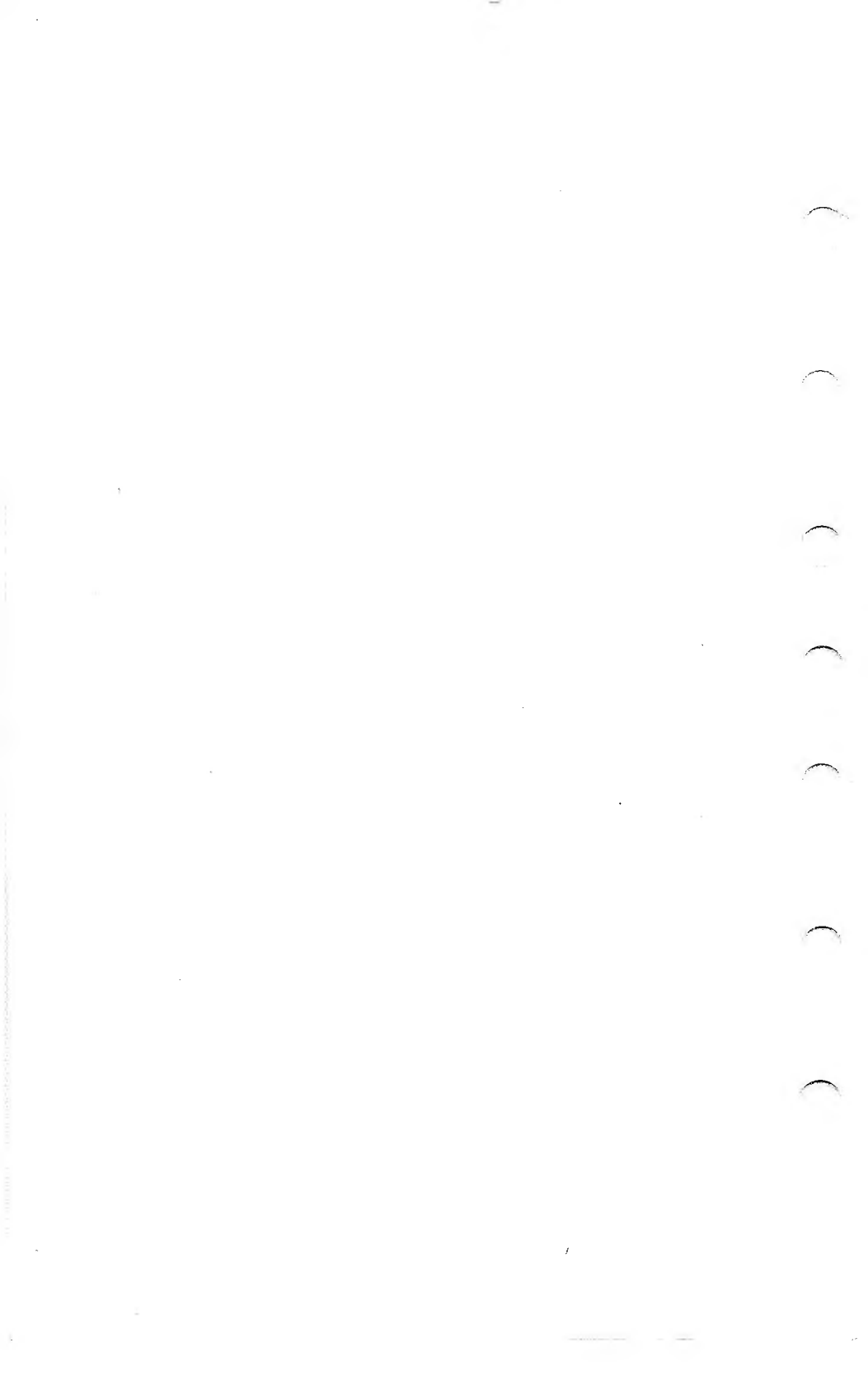
Installation of static dischargers reduces interference from precipitation static, but it is possible to encounter severe precipitation static conditions which might cause the loss of radio signals, even with static dischargers installed. Whenever possible, avoid known severe precipitation areas to prevent 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

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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

**SECTION 8
HANDLING, SERVICE
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**CESSNA
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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 accumu-

lated moisture may freeze the brakes, or when the brakes are overheated. Close the cowl flaps, install the control wheel lock and chock the wheels. In severe weather and high wind conditions, tie the airplane down as outlined in the following paragraph.

TIE-DOWN

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

1. Set the parking brake and install the control wheel lock.
2. Install a surface control lock over the fin and rudder.
3. Tie sufficiently strong ropes or chains (700 pounds tensile strength) to the wing and tail tie-down fittings and secure each rope or chain to a ramp tie-down.
4. Tie a rope (no chains or cables) to the nose gear 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 and turbocharger controller operation 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 replace filter. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to dispersant oil. Drain the engine oil sump and replace the filter each 50 hours thereafter. The oil change interval may be extended to 100-hour intervals, providing the oil filter is changed at 50-hour intervals. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

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.

CLEANING AND CARE

WINDSHIELD-WINDOWS

The plastic windshield and windows should be cleaned with an aircraft windshield cleaner. Apply the cleaner sparingly with soft cloths, and rub

with moderate pressure until all dirt, oil scum and bug stains are removed. Allow the cleaner to dry, then wipe it off with soft flannel cloths.

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

NOTE

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

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

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

PAINTED SURFACES

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

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

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

When the airplane is parked outside in cold climates and it is necessary

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

PROPELLER CARE

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

LANDING GEAR CARE

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

ENGINE CARE

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

CAUTION

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

INTERIOR CARE

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

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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)

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Introduction

Supplements:

Emergency Locator Transmitter (ELT)	(4 pages)
Electric Elevator Trim System	(2 pages)
Oxygen System	(6 pages)
Wing And Stabilizer De-Ice System	(4 pages)
Propeller Anti-Ice System	(2 pages)
Windshield Anti-Ice System	(2 pages)
Cessna 300 Nav/Com (Type RT-385A)	(8 pages)
Cessna 300 Nav/Com (Type RT-385A) With Cessna 400 Area Navigation (Type RN-478A)	(8 pages)
Cessna 300 ADF (Type R-546E)	(6 pages)
HF Transceiver (Type PT10-A)	(4 pages)
SSB HF Transceiver (Type ASB-125)	(4 pages)
Cessna 400 Nav/Com (Type RT-485A)	(10 pages)
Cessna 400 Nav/Com (Type RT-485A) With Cessna 400 Area Navigation (Type RN-478A)	(10 pages)
Cessna 400 Area Navigation (Type RN-478A)	(6 pages)
Cessna 400 ADF (Type R-446A)	(6 pages)
Cessna 400 DME (Type R-476A)	(4 pages)
Cessna 400 Marker Beacon (Type R-402A)	(4 pages)
Cessna 400 Transponder (Type RT-459A) And Optional Encoding Altimeter (Type EA-401A)	(6 pages)
Cessna 400 Glide Slope (Type R-443B)	(4 pages)
Cessna Horizontal Situation Indicator (Type IG-832C)	(6 pages)
Cessna Horizontal Situation Indicator (Type IG-832A)	(6 pages)
Cessna 800 Altitude Encoder/Alert/Pre Sel (Type AA-801A) With Encoding Altimeter (Type EA-801A)	(8 pages)
Cessna 200A Navomatic Autopilot (Type AF-295B)	(6 pages)
Cessna 300A Navomatic Autopilot (Type AF-395A)	(6 pages)
Cessna 400 Navomatic Autopilot (Type AF-420A)	(8 pages)
Cessna 400B Navomatic Autopilot (Type AF-550A)	(14 pages)

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Cessna 400B Integrated Flight Control System
 (Type IF-550A) (18 pages)
Weather Radar (Type RDR-160) (10 pages)
AM-FM Stereo (8 pages)

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.

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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

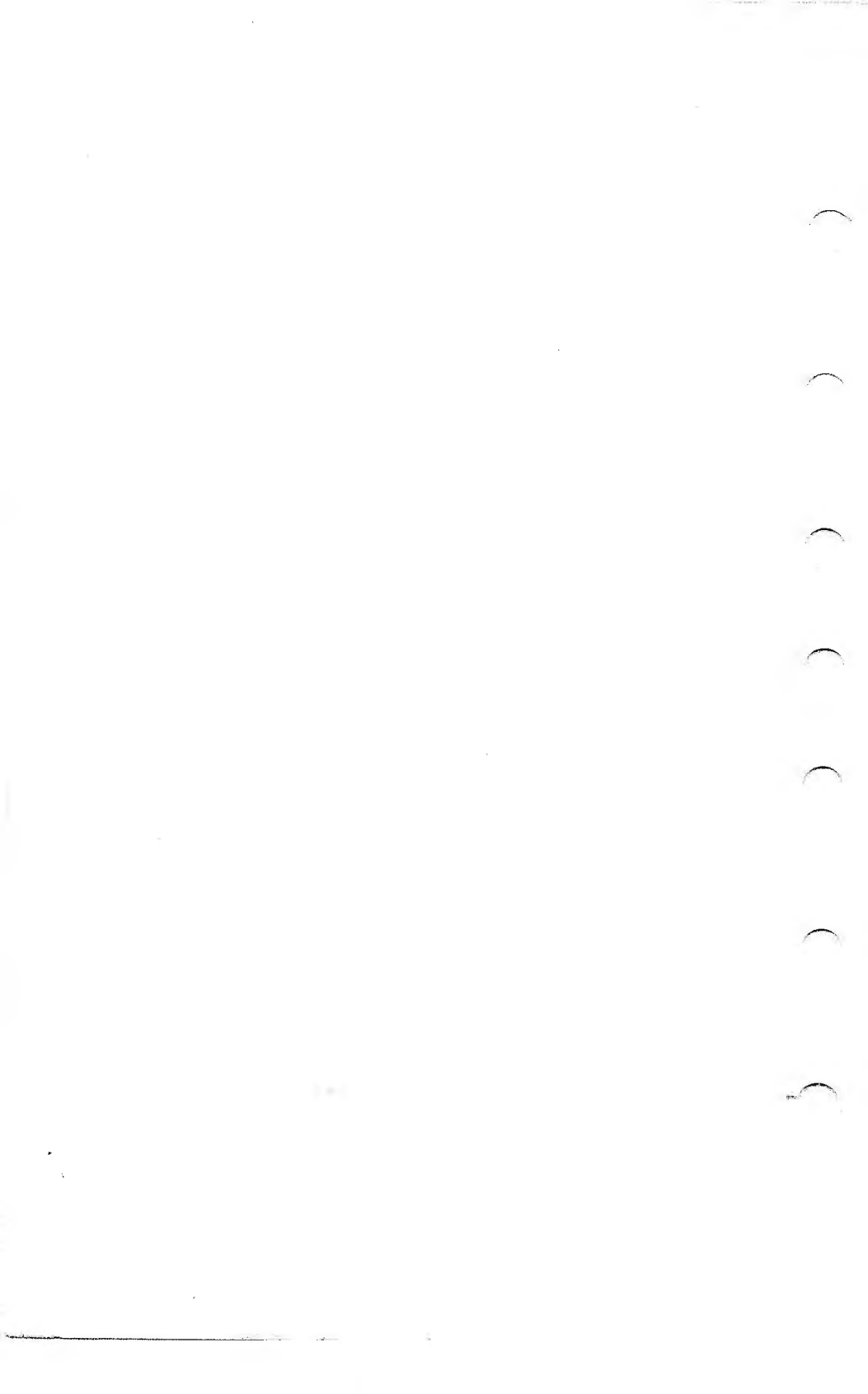
As long as the function selector switch remains in the AUTO position, the ELT automatically activates following an impact of 5g or more over a short period of time.

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 switch 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 T210)

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 at 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 T210)

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 doorpost under a round cover plate. Cylinder pressure is indicated by a pressure gage located in the overhead console above the pilot's 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 a red band adjacent to the plug-in fitting. The passenger hoses are color-coded with an orange 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's 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 a properly filled cylinders. Fill to pressures indicated on the table below for ambient temperatures.

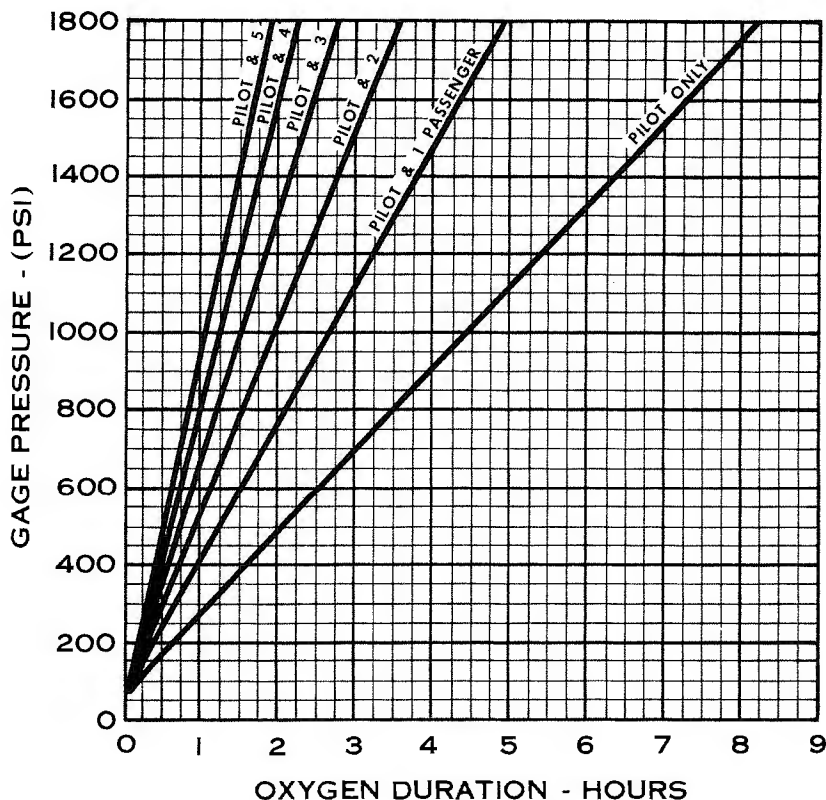
WARNING

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 a red color-coded oxygen line fitting and passengers with orange 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, 1400 PSI of pressure will safely sustain the pilot only for 6 hours and 20 minutes. The same pressure will sustain the pilot and three passengers for approximately 2 hours and 10 minutes.

NOTE

The Oxygen Duration Chart is based on a standard configuration oxygen system having one red color-coded hose assembly for the pilot and orange color-coded hoses for the passengers. If red 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.

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SUPPLEMENT

WING AND STABILIZER DE-ICE SYSTEM (MODEL T210)

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 consist 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 produces 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.

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SUPPLEMENT

PROPELLER ANTI-ICE SYSTEM (MODEL T210)

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 T210)

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 co-pilot'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

This 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

Inadvertent 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

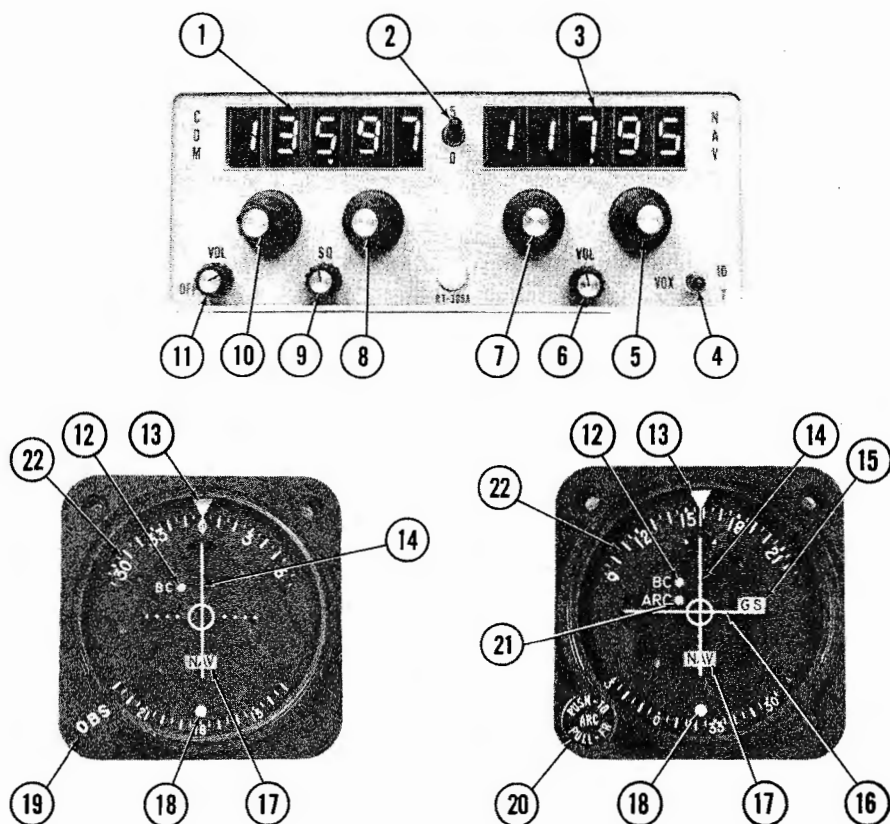
The Cessna 300 Nav/Com (Type RT-385A), shown in figure 1, consists of a panel-mounted receiver-transmitter and a single or dual-pointer remote course deviation indicator.

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

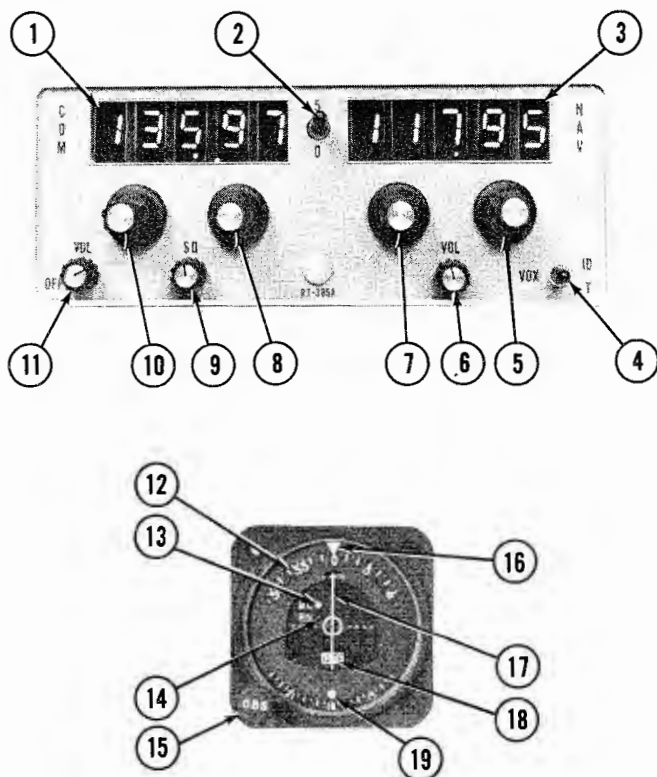
CESSNA 400 AREA NAVIGATION SYSTEM (Type RN-478A)

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 avionics 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 avionics 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

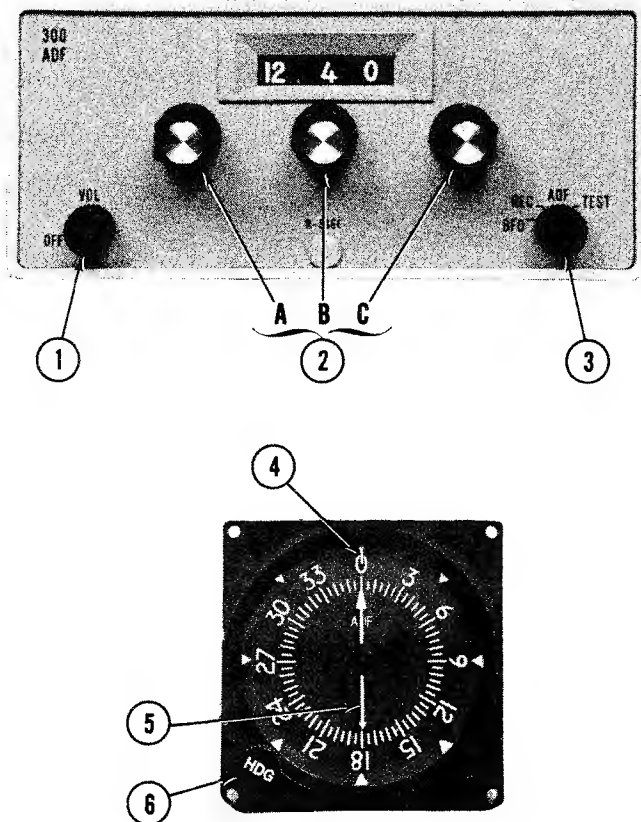
The Cessna 300 ADF is a panel-mounted, digitally tuned automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1,699 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, loop antenna, bearing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

HF TRANSCEIVER

(TYPE PT10-A)

SECTION 1

GENERAL

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

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

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

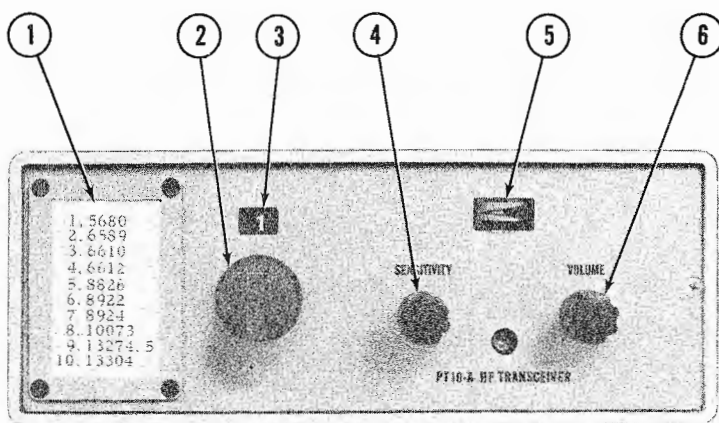
The meter on the face of the transceiver indicates transmitter output.

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

SECTION 2

LIMITATIONS

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



1. **FREQUENCY CHART** - Shows the frequency of the channel in use (frequencies shown may vary and are shown for reference purposes only).
2. **CHANNEL SELECTOR** - Selects channels 1 thru 10 as listed in the frequency chart.
3. **CHANNEL READOUT WINDOW** - Displays channel selected in frequency chart.
4. **SENSITIVITY CONTROL** - Controls the receiver sensitivity for audio gain.
5. **ANTENNA TUNING METER** - Indicates the energy flowing from the transmitter into the antenna. The optimum power transfer is indicated by the maximum meter reading.
6. **ON/OFF VOLUME CONTROL** - Turns complete set on and controls volume of audio.

Figure 1. HF Transceiver (Type PT10-A)

SECTION 3

EMERGENCY PROCEDURES

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

SECTION 4

NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

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

NOTE

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

NOTE

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

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

NOTE

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

- b. To Receive -- RELEASE mike button.

SECTION 5

PERFORMANCE

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

SUPPLEMENT

SSB HF TRANSCEIVER

(TYPE ASB-125)

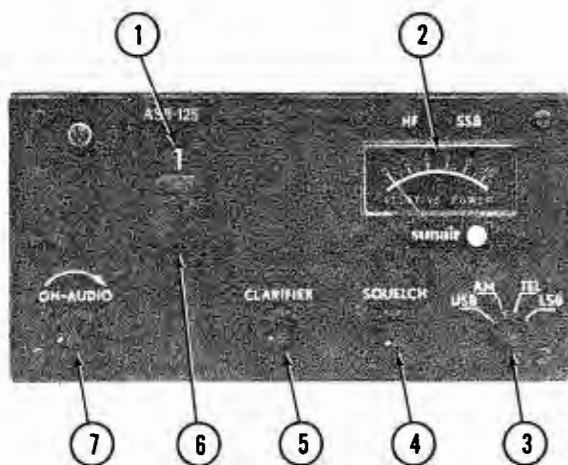
SECTION 1

GENERAL

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

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

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



1. CHANNEL WINDOW - Displays selected channel.
2. RELATIVE POWER METER - Indicates relative radiated power of the power amplifier/antenna system.
3. MODE SELECTOR CONTROL - Selects one of the desired operating modes:
 - USB - Selects upper sideband operation for long range voice communications.
 - AM - Selects compatible AM operation and full AM reception.
 - TEL - Selects upper sideband with reduced carrier, used for public correspondence telephone and ship-to-shore.
 - LSB - (Optional) Selects lower sideband operation (not legal in U.S., Canada and most other countries).
4. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
5. CLARIFIER CONTROL - Used to "clarify" single sideband speech during receive while in USB mode only.
6. CHANNEL SELECTOR CONTROL - Selects desired channel. Also selects AM mode if channel frequency is 2003 kHz, 2182 kHz or 2638 kHz.
7. ON - AUDIO CONTROL - Turns set ON and controls receiver audio gain.

Figure 1. SSB HF Transceiver Operating Controls

SECTION 2

LIMITATIONS

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

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

SECTION 3

EMERGENCY PROCEDURES

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

SECTION 4

NORMAL PROCEDURES

COMMUNICATIONS TRANSCEIVER OPERATION:

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

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

NOTE

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

- b. To Receive -- RELEASE mike button.

NOTE

Voice communications are not available in the LSB mode.

NOTE

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

SECTION 5 PERFORMANCE

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

SUPPLEMENT

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

SECTION 1 GENERAL

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

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

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

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

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

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

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

SECTION 2

LIMITATIONS

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

SECTION 3

EMERGENCY PROCEDURES

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

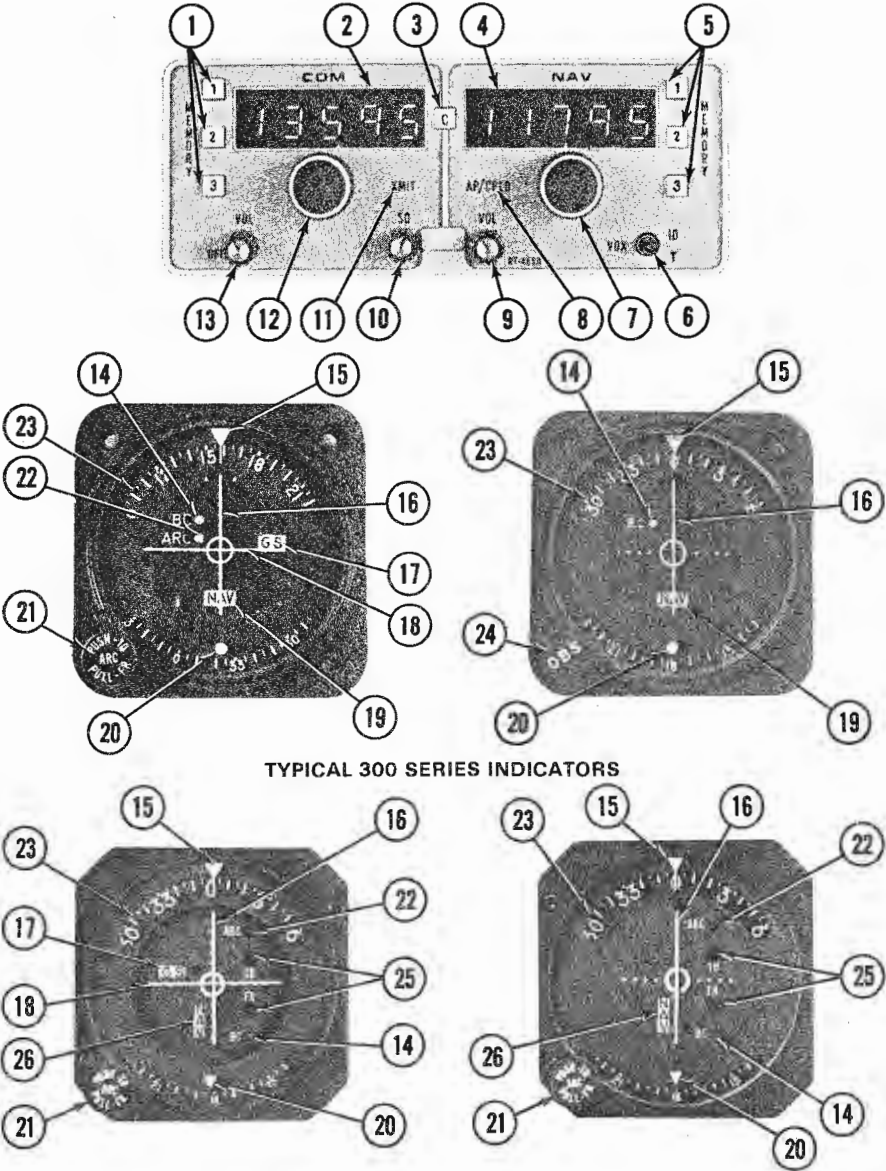


Figure 1. Cessna 400 Nav/Com (Type RT-485A), Operating Controls and Indicators (Sheet 1 of 4)

1. COM MEMORY 1, 2 & 3 PUSHBUTTONS - When a COM MEMORY pushbutton is pressed, the preset selected frequency will appear in the COM frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate COM MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will 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.
2. COMMUNICATION OPERATING FREQUENCY READOUT - Indicates COM frequency in use. Third decimal place not shown.
3. CYCLE BUTTON (C) - Selects last illuminated decimal place on COM frequency in use. If last decimal place is 2 or 7, pressing C pushbutton changes number to 5 or 0, respectively. If last decimal place is 5 or 0, pressing C pushbutton changes number to 7 or 2, respectively. When the last illuminated digit on the set is 2 or 7, the third digit on the set (not shown) will always be 5. When the last illuminated digit on the set is 0 or 5, the third digit on the set (not shown) will always be 0. Also provides test function by holding C pushbutton pressed for more than 1.7 seconds. This lights each COM and NAV MEMORY pushbutton in turn, and displays the corresponding preset frequency in MEMORY.
4. NAVIGATION OPERATING FREQUENCY READOUT - Indicates NAV frequency in use.
5. NAV MEMORY 1, 2 & 3 PUSHBUTTONS - When a NAV MEMORY pushbutton is pressed, the preset selected frequency will appear in the NAV frequency window for use as the selected operating frequency. Each pushbutton will illuminate white when pressed and the light will go out on the previously selected pushbutton. Three preset frequencies may be stored in MEMORY and selected as desired, by merely pressing the appropriate NAV MEMORY pushbutton to recall the desired operating frequency. If electrical power to the set's "keep-alive" circuit has not been interrupted, upon turn-on, the set will automatically recall the last NAV MEMORY frequency selected by the MEMORY pushbutton. If electrical power is removed from the set's "keep-alive" circuit (such as radio removal or battery replacement) for more than 15 seconds, upon turn-on, the NAV MEMORY circuits will have to be reset and NAV 1 MEMORY will automatically be selected with the lowest operating frequency (108.000 MHz) selected.
6. ID-VOX-T SWITCH - In ID position, station identifier signal is audible; in VOX (Voice) position, identifier signal is suppressed; in T (Momentary On) position, the self-test function is selected, and the AP/CPLD annunciator illuminates amber and the XMIT annunciator illuminates green.
7. NAVIGATION RECEIVER FREQUENCY SELECTORS - Outer knob changes NAV frequency in 1-MHz steps between 108 and 117 MHz; inner knob changes NAV frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency and DME channel.

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

8. AUTOPILOT COUPLED ANNUNCIATOR (AP/CPLD) - Illuminates amber when a 400B or 400B IFCS autopilot is coupled to NAV VOR/LOC converter output (non-operational with 200A, 300A, 400, 400A and 400A IFCS autopilots).
9. NAV VOLUME CONTROL (VOL) - Adjusts volume of navigation receiver audio.
10. SQUELCH CONTROL - Used to adjust signal threshold necessary to activate COM receiver audio. Clockwise rotation increases background noise (decreases squelch action); counterclockwise rotation decreases background noise.
11. TRANSMIT ANNUNCIATOR (XMIT) - Illuminates green when transmitter output is normal while mike is keyed.
12. COMMUNICATION RECEIVER FREQUENCY SELECTORS - Outer knob changes COM frequency in 1-MHz steps between 118 and 135 MHz; inner knob changes COM frequency in .05 MHz steps between .025 and .975 MHz or between .000 and .950 MHz depending on selection of C button.
13. COM OFF-VOLUME CONTROL (OFF-VOL) - Combination ON/OFF switch and volume control; turns on Nav/Com set and controls volume of COM receiver audio.
14. BACK-COURSE LAMP (BC) - Amber light illuminates when an autopilot with reverse sense feature is installed and the reverse sense switch or autopilot's back-course function is engaged and receiver is tuned to a localizer frequency; indicates course deviation pointer is reversed.
15. COURSE INDEX - Indicates selected VOR COURSE.
16. COURSE DEVIATION POINTER - Indicates course deviation from selected omni course or localizer centerline.
17. GLIDE SLOPE "GS" FLAG - When visible, red GS flag indicates unreliable glide slope signal or improperly operating equipment. Flag disappears when a reliable glide slope signal is being received.
18. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from ILS glide slope.
19. NAV/TO-FROM INDICATOR - Operates only with a VOR or localizer signal. Red NAV position (Flag) indicates unusable signal. With usable VOR signal, indicates whether selected VOR course is TO or FROM station. With usable localizer signal, shows TO.
20. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
21. AUTOMATIC RADIAL CENTERING (ARC) PUSH-TO/PULL-FR SELECTOR - In center detent, functions as conventional OBS. Pushed to inner (Momentary On) position, rotates OBS course card to center course deviation pointer with a TO flag, then returns to conventional OBS selection. Pulled to outer detent, continuously drives OBS course card to indicate bearing from VOR station, keeping

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

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

NOTE

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

22. AUTOMATIC RADIAL CENTERING (ARC) LAMP - Amber light illuminates when Automatic Radial Centering is in use.
23. COURSE CARD - Indicates selected VOR course under course index.
24. OMNI BEARING SELECTOR (OBS) - Rotates course card to select desired course.
25. TO/FROM INDICATOR (TO/FR) - Operates only with a usable VOR or localizer signal. When white flag is in view, indicates whether selected course is TO or FROM station. With usable localizer signal, shows TO.
26. NAV INDICATOR FLAG - When in view, red NAV position (Flag) indicates the selected VOR or localizer signal is unusable.

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

SECTION 4

NORMAL PROCEDURES

PRESETTING NAV/COM FREQUENCIES IN MEMORY:

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

NOTE

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

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

NOTE

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

COMMUNICATION RECEIVER-TRANSMITTER OPERATION:

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

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

NOTE

Sidetone may be selected by placing the AUTO selector switch (on audio control panel) in either the SPEAKER or PHONE position. 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 (ARC/PUSH-TO) knob to inner (Momentary On) position.

NOTE

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

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

NOTE

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

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

NOTE

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

VOR SELF-TEST OPERATION:

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

NOTE

This test does not fulfill the requirements of FAR 91.25.

MEMORY TEST OPERATION:

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

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

NOTE

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

SECTION 5 PERFORMANCE

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

SUPPLEMENT

CESSNA 400 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.

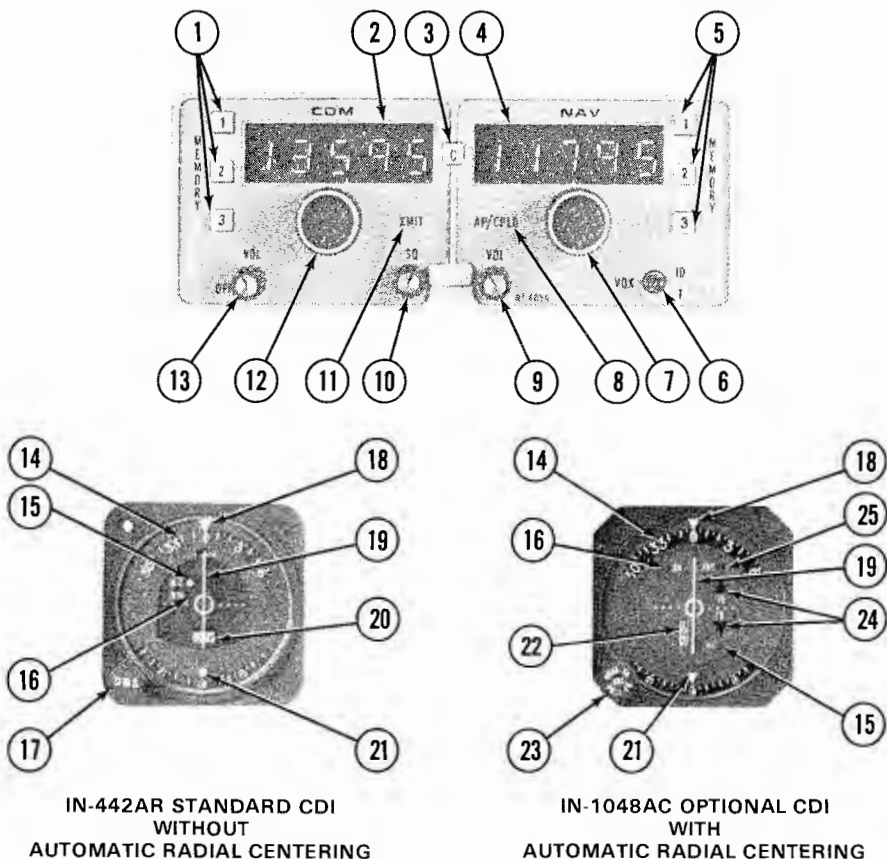
The course indicator includes a Course Deviation Indicator (CDI), an Omni Bearing Selector (OBS) or Automatic Radial Centering (ARC) knob, and OFF (or NAV)/To-From Indicator Flags. It also includes an RNAV lamp (RN) which lights when area navigation operation is selected, and a back-course lamp (BC) 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 avionics 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.



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

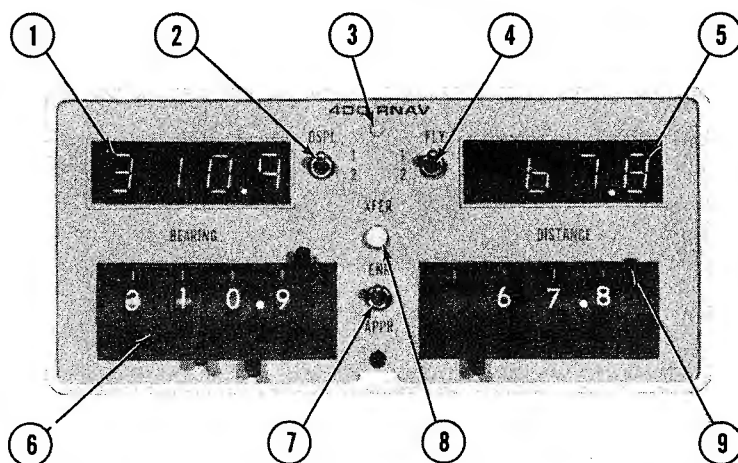
The Cessna 400 Area Navigation System (Type RN-478A) consists of an RN-478A Area NAV Computer (RNAV), a compatible VHF navigation receiver and course deviation indicator, and the Type R-476A distance measuring equipment (DME). The RNAV includes converter circuits which operate with the VHF navigation 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 ($\pm 1-1/4$ 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.

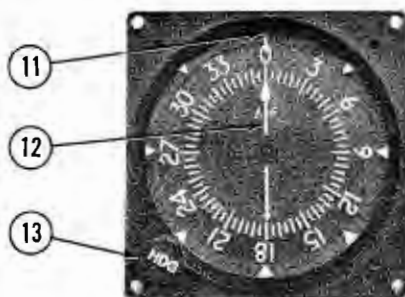
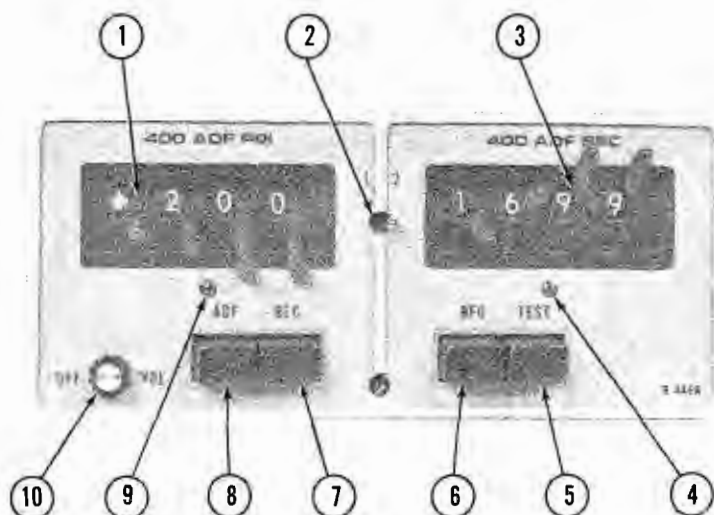


Figure 1. Cessna 400 ADF Operating Controls and Indicator
(Sheet 1 of 2)

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 reliable, 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 until 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

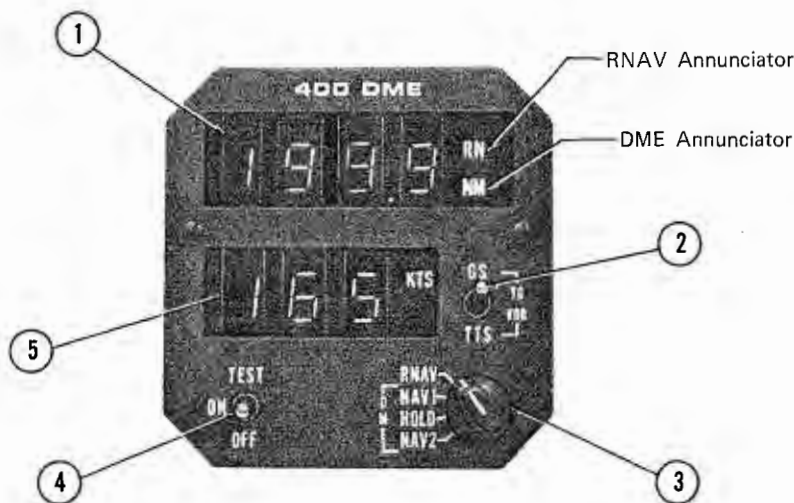
LIMITATIONS

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).

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.

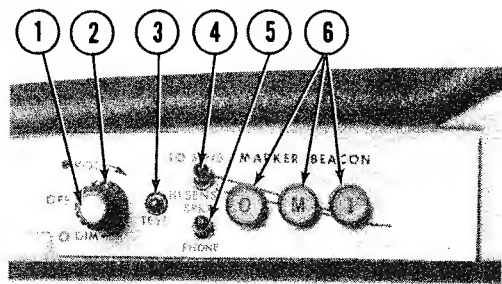
This system provides visual and aural indications of 75 MHz ILS marker beacon signals as the marker is passed. The following table lists the three most currently used marker facilities and their characteristics.

MARKER FACILITIES

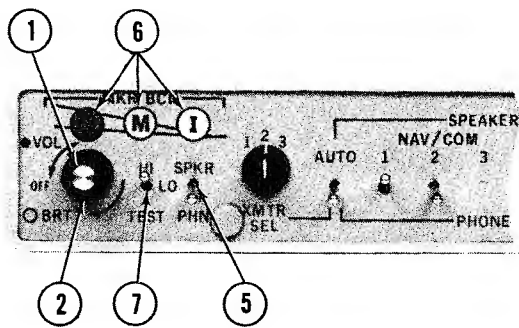
MARKER	IDENTIFYING TONE	LIGHT*
Inner	Continuous 6 dots/sec (300 Hz)	White
Middle	Alternate dots and dashes (1300 Hz)	Amber
Outer	2 dashes/sec (400 Hz)	Blue

* 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)

PILOT'S OPERATING HANDBOOK CESSNA 400 MARKER BEACON
SUPPLEMENT (TYPE R-402A)

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.

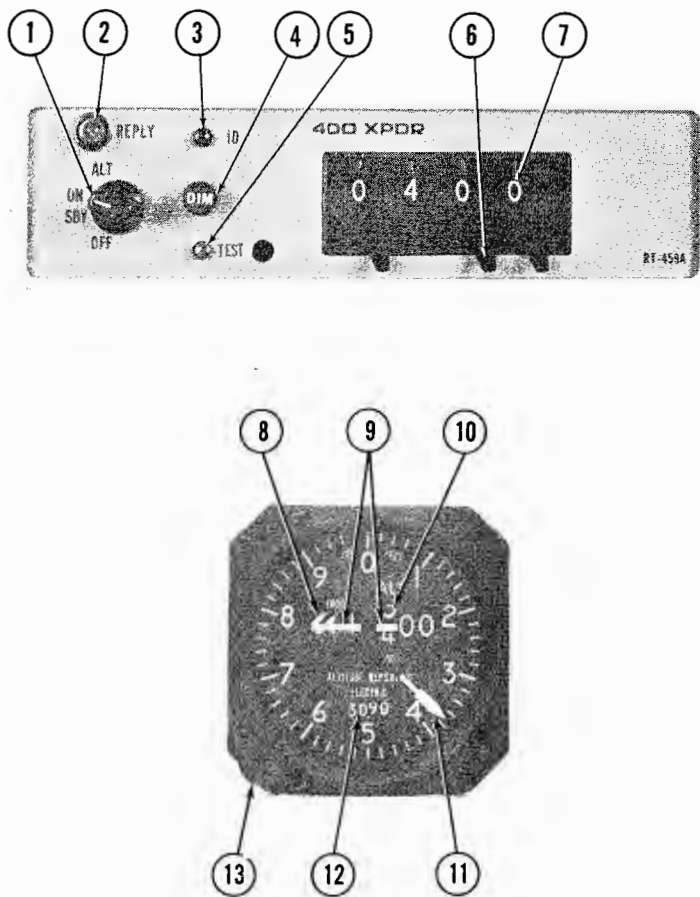


Figure 1. Cessna 400 Transponder and Encoding Altimeter
Operating Controls (Sheet 1 of 2)

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 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.

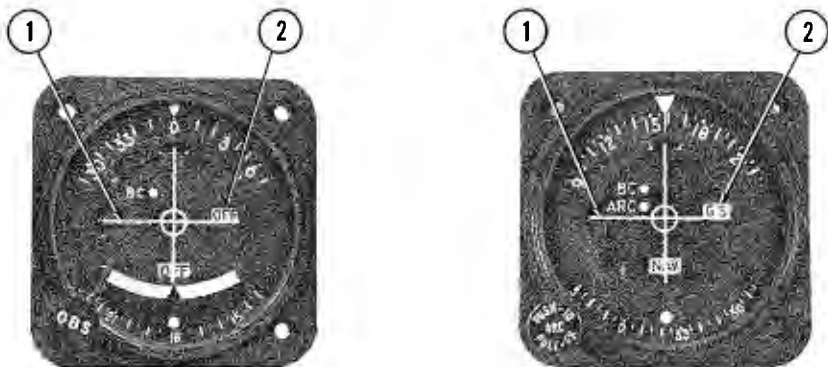
Operation of the Cessna 400 Glide Slope system is controlled by the associated navigation system. The functions and indications of typical 300 series glide slope indicators are pictured and described in Figure 1. The 300 series glide slope indicators shown in Figure 1 depict typical indications for all 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 $\pm$ 100 RPM on airplanes equipped with a two-bladed propeller or 1800 $\pm$ 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 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 red glide slope "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)

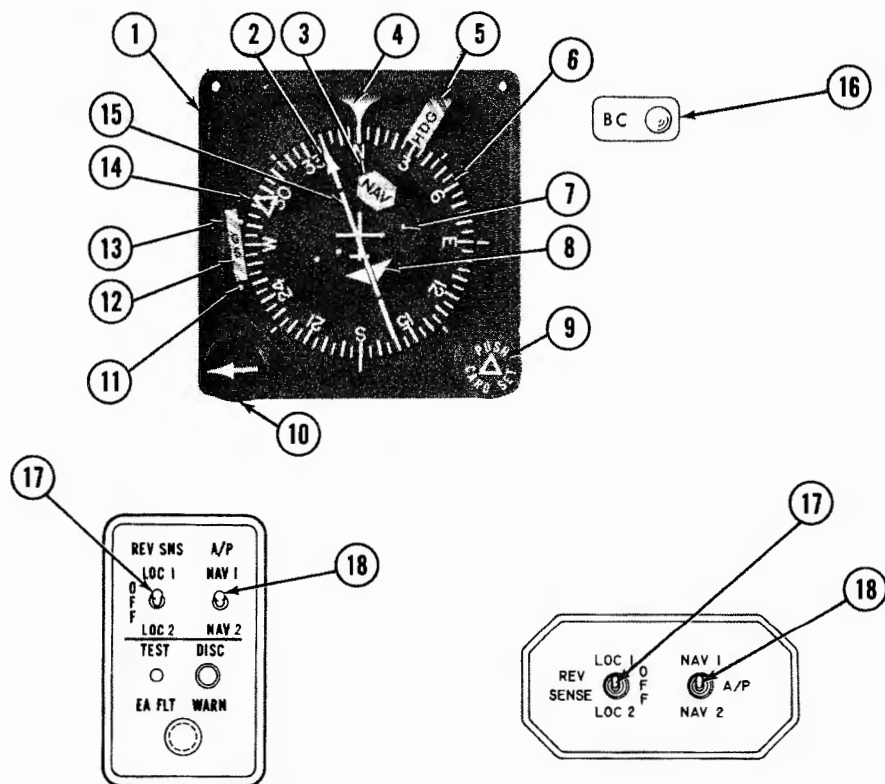
SECTION 1 GENERAL

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 = $\pm 10^\circ$ approx.
 - b. LOC = $\pm 2-1/2^\circ$ approx.
8. TO/FROM INDICATOR FLAG - Indicates direction of VOR station relative to selected course.
9. HEADING SELECTOR AND CARD SET KNOB (PUSH $\blacktriangle$ 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 ($\uparrow$) KNOB - When rotated, positions omni bearing pointer (2) on the compass card (6) to select desired VOR radial or localizer course.
11. GLIDE SLOPE SCALE - Indicates displacement from glide slope beam center. A glide slope deviation bar displacement of 2 dots, represents full scale (0.7°) deviation above or below glide slope beam centerline.
12. GLIDE SLOPE POINTER - Indicates on glide slope scale (11) aircraft displacement from glide slope beam center.
13. GLIDE SLOPE FLAG - When in view, indicates glide slope receiver signal is not reliable.
14. HEADING BUG - Indicates selected reference heading relative to compass card (6).
15. COURSE (OMNI) DEVIATION BAR - Bar is center portion of omni bearing pointer and moves laterally to pictorially indicate relationship of aircraft to selected course. It relates in degrees of angular displacement from VOR radials or localizer beam center (see Item 7).

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

16. BACK-COURSE LIGHT (BC) (Installed in a remote position, as shown, with 300A, 400A and 400B autopilots only.) - The remote amber BC light will illuminate when back-course operation is selected by the REV SNS LOC 1 switch (17) mounted on the left-hand instrument panel or the BC function of 300A autopilot.

CAUTION

When back-course operation is selected, the course (omni) deviation bar (15) on the HSI does not reverse. However, selection of back-course operation will always cause the localizer signal to the autopilot to reverse for back-course operation.

17. BACK COURSE REVERSE SENSE (REV SNS) LOC 1 OR LOC 2 SELECTOR SWITCH - With AP switch ON (on 400A or 400B Autopilot control units) and either LOC 1 or LOC 2 selected, localizer signals to the Cessna 400A or 400B Autopilots will reverse for back-course operation. With autopilot ON or OFF, the course (omni) deviation bar on the HSI will not reverse but the standard CDI pointer will reverse depending on the position of the REV SNS switch.
18. AUTOPILOT (A/P) NAV 1 OR NAV 2 SELECTOR SWITCH - (Installed with 400A and 400B Autopilots only) Selects appropriate signals from the desired navigation receiver to be coupled to the autopilot.

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

SECTION 3

EMERGENCY PROCEDURES

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

SECTION 4

NORMAL PROCEDURES

Normal procedures for operation of this system differ little from those required for the more conventional Course Deviation Indicators. However, several small differences are worth noting.

The rectilinear movement of the omni deviation bar in combination with the rotation of the compass card in response to heading changes, provides an intuitive picture of the navigation situation at a glance when turned to an omni station. When tuned to a localizer frequency, the omni bearing pointer must be set to the inboard front course for both front and back-course approaches to retain this pictorial presentation.

When the HSI system is installed with a Cessna 300A (Type AF-395A), Cessna 400A (Type AF-530A) or Cessna 400B (Type IF-550A) Autopilot, a back-course indicator light labeled BC, is mounted adjacent to the HSI and will illuminate amber when the reverse sense (REV SNS) switch (mounted in the upper portion of the pilot's instrument panel on 337 Models or is mounted in the autopilot's accessory unit on 210 Models) is placed in the ON (LOC 1) position to alert the pilot that back-course operation is selected. The HSI needle will not be reversed but the LOC signals to the autopilot will be. Light dimming for the BC light is provided for low ambient light conditions.

For normal procedures with autopilots, refer to the 300A, 400A and 400B Autopilot Supplements in this handbook if they are listed in this section as options.

SECTION 5

PERFORMANCE

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

SUPPLEMENT

OPTIONAL SLAVED HORIZONTAL SITUATION INDICATOR (HSI) (TYPE IG-832A)

(STANDARD EQUIPMENT ON 400 SERIES IFC SYSTEMS)

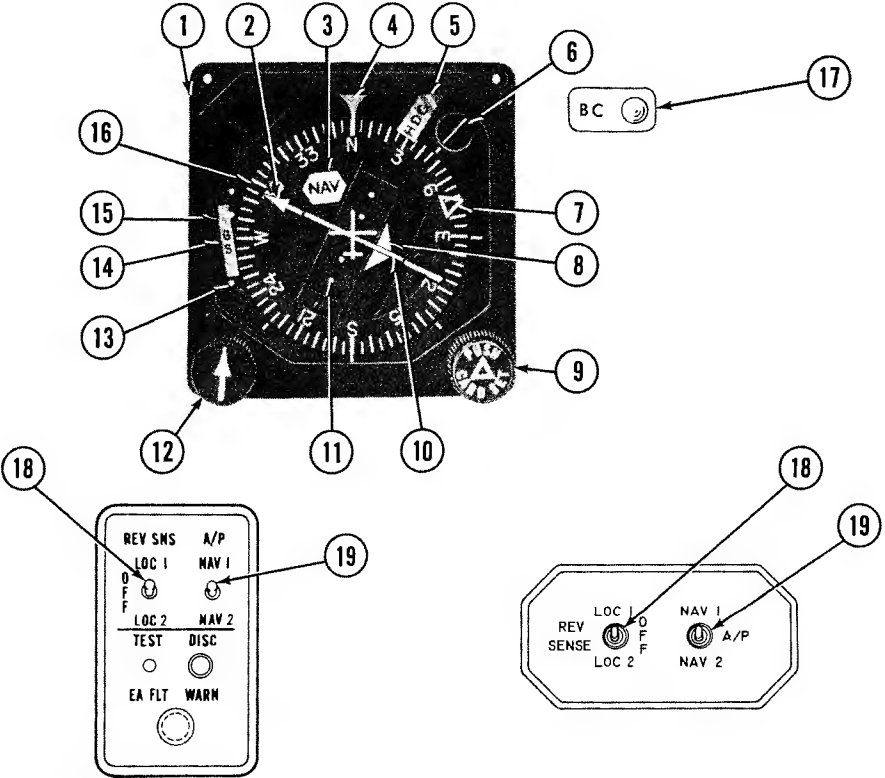
SECTION 1 GENERAL

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 = $\pm 10^\circ$ or LOC = $\pm 2\frac{1}{2}^\circ$) 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 avionics 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.

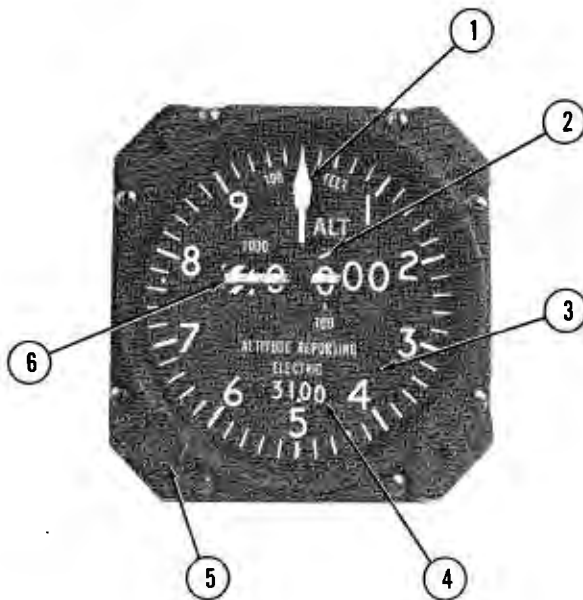
The local altimeter setting is set into the altimeter with a manually operated baroset knob, and is displayed on a four-digit readout, either in inches of mercury or in millibars (as ordered). The altimeter setting does not affect the output of the optical encoder, since the encoder is always referenced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

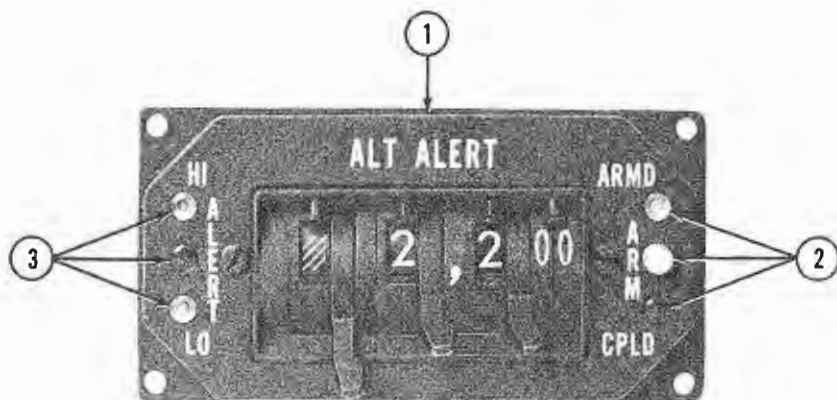
The altitude capture function is selected by a white pushbutton switch (ARM) which energizes the preselector logic circuits. For altitude capture function operation, the Integrated Flight Control System must be turned on but not engaged in a vertical mode (altitude hold or glide slope coupled). When 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 altitude (ones, tens, and hundreds).
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 baro set 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.

ARMED 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. Baro set 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 lights.
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 HISENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

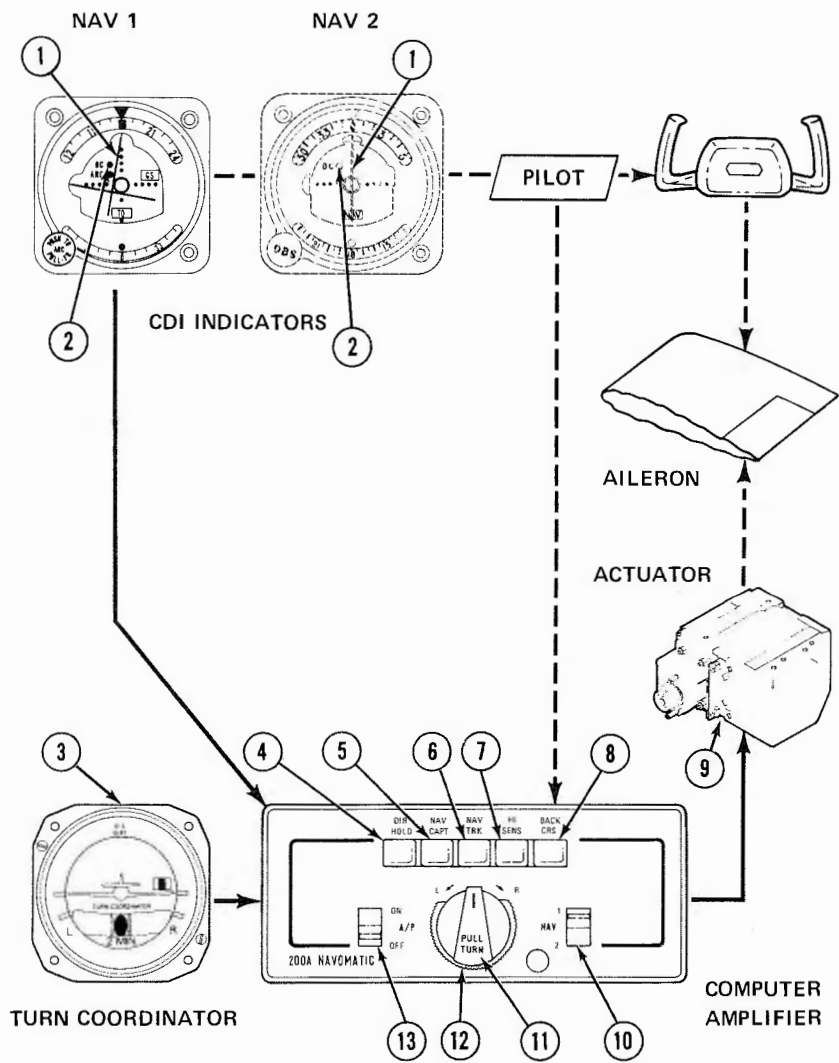


Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

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 float-planes, 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 $\pm 5^\circ$ of desired course.

8. PULL TURN Knob -- CENTER and PUSH in. The airplane should then turn toward desired course at $45^\circ \pm 10^\circ$ 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 $\pm 5^\circ$ 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.

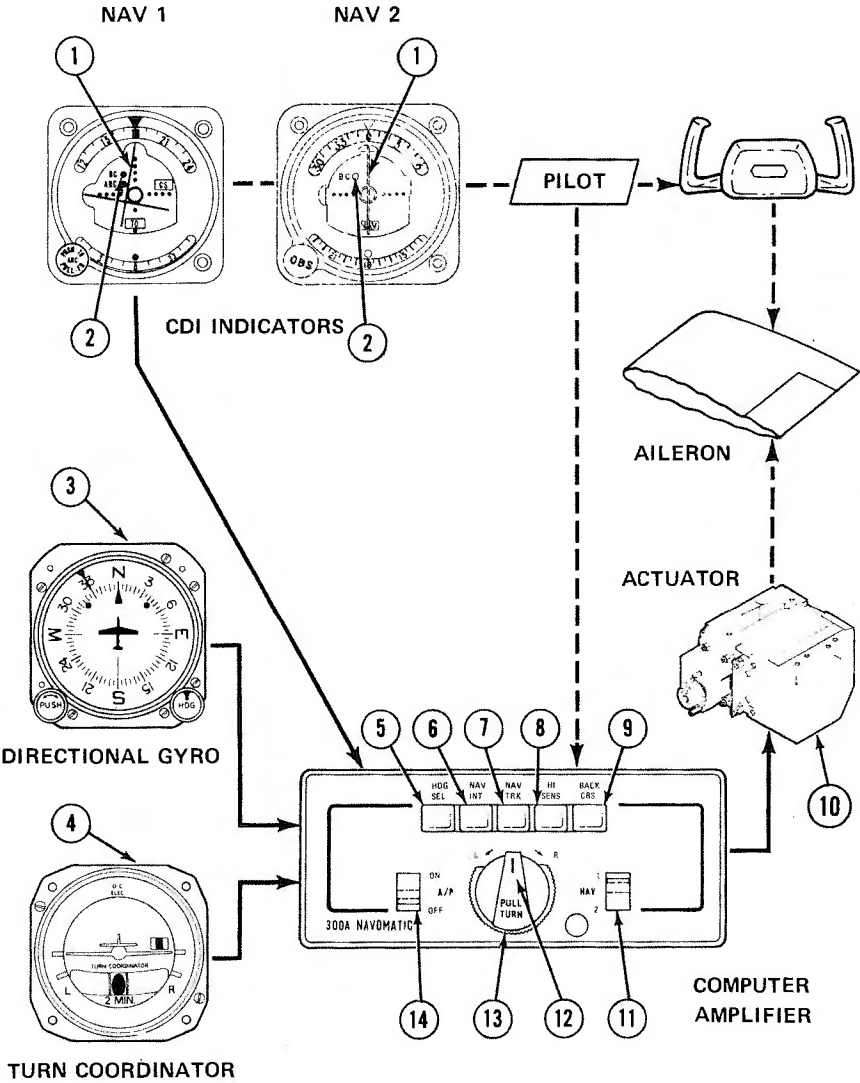


Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

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 (push-button 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 float-planes, 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 $\pm 10^\circ$ 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.

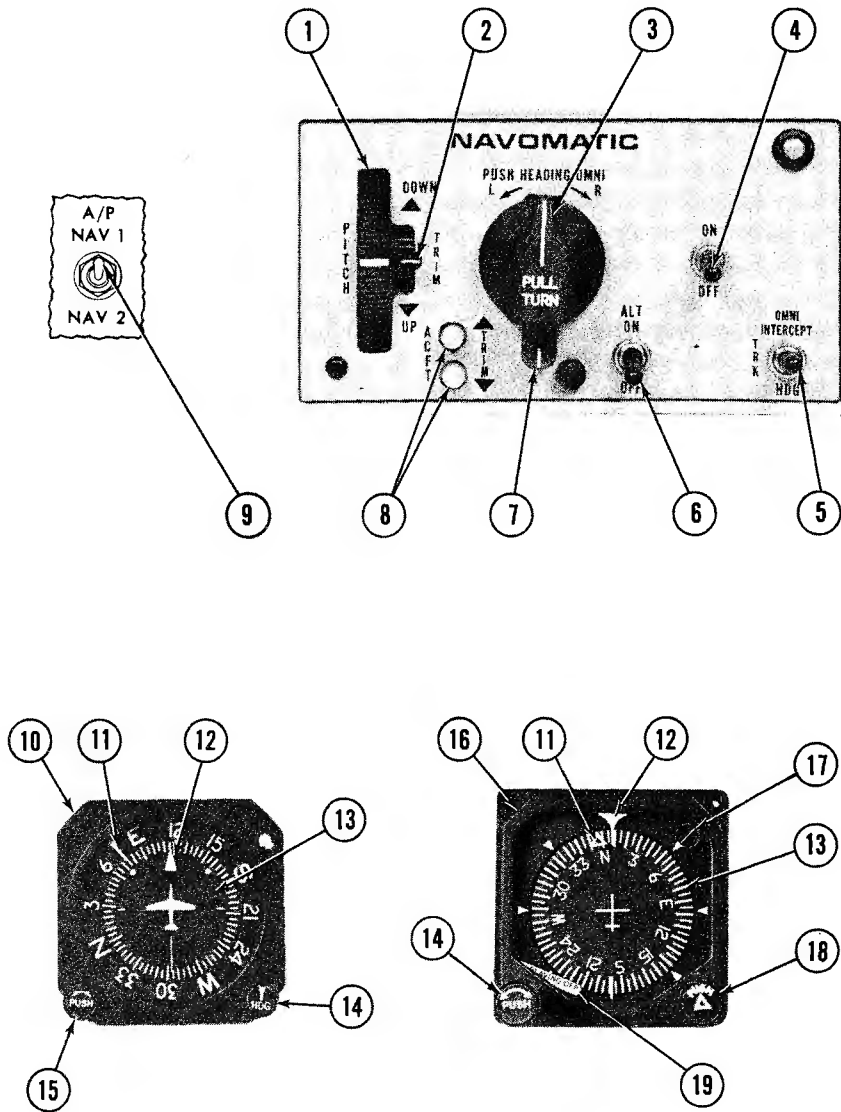


Figure 1. Cessna 400 Autopilot (Type AF-420A) (Sheet 1 of 3)

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/Δ)** - When pushed in the heading bug (11) may be positioned to the desired magnetic heading by rotating the PUSH/Δ 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

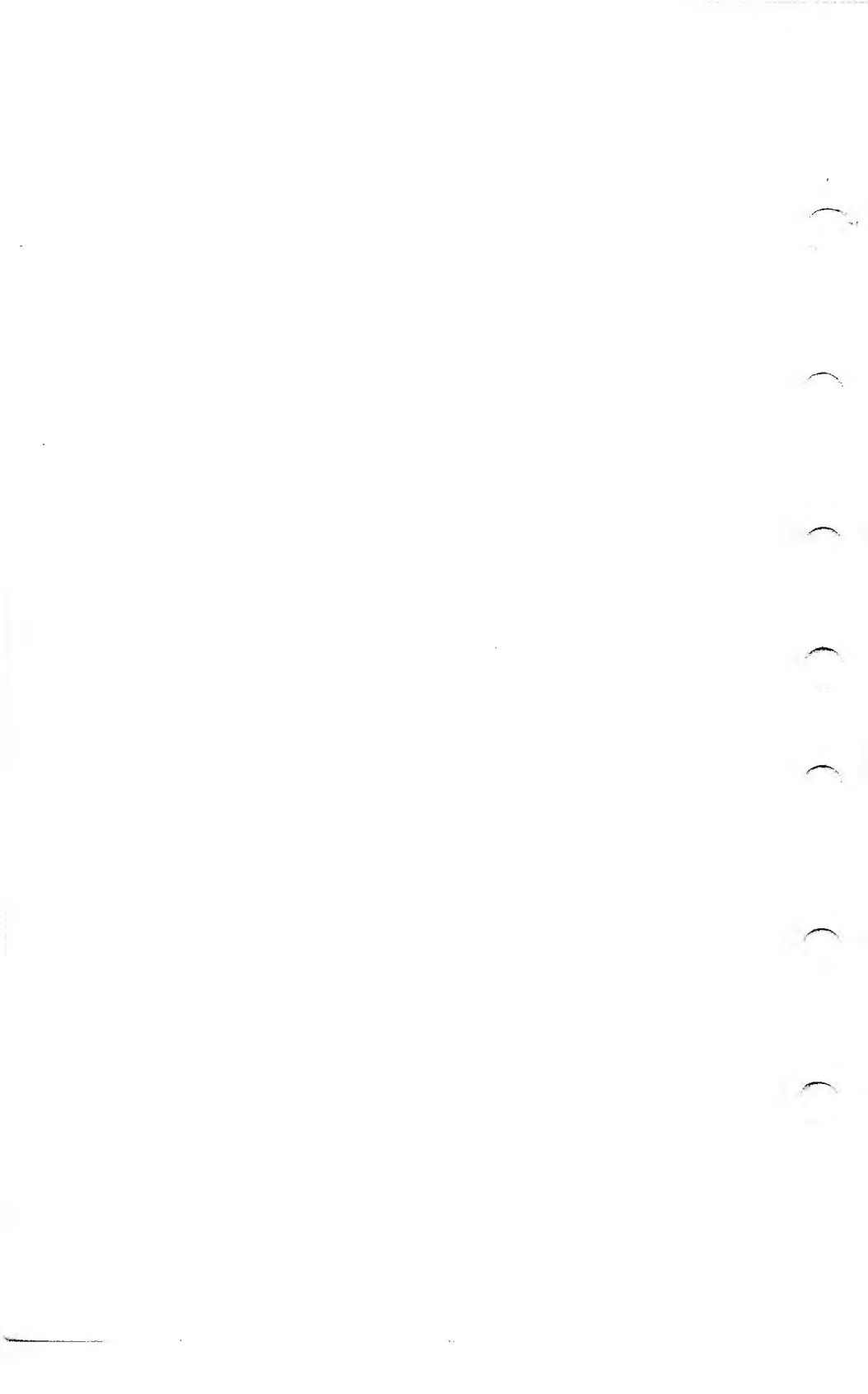
Airplane will automatically intercept at 45° and then track the selected omni course.

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 acces-

sory 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.

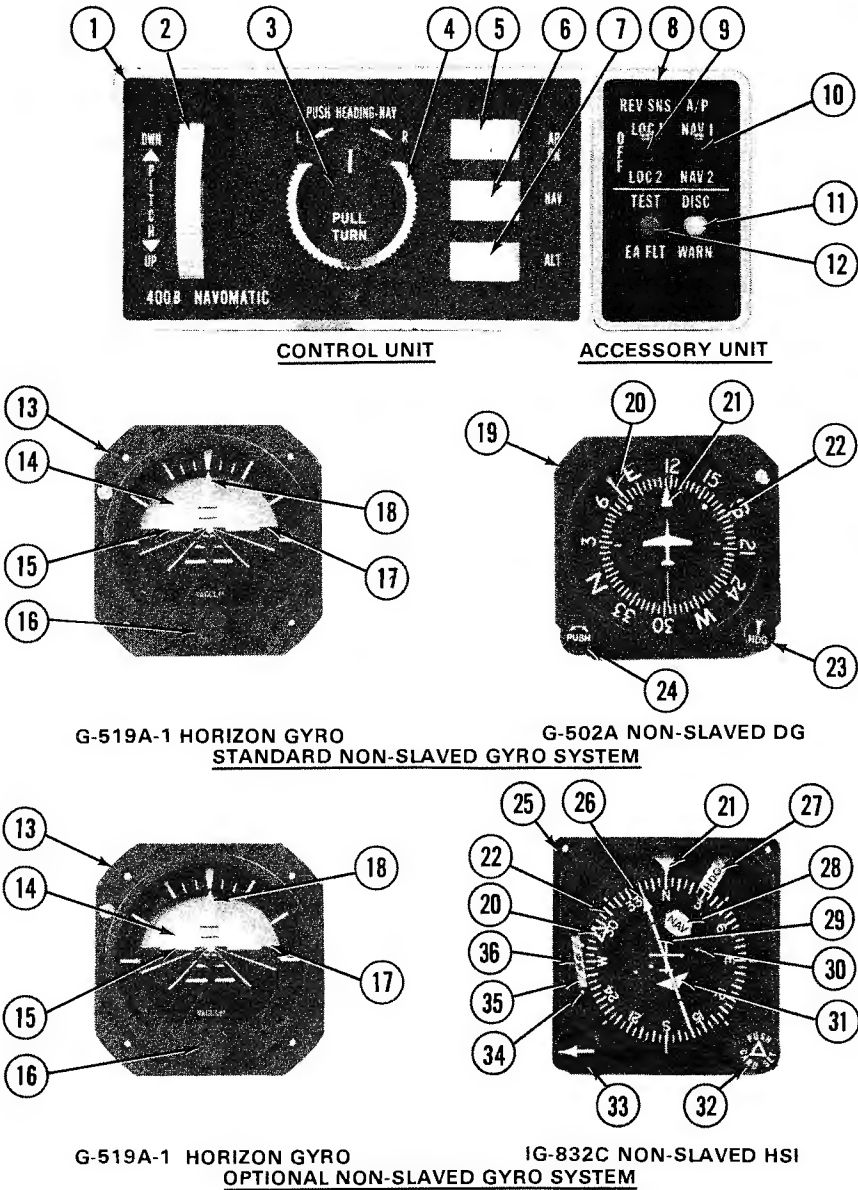
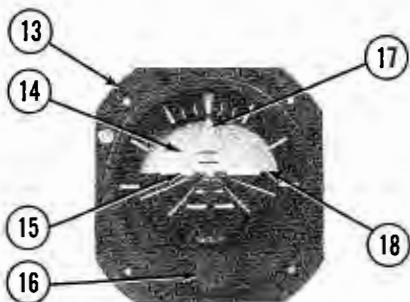
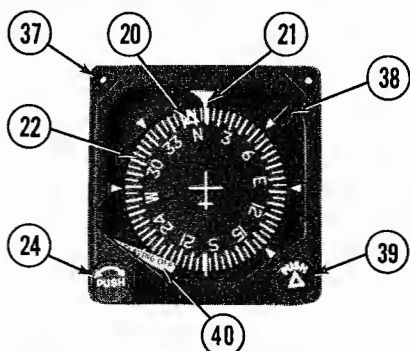


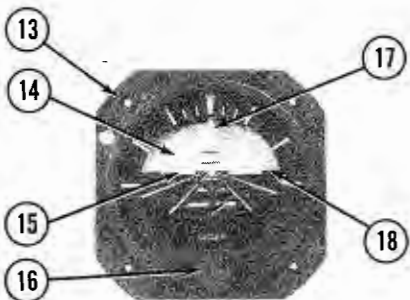
Figure 1. Cessna 400B Navomatic Autopilot (Type AF-550A)
(Sheet 1 of 6)



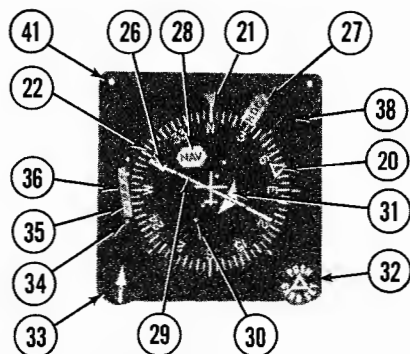
G-519A-1 HORIZON GYRO
OPTIONAL SLAVED GYRO SYSTEM



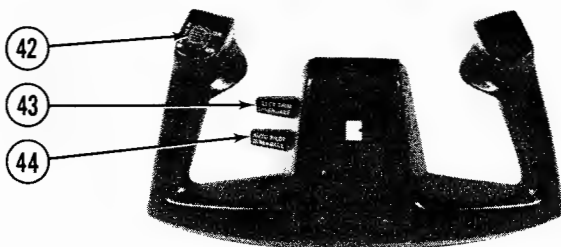
G-504A SLAVED DG
OPTIONAL SLAVED GYRO SYSTEM



G-519A-1 HORIZON GYRO
OPTIONAL SLAVED GYRO SYSTEM



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 identification 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 Δ Knob on Slaved DG or PUSH CARD SET Δ 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 = $\pm 10^\circ$ or LOC = $\pm 2\frac{1}{2}^\circ$) 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/ Δ) - 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.

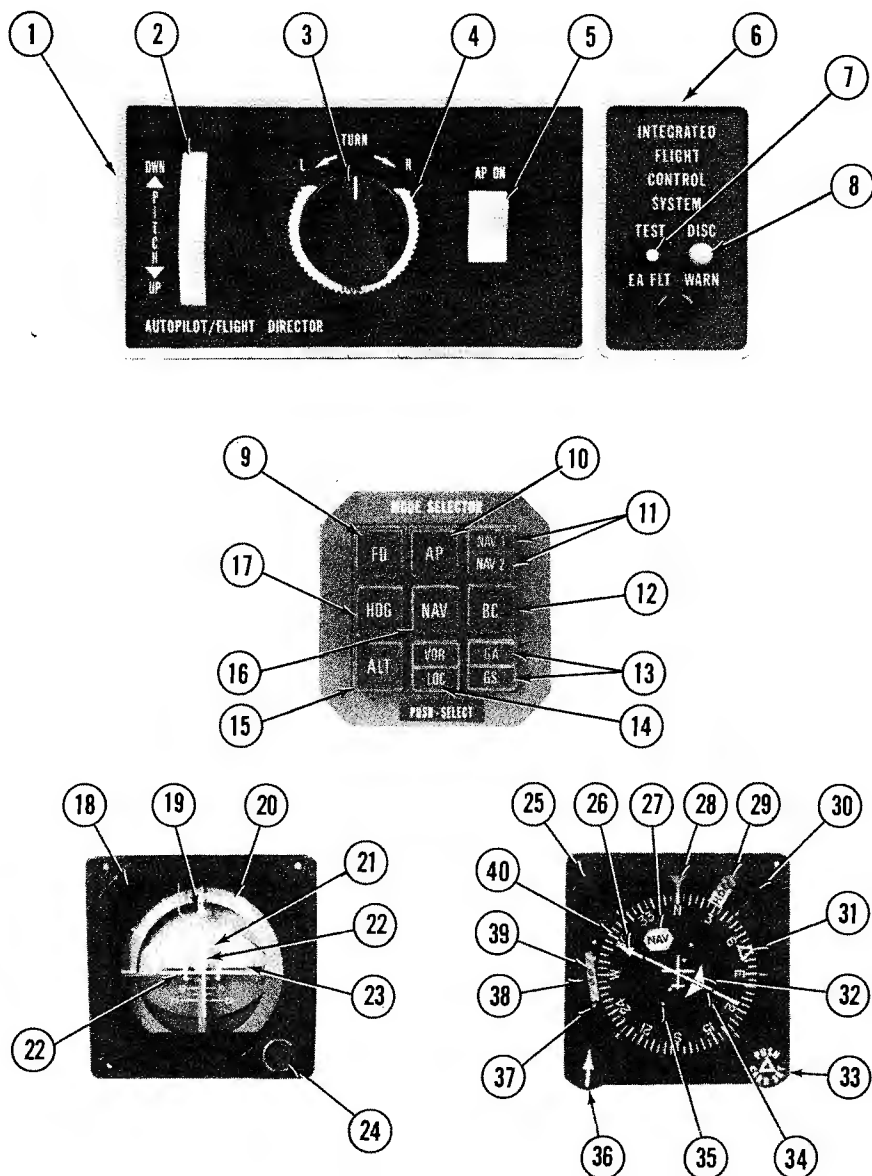
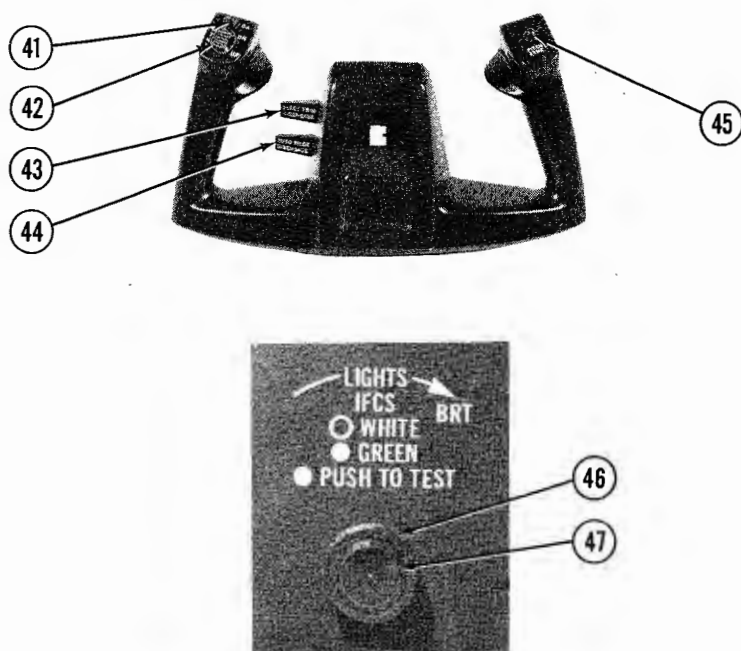


Figure 1. Cessna 400B IFCS (Type IF-550A) (Sheet 1 of 6)



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/ Δ) - 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 = $\pm 10^\circ$ or LOC = $\pm 2\frac{1}{2}^\circ$) 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 front course heading for both 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 GS 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**

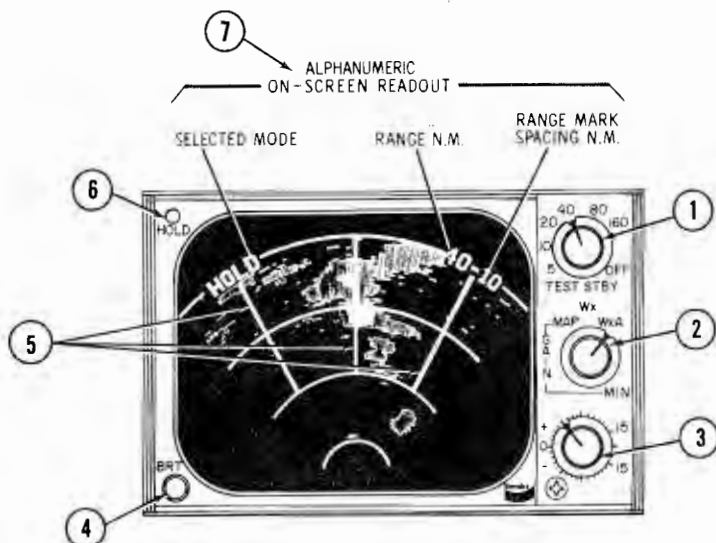
The RDR-160 Weather Radar system consists of a wing pod mounted receiver-transmitter and X-band radar antenna, and a radar indicator that is mounted in the right portion of the instrument panel. All operating controls are mounted on the front panel of the radar indicator and operating controls and functions 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 airplane'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 -- $+4^{\circ}$ to $+6^{\circ}$ (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.

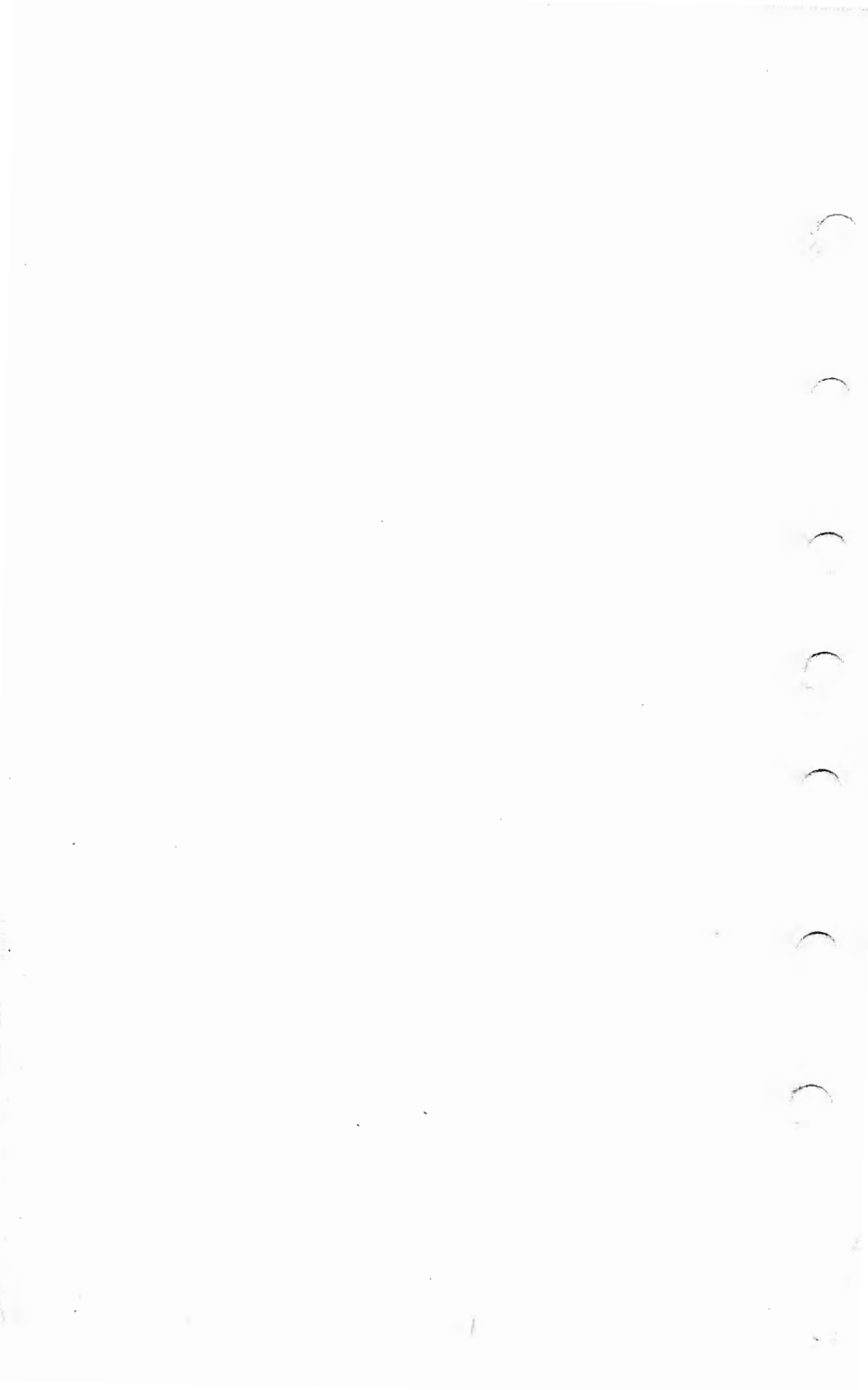
1. Function Switch -- SELECT DESIRED RANGE (allow 2 minutes warmup).

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 monaural 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 monaural (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.

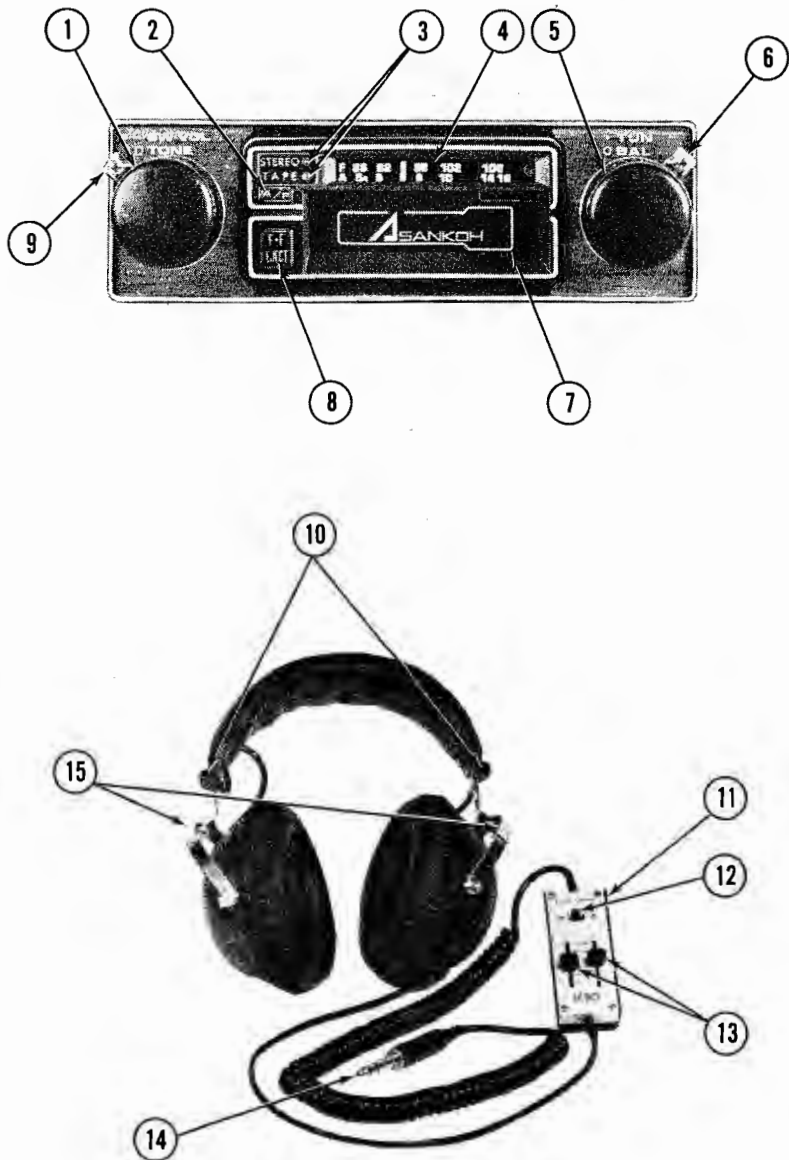


Figure 1. Cassette Player-AM/FM Radio, Operating Controls
(Sheet 1 of 3)

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 preselected 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 monaural 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 Monaural-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.

