PILOT'S OPERATING HANDBOOK

Cessna® 1976

Cardinal

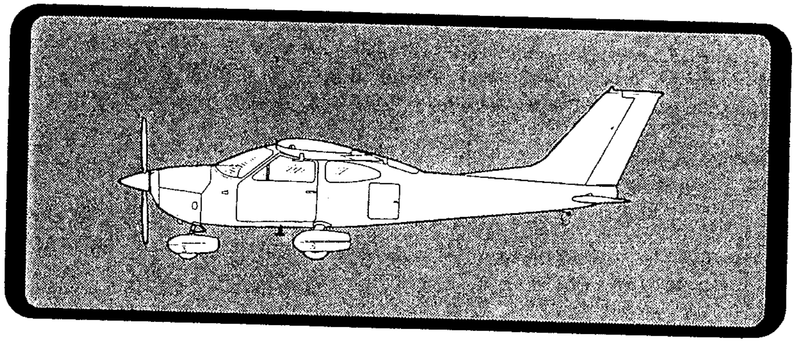
CESSNA MODEL 177B

PERFORMANCE - SPECIFICATIONS

SPEED:		
Maximum at Sea Level		139 KNOTS
Cruise, 75% Power at 10,000 Ft		130 KNOTS
CRUISE: Recommended Lean Mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.		
75% Power at 10,000 Ft	Range	535 NM
49 Gallons Usable Fuel	Time	4.2 HRS
75% Power at 10,000 Ft	Range	675 NM
60 Gallons Usable Fuel	Time	5.3 HRS
Maximum Range at 10,000 Ft	Range	615 NM
49 Gallons Usable Fuel	Time	6.1 HRS
Maximum Range at 10,000 Ft	Range	780 NM
60 Gallons Usable Fuel	Time	7.7 HRS
RATE OF CLIMB AT SEA LEVEL		840 FPM
SERVICE CEILING		14,600 FT
TAKEOFF PERFORMANCE:		
Ground Roll		750 FT
Total Distance Over 50-Ft Obstacle		1400 FT
LANDING PERFORMANCE:		
Ground Roll		600 FT
Total Distance Over 50-Ft Obstacle		1220 FT
STALL SPEED (CAS):		
Flaps Up, Power Off		55 KNOTS
Flaps Down, Power Off		46 KNOTS
MAXIMUM WEIGHT		2500 LBS
STANDARD EMPTY WEIGHT:		
Cardinal		1533 LBS
Cardinal II		1560 LBS
MAXIMUM USEFUL LOAD:		
Cardinal		967 LBS
Cardinal II		940 LBS
BAGGAGE ALLOWANCE		120 LBS
WING LOADING: Pounds/Sq Ft		14.4
POWER LOADING: Pounds/HP		13.9
FUEL CAPACITY: Total		
Standard Tanks		50 GAL.
Long Range Tanks		61 GAL.
OIL CAPACITY		9 QTS
ENGINE: Avco Lycoming 180 BHP at 2700 RPM		O-360-A1F6D
PROPELLER: Constant Speed, Diameter		76 IN.

D1058-13
(RGI-100-11/00)

PILOT'S OPERATING HANDBOOK



CARDINAL

1976 MODEL 177B

Serial No. ____________________

Registration No. ________________

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

CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

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 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.

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TABLE OF CONTENTS

	SECTION
GENERAL	1
LIMITATIONS	2
EMERGENCY PROCEDURES	3
NORMAL PROCEDURES	4
PERFORMANCE	5
WEIGHT & BALANCE/ EQUIPMENT LIST	6
AIRPLANE & SYSTEMS DESCRIPTIONS	7
AIRPLANE HANDLING, SERVICE & MAINTENANCE	8
SUPPLEMENTS (Optional Systems Description & Operating Procedures)	9

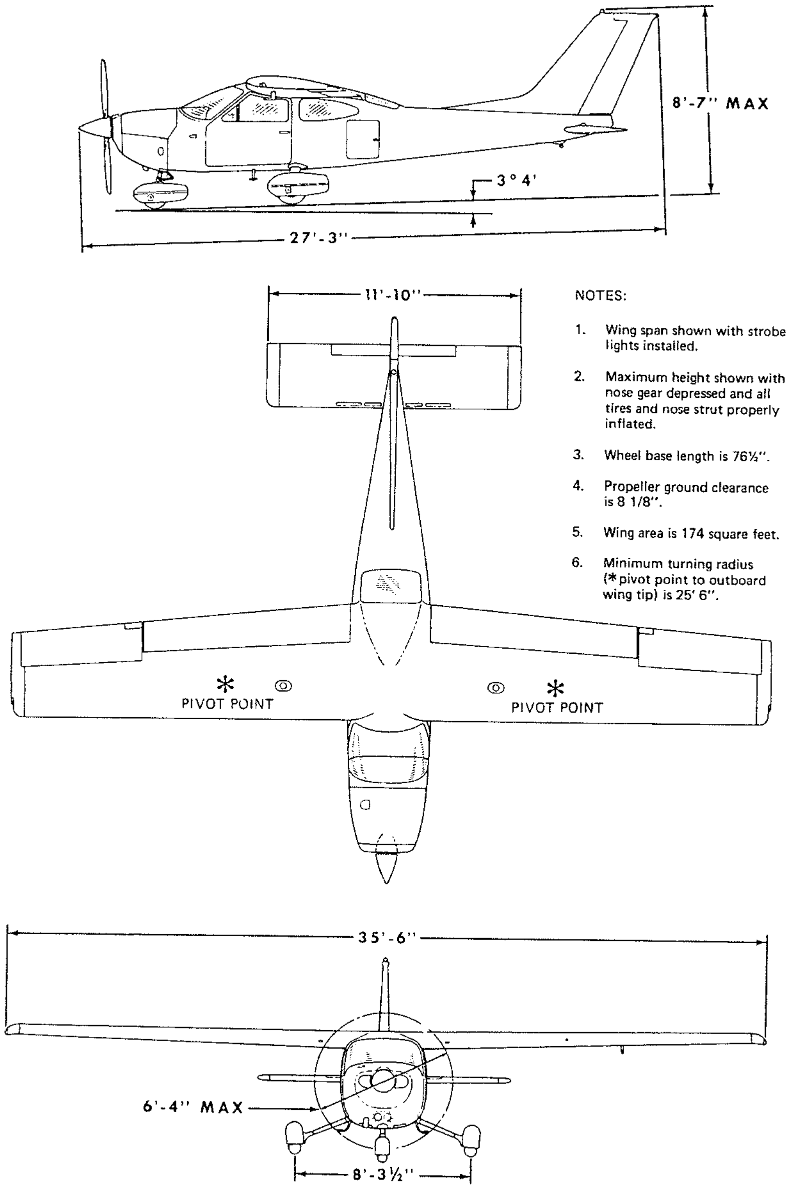
This handbook will be kept current by Service Letters published by Cessna Aircraft Company. These are distributed to Cessna Dealers and to those who subscribe through the Owner Follow-Up System. If you are not receiving subscription service, you will want to keep in touch with your Cessna Dealer for information concerning the change status of the handbook. Subsequent changes will be made in the form of stickers. These should be examined and attached to the appropriate page in the handbook immediately after receipt; the handbook should not be used for operational purposes until it has been updated to a current status.

SECTION 1
GENERAL

TABLE OF CONTENTS

Page

Three View 1-2
Introduction 1-3
Descriptive Data 1-3
Engine 1-3
Propeller 1-3
Fuel 1-3
Oil 1-4
Maximum Certificated Weights 1-4
Standard Airplane Weights 1-5
Cabin and Entry Dimensions 1-5
Baggage Space and Entry Dimensions 1-5
Specific Loadings 1-5
Symbols, Abbreviations and Terminology 1-6
General Airspeed Terminology and Symbols 1-6
Meteorological Terminology 1-6
Engine Power Terminology 1-7
Airplane Performance and Flight Planning Terminology . . . 1-7
Weight and Balance Terminology 1-7



NOTES:

1. Wing span shown with strobe lights installed.
2. Maximum height shown with nose gear depressed and all tires and nose strut properly inflated.
3. Wheel base length is 76½".
4. Propeller ground clearance is 8 1/8".
5. Wing area is 174 square feet.
6. Minimum turning radius (*pivot point to outboard wing tip) is 25' 6".

Figure 1-1. Three View

INTRODUCTION

This handbook contains 9 sections, and includes the material required to be furnished to the pilot by FAR Part 23. It also contains supplemental data supplied by Cessna Aircraft Company.

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

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.
Engine Manufacturer: Avco Lycoming.
Engine Model Number: O-360-A1F6D.
Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, carburetor equipped, four-cylinder engine with 361 cu. in. displacement.
Horsepower Rating and Engine Speed: 180 rated BHP at 2700 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B2D34C211/82PCA-6.
Number of Blades: 2.
Propeller Diameter, Maximum: 76 inches.
Minimum: 75 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 12.1° and a high pitch setting of 26.0° (30 inch station).

FUEL

Fuel Grade (and Color): 100/130 Minimum Grade Aviation Fuel (green). 100/130 low lead aviation fuel (green) with a lead content limited to 2 cc per gallon is also approved.
Fuel Capacity:
Standard Tanks:
Total Capacity: 50 gallons.
Total Capacity Each Tank: 25 gallons.
Total Usable: 49 gallons.

Long Range Tanks:
Total Capacity: 61 gallons.
Total Capacity Each Tank: 30.5 gallons.
Total Usable: 60 gallons.

NOTE

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

OIL

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

NOTE

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

MIL-L-22851 Ashless Dispersant Oil: This oil must be used after first 50 hours or oil consumption has stabilized.
Recommended Viscosity For Temperature Range:
SAE 50 above 16°C (60°F).
SAE 10W30 or SAE 30 between -18°C (0°F) and 21°C (70°F).
SAE 10W30 or SAE 20 below -12°C (10°F).

NOTE

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

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

MAXIMUM CERTIFICATED WEIGHTS

Takeoff, Normal Category: 2500 lbs.
Utility Category: 2200 lbs.

Landing, Normal Category: 2500 lbs.
Utility Category: 2200 lbs.
Weight in Baggage Compartment, Normal Category: Baggage, passenger on auxiliary seat, or cargo area 2 and hatshelf - Station 142 to 185: 120 lbs.

NOTE

The maximum combined weight capacity for cargo area 2 and the hatshelf is 120 lbs. The maximum weight capacity for the hatshelf is 25 lbs.

Weight in Baggage Compartment, Utility Category: In this category, the baggage compartment and rear seat must not be occupied.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Cardinal: 1533 lbs.
Cardinal II: 1560 lbs.
Maximum Useful Load:

	Normal Category	Utility Category
Cardinal:	967 lbs.	667 lbs.
Cardinal II:	940 lbs.	640 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: 14.4 lbs./sq. ft.
Power Loading: 13.9 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

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

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

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

V_A — 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_{NO} — Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air, then only with caution.

V_{NE} — Never Exceed Speed is the speed limit that may not be exceeded at any time.

V_S — Stalling Speed or the minimum steady flight speed at which the airplane is controllable.

V_{S_O} — Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.

V_X — Best Angle-of-Climb Speed is the speed which results in the greatest gain of altitude in a given horizontal distance.

V_Y — Best Rate-of-Climb Speed is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

OAT — Outside Air Temperature is the free air static temperature. It is expressed in either degrees Celsius (formerly Centigrade) or degrees Fahrenheit.

Standard Temperature — Standard Temperature is 15°C at sea level pressure altitude and decreases by 2°C for each 1000 feet of altitude.

Pressure Altitude — Pressure Altitude is the altitude read from an altimeter when the barometric subscale has been set to 29.92 inches of mercury (1013 mb).

ENGINE POWER TERMINOLOGY

BHP — Brake Horsepower is the power developed by the engine.

RPM — Revolutions Per Minute is engine speed.

MP — Manifold Pressure is a pressure measured in the engine's induction system and is expressed in inches of mercury (Hg).

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

Demonstrated Crosswind Velocity — Demonstrated Crosswind Velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting.

Usable Fuel — Usable Fuel is the fuel available for flight planning.

Unusable Fuel — Unusable Fuel is the quantity of fuel that can not be safely used in flight.

GPH — Gallons Per Hour is the amount of fuel (in gallons) consumed per hour.

NMPG — Nautical Miles Per Gallon is the distance (in nautical miles) which can be expected per gallon of fuel consumed at a specific engine power setting and/or flight configuration.

g — g is acceleration due to gravity.

WEIGHT AND BALANCE TERMINOLOGY

Reference Datum — Reference Datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes.

Station — Station is a location along the airplane fuselage given in terms of the distance from the reference datum.

Arm — Arm is the horizontal distance from the reference datum to the center of gravity (C. G.) of an item.

Moment — Moment is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.)

Center of Gravity (C. G.) — Center of Gravity is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane.

C. G. Arm — Center of Gravity Arm is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.

C.G. Limits — Center of Gravity Limits are the extreme center of gravity locations within which the airplane must be operated at a given weight.

Standard Empty Weight — Standard Empty Weight is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil.

Basic Empty Weight — Basic Empty Weight is the standard empty weight plus the weight of optional equipment.

Useful Load — Useful Load is the difference between takeoff weight and the basic empty weight.

Gross (Loaded) Weight — Gross (Loaded) Weight is the loaded weight of the airplane.

Maximum Takeoff Weight — Maximum Takeoff Weight is the maximum weight approved for the start of the takeoff run.

Maximum Landing Weight — Maximum Landing Weight is the maximum weight approved for the landing touchdown.

Tare — Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

SECTION 2
LIMITATIONS

TABLE OF CONTENTS

Page

Introduction 2-3
Airspeed Limitations 2-4
Airspeed Indicator Markings 2-4
Power Plant Limitations 2-5
Power Plant Instrument Markings 2-6
Weight Limits 2-6
    Normal Category 2-6
    Utility Category 2-7
Center of Gravity Limits 2-7
    Normal Category 2-7
    Utility Category 2-7
Maneuver Limits 2-7
    Normal Category 2-7
    Utility Category 2-8
Flight Load Factor Limits 2-8
    Normal Category 2-8
    Utility Category 2-9
Kinds of Operation Limits 2-9
Fuel Limitations 2-9
Placards 2-10

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. A13CE as Cessna Model No. 177B.

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	161	167	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	134	138	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed: 2500 Pounds 2100 Pounds 1700 Pounds	 101 93 84	 102 93 83	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed: To 10^o Flaps 10^o - 30^o Flaps	 113 90	 115 90	Do not exceed these speeds with the given flap settings.
	Maximum Window Open Speed	104	105	Do not exceed this speed with windows open.

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

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

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	45 - 90	Full Flap Operating Range. Lower limit is maximum weight V_{S_O} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	54 - 138	Normal Operating Range. Lower limit is maximum weight V_S with flaps retracted. Upper limit is maximum structural cruising speed.
Yellow Arc	138 - 167	Operations must be conducted with caution and only in smooth air.
Red Line	167	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Avco Lycoming.
Engine Model Number: O-360-A1F6D.
Engine Operating Limits for Takeoff and Continuous Operations:
- Maximum Power: 180 BHP.
- Maximum Engine Speed: 2700 RPM.
- Maximum Cylinder Head Temperature: 260°C (500°F).
- Maximum Oil Temperature: 118°C (245°F).

Oil Pressure, Minimum: 25 psi.
Maximum: 100 psi.
Fuel Pressure, Minimum: 2 psi.
Maximum: 8 psi.
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B2D34C211/82PCA-6.
Propeller Diameter, Maximum: 76 inches.
Minimum: 75 inches.
Propeller Blade Angle at 30 Inch Station, Low: 12.1°.
High: 26.0°.
Propeller Operating Limits: Avoid continuous operation between 1700 and 1900 RPM with less than 10 inches manifold pressure.

POWER PLANT INSTRUMENT MARKINGS

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

INSTRUMENT	RED LINE	GREEN ARC	YELLOW ARC	RED LINE
	MINIMUM LIMIT	NORMAL OPERATING	CAUTION RANGE	MAXIMUM LIMIT
Tachometer SL to 8000 Ft	- - -	2100 - 2500 RPM (inner arc)	1700 - 1900 RPM	2700 RPM
8000 Ft & above		2100 - 2700 RPM (outer arc)		
Manifold Pressure	- - -	15-24 in.Hg	- - -	- - -
Oil Temperature	- - -	100° - 245°F	- - -	245°F
Cylinder Head Temperature	- - -	200° - 500°F	- - -	500°F
Fuel Pressure	2 psi	2 - 8 psi	- - -	8 psi
Oil Pressure	25 psi	60-90 psi	- - -	100 psi
Carburetor Air Temperature	- - -	- - -	-15° to 5°C	- - -

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

NORMAL CATEGORY

Maximum Takeoff Weight: 2500 lbs.
Maximum Landing Weight: 2500 lbs.
Weight in Baggage Compartment, Normal Category: Baggage, passenger on auxiliary seat, or cargo area 2 and hatshelf - Station 142 to 185: 120 lbs.

NOTE

The maximum combined weight capacity for cargo area 2 and the hatshelf is 120 lbs. The maximum weight capacity for the hatshelf is 25 lbs.

UTILITY CATEGORY

Maximum Takeoff Weight: 2200 lbs.
Maximum Landing Weight: 2200 lbs.
Maximum Weight in Baggage Compartment: In the utility category, the baggage compartment and rear seat must not be occupied.

CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Center of Gravity Range:
Forward: 101.0 inches aft of datum at 2000 lbs. or less, to 102.2 inches aft of datum at 2250 lbs., to 105.7 inches aft of datum at 2500 lbs., with straight line variation between points.
Aft: 114.5 inches aft of datum at all weights.
Reference Datum: 54.0 inches forward of front face of lower portion of firewall.

UTILITY CATEGORY

Center of Gravity Range:
Forward: 101.0 inches aft of datum at 2000 lbs. or less, with straight line variation to 102.0 inches aft of datum at 2200 lbs.
Aft: 109.0 inches aft of datum at all weights.
Reference Datum: 54.0 inches forward of front face of lower portion of firewall.

MANEUVER LIMITS

NORMAL CATEGORY

This airplane is certificated in both the normal and utility 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) and turns in which the angle of bank is not more than 60°.

UTILITY CATEGORY

This airplane is not designed for purely aerobatic flight. However, in the acquisition of various certificates such as commercial pilot, instrument pilot and flight instructor, certain maneuvers are required by the FAA. All of these maneuvers are permitted in this airplane when operated in the utility category.

In the utility category, the baggage compartment and rear seat must not be occupied. No aerobatic maneuvers are approved except those listed below:

MANEUVER	RECOMMENDED ENTRY SPEED*
Chandelles	100 knots
Lazy Eights	100 knots
Steep Turns	100 knots
Spins	Slow Deceleration
Stalls (Except Whip Stalls)	Slow Deceleration

*Abrupt use of the controls is prohibited above 102 knots.

Aerobatics that may impose high loads should not be attempted. The important thing to bear in mind in flight maneuvers is that the airplane is clean in aerodynamic design and will build up speed quickly with the nose down. Proper speed control is an essential requirement for execution of any maneuver, and care should always be exercised to avoid excessive speed which in turn can impose excessive loads. In the execution of all maneuvers, avoid abrupt use of controls. Intentional spins with flaps extended are prohibited.

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Flight Load Factors (Gross Weight - 2500 lbs.)
*Flaps Up . . . . +3.8g, -1.52g
*Flaps Down . . . . +3.5g

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

UTILITY CATEGORY

Flight Load Factors (Gross Weight - 2200 lbs.)
*Flaps Up . . . . +4.4g, -1.76g
*Flaps Down . . . . +3.5g

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

KINDS OF OPERATION LIMITS

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

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

2 Standard Tanks: 25 U.S. gallons each.
Total Fuel: 50 U.S. gallons.
Usable Fuel (all flight conditions): 49 U.S. gallons.
Unusable Fuel: 1.0 U.S. gallons.
2 Long Range Tanks: 30.5 gallons each.
Total Fuel: 61 U.S. gallons.
Usable Fuel (all flight conditions): 60 U.S. gallons.
Unusable Fuel: 1.0 U.S. gallons.

NOTE

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

NOTE

Takeoff and land with the fuel selector valve handle in the BOTH ON position.

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 in compliance with the operating limitations as stated in the form of placards, markings, and manuals.

MAXIMUMS

	Normal Category	Utility Category
MANEUVERING SPEED (IAS)	102 knots	102 knots
GROSS WEIGHT	2500 lbs.	2200 lbs.
FLIGHT LOAD FACTOR		
Flaps Up	+3.8, -1.52	+4.4, -1.76
Flaps Down	+3.5	+3.5

Normal Category - No acrobatic maneuvers including spins approved.
Utility Category - Baggage compartment and rear seat must not be occupied.

NO ACROBATIC MANEUVERS APPROVED
EXCEPT THOSE LISTED BELOW

Maneuver	Recm. Entry Speed	Maneuver	Recm. Entry Speed
Chandelles	100 knots	Spins	Slow Deceleration
Lazy Eights	100 knots	Stalls (except whip stalls)	Slow Deceleration
Steep Turns	100 knots		

Altitude loss in stall recovery -- 180 feet.
Abrupt use of controls prohibited above 102 knots.
Spin Recovery: opposite rudder - forward stabilator - neutralize controls. Intentional spins with flaps extended are prohibited.
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 shut-off control (at appropriate location):

Fuel shut-off - pull off.

(4) On fuel selector valve (standard tanks):

Both -- 49 gal.
Left -- 24.5 gal.
Right -- 24.5 gal.
Both on for takeoff and landing.

On fuel selector valve (long range tanks):

Both -- 60 gal.
Left -- 30 gal.
Right -- 30 gal.
Both on for takeoff and landing.

(5) Aft of fuel tank cap (standard tanks):

Service this airplane with 91/96 minimum or 100/130 grade aviation gasoline. Total capacity 25.0 gal. Capacity to line of holes inside filler neck 22.0 gal.

Aft of fuel tank cap (long range tanks):

Service this airplane with 91/96 minimum or 100/130 grade aviation gasoline. Total capacity 30.5 gal. Capacity to line of holes inside filler neck 22.0 gal.

(6) In baggage compartment:

120 pounds maximum baggage and/or auxiliary seat passenger, including 25 pounds maximum in baggage wall hatshelf. For additional loading instructions, see weight and balance data.

(7) Next to door ventilation windows:

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

(8) On wing flap indicator:

0° to 10° - T.O.	(Takeoff range with blue color code and 115 knot callout; also, mechanical detent at 10°)
10° - 20° - 30°	(Indices at these positions with white color code and 90 knot callout; also, mechanical detent at 20°).

(9) On manifold pressure gage:

With less than 10" manifold pressure, avoid continuous operation between 1700-1900 RPM.

(10) On the instrument panel near over-voltage light:

HIGH VOLTAGE

SECTION 3
EMERGENCY PROCEDURES

TABLE OF CONTENTS

Page

Introduction 3-3
Airspeeds for Safe Operation 3-3

OPERATIONAL CHECKLISTS

Engine Failures 3-3
Engine Failure During Takeoff Run 3-3
Engine Failure Immediately After Takeoff 3-4
Engine Failure During Flight 3-4
Forced Landings 3-4
Emergency Landing Without Engine Power 3-4
Precautionary Landing With Engine Power 3-4
Ditching 3-5
Fires 3-5
During Start On Ground 3-5
Engine Fire In Flight 3-6
Electrical Fire In Flight 3-6
Cabin Fire 3-6
Wing Fire 3-7
Icing 3-7
Inadvertent Icing Encounter 3-7
Static Source Blockage (Erroneous Instrument Reading Suspected) 3-7
Landing With a Flat Main Tire 3-8
Electrical Power Supply System Malfunctions 3-8
Over-Voltage Light Illuminates 3-8
Ammeter Shows Discharge 3-8

AMPLIFIED PROCEDURES

Engine Failures 3-9
Forced Landings 3-10

TABLE OF CONTENTS (Continued)

	Page
Fires	3-10
Emergency Operation In Clouds (Vacuum System Failure)	3-10
Executing A 180° Turn In Clouds	3-10
Emergency Descent Through Clouds	3-11
Recovery From a Spiral Dive	3-11
Flight In Icing Conditions	3-12
Static Source Blocked	3-12
Spins	3-12
Rough Engine Operation Or Loss Of Power	3-13
Carburetor Icing	3-13
Spark Plug Fouling	3-13
Magneto Malfunction	3-14
Low Oil Pressure	3-14
Electrical Power Supply System Malfunctions	3-14
Excessive Rate Of Charge	3-15
Insufficient Rate Of Charge	3-15

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 judgement when unexpected weather is encountered. However, should an emergency arise the basic guidelines described in this section should be considered and applied as necessary to correct the problem. Emergency procedures associated with the ELT and other optional systems can be found in Section 9.

AIRSPEEDS FOR SAFE OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2500 Lbs	102 KIAS
2100 Lbs	93 KIAS
1700 Lbs	83 KIAS
Maximum Glide:	
2500 Lbs	75 KIAS
2100 Lbs	70 KIAS
1700 Lbs	65 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	75 KIAS
Wing Flaps Down	65 KIAS

OPERATIONAL CHECKLISTS

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF RUN

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

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

(1) Airspeed -- 70 KIAS.
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Shutoff Valve -- OFF (pull sharply to break safety wire).
(4) Ignition Switch -- OFF.
(5) Wing Flaps -- AS REQUIRED.
(6) Master Switch -- OFF.

ENGINE FAILURE DURING FLIGHT

(1) Airspeed -- 75 KIAS.
(2) Carburetor Heat -- ON.
(3) Fuel Selector Valve -- BOTH.
(4) Fuel Shutoff Valve -- ON.
(5) Mixture -- RICH.
(6) Auxiliary Fuel Pump -- ON for 3-5 seconds with throttle open 1/2 inch; then OFF.
(7) Ignition Switch -- BOTH (or START if propeller is stopped).

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

(1) Airspeed -- 75 KIAS (flaps UP).
65 KIAS (flaps DOWN).
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Shutoff Valve -- OFF (pull sharply to break safety wire).
(4) Ignition Switch -- OFF.
(5) Wing Flaps -- AS REQUIRED (30° recommended).
(6) Master Switch -- OFF.
(7) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(8) Touchdown -- SLIGHTLY TAIL LOW.
(9) Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

(1) Airspeed -- 65 KIAS.
(2) Wing Flaps -- 15°.
(3) Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
(4) Radio and Electrical Switches -- OFF.
(5) Wing Flaps -- 30° (on final approach).
(6) Airspeed -- 65 KIAS.
(7) Master Switch -- OFF.

(8) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
(9) Touchdown -- SLIGHTLY TAIL LOW.
(10) Ignition Switch -- OFF.
(11) 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) Flaps -- 30°.
(4) Approach -- High Winds, Heavy Seas -- INTO THE WIND.
Light Winds, Heavy Swells -- PARALLEL TO SWELLS.
(5) Power -- ESTABLISH 300 FT/MIN DESCENT at 60 KIAS.
(6) Cabin Doors -- UNLATCH.
(7) Touchdown -- LEVEL ATTITUDE AT 300 FT/MIN DESCENT.
(8) Face -- CUSHION at touchdown with folded coat or seat cushion.
(9) Airplane -- EVACUATE through cabin doors. If necessary, open vent window to flood cabin to equalize pressure so doors can be opened.
(10) Life Vests and Raft -- INFLATE.

FIRES

DURING START ON GROUND

(1) Cranking -- CONTINUE to get a start which would suck the flames and accumulated fuel through the carburetor and into the engine.

If engine starts:

(2) Power -- 1800 RPM for a few minutes.
(3) Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

(4) Cranking -- CONTINUE for two or three minutes.
(5) Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
(6) Engine -- SECURE.
a. Master Switch -- OFF.
b. Ignition Switch -- OFF.
c. Fuel Shutoff Valve -- OFF (pull sharply to break safety wire).

(7) Fire -- EXTINGUISH using fire extinguisher, seat cushion, wool blanket, or dirt.
(8) Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

ENGINE FIRE IN FLIGHT

(1) Mixture -- IDLE CUT-OFF.
(2) Fuel Shutoff Valve -- OFF (pull sharply to break safety wire).
(3) Master Switch -- OFF.
(4) Cabin Heat and Air -- OFF (except overhead vents).
(5) Airspeed -- 105 KIAS (If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture).
(6) Forced Landing -- EXECUTE (as described in Landing Without Engine Power).

ELECTRICAL FIRE IN FLIGHT

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

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

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

CABIN FIRE

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

WARNING

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

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

WING FIRE

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

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 defroster controls full out to obtain maximum windshield defroster effectiveness.
(4) Increase engine speed to minimize ice build-up on propeller blades.
(5) Watch for signs of carburetor air filter ice and apply carburetor heat as required. An unexplained loss of manifold pressure could be caused by carburetor ice or air intake filter ice. Lean the mixture if carburetor heat is used continuously.
(6) 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 significantly higher stall speed.
(8) Leave wing flaps retracted. With a severe ice build-up on the stabilator, the change in wing wake airflow direction caused by wing flap extension could result in a loss of stabilator effectiveness.
(9) Perform a landing approach using a forward slip, if necessary, for improved visibility.
(10) Approach at 75-85 KIAS, depending upon the amount of ice accumulation.
(11) Perform a landing in a level attitude.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

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

LANDING WITH A FLAT MAIN TIRE

(1) Wing Flaps -- AS DESIRED (0°- 10° below 115 KIAS, 10°- 30° below 90 KIAS).
(2) Stabilator Control -- NOSE HIGH.
(3) Aileron Control -- BANK TOWARD GOOD TIRE.
(4) Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

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

If over-voltage light illuminates again:

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

AMMETER SHOWS DISCHARGE

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

AMPLIFIED PROCEDURES

ENGINE FAILURES

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

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

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

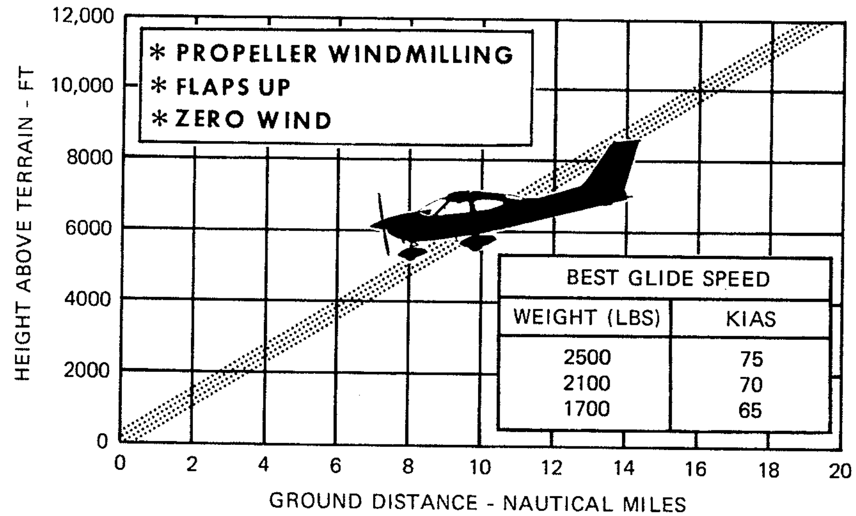


Figure 3-1. Maximum Glide

FORCED LANDINGS

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

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

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area and collect folded coats or cushions for protection of occupants' face at touchdown. Transmit Mayday message on 121.5 MHz giving location and intentions.

FIRES

Although engine fires are extremely rare in flight, the steps of the appropriate checklist should be followed if one is encountered. After completion of this procedure, execute a forced landing.

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

EMERGENCY OPERATION IN CLOUDS

(Vacuum System Failure)

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

EXECUTING A 180° TURN IN CLOUDS

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

(1) Note the time of the minute hand and observe the position of the

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

EMERGENCY DESCENT THROUGH CLOUDS

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

(1) Apply full rich mixture.
(2) Apply full carburetor heat.
(3) Reduce power to set up a 500 to 800 ft./min. rate of descent.
(4) Adjust the stabilator and rudder trim control wheels for a stabilized descent at 80 KIAS.
(5) Keep hands off control wheel.
(6) Monitor turn coordinator and make corrections by rudder alone.
(7) Adjust rudder trim to relieve unbalanced rudder force, if present.
(8) Check trend of compass card movement and make cautious corrections with rudder to stop turn.
(9) Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

(1) Close the throttle.
(2) Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon

reference line.
(3) Cautiously apply stabilator back pressure to slowly reduce the indicated airspeed to 80 KIAS.
(4) Adjust the stabilator trim control to maintain an 80 KIAS glide.
(5) Keep hand off the control wheel, using rudder control to hold a straight heading. Use rudder trim to relieve unbalanced rudder force, if present.
(6) Apply carburetor heat.
(7) Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
(8) 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 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. To avoid the possibility of large errors, the vent windows should not be open when using the alternate static source. The Airspeed Calibration chart (Figure 5-1) reflects the errors under the most adverse condition (vents and windows open) and does not imply that the alternate static source should be used with that configuration. These speeds will provide an adequate margin of safety with vents and windows closed.

Altimeter readings may vary as much as 100 feet using the alternate static source with vents and windows open.

SPINS

Should an inadvertent spin occur, the following recovery procedure should be used:

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

(4) JUST AFTER THE RUDDER REACHES THE STOP, MOVE THE WHEEL BRISKLY FORWARD FAR ENOUGH TO BREAK THE STALL.
(5) HOLD THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend 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.

For additional information on spins and spin recovery, see the discussion under SPINS in Normal Procedures (Section 4).

ROUGH ENGINE OPERATION OR LOSS OF POWER

CARBURETOR ICING

An unexplained drop in manifold pressure and eventual engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle and pull the carburetor heat knob full out until the engine runs smoothly; then remove carburetor heat and readjust the throttle. If conditions require the continued use of carburetor heat in cruise flight use the minimum amount of heat necessary to prevent ice from forming and lean the mixture for smoothest engine operation.

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 single ignition position.

MAGNETO MALFUNCTION

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

LOW OIL PRESSURE

If low oil pressure is accompanied by normal oil temperature, there is a possibility that the oil pressure gage or relief valve is malfunctioning, or a leak has developed in the oil line from the engine to the oil pressure gage transducer on the firewall. A leak in this line is not necessarily cause for an immediate precautionary landing because an orifice in the line will prevent a sudden loss of oil from the engine sump. Low electrical system voltage will also cause low oil pressure gage readings. This can be verified by checking the condition of the electrical system and the indications of the other gages in the engine instrument cluster. As electrical system voltage to the instrument cluster drops, all gage readings will drop proportionally. In the event of a suspected mechanical or electrical malfunction, land as soon as practical to properly identify and correct the problem.

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.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

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

EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than 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 setting is causing the overcharging. To preclude these possibilities, an over-voltage sensor will automatically shut down the alternator and the over-voltage warning light will illuminate if the charge voltage reaches approximately 16 volts. Assuming that the malfunction was only momentary, an attempt should be made to reactivate the alternator system. To do this, turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the warning light will go off. If the light illuminates again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. If the emergency occurs at night, power must be conserved for later operation of the wing flaps and possible use of the landing lights during landing.

INSUFFICIENT RATE OF CHARGE

If the ammeter indicates a continuous discharge rate in flight, the alternator is not supplying power to the system and should be shut down since the alternator field circuit may be placing an unnecessary load on the system. All nonessential equipment should be turned off and the flight terminated as soon as practical. As system voltage deteriorates, all of the readings in the engine instrument cluster will drop proportionally. A complete electrical system failure will cause all readings (including oil pressure) to drop to zero.

SECTION 4
NORMAL PROCEDURES

TABLE OF CONTENTS

	Page
Introduction	4-3
Speeds For Safe Operation	4-3
CHECKLIST PROCEDURES	
Preflight Inspection	4-5
Cabin	4-5
Empennage	4-5
Right Wing, Trailing Edge	4-5
Right Wing	4-5
Nose	4-5
Left Wing	4-6
Left Wing, Leading Edge	4-6
Left Wing, Trailing Edge	4-6
Before Starting Engine	4-6
Starting Engine	4-7
Before Takeoff	4-7
Takeoff	4-8
Normal Takeoff	4-8
Maximum Performance Takeoff	4-8
Enroute Climb	4-8
Normal Climb	4-8
Maximum Performance Climb	4-8
Cruise	4-9
Descent	4-9
Before Landing	4-9
Balked Landing	4-9
Normal Landing	4-10
After Landing	4-10
Securing Airplane	4-10
AMPLIFIED PROCEDURES	
Starting Engine	4-11

TABLE OF CONTENTS (Continued)

	Page
Taxiing	4-11
Before Takeoff	4-13
Warm-Up	4-13
Magneto Check	4-13
Alternator Check	4-13
Takeoff	4-13
Power Check	4-13
Wing Flap Settings	4-14
Crosswind Takeoff	4-14
Enroute Climb	4-15
Cruise	4-15
Leaning With A Cessna Economy Mixture Indicator (EGT)	4-17
Stalls	4-17
Spins	4-17
Landing	4-19
Short Field Landing	4-19
Crosswind Landing	4-20
Balked Landing	4-20
Cold Weather Operation	4-20
Starting	4-20
Flight Operations	4-22
Hot Weather Operation	4-22
Noise Abatement	4-23

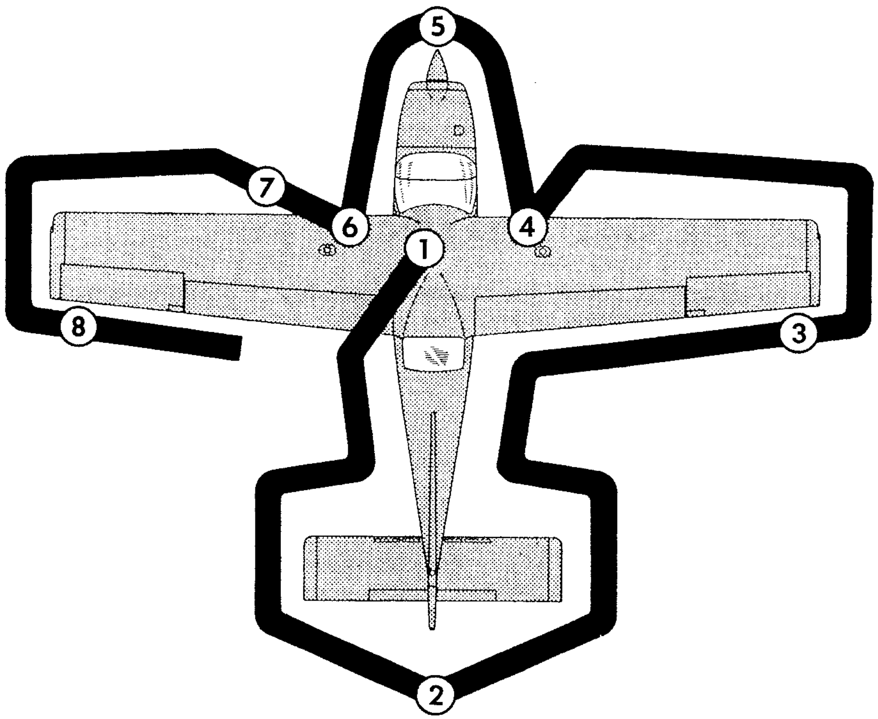
INTRODUCTION

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 SAFE OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 2500 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance, the speed appropriate to the particular weight must be used.

Takeoff:	
Normal Climb Out	65-75 KIAS
Maximum Performance Takeoff, Speed at 50 feet	57 KIAS
Enroute Climb, Flaps Up:	
Normal	75-85 KIAS
Best Rate of Climb, Sea Level	79 KIAS
Best Rate of Climb, 10,000 Feet	70 KIAS
Best Angle of Climb, Sea Level	65 KIAS
Best Angle of Climb, 10,000 Feet	65 KIAS
Landing Approach:	
Normal Approach, Flaps Up	70-80 KIAS
Normal Approach, Flaps 30°	60-70 KIAS
Short Field Approach, Flaps 30°	61 KIAS
Balked Landing:	
During Transition to Maximum Power, Flaps 20°	65 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
2500 Lbs	102 KIAS
2100 Lbs	93 KIAS
1700 Lbs	83 KIAS
Maximum Demonstrated Crosswind Velocity:	
Takeoff or Landing	16 KNOTS



NOTE

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

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

① CABIN

(1) Control Wheel Lock -- REMOVE.
(2) Ignition Switch -- OFF.
(3) Master Switch -- ON.
(4) Fuel Quantity Indicators -- CHECK QUANTITY.
(5) Master Switch -- OFF.
(6) Fuel Selector Valve -- BOTH.
(7) Fuel Shutoff Valve Knob (safety-wired) -- ON.
(8) Baggage Door -- CHECK for security, lock with key if child's seat is to be occupied.

② EMPENNAGE

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

③ RIGHT WING Trailing Edge

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

④ RIGHT WING

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

⑤ NOSE

(1) Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
(2) Engine Oil Level -- CHECK, do not operate with less than six

quarts. Fill to eight quarts for extended flight.
(3) 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, fuel selector valve drain plug, fuel vent line drain plugs, and fuel reservoir quick-drain valve will be necessary.
(4) Propeller and Spinner -- CHECK for nicks, security and oil leaks.
(5) Carburetor Air Filter (inside left nose cap opening) -- CHECK for restrictions by dust or other foreign matter.
(6) Landing and Taxi Lights -- CHECK for condition and cleanliness.
(7) Nose Wheel Strut and Tire -- CHECK for proper inflation.
(8) Nose Tie-Down -- DISCONNECT.

(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 (green).
(3) Fuel Quantity -- CHECK VISUALLY for desired level.
(4) Fuel Filler Cap -- SECURE and vent unobstructed.

(7) LEFT WING Leading Edge

(1) Stall Warning Opening -- CHECK for stoppage. To check the system, place a clean handkerchief over the vent opening and apply suction; a sound from the warning horn will confirm system operation.
(2) Pitot Tube Cover -- REMOVE and check opening for stoppage.
(3) Wing Tie-Down -- DISCONNECT.

(8) LEFT WING Trailing Edge

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

BEFORE STARTING ENGINE

(1) Preflight Inspection -- COMPLETE.
(2) Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
(3) Fuel Selector Valve -- BOTH ON.
(4) Fuel Shutoff Valve -- ON (safety wire secure).
(5) Radios, Autopilot, Electrical Equipment -- OFF.

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

STARTING ENGINE

(1) Mixture -- RICH.
(2) Propeller -- HIGH RPM.
(3) Carburetor Heat -- COLD.
(4) Master Switch -- ON.
(5) Prime -- AS REQUIRED (1 to 6 strokes; none if engine is warm).
(6) Throttle -- OPEN 1/2 INCH.
(7) Propeller Area -- CLEAR.
(8) Ignition Switch -- START (release when engine starts).
(9) Oil Pressure -- CHECK.

BEFORE TAKEOFF

(1) Parking Brake -- SET.
(2) Cabin Doors -- CLOSED and LOCKED.
(3) Flight Controls -- FREE and CORRECT.
(4) Stabilator and Rudder Trim -- TAKEOFF.
(5) Fuel Selector Valve -- BOTH ON.
(6) Mixture -- RICH (below 3000 ft).
(7) Auxiliary Fuel Pump -- CHECK (then OFF).

NOTE

Gravity feed will normally supply satisfactory fuel flow if the engine-driven fuel pump should fail. However, if fuel pressure drops below 2 PSI, use the auxiliary fuel pump.

(8) Throttle -- 1800 RPM.
a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
b. Propeller -- CYCLE from high to low RPM; return to high RPM (full in).
c. Carburetor Heat -- CHECK for RPM drop.
d. Engine Instruments and Ammeter -- CHECK.
e. Suction Gage -- CHECK.
(9) Flight Instruments and Radios -- SET.
(10) Flashing Beacon, Navigation Lights and/or Strobe Lights -- ON as required.

(11) Throttle Friction Lock -- ADJUST.
(12) Wing Flaps -- 0° - 15°.

TAKEOFF

NORMAL TAKEOFF

(1) Wing Flaps -- 0° - 10° (10° preferred).
(2) Carburetor Heat -- COLD.
(3) Power -- FULL THROTTLE and 2700 RPM.
(4) Stabilator Control -- LIFT NOSE WHEEL at 50 KIAS.
(5) Climb Speed -- 65-75 KIAS.
(6) Wing Flaps -- RETRACT.

MAXIMUM PERFORMANCE TAKEOFF

(1) Wing Flaps -- 15°.
(2) Carburetor Heat -- COLD.
(3) Brakes -- APPLY.
(4) Power -- FULL THROTTLE and 2700 RPM.
(5) Mixture -- FULL RICH (lean for maximum power above 3000 feet).
(6) Brakes -- RELEASE.
(7) Stabilator Control -- LIFT NOSE WHEEL at 50 KIAS.
(8) Climb Speed -- 57 KIAS (until all obstacles are cleared).
(9) Wing Flaps -- RETRACT slowly after obstacles are cleared.

ENROUTE CLIMB

NORMAL CLIMB

(1) Airspeed -- 75-85 KIAS.
(2) Power -- 24 INCHES Hg to FULL THROTTLE and 2500-2700 RPM.
(3) Mixture -- FULL RICH (mixture may be leaned above 3000 feet).
(4) Cowl Flaps -- OPEN as required.

MAXIMUM PERFORMANCE CLIMB

(1) Airspeed -- 79 KIAS at sea level to 70 KIAS at 10,000 feet.
(2) Power -- FULL THROTTLE and 2700 RPM.
(3) Mixture -- FULL RICH (mixture may be leaned above 3000 feet).
(4) Cowl Flaps -- FULL OPEN.

CRUISE

(1) Power -- 15-24 INCHES Hg, 2100-2700 RPM (no more than 75% power).
(2) Stabilator and Rudder Trim -- ADJUST.
(3) Mixture -- LEAN.
(4) Cowl Flaps -- CLOSED.

DESCENT

(1) Power -- AS DESIRED

NOTE

Avoid continous operation between 1700 and 1900 RPM with less than 10 inches Hg.

(2) Mixture -- RICH or lean for smooth operation.
(3) Carburetor Heat -- AS REQUIRED to prevent carburetor icing.

BEFORE LANDING

(1) Seats, Belts, Harnesses -- ADJUST and LOCK.
(2) Fuel Selector Valve -- BOTH ON.
(3) Mixture -- RICH.
(4) Carburetor Heat -- ON (apply full heat before closing throttle).
(5) Propeller -- HIGH RPM (full in).
(6) Airspeed -- 70-80 KIAS (flaps UP).
(7) Wing Flaps -- AS DESIRED (0°-10° below 115 KIAS, 10°-30° below 90 KIAS).
(8) Airspeed -- 60-70 KIAS (flaps DOWN).
(9) Stabilator and Rudder Trim -- ADJUST.

BALKED LANDING

(1) Power -- FULL THROTTLE and 2700 RPM.
(2) Carburetor Heat -- COLD.
(3) Wing Flaps -- RETRACT to 20°.
(4) Airspeed -- 65 KIAS.
(5) Wing Flaps -- RETRACT slowly.

(6) Cowl Flaps -- OPEN.

NORMAL LANDING

(1) Touchdown -- MAIN WHEELS FIRST.
(2) Landing Roll -- LOWER NOSE WHEEL GENTLY.
(3) Braking -- MINIMUM REQUIRED.

AFTER LANDING

(1) Wing Flaps -- UP.
(2) Carburetor Heat -- COLD.
(3) Cowl Flaps -- OPEN.

SECURING AIRPLANE

(1) Parking Brake -- SET.
(2) Radios, Electrical Equipment, Autopilot -- OFF.
(3) Mixture -- IDLE CUT-OFF (pull full out).
(4) Ignition Switch -- OFF.
(5) Master Switch -- OFF.
(6) Control Lock -- INSTALL.
(7) Fuel Selector Valve -- RIGHT.

AMPLIFIED PROCEDURES

STARTING ENGINE

Ordinarily the engine starts easily with one or two strokes of the primer in warm temperatures to six strokes in cold weather, with the throttle open approximately 1/2 inch. In extremely cold temperatures, it may be necessary to continue priming while cranking. No priming is required when the engine is warm.

Weak intermittent firing followed by puffs of black smoke from the exhaust stack indicates overpriming or flooding. Excess fuel can be cleared from the combustion chambers by the following procedure: Set the mixture control full lean and the throttle full open; then crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all, and additional priming will be necessary. As soon as the cylinders begin to fire, open the throttle slightly to keep it running.

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

NOTE

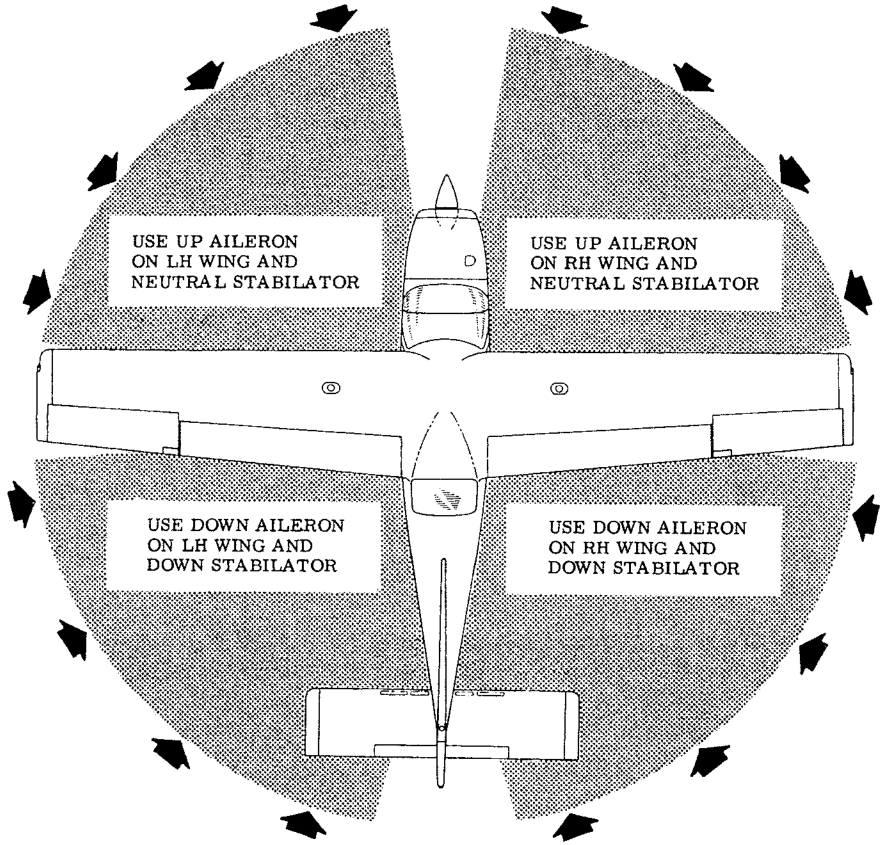
Additional details concerning cold weather starting and operation may be found under COLD WEATHER OPERATION paragraphs in this section.

TAXIING

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see Taxiing Diagram, Figure 4-2 to maintain directional control and balance.

The carburetor heat control knob should be pushed full in during all ground operations unless heat is absolutely necessary for smooth engine operation. When the knob is pulled out to the heat position, air entering the engine is not filtered.

Taxiing over loose gravel or cinders should be done at low engine



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

speed to avoid abrasion and stone damage to the propeller tips.

BEFORE TAKEOFF

WARM-UP

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

MAGNETO CHECK

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

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

ALTERNATOR CHECK

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

TAKEOFF

POWER CHECK

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

Smooth and uniform throttle application should be used to ensure best engine acceleration and to give long engine life. This technique is important under hot weather conditions which may cause a rich mixture that could hinder engine response if the throttle is applied too rapidly.

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

Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum power.

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

WING FLAP SETTINGS

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

For minimum takeoff distance, a 15° flap setting should be used. This setting gives approximately 5% shorter ground run and total distance as compared to the 10° flap setting. Flap settings of greater than 15° are not approved for takeoff.

CROSSWIND TAKEOFF

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

ENROUTE CLIMB

Normal climbs are performed at 75 to 85 KIAS with flaps up and reduced power (down to 24 inches of manifold pressure and 2500 RPM) for increased passenger comfort due to lower noise level. The mixture should be full rich below 3000 feet and may be leaned above 3000 feet for smoother engine operation. The best rate-of-climb speeds range from 79 KIAS at sea level to 70 KIAS at 10,000 feet. If an obstacle dictates the use of a steep climb angle, an obstacle clearance speed of 65 KIAS should be used with flaps up and full throttle at all altitudes.

CRUISE

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

NOTE

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

The Cruise Performance Table, Figure 4-3, illustrates the true airspeed and nautical miles per gallon during cruise for various altitudes and percent power. This table should be used as a guide, along with the

	75% POWER		65% POWER		55% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
Sea Level	120	11.9	112	13.0	103	14.1
5000 Feet	125	12.4	117	13.6	106	14.5
10,000 Feet	130	12.9	121	14.1	109	14.9
Standard Conditions						Zero Wind

Figure 4-3. Cruise Performance Table

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.

The tachometer is marked with a green arc from 2100 to 2700 RPM with a step at 2500 RPM. The use of 2500 RPM will allow 75% power at altitudes up to 8000 feet on a standard day. For hot day or high altitude conditions, the cruise RPM may be increased to 2700 RPM. Cruise at 2700 RPM permits the use of 75% power at altitudes up to 10,000 feet on a standard day. However, for reduced noise levels it is desirable to select the lowest RPM in the green arc range for a given percent power that will provide smooth engine operation.

The cowl flaps should be opened, if necessary, to maintain the cylinder head temperature at approximately three-fourths of the normal operating range (green arc).

Cruise performance data in this handbook and on the power computer is based on a recommended lean mixture setting which should be established as follows:

(1) Pull mixture control out slowly until engine becomes rough.
(2) Push the mixture control in slightly to obtain smooth engine operation; then further enrichen an equal amount.

For best fuel economy at 75% power or less, the engine may be operated at the leanest mixture that results in smooth engine operation. This can result in approximately 10 percent greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

Any change in altitude, power or carburetor heat will require a change in the lean mixture setting and a recheck of the EGT setting (if installed).

Carburetor ice, as evidenced by an unexplained drop in manifold pressure, can be removed by application of full carburetor heat. Upon regaining the original manifold pressure indication (with heat off), use the minimum amount of heat (by trial and error) to prevent ice from forming. Since heated air causes a richer mixture, readjust the mixture setting when carburetor heat is used continuously in cruising flight.

The use of full carburetor heat is recommended during flight in very heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion. The mixture setting should be readjusted for smoothest operation.

MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Pilots Operating Handbook and Power Computer)	Peak EGT Minus 50°F (Enrichen)
BEST ECONOMY	Peak EGT

Figure 4-4. EGT Table

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at 75% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by a desired increment based on figures in the table above. As noted in this table, operation at peak EGT provides best fuel economy. This can result in approximately 10 percent greater range than shown in this handbook accompanied by approximately 4 knots decrease in speed.

When leaning the mixture under some conditions, engine roughness may occur before peak EGT is reached. In this case, use the EGT corresponding to the onset of roughness as the reference point instead of peak EGT.

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.

SPINS

Intentional spins are approved in this airplane (see Section 2). Spins with the rear seats occupied and/or baggage loadings are not approved. Before attempting to perform spins several items should be carefully considered to assure a safe flight. No spins should be attempted without first having received dual instruction both in spin entries and spin recoveries from a qualified instructor who is familiar with the spin characteristics of the Cessna 177B.

The cabin should be clean and all loose equipment (including the microphone) should be stowed. For a solo flight in which spins will be conducted, the copilot's seat belt and shoulder harness and rear seat belts should be secured.

The seat belts and shoulder harnesses should be adjusted to provide proper restraint during all anticipated flight conditions. However, care should be taken to ensure that the pilot can easily reach the flight controls and produce maximum control travels.

It is recommended that, where feasible, entries be accomplished at high enough altitude that recoveries are completed 4000 feet or more above ground level. At least 1000 feet of altitude loss should be allowed for a 1-turn spin and recovery, while a 6-turn spin and recovery may require somewhat more than twice that amount. For example, the recommended entry altitude for a 6-turn spin would be 6000 feet above ground level. In any case, entries should be planned so that recoveries are completed well above the minimum 1500 feet above ground level required by FAR 91.71. Another reason for using high altitudes for practicing spins is that a greater field of view is provided which will assist in maintaining pilot orientation.

The normal entry is made from a power-off stall. As the stall is approached, the stabilator control should be smoothly pulled to the full aft position. Just prior to reaching the stall "break", rudder control in the desired direction of the spin rotation should be applied so that full rudder deflection is reached almost simultaneously with reaching full nose-up stabilator. A slightly greater rate of deceleration than for normal stall entries or the use of partial power at the entry will assure more consistent and positive entries to the spin. Care should be taken to avoid using aileron control since its application can increase the rotation rate and cause erratic rotation. Both stabilator and rudder controls should be held full with the spin until the spin recovery is initiated. An inadvertent relaxation of either of these controls could result in the development of a nose-down spiral.

For the purpose of training in spins and spin recoveries, a 1 to 2 turn spin is adequate and should be used. Up to 2 turns the spin will progress to a fairly rapid rate of rotation and a steep attitude. Application of recovery controls will produce prompt recoveries of from 1/4 to 1/2 of a turn.

Regardless of how many turns the spin is held or how it is entered, the following recovery technique should be used:

(1) VERIFY THAT THROTTLE IS IN IDLE POSITION AND AILERONS ARE NEUTRAL.

(2) APPLY AND HOLD FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
(3) JUST AFTER THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL BRISKLY FORWARD FAR ENOUGH TO BREAK THE STALL.
(4) HOLD THESE CONTROL INPUTS UNTIL ROTATION STOPS. Premature relaxation of the control inputs may extend the recovery.
(5) 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.

Variations in the basic airplane rigging or in weight and balance due to installed equipment or cockpit occupancy can cause differences in behavior, particularly in extended spins. These differences are normal and will result in variations in the spin characteristics and in recovery lengths for spins of more than 3 turns. However, the above recovery procedure should always be used and will result in the most expeditious recovery from any spin.

Intentional spins with flaps extended are prohibited, since the high speeds which may occur during recovery are potentially damaging to the flap/wing structure.

LANDING

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

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

SHORT FIELD LANDING

For maximum performance short field landing in smooth air conditions, make an approach at the minimum recommended airspeed of 61 KIAS with full flaps using enough power to control the glide path. (Slightly higher approach speeds should be used under turbulent air conditions.) After all approach obstacles are cleared, progressively reduce power and maintain the approach speed by lowering the nose of the airplane. Touchdown should be made with power off and on the main wheels first. Immediately after touchdown, lower the nose wheel and apply heavy braking as required. For maximum brake effectiveness, retract the flaps, hold the control wheel full back, and apply maximum brake pressure without sliding the tires.

CROSSWIND LANDING

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

BALKED LANDING

In balked landing (go-around) climb, apply full throttle smoothly, remove carburetor heat, and reduce wing flaps promptly to 20°. Upon reaching 65 KIAS, flaps should be slowly retracted to the full up position.

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

COLD WEATHER OPERATION

STARTING

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

NOTE

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

In extremely cold (-30°C and lower) weather, the use of an external preheater and an external power source are recommended whenever possible

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

Cold weather starting procedures are as follows:

With Preheat:

(1) With ignition switch turned off and throttle closed, prime the engine four to eight strokes as the propeller is being turned over by hand.

NOTE

Use heavy strokes of the primer for best atomization of fuel. After priming, push primer all the way in and turn to the locked position to avoid the possibility of the engine drawing fuel through the primer.

(2) Mixture -- FULL RICH.
(3) Propeller -- HIGH RPM.
(4) Propeller Area -- CLEAR.
(5) Master Switch -- ON.
(6) Throttle -- OPEN 1/2 INCH.
(7) Ignition Switch -- START (release to BOTH when engine starts).
(8) Oil Pressure -- CHECK.

Without Preheat:

(1) Prime the engine six to ten strokes while the propeller is being turned by hand with the throttle closed. Leave the primer charged and ready for a stroke.
(2) Mixture -- FULL RICH.
(3) Propeller -- HIGH RPM.
(4) Propeller Area -- CLEAR.
(5) Master Switch -- ON.
(6) Ignition Switch -- START.
(7) Pump throttle rapidly to full open twice. Return to 1/2 inch open position.
(8) Release ignition switch to BOTH when engine starts.
(9) Continue to prime the engine until it is running smoothly, or alternately, pump the throttle rapidly over the first 1/4 of total travel.
(10) Oil Pressure -- CHECK.

(11) Pull carburetor heat knob full on after the engine has started. Leave on until the engine is running smoothly.
(12) Primer -- LOCKED.

NOTE

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

CAUTION

Pumping the throttle may cause raw fuel to accumulate in the intake air duct, creating a fire hazard in the event of a backfire. If this occurs, maintain a cranking action to suck the flames into the engine. An outside attendant with a fire extinguisher is advised for cold starts without preheat.

During cold weather operations, no indication will be apparent on the oil temperature gage prior to takeoff if outside air temperatures are very cold. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for takeoff.

FLIGHT OPERATIONS

Takeoff is made normally with carburetor heat off. Avoid excessive leaning in cruise. Carburetor heat may be used to overcome any engine roughness due to uneven mixture distribution or ice.

When operating in temperatures below -18°C, avoid using partial carburetor heat. Partial heat may increase the carburetor air temperature to the 0° to 21°C range, where icing is critical under certain atmospheric conditions.

HOT WEATHER OPERATION

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

NOISE ABATEMENT

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

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

(1) Pilots operating airplanes 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.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

Page

Introduction 5-3
Use of Performance Charts 5-3
Sample Problem 5-4
Takeoff 5-4
Cruise 5-5
Fuel Required 5-6
Landing 5-7
Figure 5-1, Airspeed Calibration 5-9
Figure 5-2, Temperature Conversion Chart 5-10
Figure 5-3, Stall Speeds 5-11
Figure 5-4, Takeoff Distance - 2500 Lbs 5-12
Takeoff Distance - 2300 Lbs and 2100 Lbs 5-13
Figure 5-5, Rate of Climb 5-14
Figure 5-6, Time, Fuel, and Distance to Climb - Normal Climb . 5-15
Time, Fuel, and Distance to Climb - Maximum Rate of Climb 5-16
Figure 5-7, Cruise Performance - 2000 Feet 5-17
Cruise Performance - 4000 Feet 5-18
Cruise Performance - 6000 Feet 5-19
Cruise Performance - 8000 Feet 5-20
Cruise Performance - 10,000 Feet 5-21
Cruise Performance - 12,000 Feet 5-22
Figure 5-8, Range Profile - 49 Gallons Fuel 5-23
Range Profile - 60 Gallons Fuel 5-24
Figure 5-9, Endurance Profile - 49 Gallons Fuel 5-25
Endurance Profile - 60 Gallons Fuel 5-26
Figure 5-10, Landing Distance 5-27

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	2450 Pounds
Usable fuel	49 Gallons
TAKEOFF CONDITIONS	
Field pressure altitude	1500 Feet
Temperature	28°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	3500 Feet
CRUISE CONDITIONS	
Total distance	510 Nautical Miles
Pressure altitude	5500 Feet
Temperature	20°C (16°C above standard)
Expected wind enroute	10 Knot Headwind
LANDING CONDITIONS	
Field pressure altitude	2000 Feet
Temperature	25°C
Wind component along runway	6 Knot Headwind
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 maximum performance techniques. 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 2500 lbs., a pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	995 Feet
Total distance to clear a 50-foot obstacle	1865 Feet

A correction for the effect of wind may be made based on Note 3 of the takeoff chart. The distance correction for a 12 knot headwind is:

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

This results in the following distances, corrected for wind:

Ground roll, zero wind	995
Decrease in ground roll (995 feet x 13%)	129
Corrected ground roll	866 Feet
Total distance to clear a 50-foot obstacle, zero wind	1865
Decrease in total distance (1865 feet x 13%)	242
Corrected total distance to clear 50-foot obstacle	1623 Feet

These distances are well within the takeoff field length quoted earlier for the sample problem.

CRUISE

The cruising altitude and winds aloft information have been given for this flight. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics of the airplane 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 range profile chart illustrates the relationship between power and range. Considerable fuel savings and longer range result when lower power settings are used.

For this sample problem with a cruise altitude of 5500 feet and distance of 510 nautical miles, the range profile chart indicates that use of a 75% power setting will necessitate a fuel stop, in view of the anticipated 10 knot headwind component. However, selecting a 65% power setting from the range profile chart yields a predicted range of 571 nautical miles under zero wind conditions. The endurance profile chart, figure 5-9, shows a corresponding 4.9 hours.

The range figure of 571 nautical miles is corrected to account for the expected 10 knot headwind at 5500 feet.

Range, zero wind	571
Decrease in range due to wind (4.9 hours x 10 knot headwind)	49
Corrected range	522 Nautical Miles

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

The cruise performance chart for 6000 feet pressure altitude (figure 5-7, sheet 3) is entered using 20°C above standard temperature. These values most nearly correspond to the expected altitude and temperature conditions. The engine speed and manifold pressure chosen are 2400 RPM and 21 inches Hg, which results in the following:

Power	65%
True airspeed	120 Knots
Cruise fuel flow	8.6 GPH

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

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 (using normal climb) shows that a climb from 1000 feet to 6000 feet requires 2.0 gallons of fuel and may be used as a conservative estimate for this problem. This is for a standard temperature (as shown on the climb chart). The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

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

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

Fuel to climb, standard temperature	2.0
Increase due to non-standard temperature (2.0 x 16%)	0.3
Corrected fuel to climb	2.3 Gallons

In addition, the distance to climb, as given in figure 5-6, may be corrected for non-standard temperature as follows:

Distance to climb, standard temperature	14
Increase due to non-standard temperature (14 nautical miles x 16%)	2
Corrected distance to climb	16 Nautical Miles

The resultant cruise distance is:

Total distance	510
Climb distance	-16
Cruise distance	494 Nautical Miles

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

$$120 - 10 = 110 \text{ Knots}$$

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

$$\frac{494 \text{ Nautical Miles}}{110 \text{ Knots}} = 4.5 \text{ Hours}$$

The fuel required for cruise is endurance times fuel consumption:

4.5 hours x 8.6 gallons/hour = 38.7 Gallons

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	1.4
Climb	2.3
Cruise	38.7
Total fuel required	42.4 Gallons

This will leave a fuel reserve of:

$$49.0 - 42.4 = 6.6 \text{ Gallons}$$

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

LANDING

A procedure similar to the takeoff calculations should be used for estimating the landing distance at the destination airport. Figure 5-10 presents maximum performance technique landing distances for various airport altitude and temperature combinations. The distances corresponding to 2000 feet altitude and 30°C should be used and result in the following:

Ground roll	680 Feet
Total distance to clear a 50-foot obstacle	1335 Feet

A correction for wind may be made based on Note 2 of the landing chart. The distance correction for a 6 knot headwind is:

$$\frac{6\ \text{Knots}}{9\ \text{Knots}} \times 10\% = 7\%\ \text{Decrease}$$

This results in the following wind-corrected figures:

Ground roll	632 Feet
Total distance over a 50-foot obstacle	1242 Feet

These distances are well within the landing field length quoted previously for this sample problem.

AIRSPEED CALIBRATION

HEATED PITOT

NORMAL STATIC SOURCE

FLAPS UP														
KIAS	40	50	60	70	80	90	100	110	120	130	140	150	160	170
KCAS	44	53	63	72	81	90	99	109	118	127	136	145	154	163
FLAPS 15°														
KIAS	40	50	60	70	80	90	---	---	---	---	---	---	---	---
KCAS	46	54	63	72	81	90	---	---	---	---	---	---	---	---
FLAPS 30°														
KIAS	40	50	60	70	80	90	---	---	---	---	---	---	---	---
KCAS	46	55	63	72	81	90	---	---	---	---	---	---	---	---

ALTERNATE STATIC SOURCE
VENTS AND WINDOWS OPEN

FLAPS UP														
NORMAL KIAS	40	50	60	70	80	90	100	110	120	130	140	150	160	170
ALTERNATE KIAS	45	55	65	74	84	94	104	114	124	134	143	153	162	172
FLAPS 15°														
NORMAL KIAS	40	50	60	70	80	90	---	---	---	---	---	---	---	---
ALTERNATE KIAS	46	56	66	76	86	96	---	---	---	---	---	---	---	---
FLAPS 30°														
NORMAL KIAS	40	50	60	70	80	90	---	---	---	---	---	---	---	---
ALTERNATE KIAS	47	57	66	76	85	94	---	---	---	---	---	---	---	---

Figure 5-1. Airspeed Calibration

TEMPERATURE CONVERSION CHART

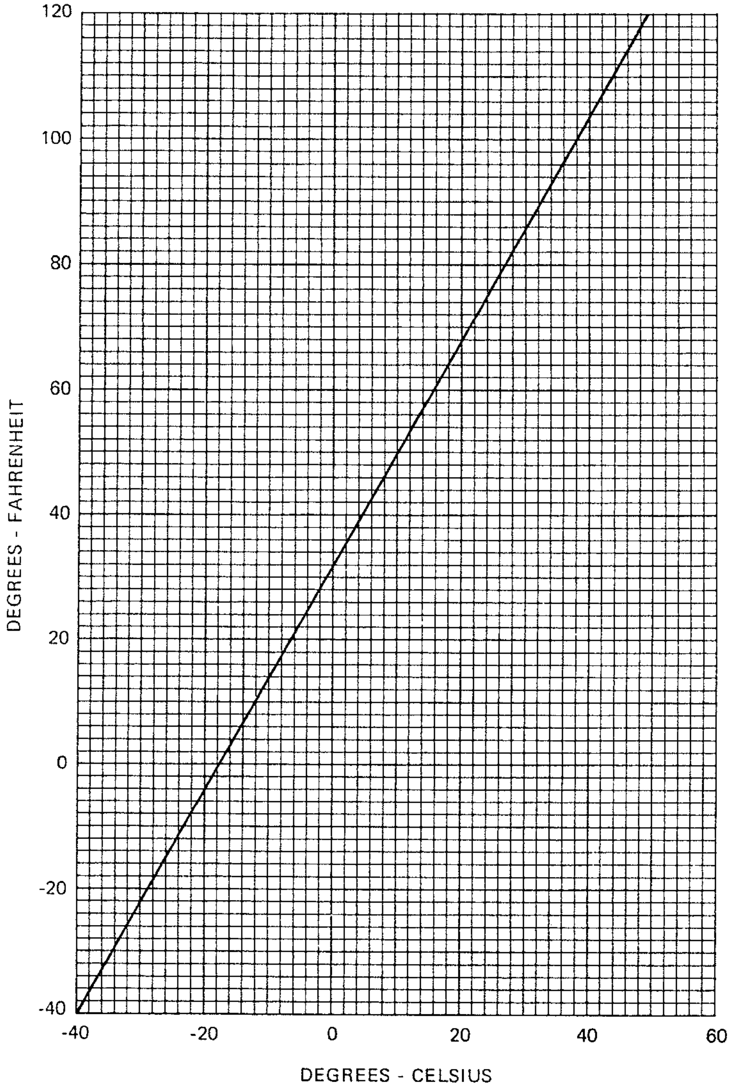


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off

NOTES:
1. Maximum altitude loss during a stall recovery is approximately 180 feet.
2. KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2500	UP	52	55	56	59	62	65	74	78
	15°	45	50	48	54	54	59	64	71
	30°	40	46	43	49	48	55	57	65

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2500	UP	54	57	58	61	64	68	76	81
	15°	47	52	51	56	56	62	66	74
	30°	45	50	48	54	54	59	64	71

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE

MAXIMUM WEIGHT 2500 LBS

CONDITIONS:
Flaps 15°
2700 RPM and Full Throttle Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind

NOTES:
1. Maximum performance technique as specified in Section 4.
2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum power in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
4. Where distance value has been deleted, climb performance after lift-off is less than 150 fpm at takeoff speed.
5. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2500	52	57	S.L.	675	1270	725	1355	775	1445	830	1545	890	1650
			1000	735	1385	790	1480	850	1585	910	1695	970	1810
			2000	805	1520	865	1625	930	1740	995	1865	1065	1995
			3000	880	1670	950	1790	1015	1920	1090	2055	1170	2205
			4000	965	1840	1040	1975	1115	2125	1200	2280	1285	2455
			5000	1065	2035	1145	2195	1230	2360	1320	2545	1415	2745
			6000	1170	2270	1260	2450	1355	2645	1455	2860	1560	3100
			7000	1290	2540	1390	2750	1495	2985	1605	3240	---	---
			8000	1425	2865	1535	3120	1655	3400	---	---	---	---

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

TAKEOFF DISTANCE

2300 LBS AND 2100 LBS

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
2300	50	55	S.L.	555	1050	595	1120	640	1195	685	1270	730	1355
			1000	605	1145	650	1220	700	1300	745	1385	800	1480
			2000	665	1250	710	1335	765	1425	815	1520	875	1620
			3000	725	1365	780	1460	835	1560	895	1670	955	1785
			4000	795	1500	855	1605	915	1720	980	1840	1050	1970
			5000	870	1650	935	1770	1005	1900	1075	2035	1155	2185
			6000	955	1825	1030	1960	1105	2105	1185	2265	1270	2435
			7000	1055	2025	1135	2180	1220	2350	1305	2530	1400	2730
			8000	1160	2260	1250	2440	1345	2635	1445	2850	1550	3090
2100	48	53	S.L.	450	865	485	920	520	980	555	1040	590	1105
			1000	495	940	530	1000	565	1065	605	1130	645	1205
			2000	535	1020	575	1090	615	1160	660	1235	705	1315
			3000	585	1115	630	1190	675	1265	720	1350	770	1440
			4000	640	1215	690	1300	740	1390	790	1480	845	1580
			5000	705	1335	755	1425	810	1525	865	1630	930	1740
			6000	770	1465	830	1570	890	1680	955	1800	1020	1925
			7000	850	1620	910	1735	980	1860	1050	1995	1125	2140
			8000	935	1790	1005	1925	1080	2070	1155	2225	1240	2390

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

RATE OF CLIMB

CONDITIONS:
Flaps Up
2700 RPM
Full Throttle
Cowl Flaps Open

NOTE:
Mixture leaned above 3000 feet for maximum power.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
2500	S.L.	79	970	895	820	745
	2000	77	850	780	705	635
	4000	76	730	660	590	525
	6000	74	610	545	480	410
	8000	72	495	430	365	300
	10,000	70	375	315	255	- - -
	12,000	68	260	200	140	- - -

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 80 KIAS

CONDITIONS:
Flaps Up
2500 RPM
24 Inches MP or Full Throttle
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 1.4 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for best power.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED GALLONS	DISTANCE NM
2500	S.L.	15	510	0	0	0
	1000	13	510	2	0.4	3
	2000	11	510	4	0.8	5
	3000	9	510	6	1.2	8
	4000	7	510	8	1.6	11
	5000	5	510	10	2.0	14
	6000	3	485	12	2.4	17
	7000	1	430	14	2.8	20
	8000	-1	375	17	3.3	24
	9000	-3	320	20	3.8	29
	10,000	-5	265	23	4.4	34
	11,000	-7	210	27	5.2	41
	12,000	-9	155	33	6.2	50

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

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
2700 RPM
Full Throttle
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 1.4 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for maximum power.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2500	S.L.	15	79	840	0	0	0
	1000	13	78	790	1	0.3	2
	2000	11	77	740	3	0.7	3
	3000	9	77	685	4	1.1	5
	4000	7	76	635	6	1.5	7
	5000	5	75	585	7	1.9	10
	6000	3	74	535	9	2.3	12
	7000	1	73	485	11	2.8	15
	8000	-1	72	430	13	3.3	18
	9000	-3	71	380	16	3.8	22
	10,000	-5	70	330	19	4.5	26
	11,000	-7	69	280	22	5.2	30
	12,000	-9	68	230	26	6.0	36

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
Recommended Lean Mixture
2500 Pounds
Cowl Flaps Closed

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	24	- - -	- - -	- - -	78	124	10.5	76	125	10.1
	23	77	120	10.3	74	121	9.9	71	122	9.5
	22	72	117	9.6	70	118	9.2	67	118	8.9
	21	68	114	8.9	65	114	8.6	63	114	8.3
2400	24	- - -	- - -	- - -	76	123	10.3	74	124	9.9
	23	75	119	10.0	72	120	9.6	70	120	9.3
	22	70	116	9.4	68	117	9.0	66	117	8.7
	21	66	113	8.7	64	113	8.4	62	113	8.1
2300	24	77	121	10.3	74	121	9.9	72	122	9.5
	23	73	118	9.7	70	118	9.3	68	118	9.0
	22	68	115	9.0	66	115	8.7	64	115	8.4
	21	64	111	8.4	62	111	8.2	60	111	7.9
2200	24	74	119	9.9	71	119	9.5	69	120	9.2
	23	70	116	9.3	67	116	8.9	65	116	8.6
	22	66	113	8.7	63	113	8.4	61	112	8.1
	21	61	109	8.1	59	109	7.9	57	108	7.6
2100	24	71	117	9.4	68	117	9.0	66	117	8.7
	23	67	114	8.8	65	114	8.5	62	113	8.2
	22	63	110	8.3	61	110	8.0	59	110	7.8
	21	59	106	7.8	57	106	7.5	55	106	7.3
	20	55	102	7.3	53	102	7.1	51	101	6.9
	19	51	98	6.9	49	97	6.7	47	96	6.6
	18	47	93	6.5	45	92	6.3	44	90	6.2

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
Recommended Lean Mixture
2500 Pounds
Cowl Flaps Closed

		20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	23	---	---	---	76	125	10.2	73	125	9.8
	22	74	121	9.9	72	121	9.5	69	122	9.2
	21	70	118	9.2	67	118	8.9	65	118	8.6
	20	65	114	8.6	63	114	8.3	61	113	8.0
2400	24	---	---	---	79	127	10.6	76	127	10.2
	23	77	123	10.3	74	123	9.9	72	124	9.6
	22	72	120	9.7	70	120	9.3	68	120	8.9
	21	68	116	9.0	66	116	8.7	63	116	8.4
2300	24	---	---	---	76	125	10.2	74	125	9.8
	23	75	121	10.0	72	122	9.6	70	122	9.2
	22	70	118	9.3	68	118	9.0	66	118	8.7
	21	66	115	8.7	64	114	8.4	62	114	8.1
2200	24	76	122	10.2	73	123	9.8	71	123	9.4
	23	72	119	9.6	69	120	9.2	67	120	8.9
	22	68	116	9.0	65	116	8.6	63	116	8.3
	21	64	112	8.4	61	112	8.1	59	112	7.8
2100	24	73	120	9.7	70	121	9.3	68	121	9.0
	23	69	117	9.1	67	117	8.8	64	117	8.5
	22	65	114	8.6	63	113	8.3	61	113	8.0
	21	61	110	8.0	59	110	7.8	57	109	7.5
	20	57	106	7.5	55	105	7.3	53	104	7.1
	19	53	101	7.1	51	101	6.9	49	99	6.7
	18	49	96	6.7	47	95	6.5	45	93	6.4
	17	45	91	6.3	43	89	6.2	42	86	6.0

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
Recommended Lean Mixture
2500 Pounds
Cowl Flaps Closed

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2500	23	---	---	---	78	128	10.5	75	129	10.1
	22	76	125	10.3	74	125	9.8	71	125	9.5
	21	72	121	9.5	69	121	9.2	67	121	8.8
	20	67	117	8.9	65	117	8.5	63	117	8.3
2400	23	---	---	---	76	127	10.2	74	127	9.8
	22	75	123	10.0	72	124	9.6	69	124	9.2
	21	70	120	9.3	67	120	8.9	65	120	8.6
	20	65	116	8.6	63	116	8.3	61	115	8.1
2300	23	77	125	10.3	74	125	9.9	71	125	9.5
	22	72	122	9.6	70	122	9.2	67	122	8.9
	21	68	118	9.0	65	118	8.6	63	118	8.4
	20	64	114	8.4	61	114	8.1	59	113	7.8
2200	23	74	123	9.9	71	123	9.5	69	123	9.1
	22	70	120	9.3	67	120	8.9	65	119	8.6
	21	66	116	8.7	63	116	8.3	61	115	8.1
	20	61	112	8.1	59	111	7.8	57	111	7.6
2100	23	71	121	9.4	68	121	9.1	66	121	8.7
	22	67	117	8.8	65	117	8.5	62	117	8.2
	21	63	113	8.3	61	113	8.0	59	113	7.8
	20	59	109	7.8	57	109	7.5	55	108	7.3
	19	55	105	7.3	53	104	7.1	51	103	6.9
	18	51	100	6.8	49	99	6.7	47	97	6.5
	17	46	94	6.5	45	92	6.3	43	90	6.2

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
Recommended Lean Mixture
2500 Pounds
Cowl Flaps Closed

		20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2700	21	---	---	---	75	128	10.0	72	128	9.6
	20	73	124	9.7	70	124	9.3	68	124	9.0
	19	68	120	9.0	66	120	8.7	63	119	8.4
	18	63	115	8.3	61	115	8.0	59	114	7.8
2600	22	---	---	---	78	130	10.4	75	130	10.0
	21	76	126	10.2	73	127	9.7	70	127	9.4
	20	71	122	9.4	68	122	9.0	66	122	8.7
	19	66	118	8.7	64	118	8.4	62	117	8.1
2500	22	79	128	10.6	76	129	10.1	73	129	9.8
	21	74	125	9.9	71	125	9.5	69	125	9.1
	20	69	121	9.2	67	121	8.8	64	120	8.5
	19	64	117	8.5	62	116	8.2	60	116	7.9
2400	22	77	127	10.3	74	127	9.9	71	127	9.5
	21	72	123	9.6	69	123	9.2	67	123	8.9
	20	67	119	8.9	65	119	8.6	63	119	8.3
	19	63	115	8.3	61	114	8.0	58	114	7.7
2300	22	74	125	9.9	72	125	9.5	69	125	9.2
	21	70	121	9.3	67	121	8.9	65	121	8.6
	20	65	117	8.6	63	117	8.3	61	117	8.0
	19	61	113	8.0	59	112	7.8	57	112	7.5
2200	22	72	123	9.6	69	123	9.2	67	123	8.8
	21	68	120	8.9	65	119	8.6	63	119	8.3
	20	63	115	8.4	61	115	8.1	59	115	7.8
	19	59	111	7.8	57	110	7.6	55	109	7.3
2100	22	69	121	9.2	67	121	8.8	64	120	8.5
	21	65	117	8.6	63	117	8.3	60	116	8.0
	19	57	108	7.5	55	108	7.3	53	106	7.1
	18	52	103	7.1	51	102	6.8	49	100	6.7
	17	48	98	6.6	47	96	6.5	45	93	6.3

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
Recommended Lean Mixture
2500 Pounds
Cowl Flaps Closed

		20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE - 5°C			20°C ABOVE STANDARD TEMP 15°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2700	20.5	77	130	10.4	75	130	10.0	72	130	9.6
	20	75	128	10.0	72	128	9.6	70	128	9.3
	19	70	124	9.3	68	123	8.9	65	123	8.6
	18	65	119	8.6	63	118	8.3	61	118	8.0
2600	20.5	75	128	10.1	73	128	9.7	70	128	9.3
	20	73	126	9.7	70	126	9.3	68	126	9.0
	19	68	122	9.0	66	121	8.7	63	121	8.4
	18	63	117	8.4	61	116	8.1	59	116	7.8
2500	20.5	74	127	9.8	71	127	9.4	68	126	9.1
	20	71	125	9.5	69	124	9.1	66	124	8.7
	19	66	120	8.8	64	120	8.4	62	119	8.2
	18	62	115	8.1	59	115	7.9	57	114	7.6
2400	20.5	72	125	9.5	69	125	9.1	67	124	8.8
	20	69	123	9.2	67	123	8.8	64	122	8.5
	19	65	118	8.5	62	118	8.2	60	117	8.0
	18	60	114	7.9	58	113	7.7	56	112	7.4
2300	20.5	70	123	9.2	67	123	8.8	65	122	8.5
	20	67	121	8.9	65	121	8.6	63	120	8.3
	19	63	116	8.3	60	116	8.0	58	115	7.7
	18	58	112	7.7	56	111	7.5	54	109	7.2
2200	20.5	68	121	8.9	65	121	8.6	63	120	8.3
	20	65	119	8.6	63	119	8.3	61	118	8.0
	19	61	115	8.1	59	114	7.8	57	113	7.5
	18	57	110	7.5	55	109	7.3	53	107	7.1
2100	20.5	65	119	8.6	63	118	8.3	60	118	8.0
	20	63	116	8.3	61	116	8.0	58	115	7.7
	19	59	112	7.8	56	111	7.5	55	110	7.3
	18	54	107	7.3	52	106	7.0	51	104	6.8
	17	50	101	6.8	48	99	6.6	47	97	6.5
	16	46	94	6.4	44	91	6.2	43	88	6.1

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
Recommended Lean Mixture
2500 Pounds
Cowl Flaps Closed

		20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2700	19	72	127	9.6	69	127	9.2	67	127	8.9
	18	67	123	8.9	65	122	8.5	62	122	8.2
	17	62	117	8.2	60	117	7.9	58	115	7.7
	16	57	112	7.6	55	110	7.3	53	108	7.1
2600	19	70	126	9.3	68	125	8.9	65	125	8.6
	18	65	121	8.6	63	120	8.3	61	119	8.0
	17	60	115	8.0	58	114	7.7	56	113	7.4
	16	55	109	7.4	53	108	7.1	51	106	6.9
2500	19	68	124	9.1	66	123	8.7	64	123	8.4
	18	64	119	8.4	61	118	8.1	59	117	7.8
	17	59	114	7.8	57	112	7.5	55	111	7.3
	16	54	108	7.2	52	106	7.0	50	104	6.8
2400	19	67	122	8.8	64	121	8.5	62	121	8.2
	18	62	117	8.2	60	116	7.9	58	115	7.6
	17	57	112	7.6	55	110	7.3	53	109	7.1
	16	53	106	7.1	51	104	6.8	49	102	6.7
2300	19	65	120	8.5	62	119	8.2	60	118	7.9
	18	60	115	7.9	58	114	7.7	56	113	7.4
	17	56	110	7.4	53	108	7.2	52	106	7.0
	16	51	103	6.9	49	101	6.7	47	98	6.5
2200	19	63	118	8.3	61	118	8.0	59	116	7.8
	18	59	113	7.8	56	112	7.5	54	111	7.3
	17	54	108	7.2	52	106	7.0	50	104	6.8
	16	50	101	6.7	48	99	6.6	46	95	6.4
2100	19	61	116	8.0	58	115	7.7	56	113	7.5
	18	56	111	7.5	54	109	7.2	52	107	7.0
	17	52	105	7.0	50	103	6.8	48	100	6.6
	16	48	98	6.6	46	95	6.4	44	91	6.2

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

RANGE PROFILE

45 MINUTES RESERVE
49 GALLONS USABLE FUEL

CONDITIONS:
2500 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6 (sheet 1).
2. Reserve fuel is based on 45 minutes at 45% BHP and is 4.7 gallons.

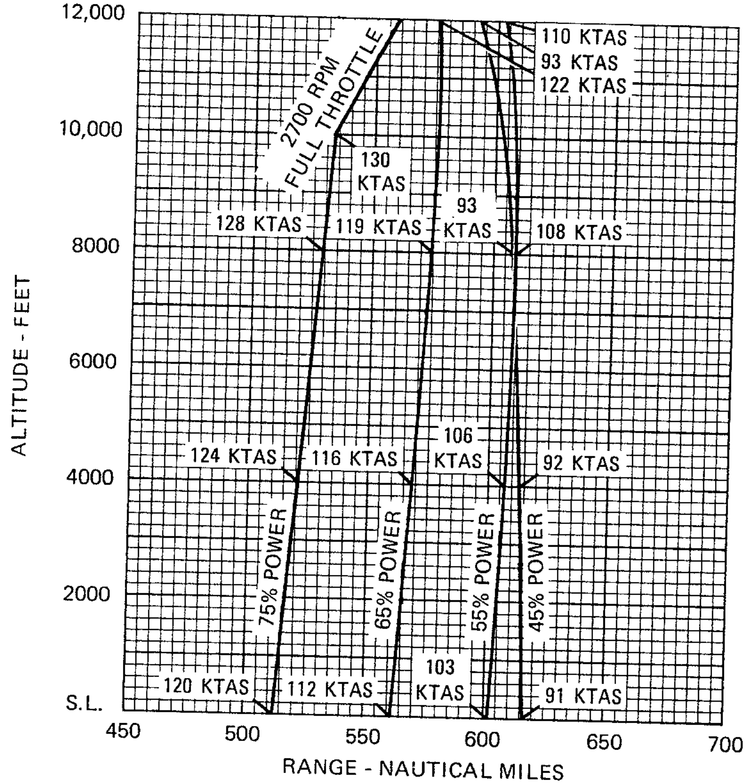


Figure 5-8. Range Profile (Sheet 1 of 2)

RANGE PROFILE
45 MINUTES RESERVE
60 GALLONS USABLE FUEL

CONDITIONS:
2500 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6 (sheet 1).
2. Reserve fuel is based on 45 minutes at 45% BHP and is 4.7 gallons.

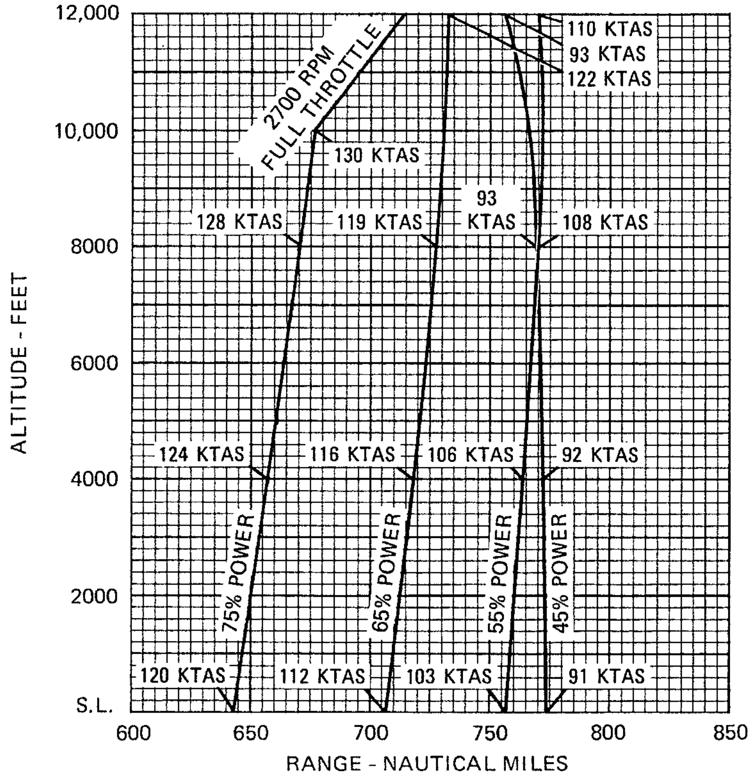


Figure 5-8. Range Profile (Sheet 2 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
49 GALLONS USABLE FUEL

CONDITIONS:
2500 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6 (sheet 1).
2. Reserve fuel is based on 45 minutes at 45% BHP and is 4.7 gallons.

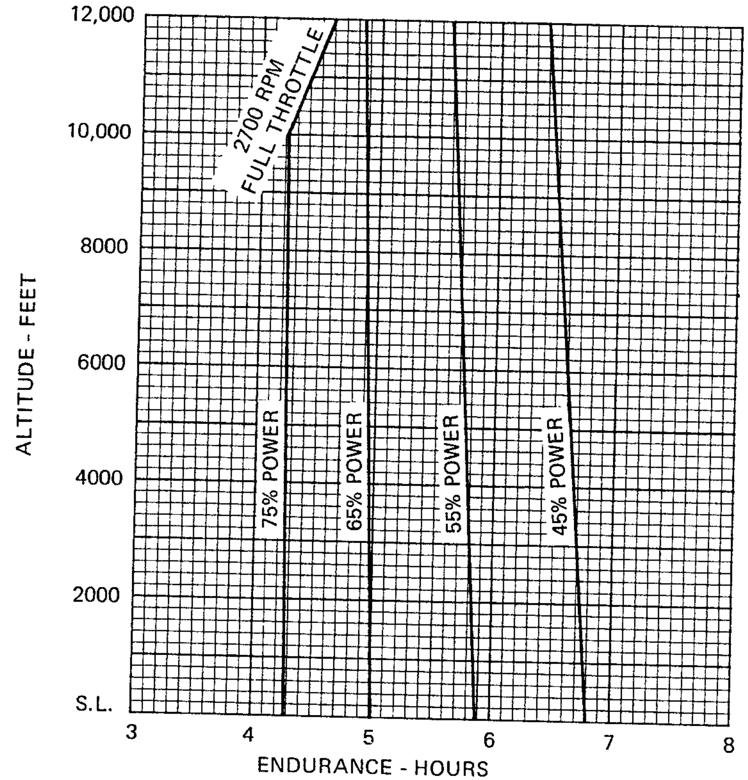


Figure 5-9. Endurance Profile (Sheet 1 of 2)

ENDURANCE PROFILE
45 MINUTES RESERVE
60 GALLONS USABLE FUEL

CONDITIONS:
2500 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6 (sheet 1).
2. Reserve fuel is based on 45 minutes at 45% BHP and is 4.7 gallons.

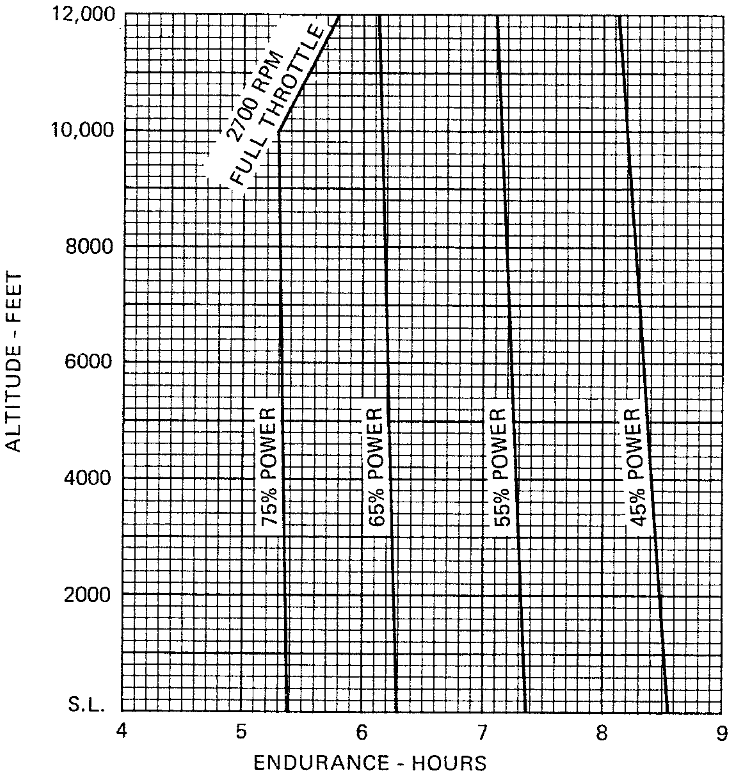


Figure 5-9. Endurance Profile (Sheet 2 of 2)

LANDING DISTANCE

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

NOTES:
1. Maximum performance technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on a dry, grass runway, increase distances by 40% of the "ground roll" figure.

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2500	61	S.L.	570	1175	590	1205	610	1235	630	1265	650	1295
		1000	590	1205	610	1235	635	1270	655	1300	675	1330
		2000	610	1235	635	1270	655	1300	680	1335	700	1370
		3000	635	1270	660	1305	680	1340	705	1375	730	1410
		4000	660	1310	685	1345	705	1375	730	1410	755	1450
		5000	685	1345	710	1380	735	1420	760	1455	785	1490
		6000	710	1380	735	1420	760	1455	790	1500	815	1535
		7000	735	1420	765	1460	790	1500	820	1540	845	1580
		8000	765	1465	795	1505	820	1545	850	1585	880	1630

Figure 5-10. Landing Distance

SECTION 6
WEIGHT & BALANCE/ EQUIPMENT LIST

TABLE OF CONTENTS

Page

Introduction 6-3
Airplane Weighing Procedures 6-3
Weight and Balance 6-5
Baggage and Cargo Tie-Down 6-6
Equipment List. 6-15

INTRODUCTION

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

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

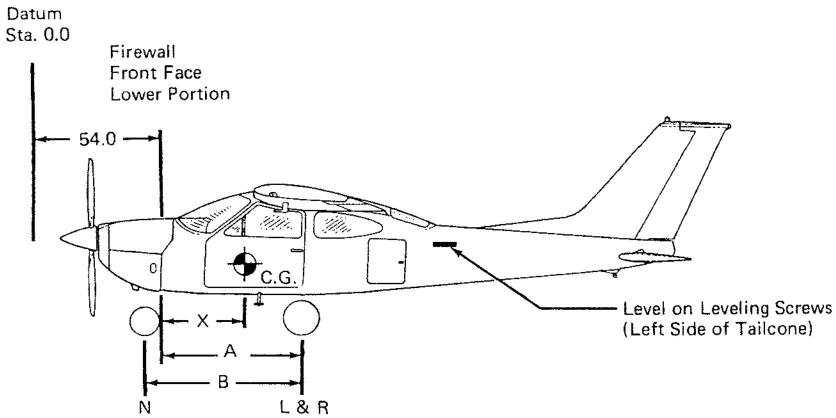
AIRPLANE WEIGHING PROCEDURES

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

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

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

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



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

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

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

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

Figure 6-1. Sample Airplane Weighing

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

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

WEIGHT AND BALANCE

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

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

NOTE

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

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

NOTE

Loading Graph information for the pilot, passengers, baggage/cargo, and hatshelf is based on seats positioned for average occupants and baggage/cargo or hatshelf items loaded in the center of these areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft c.g. range limitation (seat travel and baggage/cargo or hatshelf area limitation). Additional moment calculations, based on the actual weight and c.g. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph. A reduced fuel weight may be measured for use with heavy cabin loadings by filling both tanks to the 22 gallon marker for 43 gallons (258 pounds) usable. Both tanks may be filled for maximum range, provided maximum take-off weight is not exceeded.

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

BAGGAGE AND CARGO TIE-DOWN

A nylon baggage net is provided to secure baggage in the area aft of the rear seat and on the hatshelf. Four eyebolts serve as attaching points for the net. Two eyebolts for the forward tie-down straps are located on the cabin floor near each sidewall forward of the baggage door, and two eyebolts are located below the side windows near the aft baggage wall.

A cargo tie-down kit consisting of eight tie-down attachments is available if one desires to remove the rear seat (and auxiliary seat, if installed) and utilize the rear cabin area to haul cargo. Two tie-down block attachments clamp to the aft end of the two outboard front seat rails and are locked in place by a bolt which must be tightened to a minimum of fifty inch pounds. Six latch plate tie-down attachments bolt to standard attach points in the cabin floor. The six attach points are located as follows: two are located inboard and approximately 17 inches aft of the rear door posts at station 140; two are located at the forward edge of the baggage door at station 155; and two are located just forward of the aft baggage wall at station 173. The maximum allowable cabin floor loading is 200 pounds/square foot; however, when items with small or sharp support areas are carried, the installation of a 1/4 inch plywood floor is recommended to protect the aircraft structure. The maximum rated load weight capacity for each of the six latch plate tie-downs is 140 pounds and is 100 pounds for the two seat rail tie-downs. Rope, strap, or cable used for tie-down should be rated at a minimum of ten times the load weight capacity of the tie-down fittings used. Weight and balance calculations for cargo in the area of the second row seat (CARGO 1) and the baggage area (CARGO 2) can be figured on the Loading Graph using the lines labeled 2nd Row Passengers or Cargo 1 and/or Baggage, Passenger on Auxiliary Seat, or Cargo 2 and Hatshelf respectively. If the position of cargo loads is different from that shown on the Loading Arrangements diagram, the moment must be determined by multiplying the weight by the actual c.g. arm.

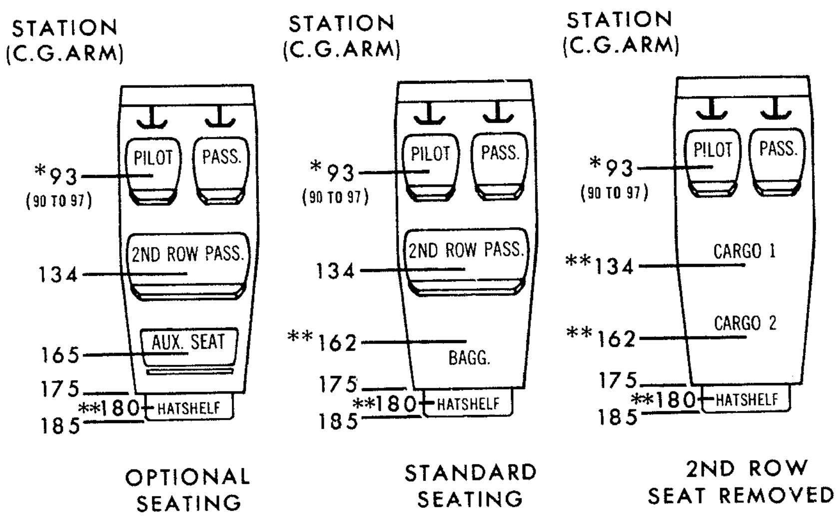
SAMPLE WEIGHT AND BALANCE RECORD

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

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

Figure 6-2. Sample Weight and Balance Record

LOADING ARRANGEMENTS



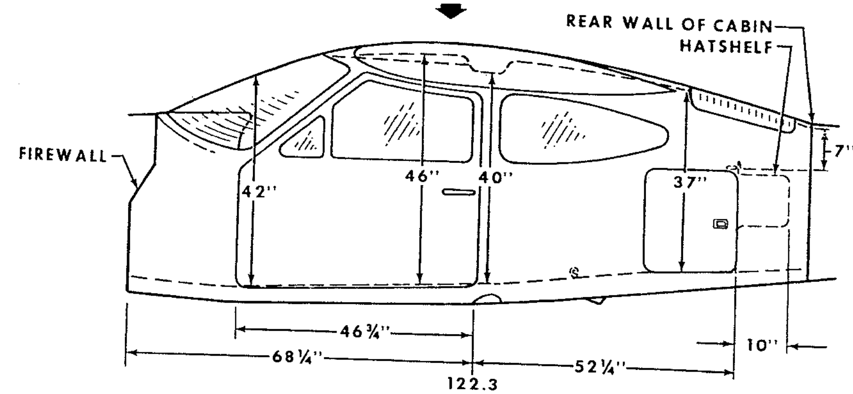
* Pilot or passenger center of gravity on adjustable seats positioned for average occupant. Numbers in parentheses indicate forward and aft limits of occupant center of gravity range.

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

NOTE: The aft baggage wall (approximate station 175) can be used as a convenient interior reference point for determining the location of baggage area fuselage stations.

Figure 6-3. Loading Arrangements

CABIN HEIGHT MEASUREMENTS



DOOR OPENING DIMENSIONS

	WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (CENTER)	HEIGHT (REAR)
CABIN DOOR	23"	47½"	23"	43"	38"
BAGGAGE DOOR	17½"	17½"	20½"	—	20"

═ WIDTH ═
• LWR. WINDOW LINE
* CABIN FLOOR

CABIN WIDTH MEASUREMENTS

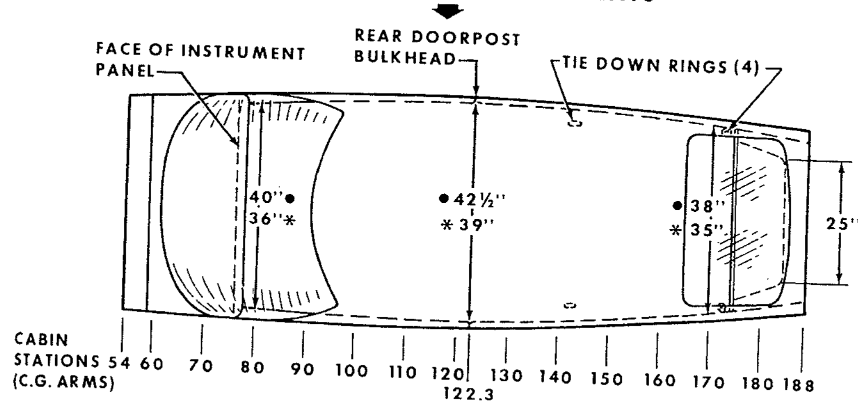


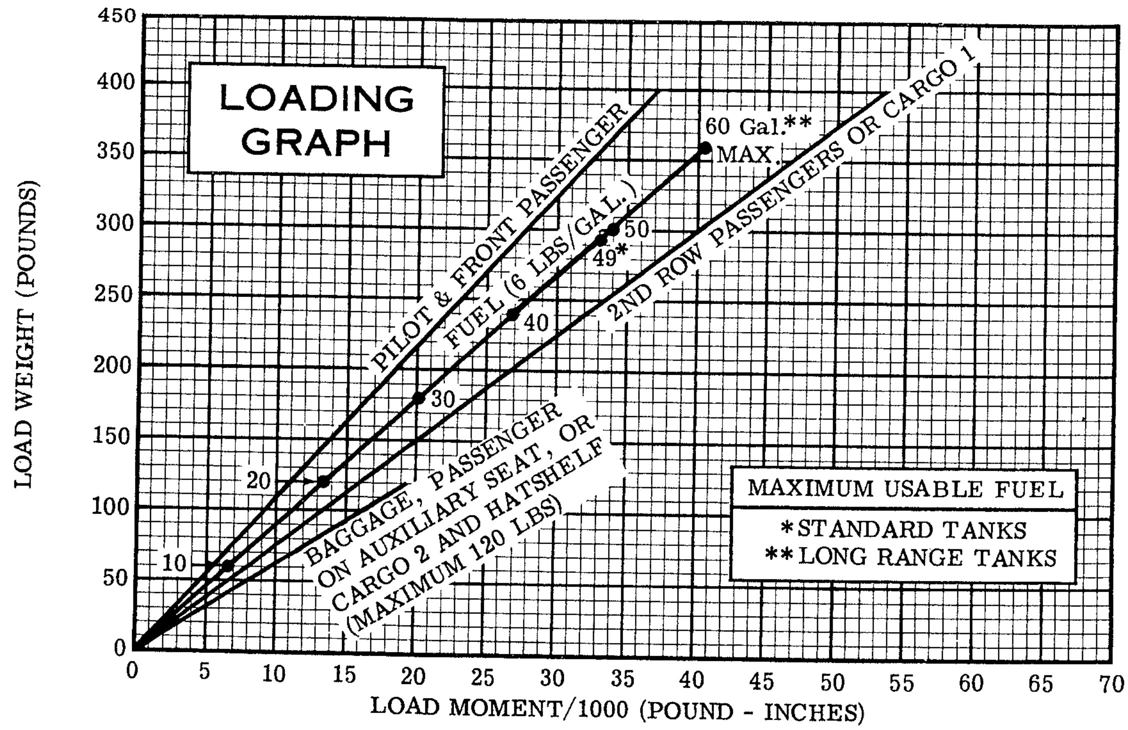
Figure 6-4. Internal Cabin Dimensions

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)
1. Basic Empty Weight (Use the data pertaining to your airplane as it is presently equipped. Includes unusable fuel and full oil)	1540	159.2		
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (49 Gal. Maximum)				
Long Range Tanks (60 Gal. Maximum)				
Reduced Fuel (43 Gal.)	258	28.9		
3. Pilot and Front Passenger (Station 90 to 97)	340	31.6		
4. Second Row Passengers	340	45.6		
Cargo 1 Replacing Second Row Seat (Station 126 to 142)				
5. Baggage, Passenger on Auxiliary Seat, or Cargo 2 and Hatshelf (Station 142 to 185) 120 Lbs. Maximum	22	3.6		
6. TOTAL WEIGHT AND MOMENT	2500	268.9		
7. Locate this point (2500 at 268.9) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.				

Figure 6-5. Sample Loading Problem

CESSNA
MODEL 177B

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST



NOTES: (1) Line representing adjustable seats shows the pilot and front passenger center of gravity on adjustable seats positioned for an average occupant. Refer to the Loading Arrangements diagram for forward and aft limits of occupant c.g. range.
(2) Hatshelf Maximum Load = 25 lbs.

Figure 6-6. Loading Graph

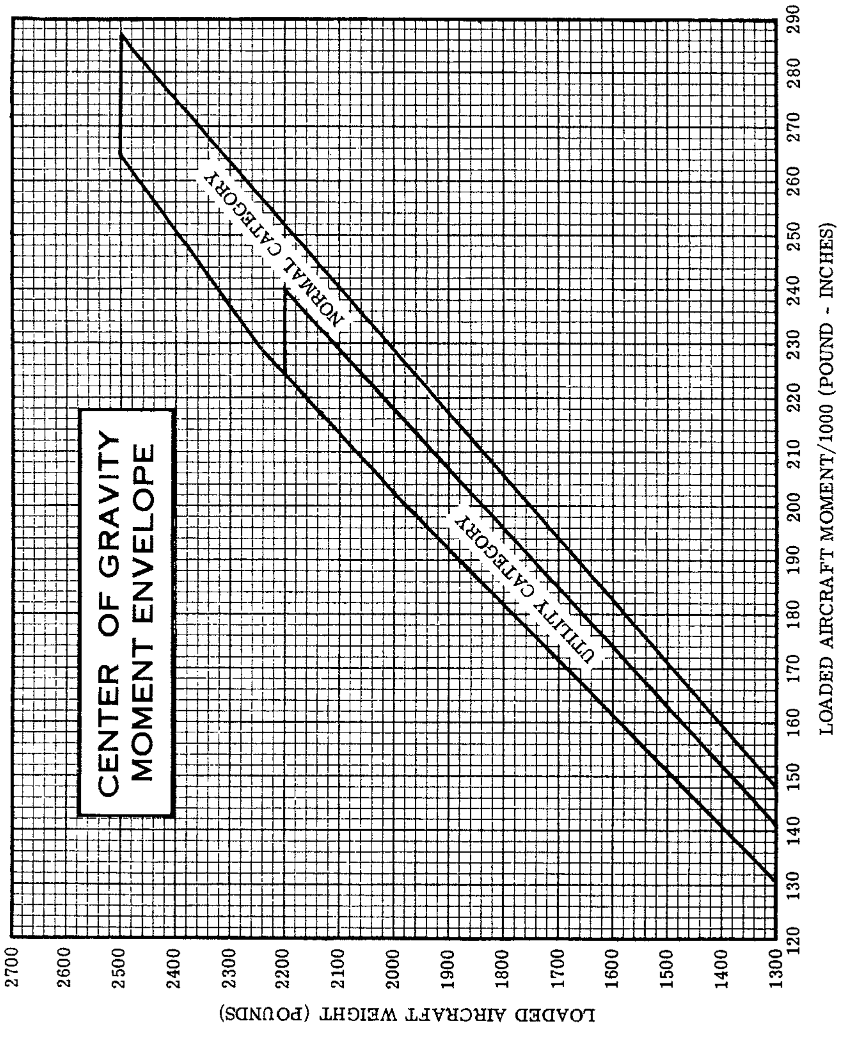


Figure 6-7. Center of Gravity Moment Envelope

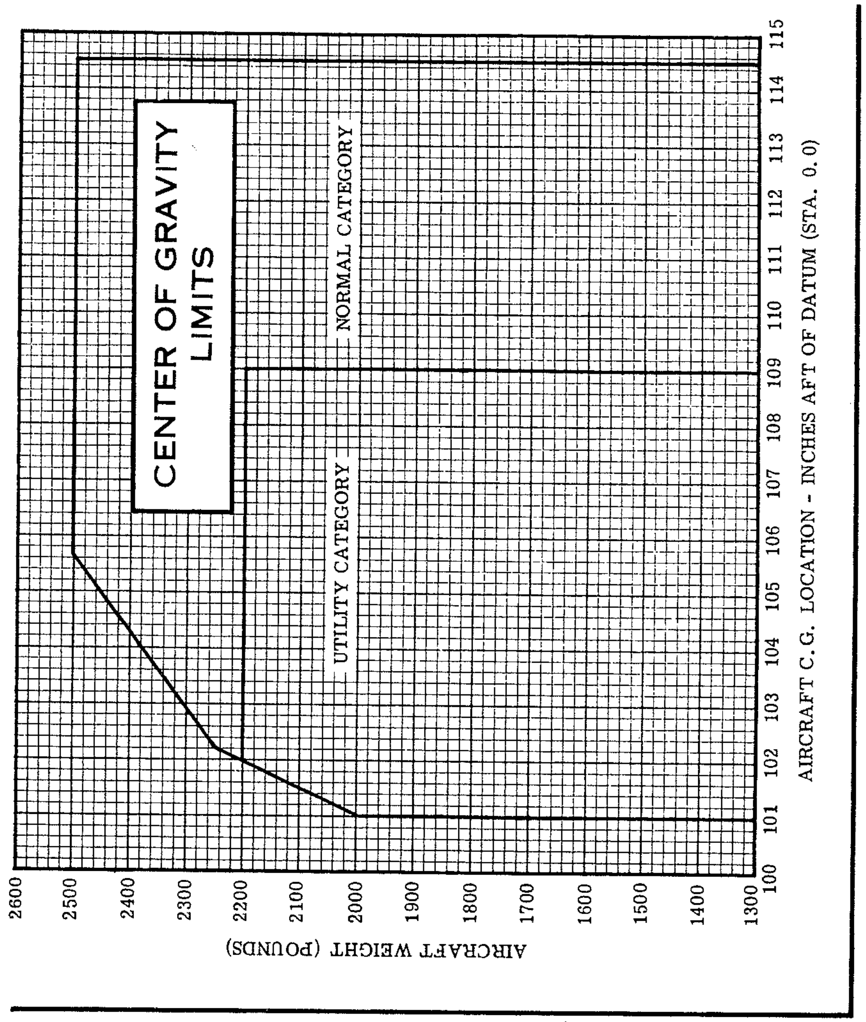


Figure 6-8. Center of Gravity Limits

EQUIPMENT LIST

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

This equipment list provides the following information:

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

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

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

NOTE

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

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

NOTE

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

NOTE

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

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	A. POWERPLANT & ACCESSORIES			
A01-R	ENGINE, LYCOMING O-360-A1F6D (INCLUDES STARTER, DUAL MAGNETO, ALTERNATOR, CARBURETOR, & OIL FILTER W/INTEGRAL MOUNT)	1750001-3	296.3	38.7
A05-R	FILTER, CARBURETOR AIR	C294510-0601	1.5	30.0
A17-R	OIL COOLER, (STEWART-WARNER 8406E)	1750001	2.5	52.0
	OR (HARRISON 8526250)	1750001	2.5	52.0
A33-R	PROPELLER, CONSTANT SPEED (MCCAULEY B2D34C211/82PCA-6)	C161008-0106	49.8	21.0
A37-R	GOVERNOR, PROPELLER (MCCAULEY C290D3/T12)	C161031-0106	3.0	51.5
A41-R	SPINNER INSTALLATION, PROPELLER	1750050	3.5*	17.9*
	SPINNER DOME	0752637	2.0	15.5
	AFT SPINNER BULKHEAD	1750051-1	1.0	24.2
	FWD SPINNER SPACER BULKHEAD	1750051-4	0.5	14.7
A61-S	VACUUM SYSTEM INSTL, ENGINE-DRIVEN	1713217	4.6*	54.2*
	DRY VACUUM PUMP	C431003	2.7	50.5
	FILTER ASSY	C294501-0101	0.5	61.0
	VACUUM GAGE	C668509-0101	0.1	74.0
	VACUUM RELIEF VALVE	C482001-0401	0.5	60.2
	HARDWARE	1713217	0.8	56.4
A70-A	PRIMING SYSTEM, 3-CYLINDER (NET CHANGE)	1756003-3	0.5	42.0
A73-A	VALVE, OIL QUICK DRAIN (NET CHANGE)	1701015-1	0.0	- -
	B. LANDING GEAR & ACCESSORIES			
B01-R-1	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN(TWO) (MCCAULEY)	C163015-0207	38.8*	123.5*
	WHEEL ASSY, MCCAULEY D-30580 (EACH)	C163003-0102	7.0	123.8
	BRAKE ASSY, MCCAULEY C-30018-4 (LEFT)	C163032-0109	1.8	120.5
	BRAKE ASSY, MCCAULEY C-30018-4 (RIGHT)	C163032-0108	1.8	120.5
	TIRE, 6-PLY BLACKWALL (EACH)	C262003-0204	8.7	123.8
	TUBE (EACH)	C262023-0102	1.9	123.8
B01-R-2	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN(TWO) (CLEVELAND)	1241156-38	39.8*	123.5*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	WHEEL ASSY, CLEVELAND 40-133 (EACH)	C163001-0104	7.4	123.8
	BRAKE ASSY, CLEVELAND 30-75 (LEFT)	C163030-0113	1.9	120.5
	BRAKE ASSY, CLEVELAND 30-75 (RIGHT)	C163030-0114	1.9	120.5
	TIRE, 6-PLY BLACKWALL (EACH)	C262003-0204	8.7	123.8
	TUBE (EACH)	C262023-0102	1.9	123.8
B04-R-1	WHEEL & TIRE ASSY, 5.00X5 NOSE (MCCAULEY)	C163015-0109	9.5*	47.2*
	WHEEL ASSY, MCCAULEY C-30480	C163003-0401	3.6	47.2
	TIRE, 4-PLY BLACKWALL	C262003-0102	4.7	47.2
	TUBE	C262023-0101	1.2	47.2
B04-R-2	WHEEL & TIRE ASSY, 5.00X5 NOSE (CLEVELAND)	1241156-2	8.3*	47.2*
	WHEEL ASSY, CLEVELAND 40-77	1241156-12	2.4	47.2
	TIRE, 4-PLY BLACKWALL	C262003-0102	4.7	47.2
	TUBE	C262023-0101	1.2	47.2
B10-S	FAIRING INSTALLATION, WHEEL & BRAKE	0741638	18.5*	108.6*
	NOSE WHEEL FAIRING		3.8	49.2
	MAIN WHEEL FAIRING (EACH)		5.6	125.8
B16-A	AXLE, HEAVY DUTY (SET OF TWO) (NET CHANGE)	0541171	1.0	123.5
	C. ELECTRICAL SYSTEM			
C01-R	BATTERY, 12 VOLT, 25 AMP HOUR	0511319	23.0	184.5
C01-O	BATTERY, 12 VOLT, 33 AMP HOUR	0712605-1	27.1	184.5
C04-R	REGULATOR, 14 VOLT, 60 AMP ALTERNATOR	C611001-0201	0.6	58.5
C07-A	GROUND SERVICE PLUG RECEPTACLE	1770004-1	2.5	66.0
C16-A	HEATING SYSTEM, PITOT (NET CHANGE)	1720099-4	0.9	112.5
C22-A	INSTRUMENT POST LIGHTS & EL PANEL INSTL.	1701030-2	2.3	74.0
C25-A-1	MAP LIGHT, CONTROL WHEEL MOUNTED	1770019-6	0.2	83.0
C25-A-2	MAP LIGHT & MIKE SWITCH, CONTROL WHEEL MOUNTED	1770019-4	0.3	81.9
C31-A	COURTESY LIGHTS (SET OF THREE)	1770005-2	1.0	109.0
C34-R	PUMP, BENDIX ELECTRIC FUEL	1216012	2.0	53.0
C37-R	LIGHTS, NAVIGATION (SET OF THREE)	1770002	1.0	139.5
C40-A	DETECTORS, NAVIGATION LIGHT (SET OF TWO)	0701013	NEGL	- -
C43-R	LIGHT INSTALLATION, OMNIFLASH BEACON	1731000	1.9*	254.4*
	FLASHER POWER SUPPLY (IN TAILCONE)	C594502-0101	0.7	267.4
	LIGHT ASSY, (ON FIN TIP)	C621001-0101	0.6	293.6
	SWITCH, CIRCUIT BREAKER, AND WIRING		0.3	134.3
	RESISTOR (MEMCOR)	OR95-1.5	0.3	273.9
C46-A	STROBE LIGHTS, WING TIP MOUNTED	2001013	3.5*	107.5*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	FLASHER POWER SUPPLY (SET OF TWO)	C622007-0101	2.3	109.3
	STROBE TUBE, WING TIP (SET OF TWO)	C622006-0101	0.3	106.5
C49-S	LANDING LIGHT INSTL, COWL MOUNTED	1701017	1.7*	41.0*
	LAMP (G.E.)	4522	0.8	39.2
C49-O	LANDING & TAXI LIGHT INSTL, COWL MOUNTED	1701026	3.1	39.3
	D. INSTRUMENTS			
D01-R	INDICATOR, AIRSPEED	C661064-0105	0.6	72.9
D01-O	INDICATOR, TRUE AIRSPEED	1713375	0.7	73.1
D04-A	STATIC SOURCE, ALTERNATE	1701018-3	0.5	86.0
D07-R	ALTIMETER, SENSITIVE	C661071-0101	1.0	72.5
D07-O-1	ALTIMETER, SENSITIVE (FEET & MILLIBARS)	C661071-0102	1.0	72.5
D07-O-2	ALTIMETER, SENSITIVE (20 FT. MARKINGS)	C661025-0102	1.0	72.5
D10-A	ALTIMETER, SENSITIVE - SECOND UNIT INSTL.	2001015	0.8	71.9
	(MAKES DUAL ALTIMETER SYSTEM)			
D16-A-1	ENCODING ALTIMETER	1701031-1	3.0	69.6
	(REQUIRES RELOCATING REGULAR ALTIMETER)			
D16-A-2	ENCODING ALTIMETER, FEET & MILLIBARS	1701031-2	3.0	69.6
	(REQUIRES RELOCATING REGULAR ALTIMETER)			
D22-A	INDICATOR, CARBURETOR AIR TEMPERATURE	1713216-4	1.2*	68.7*
	TEMPERATURE SENDER	0550209	0.1	37.7
	GAGE	S1311-3	1.0	73.2
D25-S	CLOCK INSTALLATION	1713222-1	0.4*	96.2*
	ELECTRIC CLOCK	C664508-0101	0.3	73.6
D28-R	COMPASS, MAGNETIC	C660501-0101	0.5	82.0
D37-R	GAGE CLUSTER, LEFT FUEL & OIL PRESSURE	C669515-0103	0.5	74.0
D40-R	GAGE CLUSTER, RIGHT FUEL & OIL TEMP	C669516-0103	0.5	74.0
D43-R	GAGE CLUSTER, CYL. HEAD TEMP & AMMETER	C669517-0101	0.5	74.0
D49-A	INDICATOR, ECONOMY MIXTURE	1701012-1	1.0	62.0
D58-R	GAGE, FUEL PRESSURE	C662023-0102	0.5	73.0
D64-S	GYRO INSTALLATION	1713217-5	6.0*	70.7*
	(REQUIRES ITEM A61-S VACUUM SYSTEM)			
	DIRECTIONAL INDICATOR	C661075	2.5	71.9
	ATTITUDE INDICATOR	C661076	2.1	72.1
	HOSES, FITTINGS, SCREWS, CLAMPS	1713217	1.4	66.4
D64-O-1	GYRO INSTALLATION	1713217&1201126	6.4*	70.8*
	(REQUIRES ITEM A61-S VACUUM SYSTEM)			
	DIRECTIONAL INDICATOR W/HDG SELECTOR	1201126	2.9	71.9

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ATTITUDE INDICATOR	C661076	2.1	72.1
	HOSES, FITTINGS, SCREWS, CLAMPS	1713217	1.4	66.4
D64-O-2	GYRO INSTALLATION FOR NAV-O-MATIC 300A	1713253-1	6.7*	70.9*
	(REQUIRES ITEM A61-S VACUUM SYSTEM)			
	DIRECTIONAL INDICATOR	40760-0104	3.2	72.0
	ATTITUDE INDICATOR	C661076	2.1	72.1
	HOSES, FITTINGS, SCREWS, CLAMPS	1713253	1.4	66.4
D67-A	HOURMETER INSTL.	1701029-1	0.5	64.7
D73-R	GAGE, MANIFOLD PRESSURE	C662035-0102	0.9	73.0
D82-S	INDICATOR, OUTSIDE AIR TEMP (C668507-0101)	1713117-1	0.1	85.9
D85-R	TACHOMETER INSTALLATION, ENGINE	1706060	0.9*	70.3*
	RECORDING TACHOMETER, INDICATOR	C668020-0114	0.7	73.0
	TACH FLEXIBLE SHAFT (ASES 1605-24)	S-1605-2	0.2	61.0
D88-S	INDICATOR, TURN COORDINATOR (C661003-0504)	1713223-1	1.3	72.4
D88-O-1	INDICATOR, TURN COORDINATOR(ARC42320-0014)	3930144&3930145	1.9	71.6
	(USE WITH NAV-O-MATICS 200A & 300A)			
D88-O-2	INDICATOR, TURN AND BANK (S-1413N2)	1713220-1	2.0	71.6
D91-S	INDICATOR, RATE-OF-CLIMB (C661080-0101)	1700128-1	0.9	72.6
	E. CABIN ACCOMMODATIONS			
E02-S	ARM RESTS, REAR SEAT (SET OF TWO)	0514079	2.0	137.3
E05-R	SEAT, FIXED HEIGHT - PILOT	1714096-1	13.0	101.0
E05-O	SEAT, INFINITE ADJUST - PILOT	0514123-3	23.0	98.0
E07-S	SEAT, FIXED HEIGHT - CO-PILOT	1714096-1	13.0	101.0
E07-O	SEAT, INFINITE ADJUST - CO-PILOT	0514123-3	23.0	98.0
E09-S	SEAT, REAR (ONE PIECE BACK CUSHION)	1714098-1	28.4	139.0
E09-O	SEAT, REAR (TWO PIECE BACK CUSHION)	1714097-15	29.4	139.0
E11-A	SEAT INSTL., AUXILIARY FOLD-AWAY	0501009	7.7	168.8
E15-R	BELT ASSY, PILOT LAP	S-2240-115	1.0	93.0
E15-S	SHOULDER HARNESS ASSY, PILOT	S-2240-205	0.6	93.0
E15-O	AUSTRALIAN BELT & HARNESS ASSY, PILOT	S-2240-16VH	1.6	93.0
E19-O	SHOULDER HARNESS INERTIA REEL INSTL, PILOT & CO-PILOT (NET CHANGE)	1701027	1.0	155.4
E23-S	BELT & SHOULDER HARNESS ASSY, CO-PILOT	S-2240-16	1.6	93.0
E23-O	AUSTRALIAN BELT & HARNESS ASSY, CO-PILOT	S-2240-16VH	1.6	93.0
E27-S	BELT ASSY, REAR OCCUPANT LAP (SET OF TWO)	S-1746-16	2.0	135.0
E27-O-1	BELT & SHOULDER HARNESS ASSY, REAR OCCUPANT (SET OF TWO)	S-2240-11	3.2	135.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E27-0-2	AUSTRALIAN BELT & SHOULDER HARNESS ASSY, REAR OCCUPANT (SET OF TWO)	S-2240-11VH	3.2	135.0
E29-A	BELT ASSY, AUXILIARY FOLD-AWAY SEAT	S-1746-5	0.8	168.8
E33-A	CARPET, BLACK (NET CHANGE)	CES-1164	0.0	- -
E35-A-1	LEATHER SEATING (NET CHANGE)	CES-1164	2.0	120.0
E35-A-2	SEATS, VINYL CUSHION (NET CHANGE)	CES-1164	0.0	- -
E43-A	VENTILATION SYSTEM, REAR SEAT	1706052-1	1.8	124.5
E49-A	CUP HOLDERS, RETRACTABLE (SET OF TWO)	1701023	0.1	74.5
E50-A	HEADRESTS, FRONT (SET OF TWO)	1215073-11	1.4	107.0
E51-A	HEADRESTS, REAR (SET OF TWO)	1215073-11	1.4	148.0
E53-A	MIRROR, REAR VIEW	1713224-1	0.3	72.4
E55-S	SUN VISORS (SET OF TWO)	1701001-1	1.0	93.0
E57-A	WINDOWS, TINTED (SET OF SIX) (NET CHANGE)	1701010	0.0	- -
E65-S	BAGGAGE NET	2015009	0.5	162.0
E71-A	CARGO TIE-DOWN INSTL. (STOWED) (USE CARGO INSTL. ARM)	1712017-1	1.4	- -
E75-A	STRETCHER INSTALLATION (BOXED) (USE ACTUAL INSTALLED WEIGHT & ARM)	0700164		
E85-A	CONTROLS INSTALLATION, DUAL	1760007	6.3*	76.0*
	CONTROL WHEEL, RIGHT SIDE		1.4	82.6
	RUDDER PEDALS, RIGHT SIDE (SET OF TWO)		1.1	62.1
E93-R	HEATING SYSTEM, CABIN & CARBURETOR AIR (INCLUDES EXHAUST SYSTEM)	1706061 1754001	17.5	36.0
	F. PLACARDS & WARNING			
F01-R	PLACARD, OPERATIONAL LIMITATIONS, VFR, DAY AND NIGHT	1705037-9	NEGL	- -
F01-O	PLACARD, OPERATIONAL LIMITATIONS, VFR/IFR, DAY AND NIGHT	1705037-10	NEGL	- -
F04-R	INDICATOR, AUDIBLE PNEUMATIC STALL WARNING	1706014	0.5	115.5

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	G. AUXILIARY EQUIPMENT			
G01-A	LIFT HANDLES, TAILCONE (SET OF TWO)	1712150-1	1.2	252.7
G07-A	RINGS, AIRPLANE HOISTING	1700122-1	1.8	120.7
G13-A	CORROSION PROOFING, INTERNAL	1700123	6.0	140.0
G16-A	STATIC DISCHARGE INSTL. (SET OF TEN)	2001017-1	0.3	226.0
G19-A	STABILATOR ABRASION BOOT	1701019-1	2.7	276.5
G22-S	TOW BAR (STOWED)	0501019	1.6	162.0
G25-S	PAINT, OVERALL EXTERIOR	1704014	11.1*	156.2*
	OVERALL WHITE BASE (96,266 SQ.IN.)		10.5	157.0
	COLOR STRIPE (13,175 SQ.IN.)		0.6	141.6
G28-A	JACK PAD ASSY (SET OF TWO)	1700129-1	1.2	127.7
G31-A	CABLES, CORROSION RESISTANT (NET CHANGE)	1700123	0.0	- -
G55-A	FIRE EXTINGUISHER INSTALLATION	1701008-3	3.0*	125.5*
	FIRE EXTINGUISHER	C421001-0101	2.6	125.5
	FIRE EXTINGUISHER BRACKET	C421001-0102	0.3	125.5
G88-A	WINTERIZATION KIT INSTALLATION, ENGINE	1752121-13	0.6*	35.4*
	BREATHER TUBE INSULATION		0.2	53.3
	TWO COWL INLET AIR COVERS (INSTALLED)		0.3	25.0
G92-O	WINGS, EXT. RANGE-60 GAL.FUEL (NET CHANGE)	1701024-1	3.6	118.8
G96-A	CABIN STEP INSTL. (SET OF TWO)	1701028	2.0	103.0
	H. AVIONICS & AUTOPILOTS			
H01-A	CESSNA 300 ADF	3910159-5	7.3*	79.6*
	RECEIVER WITH BFO (R-546E)	41240-0101	2.3	69.5
	INDICATOR (IN-346A)	40980-1001	0.9	71.0
	AVIONICS OPTION C1 (ITEM H40-A)	3910152-5	3.5	88.7
H04-A	NARCO DME 190	3910166-3	7.4*	73.3*
	TRANSCEIVER	3930165	4.9	68.8
	MOUNTING BOX	3930165	0.6	68.4
	DME ANTENNA	3960133-1	0.2	148.3
H07-A	CESSNA 400 GLIDESLOPE	3910157-3	4.8*	146.4*
	RECEIVER (R-443B) (40 CHANNEL)	42100-0000	2.1	181.3
	MOUNTING, RIGID	36450-0000	0.3	181.3
	ANTENNA & COVER ASSEMBLY	1200098-1	0.2	91.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H10-A-1	PANTRONICS 300 HF TRANSCEIVER, FIRST UNIT	3910156-1	25.6*	140.8*
	TRANSCEIVER (PT10-A)	C582103-0102	3.1	68.5
	MOUNTING BOX		0.8	68.5
	REMOTE POWER SUPPLY (PT-10PS-14)	C582103-0201	8.5	184.3
	ANTENNA LOAD BOX (DX10-RL-14)	C589502-0101	4.2	200.8
	ANTENNA WIRE 351 INCH LONG	1770000-614	0.3	218.2
	CABLE INSTL.	3950123-14	2.5	111.8
	AVIONICS OPTION A1 WITH ANTENNA & CABLE INSTALLATIONS & PARTIAL DELETED		5.4	79.6
H10-A-2	PANTRONICS 300 HF TRANSCEIVER, SECOND UNIT	3910156-2	20.3*	156.7*
	TRANSCEIVER (PT10-A)	C582103-0102	3.1	68.5
	MOUNTING BOX		0.8	68.5
	REMOTE POWER SUPPLY (PT-10PS-14)	C582103-0201	8.5	184.3
	ANTENNA LOAD BOX (DX10-RL-14)	C589502-0101	4.2	200.8
	ANTENNA WIRE 351 INCH LONG	1770000-614	0.3	218.2
	CABLE INSTL.	3950123-14	2.5	111.8
	SWITCH INSTL, 2ND XMTR	3970122-4	0.1	73.0
H10-A-3	PANTRONICS 300 HF TRANSCEIVER, THIRD UNIT	3910156-15	20.3*	156.7*
	TRANSCEIVER (PT10-A)	C582103-0102	3.1	68.5
	MOUNTING BOX		0.8	68.5
	REMOTE POWER SUPPLY (PT-10PS-14)	C582103-0201	8.5	184.3
	ANTENNA LOAD BOX (DX10-RL-14)	C589502-0101	4.2	200.8
	ANTENNA WIRE 351 INCH LONG	1770000-614	0.3	218.2
	CABLE INSTL.	3950123-14	2.5	111.8
	SWITCH INSTL, 3RD XMTR	3970122-2	0.1	73.0
H10-A-4	SUNAIR SSB HF TRANSCEIVER, SECOND UNIT	3910158-2	22.8*	154.7*
	TRANSCEIVER, SINGLE SIDE BAND (ASB-125)	99680	4.5	68.5
	MOUNTING BOX		0.8	68.5
	REMOTE POWER SUPPLY (PA-1010A)	99682	8.9	188.3
	ANTENNA LOAD BOX (CU-110)	99816	4.9	200.8
	ANTENNA WIRE 351 INCH LONG	1770000-614	0.3	218.2
	CABLE INSTL.	3950123-11	2.5	111.8
	SWITCH INSTL, SSB HF	3970122-1	0.1	73.0
H10-A-5	SUNAIR SSB HF TRANSCEIVER, THIRD UNIT	3910158-6	22.8*	154.7*
	TRANSCEIVER, SINGLE SIDE BAND (ASB-125)	99680	4.5	68.5
	MOUNTING BOX		0.8	68.5
	REMOTE POWER SUPPLY (PA-1010A)	99682	8.9	188.3
	ANTENNA LOAD BOX (CU-110)	99816	4.9	200.8
	ANTENNA WIRE 351 INCH LONG	1770000-614	0.3	218.2
	CABLE INSTL.	3950123-11	2.5	111.8
	SWITCH INSTL, SSB HF	3970122-1	0.1	73.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H13-A	CESSNA 400 MARKER BEACON	3910164-2	2.7*	151.8*
	RECEIVER (R-402A)	42410-5114	0.7	204.6
	ANTENNA, L-SHAPED ROD	0770681-1	0.4	200.8
H16-A	CESSNA 300 TRANSPONDER	3910127-15	3.8*	75.3*
	RECEIVER-TRANSMITTER (RT-359A)	41420-1114	2.7	68.5
	ANTENNA (A-109)	41530-0001	0.3	192.6
H19-A-1	CESSNA 300 VHF TRANSCEIVER, FIRST UNIT	3910155-1	14.6*	75.7*
	TRANSCEIVER (RT-524A)	31390-1514	6.4	68.0
	MOUNTING BOX (M-514A)	30420-0000	0.7	68.0
	CABLE INSTL, 300 XCVR	3950123-15	0.5	75.5
	AVIONICS OPTION A1 WITH OMNI ANTENNA & CABLE, NOISE FILTER & PARTIAL DELETED		6.3	85.2
H19-A-2	CESSNA 300 VHF TRANSCEIVER, SECOND UNIT	3910155-2	9.4*	72.9*
	TRANSCEIVER (RT-524A)	31390-1514	6.4	68.0
	MOUNTING BOX (M-514A)	30420-0000	0.7	68.0
	CABLE INSTL, 300 XCVR	3950123-15	0.5	75.5
	ANTENNA & CABLE, RIGHT VHF	3960113-2	1.0	109.9
	SWITCH INSTL, 2ND XMTR	3970122-4	0.1	73.0
H22-A-1	CESSNA 300 NAV/COM, 160 CH, FIRST UNIT WITH VOR/LOC	3910151-3	16.3*	89.1*
	RECEIVER-TRANSMITTER (RT-308C)	42450-1114	6.4	68.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	73.5
	AVIONICS OPTION A1 (ITEM H34-A)	3910154-1	9.3	104.7
H22-A-2	CESSNA 300 NAV/COM, 720 CH, FIRST UNIT WITH VOR/LOC	3910150-5	16.8*	88.5*
	RECEIVER-TRANSMITTER (RT-328T)	43340-1124	6.9	68.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	73.5
	AVIONICS OPTION A1 (ITEM H34-A)	3910154-1	9.3	104.7
H22-A-3	CESSNA 300 NAV/COM, 720 CH, FIRST UNIT WITH VOR/ILS	3910152-5	16.9*	88.4*
	RECEIVER-TRANSMITTER (RT-328T)	43340-1124	6.9	68.0
	VOR/ILS INDICATOR (IN-525B)	45010-2000	0.7	73.5
	AVIONICS OPTION A1 (ITEM H34-A)	3910154-1	9.3	104.7
H22-A-4	CESSNA 300 NAV/COM, 360 CH, FIRST UNIT WITH VOR/LOC (FOR EXPORT ONLY)	3910150-7	16.9*	88.4*
	RECEIVER-TRANSMITTER (RT-528E-1)	42430-1124	7.0	68.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	73.5
	AVIONICS OPTION A1 (ITEM H34-A)	3910154-1	9.3	104.7
H22-A-5	CESSNA 300 NAV/COM, 360 CH, FIRST UNIT WITH VOR/ILS (FOR EXPORT ONLY)	3910152-7	17.0*	88.3*
	RECEIVER-TRANSMITTER (RT-528E-1)	42430-1124	7.0	68.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	VOR/ILS INDICATOR (IN-525B)	45010-2000	0.7	73.5
	AVIONICS OPTION A1 (ITEM H34-A)	3910154-1	9.3	104.7
H25-A-1	CESSNA 300 NAV/COM, 160 CH, SECOND UNIT WITH VOR/LOC	3910151-4	9.7*	72.5*
	RECEIVER-TRANSMITTER (RT-308C)	42450-1114	6.4	68.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	73.5
	AVIONICS OPTION B1 (ITEM H37-A)	3910154-6	2.7	82.9
H25-A-2	CESSNA 300 NAV/COM, 720 CH, SECOND UNIT WITH VOR/LOC	3910150-6	10.2*	72.3*
	RECEIVER-TRANSMITTER (RT-328T)	43340-1124	6.9	68.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	73.5
	AVIONICS OPTION B1 (ITEM H37-A)	3910154-6	2.7	82.9
H25-A-3	CESSNA 300 NAV/COM, 360 CH, SECOND UNIT WITH VOR/LOC (FOR EXPORT ONLY)	3910150-8	10.3*	72.2*
	RECEIVER-TRANSMITTER (RT-528E-1)	42430-1124	7.0	68.0
	VOR/LOC INDICATOR (IN-514B)	45010-1000	0.6	73.5
	AVIONICS OPTION B1 (ITEM H37-A)	3910154-6	2.7	82.9
H28-A-1	EMERGENCY LOCATOR TRANSMITTER	0401008-3	2.0*	197.4*
	TRANSMITTER (LEIGH SHARC 7)	C589510-0209	1.8	197.7
	ANTENNA	C589510-0203	0.1	195.5
	CABLE & HDWR.		0.1	194.8
H28-A-2	EMERGENCY LOCATOR TRANSMITTER (FOR USE IN CANADA)	0401008-6	1.8*	197.4*
	TRANSMITTER (LEIGH SHARC 7)	C589510-0212	1.6	197.7
	ANTENNA	C589510-0107	0.1	195.5
	CABLE & HDWR.		0.1	194.8
H31-A-1	NAV-O-MATIC 200A AUTOPILOT	3910162	10.2*	107.9*
	COMPUTER & MOUNT (ARC 43610-1000)	3930144-2	1.6	67.5
	TURN COORDINATOR (NET CHANGE)	3930144-2	0.6	69.9
	ROLL ACTUATOR INSTL.	1200237-9	6.7	125.5
	RELAY INSTALLATION	3970122-7	0.1	67.0
	CABLES AND HARDWARE		1.2	85.9
H31-A-2	NAV-O-MATIC 300A AUTOPILOT	3910163	11.6*	105.5*
	CONTROLLER & MCUNT (ARC 42660-1000)	3930145-2	1.8	67.5
	GYRO INSTALLATION (NET CHANGE)	1713253-1	0.7	72.0
	TURN COORDINATOR (NET CHANGE)	3930145-2	0.6	69.9
	ROLL ACTUATOR INSTL.	1200237-4	7.2	125.1
	RELAY INSTALLATION	3970122-7	0.1	67.0
	CABLES AND HARDWARE		1.2	85.9
H34-A	AVIONICS OPTION A1 - 1ST NAV/COM PROV.	3910154-1	9.3*	104.7*
	ANTENNA & CABLE, LEFT VHF COM	3960113-1	1.0	109.9

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	ANTENNA & CABLE, OMNI	3960102-3	1.5	227.1
	AUDIO JUNCTION BOX & RELAY	3970121-1	1.4	68.0
	HEADSET INSTALLATION	3970125-3	0.2	70.5
	MICROPHONE INSTL., HAND-HELD	3970124-2	0.3	73.7
	NOISE FILTER AUDIO (S-1915-1)	3940148-2	0.1	32.3
	RADIO COOLING	3930152-4	1.4	68.2
	RELAY INSTL., SPLIT BUS BAR	3970126-1	0.4	64.9
	SPEAKER INSTL., CABIN (596504-0201)	3970123-3	1.5	111.0
	SWITCH INSTL., 1ST XMTR	3970122-3	0.1	73.0
	FIRST PARTIAL RADIO INSTL. 300 NAV/COM	3930169-3	1.4	66.9
H37-A	AVIONICS OPTION B1 - 2ND NAV/COM PROV.	3910154-6	2.7*	82.9*
	ANTENNA & CABLE, RIGHT VHF COM	3960113-2	1.0	109.9
	ANTENNA COUPLER & CABLE (S-2086-1)	3960111-1	0.2	65.0
	SWITCH INSTL., 2ND XMTR	3970122-4	0.1	73.0
	SECOND PARTIAL RADIO INSTL. 300 NAV/COM	3930169-4	1.4	66.9
H40-A	AVIONICS OPTION C1 - ADF PROVISIONS	3910154-13	3.5*	88.7*
	ADF LOOP ANTENNA & ASSOC. WIRING	3960104-1	2.2	90.8
	ADF SENSE ANTENNA & CABLES	1770000-623	0.2	177.0
	ADF SWITCH INSTL.	3970122-5	0.1	73.0
	ADF PARTIAL	3930147-6	1.0	68.1
H43-A	AVIONICS OPTION D - NAV-O-MATIC WING PROVISIONS	1200237-6	0.4	126.0
H55-A	MICROPHONE-HEADSET COMBINATION (INCLUDES MIKE SWITCH)	3970112-2	0.5	72.4
	J. SPECIAL OPTION PACKAGES			
J01-A	CARDINAL II EQUIPMENT CONSISTS OF THE FOLLOWING ITEMS	1700002	27.1*	95.4*
	C16-A HEATED PITOT	1720099-4	0.9	112.5
	C31-A COURTESY LIGHTS	1770005-2	1.0	109.0
	C40-A NAV LIGHT DETECTORS	0701013	NEGL	-
	D01-O TRUE AIRSPEED IND. (NET CHANGE)	1713375	0.1	74.3
	D04-A STATIC AIR ALTERNATE SOURCE	1701018-3	0.5	86.0
	E85-A DUAL CONTROLS	1760007	6.3	76.0
	H22-A-1 CESSNA 300 NAV/COM, FIRST UNIT	3910151-3	16.3	89.1
	H28-A-1 EMERGENCY LOCATOR TRANSMITTER	0401008-3	2.0	197.4
J04-A-1	CARDINAL II NAV PAC (NET CHANGE) CONSISTS OF THE FOLLOWING ITEMS	3910161-3	21.3*	75.3*

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
	H01-A CESSNA 300 ADF WITH BFO	3910159-5	7.3	79.6
	H16-A CESSNA 300 TRANSPONDER	3910127-15	3.8	75.3
	H22-A-2 CESSNA 300 NAV/COM, FIRST UNIT (EXCHANGE)	3910150-5	0.5	68.0
	H25-A-1 CESSNA 300 NAV/COM, SECOND UNIT	3910151-4	9.7	72.5
J04-A-2	CARDINAL II NAV PAC (NET CHANGE) (FOR EXPORT ONLY) CONSISTS OF THE FOLLOWING ITEMS	3910161-6	17.6*	75.3*
	H01-A CESSNA 300 ADF WITH BFO	3910159-5	7.3	79.6
	H22-A-4 CESSNA 300 NAV/COM, FIRST UNIT (EXCHANGE)	3910150-7	0.6	68.0
	H25-A-1 CESSNA 300 NAV/COM, SECOND UNIT	3910151-4	9.7	72.5

SECTION 7
AIRPLANE & SYSTEMS DESCRIPTIONS

TABLE OF CONTENTS

Page

Introduction 7-3
Airframe 7-3
Flight Controls 7-8
Trim Systems 7-8
Instrument Panel 7-8
Ground Control 7-9
Wing Flap System 7-9
Landing Gear System 7-10
Baggage Compartment 7-10
Seats 7-11
Seat Belts and Shoulder Harnesses 7-12
Seat Belts 7-12
Shoulder Harnesses 7-12
Integrated Seat Belt/Shoulder Harnesses With Inertia Reels . . 7-14
Entrance Doors and Cabin Windows 7-14
Control Locks 7-15
Engine 7-16
Engine Controls 7-16
Engine Instruments 7-16
New Engine Break-in and Operation 7-18
Engine Oil System 7-18
Ignition-Starter System 7-19
Air Induction System 7-19
Exhaust System 7-19
Carburetor and Priming System 7-20
Cooling System 7-20
Propeller 7-21
Fuel System 7-21
Brake System 7-24
Electrical System 7-25
Master Switch 7-25
Ammeter 7-27

TABLE OF CONTENTS (Continued)

	Page
Over-Voltage Sensor and Warning Light	7-27
Circuit Breakers and Fuses	7-27
Ground Service Plug Receptacle	7-27
Lighting Systems	7-28
Exterior Lighting	7-28
Interior Lighting	7-29
Cabin Heating, Ventilating and Defrosting System	7-30
Pitot-Static System and Instruments	7-32
Airspeed Indicator	7-33
Rate-of-Climb Indicator	7-33
Altimeter	7-33
Vacuum System and Instruments	7-33
Attitude Indicator	7-35
Directional Indicator	7-35
Suction Gage	7-35
Stall Warning System	7-35
Avionics Support Equipment	7-36
Audio Control Panel	7-36
Transmitter Selector Switch	7-36
Automatic Audio Selector Switch	7-36
Audio Selector Switches	7-38
Microphone-Headset	7-38
Static Dischargers	7-39

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

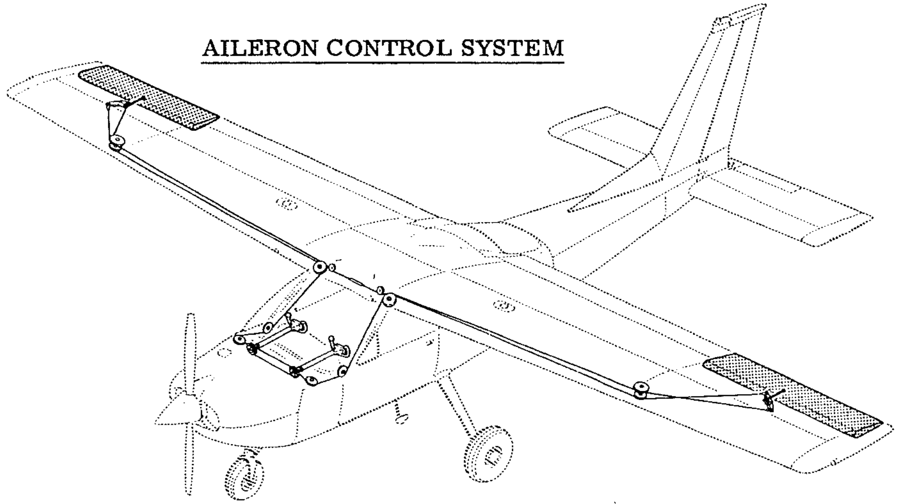
The Cardinal is an all-metal, four-place, high-wing, single-engine airplane equipped with tricycle landing gear, and designed for general utility purposes.

The construction of the fuselage is a conventional formed sheet metal bulkhead and skin design referred to as semi-monocoque. Incorporated into the fuselage structure are a flat floorboard extending from the firewall to the back of the baggage compartment, 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 main landing gear. A reinforced tail skid/tie-down ring is installed on the tailcone for tailcone protection.

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

The empennage (tail assembly) consists of a conventional vertical stabilizer and rudder, and a stabilator. The vertical stabilizer and rudder are of conventional construction consisting of formed sheet metal forward and aft spars, and formed sheet metal ribs covered with aluminum skin. The tip of the rudder is designed with a leading edge overhang which contains a balance weight. The stabilator is a combination of the horizontal stabilizer and elevator, and incorporates a 40% span anti-servo trim tab. The stabilator is constructed of a torque transmitting primary spar, an aft spar, formed sheet metal ribs, and aluminum skin. The stabilator contains a beam mounted balance weight attached to the center of the pri-

AILERON CONTROL SYSTEM



RUDDER AND RUDDER TRIM CONTROL SYSTEM

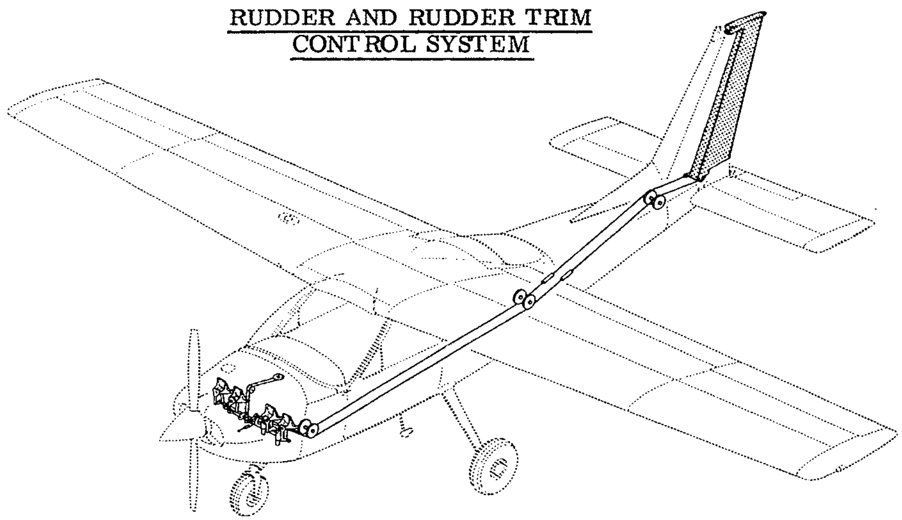
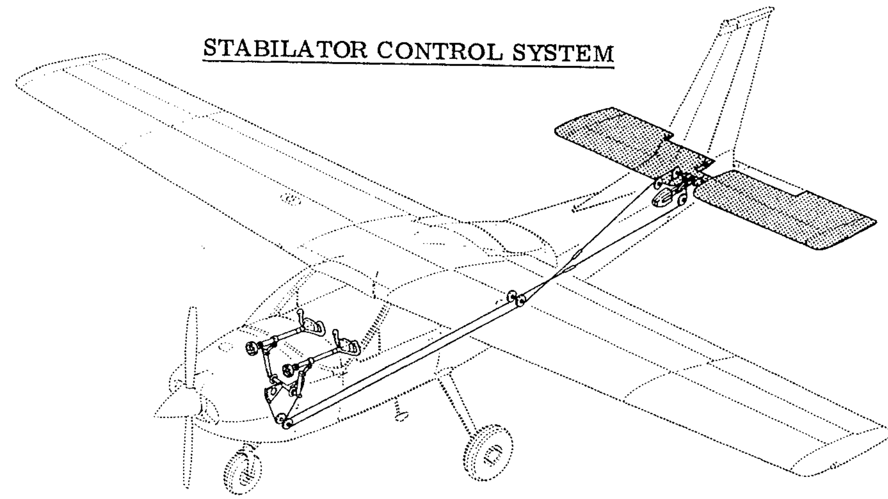


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

STABILATOR CONTROL SYSTEM



STABILATOR TRIM CONTROL SYSTEM

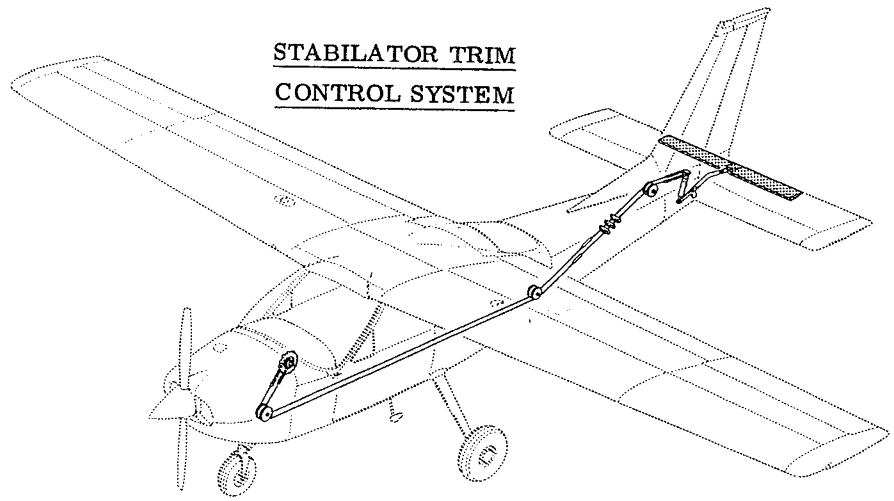


Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

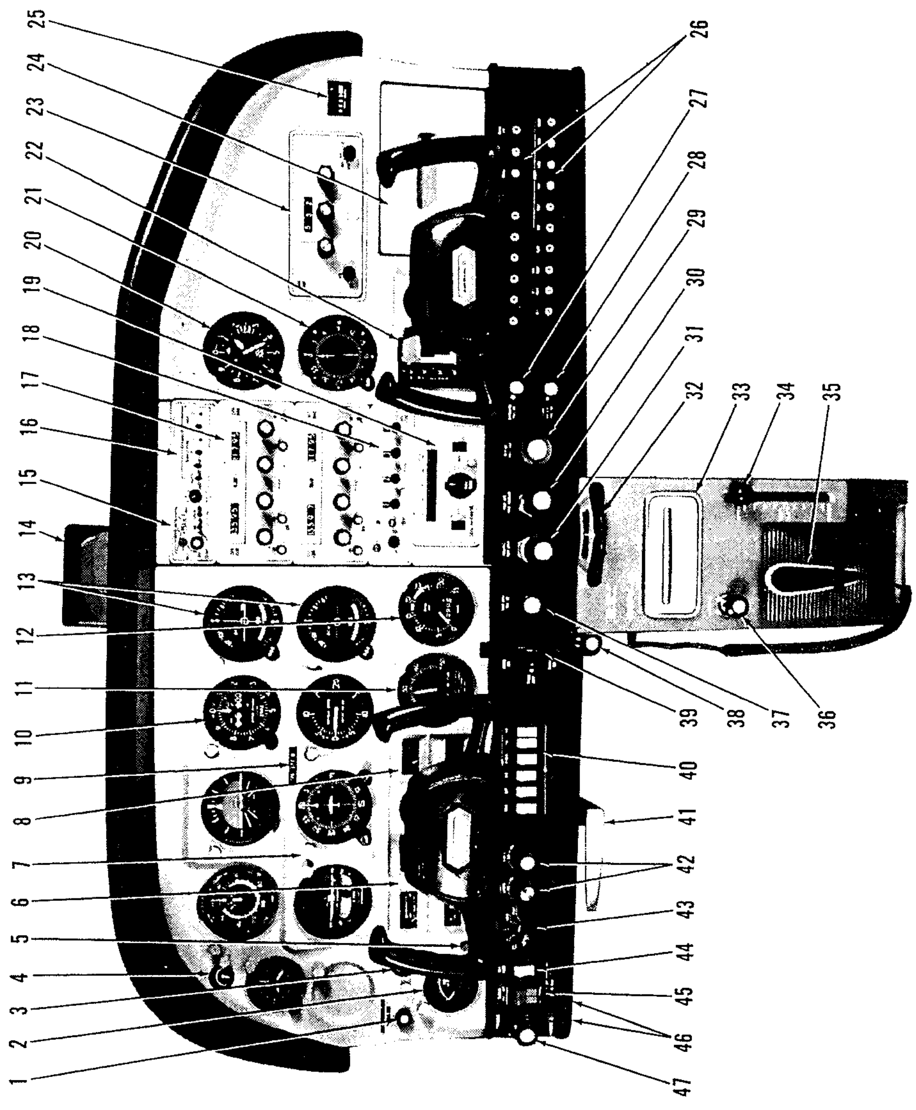


Figure 7-2. Instrument Panel (Sheet 1 of 2)

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

Figure 7-2. Instrument Panel (Sheet 2 of 2) mary spar and extending into the fuselage tailcone. The leading edge contains four inverted slots formed of sheet metal and positioned to place two on each side of the fuselage.

FLIGHT CONTROLS

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

TRIM SYSTEMS

Manually-operated rudder and stabilator trim is provided. Rudder trimming is accomplished through the rudder control system (see figure 7-1) by rotating the horizontally mounted trim control wheel either left or right, which will offset the rudder. Stabilator trimming is accomplished through the stabilator trim tab by utilizing the vertically mounted trim control wheel. Upward rotation of the trim wheel will trim nose-down; conversely, downward rotation will trim nose-up.

INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed around the basic "T" configuration. The gyros are located immediately in front of the pilot, and arranged vertically over the control column. The airspeed indicator and altimeter are located to the left and right of the gyros respectively. The remainder of the flight instruments are located around the basic "T". Engine and electrical instruments and fuel quantity indicators are arranged around the base of the control wheel shaft. An alternate static source valve control knob and two additional instruments may be installed along the left edge of the instrument panel. Avionics equipment is stacked approximately on the centerline of the panel, with the right side of the panel containing the wing flap switch and indicator, map compartment, and space for additional instruments and avionics equipment. A switch and control panel, at the lower edge of the instrument panel, contains most of the switches, controls, and circuit breakers necessary to operate the airplane. The left side of the panel contains the primer, master switch, auxiliary fuel pump switch, ignition switch, panel light intensity controls, and electrical switches for installed equipment. The center area contains the stabilator trim control wheel, carburetor heat control knob, throttle, propeller control, and mixture control. The right side of the panel contains the defroster control knob, cabin air/heat control knob, and circuit

breakers. A pedestal, extending from the edge of the switch and control panel to the floorboard, contains the rudder trim control wheel, an ashtray, a cigar lighter, the cowl flap control lever, and the microphone bracket. A fuel shutoff valve is positioned at the upper left corner of the pedestal, and a parking brake handle is mounted under the switch and control panel, in front of the pilot.

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

GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 9° each side of center. By applying either left or right brake, the degree of turn may be increased up to 45° each side of center.

Moving the airplane by hand is most easily accomplished by attaching a tow bar to the nose gear strut. If a tow bar is not available, or pushing is required, use the main landing gear struts as push points. Do not use the vertical or horizontal surfaces to move the airplane. If the airplane is to be towed by vehicle, never turn the nose wheel more than 45° 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 25 feet 6 inches. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down at a tailcone bulkhead just forward of the stabilator to raise the nose wheel off the ground.

WING FLAP SYSTEM

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

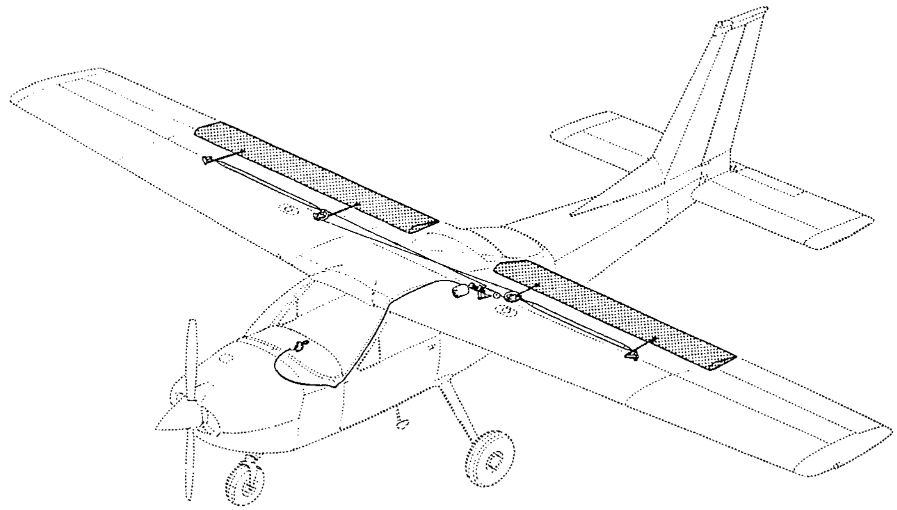


Figure 7-3. Wing Flap System

in degrees. The wing flap system circuit is protected by a 15-ampere circuit breaker, labeled FLAP, on the right side of the instrument panel.

LANDING GEAR SYSTEM

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

BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. Mounted to the aft cabin bulkhead, and extending aft of it, is a hatshelf. Access to the baggage compartment and the hatshelf is gained through a lockable baggage door on the left side of the airplane, or from within the airplane cabin. A baggage net with six tie-down straps is provided for securing baggage and is attached by tying the straps to tie-down rings provided in the airplane. A cargo tie-down kit may also be installed. For further information on bag-

gage and cargo tie-down, refer to Section 6. When loading the airplane, children should not be placed or permitted in the baggage compartment unless a child's seat is installed, and any material that might be hazardous to the airplane or occupants should not be placed anywhere in the airplane. For baggage area and door dimensions, refer to Section 6.

SEATS

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

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

The six-way seats may be moved forward or aft, adjusted for height, and the seat back angle is infinitely adjustable. Position the seat by lifting the tubular handle, under the center of the seat bottom, and slide the seat into position; then release the lever and check that the seat is locked in place. Raise or lower either seat by rotating a crank under the left corner of the seat. Seat back angle is adjustable by rotating a crank under the right corner of either seat. The seat bottom angle will change as the seat back angle changes, providing proper support. The seat backs will also fold full forward.

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

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

SEAT BELTS AND SHOULDER HARNESSES

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

SEAT BELTS

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

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

SHOULDER HARNESSES

Each front seat shoulder harness is attached to a rear doorpost above the window line and is stowed behind a stowage sheath above the cabin door. To stow the harness, fold it and place it behind the sheath. When rear seat shoulder harnesses are furnished, they are attached adjacent to the lower corners of the rear window. Each rear seat harness is stowed behind a stowage sheath above an aft side window. No harness is available for the child's seat.

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

Removing the shoulder harness is accomplished by pulling upward on

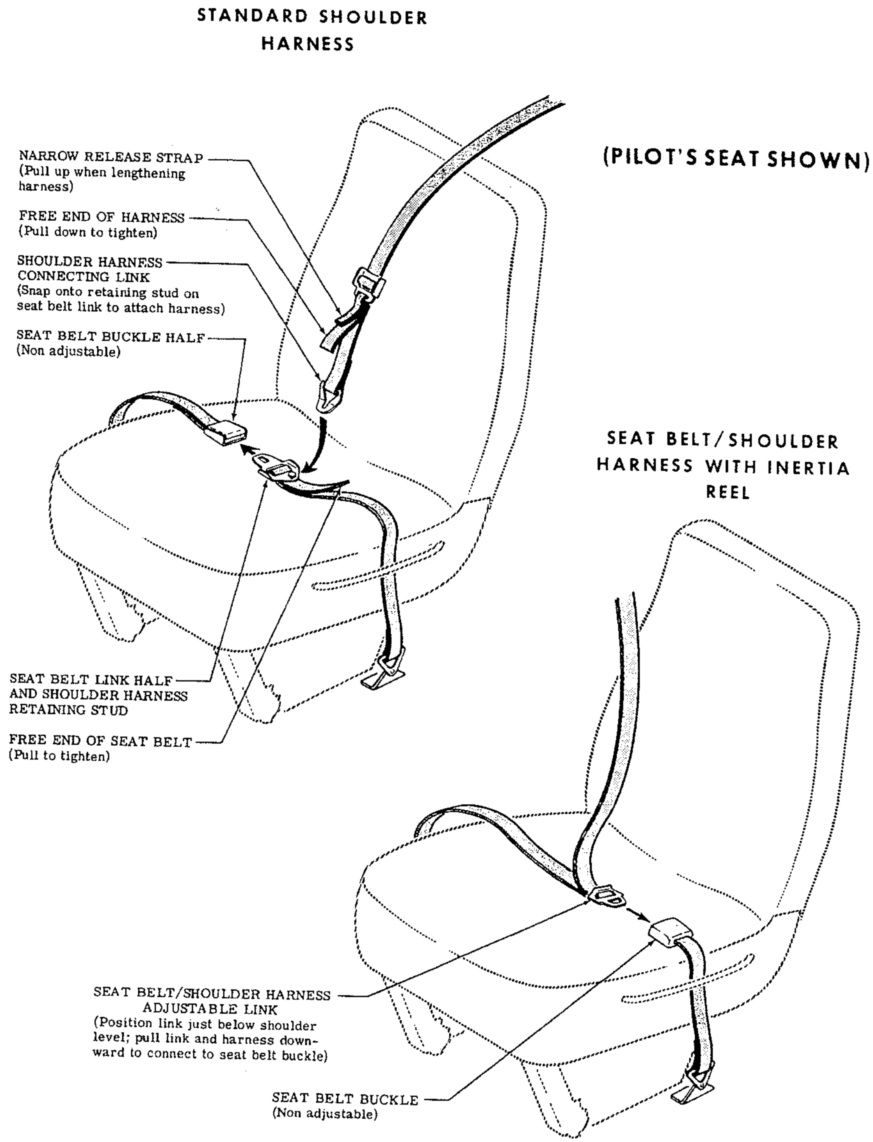


Figure 7-4. Seat Belts and Shoulder Harnesses

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

INTEGRATED SEAT BELT/SHOULDER HARNESSES WITH INERTIA REELS

Integrated seat belt/shoulder harnesses with inertia reels are available for the pilot and front seat passenger (see figure 7-4). The seat belt/shoulder harnesses extend from inertia reels located in the cabin ceiling to attach points inboard of the two front seats. A separate seat belt half and buckle is located outboard of the seats. Inertia reels allow complete freedom of body movement. However, in the event of a sudden deceleration, they will lock automatically to protect the occupants.

NOTE

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

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

ENTRANCE DOORS AND CABIN WINDOWS

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

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

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

NOTE

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

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

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

CONTROL LOCKS

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

ENGINE

The airplane is powered by a horizontally-opposed, four-cylinder overhead-valve, air-cooled, carbureted engine with a wet sump oil system. The engine is a Lycoming Model O-360-A1F6D and is rated at 180 horsepower at 2700 RPM. Major accessories mounted on the engine include a direct-drive starter and belt-driven alternator on the front of the engine, and dual magnetos, an engine-driven fuel pump, a full flow oil filter, a propeller governor, and a vacuum pump on the rear of the engine.

ENGINE CONTROLS

Engine power 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 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. To adjust the mixture, move the control forward or aft by depressing the lock button in the end of the control.

ENGINE INSTRUMENTS

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

The oil pressure gage, located below and to the left of the pilot's control wheel shaft, is operated electrically and by oil pressure. A direct pressure oil line from the engine delivers oil at engine operating pressure to a transducer. The transducer then transmits the oil pressure electrically to the gage. Gage markings indicate that minimum idling pressure is 25 PSI (red line), the normal operating range is 60 to 90 PSI (green arc), and maximum pressure is 100 PSI (red line).

Oil temperature is indicated by a gage located below and to the right of the pilot's control wheel shaft. The gage is operated by an electrical-resistance type temperature sensor which receives power from the air-

plane electrical system. Oil temperature limitations are the normal operating range (green arc) which is 38°C (100°F) to 118°C (245°F), and the maximum (red line) which is 118°C (245°F).

The cylinder head temperature gage is located directly to the left of the pilot's control wheel shaft. An electrical-resistance type temperature sensor, which receives power from the airplane electrical system, operates the gage. Temperature limitations are the normal operating range (green arc) which is 93°C (200°F) to 260°C (500°F) and the maximum (red line) which is 260°C (500°F).

The engine-driven mechanical tachometer is located near the lower center portion of the instrument panel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours and tenths. Instrument markings include a normal operating range (stepped green arc) of 2100 to 2700 RPM with a step at the 2500 RPM indicator mark. The normal operating range upper limit is 2500 RPM at sea level and increases to 2700 RPM at 8000 feet. 2500 to 2700 RPM may be used at any altitude during hot day conditions. Maximum (red line) at any altitude is 2700 RPM. A yellow arc from 1700 to 1900 RPM is provided to caution the pilot against continuous engine operation at or below 10 inches Hg manifold pressure in the 1700 to 1900 RPM range.

The manifold pressure gage is mounted to the left of the tachometer. The gage is direct reading and indicates induction air manifold pressure in inches of mercury. It has a normal operating range (green arc) of 15 to 24 inches of mercury.

A fuel pressure gage, on the lower left side of the instrument panel, indicates fuel pressure to the carburetor in pounds per square inch. The gage is operated by fuel pressure from the output side of the engine-driven and/or electric auxiliary fuel pump. Gage markings are in 1 PSI increments with a red line at 2 PSI and 8 PSI. A green arc extends from 2 PSI to 8 PSI to indicate the normal operating range.

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

A carburetor air temperature gage may be installed on the left side of the instrument panel to help detect carburetor icing conditions. The gage is marked in 5° increments from -30°C to +30°C, and has a yellow arc between -15°C and +5°C which indicates the temperature range most conducive to icing in the carburetor. A placard on the lower half of the gage face reads KEEP NEEDLE OUT OF YELLOW ARC DURING POSSIBLE CARBURETOR ICING CONDITIONS.

NEW ENGINE BREAK-IN AND OPERATION

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

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

ENGINE OIL SYSTEM

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

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

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

IGNITION-STARTER SYSTEM

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

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

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through the left intake in the cowling nose cap. Just inside the intake is an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox at the front of the engine. After passing through the airbox, induction air enters the inlet in the carburetor which is under the engine, and is then ducted to the engine cylinders through intake manifold tubes. In the event carburetor ice is encountered or the intake filter becomes blocked, alternate heated air can be obtained from a shroud around an exhaust riser through a duct to a valve, in the airbox, operated by the carburetor heat control on the instrument panel. Heated air from the muffler shroud is obtained from an unfiltered outside source. Use of full carburetor heat at full throttle will result in a power loss of approximately 13%.

EXHAUST SYSTEM

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

CARBURETOR AND PRIMING SYSTEM

The engine is equipped with an up-draft, float-type, fixed jet carburetor mounted on the bottom of the engine. The carburetor is equipped with an enclosed accelerator pump, simplified fuel passages to prevent vapor locking, an idle cut-off mechanism, and a manual mixture control. Fuel is delivered to the carburetor by gravity flow from the fuel system. In the carburetor, fuel is atomized, proportionally mixed with intake air, and delivered to the cylinders through intake manifold tubes. The proportion of atomized fuel to air is controlled, within limits, by the mixture control on the instrument panel.

For easy starting in cold weather, the engine is equipped with a manual primer. The primer is actually a small pump which draws fuel from the fuel strainer when the plunger is pulled out, and injects it into the cylinder intake ports when the plunger is pushed back in. The plunger knob, on the instrument panel, is equipped with a lock, and, after being pushed full in, must be rotated either left or right until the knob cannot be pulled out.

COOLING SYSTEM

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

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

PROPELLER

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

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

FUEL SYSTEM

The airplane may be equipped with either a standard fuel system or a long range system (see figure 7-6). Both systems consist of two vented integral fuel tanks (one in each wing), a three-position fuel selector valve,

FUEL QUANTITY DATA (U.S. GALLONS)			
TANKS	TOTAL USABLE FUEL ALL FLIGHT CONDITIONS	TOTAL UNUSABLE FUEL	TOTAL FUEL VOLUME
STANDARD (25 Gal. Each)	49	1	50
LONG RANGE (30.5 Gal. Each)	60	1	61

Figure 7-5. Fuel Quantity Data

fuel reservoir tank, fuel shutoff valve, fuel strainer, manual primer, auxiliary fuel pump, engine-driven fuel pump, and carburetor. Refer to figure 7-5 for fuel quantity data for both systems.

Fuel flows by gravity from the two integral wing tanks to the three-position selector valve labeled BOTH ON, LEFT, and RIGHT. From the selector valve, fuel flows to a reservoir tank and a shutoff valve. With the shutoff valve knob pushed full in, fuel will then flow through the strainer to an engine-driven fuel pump, or an electric fuel pump which parallels the engine-driven pump and is used in the event the fuel pressure drops below 2 psi. The engine-driven fuel pump (or electric fuel pump, if in use) delivers fuel to the carburetor.

NOTE

> In the event the engine-driven fuel pump should fail during operations that require high power, the electric fuel pump should be turned on.

From the carburetor, mixed fuel and air flows to the cylinders through intake manifold tubes. The manual primer draws its fuel from the fuel strainer and injects it into the cylinder intake ports.

The airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by utilizing a marker in the filler neck in either the standard or long range tanks. The marker consists of a series of small holes at the bottom of the filler neck. When both tanks are filled to this level, the total usable fuel is 43 gallons with either the standard or long range tank installations.

Fuel system venting is essential to system operation. Blockage of the venting system will result in a decreasing fuel flow and eventual engine stoppage. Venting is accomplished by vent lines, one from each fuel tank, which are designed to prevent fuel loss when the airplane is not parked on a level surface. The left fuel tank vent line vents overboard at the right wing tip, and the right fuel tank vent line vents overboard at the left wing tip. The fuel filler caps are also vented. A connecting vent line from the right fuel tank vent line to the reservoir tank prevents the reservoir tank from becoming air locked during refueling operations.

Fuel quantity is measured by two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity indicators on the lower left portion of the instrument panel. An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately 0.5 gallon remains in the tank as unusable fuel. The indicators cannot be relied upon for accurate readings during

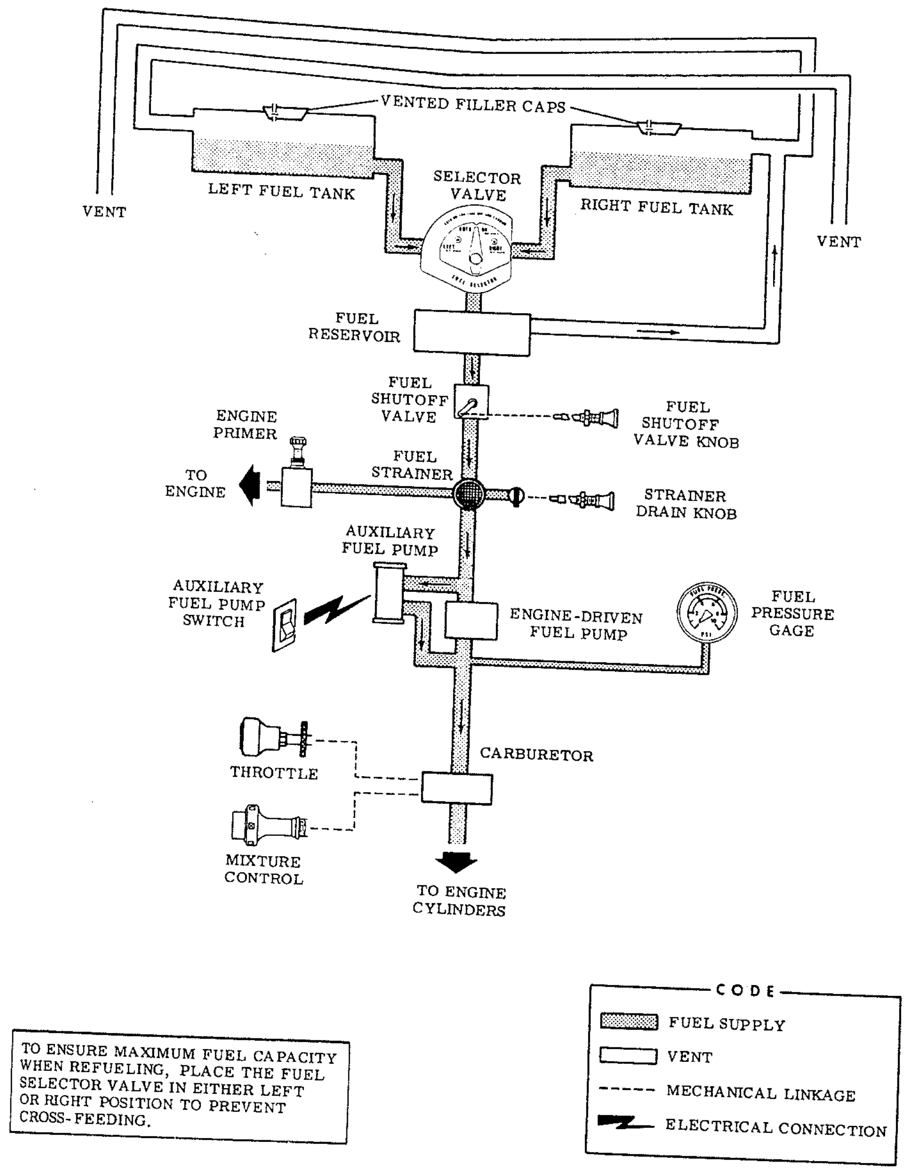


Figure 7-6. Fuel System (Standard and Long Range)

skids, slips, or unusual attitudes. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature gage, oil temperature gage, or oil pressure gage for readings. If these gages are not indicating, an electrical malfunction has occurred.

NOTE

Take off with the fuel selector valve handle in the BOTH ON position to prevent inadvertent takeoff on an empty tank. However, during long range flight with the selector valve handle in the BOTH ON position, unequal fuel flow from each tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the fuel tank in the "heavy wing." The recommended cruise fuel management procedure for extended flight is to use the left and right tank alternately.

NOTE

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

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system for contamination and grade. The system should be examined before the first flight of every day and after each refueling, by using the sampler cup provided to drain fuel from the wing tank sumps, and by utilizing the fuel strainer drain under an access panel on the right side of the engine cowling. An additional drain valve is provided in the reservoir tank and should be used to check the fuel if water is detected. The fuel tanks should be filled after each flight to prevent condensation.

BRAKE SYSTEM

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

the instrument panel.

For maximum brake life, keep the brake systems 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, short pedal travel and hard pedal, 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 7-7) is supplied by a 14-volt, direct-current system powered by an engine-driven, 60-amp alternator. The 12-volt, 33-amp hour battery is located aft of the rear cabin wall. Power is supplied to all electrical circuits through a split bus bar, one side containing electronic system circuits and the other side having general electrical system circuits. Both sides of the bus are on at all times except when either an external power source is connected or the starter switch is turned on; then a power contactor is automatically activated to open the circuit to the electronic bus. Isolating the electronic circuits in this manner prevents harmful transient voltages from damaging the transistors in the electronic equipment.

MASTER SWITCH

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

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

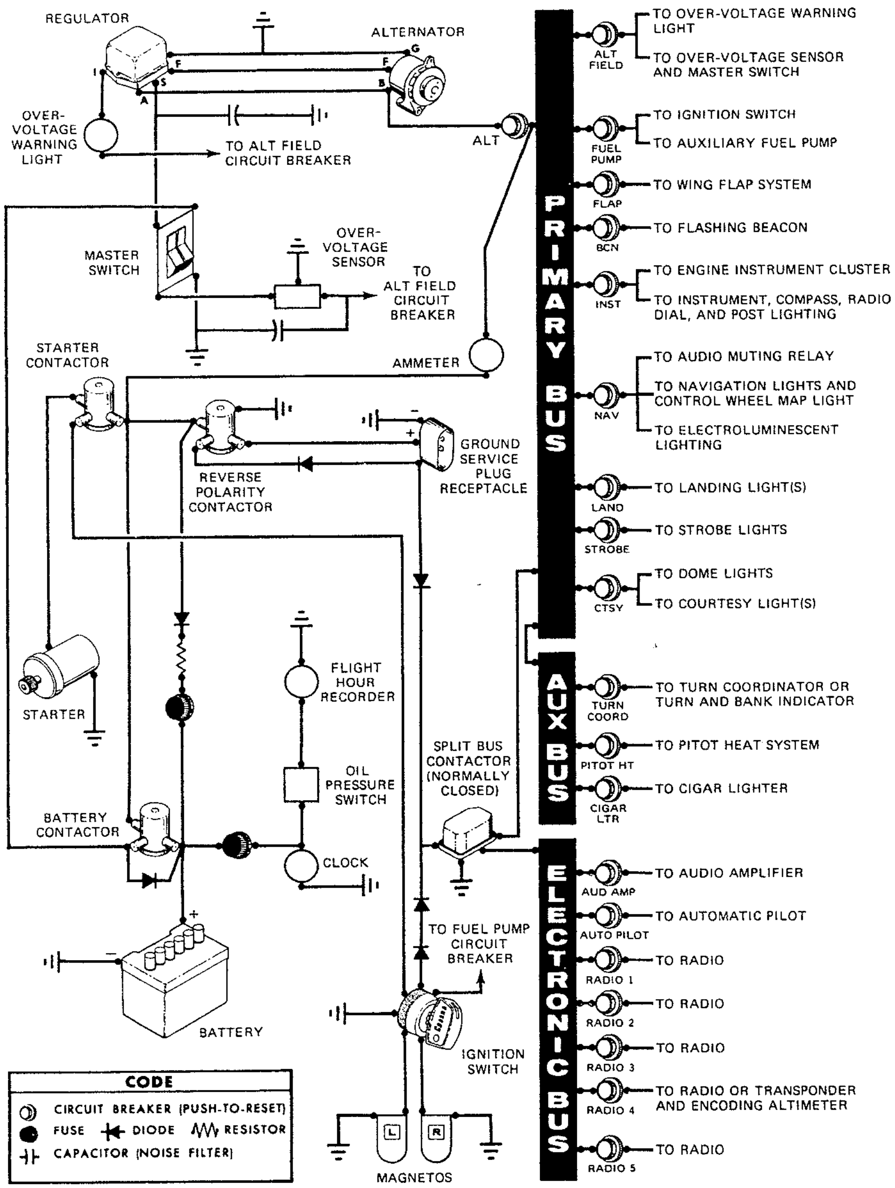


Figure 7-7. Electrical System

the battery contactor, remove power from the alternator field, and prevent alternator restart.

AMMETER

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

OVER-VOLTAGE SENSOR AND WARNING LIGHT

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

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

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

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

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" circuit breakers mounted on the right side of the instrument panel. Exceptions to this are the battery contactor closing (external power) circuit, clock and flight hour recorder circuits which have fuses mounted near the battery. The cigar lighter also has a manually reset type circuit breaker mounted on the back of the lighter socket.

GROUND SERVICE PLUG RECEPTACLE

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

NOTE

Electrical power for the airplane electrical circuits is provided through a split bus bar having all electronic circuits on one side of the bus and other electrical circuits on the other side of the bus. When an external power source is connected, a contactor automatically opens the circuit to the electronic portion of the split bus bar as a protection against damage to the transistors in the electronic equipment by transient voltages from the power source. Therefore, the external power source can not be used as a source of power when checking electronic components.

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

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

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

LIGHTING SYSTEMS

EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and top of the rudder. Landing and taxi lights are installed in the nose cap, and a flashing beacon is mounted on top of the vertical fin. Additional lighting is available and includes a strobe light on each wing tip and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are operated by a switch located on the left rear door post. All ex-

terior lights, except the courtesy lights, are controlled by rocker type switches on the left switch and control panel. The switches are ON in the up position and OFF in the down position.

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

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

INTERIOR LIGHTING

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

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

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

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

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

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

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

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

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

CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated to any degree desired by adjustment of a single push-pull control knob labeled CABIN AIR/HEAT (see figure 7-8). When the knob is positioned full in, no air flows into the cabin. As the knob is pulled out to approximately one inch of travel (as noted by a notch on the control shaft) a flow of un-heated fresh air will enter the cabin. Further actuation of the control knob (past the notch) toward the full out position blends in heated fresh air in increasing amounts.

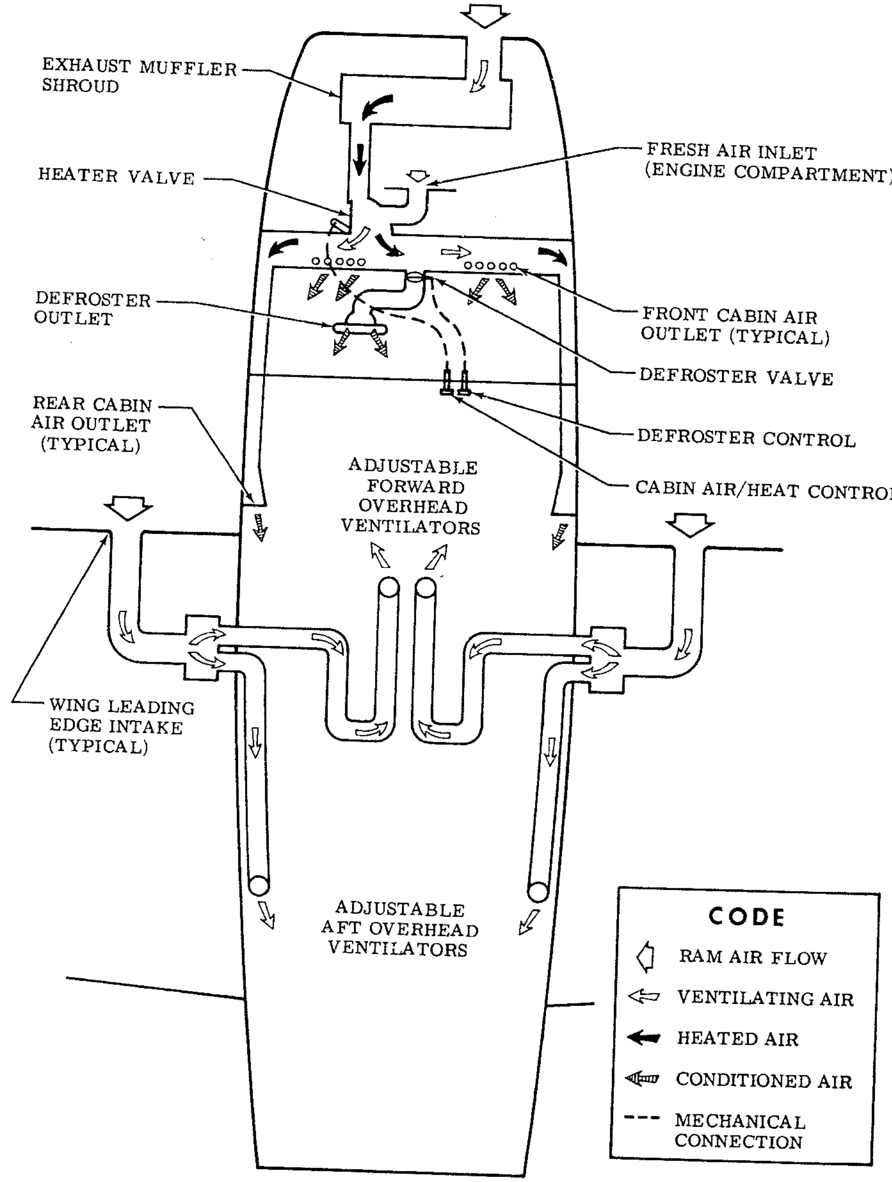


Figure 7-8. Cabin Heating, Ventilating, and Defrosting System

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

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

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

PITOT-STATIC SYSTEM AND INSTRUMENTS

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

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

A static pressure alternate source valve is installed in the left side of the instrument panel for use when the external static source is malfunctioning. This valve supplies static pressure from inside the rear fuselage instead of the external static ports. An external condensate drain, located in the alternate source line under the floorboard, is provided for periodic draining of any moisture accumulation.

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

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

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings include the white arc (47 to 90 knots), green arc (57 to 138 knots), yellow arc (138 to 167 knots), and a red line (167 knots).

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

RATE-OF-CLIMB INDICATOR

The rate-of-climb indicator depicts airplane rate of climb or descent in feet per minute. The pointer is actuated by an atmospheric pressure change 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 proper barometric pressure reading.

VACUUM SYSTEM AND INSTRUMENTS

An engine-driven vacuum system (see figure 7-9) is available and provides the suction necessary to operate the attitude indicator and directional indicator. The system consists of a vacuum pump mounted on the en-

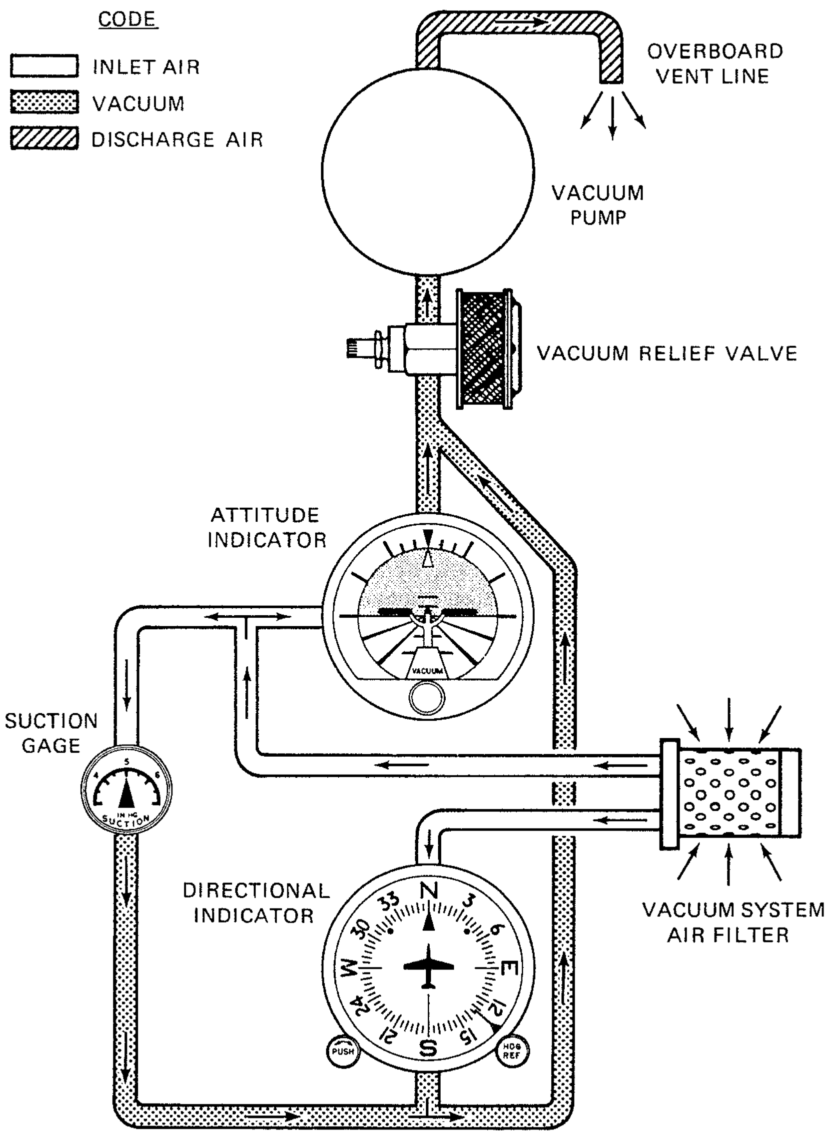


Figure 7-9. Vacuum System

gine, a vacuum relief valve and vacuum system air filter on the aft side of the firewall below the instrument panel, and instruments (including a suction gage) on the left side of the instrument panel.

ATTITUDE INDICATOR

An attitude indicator is available and gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which is marked in increments of 10°, 20°, 30°, 60°, and 90° either side of the center mark. Pitch attitude is 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 at the upper left edge 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 pneumatic-type stall warning system consisting of an inlet in the leading edge of the left wing, an air-operated horn near the upper left corner of the windshield, and associated plumbing. As the airplane approaches a stall, a low pressure condition is created over the leading edge of the wings. This low pressure creates a differential pressure (vacuum) in the stall warning system which draws air through the warning horn, resulting in an audible warning at 5 to 10 knots above stall in all flight conditions.

The stall warning system should be checked during the preflight inspection by placing a clean handkerchief over the vent opening and applying suction. A sound from the warning horn will confirm that the system is operative.

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 7-10). The operation of this switching system is described in the following paragraphs.

TRANSMITTER SELECTOR SWITCH

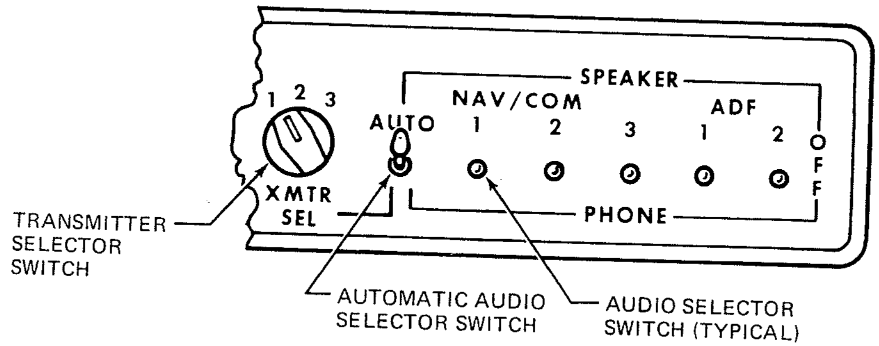
A rotary type transmitter selector switch, labeled XMTR SEL, is provided to connect the microphone to the transmitter the pilot desires to use. To select a transmitter, rotate the switch to the number corresponding to that transmitter. The numbers 1, 2 and 3 above the switch correspond to the top, second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

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

AUTOMATIC AUDIO SELECTOR SWITCH

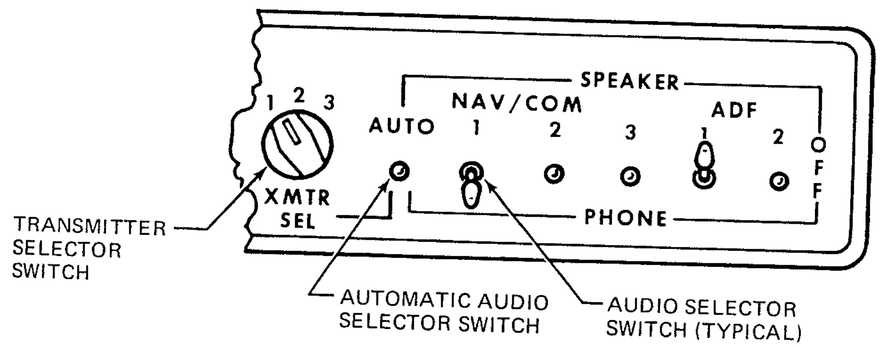
A toggle switch, labeled AUTO, can be used to automatically match the appropriate NAV/COM receiver audio to the transmitter being selected. To utilize this automatic feature, leave all NAV/COM receiver switches in the OFF (center) position, and place the AUTO selector switch

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 7-10. Audio Control Panel

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.

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, freezing rain, snow or ice crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, stabilator, propeller tips, and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

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

SECTION 8
AIRPLANE HANDLING, SERVICE & MAINTENANCE

TABLE OF CONTENTS

Page

Introduction 8-3
Identification Plate 8-3
Owner Follow-Up System 8-3
  Publications 8-3
Airplane File 8-4
Airplane Inspection Periods 8-5
  FAA Required Inspections 8-5
  Cessna Progressive Care 8-6
  Cessna Customer Care Program 8-6
Pilot Conducted Preventive Maintenance 8-7
Alterations or Repairs 8-7
Ground Handling 8-7
  Towing 8-7
  Parking 8-7
  Tie-Down 8-8
  Jacking 8-8
  Leveling 8-9
  Flyable Storage 8-9
Servicing 8-10
  Engine Oil 8-10
  Fuel 8-11
  Landing Gear 8-11
Cleaning and Care 8-12
  Windshield-Windows 8-12
  Painted Surfaces 8-12
  Propeller Care 8-13
  Engine Care 8-13
  Interior Care 8-13

INTRODUCTION

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

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

IDENTIFICATION PLATE

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

OWNER FOLLOW-UP SYSTEM

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

PUBLICATIONS

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

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

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

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

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

AIRPLANE FILE

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

A. To be displayed in the airplane at all times:

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

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

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

C. To be made available upon request:

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

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

Cessna recommends that these items, plus the Pilot's Operating Handbook, 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 45° either side of center, or damage to the gear will result. If the airplane is towed or pushed over a rough surface during hangaring, watch that the normal cushioning action of the nose strut does not cause excessive vertical movement of the tail and the resulting contact with low hangar doors or structure. A flat nose tire or deflated strut will also increase tail height.

PARKING

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

TIE-DOWN

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

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

JACKING

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

A jack pad assembly is available to facilitate jacking individual main gear. Prior to the jacking operation, the strut-to-fuselage fairing must be removed. With this fairing removed, the jack pad is then inserted on the tube in the area between the fuselage and the upper end of the tube fairing, and the gear jacked as required. When using the individual main gear jack point, 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 points.

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

NOTE

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

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

NOTE

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

LEVELING

Longitudinal leveling of the airplane is accomplished by placing a level on leveling screws on the side of the tailcone. Deflate the nose tire and/or lower or raise the nose strut to properly center the bubble in the level. A level placed across the front seat rails, at corresponding points, is used to level the airplane laterally.

FLYABLE STORAGE

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

WARNING

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

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

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

SERVICING

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

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

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

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

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

ENGINE OIL

GRADE -- Aviation Grade SAE 50 Above 16°C(60°F).
Aviation Grade SAE 10W30 or SAE 30 Between -18°C(0°F) and 21°C(70°F).
Aviation Grade SAE 10W30 or SAE 20 Below -12°C(10°F).
Multi-viscosity oil with a range of SAE 10W30 is recommended for improved starting in cold weather. Ashless dispersant oil, conforming to Specification No. MIL-L-22851, 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 -- 8 Quarts.
Do not operate on less than 6 quarts. To minimize loss of oil through breather, fill to 7 quart level for normal flights of less than 3 hours. For extended flight, fill to 8 quarts. These quantities refer to oil dipstick level readings. During oil and oil filter changes, one additional quart is required when the filter element is changed.

OIL AND OIL FILTER CHANGE --
After the first 25 hours of operation, drain engine oil sump and oil cooler, clean the oil suction strainer, and change the filter element. Refill sump with straight mineral oil and use until a total of 50 hours has accumulated or oil consumption has stabilized; then change to dispersant oil. Drain the engine oil sump and oil cooler, clean the oil suction strainer, and change the filter element each 50 hours thereafter. The oil change interval may be extended to 100-hour intervals, providing the oil filter element is changed at 50-hour intervals. Change engine oil at least every 6 months even though less than the recommended hours have accumulated. Reduce intervals for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

FUEL

GRADE (AND COLOR) -- 100/130 Minimum Grade Aviation Fuel (green).
100/130 low lead aviation fuel (green) with a lead content limited to 2 cc per gallon is also approved.
CAPACITY EACH STANDARD TANK -- 25 Gallons.
CAPACITY EACH LONG RANGE TANK -- 30.5 Gallons.
REDUCED CAPACITY, STANDARD AND LONG RANGE (INDICATED BY SMALL HOLES INSIDE FILLER NECK) -- 22 Gallons.

NOTE

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

LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 35 PSI on 5.00-5, 4-Ply Rated Tire.
MAIN WHEEL TIRE PRESSURE -- 30 PSI on 6.00-6, 6-Ply Rated Tires.
NOSE GEAR SHOCK STRUT --
Keep filled with MIL-H-5606 hydraulic fluid and inflated with air to 40 PSI.

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.

ENGINE CARE

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

CAUTION

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

INTERIOR CARE

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

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

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

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

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

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

SECTION 9
SUPPLEMENTS
(Optional Systems Description & Operating Procedures)

TABLE OF CONTENTS

Introduction
Supplements:
Emergency Locator Transmitter (ELT) . . . . (4 pages)
Cessna 300 Transceiver (Type RT-524A) . . . . (4 pages)
Cessna 300 Nav/Com (Type RT-308C) . . . . (4 pages)
Cessna 300 Nav/Com (Type RT-528E-1) . . . . (6 pages)
Cessna 300 Nav/Com (Type RT-328T) . . . . (6 pages)
Cessna 300 ADF (Type R-546E) . . . . (6 pages)
Cessna 300 Transponder (Type RT-359A) and Optional Altitude Encoder (Type EA-401A) . . . . (6 pages)
DME (Type 190) . . . . (4 pages)
HF Transceiver (Type PT10-A) . . . . (4 pages)
SSB HF Transceiver (Type ASB-125) . . . . (4 pages)
Cessna 400 Marker Beacon (Type R-402A) . . . . (4 pages)
Cessna 200A Autopilot (Type AF-295B) . . . . (6 pages)
Cessna 300A Autopilot (Type AF-395A) . . . . (6 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.

SUPPLEMENT

EMERGENCY LOCATOR TRANSMITTER (ELT)

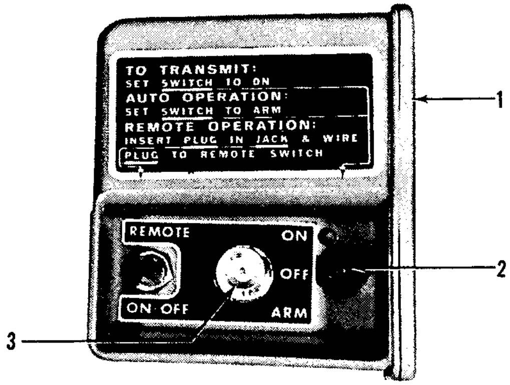
SECTION 1
GENERAL

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 duration of ELT transmissions is affected by ambient temperature. At temperatures of +21° to +54°C (+70° to +130°F), continuous transmission for 115 hours can be expected; a temperature of -40°C (-40°F) will shorten the duration to 70 hours.

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. COVER - Removable for access to battery.

2. 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.

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

3. ANTENNA RECEPTACLE - Connection to antenna mounted on top of the 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 se-

lector 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 ARM 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 ARM position to re-set the ELT for normal operation.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

CESSNA 300 TRANSCEIVER

(Type RT-524A)

SECTION 1

GENERAL

The Cessna 300 Transceiver, shown in Figure 1, is a self-contained communications system capable of receiving and transmitting on any one of 360 manually tuned, crystal-controlled channels. The channels are spaced 50 kHz apart and cover a frequency range of 118.00 thru 135.95 MHz.

The 300 Transceiver system consists of a panel-mounted receiver/transmitter, a spike antenna and interconnecting cables. The system utilizes the airplane microphone, headphone and speaker.

All of the required operating controls are mounted on the front panel of the 300 Transceiver except the microphone switch. In addition, when two or more radios are installed, a transmitter selector switch and a speaker-phone selector switch are provided. Each control function is described in Figure 1.

SECTION 2

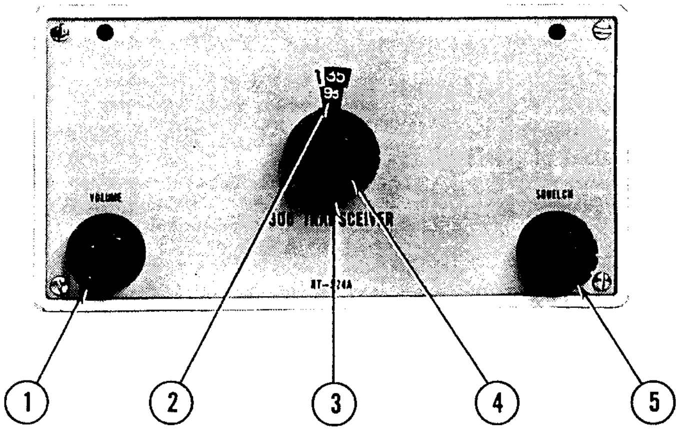
LIMITATIONS

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.



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

2. RECEIVER-TRANSMITTER FREQUENCY DIAL.

3. RECEIVER-TRANSMITTER FREQUENCY SELECTOR - Selects receiver-transmitter frequency in 1-MHz steps between 118.00 and 135.00 MHz.

4. RECEIVER-TRANSMITTER FRACTIONAL FREQUENCY SELECTOR - Selects receiver-transmitter fractional frequency in 0.05-MHz steps.

5. 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.

Figure 1. Cessna 300 Transceiver Controls

SECTION 4
NORMAL PROCEDURES

TO TRANSMIT:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) Frequency Selector Knobs -- SELECT operating frequency.
(3) Radio VOLUME Control -- ON.
(4) Mike Button -- DEPRESS.

TO RECEIVE:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE Switch -- SELECT desired mode.
(3) Frequency Selector Knobs -- SELECT operating frequency.
(4) Radio VOLUME Control -- ON and adjust to listening level.
(5) SQUELCH Control -- ROTATE counterclockwise to decrease background noise.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

CESSNA 300 NAV/COM

(VOR Only - Type RT-308C)

SECTION 1

GENERAL

The Cessna 300 Nav/Com (Type RT-308C), shown in Figure 1, consists of a panel-mounted receiver-transmitter (RT-308C) and a single course deviation indicator (IN-514R or IN-514B). The RT-308C Receiver-Transmitter includes a 360-channel VHF communication receiver-transmitter and a 160-channel VHF navigation receiver, both of which may be operated simultaneously.

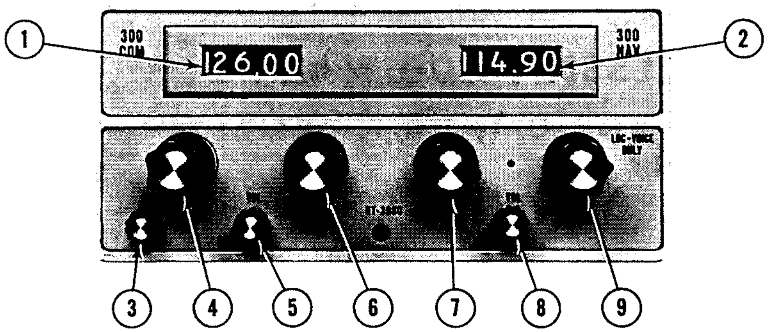
The communication receiver-transmitter receives and transmits signals between 118.00 and 135.95 MHz in 50 kHz steps. The navigation receiver receives and interprets VHF omnidirectional range (VOR) signals between 108.00 and 117.95 MHz. Although localizer signals (all odd-tenth frequencies between 108.1 and 111.9 MHz) can also be received, the navigation receiver does not include the circuits required to actuate the course deviation needle. However, the audio portion of the localizer is audible so that flight information, such as that broadcast in certain areas on selected localizer frequencies by the Automatic Terminal Information Service (ATIS), may be heard.

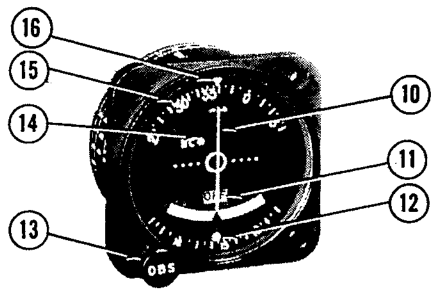
All controls for the Cessna 300 Nav/Com (Type RT-308C), except the omni bearing selector (OBS), are mounted on the front panel of the receiver-transmitter. The course selector and the navigation indicators are included in the course deviation indicator. The communication receiver-transmitter and the navigation receiver are synthesizer-controlled and are tuned automatically when the frequency is selected. In addition, when two or more radios are installed, a transmitter selector switch and a speaker-phone selector switch are provided. Each control function is described in Figure 1.

SECTION 2

LIMITATIONS

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





1. RECEIVER-TRANSMITTER FREQUENCY INDICATOR.
2. NAVIGATION RECEIVER FREQUENCY INDICATOR.
3. 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.
4. COMMUNICATION RECEIVER-TRANSMITTER MEGAHERTZ SELECTOR - Selects communication receiver-transmitter frequency in 1-MHz steps between 118 and 135 MHz.

Figure 1. Cessna 300 Nav/Com (Type RT-308C) - VOR only (Sheet 1 of 2)

5. OFF/ON VOLUME CONTROL - Turns complete set on and controls volume of audio from communication receiver.
6. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Selects communication receiver-transmitter fractional frequency in 0.05 MHz steps between 0.00 and 0.95 MHz.
7. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 1-MHz steps between 108 and 117 MHz.
8. NAVIGATION RECEIVER VOLUME CONTROL - Controls volume of audio from navigation receiver only. Clockwise rotation increases audio level.
9. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 0.05 MHz steps between 0.00 and 0.95 MHz.
10. COURSE DEVIATION POINTER - Indicates course deviation from selected omni bearing.
11. OFF/TO-FROM (OMNI) INDICATOR - Operates only with VOR signal. "OFF" position (flag) indicates unreliable signal or no signal. When "OFF" position disappears, indicator shows whether selected course is "TO" or "FROM" the station.
12. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
13. OMNI BEARING SELECTOR (OBS) - Selects desired course to or from a VOR station.
14. BACK COURSE (BC) INDICATOR LIGHT (On IN-514B Only) - Not used with this radio.
15. BEARING DIAL.
16. COURSE INDEX - Indicates selected VOR course.

Figure 1. Cessna 300 Nav/Com (Type RT-308C) - VOR only (Sheet 2 of 2)

SECTION 3

EMERGENCY PROCEDURES

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

SECTION 4

NORMAL PROCEDURES

TO TRANSMIT:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) COM Frequency Selector Knobs -- SELECT operating frequency.
(3) OFF/VOL control -- ON.
(4) Mike Button -- DEPRESS.

TO RECEIVE:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE Switch -- SELECT desired mode.
(3) COM/NAV Frequency Selector Knobs -- SELECT frequency.
(4) VOL Control -- ADJUST to listening level (OFF/VOL knob must be ON).
(5) SQ Control -- ROTATE counterclockwise to decrease background noise.

SECTION 5

PERFORMANCE

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

SUPPLEMENT

CESSNA 300 NAV/COM

(360-Channel - Type RT-528E-1)

SECTION 1

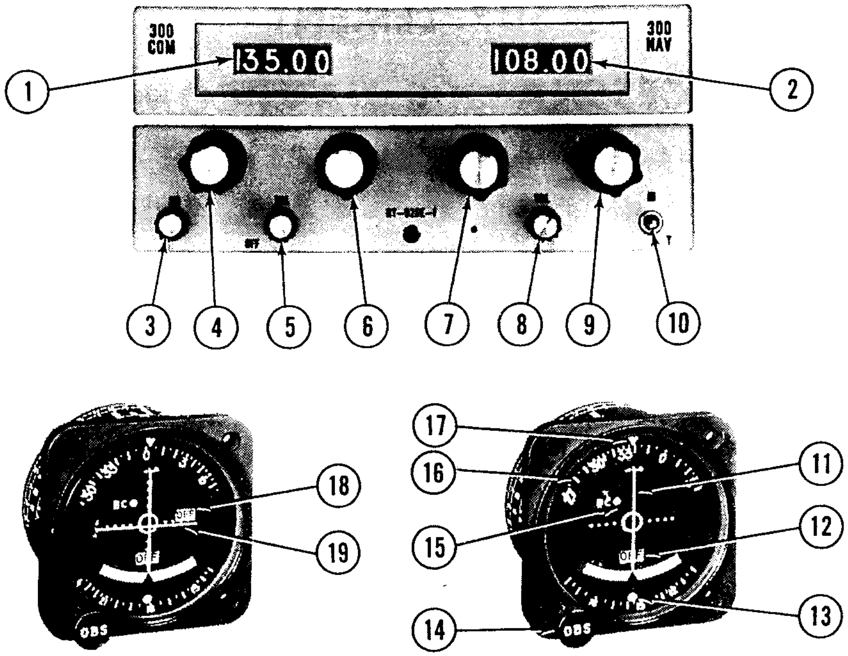
GENERAL

The Cessna 300 Nav/Com (Type RT-528E-1), shown in Figure 1, consists of a panel-mounted receiver-transmitter and a single- or dual-pointer remote course indicator. The receiver-transmitters include a 360-channel VHF communication receiver-transmitter and a 200-channel VHF navigation receiver.

The communication receiver-transmitter receives and transmits signals between 118.00 and 135.95 MHz in 50 kHz steps. The navigation receiver receives and interprets VOR and localizer signals between 108.00 and 117.95 MHz in 50 kHz steps. The communication receiver-transmitter and the navigation receiver are synthesizer-controlled and are tuned automatically when the frequency is selected.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Cessna 300 Nav/Com set for automatic selection of the associated DME or GS 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.

All controls of the Cessna 300 Nav/Com, except the omni bearing selector knob (OBS), which is located on the course indicator, are mounted on the front panel of the receiver-transmitter. The course indicator includes either a single pointer and related OFF flag for VOR/LOC indication only, or dual pointers and related OFF flags for both VOR/LOC and glide slope indications. The course indicator also incorporates a back-course lamp (BC) which lights when back-course operation is selected. In addition, when two or more radios are installed, a transmitter selector switch and a speaker-phone selector switch are provided. Each control function is described in Figure 1.



1. RECEIVER-TRANSMITTER FREQUENCY INDICATOR.
2. NAVIGATION RECEIVER FREQUENCY INDICATOR.
3. 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.
4. COMMUNICATION RECEIVER-TRANSMITTER MEGAHERTZ SELECTOR - Selects communication receiver-transmitter frequency in 1-MHz steps between 118 and 135 MHz.
5. OFF/ON VOLUME CONTROL - Turns complete set on and controls volume of audio from communication receiver.
6. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Selects communication receiver-transmitter fractional frequency in 0.05-MHz steps between 0.00 and 0.95 MHz.

Figure 1. Cessna 300 Nav/Com (Type RT-528E-1) (Sheet 1 of 2)

7. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 1-MHz steps between 108 and 117 MHz.
8. NAVIGATION RECEIVER VOLUME CONTROL - Controls volume of audio from navigation receiver only. Clockwise rotation increases audio level.
9. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 0.05-MHz steps between 0.00 and 0.95 MHz.
10. COMBINED INDENTIFIER SIGNAL SELECTOR AND VOR SELF-TEST SELECTOR SWITCH - When VOR station is selected in ID position, station identifier is audible; in center (unmarked) position, identifier is off; in T (momentary on) position, tests VOR navigation circuits.
11. COURSE DEVIATION POINTER - Indicates course deviation from selected omni bearing or localizer centerline.
12. OFF/TO-FROM (OMNI) INDICATOR - Operates only with VOR or localizer signal. "OFF" position (flag) indicates unreliable signal. When "OFF" position disappears, indicator shows whether selected VOR course is "TO" or "FROM" the station (if LOC frequency is selected, indicator will only show "TO").
13. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
14. OMNI BEARING SELECTOR (OBS) - Selects desired course to or from a VOR station.
15. BC - Amber light illuminates when an optional autopilot system is installed and the autopilot's back-course button is engaged; indicates CDI needle is reversed on selected receiver when tuned to a localizer frequency (type IN-514B or IN-525B Indicators only).
16. BEARING DIAL.
17. COURSE INDEX - Indicates selected VOR course.
18. GLIDE SLOPE "OFF" FLAG - When visible, indicates unreliable glide slope signal or no glide slope signal. The flag disappears when a reliable glide slope signal is being received.
19. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from normal glide slope.

Figure 1. Cessna 300 Nav/Com (Type RT-528E-1) (Sheet 2 of 2)

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 propeller interference caused oscillations of the glide slope deviation pointer.

SECTION 3
EMERGENCY PROCEDURES

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

SECTION 4
NORMAL PROCEDURES

TO TRANSMIT:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) COM Frequency Selector Knobs -- SELECT operating frequency.
(3) OFF/VOL Control -- ON.
(4) Mike Button -- DEPRESS.

TO RECEIVE:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE Switch -- SELECT desired mode.
(3) COM/NAV Frequency Selector Knobs -- SELECT frequency.
(4) VOL Control -- Adjust to listening level (OFF/VOL knob must be ON).
(5) SQ Control -- ROTATE counterclockwise to decrease background noise.

TO OPERATE IDENT FILTER:

(1) ID-T Switch -- CENTER (unmarked) to include filter in audio circuit of both receivers.

(2) ID-T Switch -- ID position disconnects filter from audio circuit to hear navigation station identifier (Morse Code) signal.

NOTE

The ID-T switch should be left in ID position for best communications reception.

TO SELF TEST VOR NAVIGATION CIRCUITS:

(1) Tune to usable VOR signal from either a VOR station or a test signal.
(2) OBS Knob -- ROTATE course index to 0°.
(3) ID-T Switch -- T position. Vertical pointer should center and OFF-TO-FROM indicator should show FROM.
(4) ID-T Switch -- T position and rotate OBS knob to displace course index approximately 10° to either side of 0°. Vertical pointer should deflect full scale in direction corresponding to course index displacement.
(5) ID-T Switch -- CENTER (unmarked) position for normal VOR 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.

SUPPLEMENT

CESSNA 300 NAV/COM

(720-Channel - Type RT-328T)

SECTION 1

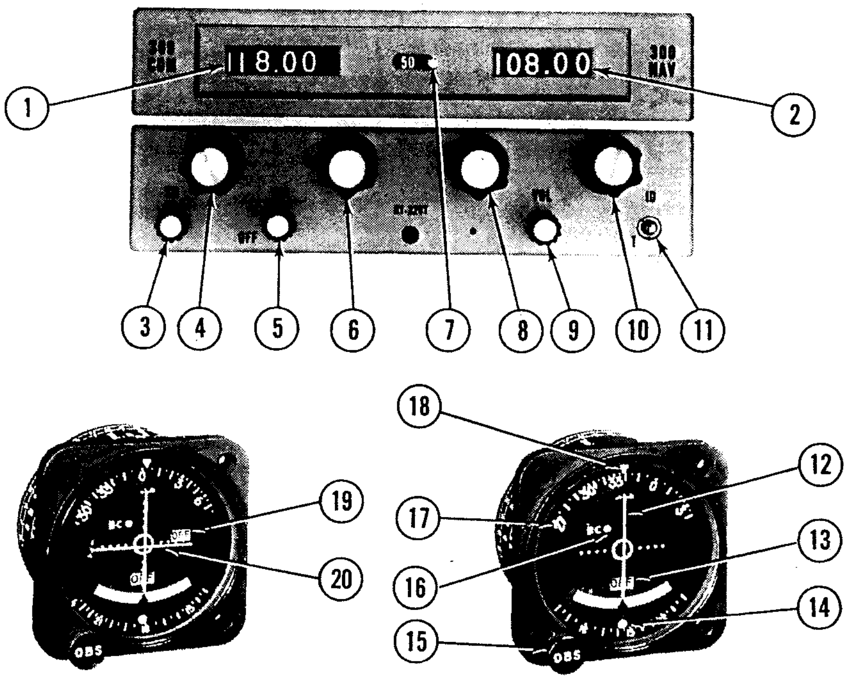
GENERAL

The Cessna 300 Nav/Com (Type RT-328T), shown in Figure 1, consists of a panel-mounted receiver-transmitter and a single- or dual-pointer remote course indicator. The set includes a 720-channel VHF communication receiver-transmitter and a 200-channel VHF navigation receiver, both of which may be operated simultaneously.

The communication receiver-transmitter receives and transmits signals between 118.000 and 135.975 MHz in 25-kHz steps. The navigation receiver receives and interprets VHF omnidirectional and localizer signals between 108.00 and 117.95 MHz in 50-kHz steps. The communication receiver-transmitter and the navigation receiver are synthesizer-controlled and are tuned automatically when the frequency is selected.

A DME receiver-transmitter or a glide slope receiver, or both, may be interconnected with the Cessna 300 Nav/Com set for automatic selection of the associated DME or GS 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.

All controls of the Cessna 300 Nav/Com, except the omni bearing selector knob (OBS), which is located on the course indicator, are mounted on the front panel of the receiver-transmitter. The course indicator includes either a single pointer and related OFF flag for VOR/LOC indication only, or dual pointers and related OFF flags for both VOR/LOC and glide slope indications. The course indicator also incorporates a back-course lamp (BC) which lights when back-course operation is selected. In addition, when two or more radios are installed, a transmitter selector switch and a speaker-phone selector switch are provided. Each control function is described in Figure 1.



1. RECEIVER-TRANSMITTER FREQUENCY INDICATOR.
2. NAVIGATION RECEIVER FREQUENCY INDICATOR.
3. 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.
4. COMMUNICATION RECEIVER-TRANSMITTER MEGAHERTZ SELECTOR - Selects communication receiver-transmitter frequency in 1-MHz steps between 118 and 135 MHz.
5. OFF/ON VOLUME CONTROL - Turns set on and controls volume of audio from communications receiver.
6. COMMUNICATION RECEIVER-TRANSMITTER FRACTIONAL MEGAHERTZ SELECTOR - Selects communication receiver-transmitter fractional frequency in .05-MHz steps between .000 and .950 MHz or between .025 and .975 MHz depending on position of 50-25 MHz selector switch.

Figure 1. Cessna 300 Nav/Com (Type RT-328T) (Sheet 1 of 2)

7. 50-25 FRACTIONAL MHz SELECTOR SWITCH - In "50" position, enables communication whole MHz frequency readout to display, and communication fractional MHz control to select fractional part of frequency in .05-MHz steps between .000 and .950 MHz. In "25" position, frequency display and coverage is in .05-MHz steps between .025 and .975.

   NOTE

   The third-decimal-place digit is not shown on the receiver-transmitter frequency readout.

8. NAVIGATION RECEIVER MEGAHERTZ SELECTOR - Selects navigation receiver frequency in 1-MHz steps between 108 and 117 MHz; simultaneously selects paired glide slope frequency or DME channel.
9. NAVIGATION RECEIVER VOLUME CONTROL - Controls volume of audio from navigation receiver only. Clockwise rotation increases audio level.
10. NAVIGATION RECEIVER FRACTIONAL MEGAHERTZ SELECTOR - Selects navigation receiver frequency in .05-MHz steps between .00 and .95 MHz; simultaneously selects paired glide slope frequency or DME channel.
11. COMBINED IDENTIFIER SIGNAL SELECTOR AND VOR SELF-TEST SELECTOR SWITCH - When VOR station is selected in ID position, station identifier is audible; in center (unmarked) position, identifier is off; in T (momentary on) position, tests VOR navigation circuits.
12. COURSE DEVIATION POINTER - Indicates course deviation from selected omni bearing or localizer centerline.
13. OFF/TO-FROM (OMNI) INDICATOR - Operates only with VOR or localizer signal. "OFF" position (flag) indicates unreliable signal. When "OFF" position disappears, indicator shows whether selected VOR course is "TO" or "FROM" the station (if LOC frequency is selected, indicator will only show "TO").
14. RECIPROCAL COURSE INDEX - Indicates reciprocal of selected VOR course.
15. OMNI BEARING SELECTOR (OBS) - Selects desired course to or from a VOR station.
16. BC - Amber light illuminates when an optional system is installed and the autopilot's back-course button is engaged; indicates CDI needle is reversed on selected receiver when tuned to a localizer frequency (Type IN-514B or IN-525B Indicators Only).
17. BEARING DIAL.
18. COURSE INDEX - Indicates selected VOR course.
19. GLIDE SLOPE "OFF" FLAG - When visible, indicates unreliable glide slope signal or no glide slope signal. The flag disappears when a reliable glide slope signal is being received.
20. GLIDE SLOPE DEVIATION POINTER - Indicates deviation from normal glide slope.

Figure 1. Cessna 300 Nav/Com (Type RT-328T) (Sheet 2 of 2)

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 propeller interference caused oscillations of the glide slope deviation pointer.

SECTION 3
EMERGENCY PROCEDURES

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

SECTION 4
NORMAL PROCEDURES

TO TRANSMIT:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) COM Frequency Selector Knobs -- SELECT operating frequency.
(3) 50-25 Fractional MHz Selector Switch -- SELECT operating frequency.
(4) OFF/VOL Control -- ON.
(5) Mike Button -- DEPRESS.

TO RECEIVE:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE Switch -- SELECT desired mode.
(3) COM/NAV Frequency Selector Knobs -- SELECT operating frequency.
(4) 50-25 Fractional MHz Selector Switch -- SELECT operating frequency (not selected for navigational frequencies).
(5) VOL Control -- ADJUST to listening level (OFF/VOL knob must be ON).
(6) SQ Control -- ROTATE counterclockwise to decrease background noise.

TO OPERATE IDENT FILTER:

(1) ID-T Switch -- CENTER (unmarked) to include filter in audio circuit of both receivers.
(2) ID-T Switch -- ID position disconnects filter from audio circuit to hear navigation station identifier (Morse Code) signal.

NOTE

The ID-T switch should be left in ID position for best communications reception.

TO SELF TEST VOR NAVIGATION CIRCUITS:

(1) Tune to usable VOR signal from either a VOR station or a test signal.
(2) OBS Knob -- ROTATE course index to 0°.
(3) ID-T Switch -- T position. Vertical pointer should center and OFF-TO-FROM indicator should show FROM.
(4) ID-T Switch -- T position and rotate OBS knob to displace course index approximately 10° to either side of 0°. Vertical pointer should deflect full scale in direction corresponding to course index displacement.
(5) ID-T Switch -- CENTER (unmarked) position for normal VOR 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.

SUPPLEMENT

CESSNA 300 ADF

(Type R-546E)

SECTION 1

GENERAL

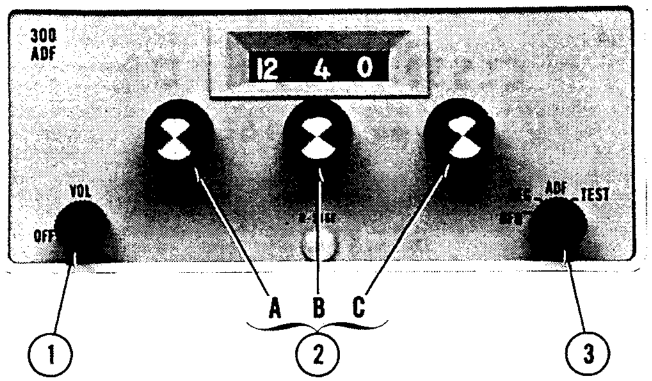
The Cessna 300 ADF is a panel-mounted, digitally tuned automatic direction finder. It is designed to provide continuous 1 kHz digital tuning in the frequency range of 200 kHz to 1,699 kHz and eliminates the need for mechanical band switching. The system is comprised of a receiver, loop antenna, bearing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

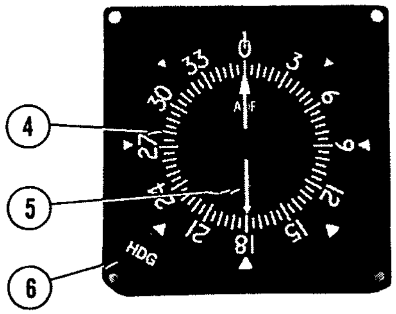
The Cessna 300 ADF can be used for position plotting and homing procedures, and for aural reception of amplitude-modulated (AM) signals.

With the function selector knob at ADF, the Cessna 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 ADF uses only the sense antenna and operates as a conventional low-frequency receiver. In the REC, position, the indicator will automatically move to the pointer stow position. This feature alerts the operator to non-ADF operation by positioning and retaining the pointer at the 3:00 o'clock position.

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 - 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

BFO: Set operates 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: Set operates as standard communication receiver using only sense antenna.

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 300 ADF is in the REC function.

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.

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 from which radio signal is being received.

6. HEADING CONTROL - Rotates card to induce 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.

NOTE

Indicator's pointer will stow at a 3:00 o'clock position to alert the pilot to non-ADF operation.

(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.

NOTE

When switching stations place function selector knob in REC position. Then, after station has been selected, return selector knob to ADF 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) 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.

SUPPLEMENT

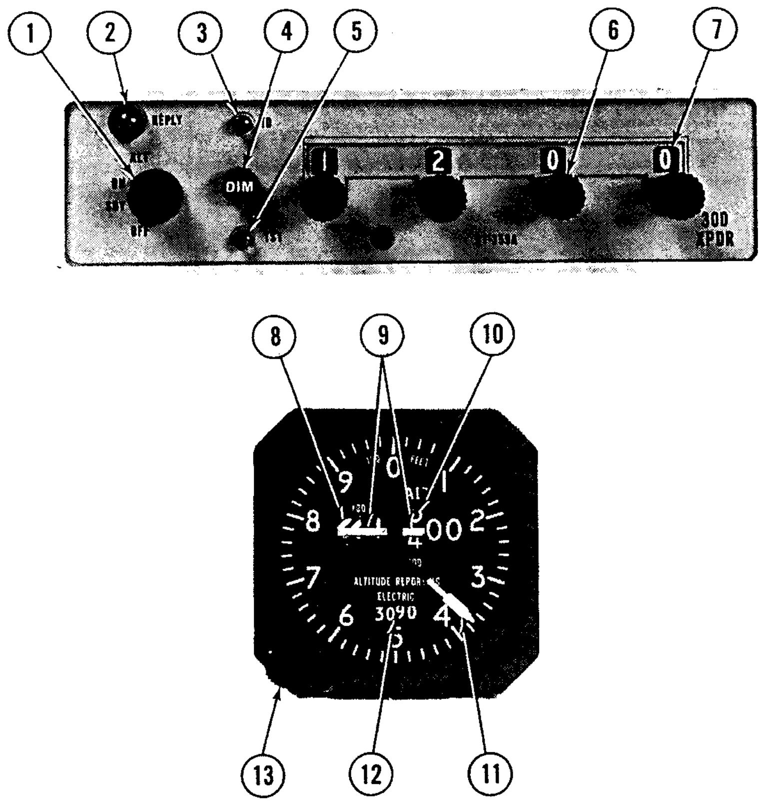
CESSNA 300 TRANSPONDER
(Type RT-359A)
AND
OPTIONAL ALTITUDE ENCODER
(Type EA-401A)

SECTION 1
GENERAL

The Cessna 300 Transponder (Type RT-359A), shown in Figure 1, is the airborne component of an Air Traffic Control Radar Beacon System (ATCRBS). The transponder enables the ATC ground controller to "see" and identify the aircraft, while in flight, at distances beyond the primary radar range.

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

All Cessna 300 Transponder operating controls, with the exception of the optional altitude encoder's barometric pressure set knob, are located on the front panel of the unit. The barometric pressure set knob is located on the altitude encoder. Function of the operating controls is described in Figure 1.



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

2. REPLY LAMP - Provides visual indication of transponder replies. During normal operation, lamp flashes when reply pulses are transmitted; when special pulse identifier is

Figure 1. Cessna 300 Transponder (Sheet 1 of 2)

selected, lamp glows steadily for duration of IDENT pulse transmission. (Reply Lamp will also glow steadily during initial warm-up period.)

3. IDENT 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 CONTROL - Allows pilot to control brilliance of reply lamp.

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

6. REPLY-CODE SELECTOR SWITCHES (4) - Selects assigned Mode A (or Mode C) reply code.

7. REPLY-CODE INDICATORS (4) - Displays selected Mode A (or Mode C) reply code.

8. 1000-FOOT DRUM TYPE INDICATOR - Provides digital altitude readout in 1000-foot increments between -1000 feet and +35,000 feet.

9. OFF INDICATOR WARNING FLAG - Flag appears when power is removed from the system.

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. BAROMETRIC PRESSURE SET INDICATOR - DRUM TYPE - Indicates selected barometric pressure in the range of 27.9 to 31.0 inches of mercury.

13. BAROMETRIC PRESSURE SET KNOB - Dials in desired barometric pressure setting in the range of 27.9 to 31.0 inches of mercury.

Figure 1. Cessna 300 Transponder (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 to effect immediate identification of aircraft on ground controller's display.
(4) DIM Control -- ADJUST light brilliance of reply lamp.

TO TRANSMIT A SIGNAL REPRESENTING LOSS OF ALL COMMUNICATIONS:

(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 for remainder of flight.
(3) ID Switch -- DEPRESS to effect immediate identification of aircraft on ground controller's display.
(4) DIM Control -- ADJUST light brilliance of reply lamp.

SECTION 4
NORMAL PROCEDURES

BEFORE TAKEOFF AND WHILE TAXIING:

(1) Function Switch -- SBY.

TO TRANSMIT MODE A (AIRCRAFT POSITION 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 INFORMATION) CODES IN FLIGHT:

(1) Altitude Encoder Barometric Pressure Set Knob -- DIAL assigned barometric pressure.
(2) Reply-Code Selector Switches -- SELECT assigned code.
(3) 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, and conversion to indicated altitude is done in ATC computers. Altitude squawk will agree with indicated altitude when altimeter setting in use by the ground controller is set in the altitude encoder.

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

TO SELF-TEST TRANSPONDER OPERATION:

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

SECTION 5
PERFORMANCE

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

SUPPLEMENT
DME
(Type 190)

SECTION 1
GENERAL

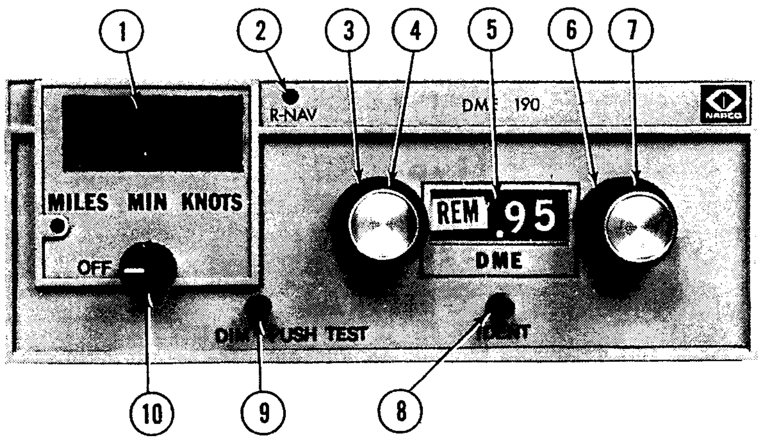
The DME 190 (Distance Measuring Equipment) system consists of a panel mounted 200 channel UHF transmitter-receiver and an externally mounted antenna. The transceiver has a single selector knob that changes the DME's mode of operation to provide the pilot with: distance-to-station, time-to-station, or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

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

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

SECTION 2
LIMITATIONS

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



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

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

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

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

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

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

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

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

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

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

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

10. MODE SELECTOR SWITCH -
   OFF: Turns the DME OFF.
   MILES: Allows a digital readout to appear in the window which represents slant range (in nautical miles) to or from the channeled station.
   MIN: Allows a digital readout (in minutes) to appear in the window that it will take the airplane to travel the distance to the channeled station. This time is only accurate when flying directly TO the station and after the ground speed has stabilized.
   KNOTS: Allows a digital readout (in knots) to appear in the window that is ground speed and is valid only after the stabilization time (approximately 2 minutes) has elapsed when flying directly TO or FROM the channeled station.

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

SECTION 3
EMERGENCY PROCEDURES

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

SECTION 4
NORMAL PROCEDURES

TO OPERATE:

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

NOTE

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

(3) PUSH TEST Control -- PUSH and observe reading of 188.8 in function window.
(4) DIM Control -- ADJUST.
(5) IDENT Control -- ADJUST audio output in speaker.
(6) Mode Selector Functions:
MILES Position -- Distance-to-Station is slant range in nautical miles.
MIN Position -- Time-to-Station when flying directly to station.
KNOTS Position -- Ground Speed in knots when flying directly to or from station.

CAUTION

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

SECTION 5
PERFORMANCE

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

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.

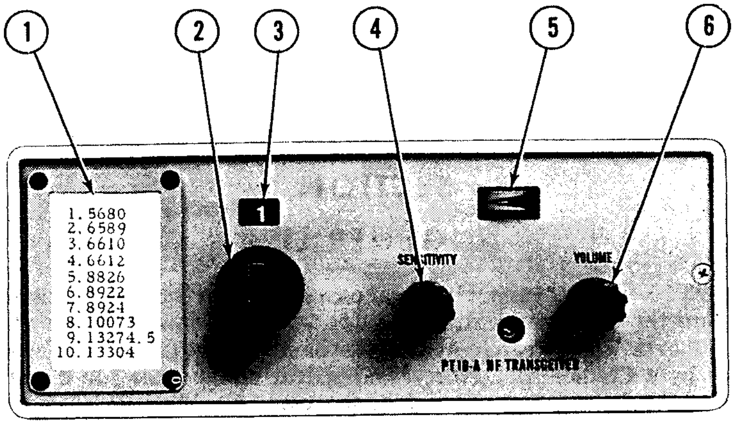
The VOLUME control incorporates the power switch for the transceiver. Clockwise rotation of the volume control turns the set on and increases the volume of audio.

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

TO OPERATE:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE Switch -- SELECT desired mode.
(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) To Transmit -- DEPRESS microphone switch button and speak directly into microphone.
(8) To Receive -- RELEASE microphone switch button.

SECTION 5
PERFORMANCE

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

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.

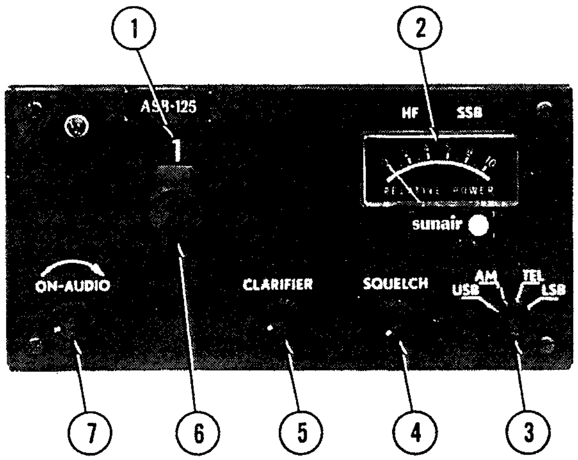
A channel selector knob determines the operating frequency of the transceiver which has predetermined crystals installed to provide the desired operating frequencies. A mode selector control is provided to supply the type of emission required for the channel, either sideband, AM or telephone for public 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.

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



1. CHANNEL WINDOW - Displays selected operating 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 side band 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

other countries, only the upper sideband may be used. Use of lower side band 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

TO OPERATE:

(1) XMTR SEL Switch -- SELECT transceiver.
(2) SPEAKER/PHONE Switch -- SELECT.
(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 operating 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 -- DEPRESS to transmit voice communications.

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.

SUPPLEMENT
CESSNA 400 MARKER BEACON
(Type R-402A)

SECTION 1
GENERAL

The system consists of a 75 MHz marker beacon receiver, three indicator lights, one speaker/phone switch, a light dimming control, an ON/OFF/VOLUME control, and a 75 MHz marker beacon antenna. In addition, on 150, 182, 206, 207, 210 and 337 series models, a HI-LO sensitivity selector switch and a press-to-test button are provided. On all 172, 177, 177RG, 180 and 185 series models, a single, three position switch is provided for HI-LO sensitivity selection or test selection.

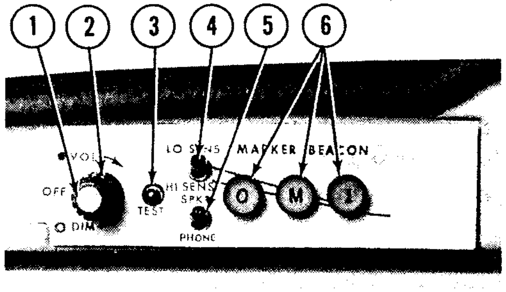
This system provides visual and aural indications of 75 MHz ILS marker beacon signals as the marker is passed. The following table lists the three most currently used marker facilities and their characteristics.

MARKER FACILITIES

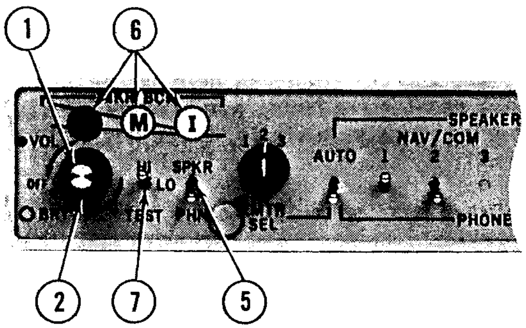
MARKER	IDENTIFYING TONE	LIGHT*
Inner	Continuous 6 dots/sec (3000 Hz)	White
Middle	Alternate dots and dashes (1300 Hz)	Amber
Outer	2 dashes/sec (400 Hz)	Blue

* When the identifying tone is keyed, the respective indicating light will blink accordingly.

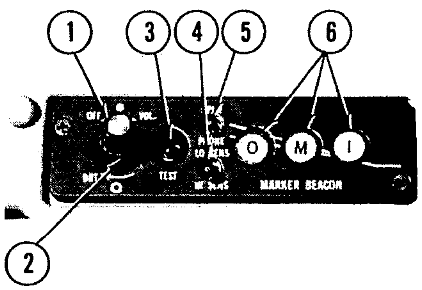
Operating controls and indicator lights are shown and described in Figure 1.



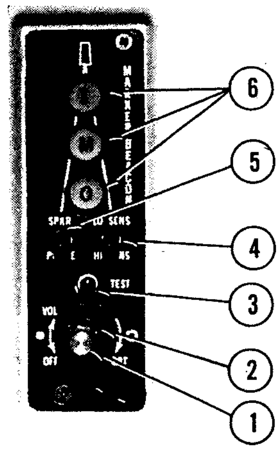
TYPICAL INSTALLATION
ON ALL 150 MODEL SERIES



TYPICAL INSTALLATION
ON ALL 172, 177, 177RG,
180 & 185 MODEL SERIES



TYPICAL INSTALLATION
ON ALL 337 MODEL SERIES



TYPICAL INSTALLATION
ON ALL 182, 206, 207
& 210 MODEL SERIES

Figure 1. Cessna 400 Marker Beacon Operating Controls and Indicator Lights (Sheet 1 of 2)

1. OFF/VOLUME CONTROL - The small, inner control turns the set on or off and adjusts the audio listening level. Clockwise rotation turns the set on and increases the audio level.

2. DIM/BRT CONTROL - The large, outer control provides light dimming for the marker lights. Clockwise rotation increases light intensity.

3. TEST SWITCH - (150, 182, 206, 207, 210 & 337 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).

NOTE

Turn the set on, and rotate the DIM control clockwise (fully on) in order to view the marker beacon lights during test.

4. LO/HI SENS SWITCH - (150, 182, 206, 207, 210 & 337 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 - (172, 177, 177RG, 180 & 185 Model Series Only) 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).

NOTE

Turn the set on, and rotate the BRIGHT control clockwise (fully on) in order to view the marker beacon lights during test. The TEST position on the switch is spring loaded to return the switch to the LO SENS position when TEST position is released.

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.

NOTE

Ensure that BRT control is on enough to view the marker beacon.

SECTION 5
PERFORMANCE

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

SUPPLEMENT

CESSNA NAVOMATIC 200A AUTOPILOT

(Type AF-295B)

SECTION 1
GENERAL

The Cessna 200A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, an aileron actuator, and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude.

The 200A Navomatic will also capture and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 200A Navomatic are located on the front panel of the computer-amplifier, shown in Figure 1. The primary function pushbuttons (DIR HOLD, NAV CAPT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

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:

BEFORE TAKE-OFF AND LANDING:

(1) A/P ON-OFF Switch -- OFF.

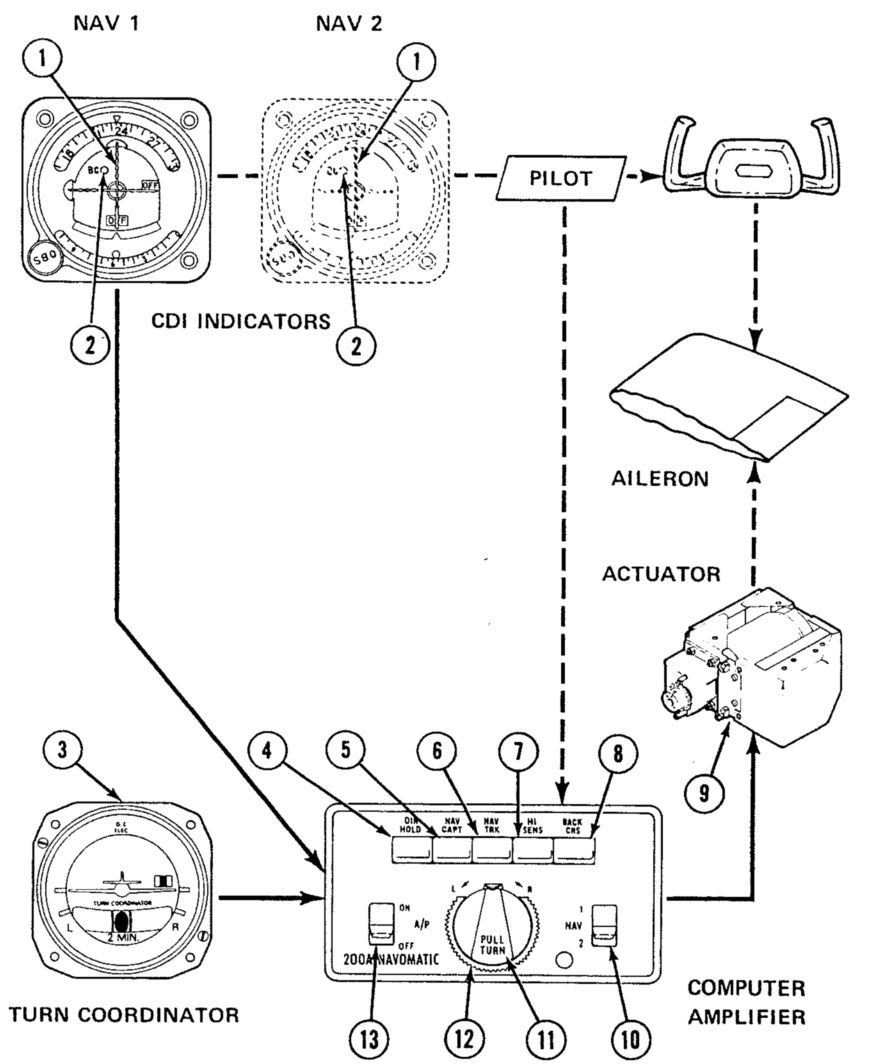


Figure 1. Cessna 200A Autopilot, Operating Controls and Indicators
(Sheet 1 of 2)

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 tuned 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 - Airplane holds direction it is flying at time button is pushed.
5. NAV CAPT - Airplane will turn to and capture selected VOR or LOC course.
6. NAV TRK - Airplane tracks selected VOR or LOC course.
7. HI SENS - 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 - 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 desired direction.
10. NAV - Selects NAV 1 or NAV 2 navigation receiver.
11. PULL TURN - 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 push button 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 must be manually trimmed before the autopilot is engaged.)
13. A/P - Turns autopilot ON or OFF.

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

(2) BACK CRS Button -- DISENGAGED (OUT). (Refer to Section 4 of this supplement and see Step 6 and Caution note under "NAV CAPTURE (VOR/LOC)".)

NAV CAPTURE (VOR/LOC):

(1) Fly a manual intercept procedure if more than 15 miles from the station or more than 3 minutes from intercept.

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 Trim -- ADJUST.
(2) PULL-TURN Knob -- PULL out and center in detent.
(3) A/P ON-OFF Switch -- ON.
(4) Autopilot TRIM Control -- ADJUST for zero turn rate.

COMMAND TURNS:

(1) PULL-TURN Knob -- PULL and ROTATE.

DIRECTION HOLD:

(1) PULL-TURN Knob -- PULL out and center in detent.
(2) DIR HOLD Button -- PUSH.
(3) PULL-TURN Knob -- PUSH in detent position.
(4) Autopilot TRIM Control -- READJUST to minimize heading drift.

NAV CAPTURE (VOR/LOC):

(1) PULL-TURN Knob -- PULL out.
(2) NAV 1-2 Selector Switch -- SELECT desired VOR receiver.
(3) Nav Receiver OBS -- SET VOR course (if tracking omni).
(4) NAV CAPT Button -- PUSH.
(5) HI SENS Button -- PUSH.
(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 course. Then PUSH for automatic intercept. If more than 15 miles from the station or more than 3 minutes from intercept, use a manual intercept procedure.
(8) NAV TRK Button -- PUSH when CDI centers and airplane is within ±5° of course heading.
(9) HI SENS Button -- DISENGAGE for omni tracking (leave ENGAGED for localizer).

NAV TRACKING (VOR/LOC):

(1) PULL-TURN Knob -- PULL out.

(2) NAV 1-2 Selector Switch -- SELECT desired VOR receiver.
(3) Nav Receiver OBS -- SET VOR course (if tracking omni).
(4) NAV TRK Button -- PUSH.
(5) HI SENS Button -- PUSH for localizer; disengage for omni.
(6) BACK CRS Button -- PUSH only if tracking localizer front course outbound or back course inbound.

CAUTION

See caution paragraph under Nav Capture.

(7) PULL-TURN Knob -- PUSH when airplane is on course and on heading.
(8) Autopilot TRIM Control -- READJUST 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 localized 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.

SECTION 2
LIMITATIONS

There is no change to the airplane limitations when this avionic equip-

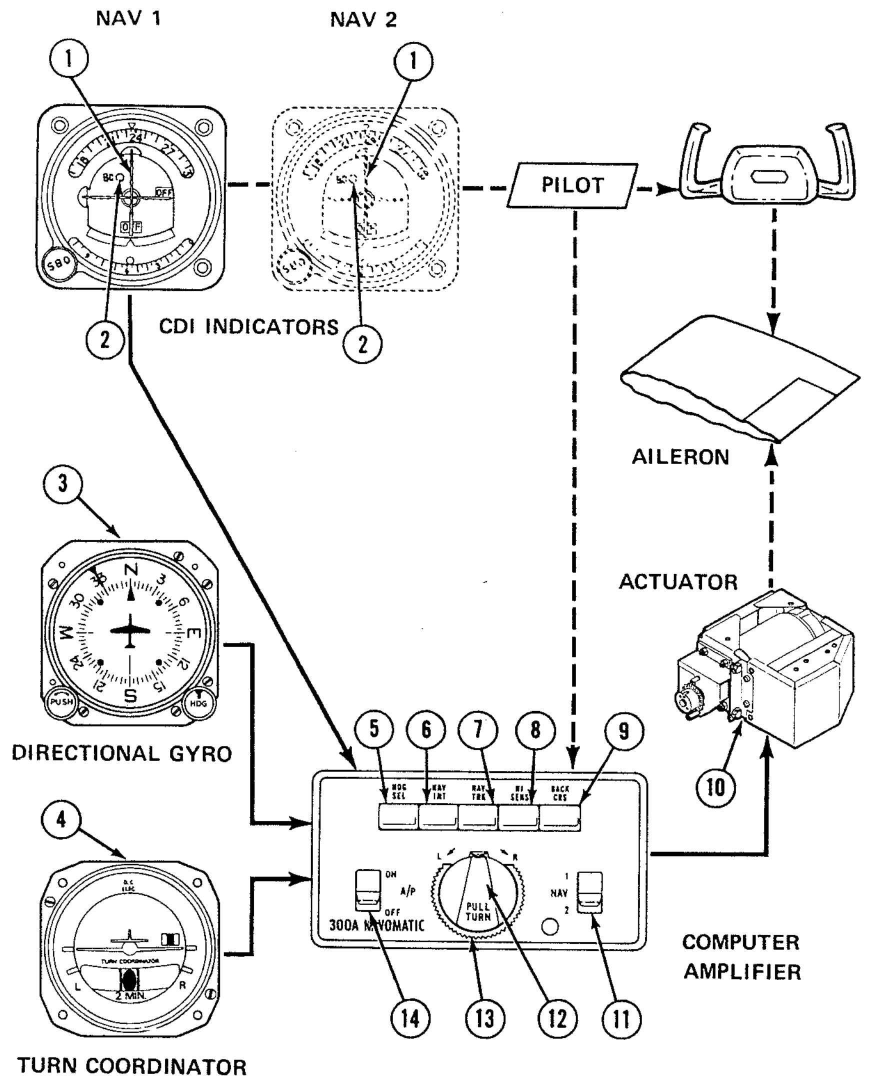


Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators (Sheet 1 of 2)

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.
4. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.
5. HDG SEL - Aircraft will turn to and hold heading selected by the heading "bug" on the directional gyro.
6. NAV INT - When heading "bug" on DG is set to selected course, aircraft will turn to and intercept selected VOR or LOC course.
7. NAV TRK - When heading "bug" on DG is set to selected course, aircraft will track selected VOR or LOC course.
8. HI SENS - During NAV INT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low-sensitivity position (pushbutton out), response to NAV signal is dampened for smoother tracking of enroute VOR radials; it also smooths out effect of course scalloping during NAV operation.
9. BACK CRS - 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 desired direction.
11. NAV - Selects NAV 1 or NAV 2 navigation receiver.
12. PULL TURN - 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 push button 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 must be manually trimmed before the autopilot is engaged.)
14. A/P - Controls primary power to autopilot servo (turns autopilot ON or OFF).

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

ment is installed. However, the following autopilot limitations should be adhered to during airplane operation:

BEFORE TAKE-OFF AND LANDING:

(1) A/P ON-OFF Switch -- OFF.
(2) BACK CRS Button -- DISENGAGED (OUT). (Refer to Section 4 of this supplement and see Step 8 and Caution note under "NAV INTERCEPT (VOR/LOC)".)

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 Trim -- ADJUST.

(2) PULL-TURN Knob -- PULL out and center in detent.
(3) A/P ON-OFF Switch -- ON.
(4) Autopilot TRIM Control -- ADJUST for zero turn rate.

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 -- PUSH.

NOTE

Airplane will return automatically to selected heading. If airplane fails to hold the precise heading, readjust autopilot lateral TRIM knob as required or disengage autopilot and reset manual trim.

NAV INTERCEPT (VOR/LOC):

(1) PULL-TURN Knob -- PULL out.
(2) NAV 1-2 Selector Switch -- SELECT.
(3) Nav Receiver OBS -- SET VOR course (if tracking omni).
(4) Heading Selector Knob -- ROTATE bug to selected course (VOR or localizer).
(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.

(10) NAV TRK Button -- PUSH when CDI centers (within one dot) and airplane is within ±10° of course heading.

(11) HI SENS Button -- Disengage for omni tracking (leave engaged for localizer).

NAV TRACKING (VOR/LOC):

(1) PULL-TURN Knob -- PULL out.
(2) NAV 1-2 Selector Switch -- SELECT desired VOR receiver.
(3) Nav Receiver OBS -- SET VOR course (if tracking omni).
(4) Heading Selector Knob -- ROTATE bug to selected course (VOR or localizer).
(5) Directional Gyro -- SET for magnetic heading.
(6) NAV TRK Button -- PUSH.
(7) HI SENS Button -- PUSH for localizer; disengage for omni.
(8) BACK CRS Button -- PUSH only if tracking localizer front course outbound or back course inbound.

CAUTION

See caution paragraph under Nav Intercept.

(9) PULL-TURN Knob -- PUSH when CDI is within 1 dot and airplane is within ±10° of course heading.

NOTE

If CDI remains steadily off center, readjust autopilot lateral trim control as required.

SECTION 5
PERFORMANCE

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

Notes

Notes

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