N405JH

# INFORMATION MANUAL

# 1981

Cessna

SALES AND SERVICE

MODEL

R182

# SKYLANE RG

# NOTICE

AT THE **TIME** OF ISSUANCE, **THIS** INFORMATION MANUAL WAS AN EXACT DUPLICATE OF THE OFFICIAL PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL AND IS TO BE USED FOR GENERAL PURPOSES ONLY.

IT **WILL** NOT BE KEPT CURRENT AND, THEREFORE, CANNOT BE USED AS A SUBSTITUTE FOR THE OFFICIAL PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL INTENDED FOR OPERATION OF THE AIRPLANE.

**CESSNA AIRCRAFT COMPANY**
**15 AUGUST 1980**

# PERFORMANCE - SPECIFICATIONS

SPEED:
- Maximum at Sea Level . . . . . . . . . . . . . . . . **160** KNOTS
- Cruise. 75% Power at 7500 Ft . . . . . . . . . . . . . 156 KNOTS

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

| | | |
|---|---|---|
| 75% Power at 7500 Ft . . . . . . . . . . . . . | Range | 845 NM |
| 88 Gallons Usable Fuel | Time | 5.5 HRS |
| Maximum Range at 10,000 Ft . . . . . . . . | Range | 1135 NM |
| 88 Gallons Usable Fuel | Time | 9.0 HRS |

RATE OF CLIMB AT SEA LEVEL . . . . . . . . . . . . 1140 **FPM**

*SERVICE CEILING . . . . . . . . . . . . . . . . . . . 14,300 FT

TAKEOFF PERFORMANCE:
- Ground Roll . . . . . . . . . . . . . . . . . . . . . . 820 FT
- Total Distance Over 50-Ft Obstacle . . . . . . . . . . 1570 FT

LANDING PERFORMANCE:
- Ground Roll . . . . . . . . . . . . . . . . . . . . . . 600 FT
- Total Distance Over 50-Ft Obstacle . . . . . . . . . . 1320 FT

STALL SPEED **(KCAS)**:
- Flaps Up, Power Off . . . . . . . . . . . . . . . . 54 KNOTS
- Flaps Down, Power Off . . . . . . . . . . . . . . . 50 KNOTS

MAXIMUM WEIGHT:
- Ramp . . . . . . . . . . . . . . . . . . . . . . . . **3112 LBS**
- Takeoff or Landing . . . . . . . . . . . . . . . . . 3100 LBS

STANDARD EMPTY WEIGHT:
- **Skylane** RG . . . . . . . . . . . . . . . . . . . 1752 LBS
- **Skylane** RG **II** . . . . . . . . . . . . . . . . 1805 LBS

MAXIMUM USEFUL LOAD:
- **Skylane** RG . . . . . . . . . . . . . . . . . . . 1360 LBS
- **Skylane** RG **II** . . . . . . . . . . . . . . . . 1307 LBS

BAGGAGE ALLOWANCE . . . . . . . . . . . . . . . . . **200** LBS

WING LOADING: Pounds/Sq Ft . . . . . . . . . . . . . 17.8

POWER LOADING: **Pounds/**HP . . . . . . . . . . . . . 13.2

FUEL CAPACITY: Total . . . . . . . . . . . . . . . . . 92 GAL.

OIL CAPACITY . . . . . . . . . . . . . . . . . . . . . 9 QTS

ENGINE: Avco Lycoming . . . . . . . . . . . . . . . . **O-540-J3C5D**
235 BHP at 2400 RPM

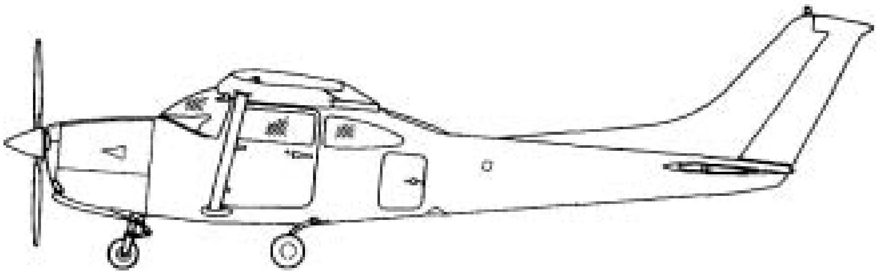
**PROPELLER: 2-Bladed Constant Speed, Diameter . . . . 82 IN.

*The Service Ceiling is 18.000 ft if an EGT indicator is used to set the mixture.

**Performance with an optional 3-bladed propeller is essentially the same as shown above.

The above performance figures are based on the indicated weights, standard atmospheric conditions. level hard-surface dry runways and no wind. **They** are calculated values derived from flight tests conducted by the Cessna Aircraft Company under carefully documented conditions and will vary with individual airplanes and numerous factors affecting flight performance.

# INFORMATION MANUAL



**CESSNA AIRCRAFT COMPANY**

**1981 MODEL R182**

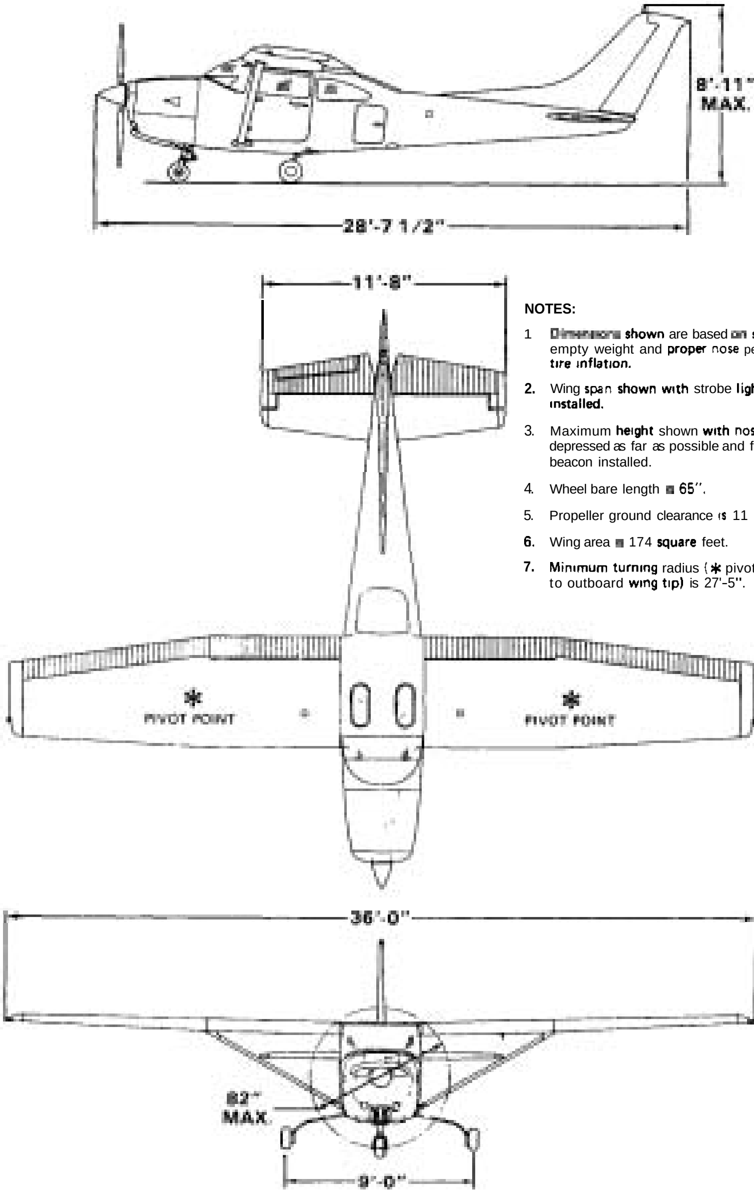


**THE PRINTING OF THIS MANUAL INCORPORATES INFORMATION ISSUED IN REVISION 1 DATED 24 MAY 1982 FROM THE PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL.**

# TABLE OF CONTENTS

# SECTION 1
# GENERAL

## TABLE OF CONTENTS




NOTES:

1. Dimensions shown are based on standard empty weight and proper nose gear and tire inflation.
2. Wing span shown with strobe lights installed.
3. Maximum height shown with nose gear depressed as far as possible and flashing beacon installed.
4. Wheel base length is 65".
5. Propeller ground clearance is 11 1/2".
6. Wing area is 174 square feet.
7. Minimum turning radius (* pivot point to outboard wing tip) is 27'-5".

**Figure 1-1. Three View**

# INTRODUCTION

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

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

# DESCRIPTIVE DATA

## ENGINE

Number of Engines: 1.
Engine Manufacturer: Avco Lycoming.
Engine Model Number: O-540-J3C5D.
Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, carburetor equipped, six-cylinder engine with 541.5 cu. in. displacement.
Horsepower Rating and Engine Speed: 235 rated BHP at 2400 RPM.

## PROPELLER (2-BLADED)

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B2D34C218/90DHB-8.
Number of Blades: 2.
Propeller Diameter, Maximum: 82 inches.
Minimum: 80.5 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 15.8° and a high pitch setting of 29.4° (30 inch station).

## PROPELLER (3-BLADED)

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: B3D32C407/82NDA-3.
Number of Blades: 3.
Propeller Diameter, Maximum: 79 inches.
Minimum: 78 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 16.0° and a high pitch setting of 31.7° (30 inch station).

## FUEL

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

NOTE

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

Total Capacity: 92 gallons.
Total Capacity Each Tank: 46 gallons.
Total Usable: 88 gallons.

NOTE

To ensure maximum fuel capacity when refueling, and minimize cross-feeding when parked on a sloping surface. place the fuel selector valve in either LEFT or RIGHT position.

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

Recommended Viscosity For Temperature Range:
- MIL-L-6082 Aviation Grade Straight Mineral Oil:
  - All temperatures, use SAE 20W-50 or
  - Above 16°C (60°F), use SAE 50
  - -1°C (30°F) to 32°C (90°F), use SAE 40
  - -18°C (0°F) to 21°C (70°F), use SAE 30
  - Below -12°C (10°F), use SAE 20
- MIL-L-22851 Ashless Dispersant Oil:
  - All temperatures, use SAE 20W-50 or
  - Above 16°C (60°F), use SAE 40 or SAE 50
  - -1°C (30°F) to 32°C (90°F), use SAE 40
  - -18°C (0°F) to 21°C (70°F), use SAE 40 or SAE 30
  - Below -12°C (10°F), use SAE 30

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

## MAXIMUM CERTIFICATED WEIGHTS

Ramp: 3112 lbs.
Takeoff: 3100 lbs.
Landing: 3100 lbs.
Weight in Baggage Compartment:
Baggage Area "A" (or passenger on child's seat) - Station 82 to 110: 120 lbs. See note below.
Baggage Area "B" - Station 110 to 134: 80 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas A and B is 200 lbs.

## STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Skylane RG: 1752 lbs.
Skylane RG II: 1805 lbs.
Maximum Useful Load, Skylane RG: 1360 lbs.
Skylane RG II: 1307 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: 17.8 lbs./sq. ft.
Power Loading: 13.2 lbs./hp.

# SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

## GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

| | |
|---|---|
| KCAS | Knots Calibrated Airspeed is indicated airspeed corrected for position and instrument error and expressed in knots. Knots calibrated airspeed is equal to KTAS in standard atmosphere at sea level. |
| KIAS | Knots Indicated Airspeed is the speed shown on the airspeed indicator and expressed in knots. |
| KTAS | Knots True Airspeed is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature. |
| $V_A$ | Manuevering Speed is the maximum speed at which you may use abrupt control travel. |
| $V_{FE}$ | Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position. |
| $V_{LE}$ | Maximum Landing Gear Extended Speed is the maximum speed at which an airplane can be safely flown with the landing gear extended. |
| $V_{LO}$ | Maximum Landing Gear Operating Speed is the maximum speed at which the landing gear can be safely extended or retracted. |
| $V_{NO}$ | Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air, then only with caution. |
| $V_{NE}$ | Never Exceed Speed is the speed limit that may not be exceeded at any time. |
| $V_S$ | Stalling Speed or the minimum steady flight speed at which the airplane is controllable. |
| $V_{S_O}$ | Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity. |

| | |
|---|---|
| $V_X$ | Best Anglesf-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 or degrees Fahrenheit. |
| Standard Temperature | Standard Temperature is 15°C at sea level pressure altitude and decreases by 2°C for each 1000 feet of altitude. |
| Pressure Altitude | Pressure Altitude is the altitude read from an altimeter when the altimeter's barometric scale has been set to 29.92 inches of mercury (1013 mb). |

## ENGINE POWER TERMINOLOGY

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

## AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

| | |
|---|---|
| Demonstrated Crosswind Velocity | Demonstrated Crosswind Velocity is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. The value shown is not considered to be limiting. |
| Usable Fuel | Usable Fuel is the fuel available for flight planning. |
| Unusable Fuel | Unusable Fuel is the quantity of fuel that can not be safely used in flight. |
| GPH | Gallons Per Hour is the amount of fuel consumed per hour. |

| | |
|---|---|
| NMPG | Nautical Miles Per Gallon is the distance which can be expected per gallon of fuel consumed at a specific engine power setting and/or flight configuration. |
| g | g is acceleration due to gravity. |

## WEIGHT AND BALANCE TERMINOLOGY

| | |
|---|---|
| Reference Datum | Reference Datum is an imaginary vertical plane from which all horizontal distances are measured for balance purposes. |
| Station | Station is a location along the airplane fuselage given in terms of the distance from the reference datum. |
| Arm | Arm is the horizontal distance from the reference datum to the center of gravity (C.G.) of an item. |
| Moment | Moment is the product of the weight of an item multiplied by its arm. (Moment divided by the constant 1000 is used in this handbook to simplify balance calculations by reducing the number of digits.) |
| Center of Gravity (C.G.) | Center of Gravity is the point at which an airplane, or equipment, would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the total weight of the airplane. |
| C.G. Arm | Center of Gravity Arm is the arm obtained by adding the airplane's individual moments and dividing the sum by the total weight. |
| C.G. Limits | Center of Gravity Limits are the extreme center of gravity locations within which the airplane must be operated at a given weight. |
| Standard Empty Weight | Standard Empty Weight is the weight of a standard airplane, including unusable fuel, full operating fluids and full engine oil. |
| Basic Empty Weight | Basic Empty Weight is the standard empty weight plus the weight of optional equipment. |
| Useful Load | Useful Load is the difference between ramp weight and the basic empty weight, |

| | |
|---|---|
| Maximum Ramp Weight | Maximum Ramp Weight is the maximum weight approved for ground maneuver. (It includes the weight of start, taxi and runup fuel.) |
| 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

# 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 and in Section 9 have been approved by the Federal Aviation Administration. Observance of these operating limitations is required by Federal Aviation Regulations.

NOTE

Refer to Section 9 of this Pilot's Operating Handbook for amended operating limitations, operating procedures, performance data and other necessary information for airplanes equipped with specific options.

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, with the exception of the bottom of the green and white arcs on the airspeed indicator. These are based on a power-off airspeed calibration. 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. 3A13 as Cessna Model No. R182.

# AIRSPEED LIMITATIONS

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

| | SPEED | KCAS | KIAS | REMARKS |
|---|---|---|---|---|
| $V_{NE}$ | Never Exceed Speed | 175 | 181 | Do not exceed this speed in any operation. |
| $V_{NO}$ | Maximum Structural Cruising Speed | 155 | 159 | Do not exceed this speed except in smooth air, and then only with caution. |
| $V_A$ | Maneuvering Speed:<br>3100 Pounds<br>2550 Pounds<br>2000 Pounds | <br>111<br>100<br>89 | <br>112<br>101<br>89 | Do not make full or abrupt control movements above this speed. |
| $V_{FE}$ | Maximum Flap Extended Speed:<br>To 10° Flaps<br>10° - 40° Flaps | <br>137<br>96 | <br>140<br>95 | Do not exceed these speeds with the given flap settings. |
| $V_{LO}$ | Maximum Landing Gear Operating Speed | 137 | 140 | Do not extend or retract landing gear above this speed. |
| $V_{LE}$ | Maximum Landing Gear Extended Speed | 137 | 140 | Do not exceed this speed with landing gear extended. |
| | Maximum Window Open Speed | 175 | 181 | 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 | 39 - 95 | Full Flap Operating Range. Lower limit is maximum weight $V_{S_0}$ in landing configuration. Upper limit is maximum speed permissible with flaps extended. |
| Green Arc | 41 - 159 | Normal Operating Range. Lower limit is maximum weight $V_S$ at most forward C.G. with flaps retracted. Upper limit is maximum structural cruising speed. |
| Yellow Arc | 159 - 181 | Operations must be conducted with caution and only in smooth air. |
| Red Line | 181 | Maximum speed for all operations. |

Figure 2-2. Airspeed Indicator Markings

## POWER PLANT LIMITATIONS

Engine Manufacturer: Avco Lycoming.
Engine Model Number: O-540-J3C5D.
Maximum Power: 235 BHP rating.
Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Engine Speed: 2400 RPM.
Maximum Cylinder Head Temperature: 500°F (260°C).
Maximum Oil Temperature: 245°F (118°C).
Oil Pressure, Minimum: 25 psi.
Maximum: 115 psi.
Fuel Pressure, Minimum: 0.5 psi.
Maximum: 8.0 psi.
Fuel Grade: See Fuel Limitations.
Oil Grade (Specification):
MIL-L-6082 Aviation Grade Straight Mineral Oil or MIL-L-22851 Ashless Dispersant Oil.
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number 2-Bladed: B2D34C218/90DHB-8
3-Bladed: B3D32C407/82NDA-3.
Propeller Diameter, 2-Bladed Maximum: 82 inches.
2-Bladed Minimum; 80.5 inches.
3-Bladed Maximum: 79 inches.
3-Bladed Minimum: 78 inches.

**Propeller Blade Angle at 30 Inch Station, 2-Bladed Low: 15.8°.**
**2-Bladed High: 29.4°.**
**3-Bladed Low: 16.0".**
**3-Bladed High: 31.7°.**

# POWER PLANT INSTRUMENT MARKINGS

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

| INSTRUMENT | RED LINE<br>MINIMUM LIMIT | GREEN ARC<br>NORMAL OPERATING | RED LINE<br>MAXIMUM LIMIT |
|---|---|---|---|
| Tachometer | - - - | 2100 - 2400 RPM | 2400 RPM |
| Manifold Pressure | - - - | 15-23 in.Hg | - - - |
| Oil Temperature | - - - | 100°-245°F | 245°F |
| Cylinder Head Temperature | - - - | 200° - 500°F | 500°F |
| Fuel Pressure | 0.5 psi | 0.5 - 8.0 psi | 8.0 psi |
| Oil Pressure | 25 psi | 60-90 psi | 115 psi |
| Suction | - - - | 4.5 - 5.4 in. Hg | - - - |
| Fuel Quantity | E (2 Gal. Unusable Each Tank) | - - - | - - - |

**Figure 2-3. Power Plant Instrument Markings**

# WEIGHT LIMITS

Maximum Ramp Weight: 3112 Ibs.
Maximum Takeoff Weight: 3100 Ibs.
Maximum Landing Weight: 3100 lbs.
Maximum Weight in Baggage Compartment:
Baggage Area "A" (or passenger on child's seat) - Station 82 to 110:120 lbs. See note below.
Baggage Area "B" - Station 110 to 134: 80 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas A and B is 200 lbs.

# CENTER OF GRAVITY LIMITS

Center of Gravity Range:
Forward: 33.0 inches aft of datum at 2250 lbs. or less, with straight line variation to 35.5 inches aft of datum at 2700 lbs., with straight line variation to 40.9 inches aft of datum at 3100 lbs.
Aft: 46.0 inches aft of datum at all weights.
Moment Change Due To Retracting Landing Gear: +3052 1b.-ins.
Reference Datum: Front face of firewall.

# MANEUVER LIMITS

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

Aerobatic maneuvers, including spins, are not approved.

# FLIGHT LOAD FACTOR LIMITS

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

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

## KINDS OF OPERATION LIMITS

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

Flight into known icing conditions is prohibited.

## FUEL LIMITATIONS

2 Standard Tanks: 46 U.S. gallons each.
Total Fuel: 92 U.S. gallons.
Usable Fuel (all flight conditions): 88 U.S. gallons.
Unusable Fuel: 4 U.S. gallons

NOTE

To ensure maximum fuel capacity when refueling, and minimize cross-feeding when parked on a sloping surface, place the fuel selector valve in either LEFT or RIGHT position.

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

Operation on either left or right tank is limited to level flight only.

With 1/4 tank or less, prolonged uncoordinated flight is prohibited when operating on either left or right tank in level flight.

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

## OTHER LIMITATIONS

### FLAP LIMITATIONS

Approved Takeoff Range: 0° to 20°.
Approved Landing Range: 0° to 40°.

# PLACARDS

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

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

> The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category are contained in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual.
>
> No acrobatic maneuvers, including spins, approved.
>
> Flight into known icing conditions prohibited.
>
> This airplane is certified for the following flight operations as of date of original airworthiness certificate:
>
> DAY—NIGHT—VFR—IFR

2. Near airspeed indicator:

| MAX SPEED - KIAS | |
|---|---|
| MANEUVER | . . 112 |
| GEAR OPER | . . 140 |
| GEAR DOWN | . . 140 |

3. On control lock:

> CONTROL LOCK - REMOVE BEFORE STARTING ENGINE.

4. On the fuel selector valve:

| |
|---|
| OFF<br>LEFT - 44 GAL. LEVEL FLIGHT ONLY<br>BOTH - 88 GAL. ALL FLIGHT ATTITUDES<br>BOTH ON FOR TAKEOFF AND LANDING<br>RIGHT - 44 GAL. LEVEL FLIGHT ONLY |

5. On the baggage door:

| |
|---|
| 120 POUNDS MAXIMUM<br>BAGGAGE AND/OR AUXILIARY PASSENGER<br>FORWARD OF BAGGAGE DOOR LATCH AND<br>80 POUNDS MAXIMUM<br>BAGGAGE AFT OF BAGGAGE DOOR LATCH<br>MAXIMUM 200 POUNDS COMBINED<br>FOR ADDITIONAL LOADING INSTRUCTIONS<br>SEE WEIGHT AND BALANCE DATA |

6. On flap position indicator:

| | |
|---|---|
| 0° to 10° | (Partial flap range with blue color code and 140 kt callout; also, mechanical detent at 10°.) |
| 10° to Full | White color code and 95 kt callout; also, mechanical detent at 20°.) |

7. **Forward** of fuel tank **filler** cap:

| |
|---|
| FUEL<br>100LL/100 MIN GRADE AVIATION GASOLINE<br>CAP. 46.0 U.S. GAL.<br>CAP. 34.5 U.S. GAL. TO BOTTOM OF FILLER NECK |

8. Near gear hand pump:

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

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

10. On oil filler cap:

OIL
8 QTS

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

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

# SECTION 3
# EMERGENCY PROCEDURES

## TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)

Page

AMPLIFIED PROCEDURES

## INTRODUCTION

Section 3 provides checklist and amplified procedures for coping with emergencies that may occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintenance are practiced. Enroute weather emergencies can be minimized or eliminated by careful flight planning and good judgment when unexpected weather is encountered. However, should an emergency arise, the basic guidelines described in this section should be considered and applied as necessary to correct the problem. Emergency procedures associated with ELT and other optional systems can be found in Section 9.

## AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:
- Wing Flaps Up . . . . . . . . . . . . . . . . . . . . . . 70 KIAS
- Wing Flaps Down . . . . . . . . . . . . . . . . . . . 65 KIAS

Maneuvering Speed:
- 3100 Lbs . . . . . . . . . . . . . . . . . . . . . . . . . 112 KIAS
- 2550 Lbs . . . . . . . . . . . . . . . . . . . . . . . . . 101 KIAS
- 2000 Lbs . . . . . . . . . . . . . . . . . . . . . . . . . 89 KIAS

Maximum Glide:
- 3100 Lbs . . . . . . . . . . . . . . . . . . . . . . . . . 80 KIAS
- 2550 Lbs . . . . . . . . . . . . . . . . . . . . . . . . . 72 KIAS
- 2000 Lbs . . . . . . . . . . . . . . . . . . . . . . . . . 64 KIAS

Precautionary Landing With Engine Power . . . . . . . . . 65 KIAS

Landing Without Engine Power:
- Wing Flaps Up . . . . . . . . . . . . . . . . . . . . . . 70 KIAS
- Wing Flaps Down . . . . . . . . . . . . . . . . . . . 65 KIAS

# OPERATIONAL CHECKLISTS

## ENGINE FAILURES

### ENGINE FAILURE DURING TAKEOFF RUN

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

### ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. Airspeed -- 70 KIAS (flaps UP).
   65 KIAS (flaps DOWN).
2. Mixture -- IDLE CUT-OFF.
3. Fuel Selector Valve -- OFF.
4. Ignition Switch -- OFF.
5. Wing Flaps -- AS REQUIRED (40° recommended).
6. Master Switch -- OFF.

### ENGINE FAILURE DURING FLIGHT

1. Airspeed -- 80 KIAS.
2. Carburetor Heat -- ON.
3. Fuel Selector Valve -- BOTH
4. Mixture -- RICH.
5. Ignition Switch -- BOTH (or START if propeller is stopped).
6. Primer -- IN and LOCKED.

## FORCED LANDINGS

### EMERGENCY LANDING WITHOUT ENGINE POWER

1. Airspeed -- 70 KIAS (flaps UP).
   65 KIAS (flaps DOWN).
2. Mixture -- IDLE CUT-OFF.
3. Fuel Selector Valve -- OFF.
4. Ignition Switch -- OFF.
5. Landing Gear -- DOWN (UP if terrain is rough or soft).
6. Wing Flaps -- AS REQUIRED (40° recommended).
7. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
8. Master Switch -- OFF when landing is assured.
9. Touchdown -- SLIGHTLY TAIL LOW.
10. Brakes -- APPLY HEAVILY.

### PRECAUTIONARY LANDING WITH ENGINE POWER

1. Airspeed -- 65 KIAS.
2. Wing Flaps -- 20°.
3. Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
4. Electrical Switches -- OFF.
5. Landing Gear -- DOWN (UP if terrain is rough or soft).
6. Wing Flaps -- 40° (on final approach).
7. Airspeed -- 65 KIAS.

8. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
9. Avionics Power and Master Switches -- OFF.
10. Touchdown -- SLIGHTLY TAIL LOW.
11. Ignition Switch -- OFF.
12. Brakes -- APPLY HEAVILY.

### DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700 if transponder is installed.
2. Heavy Objects (in baggage area) -- SECURE OR JETTISON.
3. Landing Gear -- UP.
4. Flaps -- 20° - 40°.
5. Power -- ESTABLISH 300 FT/MIN DESCENT at 60 KIAS.
6. Approach -- High Winds, Heavy Seas -- INTO THE WIND.
   Light Winds, Heavy Swells -- PARALLEL TO SWELLS.

NOTE

If no power is available, approach at 70 KIAS with flaps up or at 65 KIAS with 10° flaps.

7. Cabin Doors -- UNLATCH.
8. Touchdown --,LEVEL ATTITUDE AT ESTABLISHED DESCENT.
9. Face -- CUSHION at touchdown with folded coat.
10. Airplane -- EVACUATE through cabin doors. If necessary, open windows and flood cabin to equalize pressure so doors can be opened.
11. 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 -- 1700 RPM for a few minutes.
3. Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

4. Throttle -- FULL OPEN.

5. Mixture -- IDLE CUT-OFF.
6. Cranking -- CONTINUE.
7. Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
8. Engine -- SECURE.
   a. Master Switch -- OFF.
   b. Ignition Switch -- OFF.
   c. Fuel Selector Valve -- OFF.
9. Fire -- EXTINGUISH using fire extinguisher, wool blanket, or dirt.
10. Fire Damage -- INSPECT, repair damage or replace damaged components or wiring before conducting another flight.

## ENGINE FIRE IN FLIGHT

1. Mixture -- IDLE CUT-OFF.
2. Fuel Selector Valve -- OFF.
3. Master Switch -- OFF.
4. Cabin Heat and Air -- OFF (except overhead vents).
5. Airspeed -- 100 KIAS (If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture).
6. Forced Landing -- EXECUTE (as described in Emergency Landing Without Engine Power).

## ELECTRICAL FIRE IN FLIGHT

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

**WARNING**

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

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

6. Master Switch -- ON.
7. Circuit Breakers -- CHECK for faulty circuit, do not reset.
8. Radio Switches -- OFF.
9. Avionics Power Switch -- ON.
10. Radio/Electrical Switches -- ON one at a time, with delay after each until short circuit is localized.

11. **Vents/Cabin Air/Heat** -- OPEN when it is ascertained that fire is completely extinguished.

## CABIN FIRE

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

**WARNING**

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

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

## WING FIRE

1. Navigation Light Switch -- OFF.
2. Strobe Light Switch (if installed) -- OFF.
3. 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 using flaps only as required for final approach and touchdown.

# 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 control full out and rotate defroster control clockwise to obtain maximum defroster airflow.
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 in 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 horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
9. Open the window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
10. Perform a landing approach using a forward slip, if necessary, for improved visibility.
11. Approach at 85 to 95 KIAS, depending upon the amount of ice accumulation.
12. Perform a landing in level attitude.

### STATIC SOURCE BLOCKAGE (Erroneous Instrument Reading Suspected)

1. Static Pressure Alternate Source Valve (if installed) -- PULL ON.
2. Airspeed -- Consult appropriate table in Section 5.
3. Altitude -- Cruise 50 feet higher than normal.

## LANDING GEAR MALFUNCTION PROCEDURES

### LANDING GEAR FAILS TO RETRACT

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

### LANDING GEAR FAILS TO EXTEND

1. Landing Gear Lever -- DOWN.
2. Emergency Hand Pump -- EXTEND HANDLE, and PUMP (perpendicular to handle until resistance becomes heavy -- about 20 cycles).
3. Gear Down Light -- ON.
4. Pump Handle -- STOW.

## GEAR UP LANDING

1. Landing Gear Lever -- UP.
2. Landing Gear and Gear Pump Circuit Breakers -- IN.
3. Runway -- SELECT longest hard surface or smooth sod runway available.
4. Wing Flaps -- 40° (on final approach).
5. Airspeed -- 65 KIAS.
6. Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Touchdown -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel Selector Valve -- OFF.
12. Airplane -- EVACUATE.

## LANDING WITHOUT POSITIVE INDICATION OF GEAR LOCKING

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

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

1. Movable Load -- TRANSFER to baggage area.
2. Passenger -- MOVE to'rear seat.
3. Before Landing Checklist -- COMPLETE.
4. Runway -- HARD SURFACE or SMOOTH SOD.
5. Wing Flaps -- 40°
6. Cabin Doors -- UNLATCH PRIOR TO TOUCHDOWN.
7. Avionics Power and Master Switches -- OFF when landing is assured.
8. Land -- SLIGHTLY TAIL LOW.
9. Mixture -- IDLE CUT-OFF.
10. Ignition Switch -- OFF.
11. Fuel Selector Valve -- OFF.
12. Elevator Control -- HOLD NOSE OFF GROUND as long as possible.
13. Airplane -- EVACUATE as soon as it stops.

### LANDING WITH A FLAT MAIN TIRE

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

## ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

### AMMETER SHOWS EXCESSIVE RATE OF CHARGE (Full Scale Deflection)

1. Alternator -- OFF.
2. Alternator Circuit Breaker -- PULL.
3. Nonessential Electrical Equipment -- OFF.
4. Flight -- TERMINATE as soon as practical.

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

NOTE

Illumination of the low-voltage light may occur during low RPM conditions with an electrical load on the system 'such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination and/or ammeter needle deflection may also occur during startup of the landing gear system hydraulic pump motor.

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

If low-voltage light illuminates again:

7. Alternator -- OFF.
8. Nonessential Radio and Electrical Equipment -- OFF.
9. Flight -- TERMINATE as soon as practical.

# AMPLIFIED PROCEDURES

## ENGINE FAILURE

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

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

After an engine failure in flight, the best glide speed as shown in figure 3-1 should be established as quickly as possible. While gliding toward a suitable landing area, an effort should be made to identify the cause of the failure. If time permits, an engine restart should be attempted as shown in

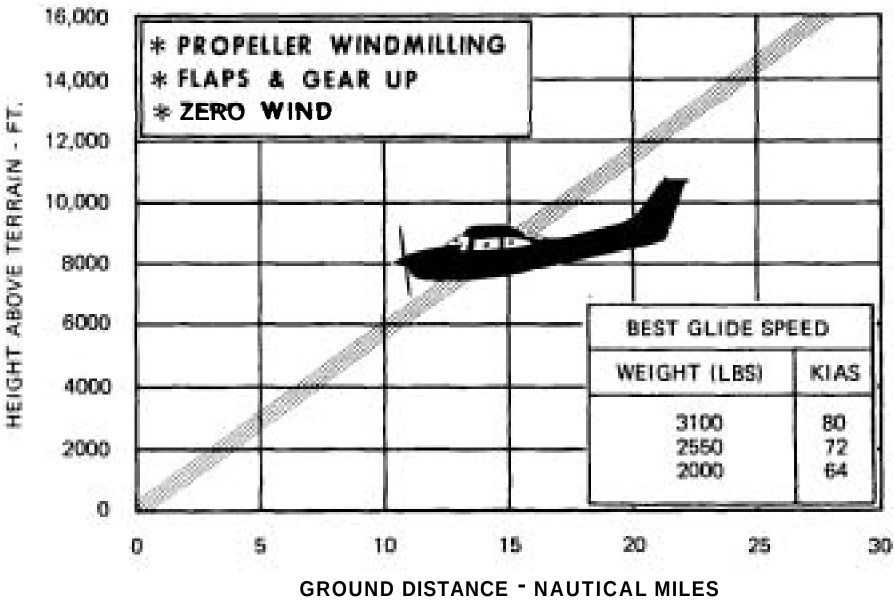



Figure 3-1. Maximum Glide

the checklist. If the engine cannot be restarted, a forced landing without power must be completed.

## 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 Emergency Landing Without Engine Power.

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

Prepare for ditching by securing or jettisoning heavy objects located in the baggage area and collect folded coats for protection of occupants' face at touchdown. Transmit Mayday message on **121.5** MHz giving location and intentions and squawk 7700 if a transponder is installed. Avoid a landing flare because of difficulty in judging height over a water surface.

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

## LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight with an airspeed of approximately **80** KIAS by using throttle and elevator trim control. Then do not change the elevator trim control setting; control the glide angle by adjusting power exclusively.

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

## FIRES

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

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

## EMERGENCY OPERATION IN CLOUDS (Vacuum System Failure)

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

### EXECUTING A 180° TURN IN CLOUDS

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

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

### EMERGENCY DESCENT THROUGH CLOUDS

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

1. Extend landing gear.
2. Apply full rich mixture.
3. Apply full carburetor heat.
4. Reduce power to set up a 500 to 800 ft/min rate of descent.
5. Adjust the elevator and rudder trim control wheels for a stabilized descent at 80 KIAS.
6. Keep hands off control wheel.
7. Monitor turn coordinator and make corrections by rudder alone.
8. Adjust rudder trim to relieve unbalanced rudder force, if present.
9. Check trend of compass card movement and make cautious corrections with rudder to stop turn.
10. 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 elevator back pressure to slowly reduce the indicated airspeed to 80 KIAS.
4. Adjust the elevator trim control to maintain an 80 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading. Use rudder trim to relieve unbalanced rudder force, if present.
6. 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.

## INADVERTENT FLIGHT INTO ICING CONDITIONS

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

### STATIC SOURCE BLOCKED

If erroneous readings of the static source instruments (airspeed, altimeter and vertical speed) are suspected, the static pressure alternate source valve should be pulled on, thereby supplying static pressure to these instruments from the cabin. Cabin pressures will vary with open ventilators or windows and with airspeed. To avoid the possibility of large errors, the windows should not be open when using the alternate static source.

NOTE

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

A calibration table is provided in Section 5 to illustrate the effect of the alternate static source on indicated airspeeds. With the windows and vents closed the airspeed indicator may typically read as much as 1 knot slower in cruise. With the vents open, the airspeed indicator may typically read as much as 3 knots slower and the altimeter 50 feet lower in cruise. If the alternate static source must be used for landing, the normal indicated approach speed may be used since the indicated airspeed variations in this configuration are 2 knots or less.

## SPINS

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

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

NOTE

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

# 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 a single ignition position.

## MAGNETO MALFUNCTION

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

## ENGINE - DRIVEN FUEL PUMP FAILURE

In the event of an engine-driven fuel pump failure, gravity flow will provide sufficient fuel flow for level or descending flight. However, in a climbing attitude or anytime the fuel pressure drops to 0.5 PSI, the auxiliary fuel pump should be turned on.

## LOW OIL PRESSURE

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

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

## LANDING GEAR MALFUNCTION PROCEDURES

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

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

### RETRACTION MALFUNCTIONS

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

### EXTENSION MALFUNCTIONS

Normal landing gear extension time is approximately 5 seconds. If the landing gear will not extend normally, perform the general checks of circuit breakers and master switch and repeat the normal extension procedures at a reduced airspeed of 100 KIAS. The landing gear lever must be in the down position with the detent engaged. If efforts to extend and lock the gear through the normal landing gear system fail, the gear can be manually extended (as long as hydraulic system fluid has not been completeiy lost) by use of the emergency hand pump. The hand pump is located between the front seats.

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

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

### GEAR UP LANDING

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

## ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

Malfunctions in the electrical power supply system can be detected by periodic monitoring of the ammeter and low-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 defective alternator control unit can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The paragraphs below describe the recommended remedy for each situation.

### EXCESSIVE RATE OF CHARGE

After engine starting and heavy electrical usage at low engine speeds (such as extended taxiing) the battery condition will be low enough to accept above normal charging during the initial part of a flight. However, after thirty minutes of cruising flight, the ammeter should be indicating less than two needle widths of charging current. If the charging rate were to remain above this value on a long flight, the battery would overheat and evaporate the electrolyte at an excessive rate.

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

## INSUFFICIENT RATE OF CHARGE

NOTE

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

If the over-voltage sensor should shut down the alternator or if the alternator output is low, a discharge rate will be shown on the ammeter followed by illumination of the low-voltage warning light. Since this may be a "nuisance" trip-out, an attempt should be made to reactivate the alternator system. To do this, turn the avionics power switch off, check that the alternator circuit breaker is in, then turn both sides of the master switch off and then on again. If the problem no longer exists, normal alternator charging will resume and the low-voltage light will go off. The avionics power switch may then be turned back on. If the light illuminates again, a malfunction is confirmed. In this event, the flight should be terminated and/or the current drain on the battery minimized because the battery can supply the electrical system for only a limited period of time. Battery power must be conserved for later operation of the landing gear and wing flaps and, if the emergency occurs at night, for possible use of the landing lights during landing.

# SECTION 4
# NORMAL PROCEDURES

## TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)

Page

AMPLIFIED PROCEDURES

## INTRODUCTION

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

## SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 3100 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 . . . . . . . . . . . . . . . . . . . 70-80 KIAS
- Short Field Takeoff. Flaps 20°, Speed at 50 Feet . . . . 59 KIAS

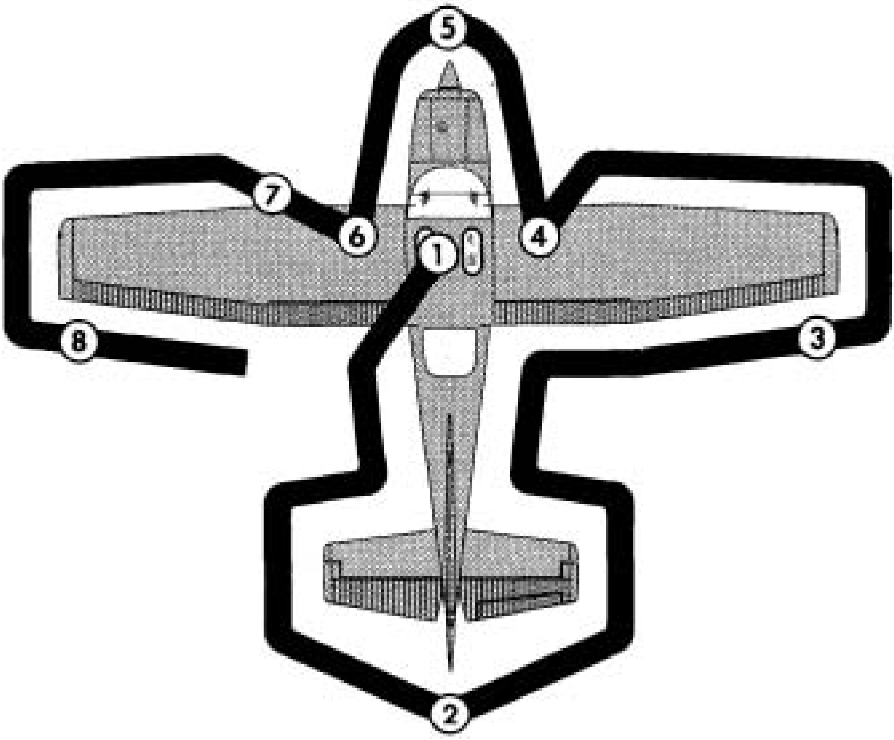
Enroute Climb, Flaps and Gear Up:
- Normal . . . . . . . . . . . . . . . . . . . . . . . . 90-100 KIAS
- Best Rate of Climb. Sea Level . . . . . . . . . . . . . . 88 KIAS
- Best Rate of Climb, 10,000 Feet . . . . . . . . . . . . . 75 KIAS
- Best Angle of Climb, Sea Level . . . . . . . . . . . . . 65 KIAS
- Best Angle of Climb, 10.000 Feet . . . . . . . . . . . . 67 KIAS

Landing Approach:
- Normal Approach, Flaps Up . . . . . . . . . . . . . . 70-80 KIAS
- Normal Approach, Flaps 40° . . . . . . . . . . . . . 65-75 KIAS
- Short Field Approach, Flaps 40° . . . . . . . . . . . . 64 KIAS

Balked Landing:
- Maximum Power, Flaps 20° . . . . . . . . . . . . . . . 75 KIAS

Maximum Recommended Turbulent Air Penetration Speed:
- 3100 Lbs . . . . . . . . . . . . . . . . . . . . . . . . 112 KIAS
- 2550 Lbs . . . . . . . . . . . . . . . . . . . . . . . . 101 KIAS
- 2000 Lbs . . . . . . . . . . . . . . . . . . . . . . . . 89 KIAS

Maximum Demonstrated Crosswind Velocity:
- Takeoff or Landing . . . . . . . . . . . . . . . . . . 18 KNOTS




NOTE

Visually check airplane for general condition during walk-around inspection. In cold weather, remove even small accumulations of frost, ice or snow from wing, tail and control surfaces. Also, make sure that control surfaces contain no internal accumulations of ice or debris. Prior to flight, check that pitot heater (if installed) is warm to touch within 30 seconds with battery and pitot heat switches on. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-1. Preflight Inspection

# CHECKLIST PROCEDURES

## PREFLIGHT INSPECTION

### (1) CABIN

1. Pilot's Operating Handbook -- AVAILABLE IN THE AIRPLANE.
2. Landing Gear Lever -- DOWN.
3. Control Wheel Lock -- REMOVE.
4. Ignition Switch -- OFF.
5. Avionics Power Switch -- OFF.
6. Master Switch -- ON.

**WARNING**

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

7. Fuel Quantity Indicators -- CHECK QUANTITY.
8. Landing Gear Position Indicator Light (green) -- ILLUMINATED.
9. Avionics Cooling Fan -- CHECK AUDIBLY FOR OPERATION.
10. Master Switch -- OFF.
11. Fuel Selector Valve -- BOTH.
12. Static Pressure Alternate Source Valve (if installed) -- OFF.
13. 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.

### (4) RIGHT WING

1. Wing Tie-Down -- DISCONNECT.
2. Fuel Tank Vent Opening -- CHECK for stoppage.

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

## (5) NOSE

1. Static Source Openings (both sides of fuselage) --CHECK for stoppage.
2. Propeller and Spinner -- CHECK for nicks, security and oil leaks.
3. Landing Lights -- CHECK for condition and cleanliness.
4. Carburetor Air Inlet -- CHECK for restrictions .
5. Nose Wheel Strut and Tire -- CHECK for proper inflation.
6. Nose Tie-Down -- DISCONNECT.
7. Engine Oil Level -- CHECK. Do not operate with less than five quarts. Fill to eight quarts for extended flight.
8. Before first flight of the day and after each refueling, pull out strainer drain knob for about four seconds to clear fuel strainer of possible water and sediment. Check strainer drain closed. If water is observed, the fuel system may contain additional water, and further draining of the system at the strainer, fuel tank sumps, and fuel selector valve drain plug will be necessary.

## (6) LEFT WING

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

## (7) LEFT WING Leading Edge

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

## (8) LEFT WING Trailing Edge

1. Aileron -- CHECK freedom of movement and security.

## BEFORE STARTING ENGINE

1. Preflight Inspection -- COMPLETE.
2. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
3. Fuel Selector Valve -- BOTH.
4. Avionics Power Switch, Autopilot (if installed), Electrical Equipment -- OFF.

**CAUTION**

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

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

## STARTING ENGINE

1. Mixture -- RICH.
2. Propeller -- HIGH RPM.
3. Carburetor Heat -- COLD.
4. Throttle --PUMP once, or as much as six times if engine is very hot; leave open 1/4 inch.
5. Master Switch -- ON.
6. Propeller Area -- CLEAR.
7. Ignition Switch -- START (release when engine starts).
8. Oil Pressure -- CHECK.
9. Flashing Beacon and Navigation Lights -- ON as required.
10. Avionics Power Switch -- ON.
11. Radios -- ON.

## BEFORE TAKEOFF

1. 'Cabin Doors and Windows -- CLOSED and LOCKED.
2. Parking Brake -- SET.
3. Seats, Seat Belts, Shoulder Harnesses -- SECURE.
4. Flight Controls -- FREE and CORRECT.
5. Flight Instruments -- SET.
6. Fuel Selector Valve -- BOTH.
7. Mixture -- RICH.
8. Auxilary Fuel Pump -- ON (check for rise in fuel pressure), then OFF.

NOTE

In flight, gravity feed will normally supply satisfactory fuel flow if the engine-driven fuel pump should fail. However, if a fuel pump failure in flight causes the fuel pressure to drop below 0.5 PSI, use the auxiliary fuel pump to assure proper engine operation.

9. Elevator and Rudder Trim -- TAKEOFF.
10. Throttle -- 1700 RPM.
    a. Magnetos -- CHECK (RPM drop should not exceed 175 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.
11. Throttle -- 800-1000 RPM.
12. Radios -- SET.
13. Electric Trim (if installed) -- PREFLIGHT TEST (See Section 9).
14. Autopilot (if installed) -- PREFLIGHT TEST (See Section 9), then OFF.
15. Air Conditioner (if installed) -- OFF.
16. Strobe Lights (if installed) -- AS DESIRED.
17. Throttle Friction Lock -- ADJUST.
18. Parking Brake -- RELEASE.

# TAKEOFF

## NORMAL TAKEOFF

1. Wing Flaps -- 0° - 20°.
2. Carburetor Heat -- COLD.
3. Power -- FULL THROTTLE and 2400 RPM.
4. Elevator Control -- LIFT NOSE WHEEL at 50 KIAS.

NOTE

When the nose wheel is lifted, the gear motor may run 1-2 seconds to restore hydraulic pressure.

5. Climb Speed -- 70 KIAS (flaps 20°).
   80 KIAS (flaps UP).
6. **Brakes -- APPLY momentarily when airborne.**
7. Landing Gear -- RETRACT in climb out.
8. Wing Flaps -- RETRACT.

### SHORT FIELD TAKEOFF

1. Wing Flaps -- 20°.
2. Carburetor Heat -- COLD.
3. Brakes -- APPLY.
4. Power -- FULL THROTTLE and 2400 RPM.
5. Brakes -- RELEASE.
6. Elevator Control -- MAINTAIN SLIGHTLY TAIL-LOW ATTITUDE.
7. Climb Speed -- 59 KIAS until all obstacles are cleared.
8. Landing Gear -- RETRACT after obstacles are cleared.
9. Wing Flaps -- RETRACT slowly after reaching 70 KIAS.

## ENROUTE CLIMB

### NORMAL CLIMB

1. Airspeed -- 90-100 KIAS.
2. Power -- 23 INCHES Hg and 2400 RPM.
3. Fuel Selector Valve -- BOTH.
4. Mixture -- FULL RICH (mixture may be leaned above 3000 feet).
5. Cowl Flaps -- OPEN as required.

### MAXIMUM PERFORMANCE CLIMB

1. Airspeed -- 88 KIAS at sea level to 75 KIAS at 10,000 feet.
2. Power -- FULL THROTTLE and 2400 RPM.
3. Fuel Selector Valve -- BOTH.
4. Mixture -- FULL RICH (mixture may be leaned above 3000 feet).
5. Cowl Flaps -- FULL OPEN.

## CRUISE

1. Power -- 15-23 INCHES Hg. 2100-2400 RPM (no more than 75% power).
2. Elevator and Rudder Trim -- ADJUST.
3. Mixture -- LEAN.
4. Cowl Flaps -- CLOSED.

## DESCENT

1. Fuel Selector Valve -- BOTH.
2. Power -- AS DESIRED.
3. Carburetor Heat -- AS REQUIRED to prevent carburetor icing.

4. Mixture -- ENRICHEN as required.
5. Cowl Flaps -- CLOSED.
6. Wing Flaps -- AS DESIRED (0° - 10° below 140 KIAS, 10° - 40° below 95 KIAS).

NOTE

The landing gear may be used below 140 KIAS to increase the rate of descent.

## BEFORE LANDING

1. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
2. Fuel Selector Valve -- BOTH.
3. Landing Gear -- DOWN (below 140 KIAS).
4. Landing Gear -- CHECK (observe main gear down and green indicator light illuminated.
5. Mixture -- RICH.
6. Carburetor Heat -- ON (apply full heat before closing throttle).
7. Propeller -- HIGH RPM.
8. Autopilot (if installed) -- OFF.
9. Air Conditioner (if installed) -- OFF.

## LANDING

### NORMAL LANDING

1. Airspeed -- 70-80 KIAS (flaps UP).
2. Wing Flaps -- AS DESIRED (0° - 10° below 140 KIAS, 10° - 40° below 95 KIAS).
3. Airspeed -- 65-75 KIAS (flaps DOWN).
4. Trim -- ADJUST.
5. Touchdown -- MAIN WHEELS FIRST.
6. Landing Roll -- LOWER NOSE WHEEL GENTLY.
7. Braking -- MINIMUM REQUIRED.

### SHORT FIELD LANDING

1. Airspeed -- 70-80 KIAS (flaps UP).
2. Wing Flaps -- 40° (below 95 KIAS).
3. Airspeed -- MAINTAIN 64 KIAS.
4. Trim -- ADJUST.
5. Power -- REDUCE to idle as obstacle is cleared.
6. **Touchdown -- MAIN WHEELS FIRST.**
7. Brakes -- **APPLY** HEAVILY.
8. Wing Flaps -- RETRACT for maximum brake effectiveness.

## BALKED LANDING

1. Power -- FULL THROTTLE and 2400 RPM.
2. Carburetor Heat -- COLD.
3. Wing Flaps -- RETRACT to 20°.
4. Climb Speed -- 75 KIAS.
5. Wing Flaps -- RETRACT slowly.
6. Cowl Flaps -- OPEN.

## AFTER LANDING

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

## SECURING AIRPLANE

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

# AMPLIFIED PROCEDURES

## STARTING ENGINE

Ordinarily the engine starts easily with one or two pumps of the throttle in warm temperatures with the mixture full rich. If the engine is very hot, up to six pumps of the throttle should be used. In cooler weather, six to eight pumps of the throttle may be necessary. In extremely cold temperatures, it may be necessary to prime while cranking.

NOTE

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

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. Additional priming will be necessary for the next starting attempt. As soon as the cylinders begin to fire, open the throttle slightly to keep it running.

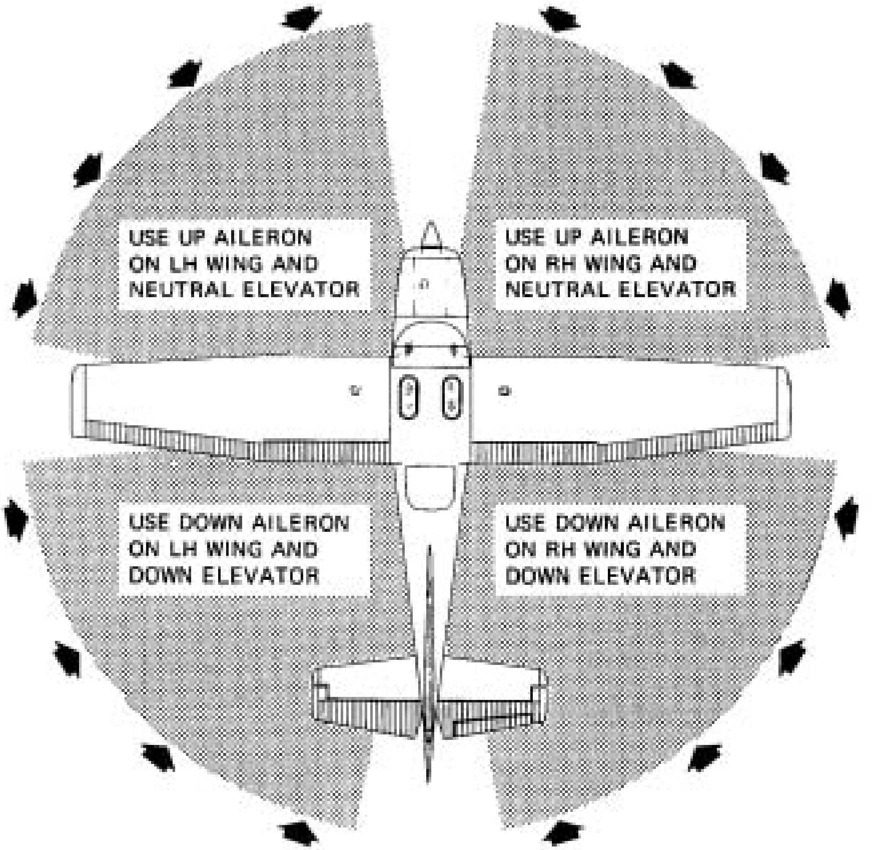
If prolonged cranking is necessary, allow the starter motor to cool at frequent intervals, since excessive heat may damage the armature.

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

## 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.




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**

Taxiing over loose gravel or cinders should be done at low engine speed to avoid abrasion and stone damage to the propeller tips.

# BEFORE TAKEOFF

## WARM-UP

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

## MAGNETO CHECK

The magneto check should be made at 1700 RPM as follows. Move ignition switch first to R position and note RPM. Next move switch back to BOTH to clear the other set of plugs. Then move switch to the L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 175 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists.

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

## ALTERNATOR CHECK

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

# TAKEOFF

## POWER CHECK

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

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

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

## WING FLAP SETTINGS

Normal takeoffs are accomplished with wing flaps 0° to 20°. Using 20° wing flaps reduces the ground run and total distance over an obstacle by approximately 20 per cent. Flap deflections greater than 20° are not approved for takeoff.

If 20° wing flaps are used for takeoff, they should be left down until all obstacles are cleared and a safe flap retraction speed of 70 KIAS is reached. To clear an obstacle with wing flaps 20°, an obstacle clearance speed of 59 KIAS should be used.

Soft field takeoffs are performed with 20° flaps by lifting the airplane off the ground as soon as practical in a slightly tail-low attitude. If no obstacles are ahead, the airplane should be leveled off immediately to accelerate to a safer climb speed.

With wing flaps retracted and no obstacles ahead, a climb-out speed of 80 KIAS would be most efficient.

## CROSSWIND TAKEOFF

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

## LANDING GEAR RETRACTION

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

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

## ENROUTE CLIMB

Normal climbs are performed at 90-100 KIAS with flaps up, 23 In. Hg. or full throttle (whichever is less) and 2400 RPM for the best combination of engine cooling, rate of climb and forward visibility. If it is necessary to climb rapidly to clear mountains or reach favorable winds at high altitudes, the best rate-of-climb speed should be used with maximum power. This speed is 88 KIAS at sea level, decreasing to 75 KIAS at 10,000 feet.

If an obstruction ahead requires a steep climb angle, a best angle-of-climb speed should be used with landing gear and flaps up and maximum power. This speed is 65 KIAS at sea level, increasing to 67 KIAS at 10,000 feet.

The mixture should be full rich during climb at altitudes up to 3000 feet. Above 3000 feet, a full rich mixture setting may be used or the mixture may be leaned for increased power. Also, the mixture may be leaned as required for smooth engine operation. With the Cessna Economy Mixture Indicator, the mixture may be leaned to maintain the EGT indication corresponding to full rich at 3000 feet. This procedure will significantly improve high altitude climb performance.

## 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 a minimum of 75% power until a total of 25 hours has accumulated or oil consumption has stabilized. Operation at this higher power will ensure proper seating of the rings and is applicable to new engines, and engines in service following cylinder replacement or top overhaul of one or more cylinders.

The Cruise Performance Table, figure 4-3, illustrates the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitudes and power setting for a given trip. The selection of cruise altitude on the basis of the most favorable wind conditions and the use of low power settings are significant factors that should be considered on every trip to reduce fuel consumption.

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

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

1. Lean the mixture until the engine becomes rough.
2. Enrichen the mixture 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 will result in approximately 6% greater range than shown in this handbook accompanied by approximately 3 knots decrease in speed.

| | 75% POWER | | 65% POWER | | 55% POWER | |
|---|---|---|---|---|---|---|
| ALTITUDE | KTAS | NMPG | KTAS | NMPG | KTAS | NMPG |
| 2500 | 148 | 11.0 | 140 | 11.9 | 131 | 13.0 |
| 5000 | 152 | 11.2 | 143 | 12.2 | 134 | 13.3 |
| 7500 | 156 | 11.5 | 147 | 12.5 | 136 | 13.5 |
| 10.000 | - - - | - - - | 150 | 12.8 | 139 | 13.8 |
| Standard Conditions | | | | | | Zero Wind |

Figure 4-3. Cruise Performance Table

Any change in altitude, power or carburetor heat will require a change in the recommended 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 the heated air causes a richer mixture, readjust the mixture setting when carburetor heat is to be used continuously in cruise flight.

## LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the 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 data in figure 4-4.

As noted in the table, operation at peak EGT provides best fuel economy. This results in approximately 6% greater range than shown in this handbook accompanied by approximately 3 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.

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

Figure 4-4. EGT Table

## STALLS

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

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

## BEFORE LANDING

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

Landing gear extension can be detected by illumination of the gear down indicator light (green), absence of a gear warning horn with the throttle retarded below 12 inches of manifold pressure and/or the wing flaps extended beyond 25°, and visual inspection of the main gear position. Should the gear indicator light fail to illuminate, the light should be checked for a burned-out bulb by pushing to test. A burned-out bulb can be replaced in flight with the landing gear up (amber) indicator light.

## LANDING

### NORMAL LANDING

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

### SHORT FIELD LANDING

For a short field landing, make a power-off approach at 64 KIAS with 40° flaps and land on the main wheels first. Immediately after touchdown, lower the nose gear to the ground and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, retract the flaps, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

### CROSSWIND LANDING

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

### BALKED LANDING

In a balked landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. After all obstacles are cleared and a safe altitude and airspeed are obtained, the wing flaps should be retracted.

## COLD WEATHER OPERATION

### STARTING

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

NOTE

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

In extremely cold (-18°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 9, Supplements, for Ground Service Plug Receptacle operating details.

Cold weather starting procedures are as follows:

With Preheat:

1. With ignition switch turned off, mixture full rich and throttle open 1/2 inch, prime the engine four to eight strokes.

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. Propeller -- CLEAR.
3. Avionics Power Switch -- OFF.
4. Master Switch -- ON.
5. Throttle -- PUMP several times.
6. Ignition Switch -- START (release to BOTH when engine starts).

Without Preheat:

1. Prime the engine five to six strokes with mixture full rich and throttle open 1/2 inch. Leave the primer charged and ready for a stroke.
2. Propeller -- CLEAR.
3. Avionics Power Switch -- OFF.
4. Master Switch -- ON.
5. Pump throttle rapidly to full open four times. Return to 1/2 inch open position.
6. Ignition Switch -- START.
7. Release ignition switch to BOTH when engine starts.
8. Continue to prime engine until it is running smoothly, or alternately, pump the throttle rapidly over first 1/4 of total travel.
9. Oil Pressure -- CHECK.
10. Primer -- LOCK.

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**

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

### OPERATION

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.

Rough engine operation in cold weather can be caused by a combination of an inherently leaner mixture due to the dense air and poor vaporization and distribution of the fuel-air mixture to the cylinders. The effects of these conditions are especially noticeable during operation on one magneto in ground checks where only one spark plug fires in each cylinder.

For optimum operation of the engine in cold weather, the appropriate use of carburetor heat may be necessary. The following procedures are indicated as a guideline:

1. Use the minimum carburetor heat required for smooth operation in takeoff, climb, and cruise.

NOTE

Care should be exercised when using partial carburetor heat to avoid icing. Partial heat may raise the carburetor air temperature to 0° to 21°C range where icing is critical under certain atmospheric conditions.

2. If the airplane is equipped with a carburetor air temperature gage, it can be used as a reference in maintaining carburetor air temperature at or slightly above the top of the yellow arc by application of carburetor heat.

## HOT WEATHER OPERATION

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

## NOISE CHARACTERISTICS

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

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

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

NOTE

The above recommended procedures do **not** apply where they would conflict with Air Traffic Control clearances or instructions, or where, in the pilot's judgment, an altitude of less than 2000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

The certificated noise level for the Model R182 at 3100 pounds maximum weight is 70.7 dB(A) with a two-bladed propeller and 68.3 dB(A) with a three-bladed propeller. No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

# SECTION 5
# PERFORMANCE

## TABLE OF CONTENTS

## INTRODUCTION

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

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

## USE OF PERFORMANCE CHARTS

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

## SAMPLE PROBLEM

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

| | |
|---|---|
| AIRPLANE CONFIGURATION | |
| Takeoff weight | 3050 Pounds |
| Usable fuel | 65 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 | 520 Nautical Miles |
| Pressure altitude | 7500 Feet |
| Temperature | 16°C (16°C above standard) |
| Expected wind enroute | 10 Knot Headwind |
| LANDING CONDITIONS | |
| Field pressure altitude | 2000 Feet |
| Temperature | 25°C |
| Field length | 3000 Feet |

## TAKEOFF

The takeoff distance chart, figure 5-4, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 3100 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

| | |
|---|---|
| Ground roll | 1085 Feet |
| Total distance to clear a 50-foot obstacle | 2110 Feet |

These distances are well within the available takeoff field length. However, a correction for the effect of wind may be made based on Note 3 of the takeoff chart. The correction for a 12 knot headwind is:

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

This results in the following distances, corrected for wind:

| | |
|---|---|
| Ground roll, zero wind | 1085 |
| Decrease in ground roll (1085 feet × 13%) | 141 |
| Corrected ground roll | 944 Feet |
| Total distance to clear a 50-foot obstacle, zero wind | 2110 |
| Decrease in total distance (2110 feet × 13%) | 274 |
| Corrected total distance to clear a 50-foot obstacle | 1836 Feet |

## CRUISE

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

The relationship between power and range is illustrated by the range profile chart. Considerable fuel savings and longer range result when lower power settings are used. For this sample problem, a cruise power of approximately 65% will be used.

The cruise performance chart for 8000 feet pressure altitude is entered using 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The power setting chosen is 2200 RPM and 21 inches of manifold pressure, which results in the following:

| | |
|---|---|
| Power | 65% |
| True airspeed | 150 Knots |
| Cruise fuel flow | 11.7 GPH |

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

## FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 shows that a normal climb from 2000 feet to 8000 feet requires 3.4 gallons of fuel. The corresponding distance during the climb is 16 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time. fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

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

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

| | |
|---|---|
| Fuel to climb, standard temperature | 3.4 |
| Increase due to non-standard temperature (3.4 × 16%) | 0.5 |
| Corrected fuel to climb | 3.9 Gallons |

Using a similar procedure for the distance during climb results in 19 nautical miles.

The resultant cruise distance is:

| | |
|---|---|
| Total distance | 520 |
| Climb distance | -19 |
| Cruise distance | 501 Nautical Miles |

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

150
-10
140 Knots

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

$$\frac{501 \text{ Nautical Miles}}{140 \text{ Knots}} = 3.6 \text{ Hours}$$

The fuel required for cruise is:

3.6 hours × 11.7 gallons/hour = 42.1 Gallons

A 45-minute reserve requires:

$$\frac{45}{60} \times 11.7 \text{ gallons/hour} = 8.8 \text{ Gallons}$$

The total estimated fuel required is as follows:

| | |
|---|---|
| Engine start, taxi, and takeoff | 2.0 |
| Climb | 3.9 |
| Cruise | 42.1 |
| Reserve | 8.8 |
| Total fuel required | 56.8 Gallons |

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

## LANDING

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

| | |
|---|---|
| Ground roll | 680 Feet |
| Total distance to clear a 50-foot obstacle | 1450 Feet |

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

# DEMONSTRATED OPERATING TEMPERATURE

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

# AIRSPEED CALIBRATION

## NORMAL STATIC SOURCE

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FLAPS UP** | | | | | | | | | | | | | |
| **KIAS** | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 |
| **KCAS** | 61 | 65 | 72 | 81 | 90 | 100 | 109 | 118 | 128 | 137 | 146 | 156 | 165 |
| **FLAPS 20°** | | | | | | | | | | | | | |
| **KIAS** | 40 | 50 | 60 | 70 | 80 | 90 | 95 | --- | --- | --- | --- | --- | --- |
| **KCAS** | 47 | 55 | 64 | 72 | 81 | 90 | 95 | --- | --- | --- | --- | --- | --- |
| **FLAPS 40°** | | | | | | | | | | | | | |
| **KIAS** | 40 | 50 | 60 | 70 | 80 | 90 | 95 | --- | --- | --- | --- | --- | --- |
| **KCAS** | 50 | 55 | 63 | 72 | 81 | 91 | 96 | --- | --- | --- | --- | --- | --- |

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

# AIRSPEED CALIBRATION

## ALTERNATE STATIC SOURCE

### HEATER/VENTS AND WINDOWS CLOSED

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **FLAPS UP** | | | | | | | | | | | |
| **NORMAL KIAS** | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 |
| **ALTERNATE KIAS** | 59 | 70 | 80 | 91 | 101 | 111 | 121 | 130 | 140 | 150 | 160 |
| **FLAPS 20$^{\circ}$** | | | | | | | | | | | |
| **NORMAL KIAS** | 50 | 60 | 70 | 80 | 90 | 95 | --- | --- | --- | --- | --- |
| **ALTERNATE KIAS** | 47 | 59 | 70 | 80 | 90 | 94 | --- | --- | --- | --- | --- |
| **FLAPS 40$^{\circ}$** | | | | | | | | | | | |
| **NORMAL KIAS** | 40 | 50 | 60 | 70 | 80 | 90 | 95 | --- | --- | --- | --- |
| **ALTERNATE KIAS** | 36 | 48 | 59 | 70 | 74 | 89 | 94 | --- | --- | --- | --- |

### HEATER/VENTS OPEN AND WINDOWS CLOSED

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **FLAPS UP** | | | | | | | | | | | |
| **NORMAL KIAS** | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 |
| **ALTERNATE KIAS** | 58 | 68 | 79 | 89 | 99 | 109 | 119 | 129 | 139 | 149 | 158 |
| **FLAPS 20$^{\circ}$** | | | | | | | | | | | |
| **NORMAL KIAS** | 50 | 60 | 70 | 80 | 90 | 95 | --- | --- | --- | --- | --- |
| **ALTERNATE KIAS** | 47 | 58 | 69 | 79 | 89 | 94 | --- | --- | --- | --- | --- |
| **FLAPS 40$^{\circ}$** | | | | | | | | | | | |
| **NORMAL KIAS** | 40 | 50 | 60 | 70 | 80 | 90 | 95 | --- | --- | --- | --- |
| **ALTERNATE KIAS** | 35 | 47 | 58 | 68 | 78 | 88 | 92 | --- | --- | --- | --- |

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

# TEMPERATURE CONVERSION CHART

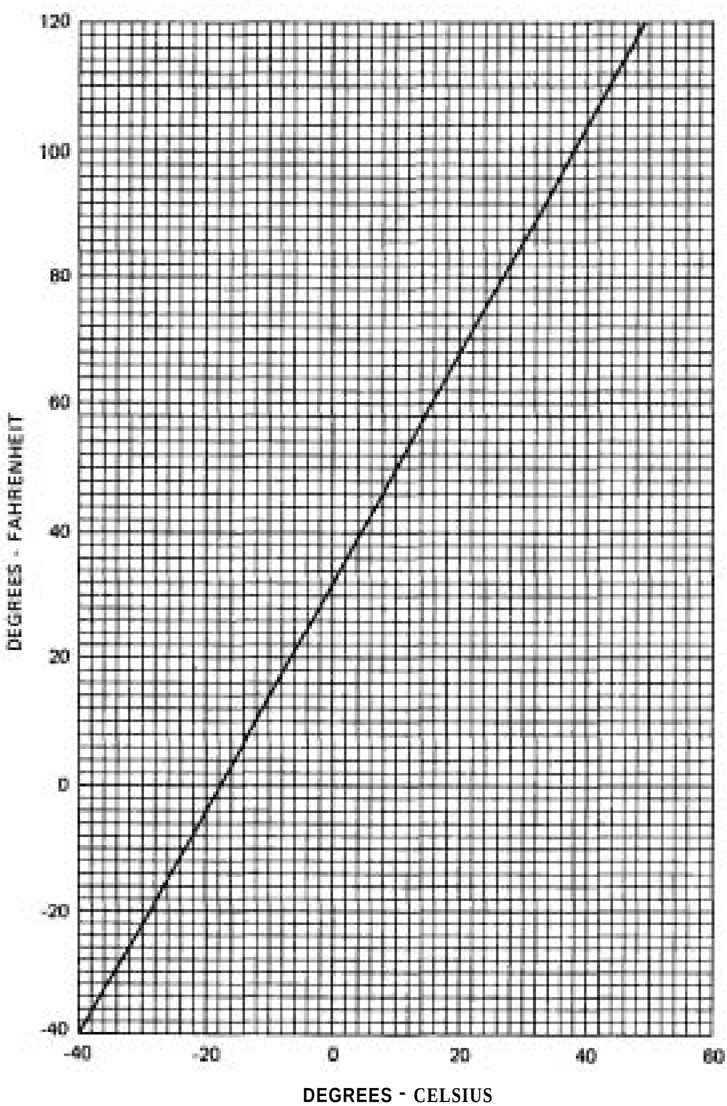



Figure 5-2. Temperature Conversion Chart

# STALL SPEEDS

**CONDITIONS:**
Power **Off**
Gear Up or Down

**NOTES:**
1. Maximum altitude loss during a stall recovery may be as much as 240 **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 |
| 3100 | UP | 39 | 54 | 42 | 58 | 46 | 64 | 55 | 76 |
| | 20° | 28 | 51 | 30 | 55 | 33 | 61 | 40 | 72 |
| | 40° | 34 | 50 | 37 | 54 | 40 | 59 | 48 | 71 |

## MOST FORWARD CENTER OF GRAVITY

| WEIGHT LBS | FLAP DEFLECTION | ANGLE OF BANK | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0° | | 30° | | 45° | | 60° | |
| | | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS | KIAS | KCAS |
| 3100 | UP | 41 | 55 | 44 | 59 | 49 | 65 | 68 | 78 |
| | 20° | 30 | 52 | 32 | 56 | 36 | 62 | 42 | 74 |
| | 40° | 39 | 52 | 42 | 56 | 46 | 62 | 55 | 74 |

**Figure 5-3. Stall Speeds**

# TAKEOFF DISTANCE

## MAXIMUM WEIGHT 3100 LBS

**SHORT FIELD**

CONDITIONS:
Flaps 20°
2400 RPM and Full Throttle Prior to Brake Release
Cowl Flaps Open
Paved, Level, Dry Runway
Zero Wind

NOTES:
1. Short field 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 |
| 3100 | 52 | 59 | S.L. | 735 | 1410 | 790 | 1515 | 850 | 1625 | 910 | 1745 | 975 | 1870 |
| | | | 1000 | 800 | 1545 | 860 | 1660 | 925 | 1785 | 995 | 1915 | 1065 | 2060 |
| | | | 2000 | 875 | 1690 | 940 | 1820 | 1010 | 1960 | 1085 | 2110 | 1165 | 2275 |
| | | | 3000 | 955 | 1860 | 1030 | 2010 | 1105 | 2165 | 1190 | 2340 | 1275 | 2525 |
| | | | 4000 | 1045 | 2055 | 1125 | 2225 | 1210 | 2405 | 1300 | 2605 | 1395 | 2825 |
| | | | 5000 | 1145 | 2280 | 1235 | 2475 | 1330 | 2690 | 1430 | 2925 | 1535 | 3185 |
| | | | 6000 | 1255 | 2550 | 1355 | 2775 | 1460 | 3030 | 1570 | 3310 | 1685 | 3635 |
| | | | 7000 | 1380 | 2870 | 1490 | 3140 | 1605 | 3450 | 1730 | 3805 | --- | --- |
| | | | 8000 | 1520 | 3260 | 1640 | 3600 | 1770 | 3990 | --- | --- | --- | --- |

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

# TAKEOFF DISTANCE

## 2800 LBS AND 2500 LBS

**SHORT FIELD**

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

| WEIGHT LBS | TAKEOFF SPEED KIAS | | PRESS ALT FT | 0°C | | 10°C | | 20°C | | 30°C | | 40°C | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LIFT OFF | AT 50 FT | | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS |
| 2800 | 49 | 56 | S.L. | 580 | 1115 | 625 | 1195 | 670 | 1275 | 720 | 1365 | 770 | 1460 |
| | | | 1000 | 635 | 1215 | 680 | 1300 | 730 | 1395 | 785 | 1490 | 840 | 1595 |
| | | | 2000 | 690 | 1325 | 745 | 1420 | 800 | 1520 | 855 | 1630 | 915 | 1750 |
| | | | 3000 | 755 | 1445 | 810 | 1555 | 870 | 1670 | 935 | 1790 | 1000 | 1920 |
| | | | 4000 | 820 | 1585 | 885 | 1705 | 950 | 1835 | 1020 | 1975 | 1095 | 2125 |
| | | | 5000 | 900 | 1745 | 970 | 1880 | 1040 | 2025 | 1120 | 2185 | 1200 | 2355 |
| | | | 6000 | 985 | 1925 | 1060 | 2080 | 1140 | 2250 | 1225 | 2430 | 1315 | 2630 |
| | | | 7000 | 1080 | 2140 | 1165 | 2315 | 1255 | 2510 | 1350 | 2725 | 1450 | 2960 |
| | | | 8000 | 1185 | 2385 | 1280 | 2595 | 1380 | 2825 | 1485 | 3080 | 1595 | 3365 |
| 2500 | 47 | 53 | S.L. | 450 | 870 | 485 | 925 | 520 | 990 | 555 | 1055 | 595 | 1125 |
| | | | 1000 | 490 | 940 | 525 | 1005 | 565 | 1075 | 605 | 1145 | 645 | 1220 |
| | | | 2000 | 530 | 1020 | 570 | 1090 | 615 | 1165 | 660 | 1245 | 705 | 1330 |
| | | | 3000 | 580 | 1110 | 625 | 1190 | 670 | 1270 | 720 | 1360 | 770 | 1455 |
| | | | 4000 | 630 | 1210 | 680 | 1300 | 730 | 1390 | 785 | 1490 | 840 | 1590 |
| | | | 5000 | 690 | 1325 | 745 | 1420 | 800 | 1525 | 855 | 1635 | 915 | 1750 |
| | | | 6000 | 755 | 1450 | 810 | 1560 | 875 | 1675 | 935 | 1800 | 1005 | 1930 |
| | | | 7000 | 825 | 1595 | 890 | 1715 | 955 | 1850 | 1025 | 1990 | 1100 | 2140 |
| | | | 8000 | 905 | 1760 | 975 | 1900 | 1050 | 2050 | 1130 | 2210 | 1210 | 2385 |

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

# MAXIMUM RATE OF CLIMB

**CONDITIONS:**
Flaps Up
Gear Up
2400 RPM
Full Throttle
Mixture Full Rich
Cowl Flaps Open

**NOTE:**
Mixture may be leaned above 3000 feet for increased power.

| WEIGHT LBS | PRESS ALT FT | CLIMB SPEED KIAS | RATE OF CLIMB - FPM | | | |
|---|---|---|---|---|---|---|
| | | | -20°C | 0°C | 20°C | 40°C |
| 3100 | S.L. | 88 | 1270 | 1195 | 1120 | 1045 |
| | 2000 | 85 | 1110 | 1035 | 960 | 890 |
| | 4000 | 82 | 945 | 875 | 805 | 730 |
| | 6000 | 80 | 785 | 715 | 645 | 570 |
| | 8000 | 77 | 625 | 555 | 485 | 415 |
| | 10.000 | 75 | 465 | 395 | 325 | - - - |
| | 12,000 | 72 | 305 | 235 | 165 | - - - |
| | 14,000 | 69 | 145 | 75 | - - - | - - - |

Figure 5-5. Maximum Rate of Climb

# TIME, FUEL, AND DISTANCE TO CLIMB

## MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Gear Up
2400 RPM
Full Throttle
Mixture Full Rich
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 2.0 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture may be leaned above 3000 feet for increased 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 |
| 3100 | S.L. | 15 | 88 | 1140 | 0 | 0 | 0 |
| | 2000 | 11 | 85 | 995 | 2 | 0.8 | 3 |
| | 4000 | 7 | 82 | 850 | 4 | 1.6 | 6 |
| | 6000 | 3 | 80 | 705 | 7 | 2.6 | 10 |
| | 8000 | -1 | 77 | 560 | 10 | 3.7 | 15 |
| | 10.000 | -5 | 75 | 415 | 14 | 5.1 | 21 |
| | 12,000 | -9 | 72 | 265 | 20 | 7.1 | 30 |
| | 14,000 | -13 | 69 | 120 | 32 | 10.6 | 47 |

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

# TIME, FUEL, AND DISTANCE TO CLIMB

## NORMAL CLIMB - 95 KIAS

CONDITIONS:
Flaps Up
Gear Up
2400 RPM
23 Inches Hg or Full Throttle
Mixture Full Rich
Cowl Flaps Open
Standard Temperature

NOTES:
1. Add 2.0 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture may be leaned above 3000 feet for increased 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 |
| 3100 | S.L. | 15 | 680 | 0 | 0 | 0 |
| | 2000 | 11 | 680 | 3 | 1.0 | 5 |
| | 4000 | 7 | 680 | 6 | 2.0 | 10 |
| | 6000 | 3 | 640 | 9 | 3.1 | 15 |
| | 8000 | -1 | 485 | 12 | 4.4 | 21 |
| | 10,000 | -5 | 330 | 18 | 6.1 | 30 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 2000 FEET

**CONDITIONS:**
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

| | | 20°C BELOW STANDARD TEMP -9°C | | | STANDARD TEMPERATURE 11°C | | | 20°C ABOVE STANDARD TEMP 31°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 23 | --- | --- | --- | 76 | 148 | 13.6 | 73 | 149 | 13.2 |
| | 22 | 74 | 143 | 13.3 | 71 | 145 | 12.8 | 69 | 146 | 12.4 |
| | 21 | 69 | 140 | 12.4 | 67 | 141 | 12.0 | 64 | 142 | 11.6 |
| | 20 | 64 | 136 | 11.6 | 62 | 137 | 11.3 | 60 | 138 | 10.9 |
| 2300 | 23 | 75 | 145 | 13.5 | 72 | 146 | 13.1 | 70 | 147 | 12.6 |
| | 22 | 71 | 141 | 12.7 | 68 | 142 | 12.3 | 66 | 143 | 11.9 |
| | 21 | 66 | 137 | 11.9 | 64 | 138 | 11.5 | 62 | 139 | 11.2 |
| | 20 | 61 | 134 | 11.2 | 59 | 135 | 10.8 | 57 | 135 | 10.5 |
| 2200 | 23 | 72 | 142 | 12.9 | 69 | 143 | 12.5 | 67 | 144 | 12.1 |
| | 22 | 67 | 139 | 12.1 | 65 | 140 | 11.7 | 63 | 141 | 11.4 |
| | 21 | 63 | 135 | 11.4 | 61 | 136 | 11.0 | 59 | 137 | 10.7 |
| | 20 | 59 | 131 | 10.7 | 57 | 132 | 10.3 | 55 | 133 | 10.0 |
| 2100 | 23 | 68 | 139 | 12.2 | 66 | 140 | 11.8 | 63 | 141 | 11.5 |
| | 22 | 64 | 136 | 11.5 | 62 | 137 | 11.2 | 60 | 137 | 10.8 |
| | 21 | 60 | 132 | 10.9 | 58 | 133 | 10.5 | 56 | 134 | 10.2 |
| | 20 | 55 | 128 | 10.1 | 54 | 129 | 9.8 | 52 | 129 | 9.5 |
| | 19 | 51 | 124 | 9.4 | 50 | 124 | 9.1 | 48 | 125 | 8.9 |
| | 18 | 47 | 119 | 8.7 | 45 | 119 | 8.5 | 44 | 120 | 8.2 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

**NOTE**

For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

| | | 20°C BELOW STANDARD TEMP -13°C | | | STANDARD TEMPERATURE 7°C | | | 20°C ABOVE STANDARD TEMP 27°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 23 | - - - | - - - | - - - | 78 | 153 | 14.0 | 75 | 154 | 13.6 |
| | 22 | 76 | 148 | 13.7 | 73 | 149 | 13.2 | 71 | 150 | 12.8 |
| | 21 | 71 | 144 | 12.8 | 69 | 145 | 12.4 | 66 | 146 | 12.0 |
| | 20 | 66 | 140 | 12.0 | 64 | 141 | 11.6 | 62 | 142 | 11.2 |
| 2300 | 23 | 77 | 149 | 14.0 | 75 | 150 | 13.5 | 72 | 151 | 13.0 |
| | 22 | 73 | 145 | 13.1 | 70 | 147 | 12.7 | 68 | 148 | 12.2 |
| | 21 | 68 | 142 | 12.3 | 66 | 143 | 11.9 | 64 | 144 | 11.5 |
| | 20 | 64 | 138 | 11.5 | 61 | 139 | 11.1 | 59 | 140 | 10.8 |
| 2200 | 23 | 74 | 146 | 13.3 | 71 | 148 | 12.9 | 69 | 149 | 12.4 |
| | 22 | 70 | 143 | 12.5 | 67 | 144 | 12.1 | 65 | 145 | 11.7 |
| | 21 | 65 | 139 | 11.8 | 63 | 140 | 11.4 | 61 | 141 | 11.0 |
| | 20 | 61 | 135 | 11.0 | 59 | 136 | 10.7 | 57 | 137 | 10.3 |
| 2100 | 23 | 70 | 143 | 12.7 | 68 | 145 | 12.2 | 65 | 146 | 11.8 |
| | 22 | 66 | 140 | 11.9 | 64 | 141 | 11.5 | 62 | 142 | 11.2 |
| | 21 | 62 | 136 | 11.2 | 60 | 137 | 10.9 | 58 | 138 | 10.5 |
| | 20 | 58 | 132 | 10.5 | 55 | 133 | 10.1 | 54 | 134 | 9.8 |
| | 19 | 53 | 128 | 9.8 | 51 | 129 | 9.5 | 50 | 129 | 9.2 |
| | 18 | 49 | 123 | 9.1 | 47 | 124 | 8.8 | 46 | 124 | 8.5 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 6000 FEET

**CONDITIONS:**
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
> For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

| | | 20°C BELOW STANDARD TEMP -17°C | | | STANDARD TEMPERATURE 3°C | | | 20°C ABOVE STANDARD TEMP 23°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 22 | --- | --- | --- | 75 | 154 | 13.6 | 73 | 155 | 13.1 |
| | 21 | 73 | 148 | 13.2 | 71 | 150 | 12.7 | 68 | 151 | 12.3 |
| | 20 | 69 | 145 | 12.3 | 66 | 146 | 11.9 | 64 | 147 | 11.5 |
| | 19 | 64 | 140 | 11.5 | 61 | 141 | 11.1 | 59 | 142 | 10.8 |
| 2300 | 23 | --- | --- | --- | 77 | 155 | 13.9 | 74 | 156 | 13.4 |
| | 22 | 75 | 150 | 13.5 | 72 | 151 | 13.0 | 70 | 152 | 12.6 |
| | 21 | 70 | 146 | 12.7 | 68 | 147 | 12.2 | 66 | 148 | 11.8 |
| | 20 | 66 | 142 | 11.9 | 63 | 143 | 11.5 | 61 | 144 | 11.1 |
| 2200 | 23 | 76 | 151 | 13.7 | 74 | 152 | 13.3 | 71 | 153 | 12.8 |
| | 22 | 72 | 147 | 12.9 | 69 | 148 | 12.5 | 67 | 150 | 12.1 |
| | 21 | 67 | 144 | 12.1 | 65 | 145 | 11.7 | 63 | 146 | 11.4 |
| | 20 | 63 | 140 | 11.4 | 61 | 141 | 11.0 | 59 | 141 | 10.7 |
| 2100 | 23 | 72 | 148 | 13.1 | 70 | 149 | 12.6 | 68 | 150 | 12.2 |
| | 22 | 68 | 144 | 12.3 | 66 | 145 | 11.9 | 64 | 146 | 11.5 |
| | 21 | 64 | 141 | 11.6 | 62 | 142 | 11.2 | 60 | 142 | 10.8 |
| | 20 | 60 | 137 | 10.9 | 57 | 137 | 10.5 | 56 | 138 | 10.2 |
| | 19 | 55 | 132 | 10.1 | 53 | 133 | 9.8 | 52 | 133 | 9.5 |
| | 18 | 51 | 128 | 9.4 | 49 | 128 | 9.1 | 48 | 128 | 8.8 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 8000 FEET

**CONDITIONS:**
3100 **Pounds**
**Recommended Lean Mixture**
**Cowl Flaps Closed**

**NOTE**
**For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.**

| | | 20°C BELOW STANDARD TEMP -21°C | | | STANDARD TEMPERATURE -1°C | | | 20°C ABOVE STANDARD TEMP 19°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 21 | 76 | 153 | 13.6 | 73 | 154 | 13.1 | 70 | 155 | 12.7 |
| | 20 | 71 | 149 | 12.7 | 68 | 150 | 12.3 | 66 | 151 | 11.9 |
| | 19 | 66 | 145 | 11.9 | 63 | 146 | 11.5 | 61 | 147 | 11.1 |
| | 18 | 61 | 140 | 11.1 | 59 | 141 | 10.7 | 57 | 142 | 10.3 |
| 2300 | 21 | 73 | 151 | 13.1 | 70 | 152 | 12.6 | 68 | 153 | 12.2 |
| | 20 | 68 | 147 | 12.2 | 65 | 148 | 11.8 | 63 | 149 | 11.4 |
| | 19 | 63 | 142 | 11.4 | 61 | 143 | 11.1 | 59 | 144 | 10.7 |
| | 18 | 58 | 138 | 10.6 | 56 | 138 | 10.3 | 54 | 139 | 9.9 |
| 2200 | 21 | 70 | 148 | 12.5 | 67 | 149 | 12.1 | 65 | 150 | 11.7 |
| | 20 | 65 | 144 | 11.7 | 63 | 145 | 11.3 | 60 | 146 | 11.0 |
| | 19 | 60 | 140 | 11.0 | 58 | 141 | 10.6 | 56 | 141 | 10.3 |
| | 18 | 56 | 135 | 10.2 | 54 | 136 | 9.9 | 52 | 136 | 9.5 |
| 2100 | 21 | 66 | 145 | 11.9 | 64 | 146 | 11.5 | 61 | 147 | 11.2 |
| | 20 | 62 | 141 | 11.2 | 59 | 142 | 10.8 | 57 | 142 | 10.5 |
| | 19 | 57 | 137 | 10.5 | 55 | 137 | 10.1 | 53 | 138 | 9.8 |
| | 18 | 53 | 132 | 9.7 | 51 | 132 | 9.4 | 49 | 133 | 9.1 |
| | 17 | 49 | 127 | 9.0 | 47 | 127 | 8.7 | 45 | 127 | 8.4 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

**NOTE**

For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

| | | 20°C BELOW STANDARD TEMP -25°C | | | STANDARD TEMPERATURE -5°C | | | 20°C ABOVE STANDARD TEMP 15°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 20 | 73 | 154 | 13.1 | 70 | 155 | 12.6 | 68 | 156 | 12.2 |
| | 19 | 68 | 149 | 12.2 | 65 | 150 | 11.8 | 63 | 151 | 11.4 |
| | 18 | 63 | 145 | 11.4 | 60 | 145 | 11.0 | 58 | 146 | 10.6 |
| | 17 | 58 | 140 | 10.6 | 56 | 140 | 10.2 | 54 | 141 | 9.9 |
| 2300 | 20 | 70 | 151 | 12.6 | 67 | 152 | 12.2 | 65 | 153 | 11.8 |
| | 19 | 65 | 147 | 11.8 | 63 | 148 | 11.4 | 61 | 149 | 11.0 |
| | 18 | 60 | 142 | 11.0 | 58 | 143 | 10.6 | 56 | 143 | 10.3 |
| | 17 | 56 | 137 | 10.2 | 53 | 138 | 9.8 | 52 | 138 | 9.5 |
| 2200 | 20 | 67 | 149 | 12.1 | 65 | 150 | 11.7 | 62 | 150 | 11.3 |
| | 19 | 62 | 144 | 11.3 | 60 | 145 | 10.9 | 58 | 146 | 10.6 |
| | 18 | 58 | 140 | 10.5 | 56 | 140 | 10.2 | 54 | 140 | 9.9 |
| | 17 | 53 | 134 | 9.8 | 51 | 135 | 9.4 | 49 | 135 | 9.1 |
| 2100 | 20 | 64 | 146 | 11.5 | 61 | 146 | 11.2 | 59 | 147 | 10.8 |
| | 19 | 59 | 141 | 10.8 | 57 | 142 | 10.4 | 55 | 142 | 10.1 |
| | 18 | 55 | 136 | 10.1 | 53 | 137 | 9.7 | 51 | 137 | 9.4 |
| | 17 | 51 | 131 | 9.3 | 49 | 131 | 9.0 | 47 | 131 | 8.7 |
| | 16 | 46 | 125 | 8.6 | 44 | 125 | 8.3 | 43 | 125 | 8.1 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> NOTE
>
> For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

| | | 20°C BELOW STANDARD TEMP -29°C | | | STANDARD TEMPERATURE -9°C | | | 20°C ABOVE STANDARD TEMP 11°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 18 | 65 | 149 | 11.7 | 62 | 150 | 11.3 | 60 | 151 | 10.9 |
| | 17 | 60 | 144 | 10.9 | 57 | 145 | 10.5 | 55 | 145 | 10.1 |
| | 16 | 55 | 138 | 10.0 | 53 | 139 | 9.7 | 51 | 139 | 9.4 |
| | 15 | 50 | 132 | 9.2 | 48 | 132 | 8.8 | 46 | 132 | 8.6 |
| 2300 | 18 | 62 | 147 | 11.3 | 60 | 148 | 10.9 | 58 | 148 | 10.6 |
| | 17 | 57 | 142 | 10.5 | 55 | 142 | 10.1 | 53 | 142 | 9.8 |
| | 16 | 53 | 136 | 9.7 | 51 | 136 | 9.3 | 49 | 136 | 9.0 |
| | 15 | 48 | 130 | 8.8 | 46 | 130 | 8.5 | 44 | 129 | 8.3 |
| 2200 | 18 | 60 | 144 | 10.9 | 58 | 145 | 10.5 | 56 | 145 | 10.2 |
| | 17 | 55 | 139 | 10.1 | 53 | 139 | 9.7 | 51 | 139 | 9.4 |
| | 16 | 50 | 133 | 9.3 | 48 | 133 | 9.0 | 47 | 133 | 8.7 |
| 2100 | 18 | 57 | 141 | 10.4 | 55 | 141 | 10.0 | 53 | 142 | 9.7 |
| | 17 | 52 | 136 | 9.6 | 50 | 136 | 9.3 | 49 | 136 | 9.0 |
| | 16 | 48 | 130 | 8.9 | 46 | 130 | 8.6 | 44 | 129 | 8.3 |

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

# CRUISE PERFORMANCE

## PRESSURE ALTITUDE 14,000 FEET

CONDITIONS:
3100 Pounds
Recommended Lean Mixture
Cowl Flaps Closed

> **NOTE**
>
> For best fuel economy, operate at the leanest mixture that results in smooth engine operation or at peak EGT if an EGT indicator is installed.

| | | 20°C BELOW STANDARD TEMP -33°C | | | STANDARD TEMPERATURE -13°C | | | 20°C ABOVE STANDARD TEMP 7°C | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RPM | MP | % BHP | KTAS | GPH | % BHP | KTAS | GPH | % BHP | KTAS | GPH |
| 2400 | 16 | 57 | 143 | 10.3 | 54 | 143 | 10.0 | 52 | 143 | 9.6 |
| | 15 | 51 | 137 | 9.5 | 49 | 137 | 9.1 | 48 | 136 | 8.8 |
| 2300 | 16 | 54 | 141 | 10.0 | 52 | 141 | 9.6 | 51 | 141 | 9.3 |
| | 15 | 49 | 134 | 9.1 | 48 | 134 | 8.8 | 46 | 134 | 8.5 |
| 2200 | 16 | 52 | 138 | 9.6 | 50 | 138 | 9.3 | 48 | 138 | 9.0 |
| | 15 | 47 | 131 | 8.8 | 46 | 131 | 8.5 | 44 | 131 | 8.2 |
| 2100 | 16 | 50 | 134 | 9.2 | 48 | 134 | 8.9 | 46 | 134 | 8.6 |

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

# RANGE PROFILE
## 45 MINUTES RESERVE
## 65 GALLONS USABLE FUEL

**CONDITIONS:**
3100 **Pounds**
**Recommended Lean Mixture for Cruise**
**Standard Temperature**
**Zero Wind**

**NOTE:**
**This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb up to 10,000 feet and maximum climb above 10,000 feet.**

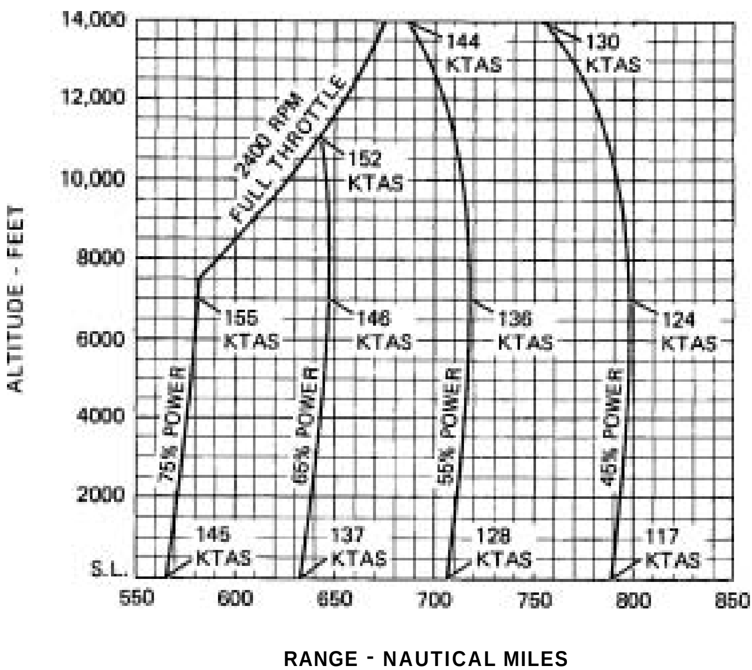



Figure 5-8. Range Profile (Sheet 1 of 2)

# RANGE PROFILE
## 45 MINUTES RESERVE
## 88 GALLONS USABLE FUEL

CONDITIONS:
3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb up to 10,000 feet and maximum climb above 10,000 feet.

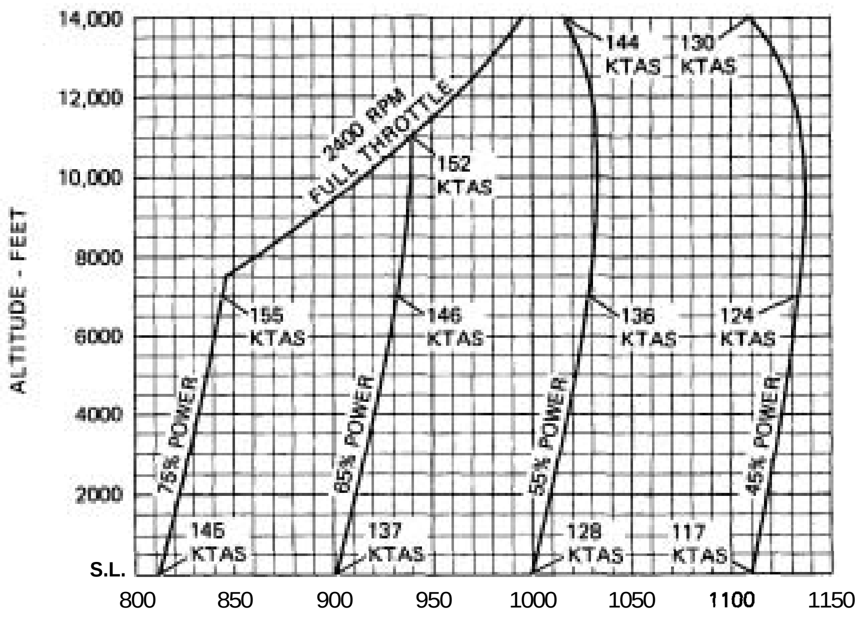



**Figure 5-8. Range Profile (Sheet 2 of 2)**

# ENDURANCE PROFILE
## 45 MINUTES RESERVE
## 65 GALLONS USABLE FUEL

CONDITIONS:
3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb up to 10,000 feet and maximum climb above 10,000 feet.

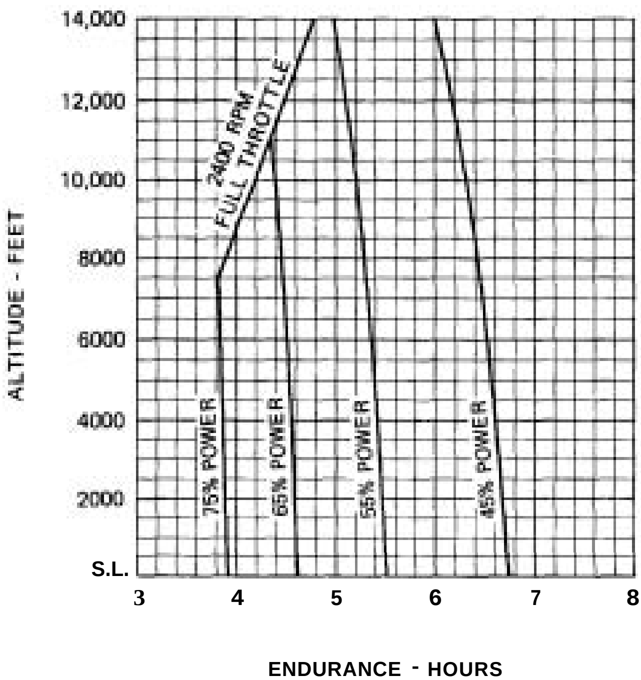



Figure 5-9. Endurance Profile (Sheet 1 of 2)

# ENDURANCE PROFILE
## 45 MINUTES RESERVE
## 88 GALLONS USABLE FUEL

**CONDITIONS:**
3100 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

**NOTE:**
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb up to 10,000 feet and maximum climb above 10,000 feet.

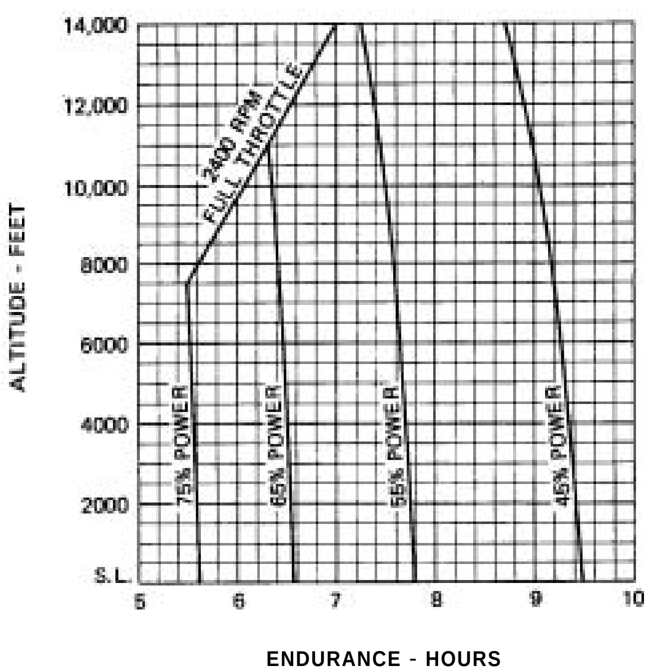



Figure 5-9. Endurance Profile (Sheet 2 of 2)

# LANDING DISTANCE

## SHORT FIELD

CONDITIONS:
Flaps 40°
Power Off
Maximum Braking
Paved, Level, Dry Runway
Zero Wind

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

| WEIGHT LBS | SPEED AT 50 FT KIAS | PRESS ALT FT | 0°C | | 10°C | | 20°C | | 30°C | | 40°C | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS | GRND ROLL | TOTAL TO CLEAR 50 FT OBS |
| 3100 | 64 | S.L. | 570 | 1270 | 590 | 1305 | 610 | 1335 | 630 | 1370 | 650 | 1400 |
| | | 1000 | 590 | 1305 | 610 | 1335 | 635 | 1375 | 655 | 1410 | 675 | 1440 |
| | | 2000 | 610 | 1335 | 635 | 1375 | 655 | 1410 | 680 | 1450 | 700 | 1480 |
| | | 3000 | 635 | 1375 | 660 | 1415 | 680 | 1450 | 705 | 1490 | 730 | 1530 |
| | | 4000 | 660 | 1415 | 685 | 1455 | 705 | 1490 | 730 | 1530 | 755 | 1570 |
| | | 5000 | 685 | 1455 | 710 | 1495 | 735 | 1535 | 760 | 1580 | 785 | 1620 |
| | | 6000 | 710 | 1500 | 735 | 1540 | 760 | 1580 | 790 | 1625 | 815 | 1665 |
| | | 7000 | 735 | 1540 | 765 | 1585 | 790 | 1630 | 820 | 1675 | 845 | 1715 |
| | | 8000 | 765 | 1585 | 795 | 1635 | 820 | 1675 | 850 | 1725 | 880 | 1770 |

Figure 5-10. Landing Distance

# SECTION 6
# WEIGHT & BALANCE/ EQUIPMENT LIST

## TABLE OF CONTENTS

# INTRODUCTION

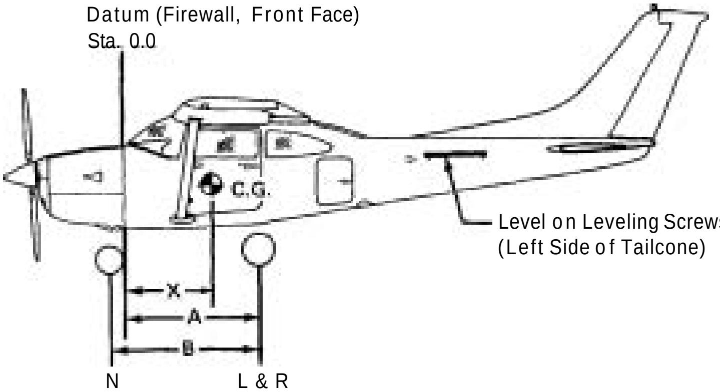
This section describes the procedure for establishing the basic empty weight and moment of the airplane. Sample forms are provided for reference. Procedures for calculating the weight and moment for various operations are also provided. A comprehensive list of all Cessna equipment available for this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

It should be noted that specific information regarding the weight, arm, moment and installed equipment for this airplane as delivered from the factory can only be found in the plastic envelope carried in the back of this handbook.

It is the responsibility of the pilot to ensure that the airplane is loaded properly.

# AIRPLANE WEIGHING PROCEDURES

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




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

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

| Item | Weight (Lbs.) | X C.G. Arm (In.) | = Moment/1000 (Lbs.-In.) |
|---|---|---|---|
| Airplane Weight (From Item 5, page 6-3) | | | |
| Add Oil:<br>(9 Qts at 7.5 Lbs/Gal) | 17 | -15.7 | -.3 |
| Add:<br>Unusable Fuel (4 Gal at 6 Lbs/Gal) | 24 | 48.0 | 1.2 |
| Equipment Changes | | | |
| Airplane Basic Empty Weight | | | |

**Figure 6-1. Sample Airplane Weighing**

# SAMPLE WEIGHT AND BALANCE RECORD

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

| AIRPLANE MODEL | | | | SERIAL NUMBER | | | | | | PAGE NUMBER | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | ITEM NO. | | DESCRIPTION OF ARTICLE OR MODIFICATION | WEIGHT CHANGE | | | | | | RUNNING BASIC EMPTY WEIGHT | |
| | | | | ADDED (+) | | | REMOVED (-) | | | | |
| | In | Out | | Wt. (lb.) | Arm (In.) | Moment 11000 | Wt. (lb.) | Arm (In.) | Moment 11000 | Wt. (lb.) | Moment /1000 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Figure 6-2. Sample Weight and Balance Record

# WEIGHT AND BALANCE

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

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

NOTE

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

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

NOTE

Loading Graph information for the pilot, passengers and baggage is based on seats positioned for average occupants and baggage 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 area limitation). Additional moment calculations, based on the actual weight and C.G. arm (fuselage station) of the item being loaded, must be made if the position of the load is different from that shown on the Loading Graph.

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

## BAGGAGE TIE-DOWN

A nylon baggage net having six tie-down straps is provided as standard equipment to secure baggage in the area aft of the rear seat (Baggage A) and over the wheel well (Baggage B). Eight eyebolts serve as attaching points for the net. Two eyebolts for the forward tie-down straps are mounted on the cabin floor near each sidewall just forward of the baggage door approximately at station 92; two eyebolts are installed on the cabin floor slightly inboard of each sidewall just forward of the wheel well approximately at station 109; and two eyebolts are mounted on the upper forward surface of the wheel well slightly inboard of each sidewall approximately at station 109. The two aft eyebolts are installed above the aft portion of the wheel well and slightly inboard of each sidewall approximately at station 124.

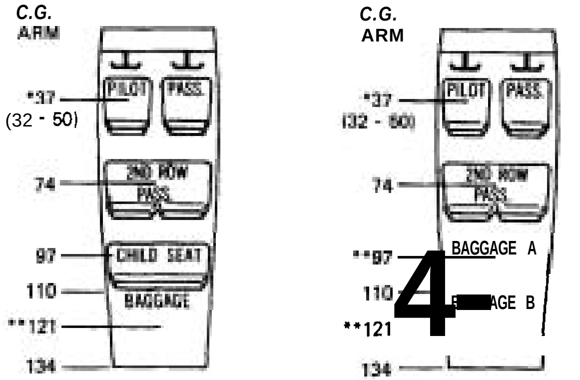
When the cabin floor (Baggage A) only is utilized for baggage, the four eyebolts located on the cabin floor may be used, or the two forward eyebolts on the cabin floor and the two eyebolts on the upper forward surface of the wheel well may be used. When the upper surface of the wheel well (Baggage B) only contains baggage, the two eyebolts on the upper forward surface of the wheel well and the two aft eyebolts above the aft portion of the wheel well should be used. When there is baggage in both areas, the two forward eyebolts on the cabin floor, the two eyebolts on the upper forward surface of the wheel well, and the two aft eyebolts above the aft portion of the wheel well should be utilized.

# LOADING ARRANGEMENTS

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

**Baggage area center of gravity.

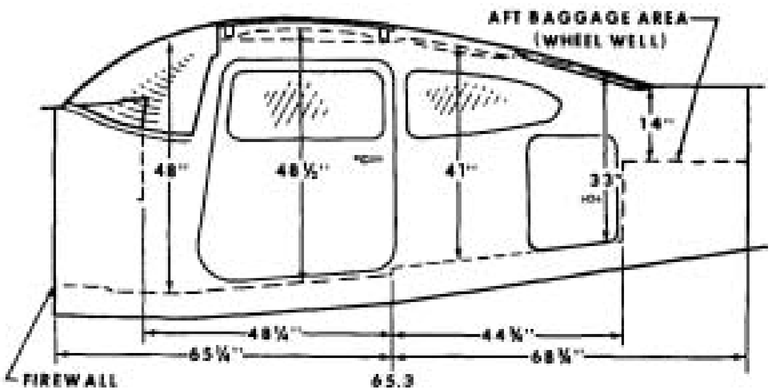
NOTES:
1. The usable fuel C.G. arm is located at station 46.5.
2. The aft baggage wall (approximate station 134) can be used as a convenient interior reference point for determining the location of baggage area fuselage stations.




OPTIONAL SEATING STANDARD SEATING

**Figure 6-3. Loading Arrangements**

## CABIN HEIGHT MEASUREMENTS




## DOOR OPENING DIMENSIONS

| | WIDTH (TOP) | WIDTH (BOTTOM) | HEIGHT (FRONT) | HEIGHT (REAR) |
|---|---|---|---|---|
| CABIN DOOR | 32" | 36%" | 41" | 38%" |
| BAGGAGE DOOR | 15¾" | 15¾" | 22" | 20½" |

═ WIDTH ═
LWR WINDOW
LINE
* CABIN FLOOR

## CABIN WIDTH MEASUREMENTS

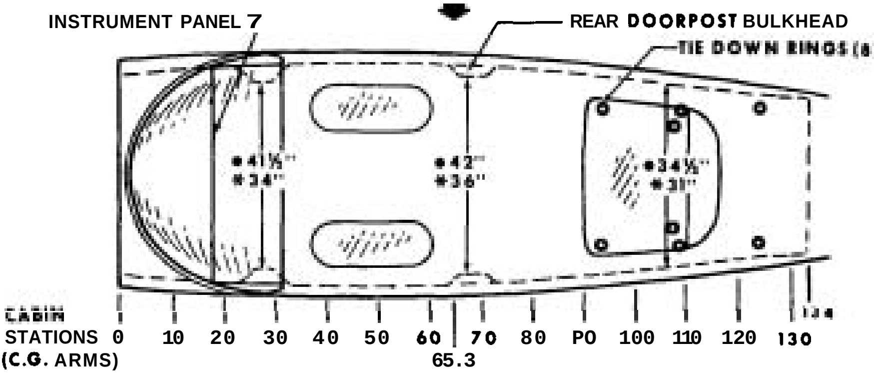
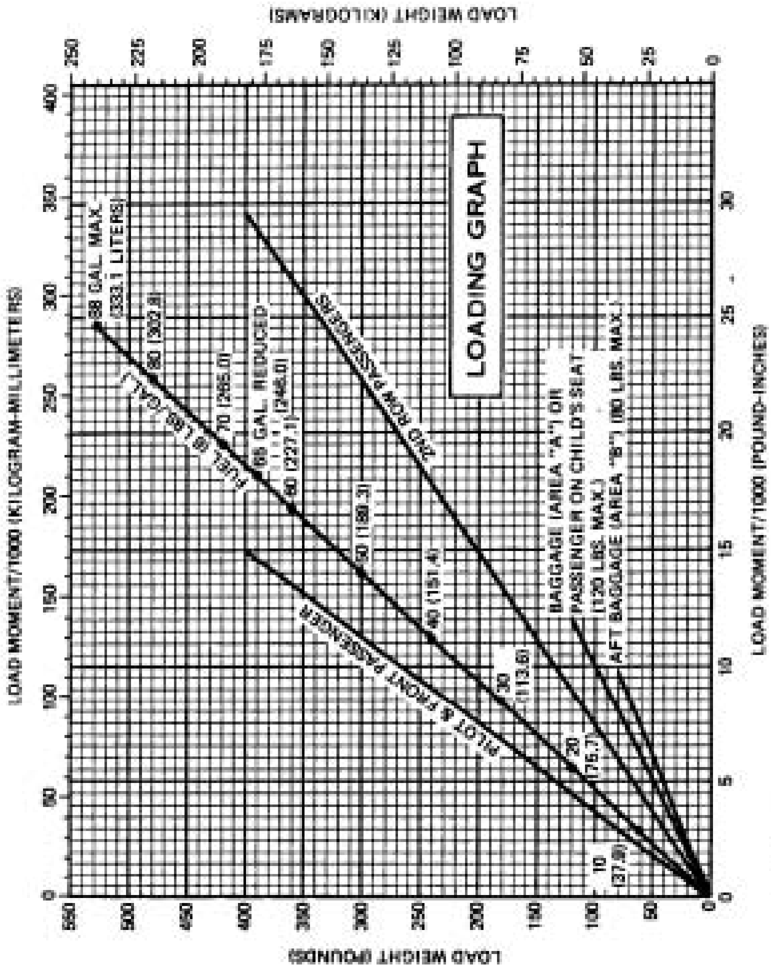



Figure 6-4. Internal Cabin Dimensions

| 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) . . . . . . . . . . . . | 1808 | 64.9 | | |
| 2. Usable Fuel (At 6 Lbs./Gal.) | | | | |
| Standard Tanks (88 Gal. Maximum) . . . . . . . . . | 528 | 24.6 | | |
| Reduced Fuel (65 Gal.) . . . . . . . . . . . . . . . . | | | | |
| 3. Pilot and Front Passenger (Sta. 32 to 50) . . . . . . . . . . | 340 | 12.6 | | |
| 4. Second Row Passengers . . . . . . . . . . . . . . . . . . | 340 | 25.2 | | |
| 5. Baggage (Area "A") or Passenger on Child's Seat (Station 82 to 110) 120 Lbs. Maximum . . . . . . . | 96 | 9.3 | | |
| 6. Baggage - Aft (Area "B") (Station 110 to 134) 80 Lbs. Maximum . . . . . . . . . | | | | |
| 7. RAMP WEIGHT AND MOMENT | 3112 | 136.6 | | |
| 8. Fuel allowance for engine start, taxi and runup . . . . . . . | -12 | -.6 | | |
| 9. TAKEOFF WEIGHT AND MOMENT (Subtract step 8 from step 7) | 3100 | 136.0 | | |
| 10. Locate this point (3100 at 136.0) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable. | | | | |

Figure 6-5. Sample Loading Problem




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

Figure 6-6. Loading Graph

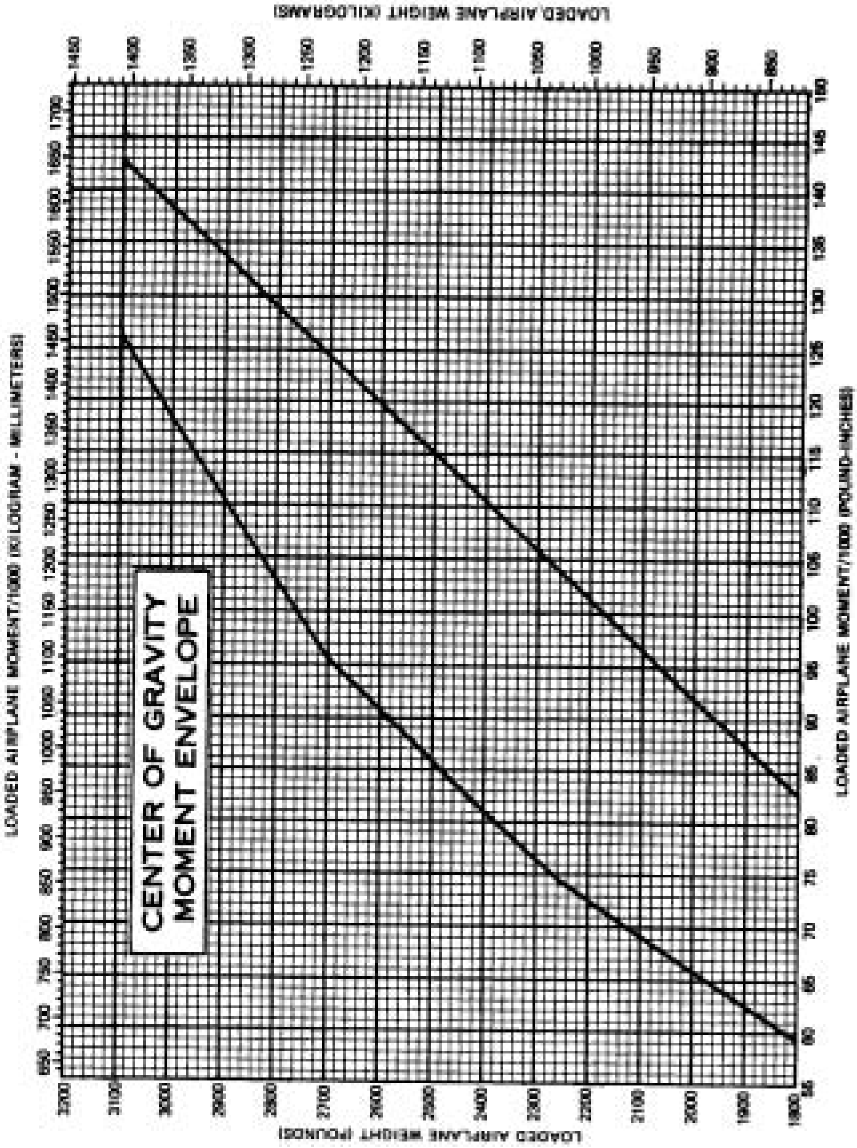



Figure 6-7. Center of Gravity Moment Envelope

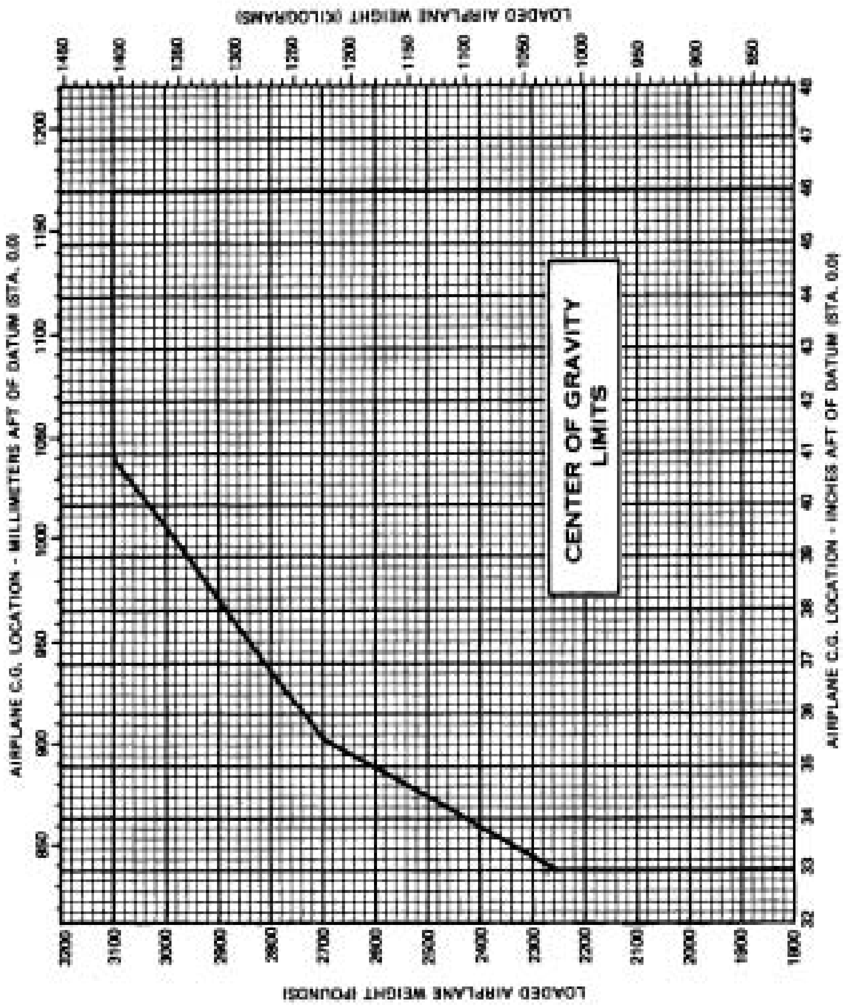



Figure 6-8. Center of Gravity Limits

# EQUIPMENT LIST

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

This equipment list provides the following information:

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

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

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

NOTE

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

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

NOTE

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

NOTE

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

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | A. POWERPLANT & ACCESSORIES | | | |
| A01-R | ENGINE, LYCOMING O-540-J3C5D | 2250000 | 389.0* | -23.0* |
| | -BENDIX MAG NIO (IMPULSE COUPLING) | D6LN-2031 | 11.5 | -6.5 |
| | -CARBURETOR, MARVEL SCHEBLER | TYPE HA-6 | 5.1 | -6.0 |
| | -STARTER, PRESTOLITE 24 VOLT | MHB 4010 | 18.0 | -33.0 |
| | -SPARK PLUGS (SHIELDED | | 2.6 | |
| | -FUEL PUMP (MECHANICAL DRIVE | | 1.7 | -6.5 |
| A05-R | FILTER ASSEMBLY CARBURETOR | C294510-0901 | 0.3 | -4.6 |
| A09-R | ALTERNATOR, 28 VOLT, 60 AMP | C611503-0102 | 10.7 | -6.5 |
| A09-O | ALTERNATOR, 28 VOLT, 95 AMP NET CHANGE | 2201083 | 6.8* | 4.9* |
| | -95 AMP ALTERNATOR | C611503-0101 | 15.3 | -36.5 |
| | -BALLAST (OR EQUIVILANT MOMENT) IS | 2201072 | 1.0 | 230.0 |
| | -REQUIRED WITH 95 AMP ALTERNATOR | | | |
| A17-S | OIL COOLER, REMOTE | 10614B | 4.9 | -6.5 |
| A22-S | OIL FILTER, SPIN-ON | C294500-0102 | 1.1 | -7.5 |
| A33-R | PROPELLER, MCCAULEY (B2D34C218/90DHB-8) | C161008-0109 | 51.8 | -45.6 |
| A33-O | PROPELLER, 3 BLADE MCCAULEY | 2252076 | 72.5* | -37.2* |
| | -PROPELLER, 3 BLADE | C1010 -0301 | 68.5 | -47.0 |
| | -BALLAST (OR EQUIVILANT MOMENT) IS | 22010 -2 | 4.0 | 230.0 |
| | -REQUIRED WITH 3 BLADE PROPELLER | | | |
| A37-R | GOVERNOR, PROPELLER MCCAULEY D290-D3 | C161031-0113 | 3.0 | -36.0 |
| A41-R | SPINNER INSTALLATION, PROPELLER | 2250124 | 3.4* | -46.0* |
| | -SPINNER DOME ASSY | 2250123-1 | 2.1 | -50.5 |
| | -AFT BULKHEAD ASSY | 2250121-1 | 1.0 | -41.8 |
| A4 O | SPINNER INSTALLATION, 3 BLADE PROPELLER | 2252076-1 | 3.4 | -42.0 |
| A6 W | VACUUM SYSTEM, ENGINE DRIVEN | 0706003-2 | 3.1* | -3.9* |
| | -VACUUM PUMP | C431003-0101 | 1.8 | -7.5 |
| | -FILTER ASSEMBLY | 1201075-2 | 0.3 | 11.5 |

| EM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| A70-S | PRIMING SYS. 4-CYL. | - - | 1.7 | -10.0 |
| A73-S | FUEL QUICK DRAIN VALVE | S-1851-5 | 0.2 | -19.0 |
| | B. LANDING GEAR & ACCESSORIES | | | |
| -01 R | WHEEL & TIRE ASSY., BRAKE ASSY * MAIN (2) | 41107 | 37.8* | 57.56 |
| | -WHEEL & TIRE ASSY (EACH SIDE) | C163019B0206 | 15.8 * | 58.06 |
| | WHEEL ASSY. MCCAULEY | C163006-0103 | 3.4 | 58.0 |
| | TIRE 15X6.00X6, 6 PLY | C262006-0101 | 6.2 | 58.0 |
| | TUBE | C262026-0101 | 1.2 | 58.0 |
| | -BRAKE ASSY -RH | C163032-0206 | 3.1 | 55.0 |
| | -BRAKE ASSY. -LH | C163032-0205 | 3.1 | 55.0 |
| 304-R-1 | WHEEL & TIRE ASSY, 5.00X5 NOSE | 1241156-104 | 9.4* | -7.2* |
| | -WHEEL ASSY, CLEVELAND C-77 | 1241156-12 | 5.2 | -7.2 |
| | -TIRE, 6 PLY RATED BLACKWALL | C262003-0202 | 1.4 | -7.2 |
| | -TUBE | C262023-0101 | 1.2 | -7.2 |
| 04 R-2 | WHEEL & TIRE ASSY, 500X5 NOSE GEAR | C16301BB0105 | 10.4* | -7.2* |
| | -WHEEL ASSY | C163005-0201 | 3.8 | -7.2 |
| | -TIRE, 6 PLY RATED BLACKWALL | C262003-0202 | 5.2 | -7.2 |
| | -TUBE | C262023-0101 | 1.4 | -7.2 |
| 04 R-3 | WHEEL & TIRE ASSY, 5.00X5 NOSE GEAR | C16301BB0108 | 10.4 * | -7.2 |
| | -WHEEL ASSY | C163005-0201 | 3.6 | -7.2 |
| | -TIRE, 6 PLY RATED BLACKWALL | C262003-0212 | 5.2 | -7.2 |
| | -TUBE | C262023-0101 | 1.4 | -7.2 |
| B16-R | AXLE, STANDARD DUTY MAIN GEAR (SET OF 2) | 0541124-1 | 1.9 | 58.0 |
| | C. ELECTRICAL SYSTEMS | | | |
| C01-R | BATTERY, 24 VOLT, STANDARD DUTY | C614002-0101 | 23.2 | 130.0 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| C01-R | BATTERY, 24 VOLT, HEAVY DUTY | C614002-010 | 25.2 | 130.0 |
| C04-R | ALTERNATOR CONTROL UNIT (WITH HIGH VOLTAGE PROTECTION AND LOW VOLTAGE SENSING) | C611005-010 | 0.4 | -0.3 |
| C07-A | GROUND SERVICE PLUG RECEPTACLE | 2270017-1 | 2.8 | 136.5 |
| C10-A | ELECTRIC ELEVATOR TRIM INSTL (REQUIRES ALL-PURPOSE CONTROL WHEEL) | 2270028-1 | 4.8* | 164.4* |
| | -DRIVE ASSY | -- | 2.3 | 220.0 |
| | -ACTUATOR ASSY (NET CHANGE) | 1260074-7 | NEGL | -- |
| C19-U | HEATING SYSTEM, PITOT & STALL WARNING SWITCH | 1770724-3 | 0.5 | 26.5 |
| C22 | LIGHTS, INSTRUMENT POST | 2200003 | 0.5 | 17.5 |
| C23 | LIGHTS, PANEL ELECTRO-LUMINESCENT | 0770419 | 2.1 | 16.5 |
| C25 | MAP LIGHT, CONTROL WHEEL MOUNTED (REQUIRES E69-O CHANGE FROM 2260126-1 TO 2260126-2) | 2260126-2 | 0.2 | 22.5 |
| C31-A | LIGHTS, COURTESY (NET CHANGE) | 0700615-11 | 0.5 | 61.7 |
| C34-S | FUEL PUMP, AUXILIARY (ELECTRIC) | C291506-0101 | 1.8 | -1.2 |
| C40-A | DETECTORS, NAVIGATION LIGHT (SET OF 2) | 0701013-1,-2 | NEGL | -- |
| C43-A | OMNI FLASHING BEACON LIGHT | 0701042-3 | 1.6* | 208.6* |
| | -LIGHT ASSY (IN FIN TIP) | C621001-0102 | 0.7 | 253.0 |
| | -FLASHER ASSY (IN FIN TIP) | C594502-0102 | 0.4 | 253.0 |
| | -LOADING RESISTOR | OR95-6 | 0.2 | 212.0 |
| C46-C | STROBE LIGHTS INSTL. (NET CHANGE) | 2201008-7 | 3.5* | 44.4* |
| | -POWER SUPPLY INSTL | 0701018-5 &-6 | 3.4 | 44.4 |
| | -OPT WING TIPS (0723200-26, 27) REPLACES STD TIPS (0723200-14,-15) WHICH INCLUDES LIGHT ASSY (SET OF TWO) | C622006-0107 | 0.4 | 42.0 |
| | -POWER UNIT (SET OF TWO) | C622008-0102 | 2.4 | 46.7 |
| C49-S | LIGHT INSTL, COWL MOUNTED LANDING & TAXI | 2270002 | 1.6* | -28.1 |
| | -LIGHT BULBS (SET OF 2) | 4591 | 1.0 | -37.0 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | D. INSTRUMENTS | | | |
| D01-R | INDICATOR, AIRSPEED | C661064-0223 | 0.6 | 16.0 |
| D01-O | INDICATOR, TRUE AIRSPEED (NET CHANGE) | 1201108-19 | 0.2 | 16.5 |
| D04-A | STATIC ALTERNATE AIR SOURCE | 0701028-1 | 0.3 | 14.4 |
| D07-R | ALTIMETER, SENSITIVE | C661071-0101 | 0.7 | 16.5 |
| D07-O-1 | ALTIMETER, SENSITIVE (FEET & MILLIBARS) | C661071-0102 | 0.7 | 16.5 |
| D07-O-2 | ALTIMETER, SENSITIVE (20 FT. MARKINGS) | C661025-0102 | 0.7 | 16.5 |
| D10-A-1 | ALTIMETER INSTL. SECOND UNIT | 1213681-1 | 0.8 | 16.0 |
| D16-A-1 | ENCODING ALTIMETER INCHES HG. (REQUIRES RELOCATING STD. ALTIMETER) | 1213732 | 3.0 | 14.0 |
| D16-A-2 | ENCODING ALTIMETER, FEET AND MILLIBARS (REQUIRES RELOCATING STANDARD ALTIMETER) | 1213732 | 3.0 | 14.0 |
| D16-A-3 | ALTITUDE ENCODER (BLIND)(DOES NOT REQUIRE PANEL MOUNTING) | 0701099-5 | 1.5 | 13.6 |
| D22-A | GAGE, CARBURETOR AIR TEMPERATURE | 2201005-1 | 1.1 | 16.4 |
| D25-S | ELECTRIC CLOCK | C664508-0102 | 0.4 | 16.6 |
| D25-O | ELECTRIC CLOCK, DIGITAL READOUT | C664511-0101 | 0.4 | 16.6 |
| D28-R | COMPASS, MAGNETIC & MOUNT | 1213679-3 | 1.1 | 20.5 |
| D34-R | INSTRUMENT CLUSTER, ENGINE & FUEL | C669545-0108 | 1.3 | 16.5 |
| D49-A | INDICATOR INSTALLATION, ECONOMY MIXTURE | 0750609-3 | 0.7* | 8.2 * |
| | -EGT INDICATOR | C668501-0211 | 0.4 | 17.1 |
| | -THERMOCOUPLE PROBE | C668501-0204 | 0.1 | -20.5 |
| | -THERMOCOUPLE LEAD WIRE (IC) | C668501-0206 | 0.1 | -0.3 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| D 8-R | GAGE MANIFOLD AND FUEL PRESSURE, 2 NEEDLE | C 62038-0103 | 1.0 | 16.5 |
| D 4-S | GYRO SYSTEM INSTL. (NON AUTO-PILOT)<br>-DIRECTIONAL INDICATOR<br>-ATTITUDE INDICATOR<br>-HOSES, FITTINGS, SCREWS, CLAMPS & ETC. | 0 01030-2<br>C661075-0 1<br>C661076-0 2 | 5.8 *<br>2.5<br>2.0<br>1.3 | 13.6 *<br>14.0<br>14.6<br>11.5 |
| D64- -1 | GYRO SYSTEM FOR NAV-O-MATIC 300A AUTOPILOT<br>-DIRECTIONAL INDICATOR<br>-ATTITUDE INDICATOR | 07U1038<br>40760-0104<br>C661076-0102 | 6.2*<br>2.7<br>2.0 | 13.4*<br>13.4<br>14.6 |
| D64-E-2 | GYRO SYSTEM FOR NON 400B NON SLAVED DG<br>-DIRECTIONAL INDICATOR<br>-ATTITUDE INDICATOR | <br>40760-0104<br>37570-0105 | 6.3*<br>2.T<br>2.3 | 13.4*<br>13.4<br>14.6 |
| D64-O-3 | GYRO SYSTEM FOR NON 400B SLAVED DG<br>-DIRECTIONAL INDICATOR, SLAVED<br>-ATTITUDE INDICATOR | <br>44760-0000<br>37570-0105 | 7.1*<br>3.5<br>2.3 | 13.4*<br>13.4<br>14.6 |
| D6 -R | HOURMETER, INSTALLATION<br>-RECORDING INDICATOR<br>-OIL PRESSURE SWITCH | 2201004-1<br>C664503-0101<br>S1711-1 | 0.6*<br>0.2<br>0.2 | 7.8*<br>16.5<br>-1.0 |
| D82-S | GAGE, OUTSIDE AIR TEMPERATURE | C668507-0101 | 0.1 | 28.5 |
| D85-R | TACHOMETER INSTALLATION, ENGINE<br>-RECORDING TACH INDICATOR | 2200001<br>C668020-010T | 0.9*<br>0.7 | 13.8*<br>16.9 |
| D88-S-1 | INDICATOR, TURN COORDINATOR (28 VOLT ONLY) | C661003-0507 | 1.0 | 15.0 |
| D88-S-2 | INDICATOR, TURN COORDINATOR (10-30 VOLT) | C661003-0506 | 1.0 | 15.0 |
| D88-O-1 | INDICATOR, TURN COORDINATOR (FOR N.O.M.'S) | 42320-0028 | 1.3 | 15.0 |
| D91-S | INDICATOR, RATE OF CLIMB | C661080-010 | 1.0 | 15.4 |
| | E. CABIN ACCOMMODATIONS | | | |
| E03-R | SEAT, ADJUSTABLE FORE & AFT - PILOT | 1214124-13 | 13.0 | 44.0 |

| ITEM NO | EQUIPMENT DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| E05-R | SEAT, ARTICULATING VERT. ADJ. - PILOT | 2214015-15 | 24.0 | 41.5 |
| E07-S | SEAT, ADJUSTABLE FORE & AFT - CO-PILOT | 1214124-15 | 13.0 | 44.0 |
| E07-O | SEAT, ARTICULATING VERT. ADJ. - CO-PILOT | 2214013-14 | 24.0 | 41.5 |
| E09-S | SEAT, 2ND ROW BENCH | 2214004-15 | 23.0 | 80.5 |
| E11-A | SEAT INSTALLATION, CHILDS (NOT FACTORY INSTALLED)<br>-SEAT ASSY, FOLDAWAY (CAP 120 LB MAX)<br>-BELT ASSY, LAP | 2201001<br>0714050<br>S1746-5 | 8.4*<br>6.9<br>0.9 | 103.5*<br>104.4<br>101.1 |
| E15-R | BELT ASSY, LAP (PILOT SEAT) | S2275-103 | 1.0 | 37.0 |
| E15-S | SHOULDER HARNESS ASSY, PILOT | S2275-201 | 0.6 | 37.0 |
| E19-O | INERTIA REEL INSTL., PILOT & CO-PILOT (NET CHANGE) | 0701077-1 | 3.6 | 92.0 |
| E25-S | BELT & SHOULDER HARNESS ASSY, CO-PILOT | S2275-3 | 1.6 | 37.0 |
| E27-S | BELT ASSY, 2ND ROW OCCUPANTS (SET OF 2) | S1746-40 & -41 | 1.6 | 74.5 |
| E27-O | SHOULDER HARNESS INSTL. REAR (EXCHANGE) (S2275-7 HARNESS REPLACES STANDARD BELT, SEE E27-S FOR STANDARD BELTS) | 0701026-5 | 1.8 | 74.5 |
| E35-A-1 | INTERIOR, VINYL SEAT COVERS (NET CHANGE) | CES-1249 | 0.0 | -- |
| E35-A-2 | INTERIOR, LEATHER SEAT COVERS (NET CHANGE) | CES-1249 | 2.0 | 62.3 |
| E35-A-3 | SEAT COVERING-LEATHER & FABRIC | WES-1249 | 1.0 | 62.3 |
| E35-A-4 | INTERIOR, UPHOLSTERY SIDE PANELS LEATHER STYLING (NET CHANGE) | | 1.0 | 65.0 |
| E35-A- | INTERIOR, UPHOLSTERY SIDE PANELS LEATHER AND VINYL OR FABRIC STYLING (NET CHANGE) | | 0.5 | 65.0 |
| E37-O | OPENABLE RH CABIN DOOR WINDOW (NET CHANGE) | 0701065-8 | 2.3 | 47.0 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| E39-A | WINDOWS, OVERHEAD CABIN TOP (NET CHANGE) | 0701017-4 | 0.6 | 45.5 |
| E43-A | VENTILATION SYSTEM, 2ND ROW SEATING | 2201046-1 | 23 | 57.7 |
| E47-A | OXYGEN SYSTEM, INCLUDES MASKS<br>-CYLINDER & REGULATOR, EMPTY<br>-OXYGEN - 48 CU FT @ 1800 PSI<br>-OXYGEN MASKS - PILOT & 3 PASSENGERS | 2201006-7<br>C166001-0601 | 36.0*<br>25.0<br>4.0<br>1.1 | 132.9*<br>143.6<br>143.6<br>61.1 |
| E49-A | CUP HOLDER, RETRACTABLE (SET OF 2) | 1201124-2 & -3 | 0.1 | 16.0 |
| E50-A | HEADREST, 1ST ROW (INSTALLED ARM) (EACH) | 1215073-1 | 0.9 | 47.0 |
| E51-A | HEADREST, 2ND ROW (INSTALLED ARM) (EACH) | 1215073-1 | 0.9 | 87.0 |
| E55-S | SUN VISORS (SET OF 2) | 0514166 | 32 | 33.0 |
| E59-A | APPROACH PLATE HOLDER | 0715083-1 | 0.1 | 27.5 |
| E65-S | BAGGAGE TIE DOWN NET | 1215171-1 | 0.5 | 122.0 |
| E75-A | STRETCHER PORTABLE (AVAILABLE FROM DEALER ONLY) (USE ACTUAL INSTALLED WT & ARM) | 0700164 | - - | - - |
| E85-A | CONTROLS INSTALLATION, DUAL (CO-PILOT) | 0760101-7 | 6.7 | 14.1 |
| E86-A | CABIN AIRCONDITIONING SYSTEM<br>-COMPRESSOR ASSEMBLY (SANYO)<br>-CONDENSOR (ARA)<br>-EVAPORATOR & BLOWER ASSY (ARA) | 2201020<br>C413001-0101<br>0519158<br>0507574 | 68.9*<br>18.4<br>53<br>9.1 | 52.0*<br>-37.1<br>120.2<br>124.0 |
| E89-O | CONTROL WHEEL - ALL PURPOSE (EXCHANGE) PILOT ONLY, INCLUDES MIC SWITCH AND PANEL MOUNTED AUX MIC JACK WITH WIRING AND CHANGES 2260126-1 CONTROL WHEEL TO 2260126-2 CONTROL WHEEL | 2260126-2 | 0.2 | 22.5 |
| E93-R | HEATING SYSTEM, CABIN & CARBURETOR AIR | - - | 13.5 | -4.8 |
| | F. PLACARDS, WARNINGS & MANUALS | | | |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| F01-R | PLACARD, OPERATIONAL LIMITATIONS-VFR DAY | 0505087-7 | NEGL | - - |
| F01-O-1 | PLACARD, OPERATIONAL LIMITATIONS-VFR DAY-NIGHT | 0505087-8 | NEGL | - - |
| F01-O-2 | PLACARD, OPERATIONAL LIMITATIONS VFR-IFR/DAY-NIGHT | 0505087-9 | NEGL | - - |
| F04-R | INDICATOR, STALL WARNING UNIT (USES RADIO SPEAKER FOR AUDIBLE TONE) | 1270733-1 | 0.3 | 45.0 |
| F10-S | CHECK LIST, PILOTS (STOWED | 66070 | NEGL | - - |
| F16-R | PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL, STOWED | D1198-13PH | 1.3 | - - |
| | G. AUXILIARY EQUIPMENT | | | |
| G01-A | TAILCONE LIFT HANDLES (SET OF 2) | 2201009 | 1.0 | 186.5 |
| G07-A | HOISTING RINGS (DEALER INSTALLED) | 0700612-1 | 1.5 | 45.6 |
| G10-S | FUEL SAMPLER CUP (STOWED ITEM) | S-2107-1 | 0.1 | - - |
| G13-A | CORROSION PROOFING, INTERNAL | 0760007-2 | 7.1 | 70.0 |
| G16-A | STATIC DISCHARGERS (SET OF 10) | 1201131-2 | 0.4 | 130.5 |
| G19-A | STABILIZER ABRASION BOOTS | 0500041-5 | 2.7 | 206.0 |
| G22-O | TOWBAR, AIRCRAFT, TELESCOPING HANDLE | 0700315 | 2.0 | 97.0 |
| G25-S | PAINT, OVERALL COVER-EXTERIOR<br>-OVERALL BASE COLOR (102773 SQ IN)<br>-COLORED STRIPE | 2204004 | 13.0*<br>12.1<br>0.5 | 91.9*<br>91.5<br>82.1 |
| G28-A | JACK PADS (UNDERSIDE OF WING)(SET OF 2) INSTALLED ARM SHOWN (NORMALLY STOWED) | 1200031 | 0.2 | 37.0 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| G31-A | CABLES, CORROSION RESISTANT (NET CHANGE) | 0760007-2 | 0.0 | - - |
| G55-A-1 | FIRE EXTINGUISHER, HAND TYPE (FOR USE WITH STANDARD PILOT SEAT) | 0001014-1 | 4.8 | 35.0 |
| G55-A-2 | FIRE EXTINGUISHER, HAND TYPE (FOR USE WITH VERTICAL L' ADJUSTING PILOT SEAT) | 0701014-2 | 5.0 | 29.0 |
| G58-A | REFUELING STEP & HANDLE (BOTH SIDES) | 0701127-1 | 1.8 | 15.3 |
| G61-A | WRITING TABLE | 1715072-1 | 3.6 | 61.5 |
| G67-A | RUDDER PEDAL EXTENSIONS (DEALER INSTL.) | 0701048-1 | 2.3 | 8.0 |
| G89-A | WINTERIZATION KIT, ENGINE | 2201012-1 | 0.3* | -40.0 |
| | H. AVIONICS & AUTOPILOTS | | | |
| H01-A-1 | CESSNA 300 ADF WITH BFO | 3910159-20 | 6.6* | 22.4 * |
| | -RECEIVER R-546E | 41240-0001 | 2.3 | 13.0 |
| | -INDICATOR (IN-346A) | 40980-1001 | 0.9 | 15.5 |
| | -LOOP ANTENNA | 41000-1000 | 1.4 | 32.6 |
| | -RECEIVER MOUNT | 40900-0000 | 0.5 | 13.0 |
| | -SENSE ANTENNA | 3960140-1 | 0.3 | 112.2 |
| H01-A-2 | CESSNA 400 ADF WITH BFO | 3910160-19 | 7.5 * | 21.2 * |
| | -ADF RECEIVER WITH | 43090-1028 | 3.3 | 13.0 |
| | -INDICATOR (IN-346A) | 40980-1001 | 0.9 | 15.5 |
| | -ADF LOOP ANTENNA | 41000-1000 | 1.4 | 32.2 |
| | -ADF SENSE ANTENNA | 3960140-1 | 0.3 | 112.2 |
| | -MOUNT & INSTALLATION ITEMS | | 2.6 | 17.0 |
| H03-A | AM/FM STEREO RECEIVER & CASSETTE PLAYER | 3910209-2 | 5.5 * | 32.8* |
| | -HEADSET (SET OF 2, 4 MAY BE USED) | C596532-0101 | 2.2 | 17.5 |
| | -STEREO RECEIVER INSTALLATION | 393019* | 2.3 | 13.5 |
| | -ANTENNA, WIRING & MISC. ITEMS | | 1.2 | 96.6 |
| H04-A-1 | DME INSTL. NARCO DME 190 | 3910160-11 | 4.4* | 27.0 * |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | -TRANSCEIVER & MOUNT | 3312 406 | 5.2 | 12.0 |
| | -ANTENNA INSTL. | 3960 33 | 0.2 | 188.0 |
| | -WIRING, COOLING TUBING & MISC ITEMS | - - | 1.0 | 72.9 |
| H04 A-2 | CESSNA 400 DME INSTL | 3910167-18 | 16.1* | 105.1* |
| | -RECEIVER-TRANSMITTER (REMOTE MOUNTED) | 44000 | 9.0 | 132.4 |
| | MOUNT | 44086 | 0.8 | 132.4 |
| | -ANTENNA INSTL | 3960134-1 | 0.2 | 188.0 |
| | -CONTROL UNIT | 44020-1100 | 1.5 | 12.0 |
| | MOUNTING CLAMP | 41038-0000 | 0.1 | 16.5 |
| | -WIRING & MISC ITEMS | - - | 5.2 | 83.9 |
| H04-A-3 | COLLINS DME 451 | | 10.0* | 97.9* |
| | -RECEIVER/TRANSMITTER, TCR-451 | 622-3670-001 | 5.3 | 132.4 |
| | -INDICATOR/CONTROL, IND-450C | 622-3588-001 | 0.9 | 14.0 |
| | -ANTENNA, ANT-451 | 622-4011-001 | 0.2 | 188.0 |
| H05 A-1 | CESSNA 400 R-NAV INSTL. | 3910168-1 | 4.1* | 11.9* |
| | -COMPUTER (R-478A) | 44100-0100 | 3.8 | 12.5 |
| | -MOUNT | 44091-0000 | 0.3 | 12.5 |
| | -INDICATOR INSTALLATION, 43910-1000 IND. | 3930182-8 | -0.5 | 15.5 |
| | REPLACES REGULAR 300 OR 400 IND. | - - | -.- | -.- |
| | -CABLE INSTALLATION | 3950136 | 0.4 | 10.0 |
| H05-A-2 | FOSTER R-NAV INSTALLATION (W/CESSNA 400 OR NARCO 190 DME | 3910203 | 3.4* | 12.2* |
| | -R-NAV RECEIVER-INDICATOR (511) | | 2.4 | 12.5 |
| H05-A-3 | COLLINS R-NAV, ANS-351C | 622-5579-001 | 4.3 | 12.3 |
| H07-A | CESSNA 400 GLIDESLOPE | 3910157-11 | 5.1 * | 107.2 * |
| | -RECEIVER R-443B | 42100-0000 | 2.1 | 132.1 |
| | -MOUNT | 36450-0000 | 0.2 | 132.1 |
| | -VOR/ILS INDICATOR IN-386A (EXCHANGE) (ACTUAL WT IS 1.7 LB) | 46860-2000 | 0.2 | 15.5 |
| | -ANTENNA (MOUNTED ON UPPER WINDSHIELD) | 1200098-1 | 0.2 | 26.1 |
| | -WIRING | 3950136 | 2.4 | 89.1 |
| H08-A-1 | AUTO RADIAL CENTERING INDICATOR ARC/LOC EXCHANGE FOR VOR/LOC IN ITEM H2 A (WT NET CHANGE) | 3910196-1 | 0.2 * | 15.5* |
| | -ARC/LOC INDICATOR ADDED | 46860-1200 | 1.8 | 15.5 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | -VOR/LOC INDICATOR DELETED | 46860-1000 | -1.6 | 15.5 |
| H08-A-2 | AUTO RADIAL CENTERING INDICATOR ARC/ILS EXCHANGE FOR VOR/ILS, USED WITH H07-A ONLY (WT NET CHANGE) | 3910196-2 | 0.2* | 15.5* |
| | -ARC/ILS INDICATOR ADDED | 46860-2200 | 1.9 | 15.5 |
| | -VOR/ILS INDICATOR DELETEC | 46860-2000 | -1.7 | 15.5 |
| H09-A-1 | HSI NON-SLAVED INDICATOR INSTALLATION WITH DIRECTIONAL AND NAV INDICATORS NET CHANGE | | 3.2* | 96.7* |
| | -HSI INDICATOR IG-832C | 44690-2000 | 4.4 | 13.0 |
| | -HSI VOR CONVERTER INSTALLATION | | 1.1 | 165.7 |
| | -CONVERTER CABLE | | 2.1 | 64.4 |
| | -N.D.M. DIRECTIONAL IND. DELETED | | -2.7 | 13.4 |
| | -VOR/ILS INDICATOR DELETED | | -1.7 | 15.5 |
| H09-A-2 | HSI SLAVED INDICATOR INSTALLATION WITH DIRECTIONAL AND NAV INDICATORS NET CHANGE | | 6.3* | 86.9* |
| | -HSI INDICATOR (SLAVED) IG-832B | 44690-0000 | 4.9 | 13.0 |
| | -VOR/ILS CONVERTER INSTALLATION | | 1.1 | 165.7 |
| | -SLAVING SYSTEM | | 3.1 | 76.6 |
| | -N.D.M. DIRECTIONAL INDICATOR DELETE | | -2.7 | 13.4 |
| | -VOR/ILS INDICATOR DELETED | | -1.7 | 15.5 |
| H11-A | SUNAIR ASB-125 SINGLE SIDE BAND HF XCVR | 3910158-39 | 24.7* | 97.3* |
| | -TRANSCEIVER ASB-125 | 99681 | 5.3 | 12.5 |
| | -POWER SUPPLY PA1010A | 99683 | 8.5 | 128.3 |
| | -POWER SUPPLY MOUNT | 99916 | 0.4 | 128.3 |
| | -ANTENNA COUPLER CU-110 | 99816 | 4.9 | 145.0 |
| | -ANTENNA COUPLER SUPPORTS | 2270006-1,-2 | 0.2 | 148.0 |
| | -ANTENNA INSTALLATION | 3960117-1 | 0.3 | 152.1 |
| | -WIRING | 3950136 | 5.1 | 80.3 |
| H13-A | CESSNA 400 MARKER BEACON | 3910164-26 | 2.8* | 93.5* |
| | -RECEIVER (R-402A) | 42410-5128 | 0.7 | 11.5 |
| | -ANTENNA INSTL. | 3960126-1 | 1.0 | 178.6 |
| H16-A-1 | CESSNA 300 TRANSPONDER | 3910127-28 | 3.9* | 16.1* |
| | -TRANSCEIVER (RT-359A) | 41420-0328 | 27 | 12.5 |
| | -MOUNT BOX | | C.3 | 12.5 |
| | -ANTENNA | 3960136-1 | 0.2 | 58.8 |
| | -WIRING, COOLING TUBING & MISC ITEMS | - - | 0.6 | 20.3 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| H16-A-2 | CESSNA 400 TRANSPONDER (SAME AS H16-A-1 EXCEPT 3930126-16 RT-459A XCVR INSTL REPLACES 3930132-15 NEGL CHNG) | 3910128-25 | 9+ | 16.1* |
| H22-A-1 | FIRST 300 NAV/COM, 720 CHANNEL COM VOR/LOC REQUIRES H34-A FOR FIRST UNIT AND H37-A FOR SECOND UNIT INSTALLATION | 3910183-20 | 8.0 * | 12.8* |
| | -RECEIVER-TRANSCEIVER (RT-385A) | 46660-1000 | 5.5 | 12.5 |
| | -VOR/LOC INDICATOR (IN-385A) | 46860-1000 | .6 | 15.5 |
| | -MOUNT, COOLING TUBE & MISC ITEMS | | 0.9 | 9.7 |
| H22-A-2 | CESSNA 400 NAV/COM WITH 300 SERIES INDICATOR: REQUIRES H34-A FOR FIRST UNIT AND H37-A FOR SECOND UNIT INSTALLATION | 3910189 | 8.0* | 12.8* |
| | -RECEIVER-TRANSCEIVER (RT-485A) | 47360-1000 | 5.5 | 12.5 |
| | -VOR/LOC INDICATOR (IN-385A) | 46860-1000 | 1.6 | 15.5 |
| | -MOUNT, COOLING TUBE & MISC ITEMS | | 0.9 | 9.7 |
| H28-A- | EMERGENCY LOCATOR TRANSMITTER | 0470419-27 | 3.5 * | 152.2* |
| | -TRANSMITTER ASSY (D & M DMELT-6- ) | C589511-0117 | 3.3 | 151.5 |
| | -ANTENNA | C589511-0109 | 0.1 | 168.0 |
| H28-A-2 | EMERGENCY LOCATOR TRANSMITTER (USED IN CANADA) | 0470419-28 | 3.5* | 152.2* |
| | -TRANSMITTER ASSY (D & M DMELT-6-1C) | C589511-0113 | 3.3 | 151.5 |
| | -ANTENNA | C589511-0105 | 0.1 | 168.0 |
| H31-A-1 | NAV-O-MATIC 200A INSTALLATION (AF-295B) | 3910162-24 | 8.8 * | 49.4* |
| | -CONTROLLER-AMPLIFIER | 43610-1202 | 1.1 | 13.5 |
| | -TURN COORDINATOR (D88-0-1) NET CHANGE | 42320-0028 | 0.3 | 15.5 |
| | -WING SERVO INSTALLATION | 0700215 | 5.4 | 69.8 |
| H31-A-2 | NAV-O-MATIC 300A INSTALLATION (AF-395-A) | 3910163-24 | 9.5* | 47.8 * |
| | -CONTROLLER-AMPLIFIER (C-395A) | 42660-1202 | 1.4 | 13.5 |
| | -GYRO INSTALLATION, NET CHANGE (ITEM D64-0-1 REPLACES ITEM D64-5) | 0701038-1 | 0.4 | 10.5 |
| | -TURN COORDINATOR (D88-0-1) NET CHANGE | 42320-0028 | 0.3 | 15.5 |
| | -WING SERVO INSTALLATION | 0700215-4 | 5.4 | 69.8 |
| H31-A-3 | NAV-O-MATIC 300A W/NON SLAVED HSI | 3910195-5 | 12.5* | 61.0* |
| | -CONTROLLER-AMPLIFIER (TYPE C-395A) | 42660-2202 | 1.4 | 15.5 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | -H09-A-1 NON-SLAVED HSI INSTALLATION | -- | 3.2 | 96.7 |
| | -D85-1 TURN COORDINATOR NET CHANGE | 42320-0028 | 0.3 | 15.5 |
| | -WING SERVO INSTALLATION | 0700215 | 5.4 | 69.8 |
| | -MISC ITEMS | 42320-002 | 2.2 | 22.6 |
| H31-A-4 | CESSNA 400B AUTOPILOT WITH HSI INSTL. | 3910212 | - | - |
| | -WITH NON-SLAVED HSI | | 41.8* | 106.3* |
| | -WITH SLAVED HSI | | 47.8* | 101.6* |
| | -CONTROLLER C-550A | 37960-1128 | 1.5 | 15.0 |
| | -AILERON ROLL ACTUATOR PA-495A-2 | 43989-4801 | 4.2 | 68.0 |
| | -PITCH ACTUATOR PA-495A-2 | 45850-3913 | 4.2 | 157.4 |
| | -ELEVATOR TRIM ACTUATOR TA-495A | -- | 2.3 | 220.0 |
| | -AUTOPILOT ACCESSORY UNIT | | 1.0 | 14.0 |
| | -H09-A-1 NON-SLAVED HSI INSTALLATION | | 3.2 | 96.7 |
| | -H09-A-2 SLAVED HSI INSTALLATION | 46 90-0000 | 6.3 | 86.9 |
| | -BATTERY CHANGE TO HEAVY DUTY BATTERY | | 2.0 | 130.0 |
| | -SLAVING SYSTEM | | 3.1 | 76.6 |
| | -COMPUTER-AMPLIFIER | 42 80-0009 | 5.8 | 151.4 |
| | -MISC ITEMS, CABLES & HARDWARE | -- | 7.6 | 85.6 |
| H31-A-5 | CESSNA 400B AUTOPILOT | 3902 12 | | |
| | -WITH NON-SLAVED DIRECTIONAL INDICATOR | | 39.0* | 114.0 * |
| | -WITH SLAVED DIRECTIONAL INDICATOR | | 42.2* | 111.0 |
| | -CONTROLLER | 79 60-1128 | 1.5 | 15.0 |
| | -PITCH ACTUATOR PA-495A-2 | 58 50-3913 | 4.2 | 157.4 |
| | -ROLL ACTUATOR PA-495A-2 | 39 89-4801 | 4.2 | 68.0 |
| | -PITCH TRIM ACTUATOR TA-495A | | 2.3 | 220.0 |
| | -COMPUTER | 26 90-0007 | 5.8 | 151.4 |
| | -D64-D-2 GYROS FOR NON 400B NON SLAVED | | 6.3 | 13.4 |
| | -D64-D-3 GYROS FOR SLAVED D.G. | | 7.1 | 13.4 |
| | -SLAVING SYSTEM FOR SLAVED D.G. | | 3.1 | 76.6 |
| | -C01-D HEAVY DUTY BATTERY NET CHANGE | | 2.0 | 130.0 |
| | -D64-S STANDARD GYROS DELETED | | -5.8 | 13.6 |
| | -MISC ITEMS | | 16.5 | 98.8 |
| H33-A | INTERCOM INSTALLATION | 3910210 | 2.9 * | 15.0* |
| | (REQUIRES E85-A DUAL CONTROLS INSTL.) | | | |
| | -JACK INSTALLATION FOR MICROPHONE | 3970150 | 0.3 | 18.0 |
| | -H55-A-2 HEADPHONE-MIKE SET, 2 INCLUDED | C596531-0101 | 2.2 | 14.0 |
| | -INTERCOM P/C BOARD ASSY | 3970149 | 0.1 | 14.0 |
| H34-A | BASIC AVIONICS KIT INSTALLED AND AVAILABLE | 3910186-14 | 7.2 * | 53 * |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | ONLY WITH 1ST OPERATING NAV/COM) | | | |
| | -BUS BAR ASSY | 3930178-14 | 0.1 | 22.0 |
| | -NOISE FILTER INSTL | 3940148-2 | 0.1 | -32.5 |
| | -OMNI ANTENNA INSTL | 3960142-6 | 0.6 | 250.6 |
| | -VHF ANTENYA INST | 3910113-2 | 0.5 | 63.4 |
| | -AUDIO CONTROL PANEL INSTL | 3970152 | 1.9 | 12.5 |
| | -HEADSET INSTL | 3970137-2 | 0.3 | 14.7 |
| | -MICROPHONE INSTL. | 3970139-1 | 0.3 | 18.5 |
| | -ANTENNA ADAPTOR | 3960139-1 | 0.1 | 6.0 |
| | -FIRST NAV/COM INSTL. COMPONENTS | 3930186-6 | 0.1 | 14.6 |
| | -CABLE INSTL., RH COM & OMNI ANTENNAS | 3950136 | 1.7 | 94.7 |
| | -RADIO COOLING | 3930216 | 1.5 | 6.0 |
| H37-A | COM. ANTENNA & NAV COUPLER KIT (REQUIRED FOR & AVAILABLE ONLY WITH SECOND NAV/COM) | 3910185-12 | 1.0* | 39.3* |
| | -2ND NAV/COM INSTL. KIT | 3930186-7 | 0.2 | 14.6 |
| | -LH VHF COM ANTENNA INSTL. | 3960113-1 | 0.5 | 63.4 |
| | -NAV ANTENNA CCUPLER INSTALLATION | 3960111-8 | 0.2 | 1.6 |
| | -CABLE INSTL., COM ANTENNA | 3950136-29 | 0.3 | 22.0 |
| | -ANTENNA ADAPTOR REMOVED | 3960139-1 | -0.1 | 3.0 |
| H43-A-1 | NAV-O-MATIC 200A PARTIAL INSTL (NOT AVAILABLE WITH FACTORY INSTALLED NAV/COM'S) | 3910154-111 | 8.8* | 49.4* |
| | -CONTROLLER-AMPLIFIER | 43610-1202 | 11 | 13.5 |
| | -TURN COORDINATOR (D88-O-1)(NET CHANGE) | 42320-0028 | 0.3 | 15.5 |
| | -WING SEKVO INSTALLATION | 0700215 | 5.4 | 69.8 |
| H43-A-2 | NAV-O-MATIC 300A PARTIAL INSTL (NOT AVAILABLE WITH FACTORY INSTALLED NAV/COM'S) | 3910154-122 | 9.5* | 47.8* |
| | -CONTROLLER-AMPLIFIER (C-395A) | 42660-1202 | 1.4 | 13.5 |
| | -GYRO INSTALLATION, NET CHANGE (ITEM D64-O-1 REPLACES ITEM D64-S) | 0701036-1 | 0.4 | 10.5 |
| | -TURN COORDINATOR (D88-O-1)(NET CHANGE) | 42320-0028 | 0.3 | 15.5 |
| | -WING SERVO INSTALLATION | 0700215 | 5.4 | 69.8 |
| H43-A-3 | NAV-O-MATIC 400B PARTIAL INSTL | 3910154-140 | 39.0* | 114.0* |
| | -CONTROLLER | 37960-1128 | 1.5 | 15.0 |
| | -PITCH ACTUATOR ASSEMBLY | 45850-3913 | 4.2 | 157.4 |
| | -ROLL ACTUATOR ASSEMBLY | 43989-4801 | 4.2 | 68.0 |
| | -ELEVATOR TRIM ACTUATOR ASSEMBLY | -- | 2.3 | 220.0 |
| | -HEAVY DUTY BATTERY NET CHANGE | -- | 2.0 | 130.0 |

| ITEM NO | EQUIPMENT LIST DESCRIPTION | REF DRAWING | WT LBS | ARM INS |
|---|---|---|---|---|
| | -COMPUTER-AMPLIFIER | 42680-0009 | 5.8 | 151.4 |
| | -MISC ITEMS INCL. CABLES & HARDWARE | | 19.0 | 96.5 |
| H46-A | ADF ANTI PRECIP SENSE ANTENNA | 3960116-6 | 0.8 | 141.8 |
| H55-A-1 | HEADSET-MICROPHONE, LIGHT WEIGH7 | C596533-0101 | G.3 | 14.0 |
| H55-A-2 | HEADSET-MICROPHONE, PADDED (STOWED) | C596531-0101 | 11 | 14.0 |
| H56-A | HEADSET FOR STEREO, REAR SEAT (2) | C596532-0101 | 2.2 | 50.0 |
| H61-R | CABIN SPEAKER (REQUIRED AS PART OF STALL WARNING SYS.) | C596510-0101 | 1.9 | 45.1 |
| H64-A | NAV/COM PARTIAL INSTL A (FOR EXPORT ONLY) | 3910206-13 | 4.7* | 72.8* |
| | -RADIO COOLING PARTIAL | 3930216 | 1.5 | 6.0 |
| | -OMNI ANTENNA CABLE ASSEMBLY | 3950136-5 | 11 | 127.4 |
| | -COM ANTENNA CABLE INSTL RH SIDE | 3950136-28 | 0.6 | 22.0 |
| | -COM ANTENNA INSTL, RH | 3960113-2 | 0.5 | 63.4 |
| | -OMNI ANTENNA INSTL. | 3960142-6 | 0.6 | 250.6 |
| | -HEADPHONE INSTALLATION | 3970137-2 | 0.3 | 14.6 |
| | -MICROPHONE INSTALLATION | 3970139-1 | 0.3 | 18.5 |
| H67-A | NAV/COM PARTIAL B INSTL FOR DUAL NAV/COMS (FOR EXPORT AIRCRAFT ONLY) | 3910206-14 | 6.0* | 64.7* |
| | -PARTIAL OPTION A | 3910206-13 | 4.7 | 72.8 |
| | -COM ANTENNA CABLE INSTL LH SIDE | 3950136-29 | 0.6 | 22.0 |
| | -ANTENNA COUPLER ASSEMBLY FOR NAV. | 3960111-8 | 0.2 | 1.6 |
| | -COM ANTENNA INSTL LH SIDE | 3960113-1 | 0.5 | 63.4 |
| H70-A | REMOTE TRANSPONDER IDENT SWITCH & HIKING | 3910205 | 0.2 | 17.0 |
| | J. SPECIAL OPTION PACKAGES | | | |
| J01-A | SKYLANE RG II KIT | 2200001 | 51.9* | 50.7* |
| | -C07-A GROUND SERVICE RECEPTACLE | 2270017-1 | 2.8 | 136.5 |
| | -C19-C HEATED PITOT & STILL WARNING | 0770724-7 | 0.5 | 26.5 |
| | -C31-A COURTESY ENTRANCE LIGHTS (2) | 0700615-11 | 0.5 | 61.7 |
| | -C40-A NAV LIGHT DETECTORS (2) | 0701013-1 &-2 | NEGL | -- |

| ITEM NO | IPMENT IST SCRI T IO N | E DR IN | WT | A |
|---|---|---|---|---|
| | -C43-A FLASWING BEACON LIGT | 0701042-3 | 1.8 | 208.6 |
| | -D01-O TRUE AIRSPEED IND.IN ET CHANGE | 1201108-19 | 0.2 | 16.5 |
| | -D04-A STATIC ALTERNATE AR SOURC | 0701028-1 | 0.3 | 14.4 |
| | -D49-A E.G.T. INDICATOR | 0750609-3 | 0.7 | 8.2 |
| | -E85-A DUAL CONTROLS | 0760101-9 | 6.7 | 14.1 |
| | -G16-A STATIC DISCHARGERS (SET OF 10) | 1201131-2 | 0.4 | 130.5 |
| | -H01-A-1 CESSNA 300 ADF (R-546E) | 3910159-20 | 6.6 | 22.4 |
| | -H16-A-1 CESSNA 300 TRANSPONDER RT-359a | 3910127-28 | 3.9 | 16.1 |
| | -H22-A-1 NAV/COM, 1ST UNIT (RT-385A) | 3910183-20 | 8.0 | 12.8 |
| | -H28-A-1 EMERGENCY LOCATOR TRANSMITTER | 0470419-27 | 3.5 | 152.2 |
| | -H31-A-1 CESSNA 200A AUTOPILOT | 3910162-24 | 8.8 | 49.4 |
| | -H34-A BASIC AVIONICS PACKAGE | 3910186-14 | 7.2 | 53.7 |
| J04-a | NAV-PAC (SKYLANE R II ONLY) (NET CHANGE) | | 16.9 * | 56.2* |
| | -H07-A 400 GL ESLOPE (R-443B) | 3910157-11 | 5.1 | 107.2 |
| | -H13-A 400 MA ER BEACON (R-402A) | 3910164-26 | 2.8 | 93.5 |
| | -H22-A-1 2ND UN 300 NAV/COM RT-385A | 3910183-20 | 8.0 | 12.8 |
| | -H37-A ANTENN & COUPLER KIT | 3910185-12 | 1.0 | 39.3 |

# SECTION 7
# AIRPLANE & SYSTEMS DESCRIPTIONS

## TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)

Page

# INTRODUCTION

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

# AIRFRAME

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

The construction of the fuselage is a conventional formed sheet metal bulkhead, stringer, and skin design referred to as semimonocoque. Major items of structure are the front and rear carry-through spars to which the wings are attached, a bulkhead with attaching plates at the base of the forward doorposts for the lower attachment of the wing struts, and the forgings and structure for the retractable main landing gear in the lower aft portion of the fuselage center section. Four engine mount stringers are also attached to the forward doorposts and extend forward to the firewall. A tunnel incorporated into the fuselage structure below the engine, in front of the firewall, is required for the forward retracting nose wheel.

The externally braced wings, containing the fuel tanks, are constructed of a front and rear spar with formed sheet metal ribs, doublers, and stringers. The entire structure is covered with aluminum skin. The front spars are equipped with wing-to-fuselage and wing-to-strut attach fittings. The aft spars are equipped with wing-to-fuselage attach fittings, and are partial-span spars. Conventional hinged ailerons and single-slot type flaps are attached to the trailing edge of the wings. The ailerons are constructed of a forward spar containing balance weights, formed sheet metal ribs and "V" type corrugated aluminum skin joined together at the trailing edge. The flaps are constructed basically the same as the ailerons, with the exception of balance weights and the addition of a formed sheet metal leading edge section.

The empennage (tail assembly) consists of a conventional vertical stabilizer, rudder, horizontal stabilizer, and elevator. The vertical stabilizer consists of a forward and aft spar, formed sheet metal ribs and reinforcements, four skin panels, formed leading edge skins, and a dorsal. The rudder is constructed of a forward and aft spar, formed sheet metal ribs and reinforcements, and a wrap-around skin panel. The top of the rudder incorporates a leading edge extension which-contains a balance weight. The horizontal stabilizer is constructed of a forward and aft spar, ribs and

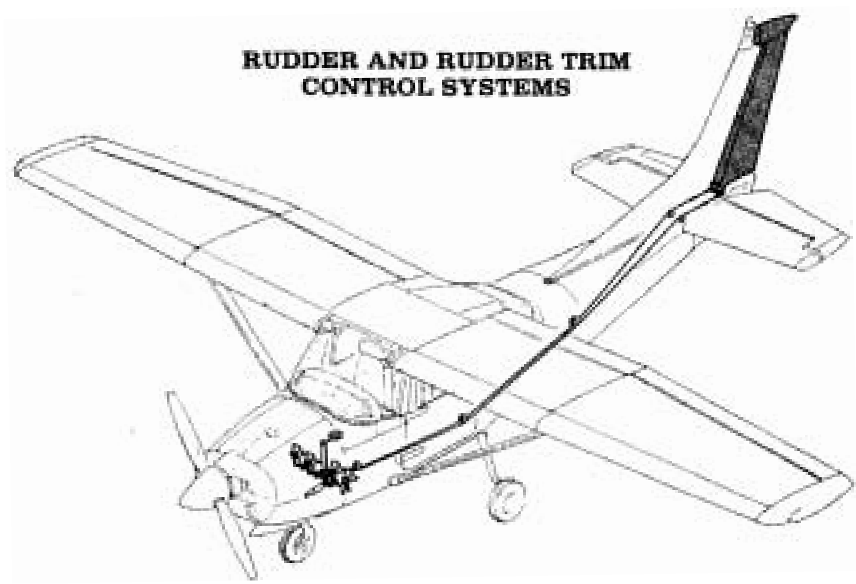




Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)

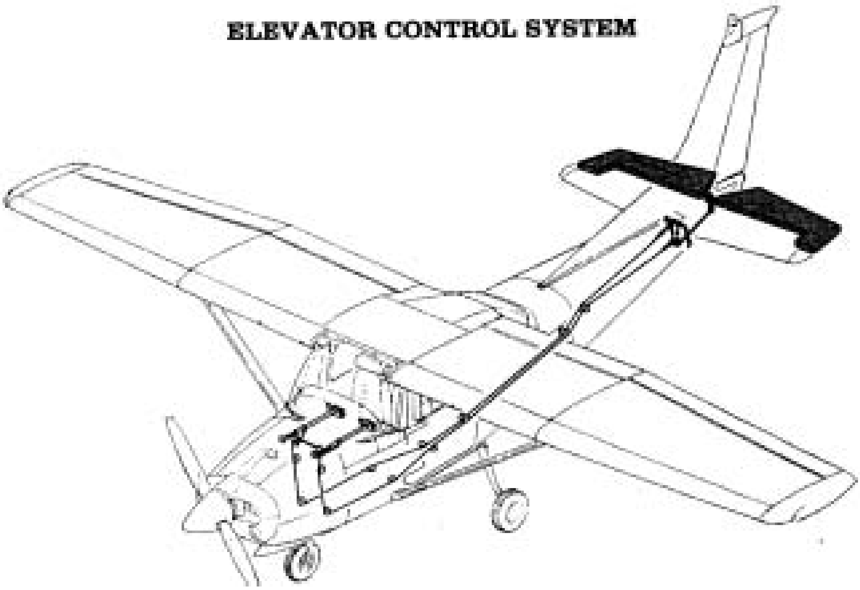




Figure 7-1. Flight Control and Trim Systems (Sheet 2 of 2)

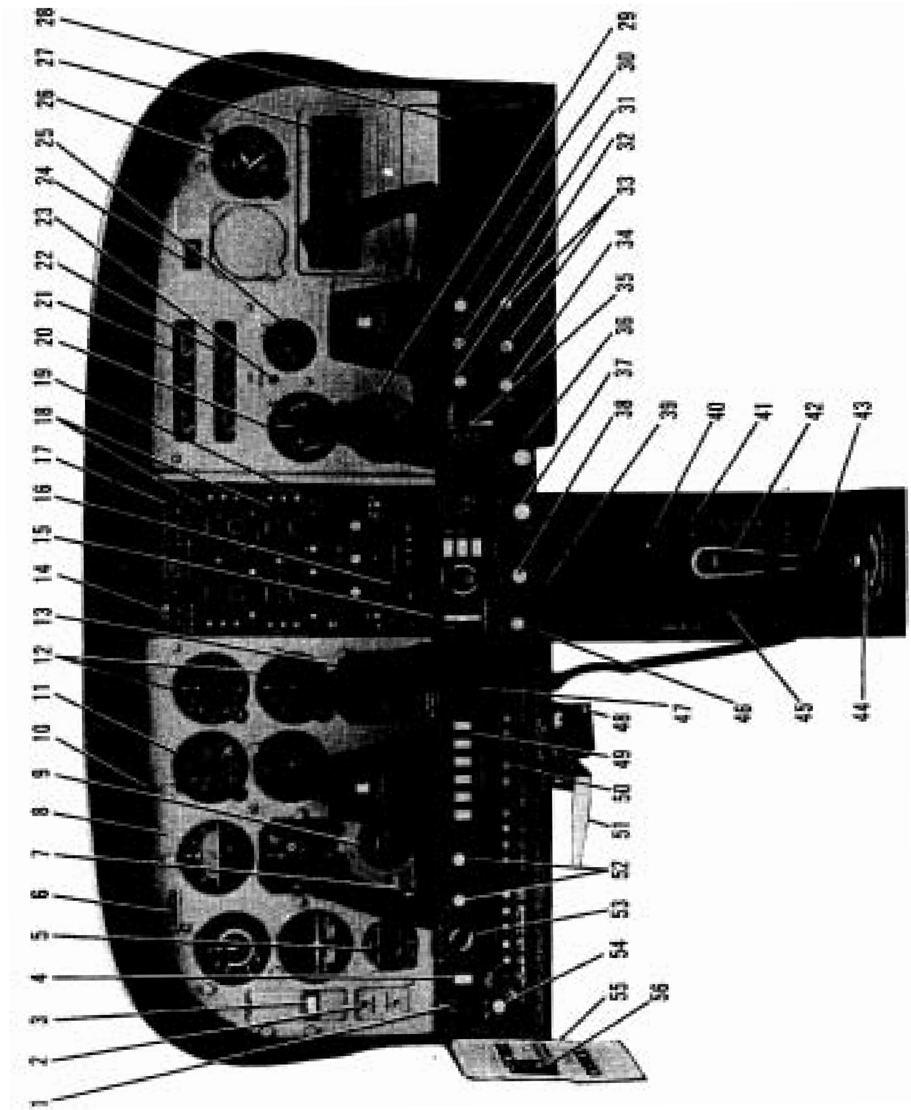



**Figure 7-2. Instrument Panel (Sheet 1 of 2)**

1. Master Switch
2. Phone and Auxiliary Mike Jacks
3. Pitot Heat Switch
4. Auxiliary Fuel Pump Switch
5. Digital Clock
6. Airplane Registration Number
7. Suction Gage
8. Flight Instrument Group
9. Carburetor Air Temperature Gage
10. Map Light and Switch
11. Encoding Altimeter
12. ADF Bearing and NAV 2 Course Deviation Indicators
13. DME
14. Marker Beacon Indicator Lights and Switches
15. Autopilot Control Unit
16. Transponder
17. Audio Control Panel
18. NAV/COM Radios
19. ADF Radio
20. Manifold Pressure Gage/ Fuel Pressure Gage
21. Fuel Quantity Indicators and Ammeter
22. Cylinder Head Temperature, Oil Temperature, and Oil Pressure Gages
23. Low-Voltage Warning Light
24. Flight Hour Recorder
25. Economy Mixture Indicator (EGT)
26. Secondary Altimeter
27. AM/FM Cassette Stereo Entertainmnet Center
28. Map Compartment
29. Tachometer
30. Defroster Control
31. Cabin Air Control
32. Cabin Heat Control
33. Air Conditioning System Controls
34. Lighter
35. Wing Flap Switch and Position Indicator
36. Mixture Control
37. Propeller Control
38. Throttle (With Friction Lock)
39. Control Pedestal Light
40. Rudder Trim Control Wheel and Position Indicator
41. Cowl Flap Control Lever
42. Microphone
43. Fuel Selector Light
44. Fuel Selector Valve Handle
45. Elevator Trim Control Wheel and Position Indicator
46. Carburetor Heat Control
47. Landing Gear Lever and Position Indicator Lights
48. Static Pressure Alternate Source Valve
49. Electrical Switches
50. Circuit Breakers
51. Parking Brake Handle
52. Interior Lighting Controls
53. Ignition Switch
54. Primer
55. Sidewall Circuit Breaker Panel
56. Avionics Power Switch

Figure 7-2. Instrument Panel (Sheet 2 of 2) stiffeners, center upper and lower skin panels, and two left and two right wrap-around skin panels which also form the leading edges. The horizontal stabilizer also contains the elevator trim tab actuator. Construction of the elevator consists of formed leading edge skins, a forward spar, ribs, torque tube and bellcrank, left upper and lower "V" type corrugated skins, and right upper and lower "V" type corrugated skins incorporating a trailing edge cut-out for the trim tab. The elevator trim tab consists of a spar and upper and lower "V" type corrugated skins. Both elevator tip leading edge extensions incorporate balance weights.

## FLIGHT CONTROLS

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

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

### TRIM SYSTEMS

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

## INSTRUMENT PANEL

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

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

## GROUND CONTROL

Effective ground control while taxiing is accomplished through nose wheel steering by using the rudder pedals; left rudder pedal to steer left and right rudder pedal to steer right. When a rudder pedal is depressed, a spring-loaded steering bungee (which is connected to the nose gear and to the rudder bars) will turn the nose wheel through an arc of approximately 15° each side of center. By applying either left or right brake, the degree of turn may be increased up to 30° 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 wing 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 30° 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 *27* feet 5 inches. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down on a tailcone bulkhead just forward of the horizontal stabilizer to raise the nose wheel off the ground.

## WING FLAP SYSTEM

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

Figure **7-3.** Wing Flap System

reset" type circuit breaker, labeled FLAP, on the left side of the switch and control panel.

A gear warning interconnect switch is incorporated in the flap system, and sounds a warning horn when the flaps are extended beyond 25° with the landing gear retracted.

## LANDING GEAR SYSTEM

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

The landing gear extension, retraction, and main gear down lock operation is accomplished by hydraulic actuators powered by an electrically-driven hydraulic power pack (see figure 7-7). The power pack is located aft of the firewall between the pilot's and copilot's rudder pedals. The hydraulic system fluid level may be checked by utilizing the dip-stick/filler cap located on the top right side of the power pack adjacent to the motor mounting flange. The system should be checked at 25-hour intervals. If the fluid level is at or below the ADD line on the dipstick, hydraulic fluid (MIL-H-5606) should be added to bring the level to the top of the dipstick/filler cap opening. A normal operating pressure of 1000 PSI to 1500 PSI is automatically maintained in the landing gear system, and is sufficient to provide a positive up pressure on the main landing gear. The nose gear incorporates an over-center mechanical linkage which provides a positive mechanical up and down lock. Mechanically-actuated wheel well doors are provided for the nose gear. The doors open when the nose gear extends, and close when it retracts.

Power pack operation is started and stopped by a pressure switch, and hydraulic pressure is directed by the landing gear lever. Two position indicator lights are provided to show landing gear position. The landing gear system is also equipped with a nose gear safety (squat) switch, an emergency extension hand pump, and a gear-up warning system.

### LANDING GEAR LEVER

The landing gear lever is located on the switch and control panel to the right of the electrical switches. The lever has two positions, labeled GEAR UP and GEAR DOWN, which give a mechanical indication of the gear position selected. From either position, the lever must be pulled out to clear a detent before it can be repositioned; operation of the landing gear system will not begin until the lever has been repositioned. After the lever has been repositioned, it directs hydraulic pressure within the system to actuate the gear to the selected position.

## LANDING GEAR POSITION INDICATOR LIGHTS

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

## LANDING GEAR OPERATION

To retract or extend the landing gear, pull out on the gear lever and move it to the desired position. After the lever is positioned, the power pack will create pressure in the system and actuate the landing gear to the selected position. During a normal cycle, the gear retracts fully or extends and locks, limit switches close, and the indicator light comes on (amber for up and green for down) indicating completion of the cycle. After indicator light illumination, the power pack will continue to run until the fluid pressure reaches 1500 PSI, opens the pressure switch, and turns the power pack off. Whenever fluid pressure in the system drops below 1000 PSI, the pressure switch will close and start power pack operation, except when the nose gear safety (squat) switch is open. During cruising flight with the landing gear retracted, automatic cycling on of the hydraulic pump motor to restore system pressure bleed down may normally occur up to twice per hour. More frequent cycling is an indication of abnormal pressure loss and cause of this condition should be investigated.

The safety (squat) switch, actuated by the nose gear, electrically prevents inadvertent retraction whenever the nose gear strut is compressed by the weight of the airplane. When the nose gear is lifted off the runway during takeoff, the squat switch will close, which may cause the power pack to operate for 1 to 2 seconds and return system pressure to 1500 PSI in the event pressure has dropped below 1000 PSI. A "pull-off" type circuit breaker is also provided in the system as a maintenance safety feature. With the circuit breaker pulled out, landing gear operation by the gear pump motor is prevented. After maintenance is completed, and prior to flight, the circuit breaker should be pushed back in.

## EMERGENCY HAND PUMP

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

### LANDING GEAR WARNING SYSTEM

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

When the throttle is retarded below approximately 12 inches of manifold pressure at low altitude (master switch on), the throttle linkage will actuate a switch which is electrically connected to the gear warning portion of a dual warning unit. If the landing gear is retracted (or not down and locked), an intermittent tone will be heard on the airplane speaker. An interconnect switch in the wing flap system also sounds the horn when the wing flaps are extended beyond 25° with the landing gear retracted.

## BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the rear passenger seats to the aft cabin bulkhead. A baggage shelf, above the wheel well, extends aft from the aft cabin bulkhead. Access to the baggage compartment and the shelf 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. For further information on baggage tie-down, refer to Section 6. When loading the airplane, children should not be placed or permitted in the baggage compartment, and any material that may 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 individually adustable four-way or six-way seats for the pilot and front seat passenger, and a split-backed fixed seat for the rear seat passengers. A child's seat (if installed) is located at the aft cabin bulkhead behind the rear seat.

The four-way seats may be moved forward or aft, and the seat back angle adjusted to any comfortable angle. To position either seat, lift the tubular handle under the center of the seat, slide the seat into position, release the handle, and check that the seat is locked in place. The seat baok angle is controlled by a cylinder lock release button which is spring-loaded to the locked position. The release button is located on the inboard side, below the forward corner of the seat cushion. To adjust the angle of the seat back, push up on the release button, position the seat back to the desired angle and release the button. When the seat is not occupied, the seat back will fold forward whenever the release button is pushed up.

The six-way seats may be moved forward or aft, and are infinitely adjustable for height and seat back angle. To position the seat, lift the tubular handle under the center of the seat bottom, slide the seat into position, release the handle, and check that the seat is locked in place. Raise or lower the seat by rotating the large crank under the front inboard corner of either seat. The seat back is adjusted by rotating the small crank under the front outboard 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 passengers' seat consists of a fixed one-piece seat bottom with individually adjustable seat backs. The seat backs are adjusted by cylinder lock release buttons, recessed into skirts located below the seat frame at the outboard ends of the seat. To adjust a seat back, push up on the adjacent cylinder lock release button, which is spring-loaded to the locked position, recline the seat back to the desired position and release the button. When the seat is not occupied, the seat backs will automatically fold forward whenever the cylinder lock release button is pushed up.

A child's seat may be installed aft of the rear passengers' seat, and is held in place by two brackets mounted- on the floorboard. The seat is designed to swing upward into a stowed position against the aft cabin bulkhead when not in use. To stow the seat, rotate the seat bottom up and aft as far as it will go. When not in use, the seat should be kept in the stowed position.

Headrests are available for any of the seat configurations except the child's seat. 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 also available for the rear 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 seat, 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 aft side windows. 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 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.

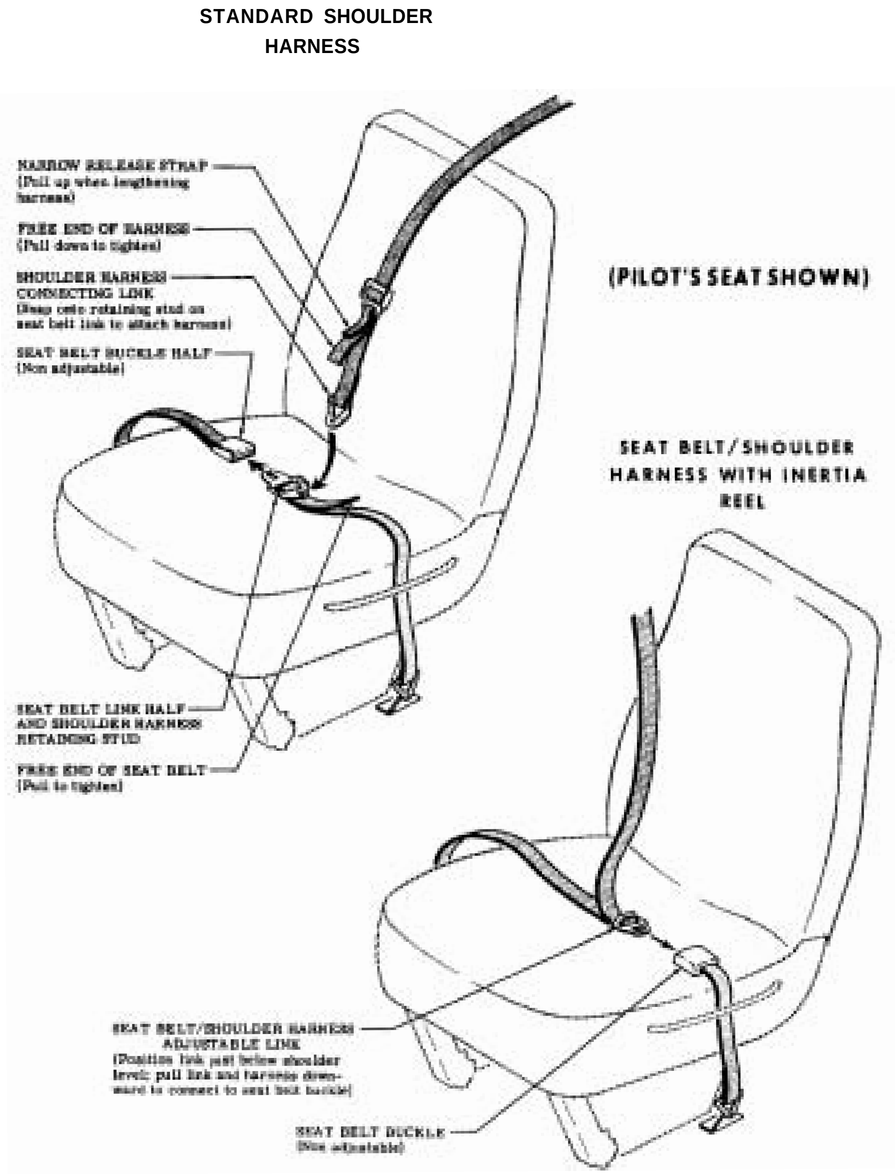



Figure 7-4. Seat Belts and Shoulder Harnesses

## INTEGRATED SEAT BELT/SHOULDER HARNESSES WITH INERTIA REELS

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

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 an openable window in the left door. An openable right door window is also available.

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

NOTE

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

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

The left cabin door is equipped with an openable window which is held in the closed position by a detent equipped latch on the lower edge of the window frame. To open the window, rotate the latch upward. The window is equipped with a spring-loaded retaining arm which will help rotate the window outward and hold it there. An openable window is also available for the right door, and functions in the same manner as the left window. If required, either window may be opened at any speed up to 181 KIAS. The cabin top windows (if installed), rear side windows, and rear window are of the fixed type and cannot be opened.

## CONTROL LOCKS

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

## ENGINE

The airplane is powered by a horizontally-opposed, six-cylinder, overhead-valve, air-cooled, carbureted engine with a wet sump oil system. The engine is a Lycoming Model O-540-J3C5D and is rated at 235 horsepower at 2400 RPM. Major accessories include a starter, belt-driven alternator, belt-driven air conditioner compressor (if installed) and propeller governor on the front of the engine and dual magnetos encased in a single drive housing, fuel pump, vacuum pump, and full-flow oil filter on the rear of the engine.

## ENGINE CONTROLS

Engine manifold pressure is controlled by a throttle located on the center area of the switch and control 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 near the propeller control, is a red knob with raised points around the circumference and is equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cut-off position. For small adjustments, the control may be moved forward by rotating the knob clockwise, and aft by rotating the knob counterclockwise. For rapid or large adjustments, the knob may be moved forward or aft by depressing the lock button in the end of the control, and then positioning the control as desired.

## ENGINE INSTRUMENTS

Engine operation is monitored by the following instruments: oil pressure gage, oil temperature gage, cylinder head temperature gage, tachometer, 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 on the right side of the instrument panel. is operated by oil pressure. A direct pressure oil line from the engine delivers oil at engine operating pressure to the oil pressure gage. Gage markings indicate that minimum idling pressure is 25 PSI (red line), the normal operating range is 60 to 90 PSI (green arc), and maximum pressure is 115 PSI (red line).

Oil temperature is indicated by a gage adjacent to the oil pressure gage. The gage is operated by an electrical resistance type temperature sensor which receives power from the airplane electrical system. Gage markings indicate the normal operating range (green arc) which is 100°F (38°C) to 245°F (118°C), and the maximum (red line) which is 245°F (118°C).

The cylinder head temperature gage, below the left fuel quantity indicator, is operated by an electrical-resistance type temperature sensor on the engine which receives power from the airplane electrical system. Gage markings indicate the normal operating range (green arc) which is 200°F (93°C) to 500°F (260°C) and the maximum (red line) which is 500°F (260°C) .

The engine-driven mechanical tachometer is located on the lower right side of the instrument panel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours and tenths. Instrument markings include a normal operating range (green arc) of 2100 to 2400 RPM, and a maximum (red line) of 2400 RPM.

The manifold pressure gage is the left half of a dual-indicating instrument located on the right side of the instrument panel above the tachometer. The gage is direct reading and indicates induction air manifold pressure in inches of mercury. It has a normal operating range (green arc) of 15 to 23 inches of mercury.

The fuel pressure gage is the right half of the dual-indicating instrument described above and indicates fuel pressure to the carburetor. Gage markings indicate that minimum pressure is 0.5 PSI (red line), normal operating range is 0.5 to 8 PSI (green arc), and maximum pressure is 8 PSI (red line).

An economy mixture (EGT) indicator is available for the airplane and is located on the right side of the instrument panel. A thermocouple probe in the left exhaust stack assembly measures exhaust gas temperature and transmits it to the indicator. The indicator serves as a visual aid to the pilot in adjusting the mixture during climb or cruise as described in Section 4. Exhaust gas temperature varies with fuel-to-air ratio, power, and RPM. However, the difference between the peak EGT and the EGT at the desired mixture setting is essentially constant and this provides a useful leaning aid. The indicator is equipped with a manually positioned reference pointer which is especially useful for leaning during climb.

A carburetor air temperature gage is available for the airplane. Details of this gage are presented in Section 9, Supplements.

## 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 a minimum of 75% power until a total of 25 hours has accumulated or oil consumption has stabilized. This will ensure proper seating of the rings.

## 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 sump is 8 quarts (one additional quart is contained in the engine oil filter). Oil is drawn from the sump through a filter screen on the end of a pickup tube to the engine-driven oil pump. Oil from the pump passes through an oil pressure screen, full flow oil filter, a pressure relief valve at the rear of the right oil gallery, and a thermostatically controlled remote oil cooler. Oil from the remote cooler is then circulated to the left gallery and propeller governor. The engine parts are then lubricated by oil from the galleries. After lubricating the engine, the oil returns to the sump by gravity. The filter adapter in the full flow oil filter is equipped with a bypass valve which will cause lubricating oil to bypass the filter in the event the filter becomes plugged, or the oil temperature is extremely cold.

An oil dipstick is located at the rear of the engine on the right side, and an oil filler tube is on top of the crankcase near the front of the engine. The dipstick and oil filler are accessible through doors on the engine cowling. The engine should not be operated on less than five 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 installed on the bottom of the oil sump, to provide a quick, clean method of draining the engine oil. To drain the oil, 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 two engine-driven magnetos encased in a single drive housing, 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 an intake scoop in the upper left hand engine cowling. The intake scoop is covered by an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox. After passing through the airbox, induction air enters the inlet in the carburetor which is below 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 the left muffler 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 unfiltered air inside the cowling. Use of full carburetor heat at full throttle will result in a loss of approximately one inch of manifold pressure.

## EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler and tailpipe on each side of the engine. Shrouds are constructed around the outside of the mufflers to form heating chambers. The left muffler supplies heat to the carburetor, and the right muffler supplies heat to the cabin.

## CARBURETOR AND PRIMING SYSTEM

The engine is equipped with a side-draft, float-type, fixed jet carburetor mounted below the engine adjacent to the firewall. The carburetor is equipped with an enclosed accelerator pump, an idle cut-off mechanism, and a manual mixture control. Fuel is delivered from the fuel system to the carburetor by gravity flow, the engine-driven fuel pump, and/or auxiliary fuel pump. 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 may be controlled, within limits, by the mixture control located on the lower center portion of 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 knob is pulled out, and injects it into the engine intake ports when the knob is pushed back in. The plunger knob 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 front of the engine cowling. The cooling air is directed around the cylinders by baffling and through the remote oil cooler 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. Before starting the engine, and throughout takeoff and high power operation, the cowl flap lever should be placed in the OPEN position for maximum cooling. This is accomplished by moving the lever to the right to clear a detent, then moving the lever up to the OPEN position. Anytime the lever is repositioned, it must first be moved to the right. While in cruise flight, cowl flaps should be adjusted to keep the cylinder head temperature at approximately two-thirds of the normal operating range (green arc). During extended let-downs, the cowl flaps should be completely closed by pushing the cowl flap lever down to the CLOSED position.

A winterization kit is available for the airplane. Details of this kit are presented in Section 9, Supplements.

## PROPELLER

The airplane has an all-metal, two-bladed, constant-speed, governor-regulated propeller. A three-bladed propeller is also available. 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 center area of the switch and control panel is used to set the propeller and control engine RPM as desired for various flight conditions. The knob is labeled PROPELLER, PUSH INCR RPM. When the control knob is pushed in, blade pitch will decrease, giving a higher RPM. When the control knob is pulled out, the blade pitch increases, thereby decreasing RPM. The propeller control knob is equipped with a vernier feature which allows slow or fine RPM adjustments by rotating the knob clockwise to increase RPM, and counterclockwise to decrease it. To make rapid or large adjustments, depress the button on the end of the control knob and reposition the control as desired.

# FUEL SYSTEM

The airplane fuel system (see figure 7-5) consists of two vented integral fuel tanks (one in each wing), a four-position selector valve, fuel strainer, manual primer, auxiliary fuel pump, engine-driven fuel pump, and carburetor. Refer to figure 7-6 for fuel quantity data for the system.

Fuel flows by gravity from the two integral wing tanks to a four-position selector valve, labeled BOTH, RIGHT, LEFT, and OFF. With the selector valve in either the BOTH, RIGHT, or LEFT position, fuel flows through a strainer and a bypass in the auxiliary fuel pump (when it is not in operation) to the engine-driven fuel pump, and from the pump to the carburetor. 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 engine intake ports.

The airplane may be serviced to a reduced fuel capacity to permit heavier cabin loadings by filling each fuel tank to the bottom edge of the fuel filler neck, thus giving a reduced fuel load of 34.5 gallons in each tank (32.5 gallons usable in all flight conditions).

Fuel system venting is essential to system operation. Complete blockage of the venting system will result in a decreasing fuel flow and eventual engine stoppage. Venting consists of an interconnecting vent line between the tanks, and check valve equipped overboard vents in each tank. The overboard vents protrude from the bottom surfaces of the wings behind the wing struts, slightly below the upper attach points of the struts. The fuel filler caps are vacuum vented; the vents will open and allow air to enter the fuel tanks in case the overboard vents become blocked.

Fuel quantity is measured by two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity indicators on the right side of the instrument panel. The fuel quantity indicators are calibrated in gallons (lower scale) and pounds (upper scale). An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately 2 gallons remain in a tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips, or unusual attitudes. If both indicator pointers should rapidly move to a zero reading, check the cylinder head temperature gage for operation. If these gages are not indicating, an electrical malfunction has occurred.

The auxiliary fuel pump switch is located on the left side of the switch and control panel and is a rocker-type switch. It is labeled AUX FUEL PUMP. When the pump is operating, it will maintain fuel pressure to the carburetor. It should be used whenever the indicated fuel pressure falls below 0.5 PSI, but is not required when gravity flow and/or the engine-

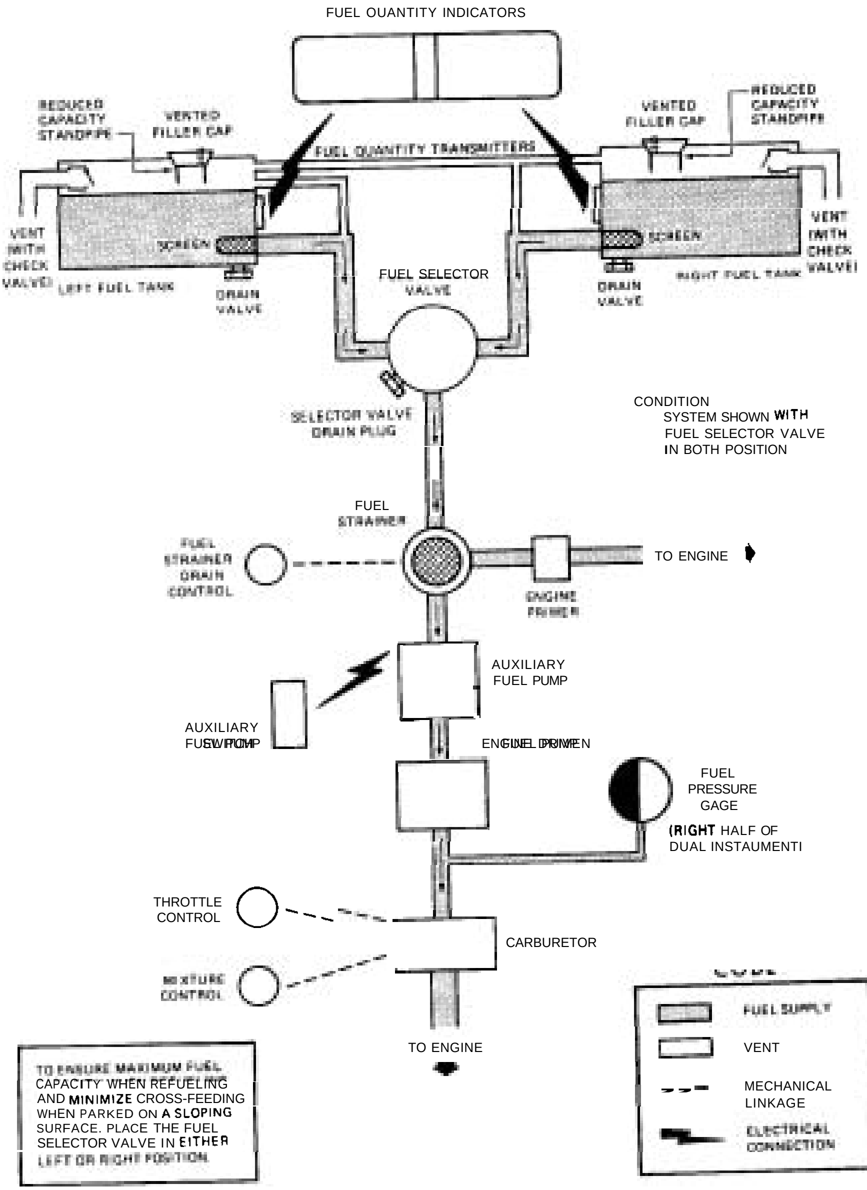



*Figure 7-5. Fuel System*

| FUEL QUANTITY DATA (U.S. GALLONS) | | | | |
|---|---|---|---|---|
| FUEL TANKS | FUEL LEVEL (QUANTITY EACH TANK) | TOTAL FUEL | TOTAL UNUSABLE | TOTAL USABLE ALL FLIGHT CONDITIONS |
| STANDARD | FULL (46) | 92 | 4 | 88 |
| STANDARD | REDUCED (34.5) | 69 | 4 | 65 |

Figure 7-6. Fuel Quantity Data

driven fuel pump can maintain indicated pressures above 0.5 PSI.

The fuel selector valve should be in the BOTH position for takeoff, climb, descent, landing, and maneuvers that involve prolonged slips or skids. Operation from either LEFT or RIGHT tank is reserved for level cruising flight only.

NOTE

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

NOTE

When the fuel selector valve handle is in the BOTH position in cruising flight, 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 tank in the "heavy" wing.

NOTE

It is not practical to measure the time required to consume all of the fuel in one tank, and, after switching to the opposite tank, expect an equal duration from the remaining fuel. The airspace in both fuel tanks is interconnected by a vent line and, therefore, some sloshing of fuel between tanks can be expected when the tanks are nearly full and the wings are not level.

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

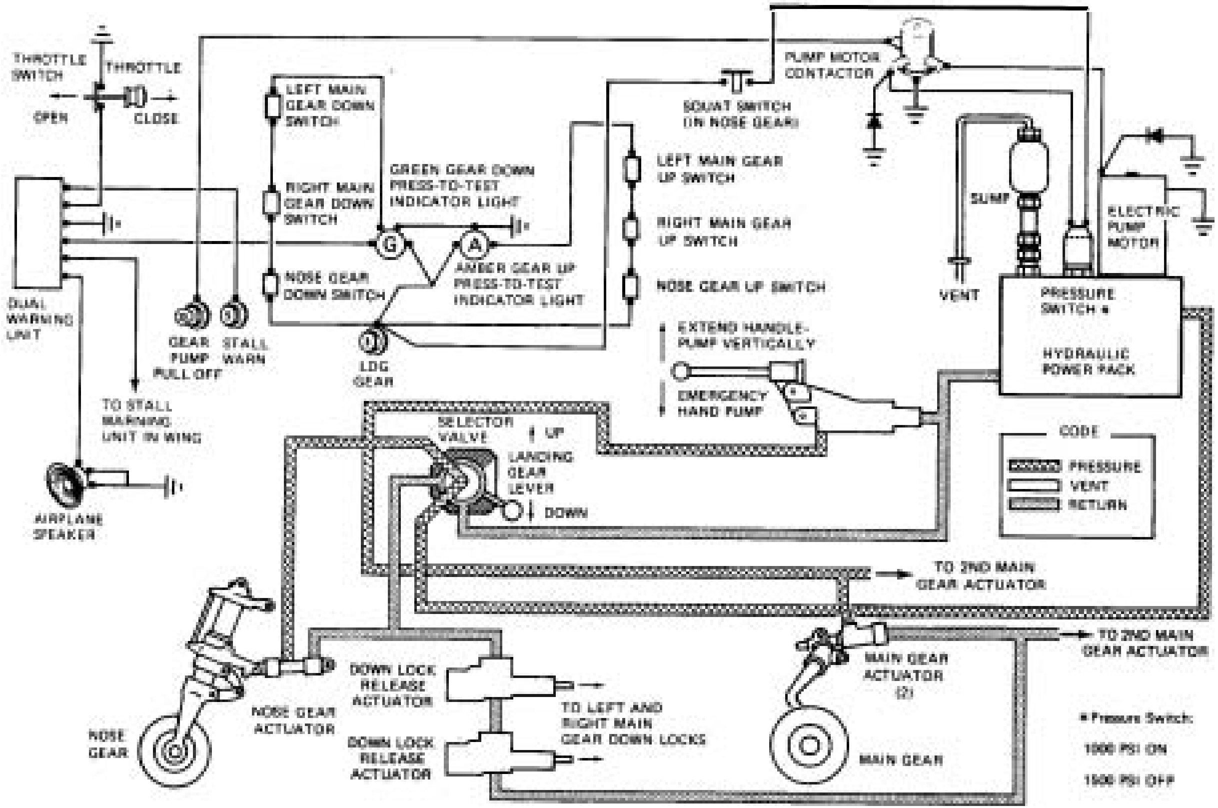
## HYDRAULIC SYSTEM

Hydraulic power (see figure 7-7) is supplied by an electrically-driven hydraulic power pack located behind the firewall between the pilot's and copilot's rudder pedals. The power pack's only function is to supply hydraulic power for operation of the retractable landing gear. This is accomplished by applying hydraulic pressure to actuator cylinders which extend or retract the gear. The hydraulic system normally operates at 1000 PSI to 1500 PSI, and is protected by relief valves which prevent high pressure damage to the pump and other components in the system. The electrical portion of the power pack is protected by a 30-amp "pull-off" type circuit breaker, labeled GEAR PUMP, on the left switch and control panel.

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

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

During normal operations, the landing gear should require from 5 to 7 seconds to fully extend or retract. For malfunctions of the hydraulic and landing gear systems, refer to Section 3 of this handbook.




CONDITION: AIRPLANE ON GROUND - ENGINE AND ELECTRICAL POWER OFF

**Figure 7-7. Hydraulic System**

## 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 below the left side of the switch and control panel. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down.

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

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

## ELECTRICAL SYSTEM

The airplane is equipped with a 28-volt, direct-current electrical system (see figure 7-8). The system uses a battery located aft of the baggage compartment wall as the source of electrical energy and a belt-driven 60-amp alternator (or a 95-amp, if installed) to maintain the battery's state of charge. Power is supplied to most general electrical and all avionics circuits through the primary bus bar and the avionics bus bar, which are interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on.

**CAUTION**

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

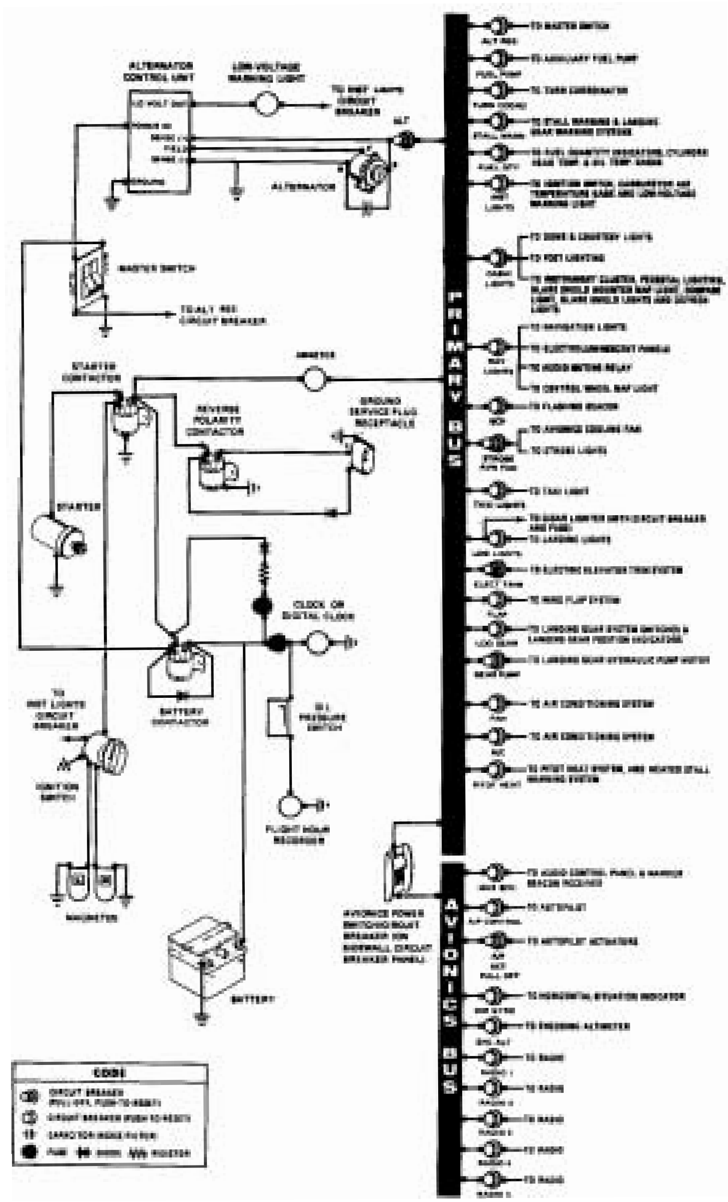



Figure 7-8. Electrical System

## MASTER SWITCH

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

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

## AVIONICS POWER SWITCH

Electrical power from the airplane primary bus to the avionics bus (see figure 7-8) is controlled by a single-rocker switch/circuit breaker labeled AVN PWR. The switch is located on the left sidewall circuit breaker panel and is ON in the up position and OFF in the down position. With the switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch or the individual equipment switches. The avionics power switch also functions as a circuit breaker. If an electrical malfunction should occur and cause the circuit breaker to open, electrical power to the avionics equipment will be interrupted and the switch will automatically move to the OFF position. If this occurs, allow the circuit breaker to cool approximately two minutes before placing the switch in the ON position again. If the circuit breaker opens again, do not reset it. The avionics power switch should be placed in the OFF position prior to turning the master switch ON or off, starting the engine, or applying an external power source, and may be utilized in place of the individual avionics equipment switches.

## AMMETER

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

## ALTERNATOR CONTROL UNIT AND LOW-VOLTAGE WARNING LIGHT

The airplane is equipped with a combination alternator regulator high-low voltage control unit mounted on the engine side of the firewall and a red warning light labeled LOW VOLTAGE, on the right side of the instrument panel adjacent to the manifold pressure/fuel pressure gage.

In the event an over-voltage condition occurs, the alternator control unit automatically removes alternator field current which shuts down the alternator. The battery will then supply system current as shown by a discharge rate on the ammeter. Under these conditions, depending on electrical system load, the low-voltage warning light will illuminate when system voltage drops below normal. The alternator control unit may be reset by turning the master switch off and back on again. If the warning light does not illuminate, normal alternator charging has resumed; however, if the light does illuminate again, a malfunction has occurred, and the flight should be terminated as soon as practicable.

NOTE

Illumination of the low-voltage light and ammeter discharge indications may occur during low RPM conditions with an electrical load on the system, such as during a low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occurred to de-activate the alternator system. Momentary illumination of the low-voltage warning light and/or ammeter needle deflection may also occur during startup of the landing gear system hydraulic pump motor.

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

## CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" type circuit breakers mounted on the lower left side of the switch and control panel. However, the alternator output, the avionics cooling fan-/strobe light circuits, and the landing gear circuits are protected by "pull-off" type circuit breakers on the switch and control panel. In addition to the individual circuit breakers, a single-rocker switch/circuit breaker, labeled AVN PWR on the avionics panel, located on the left cabin sidewall between the forward doorpost and the switch and control panel, also protects the avionics systems. The cigar lighter is protected by a manually-reset type circuit breaker on the back of the lighter, and a fuse behind the instrument panel. The control wheel map light (if installed) is protected by the NAV LIGHTS circuit breaker and a fuse behind the instrument panel. Electrical circuits which are not protected by circuit breakers are the battery contactor closing (external power) circuit, clock circuit, and flight hour recorder circuit. These circuits are protected by fuses mounted adjacent to the battery.

### GROUND SERVICE PLUG RECEPTACLE

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

## LIGHTING SYSTEMS

### EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and tail stinger, and dual landing/taxi lights are installed in the cowl nose cap. Additional lighting is available and includes a strobe light on each wing tip. a flashing beacon on top of the vertical stabilizer, and two courtesy lights, one under each wing, just outboard of the cabin doors. Details of the strobe light system are presented in Section 9, Supplements. The courtesy lights are operated by a switch located on the left rear door post. All exterior lights, except the courtesy lights, are operated by rocker switches on the left switch and control panel. The switches are ON in the up position and off in the down position.

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

### INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood and integral lighting, with electroluminescent and post lighting also available. Dual concentric light dimming rheostats on the left side of the switch and control panel control the intensity of all lighting. The following paragraphs describe the various lighting systems and their controls.

The left and right sides of the switch and control panel, and the marker beacon/audio control panel may be lighted by electroluminescent panels which do not require light bulbs for illumination. To utilize this lighting, turn the NAV light rocker switch to the ON position and rotate the inner knob labeled EL PANEL, on the right dimming rheostat, clockwise to the desired light intensity.

Instrument panel flood lighting consists of four red lights on the underside of the glare shield, and two red flood lights in the forward section of the overhead console. This lighting is controlled by rotating the outer knob labeled FLOOD, on the left dimming rheostat, clockwise to the desired intensity.

The instrument panel may be equipped with post lights which are mounted at the edge of each instrument or control and provide direct lighting. This lighting is controlled by rotating the inner knob labeled POST, on the left dimming rheostat, clockwise to the desired light intensity. Flood and post lights may be used simultaneously by rotating both the FLOOD and POST knobs clockwise to the desired intensity for each type of lighting.

The engine instrument cluster, radio equipment, and magnetic compass have integral lighting and operate independently of post or flood lighting. To operate these lights, rotate the outer knob labeled ENG-RADIO, on the right dimming rheostat, clockwise to the desired intensity. However, for daylight operation, the compass and engine instrument lights may be turned off while still maintaining maximum light intensity for the digital readouts in the radio equipment. This is accomplished by rotating the ENG-RADIO knob full counterclockwise. Checkthat the flood lights, post lights, and electroluminescent lights are turned off for daylight operation by rotating the FLOOD, POST, and EL PANEL knobs full counterclockwise.

The control pedestal has two integral lights and, if the airplane is equipped with oxygen, the overhead console is illuminated by post lights. Pedestal and console light intensity is controlled by the knob labeled ENG-RADIO, on the right dimming rheostat.

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

The airplane is equipped with a dome light aft of the overhead console. The light is operated by a slide-type switch, aft of the light lens, which turns the light on when moved to the right.

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

## CABIN HEATING, VENTILATING AND DEFROSTING SYSTEM

The temperature and volume of airflow into the cabin can be regulated by manipulation of the push-pull CABIN HEAT and CABIN AIR control knobs (see figure 7-9). Both control knobs are the double button type with locks to permit intermediate settings.

NOTE

For improved partial heating on mild days, pull out the CABIN AIR knob slightly when the CABIN HEAT knob is out. This action increases the airflow through the system, increasing efficiency, and blends cool outside air with the exhaust manifold heated air, thus eliminating the possibility of overheating the system ducting.

Front cabin heat and ventilating air is supplied by outlet holes spaced across a cabin manifold just forward of the pilot's and copilot's feet. Rear cabin heat and air is supplied by two ducts from the manifold, one extending down each side of the cabin to an outlet at the front door post at floor level. Windshield defrost air is also supplied by a duct leading from the cabin manifold to an outlet on top of the antiglare shield. Defrost air flow is controlled by a rotary type knob labeled DEFROST.

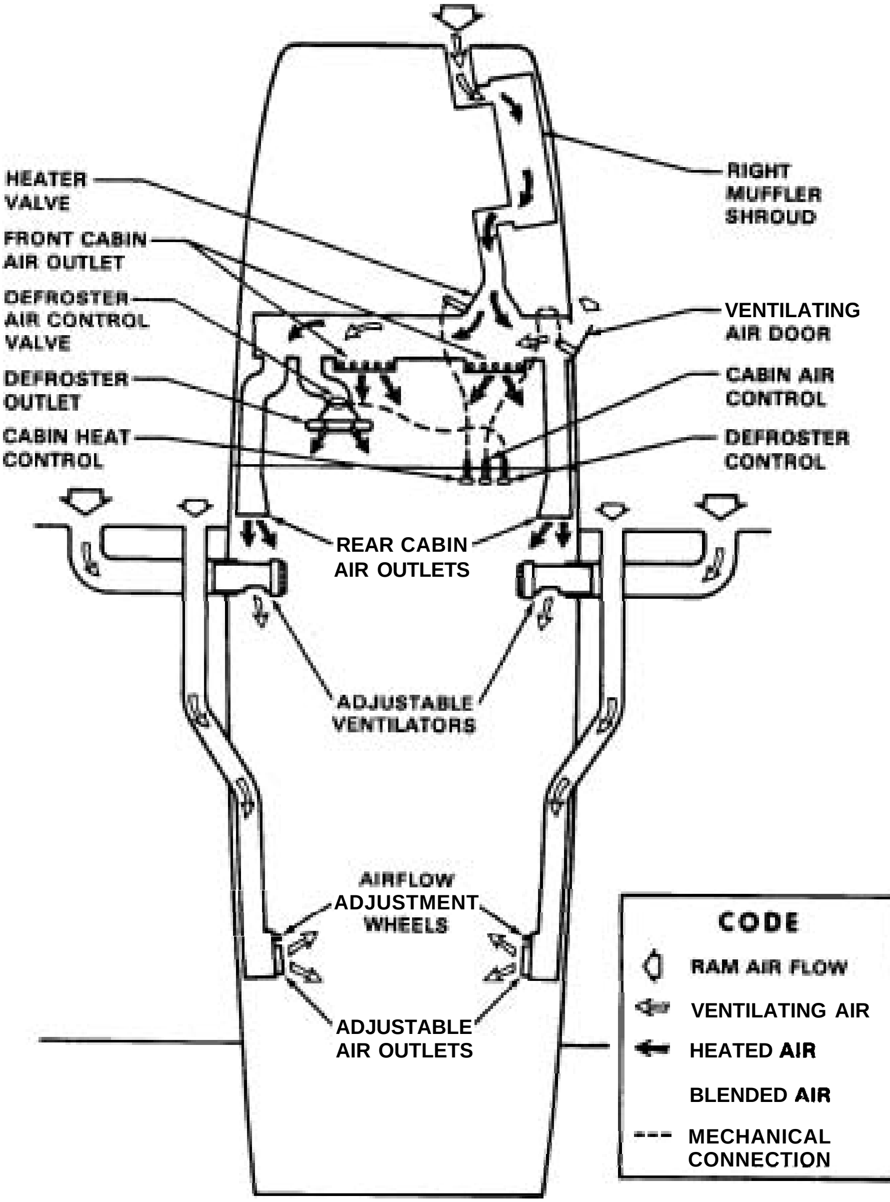



Figure 7-9. Cabin Heating, Ventilating, and Defrosting System

For cabin ventilation, pull the CABIN AIR knob out, with the CABIN HEAT knob pushed full in. To raise the air temperature, pull the CABIN HEAT knob out until the desired temperature is attained. Additional heat is available by pulling the knob out farther; maximum heat is available with the CABIN HEAT knob pulled out and the CABIN AIR knob pushed full in.

Separate adjustable ventilators supply additional ventilation air to the cabin. One near each upper corner of the windshield supplies air for the pilot and copilot, and two ventilators are available for the rear cabin area to supply air to the rear seat passengers. Each rear ventilator outlet can be adjusted in any desired direction by moving the entire outlet to direct the airflow up or down, and by moving a tab protruding from the center of the outlet left or right to obtain left or right airflow. Ventilation airflow may be closed off completely, or partially closed according to the amount of airflow desired, by rotating an adjustment wheel adjacent to the outlet. An air conditioning system may be installed in the airplane. Details of this system are presented in Section 9, Supplements.

## PITOT-STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the airspeed indicator, vertical speed indicator and altimeter. The system is composed of either an unheated or heated pitot tube mounted on the lower surface of the left wing, two external static ports on the left and right sides of the forward fuselage, and the associated plumbing necessary to connect the instruments to the sources.

The heated pitot system (if installed) consists of a heating element in the pitot tube, a rocker switch labeled PITOT HEAT, a 10-amp "push-to reset" type circuit breaker on the left sidewall circuit breaker panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

A static pressure alternate source valve may be installed adjacent to the parking brake, and can be used if the external static source is malfunctioning. This valve supplies static pressure from inside the cabin instead of the external static ports.

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

Pressures within the cabin will vary with heater/vents opened or closed and windows open. Refer to Sections 3 and 5 for the effect of varying cabin pressures on airspeed and altimeter readings.

### AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings (in KIAS) include the white arc (39 to 95 knots), green arc (41 to 159 knots), yellow arc (159 to 181 knots), and a red line (181 knots).

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

### VERTICAL SPEED INDICATOR

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

### ALTIMETER

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

## VACUUM SYSTEM AND INSTRUMENTS

An engine-driven vacuum system (see figure 7-10) provides the suction necessary to operate the attitude indicator and directional indicator. The system consists of a vacuum pump mounted on the engine, a vacuum relief valve and vacuum system air filter on the aft side of the

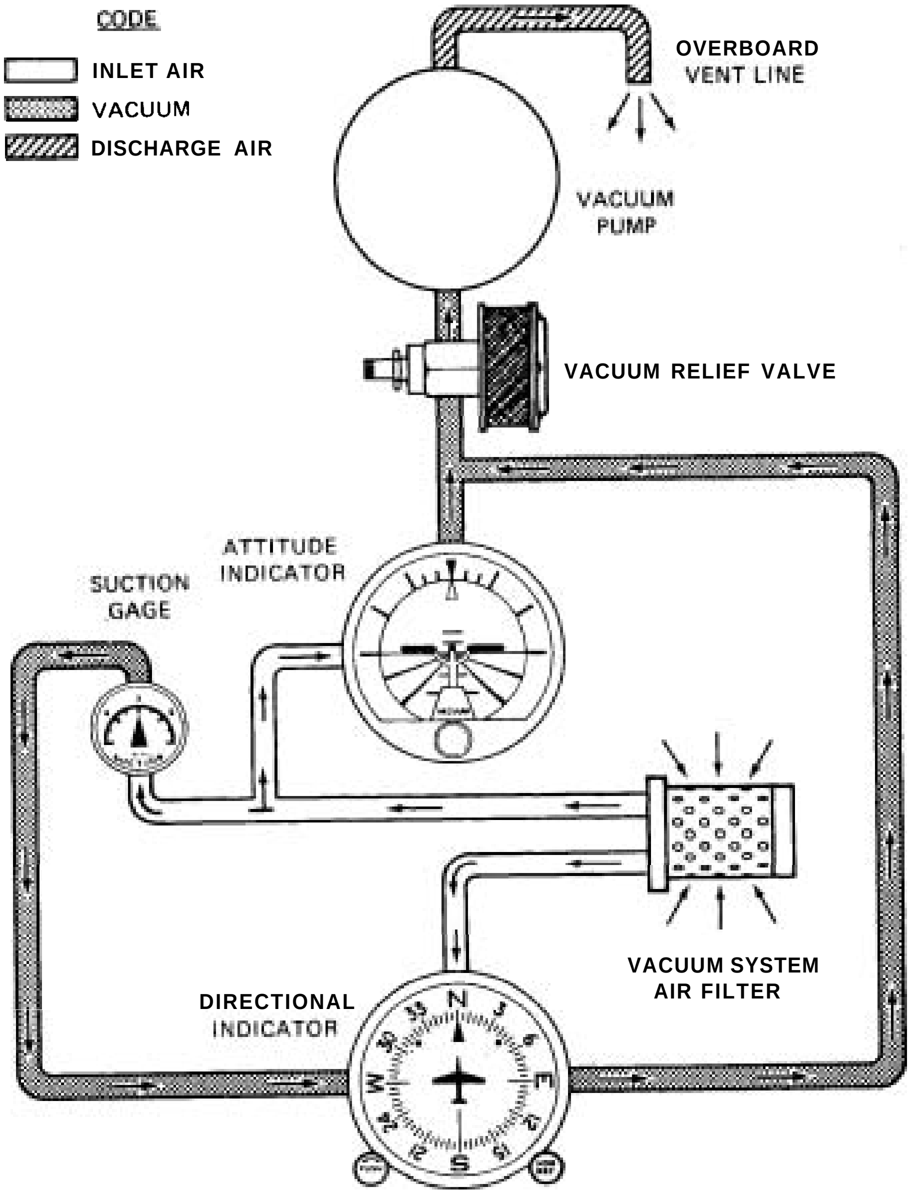



**Figure 7-10. Vacuum System**

firewall below the instrument panel, and instruments (including a suction gage) on the left side of the instrument panel.

## ATTITUDE INDICATOR

An attitude indicator is available and gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which has index marks at 10°, 20°, 30°; 60°, and 90° either side of the center mark. Pitch and roll attitudes are presented by a miniature airplane superimposed over a symbolic horizon area divided into two sections by a white horizon bar. The upper "blue sky" area and the lower "ground" area have arbitrary, pitch reference lines useful for pitch attitude control. A knob at the bottom of the instrument is provided for in-flight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

## DIRECTIONAL INDICATOR

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

## SUCTION GAGE

The suction gage, located below the flight instruments, is calibrated in inches of mercury and indicates suction available for operation of the attitude and directional indicators. The desired suction range is 4.5 to 5.4 inches of mercury. A suction reading out of this range may indicate a system malfunction or improper adjustment, and in this case, the indicators should not be considered reliable.

# STALL WARNING SYSTEM

The airplane is equipped with a vane-type stall warning unit, in the leading edge of the left wing, which is electrically connected to a stall warning horn under the map compartment. A 5-amp "push-to-reset" type circuit breaker labeled STALL WARN, on the left side of the switch and control panel, protects the stall warning system. The vane in the wing senses the change in airflow over the wing, and operates the warning horn at airspeeds between 5 and 10 knots above the stall in all configurations.

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

The stall warning system should be checked during the pre-flight inspection by momentarily turning on the master switch and actuating the vane in the wing. The system is operational if the warning horn sounds as the vane is pushed upward.

# AVIONICS SUPPORT EQUIPMENT

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

## AVIONICS COOLING FAN

An avionics cooling fan system is provided whenever a factory-installed Nav/Com radio is installed. The system is designed to provide internal cooling air from a small electric fan to the avionics units and thereby eliminate the possibility of moisture contamination using an external cooling air source.

Power to the electric fan is supplied directly from a "pull-off" type circuit breaker labeled STROBE, AVN FAN, located on the left switch and control panel. Hence, power is supplied to the fan anytime the master switch is ON. This arrangement provides air circulation through the radios to remove a possible heat soak condition before the radios are turned on after engine start. It is recommended that the circuit breaker be left ON except during periods of lengthy maintenance with the master switch ON.

## MICROPHONE-HEADSET INSTALLATIONS

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

NOTE

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

## STATIC DISCHARGERS

If frequent IFR flights are planned, installation of wick-type static dischargers is recommended to improve radio communications during flight through dust or various forms of precipitation (rain, snow or ice crystals). Under these conditions, the build-up and discharge of static electricity from the trailing edges of the wings, rudder, elevator, propeller tips, and radio antennas can result in loss of usable radio signals on all communications and navigation radio equipment. Usually the ADF is first to be affected and VHF communication equipment is the last to be affected.

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

# SECTION 8
# AIRPLANE HANDLING. SERVICE & MAINTENANCE

## TABLE OF CONTENTS

# INTRODUCTION

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

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

# IDENTIFICATION PLATE

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

# OWNER FOLLOW-UP SYSTEM

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

## PUBLICATIONS

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

- CUSTOMER CARE PROGRAM BOOK
- PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL
- AVIONICS OPERATION GUIDE
- PILOT'S CHECKLISTS
- POWER COMPUTER
- CUSTOMER CARE DEALER DIRECTORY

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

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

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

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

**NOTE**

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

## AIRPLANE FILE

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

C. To be made available upon request:

1. Airplane Log Book.
2. Engine Log Book.

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

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

# AIRPLANE INSPECTION PERIODS

## FAA REQUIRED INSPECTIONS

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

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

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

The CESSNA PROGRESSIVE CARE PROGRAM has been developed to provide a modern progressive inspection schedule that satisifies 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 andmaintained 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 30° 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 torque link and secure to a ramp tie-down.
5. Install a pitot tube cover.

## JACKING

When a requirement exists to jack one or both main gear, the entire airplane should be jacked by using the wing jack points. Refer to the Service Manual for specific procedures and equipment required.

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

**NOTE**

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

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

NOTE

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

## LEVELING

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

## FLYABLE STORAGE

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

**WARNING**

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

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

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

## SERVICING

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

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

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

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

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

### ENGINE OIL

GRADE AND VISCOSITY FOR TEMPERATURE RANGE --
The airplane was delivered from the factory with aviation grade straight mineral oil. This oil should be drained after the first 25 hours of operation, and the,following oils used as specified for the average ambient air temperature in the operating area.

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

**All temperatures, use SAE 20W-50 or**
Above 16°C (60°F), use SAE 50
-1°C (30°F) to 32°C (90°F), use SAE 40

-18°C (0°F) to 21°C (70°F), use SAE 30
Below -12°C (10°F), use SAE 20

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

All temperatures, use SAE 20W-50 or
Above 16°C (60°F), use SAE 40 or SAE 50
-1°C (30°F) to 32°C (90°F), use SAE 40
-18°C (O°F) to 21°C (70°F). use SAE 40 or SAE 30
Below -12°C (10°F), use SAE 30

CAPACITY OF ENGINE SUMP -- 8 Quarts.

Do not operate on less than 5 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.

OIL AND OIL FILTER CHANGE --

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

NOTE

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

## FUEL

APPROVED FUEL GRADES (AND COLORS) --
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).

NOTE

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

CAPACITY EACH TANK -- 46.0 U.S. Gallons.
REDUCED CAPACITY EACH TANK (WHEN FILLED TO BOTTOM OF FUEL FILLER NECK) -- 34.5 U.S. Gallons.

NOTE

To ensure maximum fuel capacity when refueling and minimize cross-feeding when parked on a sloping surface, place the fuel selector valve handle in either LEFT or RIGHT position.

NOTE

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

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

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

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

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

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

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

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

1. For best results, the alcohol should be added during the fueling operation by pouring the alcohol directly on the fuel stream issuing from the fueling nozzle.

2. An alternate method that may be used is to premix the complete alcohol dosage with some fuel in a separate clean container (approximately 2-3 gallon capacity) and then transferring this mixture to the tank prior to the fuel operation.

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

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

## CAUTION

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

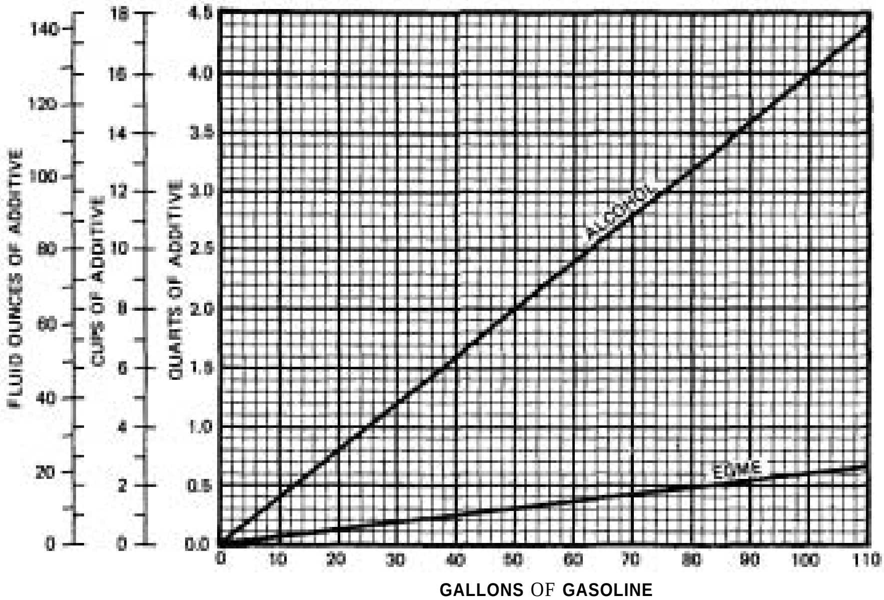



Figure 8-1. Additive Mixing Ratio

**CAUTION**

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

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

## LANDING GEAR

NOSE WHEEL TIRE PRESSURE -- 50 PSI on 5.00-5, 6-Ply Rated Tire.
MAIN WHEEL TIRE PRESSURE -- 68 PSI on 15 x 6.00-6, 6-Ply Rated Tires.
NOSE GEAR SHOCK STRUT --
Keep filled with MIL-H-5606 hydraulic fluid per filling instructions placard, and with no load on the strut, inflate with air to 55 PSI. Do not **over-inflate.**
HYDRAULIC FLUID RESERVOIR -- Check every 25 hours and service with MIL-H-5606 hydraulic fluid.

### OXYGEN

AVIATOR'S BREATHING OXYGEN -- Spec. No. MIL-0-27210.
MAXIMUM PRESSURE (cylinder temperature stabilized after filling) -- 1800 PSI at 21°C (70°F). Refer to Oxygen System Supplement (Section 9) for filling pressures.

## CLEANING AND CARE

### WINDSHIELD-WINDOWS

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

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

NOTE

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

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

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

### PAINTED SURFACES

The painted exterior surfaces of your new Cessna have a durable, long lasting finish and, under normal conditions, require no polishing or buffing. Approximately 10 days are required for the paint to cure completely; in most cases, the curing period will have been completed prior to delivery of the airplane. In the event that polishing or buffing is required within the curing period, it is recommended that the work be done by someone experienced in handling uncured paint. Any Cessna Dealer can accomplish this work.

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

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

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

## PROPELLER CARE

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

## LANDING GEAR CARE

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

## ENGINE CARE

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

**CAUTION**

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

## INTERIOR CARE

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

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

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

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

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

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

# SECTION 9
# SUPPLEMENTS
## (Optional Systems Description & Operating Procedures)

## TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)



NOTE: Only the following supplements are included in this electronic copy of the POH:

2 Carburetor Air Temperature
6 Ground Service Receptacle
8 Strobe Light System
25 Cessna 300A Navomatic Autopilot

# 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. As listed in the Table of Contents, the supplements are classified under the headings of General and Avionics, and have been provided with reference numbers. Also the supplements are arranged alphabetically and numerically to make it easier to locate a particular supplement. Other routinely installed items of optional equipment, whose function and operational procedures do not require detailed instructions. are discussed in Section 7.

Limitations contained in the following supplements are FAA approved. Observance of these operating limitations is required by Federal Aviation Regulations.

# SUPPLEMENT

# CARBURETOR AIR TEMPERATURE GAGE

## SECTION 1
## GENERAL

The carburetor air temperature gage provides a means of detecting carburetor icing conditions. The gage is located on the left side of the instrument panel below the gyros. It 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 carburetor icing.

## SECTION 2
## LIMITATIONS

There is no change to the airplane limitations when the carburetor air temperature gage is installed.

## SECTION 3
## EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the carburetor air temperature gage is installed.

## SECTION 4
## NORMAL PROCEDURES

There is no change to the airplane normal procedures when the carburetor air temperature gage is installed. It is good practice to monitor the gage periodically and keep the needle out of the yellow arc during possible carburetor icing conditions. Refer to Section 4 of the basic handbook for procedures used when operating with carburetor heat applied.

## SECTION 5
## PERFORMANCE

There is no change to the airplane performance when the carburetor air temperature gage is installed. However, if it is necessary to operate with carburetor heat applied, a small performance loss may be expected at any given power setting due to the warmer induction air temperature.

# SUPPLEMENT

# GROUND SERVICE PLUG RECEPTACLE

## SECTION 1

## GENERAL

The ground service plug receptacle permits the use of an external power source for cold weather starting and during lengthy maintenance work on the electrical and avionics equipment. The receptacle is located behind a door on the fuselage tailcone aft of the baggage compartment door.

NOTE

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

A special fused circuit is included with the ground service plug receptacle which will close the battery contactor when external power is applied with the master switch turned on. This circuit is intended as a servicing aid when battery power is too low to close the contactor, and should not be used to avoid performing proper maintenance procedures on a low battery.

NOTE

Use of the ground service plug receptacle for starting an airplane with a "dead" battery or charging a "dead battery in the airplane is not recommended. The battery should be removed from the airplane and serviced in accordance with Service Manual procedures. Failure to observe this precaution could result in loss of electrical power during flight.

# SECTION 2
# LIMITATIONS

The following information must be presented in the form of a placard located on the inside of the ground service plug access door:

CAUTION 24 VOLTS D.C.
This aircraft is equipped with alternator
and a negative ground system.
OBSERVE PROPER POLARITY
Reverse polarity will damage electrical
components.

# SECTION 3
# EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when the ground service plug receptacle is installed.

# SECTION 4
# NORMAL PROCEDURES

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

**WARNING**

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

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 following check should be made after engine start and removal of the external power source, if there is any question as to the condition of the battery.

1. Master Switch -- OFF.
2. Taxi and Landing Light Switches -- ON.
3. Engine RPM -- REDUCE to idle.
4. Master Switch -- ON (with taxi and landing lights turned on).
5. Engine RPM -- INCREASE to approximately 1500 RPM.
6. Ammeter and Low-Voltage Warning Light -- CHECK.

NOTE

If the ammeter does not show a charge or the low-voltage warning light does not go out, the battery should be removed from the airplane and properly serviced prior to flight.

## SECTION 5
## PERFORMANCE

There is no change to the airplane performance when the ground service plug receptacle is installed.

# SUPPLEMENT

# STROBELIGHT SYSTEM

## SECTION 1

## GENERAL

The high intensity strobe light system enhances anti-collision protection for the airplane. The system consists of two wing tip-mounted strobe lights (with integral power supplies), a two-position rocker switch labeled STROBE LIGHTS, and a 5-amp "pull-off" type circuit breaker, labeled STROBE/AVN FAN. The rocker switch and circuit breaker are located on the left side of the switch and control panel.

## SECTION 2

## LIMITATIONS

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

## SECTION 3

## EMERGENCY PROCEDURES

There is no change to the airplane emergency procedures when strobe lights are installed.

## SECTION 4

## NORMAL PROCEDURES

To operate the strobe light system, proceed as follows:

1. Master Switch -- ON.
2. Strobe Light Switch -- ON.

# SECTION 5

# PERFORMANCE

The installation of strobe lights will result in a minor reduction in cruise performance.

# SUPPLEMENT

# CESSNA NAVOMATIC 300A AUTOPILOT
## (Type AF-395A)

## SECTION 1
## GENERAL

The Cessna 300A Navomatic is an all electric, single-axis (aileron control) autopilot system that provides added lateral and directional stability. Components are a computer-amplifier, a turn coordinator, a directional gyro, an aileron actuator and a course deviation indicator(s) incorporating a localizer reversed (BC) indicator light.

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

The actuator includes a thermostatic switch which monitors the operating temperature of the motor. If the temperature becomes abnormal, the thermostatic switch opens and disengages the autopilot to remove power from the actuator. After approximately 10 minutes, the switch will automatically close to reapply power to the actuator and autopilot system.

The 300A Navomatic will also intercept and track a VOR or localizer course using signals from a VHF navigation receiver.

The operating controls for the Cessna 300A Navomatic are located on the front panel of the computer-amplifier and on the directional gyro, shown in Figure 1. The primary function pushbuttons (HDG SEL, NAV INT, and NAV TRK), are interlocked so that only one function can be selected at a time. The HI SENS and BACK CRS pushbuttons are not interlocked so that either or both of these functions can be selected at any time.

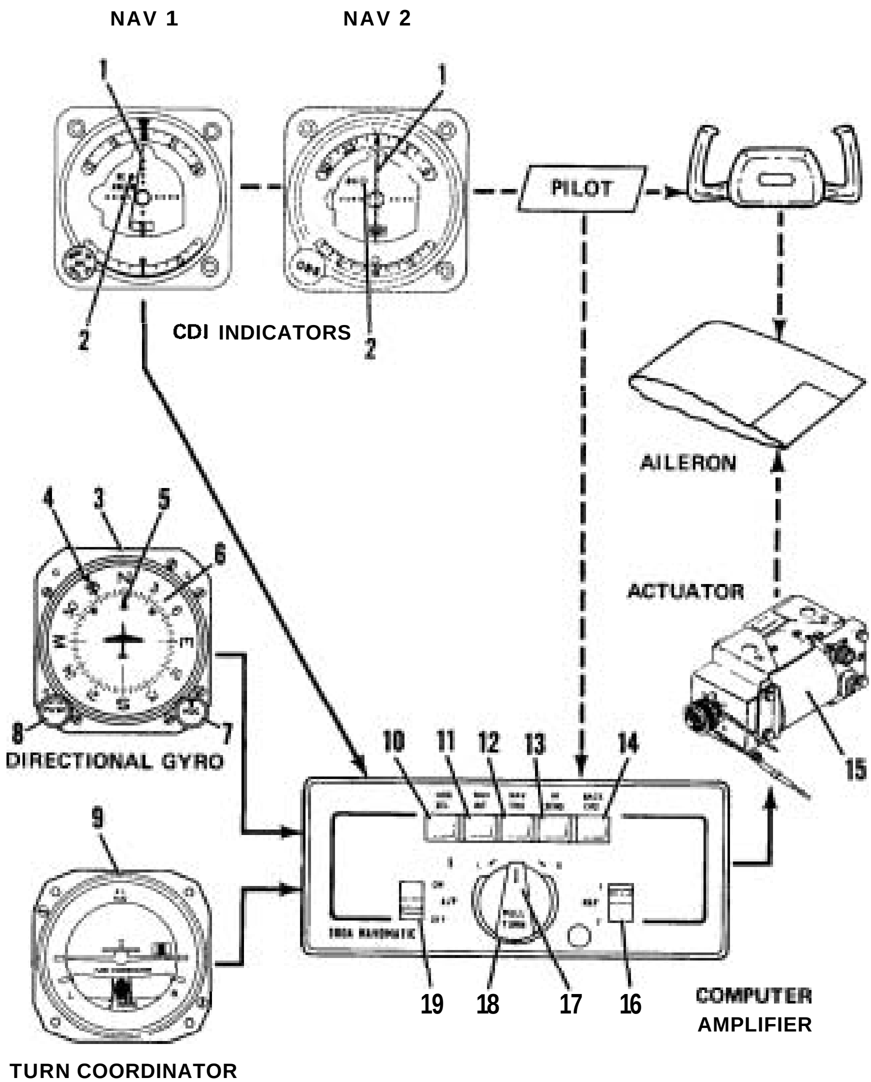



**Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators (Sheet 1 of 3)**

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. NON-SLAVED DIRECTIONAL GYRO - Provides a stable visual indication of aircraft heading to the pilot and provides heading information to the autopilot for heading intercept and hold.

4. HEADING BUG - Moved by HDG knob to select desired heading.

5. LUBBER LINE - Indicates aircraft heading on compass card (6).

6. COMPASS CARD - Rotates to display heading of airplane with reference to lubber line (5).

7. HEADING SELECTOR KNOB (HDG) - When pushed in, the heading bug (4) may be positioned to the desired magnetic heading by rotating the HDG selector knob. Also used to select VOR or LOC course.

8. GYRO ADJUSTMENT KNOB (PUSH) - When pushed in. allows the pilot to manually rotate the compass card (6) to correspond with the magnetic heading indicated by the compass. The compass card must be manually reset periodically to compensate for precessional errors in the gyro.

9. TURN COORDINATOR - Senses roll and yaw for wings leveling and command turn functions.

10. HDG SEL PUSHBUTTON - Aircraft will turn to and hold heading selected by the heading "bug" on the directional gyro.

11. NAV INT PUSHBUTTON - When heading "bug" on DG is set to selected course. aircraft will turn to and intercept selected VOR or LOC course.

12. NAV TRK PUSHBUTTON - When heading "bug" on DG is set to selected course, aircraft will track selected VOR or LOC course.

13. HI SENS PUSHBUTTON - During NAV INT or NAV TRK operation, this high sensitivity setting increases autopilot response to NAV signal to provide more precise operation during localizer approach. In low-sensitivity position (pushbutton out), response to NAV signal is dampened for smoother tracking of enroute VOR radials: it also smooths out effect of course scalloping during NAV operation.

14. BACK CRS PUSHBUTTON - Used with LOC operation only. With A/P switch OFF or ON, and when navigation receiver selected by NAV switch is set to a localizer frequency, it reverses normal localizer needle indication (CDI) and causes localizer reversed (BC) light to illuminate. With A/P switch ON, reverses localizer signal to autopilot.

Figure 1. Cessna 300A Autopilot, Operating Controls and Indicators (Sheet 2 of 3)

15. ACTUATOR - The torque motor in the actuator causes the ailerons to move in the commanded direction.

16. NAV SWITCH - Selects NAV 1 or NAV 2 navigation receiver.

17. PULL TURN KNOB - When pulled out and centered in detent, airplane will fly wings-level; when turned to the right (R), the airplane will execute a right, standard rate turn; when turned to the left (L), the airplane will execute a left. standard rate turn. When centered in detent and pushed in, the operating mode selected by a pushbutton is engaged.

18. TRIM - Used to trim autopilot to compensate for minor variations in aircraft trim or lateral weight distribution. (For proper operation, the aircraft's rudder trim, if so equipped, must be manually trimmed before the autopilot is engaged.)

19. A/P SWITCH - Turns autopilot ON or OFF.

**Figure 1. Cessna 300A Autopilot. Operating Controls and Indicators (Sheet 3 of 3)**

# SECTION 2
# LIMITATIONS

The following autopilot limitation must be adhered to:

BEFORE TAKE-OFF AND LANDING:

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

# SECTION 3
# EMERGENCY PROCEDURES

TO OVERRIDE THE AUTOPILOT:

1. Airplane Control Wheel -- ROTATE as required to override autopilot.

NOTE

The servo may be overpowered at any time without damage.

TO TURN OFF AUTOPILOT:

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

# SECTION 4
# NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING:

1. A/P ON-OFF Switch -- OFF.
2. BACK CRS Button -- OFF (see Caution note under Nav Intercept).

NOTE

Periodically verify operation of amber warning light(s), labeled BC on CDI(s), by engaging BACK CRS button with a LOC frequency selected, or use TEST function on the audio control panel to verify BC light operation.

INFLIGHT WINGS LEVELING:

1. Airplane Rudder Trim -- ADJUST for zero slip ("Ball" centered on Turn Coordinator).
2. PULL-TURN Knob -- CENTER and PULL out.
3. A/P ON-OFF Switch -- ON.
4. Autopilot TRIM Control -- ADJUST for zero turn rate (wings level indication on Turn Coordinator).

NOTE

For optimum performance in airplanes equipped as float-planes, use autopilot only in cruise flight or in approach configuration with flaps down no more than 10° and airspeed no lower than 75 KIAS on 172 and R172 Series Models or 90 KIAS on 180, 185, U206 and TU206 Series Models.

COMMAND TURNS:

1. PULL-TURN Knob -- CENTER, PULL out and ROTATE.

HEADING SELECT:

1. Directional Gyro -- SET to airplane magnetic heading.
2. Heading Selector Knob -- ROTATE bug to desired heading.
3. Heading Select Button -- PUSH.
4. PULL-TURN Knob -- CENTER and PUSH.

NOTE

Airplane will turn automatically to selected heading. If airplane fails to hold the precise heading, readjust autopilot TRIM control as required or disengage autopilot and reset manual rudder trim (if installed).

NAV INTERCEPT (VOR/LOC):

1. PULL-TURN Knob -- CENTER and PULL out.
2. NAV 1-2 Selector Switch -- SELECT desired receiver.
3. Nav Receiver OBS or ARC Knob -- SET desired VOR course (if tracking omni).

NOTE

Optional ARC knob should be in center position and ARC warning light should be off.

4. Heading Selector Knob -- ROTATE bug to selected course (VOR or localizer - inbound or outbound as appropriate).
5. Directional Gyro --SET for magnetic heading.
6. NAV INT Button -- PUSH.
7. HI SENS Button -- PUSH for localizer and "close-in" omni intercepts.
8. BACK CRS Button -- PUSH only if intercepting localizer front course outbound or back course inbound.

**CAUTION**

With BACK CRS button pushed in and localizer frequency selected, the CDI on selected nav radio will be reversed even when the autopilot switch is OFF.

9. PULL-TURN Knob -- PUSH.

NOTE

Airplane will automatically turn to a 45° intercept angle.

NAV TRACKING (VOR/LOC):

1. NAV TRK Button -- PUSH when CDI centers (within one dot) and airplane is within ± 10° of course heading.
2. HI SENS Button -- Disengage for enroute omni tracking (leave engaged for localizer).

NOTE

Optional ARC feature, if installed, should not be used for autopilot operation. If airplane should deviate off course, pull out PULL TURN knob and readjust airplane rudder trim for straight flight on the turn coordinator. Push in PULL TURN knob and reintercept the course. If deviation persists, progressively make slight adjustments of the autopilot TRIM control towards the course as required to maintain track.

## SECTION 5
## PERFORMANCE

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