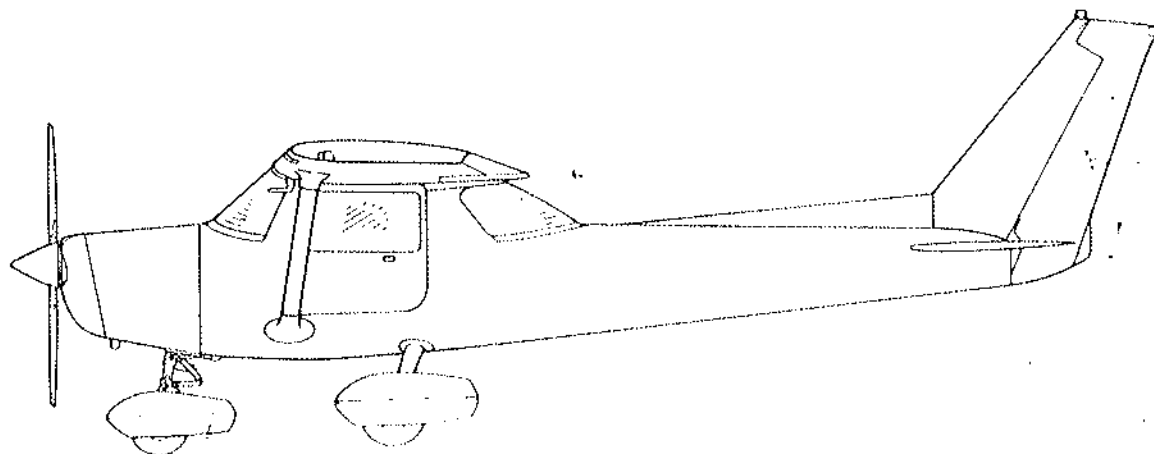


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Pilot's Operating Handbook and FAA Approved Airplane Flight Manual



Cessna Aircraft Company

THIS DOCUMENT MUST BE
CARRIED IN THE AIRPLANE
AT ALL TIMES.

1985 Model 152

Serial No. 15285960

Registration No. N95705

PH TGD

THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO
BE FURNISHED TO THE PILOT BY CAR PART 3 AND CONSTI-
TUTES THE FAA APPROVED AIRPLANE FLIGHT MANUAL.

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Cessna Aircraft Company
Wichita, Kansas USA

THIS MANUAL WAS PROVIDED FOR THE AIRPLANE
IDENTIFIED ON THE TITLE PAGE ON 01-30-85 .
SUBSEQUENT REVISIONS SUPPLIED BY CESSNA
AIRCRAFT COMPANY MUST BE PROPERLY IN-
SERTED.

R. Rogers

Cessna Aircraft Company, Aircraft Division

CONGRATULATIONS

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

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

The worldwide Cessna Dealer Organization and Cessna Customer Services stand ready to serve you. You will find the following services are offered by most Cessna Dealers:

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

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

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

PERFORMANCE - SPECIFICATIONS

***SPEED:**

Maximum at Sea Level	109 KNOTS
Cruise, 75% Power at 8500 Ft	108 KNOTS

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

75% Power at 8500 Ft	Range	315 NM
24.5 Gallons Usable Fuel	Time	3.0 HRS
75% Power at 8500 Ft	Range	540 NM
37.5 Gallons Usable Fuel	Time	5.2 HRS
Maximum Range at 10,000 Ft	Range	370 NM
24.5 Gallons Usable Fuel	Time	4.1 HRS
Maximum Range at 10,000 Ft	Range	625 NM
37.5 Gallons Usable Fuel	Time	6.9 HRS

RATE OF CLIMB AT SEA LEVEL	715 FPM
SERVICE CEILING	14,700 FT

TAKEOFF PERFORMANCE:

Ground Roll	725 FT
Total Distance Over 50-Ft Obstacle	1340 FT

LANDING PERFORMANCE:

Ground Roll	475 FT
Total Distance Over 50-Ft Obstacle	1200 FT

STALL SPEED (KCAS):

Flaps Up, Power Off	48 KNOTS
Flaps Down, Power Off	43 KNOTS

MAXIMUM WEIGHT:

Ramp	1675 LBS
Takeoff or Landing	1670 LBS

STANDARD EMPTY WEIGHT 1109 LBS

MAXIMUM USEFUL LOAD 566 LBS

BAGGAGE ALLOWANCE 120 LBS

WING LOADING: Pounds/Sq Ft 10.5

POWER LOADING: Pounds/HP 15.5

FUEL CAPACITY: Total

Standard Tanks	26 GAL.
Long Range Tanks	39 GAL.

OIL CAPACITY 7 QTS

ENGINE: Avco Lycoming O-235-N2C
108 BHP at 2550 RPM

PROPELLER: Fixed Pitch, Diameter 69 IN.

*Speed performance is shown for an airplane equipped with optional speed fairings, which increase the speeds by approximately 2 knots. There is a corresponding difference in range, while all other performance figures are unchanged when speed fairings are installed.

The above performance figures are based on 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.

COVERAGE

The Pilot's Operating Handbook in the airplane at the time of delivery from Cessna Aircraft Company contains information applicable to the 1985 Model 152 airplane designated by the serial number and registration number shown on the Title Page of this handbook. This information is based on data available at the time of publication.

REVISIONS

Changes and/or additions to this handbook will be covered by revisions published by Cessna Aircraft Company. These revisions are distributed to owners of U.S. Registered aircraft according to FAA records at the time of revision issuance, and to Internationally Registered aircraft according to Cessna Owner Advisory records at the time of issuance.

Revisions should be examined immediately upon receipt and incorporated in this handbook.

NOTE

It is the responsibility of the owner to maintain this handbook in a current status when it is being used for operational purposes.

Owners should contact their Cessna Dealer whenever the revision status of their handbook is in question.

A revision bar will extend the full length of new or revised text and/or illustrations added on new or presently existing pages. This bar will be located adjacent to the applicable revised area on the outer margin of the page.

All revised pages will carry the revision number and date on the applicable page.

The following Log of Effective Pages provides the dates of issue for original and revised pages, and a listing of all pages in the handbook. Pages affected by the current revision are indicated by an asterisk (*) preceding the pages listed.

LOG OF EFFECTIVE PAGES

Dates of issue for original and revised pages are:

Original 20 August 1984

Page	Date	Page	Date
Title	20 August 1984	6-1	20 August 1984
Assignment Record	20 August 1984	6-2 Blank	20 August 1984
i thru v	20 August 1984	6-3 thru 6-26	20 August 1984
vi Blank	20 August 1984	7-1 thru 7-35	20 August 1984
1-1 thru 1-8	20 August 1984	7-36 Blank	20 August 1984
2-1	20 August 1984	8-1	20 August 1984
2-2 Blank	20 August 1984	8-2 Blank	20 August 1984
2-3 thru 2-11	20 August 1984	8-3 thru 8-19	20 August 1984
2-12 Blank	20 August 1984	8-20 Blank	20 August 1984
3-1 thru 3-16	20 August 1984	9-1 thru 9-2	20 August 1984
4-1 thru 4-25	20 August 1984		
4-26 Blank	20 August 1984		
5-1	20 August 1984		
5-2 Blank	20 August 1984		
5-3 thru 5-20	20 August 1984		

NOTE

Refer to Section 9 Table of Contents for supplements applicable to optional systems.

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SECTION 1
GENERAL

CESSNA
MODEL 152

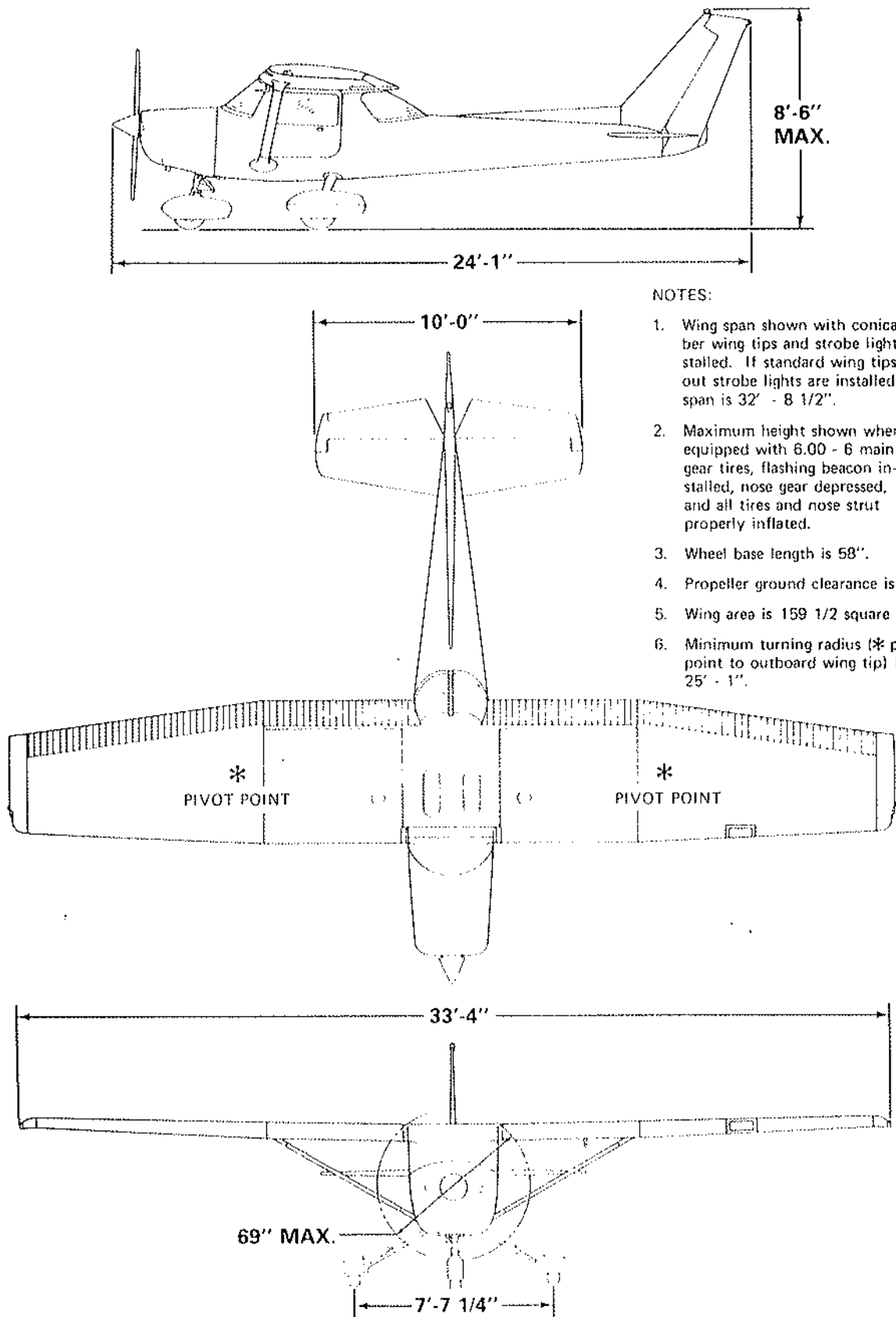


Figure 1-1. Three View

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-235-N2C.

Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, carburetor equipped, four-cylinder engine with 233.3 cu. in. displacement.

Horsepower Rating and Engine Speed: 108 rated BHP at 2550 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.

Propeller Model Number: 1A103/TCM6958.

Number of Blades: 2.

Propeller Diameter, Maximum: 69 inches.

Minimum: 67.5 inches.

Propeller Type: Fixed pitch.

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.

Fuel Capacity:

Standard Tanks:

Total Capacity: 26 gallons.

Total Capacity Each Tank: 13 gallons.

Total Usable: 24.5 gallons.

Long Range Tanks:

Total Capacity: 39 gallons.

Total Capacity Each Tank: 19.5 gallons.

Total Usable: 37.5 gallons.

NOTE

Due to cross-feeding between fuel tanks, the tanks should be re-topped after each refueling to assure maximum capacity.

OIL

Oil Specification:

MIL-L-6082 Aviation Grade Straight Mineral Oil: Used when the airplane was delivered from the factory and should be used to replenish the supply during the first 25 hours. This oil should be drained after the first 25 hours of operation. Refill the engine and continue to use until a total of 50 hours has accumulated or oil consumption has stabilized.

MIL-L-22851 Aviation Grade Ashless Dispersant Oil: Oil conforming to Avco Lycoming Service Instruction No. 1014, and all revisions and supplements thereto, must be used after first 50 hours or oil consumption has stabilized.

Recommended Viscosity for Temperature Range:

All temperatures, use multi-viscosity oil 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

NOTE

When operating temperatures overlap, use the lighter grade of oil.

Oil Capacity:

Sump: 6 Quarts.

Total: 7 Quarts.

MAXIMUM CERTIFICATED WEIGHTS

Ramp: 1675 lbs.

Takeoff: 1670 lbs.

Landing: 1670 lbs.

Weight in Baggage Compartment:

Baggage Area 1 (or passenger on child's seat) - Station 50 to 76: 120 lbs. See note below.

Baggage Area 2 - Station 76 to 94: 40 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas 1 and 2 is 120 lbs.

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight : 1109 lbs.

Maximum Useful Load : 566 lbs.

CABIN AND ENTRY DIMENSIONS

Detailed dimensions of the cabin interior and entry door openings are illustrated in Section 6.

BAGGAGE SPACE DIMENSIONS

Baggage area dimensions are illustrated in detail in Section 6.

SPECIFIC LOADINGS

Wing Loading: 10.5 lbs./sq. ft.

Power Loading: 15.5 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

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

KIAS	Knots Indicated Airspeed is the speed shown on the airspeed indicator and expressed in knots.
KTAS	Knots True Airspeed is the airspeed expressed in knots relative to undisturbed air which is KCAS corrected for altitude and temperature.
V_A	Maneuvering Speed is the maximum speed at which full or abrupt control movements may be used.
V_{FE}	Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.
V_{NO}	Maximum Structural Cruising Speed is the speed that should not be exceeded except in smooth air, then only with caution.
V_{NE}	Never Exceed Speed is the speed limit that may not be exceeded at any time.
V_S	Stalling Speed or the minimum steady flight speed at which the airplane is controllable.
V_{S_0}	Stalling Speed or the minimum steady flight speed at which the airplane is controllable in the landing configuration at the most forward center of gravity.
V_X	Best Angle-of-Climb Speed is the speed which results in the greatest gain of altitude in a given horizontal distance.
V_Y	Best Rate-of-Climb Speed is the speed which results in the greatest gain in altitude in a given time.

METEOROLOGICAL TERMINOLOGY

OAT	Outside Air Temperature is the free air static temperature. It is expressed in either degrees Celsius 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.
Static RPM	Static RPM is engine speed attained during a full-throttle engine runup when the airplane is on the ground and stationary.

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 roll.
Maximum Landing Weight	Maximum Landing Weight is the maximum weight approved for the landing touchdown.
Tare	Tare is the weight of chocks, blocks, stands, etc. used when weighing an airplane, and is included in the scale readings. Tare is deducted from the scale reading to obtain the actual (net) airplane weight.

SECTION 2 LIMITATIONS

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INTRODUCTION

Section 2 includes operating limitations, instrument markings, and basic placards necessary for the safe operation of the airplane, its engine, standard systems and standard equipment. The limitations included in this section 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.

Your Cessna is certificated under FAA Type Certificate No. 3A19 as Cessna Model No. 152.

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V _{NE}	Never Exceed Speed	145	149	Do not exceed this speed in any operation.
V _{NO}	Maximum Structural Cruising Speed	108	111	Do not exceed this speed except in smooth air, and then only with caution.
V _A	Maneuvering Speed: 1670 Pounds 1500 Pounds 1350 Pounds	101 96 91	104 98 93	Do not make full or abrupt control movements above this speed.
V _{FE}	Maximum Flap Extended Speed	87	85	Do not exceed this speed with flaps down.
	Maximum Window Open Speed	145	149	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	35 - 85	Full Flap Operating Range. Lower limit is maximum weight V_{SO} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	40 - 111	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	111 - 149	Operations must be conducted with caution and only in smooth air.
Red Line	149	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Avco Lycoming.

Engine Model Number: O-235-N2C.

Maximum Power: 108 BHP rating.

Engine Operating Limits for Takeoff and Continuous Operations:

Maximum Engine Speed: 2550 RPM.

NOTE

The static RPM range at full throttle (carburetor heat off and mixture leaned to maximum RPM) is 2280 to 2380 RPM. For allowable variations in static RPM at non-standard temperatures, refer to the Service Manual.

Maximum Oil Temperature: 245°F (118°C).

Oil Pressure, Minimum: 25 psi.

Maximum: 115 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: 1A103/TCM6958.

Propeller Diameter, Maximum: 69 inches.

Minimum: 67.5 inches.

POWER PLANT INSTRUMENT MARKINGS

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

INSTRUMENT	RED LINE	GREEN ARC	RED LINE
	MINIMUM LIMIT	NORMAL OPERATING	MAXIMUM LIMIT
Tachometer: Sea Level 4000 Feet 8000 Feet	---	1900 - 2350 RPM 1900 - 2450 RPM 1900 - 2550 RPM	2550 RPM
Oil Temperature	---	100° - 245°F	245°F
Oil Pressure	25 psi	60 - 90 psi	115 psi
Fuel Quantity	E (0.75 Gal. Unusable Each Tank)	---	---
Suction	---	4.5 - 5.4 in. Hg	---

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

Maximum Ramp Weight: 1675 lbs.

Maximum Takeoff Weight: 1670 lbs.

Maximum Landing Weight: 1670 lbs.

Maximum Weight in Baggage Compartment:

Baggage Area 1 (or passenger on child's seat) - Station 50 to 76: 120 lbs.

See note below.

Baggage Area 2 - Station 76 to 94: 40 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas 1 and 2 is 120 lbs.

CENTER OF GRAVITY LIMITS

Center of Gravity Range:

Forward: 31.0 inches aft of datum at 1350 lbs. or less, with straight line variation to 32.65 inches aft of datum at 1670 lbs.

Aft: 36.5 inches aft of datum at all weights.

Reference Datum: Front face of firewall.

MANEUVER LIMITS

This airplane is certificated in the utility category and is designed for limited aerobatic flight. In the acquisition of various certificates such as commercial pilot and flight instructor, certain maneuvers are required. All of these maneuvers are permitted in this airplane.

No aerobatic maneuvers are approved except those listed below:

MANEUVER	RECOMMENDED ENTRY SPEED*
Chandelles95 knots
Lazy Eights95 knots
Steep Turns95 knots
Spins	Use Slow Deceleration
Stalls (Except Whip Stalls)	Use Slow Deceleration

*Higher speeds can be used if abrupt use of the controls is avoided.

The baggage compartment and/or child's seat must not be occupied during aerobatics.

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

FLIGHT LOAD FACTOR LIMITS

Flight Load Factors:

- *Flaps Up: +4.4g, -1.76g
- *Flaps Down: +3.5g

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

KINDS OF OPERATION LIMITS

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

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

2 Standard Tanks: 13 U.S. gallons each.

Total Fuel: 26 U.S. gallons.

Usable Fuel (all flight conditions): 24.5 U.S. gallons.

Unusable Fuel: 1.5 U.S. gallons.

2 Long-Range Tanks: 19.5 U.S. gallons each.

Total Fuel: 39 U.S. gallons.

Usable Fuel (all flight conditions): 37.5 U.S. gallons.

Unusable Fuel: 1.5 U.S. gallons.

NOTE

Due to cross-feeding between fuel tanks, the tanks should be re-topped after each refueling to assure maximum capacity.

Takeoffs have not been demonstrated with less than 2 gallons of total fuel (1 gallon per tank).

Fuel remaining in the tank after the fuel quantity indicator reads empty (red line) cannot be safely used in 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 10°.

Approved Landing Range: 0° to 30°.

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 Utility 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 APPROVED EXCEPT THOSE LISTED BELOW

<u>Maneuver</u>	<u>Rec. Entry Speed</u>	<u>Maneuver</u>	<u>Rec. Entry Speed</u>
Chandelles	95 KIAS	Spins.....	Slow Decel.
Lazy 8's	95 KIAS	Stalls (Ex-	
Steep Turns	95 KIAS	cept Whip	
		Stalls).....	Slow Decel.

Intentional spins prohibited with flaps extended.
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. In the baggage compartment:

120 LBS. MAXIMUM BAGGAGE AND/OR AUXILIARY SEAT PASSENGER. FOR ADDITIONAL LOADING INSTRUCTIONS SEE WEIGHT AND BALANCE DATA.

3. Near fuel shutoff valve (standard tanks):

FUEL - 24.5 GALS - ON-OFF

- Near fuel shutoff valve (long range tanks):

FUEL - 37.5 GALS - ON-OFF

4. Near fuel tank filler cap (standard tanks):

FUEL
100LL/100 MIN. GRADE AVIATION GASOLINE
CAP. 13 U.S. GAL.

- Near fuel tank filler cap (long range tanks):

FUEL
100LL/100 MIN. GRADE AVIATION GASOLINE
CAP. 19.5 U.S. GAL.
CAP 13.0 U.S. GAL. TO BOTTOM OF FILLER COLLAR

5. On the instrument panel near the altimeter:

SPIN RECOVERY

1. VERIFY AILERONS NEUTRAL AND THROTTLE CLOSED
2. APPLY FULL OPPOSITE RUDDER
3. MOVE CONTROL WHEEL BRISKLY FORWARD TO BREAK STALL
4. NEUTRALIZE RUDDER AND RECOVER FROM DIVE

6. A calibration card must be provided to indicate the accuracy of the magnetic compass in 30° increments.

7. On oil filler cap:

OIL
6 QTS

8. On control lock:

CAUTION!
CONTROL LOCK
REMOVE BEFORE STARTING ENGINE

9. Near airspeed indicator:

MANEUVER SPEED - 104 KIAS

10. On forward face of firewall adjacent to the battery:

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

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INTRODUCTION

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

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff	60 KIAS
Maneuvering Speed:	
1670 Lbs	104 KIAS
1500 Lbs	98 KIAS
1350 Lbs	93 KIAS
Maximum Glide	60 KIAS
Precautionary Landing With Engine Power	55 KIAS
Landing Without Engine Power:	
Wing Flaps Up	65 KIAS
Wing Flaps Down	60 KIAS

OPERATIONAL CHECKLISTS

Procedures in the Operational Checklists portion of this section shown in **bold-faced** type are immediate-action items which should be committed to memory.

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF ROLL

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 -- 60 KIAS.**
2. **Mixture -- IDLE CUT-OFF.**
3. **Fuel Shutoff Valve -- OFF.**
4. **Ignition Switch -- OFF.**
5. **Wing Flaps -- AS REQUIRED.**
6. **Master Switch -- OFF.**

ENGINE FAILURE DURING FLIGHT (RESTART PROCEDURES)

1. **Airspeed -- 60 KIAS.**
2. **Carburetor Heat -- ON.**
3. **Primer -- IN and LOCKED.**
4. **Fuel Shutoff Valve -- ON.**
5. **Mixture -- RICH.**
6. **Ignition Switch -- BOTH (or START if propeller is stopped).**

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

1. **Seats, Seat Belts, Shoulder Harnesses -- SECURE.**
2. **Airspeed -- 65 KIAS (flaps UP).
60 KIAS (flaps DOWN).**
3. **Mixture -- IDLE CUT-OFF.**
4. **Fuel Shutoff Valve -- OFF.**
5. **Ignition Switch -- OFF.**
6. **Wing Flaps -- AS REQUIRED (30° recommended).**
7. **Master Switch -- OFF.**
8. **Doors -- UNLATCH PRIOR TO TOUCHDOWN.**
9. **Touchdown -- SLIGHTLY TAIL LOW.**
10. **Brakes -- APPLY HEAVILY.**

PRECAUTIONARY LANDING WITH ENGINE POWER

1. **Seats, Seat Belts, Shoulder Harnesses -- SECURE.**
2. **Airspeed -- 60 KIAS.**
3. **Wing Flaps -- 20°.**
4. **Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.**
5. **Radio and Electrical Switches -- OFF.**
6. **Wing Flaps -- 30° (on final approach).**
7. **Airspeed -- 55 KIAS.**
8. **Master Switch -- OFF.**
9. **Doors -- UNLATCH PRIOR TO TOUCHDOWN.**

10. Touchdown -- SLIGHTLY TAIL LOW.
11. Ignition Switch -- OFF.
12. Brakes -- APPLY HEAVILY.

DITCHING

1. Radio -- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700 if transponder is installed.
2. Heavy Objects (in baggage area) -- SECURE OR JETTISON.
3. Seats, Seat Belts, Shoulder Harnesses -- SECURE.
4. Approach -- High Winds, Heavy Seas -- INTO THE WIND.
Light Winds, Heavy Swells -- PARALLEL TO SWELLS.
5. Wing Flaps -- 30° .
6. Power -- ESTABLISH 300 FT/MIN DESCENT AT 55 KIAS.
7. Cabin Doors -- UNLATCH.
8. Touchdown -- LEVEL ATTITUDE AT 300 FT/MIN DESCENT.
9. Face -- CUSHION at touchdown with folded coat.
10. Airplane -- EVACUATE through cabin doors. If necessary, open 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 CUTOFF.
6. Cranking -- CONTINUE in an effort to obtain a start.
7. Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
8. Engine -- SECURE.
 - a. Master Switch -- OFF.
 - b. Ignition Switch -- OFF.
 - c. Fuel Shutoff 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 Shutoff Valve -- OFF.
3. Master Switch -- OFF.
4. Cabin Heat and Air -- OFF (except wing root vents).
5. Airspeed -- 85 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. Vents/Cabin Air/Heat -- CLOSED.
3. Fire Extinguisher -- ACTIVATE (if available).

WARNING

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

4. All Other Switches (except ignition switch) -- OFF.

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

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

CABIN FIRE

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

WARNING

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

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

WING FIRE

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

NOTE

Perform a side slip to keep the flames away from the fuel tank and cabin, and land as soon as possible, with flaps retracted.

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** to obtain maximum defroster air temperature. For greater air flow at reduced temperatures, adjust the cabin air control as required.
4. Open the throttle to increase engine speed and minimize ice build-up on propeller blades.
5. Watch for signs of carburetor air filter ice and apply carburetor heat as required. An unexpected loss in engine speed could be caused by carburetor ice or air intake filter ice. Lean the mixture for maximum RPM, 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 left 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 65 to 75 KIAS depending upon the amount of ice accumulation.
12. Perform a landing in level attitude.

LANDING WITH A FLAT MAIN TIRE

1. Wing Flaps -- AS DESIRED.
2. Approach -- NORMAL.
3. Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible with aileron control.

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.

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

The following Amplified Procedures elaborate upon information contained in the Operational Checklists portion of this section. These procedures also include information not readily adaptable to a checklist format, and material to which a pilot could not be expected to refer in resolution of a specific emergency.

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.

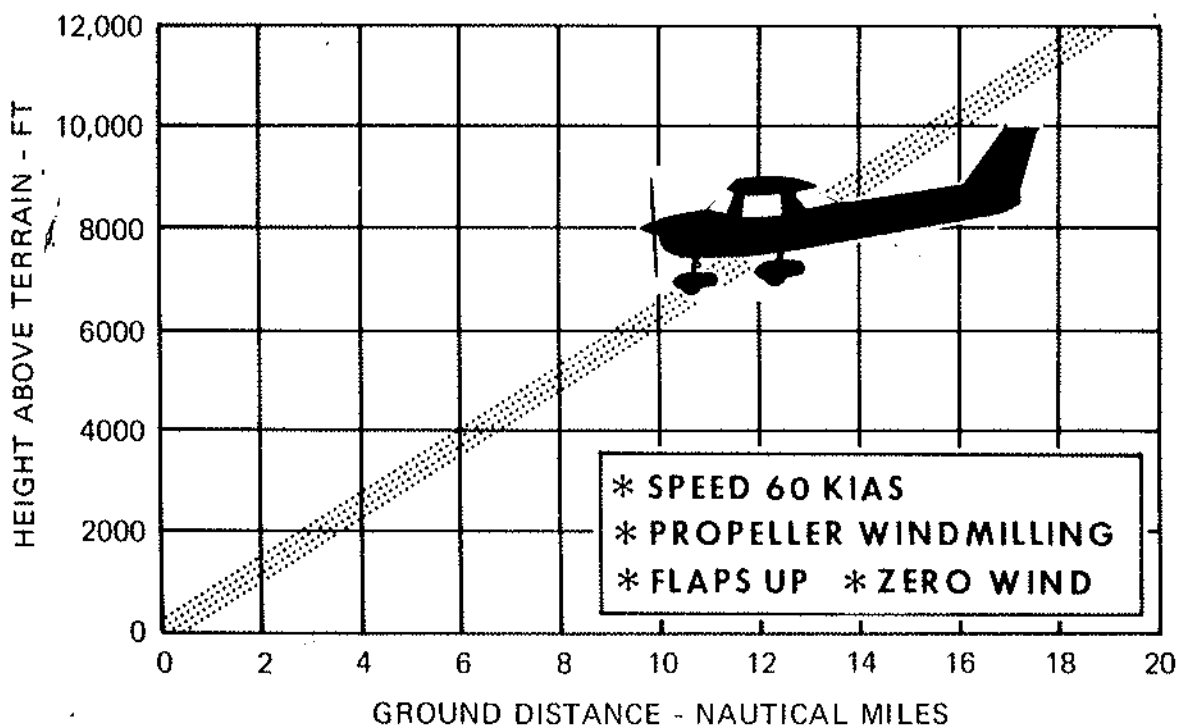


Figure 3-1. Maximum Glide

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

FORCED LANDINGS

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

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

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

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight (with an airspeed of approximately 55 KIAS and flaps lowered to 20°) by using throttle and elevator trim controls. 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 trim control should be set at 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)

If the optional electric standby vacuum pump is not installed and a complete vacuum system failure occurs 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. Refer to Section 9, Supplements, for additional details concerning electric standby vacuum pump operation. 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 through clouds. To guard against a spiral dive, choose an easterly or westerly heading to minimize compass card swings due to changing bank angles. In addition, keep hands off the control wheel and steer a straight course with rudder

control by monitoring the turn coordinator. Occasionally check the compass heading and make minor corrections to hold an approximate course. Before descending into the clouds, set up a stabilized let-down condition as follows:

1. Apply full rich mixture.
2. Use full carburetor heat.
3. Reduce power to set up a 500 to 800 ft/min rate of descent.
4. Adjust the elevator trim for a stabilized descent at 70 KIAS.
5. Keep hands off control wheel.
6. Monitor turn coordinator and make corrections by rudder alone.
7. Check trend of compass card movement and make cautious corrections with rudder to stop turn.
8. Upon breaking out of clouds, resume normal cruising flight.

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows:

1. Retard throttle to idle position.
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 airspeed to 70 KIAS.
4. Adjust the elevator trim control to maintain a 70 KIAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading.
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.

SPINS

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

1. **PLACE AILERONS IN NEUTRAL POSITION.**

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

NOTE

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

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

ROUGH ENGINE OPERATION OR LOSS OF POWER

CARBURETOR ICING

A gradual loss of RPM 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 maximum RPM or recommended lean mixture as desired.

SPARK PLUG FOULING

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

the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION

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

LOW OIL PRESSURE

If low oil pressure is accompanied by normal oil temperature, there is a possibility the oil pressure gage or relief valve is malfunctioning. 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.

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.

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 radios 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 radios 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 use of the flaps during landing and, if the emergency occurs at night, for possible use of the landing light during landing.

OTHER EMERGENCIES

WINDSHIELD DAMAGE

If a bird strike or other incident should damage the windshield in flight to the point of creating an opening, a significant loss in performance may be expected. This loss may be minimized in some cases (depending on amount of damage, altitude, etc.) by opening the side windows while the airplane is maneuvered for a landing at the nearest airport.

If airplane performance or other adverse conditions preclude landing at an airport, prepare for an "off airport" landing in accordance with the Precautionary Landing With Engine Power or Ditching checklists.

SECTION 4

NORMAL PROCEDURES

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INTRODUCTION

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

SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 1670 pounds and may be used for any lesser weight.

Takeoff:

Normal Climb Out	65-75 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	54 KIAS

Climb, Flaps Up:

Normal	70-80 KIAS
Best Rate of Climb, Sea Level	67 KIAS
Best Rate of Climb, 10,000 Feet	61 KIAS
Best Angle of Climb, Sea Level thru 10,000 Feet	55 KIAS

Landing Approach:

Normal Approach, Flaps Up	60-70 KIAS
Normal Approach, Flaps 30°	55-65 KIAS
Short Field Approach, Flaps 30°	54 KIAS

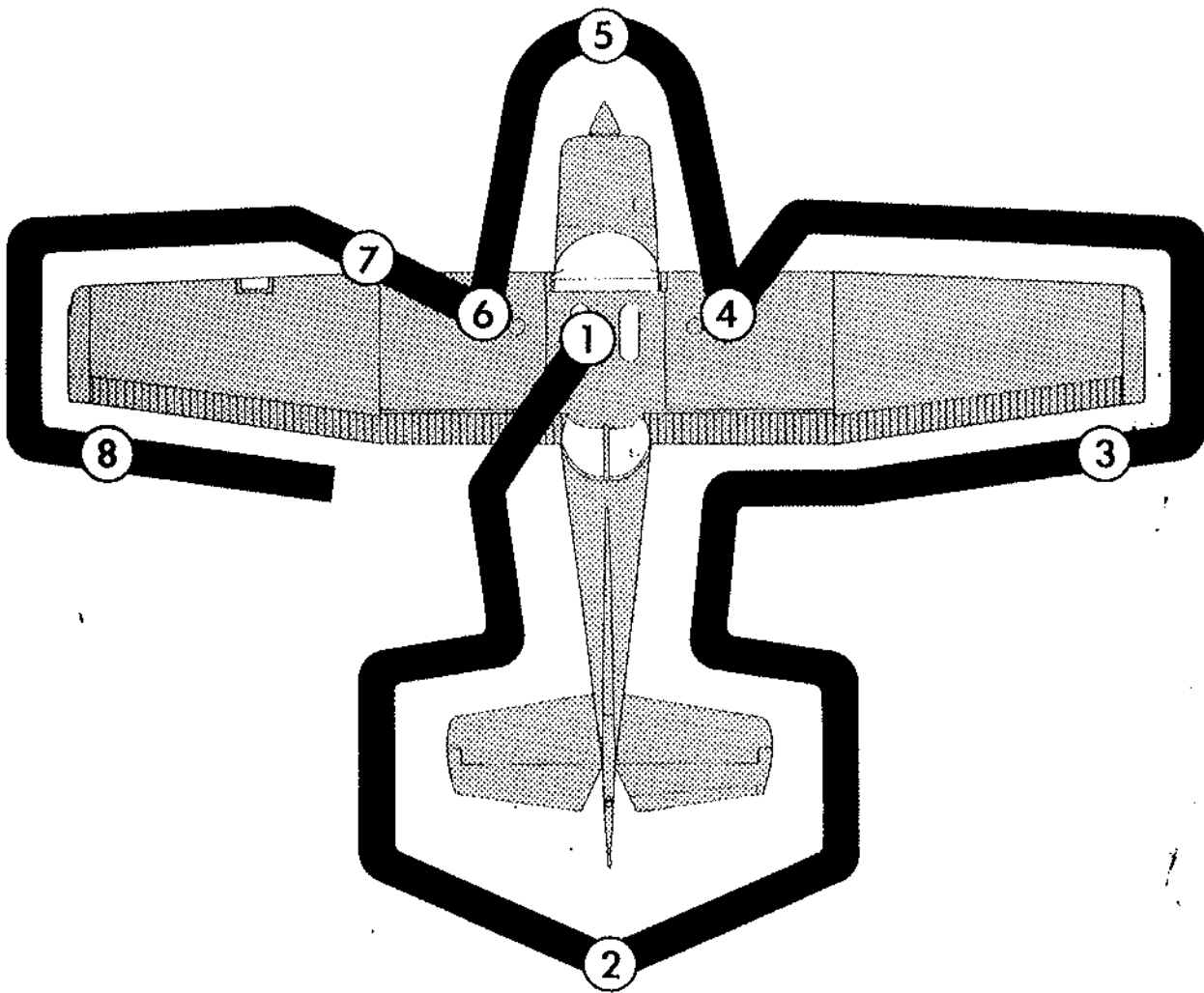
Balked Landing:

Maximum Power, Flaps 20°	55 KIAS
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Maximum Recommended Turbulent Air Penetration Speed:

1670 Lbs	104 KIAS
1500 Lbs	98 KIAS
1350 Lbs	93 KIAS

Maximum Demonstrated Crosswind Velocity	12 KNOTS
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NOTE

Visually check airplane for general condition during walk-around inspection. Use of the refueling steps and assist handles (if installed) will simplify access to the upper wing surfaces for visual checks and refueling operations. 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. Parking Brake -- SET.
3. Control Wheel Lock -- REMOVE.
4. Ignition Switch -- OFF.
5. 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.

6. Fuel Quantity Indicators -- CHECK QUANTITY.
7. Avionics Cooling Fan -- CHECK AUDIBLY FOR OPERATION.
8. Low-Vacuum Warning Light -- CHECK ON.
9. Master Switch -- OFF.
10. Fuel Shutoff Valve -- ON.

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. Main Wheel Tire -- CHECK for proper inflation.
3. Fuel Line Quick-Drain Valve (on bottom of fuselage near cabin door) -- DRAIN at least a cupful of fuel (using sampler cup) to check for water, sediment, and proper fuel grade before first flight of day and after each refueling. If water is observed, take further

samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all drain points until all contamination has been removed.

4. Fuel Tank Sump Quick-Drain Valve -- DRAIN at least a cupful of fuel (using sampler cup) to check for water, sediment, and proper fuel grade before first flight of day and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all drain points until all contamination has been removed.
5. Fuel Quantity -- CHECK VISUALLY for desired level.
6. Fuel Filler Cap -- SECURE.

5 NOSE

1. Engine Oil Dipstick/Filler Cap -- CHECK oil level, then check dipstick/filler cap SECURE. Do not operate with less than four quarts. Fill to six quarts for extended flight.
2. Fuel Strainer Drain Knob -- PULL OUT for at least four seconds to clear strainer of possible water and sediment before first flight of day and after each refueling. Return drain knob full in and check strainer drain CLOSED. If water is observed, perform further draining at all drain points until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all drain points until all contamination has been removed.
3. Propeller and Spinner -- CHECK for nicks and security.
4. Engine Cooling Air Inlets and Oil Cooler -- CLEAR of obstructions.
5. Carburetor Air Filter -- CHECK for restrictions by dust or other foreign matter.
6. Nose Wheel Strut and Tire -- CHECK for proper inflation.
7. Nose Tie-Down -- DISCONNECT.
8. Static Source Opening (left side of fuselage) -- CHECK for stoppage.

6 LEFT WING

1. Fuel Quantity -- CHECK VISUALLY for desired level.
2. Fuel Filler Cap -- SECURE.
3. Fuel Tank Sump Quick-Drain Valve -- DRAIN at least a cupful of fuel (using sampler cup) to check for water, sediment, and proper fuel grade before first flight of day and after each refueling. If water is observed, take further samples until clear and then gently rock wings and lower tail to the ground to move any additional contaminants to the sampling points. Take repeated samples from all drain points until all contamination has been removed.

4. Main Wheel Tire -- CHECK for proper inflation.

⑦ LEFT WING Leading Edge

1. Pitot Tube Cover -- REMOVE and check opening for stoppage.
2. Stall Warning Opening -- CHECK for stoppage. To check the system, place a clean handkerchief over the vent opening and apply suction; a sound from the warning horn will confirm system operation.
3. Fuel Tank Vent Opening -- CHECK for stoppage.
4. Wing Tie-Down -- DISCONNECT.
5. Landing Light(s) -- CHECK for condition and cleanliness of lens.

⑧ LEFT WING Trailing Edge

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

BEFORE STARTING ENGINE

1. Preflight Inspection -- COMPLETE.
2. Passenger Briefing -- COMPLETE.
3. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
4. Brakes -- TEST and SET.
5. Electrical Equipment -- OFF.
6. Radios -- OFF.
7. Circuit Breakers -- CHECK IN.
8. Fuel Shutoff Valve -- ON.

STARTING ENGINE (Temperatures Above Freezing)

NOTE

For cold weather starting procedures, refer to page 4-23.

1. Prime -- AS REQUIRED (up to 3 strokes - none if engine is warm).
2. Carburetor Heat -- COLD.
3. Throttle -- OPEN 1/2 INCH (CLOSED if engine is warm).
4. Mixture -- RICH.
5. Propeller Area -- CLEAR.
6. Master Switch -- ON.
7. Ignition Switch -- START (release when engine starts).
8. Throttle -- ADJUST for 1000 RPM or less.
9. Oil Pressure -- CHECK.
10. Starter -- CHECK DISENGAGED (if starter were to remain engaged, ammeter would indicate two-thirds scale or more charge with engine running at 1000 RPM).
11. Navigation Lights and Flashing Beacon -- ON as required.
12. Radios -- ON.

BEFORE TAKEOFF

1. Parking Brake -- SET.
2. Seats, Seat Belts, Shoulder Harnesses -- CHECK SECURE.
3. Cabin Doors -- CLOSED and LATCHED.
4. Flight Controls -- FREE and CORRECT.
5. Flight Instruments -- CHECK and SET.
6. Primer -- IN and LOCKED.
7. Fuel Quantity -- CHECK.
8. Fuel Shutoff Valve -- RECHECK ON.
9. Mixture -- RICH (below 3000 feet).
10. Elevator Trim -- SET for takeoff.
11. Throttle -- 1700 RPM.
 - a. Magnetos -- CHECK (RPM drop should not exceed 125 RPM on either magneto or 50 RPM differential between magnetos).
 - b. Carburetor Heat -- CHECK (for RPM drop).
 - c. Suction Gage -- CHECK.
 - d. Engine Instruments and Ammeter -- CHECK.
12. Throttle -- 1000 RPM OR LESS.
13. Throttle Friction Lock -- ADJUST.
14. Strobe Lights -- AS DESIRED.
15. Radios and Avionics -- SET.
16. Wing Flaps -- SET for takeoff (see Takeoff checklists).
17. Brakes -- RELEASE.

TAKEOFF

NORMAL TAKEOFF

1. Wing Flaps -- 0°- 10°.
2. Carburetor Heat -- COLD.
3. Throttle -- FULL OPEN.
4. Elevator Control -- LIFT NOSE WHEEL at 50 KIAS.
5. Climb Speed -- 65-75 KIAS.

SHORT FIELD TAKEOFF

1. Wing Flaps -- 10°.
2. Carburetor Heat -- COLD.
3. Brakes -- APPLY.
4. Throttle -- FULL OPEN.
5. Mixture -- RICH (above 3000 feet, LEAN to obtain maximum RPM).
6. Brakes -- RELEASE.
7. Elevator Control -- SLIGHTLY TAIL LOW.
8. Climb Speed -- 54 KIAS (until all obstacles are cleared).
9. Wing Flaps -- RETRACT slowly after reaching 60 KIAS.

ENROUTE CLIMB

1. Airspeed -- 70-80 KIAS.

NOTE

If a maximum performance climb is necessary, use speeds shown in the Maximum Rate Of Climb chart in Section 5.

2. Throttle -- FULL OPEN.
3. Mixture -- RICH below 3000 feet, LEAN for maximum RPM above 3000 feet (after a total of 50 hours has accumulated).

CRUISE

1. Power -- 1900-2550 RPM (no more than 75% is recommended).
2. Elevator Trim -- ADJUST.
3. Mixture -- LEAN.

DESCENT

1. Carburetor Heat -- FULL HEAT AS REQUIRED.
2. Power -- AS DESIRED.
3. Mixture -- ADJUST for smooth operation (full rich for idle power).

BEFORE LANDING

1. Seats, Seat Belts, Shoulder Harnesses -- ADJUST and LOCK.
2. Mixture -- RICH.
3. Carburetor Heat -- ON (apply full heat before reducing power).

LANDING

NORMAL LANDING

1. Airspeed -- 60-70 KIAS (flaps UP).
2. Wing Flaps -- AS DESIRED (below 85 KIAS).
3. Airspeed -- 55-65 KIAS (flaps DOWN).
4. Touchdown -- MAIN WHEELS FIRST.
5. Landing Roll -- LOWER NOSE WHEEL GENTLY.
6. Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

1. Airspeed -- 60-70 KIAS (flaps UP).
2. Wing Flaps -- 30° (below 85 KIAS).
3. Airspeed -- MAINTAIN 54 KIAS.
4. Power -- REDUCE to idle as obstacle is cleared.
5. Touchdown -- MAIN WHEELS FIRST.
6. Brakes -- APPLY HEAVILY.
7. Wing Flaps -- RETRACT.

BALKED LANDING

1. Throttle -- FULL OPEN.
2. Carburetor Heat -- COLD.
3. Wing Flaps -- RETRACT to 20°.
4. Airspeed -- 55 KIAS.
5. Wing Flaps -- RETRACT (slowly).

AFTER LANDING

1. Carburetor Heat -- COLD.
2. Wing Flaps -- UP.

SECURING AIRPLANE

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

AMPLIFIED PROCEDURES

PREFLIGHT INSPECTION

The Preflight Inspection, described in figure 4-1 and adjacent checklist, is recommended for the first flight of the day. Inspection procedures for subsequent flights are normally limited to brief checks of control surface hinges, fuel and oil quantity, and security of fuel and oil filler caps and draining of the fuel strainer. If the airplane has been in extended storage, has had recent major maintenance, or has been operated from marginal airports, a more extensive exterior inspection is recommended.

After major maintenance has been performed, the flight and trim tab controls should be double-checked for free and correct movement and security. The security of all inspection plates on the airplane should be checked following periodic inspection. If the airplane has been waxed or polished, check the external static pressure source hole for stoppage.

If the airplane has been exposed to much ground handling in a crowded hangar, it should be checked for dents and scratches on wings, fuselage, and tail surfaces, as well as damage to navigation and anti-collision lights, and avionic antennas.

Outside storage for long periods may result in dust and dirt accumulation on the induction air filter, obstructions in airspeed system lines, and condensation in fuel tanks. If any water is detected in the fuel system, the fuel tank sump quick-drain valves, fuel line quick-drain valve, and fuel strainer should all be thoroughly drained again. Then, the wings should be gently rocked and the tail lowered to the ground to move any further contaminants to the sampling points. Repeated samples should be taken from all drain points until all contamination has been removed. If, after repeated sampling, evidence of contamination still exists, the fuel tanks should be completely drained and the fuel system cleaned. Outside storage in windy or gusty areas, or tie-down adjacent to taxiing airplanes, calls for special attention to control surface stops, hinges, and brackets to detect the presence of wind damage.

If the airplane has been operated from muddy fields or in snow or slush, check the main and nose gear wheel fairings for obstructions and cleanliness. Operation from a gravel or cinder field will require extra attention to propeller tips and abrasion on leading edges of the horizontal tail. Stone damage to the propeller can seriously reduce the fatigue life of the blades.

Airplanes that are operated from rough fields, especially at high

altitudes, are subjected to abnormal landing gear abuse. Frequently check all components of the landing gear, shock strut, tires, and brakes. If the shock strut is insufficiently extended, undue landing and taxi loads will be subjected on the airplane structure.

To prevent loss of fuel in flight, make sure the fuel tank filler caps are tightly sealed after any fuel system check or servicing. Fuel system vents should also be inspected for obstructions, ice or water, especially after exposure to cold, wet weather.

STARTING ENGINE (Temperatures Above Freezing)

During engine starting, open the throttle approximately 1/2 inch. In warm weather, one stroke of the primer should be sufficient. In temperatures near freezing, up to 3 strokes of the primer may be necessary. As the engine starts, slowly adjust the throttle as required for 1000 RPM or less. If the engine is still warm from previous operation, it may be started with the throttle closed and no priming.

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 in the idle cut-off position, the throttle full open, and crank the engine through several revolutions with the starter. Repeat the starting procedure without any additional priming.

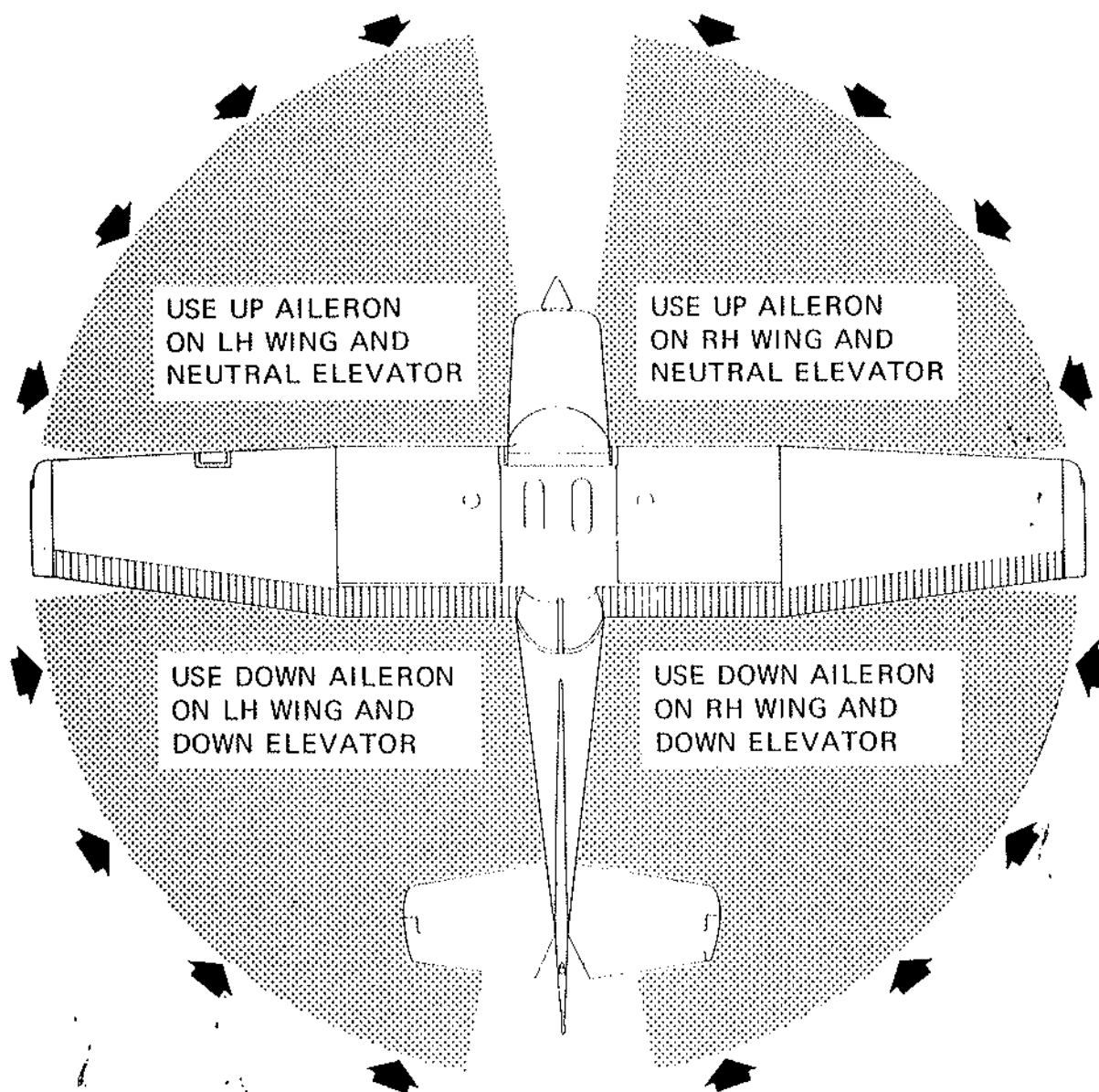
If the engine is underprimed (most likely in cold weather with a cold engine) it will not fire at all, and additional priming will be necessary.

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 the engine and investigate. Lack of oil pressure can cause serious engine damage. After starting, avoid the use of carburetor heat unless icing conditions prevail.

NOTE

Details concerning cold weather starting and operation at temperatures below freezing may be found under Cold Weather Operation paragraphs in this section.

After the completion of normal engine starting procedures, it is a good practice to verify that the engine starter has disengaged. If the starter contactor were to stick closed, causing the starter to remain engaged, an excessively high charge indication (two-thirds scale or more at 1000 RPM) would be evident on the ammeter. In this event, immediately shut down the engine and take corrective action prior to flight.



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

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. When the knob is pulled out to the heat position, air entering the engine is not filtered.

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

The nose wheel is designed to automatically center straight ahead when the nose strut is fully extended. In the event the nose strut is over-inflated and the airplane is loaded to a rearward center of gravity position, it may be necessary to partially compress the strut to permit steering. This can be accomplished prior to taxiing by depressing the airplane nose (by hand) or during taxi by sharply applying brakes.

BEFORE TAKEOFF

WARM-UP

Most of the warm-up will have been conducted during taxi, and additional warm-up before takeoff should be restricted to the checklist procedures. Since the engine is closely cowled for efficient in-flight cooling, precautions should be taken to avoid overheating on the ground.

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 125 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 light, or by operating the wing flaps during the engine runup (1700 RPM). The ammeter will remain within a needle width of its initial position if the alternator and alternator control unit are operating properly.

NOTE

If landing lights are to be used to enhance the conspicuity of the airplane in the traffic pattern or enroute, it is recommended that only the taxi light be used. This will extend the service life of the landing light appreciably.

TAKEOFF

POWER CHECK

It is important to check full-throttle engine operation early in the takeoff roll. Any sign of rough engine operation or sluggish engine acceleration is good cause for discontinuing the takeoff. If this occurs, you are justified in making a thorough full-throttle static runup before another takeoff is attempted. The engine should run smoothly and turn approximately 2280 to 2380 RPM with carburetor heat off and mixture leaned to maximum RPM. The static RPM check should be made in no-wind conditions. It is normal for static RPM to increase as temperature increases. For further information, refer to the Service Manual.

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

Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full-throttle, static runup.

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

WING FLAP SETTINGS

Normal takeoffs are accomplished with wing flaps 0°- 10°. Using 10°

wing flaps reduces the total distance over an obstacle by approximately 10%. Flap deflections greater than 10° are not approved for takeoff. If 10° wing flaps are used for takeoff, they should be left down until all obstacles are cleared and a safe flap retraction speed of 60 KIAS is reached.

On a short field, 10° wing flaps and an obstacle clearance speed of 54 KIAS should be used. This speed provides the best overall climb speed to clear obstacles when taking into account turbulence often found near ground level.

Soft or rough field takeoffs are performed with 10° wing 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 higher climb speed.

CROSSWIND TAKEOFF

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

ENROUTE CLIMB

Normal climbs are performed with flaps up and full throttle and at speeds 5 to 10 knots higher than best rate-of-climb speeds for the best combination of performance, visibility and engine cooling. The mixture should be full rich below 3000 feet and may be leaned above 3000 feet for smoother operation or to obtain maximum RPM.

NOTE

Leaning is not recommended until a total of 50 hours has accumulated.

For maximum rate of climb, use the best rate-of-climb speeds shown in the Rate-Of-Climb chart in Section 5. If an obstruction dictates the use of a steep climb angle, the best angle-of-climb speed should be used with flaps up and maximum power. Climbs at speeds lower than the best rate-of-climb speed should be of short duration to improve engine cooling.

CRUISE

Normal cruising is performed between 55% and 75% power. The engine RPM and corresponding fuel consumption for various altitudes can be determined by using the data in Section 5.

ALTITUDE	75% POWER		65% POWER		55% POWER	
	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
2500 Feet	101	16.4	95	17.6	87	18.6
5500 Feet	103	16.9	97	18.0	89	19.0
8500 Feet	106	17.3	99	18.4	91	19.4
Standard Conditions					Zero Wind	

Figure 4-3. Cruise Performance Table

NOTE

Cruising should be done at 75% power as much as practicable until a total of 50 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 data in Section 5 shows the increased range and improved fuel economy that is obtainable when operating at lower power settings. The use of lower power settings and the selection of cruise altitude on the basis of the most favorable wind conditions are significant factors that should be considered on every trip to reduce fuel consumption.

The Cruise Performance Table, figure 4-3, shows the true airspeed and nautical miles per gallon during cruise for various altitudes and percent powers. This table should be used as a guide, along with the available winds aloft information, to determine the most favorable altitude and power setting for a given trip.

To achieve the recommended lean mixture fuel consumption figures shown in Section 5, the mixture should be leaned until engine RPM peaks and drops 10-25 RPM. At lower powers it may be necessary to enrichen the mixture slightly to obtain smooth operation. An alternate method for obtaining the above cruise mixture setting in rough air is to lean until engine roughness or a sharp drop off in power is experienced and then immediately enrichen the mixture by rotating the mixture control vernier approximately 3/4 of a turn clockwise.

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

Figure 4-4. EGT Table

Use of recommended lean mixture rather than that for maximum RPM can provide fuel savings of up to 10% and an increase in flight endurance of approximately 20 minutes based on standard fuel tanks and 75% power. Use of recommended lean mixture rather than full rich mixture can provide fuel savings as high as 34% and an increase in flight endurance of approximately one hour when operating at an altitude of 7500 feet with 75% power and standard fuel tanks.

Carburetor ice, as evidenced by an unexplained drop in RPM, can be removed by application of full carburetor heat. Upon regaining the original RPM (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.

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

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

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

NOTE

For best accuracy, lean in small increments while waiting approximately 10 seconds between increments when near-

ing peak EGT. This is to enable the pilot to observe the stabilized EGT for each mixture setting.

As noted in this table, operation at peak EGT provides the best fuel economy. This results in approximately 5% greater range than shown in this handbook accompanied by approximately a 2 knot decrease in speed.

Under some conditions, engine roughness may occur while operating at peak EGT. In this case, operate at the recommended lean mixture. Any change in altitude or throttle position will require a recheck of EGT indication.

FUEL SAVINGS PROCEDURES FOR FLIGHT TRAINING OPERATIONS

For best fuel economy during flight training operations, the following procedures are recommended.

1. Lean the mixture for maximum RPM during climbs above 3000 feet (after 50 hours has accumulated). The mixture may be left leaned for practicing such maneuvers as stalls.
2. Lean the mixture for maximum RPM during all operations at any altitude, including those below 3000 feet, when using 75% or less power.

NOTE

When cruising at 75% or less power, the mixture may be further leaned until the RPM peaks and drops 10-25 RPM. This is especially applicable to cross-country training flights, but may also be practiced during transition flights to and from the practice area.

Using the above recommended procedures can provide fuel savings in excess of 5% when compared to typical training operations at full rich mixture.

STALLS

The stall characteristics are conventional for the flaps up and flaps down condition. The stall warning horn produces a steady signal 5 to 10 knots before the actual stall is reached and remains on until the airplane flight attitude is changed. Stall speeds for various combinations of flap setting and bank angle are summarized in Section 5.

SPINS

Intentional spins are approved in this airplane (see Section 2). Before attempting to perform spins, however, several items should be carefully considered to assure a safe flight. No spins should be attempted without first having received dual instruction in both spin entries and spin recoveries from a qualified instructor who is familiar with the spin characteristics of the Cessna 152.

The cabin should be clean and all loose equipment (including the microphone) should be stowed. For a solo flight in which spins will be conducted, the copilot's seat belt and shoulder harness should be secured. **Spins with baggage loadings or occupied child's seat are not approved.**

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

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

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

NOTE

- Careful attention should be taken to assure that the aileron control is neutral during all phases of the spin since any

aileron deflection in the direction of the spin may alter the spin characteristics by increasing the rotation rate and changing the pitch attitude.

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

If the spin is continued beyond the 2 to 3-turn range, some change in character of the spin may be noted. Rotation rates may vary and some additional sideslip may be felt. Normal recoveries from such extended spins may take up to a full turn or more.

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

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

NOTE

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

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

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

LANDING

NORMAL LANDING

Normal landing approaches can be made with power-on or power-off at speeds of 60 to 70 KIAS with flaps up, and 55 to 65 KIAS with flaps down. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds.

Actual touchdown should be made with power-off and on the main wheels first. The nose wheel should be lowered smoothly to the runway as speed is diminished.

SHORT FIELD LANDING

For a short field landing in smooth air conditions, make an approach at 54 KIAS with 30° flaps using enough power to control the glide path. After all approach obstacles are cleared, progressively reduce power and maintain 54 KIAS by lowering the nose of the airplane. Touchdown should be made with power-off and on the main wheels first. Immediately after touchdown, lower the nose wheel and apply heavy braking as required. For maximum brake effectiveness, retract the flaps, hold full nose-up elevator, and apply maximum brake pressure without sliding the tires.

Slightly higher approach speeds should be used under turbulent air conditions.

CROSSWIND LANDING

When landing in a strong crosswind, use the minimum flap setting required for the field length. Use a wing low, crab, or a combination method of drift correction and land in a nearly level attitude.

BALKED LANDING

In a bailed landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. Upon reaching a safe airspeed, the flaps should be slowly retracted to the full up position.

COLD WEATHER OPERATION

Special consideration should be given to the operation of the airplane fuel system during the winter season or prior to any flight in cold temperatures. Proper preflight draining of the fuel system is especially important and will eliminate any free water accumulation. The use of additives such

as isopropyl alcohol or ethylene glycol monomethyl ether may also be desirable. Refer to Section 8 for information on the proper use of additives.

Cold weather often causes conditions which require special care during airplane operations. Even small accumulations of frost, ice, or snow must be removed, particularly from wing, tail and all control surfaces to assure satisfactory flight performance and handling. Also, control surfaces must be free of any internal accumulations of ice or snow.

If snow or slush covers the takeoff surface, allowance must be made for takeoff distances which will be increasingly extended as the snow or slush depth increases. The depth and consistency of this cover can in fact prevent takeoff in many instances.

Prior to starting with temperatures below freezing, it is advisable to pull the propeller through several times by hand to "break loose" or "limber" the oil, thus conserving battery energy.

WARNING

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.

Preheat is generally required with outside air temperatures below -18°C (0°F) and is recommended when temperatures are below -7°C (20°F).

Cold weather starting procedures are as follows:

With Preheat:

1. Parking Brake -- SET.
2. Ignition Switch -- OFF.
3. Throttle -- CLOSED.
4. Mixture -- IDLE CUT-OFF.
5. Prime -- 2 to 4 STROKES as the propeller is being turned over by hand. RECHARGE for priming after engine start.

CAUTION

Caution should be used to ensure the brakes are set or a qualified person is at the controls.

6. Throttle -- OPEN 1/2 to 3/4 INCH.
7. Mixture -- RICH.
8. Propeller Area -- CLEAR.

9. Master Switch -- ON.
10. Ignition Switch -- START (release when engine starts).
11. Prime -- AS REQUIRED until the engine runs smoothly.
12. Throttle -- ADJUST for 1200 to 1500 RPM for approximately one minute after which the RPM can be lowered to 1000 or less.
13. Oil Pressure -- CHECK.
14. Primer -- LOCK.

Without Preheat:

The procedure for starting without preheat is the same as with preheat except the engine should be primed an additional two strokes while pulling the propeller through by hand. Carburetor heat should be applied after the engine starts. Leave the carburetor heat on until the engine runs smoothly.

NOTE

If the engine fires but does not start or continue running, repeat the above starting procedure beginning with step 5. If the engine does not start during the first few attempts, or if engine firing diminishes in strength, it is possible that the spark plugs have been frosted over, in which case preheat must be used before another start is attempted.

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

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

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 152 at 1670 pounds maximum weight is 66.3 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

SECTION 5 PERFORMANCE

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INTRODUCTION

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

It should be noted that the performance information presented in the range and endurance profile charts allows for 45 minutes reserve fuel 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	1610 Pounds
Usable fuel	24.5 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	265 Nautical Miles
Pressure altitude	5500 Feet
Temperature	20°C (16°C above standard)
Expected wind enroute	10 Knot Headwind

LANDING CONDITIONS

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

TAKEOFF

The takeoff distance chart, figure 5-5, 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 altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	980 Feet
Total distance to clear a 50-foot obstacle	1820 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	980
Decrease in ground roll (980 feet × 13%)	<u>127</u>
Corrected ground roll	853 Feet

Total distance to clear a 50-foot obstacle, zero wind	1820
Decrease in total distance (1820 feet × 13%)	<u>237</u>
Corrected total distance to clear 50-foot obstacle	1583 Feet

CRUISE

The cruising altitude should be selected based on a consideration of trip length, winds aloft, and the airplane's performance. A typical 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 5-8, the range profile charts presented in figure 5-9, and the endurance profile charts presented in figure 5-10.

The relationship between power and range is illustrated by the range profile charts. 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, figure 5-8, is entered at 6000 feet altitude and 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The engine speed chosen is 2400 RPM, which results in the following:

Power	66%
True airspeed	100 Knots
Cruise fuel flow	5.5 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 5-7 and 5-8. For this sample problem, figure 5-7 shows that a climb from 2000 feet to 6000 feet requires 1 gallon of fuel. The corresponding distance during the climb is 9 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:

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

SECTION 5
PERFORMANCE

CESSNA
MODEL 152

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

Fuel to climb, standard temperature	1.0
Increase due to non-standard temperature (1.0 × 16%)	<u>0.2</u>
Corrected fuel to climb	1.2 Gallons

Using a similar procedure for the distance to climb results in 10 nautical miles.

The resultant cruise distance is:

Total distance	265
Climb distance	<u>-10</u>
Cruise distance	255 Nautical Miles

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

$$\begin{array}{r} 100 \\ -10 \\ \hline 90 \text{ Knots} \end{array}$$

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

$$\frac{255 \text{ Nautical Miles}}{90 \text{ Knots}} = 2.8 \text{ Hours}$$

The fuel required for cruise is:

$$2.8 \text{ hours} \times 5.5 \text{ gallons/hour} = 15.4 \text{ Gallons}$$

A 45-minute reserve requires:

$$\frac{45}{60} \times 5.5 \text{ gallons/hour} = 4.1 \text{ Gallons}$$

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	0.8
Climb	1.2
Cruise	15.4
Reserve	<u>4.1</u>
Total fuel required	21.5 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 5-11 presents landing distances for various airport altitude and temperature combinations using the short field technique. The distances corresponding to 2000 feet and 30°C are as follows:

Ground roll	535 Feet
Total distance to clear a 50-foot obstacle	1300 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

CONDITIONS:

Power required for level flight or maximum rated RPM dive.

FLAPS UP												
KIAS	40	50	60	70	80	90	100	110	120	130	140	
KCAS	46	53	60	69	78	88	97	107	117	127	136	
FLAPS 10°												
KIAS	40	50	60	70	80	85	---	---	---	---	---	
KCAS	44	52	61	70	80	84	---	---	---	---	---	
FLAPS 30°												
KIAS	40	50	60	70	80	85	---	---	---	---	---	
KCAS	43	51	61	71	82	87	---	---	---	---	---	

Figure 5-1. Airspeed Calibration

TEMPERATURE CONVERSION CHART

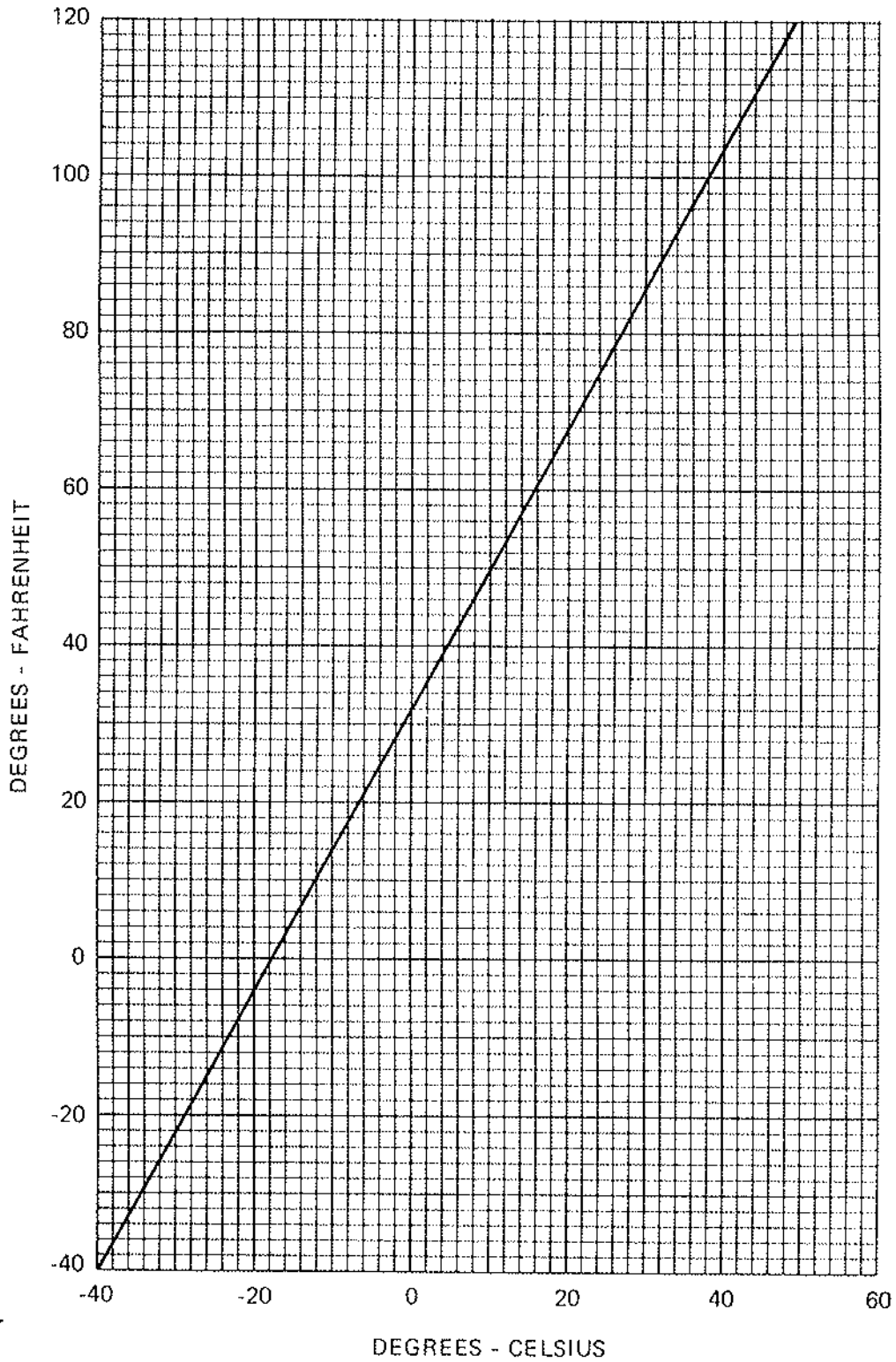


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off

NOTES:

- Altitude loss during a stall recovery may be as much as 160 feet.
- KIAS values are approximate and are based on airspeed calibration data with power off.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
1670	UP	36	46	39	49	43	55	51	65
	10°	36	43	39	46	43	51	51	61
	30°	31	41	33	44	37	49	44	58

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
1670	UP	40	48	43	52	48	57	57	68
	10°	40	46	43	49	48	55	57	65
	30°	35	43	38	46	42	51	49	61

Figure 5-3. Stall Speeds

WIND COMPONENTS

NOTE:

Maximum demonstrated crosswind velocity is 12 knots (not a limitation).

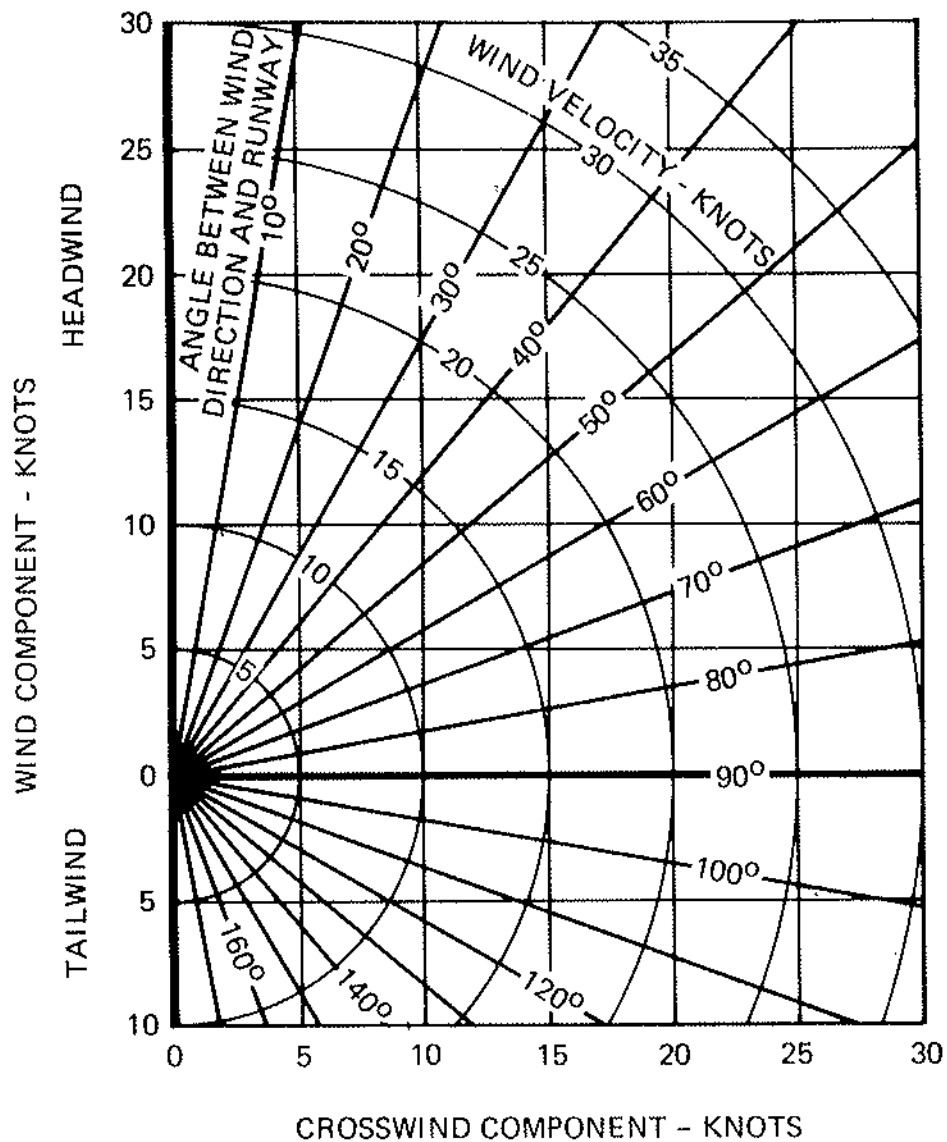


Figure 5-4. Wind Components

TAKEOFF DISTANCE

SHORT FIELD

CONDITIONS:

- Flaps 10°
- Full Throttle Prior to Brake Release
- 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 RPM 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. 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 FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	
1670	50	54	S.L.	640	1190	695	1290	755	1390	810	1495	875	1605	810	1495	875	1605	
			1000	705	1310	765	1420	825	1530	890	1645	960	1770	890	1645	960	1770	
			2000	775	1445	840	1565	910	1690	980	1820	1055	1960	980	1820	1055	1960	
			3000	855	1600	925	1730	1000	1870	1080	2020	1165	2185	1080	2020	1165	2185	
			4000	940	1775	1020	1920	1100	2080	1190	2250	1285	2440	1190	2250	1285	2440	
			5000	1040	1970	1125	2140	1215	2320	1315	2525	1420	2750	1420	2750	1420	2750	
			6000	1145	2200	1245	2395	1345	2610	1455	2855	1570	3125	1570	3125	1570	3125	
			7000	1270	2470	1375	2705	1490	2960	1615	3255	1745	3590	1745	3590	1745	3590	
8000	1405	2800	1525	3080	1655	3395	1795	3765	1940	4195	1940	4195	1940	4195				

Figure 5-5. Takeoff Distance

MAXIMUM RATE OF CLIMB

CONDITIONS:

Flaps Up
Full Throttle

NOTE:

Mixture leaned above 3000 feet for maximum RPM.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
1670	S.L.	67	835	765	700	630
	2000	66	735	670	600	535
	4000	65	635	570	505	445
	6000	63	535	475	415	355
	8000	62	440	380	320	265
	10,000	61	340	285	230	175
	12,000	60	245	190	135	85

Figure 5-6. Maximum Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:

Flaps Up
Full Throttle
Standard Temperature

NOTES:

1. Add 0.8 of a gallon of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for maximum RPM.
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
1670	S.L.	15	67	715	0	0	0
	1000	13	66	675	1	0.2	2
	2000	11	66	630	3	0.4	3
	3000	9	65	590	5	0.7	5
	4000	7	65	550	6	0.9	7
	5000	5	64	505	8	1.2	9
	6000	3	63	465	10	1.4	12
	7000	1	63	425	13	1.7	14
	8000	-1	62	380	15	2.0	17
	9000	-3	62	340	18	2.3	21
	10,000	-5	61	300	21	2.6	25
	11,000	-7	61	255	25	3.0	29
	12,000	-9	60	215	29	3.4	34

Figure 5-7. Time, Fuel, and Distance to Climb

CRUISE PERFORMANCE

CONDITIONS:
1670 Pounds
Recommended Lean Mixture (See Section 4, Cruise)

NOTE:
Cruise speeds are shown for an airplane equipped with speed fairings which increase the speeds by approximately two knots.

PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2400	---	---	---	77	102	6.3	73	101	6.0
	2300	73	97	6.0	69	97	5.7	66	96	5.4
	2200	65	93	5.4	62	92	5.1	58	91	4.9
	2100	58	88	4.9	55	87	4.7	52	85	4.5
	2000	51	82	4.5	48	81	4.3	45	79	4.2
4000	2450	---	---	---	78	104	6.4	74	103	6.0
	2400	78	102	6.4	74	101	6.0	70	101	5.8
	2300	70	97	5.8	66	97	5.5	62	96	5.2
	2200	62	92	5.2	59	91	4.9	55	90	4.7
	2100	55	87	4.7	52	86	4.5	49	84	4.4
6000	2500	---	---	---	78	106	6.4	74	105	6.1
	2400	75	101	6.1	70	101	5.8	66	100	5.5
	2300	67	97	5.5	63	96	5.2	59	95	5.0
	2200	59	91	5.0	56	90	4.7	53	89	4.6
	2100	53	86	4.6	49	84	4.4	47	82	4.3
8000	2550	---	---	---	78	108	6.4	74	107	6.1
	2500	79	106	6.4	74	105	6.1	70	105	5.8
	2400	71	101	5.8	67	100	5.5	63	99	5.2
	2300	64	96	5.3	60	95	5.0	56	94	4.8
	2200	57	91	4.8	53	89	4.6	50	87	4.4
10,000	2500	75	105	6.2	71	105	5.8	67	104	5.5
	2400	68	101	5.6	63	99	5.3	60	98	5.0
	2300	60	95	5.1	57	94	4.8	54	92	4.6
	2200	54	89	4.6	51	87	4.5	48	84	4.3
12,000	2450	68	102	5.6	64	101	5.3	60	100	5.0
	2400	64	100	5.3	60	98	5.0	57	97	4.8
	2300	57	94	4.9	54	92	4.6	51	89	4.5
	2200	51	88	4.5	48	84	4.4	45	79	4.2

Figure 5-8. Cruise Performance

RANGE PROFILE

45 MINUTES RESERVE 24.5 GALLONS USABLE FUEL

CONDITIONS:

1670 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during climb.
2. Performance is shown for an airplane equipped with speed fairings which increase the cruise speeds by approximately two knots.

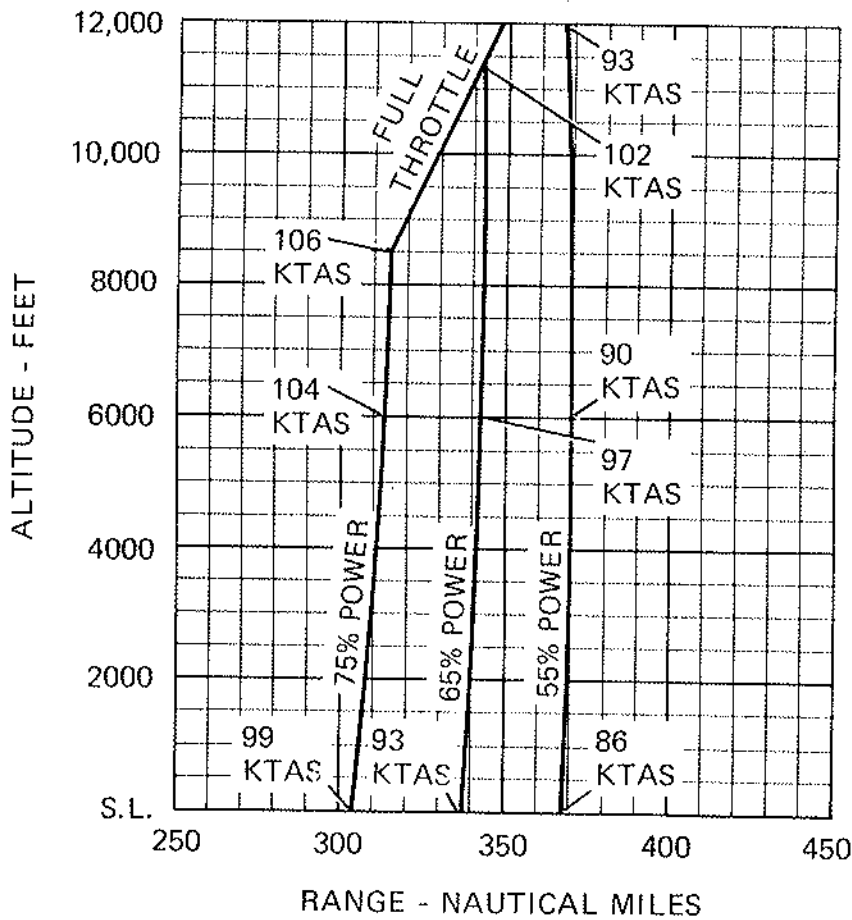


Figure 5-9. Range Profile (Sheet 1 of 2)

RANGE PROFILE

45 MINUTES RESERVE 37.5 GALLONS USABLE FUEL

CONDITIONS:

1670 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during climb.
2. Performance is shown for an airplane equipped with speed fairings which increase the cruise speeds by approximately two knots.

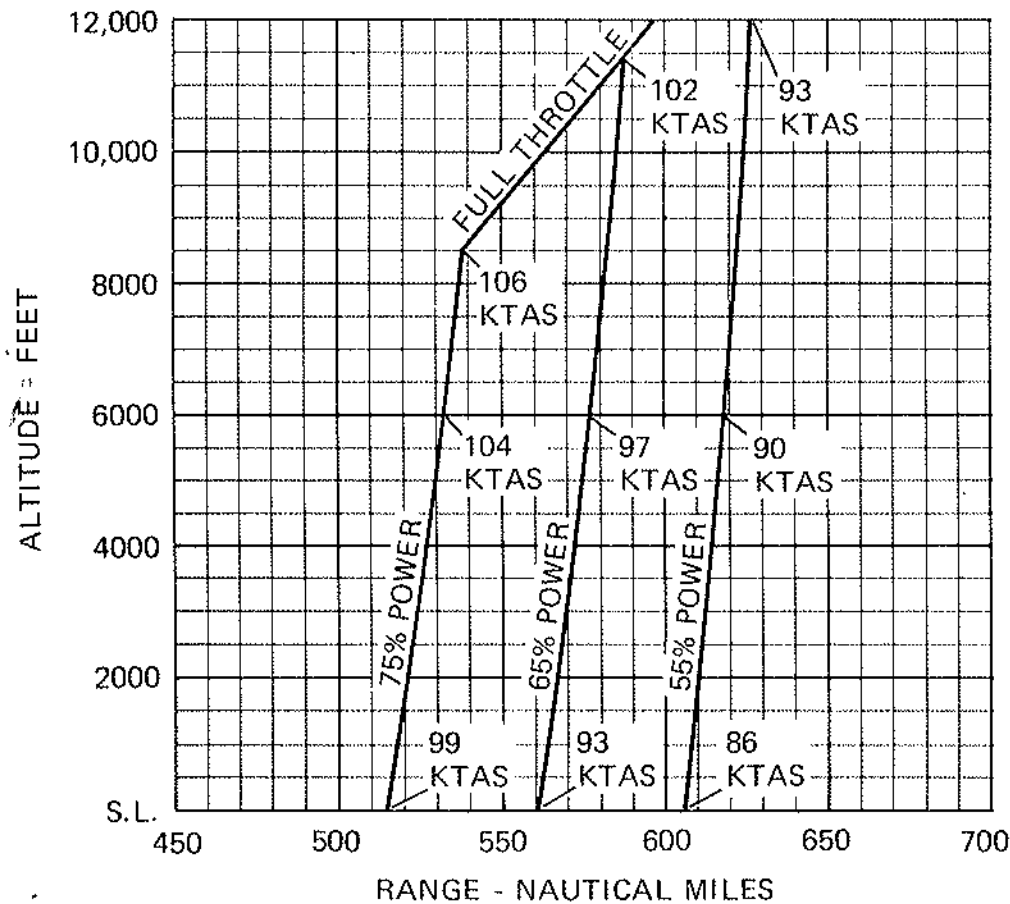


Figure 5-9. Range Profile (Sheet 2 of 2)

ENDURANCE PROFILE

45 MINUTES RESERVE
24.5 GALLONS USABLE FUEL

CONDITIONS:

1670 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 climb.

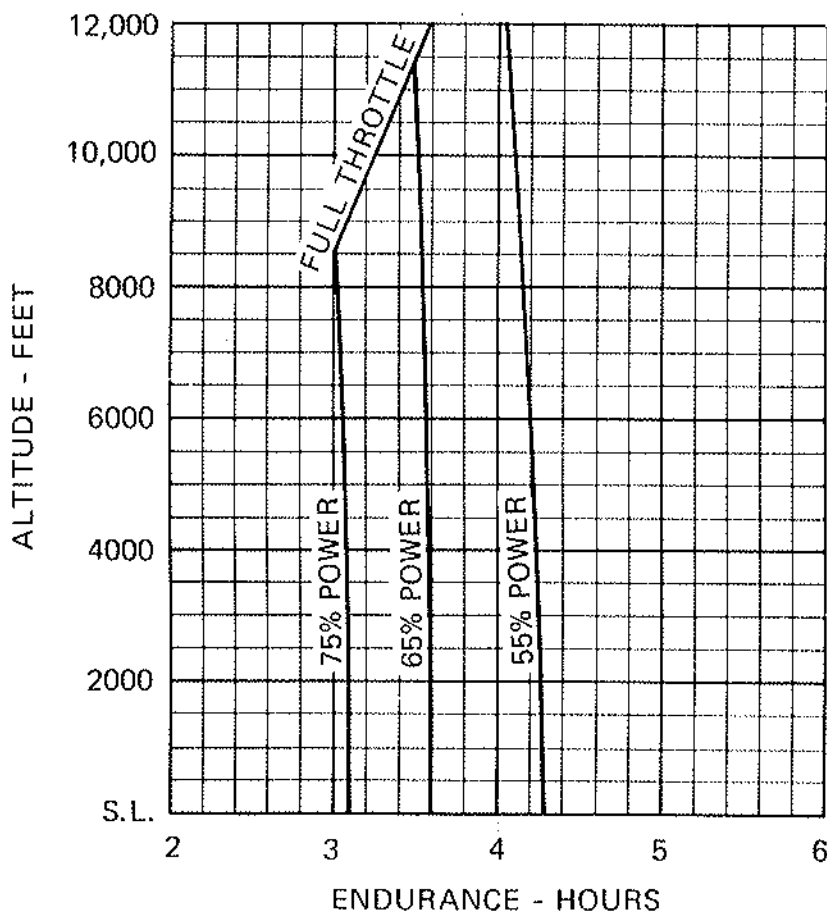


Figure 5-10. Endurance Profile (Sheet 1 of 2)

ENDURANCE PROFILE

45 MINUTES RESERVE
37.5 GALLONS USABLE FUEL

CONDITIONS:
1670 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 climb.

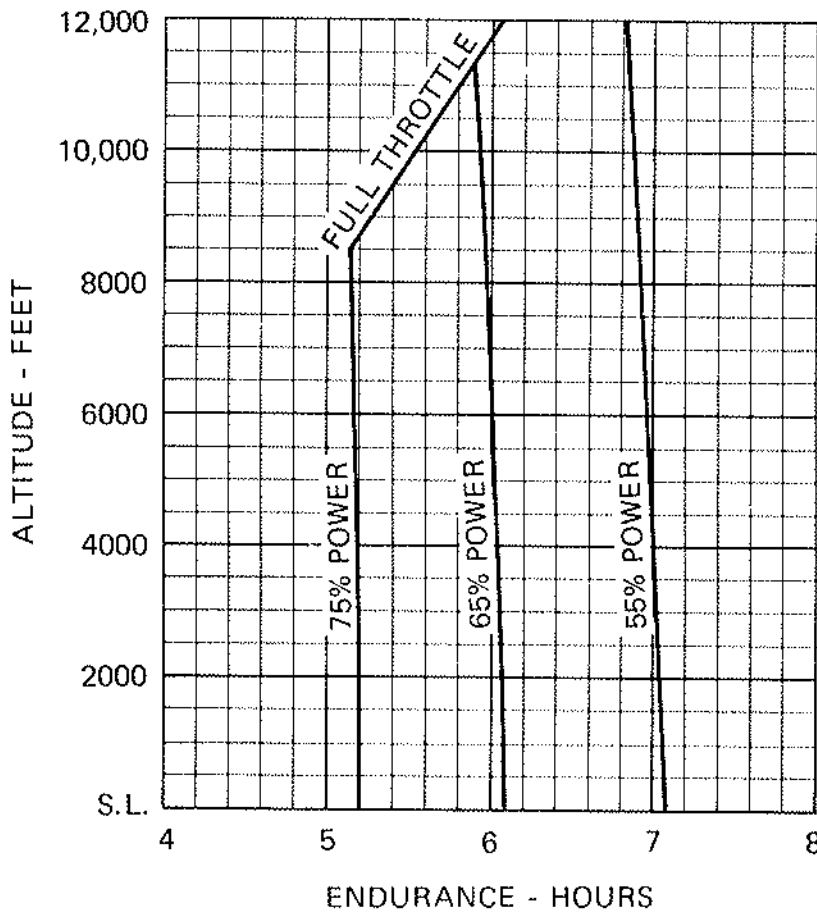


Figure 5-10. Endurance Profile (Sheet 2 of 2)

LANDING DISTANCE

SHORT FIELD

CONDITIONS:

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

NOTES:

1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on a dry, grass runway, increase distances by 45% of the "ground roll" figure.
4. If a landing with flaps up is necessary, increase the approach speed by 7 KIAS and allow for 35% longer distances.

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
1670	54	S.L.	450	1160	465	1185	485	1215	500	1240	515	1265
		1000	465	1185	485	1215	500	1240	520	1270	535	1295
		2000	485	1215	500	1240	520	1270	535	1300	555	1330
		3000	500	1240	520	1275	540	1305	560	1335	575	1360
		4000	520	1275	540	1305	560	1335	580	1370	600	1400
		5000	540	1305	560	1335	580	1370	600	1400	620	1435
		6000	560	1340	580	1370	605	1410	625	1440	645	1475
		7000	585	1375	605	1410	625	1440	650	1480	670	1515
8000	605	1410	630	1450	650	1480	675	1520	695	1555		

Figure 5-11. Landing Distance

SECTION 6 WEIGHT & BALANCE/ EQUIPMENT LIST

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Aero Noord FTO
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7903 BE HOOGEVEEN
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INTRODUCTION

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

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

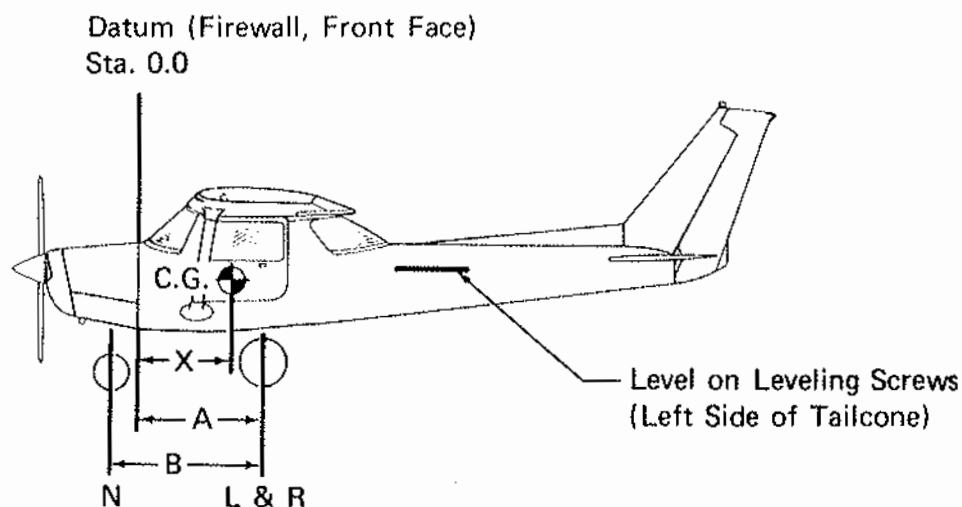
It is the responsibility of the pilot to ensure that the airplane is loaded properly.

AIRPLANE WEIGHING PROCEDURES

1. Preparation:
 - a. Inflate tires to recommended operating pressures.
 - b. Remove fuel tank sump quick-drain fittings and use sampler cup at quick-drain valve in fuel line to drain all fuel.
 - c. Service engine oil as required to obtain a normal full indication (six quarts on dipstick).
 - 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 (500 pound minimum capacity for scales).
 - b. Deflate nose tire and/or lower or raise the nose strut to center bubble on 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.

**SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST**

**CESSNA
MODEL 152**



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

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

Item	Weight (Lbs.)	C.G. Arm (In.)	Moment/1000 (Lbs.-In.)
Airplane Weight (From Item 5, page 6-3)			
Add Unusable Fuel: Std. or L.R. Tanks (1.5 Gal at 6 Lbs/Gal)	9.0	40.0	0.4
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		WEIGHT CHANGE						RUNNING BASIC EMPTY WEIGHT	
						ADDED (+)			REMOVED (-)				
DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	Wt. (lb.)	Arm (In.)	Moment /1000	Wt. (lb.)	Arm (In.)	Moment /1000	Wt. (lb.)	Moment /1000		
	In	Out											
			As Delivered										

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 loaded in the center of the baggage areas as shown on the Loading Arrangements diagram. For loadings which may differ from these, the Sample Loading Problem lists fuselage stations for these items to indicate their forward and aft C.G. range limitation (seat travel 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.

LOADING ARRANGEMENTS

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

** Arms measured to the center of the areas shown.

- NOTES:
1. The usable fuel C.G. arm for standard tanks is located at station 42.0; the C.G. arm for usable fuel in long range tanks is station 39.5.
 2. The aft baggage wall (approximate station 94) can be used as a convenient interior reference point for determining the location of baggage area fuselage stations.

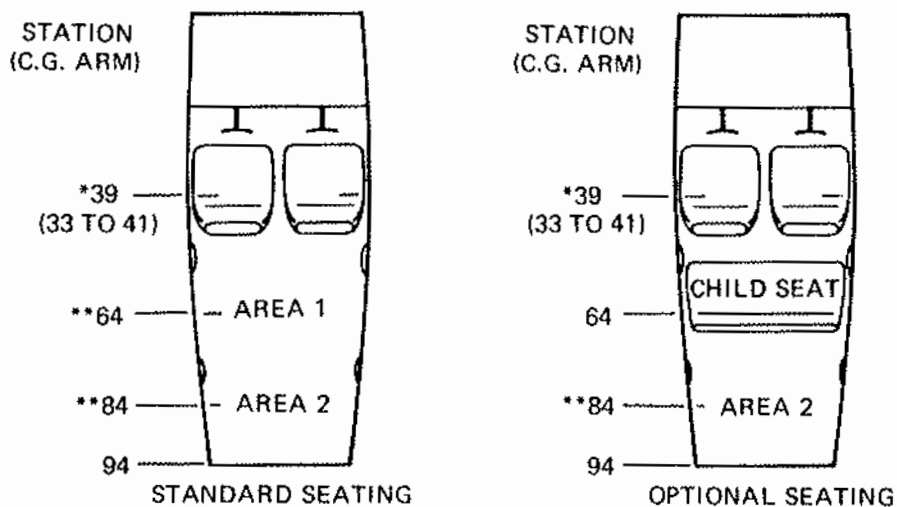


Figure 6-3. Loading Arrangements

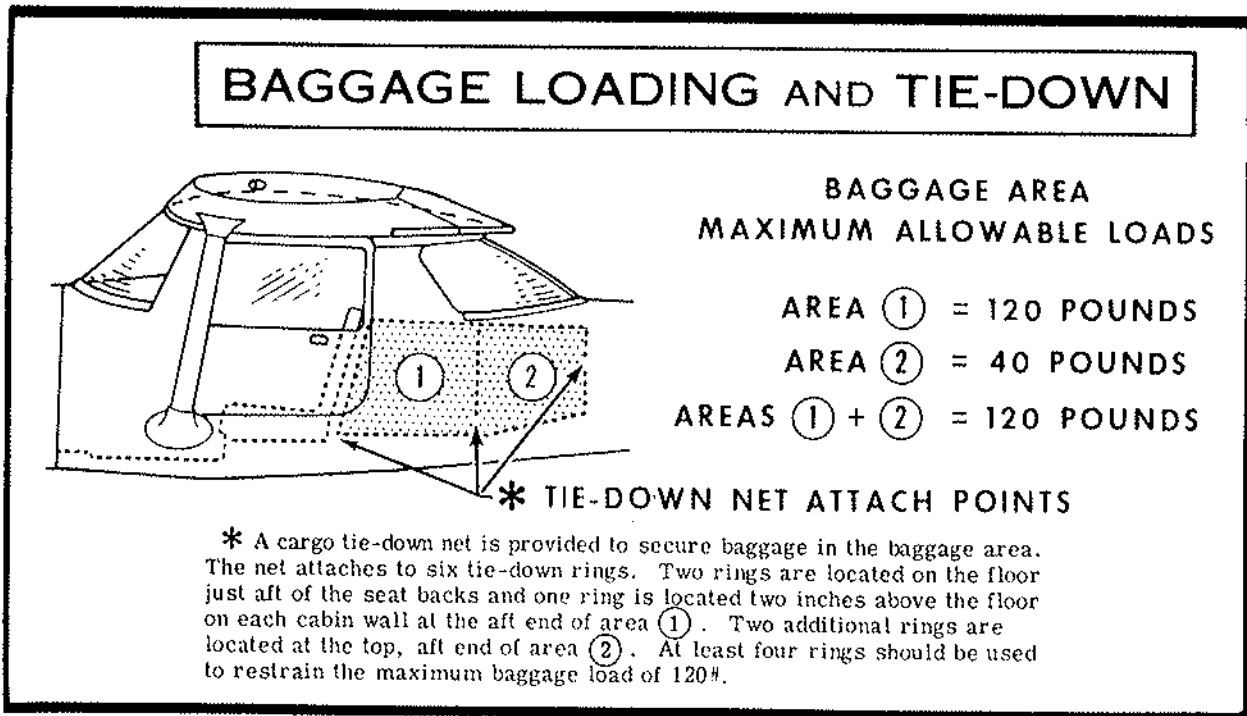
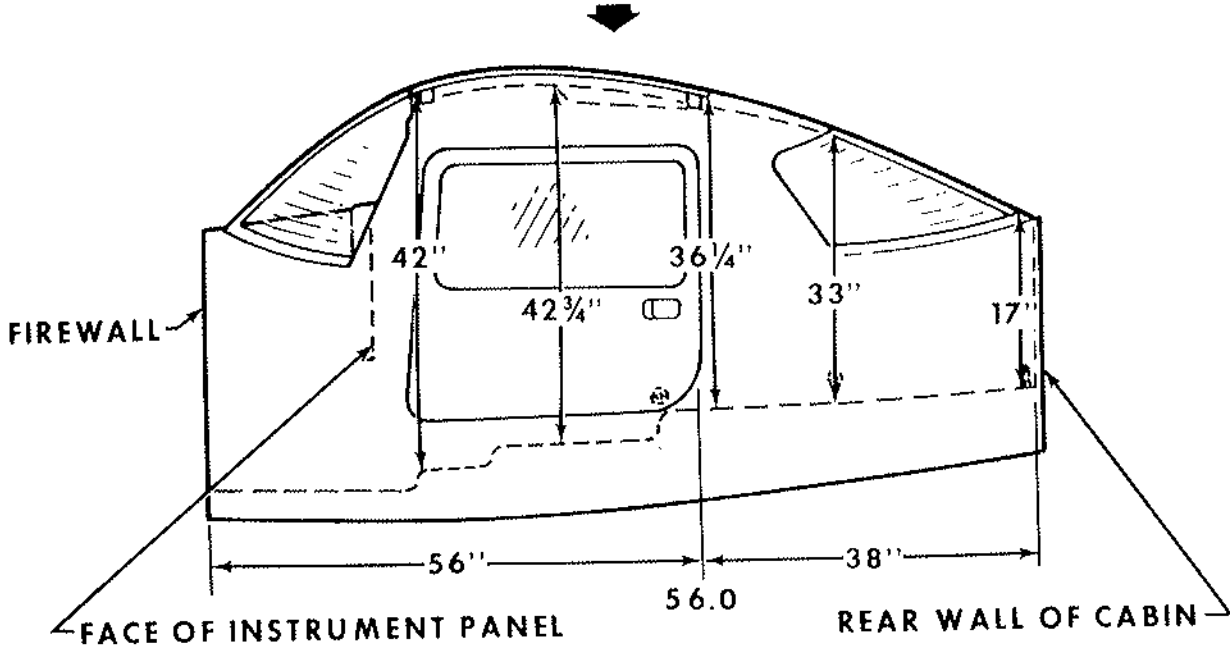


Figure 6-4. Baggage Loading and Tie-Down

CABIN HEIGHT MEASUREMENTS



DOOR OPENING DIMENSIONS

WIDTH (TOP)	WIDTH (BOTTOM)	HEIGHT (FRONT)	HEIGHT (REAR)
30"	33 1/4"	30 3/4"	30 1/4"

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

CABIN WIDTH MEASUREMENTS

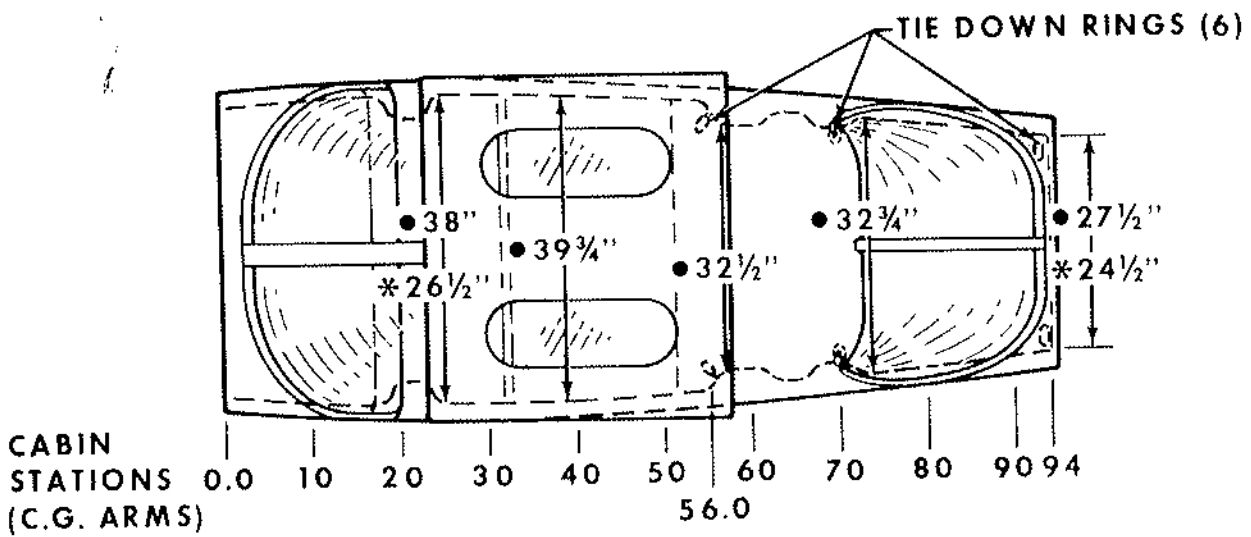


Figure 6-5. Internal Cabin Dimensions

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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)	1136	34.0		
2. Usable Fuel (At 6 Lbs./Gal.) Standard Tanks (24.5 Gal. Maximum)	147	6.2		
Long Range Tanks (37.5 Gal. Maximum)				
Reduced Fuel (As limited by max. weight)				
3. Pilot and Passenger (Station 33 to 41)	340	13.3		
4. *Baggage - Area 1 (Or passenger on child's seat) (Station 50 to 76, 120 Lbs. Max.)	52	3.3		
5. *Baggage - Area 2 (Station 76 to 94, 40 Lbs. Max.)				
6. RAMP WEIGHT AND MOMENT	1675	56.8		
7. Fuel allowance for engine start, taxi, and runup	-5	-.2		
8. TAKEOFF WEIGHT AND MOMENT (Subtract Step 7 from Step 6)	1670	56.6		
<p>9. Locate this point (1670 at 56.6) on the Center of Gravity Moment Envelope, and since this point falls within the envelope, the loading is acceptable.</p> <p>*The maximum allowable combined weight capacity for baggage areas 1 and 2 is 120 pounds.</p>				

Figure 6-6. Sample Loading Problem (Sheet 1 of 2)

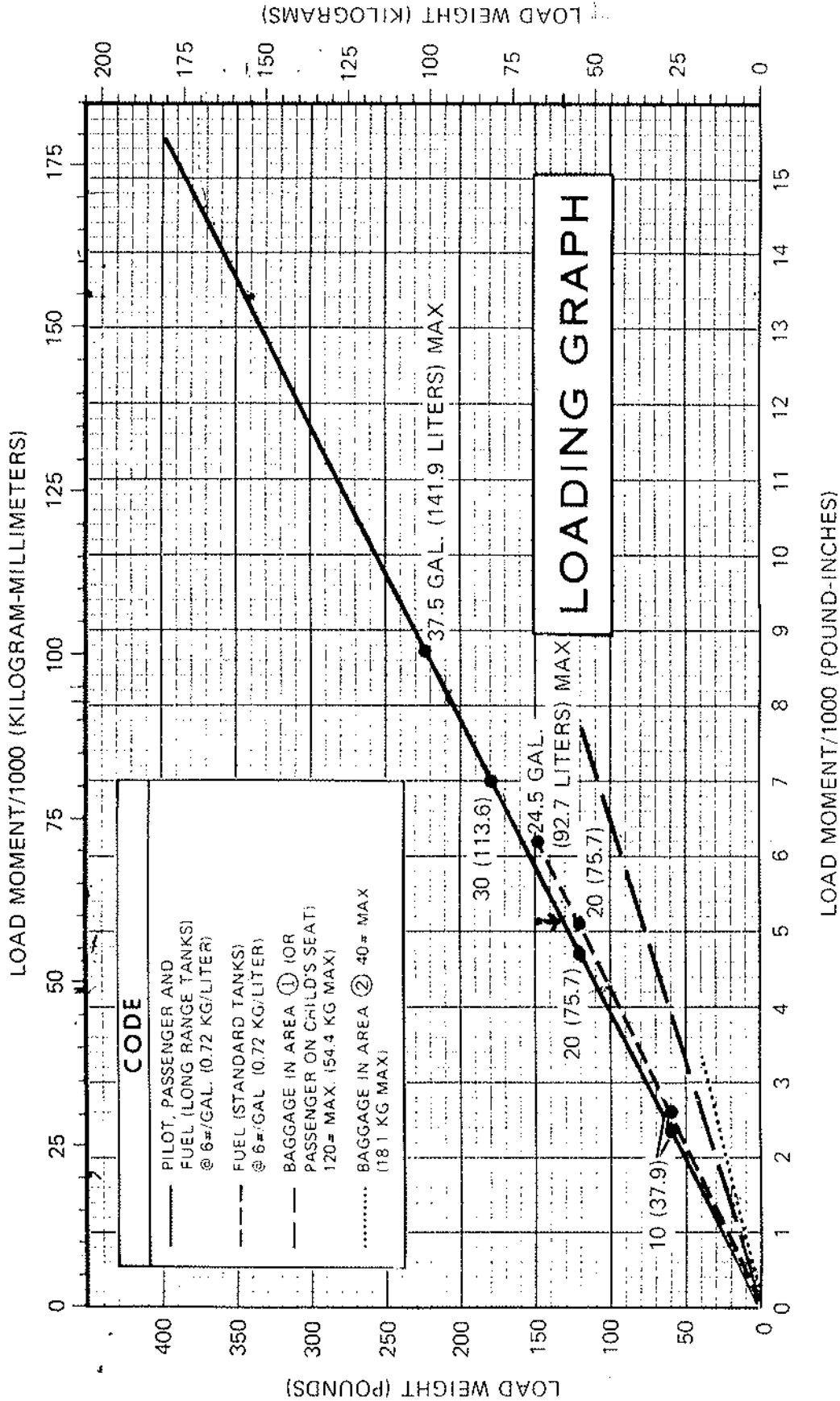
YOUR AIRPLANE		YOUR AIRPLANE		YOUR AIRPLANE		YOUR AIRPLANE	
Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)	Weight (lbs.)	Moment (lb.-ins. /1000)

When several loading configurations are representative of your operations, it may be useful to fill out one or more of the above columns so that specific loadings are available at a glance.

Figure 6-6. Sample Loading Problem (Sheet 2 of 2)

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

Figure 6-7. Loading Graph

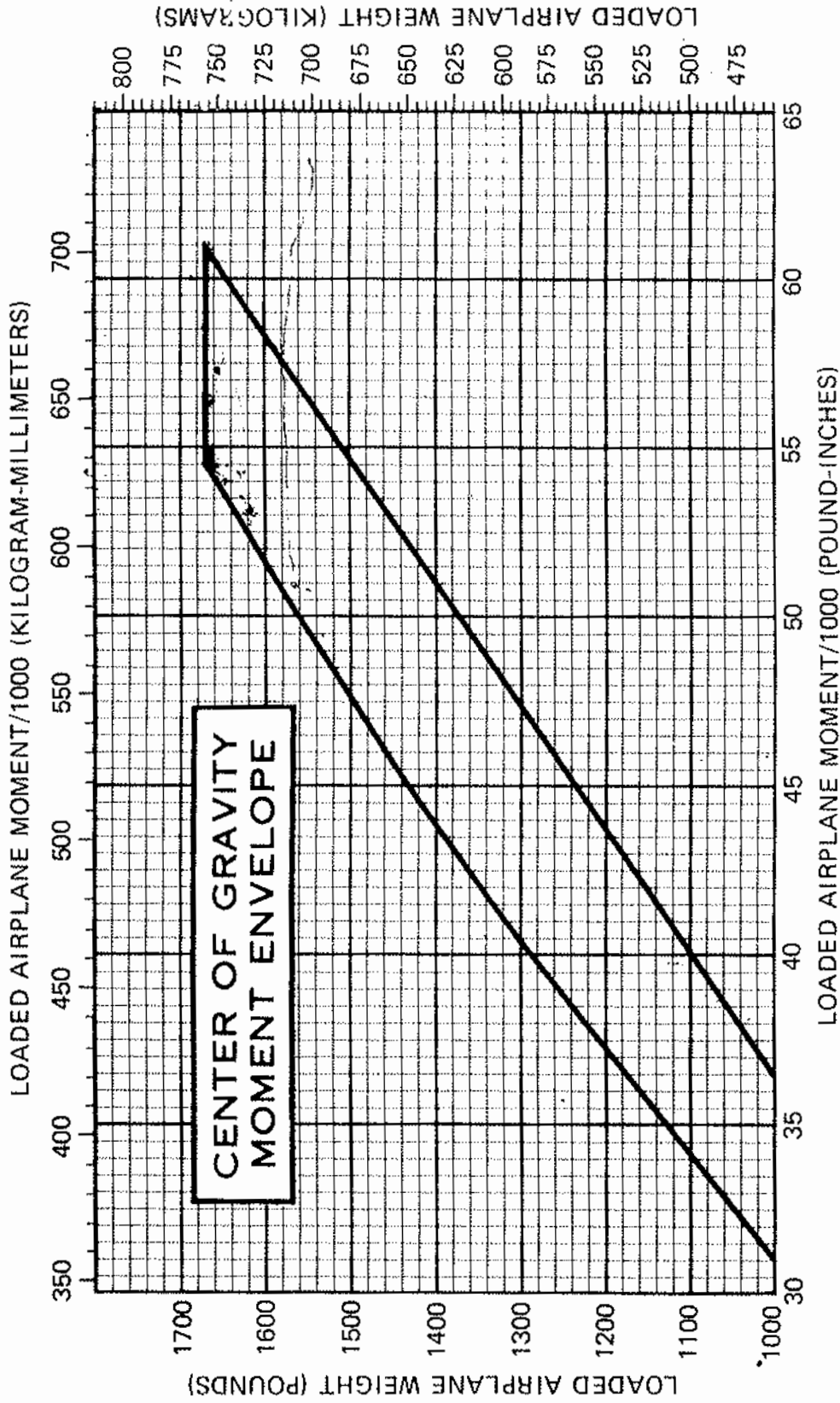


Figure 6-8. Center of Gravity Moment Envelope

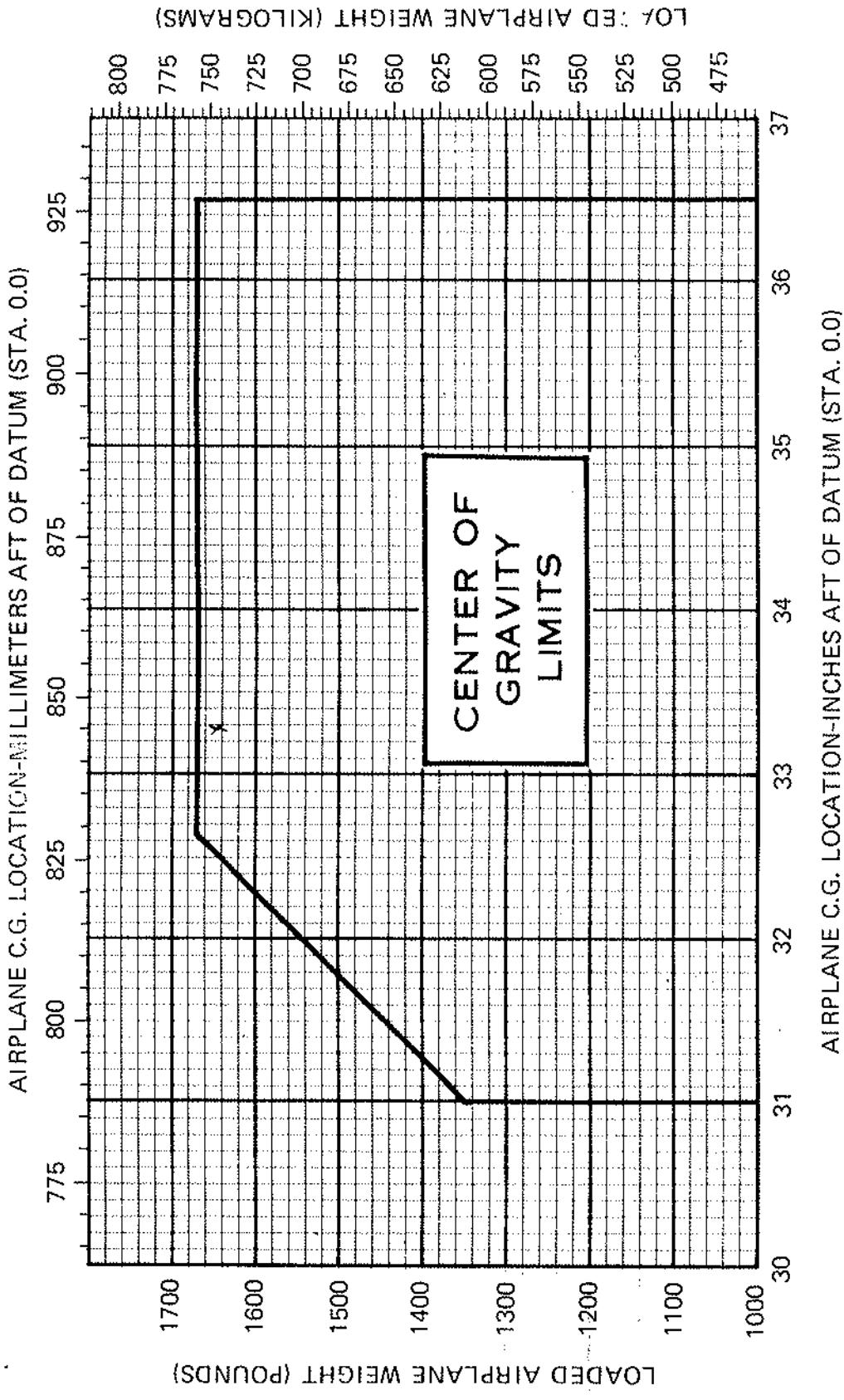


Figure 6-9. Center of Gravity Limits

EQUIPMENT LIST

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

This equipment list provides the following information:

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

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

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

NOTE

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

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

NOTE

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

NOTE

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

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ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
A01-R	A. POWERPLANT & ACCESSORIES ENGINE, LYCOMING O-235-N2C (INCLUDES ALTERNATOR BRACKETS, STARTER, CARBURETOR SPARK PLUGS AND OIL FILTER INSTALLATION)	0450071	246.0	-19.1
A05-R	FILTER, CARBURETOR AIR	C294510-0201	0.5	-16.0
A09-R	ALTERNATOR, 60 AMP, 28 VOLT (BELT DRIVE)	C611503-0102	10.7	-27.5
A17-R	OIL COOLER INSTALLATION -OIL COOLER (HARRISON) OR -OIL COOLER (STEWART WARNER)	0450071 8547332	3.6* 2.3 2.3	-24.0* -27.4 -27.4
A33-R	PROPELLER INSTALLATION -PROPELLER, MCCAULEY FIXED PITCH IA103/TCM6958	0450077 C161001-0501	28.2* 26.6	-36.5* -36.5
A41-R	SPINNER INSTALLATION, PROPELLER -SPINNER DOME -AFT BULKHEAD; (BACK SIDE OF PROP) -FWD BULKHEAD (FWD SIDE OF PROP) -MISC. ITEMS	0450077 0450073-1 0450072-1 0450076-1	2.5* 1.0 1.1 0.3 0.1	-36.2* -38.2 -34.8 -37.4 -34.0
A61-A	VACUUM SYSTEM, ELECTRICALLY DRIVEN STANDBY (REQUIRES D64-A) -VACUUM PUMP -ELECTRIC MOTOR AND GEAR BOX ASSEMBLY -MANIFOLD AND CHECK VALVE ASSEMBLY	0401043 C431003-0101 C165008-0101 A/MIH5-23	8.0* 1.9 3.8 0.5	1.7* 2.3 1.9 -2.4
A70-S	ENGINE PRIMING SYSTEM	0400152	0.5	3.1
A73-A	VALVE, ENGINE OIL QUICK DRAIN (NET CHANGE)	1701015	0.0	0.0
B01-R-1	B. LANDING GEAR & ACCESSORIES WHEEL, BRAKE & TIRE ASSY 15X6.00X6 MAIN 2 -WHEEL ASSEMBLY, MCCAULEY (EACH) -BRAKE ASSEMBLY, MCCAULEY (LEFT) -BRAKE ASSEMBLY, MCCAULEY (RIGHT) -TIRE, 4-PLY BLACKWALL (EACH) -TUBE, (EACH)	C163019-0211 C163006-0101 C163033-0102 C163033-0102 C262006-0102 C262026-0101	35.8* 7.6 1.9 1.9 7.1 1.3	46.7* 47.1 43.7 43.7 47.1 47.1

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
B01-R-2	WHEEL, BRAKE & TIRE ASSY, 15X6.00X6 MAIN 2 -WHEEL ASSY, CLEVELAND 40-113 (EACH) -BRAKE ASSY, CLEVELAND 30-75A (LEFT) -BRAKE ASSY, CLEVELAND 30-75A (RIGHT) -TIRE, 4-PLY BLACKWALL (EACH) -TUBE (EACH)	1241156-41 C163001-0104 C163030-0113 C163030-0114 C262006-0102 C262026-0101	35.4* 7.4 1.9 1.9 7.1 1.3	46.7* 47.1 43.7 43.7 47.1 47.1
B01-0-1	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN (2) -WHEEL ASSY, MCCAULEY (EACH) -BRAKE ASSY, MCCAULEY (LEFT) -BRAKE ASSY, MCCAULEY (RIGHT) -TIRE, 4-PLY BLACKWALL (EACH) -TUBE (EACH)	C163019-0201 C163006-0101 C163033-0101 C163033-0101 C262003-0101 C262023-0102	37.6* 7.6 1.9 1.9 8.0 1.3	46.8* 47.1 43.7 43.7 47.1 47.1
B01-0-2	WHEEL, BRAKE & TIRE ASSY, 6.00X6 MAIN (2) -WHEEL ASSY, CLEVELAND 40-113 (EACH) -BRAKE ASSY, CLEVELAND 30-75A (LEFT) -BRAKE ASSY, CLEVELAND 30-75A (RIGHT) -TIRE, 4-PLY BLACKWALL (EACH) -TUBE (EACH)	1241156-40 C163001-0104 C163030-0111 C163030-0112 C262003-0101 C262023-0102	37.2* 7.4 1.9 1.9 8.0 1.3	46.8* 47.1 43.7 43.7 47.1 47.1
B04-R-1	WHEEL & TIRE ASSY, 5.00X5 NOSE -WHEEL ASSY, MCCAULEY -TIRE, 4-PLY BLACKWALL -TUBE	C163018-0101 C163005-0201 C262003-0102 C262023-0101	10.3* 3.8 5.1 1.4	-10.8* -10.8 -10.8 -10.8
B04-R-2	WHEEL & TIRE ASSY, 5.00X5 NOSE -WHEEL ASSY, CLEVELAND 40-77 -TIRE, 4-PLY BLACKWALL -TUBE	1241156-2 1241156-12 C262003-0102 C262023-0101	9.3* 2.8 5.1 1.4	-10.8* -10.8 -10.8 -10.8
B10-A	WHEEL FAIRING INSTALLATION -NOSE WHEEL FAIRING -MAIN WHEEL FAIRING (EACH) -BRAKE FAIRINGS (EACH) C. ELECTRICAL SYSTEMS	0541225-4 0543088-1 0541229 0441227	16.7* 3.5 5.4 0.6	36.7* -9.5 49.5 50.5
C01-R	BATTERY, 24 VOLT STANDARD DUTY	C614002-0101	23.2	-5.5
C01-O	BATTERY, 24 VOLT HEAVY DUTY	C614002-0102	25.2	-5.5

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C04-R	ALTERNATOR CONTROL UNIT WITH HIGH VOLTAGE PROTECTION AND LOW VOLTAGE SENSING	C611005-0101	0.4	0.5
C07-A	GROUND SERVICE RECEPTACLE	0401026-1	2.2	-2.1
C16-A	PITOT HEATER	0422355-1	0.6	21.5
C22-A	POST LIGHTS (INSTRUMENT PANEL LIGHTING)	0413612	0.5	18.0
C25-A	MIC SWITCH & MAP LIGHT CONTROL WHEEL MTD (REQUIRED WITH E89-0)	0470433-1	0.2	22.5
C28-A	MAP LIGHT, DOOR POST MOUNTED	0470425-1	0.3	21.6
C43-A	LIGHT INSTALLATION, OMNIFLASH BEACON -BEACON LIGHT IN FIN TIP -FLASHER POWER SUPPLY IN AFT TAILCONE -RESISTOR (MEMCOR) -MISC. ITEMS	0406003-1 C621001-0102 C594502-0102 OR95-6	1.3* 0.4 0.5 0.2 0.2	193.7* 217.2 173.9 183.4 206.5
C46-A	LIGHT INSTALLATION WING TIP STROBE -STROBE LIGHTS IN WING TIP (SET OF 2) -FLASHER POWER SUPPLIES IN TIPS (SET OF 2)	0401009-1 C622006-0107 C622008-0102	3.4* 0.3 2.5	37.0* 35.5 39.5
C49-S	LANDING & TAXI LIGHT INSTALLATION (DUAL LAMP LOCATED IN LEADING EDGE OF WING)	0401040	2.5	24.5
D01-R	D. INSTRUMENTS INDICATOR, AIRSPEED	C661064-0107	0.6	17.2
D01-0	INDICATOR, TRUE AIRSPEED (0513279)	C661065-0105	0.7	17.3
D07-R	ALTIMETER, SENSITIVE	C661071-0101	0.9	17.6
D07-0-1	ALTIMETER, SENSITIVE (20 FT MARKINGS) (FEET AND MILLIBARS)	C661025-0102	0.7	17.6
D07-0-2	ALTIMETER, SENSITIVE (50 FT. MARKINGS) (FEET AND MILLIBARS)	C661071-0102	0.8	17.6

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
D16-A-1	ENCODING ALTIMETER (INCLUDES RELOCATION OF CONVENTIONAL ALTIMETER)	0401013	2.9	17.0
D16-A-2	ENCODING ALTIMETER, FEET & MILLIBARS (INCLUDES RELOCATION OF CONVENTIONAL ALTIMETER)	0401013	2.9	17.0
D16-A-3	ALTITUDE ENCODER (BLIND, DOES NOT REQUIRE PANEL MOUNTING)	0401019-1	1.5	2.0
D19-R	AMMETER INSTALLATION	S-1320-5	0.1	18.0
D25-A-1	CLOCK INSTALLATION -CLOCK, ELECTRIC	0400341 C664508-0102	0.4* 0.3	14.4* 18.1
D25-A-2	CLOCK INSTALLATION, DIGITAL READOUT -CHRONOMETER, DIGITAL	0470426-1 C664511-0102	0.6* 0.6	18.2* 18.2
D28-R	COMPASS	C660501-0102	0.5	20.0
D37-R	INSTRUMENT CLUSTER (LH & RH FUEL)	C669537-0104	0.4	18.0
D37-0	INSTRUMENT CLUSTER (LH & RH FUEL) (USED WITH G92-0, LONG RANGE WING ONLY)	C669537-0105	0.4	18.0
D40-R	INSTRUMENT CLUSTER (OIL PRES. & OIL TEMP.) OR AS A REPLACEMENT ALTERNATE	C669535-0101 C669564-0101	0.4	18.0
D49-A	ECONOMY MIXTURE INDICATOR (EGT) INSTL. -PROBE -LEAD -EGT GAGE -MISC. ITEMS	0401028-1 C668501-0204 C668501-0206 C668501-0213	0.7* 0.1 0.1 0.4 0.1	11.3* -7.0 11.9 17.8 3.0
D59-A	INDICATOR, 'G' METER	0400335	0.7	17.4

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D64-A	GYRO & VACUUM SYSTEM INSTALLATION -DIRECTIONAL INDICATOR -ATTITUDE INDICATOR -SUCCTION GAGE -GYRO FILTER ASSEMBLY (C431001-0101 OR -VACUUM PUMP (C431001-0302 MAY BE USED) -VACUUM RELIEF VALVE -MISC ITEMS	0413596 C661075-0101 C661075-0102 C668509-0101 1201075-2 C431003-0104 C482001-0401	9.2* 2.4 2.2 0.1 0.3 1.9 0.3 2.0	8.2* 15.4 17.1 2.0 -4.0
D67-A	RECORDER, ENGINE HOUR METER	0401017	0.6	5.2
D82-A	OUTSIDE AIR TEMPERATURE INDICATOR	C668507-0101	0.1	22.0
D85-R	TACHOMETER INSTALLATION, ENGINE -RECORDING TACH INDICATOR	0400152 C663020-0120	1.0* 0.6	12.5* 17.0
D88-A-1	INDICATOR, TURN COORDINATOR (24 VOLT ONLY)	C661003-0507	1.8	17.2
D88-A-2	INDICATOR, TURN COORDINATOR (10-30 VOLT)	C661003-0506	1.0	17.2
D88-A-3	INDICATOR, TURN AND BANK	S1303-2	1.0	17.2
D91-A	INDICATOR, VERTICAL SPEED E. CABIN ACCOMMODATIONS	C661080-0101	1.0	18.0
E05-R	SEAT, PILOT INDIVIDUAL SLIDING	0414090-1	11.1	45.2
E05-0	SEAT, VERTICALLY ADJUSTABLE, PILOT	0414089-1	17.0	45.2
E07-S	SEAT, CO-PILOT INDIVIDUAL SLIDING	0414090-2	11.1	45.2
E07-0	SEAT, VERTICALLY ADJUSTABLE, CO-PILOT	0414089-2	17.0	45.2
E09-A	CHILD SEAT INSTALLATION, AUXILIARY -UPPER BACK REST CUSHION -LOWER SEAT CUSHION ASSEMBLY -LAP BELT ASSEMBLY -MISC. ITEMS	0400134-1 0711080-1 0400136-9 S-1746-2	10.5* 1.3 6.4 1.0 1.8	66.5* 72.9 64.5 66.0 69.3
E15-R	RESTRAINING BELT, LAP; PILOT	S-2275-101	1.0	39.0

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
E15-S	SHOULDER HARNESS - PILOT	S-2275-202	0.6	39.0
E19-0	INERTIA REEL INSTALLATION, NET CHANGE FOR PILOT & CO-PILOT BELT & HARNESS	0401012-1	1.3	71.1
E23-S	BELT & HARNESS ASSY - CO-PILOT	S-2275-4	1.6	39.0
E34-0-1	INTERIOR, DELUXE (NET CHANGE)	0415020	1.5	40.0
E34-0-2	INTERIOR (SIDEWALL) LEATHER, NET CHANGE	CES-1157	1.5	40.0
E35-0-1	SEAT COVERING, FULL COVER, LEATHER PILOT & CO-PILOT (NET CHANGE)	CES-1157	1.0	39.0
E35-0-2	SEAT COVERING, PART COVER, LEATHER PILOT & CO-PILOT (NET CHANGE)	CES-1157	0.5	39.0
E39-A	WINDOWS, OVERHEAD CABIN TOP (NET INCREASE)	0401034-1	0.5	49.0
E55-A	SUN VISORS (SET OF 2)	0514166-1	1.0	27.0
E57-0	WINDOWS, TINTED, CABIN (NET CHANGE)	0400324-1	0.0	0.0
E59-A	APPROACH PLATE HOLDER	0415044-2	0.1	20.5
E65-S	BAGGAGE NET	2015009-2	0.5	84.0
E85-A	CONTROLS, RH SIDE (WHEEL, PEDALS & BRAKES)	0460118-2	4.5	11.5
E89-0	ALL PURPOSE CONTROL WHEEL (REQUIRED WITH C25-A, WT. NET CHANGE)	0470117	0.0	0.0
E93-R	HEATING SYSTEM, CABIN (INCLUDES ENGINE EXHAUST SYSTEM)	0450071	14.0	-22.0
F01-R	F. PLACARDS, WARNINGS & MANUALS	0405068-1	0.0	23.0
F01-0-1	OPERATIONAL LIMITATIONS PLACARD VFR-DAY NIGHT	0405068-2	0.0	23.0

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F01-0-2	OPERATIONAL LIMITATIONS PLACARD VFR-IFR DAY & NIGHT	0405068-3	0.0	23.0
F04-R	STALL WARNING HORN, PNEUMATIC, AUDIBLE	0413029	0.5	21.5
F10-S	PILOT'S CHECKLIST (STOWED IN GLOVE BOX)	D6141	0.3	14.5
F16-R	PILOT'S OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL (AT SEAT BACK POCKET OF PILOT SEAT)	D1270-13PH	1.0	50.7
	G. AUXILIARY EQUIPMENT			
G04-A	TOW HOOK (NOT FACTORY INSTALLED) (INSTALLED ARM SHOWN)(NORMALLY STOWED)	0500228-6	0.5	200.0
G07-A	HOISTING RINGS, AIRCRAFT CABIN TOP (NOT FACTORY INSTALLED)	0541115-0	2.0	42.0
G10-S	FUEL SAMPLER CUP (STOWED)	0756035-5	0.0	0.0
G13-A	CORROSION PROOFING, INTERNAL	0400027-2	8.5	79.0
G16-A	STATIC DISCHARGERS (SET OF 10)	0401015-1	0.3	116.2
G19-A	STABILIZER ABRASION BOOTS	0500041-3	2.5	179.4
G22-A	TOW BAR, AIRCRAFT NOSE WHEEL (STOWED)	0401039	1.6	84.0
G25-S	PAINT, OVERALL EXTERIOR -OVERALL BASE WHITE -COLOR STRIPE	0404042	9.4* 9.0 0.4	80.8* 79.0 122.1
G31-A	CABLES, CORROSION RESISTANT CONTROL (NET CHANGE)	0400027-2	0.0	0.0
G49-0	WING TIPS, MODIFIED CONICAL (NET CHANGE)	0401033-1	2.5	41.0
G55-A	FIRE EXTINGUISHER, HAND TYPE	0401038	3.0	10.9
G58-A	STEPS & HANDLES, REFUELING ASSIST	0413456-2	2.1	9.9

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
G67-A	PEDAL EXTENSIONS, RUDDER, REMOVABLE -- SET OF 2 (STOWABLE -- INSTALLED ARM SHOWN) AVAILABLE FROM DEALERS ONLY	0501082-1	2.8	8.0
G88-A	WINTERIZATION KIT INSTALLATION, ENGINE -COVER PLATES, FORWARD COWL AND OIL COOLER COVER (SET OF 3) -COVER PLATES (STOWED ARM ESTIMATED) -CRANKCASE BREATHER TUBE INSULATION	0401024-14 0450080	0.5* 0.1	-20.9* -33.0
G92-A	WINGS WITH 39 GALLON CAPACITY, EXTENDED RANGE FUEL TANKS, (NET CHANGE)	- 0401018-3	0.1 0.2 5.9	-33.0 -12.0 37.3
H01-A	H. AVIONICS & AUTOPILOTS SPERRY 300 ADF INSTALLATION -RECEIVER W/BFO, R-546E -INDICATOR, IN-346A -ANTENNA INSTALLATION (SENSE) -LOOP ANTENNA INSTALLATION -CABLE INSTALLATION -ADF SWITCH INSTALLATION -MISC. INSTALLATION COMPONENTS	3910159-11 41240-0001 40980-1001 0470400-621 3960104-1 3950104-14 3970146-4	7.9* 3.3 0.9 0.2 1.4 1.1 0.1 0.9	18.7* 14.5 15.5 92.7 24.2 12.2 16.0 20.5
H07-A	SPERRY 400 GLIDESLOPE WITH ILS INDICATOR EXCHANGED FOR LOC INDICATOR -RECEIVER, R-443B -MOUNTING -ANTENNA COUPLER, DUAL ADDED -VOR/ILS IND., IN-381A -VOR/LOC IND., IN-380A DELETED -VOR/ILS IN-386A ADDED, (ALTERNATE) -VOR/LOC IN-385A DELETED (ALTERNATE) -MISC. ITEMS	3910157-10 42100-0000 36450-0000 S2473-1 50570-2000 50570-1000 46860-2000 46860-1000	5.3* 2.1 0.3 0.2 +1.5 -1.4 +1.8 -1.6 -2.6	79.0* 100.7 100.7 5.0 15.5 15.5 15.5 15.5 67.1
H08-A-1	AUTO RADIAL CENTERING INDICATOR ARC/LOC EXCHANGE FOR VOR/LOC IN ITEM H22-A -ARC/LOC IND., IN-380AC ADDED -VOR/LOC IND., IN-380A DELETED	3910196-1 50570-1200 50570-1000	0.1* 1.5 -1.4	15.5* 15.5 15.5

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H08-A-2	AUTO RADIAL CENTERING INDICATOR, ARC/ILS EXCHANGE FOR VOR/ILS INDICATOR IN ITEM H07-A ONLY -ARC/ILS IND., IN-381AC ADDED -VOR/ILS IND., IN-381A DELETED	3910196-2	0.1*	15.5*
H08-A-3	AUTO RADIAL CENTERING INDICATOR ARC/LOC EXCHANGE FOR VOR/LOC (ALT. INDICATOR) -ARC/LOC INDICATOR, IN-385AC ADDED -VOR/LOC INDICATOR, IN-385A DELETED	50570-2200 50570-2000	1.6 -1.5	15.5 15.5
H08-A-4	AUTO RADIAL CENTERING INDICATOR ARC/ILS EXCHANGE FOR VOR/ILS (ALT. INDICATOR) -ARC/ILS INDICATOR, IN-386AC ADDED -VOR/ILS INDICATOR, IN-386A DELETED	3910196-1	0.2*	15.5*
H13-A	SPERRY 400 MARKER BEACON INSTALLATION -RECEIVER, R-402B -ANTENNA, L SHAPED ROD -MKR BCN KIT & MISC. ITEMS	46860-2200 46860-2000	1.9 -1.7	15.5 15.5
H16-A-1	SPERRY 300 TRANSPONDER INSTALLATION -TRANSCIVER, RT-359A -ANTENNA -RADIO COOLING & MISC. ITEMS	3910164-14 51170-0000 0770681-1	2.8* 0.7 0.7 1.4	32.7* 10.0 94.6 13.1
H16-A-2	SPERRY 400 TRANSPONDER (FOR EXPORT USE) -TRANSCIVER, RT-459A -ANTENNA -RADIO COOLING & MISC. ITEMS	3910127-1 41420-0028 42940-0000	3.8* 2.7 0.2 0.8	16.8* 13.0 67.0 17.0
H22-A-1	SPERRY 300 NAV/COM, 720 CH COM INSTL. REQUIRES--H34-A TO OPERATE, 1ST UNIT --H37-A TO OPERATE, 2ND UNIT -RECEIVER/TRANSCIVER, RT-385A -VOR/LOC INDICATOR, IN-360A -MOUNT, WIRING & MISC ITEMS	3910128-20 41470-1028 42940-0000	3.9* 2.8 0.2 0.8	16.8* 13.0 67.0 17.0
		3910183-1	7.6*	13.8*
		46660-1000 50570-1000	5.5 1.4 0.7	13.3 15.5 15.8

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
H22-A-2	SPERRY 300 NAV/COM, 720 CH COM INSTL. REQUIRES --H34-A TO OPERATE, 1ST UNIT --H37-A TO OPERATE, 2ND UNIT -RECEIVER/TRANSCEIVER; RT-385A -VOR/LOC INDICATOR; IN-385A -MOUNT, WIRING & MISC. ITEMS	3910183-1 46660-1000 46860-1000	7.8*	13.8*
H28-A	EMERGENCY LOCATOR TRANSMITTER -TRANSMITTER -ANTENNA AND CABLE	0470435-1 C589512-0103 C589512	3.0* 2.7 0.2	106.7* 107.1 101.3
H33-A	INTERCOM SYSTEM INSTALLATION INCLUDES 2 PADDED HEADSETS (H56-A) REQUIRES AUDIO PANEL HEADSET ARM AS USED BY OCCUPANT	3910210	3.1	33.8
H34-A	BASIC AVIONICS KIT INSTALLATION REQUIRED W/1ST UNIT NAV/COM RADIO -RADIO COOLING FAN & 1ST N/C DUCTING -NOISE FILTER (AUDIO) (ON ALTERNATOR) -LH COM ANTENNA CABLE -OMNI ANTENNA CABLE -ANTI-P-STATIC NAV ANTENNA -VHF L.H. COM ANTENNA -MICROPHONE INSTALLATION -1ST N/C TRAKER RECEIVER KIT -CABIN SPEAKER INSTALLATION -HEADPHONE INSTALLATION -SWITCH, POTENTIOMETER & ANT. ADAPTER	3910186-1 3930261 3940148-2 3950140-5 3950104-4 3960102-9 3960113-1 3970261 3930260-2 3970123-6 3970125-1 3970146	5.7* 1.3 0.1 0.3 0.7 0.5 0.4 0.4 0.1 1.1 0.2 0.2	49.7* 3.8 -24.5 -22.0 95.3 220.8 55.9 17.8 15.5 49.5 14.3 18.4
H37-A	ANTENNA & COUPLER KIT INSTALLATION REQUIRED W/2ND UNIT NAV/COM RADIO -RH COM ANTENNA INSTALLATION -RH COM ANTENNA CABLE -OMNI ANTENNA COUPLER INSTL. -RADIO COOLING	3910185-1 3960113-2 3950140-4 3960111-11 3930261	1.0* 0.4 0.3 0.2 0.1	30.5* 55.9 22.0 5.0 5.2
H55-A	HEADSET-MICROPHONE, REQUIRES ALL-PURPOSE CONTROL WHEEL	C596533-0101	0.3	17.2
H56-A	PADDED HEADPHONE-MIKE ASSY, REQUIRES ALL-PURPOSE CONTROL WHEEL	C596531-0101	1.1	14.0

SECTION 6
WEIGHT & BALANCE/
EQUIPMENT LIST

CESSNA
MODEL 152

ITEM NO	EQUIPMENT LIST DESCRIPTION	REF DRAWING	WT LBS	ARM INS
J01-A	<p>J. SPECIAL OPTION PACKAGES</p> <p>152 VALUE GROUP A EQUIPMENT PACKAGE -C43-A OMNI FLASHING BEACON LIGHT -D64-A GYRO & VACUUM SYSTEM -D82-A OUTSIDE AIR TEMP. INDICATOR -D88-A-2 TURN COORDINATOR -D91-A VERTICAL SPEED INDICATOR -E55-A SUN VISORS -E85-A DUAL CONTROLS -H22-A 300 NAV/COM, RT-385A -H34-A BASIC AVIONICS KIT -G13-A INTERNAL CORROSION PROOFING</p>	<p>406003-1 04135596 C668507-0101 C661003-0506 C661080-0101 0514166-1 0460118-2 3910183-1 3910186-1 0400027</p>	<p>39.9* 1.3 9.2 0.1 1.0 1.0 1.0 4.5 7.6 5.7 8.5</p>	<p>37.7* 193.2 8.0 22.2 17.2 18.0 27.0 11.5 13.3 49.7 79.0</p>
J05-A	<p>TRAINER PACKAGE REQUIRED VALUE GROUP A AND INCLUDES THE FOLLOWING ITEMS IN ADDITION TO ITEMS IN J01-A (VALUE GROUP A)</p> <p>-A73-A OIL QUICK DRAIN -D49-A EGT INDICATOR -D67-A RECORDER, FLIGHT HOURMETER -E57-A WINDOWS, TINTED, CABIN -E69-A ALL PURPOSE CONTROL WHEEL -G58-A STEP & HANDLES -H16-A-1 SPERRY 300 TRANSPONDER -H33-A INTERCOM SYSTEM (INCLUDED) H56-A HEADSET ASSY-PADDED)</p>	<p>1701015 0401028-1 0491017 0400324-1 0470117 0413456-2 3910127-1 3910210 0400027</p>	<p>10.3* 0.0 0.7 0.6 0.0 0.0 2.1 3.8 3.1 8.5</p>	<p>19.3* 0.0 9.2 5.2 0.0 0.0 9.9 16.3 33.8 79.0</p>

SECTION 7

AIRPLANE & SYSTEMS

DESCRIPTIONS

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Aero Noord FTO
Plesmanstraat 12
7903 BE HOOGEVEEN
0528 - 27 48 55 www.aeronoord.nl

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INTRODUCTION

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

AIRFRAME

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

The construction of the fuselage is a conventional formed sheet metal bulkhead, 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 and forgings for main landing gear attachment at the base of the rear door posts, and a bulkhead with attaching plates at the base of the forward door posts for the lower attachment of the wing struts. Four engine mount stringers are also attached to the forward door posts and extend forward to the firewall.

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-slotted 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 the 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 spar, formed sheet metal ribs and reinforcements, a wrap-around skin panel, formed leading edge skin and a dorsal. The rudder is constructed of a formed leading edge skin containing hinge halves, a wrap-around skin panel and ribs, and a formed trailing edge skin with a ground adjustable trim tab at its base. The top of the rudder incorporates a leading edge extension which contains a balance weight. The horizontal stabilizer is constructed of a forward spar, main spar, formed sheet metal ribs and stiffeners, a wrap-around skin panel, and formed leading edge skins. The

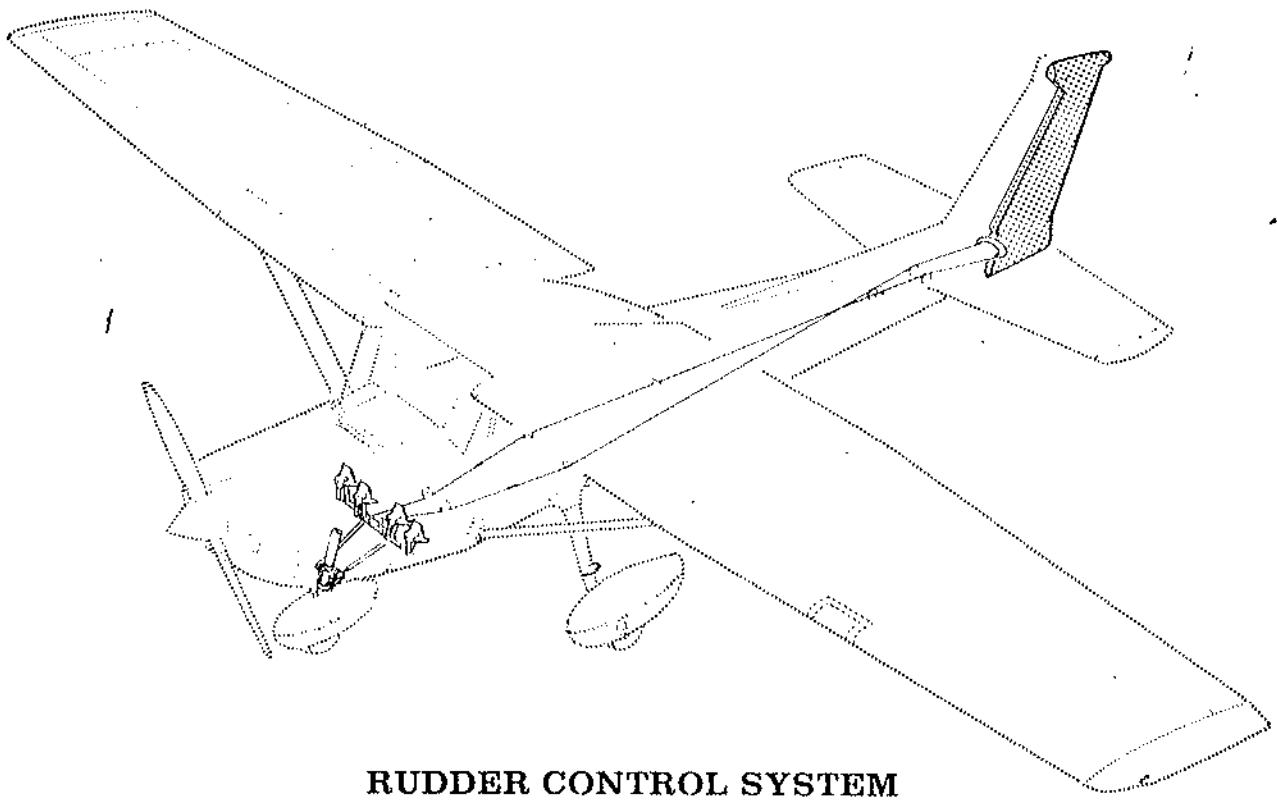
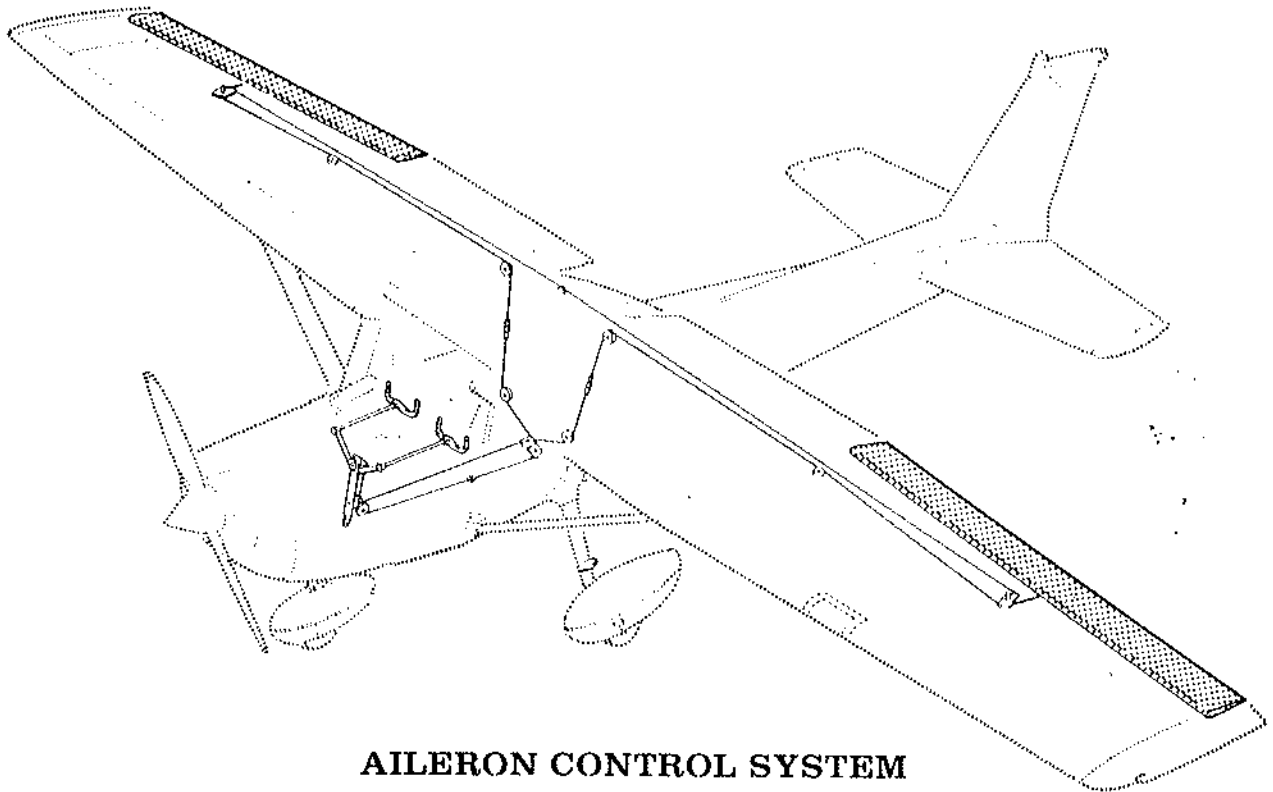
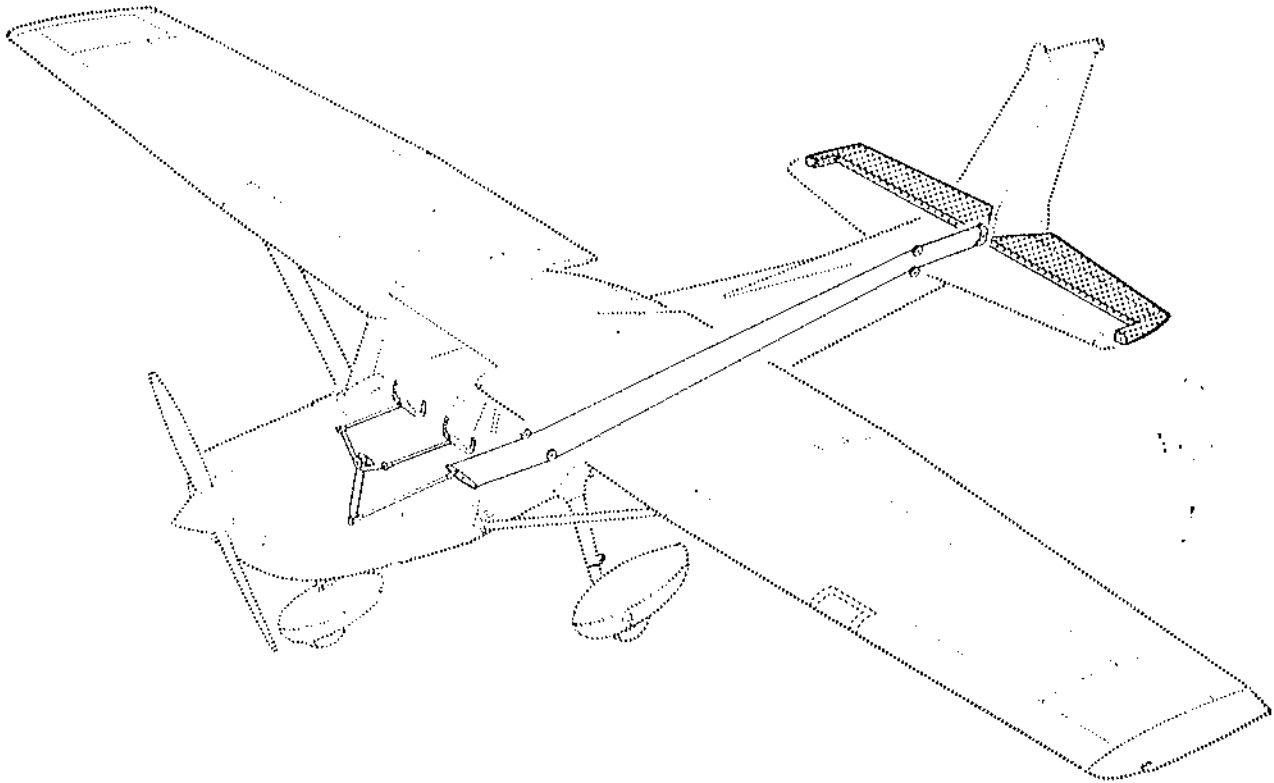
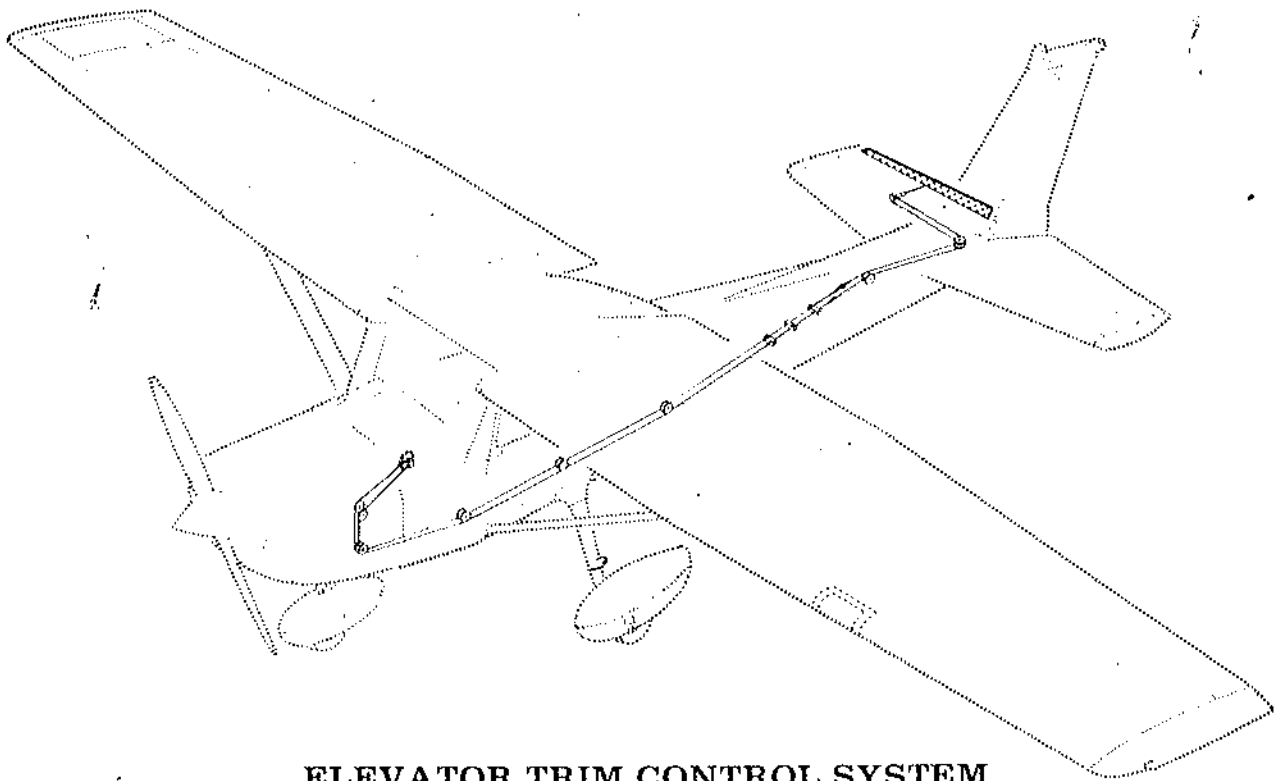


Figure 7-1. Flight Control and Trim Systems (Sheet 1 of 2)



ELEVATOR CONTROL SYSTEM



ELEVATOR TRIM CONTROL SYSTEM

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

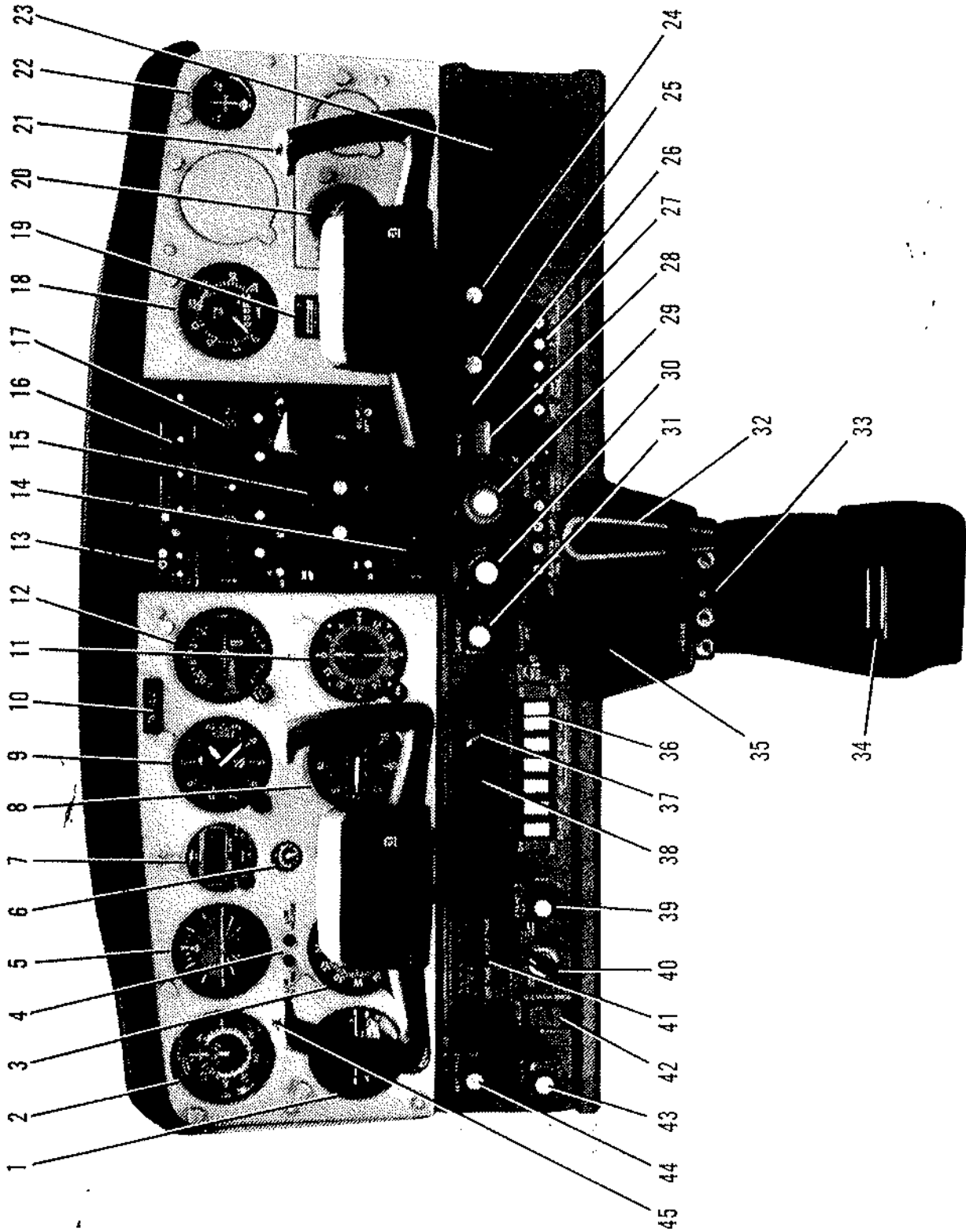


Figure 7-2. Instrument Panel (Sheet 1 of 2)

- | | | | |
|-----|--|-----|---|
| 1. | Turn Coordinator | 24. | Cabin Heat Control |
| 2. | Airspeed Indicator | 25. | Cabin Air Control |
| 3. | Directional Indicator | 26. | Standby Vacuum Pump Switch |
| 4. | Low-Voltage and Low-Vacuum
Warning Lights | 27. | Circuit Breakers |
| 5. | Attitude Indicator | 28. | Wing Flap Switch and Position
Indicator |
| 6. | Suction Gage | 29. | Mixture Control |
| 7. | Digital Clock | 30. | Throttle (With Friction Lock) |
| 8. | Vertical Speed Indicator | 31. | Carburetor Heat Control |
| 9. | Altimeter | 32. | Microphone |
| 10. | Airplane Registration Number | 33. | Headset Jacks |
| 11. | ADF Bearing Indicator | 34. | Ash Tray |
| 12. | Course Deviation and ILS Glide
Slope Indicator | 35. | Elevator Trim Control Wheel
and Position Indicator |
| 13. | Marker Beacon Indicator Lights
and Switches | 36. | Electrical Switches |
| 14. | Transponder | 37. | Oil Pressure Gage |
| 15. | ADF Radio | 38. | Oil Temperature Gage |
| 16. | Audio Control Panel | 39. | Instrument Panel and Radio
Dial Lights Rheostat |
| 17. | Nav/Com Radio | 40. | Ignition Switch |
| 18. | Tachometer | 41. | Left and Right Fuel
Quantity Indicators |
| 19. | Flight Hour Recorder | 42. | Master Switch |
| 20. | Economy Mixture Indicator (EGT) | 43. | Primer |
| 21. | Passenger's Microphone-Headset
Remote Keying Switch | 44. | Parking Brake Control |
| 22. | Ammeter | 45. | Pilot's Microphone-Headset
Remote Keying Switch |
| 23. | Map Compartment | | |

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

horizontal stabilizer also contains the elevator trim tab actuator. Construction of the elevator consists of a main spar and bellcrank, left and right wrap-around skin panels, and a formed trailing edge skin on the left half of the elevator; the entire trailing edge of the right half is hinged and forms the elevator trim tab. The leading edge of both left and right elevator tips incorporate extensions which contain 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.

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 SYSTEM

A manually-operated elevator trim tab is provided. 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.

INSTRUMENT PANEL

The instrument panel (see figure 7-2) is designed to place the primary flight instruments directly in front of the pilot. The gyro-operated flight instruments are arranged one above the other, slightly to the left of the control column with the low-vacuum and low-voltage warning lights between them. To the left of these instruments are the airspeed indicator and turn coordinator. The altimeter, vertical speed indicator, digital clock, suction gage and navigation instruments are above and/or to the right of the control column. Avionics equipment is stacked approximately on the centerline of the panel, with space for additional equipment on the lower right side of the instrument panel. The right side of the panel also contains the tachometer, ammeter, economy mixture indicator (EGT) and additional instruments such as a flight hour recorder and accelerometer. The left switch and control panel, under the primary instrument panel, contains the fuel quantity indicators and engine instruments positioned below the

pilot's control wheel. The electrical switches, panel and radio light rheostat knob, ignition and master switches, primer, and parking brake control are located around these instruments. The engine controls, wing flap switch, standby vacuum pump switch, and cabin air and heat control knobs are to the right of the pilot, near the center of the switch and control panel. Directly below these controls are the elevator trim control wheel, trim position indicator, microphone, and circuit breakers. A map compartment is on the extreme right side of the switch and control panel.

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 8.5° 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.

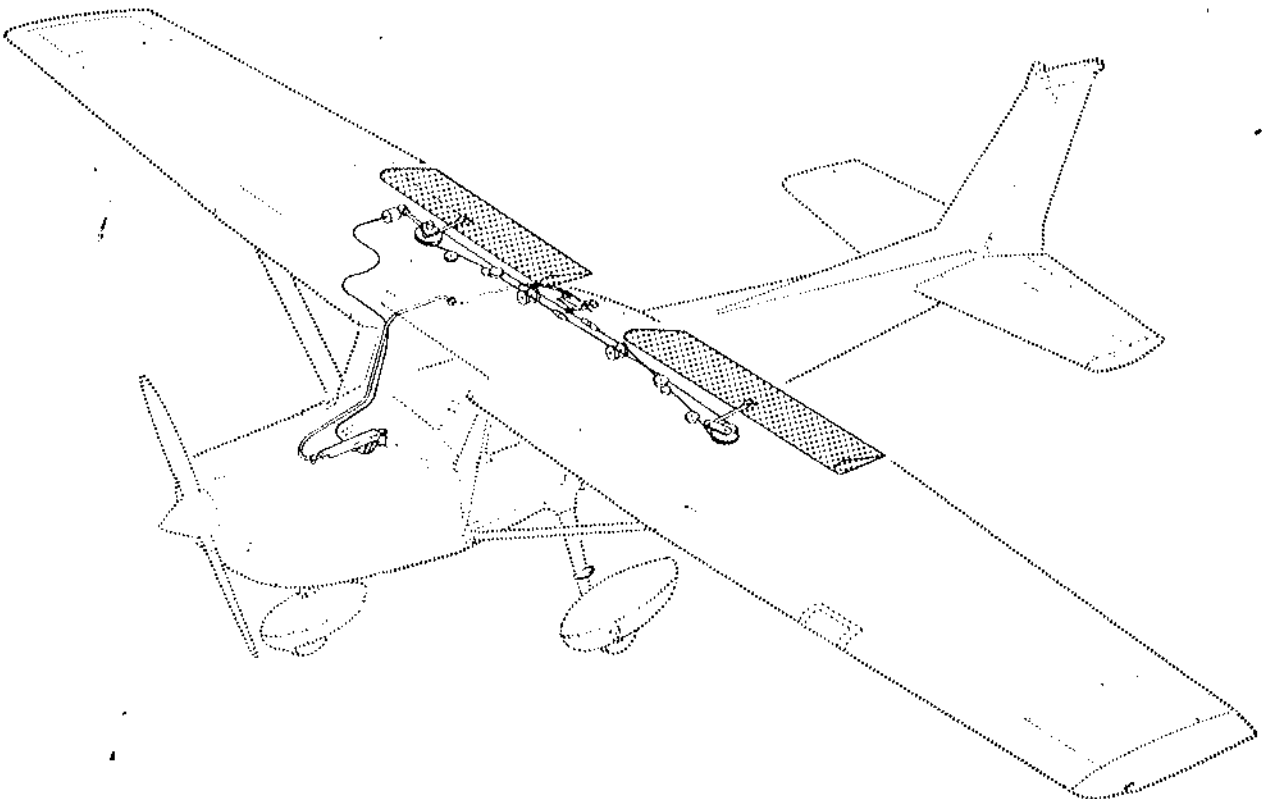


Figure 7-3. Wing Flap System

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 25 feet 1 inch. To obtain a minimum radius turn during ground handling, the airplane may be rotated around either main landing gear by pressing down on the tailcone just forward of the vertical stabilizer to raise the nose wheel off the ground.

WING FLAP SYSTEM

The wing flaps (see figure 7-3) are of the single-slot type with a maximum deflection of 30°. They are extended or retracted by positioning the wing flap switch lever on the instrument panel to the desired flap deflection position. The switch lever is moved up or down in a slot in the instrument panel that provides mechanical stops at the 10° and 20° positions. For flap settings greater than 10°, move the switch lever to the right to clear the stop and position it as desired. A scale and pointer on the left side of the switch lever indicates flap travel in degrees. The wing flap system circuit is protected by a 15-ampere circuit breaker, labeled FLAP, near the center of the switch and control panel.

LANDING GEAR SYSTEM

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

BAGGAGE COMPARTMENT

The baggage compartment consists of the area from the back of the

pilot and passenger's seats to the aft cabin bulkhead. Access to the baggage compartment is gained from within the airplane cabin. A baggage net with six tie-down straps is provided for securing baggage and is attached by tying the straps to tie-down rings provided in the airplane. When loading the airplane, children should not be placed or permitted in the baggage compartment, unless a child's seat is installed, and any material that might be hazardous to the airplane or occupants should not be placed anywhere in the airplane. For baggage area dimensions, refer to Section 6.

SEATS

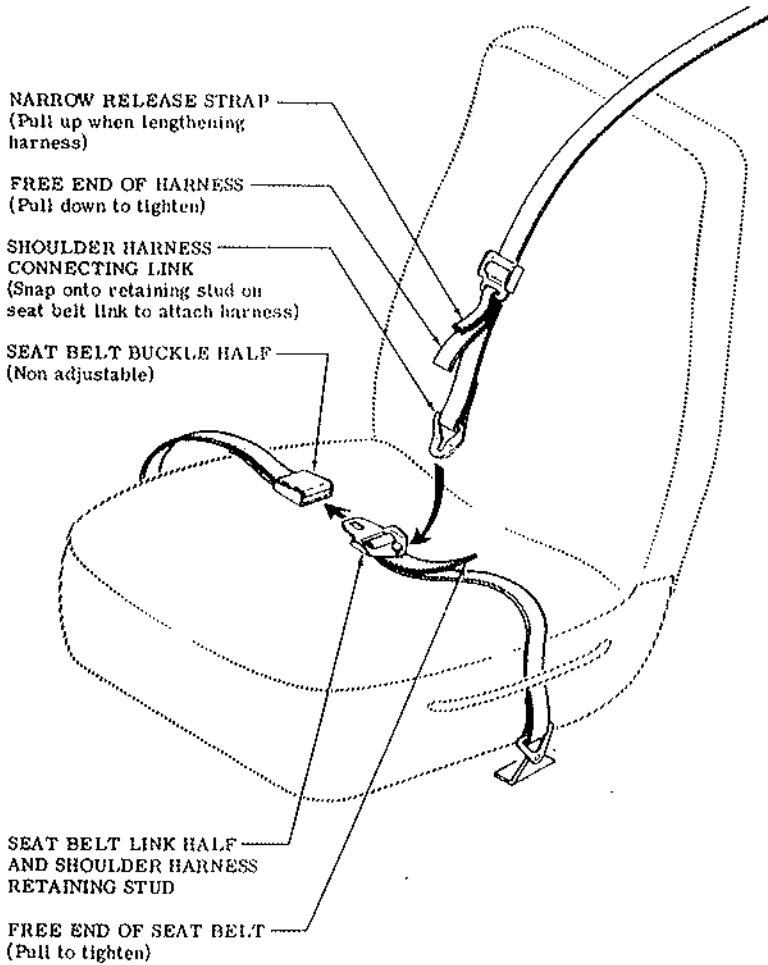
The seating arrangement consists of two separate adjustable seats for the pilot and passenger and, if installed, a child's seat in the rear cabin area. The pilot's and passenger's seats are available in two designs: four-way and six-way adjustable.

Four-way seats may be moved forward or aft, and the seat back angle changed. To position either seat, lift the lever under the inboard corner of the seat, slide the seat into position, release the lever, and check that the seat is locked in place. To adjust the seat back, pull forward on the knob under the center of the seat and apply pressure to the back. To return the seat back to the upright position, pull forward on the exposed portion of the seat back frame. Both seat backs will also fold full forward.

The six-way seats may be moved forward or aft, adjusted for height, and the seat back angle changed. Position either seat by lifting the tubular handle under the inboard front corner of the seat bottom and slide the seat to the desired position. Release the lever and check that the seat is locked in place. To raise or lower the seat, rotate the crank located under the outboard corner of each seat. Seat back angle is adjustable by rotating a lever on the rear inboard corner of each seat. To adjust either seat back, rotate the lever aft and apply pressure against the back until it stops moving; then release the lever. The seat back may be returned to the upright position by pulling forward on the exposed portion of the lower seat back frame. Check that the release lever has returned to its vertical position. Both seat backs will fold full forward.

A child's seat is available for installation in the rear of the cabin. The seat back is secured to the cabin sidewalls, and the seat bottom is attached to brackets on the floor. This seat is non-adjustable.

STANDARD SHOULDER
 HARNESS



(PILOT'S SEAT SHOWN)

SEAT BELT/SHOULDER
 HARNESS WITH INERTIA
 REEL

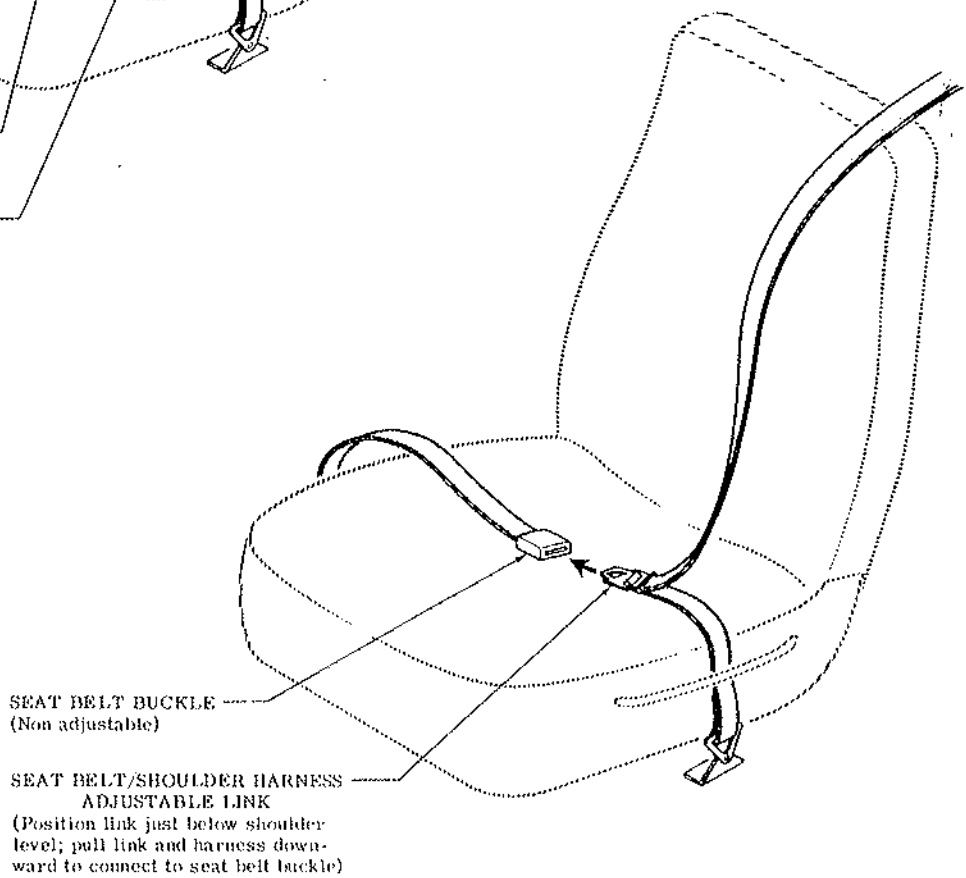


Figure 7-4. Seat Belts and Shoulder Harnesses

SEAT BELTS AND SHOULDER HARNESSSES

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

SEAT BELTS

The seat belts used with the pilot's seat, passenger's seat, and the child's seat (if installed) are attached to fittings on the floorboard. The buckle half of the seat belt is inboard of each seat and has a fixed length; the link half of the belt is outboard and is the adjustable part of the belt.

To use the seat belts for the pilot's and passenger's 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 by pulling the free end of the belt. The seat belt for the child's seat (if installed) is used in the same manner as the belts for the pilot's and passenger's seats. To release the seat belts, grasp the top of the buckle opposite the link and pull upward.

SHOULDER HARNESSSES

Each 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. No harness is available for the child's seat.

The shoulder harnesses are used by fastening and adjusting the seat belt first. Then, 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. Removing the 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.

Adjustment of the shoulder harness is important. 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.

INTEGRATED SEAT BELT/SHOULDER HARNESSSES 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 upper cabin sidewall just aft of each cabin door to attach points outboard of the front seats. A separate seat belt half and buckle is located inboard of the seats. Inertia reels allow complete freedom of body movement. However, in the event of a sudden deceleration, they will lock automatically to protect the occupants.

To use the seat belt/shoulder harness, position the adjustable metal link on the harness 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 outboard 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 (refer to Section 6 for cabin and cabin door dimensions). The doors incorporate a recessed exterior and interior door handle, a key-operated door lock (left door only), a door stop mechanism, and an openable window.

To open the doors from outside the airplane, utilize the recessed door handle near the aft edge of each door. Grasp the forward edge of the handle and pull out. To close or open the doors from inside the airplane, use the recessed door handle and arm rest. Both cabin doors should be checked for security 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 65 KIAS, momentarily shove the door outward slightly, and forcefully close the door.

Exit from the airplane is accomplished by grasping the forward edge of the door handle and pulling. To lock the airplane, lock the right cabin door from the inside by lifting up on the lever near the aft edge of the door, close the left cabin door, and using the ignition key, lock the door.

Both cabin doors are equipped with openable windows. The windows are held in the closed position by a detent equipped latch on the lower edge of the window frame. To open either window, rotate the latch upward. The windows are equipped with a spring-loaded retaining arm which will help rotate the window outward, and hold it there. If required, the windows may be opened at any speed up to 149 KIAS. All other cabin windows are of the fixed type and cannot be opened. Two additional fixed windows may be installed in the cabin top.

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 and flag. The flag identifies the control lock and cautions about its removal before starting the engine. To install the control lock, align the hole in the top of the pilot's control wheel shaft with the hole in the top 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 flag over the ignition switch. In areas where high or gusty winds occur, a control surface lock should be installed over the vertical stabilizer and rudder. The control lock and any other type of locking device should be removed prior to starting the engine.

ENGINE

The airplane is powered by a horizontally-opposed, four-cylinder, overhead-valve, air-cooled, carbureted engine with a wet sump lubrication system. The engine is a Lycoming Model O-235-N2C and is rated at 108 horsepower at 2550 RPM. Major engine accessories (mounted on the front of the engine) include a starter, a belt-driven alternator, and an oil cooler. Dual magnetos and a full-flow oil filter are mounted on the rear of the engine. Provisions are also made for a vacuum pump.

ENGINE CONTROLS

Engine power is controlled by a throttle located on the lower center portion of the instrument panel. The throttle operates in a conventional manner: in the full forward position, the throttle is open, and in the full aft position, it is closed. A friction lock, which is a round knurled disk, is located at the base of the throttle and is operated by rotating the lock clockwise to increase friction or counterclockwise to decrease it.

The mixture control, mounted above the right corner of the control pedestal, is a red knob with raised points around the circumference and is equipped with a lock button in the end of the knob. The rich position is full forward, and full aft is the idle cut-off position. 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, and a tachometer. An economy mixture (EGT) indicator is also available.

The oil pressure gage, located on the left switch and control 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 located on the left switch and control panel. 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 engine-driven mechanical tachometer is located near the upper center portion of the instrument panel. The instrument is calibrated in increments of 100 RPM and indicates both engine and propeller speed. An hour meter below the center of the tachometer dial records elapsed engine time in hours and tenths. Instrument markings include a normal operating range (green arc) of 1900 to 2550 RPM, and a maximum (red line) of 2550 RPM. The upper end of the green arc is "stepped" to indicate approximate RPM for 75% engine power at sea level (2350 RPM), at 4000 feet (2450 RPM), and at 8000 feet (2550 RPM).

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 muffler tailpipe measures exhaust gas temperature and transmits it to the indicator. The indicator serves as a visual aid to the pilot in adjusting cruise mixture. Exhaust gas temperature varies with fuel-to-air ratio, power, and RPM. However, the difference between the peak EGT and the EGT at the cruise mixture setting is essentially constant and this provides a useful leaning aid. The indicator is equipped with a manually positioned reference pointer.

NEW ENGINE BREAK-IN AND OPERATION

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

ENGINE LUBRICATION SYSTEM

The engine utilizes a full pressure, wet sump-type lubrication system with aviation grade oil used as the lubricant. The capacity of the engine sump (located at the bottom of the engine) is six quarts (one additional quart is required for the full flow oil filter). Oil is drawn from the sump through an oil suction strainer screen into the engine-driven oil pump. Oil passes from the pump to a thermostatically controlled bypass valve. If the oil is cold, the bypass valve allows the oil to bypass the oil cooler and flow directly to the filter. If the oil is hot, the bypass valve routes the oil from the accessory case forward through a flexible hose to the engine oil cooler mounted on the left forward side of the engine. Returning to the accessory case, the oil passes through the filter. The filtered oil then enters a pressure relief valve which regulates engine oil pressure by allowing excessive oil to return to the sump, while the balance of the pressure oil is circulated to various engine parts for lubrication. Residual oil returns to the sump by gravity flow.

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

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

IGNITION-STARTER SYSTEM

Engine ignition is provided by two engine-driven magnetos, and two spark plugs in each cylinder. The right magneto fires the lower right and the 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 in the lower portion of the engine cowling. The intake 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 under the engine, and is then ducted to the engine cylinders through intake manifold tubes. In the event carburetor ice is encountered or the intake filter becomes blocked, alternate heated air can be obtained from a shroud around an exhaust riser through a duct to a valve, in the airbox, operated by the carburetor heat control on the instrument panel. Heated air from the shroud is obtained from an unfiltered outside source. Use of full carburetor heat at full throttle will result in a loss of approximately 150 RPM.

EXHAUST SYSTEM

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

CARBURETOR AND PRIMING SYSTEM

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

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

COOLING SYSTEM

Ram air for engine cooling enters through two intake openings in the front of the engine cowling. The cooling air is directed around the cylinders and other areas of the engine by baffling, and is then exhausted through an opening at the bottom aft edge of the cowling. No manual cooling system control is provided.

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

PROPELLER

The airplane is equipped with a two-bladed, fixed-pitch, one-piece forged aluminum alloy propeller which is anodized to retard corrosion. The propeller is 69 inches in diameter.

FUEL SYSTEM

The airplane may be equipped with either a standard fuel system or long range system (see figure 7-6). Both systems consist of two vented fuel tanks (one in each wing), a fuel shutoff valve, fuel strainer, manual primer, and carburetor. Refer to figure 7-5 for fuel quantity data for both systems.

Fuel flows by gravity from the two wing tanks to a fuel shutoff valve. With the valve in the ON position, fuel flows through a strainer 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 cylinder intake ports.

Fuel system venting is essential to system operation. Blockage of the venting system will result in a decreasing fuel flow and eventual engine stoppage. Venting is accomplished by an interconnecting line from the right fuel tank to the left tank. The left tank is vented overboard through a vent line which is equipped with a check valve, and protrudes from the bottom surface of the left wing near the wing strut attach point. The right fuel tank filler cap is also vented.

Fuel quantity is measured by two float-type fuel quantity transmitters (one in each tank) and indicated by two electrically-operated fuel quantity

FUEL QUANTITY DATA (U.S. GALLONS)				
FUEL TANKS	FUEL LEVEL (QUANTITY EACH TANK)	TOTAL FUEL	TOTAL UNUSABLE	TOTAL USABLE ALL FLIGHT CONDITIONS
STANDARD	FULL (13)	26.0	1.5	24.5
LONG RANGE	FULL (19.5)	39.0	1.5	37.5
	REDUCED (13)	26.0	1.5	24.5

Figure 7-5. Fuel Quantity Data

indicators on the lower left portion of the instrument panel. An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately .75 gallon remains in either a standard or long range tank as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips, or unusual attitudes.

The amount of unusable fuel is relatively small due to the dual outlets at each tank. The maximum unusable fuel quantity, as determined from the most critical flight condition, is about 1.5 gallons total. This quantity was not exceeded by any other reasonable flight condition, including prolonged 30 second full-rudder sideslips in the landing configuration. Takeoffs have not been demonstrated with less than 2 gallons total fuel (1 gallon per tank).

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 sump drains and the fuel line drain (on the right side of the fuselage belly below the lift strut to fuselage intersection). Also, drain a sample of fuel from the fuel strainer by utilizing the fuel strainer drain control under the access panel on the right side of the engine cowling. If any evidence of fuel contamination is found, it must be eliminated in accordance with the Preflight Inspection checklist and the discussion in Section 8 of this handbook. The fuel tanks should be filled after each flight to minimize condensation.

When the airplane is equipped with long range tanks, it may be serviced to a reduced fuel capacity to permit heavier cabin loadings. This

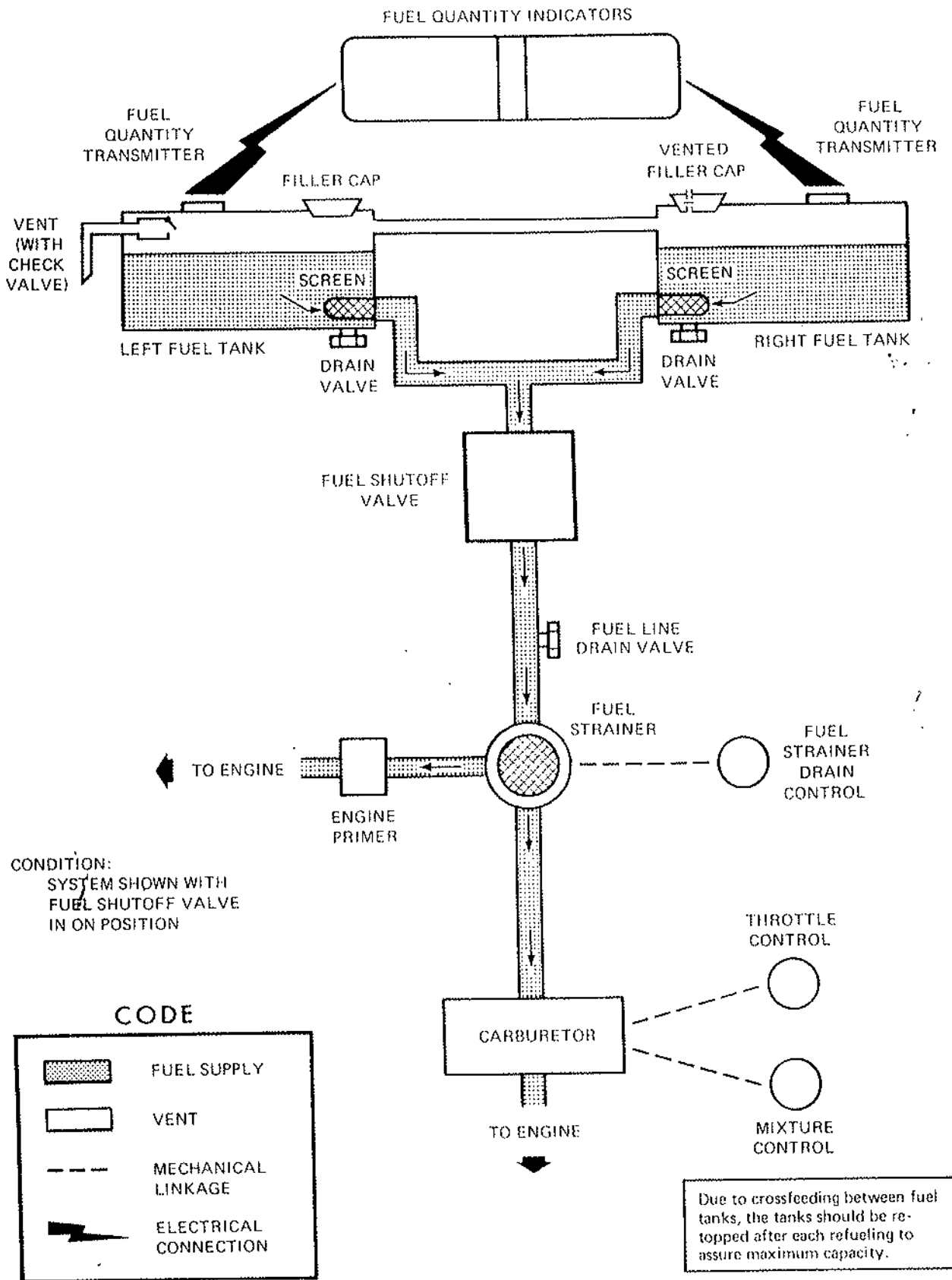


Figure 7-6. Fuel System (Standard and Long Range)

is accomplished by filling each tank to the bottom of the indicator on the fuel filler neck. When filled to this level, each tank contains 13 gallons (12.25 usable in all flight conditions).

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 knob on the lower left side of the instrument panel.

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

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

ELECTRICAL SYSTEM

The airplane is equipped with a 28-volt, direct-current electrical system (see figure 7-7). This system uses a 24-volt battery mounted on the right forward side of the firewall as the source of electrical energy and a belt-driven 60-amp alternator to maintain the battery's state of charge. Power is supplied to a bus bar, and a master switch controls this power to all circuits, except the engine ignition system, clock, and flight hour recorder (if installed). The flight hour recorder receives power through activation of an oil pressure switch whenever the engine is operating, and the clock is supplied with current at all times. All avionics equipment should be turned off prior to starting the engine or using an external power source to prevent harmful transient voltages from damaging the transistors in this equipment.

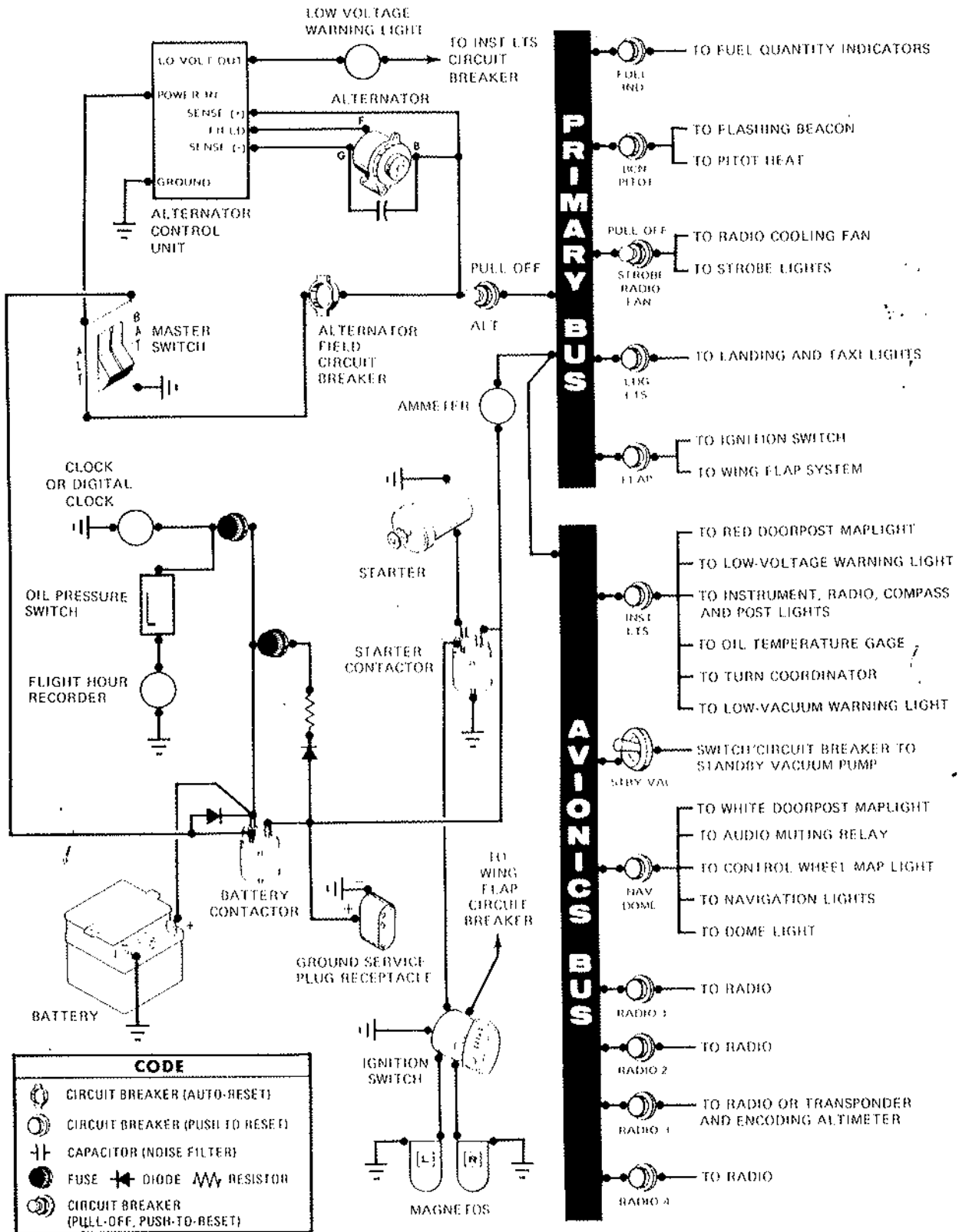


Figure 7-7. Electrical System

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. 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.

AMMETER

The ammeter, located on the upper right side of the instrument panel, 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, above the pilot's control column on the instrument panel.

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.

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 under the engine controls on the instrument panel. However, circuit breakers protecting the alternator output and the radio cooling fan/strobe light circuits are the "pull-off" type. The control wheel map light (if installed) is protected by the NAV/DOME 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.

Spare fuses are required to be carried in the airplane at all times. To assist the pilot in meeting this requirement, a special spare fuse holder is located inside the cover of the Pilot's Operating Handbook. This holder contains an assortment of spare fuses to be used in the event an installed fuse requires replacement. If one of the fuses from the holder is used, a replacement spare should be obtained for the fuse holder.

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 top of

the rudder, and dual landing/taxi lights are mounted in the left wing leading edge. Additional lighting is available and includes a flashing beacon located on top of the vertical fin, and a strobe light installed on each wing tip. Details of the strobe light system are presented in Section 9, Supplements.

All exterior lights are controlled 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 lighting, integral lighting, and post lighting (if installed). Two concentric rheostat control knobs on the left switch and control panel, labeled PANEL LT and RADIO LT, control intensity of the instrument and control panel lighting. A slide-type switch (if installed) on the overhead console, labeled PANEL LIGHTS, is used to select flood lighting in the FLOOD position, post lighting in the POST position, or a combination of post and flood lighting in the BOTH position.

Instrument and control panel flood lighting consists of a single red flood light in the forward part of the overhead console. To use the flood lighting, rotate the PANEL LT rheostat control knob clockwise to the desired intensity.

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

The engine instrument cluster (if post lighting is installed), radio equipment, and magnetic compass have integral lighting and operate independently of post or flood lighting. Light intensity of the radio lighting is controlled by the RADIO LT rheostat control knob. The integral compass and engine instrument cluster light intensity is controlled by the PANEL LT rheostat control knob.

A cabin dome light, in the overhead console, is operated by a switch on

the left switch and control panel. To turn the light on, move the switch to the ON position.

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

A doorpost map light is available, and is located on the left forward doorpost. It contains both red and white bulbs and may be positioned to illuminate any area desired by the pilot. The light is controlled by a switch, above the light, which is labeled RED, OFF, and WHITE. Placing the switch in the top position will provide a red light. In the bottom position, standard white lighting is provided. In the center position, the map light is turned off. Light intensity of the red light is controlled by the PANEL LT rheostat control knob.

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 HT and CABIN AIR control knobs (see figure 7-8).

Heated fresh air and outside air are blended in a cabin manifold just aft of the firewall by adjustment of the heat and air controls; this air is then vented into the cabin from outlets in the cabin manifold near the pilot's and passenger's feet. Windshield defrost air is also supplied by a duct leading from the manifold to a pair of outlets below the windshield.

For cabin ventilation, pull the CABIN AIR knob out. To raise the air temperature, pull the CABIN HT knob out approximately 1/4 to 1/2 inch for a small amount of cabin heat. Additional heat is available by pulling the knob out farther; maximum heat is available with the CABIN HT knob pulled out and the CABIN AIR knob pushed full in. When no heat is desired in the cabin, the CABIN HT knob is pushed full in.

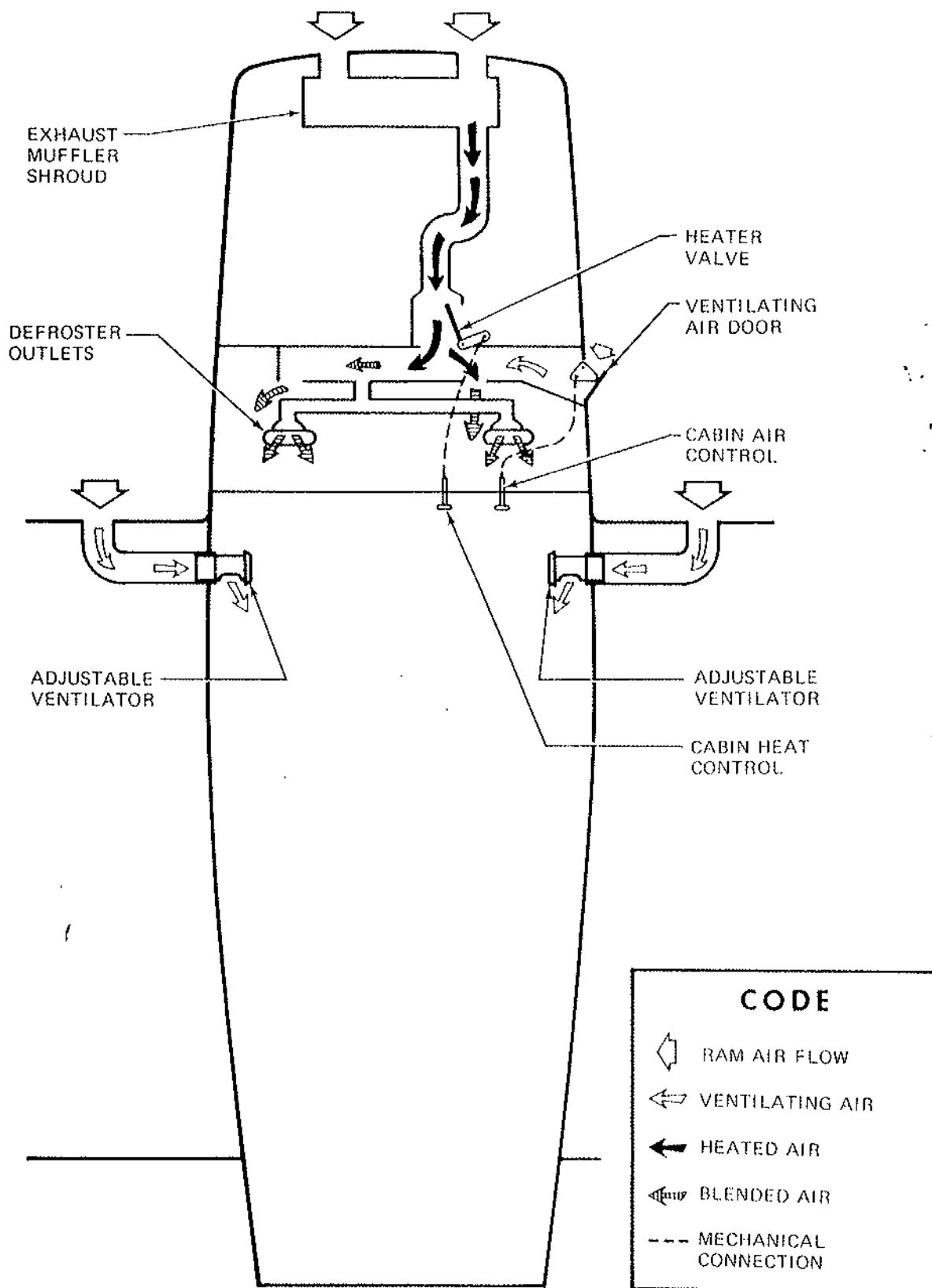


Figure 7-8. Cabin Heating, Ventilating, and Defrosting System

Additional ventilation air may be obtained by opening the adjustable ventilators near the upper left and right corners of the windshield.

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, an external static port on the lower left side of the forward fuselage, and the associated plumbing necessary to connect the instruments to the sources.

The heated pitot system consists of a heating element in the pitot tube, a rocker-type switch labeled PITOT HT on the left switch and control panel, a 15-amp circuit breaker under the engine controls on the instrument panel, and associated wiring. When the pitot heat switch is turned on, the element in the pitot tube is heated electrically to maintain proper operation in possible icing conditions. Pitot heat should be used only as required.

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots and miles per hour. Limitation and range markings (in KIAS) include the white arc (35 to 85 knots), green arc (40 to 111 knots), yellow arc (111 to 149 knots), and a red line (149 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 7-9) is available and provides the suction necessary to operate the attitude indicator and directional indicator. The system consists of a vacuum pump mounted on the engine, a vacuum relief valve and vacuum system air filter on the aft side of the firewall below the instrument panel, vacuum-operated instruments, and a suction gage and low-vacuum warning light on the left side of the instrument panel. An optional electrically-driven standby vacuum pump may also be installed. It is designed to provide adequate vacuum in the event of failure of the engine-driven vacuum pump. Details of this system are presented in Section 9, Supplements.

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 inflight adjustment of the miniature airplane to the horizon bar for a more accurate flight attitude indication.

DIRECTIONAL INDICATOR

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

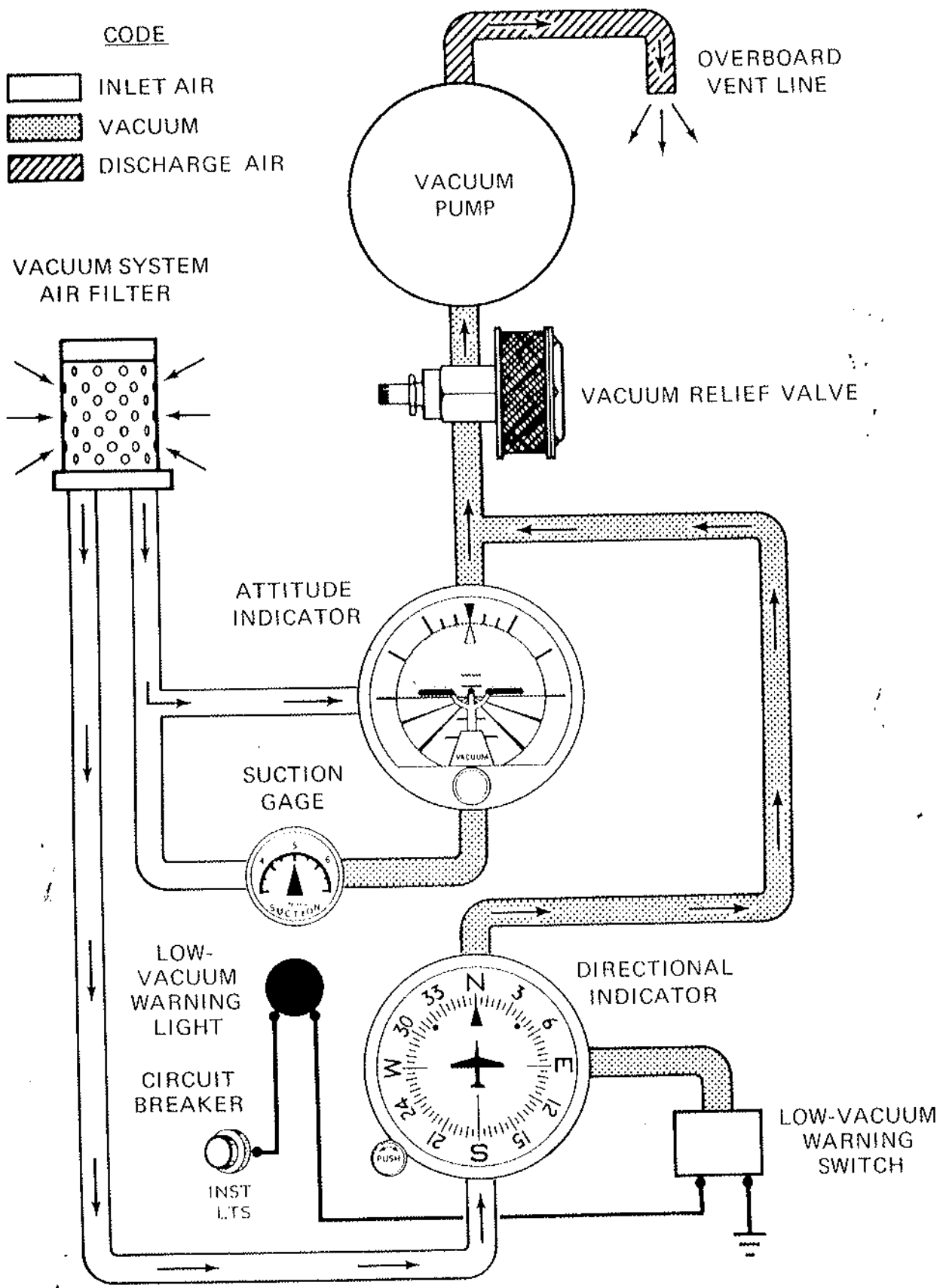


Figure 7-9. Vacuum System

SUCTION GAGE

A suction gage is located on the left side of the instrument panel when the airplane is equipped with a vacuum system. Suction available for operation of the attitude indicator and directional indicator is shown by this gage, which is calibrated in inches of mercury. The desired suction range is 4.5 to 5.4 inches of mercury. Normally, 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. However, due to lower atmospheric pressures at higher altitudes, the suction gage may indicate as low as 4.0 in. Hg. at 20,000 feet and still be adequate for normal system operation.

LOW-VACUUM WARNING LIGHT

A red low-vacuum warning light is installed on the instrument panel to warn the pilot of a possible low-vacuum condition existing in the vacuum system. Illumination of the light warns the pilot to check the suction gage and to be alert for possible erroneous vacuum-driven gyro instrument indications.

OUTSIDE AIR TEMPERATURE (OAT) GAGE

An outside air temperature (OAT) gage is installed in the right wing root ventilator. The gage is calibrated in degrees Fahrenheit and Centigrade. For best indicator accuracy, air should be flowing through the ventilator across the probe.

STALL WARNING SYSTEM

The airplane is equipped with a pneumatic-type stall warning system consisting of an inlet in the leading edge of the left wing, an air-operated horn near the upper left corner of the windshield, and associated plumbing. As the airplane approaches a stall, the low pressure on the upper surface of the wings moves forward around the leading edge of the wings. This low pressure creates a differential pressure in the stall warning system which draws air through the warning horn, resulting in an audible warning at 5 to 10 knots above stall in all flight conditions.

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

AVIONICS SUPPORT EQUIPMENT

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, RADIO FAN, located on the right 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 light weight 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 pedestal below 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

To ensure audibility and clarity when transmitting with the hand-held microphone, always hold it as closely as pos-

sible to the lips, then key the microphone and speak directly into it. Avoid covering opening on back side of microphone for optimum noise canceling.

STATIC DISCHARGERS

If frequent IFR flights are planned, installation of wick-type static dischargers is recommended (included with factory-installed avionics) 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.

Static dischargers lose their effectiveness with age, and therefore, should be checked periodically (at least at every annual inspection) by qualified avionics technicians, etc. If testing equipment is not available, it is recommended that the wicks be replaced every two years, especially if the airplane is operated frequently in IFR conditions.

CABIN FEATURES

CABIN FIRE EXTINGUISHER

A portable Dry Chemical (Sodium Bicarbonate) fire extinguisher is available for installation on the right cabin wall where it would be accessible in case of fire. The extinguisher has an Underwriters Laboratories classification of 5 B:C. If installed, the extinguisher should be checked prior to each flight to ensure that its bottle pressure, as indicated by the gage on the bottle, is within the green arc (approximately 100 psi) and the tamper tape which secures the carrying handle in the stowed position is intact.

To operate the fire extinguisher:

1. Loosen retaining clamp and remove extinguisher from bracket.

2. Lift carrying handle (breaking tamper tape), hold extinguisher upright, and press operating lever while directing the discharge at the base of the fire at the near edge. Progress toward the back of the fire by moving the nozzle rapidly with a side-to-side sweeping motion.

CAUTION

Care must be taken not to direct the initial discharge directly at the burning surface at close range (less than five feet) as this may cause splashing and/or scattering of the burning material.

3. Anticipate approximately eight seconds of discharge duration.

WARNING

Ventilate the cabin promptly after successfully extinguishing the fire to reduce the gases produced by thermal decomposition.

Fire extinguishers should be recharged by a qualified fire extinguisher agency after each use. Such agencies are listed under "Fire Extinguisher" in the telephone directory. After recharging, secure the extinguisher to its mounting bracket; do not allow it to lie loose on shelves or seats.