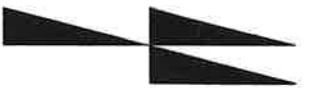
PILOT'S OPERATING HANDBOOK

Cessna® 1977

Hawk XP

CESSNA MODEL R172K



PERFORMANCE - SPECIFICATIONS

SPEED:		
Maximum at Sea Level		133 KNOTS
Cruise, 80% Power at 6000 Ft		130 KNOTS
CRUISE: Recommended Lean Mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45% power.		
80% Power at 6000 Ft	Range	480 NM
49 Gallons Usable Fuel	Time	3.7 HRS
Maximum Range at 10,000 Ft	Range	575 NM
49 Gallons Usable Fuel	Time	6.1 HRS
RATE OF CLIMB AT SEA LEVEL		870 FPM
SERVICE CEILING		17,000 FT
TAKEOFF PERFORMANCE:		
Ground Roll		800 FT
Total Distance Over 50-Ft Obstacle		1360 FT
LANDING PERFORMANCE:		
Ground Roll		620 FT
Total Distance Over 50-Ft Obstacle		1270 FT
STALL SPEED (CAS):		
Flaps Up, Power Off		53 KNOTS
Flaps Down, Power Off		46 KNOTS
MAXIMUM WEIGHT		2550 LBS
STANDARD EMPTY WEIGHT:		
Hawk XP		1549 LBS
Hawk XP II		1573 LBS
MAXIMUM USEFUL LOAD:		
Hawk XP		1001 LBS
Hawk XP II		977 LBS
BAGGAGE ALLOWANCE		200 LBS
WING LOADING: Pounds/Sq Ft		14.7
POWER LOADING: Pounds/HP		13.1
FUEL CAPACITY: Total		52 GAL.
OIL CAPACITY		8 QTS
ENGINE: Teledyne Continental, Fuel Injection 195 BHP at 2600 RPM		IO-360-K
PROPELLER: Constant Speed, Diameter		76 IN.

PILOT'S OPERATING HANDBOOK

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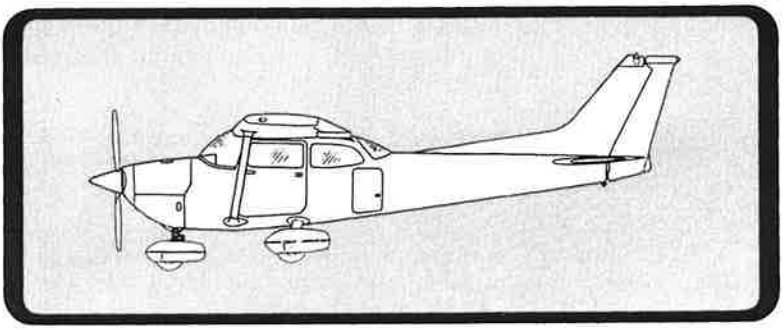


HAWK XP

1977 MODEL R172K

Serial No. _____

Registration No. _____

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

CESSNA AIRCRAFT COMPANY
WICHITA, KANSAS, USA

CONGRATULATIONS . . . .

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

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

Our interest in your flying pleasure has not ceased with your purchase of a Cessna. Worldwide, the Cessna Dealer Organization backed by the Cessna Customer Services Department stands ready to serve you. The following services are offered by most Cessna Dealers:

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

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

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

TABLE OF CONTENTS

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

SECTION 1
GENERAL

TABLE OF CONTENTS

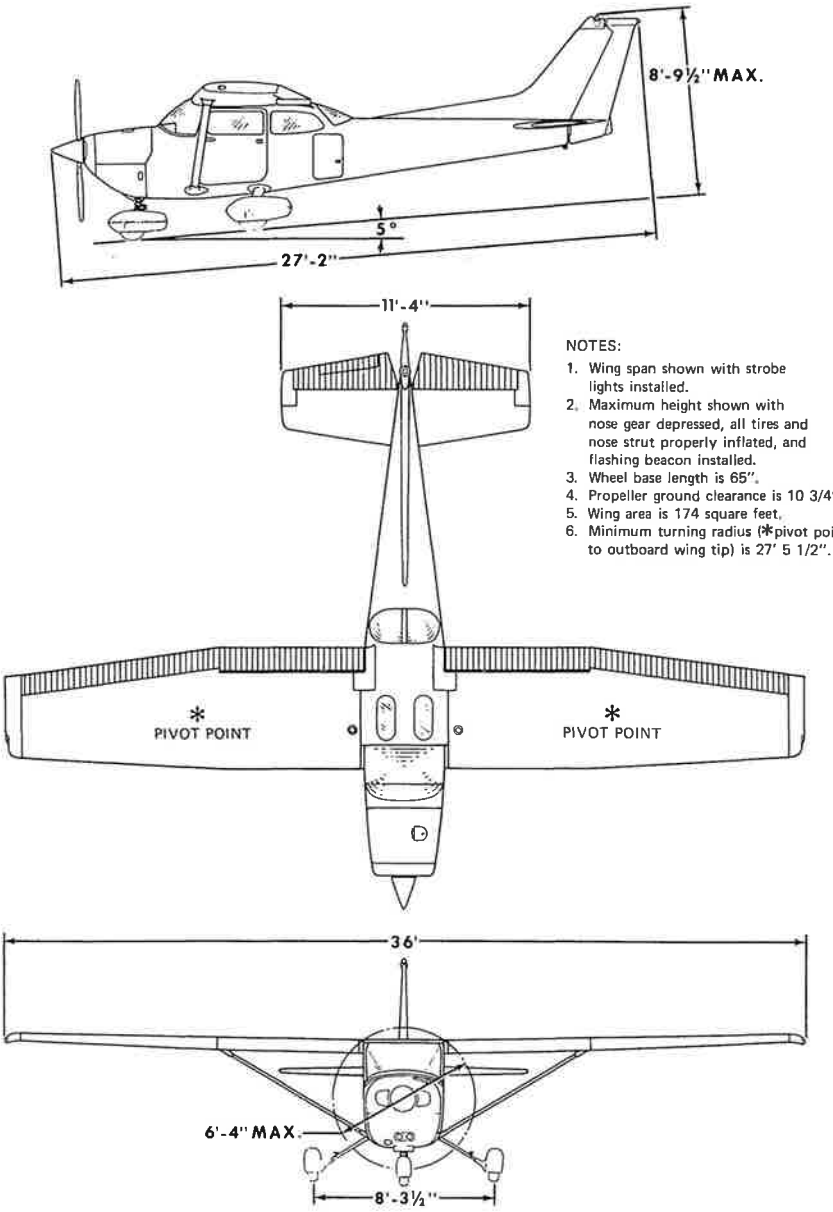


Figure 1-1. Three View

INTRODUCTION

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

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

DESCRIPTIVE DATA

ENGINE

Number of Engines: 1.
Engine Manufacturer: Teledyne Continental.
Engine Model Number: IO-360-K.
Engine Type: Normally-aspirated, direct-drive, air-cooled, horizontally-opposed, fuel-injected, six-cylinder engine with 360 cu. in. displacement.
Horsepower Rating and Engine Speed: 195 rated BHP at 2600 RPM.

PROPELLER

Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: 2A34C203/90DCA-14.
Number of Blades: 2.
Propeller Diameter, Maximum: 76 inches.
Minimum: 74.5 inches.
Propeller Type: Constant speed and hydraulically actuated, with a low pitch setting of 12.0° and a high pitch setting of 25.1° (30 inch station).

FUEL

Approved Fuel Grades (and Colors):
100LL Grade Aviation Fuel (Blue).
100 (Formerly 100/130) Grade Aviation Fuel (Green).
Total Capacity: 52 gallons.
Total Capacity Each Tank: 26 gallons.
Total Usable: 49 gallons.

NOTE

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

OIL

Oil Grade (Specification):

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

NOTE

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

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

Recommended Viscosity For Temperature Range:

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

NOTE

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

Oil Capacity:

Sump: 8 Quarts.
Total: 9 Quarts (if oil filter installed).

MAXIMUM CERTIFICATED WEIGHTS

Takeoff, Normal Category: 2550 lbs.
Utility Category: 2200 lbs.
Landing, Normal Category: 2550 lbs.
Utility Category: 2200 lbs.

Weight in Baggage Compartment, Normal Category:
Baggage Area 1 (or passenger on child's seat)-Station 82 to 108: 200 lbs. See note below.
Baggage Area 2 - Station 108 to 142: 50 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas 1 and 2 is 200 lbs.

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

STANDARD AIRPLANE WEIGHTS

Standard Empty Weight, Hawk XP: 1549 lbs.
Hawk XP II: 1573 lbs.

Maximum Useful Load:

	Normal Category	Utility Category
Hawk XP:	1001 lbs.	651 lbs.
Hawk XP II:	977 lbs.	627 lbs.

CABIN AND ENTRY DIMENSIONS

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

BAGGAGE SPACE AND ENTRY DIMENSIONS

Dimensions of the baggage area and baggage door opening are illustrated in detail in Section 6.

SPECIFIC LOADINGS

Wing Loading: 14.7 lbs./sq. ft.
Power Loading: 13.1 lbs./hp.

SYMBOLS, ABBREVIATIONS AND TERMINOLOGY

GENERAL AIRSPEED TERMINOLOGY AND SYMBOLS

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

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

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

V_A — Maneuvering Speed is the maximum speed at which you may use abrupt control travel.

V_{FE} — Maximum Flap Extended Speed is the highest speed permissible with wing flaps in a prescribed extended position.

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

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

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

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

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

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

METEOROLOGICAL TERMINOLOGY

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

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

ENGINE POWER TERMINOLOGY

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

AIRPLANE PERFORMANCE AND FLIGHT PLANNING TERMINOLOGY

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

WEIGHT AND BALANCE TERMINOLOGY

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

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

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

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

SECTION 2
LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION

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

NOTE

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

Your Cessna is certificated under FAA Type Certificate No. 3A17 as Cessna Model No. R172K.

AIRSPEED LIMITATIONS

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

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	161	163	Do not exceed this speed in any operation.
V_{NO}	Maximum Structural Cruising Speed	127	129	Do not exceed this speed except in smooth air, and then only with caution.
V_A	Maneuvering Speed: 2550 Pounds 2150 Pounds 1750 Pounds	 103 94 85	 105 96 87	Do not make full or abrupt control movements above this speed.
V_{FE}	Maximum Flap Extended Speed	84	85	Do not exceed this speed with flaps down.
	Maximum Window Open Speed	161	163	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	46 - 85	Full Flap Operating Range. Lower limit is maximum weight V_{S_0} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	54 - 129	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	129 - 163	Operations must be conducted with caution and only in smooth air.
Red Line	163	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Markings

POWER PLANT LIMITATIONS

Engine Manufacturer: Teledyne Continental.
Engine Model Number: IO-360-K.
Engine Operating Limits for Takeoff and Continuous Operations:
Maximum Power: 195 BHP.
Maximum Engine Speed: 2600 RPM.
Maximum Cylinder Head Temperature: 238°C (460°F).
Maximum Oil Temperature: 116°C (240°F).
Oil Pressure, Minimum: 10 psi.
Maximum: 100 psi.
Fuel Pressure, Minimum: 3 psi.
Maximum: 17 psi (17 gal/hr).
Propeller Manufacturer: McCauley Accessory Division.
Propeller Model Number: 2A34C203/90DCA-14.
Propeller Diameter, Maximum: 76 inches.
Minimum: 74.5 inches.
Propeller Blade Angle at 30 Inch Station, Low: 12.0°.
High: 25.1°.

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	- - -	2200 - 2600 RPM	2600 RPM
Manifold Pressure	- - -	15 - 25 in. Hg	- - -
Oil Temperature	- - -	100° - 240°F	240°F
Cylinder Head Temperature	- - -	300° - 460°F	460°F
Fuel Flow (Pressure)	(3 psi)	4.5 - 11.5 gal/hr	17 gal/hr (17 psi)
Oil Pressure	10 psi	30 - 60 psi	100 psi

Figure 2-3. Power Plant Instrument Markings

WEIGHT LIMITS

NORMAL CATEGORY

Maximum Takeoff Weight: 2550 lbs.
Maximum Landing Weight: 2550 lbs.
Maximum Weight in Baggage Compartment:
Baggage Area 1 (or passenger on child's seat)-Station 82 to 108: 200 lbs. See note below.
Baggage Area 2 - Station 108 to 142: 50 lbs. See note below.

NOTE

The maximum combined weight capacity for baggage areas 1 and 2 is 200 lbs.

UTILITY CATEGORY

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

CENTER OF GRAVITY LIMITS

NORMAL CATEGORY

Center of Gravity Range:
Forward: 35.0 inches aft of datum at 1950 lbs. or less, with straight line variation to 41.0 inches aft of datum at 2550 lbs.
Aft: 47.3 inches aft of datum at all weights.
Reference Datum: Lower portion of front face of firewall.

UTILITY CATEGORY

Center of Gravity Range:
Forward: 35.0 inches aft of datum at 1950 lbs. or less, with straight line variation to 37.5 inches aft of datum at 2200 lbs.
Aft: 40.5 inches aft of datum at all weights.
Reference Datum: Lower portion of front face of firewall.

MANEUVER LIMITS

NORMAL CATEGORY

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

UTILITY CATEGORY

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

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

MANEUVER	RECOMMENDED ENTRY SPEED*
Chandelles	110 knots
Lazy Eights	110 knots
Steep Turns	105 knots
Spins	Slow Deceleration
Stalls (Except Whip Stalls)	Slow Deceleration

*Abrupt use of the controls is prohibited above 105 knots.

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

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Flight Load Factors (Gross Weight - 2550 lbs.):

*Flaps Up	+3.8g, -1.52g
*Flaps Down	+3.0g

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

UTILITY CATEGORY

Flight Load Factors (Gross Weight - 2200 lbs.):

*Flaps Up	+4.4g, -1.76g
*Flaps Down	+3.0g

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

KINDS OF OPERATION LIMITS

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

Flight into known icing conditions is prohibited.

FUEL LIMITATIONS

2 Standard Tanks: 26 U.S. gallons each.
Total Fuel: 52 U.S. gallons.
Usable Fuel (all flight conditions): 49 U.S. gallons.
Unusable Fuel: 3.0 U.S. gallons.

NOTE

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

NOTE

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

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

PLACARDS

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

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

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

MAXIMUMS

	Normal Category	Utility Category
MANEUVERING SPEED (IAS)	105 knots	105 knots
GROSS WEIGHT	2550 lbs.	2200 lbs.
FLIGHT LOAD FACTOR		
Flaps Up	+3.8, -1.52	+4.4, -1.76
Flaps Down	+3.0	+3.0

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

NO ACROBATIC MANEUVERS APPROVED
EXCEPT THOSE LISTED BELOW

Maneuver	Recm. Entry Speed	Maneuver	Recm. Entry Speed
Chandelles	110 knots	Spins	Slow Deceleration
Lazy Eights	110 knots	Stalls (except whip stalls)	Slow Deceleration
Steep Turns	105 knots		

Altitude loss in stall recovery -- 160 feet.
Abrupt use of controls prohibited above 105 knots.
Spins Recovery: opposite rudder - forward elevator - neutralize controls. Intentional spins with flaps extended are prohibited. Flight into known icing conditions prohibited.
This airplane is certified for the following flight operations as of date of original airworthiness certificate:

DAY - NIGHT - VFR - IFR

(2) Near flap indicator:

AVOID SLIPS WITH FLAPS EXTENDED

(3) On the fuel selector valve:

BOTH - 49 GAL. LEFT - 24.5 GAL. RIGHT - 24.5 GAL.

(4) On the fuel selector valve:

WHEN SWITCHING FROM DRY TANK, TURN PUMP ON HIGH MOMENTARILY.

(5) Near fuel tank filler cap:

FUEL 100/130 MIN. GRADE AVIATION GASOLINE CAP. 26 U.S. GAL.

(6) On control lock:

CONTROL LOCK REMOVE BEFORE STARTING ENGINE.

(7) In baggage compartment:

200 POUNDS MAXIMUM
BAGGAGE OR 120 LBS AUX SEAT PASSENGER
FORWARD OF BAGGAGE DOOR LATCH

50 POUNDS MAXIMUM
BAGGAGE AFT OF BAGGAGE DOOR LATCH

MAXIMUM 200 POUNDS COMBINED

FOR ADDITIONAL LOADING INSTRUCTIONS
SEE WEIGHT AND BALANCE DATA

(8) Near manifold pressure/fuel flow gage:

FUEL FLOW
AT FULL THROTTLE

	2600 RPM
SL	16 GPH
4000 FT	14 GPH
8000 FT	12 GPH
12000 FT	10 GPH

SECTION 3
EMERGENCY PROCEDURES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

INTRODUCTION

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

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS
Maneuvering Speed:	
2550 Lbs	105 KIAS
2150 Lbs	96 KIAS
1750 Lbs	87 KIAS
Maximum Glide:	
2550 Lbs	75 KIAS
2150 Lbs	69 KIAS
1750 Lbs	62 KIAS
Precautionary Landing With Engine Power	65 KIAS
Landing Without Engine Power:	
Wing Flaps Up	70 KIAS
Wing Flaps Down	65 KIAS

OPERATIONAL CHECKLISTS

ENGINE FAILURES

ENGINE FAILURE DURING TAKEOFF RUN

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

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

(1) Airspeed -- 70 KIAS (flaps UP).
65 KIAS (flaps DOWN).
(2) Mixture -- IDLE CUT-OFF.
(3) Fuel Shutoff Valve -- OFF (pull out).
(4) Ignition Switch -- OFF.
(5) Wing Flaps -- AS REQUIRED (full down recommended).
(6) Master Switch -- OFF.

ENGINE FAILURE DURING FLIGHT

(1) Airspeed -- 75 KIAS.
(2) Primer -- IN and LOCKED.
(3) Fuel Shutoff Valve -- ON (push full in).
(4) Fuel Selector Valve -- BOTH.
(5) Mixture -- RICH.
(6) Throttle -- 1/2 OPEN.
(7) Auxiliary Fuel Pump -- LOW for 3-5 seconds then OFF.
(8) Ignition Switch -- BOTH (or START if propeller is stopped).

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

(1) Airspeed -- 70 KIAS (flaps UP).
65 KIAS (flaps DOWN).
(2) Seat Belts and Shoulder Harnesses -- SECURE.
(3) Mixture -- IDLE CUT-OFF.
(4) Fuel Shutoff Valve -- OFF.
(5) All Switches (except master switch) -- OFF.
(6) Wing Flaps -- AS REQUIRED (full down 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) Seat Belts and Shoulder Harnesses -- SECURE.
(2) Wing Flaps -- 20°.
(3) Airspeed -- 65 KIAS.
(4) Selected Field -- FLY OVER, noting terrain and obstructions, then retract flaps upon reaching a safe altitude and airspeed.
(5) All Switches (except master and ignition switches) -- OFF.

(6) Wing Flaps -- FULL DOWN (on final approach).
(7) Airspeed -- 65 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.
(2) Heavy Objects (in baggage area) -- SECURE or JETTISON.
(3) Seat Belts and Shoulder Harnesses -- SECURE.
(4) Wing Flaps -- 20° - 40°.
(5) Power -- ESTABLISH 300 FT/MIN DESCENT at 55 KIAS.
(6) Approach -- High Winds, Heavy Seas -- INTO THE WIND.
Light Winds, Heavy Swells -- PARALLEL TO SWELLS

NOTE

If no power is available, approach at 65 KIAS with flaps up or at 60 KIAS with 10° flaps.

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

FIRES

DURING START ON GROUND

(1) Auxiliary Fuel Pump -- OFF.
(2) Mixture -- IDLE CUT-OFF.
(3) Parking Brake -- RELEASE.
(4) Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
(5) Airplane -- EVACUATE.
(6) Fire -- EXTINGUISH.

NOTE

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

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

ENGINE FIRE IN FLIGHT

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

ELECTRICAL FIRE IN FLIGHT

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

WARNING

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

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

(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 sideslip to keep the flames away from the fuel tank and cabin, and land as soon as possible using flaps only as required for final approach and touchdown.

ICING

INADVERTENT ICING ENCOUNTER

(1) Turn pitot heat switch ON (if installed).
(2) Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
(3) Pull cabin heat control full out to obtain maximum windshield defroster airflow.
(4) Increase engine speed to minimize ice build-up on propeller blades.
(5) Watch for signs of induction air filter ice and regain manifold pressure by increasing the throttle setting.
(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 80 to 90 KIAS, depending upon the amount of the accumulation.
(12) Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE (Erroneous Instrument Reading Suspected)

(1) Alternate Static Source Valve -- PULL ON.
(2) Airspeed -- Consult appropriate calibration table in Section 5 or climb and approach 3 knots faster than normal.
(3) Altitude -- Cruise and approach 25 feet higher than normal.

LANDING WITH A FLAT MAIN TIRE

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

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

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

If over-voltage light illuminates again:

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

AMMETER SHOWS DISCHARGE

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

AMPLIFIED PROCEDURES

ENGINE FAILURE

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

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

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

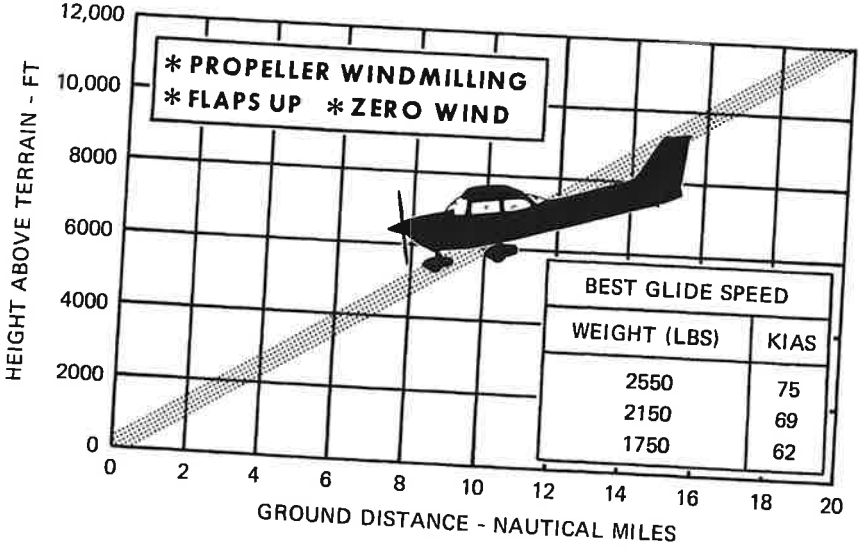


Figure 3-1. Maximum Glide

FORCED LANDINGS

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

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

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

LANDING WITHOUT ELEVATOR CONTROL

Trim for horizontal flight to an airspeed of approximately 65 KIAS with flaps set to 20° by using throttle and elevator trim control. Then do not change the elevator trim control setting; control the glide angle by adjusting power exclusively.

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

FIRES

Improper starting procedures involving the excessive use of auxiliary fuel pump operation can cause engine flooding and subsequent puddling of fuel on the parking ramp as the excess fuel drains overboard from the intake ports. This is sometimes experienced in difficult starts in cold weather where preheat service is not available. If this occurs, the airplane should be pushed away from the fuel puddle before another engine start is attempted. Otherwise, there is a possibility of raw fuel accumulations in the exhaust system igniting during an engine start, causing a long flame from the tailpipe, and possibly igniting the fuel puddle on the pavement. In the event that this occurs, proceed in accordance with the Fire During Start On Ground checklist.

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

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

EMERGENCY OPERATION IN CLOUDS (Vacuum System Failure)

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

EXECUTING A 180° TURN IN CLOUDS

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

(1) Note the time of the minute hand and observe the position of the sweep second hand on the clock.
(2) When the sweep second hand indicates the nearest half-minute, initiate a standard rate left turn, holding the turn coordinator symbolic airplane wing opposite the lower left index mark for 60 seconds. Then roll back to level flight by leveling the miniature airplane.
(3) Check accuracy of the turn by observing the compass heading which should be the reciprocal of the original heading.
(4) If necessary, adjust heading primarily with skidding motions rather than rolling motions so that the compass will read more accurately.
(5) Maintain altitude and airspeed by cautious application of 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) Reduce power to set up a 500 to 800 ft./min. rate of descent.
(2) Adjust the mixture as required for smooth engine operation.
(3) Adjust the elevator and rudder trim for a stabilized descent at 75 KIAS.
(4) Keep hands off control wheel.
(5) Monitor turn coordinator and make corrections by rudder alone.
(6) Adjust rudder trim to relieve unbalanced rudder force, if present.
(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) Close the throttle.
(2) Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
(3) Cautiously apply elevator back pressure to slowly reduce the airspeed to 75 KIAS.
(4) Adjust the elevator trim control to maintain a 75 KIAS glide.
(5) Keep hands off the control wheel, using rudder control to hold a straight heading. Use rudder trim to relieve unbalanced rudder force, if present.
(6) Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
(7) Upon breaking out of clouds, resume normal cruising flight.

FLIGHT IN ICING CONDITIONS

Intentional flight into known icing conditions is prohibited in this airplane. During instrument flights, however, icing conditions may be encountered inadvertently and therefore some corrective action will be required as shown in the checklists. Initiation of a climb is usually the

best ice avoidance action to take; however, alternatives are descent to warmer air or to reverse course.

STATIC SOURCE BLOCKED

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

A calibration table is provided in Section 5 to illustrate the effect of the alternate static source on indicated airspeeds. With the windows and vents closed the airspeed indicator may typically read as much as 4 knots slower and the altimeter 50 feet lower in cruise. With the vents open and heater on, these variations increase to 7 knots slower and 50 feet lower respectively. If the alternate static source must be used for landing, airspeed errors of up to 10 knots slower with vents open and 4 knots slower with vents closed can be expected. Altimeter errors remain 50 feet low.

NOTE

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

SPINS

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

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

NOTE

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

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

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.

If ignition system malfunctions occur at high altitude and high power, as evidenced by roughness and possible backfiring on one or both magnetos, the power should be reduced as required. This condition is an indication of excessive spark plug gaps which, in turn, causes arcing across the magneto points.

ENGINE-DRIVEN FUEL PUMP FAILURE

Failure of the engine-driven fuel pump will be evidenced by a sudden reduction in the fuel flow indication prior to a loss of power, while operating with adequate fuel in either or both fuel tanks.

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

If an engine-driven fuel pump failure occurs during cruising flight, apply full rich mixture and hold the auxiliary fuel pump switch in the HIGH position to re-establish fuel flow. Then the LOW position of the fuel pump switch may be used to sustain level flight. If necessary, additional fuel flow is obtainable by holding the pump switch in the HIGH position. If either LOW or HIGH fuel pump switch positions results in rough engine operation, lean the mixture as required for smooth operation.

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 over-voltage warning light; however, the cause of these malfunctions is usually difficult to determine. A broken alternator drive belt or wiring is most likely the cause of alternator failures, although other factors could cause the problem.

A damaged or improperly adjusted voltage regulator can also cause malfunctions. Problems of this nature constitute an electrical emergency and should be dealt with immediately. Electrical power malfunctions usually fall into two categories: excessive rate of charge and insufficient rate of charge. The following paragraphs describe the recommended remedy for each situation.

EXCESSIVE RATE OF CHARGE

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

INSUFFICIENT RATE OF CHARGE

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

SECTION 4
NORMAL PROCEDURES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

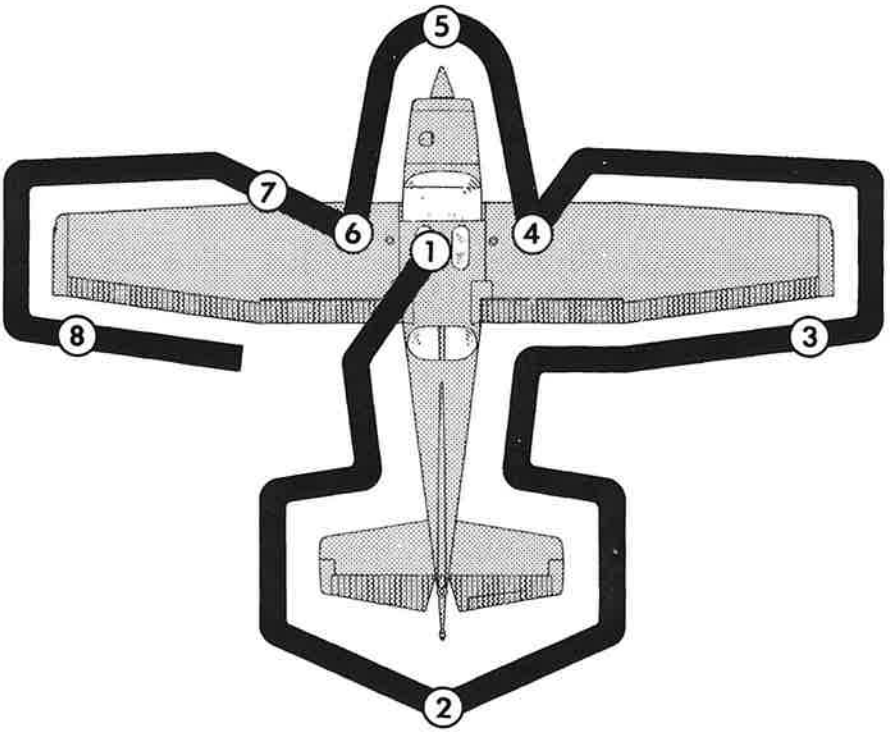
INTRODUCTION

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 2550 pounds and may be used for any lesser weight. However, to achieve the performance specified in Section 5 for takeoff distance, the speed appropriate to the particular weight must be used.

Takeoff, Flaps Up:	
Normal Climb Out	75-85 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	60 KIAS
Enroute Climb, Flaps Up:	
Normal	85-95 KIAS
Best Rate of Climb, Sea Level	81 KIAS
Best Rate of Climb, 10,000 Feet	76 KIAS
Best Angle of Climb, Sea Level	59 KIAS
Best Angle of Climb, 10,000 Feet	65 KIAS
Landing Approach:	
Normal Approach, Flaps Up	65-75 KIAS
Normal Approach, Flaps Full Down	60-70 KIAS
Short Field Approach, Flaps Full Down	63 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	55 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
2550 Lbs	105 KIAS
2150 Lbs	96 KIAS
1750 Lbs	87 KIAS
Maximum Demonstrated Crosswind Velocity:	
Takeoff and Landing	20 KNOTS



NOTE

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

Figure 4-1. Preflight Inspection

CHECKLIST PROCEDURES

PREFLIGHT INSPECTION

① CABIN

(1) Control Wheel Lock -- REMOVE and STOW.
(2) Ignition Switch -- OFF.
(3) Master Switch -- ON.
(4) Fuel Quantity Indicators -- CHECK QUANTITY.
(5) Master Switch -- OFF.
(6) Fuel Shutoff Valve -- ON (push full in).
(7) Fuel Selector Valve -- BOTH.
(8) Trim Controls -- NEUTRAL.
(9) Baggage Door -- CHECK for security, lock with key if child's seat is to be occupied.

② EMPENNAGE

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

③ RIGHT WING Trailing Edge

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

④ RIGHT WING

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

⑤ NOSE

(1) Static Source Openings (both sides of fuselage) -- CHECK for stoppage.
(2) Propeller and Spinner -- CHECK for nicks, security and oil leaks.

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

(6) LEFT WING

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

(7) LEFT WING Leading Edge

(1) Pitot Tube Cover -- REMOVE and check opening for stoppage.
(2) Fuel Tank Vent Opening -- CHECK for stoppage.
(3) Stall Warning 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.
(4) Wing Tie-Down -- DISCONNECT.

(8) LEFT WING Trailing Edge

(1) Aileron -- CHECK for freedom of movement and security.

BEFORE STARTING ENGINE

(1) Preflight Inspection -- COMPLETE.
(2) Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
(3) Fuel Shutoff Valve -- ON (push full in).
(4) Fuel Selector Valve -- BOTH.
(5) Radios, Autopilot (if installed), Electrical Equipment -- OFF.
(6) Brakes -- TEST and SET.

(7) Cowl Flap -- OPEN (move lever inboard out of locking hole to reposition).
(8) Circuit Breakers -- CHECK IN.

STARTING ENGINE

(1) Mixture -- RICH.
(2) Propeller -- HIGH RPM.
(3) Throttle -- CLOSED.
(4) Master Switch -- ON.
(5) Auxiliary Fuel Pump Switch -- HIGH.
(6) Throttle -- ADVANCE to obtain 8-10 GPH fuel flow then return to CLOSED position.
(7) Auxiliary Fuel Pump Switch -- OFF.
(8) Propeller Area -- CLEAR.
(9) Ignition Switch -- START (release to BOTH when engine starts).

NOTE

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

(10) Throttle -- 800 to 1000 RPM.
(11) Oil Pressure -- CHECK.

BEFORE TAKEOFF

(1) Parking Brake -- SET.
(2) Cabin Doors -- CLOSED and LOCKED.
(3) Flight Controls -- FREE and CORRECT.
(4) Flight Instruments -- SET.
(5) Fuel Selector Valve -- BOTH.
(6) Elevator and Rudder Trim -- SET.
(7) Throttle -- 1800 RPM.
a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).

b. Propeller -- CYCLE from high to low RPM; return to high RPM (full in).
c. Engine Instruments and Ammeter -- CHECK.
d. Suction Gage -- CHECK (4.6 to 5.4 In.Hg.).

(8) Radios -- SET.
(9) Autopilot (if installed) -- OFF.
(10) Flashing Beacon, Navigation Lights and/or Strobe Lights -- ON as required.
(11) Throttle Friction Lock -- ADJUST.

TAKEOFF

NORMAL TAKEOFF

(1) Wing Flaps -- 0° - 10° (10° preferred).
(2) Power -- FULL THROTTLE and 2600 RPM.
(3) Mixture -- LEAN for field elevation per fuel flow placard.
(4) Elevator Control -- LIFT NOSE WHEEL at 55 KIAS.
(5) Climb Speed -- 75-85 KIAS.

SHORT FIELD TAKEOFF

(1) Wing Flaps -- 10°.
(2) Brakes -- APPLY.
(3) Power -- FULL THROTTLE and 2600 RPM.
(4) Mixture -- LEAN for field elevation per fuel flow placard.
(5) Brakes -- RELEASE.
(6) Elevator Control -- MAINTAIN SLIGHTLY TAIL-LOW ATTITUDE.
(7) Climb Speed -- 60 KIAS (until all obstacles are cleared).
(8) Wing Flaps -- RETRACT after obstacles are cleared.

ENROUTE CLIMB

NORMAL CLIMB

(1) Airspeed -- 85-95 KIAS
(2) Power -- FULL THROTTLE and 2600 RPM
(3) Fuel Selector Valve -- BOTH.
(4) Mixture -- LEAN for altitude per fuel flow placard.
(5) Cowl Flap -- OPEN as required.

MAXIMUM PERFORMANCE CLIMB

(1) Airspeed -- 81 KIAS at sea level to 76 KIAS at 10,000 feet.
(2) Power -- FULL THROTTLE and 2600 RPM.
(3) Fuel Selector Valve -- BOTH.
(4) Mixture -- LEAN for altitude per fuel flow placard.
(5) Cowl Flap -- OPEN.

CRUISE

(1) Power -- 15-25 INCHES Hg, 2200-2600 RPM (no more than 80% power).
(2) Elevator and Rudder Trim -- ADJUST.
(3) Mixture -- LEAN for cruise fuel flow using the EGT gage, Cessna Power Computer or the data in Section 5.
(4) Cowl Flap -- CLOSED.

DESCENT

(1) Power -- AS DESIRED.
(2) Mixture -- ENRICHEN as required for engine smoothness.
(3) Cowl flap -- CLOSED.

BEFORE LANDING

(1) Seats, Belts, Shoulder Harnesses -- ADJUST and LOCK.
(2) Fuel Selector Valve -- BOTH.
(3) Propeller -- HIGH RPM.
(4) Cowl Flap -- CLOSED.

LANDING

NORMAL LANDING

(1) Airspeed -- 65-75 KIAS (flaps UP).
(2) Wing Flaps -- AS DESIRED (below 85 KIAS).
(3) Airspeed -- 60-70 KIAS (flaps DOWN).
(4) Elevator and Rudder Trim -- ADJUST.

(5) Touchdown -- MAIN WHEELS FIRST.
(6) Landing Roll -- LOWER NOSE WHEEL GENTLY.
(7) Braking -- MINIMUM REQUIRED.

SHORT FIELD LANDING

(1) Airspeed -- 65-75 KIAS (flaps UP).
(2) Wing Flaps -- FULL DOWN (below 85 KIAS).
(3) Airspeed -- MAINTAIN 63 KIAS.
(4) Elevator and Rudder Trim -- ADJUST.
(5) Power -- REDUCE TO IDLE as obstacle is cleared.
(6) Touchdown -- MAIN WHEELS FIRST.
(7) Brakes -- APPLY HEAVILY.
(8) Wing Flaps -- RETRACT for maximum brake effectiveness.

BALKED LANDING

(1) Power -- FULL THROTTLE and 2600 RPM.
(2) Wing Flaps -- RETRACT to 20°.
(3) Airspeed -- 55 KIAS.
(4) Wing Flaps -- RETRACT slowly after reaching 65 KIAS.
(5) Cowl Flap -- OPEN.

AFTER LANDING

(1) Wing Flaps -- RETRACT.
(2) Cowl Flap -- OPEN.

SECURING AIRPLANE

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

AMPLIFIED PROCEDURES

STARTING ENGINE

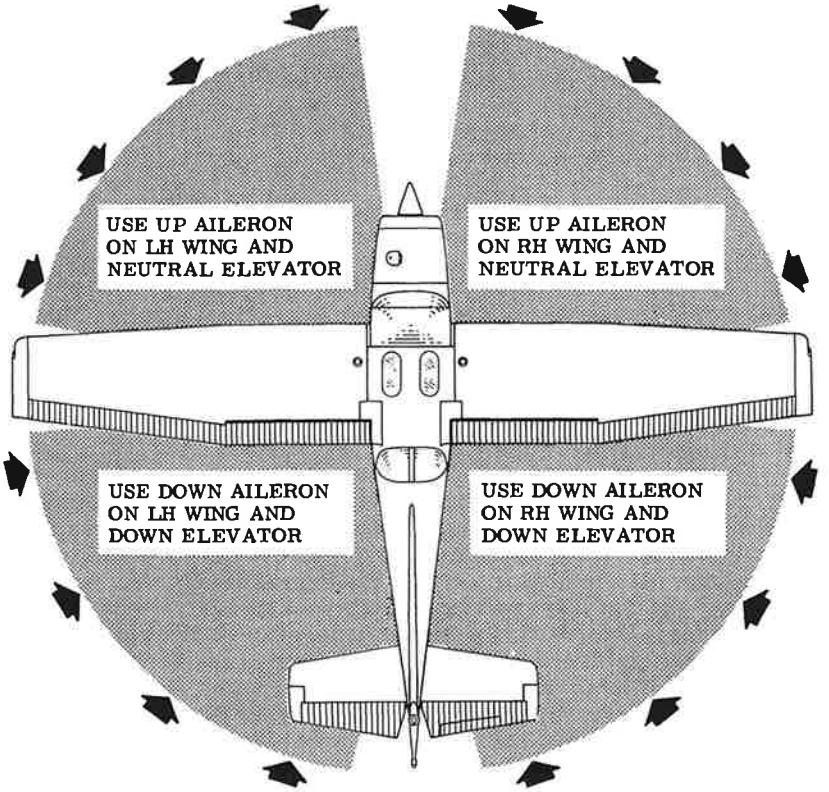
Proper fuel management and throttle adjustments are the determining factors in securing an easy start from your continuous-flow fuel-injection engine. The procedure outlined in this section should be followed closely as it is effective under nearly all operating conditions.

Conventional full rich mixture and high RPM propeller settings are used for starting; the throttle, however, should be fully closed initially. When ready to start, place the auxiliary fuel pump switch in the HIGH position and advance the throttle to obtain 8-10 gal/hr fuel flow. Then close the throttle and release the auxiliary fuel pump switch. Place the ignition switch in the START position. While cranking, slowly advance the throttle until the engine starts. Slow throttle advancement is essential since the engine will start readily when the correct fuel/air ratio is obtained. When the engine has started, reset the throttle to the desired idle speed (800-1000 RPM).

The continuous-flow fuel injection system will inject atomized fuel in the intake ports as soon as the throttle and mixture controls are opened and the auxiliary fuel pump is turned on. If the auxiliary pump is turned on accidentally while the engine is stopped, with the throttle open and the mixture rich, solid fuel will collect temporarily in the cylinder intake ports, the quantity depending on the amount of the throttle opening and the length of time the pump has been operating. If this happens, it is advisable to wait a few minutes until this fuel drains away before starting the engine. To avoid flooding, turn the auxiliary fuel pump switch off promptly when the fuel flow reaches 10 gal/hr during preparation for engine start.

Engine mis-starts characterized by weak, intermittent firing followed by puffs of black smoke from the exhaust are caused by over-priming or flooding. This situation is more apt to develop in hot weather, or when the engine is hot. If it occurs, repeat the starting routine with the throttle approximately 1/2 open, the mixture in idle cut-off and the auxiliary fuel pump switch off. As the engine fires, move the mixture control to full rich and decrease the throttle to idle.

Engine mis-starts characterized by sufficient power to take the engine away from the starter but dying in 3 to 5 revolutions are the result of an excessively lean mixture after the start and can occur in warm or cold temperatures. Repeat the starting procedure but allow additional priming time with the auxiliary fuel pump switch on HIGH before cranking is started. If extremely hot temperatures have caused vapor which prevents a start, it will be necessary to hold the auxiliary fuel



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

pump switch in the HIGH position for 5 to 10 seconds or more to flush the vapor through the fuel lines until the fuel flow reaches 10 gal/hr. Then turn off the pump and proceed with normal starting procedures.

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

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

NOTE

Additional details concerning cold weather starting and operation may be found under Cold Weather Operation paragraphs in this section.

TAXIING

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

BEFORE TAKEOFF

WARM-UP

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

MAGNETO CHECK

The magneto check should be made at 1800 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 L position, note RPM and return the switch to the BOTH position. RPM drop should not exceed 150 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning operation of the ignition system, RPM checks at higher engine speed 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 flight where verification of proper alternator and voltage regulator operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (3 to 5 seconds) with the landing light during the engine runup (1800 RPM). The ammeter will remain within a needle width of the initial reading if the alternator and voltage regulator are operating properly.

TAKEOFF

POWER CHECK

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

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 takeoff RPM is developed, and the gravel will be blown back of the propeller rather than pulled into it. When unavoidable small dents appear in the propeller blades they should be corrected immediately as described in Section 8 under Propeller Care.

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

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 ground run and total distance over an obsta-

cle by approximately 5 percent.

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 70 KIAS is reached. To clear an obstacle with wing flaps 10°, an obstacle clearance speed of 60 KIAS should be used.

Soft field takeoffs can be performed with 15° flaps by lifting the airplane off the ground as soon as practical in a slightly tail-low attitude. If no obstacles are ahead, the airplane should be leveled off immediately to accelerate to a safer climb speed. When departing a soft field with an aft c.g. loading, the elevator trim should be adjusted towards the nose down direction to give comfortable control wheel forces during the initial climb. Flap deflections greater than 15° are not approved for takeoff.

With wing flaps retracted and no obstructions ahead, a takeoff climb-out speed of 75-85 KIAS would be most efficient.

CROSSWIND TAKEOFF

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

ENROUTE CLIMB

Normal climbs are performed at 85-95 KIAS with flaps up and maximum power for the best combination of engine cooling, rate of climb and forward visibility. The mixture should be leaned in accordance with the fuel flow placard.

If it is necessary to climb rapidly to clear mountains or reach favorable winds or better weather at high altitudes, the best rate-of-climb speed should be used. This speed is 81 KIAS at sea level, decreasing to 76 KIAS at 10,000 feet. Maximum power should be used and the mixture should be leaned according to the fuel flow placard.

If an obstruction ahead requires a steep climb angle, a best angle-of-climb speed should be used with flaps up and maximum power. This speed is 59 KIAS at sea level, increasing to 65 KIAS at 10,000 feet.

CRUISE

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

NOTE

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

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

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

	80% POWER		70% POWER		60% POWER	
ALTITUDE	KTAS	NMPG	KTAS	NMPG	KTAS	NMPG
3000 Feet	126	11.2	119	12.0	110	12.9
6000 Feet	130	11.5	122	12.3	112	13.1
9000 Feet	- - -	- - -	125	12.6	114	13.3
Standard Conditions						Zero Wind

Figure 4-3. Cruise Performance Table

For best fuel economy at 70% power or less, the engine may be operated at one gallon per hour leaner than shown in this handbook and on the power computer. This will result in approximately 8% greater range than shown in this handbook accompanied by approximately a 4 knot decrease in speed.

The fuel injection system employed on this engine is considered to be non-icing. In the event that unusual conditions cause the intake air filter to become clogged or iced over, an alternate intake air valve opens automatically for the most efficient use of either normal or alternate air depending on the amount of filter blockage.

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 80% power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by a desired increment based on figure 4-4.

Continuous operation at peak EGT is authorized only at 70% power or less. This best economy mixture setting results in approximately 8% greater range than shown in this handbook accompanied by approximately a 4 knot decrease in speed.

NOTE

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

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

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

Figure 4-4. EGT Table

STALLS

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

Power off stall speeds at maximum weight for both forward and aft c.g. are presented in Section 5.

SPINS

Intentional spins are approved in this airplane within certain restricted loadings. Spins with baggage loadings or occupied rear seat(s) are not approved.

However, before attempting to perform spins several items should be carefully considered to assure a safe flight. No spins should be attempted without first having received dual instruction both in spin entries and spin recoveries from a qualified instructor who is familiar with the spin characteristics of the Cessna R172K.

The cabin should be clean and all loose equipment (including the microphone and rear seat belts) should be stowed or secured. For a solo flight in which spins will be conducted, the copilot's seat belt and shoulder harness should also be secured. The seat belts and shoulder harnesses should be adjusted to provide proper restraint during all anticipated flight conditions. However, care should be taken to ensure that the pilot can easily reach the flight controls and produce maximum control travels.

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

The normal entry is made from a power-off stall. As the stall is approached, the 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, application of ailerons in the direction of the desired spin, and the use of power at the entry will assure more consistent and positive entries to the spin. As the airplane begins to spin, reduce the power to idle and return the ailerons to neutral. 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.

For the purpose of training in spins and spin recoveries, a 1 or 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 (within 1/4 turn). During extended spins of two to three turns or more, the spin will tend to change into a spiral, particularly to the right. This will be accompanied by an increase in airspeed and gravity loads on the airplane. If this occurs, recovery should be accomplished quickly by leveling the wings and recovering from the resulting dive.

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

(1) VERIFY THAT THROTTLE IS IN IDLE POSITION AND AILERONS ARE NEUTRAL.
(2) APPLY AND HOLD FULL RUDDER OPPOSITE TO THE DIRECTION OF ROTATION.
(3) JUST AFTER THE RUDDER REACHES THE STOP, MOVE THE CONTROL WHEEL BRISKLY FORWARD FAR ENOUGH TO BREAK THE STALL.
(4) HOLD THESE CONTROL INPUTS UNTIL ROTATION STOPS.
(5) AS ROTATION STOPS, NEUTRALIZE RUDDER, AND MAKE A SMOOTH RECOVERY FROM THE RESULTING DIVE.

NOTE

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

Variation in basic airplane rigging or in weight and balance due to installed equipment or right seat ocupancy 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 spiraling tendencies for spins of more than 2 turns. However, the recovery technique 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 65-75 KIAS with flaps up, and 60-70 KIAS with flaps down. Surface winds and air turbulence are usually the primary factors in determining the most comfortable approach speeds. Steep slips should be avoided with flap settings greater than 20° due to a slight tendency for the elevator to oscillate under certain combinations of airspeed, sideslip angle, and center of gravity loadings.

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

SHORT FIELD LANDING

For a short field landing in smooth air conditions, make an approach at 63 KIAS with full flaps using enough power to control the glide path. (Slightly higher approach speeds should be used under turbulent air conditions.) After all approach obstacles are cleared, progressively reduce power and maintain the approach speed by lowering the nose of the airplane. Touchdown should be made with power off and on the main wheels first. Immediately after touchdown, lower the nose wheel and apply heavy braking as required. For maximum brake effectiveness, retract the flaps, hold the control wheel full back, and apply maximum brake pressure without sliding the tires.

CROSSWIND LANDING

When landing in a strong crosswind, use the minimum flap setting required for the field length. If flap settings greater than 20° are used in sideslips with full rudder deflection, some elevator oscillation may be felt at normal approach speeds. However, this does not affect control of the airplane. Although the crab or combination method of drift correction may be used, the wing-low method gives the best control. After touchdown, hold a straight course with the steerable nose wheel and occasional braking if necessary.

BALKED LANDING

In a balked landing (go-around) climb, reduce the wing flap setting to 20° immediately after full power is applied and maintain 55 KIAS until immediate obstacles are cleared. Then slowly retract the wing flaps after accelerating to an airspeed of 65 KIAS. If obstacles must be cleared during the go-around climb, leave the wing flaps in the 10° to 20° range and maintain 55 KIAS until the obstacles are cleared. Lean the mixture according to the fuel flow placard. After clearing any obstacles, the flaps may be retracted as the airplane accelerates to the normal flaps-up climb speed of 85-95 KIAS.

COLD WEATHER OPERATION

STARTING

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

NOTE

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

Starting can be expedited by switching the auxiliary fuel pump to HIGH position and advancing the throttle for a fuel flow of 8-10 gal./hr. for 3 to 6 seconds.

In extremely cold (-18°C and lower) weather, the use of an external preheater and an external power source are recommended whenever possible to obtain positive starting and to reduce wear and abuse to the engine and electrical system. Pre-heat will thaw the oil trapped in the oil cooler, which probably will be congealed prior to starting in extremely cold temperatures. When using an external power source, the position of the master switch is important. Refer to Section 7 under Ground Service Plug Receptacle for operating details.

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

WARM-UP

In very cold weather, no oil temperature indication need be apparent before takeoff. After a suitable warm-up period (2 to 5 minutes at 1000 RPM), with cylinder head temperatures showing above 200°F, the engine is ready for takeoff if it accelerates smoothly and the oil pressure is normal and steady.

INFLIGHT

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

HOT WEATHER OPERATION

Refer to the general warm temperature starting information under Starting Engine in this section. Avoid prolonged engine operation on the ground.

NOISE ABATEMENT

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

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

(1) Pilots operating 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 2,000 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 judgement, an altitude of less than 2,000 feet is necessary for him to adequately exercise his duty to see and avoid other aircraft.

The certificated noise level for the Model R172K at 2550 pounds maximum weight is 74.8 dB(A). No determination has been made by the Federal Aviation Administration that the noise levels of this airplane are or should be acceptable or unacceptable for operation at, into, or out of, any airport.

SECTION 5
PERFORMANCE

TABLE OF CONTENTS

INTRODUCTION

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

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

USE OF PERFORMANCE CHARTS

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

SAMPLE PROBLEM

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

AIRPLANE CONFIGURATION	
Takeoff weight	2500 Pounds
Usable fuel	49 Gallons
TAKEOFF CONDITIONS	
Field pressure altitude	1500 Feet
Temperature	28°C (16°C above standard)
Wind component along runway	12 Knot Headwind
Field length	3500 Feet
CRUISE CONDITIONS	
Total distance	445 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 5-4, should be consulted, keeping in mind that the distances shown are based on the short field technique. Conservative distances can be established by reading the chart at the next higher value of weight, altitude and temperature. For example, in this particular sample problem, the takeoff distance information presented for a weight of 2550 pounds, pressure altitude of 2000 feet and a temperature of 30°C should be used and results in the following:

Ground roll	1070 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 2 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	1070
Decrease in ground roll (1070 feet × 13%)	139
Corrected ground roll	931 Feet

Total distance to clear a 50-foot obstacle, zero wind	1820
Decrease in total distance (1820 feet × 13%)	237
Corrected total distance to clear a 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 cruising altitude and the expected wind enroute have been given for this sample problem. However, the power setting selection for cruise must be determined based on several considerations. These include the cruise performance characteristics presented in figure 5-7, the range profile chart presented in figure 5-8, and the endurance profile chart presented in figure 5-9.

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

The range profile chart indicates that use of 70% power at 5500 feet yields a predicted range of 512 nautical miles with no wind. The endurance profile chart, figure 5-9, shows a corresponding 4.2 hours. Using this information, the estimated distance can be determined for the expected 10 knot headwind at 5500 feet as follows:

Range, zero wind	512
Decrease in range due to wind (4.2 hours × 10 knot headwind)	42
Corrected range	470 Nautical Miles

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

The cruise performance chart for 6000 feet pressure altitude is entered using 20° C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The power setting chosen is 2500 RPM and 22 inches of manifold pressure, which results in the following:

Power	70%
True airspeed	124 Knots
Cruise fuel flow	9.9 GPH

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

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figures 5-6 and 5-7. For this sample problem, figure 5-6 shows that a normal climb from 2000 feet to 6000 feet requires 1.5 gallons of fuel. The corresponding distance during the climb is 10 nautical miles. These values are for a standard temperature and are sufficiently accurate for most flight planning purposes. However, a further correction for the effect of temperature may be made as noted on the climb chart. The approximate effect of a non-standard temperature is to increase the time, fuel, and distance by 10% for each 10°C above standard temperature, due to the lower rate of climb. In this case, assuming a temperature 16°C above standard, the correction would be:

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

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

Fuel to climb, standard temperature	1.5
Increase due to non-standard temperature (1.5 ×16%)	0.2
Corrected fuel to climb	1.7 Gallons

Using a similar procedure for the distance during climb results in 12 nautical miles.

The resultant cruise distance is:

Total distance	445
Climb distance	-12
Cruise distance	433 Nautical Miles

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

124
-10
114 Knots

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

$$\frac{433 \text{ Nautical Miles}}{114 \text{ Knots}} = 3.8 \text{ Hours}$$

The fuel required for cruise is:

3.8 hours × 9.9 gallons/hour = 37.6 Gallons

The total estimated fuel required is as follows:

Engine start, taxi, and takeoff	1.4
Climb	1.7
Cruise	37.6
Total fuel required	40.7 Gallons

This will leave a fuel reserve of:

49.0
-40.7
8.3 Gallons

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

LANDING

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

Ground roll	700 Feet
Total distance to clear a 50-foot obstacle	1390 Feet

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

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

FLAPS UP												
KIAS	50	60	70	80	90	100	110	120	130	140	150	160
KCAS	53	61	69	78	88	98	108	118	128	138	148	158
FLAPS 10°												
KIAS	40	50	60	70	80	85	---	---	---	---	---	---
KCAS	48	54	61	70	79	83	---	---	---	---	---	---
FLAPS 40°												
KIAS	40	50	60	70	80	85	---	---	---	---	---	---
KCAS	43	51	61	70	79	84	---	---	---	---	---	---

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

AIRSPEED CALIBRATION

ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP												
NORMAL KIAS	50	60	70	80	90	100	110	120	130	140	150	160
ALTERNATE KIAS	43	57	69	79	90	100	109	119	128	137	147	156
FLAPS 10°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	---
ALTERNATE KIAS	32	43	56	68	78	84	---	---	---	---	---	---
FLAPS 40°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	---
ALTERNATE KIAS	31	42	54	64	75	81	---	---	---	---	---	---

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP												
NORMAL KIAS	50	60	70	80	90	100	110	120	130	140	150	160
ALTERNATE KIAS	42	56	67	77	87	96	106	115	125	134	144	153
FLAPS 10°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	---
ALTERNATE KIAS	30	41	55	66	76	81	---	---	---	---	---	---
FLAPS 40°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	---
ALTERNATE KIAS	25	37	49	61	72	76	---	---	---	---	---	---

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

TEMPERATURE CONVERSION CHART

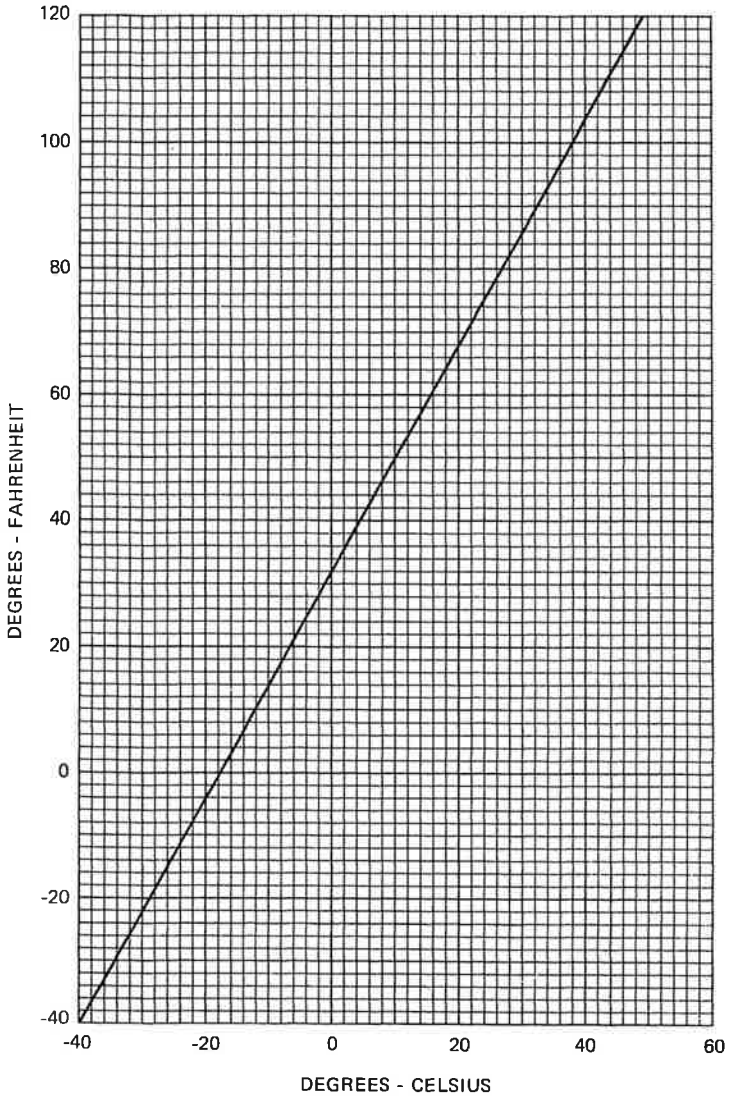


Figure 5-2. Temperature Conversion Chart

STALL SPEEDS

CONDITIONS:
Power Off

NOTES:
1. Maximum altitude loss during a stall recovery may be as much as 160 feet.
2. KIAS values are approximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2550	UP	49	53	53	57	58	63	69	75
	10°	41	50	44	54	49	59	58	71
	40°	44	46	47	49	52	55	62	65

MOST FORWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2550	UP	54	56	58	60	64	67	76	79
	10°	43	51	46	55	51	61	61	72
	40°	46	48	49	52	55	57	65	68

Figure 5-3. Stall Speeds

TAKEOFF DISTANCE

MAXIMUM WEIGHT 2550 LBS

SHORT FIELD

CONDITIONS:
Flaps 10°
2600 RPM and Full Throttle Prior to Brake Release
Mixture Set at Placard Fuel Flow
Cowl Flap Open
Paved Level, Dry Runway
Zero Wind

MIXTURE SETTING	
PRESS ALT	GPH
S.L.	16
2000	15
4000	14
6000	13
8000	12

NOTES:
1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tail winds up to 10 knots, increase distances by 10% for each 2 knots.
3. For operation on a dry, grass runway, increase distances by 15% of the "ground roll" figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2550	56	60	S.L.	715	1225	770	1315	830	1410	895	1510	960	1625
			1000	780	1335	840	1435	905	1540	975	1655	1050	1780
			2000	855	1460	920	1570	995	1690	1070	1820	1150	1960
			3000	935	1600	1010	1725	1090	1860	1175	2005	1265	2165
			4000	1025	1760	1110	1900	1195	2055	1290	2220	1390	2405
			5000	1125	1945	1220	2105	1315	2280	1420	2470	1530	2685
			6000	1240	2155	1340	2340	1450	2540	1565	2765	1690	3015
			7000	1365	2405	1480	2615	1600	2850	1730	3115	1870	3415
			8000	1510	2695	1635	2945	1770	3225	1915	3545	2075	3920

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

TAKEOFF DISTANCE

2400 LBS AND 2200 LBS

SHORT FIELD

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2400	54	58	S.L.	620	1070	670	1145	720	1225	775	1315	835	1410
			1000	680	1165	730	1250	790	1340	845	1435	910	1540
			2000	740	1270	800	1365	860	1465	925	1575	995	1690
			3000	810	1390	875	1495	945	1605	1015	1730	1095	1860
			4000	890	1520	960	1640	1035	1765	1115	1905	1200	2055
			5000	975	1675	1055	1805	1135	1950	1225	2110	1320	2280
			6000	1070	1850	1160	2000	1250	2165	1350	2345	1455	2540
			7000	1180	2050	1275	2220	1380	2410	1490	2620	1610	2850
			8000	1305	2280	1410	2480	1525	2700	1650	2950	1780	3225
2200	52	56	S.L.	510	880	550	940	590	1005	635	1075	680	1150
			1000	555	955	600	1025	645	1095	690	1175	740	1255
			2000	605	1040	655	1115	705	1195	755	1280	810	1370
			3000	660	1135	715	1215	770	1305	825	1400	890	1500
			4000	725	1240	780	1330	840	1430	905	1535	975	1650
			5000	795	1355	855	1460	925	1570	995	1690	1070	1820
			6000	870	1490	940	1605	1015	1730	1095	1865	1175	2010
			7000	955	1645	1035	1770	1115	1915	1205	2065	1295	2235
			8000	1055	1815	1140	1965	1230	2125	1330	2300	1430	2495

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

RATE OF CLIMB

MAXIMUM

CONDITIONS:
Flaps Up
2600 RPM
Full Throttle
Mixture Set at Placard Fuel Flow
Cowl Flap Open

MIXTURE SETTING	
PRESS ALT	GPH
S.L.	16
4000	14
8000	12
12,000	10

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
2550	S.L.	81	1040	945	845	750
	2000	80	925	830	740	650
	4000	79	810	720	635	545
	6000	78	695	615	530	445
	8000	77	585	505	425	345
	10,000	76	480	400	320	- - -
	12,000	75	370	295	220	- - -

Figure 5-5. Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
2600 RPM
Full Throttle
Mixture Set at Placard Fuel Flow
Cowl Flap Open
Standard Temperature

MIXTURE SETTING	
PRESS ALT	GPH
S.L.	16
4000	14
8000	12
12,000	10

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

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2550	S.L.	15	81	870	0	0	0
	1000	13	80	825	1	0.3	2
	2000	11	80	780	2	0.6	3
	3000	9	79	735	4	1.0	5
	4000	7	79	690	5	1.3	7
	5000	5	79	645	7	1.6	9
	6000	3	78	600	8	2.0	11
	7000	1	78	555	10	2.4	14
	8000	-1	77	510	12	2.7	16
	9000	-3	77	465	14	3.2	19
	10,000	-5	76	420	16	3.6	23
	11,000	-7	76	375	19	4.0	26
	12,000	-9	75	330	22	4.5	31

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

TIME, FUEL, AND DISTANCE TO CLIMB

NORMAL CLIMB - 90 KIAS

CONDITIONS:
Flaps Up
2600 RPM
Full Throttle
Mixture Set at Placard Fuel Flow
Cowl Flap Open
Standard Temperature

MIXTURE SETTING	
PRESS ALT	GPH
S.L.	16
4000	14
8000	12
12,000	10

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

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	RATE OF CLIMB FPM	FROM SEA LEVEL		
				TIME MIN	FUEL USED GALLONS	DISTANCE NM
2550	S.L.	15	860	0	0	0
	1000	13	805	1	0.3	2
	2000	11	755	3	0.6	4
	3000	9	700	4	1.0	6
	4000	7	645	5	1.3	8
	5000	5	595	7	1.7	11
	6000	3	540	9	2.1	14
	7000	1	485	11	2.5	17
	8000	-1	435	13	3.0	20
	9000	-3	380	16	3.5	25
	10,000	-5	325	18	4.0	30
	11,000	-7	275	22	4.6	36
	12,000	-9	220	26	5.3	43

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 2000 FEET

CONDITIONS:
2550 Pounds
Recommended Lean Mixture
Cowl Flap Closed

NOTE

For best fuel economy at 70% power or less, operate at 1 GPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -9°C			STANDARD TEMPERATURE 11°C			20°C ABOVE STANDARD TEMP 31°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2600	24	- - -	- - -	- - -	81	126	11.4	78	127	11.0
	23	78	122	11.1	76	122	10.7	73	123	10.3
	22	73	118	10.3	71	119	10.0	68	119	9.6
	21	68	114	9.6	65	114	9.3	63	114	9.0
2500	25	- - -	- - -	- - -	81	126	11.5	79	127	11.1
	24	80	122	11.2	77	123	10.8	74	124	10.5
	23	75	119	10.6	72	120	10.2	70	120	9.9
	22	70	116	9.9	67	116	9.5	65	116	9.2
2400	25	79	122	11.2	76	123	10.8	74	123	10.4
	24	74	119	10.5	72	120	10.2	69	120	9.8
	23	70	116	9.9	67	116	9.5	65	116	9.2
	22	65	112	9.2	63	112	8.9	61	112	8.6
2300	25	74	119	10.5	72	119	10.1	69	120	9.8
	24	70	116	9.9	67	116	9.5	65	116	9.2
	23	65	112	9.2	63	112	8.9	61	112	8.7
	22	61	108	8.6	59	108	8.4	57	107	8.1
2200	25	69	115	9.8	67	115	9.4	64	115	9.1
	24	65	112	9.2	63	112	8.9	61	111	8.6
	23	61	108	8.6	59	108	8.3	57	107	8.1
	22	57	104	8.1	55	103	7.8	53	102	7.6
	21	52	99	7.6	51	98	7.3	49	97	7.1
	20	48	94	7.0	47	93	6.8	45	91	6.6
	19	44	88	6.5	43	87	6.3	41	86	6.2

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 4000 FEET

CONDITIONS:
2550 Pounds
Recommended Lean Mixture
Cowl Flap Closed

NOTE

For best fuel economy at 70% power or less, operate at 1 GPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -13°C			STANDARD TEMPERATURE 7°C			20°C ABOVE STANDARD TEMP 27°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2600	23	81	126	11.5	79	127	11.1	76	127	10.7
	22	76	122	10.8	73	123	10.4	71	123	10.0
	21	71	119	10.0	68	119	9.7	66	119	9.3
	20	66	114	9.3	63	114	9.0	61	113	8.7
2500	24	82	126	11.6	79	127	11.2	77	128	10.8
	23	77	123	11.0	75	124	10.6	72	124	10.2
	22	73	120	10.3	70	120	9.9	68	120	9.6
	21	68	116	9.6	65	116	9.3	63	116	9.0
2400	24	77	123	10.9	74	124	10.5	72	124	10.2
	23	72	120	10.2	70	120	9.9	68	120	9.5
	22	68	116	9.6	65	116	9.2	63	116	9.0
	21	63	112	8.9	61	111	8.6	59	110	8.4
2300	24	72	120	10.2	70	120	9.9	67	120	9.5
	23	68	116	9.6	65	116	9.3	63	116	9.0
	22	63	112	9.0	61	112	8.7	59	111	8.4
	21	59	108	8.4	57	107	8.1	55	106	7.9
2200	24	68	116	9.6	65	116	9.2	63	115	8.9
	23	63	112	9.0	61	112	8.7	59	111	8.4
	22	59	108	8.4	57	107	8.1	55	106	7.9
	21	55	103	7.9	53	102	7.6	51	101	7.4
	20	51	98	7.3	49	97	7.1	47	95	6.9
	19	46	92	6.8	45	91	6.6	43	89	6.4

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 6000 FEET

CONDITIONS:
2550 Pounds
Recommended Lean Mixture
Cowl Flap Closed

NOTE

For best fuel economy at 70% power or less, operate at 1 GPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -17°C			STANDARD TEMPERATURE 3°C			20°C ABOVE STANDARD TEMP 23°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2600	23	- - -	- - -	- - -	81	131	11.5	79	131	11.1
	22	79	126	11.2	76	127	10.8	74	127	10.4
	21	74	123	10.5	71	123	10.1	69	123	9.7
	20	69	119	9.7	66	118	9.3	64	118	9.1
2500	23	80	127	11.3	77	128	10.9	75	128	10.6
	22	76	124	10.7	73	124	10.3	70	124	9.9
	21	71	120	10.0	68	120	9.6	66	120	9.3
	20	66	116	9.3	63	116	9.0	61	115	8.7
2400	23	75	124	10.6	72	124	10.2	70	124	9.9
	22	70	120	9.9	68	120	9.6	65	120	9.3
	21	65	116	9.3	63	115	9.0	61	114	8.7
	20	61	111	8.6	59	110	8.4	57	109	8.1
2300	23	71	120	10.0	68	120	9.6	66	120	9.3
	22	66	116	9.3	64	116	9.0	61	115	8.7
	21	61	112	8.7	59	111	8.4	57	110	8.2
	20	57	107	8.1	55	105	7.9	53	105	7.6
2200	23	66	116	9.3	63	116	9.0	61	115	8.7
	22	62	112	8.7	59	111	8.4	57	110	8.2
	21	57	107	8.2	55	106	7.9	53	105	7.7
	20	53	102	7.6	51	101	7.4	49	99	7.2
	19	49	96	7.1	47	95	6.8	45	93	6.7
	18	44	90	6.6	43	89	6.4	41	87	6.2

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 8000 FEET

CONDITIONS:
2550 Pounds
Recommended Lean Mixture
Cowl Flap Closed

NOTE

For best fuel economy at 70% power or less, operate at 1 GPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -21°C			STANDARD TEMPERATURE -1°C			20°C ABOVE STANDARD TEMP 19°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2600	21	77	127	10.9	74	128	10.5	72	127	10.1
	20	72	123	10.1	69	123	9.8	67	122	9.4
	19	66	118	9.4	64	118	9.0	62	116	8.8
	18	61	113	8.6	59	111	8.3	57	110	8.1
2500	21	74	125	10.4	71	125	10.0	69	124	9.7
	20	69	120	9.7	66	120	9.4	64	119	9.1
	19	64	116	9.0	61	115	8.7	59	113	8.4
	18	59	110	8.4	56	109	8.1	54	108	7.8
2400	21	68	120	9.6	65	119	9.3	63	118	9.0
	20	63	115	9.0	61	114	8.6	59	113	8.4
	19	58	110	8.3	56	108	8.0	54	107	7.8
	18	54	104	7.7	52	103	7.5	50	101	7.2
2300	21	64	116	9.1	62	115	8.7	59	114	8.5
	20	59	111	8.5	57	109	8.2	55	109	7.9
	19	55	105	7.9	53	104	7.6	51	103	7.4
	18	50	100	7.3	48	98	7.0	47	96	6.8
2200	21	60	111	8.5	57	110	8.2	55	109	7.9
	20	55	106	7.9	53	105	7.7	51	103	7.4
	19	51	100	7.4	49	99	7.1	47	97	6.9
	18	47	94	6.8	45	93	6.6	43	91	6.4

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 10,000 FEET

CONDITIONS:
2550 Pounds
Recommended Lean Mixture
Cowl Flap Closed

NOTE

For best fuel economy at 70% power or less, operate at 1 GPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -25°C			STANDARD TEMPERATURE -5°C			20°C ABOVE STANDARD TEMP 15°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2600	19	69	123	9.8	67	122	9.4	64	121	9.1
	18	64	117	9.0	61	116	8.7	59	115	8.4
	17	58	110	8.3	56	109	8.0	54	108	7.8
	16	53	104	7.6	51	102	7.3	49	100	7.1
2500	19	67	120	9.4	64	119	9.1	62	118	8.8
	18	62	115	8.7	59	113	8.4	57	112	8.2
	17	56	108	8.0	54	107	7.8	52	105	7.5
	16	50	101	7.3	49	99	7.1	47	97	6.8
2400	19	61	114	8.6	59	112	8.3	56	111	8.1
	18	56	108	8.0	54	107	7.8	52	105	7.5
	17	51	102	7.4	49	100	7.2	48	99	7.0
	16	47	95	6.8	45	94	6.6	43	91	6.4
2300	19	57	109	8.2	55	108	7.9	53	107	7.7
	18	53	104	7.6	51	102	7.3	49	100	7.1
	17	48	97	7.0	46	95	6.8	45	94	6.6
2200	19	53	104	7.7	51	103	7.4	49	101	7.2
	18	49	98	7.1	47	97	6.9	45	95	6.7
	17	45	92	6.6	43	90	6.4	42	88	6.2

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

CRUISE PERFORMANCE

PRESSURE ALTITUDE 12,000 FEET

CONDITIONS:
2550 Pounds
Recommended Lean Mixture
Cowl Flap Closed

NOTE

For best fuel economy at 70% power or less, operate at 1 GPH leaner than shown in this chart or at peak EGT if an EGT indicator is installed.

		20°C BELOW STANDARD TEMP -29°C			STANDARD TEMPERATURE -9°C			20°C ABOVE STANDARD TEMP 11°C		
RPM	MP	% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2600	18	67	122	9.4	64	121	9.1	62	120	8.8
	17	61	115	8.7	59	114	8.4	57	113	8.1
	16	55	108	7.9	53	107	7.7	51	105	7.4
	15	50	100	7.2	48	99	7.0	46	97	6.7
2500	18	64	119	9.1	62	118	8.8	60	117	8.5
	17	59	112	8.4	57	112	8.1	55	110	7.8
	16	53	106	7.7	51	104	7.4	49	102	7.2
	15	47	97	6.9	45	95	6.7	44	93	6.5
2400	18	58	112	8.3	56	111	8.0	54	109	7.8
	17	54	106	7.7	52	104	7.5	50	103	7.2
	16	49	100	7.1	47	98	6.9	46	96	6.7
	15	44	93	6.6	43	90	6.4	41	88	6.2
2300	18	55	108	7.9	53	106	7.6	51	104	7.4
	17	50	101	7.3	48	100	7.1	47	98	6.8
	16	46	95	6.7	44	93	6.5	43	90	6.3
2200	18	51	103	7.4	49	101	7.1	47	99	6.9
	17	47	96	6.8	45	94	6.6	44	92	6.4

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

RANGE PROFILE

45 MINUTES RESERVE
49 GALLONS USABLE FUEL

CONDITIONS:
2550 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 5.0 gallons.

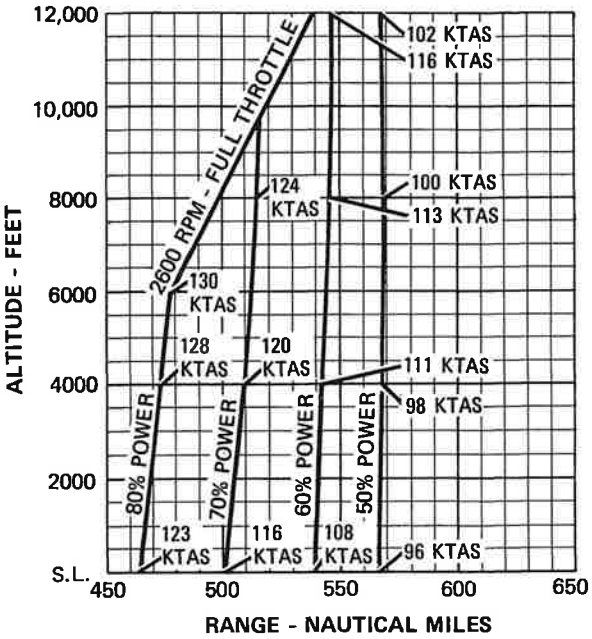


Figure 5-8. Range Profile

ENDURANCE PROFILE

45 MINUTES RESERVE
49 GALLONS USABLE FUEL

CONDITIONS:
2550 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTES:
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during a normal climb as shown in figure 5-6.
2. Reserve fuel is based on 45 minutes at 45% BHP and is 5.0 gallons.

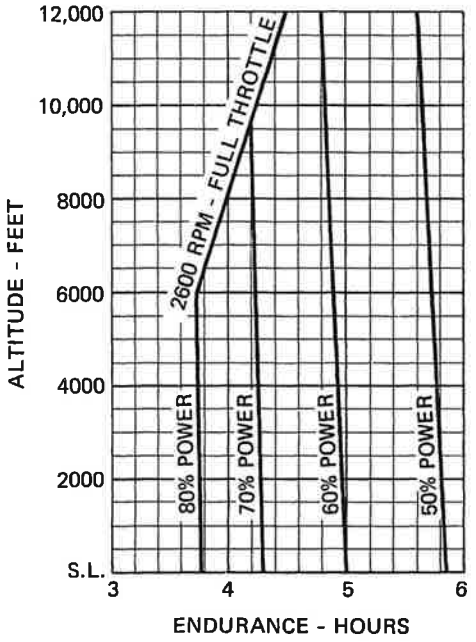


Figure 5-9. Endurance Profile

LANDING DISTANCE

SHORT FIELD

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

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

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS	GRND ROLL	TOTAL TO CLEAR 50 FT OBS
2550	63	S.L.	590	1225	610	1255	630	1285	650	1315	675	1350
		1000	610	1255	630	1285	655	1320	675	1350	700	1390
		2000	630	1285	655	1320	680	1360	700	1390	725	1425
		3000	655	1320	680	1360	705	1395	730	1430	750	1465
		4000	680	1360	705	1395	730	1435	755	1470	780	1505
		5000	705	1395	730	1435	760	1475	785	1515	810	1550
		6000	735	1440	760	1475	785	1515	815	1560	840	1595
		7000	760	1480	790	1520	815	1560	845	1605	875	1645
		8000	790	1520	820	1565	850	1610	880	1655	905	1690

Figure 5-10. Landing Distance