Dreamfleet 2000

CESSNA MODEL 172 P

P O H

THIS MANUAL IS INTENDED FOR FLIGHT SIMULATION USE ONLY. NO RESPONSIBILITY FOR TYPOGRAPHIC OR OTHER ERRORS IS TAKEN.

FOREWORD

I would like to extend my compliments and thanks to Alex Franzen, who expended a great deal of time and talent to produce this manual, based on the actual C-172P POH, for the DF2000 / FSD Cessna 172P.

It is an outstanding effort! This manual is intended for use along with the detailed documentation originally provided with our C-172P panel, and also makes reference to certain features of our panel.

It is people such as Alex who make this hobby the great one that it is, and we all hope you enjoy many happy hours flying the 172, with this manual as your guide.

Happy Flying!

Louis J Betti
Executive Director - DreamFleet 2000

SECTION 1
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INTRODUCTION

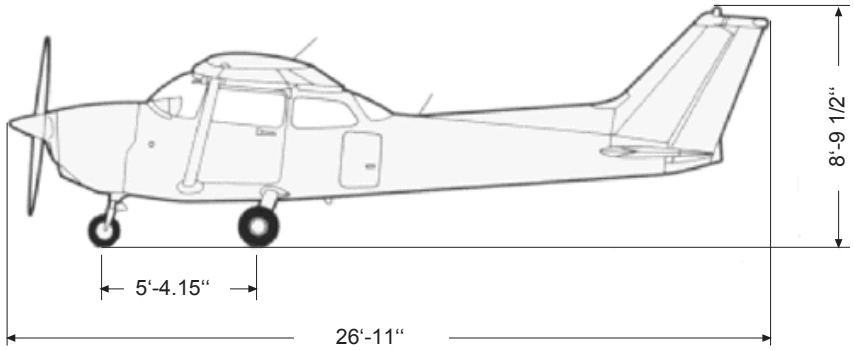
This handbook includes the material required to be furnished to the pilot by CAR Part 3. Section 1 provides basic data and information of general interest.

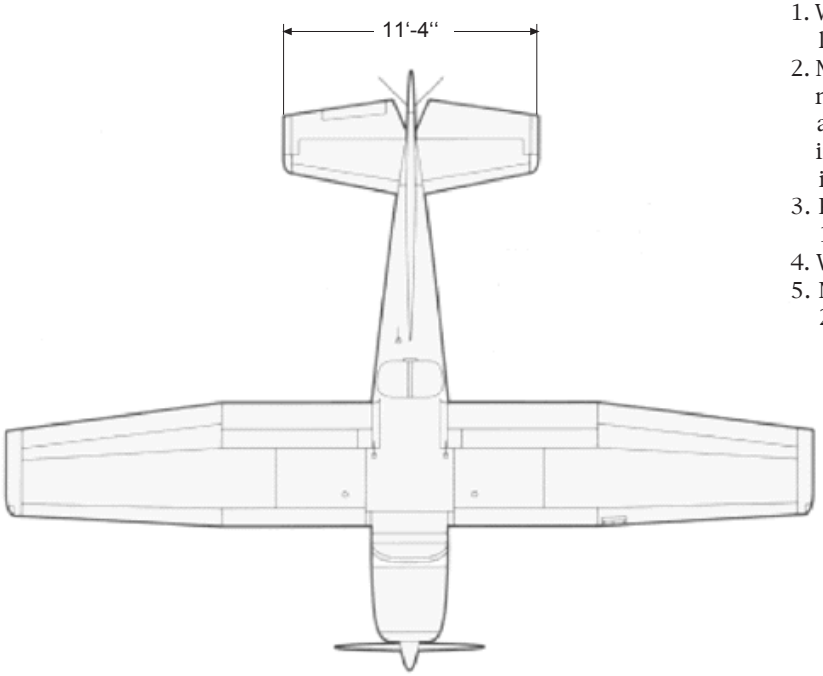
PERFORMANCE–SPECIFICATIONS

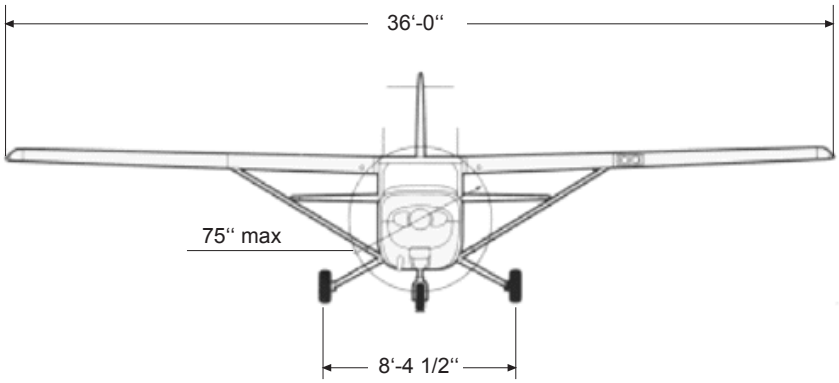
SPEED:	
Maximum at sea level	123 Knots
Cruise, 75% power at 8000 ft	120 Knots
CRUISE: Recommended lean mixture with fuel allowance for engine start, takeoff, climb and 45 minutes reserve	
75% power at 8000 ft	440 NM
40 gallons usable fuel	3.8 HRS
75% power at 8000 ft	585 NM
50 gallons usable fuel	5.0 HRS
75% power at 8000 ft	755 NM
62 gallons usable fuel	6.4 HRS
Maximum Range at 10000 ft	520 NM
40 gallons usable fuel	5.6 HRS
Maximum Range at 10000 ft	680 NM
50 gallons usable fuel	7.4 HRS
Maximum Range at 10000 ft	875 NM
62 gallons usable fuel	9.4 HRS
RATE OF CLIMB AT SEA LEVEL	700 FPM
SERVICE CEILING	13000 FT
TAKEOFF PERFORMANCE	
Ground Roll	890 FT
Total Distance Over 50-ft Obstacle	1625 FT
LANDING PERFORMANCE (KCAS)	
Ground Roll	540 FT
Total Distance Over 50-ft Obstacle	1280 FT
STALL SPEESDS (KCAS)	
Flaps Up, Power Off	51 Knots
Flaps Down, Power Off	46 Knots
MAXIMUM WEIGHT	
Ramp	2407 LBS
Takeoff or Landing	2400 LBS
STANDARD EMPTY WEIGHT	
Skyhawk	1414 LBS
Skyhawk II	1440 LBS
MAXIMUM USEFUL LOAD	
Skyhawk	993 LBS
Skyhawk II	967 LBS
BAGGAGE ALLOWANCE	120 LBS
WING LOADING: Pounds/Sq Ft	13.8
POWER LOADING: Pounds/HP	15.0
FUEL CAPACITY	
Standard Tanks	43 GAL
Long Range Tanks	54 GAL
Integral Tanks	68 GAL
PROPELLER: Fixed Pitch, Diameter	75 IN

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

DIMENSIONS







NOTES:
1. Wing span shown with strobe lights installed.
2. Maximum height shown with nose gear depressed, all tires and nose strut properly inflated and flashing beacon installed
3. Proper ground clearance is 11 3/4“
4. Wing area is 174 square feet
5. Minimum turning radius is 25‘-5 1/2“

DESCRIPTIVE DATA

ENGINE

- Number of engines: 1
- Engine Manufacturer: Avco Lycoming
- Engine Model Number: O-320-D2J
- Engine Type: Normally aspirated, direct-drive, air-cooled, horizontally opposed, carburetor equipped, four-cylinder engine with 319.8 cu.in. displacement
- Horsepower Rating and Engine Speed: 160 rated HP at 2700 RPM

PROPELLER

- Propeller Manufacturer: McCauley Accessory Division.
- Propeller Model Number: 1C160/DTM7557
- Number of Blades: 2
- Propeller Diameter, Maximum: 75 inches, Minimum: 74 inches.
- Propeller Type: Fixed Pitch

FUEL

Approved Fuel Grades:

100LL Grade Aviation Fuel (Blue)
100 (Formerly 100/130) Grade Aviation Fuel (Green)

Fuel Capacity:

Standard Tanks:
Total Capacity: 43 gallons
Total Capacity Each Tank: 21.5 gallons
Tatoal Usable: 40 gallons.

Long Range Tanks:
Total Capacity: 54 gallons
Total Capacity Each Tank: 27 gallons
Tatoal Usable: 50 gallons.

Integral Tanks:
Total Capacity: 68 gallons
Total Capacity Each Tank: 34 gallons
Tatoal Usable: 62 gallons.

NOTE:
Isopropyl alcohol or ethylene glycol monomethyl ether may be added to the fuel supply.

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

OIL

Oil Grade (Specifications): MIL-L-6082 Aviation Grade Straight Mineral Oil: Use to replenish supply during first 25 hours and at the forst 25-hour oil change. Continue to use until a total of 50 hours has accumulated or oil consumption has stabilized. MIL-L-22851 Ashless Dispersant Oil: This oil must be used after first 50 hours or oil consumption has stabilized.

MAXIMUM CERTIFICATED WEIGHT

-Ramp
  Normal Category: 2407 lbs
  Utility Category: 2107 lbs
-Takeoff
  Normal Category: 2400 lbs
  Utility Category: 2100 lbs
-Landing
  Normal Category: 2400 lbs
  Utility Category: 2100 lbs

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

STANDARD AIRPLANE WEIGHT

-Standard empty weight:
  Skyhawk: 1414 lbs
  Skyhawk II: 1440 lbs
-Maximum useful load:
  Skyhawk
    Normal Category: 993 lbs
    Utility Category: 693 lbs
  Skyhawk II
    Normal Category: 967 lbs
    Utility Category: 667 lbs

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AIRSPEED LIMITATIONS

Airspeed Limitations and their operational significance are shown in figure 2-1. Maneuvering speed shown apply to normal category operations. The utility category maneuvering speed is 102 KIAS at 2100 pounds.

	SPEED	KCAS	KIAS	REMARKS
V_{NE}	Never Exceed Speed	152	158	Do not exceed this speed in any operation
V_{NO}	Maximum Structural Cruising Speed	123	127	Do not exceed this speed except in smooth air, and then only with caution
V_A	Maneuvering Speed:			
	2400 Pounds	97	99	Do not make full or abrupt control movements above this speed
	2000 Pounds	91	92	
	1600 Pounds	81	82	
V_{FE}	Maximum Flaps Extended Speed:			
	10° Flaps	108	110	Do not exceed this speed with flaps down
	10° - 30° Flaps	84	85	
	Maximum Window Open Speed	152	158	Do not exceed this speed with windows open

Figure 2-1. Airspeed Limitations

AIRSPEED INDICATOR MARKINGS

Airspeed Indicator markings and their color code significance areshown in figure 2-2.

MARKING	KIAS VALUE OR RANGE	SIGNIFICANCE
White Arc	33 - 85	Full Flap Operating Range. Lower limit is maximum weight V_{S0} in landing configuration. Upper limit is maximum speed permissible with flaps extended.
Green Arc	44 - 127	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	127 - 158	Operating must be conducted with aution and only in smooth air.
Red Line	158	Maximum speed for all operations.

Figure 2-2. Airspeed Indicator Makings

POWER PLANT LIMITATIONS

-Engine Manufacturer:
Avco Lycoming.
-Engine Model Number:
O-320-D2J.
-Maximum Power:
160 BHP rating.
-Engine Operating Limits or Takeoff and continous Operations:
Maximum Engine Speed:
2700 RPM.
Maximum Oil Temperature:
245°F (118°C).
-Oil Pressure
Minimum: 25 psi.
Maximum: 115 psi.
-Fuel Grade: See Fuel Limitations.
-Oil Grade (Specification):
MIL-L-6082 Aviation Grade Streight Mineral Oil or MIL-L-22851 Ashless Dispersant Oil.
-Propeller Manufacturer:
McCauley Accessory Division.
Propeller Model Number:
1C160/DTM7557.
-Propeller Diameter,
Maximum: 75 inches.
Minimum: 74 inches.

NOTE:
The static RPM range at full throttle (carburetor heat off and mixrure leaned to maximize RPM) is 2300 tp 2420 RPM.

POWER PLANT INSTRUMENT MARKINGS

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

INSTRUMENT	RED LINE MINIMUM LIMIT	GREEN ARC NORMAL OPERATING	RED LINE MAXIMUM LIMIT
Tachometer: Sea Level 5000 Feet 10000 Feet	- - -	2100-2450 RPM 2100-2575 RPM 2100-2700 RPM	2700 RPM
Oil Temperature	- - -	100°-245°F	245°F
Oil Pressure	25 psi	60-90 psi	115 psi
Fuel Quantity (Standard Tanks)	E (1.5 gal. Unusable Each Tank)	- - -	- - -
Fuel Quantity (Long Range Tanks)	E (2.0 gal. Unusable Each Tank	- - -	- - -
Fuel Quantity (Integral Tanks)	R (3.0 gal. Unusable Each Tank)	- - -	- - -
Suction	- - -	4.5 - 5.5 in. Hg	- - -

Figure 2-3 Power Plant Instrument Markings

WEIGHT LIMITS

NORMAL CATEGORY

-Maximum Ramp Weight:
2407 lbs.
-Maximum Takeoff Weight:
2400 lbs.
-Maximum Landing Weight:
2400 lbs.
-Maximum Weight in Baggage Compartment:
Baggage Area 1 (or passenger on child's seat) - Station 82 tp 108: 120lbs. See following note.
Baggage Area 2 - Station 108 to 142: 50 lbs. See following note.

UTILITY CATEGORY

-Maximum Ramp Weight:
2107 lbs.
-Maximum Takeoff Weight:
2100 lbs.
-Maximum Landing Weight:
2100 lbs.
-Maximum Weight in Baggage Compartment:
In the utility category, the baggage compartement and rear seat must not be occupied.

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

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 39.5 inches aft of datum at 2400 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 36.5 inches aft of datum at 2100 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 aquisition of various certificates such a commercial 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	105 knots
Lazy Eights	105 knots
Steep Turns	95 knots
Spins	Slow Deceleration
Stalls (except Whip Stalls)	Slow Deceleration

*Abrupt use of the controls is prohibited above 99 knots

Aerobatics that may impose high loads should not be attempted. The important thing to bear in mind in flight maneuveres is that the airplane is clean in aerodynamic design and will buils 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 the controls. Intentional spins with flaps extended are prohibited.

FLIGHT LOAD FACTOR LIMITS

NORMAL CATEGORY

Flight Load Factors (maximum Takeoff Weight - 2400 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 (maximum Takeoff Weight - 2100 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 OPERATIONAL 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. Flights into known icing conditions is prohibited.

FUEL LIMITATIONS

Fuel Capacity:

Standard Tanks:
- Total Capacity: 43 gallons
- Total Capacity Each Tank: 21.5 gallons
- Tatal Usable: 40 gallons

Long Range Tanks:
- Total Capacity: 54 gallons
- Total Capacity Each Tank: 27 gallons
- Tatal Usable: 50 gallons

Integral Tanks:
- Total Capacity: 68 gallons
- Total Capacity Each Tank: 34 gallons
- Tatal Usable: 62 gallons

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

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

Maximum slip or skid duration with one tank dry: 30 seconds.

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

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

SECTION 3
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INTRODUCTION

This Section provides checklists and amplified procedures for coping with emergencies that might occur. Emergencies caused by airplane or engine malfunctions are extremely rare if proper preflight inspections and maintainance 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. •

AIRSPEEDS FOR EMERGENCY OPERATION

Engine Failure After Takeoff:	
Wing Flaps Up	65 KIAS
Wing Flaps Down	60 KIAS
Maneuvering Speed:	
2400 Lbs	99 KIAS
2000 Lbs	92 KIAS
1600 Lbs	82 KIAS
Maximum Glide	65 KIAS
Precautionary Landing With Engine Power	60 KIAS
Landing Without Engine Power:	
Wing Flaps Up	65 KIAS
Wing Flaps Down	60 KIAS

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	--- 65 KIAS (flaps up) 60 KIAS (flaps down)
[2]	Mixture	--- IDLE CUT-OFF
[3]	Fuel Selector Valve	--- OFF
[4]	Ignition Switch	--- OF
[5]	Wing Flaps	--- AS REQUIRED
[6]	Master Switch	--- OFF

ENGINE FAILURE DURING FLIGHT

[1]	Airspeed	--- 65 KIAS
[2]	Carburetor Heat	--- ON
[3]	Fuel Selevtor Valve	--- BOTH
[4]	Mixture	--- RICH
[5]	Ignition Switch	--- BOTH
[6]	Primer	--- IN and LOCKED

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

[1]	Airspeed	--- 65 KIAS (flaps up) 60 KIAS (flaps down)
[2]	Mixture	--- IDLE CUT-OFF
[3]	Fuel Selector Valve	--- OFF
[4]	Igition Switch	--- OFF
[5]	Wing Flaps	--- AS REQUIRED (30° recommended)
[6]	Master Switch	--- OFF
[7]	Doors	--- UNLATCH PRIOR TO TOUCHDOWN
[8]	Touchdown	--- SLIGHTLY TAIL LOW
[9]	Brakes	--- APPLY HEAVILY

PRECAUTIONARY LANDING WITH ENGINE POWER

[1]	Wing Flaps	--- 20°
[2]	Airspeed	--- 60 KIAS
[3]	Selected Field	--- FLY OVER, noting terrain and obstruction then retract flaps upon reaching a safe altitude and airspeed
[4]	Avionics Power Switch and Electrical Switches	--- OFF
[5]	Wing Flaps	--- 30° (on final approach)
[6]	Airspeed	--- 60 KIAS
[7]	Master Switch	--- OFF
[8]	Doors	--- UNLATCH PRIOR TO TOUCHDOWN
[9]	Touchdown	--- SLIGHTLY TAIL LOW
[10]	Ignition Switch	--- OFF
[11]	Brakes	--- APPLY HEAVILY

DITCHING

[1]	Radio	--- TRANSMIT MAYDAY on 121.5 MHz, giving location and intentions and SQUAWK 7700
[2]	Heavy Objects)	--- SECURE OR JETTISON
[3]	Approach	
	High Winds, Heavy Seas	--- INTO THE WIND
	Lgt. Winds, Heavy Swells	--- PARALLEL TO SWELLS
[4]	Wing Flaps	--- 20° - 30°
[5]	Power	--- ESTABLISH 300 FT/MIN DESCENT AT 55 KIAS
[6]	Cabin Doors	--- UNLATCH
[7]	Touchdown	--- LEVEL ATTITUDE AT EST. RATE OF DESCENT
[8]	Face	--- CUSHION at touchdown with folded coat
[9]	Airplane	--- EVACUATE through cabin doors.
[10]	Life Vests and Raft	--- INFLATE

REMEMBER:
Mayday 121.5 MHz
Squawk 7700

If necessary, open window and flood the cabin to equalize pressure so doors can be opened.

FIRES

DURING START ON GROUND

[1]	Cranking	--- CONTINUE to get a start...
A. If engine starts		
[2]	Power	--- 1700 RPM for a few minutes
[3]	Engine	--- SHUTDOWN and inspect for damage
B. If engine fails to start		
[4]	Throttle	--- FULL OPEN
[5]	Mixture	--- IDLE CUT-OFF
[6]	Cranking	--- CONTINUE
[7]	Fire Extinguisher	--- OBTAIN (have ground attendants obtain if not installed)
[8]	Engine	--- SECURE a. Master Switch --- OFF b. Ignition Switch --- OFF c. Fuel Selector Valve --- OFF
[9]	Fire	--- EXTINGUISH using fire extinguisher, wool blanket or dirt
[10]	Fire Damage	--- INSPECT

...which would suck the flames and accumulated fuel through the carburetor and into the engine

repair damage or replace damaged components or wiring before conducting another flight

ENGINE FIRE IN FLIGHT

[1]	Mixture	--- IDLE CUT-OFF
[2]	Fuel Selector Valve	--- OFF
[3]	Master Switch	--- OFF
[4]	Cabin Heat and Air	--- OFF (except overhead vents)
[5]	Airspeed	--- 100 KIAS
[6]	Forced Landing	--- EXECUTE

If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture

ELECTRICAL FIRE IN FLIGHT

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

WARNING:
After discharging an extinguisher within closed cabin, ventilate the cabin!

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

[6]	Master Switch	--- ON
[7]	Circuit Breakers	--- CHECK for faulty circuit Do not reset
[8]	Radio Switches	--- OFF
[9]	Avionics Power Switch	--- ON
[10]	Radio/Electrical Switches	--- ON one at a time, with delay after each until short circuit is localized
[11]	Vents/Cabin Air/Heat	--- OPEN when it is ascertained that fire completely extinguished

CABIN FIRE

[1]	Master Switch	--- OFF
[2]	Vents/Cabin Air/Heat	--- CLOSED (to avoid drafts)
[3]	Fire Extinguisher	--- ACTIVATE (if available)
[4]	Land the airplane as soon as possible to inspect for damage	

WARNING:
After discharging an extinguisher within closed cabin, ventilate the cabin!

WING FIRE

[1]	Navigation Light Switch	--- OFF
[2]	Pitot Heat Switch (if installed)	--- OFF
[3]	Strobe Light 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 wing flaps only as required for final approach.

LANDING WITH A FLAT MAIN TIRE

LANDING WITH A FLAT MAIN TIRE

[1]	Approach	--- NORMAL
[2]	Touchdown	--- GOOD TIRE FIRST

NOTE:
Try to hold airplane off flat tire as long as possible.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

AMMETER SHOWS EXCESSIVE RATE OF DISCHARGE

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

LOW–VOLTAGE LIGHT ILLUMINATES DURING FLIGHT (Ammeter Indicates Discharge)

[1]	Avionics Power Switch	--- OFF
[2]	Alternator Circuit Breaker	--- CHECK IN
[3]	Master Switch	--- OFF
[4]	Master Switch	--- ON
[5]	Low-Voltage Light	--- CHECK OFF
[6]	Avionics Power Switch	--- ON

If low-voltage Light illuminates again:

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

NOTE:
Illumination of the low-voltage light may occur during low RPM conditions with an electrical load on the system such as during low RPM taxi. Under these conditions, the light will go out at higher RPM. The master switch need not be recycled since an over-voltage condition has not occured to de-activate the alternator system.

ICING

INADVERTED 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 conductive to icing.
[3]	Pull cabin heat control full out and open defroster outlets to obtain maximum windshield defroster airflow. Adjust cabin air control to get maximum defroster heat and airflow.
[4]	Open the throttle to increase engine speed and minimize ice build up on propeller blades.
[5]	Watch for signs of carburetor air filter ice and apply carburetor heat as required. An unexplained loss in engine speed could be caused by carburetor ice or air intake filter ice. Lean the mixture for maximum RPM, if carburetor heat is used continously.
[6]	Plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable „off airport“ landing site.
[7]	With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speed.
[8]	Leave wing flaps retracted. With a severe ice build-up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
[9]	Open left window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
[10]	Perform a landing approach using a forward slip, if necessary, for improved visibility.
[11]	Approach at 65 to 75 KIAS depending upon the amount of 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 tables in Section 5

SECTION 4
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INTRODUCTION

Section 4 provides checklists and amplified procedures for the conduct of normal operation.

SPEEDS FOR NORMAL OPERATION

Unless otherwise noted, the following speeds are based on a maximum weight of 2400 pounds and may be used for 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	70 - 80 KIAS
Short Field Takeoff, Flaps 10°, Speed at 50 Feet	56 KIAS
Enroute Climb, Flaps Up:	
Normal, Sea Level	75 - 85 KIAS
Normal, 10000 Feet	70 - 80 KIAS
Best Rate of Climb, Sea Level	76 KIAS
Best Rate of Climb, 10000 Feet	71 KIAS
Best Angle Of Climb, Sea Level	60 KIAS
Best Angle Of Climb, 10000 Feet	65 KIAS
Landing Approach:	
Normal Approach, Flaps Up	65 - 75 KIAS
Normal Approach, Flaps 30°	60 - 70 KIAS
Short Fiel Approach, Flaps 30°	61 KIAS
Balked Landing:	
Maximum Power, Flaps 20°	55 KIAS
Maximum Recommended Turbulent Air Penetration Speed:	
2400 lbs	99 KIAS
2000 lbs	92 KIAS
1600 lbs	82 KIAS
Maximum Demonstrated Crosswind Velocity:	
Takeoff or Landing	15 KNOTS

BEFORE STARTING ENGINE

BEFORE STARTING ENGINE

[1]	Preflight Inspection	--- COMPLETE
[2]	Seats, Seat Belts, Shoulder Harnesses	--- ADJUST and LOCK.
[3]	Fuel Selector Valve	--- BOTH
[4]	Avionics Power Switch, Autopilot, Electrical Equipment	--- OFF
[5]	Brake	--- TEST and SET
[6]	Circuit Breakers	--- CHECK IN

CAUTION:
The Avionics Power Switch must be OFF during engine start to prevent possible damage to avionics.

STARTING ENGINE

STARTING ENGINE

[1]	Mixture	--- RICH
[2]	Carburetor Heat	--- COLD
[3]	Master Switch	--- ON
[4]	Prime	--- AS REQUIRED
[5]	Throttle	--- OPEN 1/8 INCH
[6]	Propeller Area	--- CLEAR
[7]	Ignition Switch	--- START
[8]	Oil Pressure	--- CHECK
[9]	Flashing Beacon and Navigation Lights	--- ON as required
[10]	Avionics Power Switch	--- ON
[11]	Radios	--- ON

Prime 2 to 6 strokes; none if engine is warm

BEFORE TAKEOFF

BEFORE TAKEOFF

[1]	Parking Brake	--- SET
[2]	Cabin Doors and Windows	--- CLOSED and LOCKED
[3]	Flight Controls	--- FREE and CORRECT
[4]	Flight Instruments	--- SET
[5]	Fuel Selector Valve	--- BOTH
[6]	Mixture	--- RICH (below 3000 feet)
[7]	Elevator Trim and Rudder Trim	--- TAKEOFF
[8]	Throttle	--- 1700 RPM
	a. Magnetos	--- CHECK
	b. Carburetor Heat	--- CHECK (for RPM drop)
	c. Engine Instruments and Ammeter	--- CHECK
	d. Suction Gauge	--- CHECK
[9]	Throttle	--- 1000 RPM or LESS
[10]	Radios	--- SET
[11]	Autopilot (if installed)	--- OFF
[12]	Air Conditioner (if installed)	--- OFF
[13]	Strobe Lights	--- AS DESIRED
[14]	Brakes	--- RELEASE

RPM drop should not exceed 125 RPM on either magneto or 50 RPM difference between magnetos

TAKEOFF

NORMAL TAKEOFF

[1]	Wing Flaps	---	0° - 10°
[2]	Carburetor Heat	---	COLD
[3]	Throttle	---	FULL OPEN
[4]	Elevator Control	---	LIFT NOSE WHEEL (at 55 KIAS)
[5]	Climb Speed	---	70 - 80 KIAS

SHORT FIELD TAKEOFF

[1]	Wing Flaps	---	10°
[2]	Carburetor Heat	---	COLD
[3]	Brakes	---	APPLY
[4]	Throttle	---	FULL OPEN
[5]	Mixture	---	RICH (above 3000 feet LEAN for max RPM)
[6]	Brakes	---	RELEASE
[7]	Elevator Control	---	SLIGHTLY TAIL DOWN
[8]	Climb Speed	---	56 KIAS (until obstacles are cleared)

ENROUTE CLIMB

ENROUTE CLIMB

[1]	Airspeed	---	70 - 80 KIAS
[2]	Throttle	---	FULL OPEN
[3]	Mixture	---	RICH (above 3000 feet LEAN to obtain max RPM)

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

CRUISE

CRUISE

[1]	Power	---	2100 - 2700 RPM
[2]	Elevator and Rudder Trim (if installed)	---	ADJUST
[3]	Mixture	---	LEAN

(no more than 75% recommended)

DESCENT

DESCENT			
[1]	Fuel Selector Valve	---	BOTH
[2]	Mixture	---	ADJUST for smooth operation
[3]	Power	---	AS DESIRED
[4]	Carburetor Heat	---	FULL HEAT AS REQUIRED

BEFORE LANDING

BEFORE LANDING			
[1]	Seats, Seat Belts, Shoulder Harnesses	---	SECURE
[2]	Fuel Selector Valve	---	BOTH
[3]	Mixture	---	RICH
[4]	Carburetor Heat	---	ON
[5]	Autopilot	---	OF
[6]	Air Conditioner (if installed)	---	OFF

LANDING

NORMAL LANDING			
[1]	Airspeed	---	65 - 75 KIAS (flaps up)
[2]	Wing Flaps	---	AS DESIRED (0° - 10° below 110 KIAS, 10° - 30° below 85 KIAS)
[3]	Airspeed	---	60 - 70 KIAS (flaps DOWN)
[4]	Touchdown	---	MAIN WHEELS FIRST
[5]	Landing Roll	---	LOWER NOSE WHEEL GENTLY
[6]	Braking	---	MINIMUM REQUIRED

SHORT FIELD LANDING

[1]	Airspeed	---	65 - 75 KIAS (flaps UP)
[2]	Wing Flaps	---	FULL DOWN
[3]	Airspeed	---	61 KIAS (until flare)
[4]	Power	---	REDUCE to idle after clearing obstacles
[5]	Touchdown	---	MAIN WHEELS FIRST
[6]	Brakes	---	APPLY HEAVILY
[7]	Wing Flaps	---	RETRACT

BALKED LANDING

[1]	Throttle	---	FULL OPEN
[2]	Carburetor Heat	---	COLD
[3]	Wing Flaps	---	20° (immediately)
[4]	Climb Speed	---	55 KIAS
[5]	Wing Flaps	---	10° (until obstacles are cleared) RETRACT (after reaching a safe altitude and 60 KIAS)

AFTER LANDING

AFTER LANDING

[1]	Wing Flaps	---	UP
[2]	Carburetor Heat	---	COLD

SECURING AIRPLANE

SECURING AIRPLANE

[1]	Parking Brake	---	SET
[2]	Avionics Power Switch, Electrical Equipment, Autopilot	---	OFF
[3]	Mixture	---	IDLE CUT-OFF
[4]	Ignition Switch	---	OFF
[5]	Master Switch	---	OFF
[6]	Control Locks	---	INSTALL

SECTION 5
TABLE OF CONTENTS

EXAMPLE

Throughout this Section we will consider the following specifications an example to demonstrate usage of the performance charts.

TAKEOFF CONDITIONS	
Field length	3200 feet
Field pressure altitude	2000 feet
Temperature	30°C
CRUISE CONDITIONS	
Total distance	320 nm
Pressure Altitude	5500 feet
Temperature	20°C
Expected wind enroute	10 knot headwind
LANDING CONDITIONS	
Field length	3000 feet
Field pressure altitude	2000 feet
Temperature	25°C

TAKEOFF

The takeoff distance chart, figure 5-4 should be consultet, keeping in mind that 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, a weight of 2400 pounds, pressure altitude of 2000 feet and a temperature of 30°C should result in the following: •

Ground roll	1200 Feet
Total distance to clear a 50-foot obstacle	2220 Feet

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

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

This results in the following distances, corrected for wind:

Ground roll, zero wind	1200
Decrease in ground roll (1200 Feet × 13%)	156
Corrected Ground Roll	1044
Total distance to clear a 50-foot obstacle, zero wind	2220
Decrease in total distance (2220 Feet × 13%)	289
Corrected total distance to clear 50-foot obstacle	1931

CRUISE

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

The relationship between power and range is illustrated by the range profile chart. Considerable fuel savings and longer range result when lower power settings are used. For thze sample problem, a cruise power of approximately 65% will be used. The cruise performance chart, figure 5-7, is centered at 6000 feet altitude and 20°C above standard temperature. These values most nearly correspond to the planned altitude and expected temperature conditions. The engine speed chosen is 2500 RPM, which results in the following: •

Power	66%
True airspeed	112 knots
Cruise fuel flow	7.4 GPH

FUEL REQUIRED

The total fuel requirement for the flight may be estimated using the performance information in figzres 5-6 and 5-7. For the sample problem, figure 5-6 shows that a climb from 2000 feet to 6000 feet requires 1.6 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:

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

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

Fuel to climb, standard temperature	1.6
Increase due to non-standard temperature (1.6 × 16%)	0.3
Corrected fuel to climb	1.9 gal.

Using a similar procedure for the distance to climb results in 12 nautical miles. The resultant cruise distance is:

Total distance	320
Climb distance	-12
Cruise distance	308 nm

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

	112
	-10
	102 knots

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

$$\frac{308 \text{ nm}}{102 \text{ knots}} = 3.0 \text{ hours}$$

The fuel required for cruise is:

3.0 hours × 7.4 gallons/hour = 22.2 gallons

A 45-minute reserve requires:

$$\frac{45}{60} \times 7.4 \text{ gallons/hour} = 5.6 \text{ gallons}$$

The total estimated fuel required is as follows:

Engine start, taxi, takeoff	1.1
Climb	1.9
Cruise	22.2
Reserve	5.6
Total fuel required	30.8 gallons

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

LANDING

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

Ground roll	610	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

CONDITION:
Power required for level flight or maximum rated RPM dive.

NORMAL STATIC SOURCE

FLAPS UP												
KIAS	50	60	70	80	90	100	110	120	130	140	150	160
KCAS	56	62	70	79	89	98	107	117	126	135	145	154
FLAPS 10°												
KIAS	40	50	60	70	80	90	100	110	---	---	---	---
KCAS	49	55	62	70	79	89	98	108	---	---	---	---
FLAPS 30°												
KIAS	40	50	60	70	80	85	---	---	---	---	---	---
KCAS	47	53	61	70	80	84	---	---	---	---	---	---

HEATER/VENTS AND WINDOWS CLOSED

ALTERNATE STATIC SOURCE

FLAPS UP											
NORMAL KIAS	50	60	70	80	90	100	110	120	130	140	---
ALTERNATE KIAS	51	61	71	82	91	101	111	121	131	141	---
FLAPS 10°											
NORMAL KIAS	40	50	60	70	80	90	100	110	---	---	---
ALTERNATE KIAS	40	51	61	71	81	90	99	108	---	---	---
FLAPS 30°											
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---
ALTERNATE KIAS	48	50	60	70	79	83	---	---	---	---	---

HEATER/VENTS OPEN AND WINDOWS CLOSED

FLAPS UP											
NORMAL KIAS	40	50	60	70	80	90	100	110	120	130	140
ALTERNATE KIAS	36	48	59	70	80	89	99	108	118	128	139
FLAPS 10°											
NORMAL KIAS	40	50	60	70	80	90	100	110	---	---	---
ALTERNATE KIAS	38	49	59	69	79	88	97	106	---	---	---
FLAPS 30°											
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---
ALTERNATE KIAS	34	47	57	67	77	81	---	---	---	---	---

WINDOWS OPEN

FLAPS UP											
NORMAL KIAS	40	50	60	70	80	90	100	110	120	130	140
ALTERNATE KIAS	26	43	57	70	82	93	103	113	123	133	143
FLAPS 10°											
NORMAL KIAS	40	50	60	70	80	90	100	110	---	---	---
ALTERNATE KIAS	25	43	57	69	80	91	101	111	---	---	---
FLAPS 30°											
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---
ALTERNATE KIAS	25	41	54	67	78	84	---	---	---	---	---

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

STALL SPEEDS

CONDITIONS:
Power Off

NOTES:
1. Altitude loss during a stall recovery may be as much as 230 feet.
2. KIAS values are appoximate.

MOST REARWARD CENTER OF GRAVITY

WEIGHT LBS	FLAP DEFLECTION	ANGLE OF BANK							
		0°		30°		45°		60°	
		KIAS	KCAS	KIAS	KCAS	KIAS	KCAS	KIAS	KCAS
2400	UP	44	51	47	55	52	61	62	72
	10°	35	48	38	52	42	57	49	68
	30°	33	46	35	49	39	55	47	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
2400	UP	44	52	47	56	52	62	62	74
	10°	37	49	40	53	44	58	52	69
	30°	33	46	35	49	39	55	47	65

Figure 5-3 Stall Speeds

TAKEOFF DISTANCE

CONDITIONS:
FLAPS 10°
Full Throttle Prior to Brake Release
Pavel, Level, Dry Runway
Zero Wind
Maximum Weight 2400 lbs

NOTES:
1. Short field technique as specified in Section 4.
2. Prior to takeoff from fields above 3000 feet elevation, the mixture should be leaned to give maximum RPM in a full throttle, static runup.
3. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
4. For operation on a dry, grass runway, increase distances by 15% of the „ground roll“ figure.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS
2400	51	56	S.L	795	1460	860	1570	925	1685	995	1810	1065	1945
			1000	875	1605	940	1725	1015	1860	1090	2000	1170	2155
			2000	960	1770	1035	1910	1115	2030	1200	2220	1290	2395
			3000	1055	1960	1140	2120	1230	2295	1325	2480	1425	2685
			4000	1165	2185	1260	2365	1355	2570	1465	2790	1575	3030
			5000	1285	2445	1390	2660	1500	2895	1620	3160	1745	3455
			6000	1425	1755	1540	3015	1665	3300	1800	3620	1940	3990
			7000	1580	3140	1710	3450	1850	3805	2000	4220	- - - -	- - - -
			8000	1755	3615	1905	4015	2060	4480	- - - -	- - - -	- - - -	- - - -
2200	49	54	S.L	650	1195	700	1280	750	1375	805	1470	865	1575
			1000	710	1310	765	1405	825	1510	885	1615	950	1735
			2000	780	1440	840	1545	905	1660	975	1785	1045	1915
			3000	855	1585	925	1705	995	1835	1070	1975	1150	2130
			4000	945	1750	1020	1890	1100	2040	1180	2200	1270	2375
			5000	1040	1945	1125	2105	1210	2275	1305	2465	1405	2665
			6000	1150	2170	1240	2355	1340	2555	1445	2775	1555	3020
			7000	1270	2440	1375	1655	1485	2890	1605	3155	1730	3450
			8000	1410	2760	1525	3016	1650	3305	1785	3630	1925	4005
2000	46	51	S.L	525	970	565	1035	605	1110	650	1185	695	1265
			1000	570	1080	615	1135	665	1215	710	1295	765	1385
			2000	625	1160	675	1240	725	1330	780	1425	840	1525
			3000	690	1270	740	1365	800	1465	860	1570	920	1685
			4000	755	1400	815	1500	880	1615	945	1735	1015	1865
			5000	830	1545	900	1660	970	1790	1040	1925	1120	2070
			6000	920	1710	990	1845	1070	1990	1150	2145	1235	2315
			7000	1015	1900	1095	2055	1180	2225	1275	2405	1370	2605
			8000	1125	2125	1215	2305	1310	2500	1410	2715	1520	2950

Figure 5-4. Takeoff Distance

MAXIMUM RATE OF CLIMB

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°	0°	20°	40°
2400	S.L.	76	805	745	685	625
	2000	75	695	640	580	525
	4000	74	590	535	480	420
	6000	73	485	430	375	320
	8000	72	380	330	275	220
	10000	71	275	225	175	- - -
	12000	70	175	125	- - -	- - -

CONDITIONS:
Flaps Up
Full Throttle

NOTE:
Mixture leaned above 3000 feet for maximum RPM:

Figure 5-5. Maximum Rate of Climb

TIME, FUEL AND DIATNCE TO CLIMB

MAXIMUM RATE OF CLIMB

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2400	S.L.	15	76	700	0	0.0	0
	1000	13	76	655	1	0.3	2
	2000	11	75	610	3	0.6	4
	3000	9	75	560	5	1.0	6
	4000	7	74	515	7	1.4	9
	5000	5	74	470	9	1.7	11
	6000	3	73	425	11	2.2	14
	7000	1	72	375	14	2.6	18
	8000	-1	72	330	17	3.1	22
	9000	-3	71	285	20	3.6	26
	10000	-5	71	240	24	4.2	32
	11000	-7	70	190	29	4.9	38
	12000	-9	70	145	35	5.8	47

CONDITIONS:
Flaps Up
Full Throttle
Standard Temperature

NOTES:
1. Add 1.1 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for maximum RPM.
3. Increase time, fuel and distance by 10% for each 10°C above standard temp.
4. Distances shown are based on zero wind.

Figure 5-6. Time, Fuel, and Distance to Climb

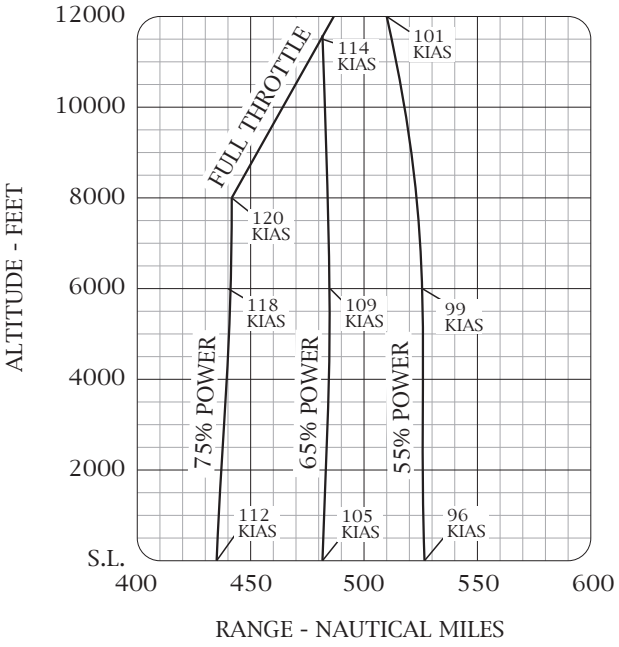
CRUISE PERFORMANCE

CONDITIONS:
2400 Pounds

PRESS ALT FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2500	- - -	- - -	- - -	76	114	8.5	72	114	8.1
	2400	72	110	8.1	69	109	7.7	65	108	7.3
	2300	65	104	7.3	62	103	6.9	59	102	6.6
	2200	58	99	6.6	55	97	6.3	53	96	6.1
	2100	52	92	6.0	50	91	5.8	48	89	5.7
4000	2550	- - -	- - -	- - -	76	117	8.5	72	116	8.1
	2500	72	115	8.6	73	114	8.1	69	113	7.7
	2400	69	109	7.8	65	108	7.3	62	107	7.0
	2300	62	104	7.0	59	102	6.6	57	101	6.4
	2200	56	98	6.3	54	96	6.1	51	94	5.9
	2100	51	91	5.8	48	89	5.7	47	88	5.5
6000	2600	- - -	- - -	- - -	77	119	8.6	72	118	8.1
	2500	73	114	8.2	69	113	7.8	66	112	7.4
	2400	66	108	7.4	63	107	7.0	60	106	6.7
	2300	60	103	6.7	57	101	6.4	55	99	6.2
	2200	54	96	6.1	52	95	5.9	50	92	5.8
	2100	49	90	5.7	47	88	5.5	46	86	5.5
8000	2650	- - -	- - -	- - -	77	121	8.6	73	120	8.1
	2600	77	119	8.7	73	118	8.2	69	117	7.8
	2500	70	113	7.8	66	112	7.4	63	111	7.1
	2400	63	106	7.1	60	106	6.7	58	104	6.5
	2300	57	101	6.4	55	100	6.2	53	97	6.0
	2200	52	95	6.0	50	93	5.8	49	91	5.7
10000	2600	74	118	8.3	70	117	7.8	66	115	7.4
	2500	67	112	7.5	64	111	7.1	61	109	6.8
	2400	61	106	6.8	58	105	6.5	56	102	6.3
	2300	55	100	6.3	53	98	6.0	51	96	5.9
	2200	50	93	5.8	49	91	5.7	47	89	5.6
12000	2550	67	114	7.5	64	112	7.1	61	111	6.9
	250	64	111	7.2	61	109	6.8	59	107	6.6
	2400	59	105	6.6	56	103	6.3	54	100	6.1
	2300	53	98	6.1	51	96	5.9	50	94	5.8

Figure 5-7. Cruise Performance

RANGE PROFILE

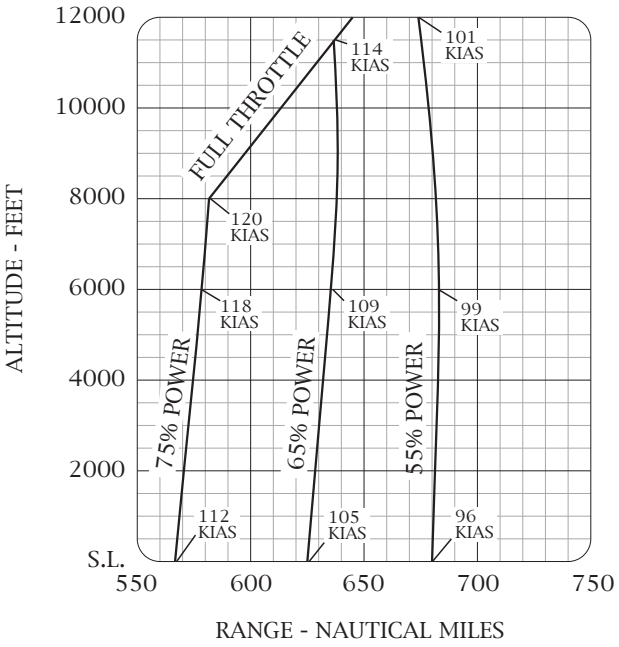


45 MINUTE RESERVE
40 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

Note:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the
distance during climb

RANGE PROFILE

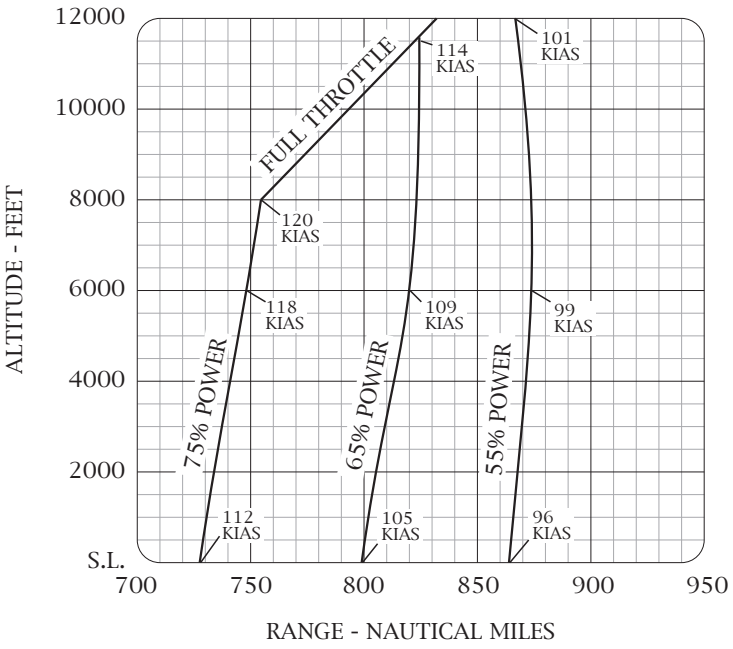


45 MINUTE RESERVE
50 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

Note:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the
distance during climb

RANGE PROFILE

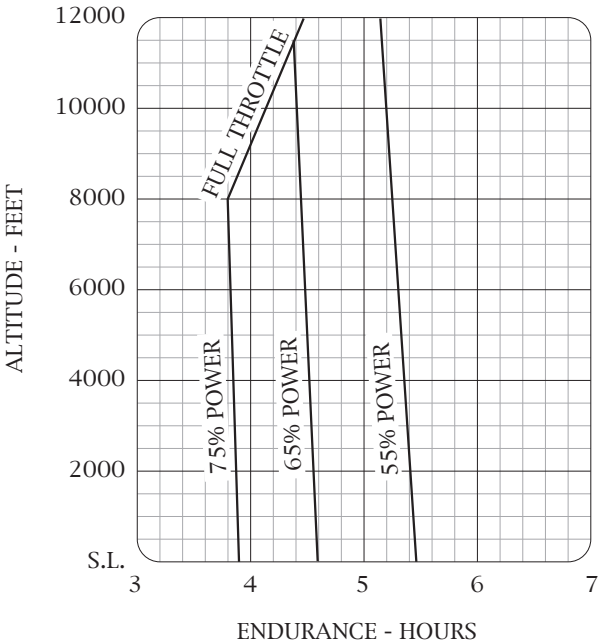


45 MINUTE RESERVE
62 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature
Zero Wind

Note:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the
distance during climb

ENDURANCE PROFILE

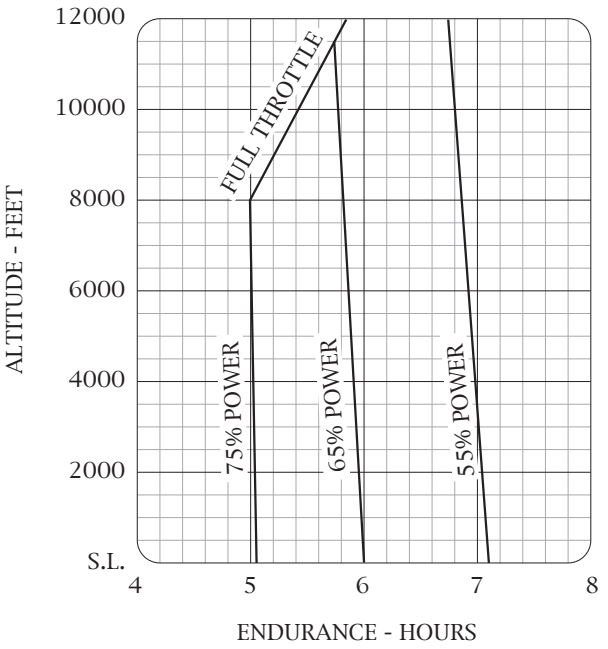


45 MINUTE RESERVE
40 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

Note:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the
distance during climb

ENDURANCE PROFILE

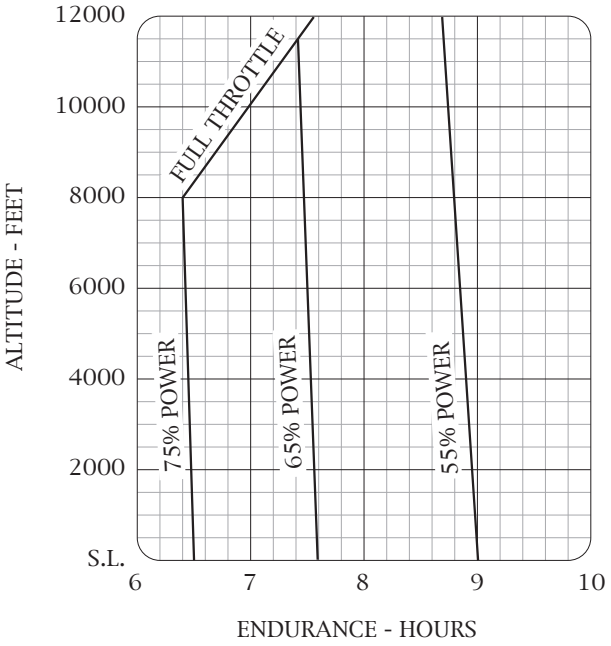


45 MINUTE RESERVE
50 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

Note:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the
distance during climb

ENDURANCE PROFILE



45 MINUTE RESERVE
62 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

Note:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the
distance during climb

LANDING DISTANCE

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

NOTES:
1. Short field technique as specified in Section 4.
2. Decrease distances 10% for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10% for each 2 knots.
4. For operation on a dry, grass runway, increase distances by 15% 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 CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS	GRND ROLL	TOTAL TO CLR 50 FT OBS
2400	61	S.L	510	1235	530	1265	550	1295	570	1325	585	1350
		1000	530	1265	550	1295	570	1325	590	1360	610	1390
		2000	550	1295	570	1330	590	1360	610	1390	630	1425
		3000	570	1330	590	1360	615	1395	635	1430	655	1460
		4000	595	1365	615	1400	635	1430	660	1470	680	1500
		5000	615	1400	640	1435	660	1470	685	1510	705	1540
		6000	640	1435	660	1470	685	1510	710	1550	730	1580
		7000	665	1475	690	1515	710	1550	735	1590	760	1630
		8000	690	1515	715	1555	740	1595	765	1635	790	1675

Figure 5-10. Landing Distance

SECTION 6
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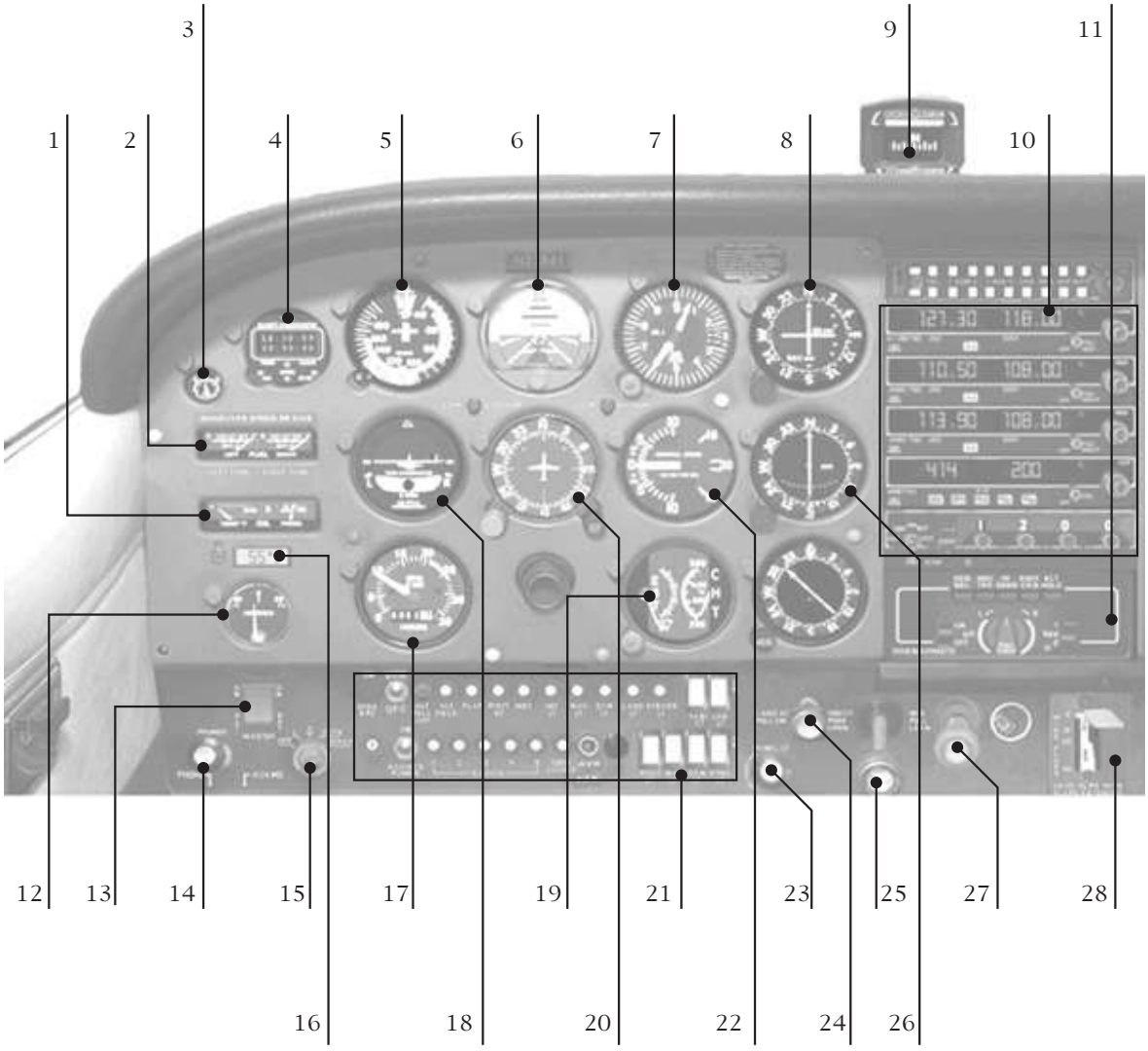
INSTRUMENT PANEL



1. Oil Temperature/Oil Pressure
2. Fuel Quantity Indicators
3. Suction gage
4. Clock/Timer
5. Air Spee Indicator
6. Attitude Indicator
7. Altimeter
8. Course Deviation Indicator
9. Magnetic Compass
10. COM/NAV Radios
11. Autopilot
12. Ammeter
13. Master Switch
14. Primer
15. Ignition Switch
16. Thermometer
17. Tachometer
18. Turn Coordinator
19. RGT / CHT
20. Heading Indicator
21. Circuit Breakers/Light Switches
22. Vertical Speed Indicator
23. Instrument Lighting Dimmer
24. Carburetor Heat
25. Throttle Control
26. Course Deviation Indicator
27. Mixture Control
28. Wing Flap Switch

ENGINE OIL SYSTEM

Oil for the engine lubrication is supplied from a sump at the bottom of the engine. The capacity of the enfine sump is seven quarts (one additional quart is contained in the full flow oil filter. Oil is drawn from the sump through an oil suction strainer screen into the engine-driven oil pump. From the pump oil is routed to a bypass valve. If the oil is cold, the bypass valve allows the oil to bypass the oil cooler and go directly from the pump to the full flow oil filter. If the oil is hot, the bypass valve routes the oil out of the accessory housing and into a flexible hose leading to the oil cooler on the right rear engine baffle. Pressure oil from the cooler returns to the accessory housing where it passes through the full flow oil filter. The filter oil then enters a pressure relief valve which regulates engine oil pressure by allowing excessive oil to return to the sump while the balance of the oil is circulated to various engine parts for lubrication. Residual oil is returned to sump by gravity flow.

An oil filter cap/oil dipstick is located at the right rear of the engine. The filler cap/dipstick is accesible through an access door on the top right side of the engine cownling. The engine should not be operated on less that five quarts of oil. For extended flight fill to seven quarts (dipstick indication only). •

IGNITION–STARTER SYSTEM

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

Ignition and starter operation is controlled by a rotary type switch located on the left switch and control panel. The switch is labelled clockwise: OFF, R, L, BOTH and START. The engine should be operated on BOTH magnetos except for magnetochecks. The R and L position are for checking purposes and emergency use only. When the switch is rotated to the spring-loaded START-position, the starter contactor is energized and the starter will crank the engine. When the switch is released, it will automatically return to the BOTH-position. •

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through an intake in the lower front portion of the engine cowling. The intake is covered by an air-filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox. After passing through the airbox, induction air enters the inlet in the carburetor which is under the engine, and is then ducted to the engine cylinders through intake manifold tubes. In the event carburetor ice is encountered or the intake filter becomes blocked, alternate heated air can beobtained from a shroud around an exhaust riser through a duct to a valve in the airbox operated by the carburetor heat control on the instrument panel. Heated air from the shroud is obtained from an unfiltered outside source. Use of full carburetor heat at full throttle will result in a loss of approximately 75 to 150 RPM. •

CARBURETOR AND PRIMING SYSTEM

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

For easy starting in cool weather, the engine is equipped with a manual primer. The primer is actually a small pump which draws fuel from the fuel strainer when the plunger is pulled out, and injects it into the cylinder intake ports when the plunger is pushed back in. •

COOLING SYSTEM

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

PROPELLER

The airplane is equipped with a two-bladed, fixed-pitch, one-piece forged aluminium alloy propeller wich is anodized to retard corrosion. The propeller is 75 inches in diameter. •

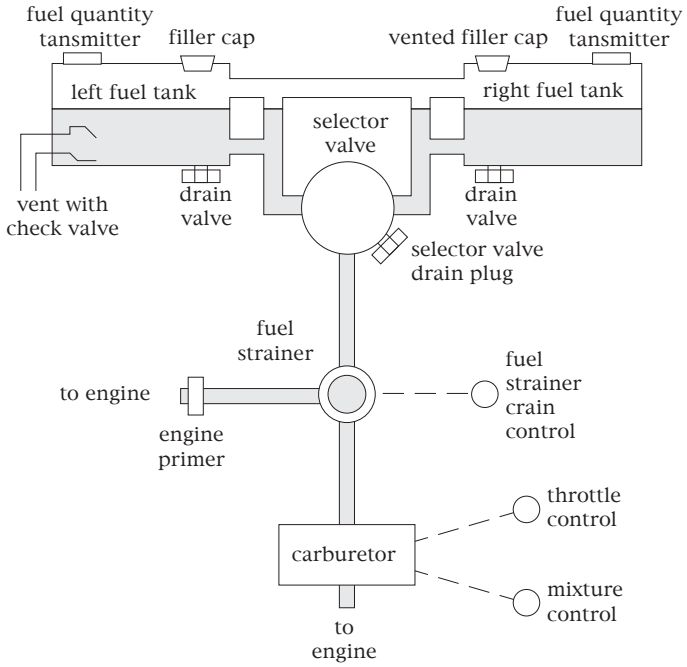
FUEL SYSTEM

The airplane may be equipped with a standard fuel system or either of two long range systems. Each system consists of two vented fuel tanks (one tank each wing), a four-position selector valve, fuel strainer, manual primer, and carburetor. The 68-gallon long-range system utilizes integral tanks and the other two systems employ removable aluminium tanks. Fuel flows by gravity from the two wing tanks to a four-position selector valve labelled BOTH, LEFT, RIGHT and OFF. With the selector valve in either the BOTH, LEFT or RIGHT position, fuel flows through a strainer to the carburetor. From the carburetor, mixed fuel and air flows to the cylinders through intake manifold tubes. The manual primer draws its fue from the fuel strainer and injects it into the cylinder intake ports. Fuel system venting is essential to system operation. Blockage of the system will result in decreasing fuel flow and eventual engine stoppage. Venting is accomlished by an interconnecting line from the right fuel tank to the left fuel tank. The left fuel tank is vented overboard through a vent line, equipped with a check valve, which protrudes from the bottom surface of the left wing near the wing strut. The right fuel tank filler cap is also vented.

When long range integral tanks are installed, the airplane may be serviced to a reduced capacity to permit heavier cabin loadings. This is accomplished by filling each tank to the bottom edge of the fuel filler collar, thus giving a reduced fuelload of 24 gallons in each tank.

Fuel Quantity is measured by two float-type fuel quantity transmitters and indicated by two elictrically-operated fuel quantity

FUEL TANKS	FUEL LEVEL	TOTAL FUEL	TOTAL UNUSABLE	TOTAL USABLE
STANDARD	FULL	43	3	40
LONG RANGE	FULL	54	4	50
LONG RANGE (INTEGRAL)	FULL	68	6	62



indicators on the left side of the instrument panel. An empty tank is indicated by a red line and the letter E. When an indicator shows an empty tank, approximately 1.5 gallons remain in a standard tank, and 2 gallons remain in a long range tank (3 gallons when long range integral tanks are installes) as unusable fuel. The indicators cannot be relied upon for accurate readings during skids, slips, or unusual attitudes. The fuel selector valve should be in BOTH position for takeoff, climb, landing and maneuvers that involve prolonged slips or skids. Operation from either LEFT or RIGHT tank is reserved for cruising flight.

NOTE1:
When the fuel selector valve handle is in the BOTH position in cruising flight, unequal fuel flow from each tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the heavy wing.

NOTE2:
When the fuel tanks are 1/4 full or less, prolonged uncoordinated flight such as slips or skids can cover the fuel tank outlets. Therefor, if operating with one fuel tank dry or if operating on LEFT or RIGHT tank when 1/4 full or less, do not allow the airplane to remain in uncoordinated flight for periods in excess of 30 seconds.

NOTE3:
It is not practical to measure the time required to consume all of the fuel in one tank, and, after switching to the opposite tank, expect an equal duration from the remaining fuel. The airspace in both fuel tanks is interconnected by a vent line and, therefor, some sloshing of fuel between tanks can be expected when the tanks are nearly full and the wings are not level.

The fuel system is equipped with drain valves to provide a means for the examination of fuel in the system foe contamination and grade. The system should be examined before the first flight of every day and after each refueling, by using the sampler cup provided to drain fuel from the wing tank sumps, and by utilizing the fuel strainer drain under an access door on the aft right side of the top engine cowling. If takeoff weight limitations for the next flight permit, the fuel tanks shoul be filled after each flight to prevent condensation.

•

BRAKE SYSTEM

The airplane has a singe -disc, hydraulically-actuated brake on ech main landing gear wheel. Each brake is connected, by a hydraulic line, to a master cylinder attached to each of the pilot‘s rudder pedals. The brakes are operated by applying pressure to the top of either the left (pilot‘s) or right (copilot‘s) set of rudder pedals, which are interconnected. When the airplane is parked, both main wheel brakes may be set by utilizing the parking brake which is operated by a handle under the left side of the instrument panel. To apply the parking brake, set the brakes with the rudder pedals, pull the handle aft, and rotate it 90° down. For maximum brake life, keep the brake system properly maintained, and minimize brake usage during taxi operations and landings.
Some of the symtoms of impending brake failure are: gradual decrease in braking action after brake application, noisy or dragging brakes, soft or spongy pedals, and excessive travel and weak braking action. If any of these symptoms appear, the brake system is in need of immediate attention. If, during taxi or landing roll, braking action decreases, let up on the pedals and then re-apply the brakes with heavy pressure. If the brakes become spongy or pedal travel increases, pumping the pedals should build braking pressure. If one brake becomes weak or fails, use the other brake sparingly while using opposite rudder, as required, to offset the good brake.

•

ELECTRICAL SYSTEM

The airplane is equipped with a 28-volt, direct-current, electrical system. The system is powered by a belt-driven, 60-amp alternator and a 24-volt battery, located on the left forward side of the firewall. Power is supplied to most general electrical and all avionics circuits through the primary bus bar and the avionics bus bar, which is interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on.

CAUTION:
Prior to turning the master switch on or off, starting the engine or applying an external power

source, the avionics power switch, labeled AVIONICS POWER, should be turned off to prevent any harmful transient voltage from damaging the avionics equipment.

MASTER SWITCH

The master switch is a split rocker-type switch labeled MASTER, and is ON in the up position. The right half of the switch labeled BAT controls all the electrical power to the airplane. The left half, labeled ALT controls the alternator. Normally, both sides of the master switch should be used simultaneously; however, the BAT side of the switch could be turned on seperately to check equipment while on the ground. To check or use avionics equipment or radios while on the ground, the avionics power switch must also be turned on. The ALT side of the switch, when placed in the OFF position, removes the alternator from the electrical system. While this switch in the OFF position, the entire electrical load is placed on the battery. Continued operation with the alternator switch in the OFF position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AVIONICS POWER SWITCH

Electrical power from the airplane primary bus to the avionics bus is controlled by a toggle switch/circuit braker labeled AVIONICS POWER. The switch is located on the left side of the switch and control panel and is ON in the up position. With the switch in the OFF position, no electrical power will be applied to the avionics equipment, regardless of the position of the master switch or the individual equipment switches. The avionics power switch also functions as a circuit breaker. If an electrical malfunction should occur and cause the circuit braker to open, electrical power to the avionics equipment will be interrupted and the switch will automatically move to OFF position. If this occurs, allow the circuit breaker to cool for about two minutes before placing the switch in the ON position again. If the circuit breaker opens again, do not reset it. The avionics power switch should be placed in the OFF position prior to turning the master switch ON or OFF, starting the engine, or applying an external power sourve, and may be utilized in place of the individual avionics equipment switches.

AMMETER

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

ALTERNATOR CONTROL UNIT AND LOW-VOLTAGE WARNING LIGHT

The airplane is equipped with a combination alternator regular high-low voltage control unit mounted on the engine side of the firewall and a red warning light , labeled LOW VOLTAGE, on the left side of the instrument panel below the ammeter. In the event an over-voltage condition occurs, the alternator control unit automatically removes alternator field current which shuts down the alternator. The battery will then supply system current as shown by a discharge rate on the ammeter. Under these conditions, depending on electrical system load, the low-voltage warning light will illuminate when system voltage drops below normal. The alternator control unit may be reset by turning the master switch off and back on again. If the warning light does not illuminate again, a malfunction has occured, and the flight should be terminated as soon as practical.

CIRCUIT BREAKERS AND FUSES

Most of the elecrical circuits in the airplane are protected by „push-to-reset“ type circuit breakers mounted on the left side of the switch and control panel. However, circuit breakers protecting the alternator output and the strobe light/avionics cooling fan circuits are the „pull-off“ type. In addition to the individual circuit breakers, a toggle switch/circuit breaker, labeled AVIONICS POWER, on the left side of the switch and control panel, also protects the avionics system. The control wheel map light (if installed) is protected by the NAV LT circuit breaker and a fuse behind the instrument panel. Electrical circuits which are not protected by circuit breakers are the battery contactor closing (external power) circuit, clock circuit, and flight hour recorder circuit. These circuits are protected by fuses mounted adjacent to the battery. •

LIGHTING

Conventional navigation lights are located on the wing tips and top of the rudder. A single landing light is located in the cowl nose cap. Dual landing/taxi lights are available and also located in the cowl nose cap. Additional lighting is available and includes a flashing beacon mounted on top of the vertical fin, a strobe light on each wing tip, and a courtesy light recessed into the lower surface of each wing slightly outboard of the cabin doors.

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

STALL WARNING SYSTEM

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

AVIONICS SUPPORT EQUIPMENT

If the airplane is equipped with avionics, various avionics support equipment may also be installed. Equipment available includes an avionics cooling fan, microphone-headset installations and control surface dischargers. •

STATIC DISCHARGERS

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

PITOT STATIC SYSTEM AND INSTRUMENTS

The pitot-static system supplies ram air pressure to the airspeed indicator and static pressure to the air speed indicator, vertical speed indicator and altimeter. The system is composed of either an unheated or heated pitot tube mounted on the lower surface of the left wing, an external static port on the lower left side of the forward fuselage, and the associated plumbing necessary to connect the instruments to the sources. The heated pitot system (if installed) consists of a heating element in the pitot tube, a rocker switch labeld PITOT HT, a 5-amp circuit breaker, and associated wiring.

A static pressure alternate source valve may be installed on the switch and control panel below the throttle, and can be used if the external static pressure source is malfunctioning.

AIRSPEED INDICATOR

The airspeed indicator is calibrated in knots. Limitation and range markings include the white arc, green arc, yellow arc and a red line.

VERTICAL SPEED INDICATOR

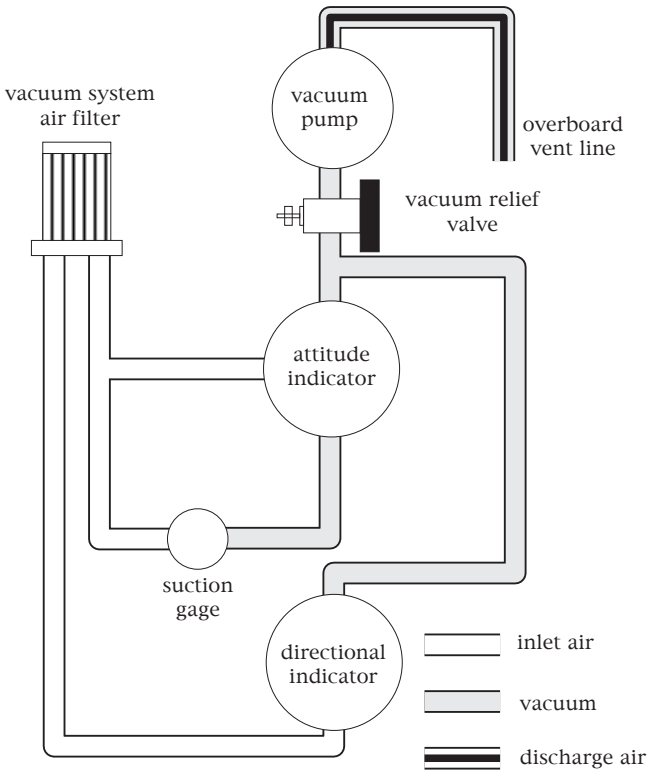
The vertical speed indicator depicts airplane rate of climb and descent in feet per minute. The pointer is actuated by atmospheric pressure changes resulting from changes of altitude as supplied by static source.

ALTIMETER

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

VACUUM SYSTEM AND INSTRUMENTS

An engine-driven vacuum system provides the suction necessary to operate the attitude indicator and directional indicator. The system consistes of a vacuum pump mounted on the engine, a vacuum relief valve and vacuum system airfilter on the left side of the firewall below the instrument panel, and instruments on the left side of the instrument panel.



ATTITUDE INDICATOR

The attitude indicator gives a visual indication of flight attitude. Bank attitude is presented by a pointer at the top of the indicator relative to the bank scale which has index marks at 10°, 20°, 30°, 60° and 90° either side of the center mark. Pitch and roll attitudes are presented by a miniature airplane superimposed over a symbolic horizon area divided into two sections by a white horizon bar.

DIRECTIONAL INDICATOR

A directional indicator displays airplane heading on a compass card in relation to a fixed simulated airplane image and index. The indicator will precess slightly over a period of time. Therefor the compass card should be set in accordance with the magnetic compass just prior to takeoff, and occasionally re-adjusted on extended flights.

SUCTION GAGE

The suction gage is calibrated in inches mercury and indicates suction available for operation of the attitude and directional indicators. •

SUPPLEMENT
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DIGITAL CLOCK/TIMER

The Astro Tech LC-2 Quartz Chronometer is a precision, solid state time keeping device which will display to the pilot the time-of-day, the calendar date, and the elapsed time interval between a series of selected events, such as in-flight check points or legs of a cross-country flight, etc. These three modes of operation fuction independently and can be alternately selected for viewing in the liquid crystal display (LCD) on the front face of the instrument. Four push button type switches directly below the display control all time keeping functions.
The digital display features an internal light to ensure good visibility under low cabin lighting conditions or at night.

Buttons:
ST/SP
Starts and Stops the Stopwatch

RST
Resets the Stopwatch

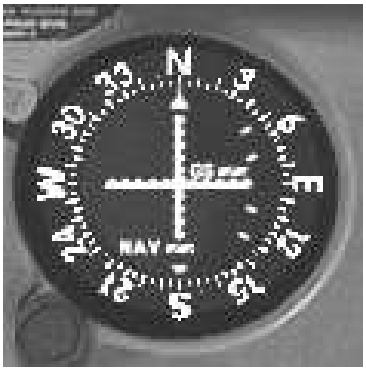
Lower MODE
Toggles between Stopwatch / Simulation Speed / Zoom Factor

Upper Mode
Switches between Local Time and Zulu Time (indicated by a yellow spot)

CESSNA 400 GLIDE SLOPE

The Cessna 400 Glide Slope is an airborne navigation receiver which receives and interprets glide slope signals from a ground-based Instrument Landing System (ILS). It is used with the localizer function of a VHF navigation system when making instrument approaches to an airport. The glide slope provides vertical path guidance while the localizer provides horizontal track guidance.

The Cessna 400 Glide Slope system consists of a remote-mounted receiver coupled to an existing navigation system, a panel-mounted indicator and an externally mounted antenna. Operation of the Cessna 400 Glide Slope system is controlled by the associated navigation system.



TO RECEIVE GLIDE SLOPE SIGNALS

[1]	NAV Frequency Select Knob	--- Select desired localizer

AUTOPILOT

GENERAL INFORMATION

The installed autopilot is a single-axis (aileron control) autopilot with an additional altitude hold and glide slope hold function. Roll and yaw motions of the airplane are sensed by the turn coordinator gyro. Deviation from the selected heading are sensed by the directional gyro. The computer-amplifier electronically computes the necessary correction and signals the actuator to move the ailerons to maintain the airplane in the commanded lateral attitude or heading.

BUTTONS

ON/OFF
The autopilot can be activated via the on/off switch located to the left of the large center knob. The switch will turn to the off-position when the battery is switched off.

HDG SEL
By engaging this button the airplane will turn to and maintain the heading selected via the bug on the directional indicator.

NAV TRK
By engaging this button the airplane will hold a radial selected on NAV1. It is possible to engage both HDG SEL and NAV TRK simultanously. HDG SEL is given priority until a VOR radial is intercepted, at which point the HDG SEL button will disengage and the aircraft will turn to and track the radial. This mode is generally unavailable if an active frequency is not selected.

HI SENS
By depressing this button the aircraft will track a localizer frontcourse and also the glide slope.

BCK CRS
This mode permits tracking of the back course localizer. generally unavailable if an active frequency is not selected.

CENTER BANK KNOB
The center knob provides variable aileron control to execute a standard rate turn. In the default state, the knob is off (pushed in). Clicking on the center of the knob will pull it in the on position, engaging the wing leveler. With the knob pulled out moving it into the right position the aircraft will enter a standard rate turn to the right. Moving it into the left position the aircraft will enter a standard rate turn to the left. Re-centering the knob from either the left or right position will re-engage the wing leveler.

AUTOPILOT PROCEDURES

BEFORE TAKE-OFF AND LANDING

[1]	A/P on/off switch	--- OFF

INFLIGHT WINGS LEVELING

[1]	Rudder Trim	--- ADJUST for zero slip
[2]	A/P turn knob	--- CENTER and PULL out
[3]	A/P on/off switch	--- ON

NAV INTERCEPT (VOR/LOC)

[1]	A/P turn knob	---	CENTER and PULL
[2]	NAV Receiver OBS	---	SET desired course
[3]	Heading Selector	---	ROTATE bug to selected course
[4]	Directional Gyro	---	SET for magnetic heading
[5]	HI SENS button	---	PUSH for localizer intercepts
[6]	BCK CRS button	---	PUSH ONLY if intercepting front course outbound or back course inbound
[7]	A/P turn knob	---	PUSH

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

NOTE:
Airplane will automatically turn to a 45° intercept angle.

NAV TRACKING (VOR/LOC)

[1]	NAV TRK button	---	PUSH when CDI centers and airplane heading is within 10° of course heading
[2]	HI SENS button	---	Disengage for enroute omni tracking

HEADING SELECT

[1]	Directional Gyro	---	SET to magnetic heading
[2]	Heading Selector	---	ROTATE bug to desired heading
[3]	HD SEL Button	---	PUSH