

FLIGHT MANUAL PH-SKC



This document is for training purposes only.
Operational data must be obtained from the original manual.

TABLE OF CONTENTS

DGAC Approved Cover Page	0-1
Table of Contents	0-2 and 0-3
List of Revised Pages	0-4
SECTION 1 - GENERAL	
Documents Available	1-1
Principal Dimensions	1-2
Description and Characteristic Dimensions	1-3 thru 1-5
Instrument Panel	1-6 and 1-7
Fuel System	1-8 and 1-9
Electrical System	1-10 thru 1-15
Wing Flap System	1-15
Cabin Heating and Ventilating System	1-16
SECTION 2 - LIMITATIONS	
Certification Basis	2-1
Indicated Airspeed Limitations	2-1 and 2-2
Approved Maneuvers	2-3
Engine Operation Limitations and Instrument Markings	2-3 and 2-4
Placards	2-5 thru 2-7
SECTION 3 - EMERGENCY PROCEDURES	
Engine Failure	3-1 and 3-2
Fires	3-2 thru 3-4
Electrical Power Supply System Malfunctions	3-4
Flight In Icing Conditions	3-4 and 3-5
Inadvertent Spin	3-5
Recovery From A Spiral Dive	3-5
Landing Without Pitch Control	3-6
Forced Landings	3-6 and 3-7
Ditching	3-7 and 3-8

SECTION 4 - NORMAL PROCEDURES

Loading Graph and Center of Gravity Moment Envelope	4-2 thru 4-6
Exterior Inspection	4-7 thru 4-9
Before Flight and In-Flight Checks	4-10 thru 4-14
Operating Details	4-15 thru 4-23
Rough Engine Operation or Loss of Power	4-23 and 4-24
Specific Operation	4-25 thru 4-27



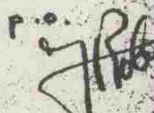
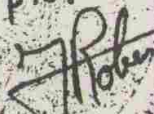
SECTION 5 - PERFORMANCE

Notification	5-1
Demonstrated Crosswind	5-1
Airspeed Correction Table	5-2
Stall Indicated Airspeeds	5-3
Performance and Specifications	5-4 and 5-5
Takeoff Distance	5-6 thru 5-8
Maximum Rate of Climb	5-9 and 5-10
Cruise Performance	5-12 and 5-13
Range and Endurance Profile	5-14 thru 5-17
Landing Distance	5-18
Maximum Glide	5-19

SECTION 6 - APPENDIX

Servicing	6-0.1 thru 6-0.4
Maintenance	6-0.5 thru 6-0.7
Optional Systems	6-1.0 and on

LIST OF REVISED PAGES

Edition N°	Revised Pages	Nature of Change	Approval	
			Date	Visa
1		Original Document	27.10.76	P.O. 
2	0-4, 6-1.0(cont'd) 6-16.1 thru 6-16.36	Insertion of the floatplane option	11.05.77	P.O. 
3	0-2 thru 0-4 1-1, 1-4, 1-6. 1-7, 1-10 thru 1-16 2-1, 2-2, 2-6 3-1 thru 3-8 4-1, 4-6, 4-8 4-10 thru 4-27 5-4 and 5-5 6-2.1, 6-7.2 and 6-7.3	1978 Model beginning with Serial Number 1640.	08.09.77	P.O. 

SECTION 1

GENERAL

NOTIFICATION

This manual contains the instructions for use, and the list of Servicing and periodic inspections, as well as the performance data of the Model REIMS/CESSNA F172N.

DOCUMENTS AVAILABLE

The following is a check list of the data, information and licenses that are part of the aircraft file and required by Regulations. They should be made available at all times to relevant Authority.

- (1) Airworthiness Certificate.
- (2) Registration Certificate.
- (3) Radio Installation License (if radio installed).
- (4) Log Books.
- (5) Flight Manual.

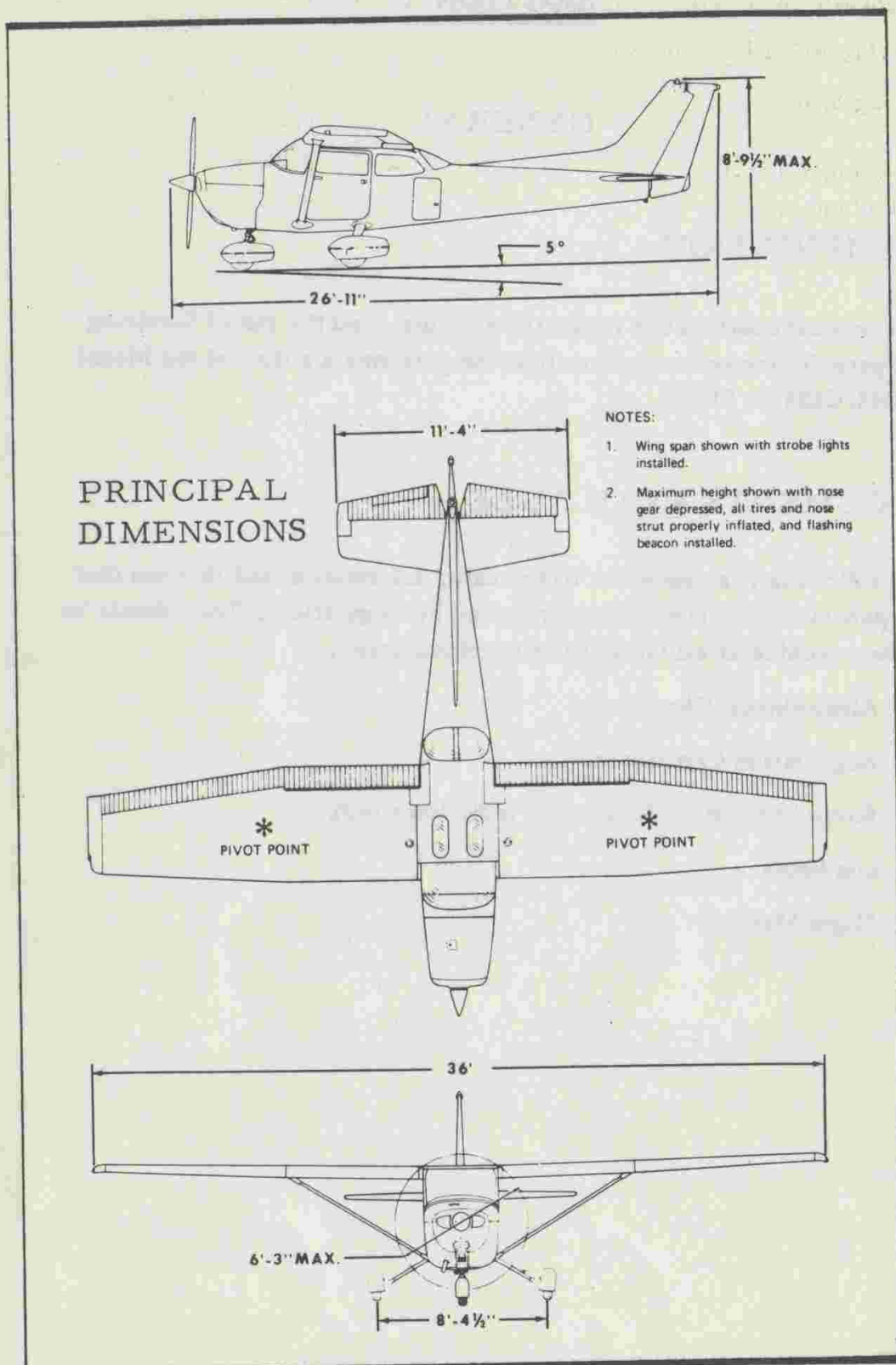


Figure 1-1

DESCRIPTION AND CHARACTERISTIC DIMENSIONS

OVER-ALL DIMENSIONS

Wing Span	10.97 m With Optional Strobe Lights
Maximum Length	8.22 m
Maximum Height	2.68 m With Flashing Beacon and Nose Strut Depressed

WING

Airfoil Type	NACA2412 (Modified)
Wing Area	16.16 m ²
Dihedral Angle	+ 1°37' (at 25 % chord)
Angle of Incidence,	+ 0°47'
Wing Root	- 2°50'
Wing Tip	

AILERONS *

Area	1.66 m ²
Control Travel,	Up 20° ± 1°
Down	15° ± 1°

WING FLAPS

Method of Actuation	Electric/Cable
Area	1.97 m ²
Control Travel	0° to 40° + 0° - 2°

HORIZONTAL STABILIZER AND ELEVATOR *

Stabilizer Area	2.00 m ²
Angle of Incidence	- 3°30'

* Cable control systems

Elevator Area		1,35 m ² (including tab)
Control Travel,	Up	28° + 1° - 0°
	Down	23° + 1° - 0°

ELEVATOR TRIM TAB

Control Travel,	Up	28° + 1° - 0°
	Down	13° + 1° - 0°

VERTICAL FIN AND RUDDER *

Fin Area		1,26 m ²
Rudder Area		0,69 m ²
Control Travel,	Left	16° ± 1°
(parallel to a/c longitudinal axis)	Right	16° ± 1°

LANDING GEAR

Type		Fixed, Tricycle
Shock Absorber,	Nose Gear	Air - Oil
	Main Gear	Tubular Spring
Tread		2,55 m
Nose Wheel Tire and Pressure	5,00 x 5	2,14 bars 31 psi
Main Wheel Tire and Pressure	6,00 x 6	2,00 bars 29 psi
Nose Gear Shock Strut Pressure		3,10 bars 45 psi

* Cable control systems

POWER PLANT

O-320-D2J (see Supplement RLD appr.
Flight manual)

Engine Lycoming O-320-H2AD 160 BHP (119 kW)
Fuel 100 LL Grade Aviation Fuel (Blue Color)

NOTE

100 (Formerly 100/130) Aviation Grade Fuel (Green)
with maximum lead content of 4.6 cc per gallon is
also approved for use (Refer to Avco Lycoming Serv-
ice Bulletin N° 1070F).

Oil : Recommended Viscosity For Temperature Range :

MIL-L-6082 Aviation Grade Straight Mineral Oil :

SAE 50 above 16°C
SAE 40 between - 1°C and 32°C
SAE 30 between - 18°C and 21°C
SAE 20 below - 12°C.

MIL-L-22851 Ashless Dispersant Oil :

SAE 40 or SAE 50 above 16°C
SAE 40 between - 1°C and 32°C
SAE 30 or SAE 40 between - 18°C and 21°C
SAE 30 below - 12°C

Carburetor Heater Manually Operated

PROPELLER

Type McCauley 1C160/DTM7557

Number of Blades : 2.

Diameter, Maximum : 1.91 m

Minimum : 1.88 m

Type : Fixed pitch.

CABIN

Seating 4 (plus optional child seat)

Doors 2

Baggage compartment

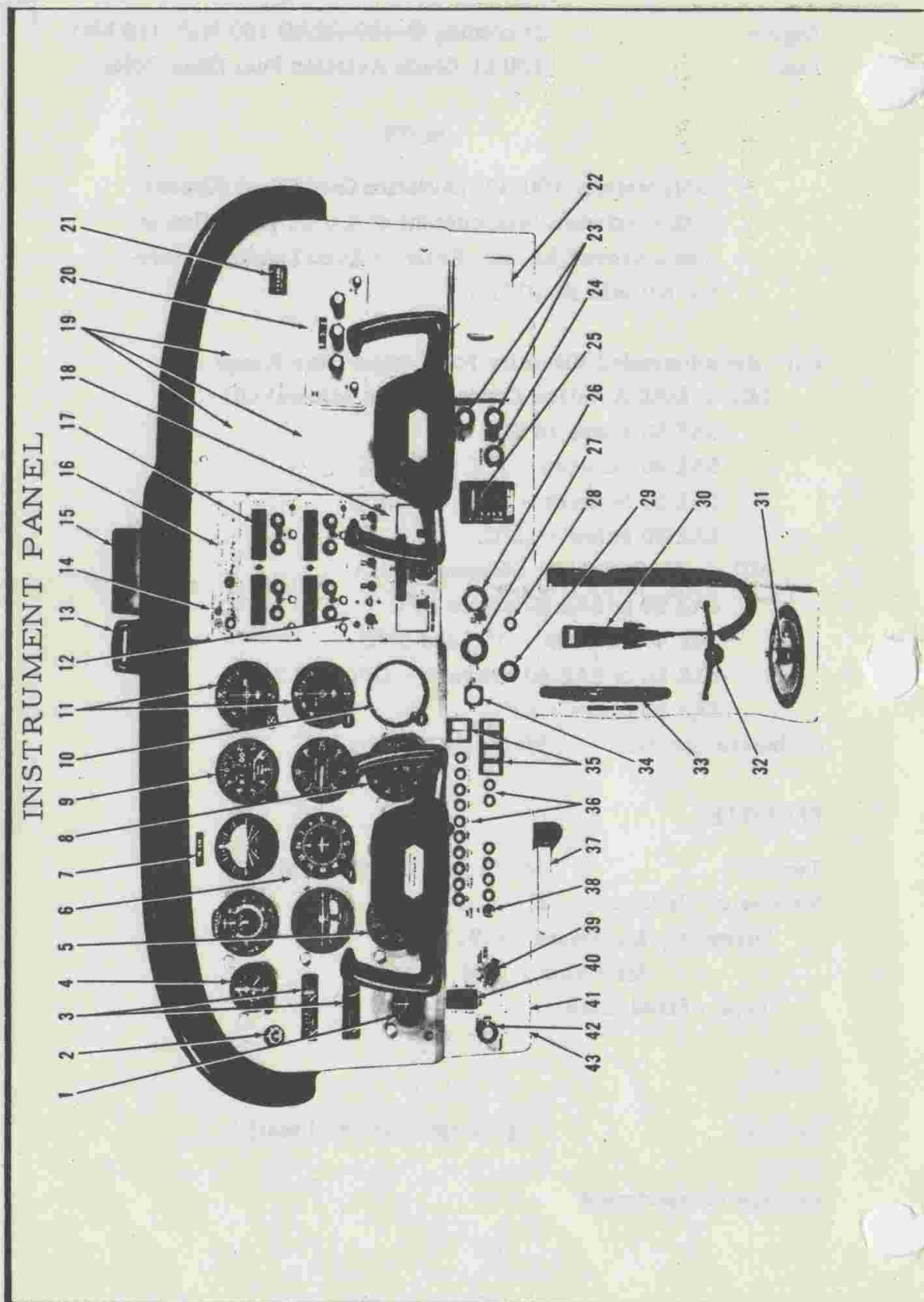


Figure 1-2 (Sheet 1 of 2)

- 
- | | |
|---|--|
| 1. Ammeter | 23. Cabin Heat and Air Control Knobs |
| 2. Suction Gage | 24. Lighter |
| 3. Oil Temperature, Oil Pressure, and Left and Right Fuel Quantity Indicators | 25. Wing Flap Switch and Position Indicator |
| 4. Clock | 26. Mixture Control Knob |
| 5. Tachometer | 27. Throttle (With Friction Lock) |
| 6. Flight Instrument Group | 28. Static Pressure Alternate Source Valve |
| 7. Airplane Registration Number | 29. Instrument and Radio Dial Light Rheostat |
| 8. Secondary Altimeter | Control Knobs |
| 9. Encoding Altimeter | 30. Microphone |
| 10. ADF Bearing Indicator | 31. Fuel Selector Valve Handle |
| 11. Omni Course Indicators | 32. Rudder Trim Control Lever |
| 12. Transponder | 33. Elevator Trim Control Wheel |
| 13. Magnetic Compass | 34. Carburetor Heat Control Knob |
| 14. Marker Beacon Indicator Lights and Switches | 35. Electrical Switches |
| 15. Rear View Mirror | 36. Circuit Breakers |
| 16. Audio Control Panel | 37. Parking Brake Handle |
| 17. Radios | 38. Avionics Power Switch |
| 18. Autopilot Control Unit | 39. Ignition Switch |
| 19. Additional Instrument Space | 40. Master Switch |
| 20. ADF Radio | 41. Auxiliary Mike Jack |
| 21. Flight Hour Recorder | 42. Primer |
| 22. Map Compartment | 43. Phone Jack |

Figure 1-2 (Sheet 2 of 2)

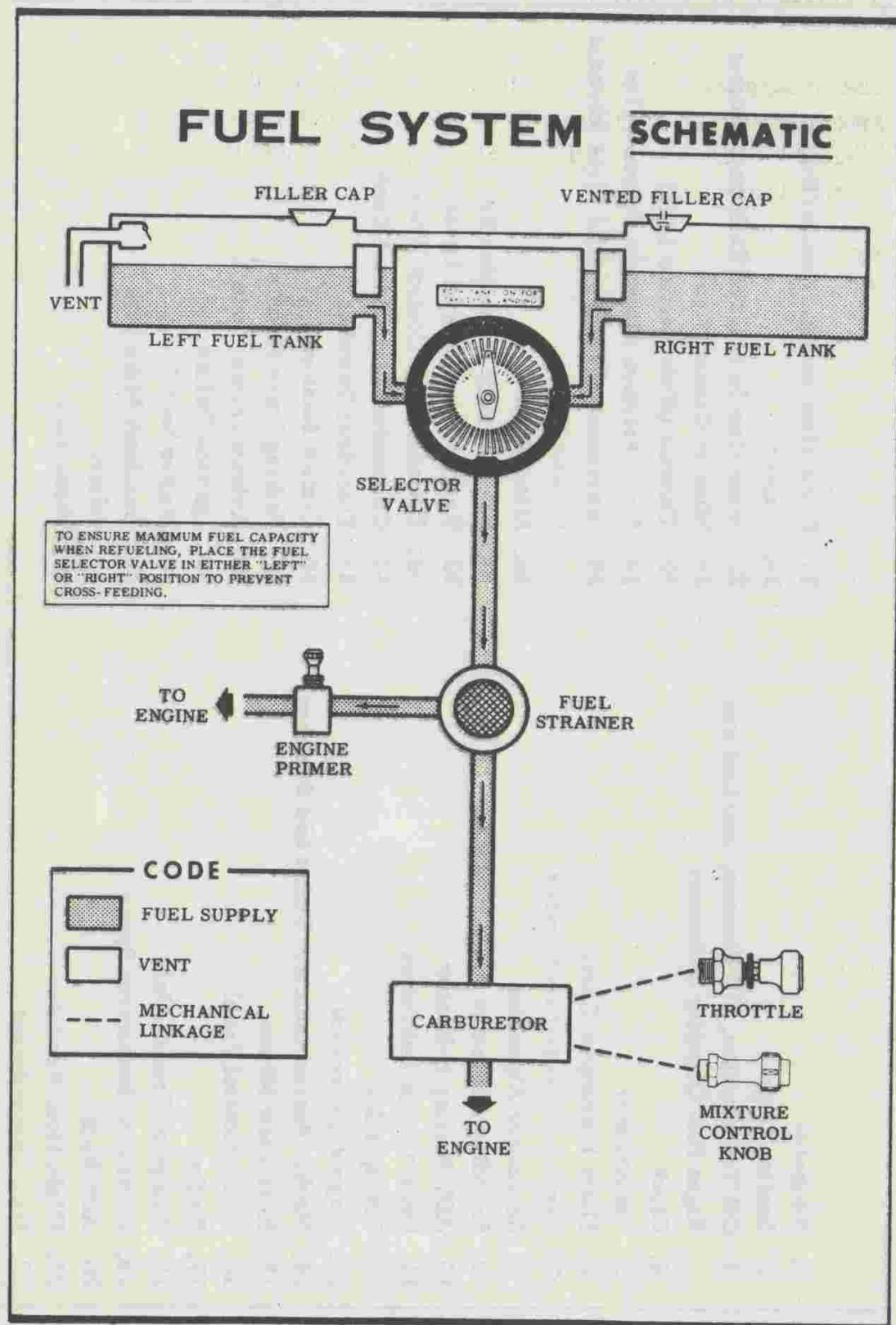


Figure 1-3

FUEL SYSTEM

Fuel is supplied to the engine from two tanks, one in each wing. From these tanks, fuel flows by gravity to a four-position selector valve labeled "RIGHT", "BOTH", "LEFT" and "OFF" and through a fuel strainer to the carburetor.

For additional information on Lubrication and Servicing, refer to the maintenance guide of this aircraft.

FUEL QUANTITY DATA			
TANKS	USABLE FUEL ALL FLIGHT CONDITIONS	UNUSABLE FUEL	TOTAL FUEL VOLUME
TWO STANDARD WING 81.5 litres 21.5 US Gal. each	152 litres 40 US Gal.	11 litres 3 US Gal.	163 litres 43 US Gal.
OPTIONAL TWO LONG RANGE WING 102 litres 27 US Gal.	189 litres 50 US Gal.	15 litres 4 US Gal.	204 litres 54 US Gal.

FUEL TANK SUMP QUICK-DRAIN VALVES

Each fuel tank sump is equipped with a fuel quick-drain valve which extends through the lower surface of the wing just outboard of the cabin door. A sampler cup stored in the aircraft is used to examine the fuel for the presence of water and sediment. A "STRAINER DRAIN KNOB" is located inside the engine nose cap access door and is connected to the strainer quick-drain valve. After the knob has been released, make sure that strainer drain is closed.

ELECTRICAL SYSTEM

Electrical energy is supplied by a 28-volt, direct-current system powered by an engine-driven, 60-amp alternator and a 24-volt, 14-amp hour battery located on the left 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 are interconnected by an avionics power switch. The primary bus is on anytime the master switch is turned on, and is not affected by starter or external power usage. Both bus bars are on anytime the master and avionics power switches are turned on.

CAUTION

Prior to turning the master switch on or off, starting the engine or applying an external power source, the avionics power switch, labeled "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 and "OFF" in the down position. The right half of the switch, labeled "BAT", controls all electrical power to the airplane. The left half, labeled "ALT", controls the alternator.

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

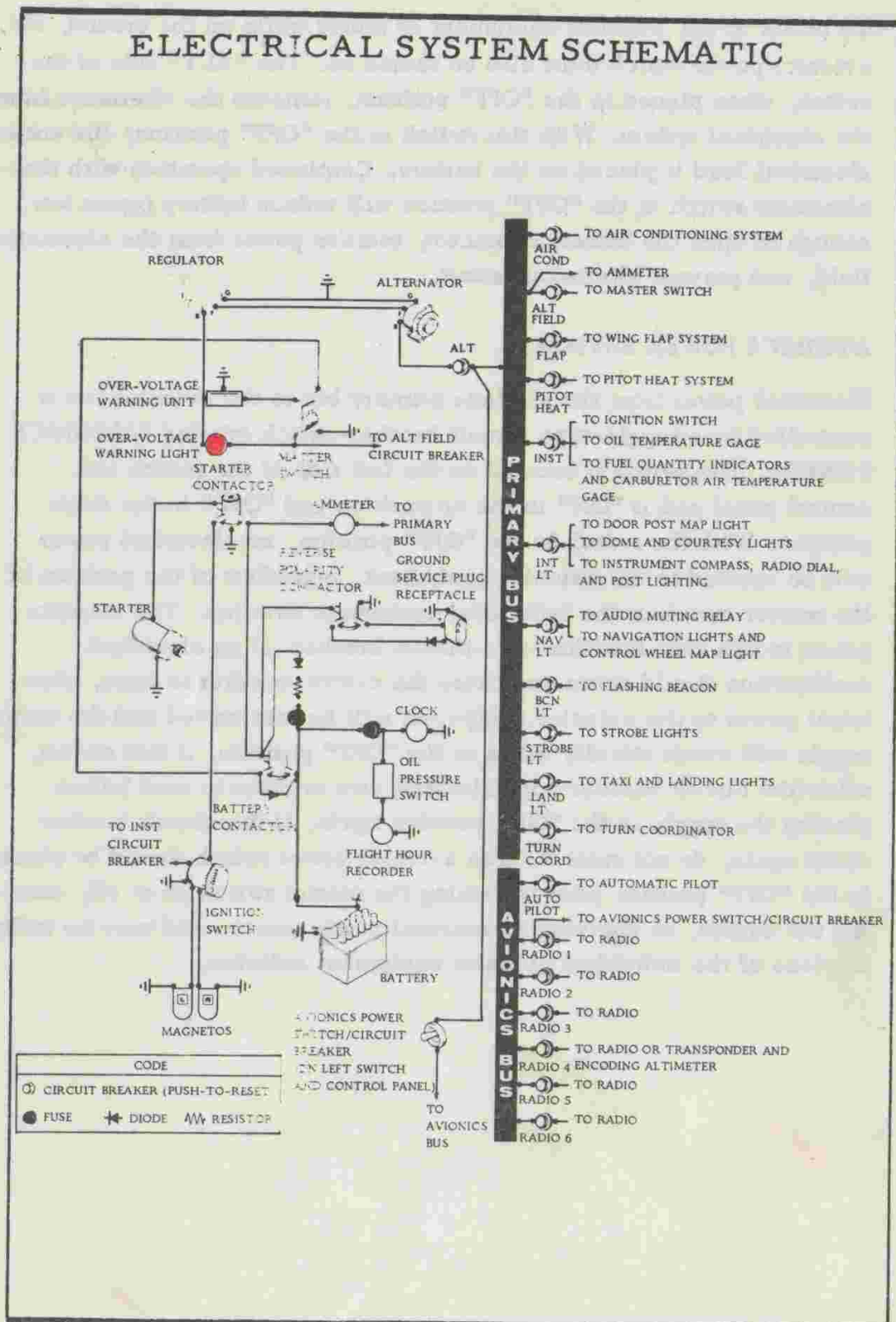


Figure 1-4

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. With this switch in the "OFF" position, the entire electrical load is placed on the battery. Continued operation with the alternator switch in the "OFF" position will reduce battery power low enough to open the battery contactor, remove power from the alternator field, and prevent alternator restart.

AVIONICS POWER SWITCH

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

AMMETER

The ammeter indicates the flow of current, in amperes, from the alternator to the battery or from the battery to the aircraft electrical system. When the engine is operating and the master switch is "ON", the ammeter indicates the charging rate applied to the battery or the discharge rate if the alternator is not functioning.

OVER-VOLTAGE SENSOR AND WARNING LIGHT

The aircraft is equipped with an automatic over-voltage protection system consisting of an over-voltage sensor behind the instrument panel and a red warning light, labeled "HIGH VOLTAGE". In the event an over-voltage condition occurs, the over-voltage sensor automatically removes alternator field current and shuts down the alternator. The red warning light will then turn on, indicating to the pilot that the aircraft battery is supplying all electrical power.

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

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" circuit breakers mounted on the lower left side of the instrument panel. In addition to the individual circuit breakers, a toggle-type circuit breaker-switch, labeled "AVIONICS POWER", on the left switch and control panel also protects the avionics systems. The cigar lighter is protected by a manually-reset type circuit breaker on the back of the lighter, and a fuse behind the instrument panel. The control wheel map light (if installed) is protected by the "NAV 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.

EXTERIOR LIGHTING

Conventional navigation lights are located on the wing tips and top of the rudder.

A single landing light or dual landing/taxi lights are installed in the cowl nose cap.

Optional flashing beacon is mounted on top of the vertical fin.

Additional lighting is available and includes a strobe light on each wing tip and two courtesy lights, one under each wing, just outboard of the cabin door. The courtesy lights are operated by a switch located on the left rear door post. All exterior lights, except the courtesy lights, are controlled by rocker type switches on the left switch and control panel.

NOTE

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

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

INTERIOR LIGHTING

Instrument and control panel lighting is provided by flood lighting, integral lighting, and post lighting (if installed). Two concentric rheostat control knobs on the left switch and control panel, labeled "PANEL LT" and "RADIO LT", control the intensity of the instrument and control panel lighting. A slide-type switch (if installed) on the overhead console, labeled "PANEL LTS", is used to select either flood lighting in the "FLOOD" position, or post lighting in the "POST" position, or a combination of post and flood lighting in the "BOTH" position.

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

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

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

WING FLAP SYSTEM

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

CABIN HEATING AND VENTILATING SYSTEM

Cabin heating is provided by actuation of the "CABIN HT" knob by pulling it approximately 1 cm (1/2 in.) for a moderate amount of cabin heat. If maximum heat is desired, pull the knob fully out.

Front cabin heat is supplied by outlet holes spaced just forward and above the rudder pedal assembly. Rear cabin heat is supplied by two ducts, one on each side of the cabin at floor level.

Windshield defrost air is also controlled by the same control.

Cabin ventilating air is controlled by the "CABIN AIR" knob.

Separate adjustable ventilators supply additional air; one near each upper corner of the windshield supplies air for the pilot and copilot.

Two optional ventilators supply air for the rear seat passengers.

PARKING BRAKE SYSTEM

To set parking brake, pull out the handle below the pilot's side instrument panel and lock it in the detents by turning it 1/4 turn downwards. To release the parking brake, unlock the handle and push it fully in.

STALL WARNING HORN

The stall warning horn produces a steady signal 9 to 18 km/h - 5 to 10 kts - 6 to 12 MPH before actual stall is reached and remains on up to the stall.

SECTION 2

LIMITATIONS

CERTIFICATION BASIS

The REIMS/CESSNA F172N is certified in the Normal and Utility Category under AIR 2052 regulations, with amendments dated 16 September 1966, with the limits indicated in this section.

INDICATED AIRSPEED LIMITATIONS

	km/h	fts	mph
V _{NE} (Never Exceed Speed)	296	160	184
V _{NO} (Maximum Structural Cruising Speed)	237	128	147
V _{FE} (Maximum Speed, Flaps Extended)	158	85	98
V _A (Maneuvering Speed)	180	97	112

AIRSPEED INDICATOR MARKINGS

Red line	296	160	184
Yellow Arc (Caution Range)	237-296	128-160	147-184
Green Arc (Normal Operating Range) ..	87-237	47-128	54-147
White Arc (Flap Operating Range)	76-158	41-85	47-98

FLIGHT MANEUVERING LOAD FACTORS AT GROSS WEIGHT

Normal Category : 1043 kg

Flaps Up	+3.8	-1.52
Flaps Down	+3.0	

Utility Category : 910 kg

Flaps Up	+4.4	-1.76
Flaps Down	+3.0	

MAXIMUM GROSS WEIGHT FOR TAKE-OFF AND LANDING

Normal Category : 1043 kg

Utility Category : 910 kg

CENTER OF GRAVITY LOCATION

Leveling Means : Upper door sill.

Center of Gravity Reference : Forward face of firewall.

Center of Gravity Limits :

NORMAL CATEGORY

Aft at 1043 kg : + 1.20 m

Forward at 885 kg or less : + 0.89 m

Forward at 1043 kg : + 0.98 m

Straight line variation between 885 and 1043 kg

UTILITY CATEGORY

Aft at 910 kg : + 1.03 m

Forward at 885 kg or less : + 0.89 m

Forward at 910 kg : + 0.98 m

Straight line variation between 885 and 910 kg

LOADING LIMITS

Number of Occupants : Front Seats : 2

Rear Seats : 2

Minimum Crew : 1 pilot

Maximum Baggage in Baggage Compartment Area 1 + Area 2 : 54 kg

Occupied Optional Child's Seat Approved if Fitted With a Safety Belt

AUTHORIZED OPERATIONS

If equipped with good condition instruments described in the approved appendix of this manual, this aircraft is certified for day, night, VFR and IFR flight operations.

FLIGHT IN ICING CONDITIONS

Flight in icing conditions is strictly prohibited.

MANEUVERS - UTILITY CATEGORY

This airplane is not designed for aerobatic maneuvers. However, certain maneuvers that are required in the acquisition of various certificates may be performed provided the limitations in the following table are not exceeded.

No aerobatic maneuvers are approved except those listed below :

MANEUVER	RECOMMENDED ENTRY INDICATED SPEED		
	km/h	kts	mph
Chandelles	195	105	120
Lazy Eights	195	105	120
Steep Turns	176	95	109
Spins	Use Slow Deceleration		
Stalls	Use Slow Deceleration		

Intentional spins with flaps extended are not approved. Inverted flight maneuvers are not recommended.

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 be exercised to avoid excessive speed which in turn can impose excessive loads. In the execution of all maneuvers, avoid abrupt use of controls.

ENGINE OPERATION LIMITATIONS

Power and Speed 119 KW (160 BHP) at 2700 RPM

ENGINE INSTRUMENT MARKINGS

OIL TEMPERATURE GAGE

Normal Operating Range Green Arc
Maximum Allowable 118°C (245°F) red line

OIL PRESSURE GAGE

Minimum Idling	25 psi (1.72 bars) (red line)
Normal Operating	60-90 psi (4.13 - 6.20 bars) (green arc)
Maximum	100 psi (6.89 bars) (red line)

FUEL QUANTITY INDICATORS

Empty E (red line)

Total unusable fuel :

Standard tank : 3 US Gal. - 11.4 l

Long range tank : 4 US Gal. - 15.1 l

TACHOMETER

Normal Operating Range 2200-2700 RPM (green arc)

Maximum Allowable 2700 RPM (red line)

PLACARDS

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

(1) In full view of the pilot :

This airplane must be operated in compliance with the operating limitations as stated in the form of placards, markings, and manuals.			
<hr/> MAXIMUMS <hr/>			
	<u>Normal Category</u>		<u>Utility Category</u>
MANEUVERING SPEED(IAS)	180 km/h - 97 kts - 112 MPH	180 km/h - 97 kts - 112 MPH	
GROSS WEIGHT	2300 lbs - 1043 kg	2000 lbs - 910 kg	
FLIGHT LOAD FACTOR	Flaps Up	13.8, 1.52	14.4, 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			
<u>Recommended</u>		<u>Recommended</u>	
<u>Maneuver</u>	<u>Entry Speed (IAS)</u>	<u>Maneuver</u>	<u>Entry Speed (IAS)</u>
Chandelles	195 km/h - 105 kts - 121 MPH	Spins	Slow Deceleration
Lazy Eights	195 km/h - 105 kts - 121 MPH	Stalls (Except	Slow Deceleration
Steep Turns	176 km/h - 95 kts - 109 MPH	Whip Stalls)	
Altitude loss in stall recovery : 180 ft - 55 m.			
Abrupt use of the controls prohibited above 180 km/h - 97 kts - 112 MPH			
Spin Recovery : opposite rudder - forward elevator - neutralize controls.			
Intentional spins with flaps extended are prohibited. Flight into known icing conditions prohibited. This airplane is certified, depending on the equipment items installed, for the following flight operations as of date of original airworthiness certificate :			
DAY - NIGHT - VFR - IFR			

(2) Forward of fuel selector valve :

BOTH TANKS ON FOR
TAKEOFF & LANDING

(3) On the fuel selector valve :

- Standard tanks

BOTH - 40 US GAL. - 152 l ALL FLIGHT ATTITUDES
LEFT - 20 US GAL. - 76 l LEVEL FLIGHT ONLY
RIGHT - 20 US GAL. - 76 l LEVEL FLIGHT ONLY
OFF

- Long range tanks

BOTH - 50 US GAL. - 189 l ALL FLIGHT ATTITUDES
LEFT - 25 US GAL. - 99.5 l LEVEL FLIGHT ONLY
RIGHT - 25 US GAL. - 99.5 l LEVEL FLIGHT ONLY
OFF

(4) Near fuel tank filler cap :

- Standard tanks

FUEL
100LL/100 MIN. GRADE AVIATION GASOLINE
CAP. 21.5 US GAL. - 81.5 litres

- Long range tanks

FUEL
100LL/100 MIN. GRADE AVIATION GASOLINE
CAP. 27 US GAL. - 102 litres

- (5) Near flap indicator :

Avoid slips with flaps extended.

- (6) In baggage compartment :

- 120 lbs - 54 kg maximum baggage and/or auxiliary seat passenger forward of baggage door latch.
 - 50 lbs - 23 kg maximum baggage aft of baggage door latch.
- Maximum combined : 120 lbs - 54 kg.
- For additional loading instructions see weight and balance data.

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

HIGH VOLTAGE

SECTION 3

EMERGENCY PROCEDURES

ENGINE FAILURE

DURING TAKE-OFF RUN (WITH SUFFICIENT RUNWAY AHEAD)

1. Throttle - IDLE.
2. Brakes - APPLY.
3. Flaps - RETRACT (if extended) during ground roll to provide more effective braking.
4. Mixture - IDLE CUT-OFF.
5. Ignition and Master Switch - OFF.

AFTER TAKE-OFF

1. Glide Speed (IAS) - 121 km/h - 65 kts - 75 MPH (Flaps UP)
111 km/h - 60 kts - 69 MPH (Flaps DOWN)
2. Mixture - IDLE CUT-OFF.
3. Fuel Selector Valve - "OFF".
4. Ignition Switch - "OFF".
5. Wing Flaps - AS REQUIRED (40° recommended).
6. Master Switch - "OFF".

CAUTION

Perform the landing straight ahead, making only small changes in heading to avoid obstructions. Never attempt to turn back to the landing strip.

DURING FLIGHT

1. Glide Speed (IAS) - 121 km/h - 65 kts - 75 MPH.
2. Fuel Selector Valve - "BOTH".
3. Mixture - RICH.
4. Throttle - CRANKED one inch (2.5 cm).
5. Ignition Switch - "BOTH".

If the engine will not start, select an unobstructed area to land in and secure the engine as follows :

6. Mixture - IDLE CUT-OFF.
7. Throttle - CLOSED.

8. Ignition Switch - "OFF".
9. Fuel Selector Valve - "OFF".
10. Master Switch - LEAVE "ON" so that wing flaps can be extended.

NOTE

Full flaps are recommended for emergency landings on unpaved surfaces.

FIRES

ENGINE FIRE DURING START ON GROUND

1. Continue cranking is an attempt to get a start which would suck the flames and accumulated fuel through the carburetor and into the engine.

If the start is successful :

2. Run the engine at 1700 RPM for a few minutes.
3. Engine - SHUT DOWN and inspect the fire damage.

If engine start is unsuccessful :

4. Throttle - FULL OPEN.
5. Mixture - IDLE CUT-OFF.
6. Engine - CONTINUE cranking for two or three minutes.
7. Use fire extinguisher (if available).
8. Engine - SHUT DOWN
 - a. Master Switch - "OFF"
 - b. Ignition Switch - "OFF"
 - c. Fuel Selector Valve - "OFF".
9. Flames - SMOTHER with fire extinguisher, wool blanket, or loose dirt. If practical, try to remove carburetor air filter if it is ablaze.
10. MAKE a thorough inspection of fire damage, and repair or replace damaged components 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. Indicated Airspeed - 185 km/h - 100 kts - 115 MPH. If fire is not extinguished, increase glide speed to find an airspeed which will provide an incombustible mixture.
6. Forced Landing - EXECUTE (as described in "Emergency Landing Without Engine Power").

CABIN FIRE

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

WING FIRE

1. Navigation Light Switch - "OFF".
2. Pitot Heat Switch (if installed) - "OFF".
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 flaps only as required for final approach and touchdown.

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) and ventilate the cabin.

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

6. Master Switch - "ON".
7. Circuit Breakers - CHECK for faulty circuit, do not reset.
8. Radio Switches - "OFF".
9. Avionics Power Switch - "ON".

10. Radio/Electrical Switches - "ON" one at a time, with delay after each until short circuit is localized.
11. Vents/Cabin Air/Heat - OPEN when it is ascertained that fire is completely extinguished.

ELECTRICAL POWER SUPPLY SYSTEM MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

1. Avionics Power Switch - "OFF".
2. Master Switch - "OFF" (both sides).
3. Master Switch - "ON".
4. Over-Voltage Light - "OFF".
5. Avionics Power Switch - "ON".

If over-voltage light illuminates again :

6. Flight - TERMINATE as soon as possible.

AMMETER SHOWS DISCHARGE

1. Alternator - "OFF".
2. Nonessential Radio/Electrical Equipment - "OFF".
3. Flight - TERMINATE as soon as practical.

FLIGHT IN ICING CONDITIONS

Although flying in known icing conditions is prohibited, an unexpected icing encounter should be handled as follows :

1. Turn pitot heat switch "ON" (if installed).
2. Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
3. Pull cabin heat control full out and open defroster outlet 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 continuously.

6. Plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
7. With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speed.
8. Leave wing flaps retracted. With a severe ice build-up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
9. Open left window and, if practical, scrape ice from a portion of the windshield for visibility in the landing approach.
10. Perform a landing approach using a forward slip, if necessary, for improved visibility.
11. Approach at 120 to 140 km/h - 65 to 75 kts - 75 to 86 MPH IAS, depending upon the amount of ice accumulation.
12. Perform a landing in level attitude.

INADVERTENT SPIN (NORMAL CATEGORY)

To recover from an inadvertent spin, use the following standard procedure :

1. Retard throttle to idle position and neutralize ailerons.
2. Apply full rudder opposite to the direction of rotation.
3. After one-fourth turn, move the control wheel forward of neutral in a brisk motion.
4. As the rotation stops, neutralize the rudder, and make a smooth recovery from the resulting dive.

RECOVERY FROM A SPIRAL DIVE

If a spiral is encountered, proceed as follows :

1. Close the throttle.
2. Stop the turn by using coordinated aileron and rudder control to align the symbolic airplane in the turn coordinator with the horizon reference line.
3. Cautiously apply elevator back pressure to slowly reduce the indicated airspeed to 148 km/h - 80 kts - 92 MPH.
4. Adjust the elevator trim control to maintain a 148 km/h - 80 kts - 92 MPH IAS glide.
5. Keep hands off the control wheel, using rudder control to hold a straight heading. Adjust rudder trim (if installed) to relieve unbalanced rudder force.

6. Apply carburetor heat.
7. Clear engine occasionally, but avoid using enough power to disturb the trimmed glide.
8. Upon breaking out of clouds, apply normal cruising power and resume flight.

LANDING

LANDING WITH ONE FLAT TIRE

1. Expect the airplane to swing off on the flat tire side.
2. Lower the flaps normally and land the airplane with nose up and wing banked to hold the flat tire off the ground as long as possible. At touch-down, directional control can be maintained with rudder and the brake on the good wheel.

LANDING WITHOUT PITCH CONTROL

Trim for horizontal flight (with an indicated airspeed of approximately 111 km/h - 60 kts - 69 MPH and flaps lowerer to 20°) by using throttle and elevator trim controls. Then do not change this elevator trim setting, control the glide angle by adjusting power exclusively. At flare out, the nose-down moment resulting from power reduction is an adverse factor and the aircraft may hit on the nose wheel.

Consequently, at flareout, the control should be set at the full nose-up position and the power adjusted so that the aircraft will rotate to the horizontal attitude for touchdown. Close the throttle at touchdown.

FORCED LANDINGS

PRECAUTIONARY LANDING WITH ENGINE POWER

Before attempting an "off airport" landing with engine power available, one should fly over the landing area at a safe but low altitude to inspect the terrain for obstructions and surface conditions, proceeding as follows.

1. Drag over selected field with flaps 20° and 111 km/h - 60 kts - 69 MPH indicated airspeed, noting the preferred area for touchdown for the next landing approach. Then retract flaps upon reaching a safe altitude and airspeed.
2. Seat Belts and Shoulder Harnesses - SECURE.
3. Avionics Power Switch and Electrical Switches - "OFF".
4. Wing Flaps - 40° (on final approach).
5. Indicated Airspeed - 111 km/h - 60 kts - 69 MPH.
6. Master Switch - "OFF".
7. Doors - UNLATCH PRIOR TO TOUCHDOWN.
8. Touchdown - SLIGHTLY TAIL LOW.
9. Ignition Switch - "OFF".
10. Brakes - APPLY HEAVILY.

EMERGENCY LANDING WITHOUT ENGINE POWER

1. Indicated Airspeed - 120 km/h - 65 kts - 75 MPH (flaps UP).
111 km/h - 60 kts - 69 MPH (flaps DOWN).
2. Seat Belts and Shoulder Harnesses - SECURE.
3. Mixture - IDLE CUT-OFF.
4. Fuel Selector Valve - "OFF".
5. Ignition Switch - "OFF".
6. Wing Flaps - AS REQUIRED (40° recommended).
7. Master Switch - "OFF".
8. Doors - UNLATCH PRIOR TO TOUCHDOWN.
9. Touchdown - SLIGHTLY TAIL LOW.
10. Brakes - APPLY HEAVILY.

DITCHING

1. Prepare for ditching by securing or jettisoning heavy objects.
2. Transmit Mayday message on 121.5 MHz.
3. Plan approach into wind if winds are high and seas are heavy. With heavy swells and light wind, land parallel to swells.
4. Approach in level attitude with flaps 20° to 40° and sufficient power for a 300 ft./min. rate of descent at 102 km/h - 55 kts - 63 MPH (IAS). If no power is available, approach at 121 km/h - 65 kts - 75 MPH (IAS) and flaps up or 111 km/h - 60 kts - 69 MPH (IAS) with 10° flaps.

5. Unlatch the cabin doors.
6. Maintain a continuous descent until touchdown in level attitude.
7. Place folded coat or cushion in front of face at time of touchdown.
8. Evacuate airplane through cabin doors. If necessary, open window to flood cabin compartment for equalizing pressure so that door can be opened.
9. Inflate life vests and raft (if available) after evacuation of cabin.

The aircraft cannot be depended on for floatation for more than a few minutes.

SECTION 4

NORMAL PROCEDURES

SAMPLE LOADING PROBLEM NORMAL CATEGORY	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight kg	Moment m. kg	Weight kg	Moment m. kg
Licensed Empty Weight (Includes unusable fuel and full oil)	648	628		
Fuel (Standard - 152 litres at 0.72 kg/litre)	108	132		
Fuel (Long Range - 189 litres at 0.72 kg/litre)				
Pilot and Front Passenger (Station 0.86 to 1.17 m)	154	145		
Rear Passengers	77	142		
** Baggage - Area 1 : 54 kg Max. (Station 2.08 to 2.74 m) or Passenger on Child's Seat	53	128		
** Baggage - Area 2 : 23 kg Max. (Station 2.74 to 3.61 m)				
TOTAL WEIGHT AND MOMENT	1043	1175		
<p>Locate this point (1043 and 1175) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.</p> <p>**Maximum Combined Weight - Area 1 + Area 2 : 54 kg</p>				

SAMPLE LOADING PROBLEM UTILITY CATEGORY	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight kg	Moment m. kg	Weight kg	Moment m. kg
Licensed Empty Weight (Includes unusable fuel and full oil)	648	628		
Fuel (Standard - 144 litres at 0.72 kg/litre)	108	132		
Fuel (Long Range - 182 litres at 0.72 kg/litre)				
Pilot and Front Passenger (Station 0.86 to 1.17 m)	154	145		
TOTAL WEIGHT AND MOMENT	910	905		
<p>Locate this point (910 and 905) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.</p>				

Figure 4-1

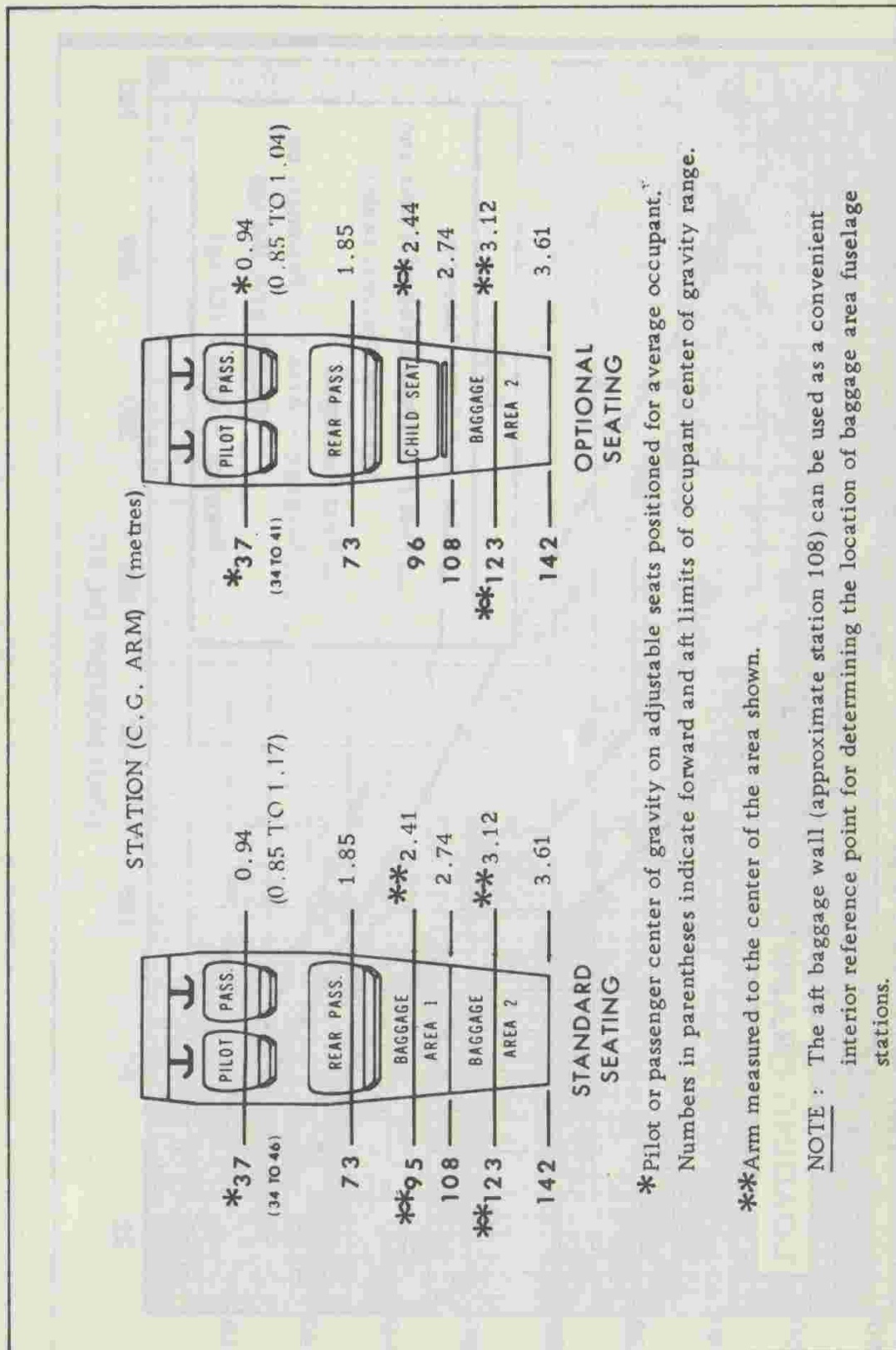


Figure 4-2

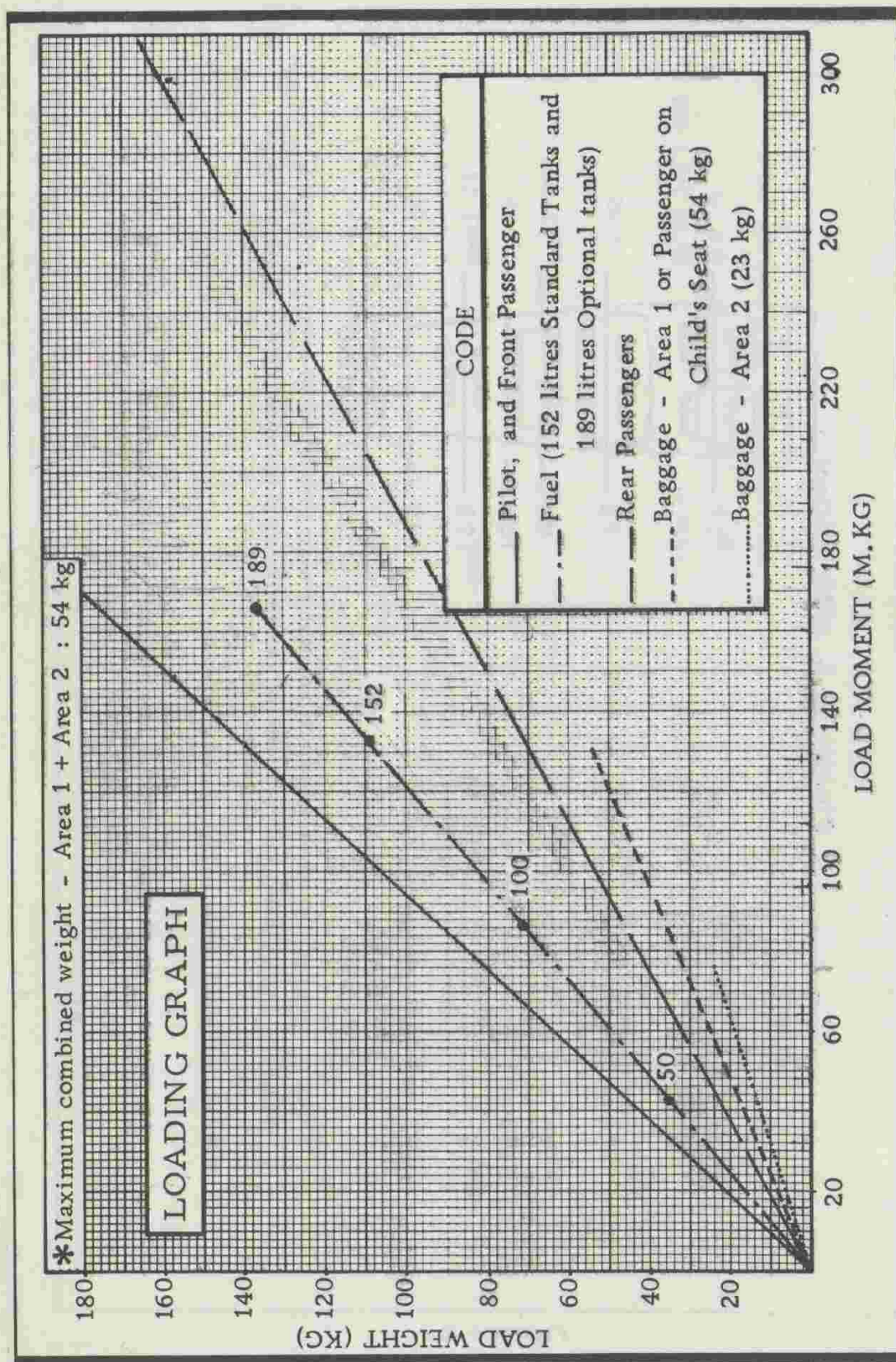


Figure 4-3

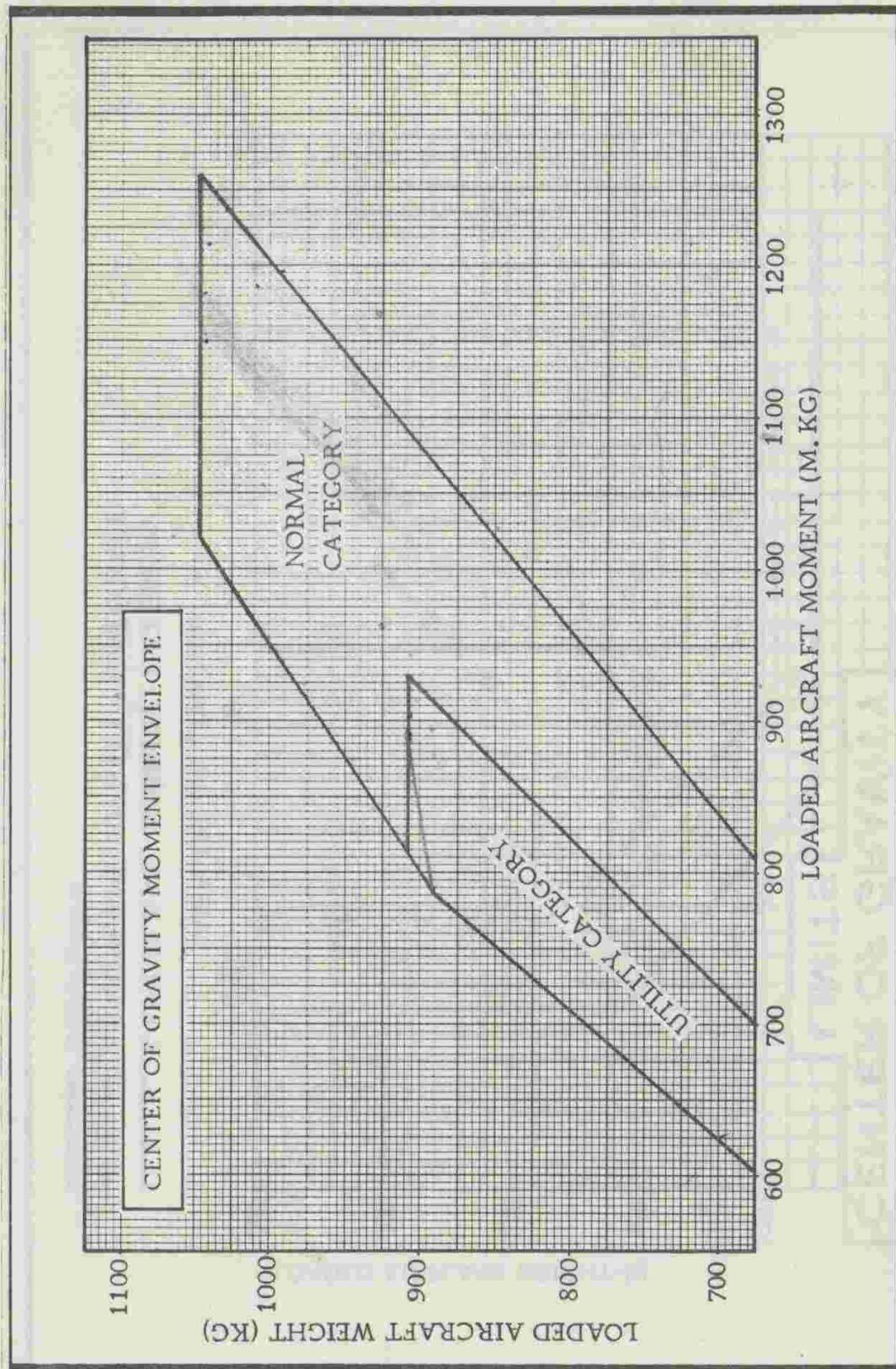


Figure 4-4

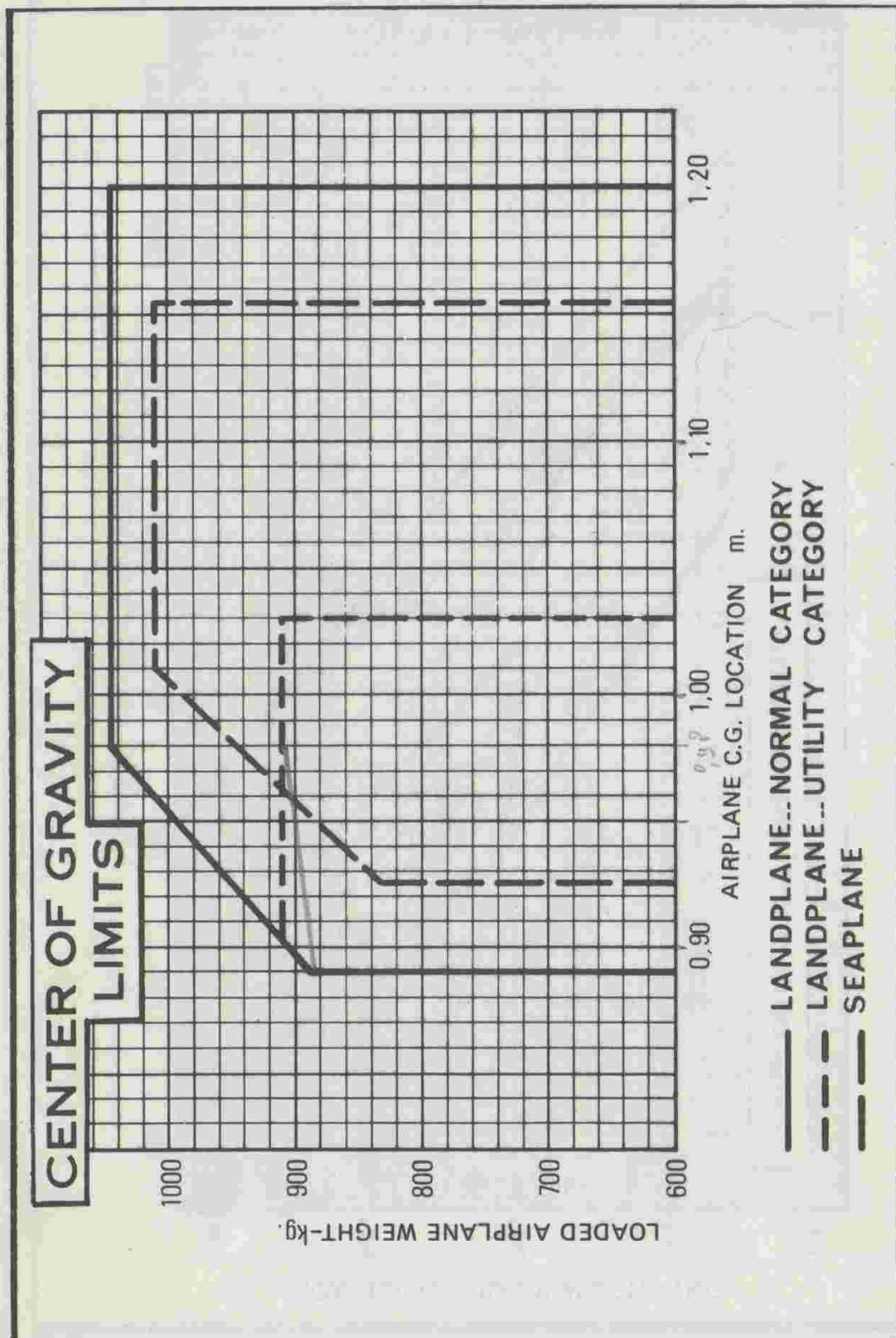
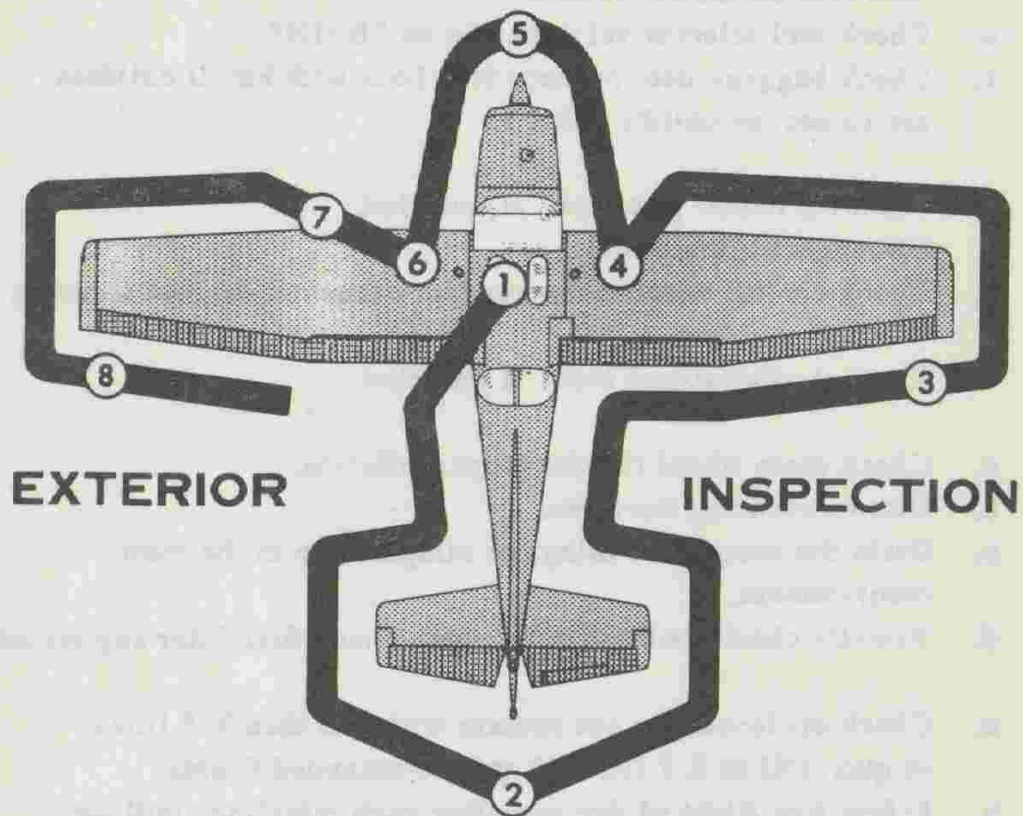


Figure 4-4A



NOTE

Visually check aircraft 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. If night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-5

- ①
 - a. Remove control wheel lock.
 - b. Check ignition switch "OFF".
 - c. Avionics Power Switch "OFF".
 - d. Turn on master switch and check fuel quantity indicators ; then turn off master switch.
 - e. Check fuel selector valve handle on "BOTH".
 - f. Check baggage door for security. Lock with key if children are to occupy child's seat.
- ②
 - a. Remove rudder gust lock, if installed.
 - b. Disconnect tail tie-down.
 - c. Check control surfaces for freedom of movement and security.
- ③
 - a. Remove aileron gust lock, if installed.
- ④
 - a. Check main wheel tire for proper inflation.
 - b. Disconnect wing tie-down.
 - c. Drain the wing tanks using the sampler cup in the map compartment.
 - d. Visually check fuel quantity ; then check fuel filler cap secure.
- ⑤
 - a. Check oil level. Do not operate with less than 3.8 litres (4 qts). Fill to 5.7 litres (6 qts) for extended flights.
 - b. Before first flight of day and after each refueling, pull out drain plug for about four seconds to clear fuel tanks of possible water and sediment. Check drain plugs closed. If water is observed, the fuel tank sump drain plugs should be removed to check for the presence of water.
 - c. Check propeller and spinner for condition.
 - d. Check landing light for condition and cleanliness.
 - e. Check carburetor air filter for cleanliness.
 - f. Check nose wheel strut and tire for proper inflation.
 - g. Disconnect nose tie-down.
 - h. Inspect flight instrument static source opening on left side of fuselage for stoppage.

- ⑥ - Same as 4 .
- ⑦ a. Remove pitot tube cover, if installed, and check pitot tube opening for stoppage.
 - b. Check fuel tank vent opening for stoppage.
 - c. Check stall warning vent opening for stoppage.
 - d. Disconnect wing tie-down.
- ⑧ - Same as 3 .

OPERATING CHECK LIST

BEFORE ENTERING THE AIRPLANE

1. Make an exterior inspection in accordance with figure 4-5.

BEFORE STARTING THE ENGINE

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

CAUTION

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

4. Brakes - TEST and SET.
5. Circuit Breakers - CHECK IN.

STARTING ENGINE

1. Mixture - RICH.
2. Carburetor Heat - COLD.
3. Master Switch - "ON".
4. Prime - AS REQUIRED (2 to 6 strokes ; none if engine is warm).
5. Throttle - OPEN 0.5 cm.
6. Propeller Area - CLEAR.
7. Ignition Switch - START (release when engine starts).
8. Oil Pressure - CHECK.

BEFORE TAKE-OFF

1. Parking Brake - SET.
2. Cabin Doors and Window(s) - 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 (if installed) - "TAKEOFF".
8. Throttle - 1700 RPM.
 - a. Magnetos - CHECK (RPM drop should not exceed 125 RPM on either magneto or 50 RPM differential between magnetos).
 - b. Carburetor Heat - CHECK (for RPM drop).
 - c. Engine Instruments and Ammeter - CHECK.
 - d. Suction Gage - CHECK.
9. Avionics Power Switch - "ON".
10. Radios - SET.
11. Autopilot (if installed) - "OFF".
12. Air Conditioner (if installed) - "OFF".
13. Flashing Beacon, Navigation Lights and/or Strobe Lights - ON as required.
14. Throttle Friction Lock - ADJUST.
15. Brakes - RELEASE.

TAKE-OFF

NORMAL TAKE-OFF

1. Wing Flaps - UP (refer to p. 4-18, "Flap Settings").
2. Carburetor Heat - COLD.
3. Throttle - FULL "OPEN".
4. Elevator Control - LIFT NOSE WHEEL AT 102 km/h - 55 kts - 63 MPH IAS.
5. Climb Speed - 130 to 148 km/h - 70 to 80 kts - 81 to 92 MPH IAS.

MAXIMUM PERFORMANCE TAKE-OFF

1. Wing Flaps - UP (refer to p. 4-18, "Flap Settings").
2. Carburetor Heat - COLD.
3. Brakes - APPLY.
4. Throttle - FULL OPEN.
5. Mixture - RICH (above 915 m - 3000 ft, LEAN to obtain maximum RPM).

6. Brakes - RELEASE.
7. Elevator Control - SLIGHTLY TAIL LOW.
8. Climb Indicated Speed - 109 km/h - 59 kts - 68 MPH (until all obstacles are cleared).

CLIMB

NORMAL CLIMB

1. Indicated Airspeed - 130 to 158 km/h - 70 to 85 kts - 81 to 98 MPH.
2. Throttle - FULL.
3. Mixture - FULL RICH (mixture may be leaned above 915 m - 3000 ft to obtain maximum RPM).

MAXIMUM PERFORMANCE CLIMB

1. Indicated Airspeed - 135 km/h - 73 kts - 84 MPH at sea level.
- 126 km/h - 68 kts - 78 MPH at 3048 m - 10,000 ft.
2. Throttle - FULL.
3. Mixture - RICH.

CRUISE

1. Power - 2200 to 2700 RPM (no more than 75 %).
2. Elevator Trim and Rudder Trim (if installed) - ADJUST.
3. Mixture - RECOMMENDED LEAN.

NOTE

If a loss of RPM is noted, use the carburetor heater (refer to "CARBURETOR ICING" on page 4-23).

LET-DOWN

1. Mixture - ADJUST for smooth operation (full rich for idle power).
2. Power - AS DESIRED.
3. Carburetor heat - AS REQUIRED to prevent carburetor icing.

BEFORE LANDING

1. Seats, Belts, Harnesses - Secure.
2. Fuel Selector Valve - "BOTH".
3. Mixture - Rich.
4. Carburetor Heat - "ON" (apply full heat before closing throttle).

LANDING

NORMAL LANDING

1. Indicated Airspeed - 111 to 130 km/h - 60 to 70 kts - 69 to 81 MPH (flaps up).
2. Wing Flaps - AS DESIRED (below 158 km/h - 85 kts - 98 MPH).
3. Indicated Airspeed - 102 to 121 km/h - 55 to 65 kts - 63 to 75 MPH (flaps down).
4. Touchdown - MAIN WHEELS FIRST.
5. Landing Roll - LOWER NOSE WHEEL GENTLY.
6. Braking - MINIMUM REQUIRED.

MAXIMUM PERFORMANCE LANDING

1. Airspeed - 111 to 130 km/h - 60 to 70 kts - 69 to 81 MPH (flaps up).
2. Wing Flaps - FULL DOWN 40°.
3. Airspeed - 111 km/h - 60 kts - 69 MPH (until flare).
4. Power - REDUCE to idle after clearing obstacle.
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 Indicated Airspeed - 102 km/h - 55 kts - 63 MPH.

5. Wing Flaps - 10° until obstacles are cleared,
RETRACT after reaching a safe altitude and
111 km/h - 60 kts - 69 MPH.

AFTER LANDING

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

SECURING THE AIRCRAFT

1. Parking Brake - SET.
2. Avionics Power Switch, Electrical Equipment, Autopilot (if installed) - "OFF".
3. Mixture - IDLE CUT-OFF (pulled full out).
4. Ignition - "OFF".
5. Master Switch - "OFF".
6. Control lock - INSTALL.

OPERATING DETAILS

STARTING ENGINE

Ordinarily the engine starts easily with one or two strokes of primer in warm temperatures to six strokes in cold weather, with the throttle open approximately 1/2 inch (1 cm). In extremely cold temperatures, it may be necessary to continue priming while cranking. Weak intermittent

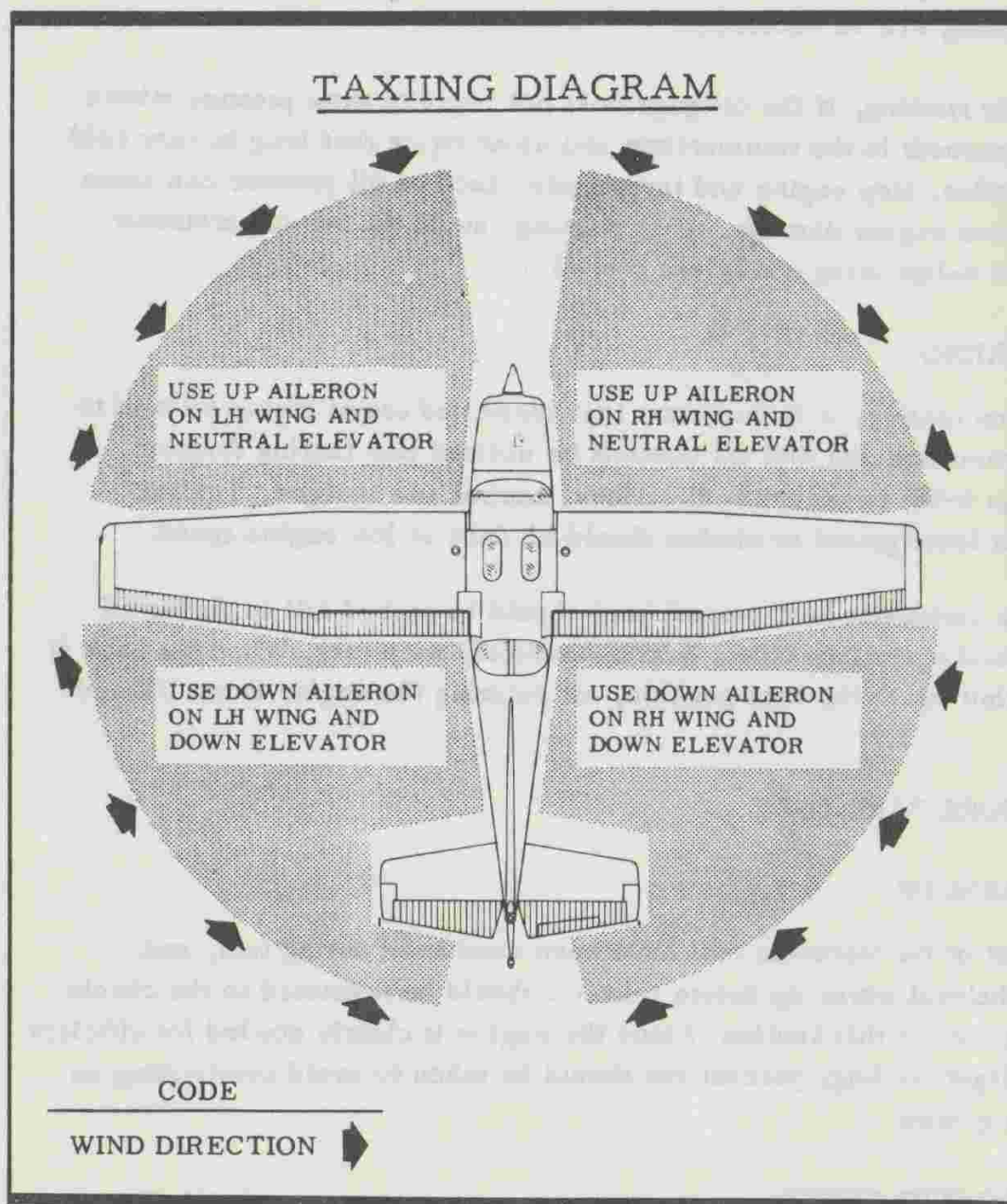


Figure 4-6

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

If the engine is underprimed it will not fire at all, and additional priming will be necessary.

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

TAXIING

When taxiing, it is important that speed and use of brakes be held to a minimum and that all controls be utilized (see taxiing diagram, page 4-15) to maintain directional control and balance. Taxiing over loose gravel or cinders should be done at low engine speed.

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

BEFORE TAKE-OFF

WARM-UP

Most of the warm-up will have been conducted during taxi, and additional warm-up before take-off should be restricted to the checks outlined in this Section. Since the engine is closely cowled for efficient inflight cooling, precautions should be taken to avoid overheating on the ground.

MAGNETO CHECK

The magneto check should be made at 1700 RPM as follows :

Move the ignition switch first to "R" position and note RPM, then move switch back to "BOTH" position. Then move switch to "L" position, note RPM and return to "BOTH". RPM drop should not exceed 125 RPM on either magneto or show greater than 50 RPM differential between magnetos. If there is a doubt concerning the operation of the ignition system, RPM checks at higher engine speeds will usually confirm whether a deficiency exists. An absence of RPM drop may be an indication of faulty grounding of one side of the ignition system or should be cause for suspicion that the magneto timing is set in advance of the setting specified.

ALTERNATOR CHECK

Prior to flights where verification of proper alternator and voltage regulator operation is essential (such as night or instrument flights), a positive verification can be made by loading the electrical system momentarily (2 to 5 seconds) with the optional landing light, (if so equipped), or by operating the wing flaps during the engine runup.

The ammeter will remain at zero if the alternator and voltage regulator are operating properly.

TAKE-OFF

POWER CHECKS

It is important to check full-throttle engine operation early in the take-off run. Any signs of rough engine operation or sluggish engine acceleration is good cause for discontinuing the take-off. If this occurs, you are justified in making a thorough full-throttle, static runup before another take-off is attempted. The engine should run smoothly and turn approximately 2280 to 2400 RPM with carburetor heat off and mixture full rich.

NOTE

Carburetor heat should not be used during take-off unless it is absolutely necessary.

Full throttle runups over loose gravel are especially harmful to propeller tips. When take-offs must be made over a gravel surface, it is very important that the throttle be advanced slowly.

Prior to take-off from fields above 915 m - 3000 ft elevation, the mixture should be leaned to give maximum RPM in a full-throttle, static runup.

The throttle being in the full open position, tighten the friction lock to prevent the throttle lever from moving back. For the other flight configurations, adjust the friction lock as required to maintain a constant throttle position.

FLAP SETTINGS

Normal and maximum performance takeoffs are performed with flaps up. Flap settings greater than 10° are not approved for takeoff.

Use of 10° flaps is reserved for minimum ground runs or for takeoff from soft or rough fields. Use of 10° flaps allows safe use of slightly lower takeoff speeds than with flaps up. The lower speeds result in shortening the ground run and total distance over a 15 m obstacle by approximately 10 %. However, this advantage will be lost if flaps up speeds are used, or in high altitude takeoffs in hot weather at maximum weight where climb would be marginal with 10° flaps. Therefore, use of 10° flaps is not recommended for takeoff over an obstacle at high altitude in hot weather.

CROSSWIND TAKE-OFFS

Take-offs into strong crosswinds normally are performed with the minimum flap setting necessary for the field length to minimize the drift angle immediately after take-off. The aircraft 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.

CLIMB

For detailed data, see Maximum Rate-Of-Climb Data chart.

CLIMB SPEEDS

Normal climbs are performed with flaps up and full throttle at speeds 9 to 18 km/h - 5 to 10 kts - 6 to 12 MPH higher than best rate-of-climb speeds for the best combination of engine cooling, rate of climb, and forward visibility. The mixture should be full rich below 915 m - 3000 ft and may be leaned above 915 m - 3000 ft for smoother engine operation or to obtain maximum RPM for maximum performance climb. The maximum rate-of-climb indicated airspeeds range from 135 km/h - 73 kts - 84 MPH at sea level to 126 km/h - 68 kts - 78 MPH at 3048 m - 10,000 ft. If an enroute obstruction dictates the use of a steep climb angle, climb at 111 km/h - 60 kts - 69 MPH IAS with flaps retracted.

NOTE

Steep climbs at low speeds should be of short duration to improve engine cooling.

CRUISE

Normal cruising is done between 55 % and 75 % power. The power settings required to obtain these powers at various altitudes and outside air temperatures can be determined by using your Power Computer or the PERFORMANCE DATA, Section 5.

This is illustrated in the following table which shows the true airspeed and nautical miles per US gallon during cruise for various altitudes and percent powers.

CRUISE PERFORMANCE						
	75 % POWER		65 % POWER		55 % POWER	
ALTITUDE	TRUE AIRSPEED	PER US GAL.	TRUE AIRSPEED	PER US GAL.	TRUE AIRSPEED	PER US GAL.
See Level	114 kts (211 km/h)	13.5 NM (25 km)	107 kts (198 km/h)	14.8 NM (27 km)	100 kts (185 km/h)	16.1 NM (30 km)
4000 ft (1220 m)	118 kts (219 km/h)	14.0 NM (26 km)	111 kts (206 km/h)	15.3 NM (28 km)	103 kts (191 km/h)	16.6 NM (31 km)
8000 ft (2440 m)	122 kts (226 km/h)	14.5 NM (27 km)	115 kts (213 km/h)	15.8 NM (29 km)	106 kts (196 km/h)	17.1 NM (32 km)
Standard Conditions					Zero Wind	

The use of full carburetor heat is recommended during flight in heavy rain to avoid the possibility of engine stoppage due to excessive water ingestion or to carburetor icing. The mixture setting should be readjusted for smoothest operation. Power changes should be made cautiously followed by prompt adjustment of the mixture for smoothest operation.

At temperatures lower than 0°C, partial carburetor heat should be avoided since the temperature rise obtained (0° to 21°C) may cause carburetor icing in certain atmospheric conditions.

To achieve the recommended lean mixture fuel consumption figures shown in section 5, the mixture should be leaned until engine RPM peaks and drops 25-50 RPM. At lower powers it may be necessary to enrichen the mixture slightly to obtain smooth operation.

Should it be necessary to cruise at higher than 75 % power, the mixture should not be set leaner than that required to provide peak RPM.

STALLS

The stall characteristics are conventional for the flaps up and flaps down condition. Slight buffeting may occur just before the stall with flaps down.

The figure of page 5-3 shows the stall indicated airspeeds with respect to the flaps position and angle of bank of the aircraft for maximum weight.

With aircraft weights lower than the full gross weight, stall speeds are reduced. The stall warning horn produces a steady signal 9 to 18 km/h - 5 to 10 kts - 6 to 12 MPH before the actual stall is reached and remains on until the normal flight attitude is resumed.

LANDINGS

NORMAL LANDING

Normal landing approaches can be made with power-on or power-off with any flap setting desired. 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.

NOTE

Carburetor heat should be applied prior to any significant reduction or closing of the throttle.

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 short field landings, in calm air, make a power-off approach at approximately 111 km/h - 60 kts - 69 MPH indicated airspeed with 40° of flaps. Touchdown should be made on the main wheels first. Immediately after touchdown, lower the nose gear to the ground and apply heavy braking as required. For maximum brake effectiveness after all three wheels are on the ground, retract the flaps, hold full nose up elevator and apply maximum possible brake pressure without sliding the tires.

Use of a slightly higher approach speed and partial power for better control to touchdown is recommended when turbulence or strong headwinds are present.

CROSSWIND LANDING

When landing in a strong crosswind, use the minimum flap setting required for the field length. Use a wing low, crab, or a combination method of drift correction and land in a nearly level attitude. Maintain directional control by using the nose wheel steering system and the brakes.

NOTE

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 aircraft.

BALKED LANDING

In a balked landing (go-around) climb, the wing flap setting should be reduced to 20° immediately after full power is applied. Upon reaching a safe airspeed, the flaps should be retracted to the full up position. If obstacles must be cleared during the go-around climb, reduce the wing flap setting to 10° and maintain a safe airspeed until the obstacles are cleared. Above 915 m - 3000 feet, lean the mixture to obtain maximum RPM. After clearing any obstacles, the flaps may be retracted as the aircraft accelerates to the normal flaps-up climb speed.

COLD WEATHER OPERATION

Prior to starting on cold mornings, it is advisable to pull the propeller through several times by hand. In extremely cold (-18°C and lower) weather, the use of an external preheater is recommended.

Cold weather starting procedures are as follows :

With Preheat :

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

NOTE

Use heavy strokes of primer for best atomization of fuel. After priming, check that the primer is in the locked position.

2. Propeller Area - Clear.
3. Avionics Power Switch - "OFF".
4. Master Switch - "ON".
5. Mixture - Rich.
6. Throttle - Open $1/8$ inch ($1/2$ cm).
7. Ignition Switch - "START".
8. Release ignition switch to "BOTH" when engine starts.
9. Oil Pressure - Check.

Without Preheat :

1. Prime the engine six to ten strokes while the propeller is being turned by hand with throttle closed. Leave primer charged and ready for stroke.
2. Propeller Area - Clear.
3. Avionics Power Switch - "OFF".
4. Master Switch - "ON".
5. Mixture - Rich.
6. Ignition Switch - "START".
7. Pump throttle rapidly to full open twice. Return to $1/8$ inch ($1/2$ cm) open position.
8. Release ignition switch to "BOTH" when engine starts.
9. Continue to prime engine until it is running smoothly.
10. Oil Pressure - Check.
11. Pull carburetor heat knob full on after engine has started. Leave on until engine is running smoothly.
12. Lock primer.

NOTE

If the engine does not start, it is probable that the spark plugs have been frosted over. Preheat must be used before another start is attempted.

CAUTION

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

BEFORE TAKE-OFF

After a suitable warm-up period (5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPM. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for take-off.

ROUGH ENGINE OPERATION OR LOSS OF POWER

CARBURETOR ICING

A gradual loss of RPM and eventual engine roughness may result from the formation of carburetor ice. To clear the ice, apply full throttle and pull the carburetor heat knob full out until the engine runs smoothly; then remove carburetor heat and readjust the throttle.

If conditions require the continued use of carburetor heat in cruise flight, use the minimum amount of heat necessary to prevent ice from forming and lean the mixture slightly for smoothest engine operation.

SPARK PLUG FOULING

A slight engine roughness in flight may be caused by one or more spark plugs becoming fouled by carbon or lead deposits. This may be verified by turning the ignition switch momentarily from "BOTH" to either "L" or "R" position. An obvious power loss in single ignition operation is

evidence of spark plug or magneto trouble. Assuming that spark plugs are the more likely cause, lean the mixture to the normal lean setting for cruising flight. If the problem does not clear up in several minutes, determine if a richer mixture setting will produce smoother operation. If not, proceed to the nearest airport for repairs using the "BOTH" position of the ignition switch unless extreme roughness dictates the use of a single ignition position.

MAGNETO MALFUNCTION

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

LOW OIL PRESSURE

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

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

SPECIFIC OPERATION

SPINS

Intentional spins are approved in this airplane. However, 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 F172N.

Spins with baggage compartment and/or child's seat occupied are prohibited. 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.

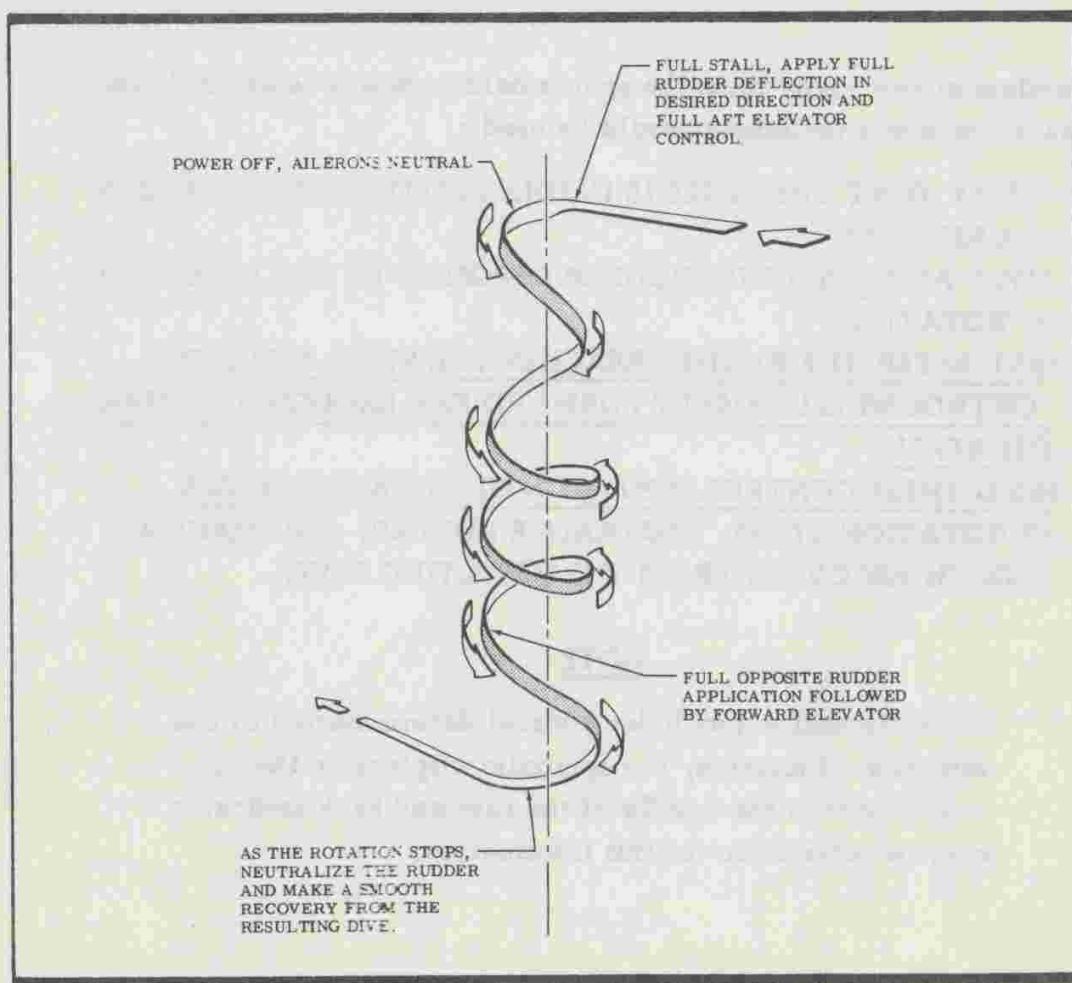


Figure 4-7

For a solo flight in which spins will be conducted, the copilot's seat belt and shoulder harness should be also secured.

It is recommended that, where feasible, entries be accomplished at high enough altitude that recoveries are completed 4000 ft (1220 m) or more above ground level. At least 1000 ft (305 m) 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 ft (1830 m) above ground level. In any case, entries should be planned so that recoveries are completed well above the minimum 1500 ft (460 m) above ground level. 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.

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 occupancy can cause differences in behavior, particularly in extended spins. These differences are normal and will result in variations in the spin characteristics and in the 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.

PERFORMANCE

NOTIFICATION

The tables appearing on the following pages result from actual tests with an airplane in good flying condition. They will be useful in flight planning ; nevertheless, it will be advisable to plan on an ample safety margin concerning the fuel reserve at arrival, since the data given does not take into account the effects of wind, navigational errors, pilot technique, run-up, climb, etc. All these factors should be considered when estimating the reserve required by regulations. Don't forget that maximum range increases by using a lower power setting.

DEMONSTRATED CROSSWIND

Take-off and landing : 28 km/h - 15 kts - 17 MPH

AIRSPEED CORRECTION TABLE

FLAPS UP													
IAS	km/h	74	93	111	130	148	167	185	204	222	241	259	
CAS	km/h	91	102	115	130	148	165	183	200	219	237	256	
IAS	kts	40	50	60	70	80	90	100	110	120	130	140	
CAS	kts	49	55	62	70	80	89	99	108	118	128	138	
IAS	MPH	46	58	69	81	92	104	115	127	138	150	161	
CAS	MPH	56	63	71	81	92	102	114	124	136	147	159	
FLAPS DOWN 10°													
IAS	km/h	74	93	111	130	148	158	-	-	-	-	-	
CAS	km/h	91	102	115	131	148	157	-	-	-	-	-	
IAS	kts	40	50	60	70	80	85	-	-	-	-	-	
CAS	kts	49	55	62	71	80	85	-	-	-	-	-	
IAS	MPH	46	58	69	81	92	98	-	-	-	-	-	
CAS	MPH	56	63	71	82	92	98	-	-	-	-	-	
FLAPS DOWN 40°													
IAS	km/h	74	93	111	130	148	158	-	-	-	-	-	
CAS	km/h	87	100	115	131	150	159	-	-	-	-	-	
IAS	kts	40	50	60	70	80	85	-	-	-	-	-	
CAS	kts	47	54	62	71	81	86	-	-	-	-	-	
IAS	MPH	46	58	69	81	92	98	-	-	-	-	-	
CAS	MPH	54	62	71	82	93	99	-	-	-	-	-	

STALL INDICATED AIRSPEEDS				
POWER OFF	ANGLE OF BANK			
	0°	30°	45°	60°
MAXIMUM GROSS WEIGHT 1043 kg CONDITIONS				
FLAPS 0°	87 km/h 47 kts 54 MPH	95 km/h 51 kts 59 MPH	104 km/h 56 kts 64 MPH	122 km/h 66 kts 76 MPH
FLAPS 10°	81 km/h 44 kts 51 MPH	87 km/h 47 kts 54 MPH	96 km/h 52 kts 60 MPH	115 km/h 62 kts 71 MPH
FLAPS 40°	76 km/h 41 kts 47 MPH	81 km/h 44 kts 51 MPH	91 km/h 49 kts 56 MPH	107 km/h 58 kts 67 MPH

PERFORMANCE

SPECIFICATIONS

GROSS WEIGHT

Normal Category

1043 kg

Utility Category

910 kg

SPEED

Maximum at Sea Level

232 km/h - 125 kts - 144 MPH

Cruise, 75 % Power at 2440 m - 8000 ft

226 km/h - 122 kts - 140 MPH

CRUISE : Recommended Lean Mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45 % power.

75 % Power at 2440 m - 8000 ft

Range 898 km - 485 NM

40 US Gal. (152 l) Usable Fuel

Time 4.1 hrs

75 % Power at 2440 m - 8000 ft

Range 1167 km - 630 NM

50 US Gal. (189 l) Usable Fuel

Time 5.3 hrs

Maximum Range at 3048 m - 10,000 ft

Range 1065 km - 575 NM

40 US Gal. (152 l) Usable Fuel

Time 5.7 hrs

Maximum Range at 3048 m - 10,000 ft

Range 1389 km - 750 NM

50 US Gal. (189 l) Usable Fuel

Time 7.4 hrs

RATE OF CLIMB AT SEA LEVEL

3.9 m/s - 770 ft/mn

SERVICE CEILING

4328 m - 14,200 ft

STALL SPEED (IAS)

Flaps Up, Power Off

87 km/h - 47 kts - 54 MPH

Flaps Down, Power Off

76 km/h - 41 kts - 47 MPH

TAKEOFF	
Ground Run	245 m
Total Distance Over 15 m Obstacle	439 m
LANDING	
Ground Roll	158 m
Total Distance Over 15 m Obstacle	381 m
EMPTY WEIGHT (Approximate)	
With Standard Tanks	606 kg
With Long Range Tanks	610 kg
BAGGAGE	54 kg
WING LOADING	64 kg/m ²
POWER LOADING	8.76 kg/kW
TOTAL FUEL CAPACITY	
With Standard Tanks	163 litres - 43 US Gal.
With Long Range Tanks	204 litres - 54 US Gal.
OIL TANK CAPACITY	6 qts - 6 litres
PROPELLER : Fixed Pitch (Diameter)	1.91 m
ENGINE : Lycoming Engine 160 BHP - 119 kW at 2700 RPM	
Type O-320-H2AD	

TAKEOFF DISTANCE [SHORT FIELD]														
CONDITIONS :				Flaps up		Full throttle prior to brake release		Paved, level, dry runway		Zero wind				
Maxi- mum Weight kg	IAS		Pressure Altitude		0°C		10°C		20°C		30°C		40°C	
	Lift Off	At 15 m	ft	m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m
1043	96 km/h	109 km/h	Sea level		219	396	236	424	255	454	273	485	293	518
			1000	305	241	433	259	465	279	497	299	532	320	568
	52 kt	59 kt	2000	610	264	474	283	509	305	546	328	584	352	626
	60 MPH	68 MPH	3000	914	290	521	312	559	335	600	361	645	387	690
			4000	1219	319	573	343	617	369	663	396	712	427	765
			5000	1524	351	632	378	683	407	735	437	791	469	852
			6000	1829	386	703	416	757	450	817	483	882	520	953
			7000	2134	427	782	460	844	497	914	535	989	576	1071
			8000	2438	472	875	511	948	550	1029	593	1119	639	1216
NOTES :														
1. Short field technique as specified in Section 4.														
2. Prior to takeoff from fields above 3000 ft - 914 m 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.														

450% wet grass

TAKEOFF DISTANCE															SHORT FIELD																																																																																																																																																																																																																																																											
CONDITIONS :															Flaps up		Full throttle prior to brake release				Paved, level, dry runway				Zero wind																																																																																																																																																																																																																																																	
Maxi- mum Weight kg	IAS		Pressure Altitude		0°C		10°C		20°C		30°C		40°C		Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll

TAKEOFF DISTANCE																
SHORT FIELD																
CONDITIONS :																
Flaps up				Full throttle prior to brake release				Paved, level, dry runway				Zero wind				
Maxi- mum Weight kg	IAS		Pressure Altitude		0°C		10°C		20°C		30°C		40°C			
	Lift Off	At 15 m	ft	m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m		
862	87	100	Sea level		143	264	154	280	165	300	177	319	189	340		
		km/h														
	47	54			1000	305	157	287	168	306	180	326	194	347	207	370
	kt	kt			2000	610	171	312	184	334	197	357	212	379	227	405
	54	62			3000	914	187	340	201	364	216	389	232	416	248	443
	MPH	MPH			4000	1219	204	372	221	398	238	427	255	456	273	486
			5000	1524	226	408	242	437	261	468	281	500	300	535		
			6000	1829	247	448	263	480	287	515	308	552	331	591		
			7000	2134	273	494	294	530	315	568	340	610	364	654		
			8000	2438	300	546	325	587	349	629	375	677	402	727		
	NOTES :															
	1. Short field technique as specified in Section 4.															
2. Prior to takeoff from fields above 3000 ft - 914 m 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.																

MAXIMUM RATE OF CLIMB														
CONDITIONS :				Full throttle										
Maximum Weight	Pressure Altitude		Climb Speed				RATE OF CLIMB							
	ft	m	km/h	kts	MPH	- 20°C		0°C		20°C		40°C		
						ft/mn	m/s	ft/mn	m/s	ft/mn	m/s	ft/mn	m/s	
1043	Sea level		135	73	84	875	4.45	815	4.14	755	3.84	695	3.53	
	2000	610	133	72	83	765	3.89	705	3.58	650	3.30	590	3	
	4000	1219	131	71	82	655	3.33	600	3.05	545	2.77	485	2.46	
	6000	1829	130	70	81	545	2.77	495	2.52	440	2.24	385	1.96	
	8000	2438	128	69	79	440	2.24	390	1.99	335	1.70	280	1.42	
	10,000	3048	126	68	78	335	1.70	285	1.45	230	1.17	-	-	
	12,000	3658	124	67	77	230	1.17	180	0.91	-	-	-	-	

NOTE : Mixture leaned above 3000 ft - 914 m for maximum RPM.

TIME, FUEL, AND DISTANCE TO CLIMB <div>MAXIMUM RATE OF CLIMB</div>													
CONDITIONS : Flaps up Full throttle Standard temperature													
Weight	Pressure Altitude		Tempe- rature	Climb Speed IAS		Rate of Climb		From Sea Level					
								Time	Fuel used		Distance		
	kg	ft		m	°C	km/h	kts		ft/mn	m/s	mn	US Gal.	Litres
726	Sea level		15	135	73	770	3.9	0	0	0	0	0	0
	1000	305	13	135	73	725	3.7	1	0.3	1.1	2	3.7	
	2000	610	11	133	72	675	3.4	3	0.6	2.3	3	5.6	
	3000	914	9	133	72	630	3.2	4	0.9	3.4	5	9.3	
	4000	1219	7	131	71	580	2.9	6	1.2	4.5	8	14.8	
	5000	1524	5	131	71	535	2.7	8	1.6	6.1	10	18.5	
	6000	1829	3	130	70	485	2.5	10	1.9	7.2	12	22.2	
	7000	2134	1	128	69	440	2.2	12	2.3	8.7	15	27.8	
	8000	2438	- 1	128	69	390	2	15	2.7	10.2	19	35.2	
	9000	2743	- 3	126	68	345	1.8	17	3.2	12.1	22	40.8	
	10,000	3048	- 5	126	68	295	1.5	21	3.7	14	27	50	
	11,000	3353	- 7	124	67	250	1.3	24	4.2	15.9	32	59.3	
12,000	3658	- 9	124	67	200	1	29	4.9	18.5	38	70.4		
NOTES :													
1. Add 1.1 gallons 4.16 litres of fuel for engine start, taxi and takeoff allowance.													
2. Mixture leaned above 3000 ft - 914 m for maximum RPM.													
3. Increase time, fuel and distance by 10 % for each 10°C above standard temperature.													
4. Distances shown are based on zero wind.													

Page intentionally
left blank

CRUISE PERFORMANCE

CRUISE PERFORMANCE																						
CONDITIONS :			Recommended lean mixture																			
			20°C Below Standard Temperature						Standard Temperature						20°C Above Standard Temperature							
Pressure Altitude ft m	RPM	% BHP	True Airspeed			Consumption			% BHP	True Airspeed			Consumption			% BHP	True Airspeed			Consumption		
			km/h	kt	mph	US gal/h	l/h	km/h		kt	mph	US gal/h	l/h	km/h	kt		mph	US gal/h	l/h			
2000 610	2500	-	-	-	-	-	-	-	75	215	116	134	8.4	31.8	71	213	115	138	7.9	29.9		
	2400	72	206	111	128	8.0	30.3	67	206	111	128	7.5	28.4	63	204	110	127	7.1	26.9			
	2300	64	196	106	122	7.1	26.9	60	195	105	121	6.7	25.4	56	195	105	121	6.3	23.8			
	2200	56	187	101	116	6.3	23.8	53	185	100	115	6.1	23.1	50	183	99	114	5.8	22			
	2100	50	176	95	109	5.8	22	47	174	94	108	5.6	21.2	45	172	93	107	5.4	20.4			
4000 1219	2550	-	-	-	-	-	-	-	75	219	118	136	8.4	31.8	71	219	118	136	7.9	29.9		
	2500	76	215	116	134	8.5	32.2	71	213	115	132	8.0	30.2	67	213	115	132	7.5	28.4			
	2400	68	206	111	128	7.6	28.8	64	204	110	127	7.1	26.9	60	202	109	125	6.7	25.4			
	2300	60	195	105	121	6.8	25.7	57	195	105	121	6.4	24.2	54	193	104	120	6.1	23.1			
	2200	54	185	100	115	6.1	23.1	51	183	99	114	5.9	22.3	48	182	98	113	5.7	21.6			
	2100	48	174	94	108	5.6	21.2	46	172	93	107	5.5	20.8	44	170	92	106	5.3	20.1			

Flight Manual
REIMS/CESSNA F172N

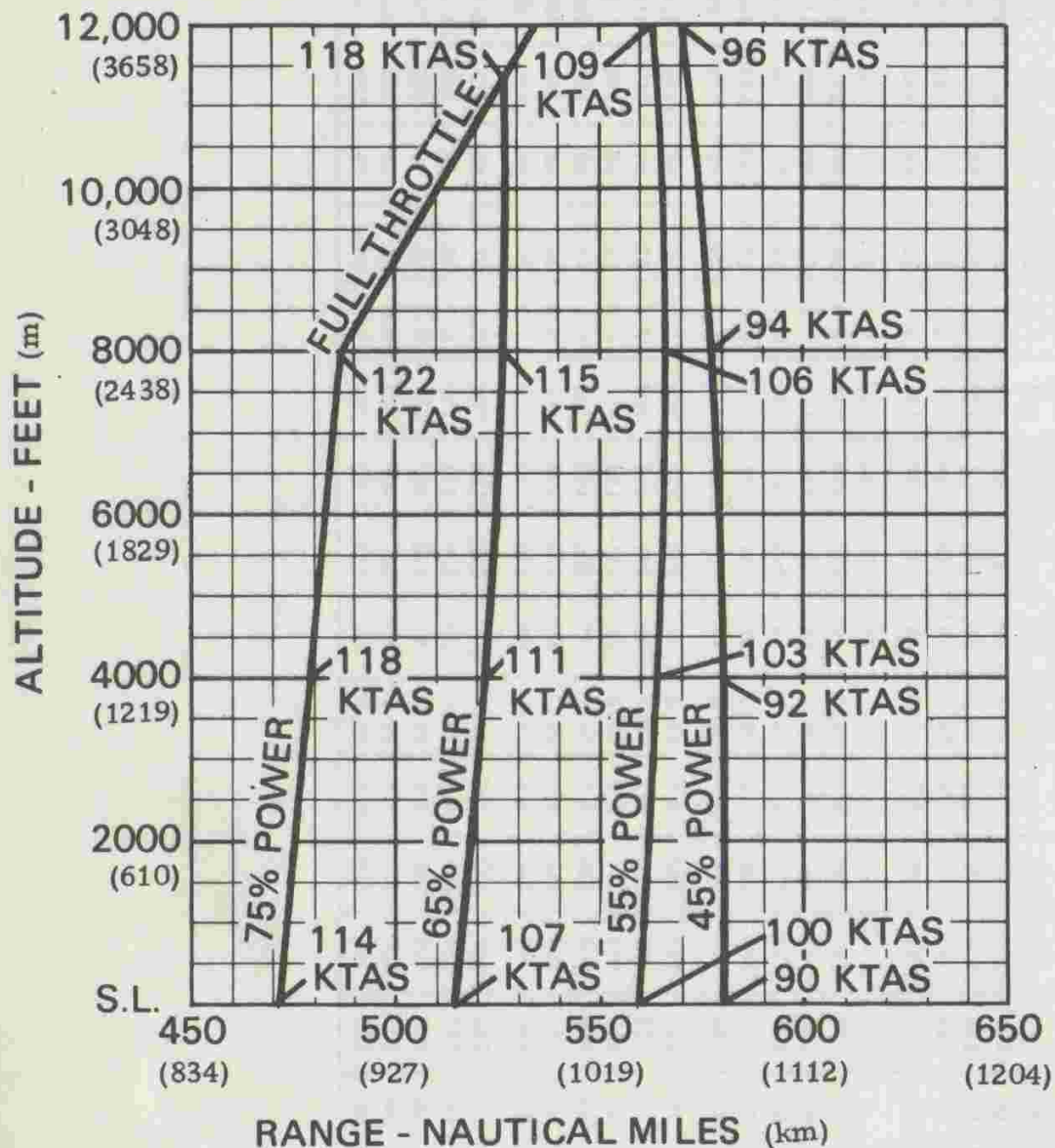
Edition 1 - August 1976

6000	1829	2600	-	215	-	-	-	75	222	120	138	8.4	31.8	71	222	120	138	7.9	29.9
		2500	72	204	116	134	8.1	30.7	213	115	132	7.6	28.8	64	211	114	131	7.1	26.9
		2400	64	195	110	127	7.2	27.3	202	109	125	6.8	25.7	57	202	109	125	6.4	24.2
		2300	57	183	105	121	6.5	24.6	193	104	120	6.2	23.5	52	191	103	118	5.9	22.3
		2200	51	172	99	114	5.9	22.3	182	98	113	5.7	21.6	47	180	97	112	5.5	20.8
		2100	46	158	93	107	5.5	20.8	170	92	106	5.4	20.4	42	169	91	105	5.2	19.7
8000	2438	2650	-	222	-	-	-	75	226	122	140	8.4	31.8	71	226	122	140	7.9	29.9
		2600	76	213	120	138	8.6	32.6	211	120	138	8.0	30.3	67	221	119	139	7.5	28.4
		2500	68	204	115	132	7.7	29.1	202	114	131	7.2	27.3	60	209	113	130	6.8	25.7
		2400	61	193	110	127	6.9	26.1	191	109	125	6.5	24.6	55	200	108	124	6.3	23.5
		2300	55	182	104	120	6.2	23.5	180	103	119	6.0	22.7	50	189	102	117	5.8	22
		2200	49	172	98	113	5.7	21.6	170	97	112	5.5	20.8	45	176	96	110	5.4	20.4
10,000	3048	2650	76	222	122	140	8.5	32.2	226	122	140	8.0	30.3	67	224	121	139	7.5	28.4
		2600	72	213	120	138	8.1	30.7	211	119	137	7.6	28.8	64	219	118	136	7.1	26.9
		2500	65	204	114	131	7.3	27.6	202	114	131	6.8	25.7	58	208	112	129	6.5	24.6
		2400	58	193	109	125	6.5	24.6	191	108	124	6.2	23.5	52	198	107	123	6.0	22.7
		2300	52	182	103	119	6.0	22.7	180	102	117	5.8	22	48	187	101	116	5.6	21.2
		2200	47	172	97	112	5.6	21.2	170	96	110	5.4	20.4	44	176	95	109	5.3	20.1
12,000	3658	2600	68	221	119	137	7.7	29.1	219	118	136	7.2	27.3	61	217	117	135	6.8	25.7
		2500	62	211	114	131	6.9	26.1	209	113	130	6.5	24.6	55	206	111	128	6.2	23.5
		2400	56	200	108	124	6.3	23.8	198	107	123	6.0	22.7	51	196	106	122	5.8	22
		2300	50	189	102	117	5.8	21.9	187	101	116	5.6	21.2	46	185	100	115	5.5	20.8
		2200	46	178	96	110	5.5	20.8	176	95	109	5.4	20.4	43	174	94	108	5.3	20.1

RANGE PROFILE

45 MINUTES RESERVE 40 US GAL - 156 l USABLE FUEL

CONDITIONS : 1043 kg - Recommended Lean Mixture for Cruise -
Standard Temperature - Zero Wind



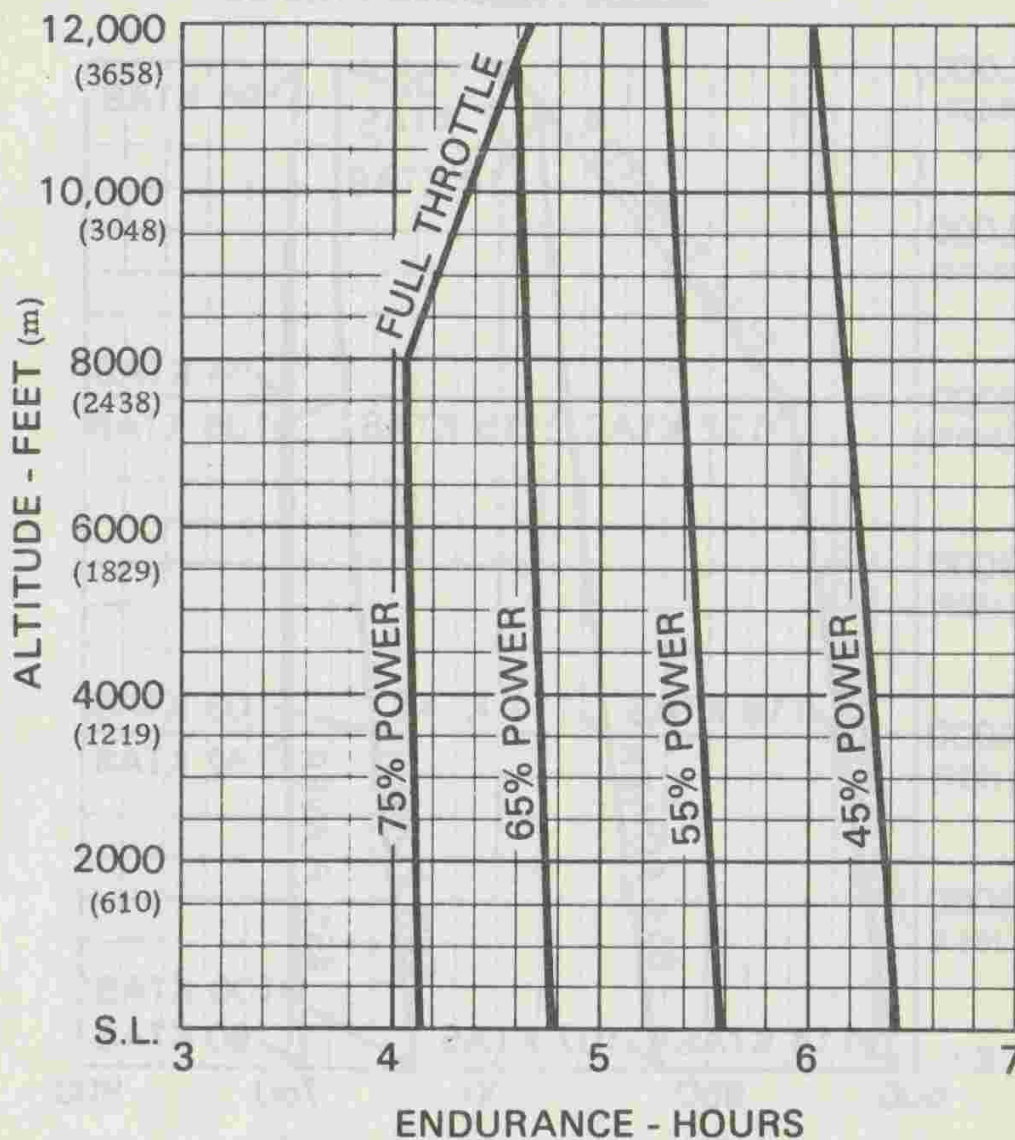
NOTES :

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during climb as shown in figure page 5-10
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l

ENDURANCE PROFILE

45 MINUTES RESERVE - 40 US GAL - 151 l USABLE FUEL

CONDITIONS : 1043 kg - Recommended Lean Mixture for Cruise -
Standard Temperature



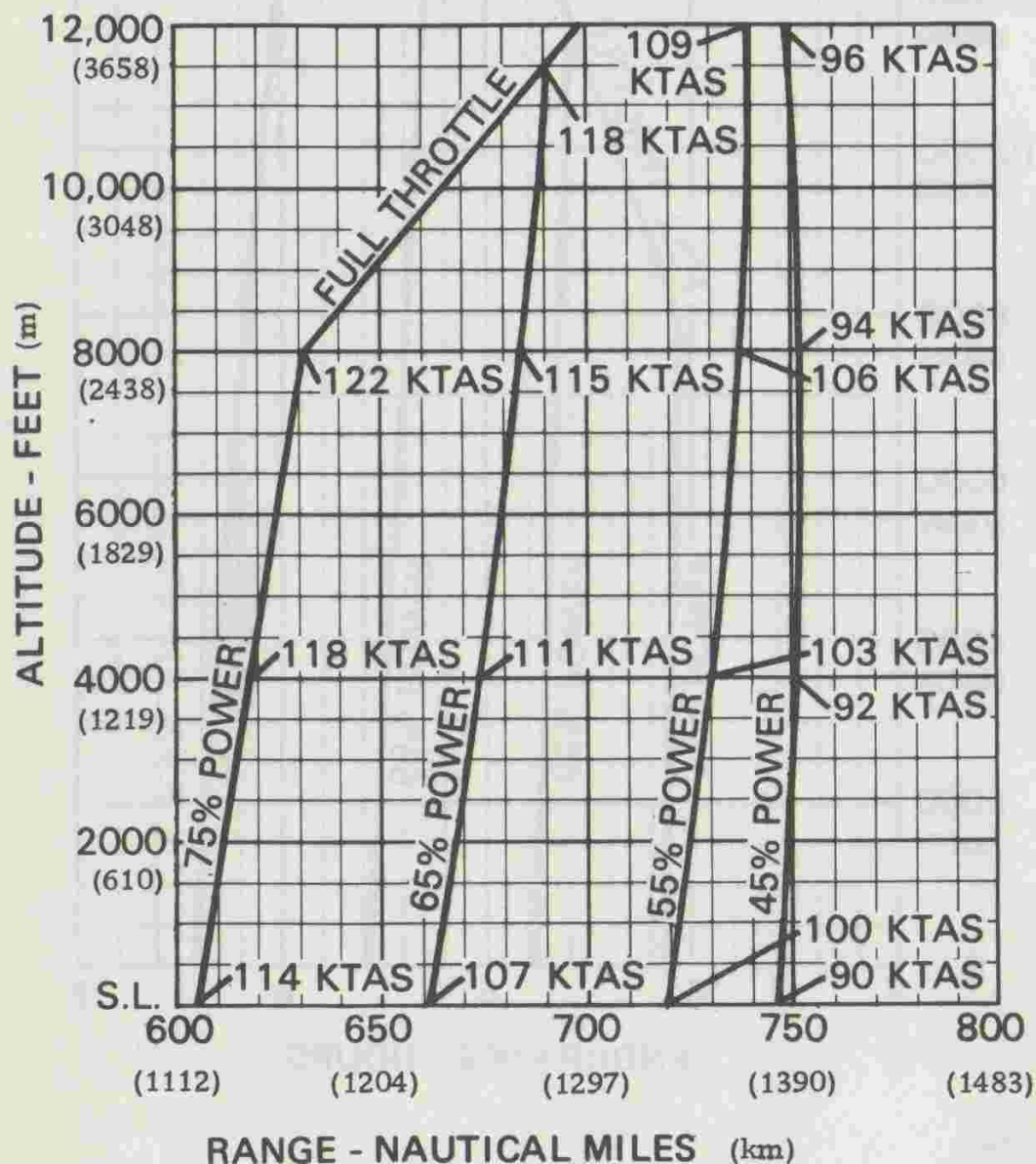
NOTES :

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb as shown in figure page 5-10
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l

RANGE PROFILE

45 MINUTES RESERVE - 50 US GAL - 189 l USABLE FUEL

CONDITIONS : 1043 kg - Recommended Lean Mixture for Cruise -
Standard Temperature - Zero Wind



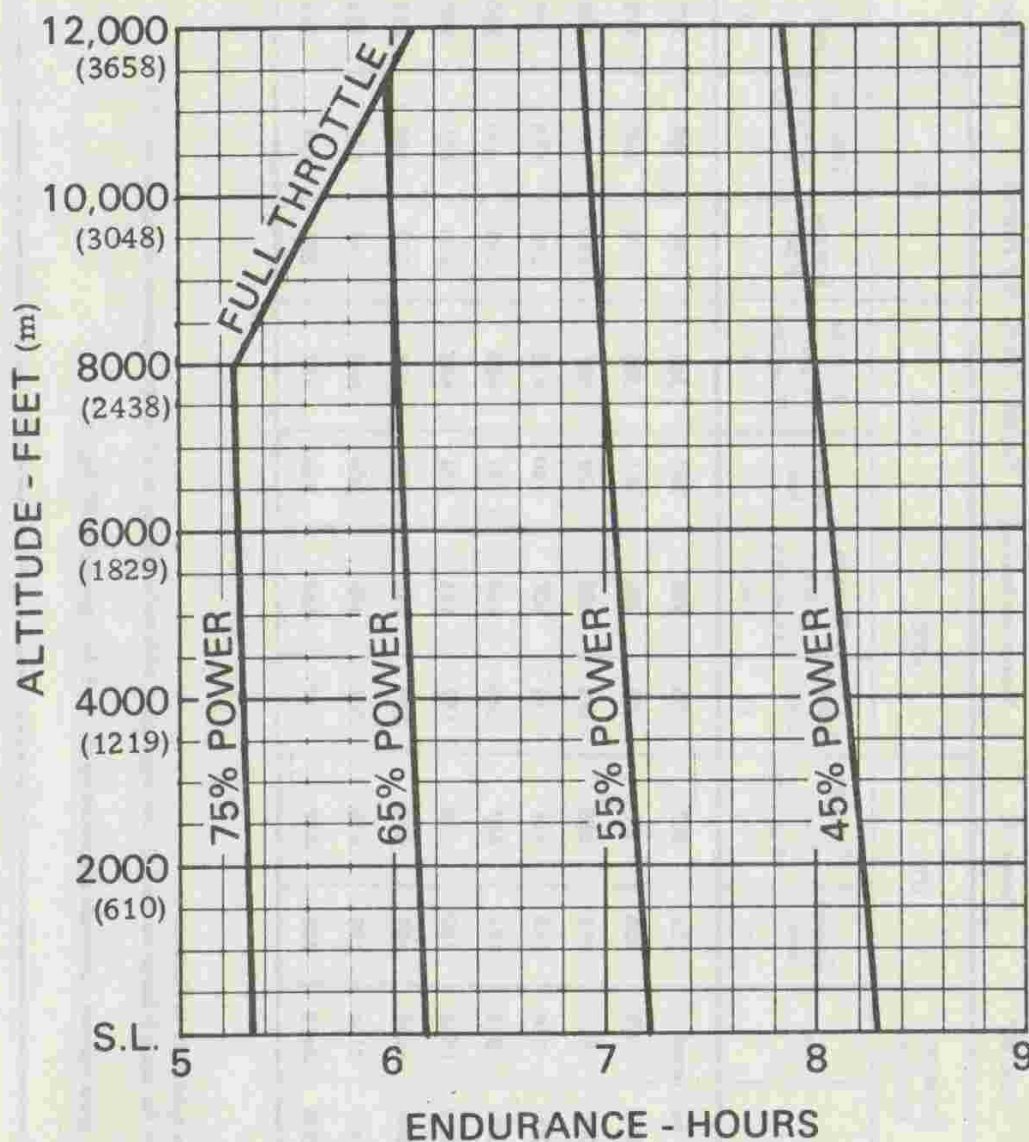
NOTES :

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during climb as shown in figure page 5-10
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l

ENDURANCE PROFILE

45 MINUTES RESERVE - 50 US GAL - 189 l USABLE FUEL

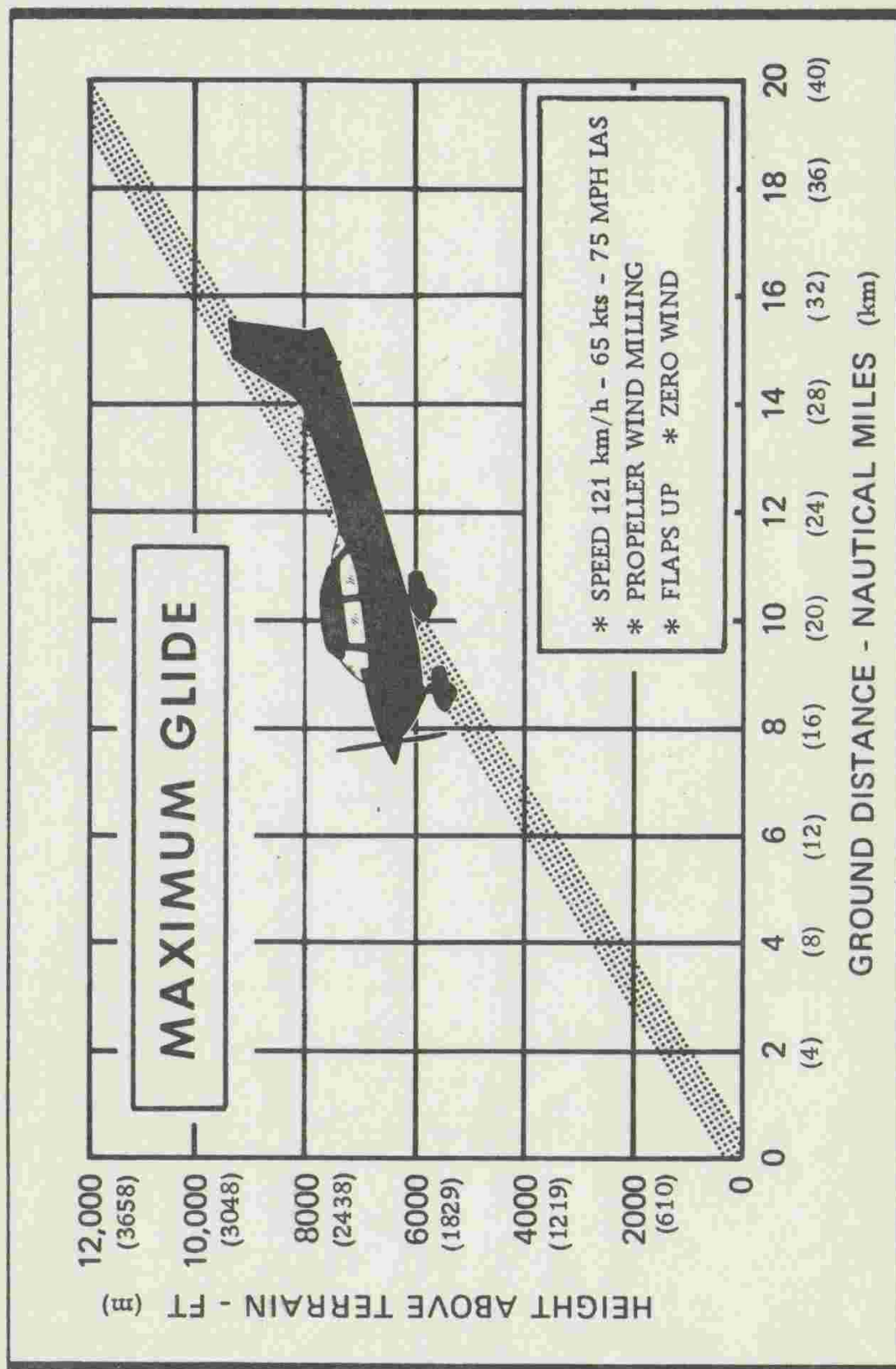
CONDITIONS : 1043 kg - Recommended Lean Mixture for Cruise -
Standard Temperature



NOTES :

1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb as shown in figure page 5-10
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l

LANDING DISTANCE													
SHORT FIELD													
CONDITIONS : Flaps 40° Paved, level, dry runway Zero Wind													
Weight kg	IAS At 15 m	Pressure Altitude		0°C		10°C		20°C		30°C		40°C	
		ft	m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m	Ground Roll m	Total to Clear 15 m Obs m
1043	111 km/h	Sea level		151	367	155	376	162	386	166	395	172	405
	60 kt	1000	305	155	376	162	386	168	396	172	405	178	416
	69 MPH	2000	610	162	386	168	396	174	407	180	418	186	428
		3000	914	168	396	174	407	180	418	186	428	192	439
		4000	1219	174	407	180	418	187	430	194	440	200	451
		5000	1524	180	418	187	431	194	442	200	453	207	465
		6000	1829	187	431	195	443	201	454	209	468	215	479
		7000	2134	195	443	201	456	209	468	216	480	223	492
		8000	2438	203	457	210	469	216	482	224	494	232	507
NOTES :													
1. Short field technique as specified in Section 4.													
2. Decrease distances 10 % for each 9 knots headwind. For operation with tailwinds up to 10 knots, increase distances by 10 % for each 2 knots.													
3. For operation on a dry, grass runway, increase distances by 45 % of the "ground roll" figure.													



SERVICING

For quick and ready reference, quantities, materials, and specifications for frequently used service items (such as fuel, oil, etc.) are shown in the following pages.

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

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

The manufacturer Progressive Care ensures that these requirements are accomplished at the required intervals to comply with the 100-HOUR or ANNUAL inspection as previously covered. Depending on various flight operations, your local Government Aviation Agency may require additional service, inspections, or tests.

For these regulatory requirements, owners should check with local aviation officials where the aircraft is being operated.

ENGINE OIL

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, and the following oils used as specified for the average ambient air temperature in the operating area.

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

SAE 50 above 16°C

SAE 40 between -1°C and 32°C

SAE 30 between -18°C and 21°C

SAE 20 below -12°C

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

SAE 40 or SAE 50 above 16°C

SAE 40 between -1°C and 32°C

SAE 30 or SAE 40 between -18°C and 21°C

SAE 30 below -12°C

OIL SUMP CAPACITY : 6 QTS (5.7 LITRES)

Do not operate on less than 4 qts (3.8 litres). To minimize loss of oil through breather, fill to 5 qts (4.7 litres) for normal flights of less than 3 hours. For extended flight, fill to 6 qts (5.7 litres). (Quantities shown above are oil dipstick level only). If optional oil filter is installed, one additional quart (0.9 litre) is required when oil and the filter element are changed.

ENGINE OIL SUMP AND OIL FILTER CHANGE

After first 25 hours of operation, drain engine oil sump and oil cooler and clean both the oil suction strainer and oil pressure screen. If an optional oil filter is installed, change filter element at this time. Refill sump with straight mineral oil (non-detergent) and use until a total of 50 hours have accumulated, then change to detergent oil.

Drain the engine oil sump and oil cooler and clean both the oil suction strainer and oil pressure screen at 50-hour intervals.

On the aircraft which have an optional oil filter, the oil change interval may be extended to 100-hour interval providing the oil filter element is changed at 50-hour intervals.

In all cases, change the oil even though less than 50 hours have accumulated within a six-month period. Reduce periods for prolonged operation in dusty areas, cold climates, or when short flights and long idle periods result in sludging conditions.

FUEL

FUEL GRADE : Aviation grade 100 LL (Blue)

NOTE

100 (Formerly 100/130) Aviation Grade Fuel (Green) with maximum lead content of 4.6 cc per gallon is also approved for use (Refer to AVCO LYCOMING Service Bulletin N° 1070F).

FUEL TANK CAPACITY (EACH STANDARD TANK) : 81.5 litres (21.5 US Gal.)

FUEL TANK CAPACITY (EACH LONG RANGE TANK) : 102 litres (27 US Gal.)

NOTE

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

LANDING GEAR

NOSE WHEEL TIRE AND PRESSURE :

5.00 x 5 - 4 PR 2.14 bar - 31 psi

6.00 x 6 - 4 PR 1.79 bar - 26 psi

MAIN WHEEL TIRE AND PRESSURE :

6.00 x 6 - 4 PR 2.00 bar - 29 psi

NOSE GEAR SHOCK STRUT

Check level, fill as required with MIL-H-5606 hydraulic fluid and inflate with air to 3.1 bars - 45 psi.

NOTE

For complete servicing requirements, refer to the aircraft Service Manual.

MAINTENANCE

GROUND HANDLING

The airplane is most easily and safely maneuvered by hand with a tow-bar attached to the nose wheel.

When using the tow-bar, never exceed the turning angle of 30° either side of center, or damage to the gear will result.

MOORING YOUR AIRPLANE

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

- (1) Set parking brake and install control wheel lock.
- (2) Install a control surface lock between each aileron and flap.
- (3) Tie sufficiently strong ropes to wing and tail tie-down fittings, and secure each rope to ramp tie-down.
- (4) Install a control surface lock over the fin and rudder.
- (5) Install a pitot tube cover.

WINDSHIELD - WINDOWS

The windshield and windows should be kept clean at all times. Wash them carefully with plenty of soap and water, using palm of hand. Chamois or sponge may be used, but only to carry water to the surface. Rinse thoroughly, then dry with a clean, moist chamois.

Rubbing the surface of the plastic with a dry cloth builds up an electrostatic charge which attracts dust particles in the air ; the use of a chamois prevents such a dust attraction.

Remove oil and grease with a cloth moistened with kerosene. Never use gasoline, benzine, alcohol, acetone, carbon tetrachloride, anti-mist

fluid, lacquer thinner, etc... These materials will soften the plastic and may cause it to craze.

After removing dirt and grease, the surface may be waxed with a good grade of wax. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry, soft flannel cloth. Do not use a power buffer ; the heat generated by the buffing pad may soften the plastic.

PAINTED SURFACES

The painted exterior surfaces of the aircraft require an initial curing period which may be as long as 15 days. During this curing period, some precautions should be taken to avoid damaging the finish. The finish should be cleaned only by washing with clean water and mild soap, followed by a rinse water and drying with chamois. Do not use polish or wax, and avoid flying through rain, hail or sleet during this period. Once the finish has cured completely, wax or polish may be used, particularly on the leading edges, engine nose cap, and propeller spinner to reduce the abrasion encountered in these areas.

PROPELLER CARE

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

INTERIOR CARE

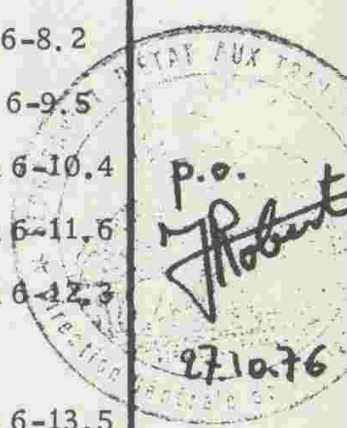
To remove dust and loose dirt from the upholstery, headliner, and carpet, clean the interior regularly with a vacuum cleaner.

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


The "royalite" trim, instrument panel and control knobs need only be wiped off with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene.

Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the plastic.

OPTIONAL EQUIPMENT LIST

DESCRIPTION	PAGE	APPROVAL
Winterization kit	6-1.1	
Ground Service Plug Receptacle	6-2.1	
Oil Quick-Drain Valve	6-3.1	
Radio Transmitter Selector Switch	6-4.1	
Combination Headgear	6-4.1	
Carburetor Air Temperature Gage	6-5.1	
True Airspeed Indicator	6-6.1	
Instrument Flying (IFR)	6-7.1 thru 6-7.5	
Glider Towing Hook	6-8.1 and 6-8.2	
Fernandez Skis Kit	6-9.1 thru 6-9.5	
ARC 300 Automatic Pilot	6-10.1 thru 6-10.4	
Skydiving Kit	6-11.1 thru 6-11.6	
Badin Crouzet RG 10 B Automatic Pilot	6-12.1 thru 6-12.3	
Nav-0-Matic 200 A Automatic Pilot	6-13.1 thru 6-13.5	
Nav-0-Matic 300 A Automatic Pilot	6-14.1 thru 6-14.7	
Auxiliary Fuel System	6-15.1 thru 6-15.5	

OPTIONAL EQUIPMENT LIST

DESCRIPTION	PAGE	
Floatplane Option	6-16.1 thru 6-16.36	

WINTERIZATION KIT

For continuous operation in temperatures consistently below -7°C , the winterization kit should be installed to improve engine operation.

The kit consists of :

- Two shields to partially cover the cowl nose cap openings.
- One shield to partially cover the oil cooler air inlet at the RH rear side of the engine.
- An insulation for the engine crankcase breather line.

NOTE

Once installed, the crankcase breather insulation is approved for permanent use in both cold and hot weather.

GROUND SERVICE PLUG RECEPTACLE

GENERAL

A ground service plug receptacle may be installed on left aft side of lower engine cowl to permit the use of an external power source (generator type or battery cart) for cold-weather starting and during lengthy maintenance work on the airplane electrical system.

OPERATING PROCEDURES

- Use a 24-volt direct current external power unit (generator type or battery cart) with grounded negative.
- Turn off the avionics power switch.
- Turn the master switch "ON" just before connecting an external power source.

NOTE

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

- The ground service plug receptacle circuit incorporates a polarity reversal protection. Power from the external power source will flow only if the ground service plug is correctly connected to the airplane.
- Use of ground service plug receptacle with "dead" battery on engine starting : The battery and external power circuits have been designed to completely eliminate the need to "jumper" across the battery contactor to close it for charging a completely "dead" battery. A special fuse circuit will close the battery contactor when the battery is completely "dead".

OIL QUICK-DRAIN VALVE

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

RADIO SELECTOR SWITCHES

When more than one radio is installed, an audio switching system is necessary. The operation of this switching system is described below.

Transmitter Selector Switch

The transmitter selector switch, labeled "XMTR SEL", has three positions. When three transmitters are installed, it is necessary to switch the microphone to the radio unit the pilot desires to use for transmission. This is accomplished by placing the transmitter selector switch to the radio unit which is to be used.

"Speaker-Phone" Switch

The switch corresponding to the selected receiver is used to apply the output of that receiver either to the speaker through the audio amplifier in the up position or directly to the headphones in the down position.

COMBINATION HEADGEAR

The pilot may transmit by depressing the microphone keying switch located on the left side of the pilot's control wheel. The plug-in jacks are located on the lower left side of the instrument panel.

CARBURETOR AIR TEMPERATURE GAGE

A carburetor air temperature gage may be installed in the aircraft to help detect carburetor icing conditions. The gage is marked with a yellow arc between -15° and $+5^{\circ}\text{C}$. The yellow arc indicates the carburetor temperature range where carburetor icing can occur ; a placard on the gage reads KEEP NEEDLE OUT OF YELLOW ARC DURING POSSIBLE ICING CONDITIONS.

Visible moisture or high humidity can cause carburetor ice formation, especially in idle or low power conditions. Under cruising conditions, the formation of ice is usually slow, providing time to detect the loss of RPM caused by the ice. Carburetor icing during take-off is rare since the full-open throttle condition is less susceptible to ice obstruction.

If the carburetor air temperature gage needle moves into the yellow arc during potential carburetor icing conditions, or there is an unexplained drop in RPM, apply full carburetor heat. Upon regaining the original RPM (with heat off), determine by trial and error the minimum amount of carburetor heat required for ice-free operation.

NOTE

Carburetor heat should not be applied during take-off unless absolutely necessary to obtain smooth engine acceleration (usually in sub-zero temperatures).

TRUE AIRSPEED INDICATOR

A true airspeed indicator is available to replace the standard airspeed indicator in your airplane. The true airspeed indicator has a calibrated rotatable ring which works in conjunction with the airspeed indicator dial in a manner similar to the operation of a flight computer.

TO OBTAIN TRUE AIRSPEED, rotate ring until pressure altitude is aligned with outside air temperature in degrees Fahrenheit. Then read true airspeed on rotatable ring opposite airspeed needle.

NOTE

Pressure altitude should not be confused with indicated altitude. To obtain pressure altitude, set barometric scale on altimeter to "1013 mb" and read pressure altitude on altimeter. Be sure to return altimeter barometric scale to original barometric setting after pressure altitude has been obtained.

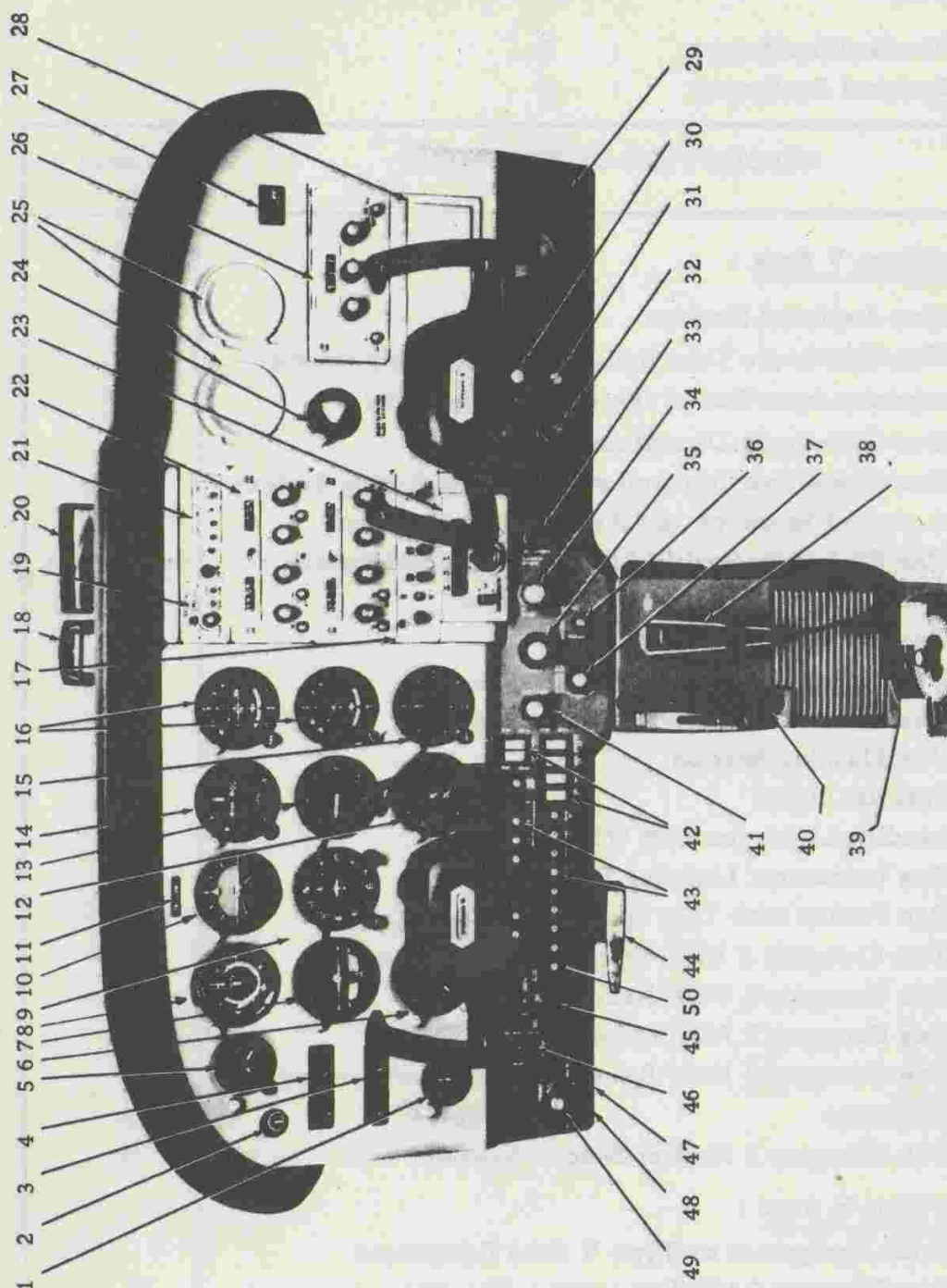
INSTRUMENT FLYING (IFR)

For IFR operation, F172N private aircraft must be equipped with the following :

Standard Equipment : S
Optional Equipment : O

DESCRIPTION OF EQUIPMENT	S or O
<u>For Type V Area :</u>	
- One Artificial Horizon	O
- One Gyroscopic Turn Indicator (with supply source separate from that of the artificial horizon)	S
- One Gyroscopic Directional Indicator	O
- One Gyroscopic Instrument Power Monitoring System	O
- A second Sensitive and Adjustable Altimeter	O
- One Pitot Tube and Stall Warning Heater System	O
- One Alternate Static Pressure Source	O
- One Rate of Climb Indicator	O
- One Outside Air Temperature Gage	O
- One Electric Clock with Second Hand	O
- One Flashing Beacon	O
- Position Lights	S
- Landing Lights (on Left Wing)	O
- One Instrument Lighting System	S
- One Pocket with Two Spare Fuses Each Rating	O
- Two Category 2 VHF Transmitter-Receivers	O
- One Category 2 VOR Receiver	O
- One Category 2 ADF System	O
- One Category 2 NAV Receiver with Localizer and ILS Functions	O
- One Category 2 Marker Beacon System	O
<u>For Type H Area :</u>	
- Same Equipment as Type V Area Equipment	
- One Category 2 HF Transmitter-Receiver	O
<u>NOTE</u> : For night flights, the crew should have an electric flashlight available.	

INSTRUMENT PANEL



DESCRIPTION

- | | |
|--|--|
| 1. Ammeter | 26. Flight Four Recorder |
| 2. Suction Gage | 27. Additional Instrument Space |
| 3. Oil Temperature and
Oil Pressure Gages | 28. Map Compartment |
| 4. Left and Right Fuel Gages | 29. Cabin Heat Control Knob |
| 5. Chronograph | 30. Cabin Air Control Knob |
| 6. Tachometer | 31. Cigar Lighter |
| 7. Gyroscopic Turn Indicator | 32. Wing Flap Switch and Position Indicator |
| 8. Airspeed Indicator | 33. Mixture Control Knob |
| 9. Gyroscopic Directional Indicator | 34. Throttle |
| 10. Artificial Horizon | 35. Alternate Static Source
Valve |
| 11. Airplane Registration Number | 36. Instrument and Radio Dial
Light Rheostats |
| 12. Secondary Altimeter | 37. Microphone |
| 13. Vertical Speed Indicator | 38. Fuel Selector Valve Handle |
| 14. Encoding Altimeter | 39. Rudder Trim Control Lever |
| 15. ADF Bearing Indicator | 40. Elevator Trim Control Wheel |
| 16. Omni Course Indicators | 41. Carburetor Heat Control Knob |
| 17. Transponder | 42. Electrical Switches |
| 18. Magnetic Compass | 43. Circuit Breakers |
| 19. Marker Beacon Indicator
Lights and Switches | 44. Parking Brake Handle |
| 20. Rear View Mirror | 45. Ignition Switch |
| 21. Radio Selector Switches | 46. Master Switch |
| 22. Over Voltage Warning Light | 47. Auxiliary Mike Jack |
| 23. Autopilot Control Unit | 48. Phone Jack |
| 24. Additional Radio Space | 49. Primer |
| 25. ADF | 50. Avionics Power Switch |

STATIC PRESSURE ALTERNATE SOURCE VALVE

A static pressure alternate source valve may be installed in the static system for use when the external static source is malfunctioning. This valve may also be used to drain condensation from the system lines.

If erroneous instrument readings are suspected due to water or ice in the static pressure lines, the static pressure alternate source valve should be opened, thereby supplying static pressure from the cabin. Cabin pressures will vary, however, with open cabin ventilators or windows. The most adverse combinations will result in airspeed and altimeter variations of no more than 11 km/h - 6 kts - 7 MPH and 9 m - 30 feet, respectively.

AIRSPEED CALIBRATION ALTERNATE STATIC SOURCE

HEATER/VENTS AND WINDOWS CLOSED

FLAPS UP												
NORMAL KIAS	40	50	60	70	80	90	100	110	120	130	140	
ALTERNATE KIAS	39	51	61	71	82	91	101	111	121	131	141	
FLAPS 10°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	
ALTERNATE KIAS	40	51	61	71	81	85	---	---	---	---	---	
FLAPS 40°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	
ALTERNATE KIAS	38	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	85	---	---	---	---	---	
ALTERNATE KIAS	38	49	59	69	79	84	---	---	---	---	---	
FLAPS 40°												
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	85	---	---	---	---	---	
ALTERNATE KIAS	25	43	57	69	80	85	---	---	---	---	---	
FLAPS 40°												
NORMAL KIAS	40	50	60	70	80	85	---	---	---	---	---	
ALTERNATE KIAS	25	41	54	67	78	84	---	---	---	---	---	

GLIDER TOWING HOOK CES-RA-F. 172. 02

BREAKDOWN OF OPTION

- A structural reinforcement factory-installed on aircraft.
- A welded tube frame fitted with an AERAZUR AIR type 12A hook.
- A release control handle on cabin LH side near pilot.
- Two rear view mirrors on wing struts.
- An operating instruction placard near the release control.

OPERATION REQUIREMENTS

- | | | |
|-------------------------------------|---|--------|
| - Maximum weight of towed glider | : | 500 kg |
| - Maximum weight of towing aircraft | : | 820 kg |
| (i. e. pilot + 80 litres fuel) | | |

GLIDER TOWING PROCEDURE

In addition to normal operating procedures :

- Functionally test aircraft and glider hooks.
- Wing flaps : 15°.
- Full throttle power.
- Lift off nose wheel at IAS = 96 km/h - 52 kts - 60 MPH.

CLIMB SPEED

Full throttle power	IAS = 101 km/h - 55 kts - 63 MPH.
---------------------	-----------------------------------

- Between take-off and an altitude of 6000 ft, the average rate of climb is 1.66 m/s (328 ft/min.).
- Do not let down with power off and do not exceed 225 km/h - 121 kts - 140 MPH IAS.

GLIDER TOWING INSTRUCTION PLACARD

This placard which is located on the cabin LH side near the pilot shows the following indications :

- Maximum weight of towed glider : 500 kg
- Maximum weight of towing aircraft : 820 kg
- Normal towing indicated airspeed : 101 km/h - 55 kts - 63 MPH
- Minimum towing indicated airspeed : 88 km/h - 48 kts - 55 MPH

FERNANDEZ TYPE SKIS

1. BREAKDOWN OF CES. RA. 172. 820 EQUIPMENT

This equipment consists of the following :

- 2 Main skis 5000 HL
- 1 Nose ski T 48-00 ou T 48-LRS
- 1 Actuating pump unit 301-00
- 1 Set of adapters
- 1 Rear view mirror on LH wing strut
- 1 Operating instruction placard in cabin near the pilot

Equipment weight 50 kg

NOSE SHOCK-STRUT

- Maximum inflation pressure : 3.8 bar - 55 PSI
- Minimum inflation pressure : 3.1 bar - 45 PSI

2. OPERATION LIMITATIONS

- SPEED LIMITATION

- Maximum permissible indicated airspeed with skis is
233 km/h - 126 kts - 145 MPH.
- Maximum ski operating indicated airspeed is 161 km/h -
87 kts - 100 MPH.

- OPERATING LIMITATION

The use of this aircraft is authorized only on airfields covered with snow or not and on horizontal platforms (with special features : frozen lake, etc...) to the exclusion of snow-covered medium altitude altiports (2000 m) and glaciers.

3. EMERGENCY PROCEDURES

Refer to Section 3 - Pages 3-1 thru 3-7

4. NORMAL CHECKS AND PROCEDURES

PREFLIGHT INSPECTION

- MAIN SKIS

- Check skis for external condition.
- Check cables and attaching snap hooks.
- Check elastic cords (from time to time, rotate elastic cords 1/4 turn on their rollers).
- Inspect lines.

- NOSE SKI

- Same checks as for main skis.
- Check nose shock-strut inflation pressure.

OPERATION WITH WHEELS

- TAXI INSTRUCTION

Since the nose wheel is rigidly interconnected with the rudder pedals, it is recommended not to apply the brakes to turn on the ground.

It is preferable to gradually push on the lower part of the rudder pedal to avoid wheel brake application ; braking a wheel will cause the aircraft to turn with a radius smaller than that allowed by the nose wheel deflection and place undue lateral stresses on the nose gear leg.

- BEFORE TAKE-OFF

Check that the selection pointer knob is in the "WHEELS" position and cycle the pump once or several times until it is hard to operate.

SKI EXTENSION IN FLIGHT

Extension indicated airspeed : 129 to 161 km/h - 70 to 87 kts - 80 to 100 MPH.

Set selection pointer knob to "SKIS" position and cycle the pump until it is hard to operate (about 30 to 40 pump strokes are required).

Correct extension of the skis can be checked from the cabin.

NOTE

For long flights and specially in turbulent atmosphere, it is recommended to select the "SKIS" position.

Retraction and extension of the skis in flight should be accomplished at an indicated airspeed between 129 and 161 km/h - 70 and 87 kts - 80 and 100 MPH.

OPERATION WITH SKIS

- BEFORE TAKE-OFF

Check that the selection pointer knob is in the "SKIS" position and cycle the pump once or several times until it is hard to operate.

- TAKE-OFF FROM SNOW-COVERED SURFACE

It is recommended to select 20° flaps and pull the aircraft nose up immediately upon power application so as to clear the nose ski from snow as quickly as possible. As the aircraft lightens, ease the stick forward but do not allow the nose ski to contact snow again.

In the case of a critical take-off, select full flaps when pulling the aircraft off ground.

- LANDING IN DEEP SNOW

If it is desired to pivot the aircraft on its skis on deep snow, this maneuver should be accompanied with a forward or backward movement.

5. PERFORMANCE

Refer to Section 5, Pages 5-1 thru 5-15, allowing for a slight performance data reduction due to the ski equipment.

6. USE AND SERVICING

- CHANGEOVER FROM WHEELS TO SKIS ON HARD GROUND

Changeover from wheels to skis on hard ground by means of the hydraulic control only is not recommended ; this operation should be accompanied with a forward motion of the aircraft to facilitate aircraft lifting on its skis. This motion may be produced either by a power pulling action or by personnel pushing the aircraft.

- MOVING AIRCRAFT OUT OF A HANGAR ON A SNOW-COVERED AIRFIELD

Roll the aircraft to hangar threshold, form a carpet of snow under the aircraft skis and place the aircraft on its skis over the snow carpet. Once this operation is completed, it will be easy to move the aircraft out of the hangar by sliding it on its skis.

PLACING THE AIRCRAFT IN "WHEELS" POSITION ON SNOW

IS TO BE PROHIBITED

- MOVING AIRCRAFT FROM SNOW-COVERED STRIP TO DRY HANGAR

Move aircraft to hangar threshold and in order to avoid damaging the bottom surface of the skis prepare with a shovel three snow tracks six feet long and corresponding to ski track.

Move aircraft over snow tracks by pushing it or by using a power pulling action.

When the aircraft wheels are inside the hangar, set the pump selector to "WHEELS" and operate the pump 30 to 40 times ; the aircraft will go on its wheels by itself.

SKI ADJUSTMENT

- MAIN SKI ADJUSTMENT

(This adjustment is made in "WHEELS" position)

The heel of the main skis should in no case trail on the ground. Adjust the heel at 5 or 6 cm from ground by means of the aft cable.

To make this adjustment, only lengthen or shorten the aft cable with the adjusting cable clamp.

- NOSE SKI ADJUSTMENT

Adjustment in "WHEELS" position

This adjustment is to be made on flat ground.

The sole of the ski must be parallel to ground. The ski may have a 1 to 2° maximum nose up attitude but its heel should in no case touch the ground.

Adjustment in "SKIS" position

The nose section of the aircraft will be raised until the nose ski is off ground.

The nose ski sole should have an attack incidence of 5 to 6° relative to the aircraft longitudinal axis.

The nose ski deflection should be + 10°.

SERVICING

The skis are to be cleaned with a water and detergent solution.

The top surface of the skis will be waxed to prevent snow sticking and the sole will be rubbed with 400 grit wet sanding paper to improve running on snow.

The fluid used in the hydraulic system is Shell fluid No. 4.

ARC NAV-O-MATIC 300 AUTOMATIC PILOT

1. GENERAL

This is a one-axis (roll) autopilot with heading coupling capabilities. The major components of the autopilot are as follows :

- A control and amplifier unit.
- A navigation coupler.
- A roll actuator.
- A vacuum-driven directional gyro.
- A turn coordinator.
- A vacuum source.
- Mechanical parts.

2. OPERATION LIMITATIONS

The automatic pilot must not be used for take-off and landing.

3. EMERGENCY PROCEDURES

In case of a malfunction, the autopilot can be easily overpowered by actuating the manual flight controls. The autopilot must then be disengaged by turning the three-position selector switch to "OFF".

4. NORMAL PROCEDURES

TAKE-OFF

Set three-position selector switch to "OFF".

CRUISE

- (1) Manually trim the aircraft for straight and level flight.
- (2) Pull out "PULL-TURN" knob and leave in detent.
- (3) Set three-position selector switch to "HEADING".
- (4) Laterally trim the aircraft using the lower control on the control unit.

MAKING TURNS WITH AUTOPILOT ENGAGED

- (1) Set three-position selector switch to "HEADING" or "OMNI".
- (2) Pull out "PULL-TURN" knob and rotate to either "L" (left) or "R" (right) position depending on the desired turn direction.

NOTE

Placing the "PULL-TURN" knob in the full "L" or "R" position establishes a standard rate turn.

- (3) Rotate "PULL-TURN" knob to the center position and place it in detent to resume straight and level flight.
Push in "PULL-TURN" knob to switch back to pre-selected function.

MAGNETIC HEADING HOLD FUNCTION

- (1) Pull out "PULL-TURN" knob and leave in detent.
- (2) Select desired heading using the heading selector on the directional gyro.
- (3) Set three-position selector switch to "HEADING".
- (4) Push in "PULL-TURN" knob ; the aircraft will turn to the selected heading.
- (5) Check that directional gyro heading is aligned with the magnetic compass and reset if necessary.

NOTE

If aircraft actual heading slightly differs from the selected heading, check that :

- (a) The aircraft is correctly trimmed laterally.
- (b) The selected heading is correctly set on the directional gyro.

OMNI COUPLING FUNCTION

- (1) Set the selected station frequency.
- (2) Pull out "PULL-TURN" knob and leave in detent.
- (3) Select desired heading on the Omni indicator.
- (4) Select the same heading using the heading selector on the directional gyro.
- (5) Set three-position selector switch to "OMNI".
- (6) Push in "PULL-TURN" knob ; the aircraft will intercept and track the selected Omni radial.

NOTE

- (a) The interception will start at an aircraft position within $\pm 30^\circ$ from the selected Omni radial.

- (b) Drift correction is limited to 10°. For more important drift values, slightly alter heading using the heading selector on the directional gyro.
- (7) Check that directional gyro heading is aligned with the magnetic compass and reset if necessary.
- (8) When approaching the Omni station, set three-position selector switch to "HEADING". If necessary, correct the drift using the heading selector on the directional gyro and check the directional gyro setting.

NOTE

If the three-position selector switch is left in the "OMNI" position, heading hold function will be inoperative and the aircraft heading erratic.

F172 AIRCRAFT SKYDIVING KIT

1. BREAKDOWN OF CES. RA. 172. 40 EQUIPMENT

- A copilot control wheel quick-release system.
- A thinner pilot's seat back.
- A skydiver seat with head rest and seat belt.
- A rear bench-type seat with dorsal strap.
- Two static line tie-down points on front feet of rear bench-type seat.
- A foothold with safety basket.
- A handrail on RH door frame.
- A baffle on RH door front doorpost.
- A tassel on top of RH door front doorpost.
- A static line protection tube on RH door rear doorpost.
- A RH side protection plate at rear bench-type seat.
- A handgrip on RH wing strut.



2. OPERATION REQUIREMENTS

MAXIMUM GROSS WEIGHT FOR TAKE-OFF AND LANDING

Normal Category Maximum Gross Weight Approved in this Flight Manual : 1043 kg

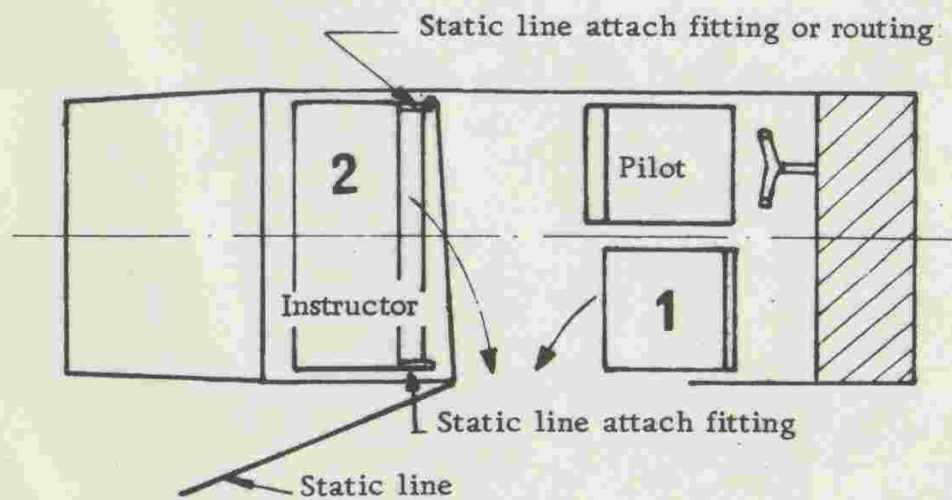
CENTER OF GRAVITY RANGE LIMITS

	<u>Forward Limit</u>	<u>Rear Limit</u>
at 1043 kg	+ 0.98 m	+ 1.20 m
at 885 kg or less	+ 0.89 m	+ 1.20 m

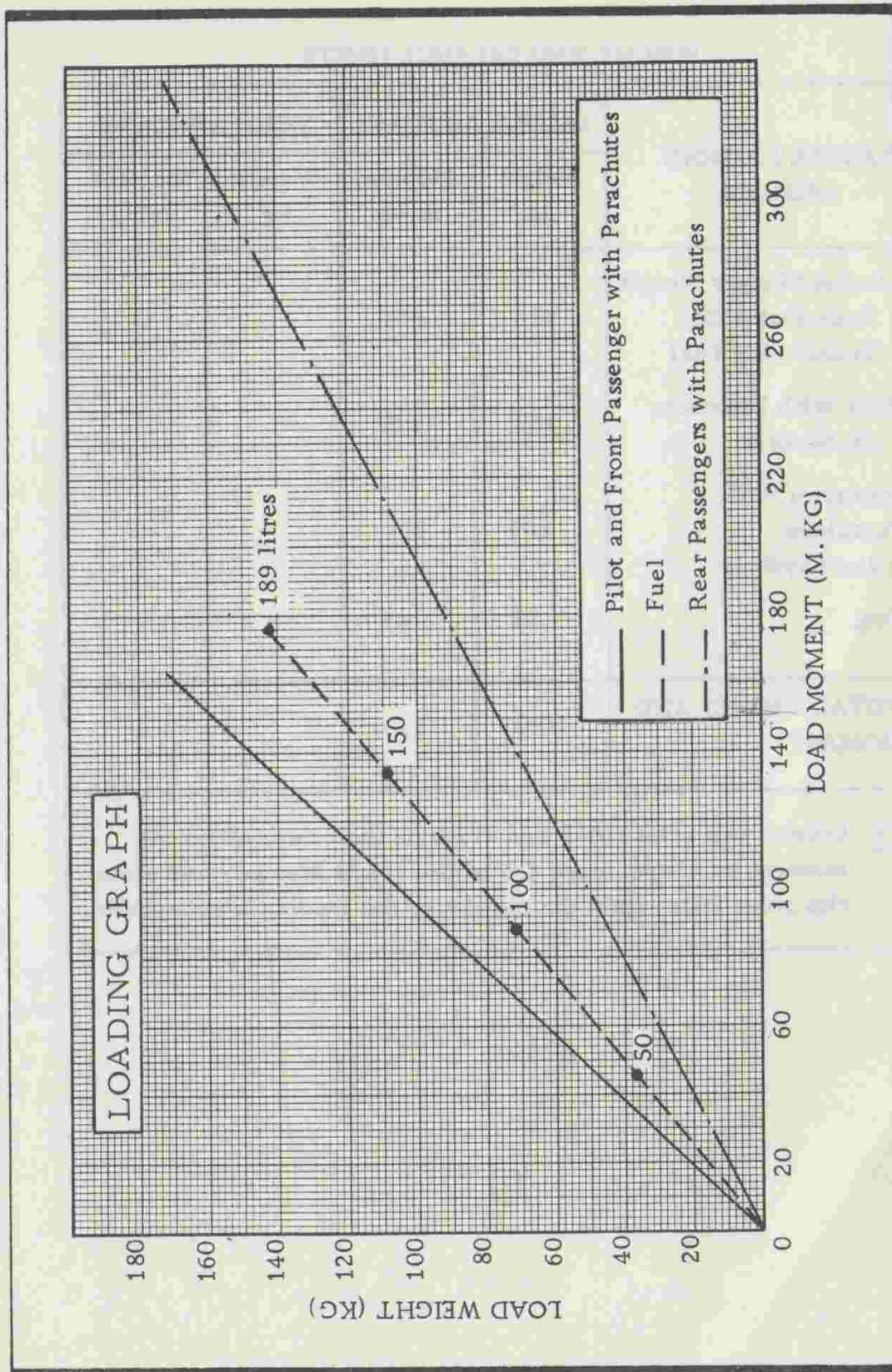
LOADING LIMITS

Number of Occupants :

Front Seats : 2 Rear Seats : 2



Depending on their length, static lines are attached to either fitting on front feet of skydiver rear bench-type seat.



WEIGHT AND BALANCE LIMITS

SAMPLE LOADING PROBLEM	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight kg	Moment m. kg	Weight kg	Moment m. kg
1. Licensed Empty Weight + Undrainable Oil + Undrainable Fuel	625	581		
2. Pilot With Parachute + 1st Skydiver	185	175		
3. Instructor With Parachute + 2nd Skydiver	200	390		
4. Fuel	33	41		
5. TOTAL WEIGHT AND MOMENT	1043	1170		
<p><u>NOTE</u> : Locate this point (1043 and 1170) on the center of gravity moment envelope, page 4-5 of this Flight Manual, and since this point falls within the envelope, the loading is acceptable.</p>				

3. OPERATING DETAILS

REMOVE

Cabin RH door
Copilot seat
Rear passenger bench-type seat
Copilot control wheel
Main gear RH wheel fairing (if installed)
Pilot seat back.

INSTALL

CES. RA. 172, 40 equipment described in chapter 1

NOTE

Check that static line does not interfere with any installation outside the fuselage.

4. SKYDIVING INSTRUCTIONS

Skydivers will leave the airplane in the sequence shown in the figure in chapter 2 :

- 1st skydiver - 2nd skydiver - Instructor

STATIC LINE JUMP

Operating Check List

- Grasp tassel with left hand.
- Bend down to maximum with knees bent.
- Grasp wing strut handgrip with right hand.
- Lay feet on foothold, with both hands on wing strut handgrip.

Jump head first with 1/8 of a turn rotation to the right.

DELAYED OPENING JUMP

Instructions are similar to those applicable for static line jump procedure. Dropping of three skydivers is possible during a single pass.

AIRCRAFT INDICATED AIRSPEED DURING SKYDIVING OPERATIONS

Aircraft indicated airspeed will not exceed 161 km/h - 87 kts - 100 MPH during skydiving operations.

Wing flaps may be extended 10° if necessary.

NOTE

In addition to his usual functions, the instructor should pay extreme attention to the routing of the static lines which may pass between the skydiver's dorsal parachute and his back. The instructor should pull back the static lines underneath the rear bench-type seat after each pass.

The second skydiver on the rear bench-type seat should not rest on the pilot's seat back.

If weight and balance limit is in accordance with the table on page 6-11.4, no load should be placed aft of the skydiver rear bench-type seat.

BADIN CROUZET RG10B AUTOMATIC PILOT + DIRECTIONAL
GYRO COUPLING + OMNI COUPLING

1. BREAKDOWN OF CES. RA. 172.770 OPTION

A. BADIN CROUZET RG10B Automatic Pilot

This automatic pilot is intended for stabilization or control of the aircraft in roll and yaw through the roll control system.

The major components are as follows :

- A flight controller.
- A roll/yaw sensor.
- An air distributor.
- Two aileron control air-driven actuators.
- A vacuum source.
- Mechanical parts.

B. Directional Gyro Coupling and Omni Coupling

The above automatic pilot may be supplemented with the following equipment :

- A vacuum-driven directional gyro.
- A "HDG-VOR" navigation coupler.

2. OPERATION LIMITATIONS

The automatic pilot must not be used for take-off and landing.

Minimum operation altitude : 200 m - 656 ft.

3. EMERGENCY PROCEDURES

Automatic Pilot Failure

- Take over manual control of the aircraft.
- Set autopilot "ON-OFF" switch to "OFF".
- Close "VIDE P. A. " ("A. P. VACUUM") valve on the instrument panel.

Electrical Failure

- Any electrical failure will result in the failure of the automatic pilot and may be cause for residual forces to be overpowered.
- Apply the above procedure.

4. NORMAL PROCEDURES

Before Take-Off

- Set "TURN" and "TRIM" knobs to neutral.
- "STAB-HDG" selector switches - "STAB".
- Autopilot "ON-OFF" switch - "OFF".
- "VIDE P. A. " ("A. P. VACUUM") valve - "OUVERT" ("OPEN").
- Suction gage - Check (4.6 to 5.4 inches of mercury).

Take-Off

- Autopilot "ON-OFF" switch - "OFF".

Automatic Pilot Engagement

- While holding the control wheel, set the following switches as follows :
 - "STAB-HDG" selector switch - "STAB".
 - Autopilot "ON-OFF" switch - "ON".
- Release the control wheel
 - Adjust "TRIM" knob for zero rate.

- Maintain a steady climb angle with the manual flight controls without counteracting the transverse movements induced by the automatic pilot.
- To make turns, rotate "TURN" knob to "L" or "R" according to the desired turn direction.
- Roll-out : Return "TURN" knob to neutral.
- "TRIM" knob must be readjusted from time to time to compensate for aerodynamic asymmetry.

NOTE

The automatic pilot is operative as soon as engaged .

Directional Gyro Coupling

- Select desired heading on the directional gyro compass card (aligned with magnetic compass heading).
- Set "HDG-VOR" selector switch to "HDG".
- Set "STAB-HDG" selector switch to "HDG" - The aircraft turns to the selected heading.
- "STAB-HDG" selector switch need not be set to "STAB" to change heading or to reset the directional gyro.

Omni Coupling Function

- Set the selected station frequency at the Omni control unit.
- Select desired heading on the directional gyro compass card and the Omni indicator.
- Set "HDG-VOR" selector switch to "VOR".
- Check "STAB-HDG" selector switch is set to "HDG".
- The selected heading is automatically maintained or corrected.

NOTE

If the aircraft is subjected to strong crosswind conditions, it is recommended to allow for a certain amount of drift upon heading selection on the directional gyro compass card, not altering the course selected on the Omni indicator.

NAV-O-MATIC 200 A AUTOMATIC PILOT

1 GENERAL

This is a one-axis (roll) with VOR coupling (OPT) capabilities.
The major components of the autopilot are as follows :

- An automatic pilot control head including a computer amplifier
- A roll actuator
- A turn coordinator
- A "VOR-LOC REVERSED" indicator light.

2 OPERATION LIMITATIONS

The automatic pilot must not be used for take-off and landing.

3 URGENCY PROCEDURES

In case of a malfunction, the autopilot can be easily overpowered by actuating the manual flight controls. The autopilot must then be switch off by pushing the A/P switch in the "OFF" position.

4 NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING

On the autopilot control head.

1. "A/P" switch in the OFF position.
2. "BACK CRS" button - OFF position (See CAUTION note under NAV intercept, page 6-13.3.

CLIMB, CRUISE, DESCENT

Basic Directional Stability

1. Level wings.
2. On autopilot control head - "PULL TURN" control knob : Pull out and center in detent.
3. On autopilot control head - "A/P" switch in "ON" position.
4. On autopilot control head - Roll trim control.- Adjust for zero turn.
5. The wing level mode may be overridden with light control pressures to turn the aircraft to a new heading.

Command Turns

1. On autopilot control head - "PULL TURN" knob - Pull and rotate to give desired turn rate up to a maximum of a standard rate turn.

Heading Hold

On autopilot control head :

1. "DIR HOLD" button - Push in.
2. "PULL TURN" knob - Center in detent and push in when aircraft is on desired heading and wings are level.
3. Roll trim knob - Adjust for zero heading drift.

Nav Intercept (VOR/LOC)

On autopilot control head :

1. "PULL TURN" knob - Pull out and turn aircraft to heading parallel to desired course.
2. "NAV 1 or 2" selector switch - Select VHF receiver providing stable VOR/LOC navigation signal.

On VOR indicator :

3. Receiver OBS - Set in desired VOR course, if tracking omni.

On autopilot control head :

4. "NAV CAPT" button - Push in.
5. "HI SENS" button - Push in.
6. "BACK CRS" button - Push in if intercepting localizer front course outbound or back course inbound.

CAUTION

With "BACK CRS" button pushed in normal indications of CDI of selected receiver are reversed, even when the "A/P" switch is in the "OFF" position and regardless of frequency selected (Whether VOR or LOC). Glide slope indicator is not affected.

An amber light located on the upper, left hand portion of the instrument panel and labeled "VOR/LOC REVERSED" will illuminate when "BACK CRS" button is pushed in to indicate the course deviation indicator is reversed.

7. "PULL TURN" knob - Center in detent and push in when aircraft heading is parallel (within $\pm 5^\circ$) to desired course (the aircraft will then turn to a $45^\circ \pm 10^\circ$ intercept angle).
8. "NAV TRACK" button - Push in when CDI center and aircraft has turned to course heading.
9. "HI SENS" button - Push off when new omni course is established (leave in for localizer tracking).

NOTA

Good NAV intercept ability is limited to within 10-15 miles of the station or within 3 minutes of interception of the desired course. The best and most practical use the "NAV INTERCEPT" mode is

course changing after passing after passing a VOR station. Another is capturing the localizer inbound. Once the new course is captured the "NAV TRACK" mode should be utilized since it contains cross-wind correction circuitry. Localizer intercept ability outbound on front or backcourse may be marginal.

Nav Tracking (VOR/LOC)

On autopilot control head :

1. "PULL TURN" knob - Pull out and leave in detent position.
2. "NAV 1 or 2" receiver switch - Select receiver providing stable navigation signal from the desired station.

On VOR/LOC Indicator :

3. Set OBS to desired VOR course.

On Autopilot head :

4. "NAV TRACK" button - Push in.
5. "HI SENS" button - Push in when tracking localizer.
6. "BACK CRS" button - Push in when tracking localizer back course inbound (or front course outbound).

CAUTION

- With "BACK CRS" button pushed in, normal indications of CDI of selected receiver are reversed, even when the autopilot "A/P" switch is in the "OFF" position and regardless of frequency selected (whether VOR or LOC). Glide slope indication is not affected.
- An amber light located on the upper, left hand portion of the instrument panel and labeled "VOR/LOC REVERSED"

will illuminate when "BACK CRS" button is pushed in to indicate the course deviation indication is reversed.

7. "PULL-TURN" knob - Center in detent and push in when CDI is within circle (less than 1 dot) and aircraft heading is parallel to course selected (within ± 5).

CAUTION

If heading and course deviations increase when tracking the localizer close in, push NAV INT button when heading is parallel to course or turn autopilot "A/P" switch "OFF" and fly aircraft manually.

NOTE

Tracking ability may be marginal outbound on front or backcourse of localizer.

NAV-O-MATIC 300A AUTOMATIC PILOT

1. GENERAL

This is a one-axis (roll) autopilot with heading coupling capabilities. The major components of the autopilot are as follows :

- An automatic pilot control head including a computer amplifier.
- A roll actuator.
- A turn coordinator.
- A directional gyro.
- "1 LOC REVERSED" or "2 LOC REVERSED" indicator lights.
- Mechanical parts.

2. OPERATION LIMITATIONS

- (1) The automatic pilot must not be used for take-off and landing
- (2) Minimum operation altitude : 200 m-656 ft.

3. URGENCY PROCEDURES

- (1) Overpower the autopilot by actuating the manual flight controls
- (2) Switch off the autopilot by pushing the A/P switch in the "OFF" position.

4. NORMAL PROCEDURES

BEFORE TAKE-OFF AND LANDING

On the autopilot control head :

- (1) "A/P" switch - "OFF".
- (2) "BACK CRS" button - "OFF" position.
(See CAUTION note under "NAV intercept", page 6-14, 4).

CLIMB, CRUISE, DESCENT

Basic Directional Stability

- (1) Level wings.
On autopilot control head :
- (2) "PULL TURN" control knob : PULL OUT and CENTER in detent.
- (3) "A/P" switch - "ON".

NOTE

A 2-second delay will occur before the autopilot will function as desired. During this period a slight left turn impulse may occur.

- (4) "ROLL TRIM" control - Adjust for zero turn.

Command Turns

On autopilot control head :

- (1) "PULL TURN" knob - Pull and rotate to give desired turn rate up to a maximum of a standard rate turn.
- (2) To resume level flight : return "PULL TURN" knob to center (detent) position.

Magnetic Heading Hold Function

- (1) Directional gyro "PUSH" button - SET to aircraft magnetic heading.
- (2) "PULL TURN" knob - PULL OUT and LEAVE in center detent position.
- (3) Directional gyro - SET "bug" to desired heading.
- (4) On autopilot control head : "HDG SEL" pushbutton - PUSH.
- (5) "PULL TURN" knob - PUSH IN. The aircraft will turn automatically toward the selected heading and will roll out and hold the heading.
- (6) On autopilot control head : "TRIM" knob - ADJUST as required to zero deviation between stabilized heading and selected heading.
- (7) To change heading, move heading bug to new heading. The aircraft will turn in the direction the bug was moved and will hold the new heading.
- (8) Check the directional gyro against the aircraft compass at 15-minute intervals and reset if necessary.

Nav Intercept (VOR/LOC)

On autopilot control head :

- (1) "PULL TURN" knob - Pull out and leave in center detent position.
- (2) "NAV 1 or 2" selector switch - Select VHF receiver providing stable VOR/LOC navigation signal.

On VOR indicator :

- (3) Receiver "OBS" - Set in desired VOR course, if tracking omni.

On directional gyro :

- (4) Heading curser - SET to selected VOR course or for localizer, set to inbound or outbound course.
- (5) Directional gyro - SET to aircraft magnetic heading.

On autopilot control head :

- (6) "NAV CAPT" button - PUSH IN.
- (7) "HI SENS" button - PUSH IN for localizer or VOR intercepts within 16 km (10 miles - 9 NM) of station. At greater distances, disengage the "HI SENS" button.
- (8) "BACK CRS" button - PUSH IN if intercepting localizer front course outbound or back course inbound.

CAUTION

- With "BACK CRS" button pushed in and a localizer frequency set on the selected receiver, normal indications for the CDI are reversed even when the autopilot "ON-OFF" switch is in the "OFF" position. Glideslope indications are not affected.
- An amber light-located on the left hand portion of the instrument panel and labeled "LOC REVERSED" will illuminate when "BACK CRS" button is pushed in to indicate the course deviation indicator is reversed.

- (9) "PULL TURN" knob - CENTER in detent and PUSH IN. The aircraft will normally turn to a $45^\circ \pm 10^\circ$ intercept angle and then gradually decrease the angle as the course centerline is approached.

NOTE

During "NAV INT" in a crosswind, observe that the CDI needle settles in a fully centered position. If it remains off center 2 dots or more the heading bug should be moved an extra 10° toward the needle.

- (10) "NAV TRK" button - PUSH when the CDI needle is within one dot and the airplane has turned to within 10° of the course heading. This mode activates crosswind correction circuits.
- (11) "HI SENS" button - DISENGAGE for omni tracking, but leave it engaged for localizer tracking.

NAV tracking (VOR LOC)

On autopilot control head :

- (1) "PULL TURN" knob - PULL OUT and LEAVE in detent position.
- (2) "NAV 1 or 2" receiver switch - SELECT receiver providing stable navigation signal.

On VOR indicator :

- (3) Omni bearing selector "OBS" - SET VOR course if tracking omni.

On directional gyro :

- (4) Heading curseur - SET to VOR course selected. For localizer, set to inbound or outbound course, as required.
- (5) Directional gyro - SET to aircraft magnetic heading. For precise tracking reset directional gyro periodically as required to remove procession error.
- (6) "NAV TRK" button - PUSH IN.
- (7) "HI SENS" button - PUSH IN when tracking localizer.
- (8) "BACK CRS" button - PUSH IN when tracking localizer back course inbound or front course outbound.

CAUTION

- With "BACK CRS" button pushed in and a localizer frequency set on the selected receiver, normal indications for the CDI are reversed even when the autopilot "ON-OFF" switch is in the "OFF" position. Glideslope indications are not affected.
 - An amber light located on the left hand portion of the instrument panel and labeled "LOC REVERSED" will illuminate when "BACK CRS" button is pushed in to indicate the course deviation indicator is reversed.
- (9) "PULL TURN" button - PUSH IN when CDI is less than 1 dot and aircraft heading is within + 10 degrees of course selected.

NOTE

If CDI remains steadily off center, adjust autopilot lateral "TRIM" control as required. If drift correction requirements exceed 25° adjust heading bug toward the needle in 10° increments until the track is established.

- (10) During a localizer final approach - Turn the autopilot switch "OFF" after the runway becomes visible and complete the approach manually.

AUXILIARY FUEL TANK SYSTEM

1. GENERAL

BREAKDOWN OF CES. RA. 172.520 EQUIPMENT

- Two auxiliary tanks installed in the wings.
- Two control valves installed in the upper section of the rear door post.
- Two electrical fuel quantity indicators on the instrument panel.
- One limitation placard.
- Lines and mechanical parts.

DESCRIPTION

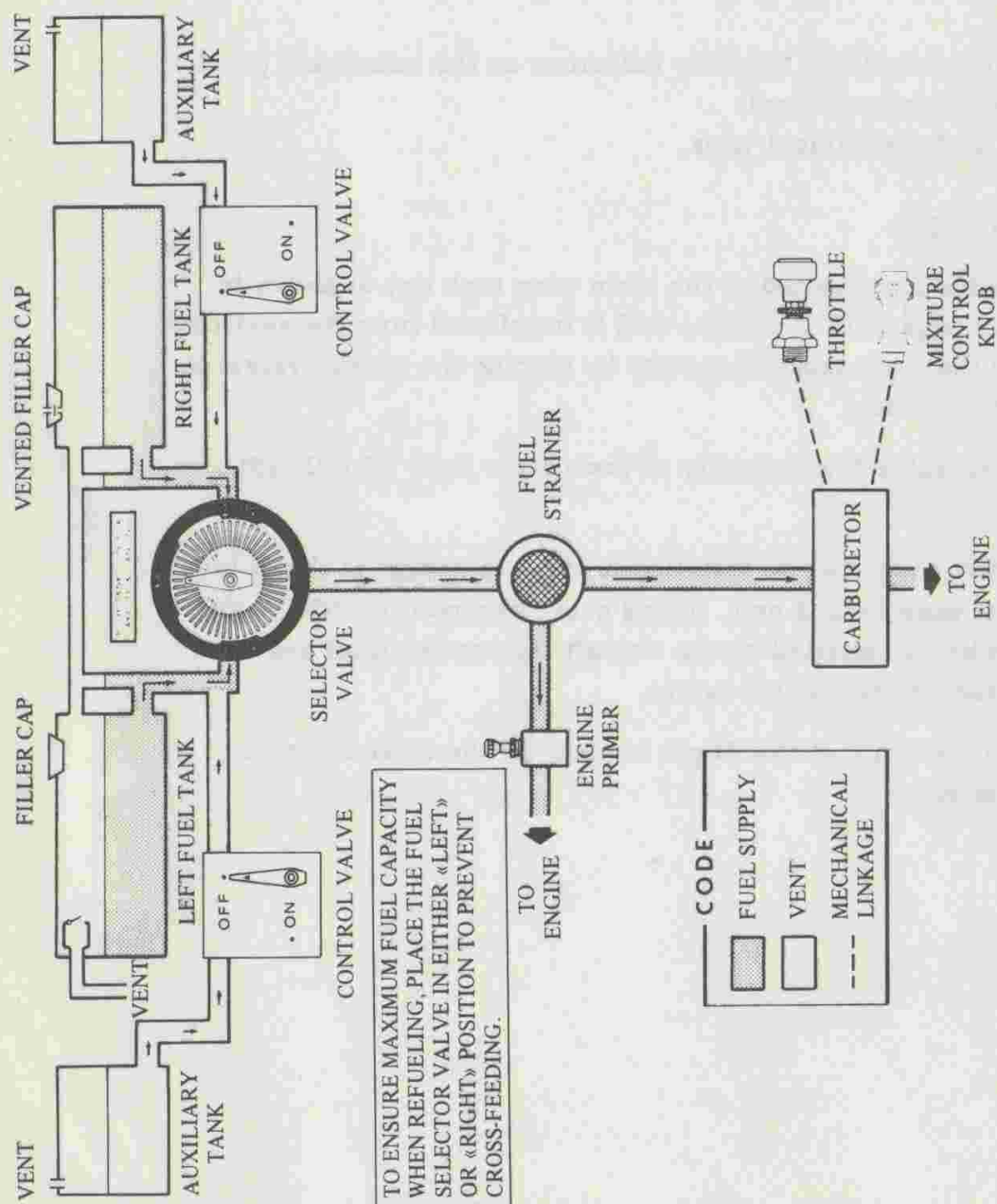
The system is connected to the main wing tank line as shown in figure on page 6-15.2 and the fuel is transferred from the auxiliary tanks to the main tanks by gravity by placing the control valves in the "ON" position.

The total usable fuel capacity of these tanks is 24 US Gal. (91 litres).

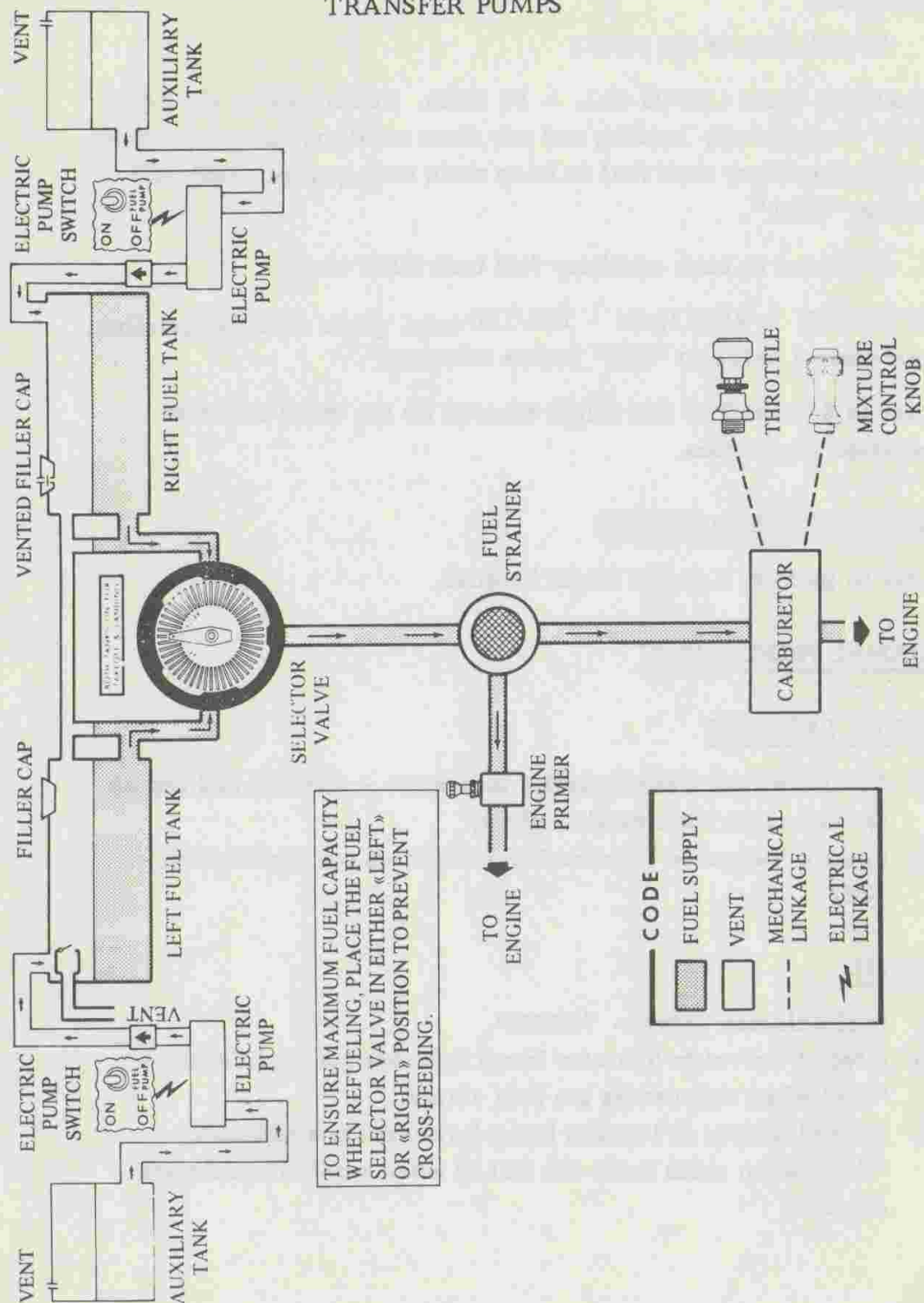
An electric pump may be installed in the fuel system as shown in figure on page 6-15.3 and, in this case, two-position "ON - OFF" pump switches installed on the aircraft instrument panel are substituted for the control valves.

Refer to Section 1 of this Flight Manual for the other common characteristics.

FUEL SYSTEM SCHEMATIC AUXILIARY FUEL TANK SYSTEM WITHOUT ELECTRIC TRANSFER PUMP



FUEL SYSTEM SCHEMATIC
AUXILIARY FUEL TANK SYSTEM WITH ELECTRIC
TRANSFER PUMPS



2. OPERATION LIMITATIONS

PLACARDS

a. In full view of the pilot :

"Auxiliary tanks : 24 US Gal. - 91 litres. Control valve should be "OFF" for take-off, landing and any time auxiliary tanks are empty. Transfer auxiliary tank fuel to keep main tank quantity indicator reading "FULL".

b. Adjacent to each auxiliary fuel tank filler cap :

"12 US Gal. - 45.5 litres - 100/130 min. grade aviation gasoline. Turn control valve to "OFF" before refueling".

Refer to Section 2 of this Flight Manual for the other common operation limitations.

3. EMERGENCY PROCEDURES

Refer to Section 3 of this Flight Manual.

4. NORMAL PROCEDURES

BEFORE TAKE-OFF

- (1) Auxiliary Fuel Tank Quantity Indicators - CHECK and top up as desired for the intended flight.
- (2) Control Valves or Transfer Pump Switches (as applicable) - "OFF".

CRUISE

- (1) Fuel Selector Valve - "BOTH".
- (2) Control Valves or Transfer Pump Switches (as applicable) - "ON" when main tanks are half empty.
- (3) Control Valves or Transfer Pump Switches (as applicable) - "OFF" when main tanks are full or when auxiliary tanks are empty.

NOTE

Total fuel transfer may last up to 45 minutes with the fuel control valves on and 20 to 25 minutes with the electric transfer pumps on.

BEFORE LANDING

1. Control Valves or Transfer Pump Switches (as applicable) - "OFF".

Refer to Section 4 of this Flight Manual for the other common normal procedures.

NOTE

If the fuel from any of the auxiliary tanks has not been transferred during the flight, it is recommended that the flap setting be limited to 20° for landing.

5. PERFORMANCE

Refer to Section 5. For cruise performance, refer to pages 5-12 through 5-17 ; increase endurance figures according to the new fuel.