Cessna®

REIMS/CESSNA
F172N Skyhawk

FLIGHT MANUAL

PH-GYS

AIRCRAFT

FLIGHT MANUAL

REIMS/CESSNA F 172 N

Manufacturer : REIMS AVIATION
Aérodrome de REIMS-PRUNAY
51100 REIMS FRANCE

French Type Certificate No. 25

Serial Number : 1871

Registration Number : PH-GYS

Sections : 2 - 3 - 5

Pages : 2-1 thru 2-7
3-1 thru 3-8
5-1 thru 5-3

This is the exact translation of the F 172 N French Flight Manual approved by DGAC on October 27, 1976.

This aircraft must be operated in accordance with the limits specified in this Flight Manual.

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

Ce manuel est la traduction en langue anglaise du manuel de vol français approuvé

P.O. Robert 27.10.76

Aircraft Serial No. 1515 on

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1	/	Original Document	14.10.76	
2	0-4, 6-1.0(cont'd) 6-16.1 thru 6-16.36	Insertion of the floatplane option	14.05.77	
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.	07.7	
4	0-2 thru 0-5 1-6 thru 1-8, 1-11 1-13 thru 1-16 2-1 and 2-2 2-4 thru 2-7 3-2 and 3-4 4-7 thru 4-10 4-13 and 4-18 5-2 6-1.0(Cont'd) 6-2.1 and 6-2.2 6-7.2 and 6-7.3	1979 Model beginning with Serial Number 1750.	25.09.78	

LIST OF REVISED PAGES

Edition N°	Revised Pages	Nature of Change	Approval
4	6-7.6 and 6-7.7 6-17.1, 6-18.1 and 6-18.2		Date: 21.7.1

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.

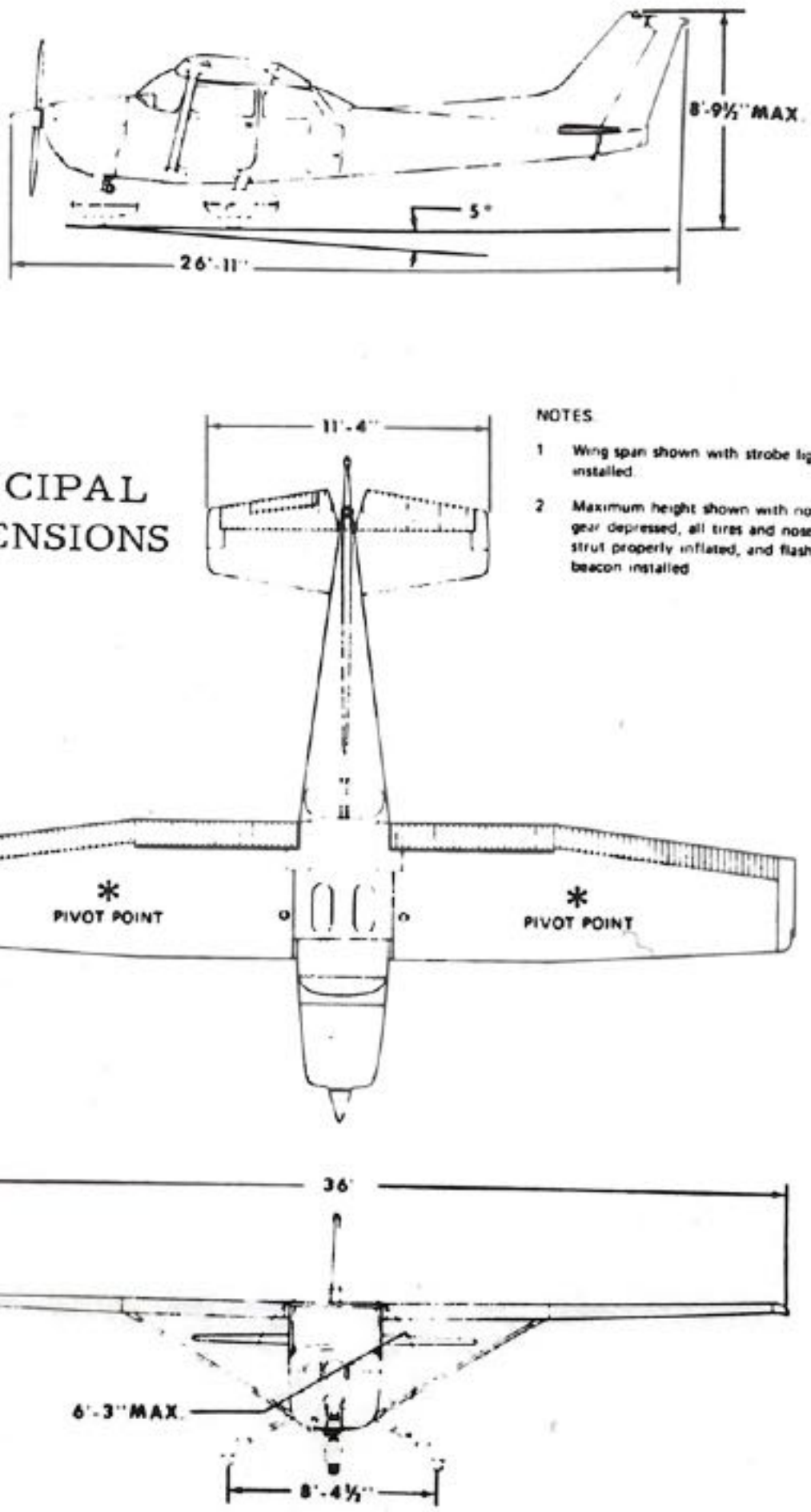
(2) Registration Certificate.

(3) Radio Installation License (if radio installed).

(4) Log Books.

(5) Flight Manual.

PRINCIPAL DIMENSIONS



NOTES

1 Wing span shown with strobe lights installed.

2 Maximum height shown with nose gear depressed, all tires and nose strut properly inflated, and flashing beacon installed.

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 m2
Dihedral Angle		+ 1°37' (at 25 % chord)
Angle of Incidence,	Wing Root	+ 0°47'
	Wing Tip	- 2°50'

AILERONS *

Area		1.66 m2
Control Travel,	Up	20° ± 1°
	Down	15° ± 1°

WING FLAPS

Method of Actuation	Electric/Cable
Area	1.97 m2
Control Travel	0° to 30° $^{+0°}_{-2°}$

HORIZONTAL STABILIZER AND ELEVATOR *

Stabilizer Area	2.00 m2
Angle of Incidence	- 3°30'

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* Cable control systems

Elevator Area		1.35 m2 (including tab)
Control Travel,	Up	$28^{\circ}\ ^{+1^{\circ}}_{-0^{\circ}}$
	Down	$23^{\circ}\ ^{+1^{\circ}}_{-0^{\circ}}$

ELEVATOR TRIM TAB

Control Travel,	Up	$28^{\circ}\ ^{+1^{\circ}}_{-0^{\circ}}$
	Down	$13^{\circ}\ ^{+1^{\circ}}_{-0^{\circ}}$

VERTICAL FIN AND RUDDER *

Fin Area		1.26 m2
Rudder Area		0.69 m2
Control Travel,	Left	$16^{\circ} \pm 1^{\circ}$
(parallel to a/c	Right	$16^{\circ} \pm 1^{\circ}$
longitudinal axis)		

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

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* Cable control systems

POWER PLANT

Engine	Lycoming O-320-~~H2AD~~ D2G 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 Service 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

INSTRUMENT PANEL

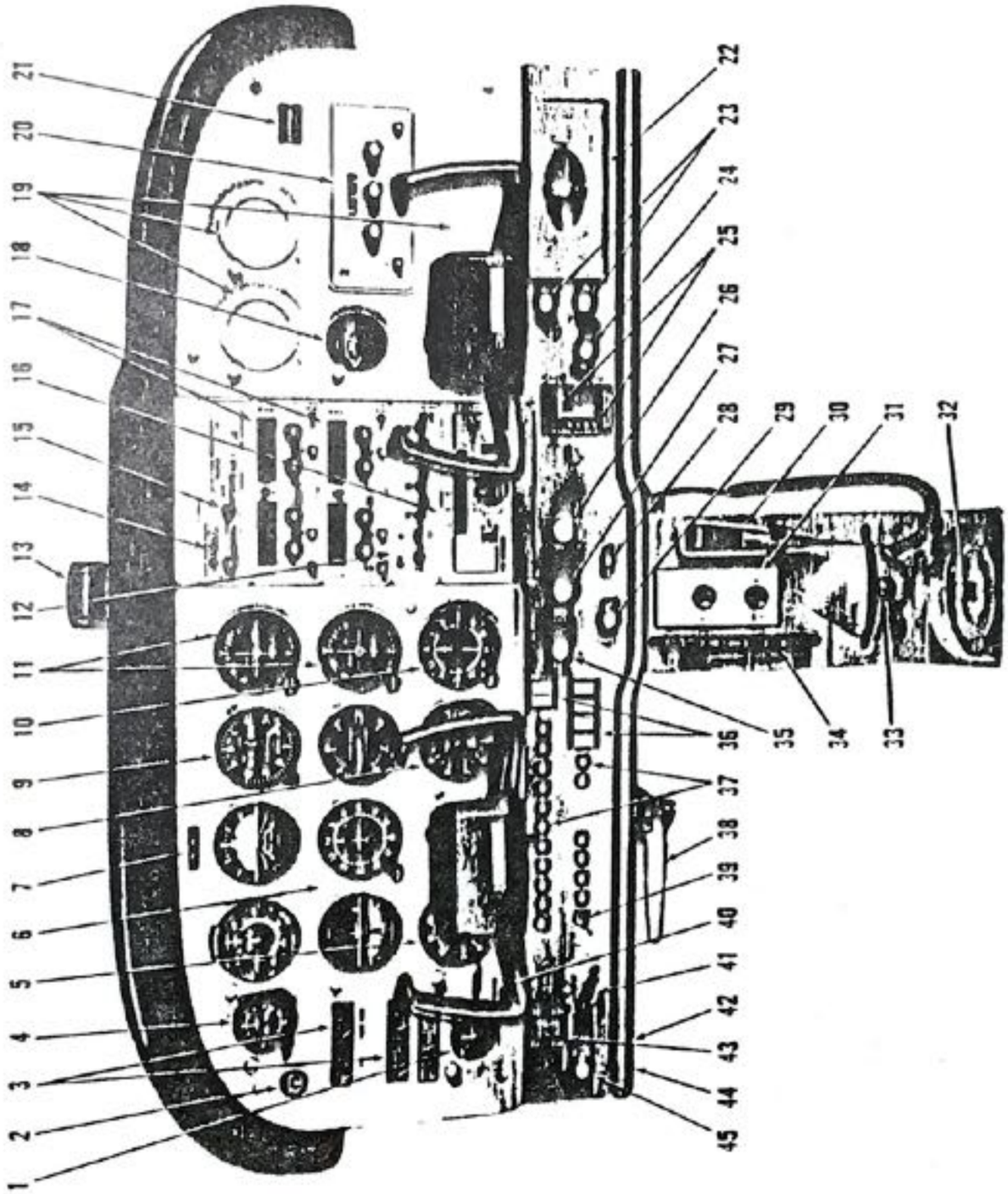

Figure 1-2 (Sheet 1 of 2)

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

Figure 1-2 (Sheet 2 of 2)

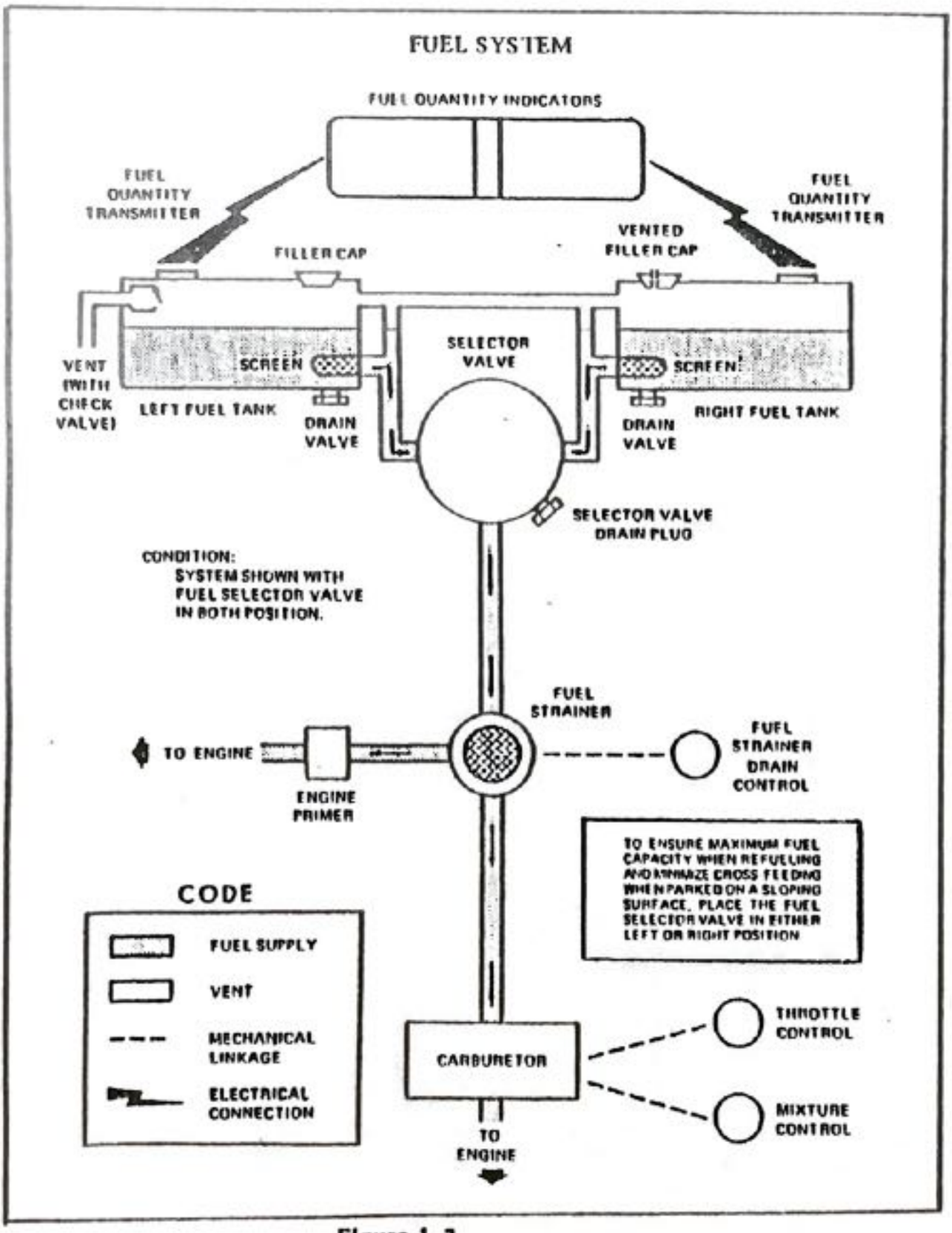
FUEL SYSTEM
FUEL QUANTITY INDICATORS
FUEL QUANTITY TRANSMITTER
FUEL QUANTITY TRANSMITTER
FILLER CAP
VENTED FILLER CAP
VENT (WITH CHECK VALVE)
SCREEN
LEFT FUEL TANK
DRAIN VALVE
SELECTOR VALVE
SCREEN
RIGHT FUEL TANK
DRAIN VALVE
SELECTOR VALVE DRAIN PLUG
CONDITION:
SYSTEM SHOWN WITH FUEL SELECTOR VALVE IN BOTH POSITION.
FUEL STRAINER
TO ENGINE
ENGINE PRIMER
FUEL STRAINER DRAIN CONTROL
TO ENSURE MAXIMUM FUEL CAPACITY WHEN REFUELING AND MINIMIZE CROSS FEEDING WHEN PARKED ON A SLOPING SURFACE, PLACE THE FUEL SELECTOR VALVE IN EITHER LEFT OR RIGHT POSITION
CODE
FUEL SUPPLY
VENT
MECHANICAL LINKAGE
ELECTRICAL CONNECTION
CARBURETOR
THROTTLE CONTROL
MIXTURE CONTROL
TO ENGINE

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.

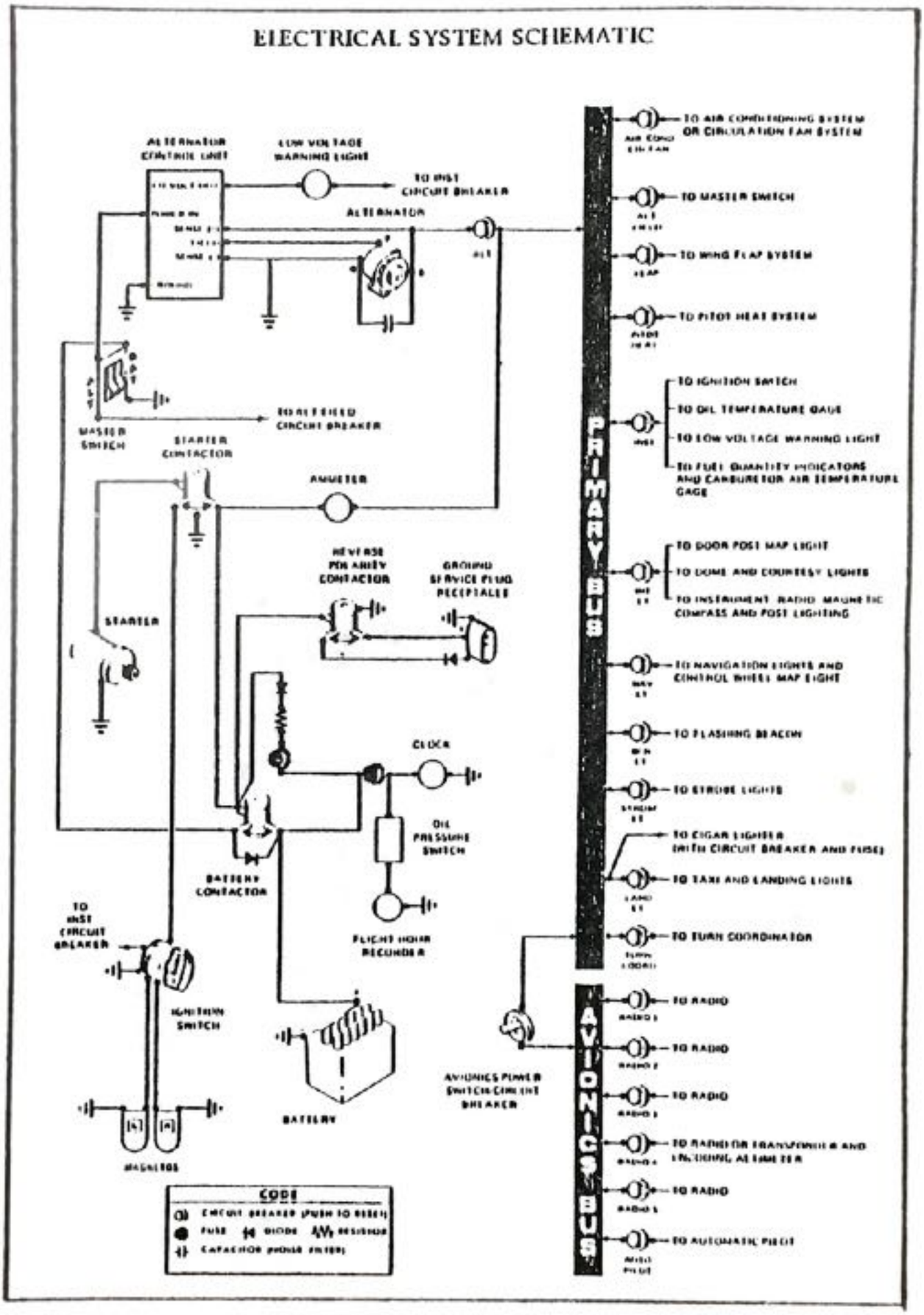
ELECTRICAL SYSTEM SCHEMATIC
ALTERNATOR CONTROL UNIT
LOW VOLTAGE WARNING LIGHT
TO INST CIRCUIT BREAKER
ALTERNATOR
TO AIR CONDITIONING SYSTEM OR CIRCULATION FAN SYSTEM
TO MASTER SWITCH
TO WING FLAP SYSTEM
TO PITOT HEAT SYSTEM
TO IGNITION SWITCH
TO OIL TEMPERATURE GAUGE
TO LOW VOLTAGE WARNING LIGHT
TO FUEL QUANTITY INDICATORS AND CARBURETOR AIR TEMPERATURE GAGE
MASTER SWITCH
TO ALTERNATE CIRCUIT BREAKER
STARTER CONTACTOR
AMMETER
TO DOOR POST MAP LIGHT
TO DOME AND COURTESY LIGHTS
TO INSTRUMENT RADIO MAGNETIC COMPASS AND POST LIGHTING
REVERSE POLARITY CONTACTOR
GROUND SERVICE PLUG RECEPTACLE
STARTER
TO NAVIGATION LIGHTS AND CONTROL WHEEL MAP LIGHT
CLOCK
TO FLASHING BEACON
TO STROBE LIGHTS
OIL PRESSURE SWITCH
TO CIGAR LIGHTER (WITH CIRCUIT BREAKER AND FUSE)
BATTERY CONTACTOR
TO TAXI AND LANDING LIGHTS
TO INST CIRCUIT BREAKER
FLIGHT HOUR RECORDER
TO TURN COORDINATOR
IGNITION SWITCH
TO RADIO
TO RADIO
TO RADIO
AVIONICS POWER SWITCH-CIRCUIT BREAKER
BATTERY
TO RADIO OR TRANSPONDER AND ENCODING ALTIMETER
TO RADIO
TO AUTOMATIC PILOT
MAGNETOS
CODE

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.

ALTERNATOR CONTROL UNIT AND LOW-VOLTAGE WARNING LIGHT

The airplane is equipped with a combination alternator regulator high-low voltage control unit mounted on the engine side of the firewall and a red warning light, labeled "LOW VOLTAGE", under the ammeter on the instrument panel.

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

NOTE

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

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

CIRCUIT BREAKERS AND FUSES

Most of the electrical circuits in the airplane are protected by "push-to-reset" 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 the "DOME LIGHTS" switch located on the overhead console. 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 panel and switch and control panel lighting is provided by flood lighting, integral lighting, and post lighting (if installed). Lighting intensity is controlled by a dual light dimming rheostat equipped with an outer knob labeled "PANEL LT", and an inner knob labeled "RADIO LT", located below the throttle. A slide-type switch (if installed) on the overhead console, labeled "PANEL LIGHTS", is used to select flood lighting in the "FLOOD" position, post lighting in the "POST" position, or a conbination of post and flood lighting in the "BOTH" position.

The engine instrument cluster (if post lights are installed), radio equipment, and magnetic compass have integral lighting and operate independently of post or flood lighting. The intensity of this lighting is controlled by the inner knob on the light dimming rheostat labeled "RADIO LT", rotate the knob clockwise to obtain the desired light intensity. However, for daylight operation, the compass and engine instrument lights may be turned off while still maintaining maximum light intensity for the digital readouts in the radio equipment. This is accomplished by rotating the "RADIO LT" knob full counterclokwise. Check that the flood lights/post lights are turned off for daylight operation by rotating the "PANEL LT" knob full counterclokwise.
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.

Windhsield 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	kts	mph
V_{NE} (Never Exceed Speed)	296	160	184
V_{NO} (Maximum Structural Cruising Speed)	237	128	147
V_{FE} (Maximum Flaps Extended Speed :			
10° Flaps	204	110	127
10 - 40° Flaps	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~~ 1088 kg : + 1.20 m
Forward at 885 kg or less : + 0.89 m
Forward at ~~1043~~ 1088 kg : + 0.98 m + 1.00 m
Straight line variation between 885 and 1043 kg

UTILITY CATEGORY

Aft at 910 953 kg : + 1.03 m
Forward at 885 kg or less : + 0.89 m
Forward at 910 953 kg : + 0.98 m + 0.93
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

NIGHT VFR AND IFR APPROVAL

For night VFR and IFR approval, the aircraft must carry the additional equipment specified by current operating regulations dated 8 July 1976 applicable on 15 June 1974. This additional equipment is to be described in section 6 of this manual.

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 (green arc)

Sea Level	2100 - 2450 RPM
5000 ft (1524m)	2100 - 2575 RPM
10000 ft (3048m)	2100 - 2700 RPM
Maximum Limit (red line)	2700 RPM

PLACARDS

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

(1) In full view of the pilot :

a) Day VFR Operation

The markings and placards installed in this airplane contain operating limitations which much be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category or in the Utility Category are contained in this Airplane Flight Manual.

Normal Category : No acrobatic maneuvers, including spins, approved.

Utility Category : No acrobatic maneuvers approved, except those listed in this Airplane Flight Manual.
Baggage compartment and rear seat must not be occupied.

Spin Recovery : Opposite rudder - forward elevator-neutralize controls.

Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate :

DAY - VFR

b) If the aircraft is equiped with equipment shown on page 6-17-1.

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category or in the Utility Category are contained in this Airplane Flight Manual.

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Baggage compartment and rear seat must not be occupied.

Spin Recovery : Opposite rudder - forward elevator-neutralize controls.

Flight into known icing conditions prohibited.

This airplane is certified for the following flight operations as of date of original airworthiness certificate :

DAY - NIGHT - VFR

c) If the aircraft is equipped with equipment shown on page 6-7.1

The markings and placards installed in this airplane contain operating limitations which must be complied with when operating this airplane in the Normal Category. Other operating limitations which must be complied with when operating this airplane in this category or in the Utility Category are contained in this Airplane Flight Manual.

Normal Category : No acrobatic maneuvers, including spins, approved.

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This airplane is certified for the following flight operations as of date of original airworthiness certificate :

DAY - NIGHT - VFR - IFR

2. On the fuel selector valve :

- Standard tanks

BOTH	-40 US GAL.	- 152 l ALL FLIGHT ATTITUDES TAKE OFF, LANDING.
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 TAKEOFF, LANDING.
LEFT	-25 US GAL.	- 99.5l LEVEL FLIGHT ONLY.
RIGHT	-25 US GAL.	- 99.5 l LEVEL FLIGHT ONLY.
OFF		

3. 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

4. Near wing flap switch :

Avoid slips with flaps extended.

5. On flap control indicator :

0° to 10°	(Partial flap range with blue color code and 204 km/h - 110 kt -127 MPH callout ; also, mechanical detent at 10°.)
10° to 40°	Indices at these positions with white color code and 158 km/h - 85 kt -98 MPH callout ; also mechanical detent at 10° and 20°.)

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 control lock :

CONTROL LOCK - REMOVE BEFORE STARTING ENGINE

8. Near airspeed indicator :

MANEUVER INDICATED AIRSPEED - 180 km/h - 97 kts - 112 MPH

g. Adjacent to the flap position selector switch:

MAXIMUM FLAP TRAVEL IS 30°

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.
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

AMMETER SHOWS EXCESSIVE RATE OF CHARGE
(Full Scale Deflection)

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

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

1. Radios - "OFF".
2. Master Switch - "OFF" (both sides).
3. Master Switch - "ON".
4. Low-Voltage Light - CHECK OFF.
5. Radios - "ON".

If low-voltage light illuminates again :

6. Alternator - "OFF".
7. Nonessential Radio and Electrical Equipment - "OFF".
8. 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 floodcabin 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~~		

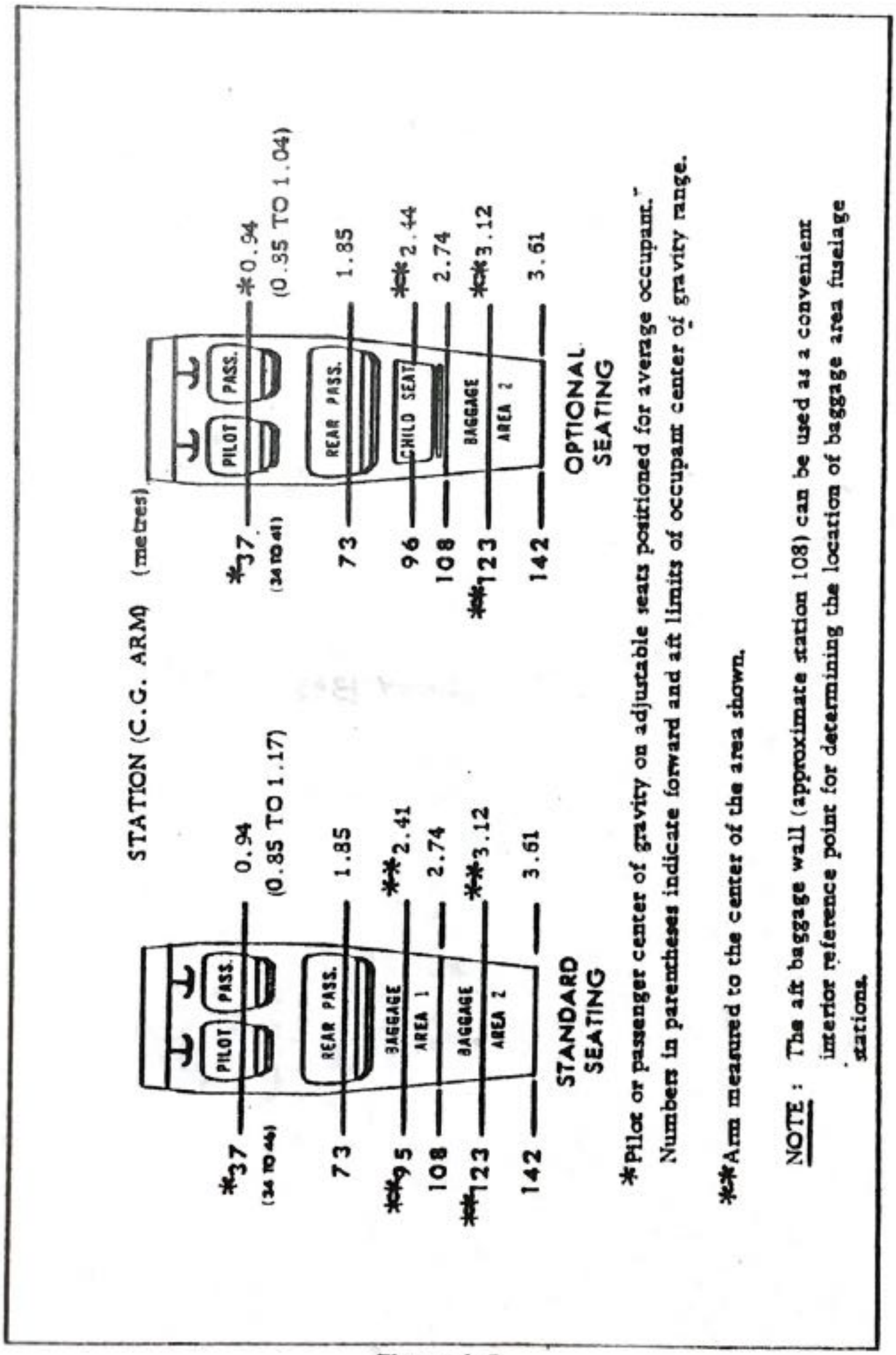
Locate this point (1043 and 1175) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.

**Maximum Combined Weight - Area 1 + Area 2 - 54 kg

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		

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.

Figure 4-1



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

**Arm measured to the center of the area shown.

NOTE: The aft baggage wall (approximate station 108) can be used as a convenient interior reference point for determining the location of baggage area fuselage stations.

Figure 4-2

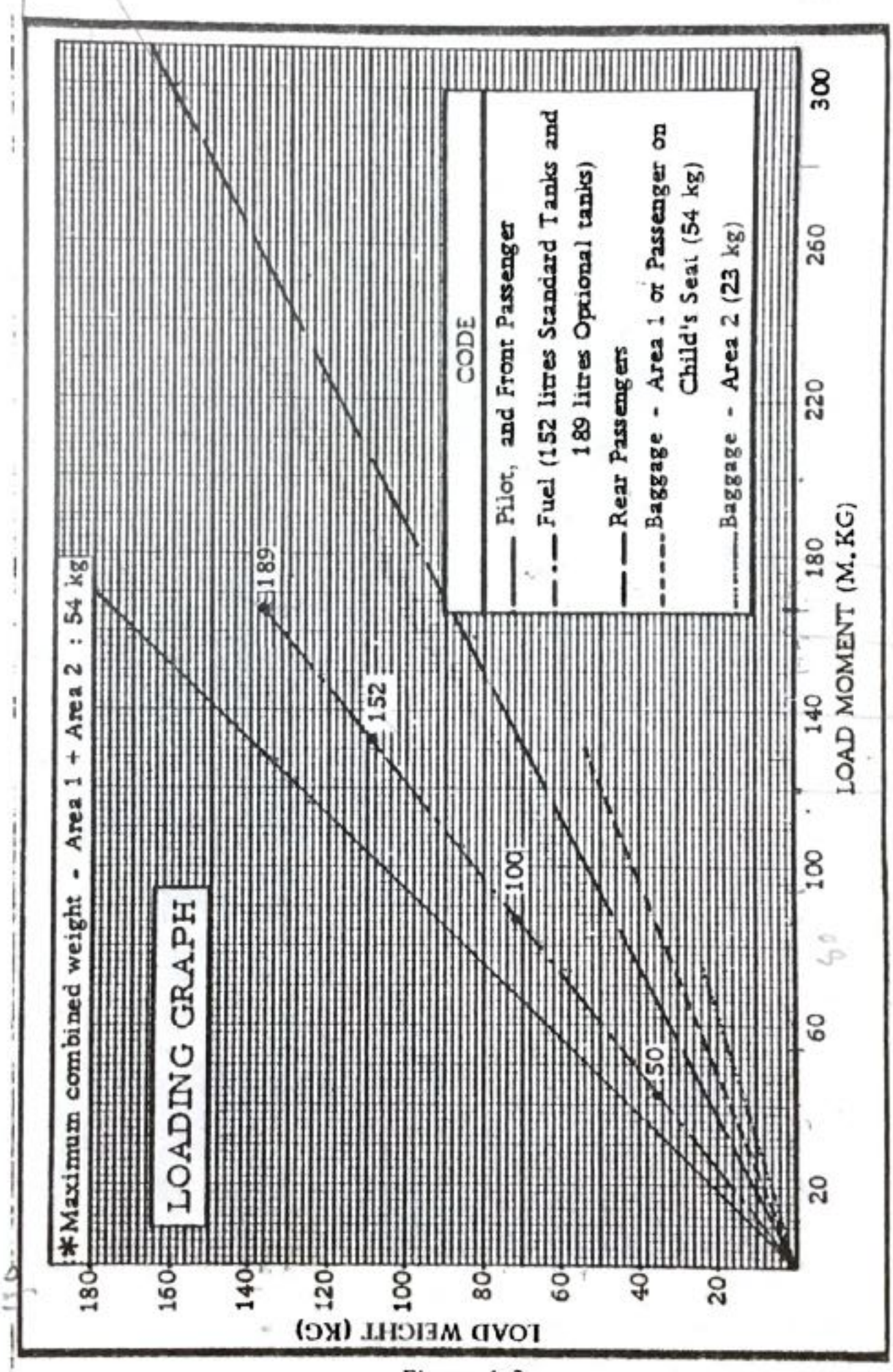

LOADING GRAPH
*Maximum combined weight - Area 1 + Area 2 : 54 kg
LOAD WEIGHT (KG)
LOAD MOMENT (M.KG)
CODE
Pilot, and Front Passenger
Fuel (152 litres Standard Tanks and 189 litres Optional tanks)
Rear Passengers
Baggage - Area 1 or Passenger on Child's Seat (54 kg)
Baggage - Area 2 (23 kg)
189
152
100
50
180
160
140
120
100
80
60
40
20
220
260
300

Figure 4-3

HEAD → see D2G

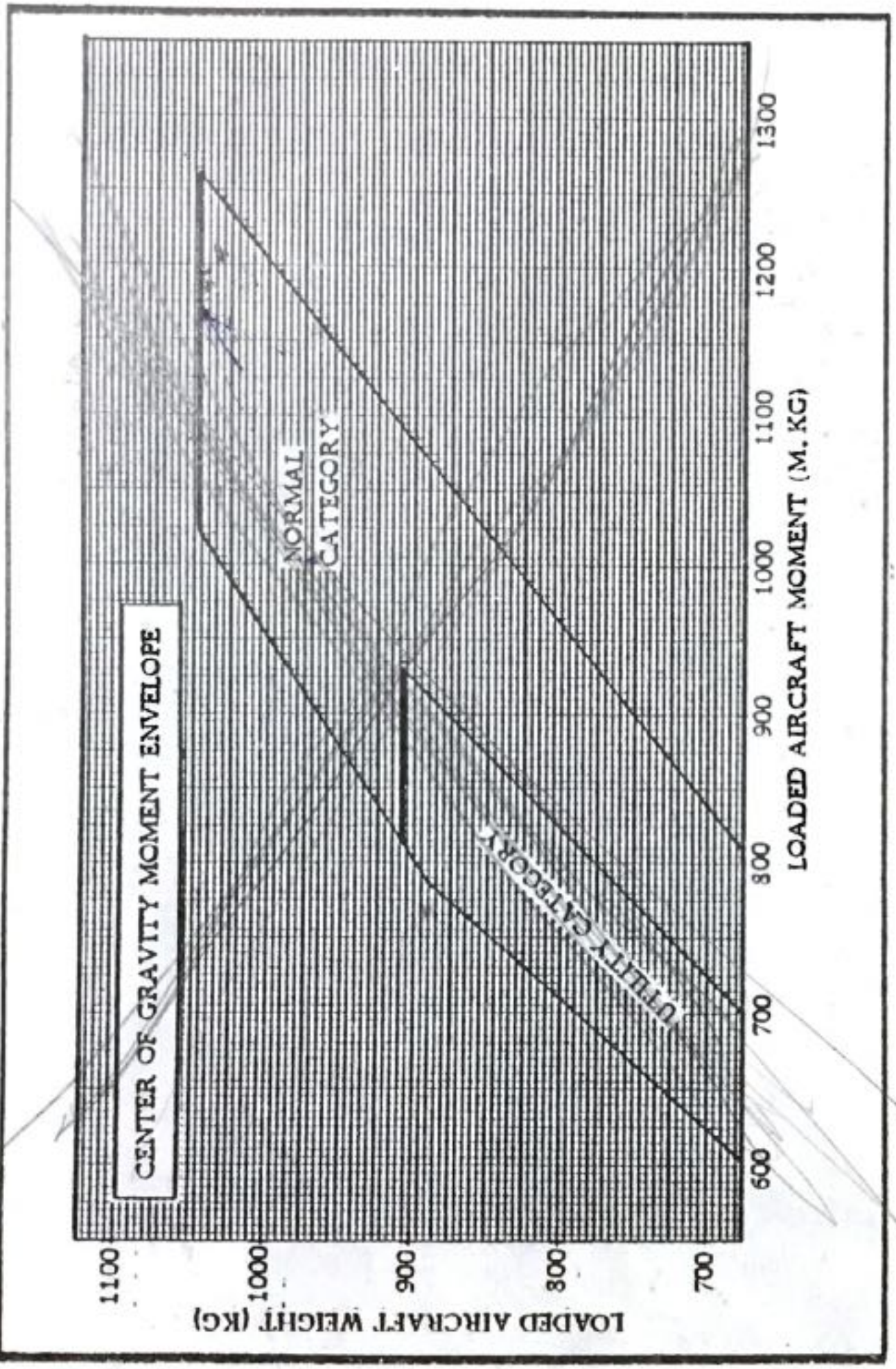


Figure 4-4

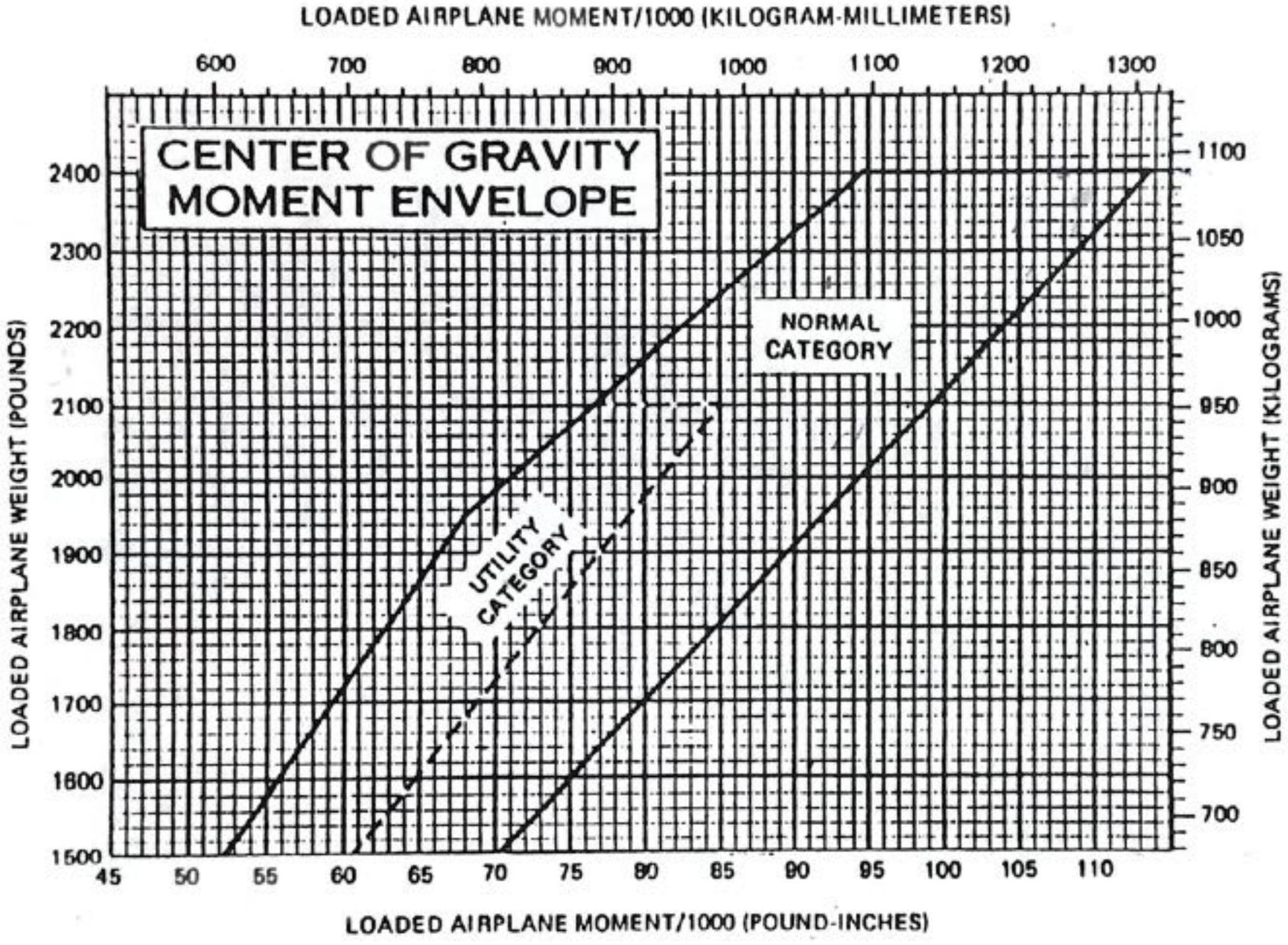


Figure 6-7. Center of Gravity Moment Envelope

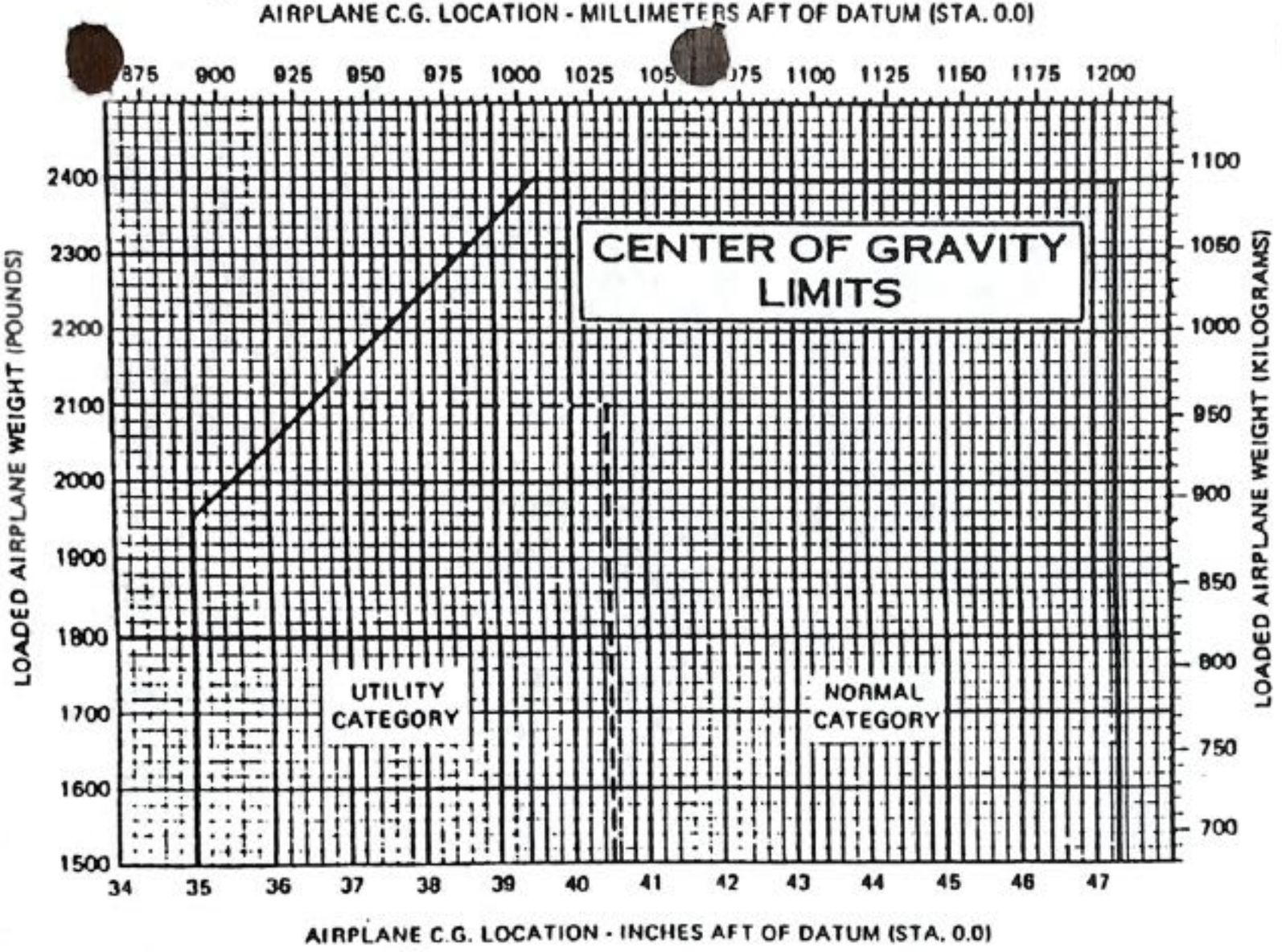


Figure 6-8. Center of Gravity Limits

HEAD → see D2G

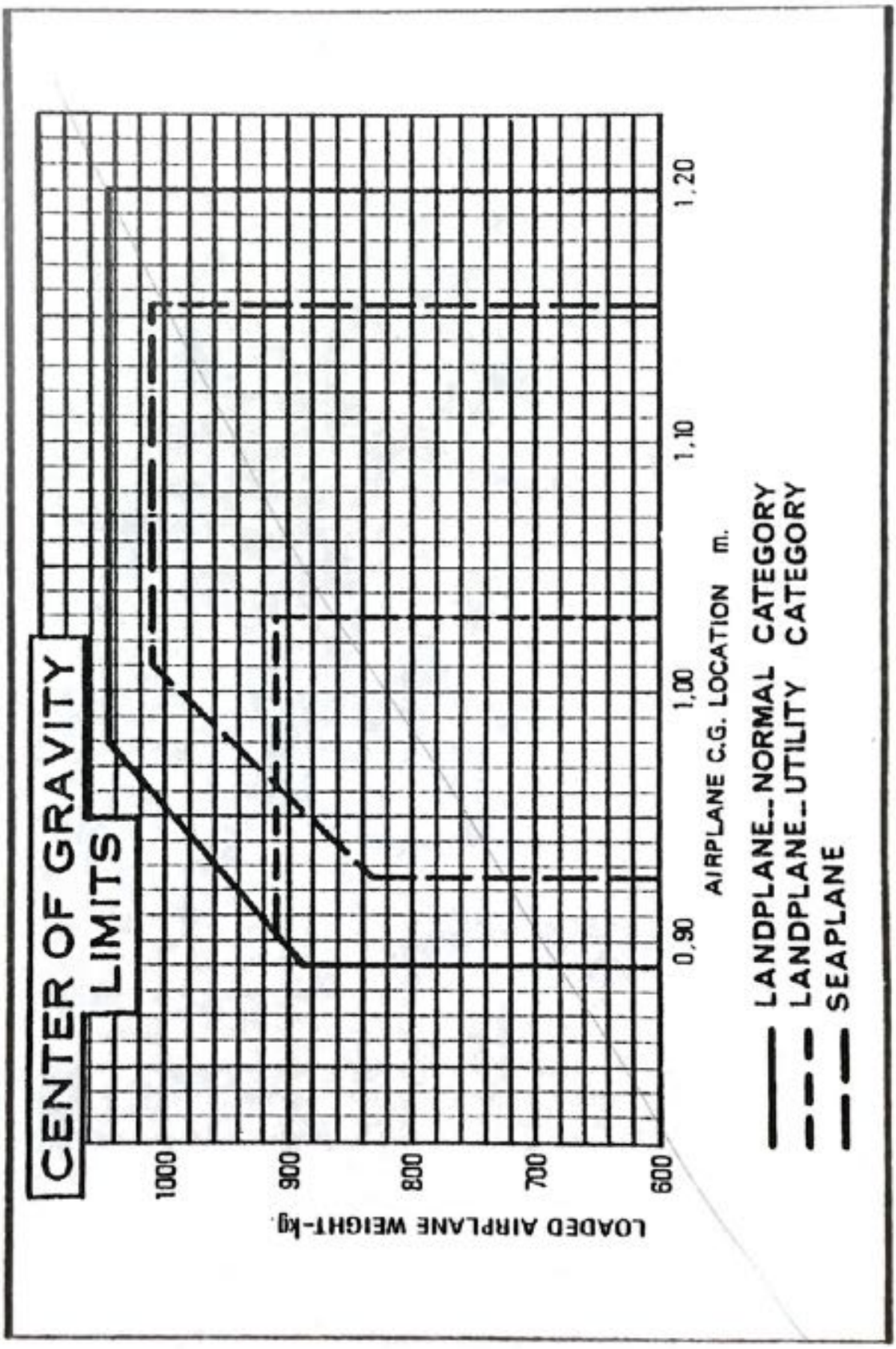
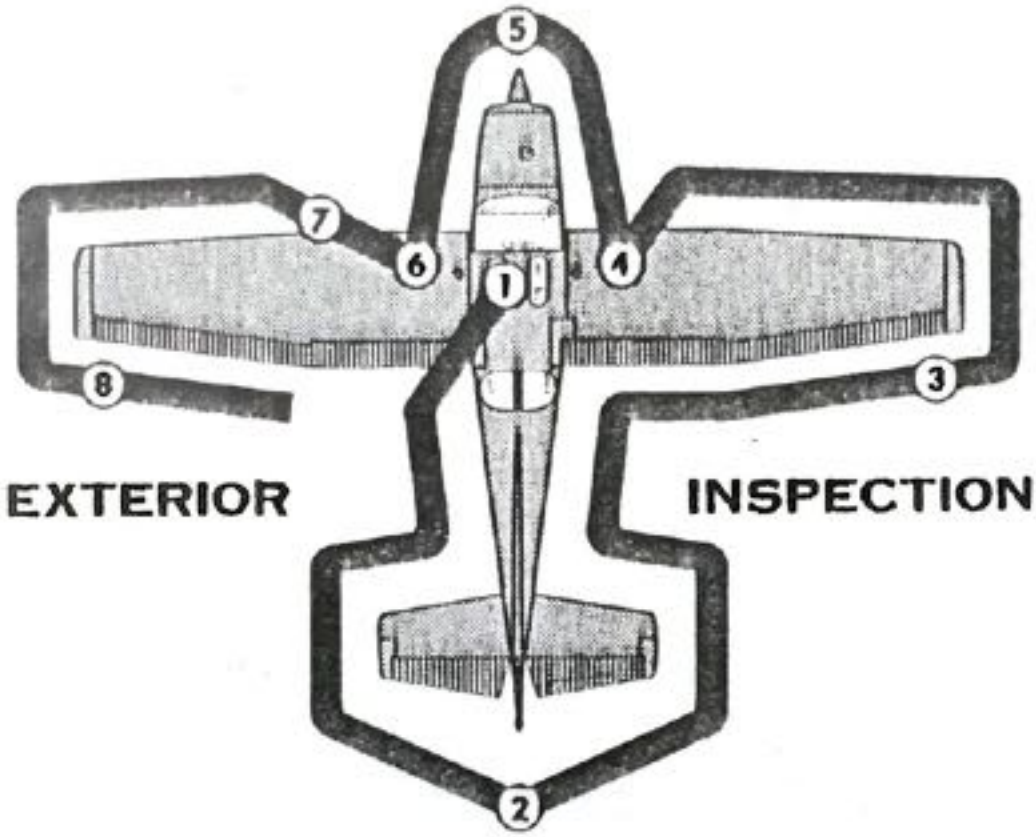


Figure 4-4A



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. Prior to flight, check that pitot heater (if installed) is warm to touch within 30 seconds with battery and pitot heat switches on. If a night flight is planned, check operation of all lights, and make sure a flashlight is available.

Figure 4-5

(1) a. Check for Flight Manual in the airplane.
b. Remove control wheel lock.
c. Check ignition switch OFF.
d. Avionics power switch OFF.
e. Turn on master switch and check fuel quantity indicators ; then turn off master switch.

WARNING

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

f. Check static pressure alternate source valve (if installed).
g. Check fuel selector valve handle on BOTH.
h. Check baggage door for security. Lock with key if children are to occupy child's seat.

(2) a. Remover 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.
2. Ensure that the C. G. of your airplane falls within the enveloppe of page 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).

DESCENT

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 (0 - 10° below 204 km/h - 110 kts - 127 MPH - 10-40° 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

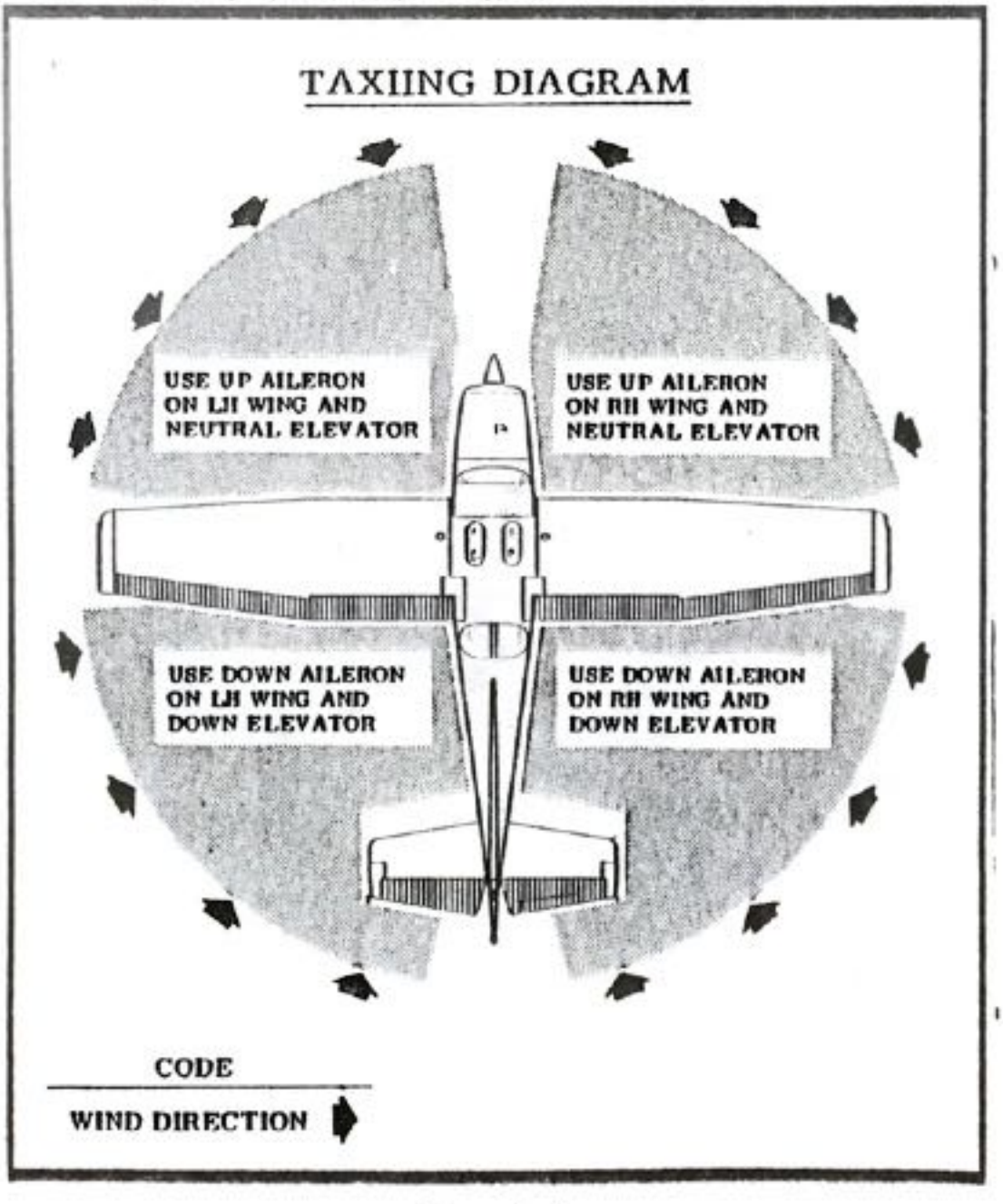


Figure 4-6

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

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

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.
Sea 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 breaking 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.

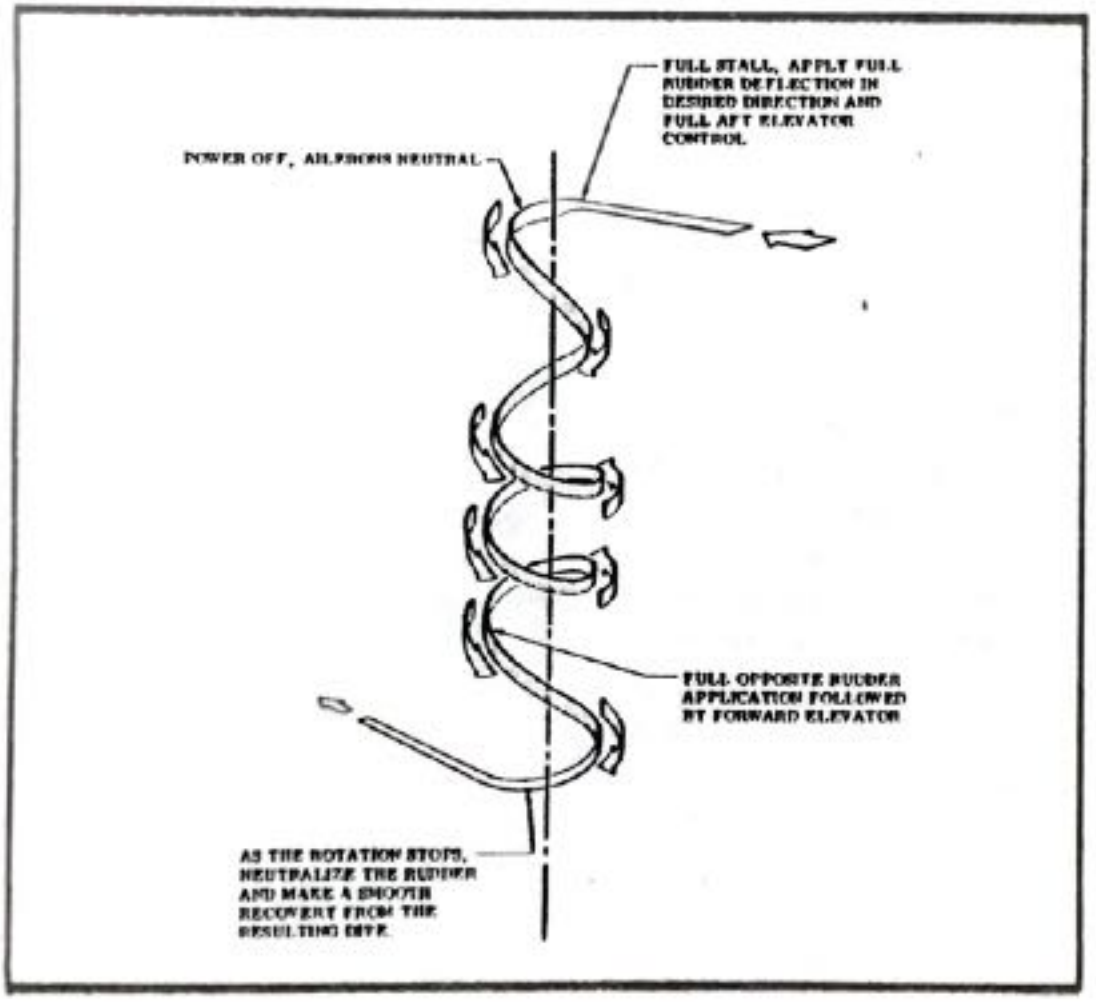


Figure 4-7

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	167	185	204	-	-	-
CAS	km/h	91	102	115	131	148	165	183	200	-	-	-
IAS	kts	40	50	60	70	80	90	100	110	-	-	-
CAS	kts	49	55	62	71	80	89	99	108	-	-	-
IAS	MPH	46	58	69	81	92	104	115	127	-	-	-
CAS	MPH	56	63	71	82	92	102	114	124	-	-	-
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	-	-	-	-	-

POWER OFF	STALL INDICATED AIRSPEEDS			
MAXIMUM GROSS WEIGHT 1043 kg CONDITIONS	ANGLE OF BANK			
	0°	30°	45°	60°
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

GROSS WEIGHT

Normal Category
Utility Category

SPEED

Maximum at Sea Level
Cruise, 75 % Power at 2440 m - 8000 ft

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
40 US Gal. (152 l) Usable Fuel

75 % Power at 2440 m - 8000 ft
50 US Gal. (189 l) Usable Fuel

Maximum Range at 3048 m - 10,000 ft
40 US Gal. (152 l) Usable Fuel

Maximum Range at 3048 m - 10,000 ft
50 US Gal. (189 l) Usable Fuel

RATE OF CLIMB AT SEA LEVEL

SERVICE CEILING

STALL SPEED (LAS)
Flaps Up, Power Off
Flaps Down, Power Off

SPECIFICATIONS

H2AD	D2G
1043 kg	1088 KG
910 kg	950 KG

232 km/h - 125 kts - 144 MPH H2AD
226 km/h - 122 kts - 140 MPH

H2AD

Range	898 km - 485 NM
Time	4.1 hrs
Range	1167 km - 630 NM
Time	5.3 hrs
Range	1065 km - 575 NM
Time	5.7 hrs
Range	1389 km - 750 NM
Time	7.4 hrs

3.9 m/s - 770 ft/mn → 745 ft/mn D2G

4328 m - 14,200 ft

87 km/h - 47 kts - 54 MPH
76 km/h - 41 kts - 47 MPH

	H2AD	D2G
TAKEOFF	↓	↓
Ground Run	245 m	282 m
Total Distance Over 15 m Obstacle	439 m	515 m
LANDING		
Ground Roll	158 m	162 m
Total Distance Over 15 m Obstacle	381 m	385 m
EMPTY WEIGHT (Approximate)		
With Standard Tanks	606 kg	
With Long Range Tanks	610 kg	700KG (PHGYS)
BAGGAGE	54 kg	
WING LOADING	64 kg/m2	
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

Maximum 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 52 kt 60 MPH	109 km/h 59 kt 68 MPH	Sea level		219	396	236	424	255	454	273	485	293	518
			1000	305	241	433	259	465	279	497	299	532	320	568
			2000	610	264	474	283	509	305	546	328	584	352	626
			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	708	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.

5. SLOPE ± 10% VOOR 1° SLOOP
6. WET GRAS + 45%

NEW HZ AD

TAKEOFF DISTANCE SHORT FIELD

CONDITIONS : Flaps up | Full throttle prior to brake release | Paved, level, dry runway | Zero wind

Maximum Weight	IAS		Pressure Altitude		0°C		10°C		20°C		30°C		40°C	
kg	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
953	98 km/h	104 km/h	Sea level		178	336	192	347	207	372	221	396	238	424
	50 kt	56 kt	1000	305	195	355	210	379	226	405	242	433	259	463
	58 MPH	64 MPH	2000	610	213	381	230	415	247	443	265	474	285	507
			3000	914	235	424	253	454	271	486	291	521	312	558
			4000	1219	258	465	277	500	299	535	320	573	344	614
			5000	1524	283	512	305	550	328	590	352	632	378	680
			6000	1829	312	564	335	607	361	652	389	701	418	754
			7000	2134	344	625	370	674	399	725	430	780	462	840
			8000	2438	379	693	410	750	442	809	475	873	512	942

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.

TAKEOFF DISTANCE SHORT FIELD

CONDITIONS : Flaps up | Full throttle prior to brake release | Paved, level, dry runway | Zero wind

Maximum Weight kg	IAS Lift Off	IAS At 15 m	Pressure Altitude ft	Pressure Altitude m	0°C Ground Roll m	0°C Total to Clear 15 m Obs m	10°C Ground Roll m	10°C Total to Clear 15 m Obs m	20°C Ground Roll m	20°C Total to Clear 15 m Obs m	30°C Ground Roll m	30°C Total to Clear 15 m Obs m	40°C Ground Roll m	40°C Total to Clear 15 m Obs m
862	87 km/h 47 kt 54 MPH	100 km/h 54 kt 62 MPH	Sea level		143	256	154	280	165	300	177	319	189	340
			1000	305	157	287	168	306	180	325	194	347	207	370
			2000	610	171	312	184	334	197	357	212	379	227	405
			3000	914	187	340	201	364	216	389	232	416	248	443
			4000	1219	204	372	221	398	238	427	255	456	273	486
			5000	1524	226	406	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 : **Flaps up** Full throttle

Maximum Weight	Pressure Altitude		Climb Speed IAS			RATE OF CLIMB - 20°C		RATE OF CLIMB 0°C		RATE OF CLIMB 20°C		RATE OF CLIMB 40°C	
kg	ft	m	km/h	kts	MPH	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.

NC 172 RD

TIME, FUEL, AND DISTANCE TO CLIMB (MAXIMUM RATE OF CLIMB)

CONDITIONS : Flaps up Full throttle Standard temperature

Weight	Pressure Altitude		Temperature	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	NM	km
726	Sea level		15	135	73	770	3.9	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.

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CRUISE PERFORMANCE

CONDITIONS : Maximum weight : 1043 kg Recommended lean mixture

Pressure Altitude ft	Pressure Altitude m	RPM	20°C Below Standard Temperature						Standard Temperature						20°C Above Standard Temperature					
			% 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	133	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	58	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	183	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

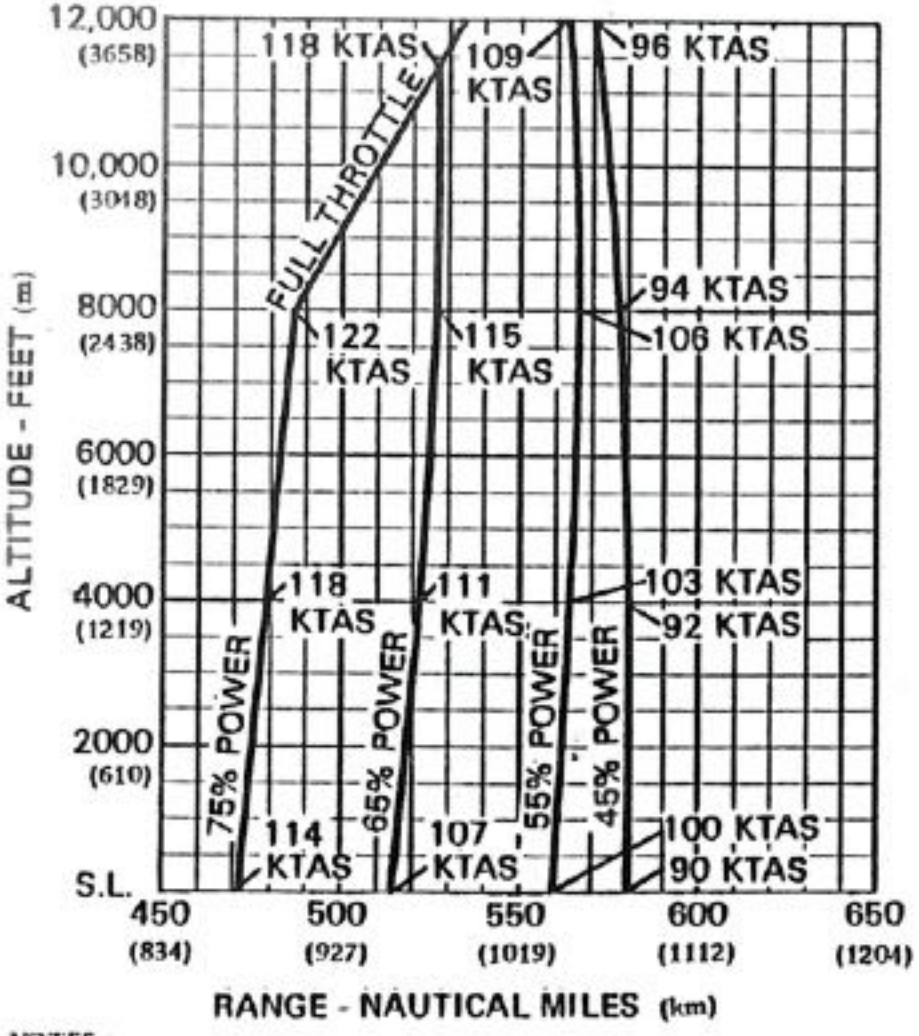
6000	1829	2600	-	-	-	-	-	-	75	222	120	138	8.4	31.8	71	222	120	138	7.9	29.9
		2500	72	215	116	134	8.1	30.7	67	213	115	132	7.6	28.8	64	211	114	131	7.1	26.9
		2400	64	204	110	127	7.2	27.3	60	202	109	125	6.8	25.7	57	202	109	125	6.4	24.2
		2300	57	195	105	121	6.5	24.6	54	193	104	120	6.2	23.5	52	191	103	118	5.9	22.3
		2200	51	183	99	114	5.9	22.3	49	182	98	113	5.7	21.6	47	180	97	112	5.5	20.8
		2100	46	172	93	107	5.5	20.8	44	170	92	106	5.4	20.4	42	169	91	105	5.2	19.7
8000	2438	2650	-	-	-	-	-	-	75	226	122	140	8.4	31.8	71	226	122	140	7.9	29.9
		2600	76	222	120	138	8.6	32.6	71	222	120	138	8.0	30.3	67	221	119	139	7.5	28.4
		2500	68	213	115	132	7.7	29.1	64	211	114	131	7.2	27.3	60	209	113	130	6.8	25.7
		2400	61	204	110	127	6.9	26.1	58	202	109	125	6.5	24.6	55	200	108	124	6.2	23.5
		2300	55	193	104	120	6.2	23.5	52	191	103	119	6.0	22.7	50	189	102	117	5.8	22
		2200	49	182	98	113	5.7	21.6	47	180	97	112	5.5	20.8	45	176	96	110	5.4	20.4
10,000	3048	2650	76	226	122	140	8.5	32.2	71	226	122	140	8.0	30.3	67	224	121	139	7.5	28.4
		2600	72	222	120	138	8.1	30.7	68	221	119	137	7.6	28.8	64	219	118	136	7.1	26.9
		2500	65	211	114	131	7.3	27.6	61	211	114	131	6.8	25.7	58	208	112	129	6.5	24.6
		2400	58	202	109	125	6.5	24.6	55	200	108	124	6.2	23.5	52	198	107	123	6.0	22.7
		2300	52	191	103	119	6.0	22.7	50	189	102	117	5.8	22	48	187	101	116	5.6	21.2
		2200	47	180	97	112	5.6	21.2	45	178	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	64	219	118	136	7.2	27.3	61	217	117	135	6.8	25.7
		2500	62	211	114	131	6.9	26.1	58	209	113	130	6.5	24.6	55	206	111	128	6.2	23.5
		2400	56	200	108	124	6.3	23.8	53	198	107	123	6.0	22.7	51	196	106	122	5.8	22
		2300	50	189	102	117	5.8	21.9	48	187	101	116	5.6	21.2	46	185	100	115	5.5	20.8
		2200	46	178	96	110	5.5	20.8	44	176	95	109	5.4	20.4	43	174	94	108	5.3	20.1

NB! H2AD

RANGE PROFILE

45 MINUTES RESERVE 40 US GAL - 156 l USABLE FUEL

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



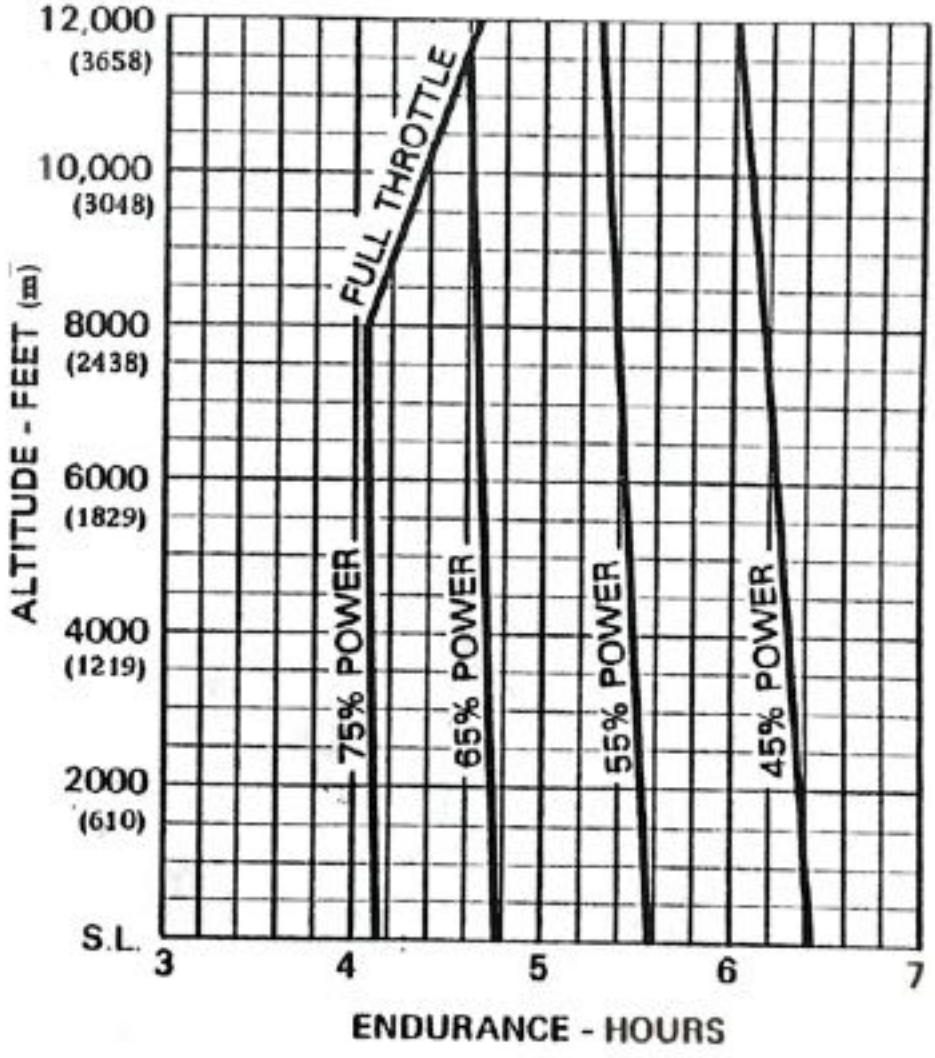
NOTES :

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 :

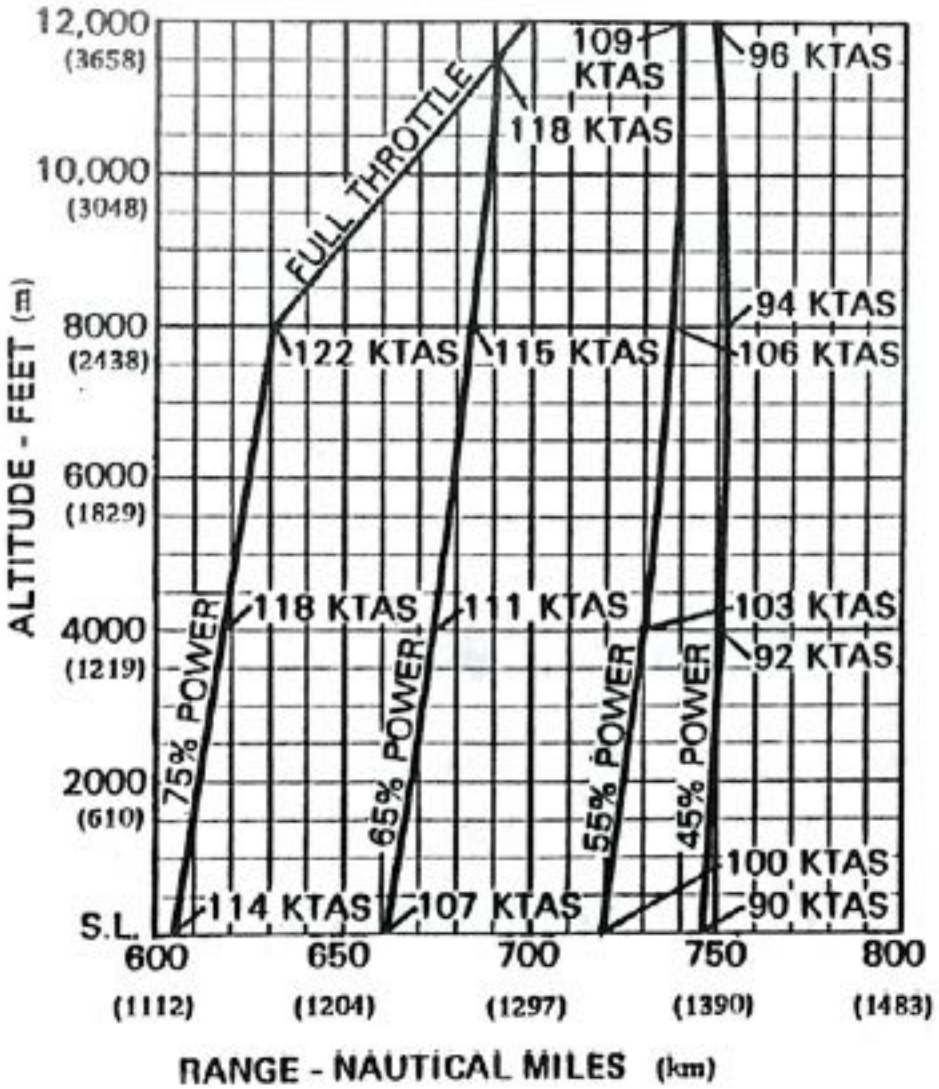
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb as shown in figure page 5-10
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l

NO! HEAD

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 :

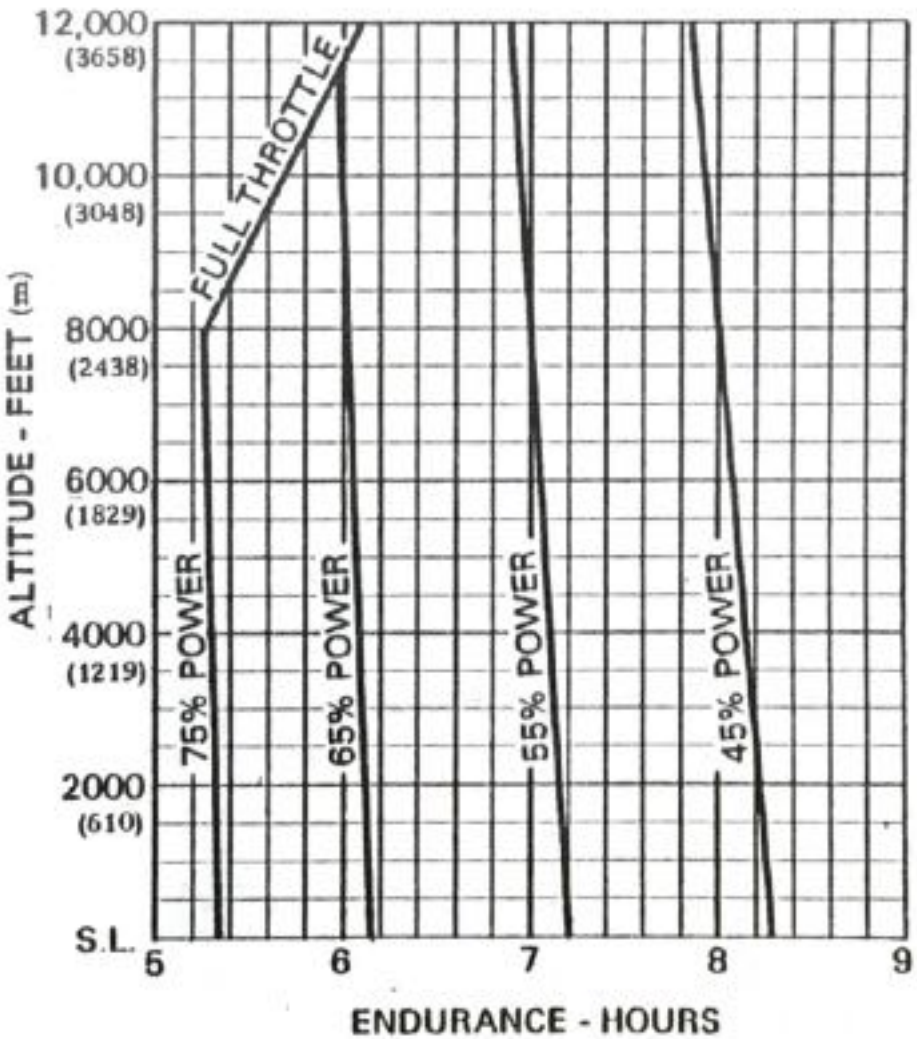
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the distance during climb as shown in figure page 5-10
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l

NB! H2 AD

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

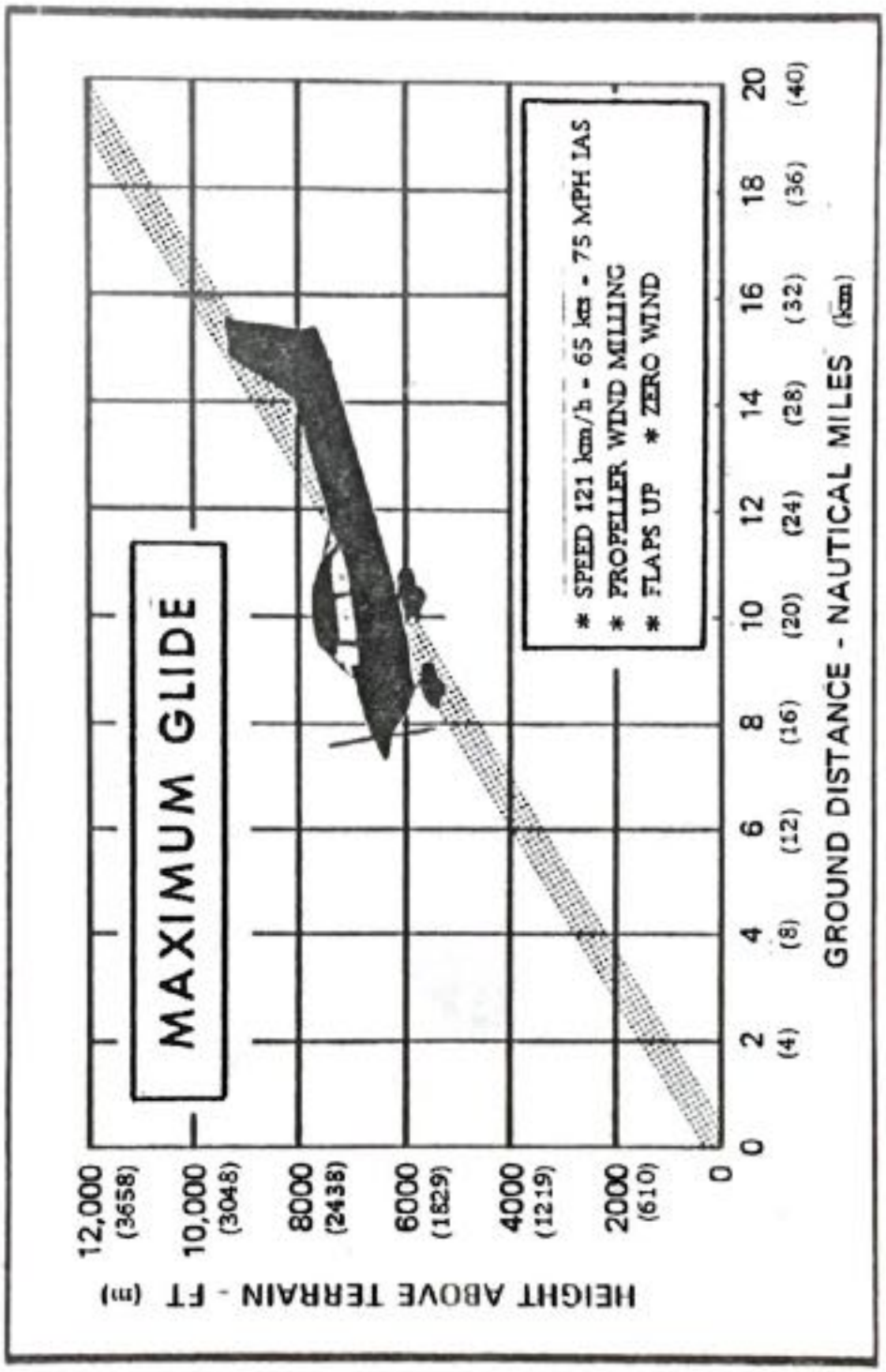
LANDING DISTANCE SHORT FIELD

CONDITIONS Flaps 40° Power off Maximum braking Paved, level, dry runway Zero Wind

Weight kg	IAS At 15 m	Pressure Altitude ft	Pressure Altitude m	0°C Ground Roll m	0°C Total to Clear 15 m Obs m	10°C Ground Roll m	10°C Total to Clear 15 m Obs m	20°C Ground Roll m	20°C Total to Clear 15 m Obs m	30°C Ground Roll m	30°C Total to Clear 15 m Obs m	40°C Ground Roll m	40°C Total to Clear 15 m Obs m
1043	111 km/h	Sea Level		151	367	155	376	162	386	166	196	172	405
	60 kt	1000	305	155	376	162	386	168	396	172	406	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.


MAXIMUM GLIDE
* SPEED 121 km/h - 65 kts - 75 MPH IAS
* PROPELLER WIND MILLING
* FLAPS UP * ZERO WIND
HEIGHT ABOVE TERRAIN - FT (m)
12,000 (3658)
10,000 (3048)
8000 (2438)
6000 (1829)
4000 (1219)
2000 (610)
0
0 2 (4) 4 (8) 6 (12) 8 (16) 10 (20) 12 (24) 14 (28) 16 (32) 18 (36) 20 (40)
GROUND DISTANCE - NAUTICAL MILES (km)

required to complete the trip with ample reserve.

LANDING

A procedure similar to takeoff should be used for estimating the landing distance at the destination airport. Figure 5-11 presents landing distance information for the short field technique. The distances corresponding to 2000 feet and 30°C are as follows:

Ground roll	610 Feet
Total distance to clear a 50-foot obstacle	1390 Feet

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

DEMONSTRATED OPERATING TEMPERATURE

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

AIRSPEED CALIBRATION

NORMAL STATIC SOURCE

NB! D2 6

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

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

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

Aircraft Modified
Per Penn Yan STC
2400 lb. gross wt.

NB! DeG

STALL SPEEDS

CONDITIONS:
Power Off

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

MOST REARWARD CENTER OF GRAVITY

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

MOST FORWARD CENTER OF GRAVITY

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

Figure 5-3. Stall Speeds

	0°C	10°C	20°C	30°C	40°C
1000	242 / 445	262 / 479	28[illegible] / [illegible]13	303 / 552	324 / 593
2000	267 / 489	286 / 526	3[illegible] / 567	332 / 610	357 / 657
3000	293 / 539	315 / 582	339 / [illegible]28	366 / 677	393 / 730
4000	321 / 597	347 / 646	375 / 700	404 / 756	434 / 818
5000	355 / 666	384 / 721	413 / 783	447 / 850	480 / 924
6000	392 / 745	424 / 811	457 / 882	494 / 963	532 / 1053
7000	434 / 840	469 / 919	507 / 1006	549 / 1103	591 / 1216
8000	482 / 957	521 / 1052	564 / 1160	609 / 1286	--- / ---
	535 / 1102	581 / 1224	628 / 1366	--- / ---	--- / ---

TAKEOFF DISTANCE
MAXIMUM WEIGHT 2400 LBS
SHORT FIELD

CONDITIONS:
Flaps 10°
Full Throttle Prior to Brake Release
Paved, Level, Dry Runway
Zero Wind

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

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
2400	61	68	S.L.	795	1460	860	1570	925	1685	995	1810	1065	1945
			1000	875	1605	940	1725	1015	1860	1090	2000	1170	2155
			2000	960	1770	1035	1910	1115	2060	1200	2220	1290	2395
			3000	1055	1960	1140	2120	1230	2295	1325	2480	1425	2685
			4000	1165	2185	1260	2365	1355	2570	1465	2790	1575	3030
			5000	1285	2445	1390	2660	1500	2895	1620	3160	1745	3455
			6000	1425	2755	1540	3015	1665	3300	1800	3620	1940	3990
			7000	1580	3140	1710	3450	1850	3805	2000	4220	- - -	- - -
			8000	1755	3615	1905	4015	2060	4480	- - -	- - -	- - -	- - -

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

Aircraft Modified
Per Penn Yan STC
2400 lb. gross wt.

NSI D2 G

	0°C	10°C	20°C	30°C	40°C
SL	198/364	213/390	229/419	245/448	264/480
1000	216/399	233/428	251/460	270/492	290/529
2000	238/439	256/471	276/506	297/544	
3000	261/481	282/520	303/559	326/602	
4000	288/533	311/576	335/622		
5000	317/593	343/642	369/697		
SL	160/296	172/315	184/338	198/361	212/386
1000	174/323	187/346	203/370	216/395	233/422
2000	191/354	206/378	221/405	238/434	
3000	210/387	225/416	244/446	262/479	
4000	230/427	248/457	268/492		
5000	253/470	274/506	296/545		

TAKEOFF DISTANCE
2200 LBS AND 2000 LBS

SHORT FIELD

REFER TO SHEET 1 FOR APPROPRIATE CONDITIONS AND NOTES.

WEIGHT LBS	TAKEOFF SPEED KIAS		PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
	LIFT OFF	AT 50 FT		GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
2200	49	54	S.L.	650	1195	700	1280	750	1375	805	1470	865	1575
			1000	710	1310	765	1405	825	1510	885	1615	950	1735
			2000	780	1440	840	1545	905	1660	975	1785	1045	1915
			3000	855	1585	925	1705	995	1835	1070	1975	1150	2130
			4000	945	1750	1020	1890	1100	2040	1180	2200	1270	2375
			5000	1040	1945	1125	2105	1210	2275	1305	2465	1405	2665
			6000	1150	2170	1240	2355	1340	2555	1445	2775	1555	3020
			7000	1270	2440	1375	2655	1485	2890	1605	3155	1730	3450
			8000	1410	2760	1525	3015	1650	3305	1785	3630	1925	4005
2000	46	51	S.L.	525	970	565	1035	605	1110	650	1185	695	1265
			1000	570	1060	615	1135	665	1215	710	1295	765	1385
			2000	625	1160	675	1240	725	1330	780	1425	840	1525
			3000	690	1270	740	1365	800	1465	860	1570	920	1685
			4000	755	1400	815	1500	880	1615	945	1735	1015	1865
			5000	830	1545	900	1660	970	1790	1040	1925	1120	2070
			6000	920	1710	990	1845	1070	1990	1150	2145	1235	2315
			7000	1015	1900	1095	2055	1180	2225	1275	2405	1370	2605
			8000	1125	2125	1215	2305	1310	2500	1410	2715	1520	2950

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

NB! D2G

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Full Throttle

NOTE:
Mixture leaned above 3000 feet for maximum RPM.

WEIGHT LBS	PRESS ALT FT	CLIMB SPEED KIAS	RATE OF CLIMB - FPM			
			-20°C	0°C	20°C	40°C
2400	S.L.	76	805	745	685	625
	2000	75	695	640	580	525
	4000	74	590	535	480	420
	6000	73	485	430	375	320
	8000	72	380	330	275	220
	10,000	71	275	225	175	- - -
	12,000	70	175	125	- - -	- - -

Figure 5-6. Maximum Rate of Climb

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Full Throttle
Standard Temperature

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

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2400	S.L.	15	76	700	0	0.0	0
	1000	13	76	655	1	0.3	2
	2000	11	75	610	3	0.6	4
	3000	9	75	560	5	1.0	6
	4000	7	74	515	7	1.4	9
	5000	5	74	470	9	1.7	11
	6000	3	73	425	11	2.2	14
	7000	1	72	375	14	2.6	18
	8000	-1	72	330	17	3.1	22
	9000	-3	71	285	20	3.6	26
	10,000	-5	71	240	24	4.2	32
	11,000	-7	70	190	29	4.9	38
	12,000	-9	70	145	35	5.8	47

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

CRUISE PERFORMANCE

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

PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2500	- - -	- - -	- - -	76	114	8.5	72	114	8.1
	2400	72	110	8.1	69	109	7.7	65	108	7.3
	2300	65	104	7.3	62	103	6.9	59	102	6.6
	2200	58	99	6.6	55	97	6.3	53	96	6.1
	2100	52	92	6.0	50	91	5.8	48	89	5.7
4000	2550	- - -	- - -	- - -	76	117	8.5	72	116	8.1
	2500	77	115	8.6	73	114	8.1	69	113	7.7
	2400	69	109	7.8	65	108	7.3	62	107	7.0
	2300	62	104	7.0	59	102	6.6	57	101	6.4
	2200	56	98	6.3	54	96	6.1	51	94	5.9
	2100	51	91	5.8	48	89	5.7	47	88	5.5
6000	2600	- - -	- - -	- - -	77	119	8.6	72	118	8.1
	2500	73	114	8.2	69	113	7.8	66	112	7.4
	2400	66	108	7.4	63	107	7.0	60	106	6.7
	2300	60	103	6.7	57	101	6.4	55	99	6.2
	2200	54	96	6.1	52	95	5.9	50	92	5.8
	2100	49	90	5.7	47	88	5.5	46	86	5.5
8000	2650	- - -	- - -	- - -	77	121	8.6	73	120	8.1
	2600	77	119	8.7	73	118	8.2	69	117	7.8
	2500	70	113	7.8	66	112	7.4	63	111	7.1
	2400	63	108	7.1	60	106	6.7	58	104	6.5
	2300	57	101	6.4	55	100	6.2	53	97	6.0
	2200	52	95	6.0	50	93	5.8	49	91	5.7
10,000	2600	74	118	8.3	70	117	7.8	66	115	7.4
	2500	67	112	7.5	64	111	7.1	61	109	6.8
	2400	61	106	6.8	58	105	6.5	56	102	6.3
	2300	55	100	6.3	53	98	6.0	51	96	5.9
	2200	50	93	5.8	49	91	5.7	47	89	5.6
12,000	2550	67	114	7.5	64	112	7.1	61	111	6.9
	2500	64	111	7.2	61	109	6.8	59	107	6.6
	2400	59	105	6.6	56	103	6.3	54	100	6.1
	2300	53	98	6.1	51	96	5.9	50	94	5.8

Figure 5-8. Cruise Performance

NB! D2G

RANGE PROFILE
45 MINUTES RESERVE
40 GALLONS USABLE FUEL

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

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

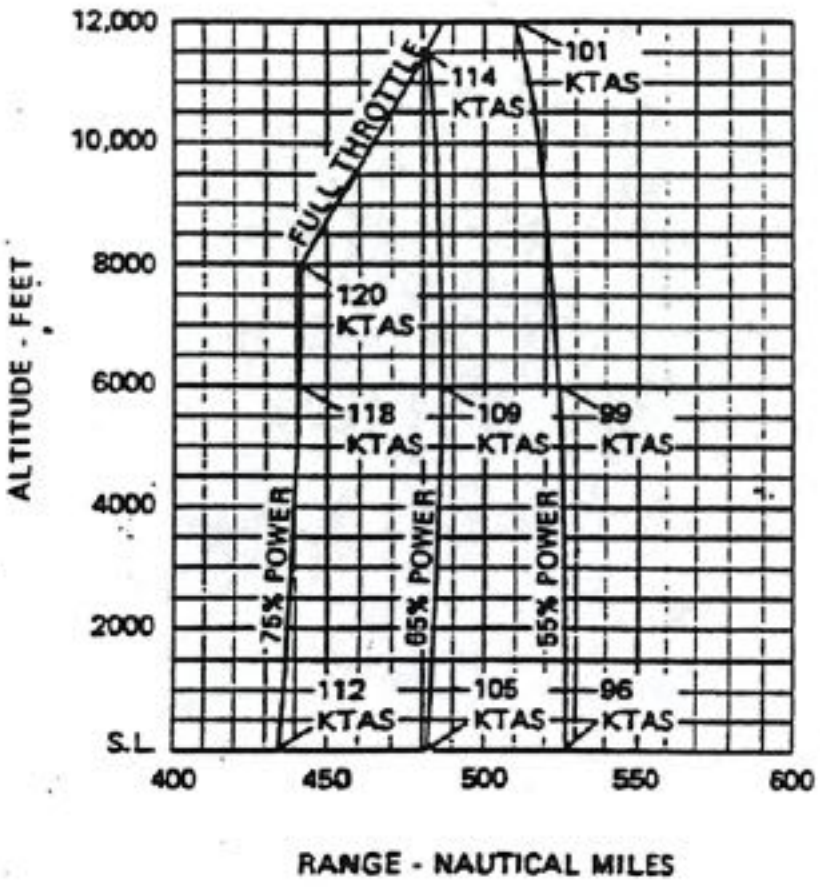


Figure 5-9. Range Profile (Sheet 1 of 3)

NB! D2 G

Aircraft Modified
Per Penn Yan STC
2400 lb. gross wt.

ENDURANCE PROFILE
45 MINUTES RESERVE
40 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb.

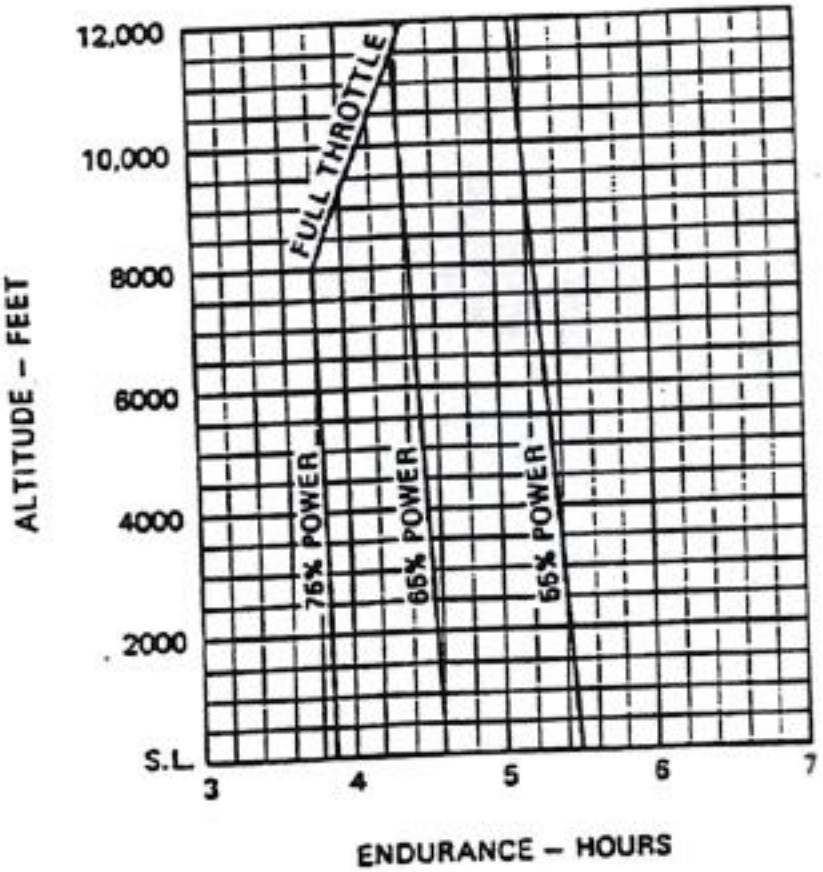


Figure 5-10. Endurance Profile (Sheet 1 of 3)

NBI D2G

Aircraft Modified
Per Penn Yan STC
2400 lb. gross wt.

RANGE PROFILE
45 MINUTES RESERVE
50 GALLONS USABLE FUEL

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

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

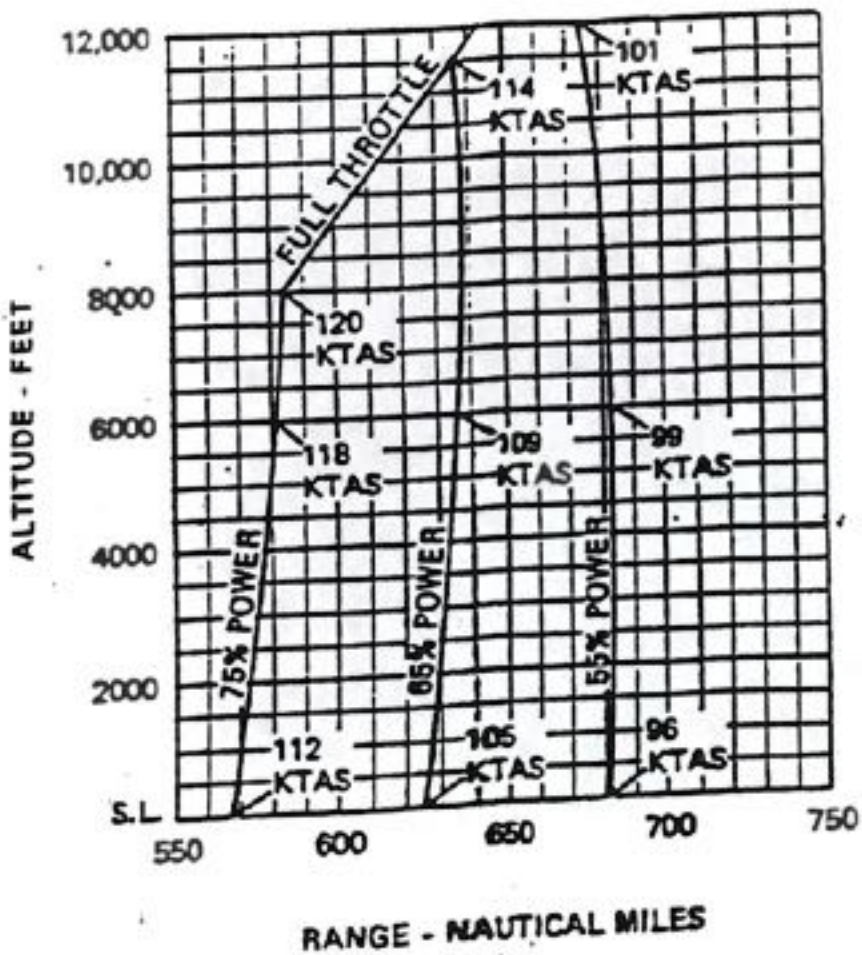


Figure 5-9. Range Profile (Sheet 2 of 3)

NB! D2G

ENDURANCE PROFILE

45 MINUTES RESERVE
50 GALLONS USABLE FUEL

CONDITIONS:
2400 Pounds
Recommended Lean Mixture for Cruise
Standard Temperature

NOTE:
This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb.

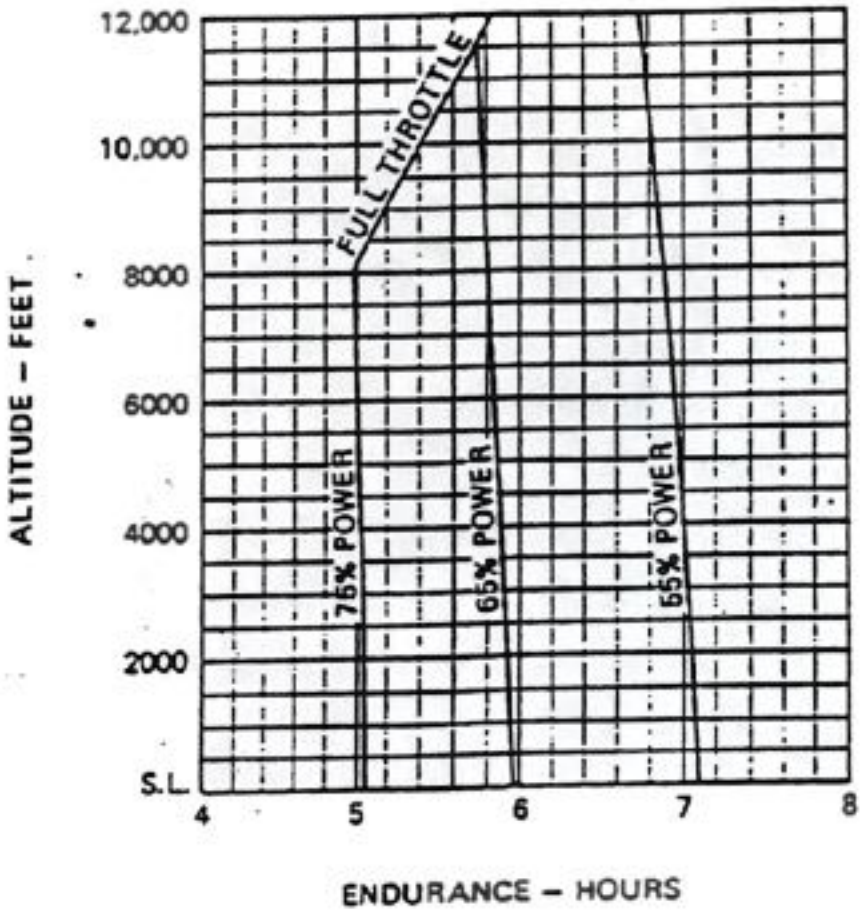


Figure 5-10. Endurance Profile (Sheet 2 of 3)

	0°C	10°C	20°C	30°C	40°C
S.L.	155/376	162/386	168/395	174/404	178/411
1000	162/386	168/395	174/404	180/414	186/424
2000	168/395	174/405	180/415	186/424	190/436
3000	174/405	180/415	187/425	194/436	201/448
4000	181/416	187/427	194/436	201/448	208/459
5000	187/427	195/437	201/448	209/460	215/471
6000	195/437	201/443	209/460	216/472	
7000	202/449	210/461	216/472		
8000	210/461	216/472			

LANDING DISTANCE

D2G

SHORT FIELD

lean boven 3000'

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

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

WEIGHT LBS	SPEED AT 50 FT KIAS	PRESS ALT FT	0°C		10°C		20°C		30°C		40°C	
			GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS	GRND ROLL FT	TOTAL FT TO CLEAR 50 FT OBS
2400	61	S.L.	510	1235	530	1285	550	1295	570	1325	585	1350
		1000	530	1265	550	1295	570	1325	590	1360	610	1390
		2000	550	1295	570	1330	590	1360	610	1390	630	1425
		3000	570	1330	590	1360	615	1395	635	1430	655	1460
		4000	595	1365	615	1400	635	1430	660	1470	680	1500
		5000	615	1400	640	1435	660	1470	685	1510	705	1540
		6000	640	1435	660	1470	685	1510	710	1550	730	1580
		7000	665	1475	690	1515	710	1550	735	1590	760	1630
		8000	690	1515	715	1565	740	1595	765	1635	790	1675

Figure 5-11. Landing Distance

Aircraft Modified
Per Penn Yan STC
400 lb. gross wt.

81-5

LET OP !

* ALLES MET H_2AD IS HET OUDE TYPE.

NIET GEBRUIKEN DUS

* ALLES MET D_2G IS GEMODIFICEERD

DIT GEBRUIKEN VOOR DE PERFORMANCE

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 and 6-2, 2	
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	p.o. Robert 27.10.76
Skydiving Kit	6-11, 1 thru 6-11, 6	
Badin Crouzet RG 10 B Automatic Pilot	6-12, 1 thru 6-12, 3	
Nav-O-Matic 200 A Automatic Pilot	6-13, 1 thru 6-13, 5	
Nav-O-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	APPROVAL
Floatplane Option	6-16, 1 thru 6-16, 36	P. Robert 11.05.78
- Night VFR Operation - Economy Mixture Indication	6-17, 1 6-18, 1 and 6-18, 2	P.O. Robert 25.09.78

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.

WARNING

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

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°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 absolulety 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.

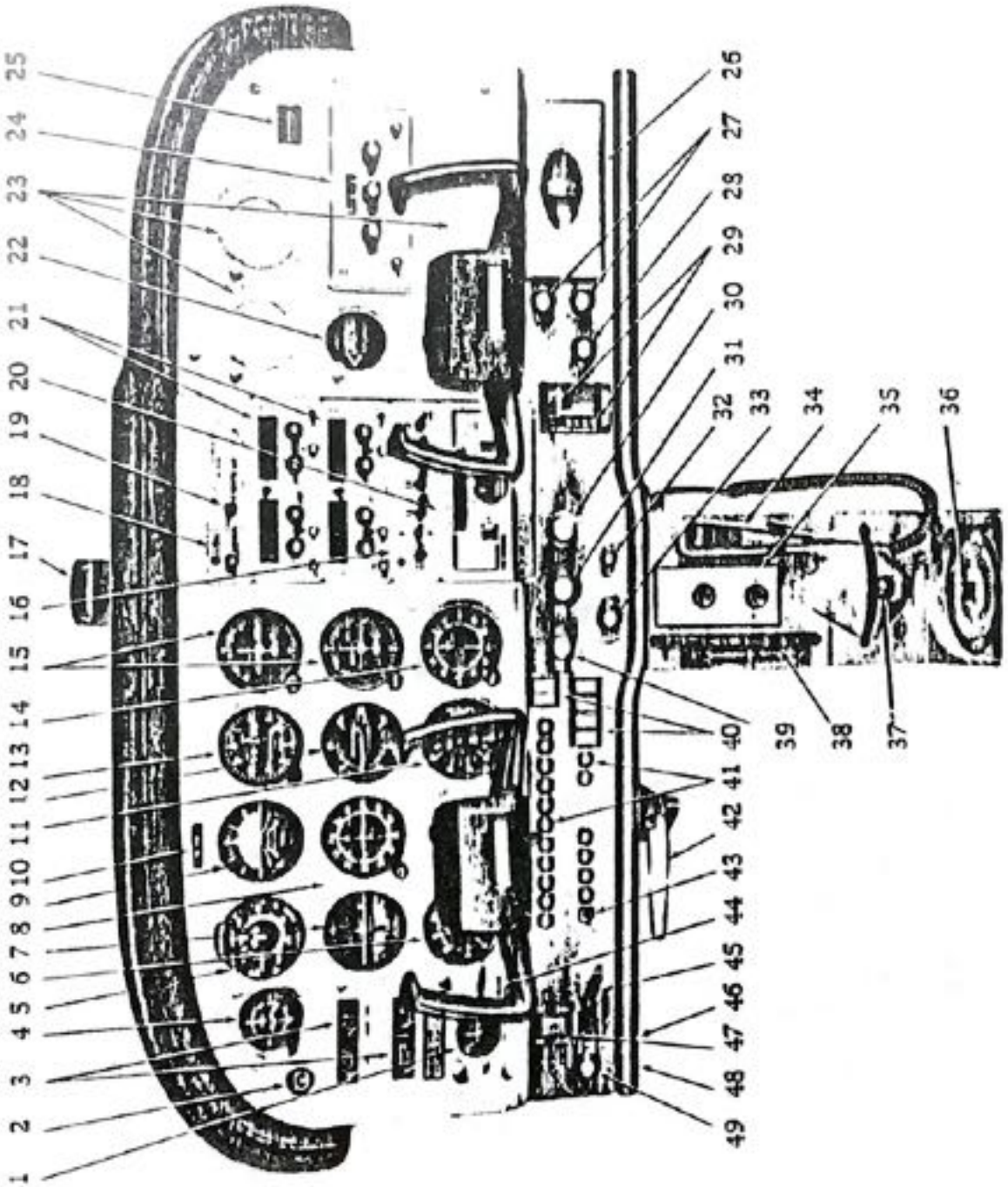
INSTRUMENT FLYING (IFR)

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

Standard Equipment : S
Optional Equipment : O

DESCRIPTION OF EQUIPMENT	S or O
For Type V Area :	
- 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
For Type II Area :	
- Same Equipment as Type V Area Equipment	
- One Category 2 HF Transmitter-Receiver	O
NOTE : For night flights, the crew should have an electric flashlight available.	

IFR INSTRUMENT PANEL



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

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	90	100	110	---	---	---
ALTERNATE KIAS	40	61	61	71	81	90	99	108	---	---	---
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	90	100	110	---	---	---
ALTERNATE KIAS	38	49	59	69	79	88	97	106	---	---	---
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	90	100	112	---	---	---
ALTERNATE KIAS	225	43	57	69	80	91	101	111	---	---	---
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° 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

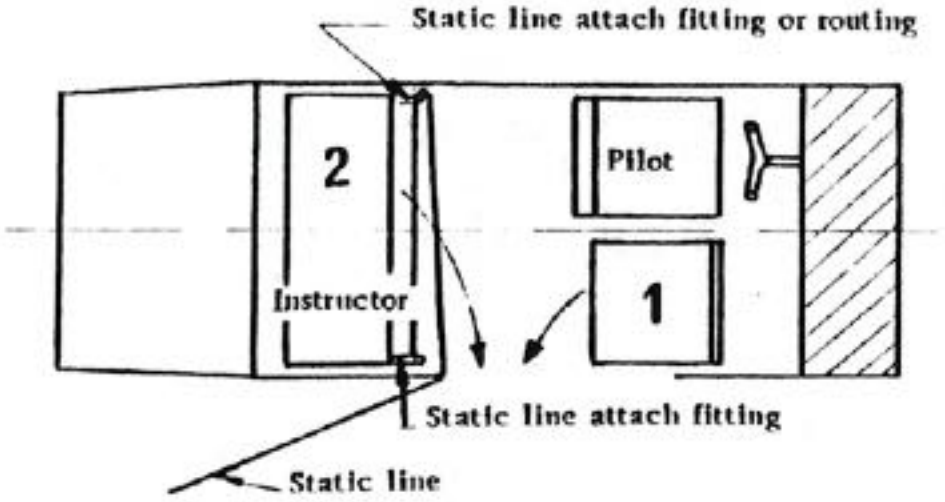
CENTER OF GRAVITY RANGE LIMITS

	Forward Limit	Rear Limit
at 1043 kg	+ 0.98 m	+ 1.20 m
at 885 kg or less	+ 0.89 m	+ 1.20 m

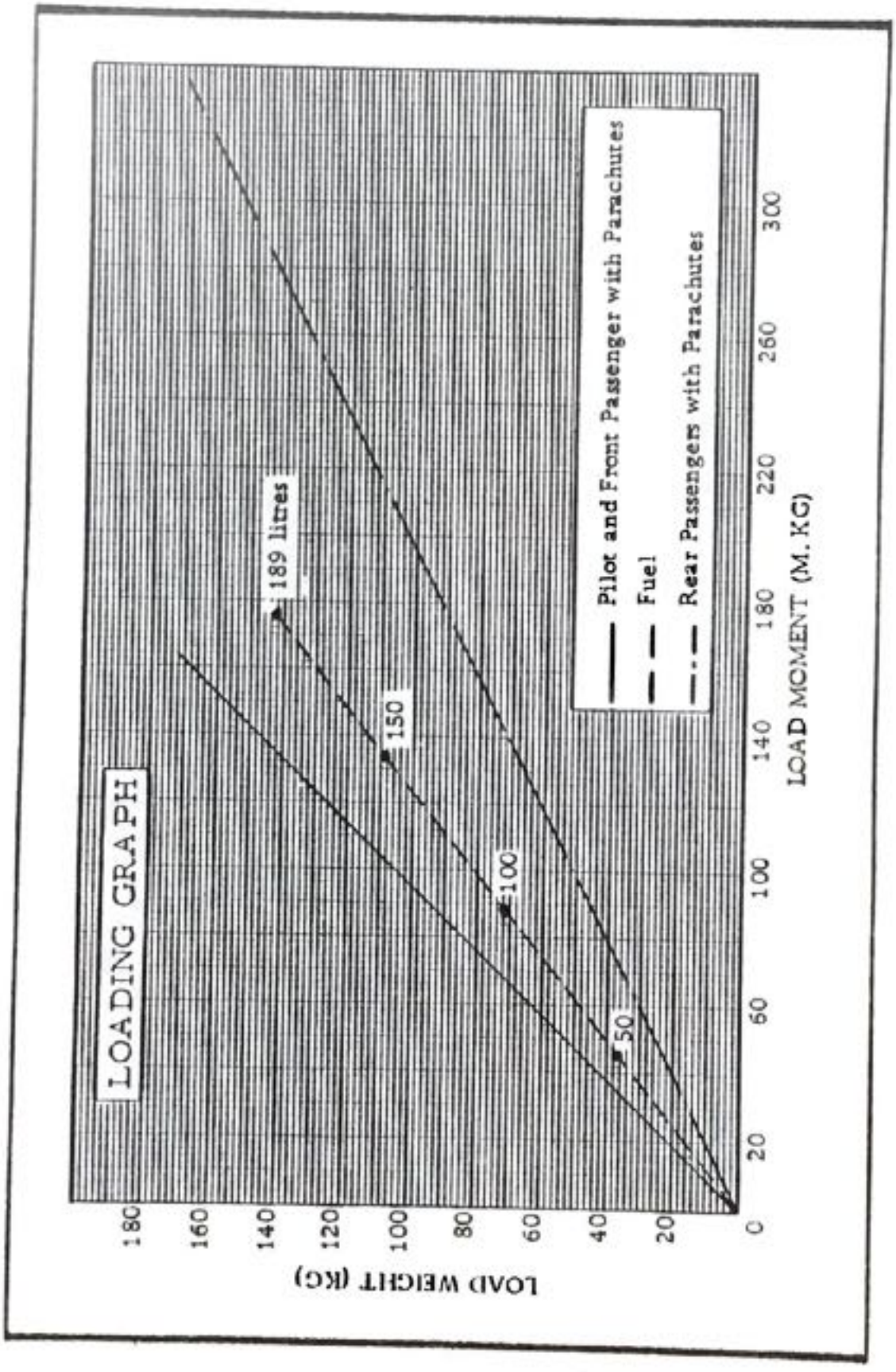
LOADING LIMITS

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.


LOADING GRAPH
LOAD WEIGHT (KG)
180
160
140
120
100
80
60
40
20
0
20
60
100
140
180
220
260
300
LOAD MOMENT (M. KG)
189 litres
150
100
50
Pilot and Front Passenger with Parachutes
Fuel
Rear Passengers with Parachutes

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		

NOTE : 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.

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 overriden 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°) to desired course (the aircraft will then turn to a 45° $\pm$ 10° 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 or 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"

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.

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.

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° ± 10° 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.

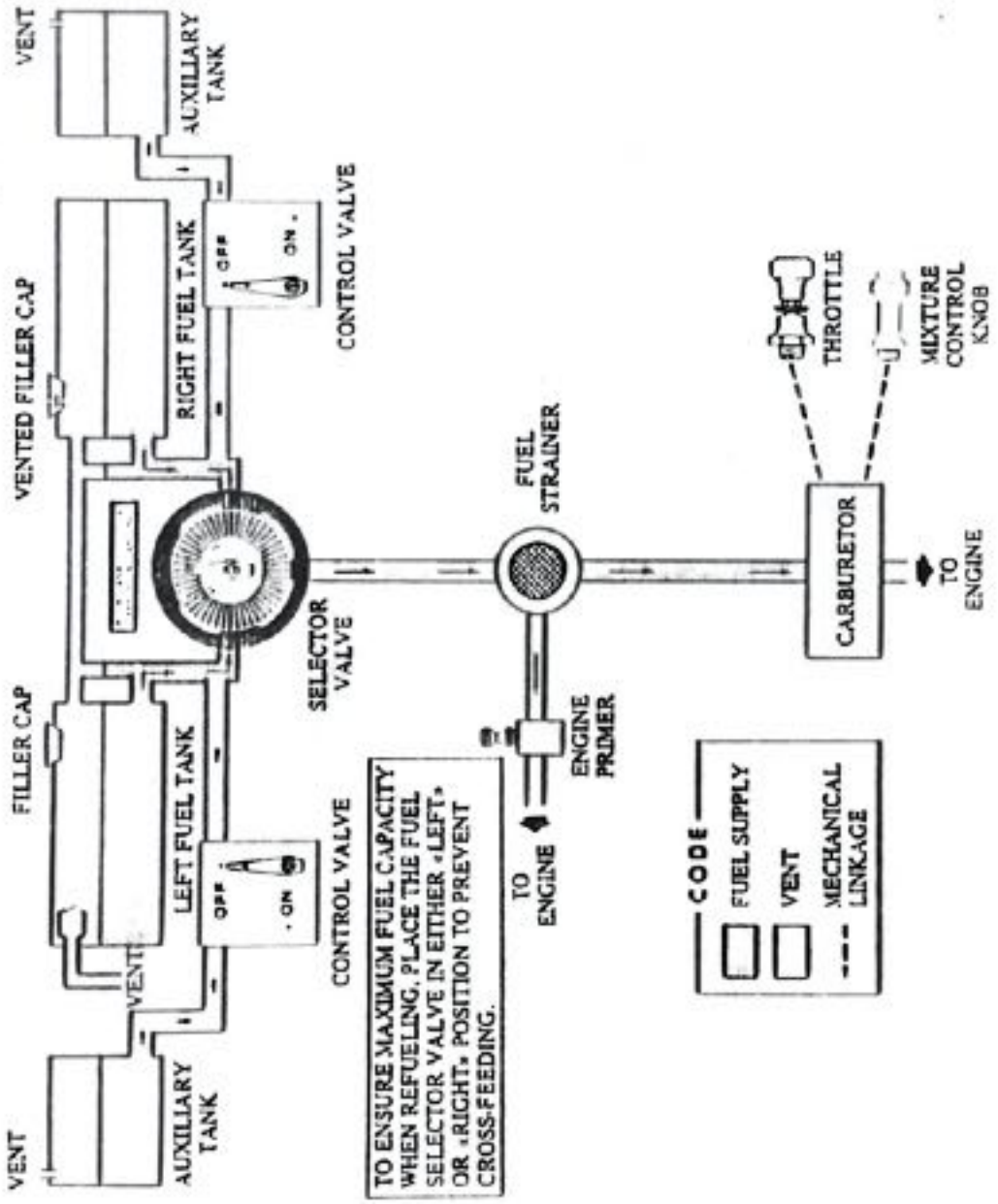
The total usable fuel capacity of these tanks is 24 US Gal. (91 litres).

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.

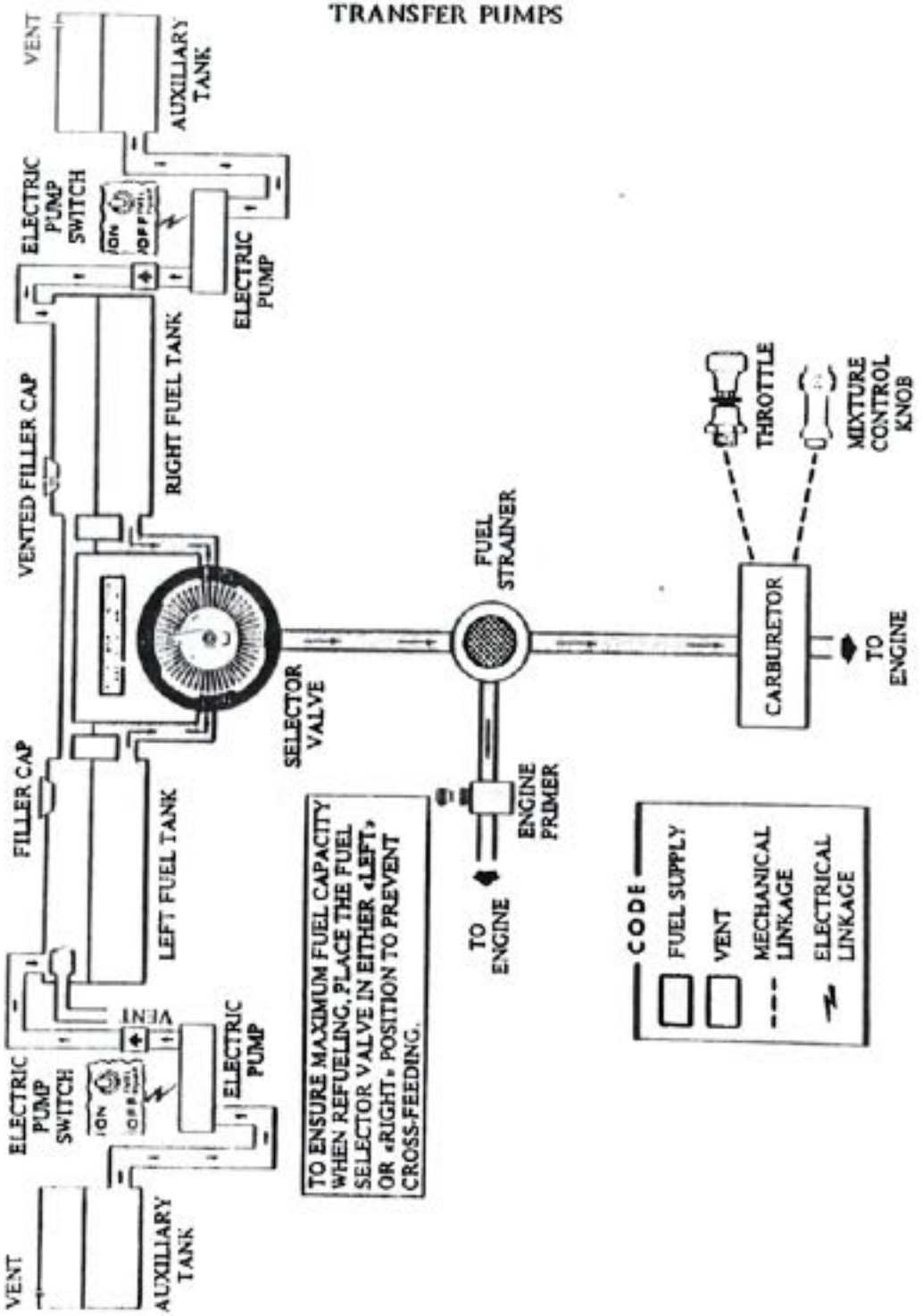
FUEL SYSTEM SCHEMATIC

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.

FLOATPLANE

SECTION I

GENERAL

INTRODUCTION

This supplement, written especially for operators of the REIMS/CESSNA Model F172 floatplane, provides information not found in the F172 Flight Manual. It contains procedures and data required for safe and efficient operation of the floatplane.

Information contained in the Flight Manual for the F172 landplane, which is the same as that for the floatplane, is not repeated in this supplement.

This information provided here was compiled from tests with an airplane equipped with Edo Model 89-2000 floats.

DESCRIPTION

The REIMS/CESSNA Model F172 floatplane is identical to the landplane with the following exceptions :

1) Floats, incorporating a water rudder steering system, replace the landing gear.

   A water rudder retraction handle, connected to the dual water rudders by cables and springs, is located on the cabin floor.

2) Additional fuselage structure is added to support the float installation.

3) An additional structural "V" brace is installed between the top of the front door posts and the cowl deck.

4) The airplane has additional corrosion-proofing and stainless steel cables.

5) Wing flap limit switches are adjusted to restrict the maximum flap travel to 30°.

6) Interconnect springs are added between the rudder and aileron control systems.

7) The fuel strainer installation is modified for floatplane use.

8) The standard fixed pitch propeller is replaced with a fixed pitched McCauley 1A175/ETM propeller of 2.03 m maximum diameter and flatter pitch.

9) A lower cowl with a larger cooling air exit for better engine cooling replaces the standard lower cowl.

10) The heated pitot is replaced with a special heated pitot.

11) Hoisting provisions are added to the top of the fuselage.

12) Fueling steps and assist handles are mounted on the forward fuselage, and steps are mounted on the wing struts to aid in refueling the airplane.

13) Floatplane placards are added.

WATER RUDDER STEERING SYSTEM

The retractable water rudders are mounted at the aft end of each float and are connected by a system of cables and springs to the airplane rudder pedals. When the water rudders are extended, normal operation of the rudder pedals moves the water rudders to provide steering control for taxiing.

A water rudder retraction handle, located on the cabin floor between the front seats, is used to manually raise and lower the water rudders.

During take-off, in flight, and landing, the retraction handle is normally secured on the stowage hook located on the cabin floor just aft of the control pedestal. With the handle in this position, the water rudders are up. When the handle is removed from the stowage hook and allowed to retract full aft, the water rudders extend to the full down position for taxiing.

Refer to Section I of the landplane flight manual for the other identical characteristic dimensions.

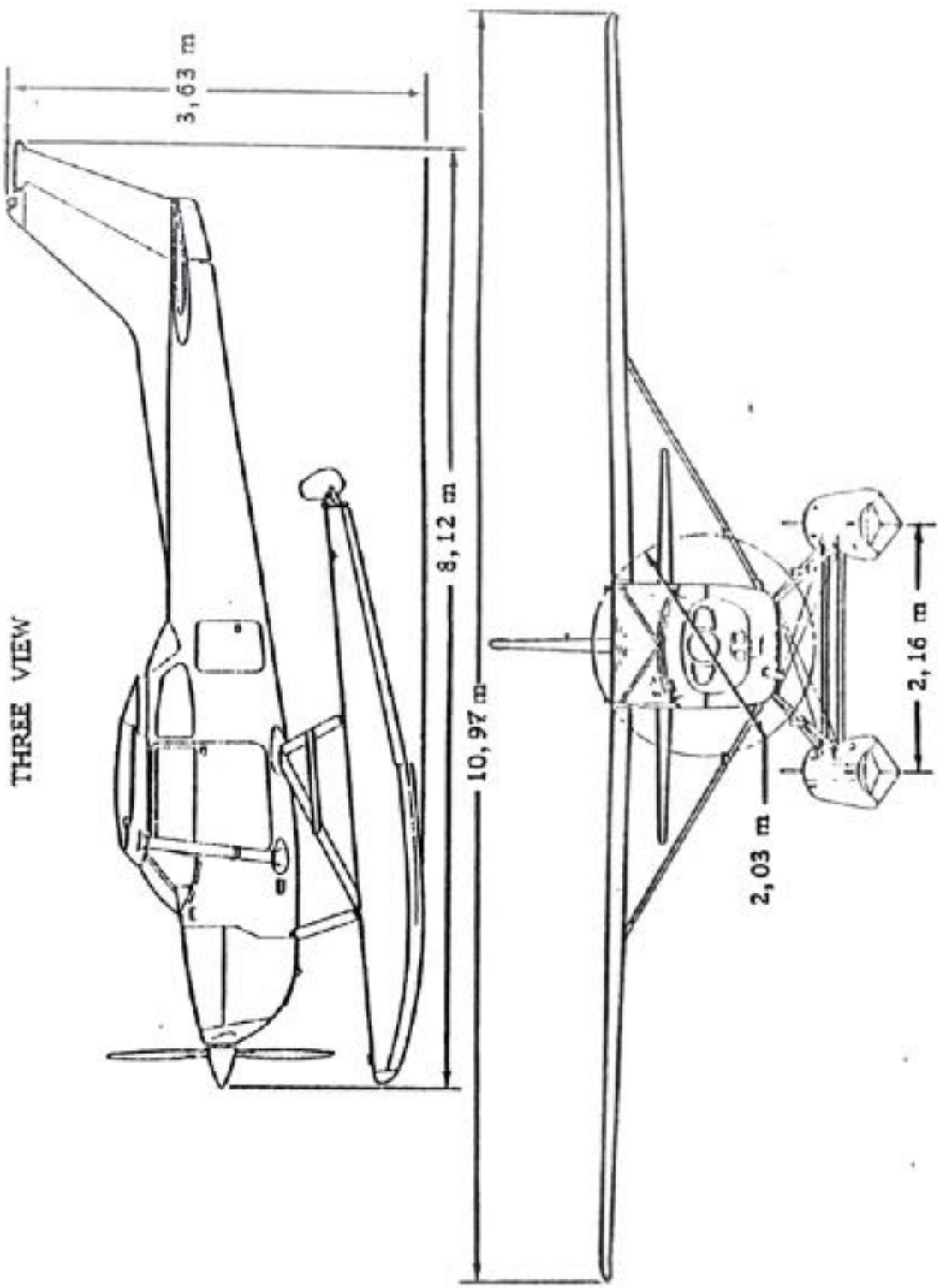


Figure 6-16.1 (1/2)

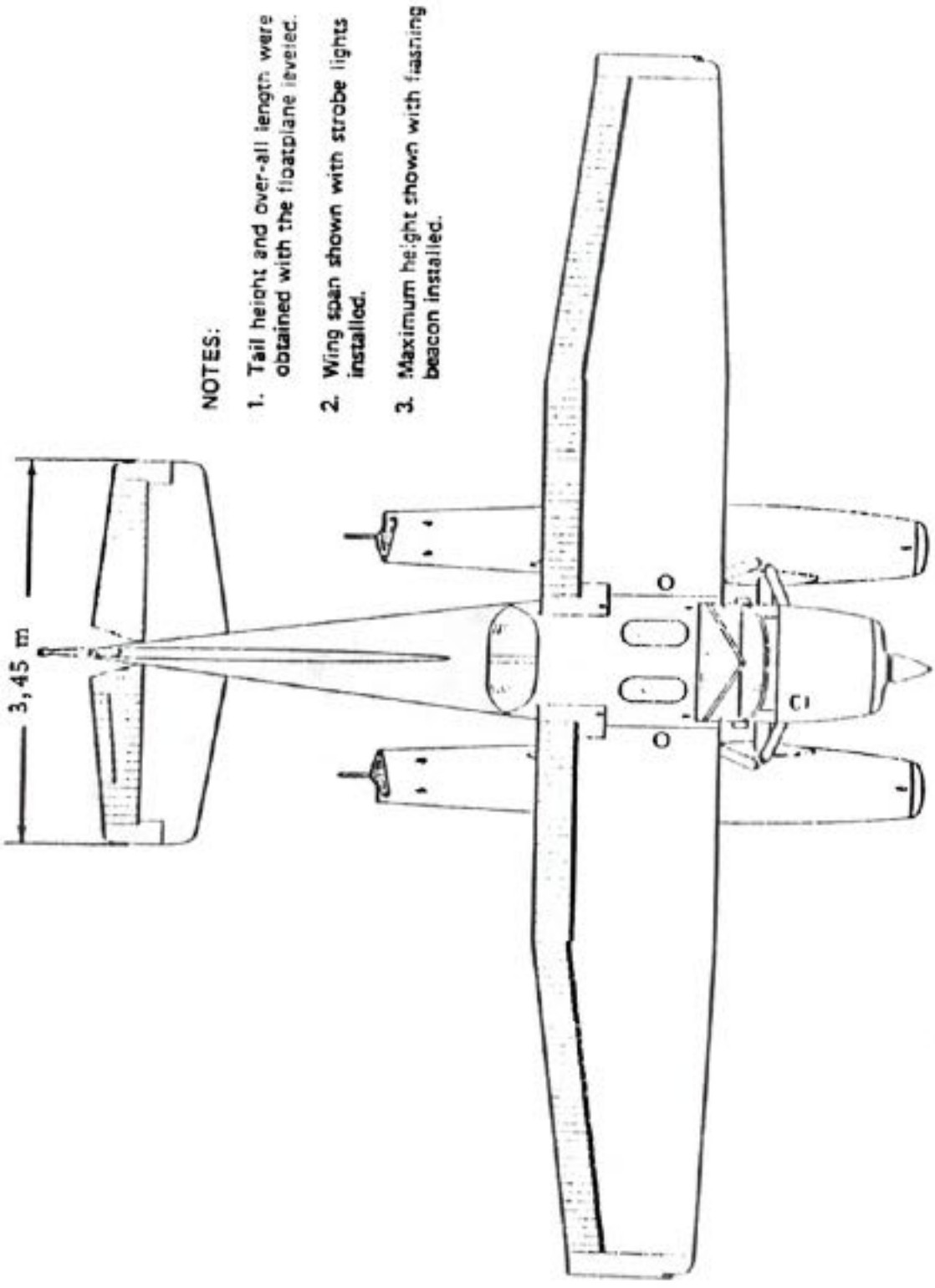


Figure 6-16.1 (2/2)

SECTION 2

LIMITATIONS

INDICATED AIRSPEED LIMITATIONS

	km/h	kts	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	86	98
V_A (Maneuvering Speed)	179	96	110

MANEUVER LIMITS

NORMAL Category only.

Aerobatic maneuvers, including spins, are not approved.

Water rudders must be retracted for all flight operations.

Refer to Section 2 of the landplane flight manual for the other operating limitations.

MAXIMUM GROSS WEIGHT FOR TAKE-OFF AND LANDING : 1007 k

CENTER OF GRAVITY LIMITS

Aft at 1007 kg : 1.16 m
Forward at 829 kg or less : 0.92 m
Forward at 1007 kg : 1.01 m
Straight line variation between 829 and 1007 kg

FLIGHT MANEUVERING LOAD FACTORS AT GROSS WEIGHT OF 1007 kg

Flaps Up	+ 3.8 - 1.52
Flaps Down	+ 3.0

PLACARDS

The following information is displayed in the form of composite or individual placards in addition to those specified in Section 2 of the landplane flight manual.

1. In full view of the pilot :

FLOATPLANE

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

MAXIMUMS

MANEUVERING SPEED (IAS)	179 km/h - 96 kts - 110 MPH	
GROSS WEIGHT	1007 kg	
FLIGHT LOAD FACTOR	Flaps Up	+ 3.8, - 1.52
	Flaps Down	+ 3.0

Water Rudder : Extend for taxi ; retract for takeoff, flight, and landing.

No acrobatic maneuvers, including spins approved. Altitude loss in a stall recovery : 200 ft - 61 m. Flight into known icing conditions prohibited. This airplane is certified for the following flight operations as of date of original airworthiness certificate :

DAY - NIGHT - VFR - IFR

2. On wing flap position indicator :

FLOATPLANE MAX. FLAPS - 30°

3. Near water rudder stowage hook :

WATER RUDDER ALWAYS UP EXCEPT FOR WATER TAXIING

SECTION 3

EMERGENCY PROCEDURES

ENGINE FAILURE

ENGINE FAILURE DURING TAKEOFF RUN

1. Throttle - IDLE.
2. Control Wheel - FULL AFT.
3. Mixture - IDLE CUT-OFF.
4. Ignition Switch - "OFF".
5. Master Switch - "OFF".

FORCED LANDINGS

EMERGENCY LANDING ON WATER WITHOUT ENGINE POWER

1. Indicated Airspeed - 130 km/h - 70 kts - 81 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. Water Rudders - UP.
6. Wing Flaps - AS REQUIRED.
7. Master Switch - "OFF".
8. Doors - UNLATCH PRIOR TO APPROACH.
9. Touchdown - SLIGHTLY TAIL LOW.
10. Control Wheel - HOLD FULL AFT as floatplane decelerates.

EMERGENCY LANDING ON LAND WITHOUT ENGINE POWER

1. Indicated Airspeed - 130 km/h - 70 kts - 81 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. Water Rudders - UP.
6. Wing Flaps - AS REQUIRED (30° recommended).
7. Master Switch - "OFF".
8. Doors - UNLATCH PRIOR TO APPROACH.

9. Touchdown - LEVEL ATTITUDE.
10. Control Wheel - FULL AFT (after contact).

Refer to Section 3 of the landplane flight manual for the other emergency procedures.

SECTION 4

NORMAL PROCEDURES

WEIGHT AND BALANCE

The following information will enable you to operate your floatplane within the prescribed weight and center of gravity limitations.

In figuring your loading problems, be certain that you use the Licensed Empty Weight of your particular floatplane as shown on its Weight and Balance Data Sheet. This sheet, plus an Equipment List, is included with each floatplane as it leaves the factory. When the floats have been installed by anyone other than the factory, the aircraft log book (Repair and Alteration Form) must be consulted for proper weight and balance information.

The loading instructions given in the Flight Manual for the landplane should be used as a guide when figuring floatplane weight and balance problems. In conjunction with these instructions, use the Sample Problem, Loading Graph, and Center of Gravity Moment Envelope in this supplement.

DESIGNATION	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight kg	Moment m.kg	Weight kg	Moment m.kg
1. Empty Weight (Includes unusable fuel and full oil). Refer to the weight and balance records of your a/c for the empty weight.	726	725		
2. Fuel (Standard - 40 US Gal - 152 l maxi at 0, 72 kg/l)	103	126		
Fuel (Long Range - 50 US Gal - 189 l maxi at 0, 72 kg/l)				
3. Pilot and Front Passenger	154	145		
4. Rear Passengers				
5. Baggage or Passenger on Child's Seat	24	57		
6. TOTAL WEIGHT AND MOMENT	1007	1053		
7. Locate this point (1007 and 1053) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.				

Figure 6-16.2

SECTION 4

NORMAL PROCEDURES

WEIGHT AND BALANCE

The following information will enable you to operate your floatplane within the prescribed weight and center of gravity limitations.

In figuring your loading problems, be certain that you use the Licensed Empty Weight of your particular floatplane as shown on its Weight and Balance Data Sheet. This sheet, plus an Equipment List, is included with each floatplane as it leaves the factory. When the floats have been installed by anyone other than the factory, the aircraft log book (Repair and Alteration Form) must be consulted for proper weight and balance information.

The loading instructions given in the Flight Manual for the landplane should be used as a guide when figuring floatplane weight and balance problems. In conjunction with these instructions, use the Sample Problem, Loading Graph, and Center of Gravity Moment Envelope in this supplement.

DESIGNATION	SAMPLE AIRPLANE		YOUR AIRPLANE	
	Weight kg	Moment m.kg	Weight kg	Moment m.kg
1. Empty Weight (Includes unusable fuel and full oil). Refer to the weight and balance records of your a/c for the empty weight.	726	725		
2. Fuel (Standard - 40 US Gal - 152 l maxi at 0, 72 kg/l)	103	126		
Fuel (Long Range - 50 US Gal - 189 l maxi at 0, 72 kg/l)				
3. Pilot and Front Passenger	154	145		
4. Rear Passengers				
5. Baggage or Passenger on Child's Seat	24	57		
6. TOTAL WEIGHT AND MOMENT	1007	1053		
7. Locate this point (1007 and 1053) on the center of gravity moment envelope, and since this point falls within the envelope, the loading is acceptable.				

Figure 6-16.2

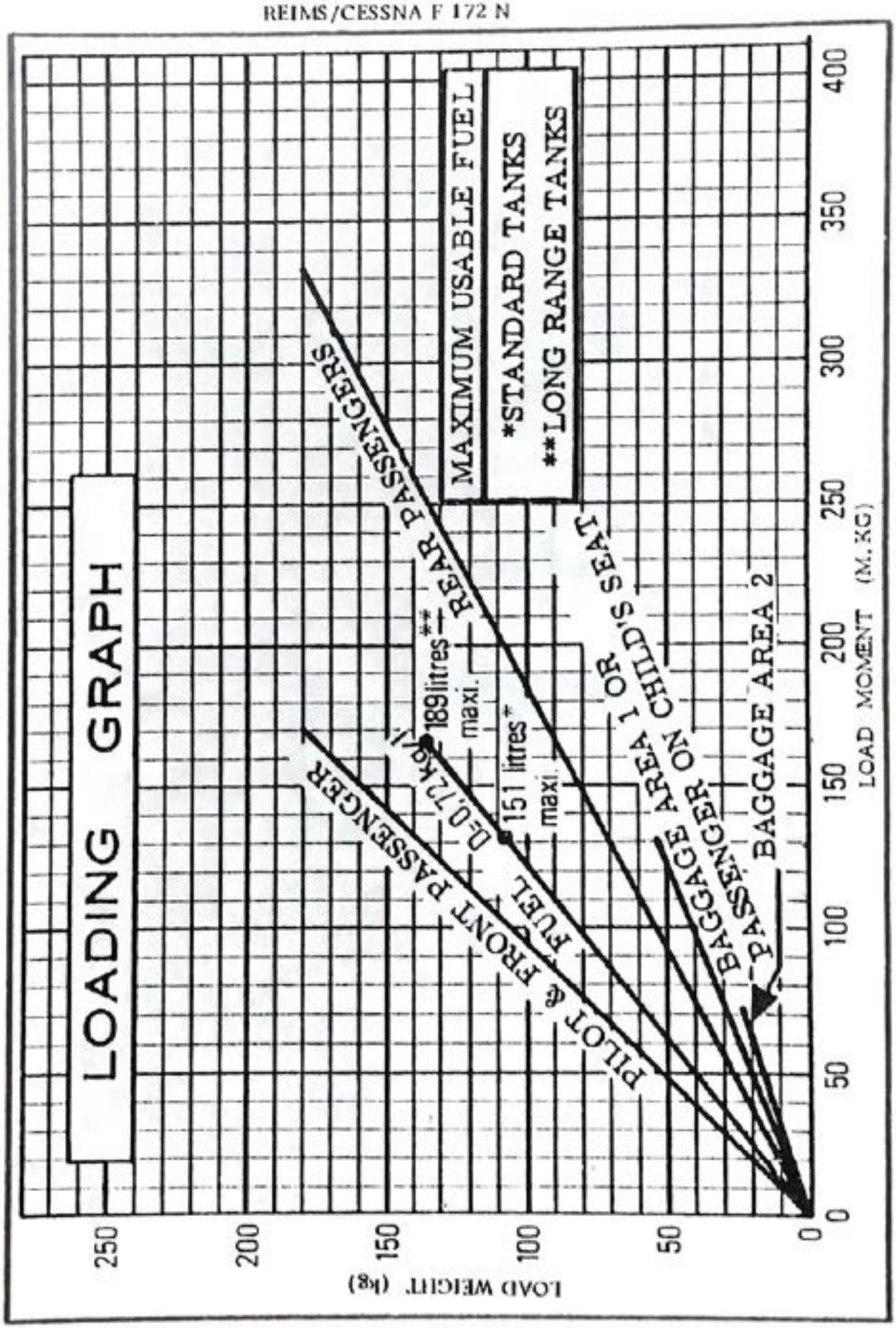

LOADING GRAPH
MAXIMUM USABLE FUEL
*STANDARD TANKS
**LONG RANGE TANKS
PASSENGERS
REAR
189 litres** maxi.
151 litres* maxi.
PILOT & FRONT PASSENGER
FUEL
DE 0,72 kg/l
1 OR 2
CHILD'S SEAT
BAGGAGE AREA 1
PASSENGER ON
BAGGAGE AREA 2
LOAD MOMENT (M.KG)
LOAD WEIGHT (kg)
0
50
100
150
200
250
300
350
400

Figure 6-16.3

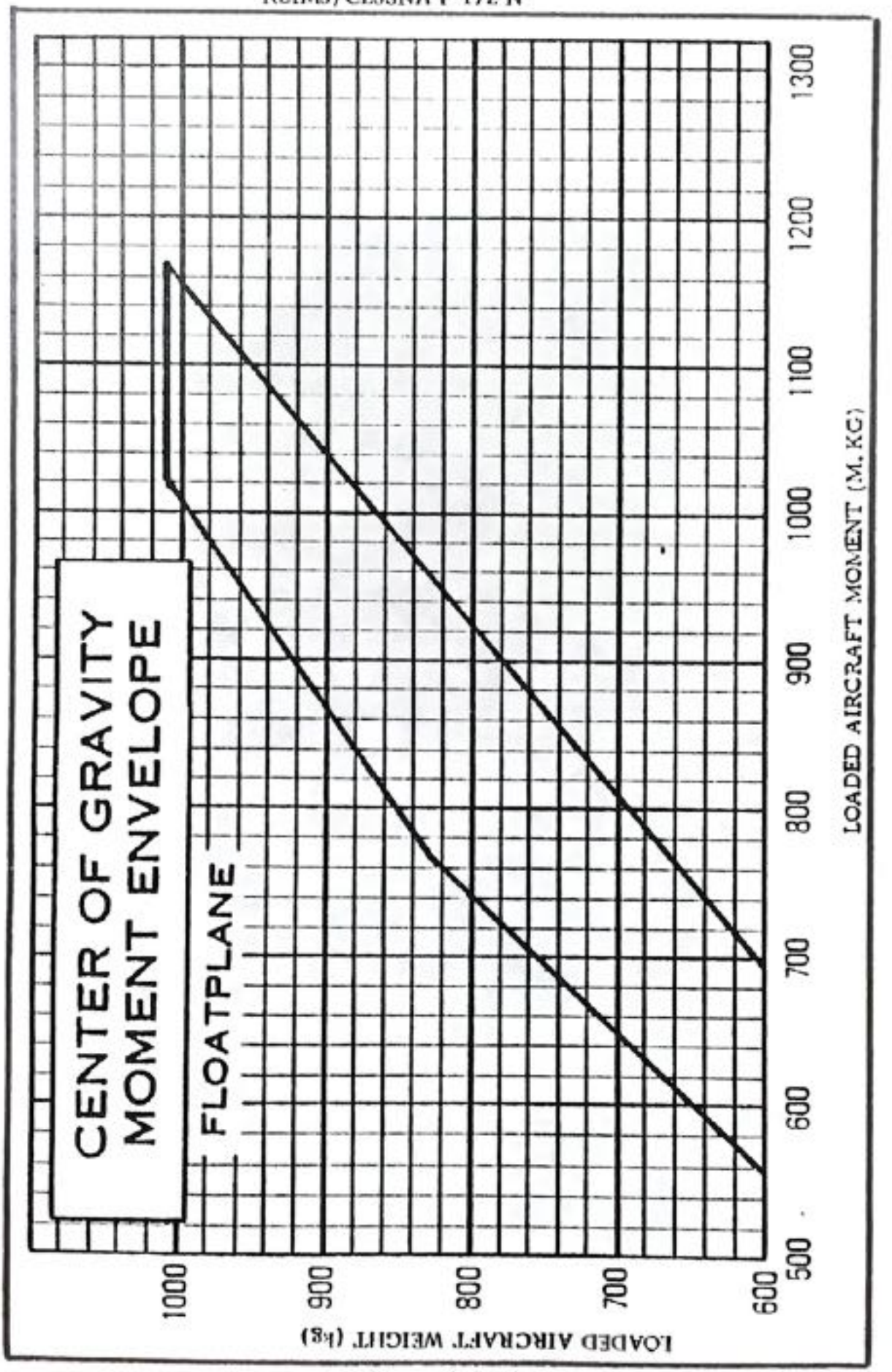

CENTER OF GRAVITY
MOMENT ENVELOPE
FLOATPLANE
LOADED AIRCRAFT WEIGHT (kg)
1000
900
800
700
600
500
600
700
800
900
1000
1100
1200
1300
LOADED AIRCRAFT MOMENT (M. KG)

Figure 6-16.4

CHECKLIST PROCEDURES

INTRODUCTION

Complete the operating checklist contained in Section 4 of the landplane flight manual with the following information.

PREFLIGHT INSPECTION

1. Floats, Struts, and Float Fairings - INSPECT for dents, cracks, scratches, etc.
2. Float Compartments - INSPECT for water accumulation.

NOTE

Remove rubber balls which serve as stoppers on the standpipe in each float compartment and pump out any accumulation of water. Reinstall rubber balls with enough pressure for a snug fit.

3. Water Rudders - CHECK freedom of movement and security.

BEFORE STARTING ENGINE

1. Water Rudder Operation - CHECK VISUALLY.
2. Water Rudders - DOWN for taxiing (retraction handle removed from stowage hook).

TAKEOFF

1. Water Rudders - UP (retraction handle secured on stowage hook).
2. Wing Flaps - 0° to 10° (10° preferred).
3. Carburetor Heat - COLD.
4. Control Wheel - HOLD FULL AFT.
5. Throttle - FULL (advance slowly).

6. Mixture - RICH (or LEAN to obtain maximum RPM above 3000 ft - 914 m).
7. Control Wheel - MOVE FORWARD when the nose stops rising to attain planing attitude (on the step).
8. Indicated Airspeed - 83 to 93 km/h - 45 to 50 kts - 52 to 58 MPH.
9. Control Wheel - APPLY LIGHT BACK PRESSURE to lift off.

NOTA

To reduce take-off water run, the technique of raising one float out of the water may be used. This procedure is described in "MAXIMUM PERFORMANCE TAKEOFF" paragraph, page 6-16.25.

10. Climb Speed :
    - 102 to 120 km/h - 55 to 65 kts - 63 to 75 MPH (flaps 10°)
    - 111 to 130 km/h - 60 to 70 kts - 69 to 81 MPH (flaps Up)

    With obstacles ahead, climb at 98 km/h - 53 kt - 61 MPH IAS (flaps 10°).
11. Wing Flaps - UP after all obstacles are cleared.

CLIMB

NORMAL CLIMB

1. Indicated Airspeed - 111 to 130 km/h - 60 to 70 kts - 69 to 81 MPH.

MAXIMUM PERFORMANCE CLIMB

1. Indicated Airspeed - 119 km/h - 64 kt - 74 MPH (sea level) to 106 km/h - 57 kts - 66 MPH (10.000 ft - 3048 m).

BEFORE LANDING

1. Water Rudders - UP.
2. Wing Flaps - AS DESIRED.
3. Indicated Airspeed :

   - 120 to 139 km/h - 65 to 75 kts - 75 to 86 MPH (flaps UP)
   - 102 to 120 km/h - 55 to 65 kts - 63 to 75 MPH (flaps DOWN)

LANDING

1. Touchdown - SLIGHTLY TAIL LOW.
2. Control Wheel - HOLD FULL AFT as floatplane decelerates to taxi speed.

NOTE

With forward loading, a slight nose-down pitch may occur if the elevator is not held full up as floatplane comes down off step.

AFTER LANDING

1. Water Rudders - DOWN.

AMPLIFIED PROCEDURES

TAXIING

Taxi with water rudders down. It is best to limit the engine speed to 800 RPM for normal taxi because water piles up in front of the float bow at higher engine speeds. Taxiing with higher engine RPM may result in engine overheating and will not appreciably increase the taxi speed. In addition, it may lead to water spray striking the propeller tips, causing propeller tip erosion.

During all low speed taxi operations, the elevator should be positioned to keep the float bows out of the water as far as possible. Normally this requires holding the control wheel full aft.

For minimum taxi speed in close quarters, use idle RPM with full carburetor heat and a single magneto. This procedure is recommended for short periods of time only.

Although taxiing is very simple with the water rudders, it is sometimes necessary to "sail" the floatplane under high wind conditions. In addition to the normal flight controls, the wing flaps and cabin doors will aid in "sailing". Water rudders should be retracted during "sailing".

To taxi great distances, it may be advisable to taxi on the step with the water rudders retracted. Turns on the step from an upwind heading may be made with safety providing they are not too sharp and if ailerons are used to counteract any overturning tendency.

TAKEOFF

The use of 10° wing flaps throughout the takeoff run is recommended.

Start the takeoff by applying full throttle smoothly while holding the control wheel full aft. When the nose stops rising, move the control wheel forward slowly to place the floatplane on the step. Slow control movement and light control pressures produce the best results. Attempts to force the floatplane into the planing attitude will generally result in loss of speed and delay in getting on the step. The

floatplane will assume a planing attitude which permits acceleration to takeoff speed, at which time the floatplane will fly off smoothly.

Upon reaching a safe altitude and airspeed, retract the wing flaps slowly, especially when flying over glassy water because a loss of altitude is not very apparent over such a surface.

If porpoising is encountered while on the step, apply additional control wheel back pressure to correct the excessively nose-low attitude. If this does not correct the porpoising, immediately reduce power to idle and allow the floatplane to slow to taxi speed, at which the takeoff can again be initiated.

MAXIMUM PERFORMANCE TAKEOFF

To clear an obstacle after takeoff with 10° wing flaps, use an obstacle clearance indicated airspeed of 98 km/h - 53 kts - 61 MPH for maximum performance. Takeoff distances are shown in Section 5 for this technique, and on water conditions that are smooth but non-glassy. Under some adverse combinations of takeoff weight, pressure altitude, and air temperature, operation on glassy water may require significantly longer takeoff distances to accelerate to the lift-off speed, and allowance should be made for this.

If lift off is difficult due to high lake elevation or glassy water, the following procedure is recommended : with the floatplane in the planing attitude, apply full aileron to raise one float out of the water. When one float leaves the water, apply slight elevator back pressure to complete the takeoff. Care must be taken to stop the rising wing as soon as the float is clear of the water, and in crosswinds, raise only the downwind wing. With one float out of the water, the floatplane accelerates to takeoff speed almost instantaneously.

CROSSWIND TAKEOFF

For a crosswind takeoff, start the takeoff run with wing flaps up and water rudders extended for better directional control. Flaps should be extended to 10° and the water rudders retracted when the floatplane

is on the step ; the remainder of the takeoff is normal. If the floats are lifted from the water one at a time, the downwind float should be lifted first.

CLIMB

Recommended procedures for enroute climb are the same as for the landplane. For a maximum rate of climb performance refer to page 6-16.26.

NOTE

Steep climbs at low airspeeds should be a short during for improved engine cooling.

CRUISE

True airspeed range and endurance information are shown in Section 5, pages 6-16.31 thru 6-16.34.

LANDING

Normal landings can be made power on or power off using approach indicated airspeeds of 120 to 139 km/h - 65 to 75 kts - 75 to 86 MPH with flaps up and 102 to 120 km/h - 55 to 65 kts - 63 to 75 MPH with flaps down.

GLASSY WATER LANDING

With glassy water conditions, flaps should be extended to 20° and enough power used to maintain a low rate of descent of approximately 200 ft/mn - 1,02 m/s. The floatplane should be flown onto the water at this sink rate with no flare attempted since height above glassy water is nearly impossible to judge. Power should be reduced to idle and control wheel back pressure increased upon contacting the surface. As the floatplane decelerates off the step, apply full back pressure on the control wheel. If this glassy water technique is used in conjunction with an obstacle clearance approach, allowance should be made for appreciably longer total distances than are shown in page 6-16.35 to clear a 15 m obstacle.

CROSSWIND LANDING

The wing-low slip method should be used with the upwind float contacting the surface first.

SECTION 5

PERFORMANCE

The tables appearing on the following pages will be useful in flight planning. Nevertheless, it will be advisable to plan on a 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, atmospheric turbulence and other undetermined variables which may cause range to vary by 10 % or more.

AIRSPEED CORRECTION TABLE

FLAPS UP

IAS km/h	74	93	111	130	148	167	185	204	222	241	259
CAS km/h	87	100	115	132	150	167	185	204	221	239	256
IAS kts	40	50	60	70	80	90	100	110	120	130	140
CAS kts	47	54	62	71	81	90	100	110	119	129	138
IAS MPH	46	58	69	81	92	104	115	127	138	150	161
CAS MPH	54	62	71	82	92	104	115	127	137	148	159

FLAPS 10°

IAS km/h	74	93	111	130	148	158
CAS km/h	85	98	115	133	152	161
IAS kts	40	50	60	70	80	85
CAS kts	46	53	62	72	82	87
IAS MPH	46	58	69	81	92	98
CAS MPH	53	61	71	83	94	100

FLAPS 30°

IAS km/h	74	93	111	130	148	158
CAS km/h	83	96	115	133	152	161
IAS kts	40	50	60	70	80	85
CAS kts	45	52	62	72	82	87
IAS MPH	46	58	69	81	92	98
CAS MPH	52	60	71	83	94	100

Figure 6-16.5

STALL INDICATED AIRSPEEDS — Power Off					
MAXIMUM GROSS WEIGHT: 1007kg	ANGLE OF BANK				
CONDITIONS	0°	30°	45°	60°
FLAPS UP	83 km/h 45 kts 52 MPH	89 km/h 48 kts 55 MPH	100 km/h 54 kts 62 MPH	119 km/h 64 kts 74 MPH
FLAPS 10°	78 km/h 42 kts 48 MPH	83 km/h 45 kts 52 MPH	93 km/h 50 kts 58 MPH	109 km/h 59 kts 68 MPH
FLAPS 30°	72 km/h 39 kts 45 MPH	78 km/h 42 kts 48 MPH	85 km/h 46 kts 53 MPH	102 km/h 55 kts 63 MPH

Figure 6-16.6

PERFORMANCES		SPECIFICATIONS
Maximum Weight		1007 kg 2220 Lbs
Speed		
Maximum at Sea Level		178 km/h - 96 kts - 110 MPH
Cruise, 75 % Power at 4000 ft		176 km/h - 95 kts - 109 MPH
Cruise		
Recommended Lean Mixture with fuel allowance for engine start, taxi, takeoff, climb and 45 minutes reserve at 45 % power		
75 % Power at 4000 ft - 1219 m 40 US Gal (152 litres) Usable Fuel	Range Time	713 km - 385 NM 4,1 hrs
75 % Power at 4000 ft - 1219 m 50 US Gal (189 litres) Usable Fuel	Range Time	926 km - 500 NM 5,3 hrs
Maximum Range at 10.000 ft - 3048 m 40 US Gal (152 litres) Usable Fuel	Range Time	806 km - 435 NM 5,3 hrs
Maximum Range at 10.000 ft - 3048 m 50 US Gal (189 litres) Usable Fuel	Range Time	1056 km - 570 NM 6,9 hrs
Rate of Climb at Sea Level		3,8 m/s - 740 ft/mn
Service Ceiling		4572 m - 15000 ft

Figure 6-16.7 (1/2)

DGAC Approved

Stall Speed (IAS) :	
Flaps Up	83 km/h - 45 kts - 52 MPH
Flaps Down	72 km/h - 39 kts - 45 MPH
Takeoff Performance	
Water Run	245 m
Total Distance Over 50 ft Obstacle	439 m
Landing Performance	
Water Run	158 m
Total Distance Over 50 ft Obstacle	381 m
Standard Empty Weight	705 kg
Maximum Useful Load	302 kg
Baggage	54 kg
Wing Loading	62 kg/m2
Power Loading	8,46 kg/kW
Fuel Capacity (Total)	
Standard Tanks	163 litres - 43 US Gallons
Long Range Tanks	204 litres - 54 US Gallons
Oil Capacity	6 qts - 6 litres
Propeller : Fixed Pitch (diameter)	2,03 m
Engine : LYCOMING - 160 HP (119 kW) at 2700 t/mn	O-320-H2AD

Figure 6-16, 7 (2/2)

DGAC Approved

TAKE OFF DISTANCE — MAXIMUM PERFORMANCE

CONDITIONS : Flaps 10° - Full Throttle - Zero Wind.

Maxi Weight kg	IAS Lift Off	IAS At 15 m	Pressure Altitude ft	Pressure Altitude m	0° C Water Run m	0° C At 15 m m	10° C Water Run m	10° C At 15 m m	20° C Water Run m	20° C At 15 m m	30° C Water Run m	30° C At 15 m m	40° C Water Run m	40° C At 15 m m
1007	87 km/h	98 km/h	Sea Level		361	570	404	628	451	692	506	764	570	847
			1000	305	421	652	472	721	533	800	602	890	684	995
	47 kts	53 kts	2000	610	495	753	561	838	639	937	730	1053	838	1190
			3000	914	593	881	678	989	779	1117	902	1269	1055	1454
	54 MPH	61 MPH	4000	1219	721	1045	834	1189	974	1359	1151	1570	1373	1833

Figure 6-16.8

RATE OF CLIMB — MAXIMUM

CONDITIONS — Flaps Up - Full Throttle

Weight kg	Pressure Altitude ft	Pressure Altitude m	Climb Speed (IAS) km/h	Climb Speed (IAS) kts	Climb Speed (IAS) MPH	RATE OF CLIMB 0° C ft/min	RATE OF CLIMB 0° C m/s	RATE OF CLIMB 20° C ft/min	RATE OF CLIMB 20° C m/s	RATE OF CLIMB 40° C ft/min	RATE OF CLIMB 40° C m/s
1007	Sea Level		119	64	74	790	4,01	725	3,68	655	3,33
	2000	610	115	62	71	690	3,51	625	3,18	560	2,84
	4000	1219	113	61	70	590	3,00	530	2,69	465	2,36
	6000	1829	111	60	69	495	2,51	435	2,21	375	1,91
	8000	2438	109	59	68	395	2,01	340	1,73	-	-
	10000	3048	106	57	66	300	1,52	245	1,24	-	-

NOTA : Mixture Leaned for Maximum RPM During Climb.

Figure 6-16.9

TIME, FUEL, AND DISTANCE TO CLIMB — MAXIMUM RATE OF CLIME

CONDITIONS : Flaps Up - Full Throttle - Standard Temperature.

Weight kg	Pressure Altitude ft	Pressure Altitude m	Temperature °C	Climb Speed IAS km/h	Climb Speed IAS kt	Rate of Climb ft/mn	Rate of Climb m/s	From Sea Level: Time mn	Fuel Used US Gal.	Fuel Used Litres	Distance NM	Distance km
1007	Sea Level		15	119	64	740	3,76	0	0	0	0	0
	1000	305	13	117	63	695	3,53	1	0,3	1,1	2	3,7
	2000	610	11	115	62	655	3,33	3	0,7	2,6	3	5,6
	3000	914	9	115	62	610	3,10	4	1,0	3,8	5	9,3
	4000	1219	7	113	61	570	2,90	6	1,4	5,3	7	13,0
	5000	1524	5	113	61	525	2,67	8	1,7	6,4	9	16,7
	6000	1829	3	111	60	485	2,46	10	2,1	7,9	11	20,4
	7000	2134	1	109	59	440	2,24	12	2,5	9,5	14	25,9
	8000	2438	- 1	109	59	400	2,03	15	3,0	11,4	16	29,6
	9000	2743	- 3	107	58	355	1,80	17	3,4	12,9	20	37,1
	10000	3048	- 5	106	57	315	1,60	20	3,9	14,8	23	42,6

NOTE : 1. Add 1,1 US Gal - 4,16 l of fuel for engine start, taxi and takeoff allowance.
2. To obtain maximum rate of climb as shown in this chart, lean to maximum RPM during climb.
3. Increase time, fuel and distance by 10 % for each 10° C above standard temperature.
4. Distances shown are based on zero wind.

Figure 6-16.10

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CONDITIONS : 1007 kg - Recommended Lean Mixture

Pressure Altitude		RPM	20° C UNDER STANDARD TEMPERATURE						STANDARD TEMPERATURE						20° C UNDER STANDARD TEMPERATURE					
			% BHP	True Airspeed			Consumption		% BHP	True Airspeed			Consumption		% BHP	True Airspeed			Consumption	
ft	m			km/h	kts	MPH	US gal/h	l/h		km/h	kts	MPH	US gal/h	l/h		km/h	kts	MPH	US gal/h	l/h
2000	610	2650	-	-	-	-	-	-	75	174	94	108	8,5	32,2	71	172	93	107	7,9	29,9
		2600	77	170	92	106	8,6	32,6	71	170	92	106	8,0	30,3	67	169	91	105	7,5	28,4
		2500	68	163	88	101	7,6	28,8	64	161	87	100	7,2	27,3	61	159	86	99	6,8	25,7
		2400	61	156	84	97	6,8	25,7	57	152	82	94	6,5	24,6	54	148	80	92	6,2	23,5
		2300	55	146	79	91	6,2	23,5	51	143	77	89	5,9	22,3	49	137	74	85	5,7	21,6
		2200	49	135	73	84	5,7	21,6	46	132	71	82	5,5	20,8	43	124	67	77	5,3	20,1
4000	1219	2700	-	-	-	-	-	-	75	176	95	109	8,4	31,8	71	176	95	109	7,9	29,9
		2600	72	170	92	106	8,1	30,7	68	169	91	105	7,6	28,8	64	167	90	104	7,2	27,3
		2500	65	163	88	101	7,3	27,6	61	159	86	99	6,8	25,7	58	153	85	98	6,5	24,6
		2400	58	154	83	96	6,5	24,6	55	150	81	93	6,2	23,5	52	145	78	90	5,9	22,3
		2300	52	143	77	89	6,0	22,7	49	139	75	86	5,7	21,6	46	133	72	83	5,5	20,8
		2200	46	132	71	82	5,5	20,8	43	126	68	78	5,3	20,1	41	119	64	74	5,1	19,3

Figure 6-16, 11 (1/2)
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6000	1829	2700	76	176	95	109	6,6	32,6	71	176	95	109	8,0	30,3	67	174	94	106	7,5	25,4
		2600	69	169	91	105	7,7	29,1	64	167	90	104	7,2	27,3	61	163	88	101	6,8	25,7
		2500	62	161	87	100	5,9	26,1	58	158	85	98	6,5	24,6	55	152	82	94	6,2	23,5
		2400	56	150	81	93	6,3	23,8	52	146	79	91	6,0	22,7	49	141	76	87	5,7	21,6
		2300	50	159	75	86	5,8	22,0	47	133	72	83	5,5	20,8	44	128	69	79	5,3	20,1
8000	2438	2700	72	176	95	109	8,1	30,7	68	174	94	108	7,6	28,8	64	170	92	106	7,2	27,3
		2600	65	167	90	104	7,3	27,6	61	165	89	102	6,9	26,1	58	159	86	99	6,5	24,6
		2500	59	158	85	98	6,6	25,0	55	154	83	96	6,2	23,5	52	148	80	92	6,0	22,7
		2400	53	146	79	91	6,0	22,7	50	143	77	89	5,8	22,0	47	135	73	84	5,5	20,8
		2300	47	135	75	84	5,6	21,2	44	128	69	79	5,4	20,4	41	120	65	75	5,2	19,7
10000	3048	2700	69	174	94	106	7,7	29,1	64	170	92	106	7,2	27,3	61	167	90	104	6,8	25,7
		2600	62	165	89	102	6,9	26,1	58	161	87	100	6,5	24,6	55	156	84	97	6,2	23,5
		2500	56	154	83	96	6,3	23,8	53	150	81	93	6,0	22,7	49	143	77	89	5,8	22,0
		2400	50	143	77	89	5,8	22,0	47	137	74	85	5,6	21,2	44	128	69	79	5,4	20,4

Figure 6-16.11 (2/2)
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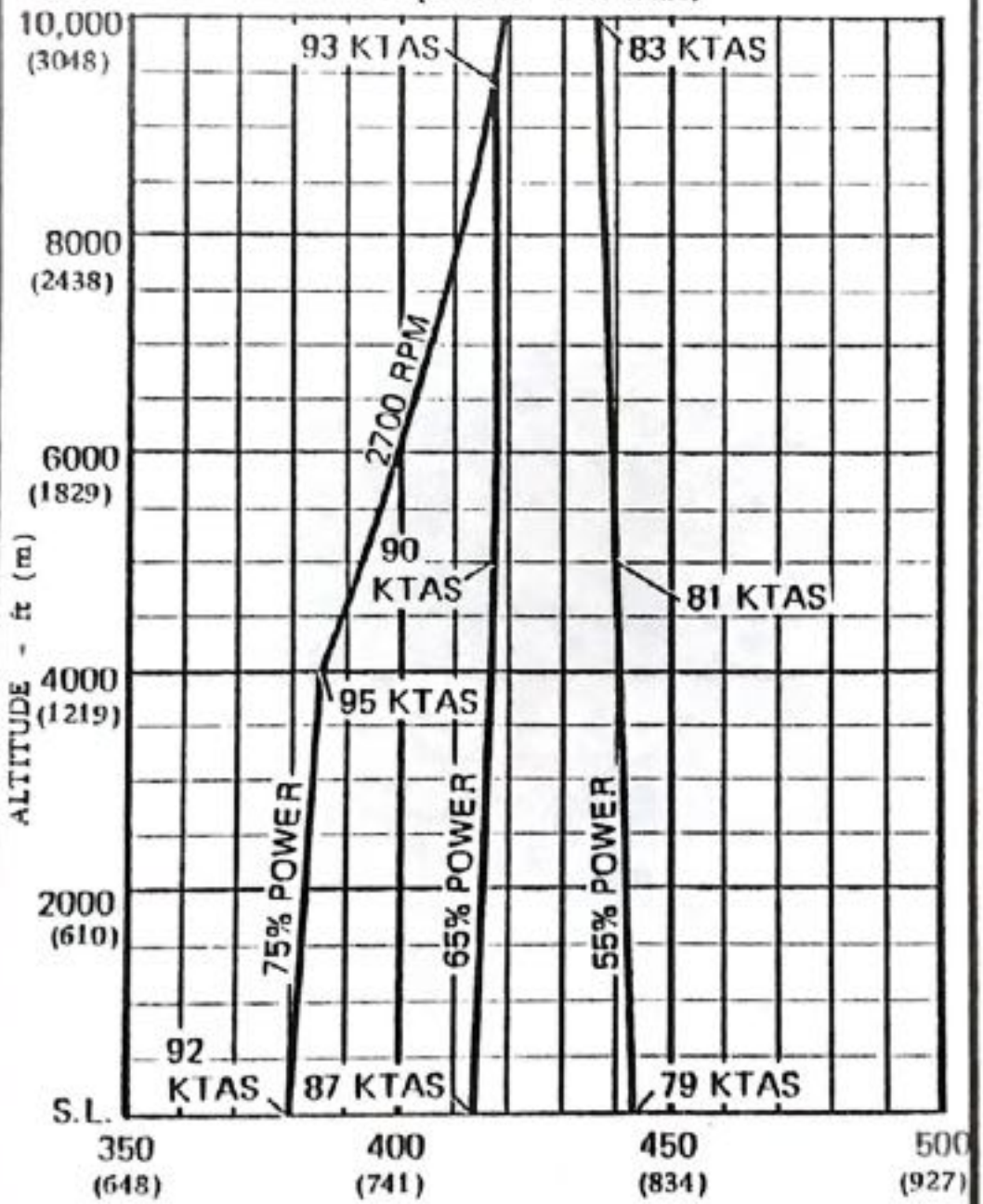
RANGE PROFILE

45 Minutes Reserve - 40 US gal - 151 litres Usable Fuel.

CONDITIONS : 1007 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 time during climb as shown in figure 6-16.10 of this supplement.
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 l.

Figure 6-16.12

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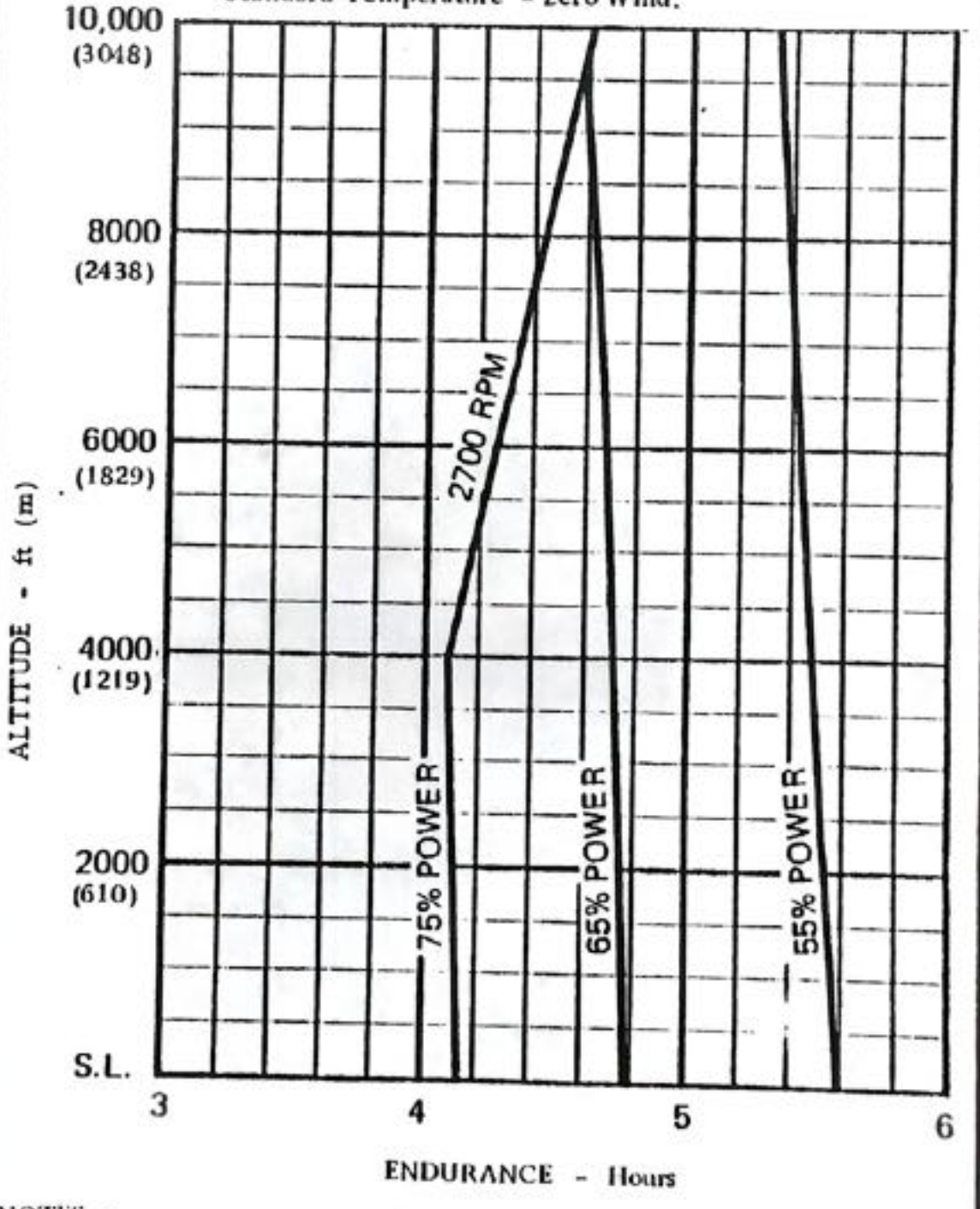
ENDURANCE PROFILE

45 Minutes Reserve - 40 US Gal - 151 litres Usable Fuel.

CONDITIONS : 1007 kg - Recommended Lean Mixture for Cruise - Standard Temperature - Zero Wind.



NOTES :

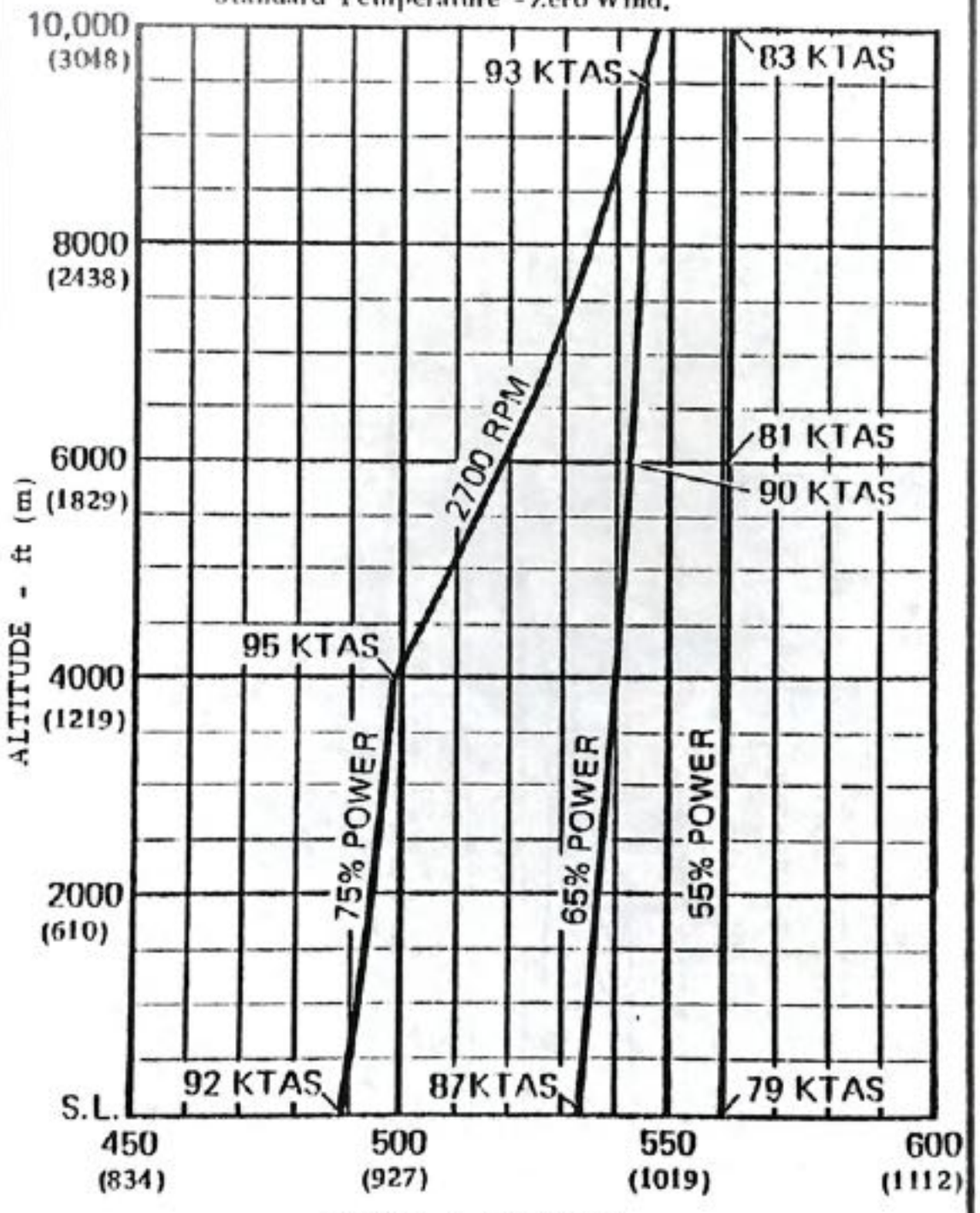
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb as shown in figure 6-16.10 of this supplement.
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 litres.

Figure 6-16.13

RANGE PROFILE

45 Minutes Reserve - 50 US Gal - 189 litres Usable Fuel.

CONDITIONS : 1007 kg - Recommended Lean Mixture for Cruise - Standard Temperature - Zero Wind.



NOTES :

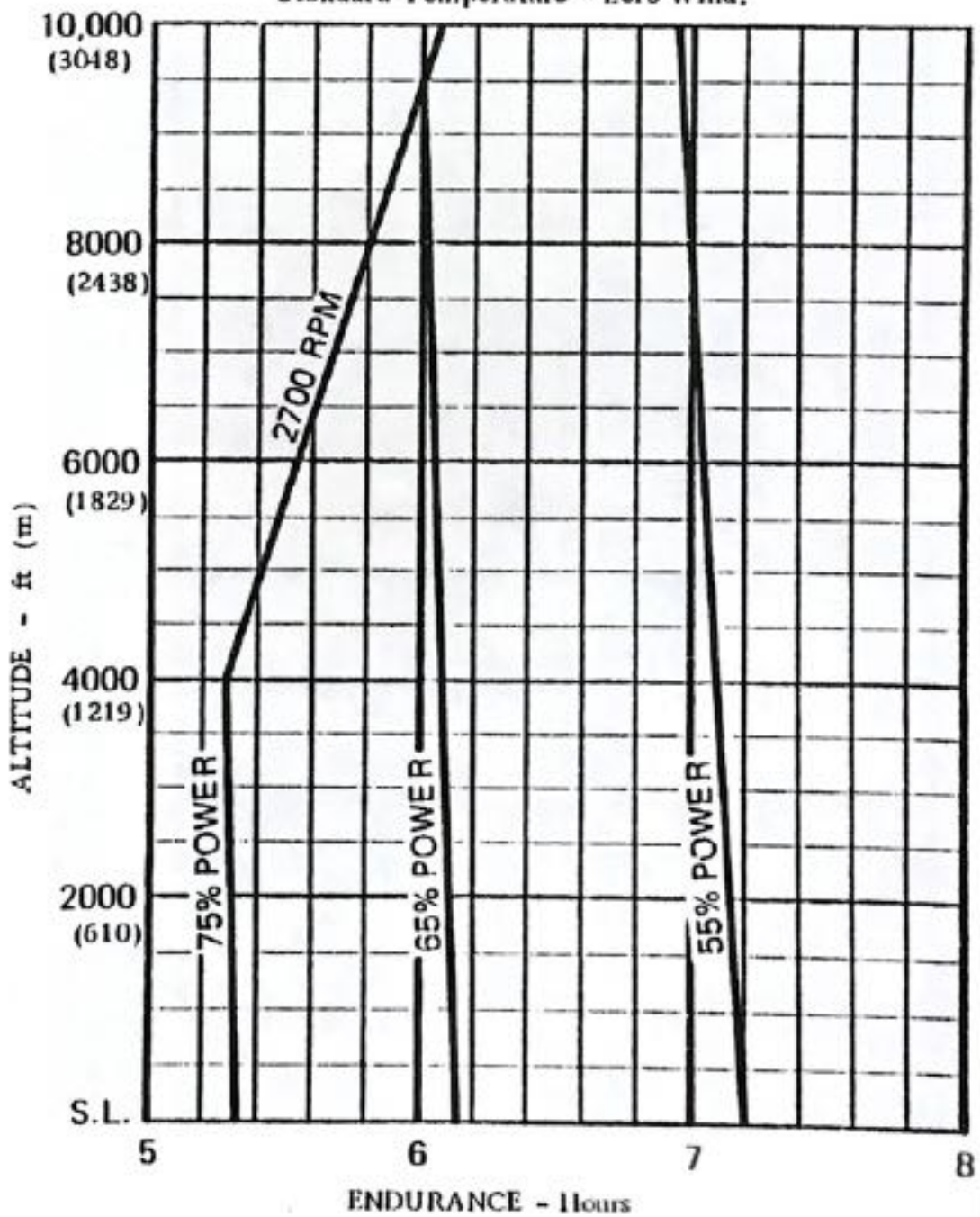
1. This chart allows for the fuel used for engine start, taxi, takeoff and climb, and the time during climb as shown in figure 6-16.10 of this supplement.
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 litres.

Figure 6-16.14

ENDURANCE PROFILE

45 Minutes Reserve - 50 US Gal - 189 litres Usable Fuel.

CONDITIONS : 1007 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 time during climb as shown in figure 6-16.10 of this supplement.
2. Reserve fuel is based on 45 minutes at 45 % BHP and is 4.1 US Gal - 16 litres.

Figure 6-16.15

LANDING DISTANCE — MAXIMUM PERFORMANCE

CONDITIONS : Flaps 30° - Power Off - Zero Wind.

Weight	LAS	Pressure Altitude		0° C		10° C		20° C		30° C		40° C	
kg	Speed at 15 m obst.	ft	m	Water Run m	At 15 m m	Water Run m	At 15 m m	Water Run m	At 15 m m	Water Run m	At 15 m m	Water Run m	At 15 m m
1007	98 km/h 53 kt 61 MPH	Sea Level		171	396	177	405	183	415	189	424	195	433
		1000	305	177	405	183	415	189	424	197	434	203	443
		2000	610	183	415	191	425	197	436	204	447	210	456
		3000	914	191	425	197	436	204	447	212	457	218	466
		4000	1219	198	437	204	447	212	457	219	469	226	479

NOTE : 1. Refer to Section 4 of this Supplement for recommended technique if water surface is glassy.
2. Decrease distances 10 % for each 9 knots headwind.

Figure 6-16.16
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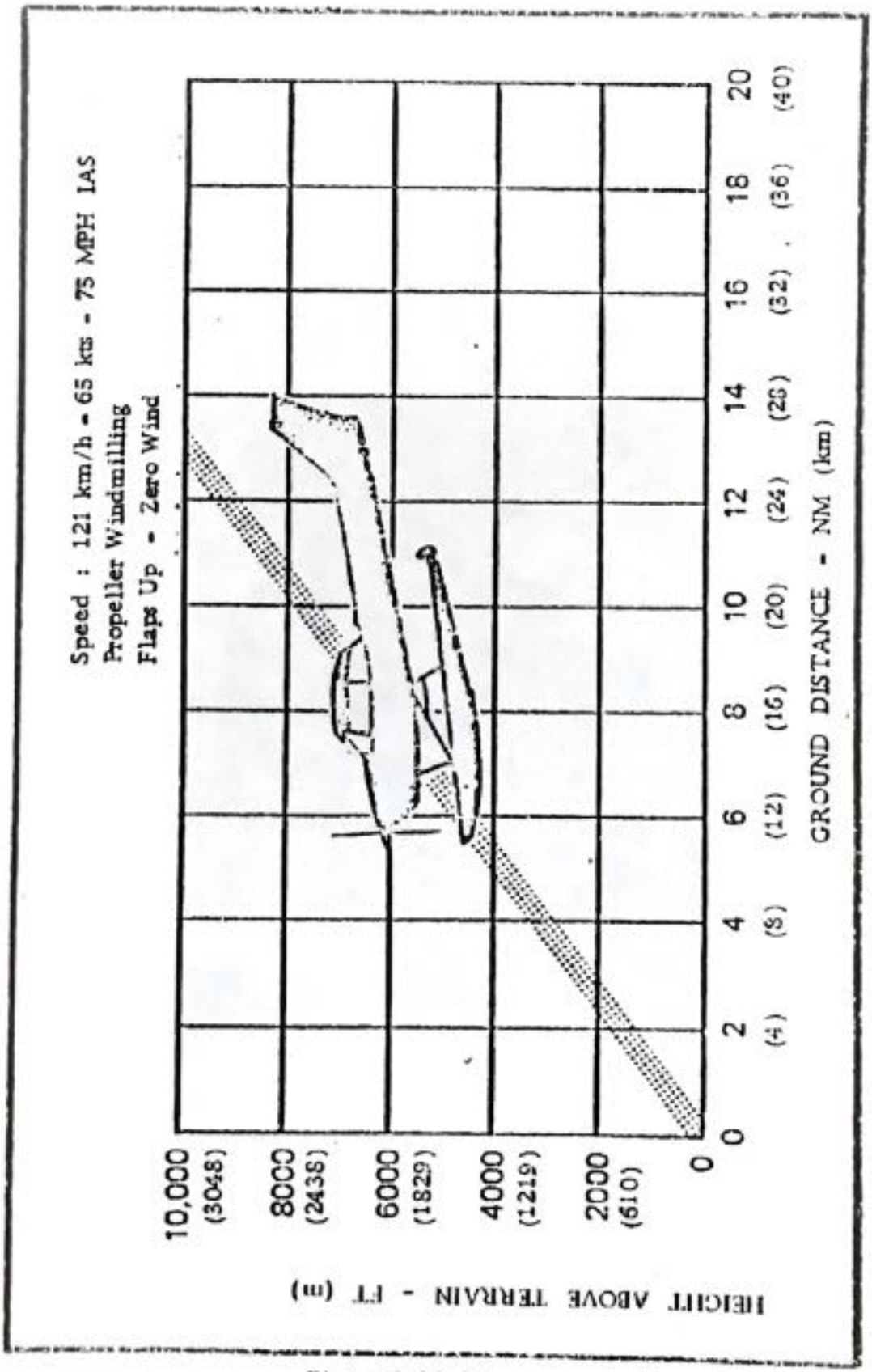

Figure 6-16, 17

OPTIONAL EQUIPMENT

NIGHT VFR OPERATION

SECTION 1

GENERAL

DESCRIPTION

For night VFR operation, F 172 N private aircraft must be equipped with the following standard equipment (S) and optional equipment (O).

DESCRIPTION OF EQUIPMENT	S/O
- 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
- One Rate of Climb Indicator	O
- One Flashing Beacon	O
- Position Lights	S
- Landing Lights	O
- One Instrument Panel Adjustable Lighting System	S
- One Category 2 VHF Transmitter-Receiver	O
- One Category 2 VOR Receiver or One Category 2 ADF System	O
- One Electric Flashlight	O

There is no change to Sections 2 thru 5 of the airplane flight manual when these optional equipment are installed.

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OPTIONAL EQUIPMENT

ECONOMY MIXTURE INDICATOR

The Economy Mixture Indicator is an exhaust gas temperature (EGT) sensing device which visually aids the pilot in adjusting the cruise mixture. Exhaust gas temperature varies with fuel-to-air ratio, power and RPM. However, the difference between the peak EGT and the EGT at the cruise mixture setting is essentially constant and this provides a useful leaning aid. Operating instructions are as follows :

LEANING WITH A CESSNA ECONOMY MIXTURE INDICATOR (EGT)

Exhaust gas temperature (EGT) as shown on the optional Cessna Economy Mixture Indicator may be used as an aid for mixture leaning in cruising flight at 75 % power or less. To adjust the mixture, using this indicator, lean to establish the peak EGT as a reference point and then enrichen the mixture by the desired increment based on figure page 6-18. 2.

As noted in this table, operation at peak EGT provides the best fuel economy. This results in approximately 4 % greater range than shown in this handbook accompanied by approximately a 3 knot decrease in speed.

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

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MIXTURE DESCRIPTION	EXHAUST GAS TEMPERATURE
RECOMMENDED LEAN (Flight Manual and Computer Perfonnance)	50° F - 28° C Rich of Peak EGT
BEST ECONOMY (65 % Power or Less)	Peak EGT

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CAA APPENDIX

HOT WEATHER OPERATION

Refer to the general warm temperature starting information under starter engine in Section 4 of this manual. Avoid prolonged engine operation on the ground and the maximum temperature at which cooling is certified is 37.8° C hot day.

No minimum air temperature has been established.

AUTHORIZED OPERATIONS

Refer to pages 2-2, 6-7.1 thru 6-7.5 and 6-17.1 of this manual.
To be deleted.