



# **R2160 FLIGHT MANUAL**

This manual is applicable to aircraft S/N 001 to 378

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**PILOTS OPERATING HANDBOOK  
AND  
CIVIL AVIATION AUTHORITY OF NEW ZEALAND  
APPROVED FLIGHT MANUAL AIR 2702  
FOR THE  
R2160  
Aircraft S/N 001 to 378**

**Manufacturer's Serial No:**

**Registration:**

**CAANZ Type Certificate No: A-15**

**THIS HANDBOOK INCLUDES THE MATERIAL REQUIRED TO BE FURNISHED TO THE PILOT BY THE CIVIL AVIATION AUTHORITY OF NEW ZEALAND AND ADDITIONAL INFORMATION PROVIDED BY THE MANUFACTURER, AND CONSTITUTES THE CIVIL AVIATION AUTHORITY OF NEW ZEALAND APPROVED AIRPLANE FLIGHT MANUAL.**

Civil Aviation Authority of New Zealand approved in the Acrobatic and Utility Category based on FAR 23. This document must be carried in the airplane at all times.

Accepted by: **FEDERAL AVIATION ADMINISTRATION  
EUROPEAN AVIATION SAFETY AGENCY**

Approved by: **CIVIL AVIATION AUTHORITY OF NEW ZEALAND**  
Manager

By:  \_\_\_\_\_  
(NAME) Aircraft Certification (TITLE)

Date:           - 7 DEC 2006          

Manufacturer's Name: ALPHA AVIATION MANUFACTURING LTD  
INGRAM ROAD  
R D 2,  
HAMILTON  
NEW ZEALAND  
Telephone: (64) 07 843 7070  
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This aircraft was originally manufactured in Darios, France by Avions Pierre Robin, which became Robin Aviation and then Apex Aircraft.

Original aircraft type approval issued by Direction Générale de l'Aviation Civile (D.G.A.C) as detailed in:

Type Certificate Data Sheet No. 143 Issue No. 12 (May/2001)

Associated with Airworthiness Type Certificate No. 70

The type certificate has been transferred from Apex to Alpha Aviation Ltd, New Zealand in June 2006. Hence from this date Alpha Aviation is responsible for providing continued airworthiness instructions and information to the aircraft owners.

Some aircraft were assembled in in Lachute, Quebec by Avions Pierre Robin Inc under Transport Canada Type Certificate A-125.

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## List of Revisions

Rev.	Description	Modified Pages	Date of Approval
June 2006	Initial issue by CAA NZ		
1	Sect 2: Night VFR ref deleted.  General update of pages.	iii, vii, ix, 1-1, 2-4, 3-4, 3-5, 3-8, 3-10, 4-11, 4-15, 4-18, 5-1 to 5-10, 7-1	

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iii	Dec 2006	3-3	June 2006	5-6	Dec 2006
iv	June 2006	3-4	Dec 2006	5-7	Dec 2006
v	June 2006	3-5	Dec 2006	5-8	Dec 2006
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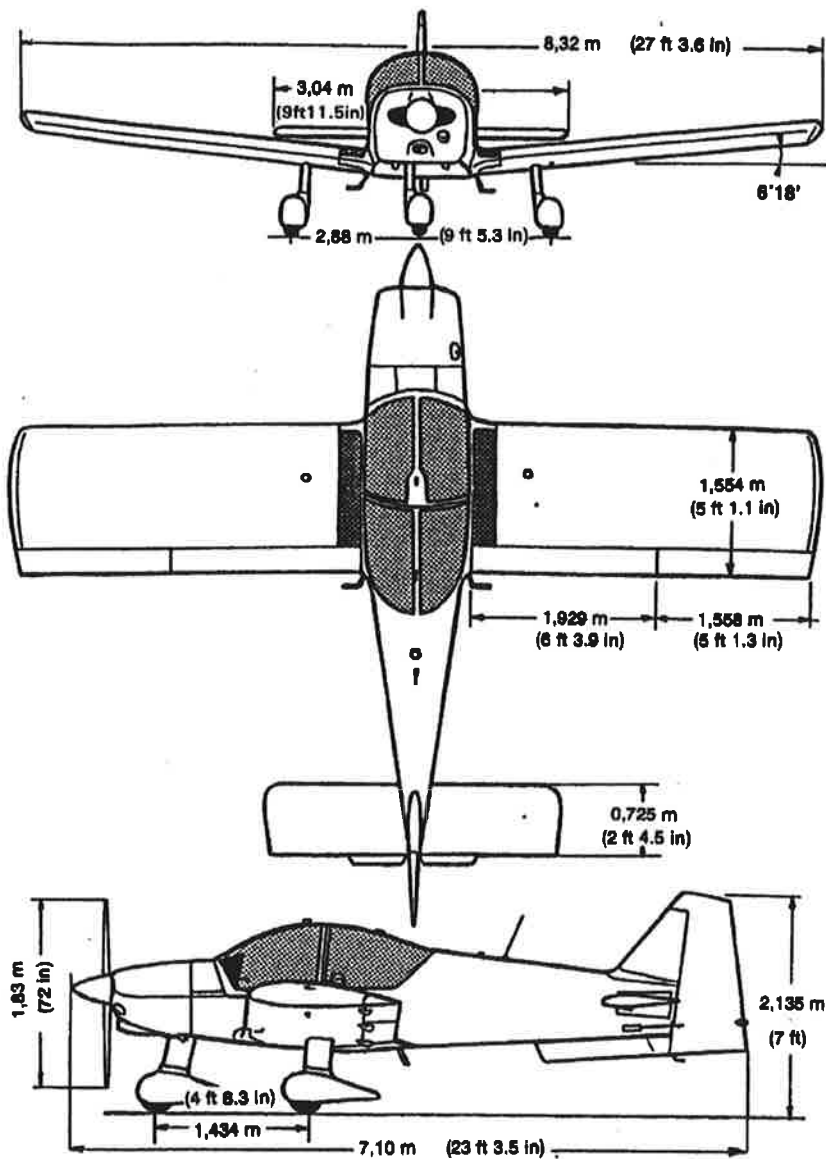
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# Section 1 : General

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3 View Drawing

## Overall Dimensions

Wing Span.....	(27ft 3.6 in) 8.32m
Overall length .....	(23 ft 3.5 in) 7.10 m
Overall height .....	(7 ft) 2.135 m

## Internal Cabin Dimensions

Length .....	(6 ft 8.7 in) 2.05 m
Width .....	(3ft5.7in) 1.06m
Height.....	(4 ft 1.2 in) 1.25 m
2 seats, accessible from both sides by a jettisonable forward sliding canopy.	
Luggage Hold .....	0.4 m <sup>3</sup> (14 cu ft)

## Wings

Wing area.....	(140 sq. ft) 13 m <sup>2</sup>
Airfoil .....	NACA 23015
Aspect ratio .....	5.42
Wing setting (40% of chord).....	6°18'

## Ailerons

Slotted type	
Surface (each).....	(5.54 sq. ft) 0.515 m <sup>2</sup>
Deflection .....	up 20° (± 1.5°)
	down 15° (± 1.5°)

## Wing Flaps

Surface (each).....	(6.8 sq. ft) 0.635 m <sup>2</sup>
Span (each).....	(6 ft 3.9 in) 1.929 m
Deflection .....	0° to 35° (± 2.0°)

## Horizontal Stabilizer

Total control area .....	(25.2 sq ft) 2.35 m <sup>2</sup>
of which anti-balance tab .....	(2 x 0.6 sq ft) 2 x 0.063 m <sup>2</sup>
Span.....	(9ft11.5in) 3.04m
Deflection.....	up 10° (± 0.5°)
.....	down 12.5° (± 0.5°)
Anti-tab deflection:	
Elevator up.....	33° ± 3°, tab up
.....	5° ± 3°, tab down
Elevator down.....	14° ± 3°, tab up
.....	22° ± 3°, tab down

## Vertical Stabilizer

Stabilizer .....	(3.7 sq ft) 0.35 m <sup>2</sup>
Rudder .....	(12.7 sq ft) 1.18 m <sup>2</sup>
Deflection.....	0° to 30° (± 2.0°)

## Landing Gear

### Fixed Tricycle Type

Oleo-pneumatic dampers.....	stroke (6.3 in) 160 mm
Track.....	(9 ft 5.3 in) 2.88 m
Wheel base .....	(4 ft 8.3 in) 1.434 m
Tyre size .....	380 x 150
Oil/Air shock strut Hydraulic Oil .....	MIL H 5606-A or AIR 3520

### Nose Gear

Tyre pressure.....	(23 psi) 1.6 bar
Shock strut pressure .....	(58 psi) 4 bar

## Main landing gear

Tyre pressure ..... (26 psi) 1.8 bar  
Shock strut pressure. .... (116 psi) 8 bar

## Brakes

The disc brakes are operated by an independent hydraulic circuit on each main gear wheel. Brakes can be applied by either pilot.

Hydraulic oil..... MIL H 5606-A or AIR 3520

## Power Plant

### Engine

Manufacturer ..... LYCOMING  
Model ..... 0-320-D2A  
Type .....Horizontally opposed, 4 cylinders, normally aspirated  
Maximum continuous power ..... 160 HP at 2700 rpm

### Propeller

Manufacturer ..... Sensenich  
Type ..... 74-DM-6S5-2-64  
or 74-DM-6S5-2-66  
Diameter ..... 1.83 m (72 in)\*  
Pitch ..... 1.62 m (64 in)  
or 1.67 m (66 in)  
Minimal Static RPM, Full Throttle at sea level..... 2150 rpm  
Maximum RPM..... 2700 rpm

- **Any reduction in diameter during repair is forbidden**



## Fuel

Aviation petroleum<sup>1</sup> .....AVGAS 100 LL  
 Fuel grade<sup>1</sup> ..... (octane) 100 minimum

Single fuselage tank :

### Standard Fuel Tank 120 litre

Total fuel capacity ..... (26.3 Imp. gal/31.7 US gal) 120 l  
 Total usable fuel..... (26.0 Imp. gal/31.2 US gal) 118 l  
 Unusable fuel ..... (0.4 Imp. gal/0.7 US gal) 2 l

### Optional Fuel Tank 160 litre

Total fuel capacity ..... (35.2 Imp. gal/42.2 US gal) 160 l  
 Total usable fuel..... (34.7 Imp. gal/41.7 US gal) 158 l  
 Unusable fuel ..... (0.4 Imp. gal/0.7 US gal) 2 l

## Oil

Total engine capacity .....(8 US quarts) 7.5l  
 Usable capacity.....(6 US quarts) 5.7l

***During the first 50 hours of operation:  
 Use Only Pure mineral oil***

***After the first 50 hours of operation:  
 Dispersant oil***

<sup>1</sup> Refer to the last edition of the Service Instruction Lycoming n°1070

**Grades<sup>2</sup>**

Oil	Dispersant	Pure Mineral
All temperatures	SAE 15W50 or 20W50	.....
Above +25°C (80°F)	SAE 60	SAE60
Above +15°C (60°F)	SAE 40 or SA E50	SAE50
From 0°C to +30°C (30°F to 90°F)	SAE 40	SAE40
From -15°C to +20°C (0°F to 70°F)	SAE 40, 30 or 20W40	SAE30
Below -10°C (10°F)	SAE30 or 20W30	SAE20

**Maximum Authorised Weights**

	<b>“U” category</b>	<b>“A” category</b>
On take off	(1984 lb) 900kg	(1764 lb) 800kg
On landing	(1984 lb) 900kg	(1764 lb) 800kg

**Flight Controls**

- Dual control, with rigid interconnection.  
Conventional, closed loop cable transmission.
- Rudder bar actuating the rudder control surface and front wheel (via spring rods)
- Elevator compensator actuated by means of a knurled handwheel located on the central console.
- Electrically operated flaps.

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<sup>2</sup> Refer to Service Instruction Lycoming 1014 latest edition.

## List of Abbreviations

sq ft .....	Square foot
ft .....	Foot
in .....	Inch
nm .....	Nautical mile
km .....	Kilometre
m .....	Meter
cm .....	Centimetre
kt .....	Knot
m/s .....	Meter per second
rpm .....	Revolution per minute
V <sub>a</sub> .....	Manoeuvring speed
V <sub>c</sub> .....	Design cruise air speed
V <sub>fe</sub> .....	Maximum Flaps extended speed
V <sub>ne</sub> .....	Never exceed speed
V <sub>no</sub> .....	Maximum cruising speed
V <sub>so</sub> .....	Stalling speed landing position
V <sub>s1</sub> .....	Stalling speed flaps up configuration
V <sub>i</sub> .....	Indicated airspeed
Km/h .....	Kilometre per hour
HP .....	Horse power
hPa .....	Hectopascal
in.Hg .....	Inch of mercury
mbar .....	Millibar
Zp .....	Pressure altitude
l .....	Litre
imp gal .....	Imperial gallon
us gal .....	US gallon
psi .....	Pound per square inch
lb .....	Pound
kg .....	Kilogram
°C .....	Degrees Celsius
°F .....	Degrees Fahrenheit
V .....	Volt
A .....	Ampere

## List of Radio Abbreviations

ADF .....	Automatic Direction Finder
ATC .....	Air Traffic Control
COM.....	Communication Transceiver
DME .....	Distance Measuring Equipment
ELT.....	Emergency Locator Transmitter
IFR .....	Instrument Flight Rules
ILS.....	Instrument Landing System
MKR .....	Marker Beacon Receiver
NAV .....	Navigation Indicator and Receiver
AUDIO.....	Audio Control Panel
VFR .....	Visual Flight Rules
VHF .....	Very High Frequency
VOR .....	VHF Omni-Range (beacon)

## Conversion Factors

nautical mile	x	1.852	=	kilometres
feet	x	0.305	=	metres
inches	x	0.0254	=	metres
inches	x	25.4	=	millimetres
feet/minute	x	0.00508	=	metre/second
gallons (US)	x	3.785	=	litres
gallons (Imp)	x	4.546	=	litres
quarts (US)	x	0.946	=	litres
knots	x	1.852	=	km/h
psi	x	0.0689	=	bar
in.Hg	x	33.86	=	mbar
lb	x	0.453	=	kg
(°F-32)	x	5/9	=	°C

kilometres	x	0.539	=	nautical mile
meters	x	3.281	=	feet
meters	x	39.37	=	inches
millimetres	x	0.03937	=	inches
meter/second	x	197	=	feet/minute
litres	x	0.264	=	gallons (US)
litres	x	0.220	=	gallons (Imp)
litres	x	1.057	=	quarts (US)
km/h	x	0.539	=	knots
bar	x	14.51	=	psi
mbar	x	0.02953	=	in.Hg
kg	x	2.205	=	lb
°C	x	9/5 + 32	=	°F

## Barometric Pressure Conversion Table

Below pressure in MILLBAR or HECTOPASCAL, the pressure in INCHES of MERCURY is indicated.

→ mbar or hPa  
in.Hg

950 28.05	960 28.35	970 28.64	980 28.94	990 29.23	1000 29.53	1010 29.63	1020 30.12	1030 30.42	1040 30.71
951 28.08	961 28.38	971 28.67	981 28.97	991 29.26	1001 29.56	1011 29.85	1021 30.15	1031 30.45	1041 30.74
952 28.11	962 28.41	972 28.70	982 29.00	992 29.29	1002 29.59	1012 29.88	1022 30.18	1032 30.47	1042 30.77
953 28.14	963 28.44	973 28.73	983 29.03	993 29.32	1003 29.62	1013 29.91	1023 30.21	1033 30.50	1043 30.80
954 28.17	964 28.47	974 28.76	984 29.06	994 29.35	1004 29.65	1014 29.94	1024 30.24	1034 30.53	1044 30.83
955 28.20	965 28.50	975 28.79	985 29.09	995 29.38	1005 29.68	1015 29.97	1025 30.27	1035 30.56	1045 30.86
956 28.23	966 28.53	976 28.82	986 29.12	996 29.41	1006 29.71	1016 30.00	1026 30.30	1036 30.59	1046 30.89
957 28.26	967 28.56	977 28.85	987 29.15	997 29.44	1007 29.74	1017 30.03	1028 30.33	1037 30.62	1047 30.92
958 28.29	968 28.58	978 28.88	988 29.18	998 29.47	1008 29.77	1018 30.06	1028 30.36	1038 30.65	1048 30.95
959 28.32	969 28.61	979 28.91	989 29.20	999 29.50	1009 29.80	1019 30.09	1029 30.39	1039 30.68	1049 30.98

### Reminder:

The standard pressure of 1013.2 mbar or hPa equals 29.92 in.Hg.

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## Section 2 : Limitations

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## Certification Standards

The R2160 aircraft has been certified in the “ACROBATIC” and “UTILITY” categories conforming to the following technical conditions:

- Standard technical conditions: FAR 23, Amendments 1 to 9 included
- Complimentary conditions AIR 2052, 3.397 and 3.399
- Special condition: the canopy must be jettisonable.

### NOTE

All speeds in this manual are indicated airspeeds unless otherwise specified.

## Approved Operation

VFR by day in non-icing conditions.

<b>AIRSPEED LIMITATIONS</b>	<b>kt</b>	<b>km/h</b>
Vne (never exceed)	178.5	331
Vno (max. cruise)	127	236
Va (max. manoeuvre)	127	236
Vfe (max. flaps extended)	97	180
Vc (Design cruising speed)	127	236
Stalling Speeds:		
Vs1 (flaps retracted)	63	117
Vs0 (35° flaps)	51	94

<b>AIRSPEED INDICATOR MARKINGS</b>		<b>kt</b>	<b>km/h</b>
Red line (never exceed)	$V_{ne}$	178.5	331
Yellow arc (operate with caution and only in "smooth air")	$V_{no}-V_{ne}$	127-178.5	236-331
Green arc (normal operating range)	$V_{s1}-V_{no}$	63-127	117-236
White arc	$V_{so}-V_{fe}$	51-97	94-180

## Stall Warning Devices

Set to operate at a speed 5 to 10 kts (9 to 18 km/h) before stalling occurs.

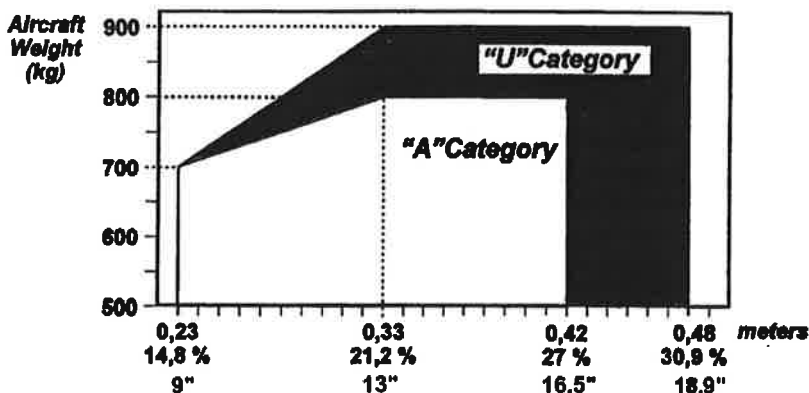
## Flight Load Factor Limits at Gross Weight

	"U" category	"A" category
Flaps up	+ 4.4 g -1.76 g	+ 6 g -3 g
Flaps down	+2 g	+2 g

## Maximum Authorised Weights

	"U" category	"A" category
On take off	(1984 lb) 900kg	(1764 lb) 800kg
On landing	(1984 lb) 900kg	(1764 lb) 800kg

## Weight and Balance Envelope



Levelling ..... upper fuselage longeron  
 Datum ..... leading edge at rib n°5  
 Chord ..... (61.2 in) 1.554 m

### NOTE

It is the responsibility of the aircraft owner and the pilot to ensure that the aircraft is properly loaded. See Section 6 Weight & Balance for proper loading instructions.

## Engine Limitations

Continuous starter operation ..... 15 to 20 sec.  
 Maximum rpm (red line) ..... 2700 rpm

## Tachometer Markings

Green arc ..... 2300 to 2700 rpm  
 Red line ..... 2700 rpm

## Fuel

Aviation petroleum<sup>3</sup> ..... AVGAS 100 LL  
 Fuel grade<sup>3</sup> ..... (octane) 100 minimum  
 Total fuel capacity ..... (26.3 Imp. gal/31.7 US gal) 120 l  
 ..... (optional 160l tank) (35.2 Imp. gal/42.2 US gal) 160 l  
 Total usable capacity ..... (26.0 Imp. gal/31.2 US gal) 118 l  
 ..... (optional 160l tank) (34.7 Imp. gal/41.7 US gal) 158 l  
 Unusable fuel ..... (0.4 Imp. gal/0.7 US gal) 2 l  
 Normal pressure ..... 0.5 to 8 psi

## Oil

Maximum temperature (red line) ..... (245°F) 118°C  
 Normal temperature (green arc) ..... (105 to 245°F) 40 to 118°C  
 Minimal idle pressure (red line) ..... 25 psi  
 Yellow arc ..... 25 to 55 psi  
 Normal pressure (green arc) ..... 55 to 95 psi  
 Yellow arc (ground warm up) ..... 95 to 115 psi  
 Maximum pressure cold start and take-off (red line) ..... 115 psi  
 Cylinder Head Temp (CHT) ..... 65 to 260°C

<sup>3</sup> Refer to Service Instruction Lycoming n° 1070.

## Payload Load Limits

Number of occupants.....	2
Maximum authorized weight of baggage (in Utility category ONLY) .....	(77 lb) 35 kg

## Operational Limits in “U” Category

Within the limits of this category, the following manoeuvres are authorized:

Turn at more than 60° bank .....	entry speed 108 kt (200 km/h)
Lazy eight.....	entry speed 130 kt (240 km/h)
Chandelle.....	entry speed 130 kt (240 km/h)

## Low Temperature Operations

The aircraft can be used down to a temperature of -25 C (-13 F) on the ground.

Refer to oil grade chart on page 1-7 when operating at low temperatures.

When ambient air temperatures less than 5°C or if the oil temperature remains below 80°C for sustained periods it is recommended that the winterisation plate P/N 54.23.17.010 is fitted to the oil cooler in accordance with the maintenance manual.

## Operation Placards

In full view of the pilot

**THIS AIRCRAFT MUST BE USED IN ACROBATIC OR UTILITY CATEGORY, IN ACCORDANCE WITH THE APPROVED FLIGHT MANUAL**

**ON THIS AIRCRAFT, ALL PLACARDS CORRESPOND TO ACROBATIC UTILISATION.**

**FOR UTILITY OPERATION, REFER TO THE APPROVED FLIGHT MANUAL**

**MANEUVERING SPEED 127 kt - 236 km/h**

**VFR FLIGHT BY DAY**

**IN NON-ICING CONDITIONS**

**NO SMOKING**

**SPIN FORBIDDEN IN UTILITY CAT.**

**INVERTED SPIN FORBIDDEN**

For aircraft fitted with oil recuperation system and dry battery in A cat.

**INVERTED FLIGHT PERMITTED DURING 20 SECONDS**

DEMONSTRATED CROSS WIND COMPONENT: 18 kt			
ACROBATIC CATEGORY APPROVED MANEUVERS			
SPIN (Rope Up) .....	84 KIAS	CHANDELLE .....	120 KIAS
POSITIVE LOOP .....	130 KIAS	HALF LOOP and ROLL OUT .....	135 KIAS
ROLL .....	100 KIAS	FLICK ROLL .....	84 KIAS
STALL TURN .....	120 KIAS	LAZY EIGHT .....	120 KIAS
45° HALF ROLL and DIVE OUT .....	120 KIAS	STEEP TURN .....	100 KIAS

**SPIN RECOVERY PROCEDURE**

**RUDDER IN FULLY OPPOSITE DIRECTION**

**ELEVATOR CONTROL FULL AFT**

**AILERONS NEUTRAL**

**AFTER ROTATION HAS STOPPED, RETURN ELEVATOR TO NEUTRAL POSITION**

Optional

DEMONSTRATED CROSSWIND COMPONENT : 18 kt			
ACROBATIC CATEGORY APPROVED MANEUVERS			
SPIN ( Rope Up ) .....	84 KIAS	CHANDELLE .....	120 KIAS
POSITIVE LOOP .....	130 KIAS	HALF LOOP and ROLL OUT .....	135 KIAS
ROLL .....	100 KIAS	FLICK ROLL .....	84 KIAS
STALL TURN .....	120 KIAS	LAZY EIGHT .....	120 KIAS
45° HALF ROLL and DIVE OUT .....	120 KIAS	STEEP TURN .....	100 KIAS

**SPIN RECOVERY PROCEDURE**

**RUDDER IN FULLY OPPOSITE DIRECTION**

**ELEVATOR CONTROL FULL AFT**

**AILERONS NEUTRAL**

For non fitted aircraft

**INVERTED FLIGHT FORBIDDEN**

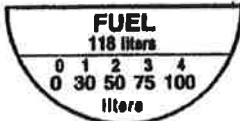
Near fuel filler cap

On the fuel quantity indicator

**AVGAS 100LL**

**120 liters**

**31.7 US Gal**



For aircraft fitted with 160 l (42.2 us gal) optional fuel tank

**AVGAS 100LL**

**160 liters**

**42.3 US Gal**



**MAX. FUEL 120 l (31.7 us gal)**

**IN ACROBATIC CAT.**

## Operation placards (cont)

Near the control pull knob

**FUEL SHUT OFF  
PULL**

On the handle

**CANOPY  
JETTISONING  
PULL  
HANDLE**

Optional

**CANOPY  
JETTISONING  
PULL  
HANDLE**  
↓

On baggage compartment aft bulkhead

**BAGGAGE MAX. LOAD  
35 kg - 77 lb  
NO BAGGAGE ALLOWED  
DURING ACROBATIC FLIGHTS**

Optional

**MAXIMUM WEIGHT  
77 lbs  
NO LUGGAGE ALLOWED  
DURING  
ACROBATIC FLIGHTS**

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# Section 3 : Emergency Procedures

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## Engine Failure During Take-Off (roll)

### With sufficient runway remaining:

Throttle ..... idle (pull)  
 Brakes ..... as required  
 Mixture ..... off (pull out)  
 Magneto switch ..... OFF  
 Alternator switch ..... OFF  
 Battery switch ..... OFF

### Without sufficient runway remaining:

Throttle ..... idle (pull)  
 Brakes ..... apply heavily  
 Mixture ..... off (pull out)  
 Magneto switch ..... OFF  
 Alternator switch ..... OFF  
 Battery switch ..... OFF

## Engine Failure Immediately After Take-Off

Glide speed ..... (800 kg) 78 kt (145 km/h)  
 (900 kg) 83 kt (154 km/h)  
 Mixture ..... cut-off (pull out)  
 Magneto switch ..... OFF  
 Alternator switch ..... OFF  
 Battery switch ..... ON (in order to use the flaps)

**NOTE CAREFULLY**

*Land straight ahead, with only small direction changes to avoid  
 obstructions.*

*Never try to turn back to the runway, as altitude after take-off is  
 seldom sufficient.*

## Engine Failure In Flight

If altitude is sufficient to try an engine restart:

Establish maximum glide speed, flaps up 78 kt (145 km/h) for 800 kg or 83 kts (154 km/h) for 900 kg. In these conditions and without wind, the aircraft covers approximately 8.7 times its altitude.

Fuel shut off control..... push in  
 Electric fuel pump..... ON  
 Mixture ..... full push in  
 Throttle .....  $\frac{1}{4}$  travel forward  
 Magneto switch .....on BOTH

If the propeller is still turning, the engine should restart.

If the propeller is stopped, operate the starter.

If the engine still does not start, prepare for a forced landing, following the procedure below.

### Power Off Forced Landing Off Airfield

Look for a suitable landing area:

Airspeed ..... (800 kg) 78 kt (145 km/h)  
 (900 kg) 83 kt ( 154 km/h)

Belts and harnesses..... tight  
 Electric fuel pump..... OFF  
 Mixture .....off (pull out)  
 Throttle ..... to idle (pull)  
 Magneto switch ..... OFF  
 Fuel shut off control..... pull out  
 Alternator switch..... OFF  
 Battery switch (for flap operation) ..... ON

#### Final

Flaps ..... full down  
 Battery switch ..... OFF  
 Canopy ..... unlocked

## Precautionary Power Landing Off Airfield

Fly over the chosen field several times at low speed, 78 kt (145 km/h) for 800 kg or 83 kts (154 km/h) for 900 kg, in order to locate the most suitable landing area, flaps in “take-off” position (10°), then make a precautionary approach at, 66 kt (122 km/h) for 800 kg or 71 kt (131 km/h) for 900 kg, flaps in “landing” position (35°).

On final, unlock the canopy.

### Before touchdown

Magneto switch ..... OFF  
 Battery switch..... OFF

### **NOTE IN CASE OF CANOPY JAMMING**

*Canopy handle in “open” position.*

*Free the two canopy release levers located on the arm rests, on both sides of the instrument panel, and place them in vertical position activating the canopy jettison system.*

*Canopy should be reinstalled in accordance with the aircraft service manual.*

## Fire

### Engine fire during starting

Keep the engine turning with starter:

Fuel shut off control ..... pull out  
 Electric fuel pump ..... OFF  
 Throttle..... full power (push)  
 Mixture ..... off (pull out)

The aim of this procedure is to make the engine “swallow” the accumulated fuel in the inlet pipes (generally following an excess of fuel priming during a difficult engine start).

**If the fire continues**

Magneto switch .....	OFF
Battery switch .....	OFF
Alternator switch.....	OFF

Abandon the aircraft and try to extinguish the fire with the aids available: fire extinguishers, covers, clothing or sand.

**Engine fire in flight**

Fuel shut off control.....	pull out
Throttle .....	full power until engine stops
Mixture .....	off (pull out)
Electric fuel pump.....	OFF
Alternator switch.....	OFF
Cabin heat and ventilation.....	off
Speed.....	86 kt (160 km/h)

Prepare for a forced landing off airfield, following the procedures in the chapter "Power off forced landing off airfield"

Do not attempt to restart the engine.

**Cabin Fire**

Extinguish the fire by all means possible (optional extinguisher).

To eliminate smoke, apply maximum ventilation.

In case of an electrical fire (fumes indicating insulation burning):

Cabin ventilation.....	reduce
Alternator switch.....	OFF
Battery switch.....	OFF
Battery circuit breaker .....	pull out
Alternator circuit breaker .....	pull out

Land immediately if the fire continues.

## Vibration and Rough Engine Operation

Vibrations and rough engine operation are generally due to (verify in this order):

- Carburettor icing: see paragraph "ICING" on next page.
- Mixture set too rich or too lean: adjust the mixture (see section 4)
- Contamination in the fuel system: verify fuel pressure. Switch on the electric fuel pump
- Ignition failure: magneto switch on "L", then "R", then return to "BOTH". Select the position providing the best engine operation and fly to the nearest airfield, at reduced power and mixture set to obtain the smoothest engine operation possible.

## Low Oil Pressure

In case of low oil pressure indication, check oil temperature and if it is too high (red arc):

- Reduce power  
If oil pressure does not recover:-
- Fly to the nearest airfield, and/or prepare for an off airfield landing.

## Canopy Jettisoning

Remove the safety locking device from central Jettison Handle

Pull handle down and aft.

If the central jettison handle fails.

Free the two canopy release levers located on the arm rests, on both sides of the instrument panel, and place them in vertical position activating the canopy jettison system.

Push canopy up

## Icing

Although it is forbidden to fly in icing conditions, proceed as follows when inadvertently encountering icing:

- Carburettor heat on (pull)
- Increase power in order to reduce ice build-up to minimum
- Switch on pitot heat (if installed)
- Select maximum cabin heat and direct the total output to the windscreen ("defrost" position) in order to remove the ice quickly
- Turn back or change altitude, to obtain an outside air temperature less conducive to icing
- Plan to land at the nearest airfield.
- Do not use the flaps

With an extremely rapid ice build-up, carry out a forced landing.

Remember that a layer of 0.5 cm (0.2 in) on the wing leading edge will increase stall speed. If needed, use a higher than normal approach speed: 139 to 150 km/h (75 to 81 kt).

### **REMARKS**

*If continuous carburettor heat is judged necessary, it is imperative to adjust the mixture control to obtain normal engine operation.*

*Always use carburettor heat fully on or fully off, in certain cases, an intermediate position could increase icing.*



## Electrical Power Supply Malfunction

Alternator failure is indicated when the amber “LOW VOLT” light on the warning panel is lit, and a progressive drop in voltage appears on the voltmeter. The “LOW VOLT” light indicates that the battery is supplying power to the bus-bar.

### If the “LOW VOLT” amber light is on

Switch off the alternator, then switch it back on.

This operation resets the overvoltage relay which may have cut-out due to a transient overvoltage.

#### **NOTE**

*Warning light may come on during low engine rpm. Check that increasing rpm makes the light go out.*

### If the “LOW VOLT” light remains on

- Switch off the alternator.
- Switch off all the electrical equipment not essential to the continuation of the flight.
- Land as soon as possible and have the electrical system inspected.

#### **NOTE**

*An alternator failure does not prevent the engine from operating normally.*

## Inadvertent Spin

Should a spin occur, use the following procedure:

Throttle ..... idle (pull)

Rudder ..... full opposite to direction of rotation

Elevator ..... forward to neutral

Ailerons ..... neutral

Once the rotation stops, rudder to neutral position and recover within flight limitations.

### **NOTE**

*If the flaps are down when the spin begins, retract them immediately.*

## Loss of Elevator Control

In case of a loss of elevator control (accidental disconnection):

- Stabilize the aircraft in level flight, flaps at 35°, at 75 kt (139 km/h), using the elevator trim and throttle.
- Do not change the elevator trim setting and control the angle of descent with throttle only. Reduce throttle only when in short final and near to the ground.

## Section 4 : Normal Procedures

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## Loading

Before each flight, insure that the total weight and the load balance are within the established limits. For this, use the weight and balance chart in Section 6.

### Normal Operating Speeds

The speeds identified hereunder are indicated Airspeeds recommended for normal operations.

They are based on a standard aircraft, operated at gross weight, in standard atmosphere, at sea level. They can change from one aircraft to another, depending on the installed equipment, aircraft and engine condition, atmospheric conditions and pilot proficiency.

#### Best rate of climb speed

Flaps in take-off position (10°) .....	(800 kg) 70 kt (130 km/h)
	(900 kg) 75 kt (139 km/h)
Flaps up .....	(800 kg) 78 kt (145 km/h) )
	(900 kg) 83 kt (154 km/h)

#### Best angle of climb speed

Flaps in take-off position (10°) .....	(800 kg) 65 kt (120 km/h) )
	(900 kg) 70 kt (130 km/h)
Flaps up .....	(800 kg) 70 kt (130 km/h) )
	(900 kg) 75 kt (139 km/h)

#### Maximum operating speed in turbulence

Flaps up .....	127 kt (238 km/h)
----------------	-------------------

#### Maximum speed

Flaps in landing position (35°).....	97 kt (180 km/h)
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#### Landing speed, final approach

Flaps in landing position (35°).....	(800 kg) 65 kt (120 km/h) )
	(900 kg) 70 kt (130 km/h)

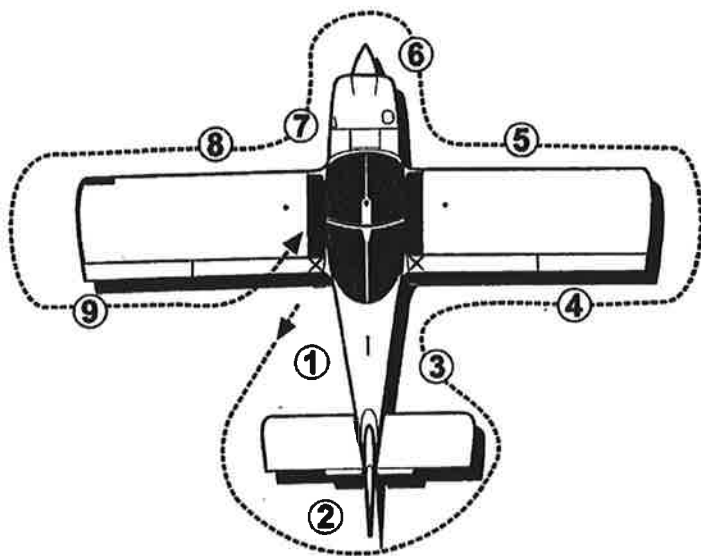
## Pre-Flight Inspection

To be performed before each flight.

This inspection may be reduced after intermediate en route landings.

Magneto switch ..... OFF  
 Controls ..... free  
 Control surface deflections ..... check  
 Battery switch ..... ON  
 Flaps ..... check operation  
 Fuel quantity ..... check  
 Battery switch ..... OFF  
 Fuel shut off control: pushed in and cover closed ..... check  
 Aircraft documents ..... check availability on board  
 Baggage ..... check stowed

Make an aircraft walk-around inspection (as shown below) beginning at the fuselage left side.



	Fuel quantity .....	check with dip stick
	Fuel filler cap.....	in place, locked
<b>1</b>	Static vent .....	clean, unobstructed
	Purge the fuel tank.....	ensure accumulated water is removed
	Canopy jettisoning handle.....	check lock wire attachment
<b>2</b>	Horizontal stabilizer.....	surface condition, hinges without play
	Rudder .....	check hinges and play
<b>3</b>	Static vent .....	clean, unobstructed
<b>4</b>	Flap, aileron .....	check condition and hinges
	Wing tip, strobe and navigation lights .....	check condition
	Stall warning .....	clean, check displacement
<b>5</b>	Right main landing gear.....	check attachment and fairing condition normal shock absorber compression, tyre inflated
	Oil level .....	check, oil cap secured, panel closed ..... Min. 2 qts, Max. 8 qts
	Engine cowl attachments .....	check
<b>6</b>	Propeller.....	clean, in good condition, check for no cracks
	Propeller spinner.....	no play, clean, in good condition, no cracking
	Air inlets .....	clean, unobstructed
	Landing Lights.....	window clean
	Nose gear.....	check attachment and fairing condition normal shock absorber compression, tyre inflated, tow-bar removed
<b>7</b>	Exhaust pipes .....	rigid
	Canopy cleanliness.....	check
	Left main landing gear .....	check attachment and fairing condition normal shock absorber compression, tyre inflated
<b>8</b>	Pitot.....	clean, unobstructed
<b>9</b>	Wing tip, navigation-, taxi- landing-lights .....	check condition
	Flap, aileron .....	check condition and hinges
	Check all surfaces (look for missing rivets, cracks, permanent buckling in panels)	
<b>10</b>	Remove the snow or ice that may be present on the wings and tail unit.	
	Remove the chocks and tethering gear.	

## Cabin Interior Check Prior Start-Up

Canopy ..... closed and locked  
Parking brake ..... ON and locked  
Seats ..... adjusted and locked  
Belts and harnesses ..... adjusted and fastened  
Flight controls ..... free, without play or excessive friction  
(check rudder on taxi)  
Elevator trim ..... verify travel, and return to take-off position  
Fuel shut-off control (pushed in and cover closed) ..... checked  
Battery switch ..... ON  
Fuel Flow Indicator ..... adjust as necessary, select FLOW mode

## Before Starting Engine

Cabin Equipment ..... Secure  
Pilot (& passenger) ..... Harness On  
Avionics Master ..... OFF

## Parking Brake Use

### Brake on

Press on both pedals. Keep pressure on, while pulling the parking brake control out. Then, release the pressure on the pedals (the parking brake control remains in the pulled position).

### Brake off

Push the control in.



## Starting the Engine

### Normal procedure

Carburettor heat ..... off (push in)  
 Mixture ..... pushed full rich  
 Strobe light ..... ON  
 Gauges ..... check  
 Magneto switch ..... on BOTH  
 Electric fuel pump ..... ON  
 Throttle ..... carry out 2 or 3 pumps, then  $\frac{1}{4}$  travel forward  
 Propeller area ..... clear  
 Starter ..... turn and push on (15 to 20 sec. maxi.)

### Hot engine procedure

Same as "Normal procedure", but without pumping throttle.

### Cold weather procedure (Below 5 C)

Same as "Normal procedure", but keep pumping throttle up to 900 or 1000 rpm until engine runs smoothly.

### Engine "flooded"

Electric fuel pump ..... OFF  
 Mixture ..... lean (pull out)  
 Throttle ..... full power (push in)  
 Alternator ..... OFF  
 Starter ..... operate for 10-15 seconds

As soon as the engine fires, reduce throttle to  $\frac{1}{4}$  and advance mixture control to "rich" and resume the normal procedure without pumping throttle.

**ATTENTION: Avoid operating the starter for more than 20 seconds. Wait at least a minute before operating it again.**

**As soon as the engine is running, check the engine oil pressure. If it is zero after 15 to 20 seconds, switch off and investigate the cause.**

## After Engine Start

RPM .....	1200
Electric fuel pump.....	OFF
Alternator switch.....	ON
Voltmeter .....	green range
Vacuum gauge .....	green range
Annunciator Lights .....	test and select brightness
Avionics Master.....	ON
COM/NAV, navigation instruments.....	set
Altimeter .....	set

## Taxiing

Parking brake .....	released
Brakes .....	test
Turn co-ordinator .....	check
Directional gyro .....	check setting

Avoid exceeding 1200 rpm while oil temperature is in yellow arc.

## Engine Run-Up

Parking brake..... applied  
 Oil pressure and temperature .....green range  
 Fuel pressure .....green range  
 Mixture ..... (full rich) in  
 Carburettor heat..... off (push in)

### Magneto check

Throttle..... 1800 rpm  
 Magneto selection:  
 Max. drop between “L” or “R” and “BOTH” ..... 175 rpm  
 Max. difference between “L” and “R” ..... 50 rpm

### Carburettor heat check

Carburettor heat (at 1800 rpm) ..... full on  
 Check rpm drop ..... between 20 and 200 rpm  
 Carburettor heat..... off (push in)

### Mixture check

Lean until rpm reduction, then return to “full rich”.

### Engine idle check

Throttle..... 600 to 650 rpm

## Before Take-Off

Controls .....	free
Magneto switch .....	BOTH
Cabin (seats and belts) .....	check
Fuel shut off control: pushed in and cover down.....	check
Electric fuel pump.....	ON
Elevator trim .....	take-off position
Instruments .....	check, set
Transponder .....	as required
Flaps .....	(10°) take-off position
Throttle .....	'holding" at 1200 rpm
Canopy .....	closed and locked

## Take-Off

### Normal take-off

Take-off minimum rpm .....	2150
Rotation speed .....	(800 kg) 55 kts (102 km/h)
	(900 kg) 58 kts (107 km/h)
Initial climb speed.....	(800 kg) 75 kts (139 km/h)
	(900 kg) 79 kts (147 km/h)

### After obstacles clearance,

Reduce angle of climb to obtain .....	(800 kg) 78 kts (145 km/h)
	(900 kg) 83 kts (154 km/h)
Electric fuel pump .....	OFF
Fuel pressure .....	check (.5 to 5 psi)
Flaps .....	up

**Short field take-off**

Flaps ..... (10°) take-off position

Apply full power, brakes applied,

then release the brakes ..... minimum 2150 rpm

Rotation speed ..... (800 kg) 55 kts (102 km/h)

(900 kg) 58 kts (107 km/h)

Then, if necessary (to clear an obstacle)

Best angle of climb speed ..... (800 kg) 70 kts (130 km/h)

(900 kg) 73 kts (135 km/h)

**Crosswind take-off (greater than 12 kts crosswind)**

Flaps ..... take-off position (10°)

Ailerons ..... into the wind

Take-off at 10% higher airspeed than normal. Correct drift in the normal way (max bank angle close to the ground: 15°).

Demonstrated crosswind velocity: 18 kts (33 km/h)

**Climb****Normal climb (flaps up)**

Set climb speed:

800 kg – 78 kts (145 km/h); 70 kts (130 km/h) at 10,000 ft.

900 kg – 83 kts (154 km/h); 75 kts (139 km/h) at 10,000 ft

Above 5 000 ft, adjust mixture.

**Best angle of climb**

The best angle of climb is obtained at, 70 kts (130 km/h) at 800 kg or 75 kts (139 km/h) at 900kg, flaps up and, 65 kts (120 km/h) at 800kg or 70 kts (130 km/h) at 900kg, flaps in take-off position (10°).

**NOTE**

*This type of climb should only be used only as necessary, due to poor engine cooling.*

## Cruise

Refer to Section 5 for rpm setting and cruise performance.

### Operation of mixture control

Maintain mixture control in the “full rich” position during take-off and in the climb.

In certain conditions (high altitude take-off, or long climb above 5000 ft), this setting may be too rich and could result in irregular engine operation or loss of power.

In these cases, adjust the mixture to recover regular engine operation, and not for fuel economy.

#### **Mixture adjustment in stable cruise:**

Progressively lean the mixture until a slight reduction in rpm is noted; then lightly enrich to re-establish power and normal operation.

#### **NOTE**

*Take care not to lean the mixture too much, which would cause engine overheating.*

**ALWAYS ENRICH THE MIXTURE BEFORE INCREASING POWER.**

## Use of Carburettor Heater

### WARNING

Never keep the carburettor heater ON, when taking off.

If, while cruising at constant altitude and in smooth air, with a given power setting, there is a drop in rpm; or a reduction of the manifold pressure (on aircraft equipped with a manifold pressure gauge).

- Pull the carburettor heater control fully ON for 30 seconds
- Note the effect on rpm; or on the manifold pressure

If they increase the carburettor was beginning to ice up.

- Push OFF the carburettor heater and check that the initial engine parameters are recovered
- Repeat this operation at regular intervals, according to the meteorological conditions

Do not set the carburettor heater control in an intermediate position, as the action of the heater is not proportional to the travel of the control.

When landing in cold or damp weather, pull the carburettor heater control ON one or two minutes before closing the throttle.

## Descent

### Rapid Descent

Power .....as required to maintain the desired descent path

Carburettor heat .....as required

Each 1500 ft, apply power to avoid excessive engine cooling and to clean the spark plugs.

### Approach or down wind

Mixture ..... full rich

Electric fuel pump..... ON

Carburettor heat (before reducing throttle)..... full on

Cabin (belts and seats) ..... check

Flaps ..... below 97 kts (180 km/h) in take-off position (10°)

Speed ..... reduce to 70 to 76 kts (130 to 140 km/h)

Elevator trim ..... set

### On Final

Carburettor heat ..... full cold

Flaps ..... landing position (35°)

Approach speed(power on) ... (800 kg) 65 to 68 kts (120 to 125 km/h)  
(900 kg) 70 to 73 kts ( 130 to 135 km/h)

Elevator trim ..... set

Maximum demonstrated cross wind 18 kts



## Landing

### Short landing

Flaps ..... landing position (35°)  
Approach speed (with power on) ..... (800 kg) 62 kts (115 km/h)  
..... (900 kg) 67 kts (124 km/h)

After touchdown, brake heavily keeping nose up with elevator and retract flaps.

### Landing in crosswind or gusty conditions

Flaps ..... (10°)  
Approach..... (800 kg) 73 kts (135 km/h) + ½ gust speed  
..... (900 kg) 78 kts (145 km/h) + ½ gust speed  
Drift .....correct in the normal way  
Demonstrated crosswind ..... 18 kts (33 km/h)

### Overshoot procedure

Carburettor heat full cold ..... check  
Throttle..... full  
Speed..... (800 kg) 65 kts (120 km/h)  
..... (900 kg) 70 kts (130 km/h)  
Flaps .....(10°) take-off position  
Normal climb speed ..... (800 kg) 70 kts (130 km/h)  
..... (900 kg) 75 kts (139 km/h)

## After Landing

Electric fuel pump ..... OFF  
Flaps ..... up  
Navigation instruments ..... off  
Transponder..... standby

## Engine Shut-Down

Park brake .....on  
 ELT ..... Check not triggered  
 Avionics master ..... OFF  
 Electrical equipment .....off  
 Canopy ..... closed, locked  
 Magneto cut-off check at idle ..... OFF then BOTH  
 RPM ..... 1000  
 Mixture ..... idle cut-off

### After the engine stops

Magneto switch ..... OFF  
 Alternator switch ..... OFF  
 Battery switch ..... OFF  
 When wheel chocks in place ..... release the parking brake

## Acrobatic Flights

### IMPORTANT NOTES

- This aircraft is not provided with a fuel or oil system allowing sustained inverted flight.
- The lubrication does not take place while the aircraft is in the inverted position. An air-oil separator is provided to prevent the oil flowing through the engine breather.
- The luggage hold must be empty and no object may be loose in the cabin.
- Make sure that the aircraft C of G is within the permissible limits.

## Spinning

It is recommended to perform the spin in the following manner:

- Flaps must be retracted
- Start the spin at an adequate height above the safety altitude, taking into consideration that the loss of altitude is about 230 ft per revolution and that the final recovery takes about 1300 ft.
- Throttle back in level flight, decrease the speed with a slightly positive vertical position
- When close to the stalling point (54 kts):  
Pull the elevator control fully back, ailerons in neutral and simultaneously apply rudder in the direction of required rotation
- When 2 or 3 rotations have been completed, apply the following recovery procedure:  
Rudder in fully opposite direction, elevator control to neutral and ailerons in neutral
- When spin rotation stops, recover to normal flight taking care to remain within operating limits.

### Example to recovery from a LH spin

- Apply and maintain full Right rudder, ailerons in neutral
- Stick to neutral
- After 3 revolutions, recovery is performed in approximately three quarters of a revolution.

### **Only one action is important - Keep the rudder fully in opposite direction!**

- In a spin of more than 3 revolutions, the engine is likely to stall. This raises no difficulty: the propeller should wind mill once airspeed is restored and re-start the engine.  
(**Caution:** do not engage starter if propeller is still rotating.)
- With a 4 revolution (or more) spin, recovery is performed in 1 ½ revolutions.
- During the recovery phase, keep a watch on the A.S.I. and on the accelerometer, to keep within the operating limits.

Authorized acrobatic figures	Initial speed
Positive spin .....	54 kts (100 km/h)
Positive loop.....	130 kts (240 km/h)
Roll .....	108kts (200 km/h)
Stall turn .....	120 kts (220 km/h)
45° half roll and dive out .....	120 kts (220 km/h)
Chandelle .....	120 kts (220 km/h)
Half loop and roll out.....	135 kts (250 km/h)
Flick roll .....	86 kts (160 km/h)
Lazy eight.....	120 kts (220 km/h)
Turns at more than 60° bank .....	108 kts (200 km/h)

Authorized "U" category figures	Initial speed
Chandelle .....	130 kts (240 km/h)
Lazy eight.....	130 kts (240 km/h)
Turns at more than 60° bank .....	108 kts (200 km/h)

Intentional spins are prohibited in utility category operations

If, during one of the figures the engine stops, it is preferable to close throttle during the recovery only. The above figures can be performed without causing the engine to stop and at a load factor not exceeding 4 g.

**INVERTED SPIN PROHIBITED.**

**Inverted flight**

Inverted flight is only permitted for aircraft fitted with an oil recuperation system and dry battery.

Inverted flight is only permitted for up to 20 seconds.

In order to prevent engine roughness apply following procedure:

Entry Speed ..... 119 kts (220 km/h)

As aircraft becomes inverted .....close throttle

For 20 seconds only..... maintain speed above 80 kts (150 km/h)

After return to normal flight .....open throttle smoothly

All aircraft are fitted with an oil recuperation system and dry battery.

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## Section 5 : Performance

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## Noise Limitation

The maximum acceptable noise level in accordance with ICAO annex 16, chapter 6, for the R2160 aircraft, at a certified gross weight of (1984 lb) 900 kg, is 72 dB(A)

The actual noise level determined under the ICAO criteria is 69.8 dB(A).

## Cross Wind

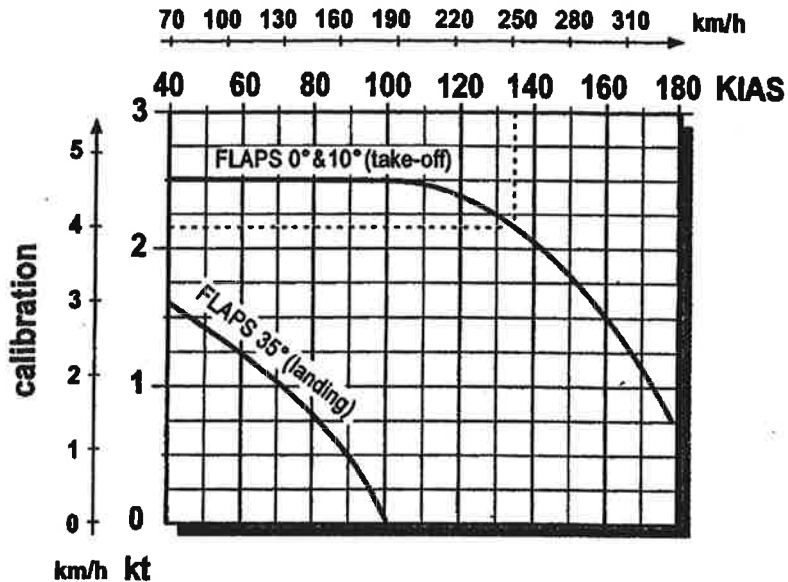
**Demonstrated cross-wind limit:** 18 kt (33 km/h)

## Stall Speeds

<b>Engine idling, weight: 800 kg (1764 lb)</b>	<b>kt (km/h)</b>		
Bank angle	0°	30°	60°
Flaps up	58 (107.5)	68 (126)	89 (165)
Flaps 10°, take off position	55 (102)	66 (121)	86 (160)
Flaps 35°, landing position	48 (89)	55 (101)	72 (133)

<b>Engine idling, weight: 900 kg (1984 lb)</b>	<b>kt (km/h)</b>		
Bank angle	0°	30°	60°
Flaps up	63 (117)	68 (126)	89 (165)
Flaps 10°, take off position	61 (113)	66 (121)	86 (160)
Flaps 35°, landing position	51 (94)	55 (101)	72 (133)

## Airspeed Installation Calibration



### Example

If KIAS is 135 kts (250 km/h), flaps up then KCAS will be 137 kts (254 km/h)

### NOTE

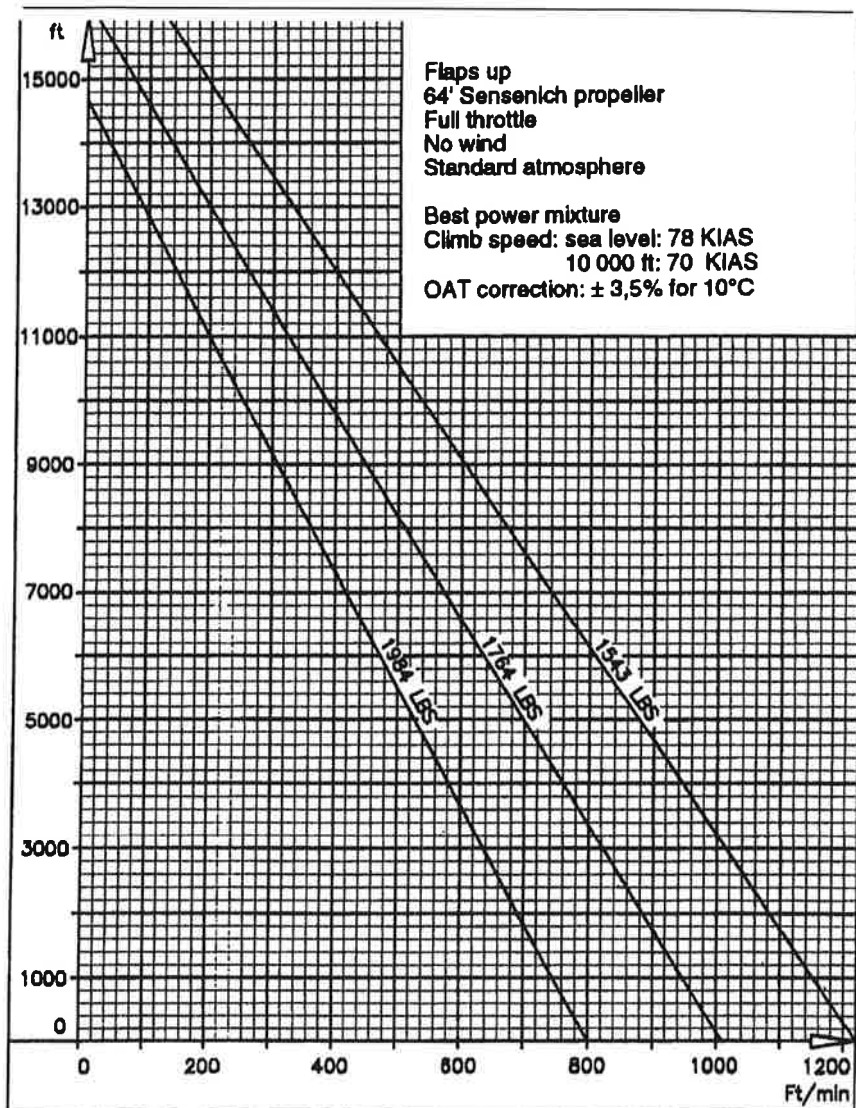
*All speeds in this manual are indicated airspeeds unless otherwise specified.*

## Take-Off Performance

Concrete level dry runway. Flaps in take-off position. Full throttle								
Max. weight kg (lb)	Head Wind (kt)	Sea level +15°C		2500 ft – (760 m) +10°C		5000 ft – (1525 m) +5°C		
		Run	15 m (50 ft) clear	Run	15 m (50 ft) clear	Run	15 m (50 ft) clear	
		m (ft)	m (ft)	m (ft)	m (ft)	m (ft)	m (ft)	
900 (1984)	0	320 (1050)	574 (1883)	400 (1312)	700 (2297)	490 (1608)	870 (2854)	
	10	224 (735)	476 (1562)	280 (919)	590 (1936)	340 (1115)	730 (2395)	
	20	147 (482)	385 (1263)	180 (590)	470 (1542)	224 (735)	590 (1936)	
800 (1764)	0	230 (754)	410 (1345)	285 (935)	500 (1640)	350 (1148)	620 (2034)	
	10	160 (525)	340 (1115)	200 (656)	420 (1377)	245 (804)	520 (1706)	
	20	105 (344)	275 (902)	130 (427)	335 (1099)	160 (525)	420 (1377)	
700 (1543)	0	160 (525)	285 (935)	200 (656)	350 (1148)	245 (804)	430 (1410)	
	10	110 (361)	240 (787)	140 (459)	290 (951)	170 (558)	360 (1181)	
	20	70 (230)	190 (623)	90 (295)	235 (771)	110 (361)	290 (951)	

- Increase distances by 8% for every 10°C increase of the standard temperature, at the appropriate altitude concerned.
- Take-off from dry grass runway: add 8%.

# Climb Performance



## Climb Time/Climb Distance

Standard atmosphere

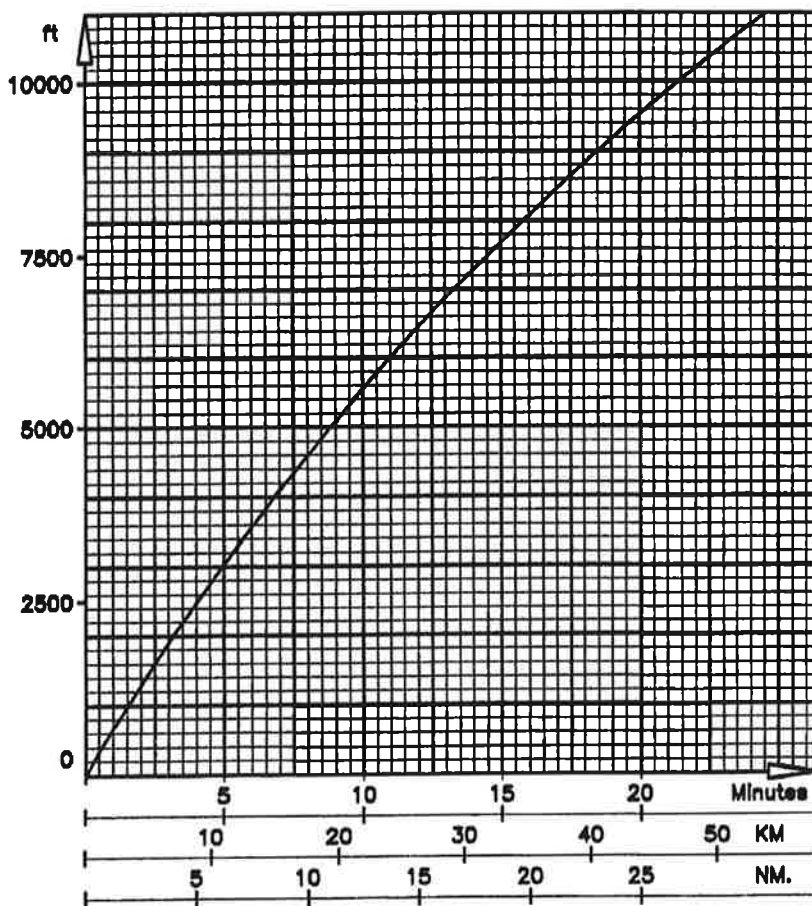
Flaps up

Full throttle

MTOW 800 kg

Climb speed (IAS): 78 kt (145Km/h)

Consumption 30 l/h



## Cruise Performance

MTOW 800 kg (1764 lb)

Flaps up

Standard atmosphere

No wind

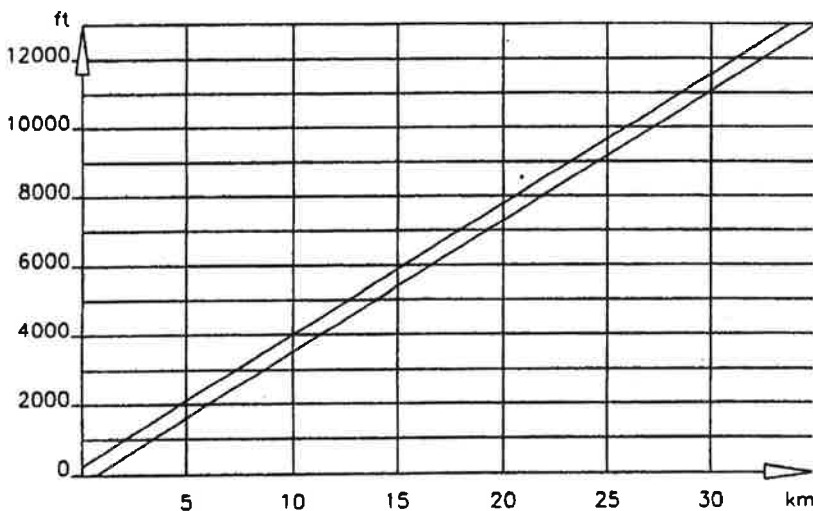
Mixture at best power setting

Altitude ZP ft	Power		True Air Speed Kt (km/h)	Fuel Consumption l/h (us gal)	Endurance H:min	Range	
	%	RPM				Km	Nm
SEA LEVEL	75	2550	116 (215)	35 (9.2)	3:20	725	390
	65	2450	111 (206)	30 (7.9)	3:55	810	435
3000	75	2625	121 (224)	35 (9.2)	3:20	755	405
	65	2525	116 (215)	30 (7.9)	3:55	845	455
5500	75	2650	125 (232)	35 (9.2)	3:20	780	420
	65	2550	119 (220)	30 (7.9)	3:55	865	465
7500	70	2675 (*)	126 (233)	32 (8.7)	3:40	860	460
	65	2600	122 (226)	30 (7.9)	3:55	890	480

(\*) full throttle

## Glide Performance

Airspeed ..... (800 kg) 78 kt (145 km/h)  
 (900 kg) 83 kt (154 km/h)  
 Propeller ..... windmilling  
 Flaps ..... up  
 Without wind



**Altitude and temperature do not have a noticeable influence.**

In wind-less conditions, with engine of, flaps up, propeller spinning and  $V_i = 78$  kt (145 km/h), the aircraft will glide over a distance equal to 8.7 times the altitude. Altitude and temperature have no substantial effect.

## Landing Performance

Dry, hard runway, flaps 35°, power off							
Max. weight kg (lb)	Head Wind (kt)	Sea level +15°C		2500 ft – 760 m +10°C		5000 ft – 1525 m +5°C	
		Run	Distance to clear 15 m (50 ft)	Run	Distance to clear 15 m (50 ft)	Run	Distance to clear 15 m (50 ft)
		m (ft)	m (ft)	m (ft)	m (ft)	m (ft)	m (ft)
900 (1984)	0	233 (764)	440 (1444)	250 (820)	465 (1526)	265 (869)	490 (1607)
	10	165 (541)	365 (1197)	175 (574)	390 (1279)	185 (607)	413 (1355)
	20	120 (394)	295 (968)	130 (426)	310 (1017)	140 (459)	335 (1099)
800 (1764)	0	220 (722)	415 (1361)	235 (771)	440 (1443)	250 (820)	465 (1525)
	10	155 (508)	345 (1132)	165 (541)	370 (1214)	175 (574)	390 (1279)
	20	115 (378)	280 (918)	125 (410)	295 (968)	130 (426)	315 (1033)
700 (1543)	0	190 (623)	375 (1230)	205 (672)	400 (1312)	215 (705)	420 (1378)
	10	135 (443)	315 (1033)	145 (476)	335 (1099)	150 (492)	350 (1148)
	20	100 (328)	250 (820)	110 (361)	270 (886)	115 (378)	280 (918)

**Landing on grass runway: increase distances by 20%.**

Approach speed: 65 kt (120 km/h)

Touch-down speed: 58 kt (107 km/h)

**Landing with flaps retracted:**

Landing speed

76 kts (140 km/h)

Increase landing distances by 50%

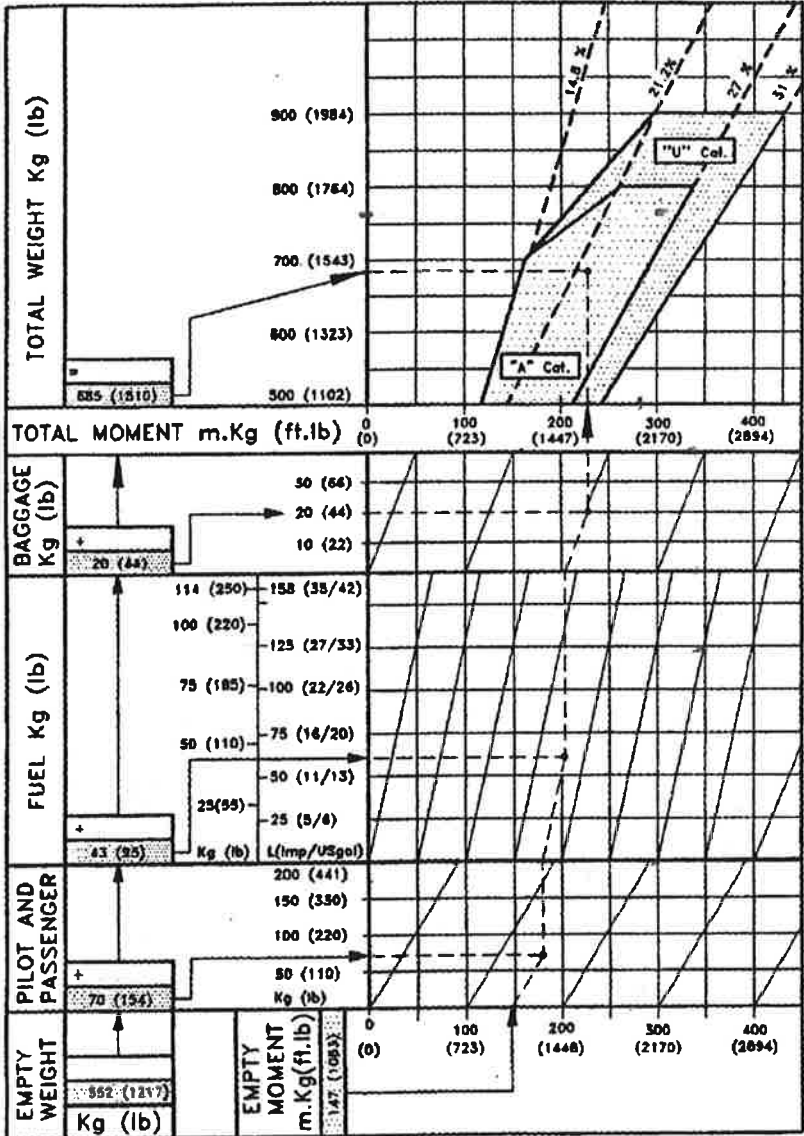


# Section 6 : Weight and Balance

## Table of Contents

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Fitted Equipment List .....	6-5

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Weight & Balance Work Sheet

## Use of Weight and Balance Diagram

- 1 Calculate the total loaded aircraft weight:

Empty weight (from the weight and balance sheet)

- Pilot and passenger
- Baggage
- Standard fuel

Ensure that total weight does not exceed 900 kg (1984 lb).

- 2 Place the empty aircraft moment (from the weight and balance sheet) on the upper scale of the previous diagrams, and follow the example indicated by the dashed line.

The resulting point must be within the centre of gravity moment envelope (shaded area) for the load to be within limits.

**EXAMPLE\***(dashed line on work sheet)

Empty aircraft moment .....	(1063 ft.lb)	147 m.kg
Empty aircraft weight.....	(1217 lb)	552 kg
Pilot and passenger .....	(154 lb)	70 kg
Fuel 60 l (13 imp/16 US gal) .....	(95 lb)	43 kg
Baggage.....	(44 lb)	20 kg
<b>TOTAL WEIGHT</b> .....	<b>(1510 lb)</b>	<b>685 kg</b>

**CENTRE OF GRAVITY:** with the envelope

1 litre AVGAS	=	0.72 kg (1.6 lb)
1 imp gal AVGAS	=	3.27 kg (7.2 lb)
1 US gal AVGAS	=	2.7 kg (6 lb)

### \* ATTENTION

*For your aircraft centre of gravity calculation, please do not use values of empty aircraft weight and empty aircraft moment indicated in the above example! Use the values indicated in the last weight and balance sheet of your aircraft.*

## Fitted Equipment List

<b>Serial No:-</b>	<b>Registration:</b>	<b>Date:</b>
--------------------	----------------------	--------------

Item No	Item	Mark if Installed	Weight (kg)	ARM (m)
1	First Aid Kit			
2	Fire Extinguisher			
3	Axe			
4	Airspeed Indicator			
5	Altimeter			
6	Compass			
7	Fuel Contents Gauge			
8	Fuel Flow/Pressure Gauge			
9	Super Clock			
10	Oil Pressure/Temperature Gauge			
11	Vacuum Gauge			
12	Carburettor Temp/OAT			
13	Volt/Ammeter Gauge			
14	Airspeed indicator (secondary)			
15	Artificial Horizon			
16	Altimeter (secondary)			
17	Turn & Slip			
18	Directional Gyro			
19	Vertical Airspeed			
20	Tachometer			
21	Intercom			
22	Voice Annunciator			
23	Encoder			
24	Avionics Cooling Fan			
25	GPS			
26	COM 1			
27	COM 2			
28	Transponder			
29	Emergency Locator Beacon			

Item No	Item	Mark if Installed	Weight (kg)	ARM (m)
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

# Section 7 : Description of Aircraft & Systems

## Contents

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## Airframe

The Robin R2160 is a low wing, tricycle undercarriage, aerobatic two seat trainer. It is an all metal design of conventional semi monocoque construction. The undercarriage is fitted with fairings to aid drag reduction.

Access to the cabin is via a built in step, hand grabs and a forward sliding bubble canopy.

## Cabin

The cabin has provision for pilot, passenger and luggage. The luggage deck has built in tie down points to secure the luggage.

The seats are adjustable fore and aft. A five point aerobatic harness is fitted as standard.

Cabin width	1.06 m (42")
Length	2.06 m (81")
Height	1.25 m (49")

## Engine

Lycoming O-320 D

160 BHP @ 2700 rpm

The engine is fitted with a carburettor and carburettor heat. An air/oil separator is fitted in the breather line. Recovered oil is returned to the sump. A "Slick Start" magneto system is installed to improve starting. Also fitted is a "Skytech" light weight starter.

## Propeller

Sensenich metal propeller

74DM6S5-2-64

or 74DM6S5-2-66

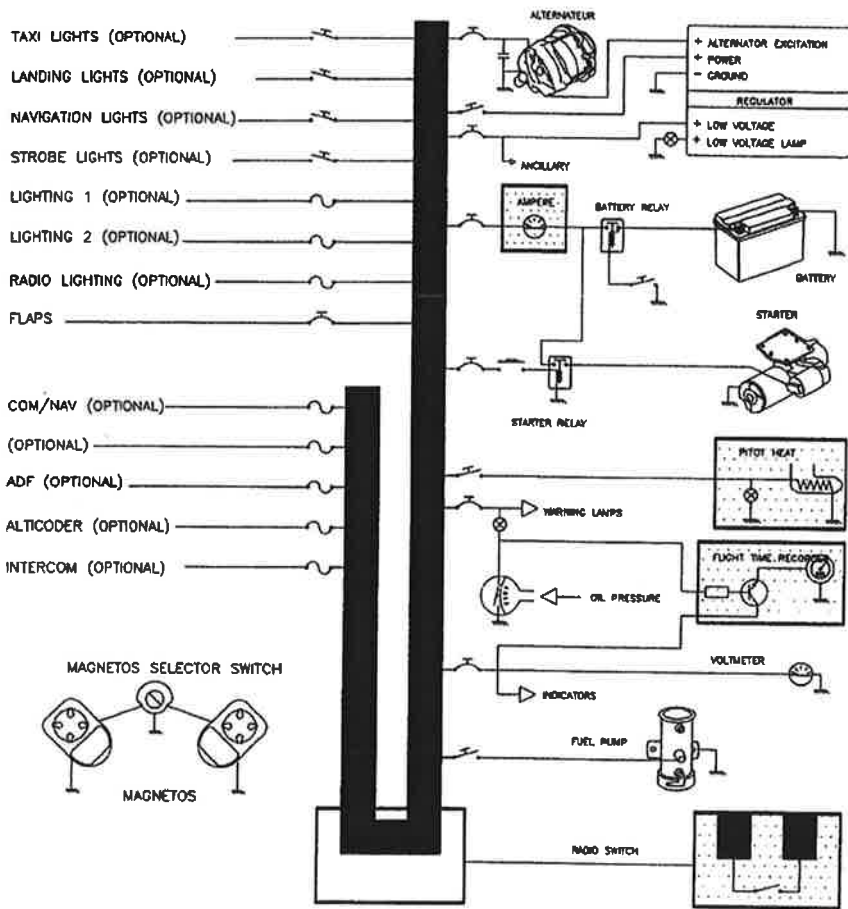
## **Electrical System**

The electrical system is conventional 12 volt with a GelCell lead acid battery and charged by an alternator of 40 Amp output (or 60 Amp output for SN 265 and on). The system is protected by Circuit Breakers of varying capacity. A dual volt/ammeter is provided to monitor the electrical system.

In the event of a failure of the alternator an amber "LOW VOLT" light illuminates in the annunciator panel.

The electrical system includes electrically actuated flaps, along with the following optional equipment: navigation lights, anti collision strobe lights, landing lights and cockpit/instrument lighting.

### Electrical System Schematic



LEGEND			
	CIRCUIT BREAKER		OPTIONAL EQUIPMENT
	SWITCH TYPE CIRCUIT BREAKER		CAPACITY
	FUSE		DIODE
	PUSH BUTTON		TRANSISTOR
	SWITCH		RESISTOR

## Fuel System

The fuel system consists of either a 120 or 160 litre tank mounted under the luggage deck and aft of the seat back. Fuel flows from the tank through a mesh finger strainer via a flexible line to the fuel shut off valve mounted on the lower fuselage skin. The shut off valve is actuated by a push/pull control mounted on the centre consol.

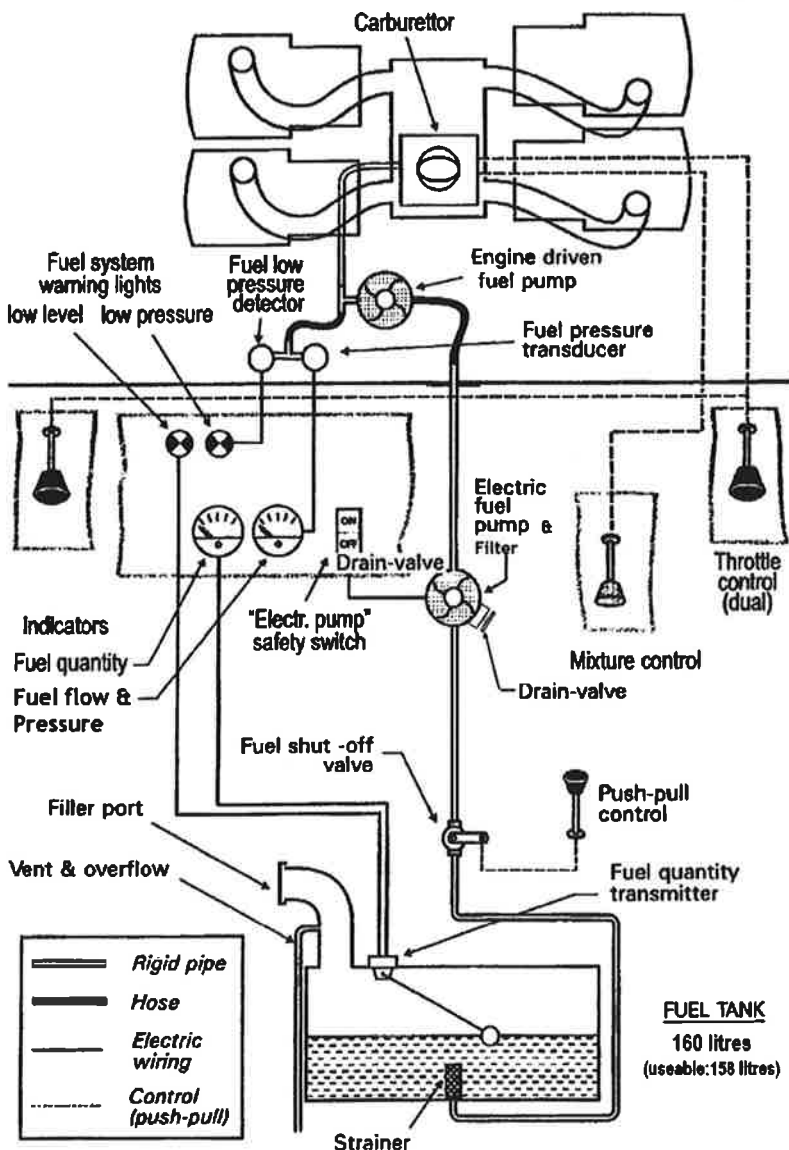
From the shut off valve fuel flows to the adjacent electric boost pump. This pump is at the lowest point in the system. The removable filter housing on the pump has been enlarged to provide an appropriate volume to trap any water or sediment in the system. A quick drain valve has been installed in the housing and permits water drain checks to be carried out during normal pre-flight walk round.

From the pump piping carries the fuel to the engine driven pump and then to the carburettor. The electric fuel pump is actuated by a switch on the centre consol.

Two warning lights in the annunciator panel are provided for the fuel system. One advises low fuel pressure (Fuel Pres) and the other low fuel level (Fuel Low Level). A fuel gauge is fitted to the lower sub panel and adjacent is a combined fuel flow/ pressure instrument.

The fuel system is schematically shown on the following page.

### Fuel System Schematic

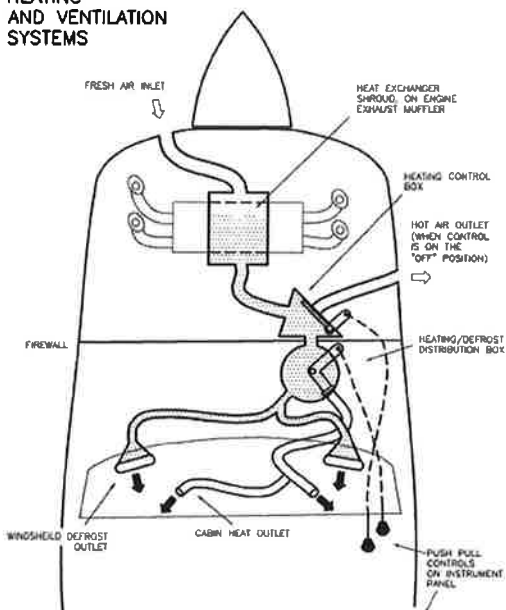


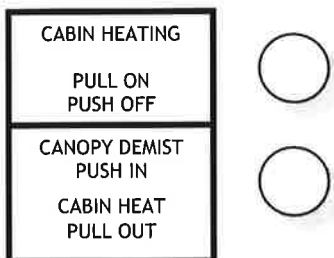
## Heating & Ventilation

Fresh air is provided by face level air vents integral with the instrument panel. Heating and demisting is also provided and selected by controls on the lower instrument panel.

The heat source is a heat muff around the muffler. The hot air is directed to a heat control box on the firewall. This on off control permits air to the heat distribution box which in turn can direct heated air to either the cabin or to the windshield for demisting.

### HEATING AND VENTILATION SYSTEMS





## Flight Controls

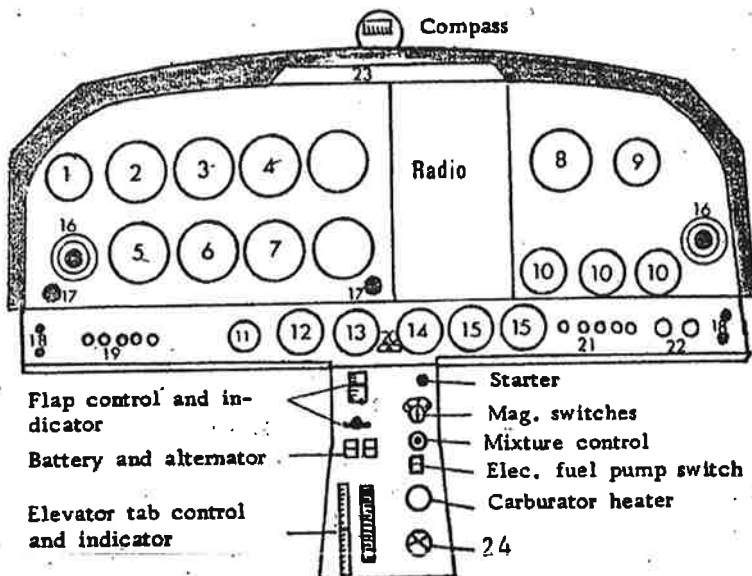
The aircraft is fitted with dual flight controls and can be flown from either the left or right hand seat. The control surfaces are of all metal construction and all are statically balanced. The control surfaces are operated by cables. In the case of the ailerons the cables operate a bellcrank which in turn moves a push rod attached to the aileron. This arrangement provides for differential movement of the ailerons.

Pitch control is provided by a horizontal stabiliser and is provided with anti-servo tabs. Apart from controlling the horizontal stabiliser the tabs are also part of the trim system. The trim system is operated by a knurled trim wheel in the centre console and via a Telflex cable controls the angular relationship between the tabs and the stabiliser.

The flaps are electrically actuated with three preset positions 0°, 10°, and 35° selected via a three position switch on the centre console. Flap position is shown on the indicator bar adjacent to the flap selector switch.

Nose gear steering is controlled by the rudder pedals.

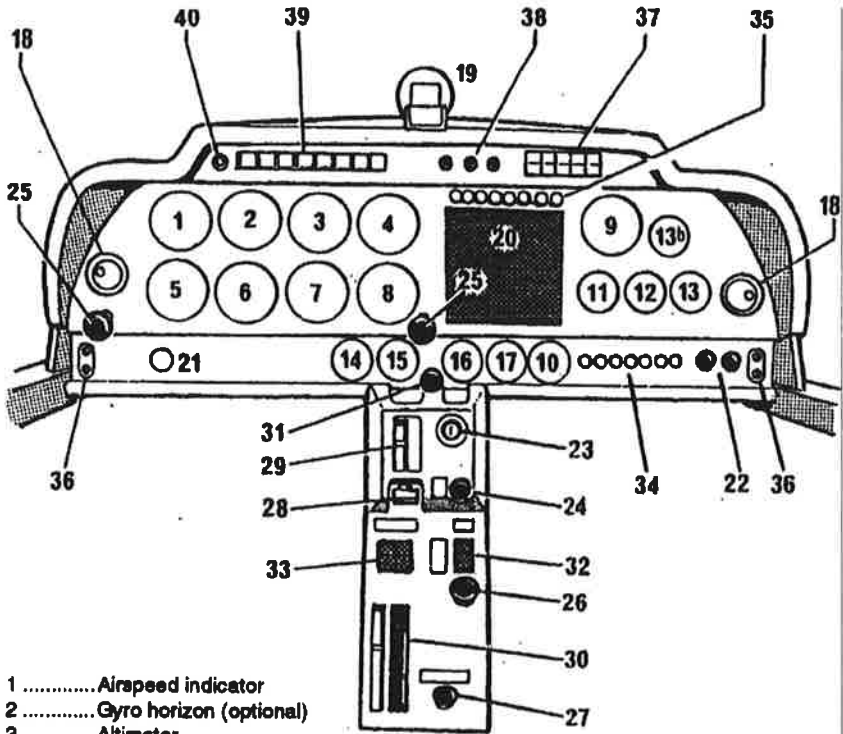
## Instrument Panel (SN 001-264)



- |   |                                |
|---|--------------------------------|
| 1 - Stop watch (option)   | 15 - Fuel content indicator    |
| 2 - A.S.I.  | 15 - Fuel pressure (optional)  |
| 3 - Artificial horizon  | 16 - Fresh air vent            |
| 4 - Altimeter   | 17 - Throttle control          |
| 5 - Bank/turn indicator   | 18 - Radio jack plugs          |
| 6 - Directional (optional)  | 19 - Switches-circuit breakers |
| 7 - Rate of climb indicator   | 20 - Handbrake                 |
| 8 - RPM indicator   | 21 - Circuit breakers          |
| 9 - Outside temp. indicator   | 22 - Heating / demisting       |
| 10 - Options: cylinder temp<br>air temp (carb), EGT<br>accelerometer, or<br>hour counter. | 23 - Warning lights (optional) |
| 11 - Vacuum gauge   | 24 - Fuel shut-off control     |
| 12 - Oil temperature indicator  |                                |
| 13 - Oil pressure indicator   |                                |
| 14 - Amp or Voltmeter   |                                |



## Instrument Panel (SN 265 and on)



- 1 ..... Airspeed indicator
- 2 ..... Gyro horizon (optional)
- 3 ..... Altimeter
- 4 ..... Optional equipment
- 5 ..... Turn coordinator (turn and bank indicator optional)
- 6 ..... Directional gyro (optional)
- 7 ..... Rate of climb indicator (optional)
- 8 ..... Tachometer (or optional equipment)
- 9 ..... Optional equipment (or tachometer)
- 10 ..... Fuel pressure
- 11 to 13 .. Optional equipment
- 14 ..... Oil pressure
- 15 ..... Oil temperature
- 16 ..... Fuel quantity indicator
- 17 ..... Voltmeter
- 18 ..... Cabin ventilators
- 19 ..... Magnetic compass
- 20 ..... COM/NAV (optional)

- 21 ..... Vacuum gauge (optional)
- 22 ..... Cabin heat control
- 23 ..... Magnetos selector switch with starter
- 24 ..... Mixture control
- 25 ..... Throttle control
- 26 ..... Carburetor heat control
- 27 ..... Fuel shut off control
- 28 ..... Flaps control lever
- 29 ..... Flaps position indicator
- 30 ..... Elevator trim tab control wheel
- 31 ..... Parking brake control
- 32 ..... Electric fuel pump switch
- 33 ..... Battery and alternator switch
- 34 ..... Circuit breakers (from L to R):
  - Ancillary systems
  - Flaps
  - Starter
  - Indicators
  - Warning lights
  - Battery
  - Charge
- 35 ..... Fuses (according to optional equipment installed):  
COM/NAV, ATC, alticoder, Intercom, option, panel lighting (under  
glareshield), overhead flood-lights, radio bay lighting
- 36 ..... Mike, Headset-Jack sockets
- 37 ..... Safety switch (from L to R):  
landing -, taxi-, strobe and navigation lights (option), pitot heat (option)
- 38 ..... Panel lighting controls (from L to R):  
1/ on glareshield 2/ panel overhead flood light 3/ radio bay equipment
- 39 ..... Warning lamps (from L to R):  
low oil pressure, low fuel pressure, low fuel level, charge, starter engaged,  
flaps down, 2 warning lamps unused
- 40 ..... Warning lamps test and dimming control

Nota:

Accelerometer: 11 to 13 (or other)

# **Section 8 : Handling, Servicing & Maintenance**

## **Contents**

Ground Handling	8-2
Mooring	8-2
Routine Maintenance	8-2

## Ground Handling

To enable the aircraft to be moved by hand without pushing on the airframe, a tow bar is provided. When steering the aircraft with the tow bar care should be taken to ensure the limit stops are not forced.

### **NOTE**

*The outer two thirds of the propeller and/or spinner should not be used to push against while manoeuvring the aircraft.*

## Mooring

Mooring points are provided under the wings near the tips. The third point is the tail spring fitting. When mooring, the controls should be prevented from moving by utilising the lap straps to secure the control stick. Care should be taken to ensure the controls are not forced by using only sufficient tension to prevent movement of the surfaces in the wind.

## Routine Maintenance

This aircraft is to be maintained in accordance with section 3 of the R2000 Service Manual.

Pilot maintenance may be permitted if the Rules of the Civil Aviation Authority of the country in which the aircraft is operated provides for such maintenance.

# Section 9 : Supplements

## Contents

Supplement 1: Night VFR Equipment.....	9-3
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**SUPPLEMENT 1: Night VFR Equipment****Table of Contents**

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Section 4 Normal Procedures	9-5
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**SECTION 1- GENERAL**

The R2160 aircraft can be used in Night VFR during non-icing conditions after implementation of "Modification majeure No. 34". This major modification provides for the installation of an instrument panel lighting system.

List of compulsory regulation equipment to enable NIGHT VFR flight.

- Artificial horizon
- Turn indicator (ball, needle)
- Directional gyro
- Vertical speed indicator
- Navigation lights
- Flashing beacon (anti-collision)
- Landing light
- Instrument panel adjustable lighting
- Electrical torch
- Night VFR placard
- Cat. 2 VHF
- Car. 2 VOR or radio compass
- Spare fuses

**SECTION 2- LIMITATIONS**

The limitations applicable to the NIGHT VFR aircraft are identical to those applicable to the standard aircraft, as indicated in Section 2 of this manual.

The following warning plate must be fixed on the instrument panel:

<p><b>NIGHT and DAY VFR in NON-ICING conditions</b></p>
---

**SECTION 3- EMERGENCY PROCEDURES**

The following procedures supplement those applicable to the standard aircraft described in Section 3.

**Lighting Failure**

Lighting 2..... on  
 Lighting 1 fuse..... verify

If the failure persists, the lighting 2 and torch can be used as emergency lighting.



### **Landing Lights Failure**

Taxi lighting switch-type circuit breaker..... verify  
Landing without lights does not raise any particular difficulties.

### **Battery Failure**

If the ammeter or voltmeter display is abnormal:

- Check the charge circuit breaker: if set, trip it. If tripped, try to reset it once
- When the circuit breaker is finally tripped, switch off the navigation lights. Switch off one by one all items of electrical equipment not essential for the continuation of the flight.

### **Total Electrical Failure**

Check all the switches, as well as the charge and alternator circuit breakers.

If the charge circuit breaker alone has tripped:

- Switch off the electrical equipment not essential for the continuation of flight.
- Reset the charge circuit breaker.

If the circuit breaker and switches are in position:

- Trip the charge and alternator circuit breakers.
- Switch off all electrical equipment and, if required, use the emergency electrical torch.

## **SECTION 4- NORMAL PROCEDURES**

These procedures supplement those applicable to the standard aircraft described in Section 4.

### **Preparation**

Study the metrological report to avoid flying in dangerous conditions (min. visibility, icing....)

Check fuel tank contents to ensure that regulations are observed.

**Preflight**

Check the operation of:

- Flashing beacon.
- Navigation lights.
- Cabin and instrument panel lighting.
- Landing light
- Make sure that an emergency electrical torch is present and in working order.

**Taxiing**

Flashing beacon, navigation light ..... on  
 Landing light..... on  
 Gyroscopic instruments ..... check operation  
 Horizon..... set model – horizontal bar  
 Directional gyro ..... correct rotation  
 Ball/needle ..... correct direction

**Before Take-Off**

Vacuum pressure for instruments ..... check  
 VHF equipment ..... test  
 VOR or radio compass equipment..... test  
 Heating – demisting ..... as required

**Take-Off**

Vertical speed indicator..... keep positive  
 At night, switch off the landing lights at the end of the runway.

**Climbing and Cruising**

It must be remembered that above 8000 ft the pilot may experience night vision trouble.

**Use of Lighting Equipment**

General lighting system 1 (adjust brightness as required) ..... switch on  
 Adjust with general lighting system 2

**SECTION 5- PERFORMANCE**

Unchanged.

**SECTION 6- WEIGHT & BALANCE**

Unchanged.

<b>SUPPLEMENT 2: CENTURY II B Autopilot Roll Stabilizer</b>
---

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## SECTION 1- GENERAL

The CENTURY II B is an all electric, single axis (roll) autopilot system. It provides course intercept, tracking and coupler for VOR/ILS optional equipment.

Operational procedures for the autopilot system are detailed in the pilot's guide furnished with the instrument.

## SECTION 2- LIMITATIONS

Do not use the roll stabilizer during take-off or landing.

Minimum use height ..... 500ft  
 Maximum use speed ..... 260 km/h (140 kts )

### IMPORTANT

Do not use the roll stabilizer in case of Directional Gyro, vacuum pump or system failure

## SECTION 3- EMERGENCY PROCEDURES

In case of incorrect operation, the roll stabilizer may be disengaged either by means of the push-button located on the control stick, or by means of the main switch located on the control console.

Furthermore, the stabilizer may be easily overridden by actuating the manual flight controls.

## SECTION 4- NORMAL PROCEDURES

### Pre-flight Checks.

With Engine running and gyro operating:

Vacuum pressure ..... 4.75 – 5.0 in Hg  
 Mode selector ..... HDG  
 Turn control knob and heading indicator ..... central  
 Auto-pilot ..... on  
 Turn control knob ..... L/R  
 Control stick movement correct ..... checked  
 Heading mode ..... on  
 Heading selector ..... L/R  
 Control stick movement correct ..... checked  
 A.P. release button ..... pressed  
 A.P. disengaged ..... checked

**Before Take-off and Landing**

Stabilizer main switch on OFF

**Climb, Cruise, and Descent**

Elevator trim..... set  
 Wings horizontal ..... checked  
 Turn control knob..... central  
 HDG mode..... selected  
 Heading selector..... central  
 A.P. .... engaged  
 Navigation mode..... selected

**NOTE**

To fly horizontally and without any heading drift, ensure that the stabilizer trim is correctly set and keep the ball of the indicator perfectly central.

**SECTION 5- PERFORMANCE**

Unchanged.

**SECTION 6- WEIGHT & BALANCE**

Refer to Weight and Balance data detailed in modification accomplishment instructions.

**SUPPLEMENT 3: Aircraft without Wheel Spats****Table of Contents**

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**SECTION 1- GENERAL**

Removal of the wheel spats is permitted.

**SECTION 2- LIMITATIONS**

Unchanged.

**SECTION 3- EMERGENCY PROCEDURES**

Unchanged.

**SECTION 4- NORMAL PROCEDURES**

Unchanged.

**SECTION 5- PERFORMANCE****Take off performance**

The 50 ft (15 m) clearance distance must be increased by 2.1%.

**Climb Performance**

The climb rate must be decreased by 2%.

**Cruise Performance**

Level flight speeds must be decreased by 6%.

**SECTION 6- WEIGHT & BALANCE**

The empty weight must be decreased by the weight of the wheel spats.

The movement of the Centre of Gravity is insignificant.

<b>SUPPLEMENT 4: GPS</b>
--------------------------

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**SECTION 1- GENERAL**

The description of the GPS and the operational procedures are detailed in the GPS pilot's guide furnished with the instrument.

**SECTION 2- LIMITATIONS**

The following placard completes those detailed in Section 2.

**GPS LIMITED TO VFR USE ONLY**

**SECTION 3- EMERGENCY PROCEDURES**

Unchanged.

**SECTION 4- NORMAL PROCEDURES**

Unchanged.

**SECTION 5- PERFORMANCE**

Unchanged.

**SECTION 6- WEIGHT & BALANCE**

Refer to Weight and Balance data detailed in modification accomplishment instructions.

**SUPPLEMENT 5: Enlarged Canopy****Table of Contents**

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**SECTION 1- GENERAL**

In order to improve the habitability of the cockpit, the R2160 can be fitted with an enlarged canopy by the incorporation of "Modification majeure No. 99".

**SECTION 2- LIMITATIONS**

Unchanged.

**SECTION 3- EMERGENCY PROCEDURES**

Speeds must be increased by 5%.

**SECTION 4- NORMAL PROCEDURES**

Unchanged with the addition of

**Spin Recovery**

The spin recovery could equally be accomplished by following the optional procedure:

- Throttle..... idle
- Flaps ..... up
- Rudder ..... fully opposed to direction of spin
- Elevator control..... full forward until rotation stops
- Ailerons ..... neutral

**SECTION 5- PERFORMANCE**

Unchanged.

**SECTION 6- WEIGHT & BALANCE**

Refer to Weight and Balance data detailed in modification accomplishment instructions.

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