

# *Sling LSA*

SERIAL NO : \_\_\_\_\_

REGISTRATION : \_\_\_\_\_



DC-POH-002-X-A-8

PILOT OPERATING HANDBOOK



DATE: 02 JUNE 2022

REVISION 3.2

SLING AIRCRAFT | HANGAR 8 TEDDERFIELD AIR PARK, JHB SOUTH, EIKENHOF, 1872  
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**Airplane model:** Sling LSA

**Manufacturer:** Sling Aircraft (Pty) Ltd

**Airplane Serial Number:** .....

**Date of Construction:** .....

**Registration:** .....

**Airworthiness Category:** Light-Sport Aircraft (LSA)

**Issue Date of POH:** 2022/06/02

*Please advise Sling Aircraft upon change of ownership of this aircraft.*

This airplane must be operated in compliance with information and limitations contained herein. This pilot operating handbook must be available on board of the airplane at all times.

**NOTICE**

This manual is written for the standard 912 iS powered Sling LSA, as manufactured on premises by Sling Aircraft (Pty) Ltd. Differences applicable to the standard 912 iS powered Sling LSA, such as a 912 ULS powered Sling LSA, are included in a supplement in Section 9 of this handbook.

Aircraft which differ from the production standard, in whatever way, are not addressed in this manual, except to the extent said aircraft corresponds with the production standard.

**NOTICE**

This manual, although written to accommodate all regions' regulations, may contain specific references to South African regulations. Therefore, the manual can be regarded as a manual accordingly consistent with RSA regulations only.

## **Compliance Statement**

The ASTM Standards used for the design, construction, and continued airworthiness for the Sling LSA are:

- ASTM F2245 – Specification for Design and Performance of a Light Sport Airplane
- ASTM F2295 – Practice for Continued Operational Safety Monitoring of a Light Sport Aircraft
- ASTM F2972 – Specification for Light Sport Aircraft Manufacturer’s Quality Assurance System

Quality Assurance records are stored with the manufacturer in South Africa, at the address below:

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## Continued Operational Safety Monitoring

### Manufacturer Responsibilities:

Sling Aircraft has a procedure in place to monitor the safety of the fleet and to alert pilots of any potential safety issues. The owner of a Light-Sport Aircraft is responsible for making sure they receive pertinent safety information and complying with bulletins. The owner of a Light-Sport Aircraft is also responsible for alerting the manufacturer of any potential flight safety issues they may encounter.

### Owner/Operator Responsibilities:

- Each owner/operator of an LSA shall read and comply with the maintenance and continued airworthiness information, along with all instructions provided by the manufacturer.
- Each owner/operator of an LSA shall be responsible for providing the manufacturer with current contact information, where the manufacturer may send the owner/operator supplemental notification bulletins/letters.
- The owner/operator of an LSA shall be responsible for notifying the manufacturer of any flight safety issues or significant service difficulty, upon discovery.
- The owner/operator of an LSA shall be responsible for complying with all manufacturer issued notices of corrective action and with all applicable aviation authority regulations, with regards to maintaining the airworthiness of the LSA.
- The owner of an LSA shall ensure that any needed corrective action be completed as specified in a bulletin/letter/notice, or by the next scheduled annual inspection.
- Should an owner/operator not comply with any mandatory service requirements, the LSA shall be considered not in compliance with applicable ASTM standards and may be subject to regulatory action by the presiding aviation authority in the respective region.

## Record of Revisions

Any revisions to this Pilots Operating Handbook must be recorded in the following table and, where applicable, be endorsed by the responsible airworthiness authority.

Revision numbers and dates appear at the foot of each page.

Rev. No.	Affected Section	Affected Pages	Date of Issue	Approved by	Sign
1.1	All	All	2011/04/20		
1.2	All	All	2012/03/12		
1.3	All	All	2012/05/10		
2.0	All	All	2012/06/04		
2.1	2	7	2012/09/01		
2.2	All	All	2012/11/01		
2.3	All	All	2014/11/10		
2.4	2	2-10/2-11	2015/03/30		
2.5	1, 2, 4, 6, 7	All	2018/09/21		
3.0	All	All	2021/04/23		
3.1	2.1	2-6	2022/04/01		
3.2	2.14	2-9	2022/06/02	JAMES PITMAN	<i>JALPitman</i>

## List of Manual Revisions

Page	Page Status	Latest Revision
i	Revised	3.0
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# 1 General Information

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## 1.1 Introduction to Airplane

The Sling LSA is a two seat (side-by-side), single engine, tricycle undercarriage, aluminium aircraft with a conventional low wing design and is compliant with the requirements of the FAA Light Sport Aircraft (LSA) category according to ASTM Standards F2245, F2279 and F2295.

The aircrafts design is based on ASTM 2245 certification standards and has a maximum all up weight of 600kg (1,320lb). The design has been tested against and complies with this standard.

With only minor modifications to the aircraft and the application of a revised Pilot Operating Handbook, the aircraft may be made to comply with the requirements of the EASA (*European Aviation Safety Agency*) CS-VLA (*Certification Standard Very Light Aircraft*) standard, having a maximum all up weight of 700 kg (1543 lb).

The Sling LSA is primarily intended for recreational and cross-country flying. It is not intended for aerobatic operation. It is considered to be suitable for use as a trainer. This Pilot Operating Handbook has been prepared to provide pilots with information for the safe and effective operation of the Sling LSA.

## 1.2 Warnings, Cautions and Notes

The following definitions apply to warnings, cautions and notes in the Pilot Operating Handbook.

### WARNING

*Warning* – Indicates that non-observation of the corresponding procedure leads to a serious and immediate degradation of flight safety.

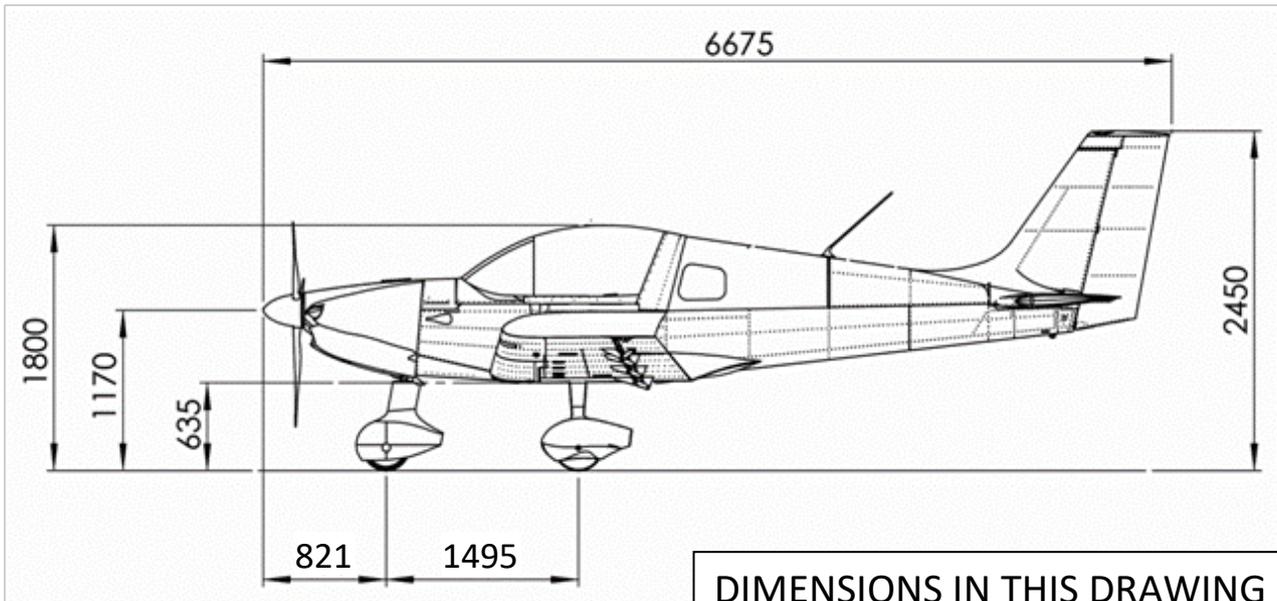
### CAUTION

*Caution* – Indicates that non-observation of the corresponding procedure leads to minor and possible long-term degradation of flight safety.

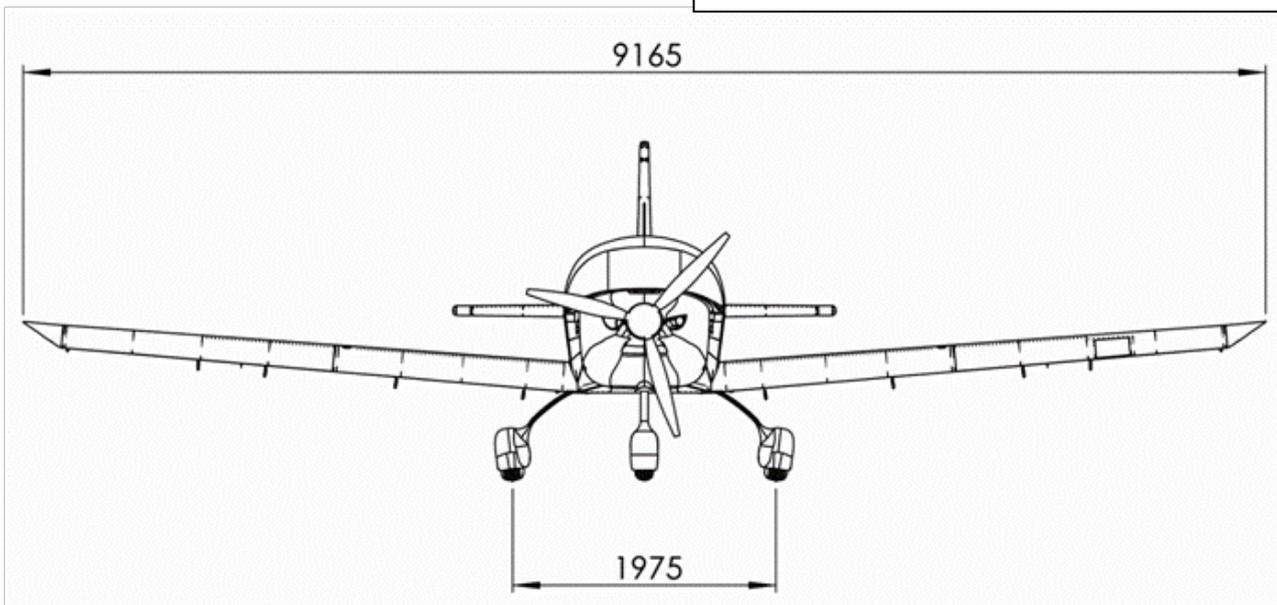
### NOTE

*Note* – Draws special attention to any item that is not related to safety but is still important or unusual.

### 1.3 Aircraft 3-View Drawing

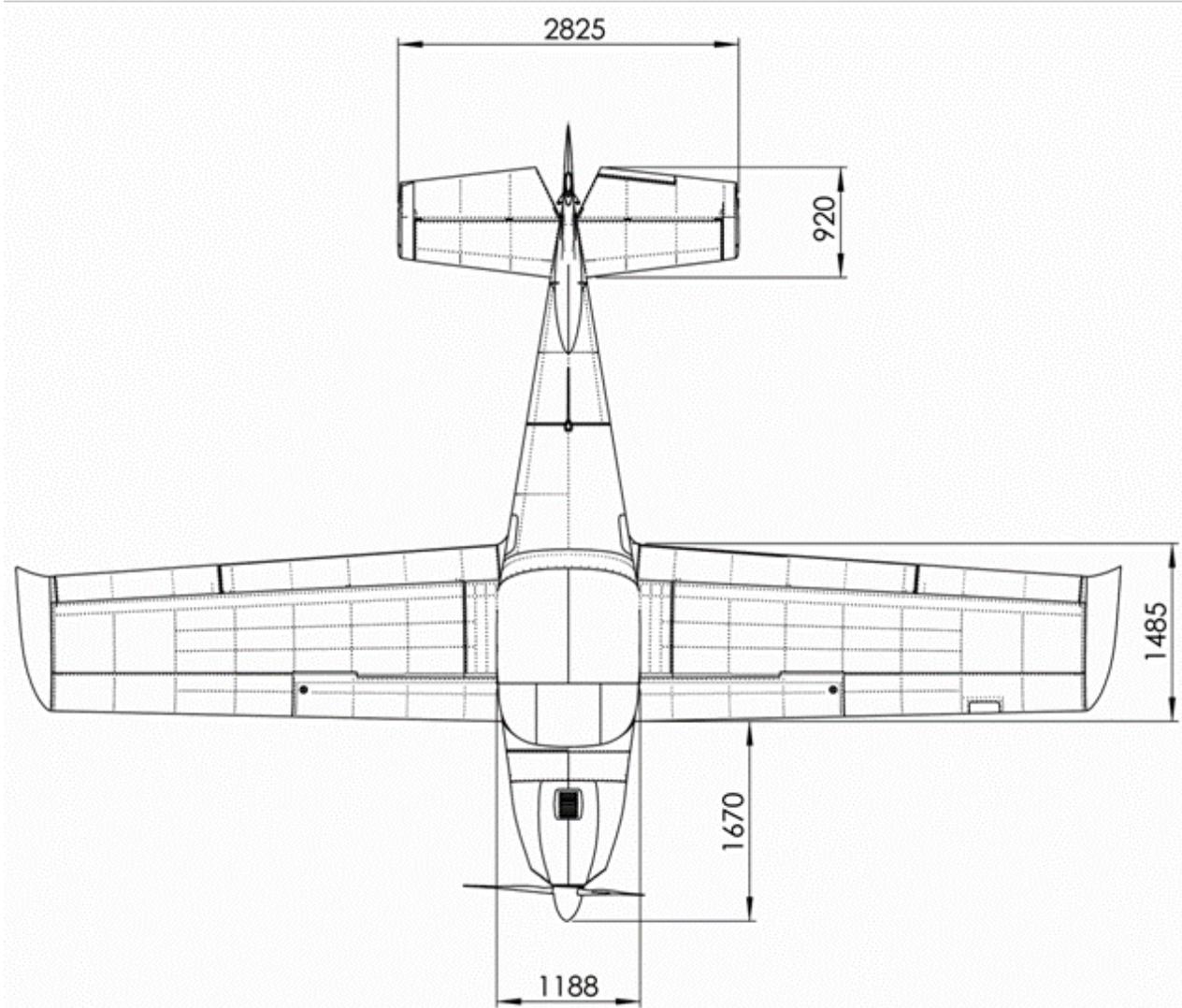


DIMENSIONS IN THIS DRAWING ARE IN MILLIMETRES.



#### CAUTION

Do not use these values for weight and balance, as they are overall dimensions for illustration purposes and do not use the prescribed reference plane.



DIMENSIONS IN THIS DRAWING  
ARE IN MILLIMETRES.

## 1.4 Data for Sling LSA Aircraft and Systems

### 1.4.1 Wing

Parameter	Value
Wingspan	9.165 m / 30ft. 0.8in.
Mean Aerodynamic Chord	1.339 m / 52.7 in.
Wing Surface Area	11.845 m <sup>2</sup> / 127.55 ft <sup>2</sup>
Wing Loading	59.10 kgm <sup>-2</sup> / 11.7 lbs/ft <sup>2</sup>
Aspect Ratio	7.04
Taper Ratio	1.375
Dihedral	5°

### 1.4.2 Fuselage

Parameter	Value
Fuselage Length	5.77 m / 18ft. 11in.
Overall Length	6.675 m / 21ft. 11in.
Overall Width	1.15 m / 45.3 in.
Overall Height	2.5 m / 98.4 in.

### 1.4.3 Empennage

Parameter	Value
Horizontal Stabilizer Span	2.825 m / 9ft. 3in.
Horizontal Stabilizer Surface Area	0.96 m <sup>2</sup> / 10.33 ft <sup>2</sup>
Horizontal Stabilizer Angle of Incidence	-4°
Elevator Surface Area	1.02 m <sup>2</sup> / 10.98 ft <sup>2</sup>
Vertical Stabilizer Span	1.47 m / 4ft. 10in.
Vertical Stabilizer Surface Area	0.53 m <sup>2</sup> / 5.70 ft <sup>2</sup>
Rudder Surface Area	0.59 m <sup>2</sup> / 6.35 ft <sup>2</sup>

### 1.4.4 Landing Gear

Parameter / Item	Value
Wheel Track	1.95 m / 6ft. 5in.
Wheelbase	1.41 m / 4ft. 6in.
Brake Type	Hydraulic
Main Gear Tyres	15x6.00-6; 6-ply (2.2 bar / 32 psi)
Nose Wheel Tyres	5.00-5; 6-ply (1.8bar / 26 psi)

### 1.4.5 Control Surface Travel Limits

Parameter	Value
Ailerons	24° up / down ( $\pm 2^\circ$ )
Elevator	30° up / down ( $\pm 2^\circ$ )
Trim Tab	5° up / 20° down ( $\pm 5^\circ$ )
Rudder	25° left / right ( $\pm 2^\circ$ )
Flaps	0° up / 32° down ( $\pm 3^\circ$ )

### 1.4.6 Engine

Parameter / Item	Value
Manufacturer	Bombardier-Rotax GmbH
Model	912 iS
Type	4-cylinder, horizontally opposed, with an overall displacement of 1352cc, mixed cooling, fuel injection, integrated reduction gearbox with torque damper (see 7.11 Engine).
Maximum Power	73.5 kW (100 hp) at 5,800 rpm (max. 5 minutes) 69 kW (93 hp) at 5,500 rpm (continuous)
Gearbox Ratio	2.43 Reduction (from engine to propeller)
Alternative	<i>For a Sling LSA fitted with the 912 ULS engine, please refer to the applicable supplement at the end of this manual.</i>

### 1.4.7 Propeller

Parameter / Item	Value
Manufacturers	Warp Drive, Whirlwind, Sensenich
Number of Blades	3
Diameter	1.78-1.83 m / 70-72 in.
Material/Type	Composite

### 1.4.8 Fuel

Parameter / Item	Value
Fuel Grade: Anti-Knock	Minimum RON 95
Fuel Grade: MOGAS	EN 228 Super EN 228 Super Plus
Fuel Grade: AVGAS	AVGAS 100 LL (ASTM D910)
Fuel Tanks	<p><b>South Africa</b> – One tank integrated in the leading edge of the <i>right</i> wing.</p> <p><b>International/US</b> – Two tanks integrated in the leading edges of <i>both</i> wings.</p> <p><b>Both</b> – Tank(s) equipped with finger strainers (in the pick-up line) and drain fittings</p>
Total Fuel Capacity	South Africa – 75 L (19.8 US Gallons) International/US – 150 L (39.6 US Gallons)
Total Useable Fuel Capacity	South Africa – 73 L (19.3 US Gallons) International/US – 146 L (38.6 US Gallons)
Total Tank Capacity	75 litres (19.8 US gallons) per tank
Total Tank Useable Fuel	73 litres (19.3 US gallons) per tank
<i>Alternative</i>	<i>For Sling LSA fitted with the 912 ULS engine, please refer to the applicable supplement at the end of this manual.</i>

### 1.4.9 Oil System

Parameter / Item	Value
Oil System Type	Forced with external oil reservoir
Oil Grade	Automotive grade API “SG” type oil, or higher, preferably synthetic, or semi-synthetic. When operating on unleaded fuels or MOGAS, fully synthetic oil is recommended. Conventional aircraft oils (a.d. = ashless dispersant) are not suitable. <i>(Refer to the latest revision of the engine operator’s manual for more)</i>
Oil Viscosity	Multi-grade oils are recommended
Oil Capacity	Approx. 3.5 litres (3.7 Quarts/7.4 pints) from dry

### 1.4.10 Cooling

Parameter / Item	Value
Cooling System	<i>Mixed</i> – Air and closed-circuit pressurized liquid. Air cooled cylinders and liquid cooled cylinder heads.
Coolant	Ethylene glycol-based coolant mixed 1:1 with distilled water.
Coolant Capacity	Approx. 2.5 litres (2.64 quarts / 5.28 pints)
<i>Alternative</i>	<i>For Sling LSA fitted with the 912 ULS engine, please refer to the applicable supplement at the end of this manual.</i>

### **1.4.11 Maximum Weights**

<b>Parameter</b>	<b>Value</b>
Maximum Take-off Weight	600 kg (1,320 lb.)
Maximum Landing Weight	600 kg (1,320 lb.)
Maximum Baggage Weight	15 kg (33 lb.)
Front Luggage Compartment Max. Weight	15 kg (33 lb.)
Rear Luggage Compartment Max. Weight	15 kg (33 lb.)

### **1.4.12 Standard Weights**

<b>Parameter</b>	<b>Value</b>
Standard Configuration Empty Weight	370 kg (814 lb.)
Maximum Useful Load	230 kg (506 lb.)

### **1.4.13 Specific Loadings**

<b>Parameter</b>	<b>Value</b>
Wing Loading ( <i>MAUW</i> )	50.65 kg/m <sup>2</sup> (10.0 lb/ft <sup>2</sup> )
Power Loading ( <i>MAUW</i> )	6.00 kg/kW (13.2 lb/hp)

## 1.5 Terminology, Symbols and Conversion Factors

### 1.5.1 General Terminology

Acronym	Description
AC	Alternating Current
AHRS	Attitude and Heading Reference System
AKI	Anti-Knock Index
ALT	Altimeter
API	American Petroleum Institute
ASI	Airspeed Indicator
AVGAS	Aviation Gasoline
COM	Communication (Radio)
EFIS	Electronic Flight Information System
FAA	Federal Aviation Authority
FAR	Federal Aviation Regulations
GLS	GPS Landing System
GmbH	Gesellschaft mit beschränkter Haftung ( <i>company with limited liability</i> )
GPS	Global Positioning System
IFR	Instrument Flying Rules
IMC	Instrument Meteorological Conditions
LE	Leading Edge
LED	Light Emitting Diode
MOGAS	Automobile (car) Gasoline
MON	Motor Octane Number
NGL	Normal Ground Line
NRV	Non-Return Valve
POH	Pilot Operating Handbook
PTT	Push-To-Talk (Button)
RSA	Republic of South Africa
RON	Research Octane Number
VFR	Visual Flying Rules
VMC	Visual Meteorological Conditions
VSI	Vertical Speed Indicator

### 1.5.2 *Speed and Performance Terminology*

<b>Acronym</b>	<b>Description</b>
<i>IAS</i>	Indicated Airspeed.
<i>KCAS</i>	Calibrated Airspeed – the indicated airspeed corrected for position and instrument error, expressed in knots.
<i>KIAS</i>	Indicated Airspeed – the speed shown on the airspeed indicator, expressed in knots.
<i>KTAS</i>	True Airspeed – the airspeed of the aircraft relative to the undisturbed air through which it passes.
<i>TAS</i>	True Airspeed.
<i>V<sub>A</sub></i>	Manoeuvring speed.
<i>V<sub>BG</sub></i>	Best Glide Speed – the speed ( <i>at MAUW</i> ) which results in the greatest gliding distance for loss in unit altitude.
<i>V<sub>FE</sub></i>	Maximum Flap Extended Speed – the highest speed permissible with wing flaps deployed.
<i>V<sub>H</sub></i>	Maximum Speed – the maximum speed in level flight at maximum continuous power.
<i>V<sub>LOF</sub></i>	Lift-off Speed – the speed at which the aircraft generally lifts off from the ground during take-off.
<i>V<sub>NE</sub></i>	Never Exceed Speed – the speed that may not be exceeded at any time.
<i>V<sub>NO</sub></i>	Maximum Structural Cruising Speed – the speed that should not be exceeded, except in smooth air, and then only with caution.
<i>V<sub>REF</sub></i>	Reference Speed – the indicated airspeed, at 15 m (50 ft) above threshold, which is not less than 1.3V <sub>SO</sub> .
<i>V<sub>ROT</sub></i>	Rotation Speed – The speed at which the aircraft should be rotated about the pitch axis during take-off (i.e., the speed at which the nose wheel is lifted off the ground).
<i>V<sub>S</sub></i>	Stall Speed – the speed at which the aircraft stalls, at <i>MAUW</i> , engine idling, flaps fully retracted.
<i>V<sub>SO</sub></i>	Stall Speed – the speed at which the aircraft stalls in the landing configuration, at <i>MAUW</i> , engine idling, flaps fully down.
<i>V<sub>X</sub></i>	Best Angle of Climb Speed – the speed (at <i>MAUW</i> , flaps fully retracted) which results in the greatest altitude gain over a given horizontal distance (i.e., highest climb angle).
<i>V<sub>Y</sub></i>	Best Rate of Climb Speed – the speed (at <i>MAUW</i> , flaps fully retracted) which results in the greatest altitude gain over a given time period.

### **1.5.3 Meteorological Terminology**

<b>Acronym</b>	<b>Description</b>
<i>ISA</i>	International Standard Atmosphere
<i>QNH</i>	The local pressure setting that if set on the subscale of an altimeter, the altimeter will indicate local altitude above mean sea level.
<i>QFE</i>	The local airfield pressure setting that if set on the subscale of an altimeter, the altimeter will indicate local altitude above the airfield.
<i>QNE</i>	The barometric pressure used for the standard altimeter setting (1013 hPa / 29.92 in. Hg)

### **1.5.4 Engine Terminology**

<b>Acronym</b>	<b>Description</b>
<i>CHT</i>	Cylinder Head Temperature.
<i>EGT</i>	Exhaust Gas Temperature.
<i>OHV</i>	Overhead Valve.
<i>RPM</i>	Revolutions per Minute.
<i>Coolant Temperature</i>	Temperature of the coolant as it leaves the cooling jacket of cylinder head 4.

### **1.5.5 Airplane Performance and Flight Planning Terminology**

<b>Terminology</b>	<b>Description</b>
<i>Crosswind Component</i>	The velocity of the crosswind component during take-off and landing.
<i>G</i>	The acceleration / load factor.
<i>Landing Run</i>	The distance measured during landing from actual touchdown to the end of the landing run.
<i>Landing Distance</i>	The distance measured during landing from clearance of a 15 m obstacle (in the air) to the end of the landing run.
<i>Take-off Run</i>	The take-off distance measured from the actual start of the take-off run to clearance of a 15 m (50 ft) obstacle (in the air).
<i>Take-off Distance</i>	The take-off distance measured from the actual start of the take-off run to clearance of a 15 m (50 ft) obstacle (in the air).
<i>Useable Fuel</i>	The fuel available for flight planning.

### **1.5.6 Weight and Balance Terminology/Symbols**

<b>Terminology</b>	<b>Description</b>
<i>Arm</i>	The horizontal distance from the reference datum to the centre of gravity / point load of / on the aircraft
<i>CG</i>	Centre of Gravity, being the point at which the airplane would balance if suspended. Value given as distance from the reference datum or as a percentage of MAC, and has minimum and maximum permissible values.
<i>Datum</i>	The reference datum is an imaginary vertical plane from which all horizontal distances are measured for weight and balance purposes. The Sling LSA datum is the forward, flat propeller mounting flange on the Rotax engine
<i>Empty Weight</i>	The weight of the airplane with engine fluids at operating levels.
<i>MAC</i>	Mean Aerodynamic Chord. The average chord value of the main wing.
<i>MAUW</i>	Maximum All Up Weight or Maximum Takeoff Weight. Maximum permissible weight approved for takeoff/flight
<i>Maximum Landing Weight</i>	The maximum weight approved for the landing touch down
<i>Moment</i>	The product of the weight of an item multiplied by its arm
$W_R$	Weight reading from scale under right main wheel during aircraft weighing
$W_L$	Weight reading from scale under left main wheel during aircraft weighing
$W_N$	Weight reading from scale under nose main wheel during aircraft weighing
$W_E$	Aircraft empty weight
$W_T$	Aircraft total weight
$L_R$	Right main wheel arm (aft of reference)
$L_L$	Left main wheel arm (aft of reference)
$L_N$	Nose wheel arm (aft of reference)
$M_T$	Total moment arm

### 1.5.7 Useful Conversion Factors

<i>Imperial</i>		<i>Metric</i>	
<i>pound</i>	<i>1</i>	0.4536	kilogram
<i>pound per square inch</i>	<i>1</i>	6.895	kilopascal
<i>inch</i>	<i>1</i>	25.4	millimetres
<i>foot</i>	<i>1</i>	0.3048	meters
<i>statute mile</i>	<i>1</i>	1.609	kilometres
<i>nautical mile</i>	<i>1</i>	1.852	kilometres
<i>millibar</i>	<i>1</i>	1	hectopascal
		0.1	kilopascal
<i>imperial gallon</i>	<i>1</i>	4.546	litres
<i>US gallon</i>	<i>1</i>	3.785	litres
<i>US quart</i>	<i>1</i>	0.946	litres
<i>cubic foot</i>	<i>1</i>	28.317	litres
<i>°F</i>		$(1.8 \times \text{°C}) + 32$	
$(\text{°F} - 32) \times \left(\frac{5}{9}\right)$		<i>°C</i>	

## 1.6 Supporting Documents

The following documents are regards as supporting documents to this Pilot Operating Handbook:

1. For aircraft fitted with the 912 iS engine
  - a. *The latest revision* of the Operators Manual for Rotax® Engine Type 912 Series, ref. no.: OM-912 i
  - b. Latest Revision of the Rotax® service instruction SI-912i-001, entitled “Selection of Suitable Operating Fluids”.
2. For aircraft fitted with the 912 ULS engine
  - a. *The latest revision* of the Operators Manual for Rotax® Engine Type 912 Series, ref. no.: OM-912
  - b. *Latest Revision* of the Rotax® service instruction SI-912-016, entitled “Selection of Suitable Operating Fluids”.
3. Garmin G3X
  - a. *The latest revision* Operators Manual for the Garmin G3X.
4. COM Radio, transponder and any other relevant equipment fitted to the aircraft.
  - a. *The latest revision* of the relevant equipment
5. Stratos 07 Magnum ballistic parachute (Optional)
  - a. *The latest revision* of the Stratos 07 Magnum ballistic parachute operator’s manual.

Reference should be made to these documents for operational guidelines and instructions. These should be incorporated into the normal and emergency procedures for the aircraft where applicable.

## 2 Limitations

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## 2.1 Introduction

This section includes operating limitations, instrument markings and placards necessary for the safe operation of the Sling LSA, its engine, systems, and equipment.

## 2.2 Airspeed Limitations

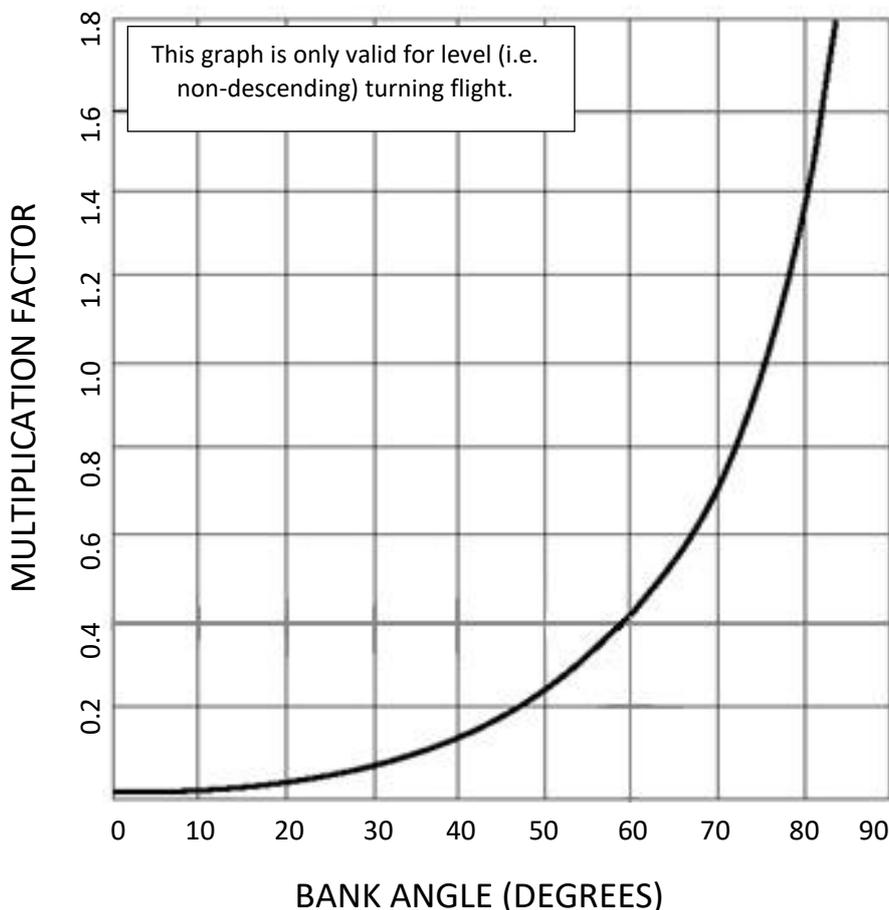
Speed		KIAS	Remarks
$V_{NE}$	Never Exceed Speed	135	Never exceed this speed in any operation.
$V_{NO}$	Maximum Structural Cruising Speed	110	Never exceed this speed unless in smooth air, and then only with caution.
$V_A$	Manoeuvring Speed	91	Do not make full or abrupt control movements above this speed, as this may cause stress in excess of limit load factor.
$V_{FE}$	Maximum Flap Extended Speed	85	Never exceed this speed unless the flaps are fully retracted.
$V_H$	Maximum Speed in Level Flight	118	Never exceed this speed in level flight, at MAUW.
$V_S$	Stall Speed	45	The aircraft will stall at this speed with flaps fully retracted, at MAUW in the most forward CG configuration and engine idling.
$V_{SO}$	Stall Speed in Landing Configuration	40	The aircraft will stall at this speed with full flap, at maximum all up weight in the most forward CG configuration and engine idling.

## 2.3    **Airspeed Indicator Markings**

<b>MARKING</b>	<b>KIAS</b>	<b>SIGNIFICANCE</b>
White Arc	40-85	Flap Operating Range Lower Limit - $V_{S0}$ (At MAUW) Upper Limit - $V_{fe}$ (Max. flap operation speed)
Green Arc	45-105	Normal Operating Range Lower Limit - $V_S$ (At MAUW, max forward CG) Upper Limit - $V_{NO}$ (Max. Structural Speed)
Yellow Arc	105-135	Manoeuvres must be conducted with caution and only in smooth air.
Red Line	135	Maximum speed for all operations.

## 2.4 Stall Speed Adjustment for Turning Flight

Stall speeds listed earlier in this section are for straight and level flight, at a load factor of 1g. Speeds should be adjusted for turning flight or increased load factor.



$$V_T = V + (V \times \text{Multiplication Factor})$$

- V is straight and level stall speed (at load factor = 1 g).
- $V_T$  is stall speed in turn (non-descending).

$$V_{ST} = V\sqrt{N}$$

- V is straight and level stall speed (at load factor = 1 g).
- $V_{ST}$  is stall speed due to increased load factor.
- N is (positive) load factor.

## 2.5 Crosswind and Wind Limitation (*Demonstrated*)

Item	Value
Maximum demonstrated crosswind component for take-off and landing	15 kts

## 2.6 Service Ceiling

Item	Value
Service Ceiling	12,000 ft. / 3658 m

## 2.7 Load Factors

Item	Value
Maximum positive limit load factor	+4g
Maximum negative limit load factor	-2g
Maximum positive load factor <i>with flap</i>	+2g
Maximum negative load factor <i>with flap</i>	-1g

## 2.8 Weights

Item	Value
Maximum take-off weight (MAUW)	600kg / 1,320 lb.
Maximum landing weight	600kg / 1,320 lb.
Maximum total baggage weight	15kg / 33 lb.
Front luggage compartment max. weight	15kg / 33 lb.
Rear luggage compartment max. weight	15kg / 33 lb.

## 2.9 Centre of Gravity Range

Item	Value
Datum	Centre of front face of engine propeller flange ( <i>without propeller extension</i> ).
Reference (Longitudinal Levelling)	Upper surface of canopy sliders on cockpit side skins, with canopy open.
Reference (Transverse Levelling)	Upper surface of centre spar cap under pilot and passenger seats.
Forward Limit	1.635 m / 5.364 ft. (20% MAC) aft of datum
Aft/Rear Limit	1.808 m / 5.931 ft. (33% MAC) aft of datum

**WARNING**

It is the pilot's responsibility to ensure that the airplane is properly loaded. Refer to Section 6 Weight and Balance for more information.

## 2.10 Prohibited Manoeuvres

The Sling LSA is approved for normal manoeuvres, including the following:

- Steep turns not exceeding 60°
- Lazy Eights
- Chandelles
- Stalls (not including whip stalls)

### WARNING

Aerobatics and intentional spins are prohibited.

### WARNING

Limit load factor would be exceeded by moving flight controls abruptly to their limits at a speed above  $V_A$  (91 KIAS – manoeuvring speed).

## 2.11 Flight Crew

Minimum crew for flight is one pilot seated on the left side.

## 2.12 Passengers

Only one passenger is allowed on board the aircraft (*in addition to the pilot*).

## 2.13 Kinds of Operation

### 2.13.1 Normal VFR Operation

The Sling LSA, in standard configuration, is approved only for day VFR operation with visual contact with terrain.

Minimum equipment is as follows:

Equipment
Altimeter, with encoding transponder
Airspeed Indicator
Magnetic Heading Indicator (Compass)
Fuel Gauges
Oil Pressure Indicator
Oil Temperature Indicator
Cylinder Head Temperature Indicator
Outside Air Temperature Indicator
Tachometer
Chronometer
First Aid Kit ( <i>Compliant with Local Authority</i> )
Fire Extinguisher

### 2.13.2 Night Operation

Subject to the legal requirements applicable in the country of registration, the Sling LSA fitted with the following additional equipment, may also be operated at night; provided that operations are at all times conducted in VMC.

Item
Red Beacon / Strobe Lights
Navigation Lights
Landing Light(s). ( <i>Two separate lights or a single light with two independent filaments</i> )
Instrument Panel Lighting

### 2.13.3 IFR Operation

Provided that the aircraft is appropriately equipped, the aircraft may be safely flown under IFR. Depending on the practical and legal requirements of the judicial region the aircraft will be operated, the aircraft may also be safely flown in IMC conditions, in accordance with IFR. It is the responsibility of the aircraft operator to ensure that all legal and safety requirements are met, along with the installation of the required systems and instrumentation for IFR (*and IMC*) flight.

However, in the United States of America, all flights (*VFR and IFR*) are to be conducted in VMC, as per the applicable LSA standards.

#### WARNING

Notwithstanding that installed equipment may include GPS and other advanced flight and navigational aids, such equipment may not be used as the sole information source for purposes of navigation or flight, except where specifically permitted by law. The airplane instrumentation is not certified, and applicable regulations should be complied with at all times.

#### NOTE

Additional equipment may be required to fulfil national or specific requirement, and may be fitted.

## 2.14 Engine Limitations

Instruments reflecting engine parameters should, in each case, be marked / set to reflect the minimum and maximum figures.

Always refer to the *latest edition / revision* of the engine Operators Manual for latest information regarding operating limitations.

### 2.14.1 Engine Start and Operation Temperature Limits

Item	Value
Start - Maximum (Ambient Temperature)	50 °C / 120 °F
Start - Minimum (Oil Temperature)	-20 °C / -13 °F
In Flight – Maximum	60 °C / 140 °F
<i>Alternative</i>	<i>For Sling LSA fitted with the 912 ULS engine, please refer to the applicable supplement at the end of this manual.</i>

### 2.14.2 Engine Load Factor Limits (Acceleration)

Item	Value
Maximum	5 seconds at maximum -0.5g

### 2.14.3 Engine Operational and Speed Limits

Item	Value	
<b>Engine Model</b>	ROTAX 912 iS	
<b>Engine Manufacturer</b>	Bombardier-Rotax GMBH	
<b>Power</b>	Maximum take-off	73.5 kW / 100 hp at 5800 rpm, max. 5 minutes
	Maximum continuous	69 kW / 92 hp at 5500 rpm
<b>RPM</b>	Maximum take-off	5800 rpm, max. 5 minutes
	Maximum continuous	5500 rpm
	Idle	1 400 rpm (minimum)
<b>CHT</b>	Minimum	N/A
	Maximum	135 °C (275 °F)
	Normal	75 to 110 °C (167 to 230 °F)
<b>Oil Temperature</b>	Minimum	50 °C (122 °F)
	Maximum	130 °C (266 °F)
	Normal	90 to 110 °C (194 to 230 °F) <sup>(a)</sup>
<b>EGT</b>	Maximum	950 °C (1742 °F)
<b>Coolant Temperature</b>	Maximum	120 °C (248 °F)
<b>Oil pressure</b>	Minimum	0.8 bar (12 psi) – below 3500 rpm
	Maximum	7 bar (102 psi) – permissible for short period during cold engine start
	Normal	2 to 5 bar (29 to 73 psi) – above 3500 rpm
<b>Fuel Pressure</b>	Minimum	2.8 bar (40.5 psi)
	Maximum	3.2 bar (46.5 psi)
<b>Alternative</b>	<i>For Sling LSA fitted with the 912 ULS engine, please refer to the applicable supplement at the end of this manual.</i>	

**NOTE**

*a. Oil temperature must, once per flight day, exceed 100°C to boil off any moisture that may have collected in the oil.*

## 2.15 Other Limitations

- No smoking is allowed on-board the airplane.
- VFR only flights are permitted unless the operator has equipped the aircraft correctly for IFR flight.

### WARNING

Intentional flights under icing conditions are prohibited!

## 2.16 Flight in Precipitation

Flying through rain should be avoided, but can be achieved with no additional steps. Airplane qualities and performance are not substantially changed. However, VMC should be maintained unless flight is under IFR.

## 2.17 Limitation Placards

The following limitation warning placards must be placed in the aircraft and positioned in plain view of the pilot and passenger.

### 2.17.1 *Instrument Panel*

Standard Sling LSA (excl. USA)
<p><b>OPERATE UNDER VMC ONLY</b> <b>MAXIMUM PERMISSIBLE AIRSPEED 135 KIAS</b> <b>MAXIMUM PERMISSIBLE RPM 5 800 RPM FOR 5 MINUTES</b> <b>MAXIMUM CONTINUOUS RPM 5 500</b> <b>MAXIMUM PERMISSIBLE MASS 600 KG/1,320 LB</b></p>

### 2.17.2 *Visible to Pilot and Passenger*

Standard Sling LSA (excl. USA)
<p><b>WARNING</b> <b>NON-CERTIFIED AIRCRAFT</b> <b>THIS AIRCRAFT IS NOT REQUIRED TO COMPLY WITH ALL THE</b> <b>REGULATIONS FOR TYPE CERTIFIED AIRCRAFT</b> <b>YOU FLY IN THIS AIRCRAFT AT YOUR OWN RISK</b></p>
<p><b>NO SMOKING</b></p>
<p><b>WARNING</b> <b>AEROBATICS AND INTENTIONAL SPINS ARE</b> <b>PROHIBITED</b></p>

**USA Sling LSA**

**PASSENGER WARNING**

**THIS AIRCRAFT DOES NOT COMPLY WITH  
FEDERAL SAFETY REGULATIONS FOR  
STANDARD AIRCRAFT**

**FASTEN SEAT BELTS**

**NO INTENTIONAL SPINS**

**2.17.3 Adjacent to Fuel Filler Cap**

**Standard Sling LSA (excl. USA)**

**AVGAS  
OR  
MOGAS  
75 LITRES**

**USA Sling LSA's**

**— FUEL —  
19.8 U.S. GALS.  
91 OCT. MOGAS  
100LL AVGAS**

### 2.17.4 *Inboard Upper Wing Flap Surface*

All Sling LSA
NO STEP

### 2.17.5 *Fireproof Metal Plate Attached to Aircraft*

Standard Sling LSA (excl. USA)
<p>ZU-###</p> <p>CONSTRUCTOR – SLING AIRCRAFT</p> <p>MODEL – SLING LSA</p> <p>SERIAL NO – ###</p> <p>ENGINE ROTAX ### – ### HP</p> <p>MANUFACTURED - ###</p>

Note:

- ### represents the information applicable to the specific aircraft.
- The registration number (on above plate) is specific to the country of registration. The format shown above is the South African standard.

USA Sling LSA
<p>AIRCRAFT IDENTIFICATION (i.e N123SL)</p> <p>BUILDER – SLING AIRCRAFT (PTY) LTD</p> <p>MODEL – SLING LSA</p> <p>SERIAL NO – ###</p> <p>MADE IN SOUTH AFRICA</p>

### **2.17.6 Other Placards**

The aircraft must be placarded to show the identity of:

- All Fuses / Circuit Breakers
- Magneto / Ignition switches
- Choke (912 ULS only)
- Starter
- Trim: NOSE UP and NOSE DOWN
- Flaps: UP, STAGES (1,2,3), DOWN
- All Other Switches
- Canopy handle OPEN and CLOSED position
- Ballistic parachute deployment handle, if equipped.

## **3 Emergency Procedures**

3.1	Introduction.....	3-1
3.2	Speeds for Emergency Operations.....	3-2
3.3	Engine Related Emergencies.....	3-3
3.4	Emergency Landing Procedures.....	3-7
3.5	Smoke and Fires.....	3-10
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3.7	Other Emergencies .....	3-14

## 3.1 Introduction

This section provides checklists and procedures for coping with various emergencies that may arise.

Emergencies caused by aircraft or engine malfunction are extremely rare if the appropriate procedures are followed, such as pre-flight inspections and general maintenance. Should an emergency arise however, basic guidelines described in this section should be considered and applied accordingly to mitigate the consequences of the emergency.

In case of an emergency, the pilot should remember the following priorities, in order of importance:

1. **FLY THE AIRCRAFT** – Keep control and continue flying.
2. **ANALYSE** – Analyse the situation as a whole, keeping an open mind.
3. **PROCEDURES** – Apply applicable procedures.
4. **COMMUNICATE** – Inform ATC / local traffic of the situation, if time permits.

### **3.1.1 *Rotax 912 iS checklist compatibility to Rotax 912 ULS***

This section will only detail the checklists for aircraft with the Rotax 912 iS powerplant. Aircraft that make use of the 912 ULS must refer to the appendix. If the checklist differs, a note will be made at the start of said checklist.

### 3.2 Speeds for Emergency Operations

Speed		KIAS	Remarks
V <sub>BG</sub>	Best Glide Speed	72	This speed (MAUW, flaps up) results in the best gliding distance, along the ground. Horizontal distance travelled (in still air) is approx. 3,050m (10,000ft.) per 305m (1,000ft) descent. Glide ratio 10:1
-	Speed for in-flight engine start	> 72	Recommended speed.

### 3.3 Engine Related Emergencies

#### 3.3.1 Engine Failure During Take-off

1. Throttle ..... IDLE
2. Brakes..... APPLY  
*with aircraft under control –*
3. Ignition Lanes / Magnetos..... OFF (BOTH)
4. Master ..... OFF
5. Fuel Selector..... OFF
6. Fuel Pump(s) ..... OFF (BOTH)

#### 3.3.2 Engine Failure Immediately After Take-Off

1. Airspeed ..... 72 KIAS
2. Landing Area ..... LOCATE (CLEAR GROUND)
3. Flaps ..... AS NEEDED
4. Fuel Pump(s) ..... OFF (BOTH)
5. Fuel Selector..... OFF  
*before touch-down –*
6. Ignition Lanes / Magnetos..... OFF (BOTH)
7. Master ..... OFF

**WARNING**

Flaps and elevator trim will not operate with the master switch off, and they are powered by the main bus. Make final flap and trim selection before turning master switch off.

### 3.3.3 Engine Failure During Flight

1. Airspeed ..... 72 KIAS
2. Landing Area ..... CLEAR GROUND
3. Air Start ..... COMMENCE  
*If engine successfully restarts –*
4. Continue..... PROCEED WITH CAUTION
5. Land..... AS SOON AS POSSIBLE  
*If engine should fail to restart –*
6. Land..... FORCED LANDING

### 3.3.4 Air-Start

Alternative for aircraft equipped with a Rotax 912 ULS.

1. ECU Backup Switch ..... ON
2. Fuel Pumps..... ON (*BOTH*)
3. Fuel Selector..... CHANGE (*UNLESS 2<sup>ND</sup> TANK DRY*)
4. Throttle ..... CHECK MOVEMENT
5. Throttle ..... MIDDLE POSITION
6. Master ..... ON
7. Ignition / Lanes..... ON (*BOTH*)
8. Starter ..... ENGAGE

**NOTE**

An air-start is possible with the propeller windmilling and the ECU Backup Switch ON. The starter can also be used while the propeller is windmilling, if needed.

### **3.3.5 Irregular Engine RPM**

Alternative for aircraft equipped with a Rotax 912 ULS.

1. Ignition / Lanes..... ON (*BOTH*)
2. Throttle ..... VERIFY POSITION
3. ECU Backup Switch..... ON
4. Fuel Quantity..... CHECK
5. Fuel Selector..... CHANGE (*UNLESS 2<sup>ND</sup> TANK DRY*)
6. Fuel Pumps..... ON (*BOTH*)
7. Oil - Pressure ..... CHECK
8. Oil - Temperature ..... CHECK
9. Coolant - Temperature ..... CHECK
10. EGT - Temperature ..... CHECK
- If engine continues to run rough –*
11. Land..... AS SOON AS POSSIBLE

### **3.3.6 Low Fuel Pressure**

1. Fuel Quantity..... CHECK
2. Fuel Selector..... CHANGE (*UNLESS 2<sup>ND</sup> TANK DRY*)
3. Fuel Pump(s) ..... ON (*BOTH*)
- If fuel pressure remains low –*
4. Throttle ..... DECREASE IF POSSIBLE
- If fuel pressure remains low –*
5. Land..... AS SOON AS POSSIBLE

### 3.3.7 Low Oil Pressure

1. Oil - Temperature ..... CHECK (MAX. 130 °C)  
*If oil temperature is high or increasing –*
2. Airspeed ..... 72 KIAS<sup>(a)</sup>  
*If oil pressure remains low or temperature remains high/increasing –*
3. Land ..... AS SOON AS POSSIBLE<sup>(b)</sup>

#### NOTES

- a. 72 KIAS is the speed at which the aircraft is most efficient.
- b. Remain vigilant for an impending engine failure.

### 3.4 Emergency Landing Procedures

#### 3.4.1 Emergency Landing without Engine Power

1. Airspeed ..... 72 KIAS
2. Trim ..... FOR BEST GLIDE
3. Landing Location ..... LOCATE
4. Engine Air-start ..... ATTEMPT *(AS TIME PERMITS)* <sup>(a)</sup>  
*If engine fails to restart –*
5. Fuel Pump(s) ..... OFF *(BOTH)*
6. Fuel Selector..... OFF
7. Throttle ..... CLOSED
8. Flaps ..... FULL *(PRIOR TO TOUCHDOWN)*
9. Communication..... REPORT IF TIME PERMITS
10. Passenger ..... BRIEF  
*Immediately Before Touchdown –*
11. Ignition / Lanes..... OFF *(BOTH)*
12. Master ..... OFF

#### NOTES

- a. Do not lose perspective of time trying to restart the engine. Retry a limited number of times, which will depend on the altitude where the failure occurred. Rather focus on the best possible landing location and your approach to it.

### **3.4.2      *Precautionary Landing with Engine Power***

1.    Airspeed ..... 75 KIAS
2.    Flaps ..... TAKE-OFF
3.    Fuel Pumps ..... ON (*BOTH*)
4.    Landing Area ..... INSPECT (*AS PER PROCEDURE*)
5.    Flaps ..... FULL (*ON FINAL APPROACH*)
6.    Airspeed ..... 65 KIAS
7.    Brakes ..... APPLY

*when aircraft is under control –*

8.    Ignition / Lanes ..... OFF (*BOTH*)
9.    Fuel Selector ..... OFF
10.    Master Switch ..... OFF

### **3.4.3      *Ditching***

1.    Airspeed ..... 65 KIAS
2.    Flaps ..... FULL
3.    Descent ..... ESTABLISH 50 ft/min
4.    Direction
  - i.    High Wind ..... INTO WIND
  - ii.    Light Wind ..... PARALLEL TO SWELLS
5.    Crew ..... BRIEF
6.    Canopy ..... OPEN
7.    Touch-down Speed ..... SLOWEST PRACTICAL
8.    Crew ..... EVACUATE
9.    Life Jackets / Raft ..... INFLATE

### 3.4.4 *Landing with a Flat Tyre/Damaged Wheel*

1. Approach..... NORMAL
2. Airspeed ..... 65 KIAS
3. Airspeed at flare ..... SLOWEST PRACTICAL ( $\approx 60$  KIAS)  
*If nosewheel is damaged/flat –*
4. Nosewheel ..... KEEP OFF GROUND FOR AS  
LONG AS POSSIBLE WITH  
ELEVATOR

#### NOTE

The LSA lands within ground effect since the wings are low to the ground. Anticipate an increase in lift just before touch-down unless airfoil stalls before entering ground effect.

## 3.5 Smoke and Fires

### 3.5.1 Engine Fire on Ground During Start

1. Starter ..... RELEASE
2. Fuel Selector..... CLOSE
3. Fuel Pumps..... OFF (*BOTH*)
4. Throttle ..... IDLE
5. Ignition / Lanes..... OFF (*BOTH*)
6. Master ..... OFF
7. Fire Extinguisher..... RETRIEVE
8. Exit Aircraft
9. Extinguish Fire

### 3.5.2 Engine Fire on Ground

1. Cabin Heat.....CLOSE
2. Fuel Selector.....CLOSE
3. Fuel Pumps.....OFF (*BOTH*)
4. Throttle ..... IDLE
5. Ignition / Lanes.....OFF (*BOTH*)
6. Master .....OFF
7. Fire Extinguisher.....RETRIEVE
8. Exit Aircraft
9. Extinguish Fire

### **3.5.3 Engine Fire during Take-off Run**

1. Throttle ..... IDLE
2. Cabin Heat..... CLOSE
3. Brakes..... APPLY UNTIL STOP
4. Fuel Selector..... CLOSE
5. Fuel Pumps..... OFF (*BOTH*)
6. Ignition / Lanes..... OFF (*BOTH*)
7. Master ..... OFF
8. Fire Extinguisher ..... RETRIEVE
9. Exit Aircraft
10. Extinguish Fire

### **3.5.4 Engine Fire in Flight**

1. Cabin Heat.....CLOSE
2. Cabin Air Vent .....OPEN
3. Throttle .....IDLE
4. Fuel Pumps.....OFF (*BOTH*)
5. Ignition / Lanes.....OFF (*BOTH*)
6. Master .....OFF (*AFTER FLAP DEPLOYMENT*)
7. Fuel Selector.....CLOSE
8. Airspeed .....INCREASE TO VNE (*135kt IAS*)
9. Forced Landing .....AS PER 3.4.1

### 3.5.5 Electrical Fire in Flight

An electrical fire is often characterized by white smoke and an acrid smell.

1. Master ..... OFF<sup>(a)(b)</sup>
2. Ignition Lanes ..... REMAIN ON
3. Electrical Switches ..... OFF
4. Extinguisher ..... USE *(IF POSSIBLE)*
5. Ventilate Cabin ..... OPEN VENTS  
*If fire is extinguished –*
6. Precautionary Landing ..... EXECUTE (AS SOON AS POSSIBLE)  
*If fire is NOT extinguished –*
7. Forced Landing ..... EXECUTE

#### NOTES

- a. If the location/source of the fire can be determined, electrical power can be removed from that circuit via the isolating switch. This will remove the need to switch off the master.
- b. The EFIS and associated equipment (iBox, RDAC etc.) can still be powered from the EFIS battery backup circuit when the master switch is off; provided that the EFIS system is not the source of the electrical fire.

### 3.5.6 Cabin Fire

1. Master ..... OFF
2. Cabin Heat ..... CLOSE
3. Ventilate Cabin ..... OPEN VENTS
4. Extinguisher ..... USE IF POSSIBLE  
*If fire is extinguished –*
5. Precautionary Landing ..... CONSIDER  
*If fire in NOT extinguished –*
6. Forced Landing ..... EXECUTE

### 3.6 Recovery from Unintentional Spin

**WARNING**  
Intentional Spins are Prohibited!

Unintentional spin recovery technique:

1. Throttle ..... IDLE
  2. Lateral Control..... AILERONS NEUTRAL
  3. Yaw Control..... RUDDER FULL IN OPPOSITE  
DIRECTION OF SPIN
- when rotation stops –*
4. Yaw Control..... RUDDER NEUTRAL
  5. Longitudinal Control..... RECOVER FROM DIVE<sup>(a)</sup>

**NOTES**

a. Do not exceed VNE or load factor limits in the recovery dive.

In the unlikely event that the aircraft enters a flat spin and the steps above do not result in recovery of control, the following may be implemented:

1. Throttle ..... IDLE
  2. Lateral Control ..... AILERONS NEUTRAL
  3. Longitudinal Control..... FULL NOSE DOWN
  4. Yaw Control..... RUDDER FULL IN OPPOSITE  
..... DIRECTION OF SPIN
- when rotation stops –*
5. Yaw Control..... RUDDER NEUTRAL
  6. Longitudinal Control..... RECOVER FROM DIVE

## 3.7 Other Emergencies

### 3.7.1 *Vibration*

If any abnormal engine vibrations occur:

1. Fuel..... CHECK QUANTITY
2. Fuel Selector..... CHANGE (*UNLESS 2<sup>ND</sup> TANK DRY*)
3. Fuel Pumps..... BOTH ON
4. ECU Backup ..... ON
5. Engine RPM ..... SET WHERE VIBRATION IS LEAST
6. Precautionary Landing ..... EXECUTE

### 3.7.2 *EFIS System Failure*

If the EFIS freezes, fails, or reacts incorrectly in flight:

1. Straight and Level Flight ..... MAINTAIN<sup>(a)</sup>
  2. EFIS Main Switch ..... OFF
  3. EFIS Back-Up Switch ..... OFF
- wait for 3 seconds –*
4. EFIS Main Switch ..... ON
  5. EFIS Back-Up..... ON
- wait for at least 15 seconds for the system to boot –*
6. EFIS Functionality ..... CONFIRM
- if EFIS still not functioning correctly –*
7. Land..... AS SOON AS PRACTICABLE<sup>(b)</sup>

**NOTES**

- a. Through use of ground references and other instruments.
- b. Execute landing at first safe opportunity and have instrument repaired.

### **3.7.3 Alternator / Charge System Failure**

Alternative for aircraft equipped with a Rotax 912 ULS.  
An alternator A/B failure is indicated by the lane warning lights.

#### **3.7.3.1 Alternator A Failure –**

Alternator A failure is evident by the steady illumination of the lane A warning light, and a drop in the main bus voltage to nominal battery voltage (+/- 12.5 V)

1. Lane A ..... CYCLE SWITCH (*OFF 1 SECOND, BACK ON*)
2. Lane A ..... VERIFY WARNING LIGHT OFF

*If Lane A warning light is still on – assume alternator failure.*

3. ECU Backup..... ON
4. EFIS Backup..... ON
5. Non-Essential Equipment..... ALL OFF<sup>(a)</sup> Lights, autopilot, secondary EFIS, etc.
6. EFIS Brightness..... MINIMUM
7. Radio Communication ..... MINIMUM
8. Land ..... AS SOON AS PRACTICABLE

**NOTES**

- a. No battery charging will occur in this scenario, and the main battery must be conserved if there is to be a subsequent alternator B failure.

**NOTE**

The ECU typically uses GEN A to run the engine, and GEN B is used to charge the main battery. If GEN A fails, GEN B is reprioritized to run the engine only and the main battery will no longer be charged.

**3.7.3.2 Alternator B Failure –**

Alternator B failure is evident by the steady illumination of the Lane B warning light, and a drop in the main bus voltage to nominal battery voltage (+/- 12.5 V).

1. Lane B ..... CYCLE SWITCH (*OFF 1 SECOND, BACK ON*)
2. Lane B ..... VERIFY WARNING LIGHT OFF

*If Lane B warning light is still on – assume alternator failure.*

3. ECU Backup ..... ON
4. EFIS Backup ..... ON
5. Non-essential Equipment ..... OFF<sup>(c)</sup> *Lights, autopilot, secondary EFIS, etc.*
6. Radio Communication ..... MINIMAL
7. Land ..... AS SOON AS PRACTICABLE

**NOTES**

- c. No battery charging will occur in this scenario, and the main battery must be conserved if there is to be a subsequent alternator B failure.

### 3.7.3.3 *Alternator A and B Dual Failure –*

This will result in engine stoppage when the main battery goes flat, since no power is available to the ECU and subsequently the fuel pumps. It must be powered by the main battery in order for the engine to run.

1. ECU Backup..... ON
2. EFIS Backup..... ON
3. Main Battery ..... VERIFY VOLTAGE<sup>(d)</sup>
4. Non-essential Equipment..... OFF Lights, autopilot, secondary EFIS, etc.
5. Radio Communication ..... MINIMAL
6. Precautionary ..... EXECUTE AS SOON AS POSSIBLE

**NOTES**

d. Expect **systems failure** when battery voltage drops below **10 Volt**. This includes the ECU and fuel pumps, which will result in engine failure.

**WARNING**

The engine can run from the main battery for approximately 30 minutes, following a dual alternator A and B failure; from a full charge with all ancillary equipment turned off. The engine will fail due to fuel starvation, as the fuel pumps will stop when the voltage is too low.

### **3.7.3.4      *Loss of Sensors***

The engine sensors, for redundancy purposes, are powered by Lane A/B separately. This means that if one of the two lanes fail, a subset of the engine sensors will also fail.

Failure of Lane	Resultant Sensor Failure
A	Coolant Temperature
	Exhaust Gas Temperature
	Ambient Temperature
	Ambient Pressure
B	Throttle Level Position
	Oil Temperature
	Oil Pressure

### **3.7.4 Main Bus Power Failure**

Please refer to 7.13.4 Main Bus, for a list of equipment affected by a loss of power to the main bus.

1. ECU Backup..... ON
2. EFIS Backup..... ON
3. Land ..... AS SOON AS POSSIBLE

#### **CAUTION**

Power loss to the main bus will not result in the main fuel pump stopping but the starter motor will become unavailable/non-operational. If the engine is allowed to run dry and stop, the engine will have to be restarted via airstream driven propeller rotation (windmilling).

## **4 Normal Procedures**

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## 4.1 Introduction

This section provides checklists and recommended procedures for normal operation of the aeroplane.

The checklists proposed are considered to be the most desirable, and checks should follow them, unless there is a valid reason to deviate from them.

## 4.2 Speeds for Normal Operation

Unless otherwise noted, the following speeds are based on a maximum weight of 600kg (1,320lb).

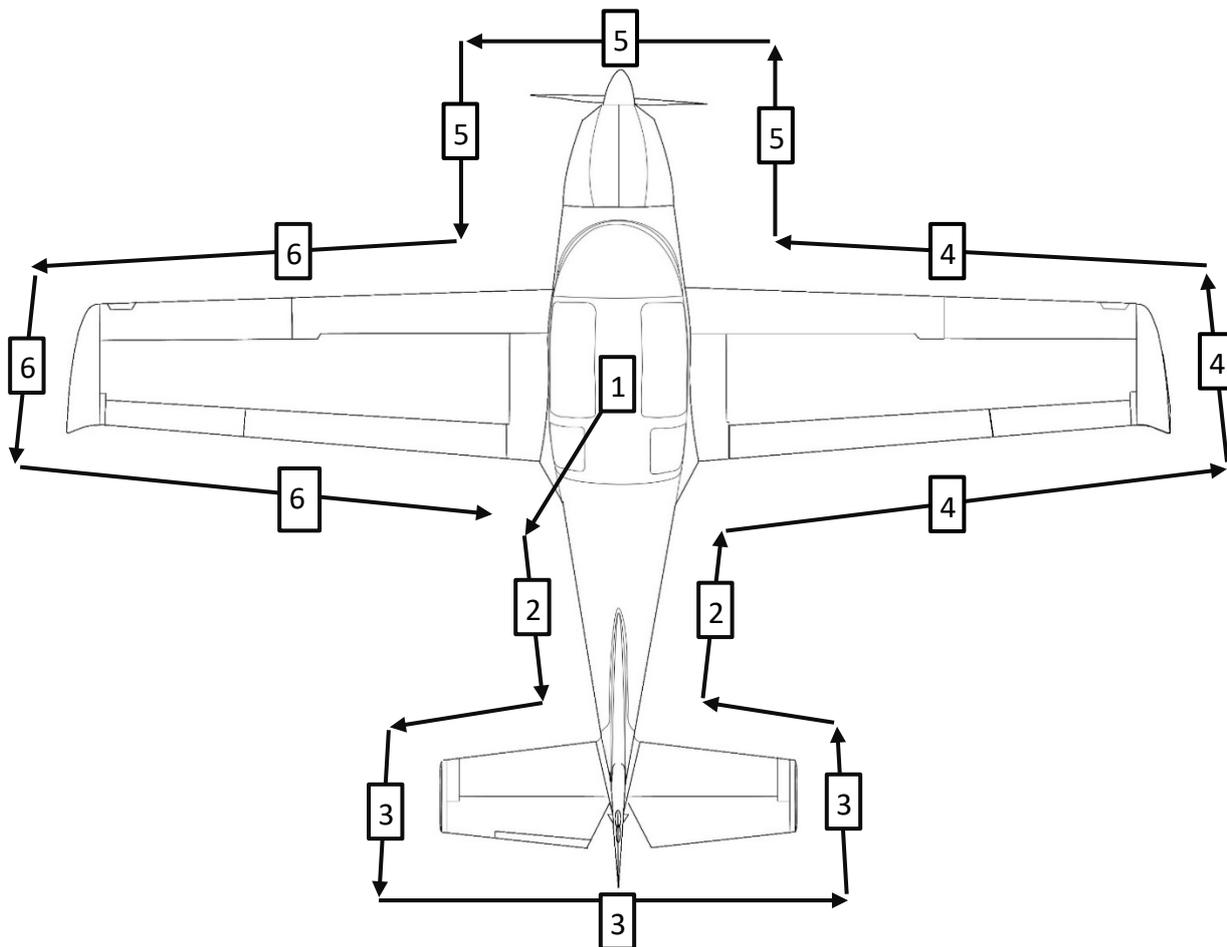
SPEED		KIAS	REMARKS
$V_x$	Best Angle of Climb Speed	65	The speed (flaps fully retracted) which results in the greatest altitude gain over a given horizontal distance.
$V_y$	Best Rate of Climb Speed	72	The speed (flaps fully retracted) which results in the greatest altitude gain over a given time period.
-	Normal Climb Out	75	
$V_{ROT}$	Rotation Speed	45	The speed at which the aircraft should be rotated about the pitch axis during take-off.
$V_{LOF}$	Lift-off Speed	48	The speed at which the aircraft generally lifts off from the ground during take-off.
-	Cruise Climb Speed	75 - 90	
-	Approach speed	65 - 75	
$V_{REF}$	Threshold crossing speed	65	Indicated airspeed at 15 m (50 ft) above threshold, which is not less than $1.3V_{SO}$ .

### 4.3 Preflight Inspection

A preflight inspection is required prior to every flight, or first flight of the day. It must also be performed after any incident, accident, maintenance activity etc. Incomplete or careless inspections can result in an accident. Carry out the inspection following the instructions on the Inspection Checklist.

**NOTE**

The word “condition” in the instructions means a visual inspection of surface for damage deformations, scratching, chafing, corrosion, or other damages, which may lead to flight safety degradation.



### **4.3.1      *Inspection Checklist***

#### **4.3.1.1      *Cabin***

Magnetos/Ignition .....	OFF
Master Switch .....	ON
Fuel .....	VERIFY QUANTITY
Flaps.....	FULL DOWN
Avionics.....	VERIFY CONDITION
Master Switch .....	OFF
Controls (all) .....	CHECK <i>for full, free movement up to stops</i>
Harnesses and Seats .....	CHECK CONDITION <sup>(a)</sup>
Canopy and Windshield .....	CHECK CONDITION and cleanliness
Cockpit.....	CHECK FOR LOOSE OBJECTS and secure
Fire Extinguisher .....	VERIFY PRESENT / VALID
Documentation .....	VERIFY PRESENT / VALID <sup>(b)</sup>

**NOTES**

- a. Check security of buckles and attachment points. Ensure the seat adjustment mechanism is locked correctly after adjustment.
- b. Documents such as current POH, ATF, RF Licence (RSA Only).

#### **4.3.1.2      *Fuselage***

Surface Condition .....	CHECK CONDITION
Wing/fuselage Fairing .....	CHECK
Empennage Fairing .....	CHECK
Antenna/e.....	CHECK CONDITION / SECURITY
Luggage Compartment Door.....	CLOSED / LOCKED
Static Source (If Applicable) .....	CHECK CONDITION

**4.3.1.3      *Empennage***

Tie-down Rope.....	REMOVED
Horizontal Stabilizer.....	CHECK CONDITION
Vertical Stabilizer .....	CHECK CONDITION
Elevator.....	CHECK CONDITION / MOVEMENT
Elevator Trim Tab.....	CHECK CONDITION
Rudder .....	CHECK CONDITION / MOVEMENT
Hinges, Bolts, Pushrods.....	CHECK CONDITION / SECURITY
Strobe .....	CHECK CONDITION

**4.3.1.4      *Right Wing and Right Main Gear***

Wheel Fairing.....	CHECK CONDITION / SECURITY
Wheel and Brakes .....	CHECK CONDITION <sup>(a)</sup>
Wheel Struts .....	CHECK CONDITION / CRACKS
Chocks .....	REMOVE
Flap .....	CHECK SECURITY
Flap Hinges, Control Horn, Pushrod .....	CHECK CONDITION / SECURITY
Wing Trailing Edge .....	CHECK CONDITION
Aileron .....	CHECK SECURITY / MOVEMENT
Aileron Hinges, Control Horn, Pushrod .....	CHECK CONDITION / SECURITY
Wingtip .....	CHECK CONDITION
Nav Light .....	CHECK CONDITION
Taxi/Landing Light Lens.....	CHECK CONDITION
Wing Leading Edge.....	CHECK CONDITION
Fuel Vent (underside of wing).....	CHECK UNOBSTRUCTED
Fuel Quantity .....	CHECK THOUGH FILLER

**NOTES**

a. Fluid Leaks, brake pad and disc condition, tyre condition, tyre inflation (See 4.3.1.7 Tyre Pressure Visual Inspection)

**WARNING**

Physically verify the fuel level before each take-off. Fuel can be visibly seen, through the filler cap, just covering the (total) bottom of the fuel tank with 30 litres present.

**4.3.1.5      *Nose Section and Nose Gear***

- Engine Cowling ..... CHECK CONDITION / SECURITY
- Propeller and Spinner ..... CHECK CONDITION / SECURITY
- Air Intakes..... CHECK CONDITION / OBSTRUCTION
- Radiators..... CHECK CONDITION
- Engine Mount ..... CHECK CONDITION / SECURITY
- Exhaust Manifold ..... CHECK CONDITION
- Leaks ..... CHECK COWL OUTLETS
- Engine Oil..... CHECK LEVEL WITH DIPSTICK
- Coolant ..... CHECK LEVEL<sup>(a)</sup>
- Parachute ..... CHECK COVER SECURITY
- Nose Wheel ..... CHECK CONDITION
- Chocks ..... REMOVE

**NOTES**

- a. DO NOT fill the coolant level to the max mark on the overflow bottle mounted to the firewall. Its best practice to have the fluid level just above the min mark when cold. If there is any doubt about fill level, remove the radiator cap (only when cold) to verify fluid presence.

**CAUTION**

During the pull-through, **make sure the ignition/magnetos are OFF.** Always handle the propeller blade area with the palm of your hand, and not only the tips of your fingers.

**4.3.1.6 Left Wing**

Fuel Quantity .....	CHECK THOUGH FILLER
Fuel Vent (underside of wing).....	CHECK UNOBSTRUCTED
Wing Leading Edge.....	CHECK CONDITION
Taxi/Landing Light Lens.....	CHECK CONDITION
Wingtip .....	CHECK CONDITION
Nav Light .....	CHECK CONDITION
Aileron .....	CHECK SECURITY / MOVEMENT
Aileron Hinges, Control Horn, Pushrod .....	CHECK CONDITION / SECURITY
Wing Trailing Edge .....	CHECK CONDITION
Flap .....	CHECK SECURITY
Flap Hinges, Control Horn, Pushrod .....	CHECK CONDITION / SECURITY
Wheel Fairing.....	CHECK CONDITION / SECURITY
Wheel and Brakes .....	CHECK CONDITION <sup>(a)</sup>
Wheel Struts .....	CHECK CONDITION / CRACKS
Chocks .....	REMOVE

**NOTES**

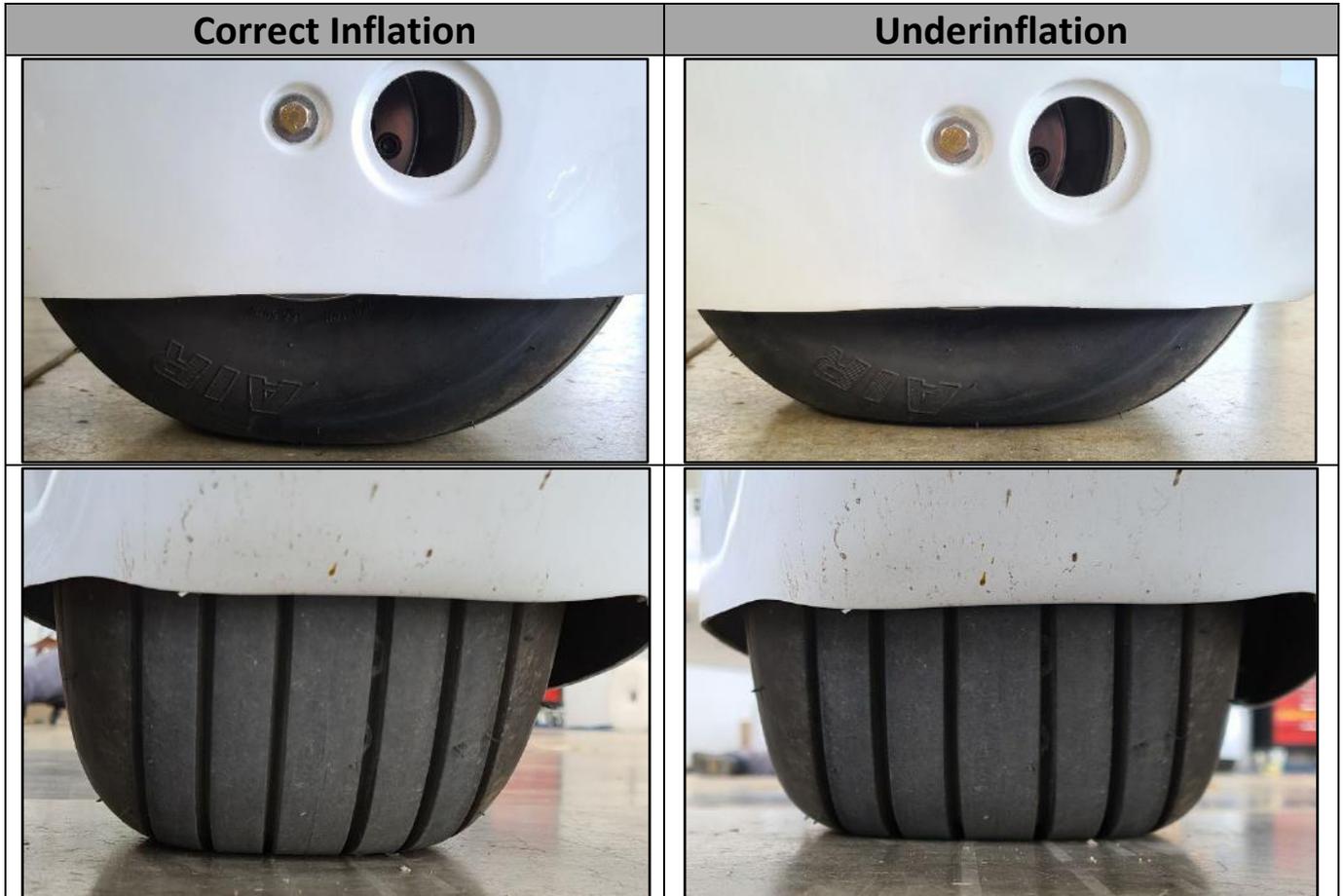
- a. Fluid Leaks, brake pad and disc condition, tyre condition, tyre inflation (See 4.3.1.7 Tyre Pressure Visual Inspection)

**WARNING**

Physically verify the fuel level before each take-off. Fuel can be visibly seen, through the filler cap, just covering the (total) bottom of the fuel tank with 30 litres present.

**4.3.1.7 Tyre Pressure Visual Inspection**

The tyres must be visually inspected prior to every flight. It is not necessary to check the pressure of the tyre with a gauge; it is sufficient to visually inspect the tyre.



**NOTE**

Pay specific attention to the following, in order to discern satisfactory inflation:

- Outmost trendlines
- Sidewall deflection

## 4.4 Engine Start and Taxi

### 4.4.1 *Before Engine Start*

1. Preflight Inspection ..... COMPLETE
2. Emergency Equipment..... ON BOARD
3. Passenger Briefing ..... COMPLETE
4. Seats ..... CORRECTLY ADJUSTED
5. Harnesses ..... SECURE
6. Park Brake ..... ON
7. Circuit Breakers ..... IN

### 4.4.2 Engine Start

Alternative checklist for aircraft equipped with a Rotax 912 ULS.

1. Fuel Selector..... EMPTIEST TANK (*IF NOT EMPTY*)
2. EFIS Backup Switch ..... ON (*VERIFY BATTERY VOLTAGE*)
3. EFIS Main Switch ..... ON
4. ECU Backup Switch ..... ON
5. Master Switch ..... ON
6. Ignition / Lanes..... ON (*BOTH*)
7. Auxiliary Fuel Pump..... ON (*FUEL PRESSURE/ABNORMAL SOUND*)  
..... OFF (*AFTER 5 SECONDS*)
8. Main Fuel Pump ..... ON (*FUEL PRESSURE/ ABNORMAL SOUND*)
9. ECU Backup Switch ..... OFF
10. Throttle ..... SET (+ -50%)
11. Propeller..... AREA CLEAR
12. Starter ..... ENGAGE (*MAX. 10 SECONDS*)
13. Oil Pressure ..... CHECK (*CORRECT WITHIN 10 SECONDS*)
14. Throttle ..... +/- 2500 RPM
15. Ignition / Lane Lights ..... VERIFY OFF
16. Alternator B..... CHECK ONLINE <sup>(a)</sup>
17. Avionics Switch..... ON
18. Oil Temperature ..... 2500 RPM *until oil temperature*  
..... *is < 50 °C (122 °F) (b)*

**NOTE**

- a. Main bus voltage should move up from +/- 12.5V to above 13V when the engine RPM is held above/at 2500 RPM for more than 5 seconds. This is the indication that Alternator B has been brought online by the ECU.
- b. When the oil is below 50 °C, the oil filter is bypassed due to the increased viscosity of the oil. Significant throttle settings must not be used during this period, as it may cause damage.

**CAUTION**

- The starter can be activated for a maximum of 10 seconds, followed by a 2-minute pause, to allow the starter to cool.
- Only increase engine speed 10 seconds after start, if the oil pressure is steady above 2 bar (29psi).
- To avoid shock loading, start the engine with the throttle to approximately 10%. Wait 3 seconds after start for the engine rpm to stabilize, then increase.

**4.4.3 Taxi**

1. Flaps ..... UP
2. Brakes..... OFF
3. Control ..... INTO WIND OR NEUTRAL
4. Power ..... AS REQUIRED
5. Brakes..... VERIFY OPERATION AT START OF TAXI

## 4.5 Before Takeoff

To be conducted at a holding point or equivalent –

### 4.5.1 Run Up & Pre-Takeoff

Alternative for aircraft equipped with a Rotax 912 ULS.

1. Face into wind ..... IF POSSIBLE
2. Oil Temperature ..... ABOVE 50°C
3. Fuel Selector..... FULLEST TANK
4. Engine..... 4000 RPM
5. Lane A..... OFF (2 SEC., NO MORE THAN 180 RPM DROP)  
..... ON (WAIT FOR LANE A LIGHT OFF)
6. Lane B..... OFF (2 SEC., NO MORE THAN 180 RPM DROP)  
..... ON (WAIT FOR LANE B LIGHT OFF)
7. Fuel Pumps..... AUX OFF  
..... MAIN ON
8. Fuel Pressure ..... CHECK (CORRECT AND STABLE)
9. Fuel Pumps..... AUX ON  
..... MAIN OFF
10. Fuel Pressure ..... CHECK (CORRECT AND STABLE)
11. Fuel Pumps..... BOTH ON
12. Engine..... 2500 RPM
13. Fuel Quantity..... VERIFY (SUFFICIENT FOR PLANNED FLIGHT)
14. Circuit Breakers ..... ALL IN
15. Switches ..... CHECK AND SET AS REQUIRED
16. Instruments ..... CHECK AND SET ALL
17. Controls ..... FREE & FULL / CORRECT SENSE
18. Trim ..... SET NEUTRAL
19. Flaps ..... SET STAGE 1 / TAKEOFF
20. Engine Parameters ..... VERIFY (TEMPERATURES, PRESSURES, VOLTAGES)
21. Canopy ..... CLOSED / LATCHED
22. Harness ..... SECURE (CORRECTLY FASTENED AND TIGHT)
23. Brief Passengers ..... BRIEF

## 4.6 Take-off

1. Throttle ..... FULL OPEN
2. Engine Speed ..... VERIFY GREATER THAN 5200 RPM
3. Elevator Control ..... NEUTRAL
4. Engine Parameters ..... VERIFY (*PRESSURES, TEMPERATURES*)
5. Rotate ..... 45 KIAS
6. Airspeed ..... 72 KIAS ( $V_y$ )
7. Brakes ..... APPLY TO STOP WHEEL SPIN
8. Flaps ..... UP (*MIN .65 KIAS / MIN. ALT. 300FT*)
9. Trim ..... AS REQUIRED
10. Power ..... AS REQUIRED
11. Climb ..... COMMENCE

### WARNING

Take-off is prohibited if:

- The engine is running rough or intermittently.
- The engine parameters (instrument indications) are outside operational limits.
- The crosswind component exceeds permitted limits (15 knots).

### CAUTION

Ensure that engine oil temperature is above 50 °C prior to take off.

Climbing with engine at 5800 rpm is permissible for 5 minutes. Thereafter, a maximum continuous engine rpm of 5500 rpm applies.

## 4.7 Flight

### 4.7.1 Climb

1. Throttle ..... GREATER THAN 5200 RPM
2. Airspeed .....  $V_x - 65$  KIAS  
.....  $V_Y - 72$  KIAS  
..... CRUISE 75 – 90 KIAS
3. Trim ..... AS REQUIRED
4. Engine Parameters ..... VERIFY (*PRESSURES, TEMPERATURES*)

#### CAUTION

If the cylinder head temperature or oil temperature approach their limits, reduce the climb angle to increase airspeed and thus fulfil the limits.

#### NOTE

It is best practice to limit using the full 5800 RPM to only when its necessary i.e. takeoff, emergency climbing.

### 4.7.2 Cruise

1. Airspeed ..... 105 – 118 KIAS
2. AUX Fuel Pump..... OFF
3. Throttle ..... AS REQUIRED
4. Trim ..... AS REQUIRED
5. Fuel..... SWITCH EVERY HOUR  
(*AUX PUMP ON DURING SWITCH*)

**4.7.3 Descent**

1. ATIS / Weather ..... CHECKED
2. Altimeter ..... SET
3. Fuel Selector..... FULLEST TANK  
(AUX PUMP ON DURING SWITCH)
4. Lights..... AS REQUIRED
5. Seatbelts..... CHECKED
6. Approach Brief ..... COMPLETE
7. Throttle ..... AS REQUIRED
8. Trim ..... AS REQUIRED

## 4.8 Landing

### 4.8.1 Before Landing

1. Brakes..... CHECK PARK BRAKE IS OFF
2. Fuel Pumps..... BOTH ON
3. Airspeed ..... 75 KIAS
4. Flaps ..... 1 STAGE ON DOWNWIND  
..... 2 STAGE ON BASE
5. Trim ..... AS NEEDED
6. Harnesses ..... SECURE
7. Landing Light ..... ON

### 4.8.2 Approach

1. Airspeed ..... 70 – 75 KIAS
2. Flaps ..... FULL ON FINAL
3. Trim ..... AS REQUIRED
4. Throttle ..... AS REQUIRED<sup>(a)</sup> (NOT BELOW 3000 RPM)

#### **WARNING**

The fuel tank pickup point is situated at the bottom of the inboard wall. In normal operation, the dihedral of the wing ensures fuel is always present at the pickup. The aircraft should never be subjected to a sustained side slip towards a near empty fuel tank that is being drawn from. This may expose the pickup point to air, thereby starving the engine and leading to engine stoppage. This is particularly dangerous at low altitudes during an approach.

### 4.8.3 Normal Landing

1. Airspeed @50 ft ..... 65 KIAS
2. Power ..... IDLE IN GROUND EFFECT
3. Flare ..... TO MINIMUM FLIGHT SPEED
4. Touchdown ..... MAINS FIRST (*HOLD NOSE WHEEL OFF*)
5. Brakes..... APPLY AS NEEDED

### 4.8.4 After Landing (Clear of Runway)

1. Flaps ..... UP
2. Auxiliary Fuel Pump..... OFF
3. Landing Light ..... OFF
4. Transponder ..... SET

### 4.8.5 Engine Shutdown

1. Engine Speed..... IDLE
2. Park Brake .....SET
3. Engine Parameters ..... WITHIN LIMITS
4. Lane B..... OFF
5. Lane A..... OFF
6. Main Fuel Pump ..... OFF
7. EFIS..... OFF
8. Master ..... OFF
9. All Switches ..... OFF
10. Fuel Selector..... OFF

#### NOTES

At least 5 minutes must pass between landing and shutting off the engine. If the ambient temperature is excessively warm, and causes the coolant temperature to rise, then engine may be shut down prior to the 5-minute mark.

#### CAUTION

Rapid engine cooling should be avoided during operation. This happens especially during descent and taxi i.e. Low engine RPM scenarios. Under normal conditions, the engine temperatures stabilize during descent and taxi at suitable values to stop the engine. If temperatures are unstable (high or low), run the engine at +/- 3000 RPM for a minimum of 2 minutes to stabilize the temperatures prior to shut down.

## 4.9 Special Procedures

### 4.9.1 *Balked / Rejected Landing*

1. Throttle ..... FULL / 5800 RPM
2. Flaps ..... RETRACT SLOWLY  
..... 2 STAGE A.S.A.P  
..... UP @ 65 KIAS, min. 300ft.
3. Auxiliary Fuel Pump..... OFF
4. Trim ..... AS NECESSARY
5. Complete circuit for new approach

### 4.9.2 *Short Field Takeoff*

1. Runway Length..... MEASURED<sup>(a)</sup> (*WITHIN AIRCRAFT CAPABILITY*)
2. Abort Point..... MARKED
3. Aircraft Weight..... MINIMISE
4. Runway Position..... MAXIMUM POSSIBLE LENGTH AHEAD
5. Elevator and Trim ..... NEUTRAL
6. Flaps ..... STAGE 2
7. Park Brake ..... SET FULL
8. Engine Parameters ..... VERIFY (*PRESSURES, TEMPERATURES*)
9. Throttle ..... FULL OPEN
10. Park Brake ..... RELEASE
11. Rotate..... 45 KIAS
12. Abort ..... IF NOT AIRBORNE BY ABORT POINT
13. Climb ..... BEST ANGLE ( $V_x - 65$  KIAS)

**NOTES**

- a. Calculate Density Altitude before takeoff.

### 4.9.3 Short Field Landing

1. Approach..... FLAT / UNDER POWER
2. Throttle ..... AS REQUIRED
3. Approach Airspeed ..... 65 KIAS<sup>(a)</sup>
4. Throttle ..... IDLE
5. Flare ..... COMMENCE
6. Touch down..... MAINS FIRST
7. Braking ..... HEAVY
- If runway overrun is possible –*
8. Ignition Lanes ..... OFF (*MINIMISE PROPELLER/GEARBOX DAMAGE*)

#### NOTES

- a. Exercise caution approaching at low speeds as the effects of a wind gust will be amplified.

### 4.9.4 Soft Field Landing

1. Crew ..... SECURE
2. Flaps ..... FULL
3. Approach ..... FLAT UNDER POWER
4. Approach Speed ..... NORMAL (70 KIAS)
5. Flare ..... ABOVE THRESHOLD
6. Power ..... IDLE
7. Hold Off..... IN GROUND EFFECT  
*(0.5M / 2FT. ABOVE RUNWAY)*
8. Speed ..... 55 KIAS
9. Main Wheels ..... TOUCH BEFORE STALL
10. Nose Wheel..... HOLD OFF WITH FULL ELEVATOR

### 4.9.5 *Soft Field Takeoff*

1. Aircraft Weight..... MINIMISE
2. Elevator Trim ..... NEUTRAL
3. Flaps ..... STAGE 2
4. Parking Brake ..... SET FULL
5. Engine Parameters ..... VERIFY (*PRESSURES, TEMPERATURES*)
6. Throttle ..... FULL OPEN
7. Parking Brake ..... RELEASE
8. Elevator ..... FULL BACK (*UNTIL NOSE WHEEL JUST LIFTS*)
9. Lift-off..... 45 KIAS

### 4.9.6 *Crosswind Takeoff*

1. Pre-Takeoff Checks..... NORMAL
2. Aileron..... FULL INTO WIND
3. Take-off Procedure..... NORMAL
4. Aileron..... REDUCE INPUT AS REQUIRED<sup>(a)</sup>

#### NOTES

- a. As the aircraft accelerates, the pilot must reduce aileron input to avoid the wing hitting the ground. Only a slight roll angle into the wind is normally required to keep the aircraft tracking true.

### 4.9.7 *Crosswind Landing*

1. Approach Procedure ..... NORMAL
2. Approach..... UNDER POWER
3. Final Approach ..... LONG
4. Rudder..... INTO CROSSWIND
5. Flare ..... OVER THRESHOLD
6. Wing Roll ..... LEVEL
7. Rudder..... APPLY OPPOSITE
8. Direction..... ALIGN WITH RUNWAY
9. Main Gear ..... TOUCH DOWN
10. Nose Wheel ..... HOLD OFF
11. Brakes..... APPLY (*ONCE NOSE WHEEL ON THE GROUND*)

## **5 Performance**

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## 5.1 Introduction

The data presented in this section has been deduced from flight tests with the aircraft and engine in good condition, and using average piloting techniques.

If not otherwise stated, the performance in this section is valid for:

- Maximum takeoff weight of 600 kg (1,320lb).
- ISA conditions.
- Rotax 912 iS @ 73.5kW (100 hp)
- Warp Drive Composite Propeller
  - Three Blade, Fixed Pitch, 72" Diameter

## 5.2 Takeoff and Landing Distance

### 5.2.1 Takeoff Distances

Surface Type	Run Distance	Distance over 15m / 15ft Obstacle
Concrete/Tar	120 m / 395 ft	230 m / 755 ft
Grass	140 m / 460 ft	250 m / 820 ft

### 5.2.2 Landing Distance

Surface Type	Landing Distance with braking	Distance over 15m / 15ft Obstacle
Concrete/Tar	80 m / 265 ft	250 m / 820 ft
Grass	80 m / 265 ft	250 m / 820 ft

## 5.3 Rate of Climb

Values relevant for maximum continuous power of 5500 RPM –

Altitude	Best Rate of Climb Speed ( $V_{IE}$ )	Rate of Climb
<i>[ft. ISA]</i>	<i>[KIAS]</i>	<i>[fpm]</i>
0	72	800
3 000		600
6 000		500
9 000		400

## 5.4 Cruise Speeds

Reminder: The propeller used for the values below is fixed pitch –

Altitude	Engine Speed	KIAS	KTAS
<i>[ft ISA]</i>	<i>[rpm]</i>	<i>[kt.]</i>	<i>[kt.]</i>
100	4 500	81	82
	4 800	95	96
	5 000	101	102
	5 300	106	108
	5 500	112	114
3 000	4 500	72	76
	4 800	87	91
	5 000	98	104
	5 300	104	109
	5 500	108	114
6 000	4 500	65	73
	4 800	80	89
	5 000	90	100
	5 300	98	108
	5 500	101	115
9 000	4 500	63	73
	4 800	74	88
	5 000	87	99
	5 300	91	105
	5 500	94	108

## 5.5 Fuel Consumption

Altitude	[ft ISA]	3 000				
Fuel Quantity	[Litres]	150				
	[US Gallons]	39.6				
Engine Speed	[rpm]	4 500	4 800	5 000	5 300	5 500
Fuel Consumption	[L/hr]	14	16	18	20	21
	[US gal./hr]	3.7	4.2	4.8	5.3	5.6
Airspeed	[KIAS]	73	91	104	109	114
Endurance	[hh:mm]	10:40	9:20	8:20	7:30	7:10
Range	[nm]	781	853	866	817	815

## 5.6 Airspeed Indicator System Calibration

IAS [knots]	CAS [knots] (average)	CAS [knots] (this aircraft)
25	28	
30	33	
35	38	
40	44	
45	45	
50	50	
55	55	
60	60	
65	65	
70	70	
75	75	
80	80	
85	85	
90	90	
95	95	
100	100	
105	105	
110	110	
115	115	
120	120	
125	125	
130	130	
135	135	

## **6 Weight and Balance**

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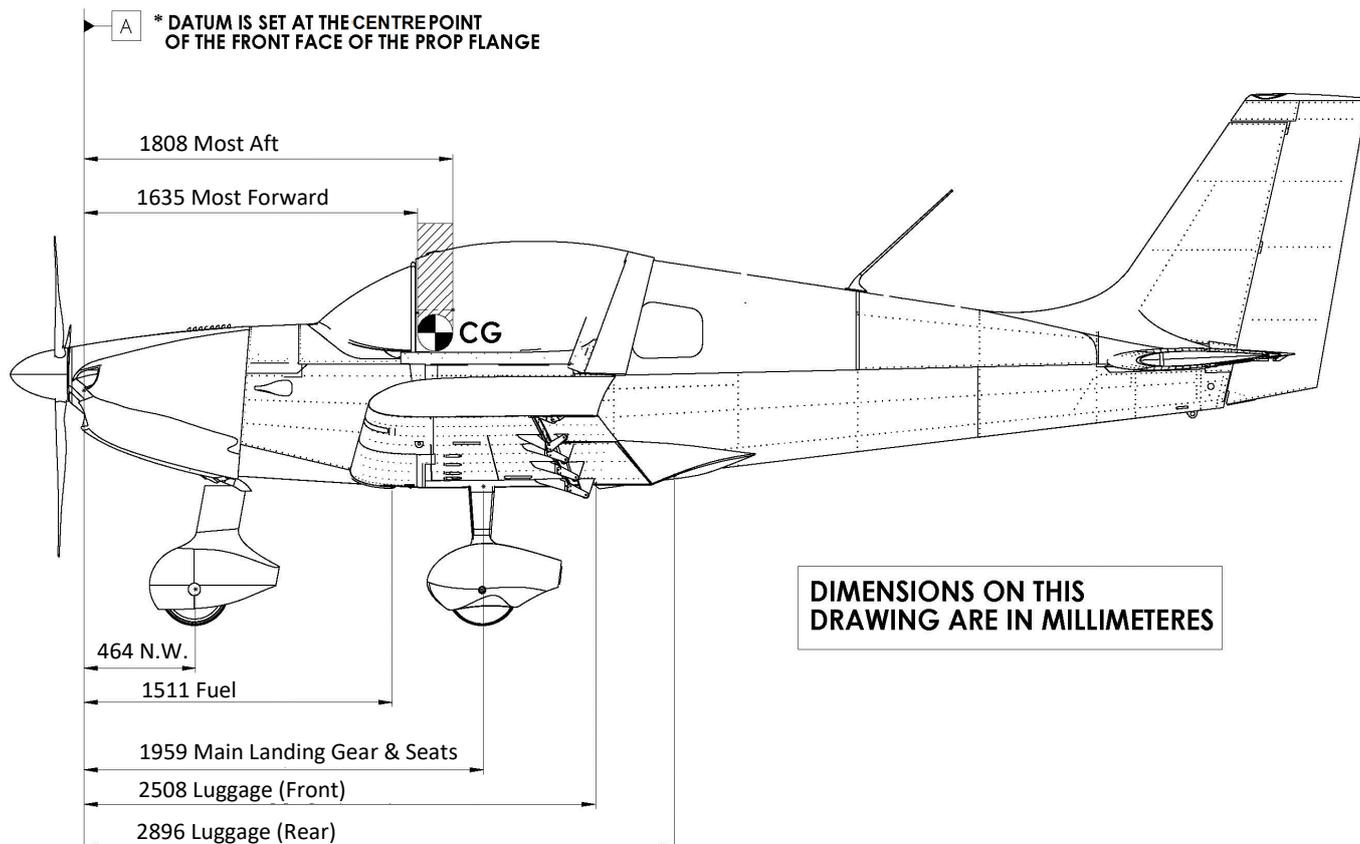
## 6.1 Introduction

This section details weight and balance information, along with payload ranges for safe operation of the aircraft.

## 6.2 Installed Equipment List

Type	Equipment Item
Standard	Garmin G3X (GDU460) Glass Cockpit
	Garmin GTX35 Transponder
	Garmin GTR200 Radio
	3Ah IBBS Backup Battery
	Electric Flap Controller
	Electric Elevator Trim System
	Magnetic Compass
Optional	Garmin G5 Certified Electronic Flight Instrument
	Garmin GMA245R Audio System
	Garmin GMC507 Auto Pilot
	Heated Pitot
	ELT

## 6.3 Centre of Gravity Arms



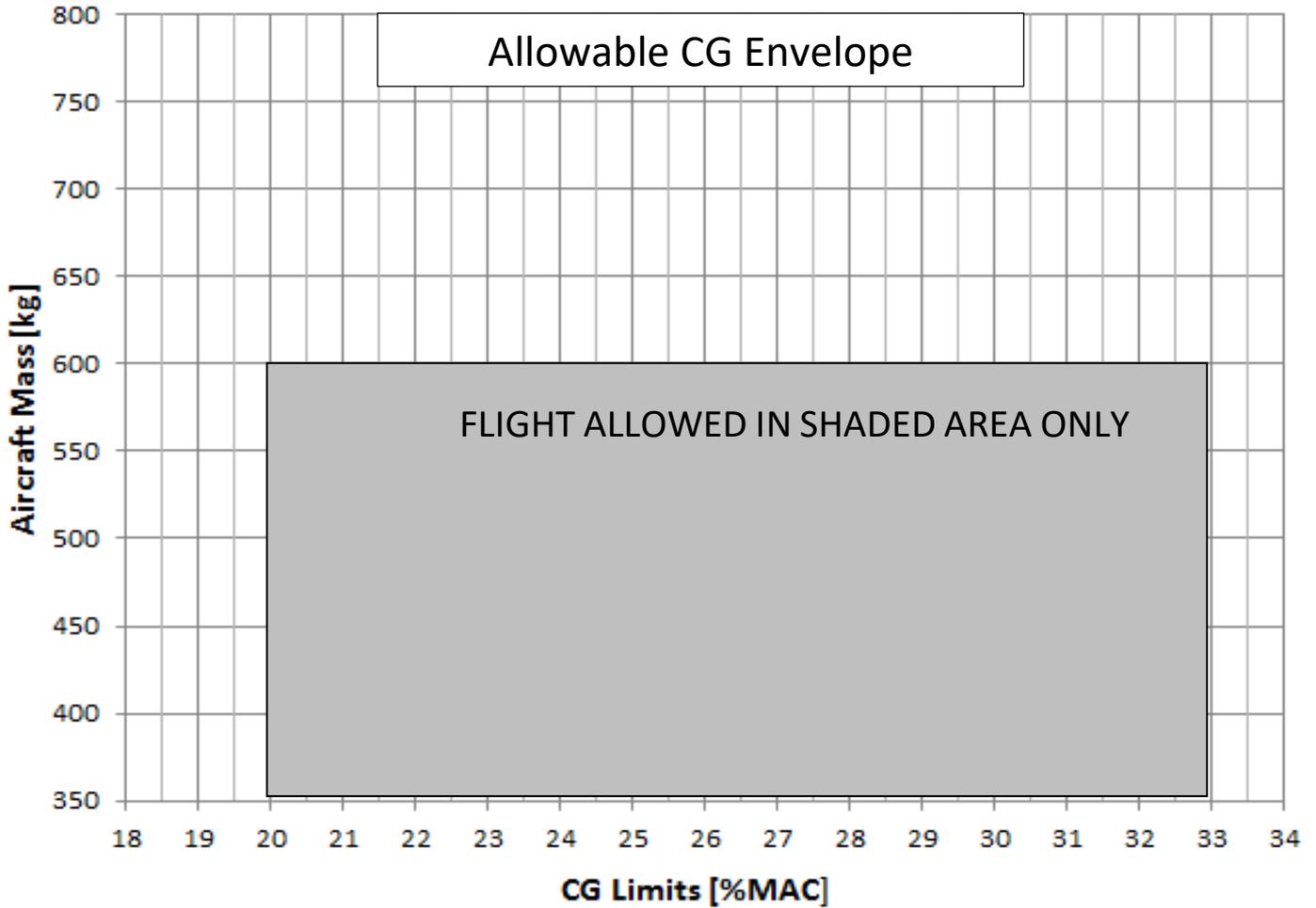
### WARNING

Aircraft CG and MAUW limitations must be adhered to at all times.

### NOTE

- GC range is 1 635mm (5.364 ft) to 1 808 mm (5.931 ft) aft of the reference datum (20 to 33% of MAC).
- The leading edge of the wing at MAC is 1 366 mm (4.482 ft) aft of the reference datum.
- The MAC is 1 339 mm (4.393 ft).

## 6.4 CG Envelope



## 6.5 Determination of CG

Sling Aircraft makes use of a numerical method in calculating the Cg of the aircraft. The following will be required to complete a CG check:

#	Item
1	Empty CG Value
2	Blank CG Form
3	Forward CG Check
4	Rear CG Check

The principal formula for CG calculation is:

$$CG = \frac{\text{Total Moment}}{\text{Total Weight}}$$

The %MAC formulas are:

$$\%MAC = (CG - 1366m) \times \frac{100}{1339mm}$$

*or,*

$$\%MAC = (CG - 4.482ft.) \times \frac{100}{4.393ft.}$$

### WARNING

For each flight, the most forward CG (full take-off fuel) and the most rearward CG (landing fuel) must be calculated to be within aircraft CG range limits.

The aircrafts empty CG is determined in a conventional manner, by weighing the aircraft whilst it is standing level. Refer to the Maintenance Manual for more.

Maximum all up weight (MAUW) = 600kg (1,320lb)

Maximum useful load (example) –

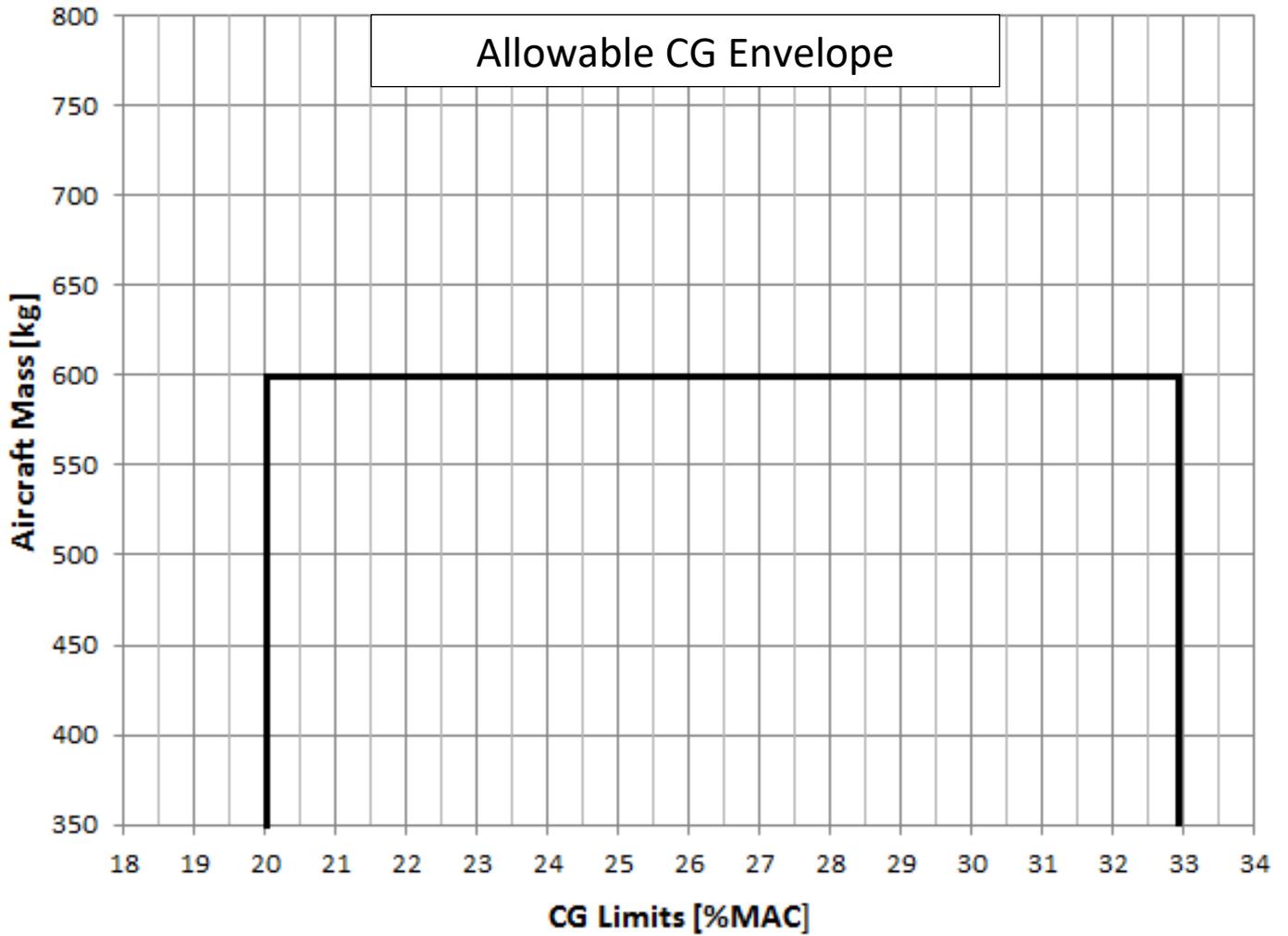
$$\begin{aligned}W_{max,useful} &= W_{MAUW} - W_E \\ &= 600kg (1,320lb) - 370kg (816lb) \\ &= 230kg (507lb)\end{aligned}$$

## 6.6 Determination of Empty CG

	ITEM	WEIGHT [kg (lb)]	ARM [mm (ft)]	MOMENT (weight x arm) [kg.mm (lb.ft)]
<b>Aircraft Empty CG</b>	Right Main Wheel	$W_R =$	$L_R = 1\,959 (6.427)$	
	Left Main Wheel	$W_L =$	$L_L = 1\,959 (6.427)$	
	Nose Wheel	$W_N =$	$L_N = 464 (1.522)$	
	Totals	Empty weight: $W_E = \dots\dots\dots$	-	Aircraft moment: $M_0 = \dots\dots\dots$
	Final CG	$CG = \dots\dots\dots \text{ mm (ft)}$		

## 6.7 Blank CG Form and Graph for Use

	WEIGHT [kg (lb)]	ARM [mm (ft)]	MOMENT (weight x arm) [kg.mm (lb.ft)]
<b>Pilot &amp; Passenger</b>		1 959 (6.427)	
<b>Baggage (Front)</b>		2 508 (8.228)	
<b>Baggage (Rear)</b>		2 896 (9.501)	
<b>Fuel</b>		1 511 (4.957)	
<b>Cg Empty Value</b>			
<b>TOTALS</b>	$W_T =$	-	$M_T =$
			CG =            mm
			CG =            %MAC



## 7 Aircraft and Systems

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## **7.1 Airframe**

The Sling LSA has an all-metal construction with single curvature stressed aluminium alloy skins riveted to stiffeners. Construction is of 6061-T6 aluminium alloy sheet metal riveted to angles, of the same material, with high quality blind rivets. This high strength aluminium alloy construction provided long life and low maintenance costs, thanks to its durability and corrosion resistance characteristics. The wing has a high lift airfoil (NACA 4415) and is equipped with semi-slotted fowler type flaps.

## 7.2 Control System / Pilot Controls

### 7.2.1 Control Column(s)

The aircraft is equipped with dual control sticks, which manipulate two of the three control axes: pitch (elevator) and roll (aileron). The stick has the following button allocations:

Button	Function
1	Trim down
2	Autopilot control
3	Trim up
4	<i>Not allocated</i>
5	Radio PTT



### 7.2.2 Rudder Pedals

The aircraft is fitted with dual rudder pedals, which control the rudder and the nose wheel, for yaw control in flight directional control while on the ground.

### **7.2.3 Brake Controls**

#### **7.2.3.1 Brake Lever –**

The braking system is typically a single hydraulic master cylinder acting on both wheels of the main landing gear, through a disk/calliper arrangement. Activation of the brakes is via the lever located on the cabins centre console.

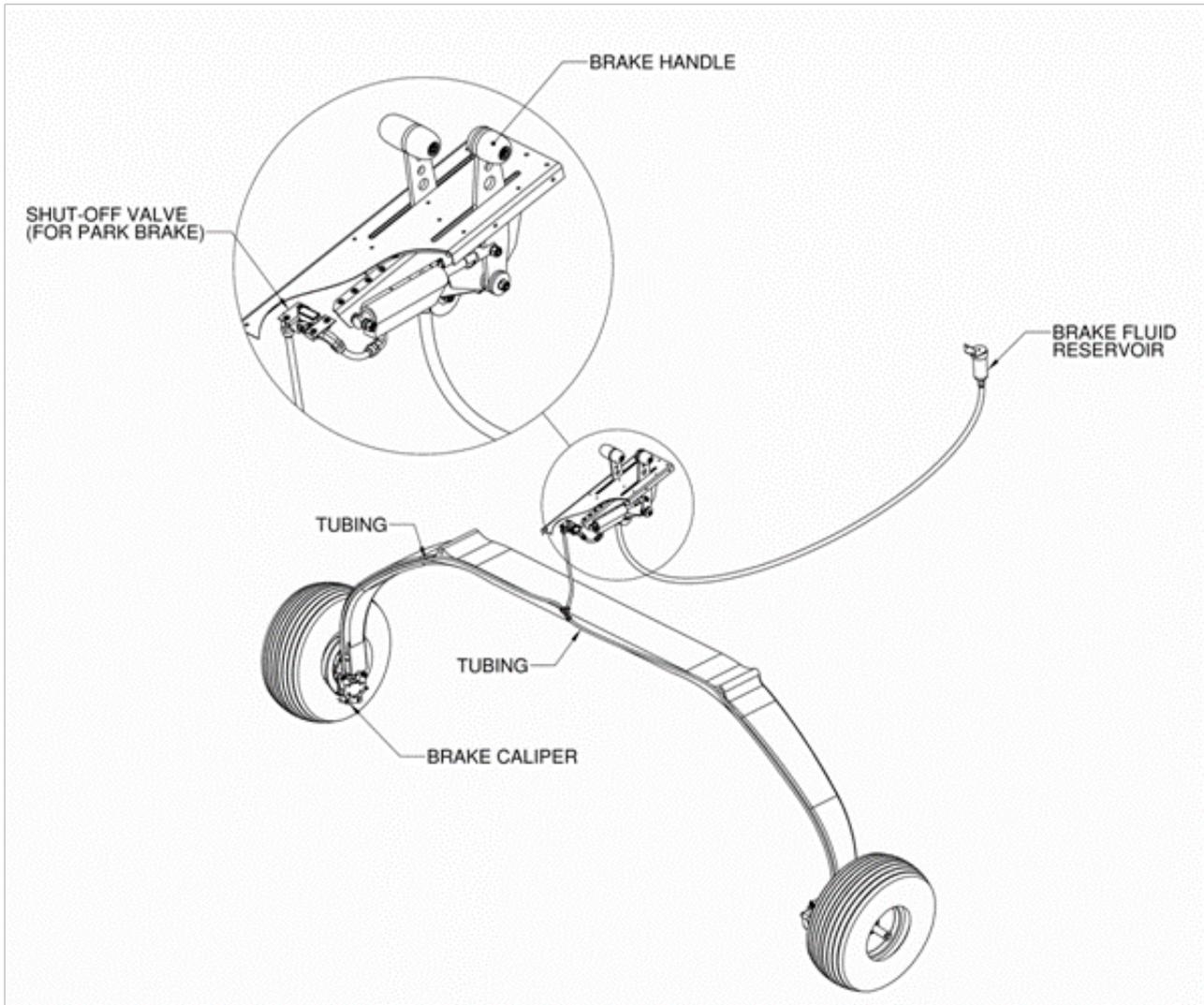
#### **7.2.3.2 Toe Brakes –**

A differential foot-controller braking system may also be fitted as an option. In such case, each brake calliper is separately actuated by way of two master brake cylinders fitted to each pedal: with the right pedal actuating the right calliper, and left pedal the left calliper.

#### **7.2.3.3 Park Brake –**

The park brake is typically an intercept valve, which stops pressure relief when pressure is removed from the brake lever/toe brakes. For normal braking operation, the intercept valve must be off.

### 7.2.3.4 Brake System Diagram



### 7.2.4 Throttle Lever

The aircraft makes use of a single lever power system, as the propeller is normally only ground-adjustable and mixture is controlled by the ECU.

Refer to 7.8 Cockpit Layout.

### 7.2.5 Fuel Selector Valve

Fuel tank feed selection is enabled by a red coloured, three-position (LEFT, RIGHT, OFF) rotary selector valve, located at the bottom centre of the instrument panel / front of centre console. Refer to in 7.8 Cockpit Layout, for the location of the selector.

An additional knob must be activated to move the selector, through a detent, to the OFF position. This prevents accidental closure of the valve (OFF position).

### 7.2.6 Ballistic parachute (if fitted)

The red coloured activation lever is located at the bottom centre of the instrument panel.

The accidental operation of the lever is prevented by a locking pin, which is tagged with a red flag.

#### Standard Sling LSA (excl. USA)

**This pin must be removed before flight.**

#### USA Sling LSA



### **7.2.7 Electrical equipment / control switches**

See appendix for alternative information for the 912 ULS.

<b>SWITCH / LABEL</b>	<b>FUNCTION</b>	<b>POSITION</b>
MASTER / STARTER KEY SWITCH	Power disconnected from main bus.	OFF
	Main bus connected to power.	ON
	Engage starter motor.	START
EFIS	Switch power (main bus) to EFIS system on/off.	UP ON  DOWN OFF
EFIS BKUP	Connects EFIS to EFIS back-up battery.	
MAIN PUMP	Switch main fuel pump on/off.	
AUX PUMP	Switch auxiliary fuel pump on/off.	
LAND	Switch landing lights on/off.	
TAXI	Switch taxi lights on/off.	
NAV	Select position (navigation) lights.	
STROBE	Select anti-collision (strobe) lights.	
AVIONICS	Switch power to radio and transponder on/off.	
ECU BKUP	Connects the EMS / ECU to the main battery (to provide back-up power).	
AUTOPILOT	Switch power to autopilot servos on/off.	
MASTER	Switch power to main bus on/off.	
LANE A	Select Lane A magneto/ignition source.	
LANE B	Select Lane A magneto/ignition source.	

### **7.2.8 EFIS**

The EFIS selection and control mechanism is described in detailed in the EFIS manufacturer documentation. Please refer to this documentation. Refer to 7.9.1 EFIS System for more detailed information.

### **7.2.9 Elevator Trim**

Elevator trim is electrically controlled by buttons on the control column, and these buttons are detailed in 7.2.1 Control Column(s).

The trim motor is located in the left elevator (if facing forward) and drives the trim tab. Pilot controls are via buttons on the control column, as detailed in 7.2.1 Control Column(s). The trim servo is powered by the main bus, though a circuit breaker.

### **7.2.10 Flap Control**

Wing flaps are electrically controlled by a four-position rotary knob or a four-pushbutton sector located on the instrument panel. Each selector position corresponds to the following flap deflection:

<b>Selector position</b>	<b>Degrees flap deflection</b>
0	0°
1	10°
2	20°
3	32°

The flap system makes use of an interconnected torque tube, with a servo in the cabin centre console. Bar a linkage failure, this prevents the flaps being deployed in an unsymmetrical manner.

The flap controller is powered from the main bus, via a circuit breaker.

**CAUTION**

If power on the main bus fails, the flap and trim system becomes defunct.

### **7.2.11 Cabin Heat**

Heated air, warmed by the heat exchanger with the engine exhaust, can be selected via a selection knob located on the instrument panel. The system can be activated by pulling out the knob.

## **7.3 Landing Gear**

The landing gear is a tricycle landing gear with a steerable nose wheel, regardless of braking architecture. The main landing gear uses a single continuous composite spring section.

## **7.4 Safety Harness and Seats**

The aircraft features side-by-side seating. Four-point safety belts are provided for each seat. Seats can be adjusted forwards and backwards, with forward movement also leading to the seat being elevated.

### **CAUTION**

Ensure that the seat(s) is securely locked into position after adjustment.

### **NOTE**

Prior to each flight, ensure that the seat belts are firmly secured to the airframe, and that the belts are not damaged. Adjust the buckle so that it assumes a central position relative to the body.

## 7.5 Baggage Compartment

The baggage compartment comprises of two sections positioned behind the seats and is designed to carry up to 15kg (33lb) in total. There is a narrow and slightly narrowed front section, and a higher, larger back section. Subject to the weight limitation, luggage may be loaded into the front or back section. *It is the pilot's obligation to ensure that the aircraft CG is within the permissible limits and that all baggage must be properly secured.*

## 7.6 Canopy

The aircraft is equipped with a sliding canopy mechanism. External access to the cabin is from either side. Latching mechanisms are provided inside and outside of the top roll-over bar, in the centre.

### WARNING

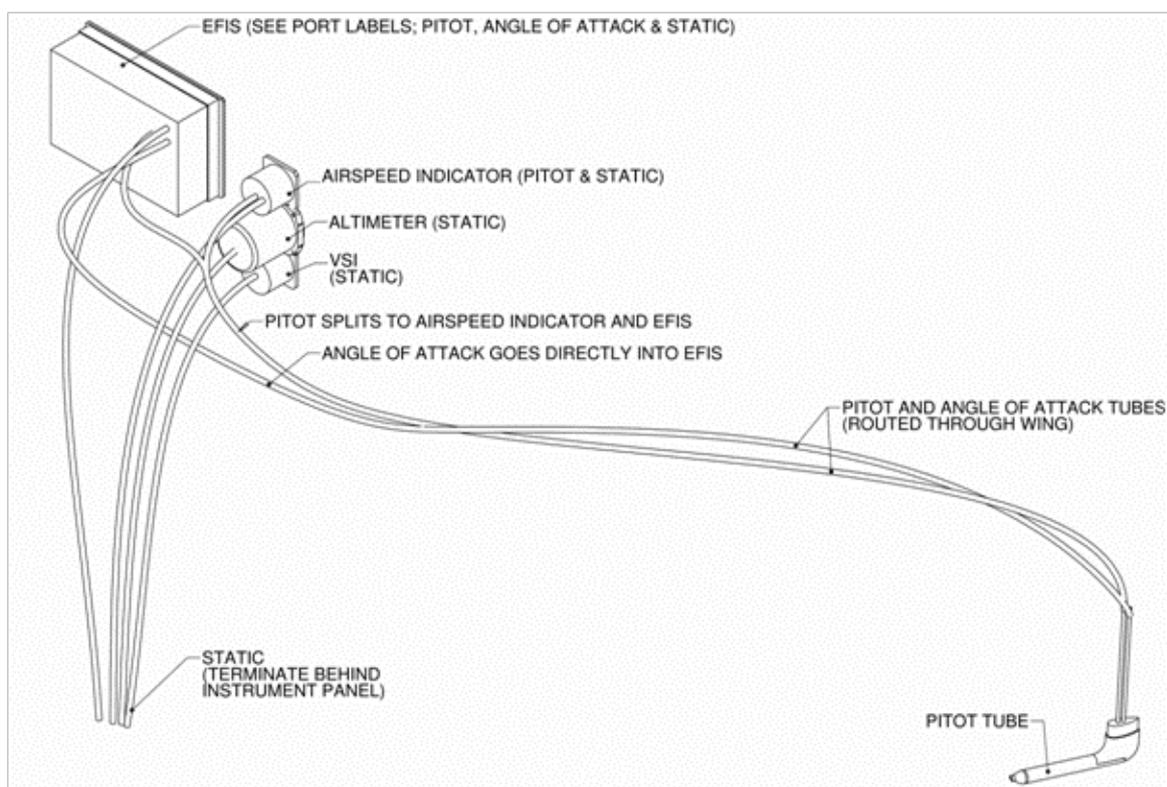
Ensure that the canopy/mechanism is securely latched into position before operating the aircraft.

## 7.7 Pitot and Static Systems

A pitot tube is located below the left wing, and the relevant pressures, experienced by the pitot, are transferred to the instrument through flexible hoses. The pitot features a second hole for the measurement of angle of attack. The static port is located behind the instrument panel. Keep the pitot head clean to ensure proper functioning of the system.

Ensure that the pitot tube cover is removed prior to every flight and that it is replaced after every flight.

An example of a pitot static system is below:

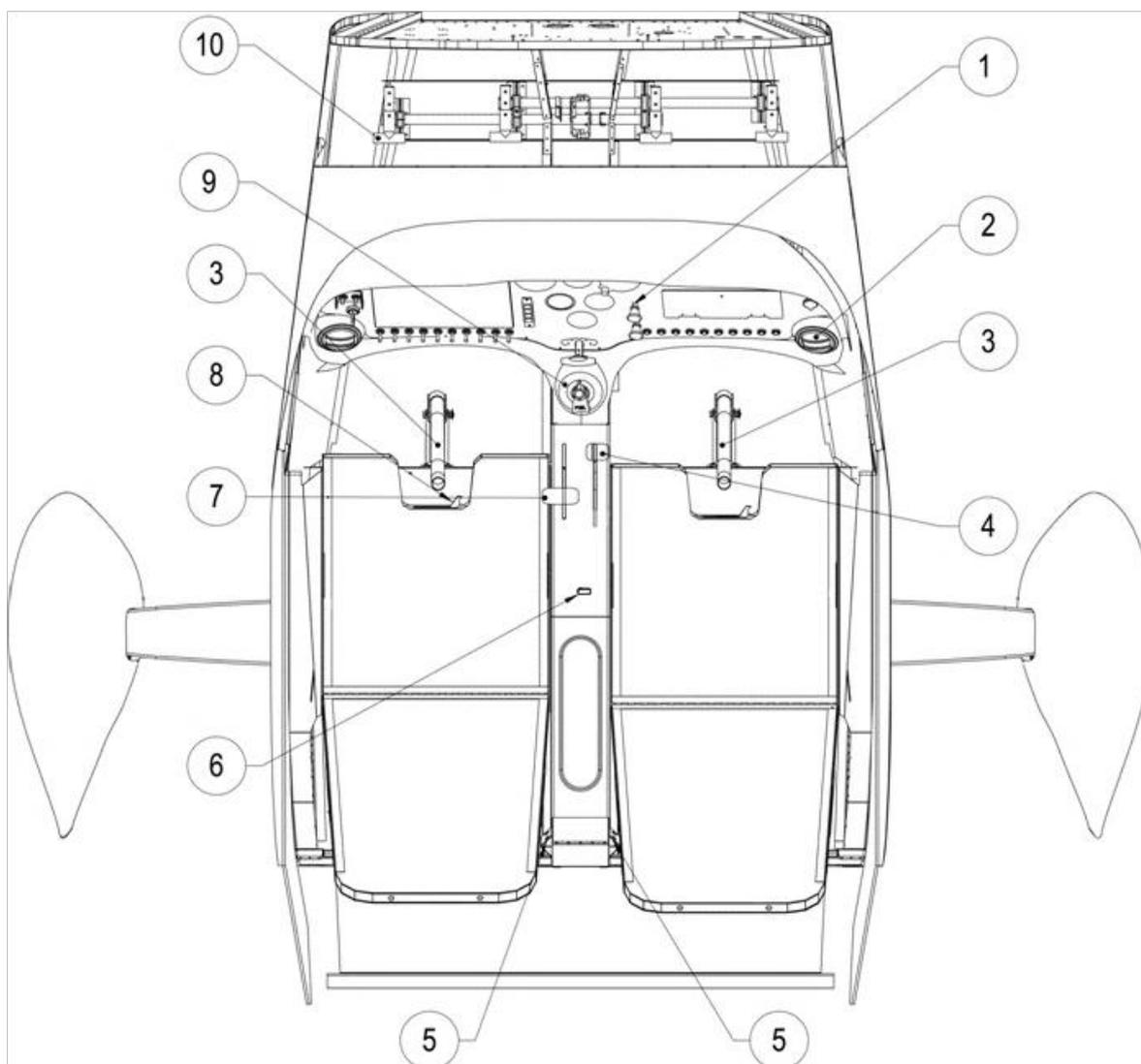


### NOTE

Please note that this drawing is representative of a pitot and static system only and may differ from the actual installation in the aircraft. For example, placement of instruments and actual instruments installed.

## 7.8 Cockpit Layout

The basic cockpit layout is the same for all Sling LSA aircraft, notwithstanding that instrumentation may differ substantially. All airplanes contain the minimum instrumentation, but particular airplanes may contain substantial additional instrumentation. The basic cockpit layout is configured as in the diagram, with key, below:



<b>Cockpit Layout Key</b>	
1	Instrument panel
2	Air vent
3	Control Stick (With PTT, Trim, AP Control)
4	Brake actuator (if footbrake not fitted)
5	Headset plugin sockets
6	Park-brake actuator valve
7	Throttle
8	Seat adjustment lever
9	Fuel selector valve
10	Rudder pedals (with brakes if footbrakes are fitted)
11	Ballistic parachute operating lever
12	Fire extinguisher

**NOTE**

If differential footbrakes are fitted, the hand operated actuator on the centre console will be absent.

Seats and pedals are adjustable. There is a unlocking leaver that allows the movement of the seat, and a locking/setting bolt that allows movement of the pedals.

A fire-extinguisher is held in place against the front retaining wall of the baggage space.

An adjustable red interior light is positioned behind and between the pilot and passengers' heads.

## 7.9 Instruments and Avionics

The diagram below represents an instrument panel containing the required minimum instrumentation, together with typical back-up and additional instrumentation supplied with the aircraft. The instrument panel in any particular aircraft may differ from that illustrated below, as choice of instruments and layout is decided by the customer. It is the responsibility of the pilot to ensure that they are familiar with the instrumentation in the aircraft, its layout and operation.



### 7.9.1 EFIS System

The Garmin G3X multifunction “Glass Cockpit” instrument is the standard EFIS used by Sling Aircraft. This instrument incorporates a range of different instruments and functions. The full instrumentation provided by the EFIS will typically include, but not limited to:

Feature	Comment
Speeds	<ul style="list-style-type: none"> <li>● ASI, IAS and TAS</li> <li>● Ground Speed</li> </ul>
Altitude	<ul style="list-style-type: none"> <li>● ALT</li> <li>● Height Above Ground (<i>Dependent on loaded maps</i>)</li> </ul>
VSI	<ul style="list-style-type: none"> <li>● Vertical Speed Indicator</li> </ul>
Compass	-
Attitude Indicator	-
Turn Coordinator	-
G-Meter	-
Time	<ul style="list-style-type: none"> <li>● Clock and Stopwatch</li> <li>● Flight Time Recorder</li> </ul>
Autopilot	<ul style="list-style-type: none"> <li>● If servos are fitted</li> </ul>
GPS Navigation	<ul style="list-style-type: none"> <li>● Comprehensive mapping and navigation software and data, including GPS and GLS (GPS Landing System)</li> </ul>
Engine Monitoring	<ul style="list-style-type: none"> <li>● RPM Indicator</li> <li>● CHT and EGT Indicators</li> <li>● Coolant Temperature</li> <li>● Oil Temperature and Pressure indicators</li> <li>● Fuel Level, Flow and Pressure Indicators</li> <li>● Hobbs and Flight Time Recorder</li> <li>● Voltmeter</li> </ul>

The EFIS installed can be powered from two separate systems:

- Main Bus
  - Through the main EFIS switch, labelled “EFIS”
- Back-up Battery
  - Through the selection switch, labelled “EFIS BKUP”
  - It is recommended that **BOTH** the main and the back-up switches are kept on during operation of the aircraft. This will ensure that, if there is a power failure on the main bus, the EFIS will automatically change over to the battery.

*Note – Use and set-up of the EFIS and its features extensively described in documentation supplied with the unit, and will not be dealt with in this handbook.*

*The autopilot functionality is incorporated in the EFIS.*

#### **WARNING**

Users should desist from entering the EFIS setup pages during flight as changes to the setup may result in incorrect readings and/or warnings resulting in safety degradation.

## 7.10 Minimum Instruments and Equipment Required for Flight

The following minimum instrumentation and equipment is required for day VFR flight:

#	Item
1	Altimeter
2	Airspeed Indicator
3	Compass
4	Fuel Gauges
5	Oil Pressure Indicator
6	Oil Temperature Indicator
7	Cylinder Head Temperature Indicator
8	Outside Air Temperature Indicator
9	Tachometer
10	Chronometer
11	First Aid Kit <i>(Compliant with Local Regulations – not required in US)</i>
12	Fire Extinguisher

### WARNING

Installed equipment may include GPS and other advanced flight and navigational aids. Such equipment may not be used as the sole information source, for purposes of navigation or flight, except where specifically permitted by law. The aircraft instrumentation is not certified, and applicable regulations should be complied with at all times.

## 7.11 Engine

The engine fitted, as standard, is the Rotax 912 iS. This engine is a 4-stroke, 4-cylinder, horizontally opposed, spark ignition engine, with one central camshaft -pushrod OHV and a displacement of 1211cc (1.2L/74 cubic inch). The engine makes use of liquid cooled cylinder heads with air cooled cylinders. The lubrication system can be described as sump forced lubrication and the ignition makes use of dual contactless capacitor discharge magneto type ignition system, that is ECU controlled. The engine is fitted with an electric starter motor, two AC alternators and two electric fuel pumps. The propeller is driven through a reduction gearbox, of ratio 2.43, and features an integrated shock absorber. The engine will continue to run after an alternator/battery failure. Please see 3.7.3 Alternator / Charge System Failure for more.

Please refer to the *latest revision* of the manufacturer documentation (Operators Manual / Maintenance Manual) for more information.

## 7.12 Cooling System

Cylinders are air-cooled, though forced air circulation from the inlets on the nose of the cowl, over cooling fins on the barrels.

Cylinder heads are liquid cooled via a closed-circuit system, with an expansion tank. The pump is driven from the camshaft and circulates the coolant in the loop (cylinder heads / radiator).

The expansion tank is closed by a pressure cap. When the coolant temperature rises, there is a pressure increase and coolant is forced into the overflow bottle, mounted on the firewall. When the coolant cools down, the coolant in the overflow bottle is drawn back into the expansion tank.

Conventional ethylene glycol coolant and distilled water mixture (1:1). Please refer to the latest edition of the engine manufacturers operators and maintenance manual.

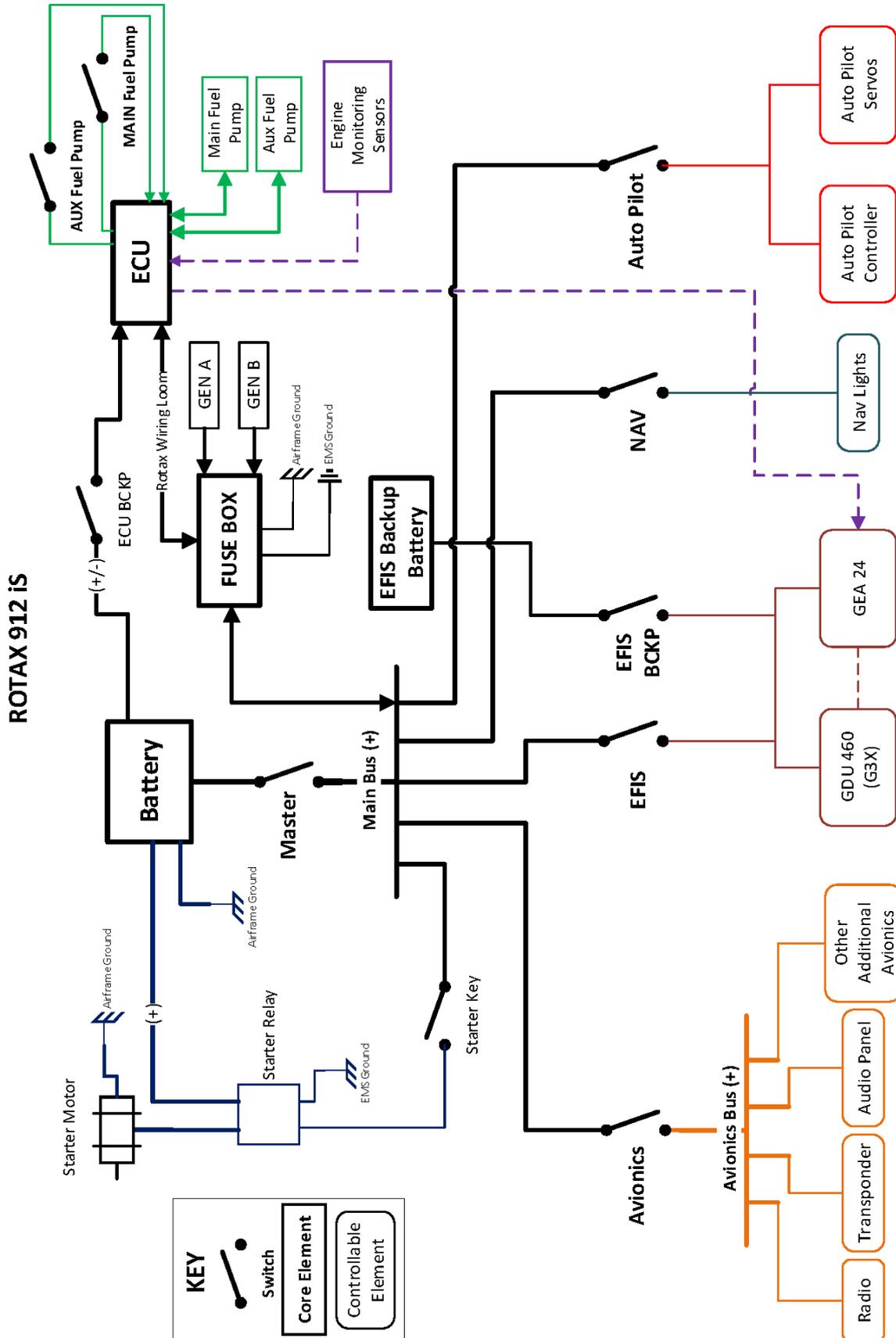
The coolant volume is approximately 2.5 litres (0.66 US Gal.)

### WARNING

Waterless coolant (*propylene-glycol*) may not be mixed with conventional (*ethylene-glycol/water*) coolant or additives. Mixture can lead to damage of the cooling system and subsequently the engine.

## 7.13 Electric System

### 7.13.1 Broad Overview Diagram



### **7.13.2 Charge System**

The alternating current (AC) output of the two alternators (A and B) is passes through a rectifier, where it is converted to direct current (DC) for the aircraft systems. The charge system output is approximately 13.5 to 14V (from 1000 +/- 250 rpm and higher). When a third external alternator is installed, the output is used to charge the battery through a breaker switch.

### **7.13.3 Main Battery**

The 12V, 17 Ah main battery is mounted on the engine side of the firewall.

### **7.13.4 Main Bus**

When power to the main bus is unavailable / fails, the following equipment will become non-operational:

#	Item
1	Autopilot (specifically, the servos)
2	Flaps
3	Radio
4	Transponder
5	Cabin Lights
6	Strobe, navigation, landing and taxi lights.
7	EFIS (unless powered by the EFIS battery back-up)

### **7.13.5 EFIS Back-up Battery / Circuit**

The 12V EFIS back-up battery is mounted on the cabin side of the firewall, under the instrument panel.

### **7.13.6 Master and Starter Switches**

The master switch is a toggle switch located on the left side of the instrument panel. It links the main bus to the 12V battery / charge system.

The starter switch is a key switch that is mounted on the left side of the instrument panel. It activates the starter motor.

### **7.13.7 Ignition Switches**

Two ignition switches, one for each system, are located on the left-hand side of the panel. The switches are marked as 'LANE A' and 'Lane B', and are two separate ignition circuits.

#### **NOTE**

The engine ignition system is independent of the aircraft electrical system (except for starter motor operation) and will operate even with the master switch and / or any circuit breaker(s) off. The 912 iS engine requires adequate power supply to at least one electrical fuel pump to remain operational (to prevent fuel starvation).

### **7.13.8 Electrical Equipment Switches**

Lever type switches are used, and are ON in the UP position, and OFF in the DOWN position. There are exceptions to this, for instance, the taxi light switch is a three-way switch, i.e. ON-WIG WAG-OFF.

### **7.13.9 Circuit Breakers**

Circuit breakers are push-to-reset (i.e. push in) for restoring/supplying electrical power to their corresponding electrical circuits. Circuit breakers are located on the instrument panel.

## **7.14 Propeller**

There are two common options for the propeller, with the default being the first:

1. Warp Drive, 72-inch, solid composite, ground adjustable, 3-blade, composite propeller.
2. Whirlwind, 70-inch, hollow composite, ground adjustable, 3-blade propeller.
3. Sensenich 65-inch, hollow composite, ground adjustable, 3-blade propeller.

**NOTE**

For technical data refer to documentation supplied by the propeller manufacturer.

## 7.15 Fuel System

The aircraft makes use of a fuel tank located in the leading edge of each wing (*only right in South Africa*). The tank is equipped with a vent (underneath the wing) and a finger screen (at fuel pickup). A drain valve is located at the lowest point of the tank to collect possible contaminants, such as water. The tank outlet leads to the fuel selector valve, situated on the central console in the cockpit. From there, it leads to the engine through two electric fuel pumps and past a fuel pressor sensor, which is displayed on the EFIS. The fuel return then is routed back to the respective tank, which returns excess fuel supplied by the pumps and not used by the engine.

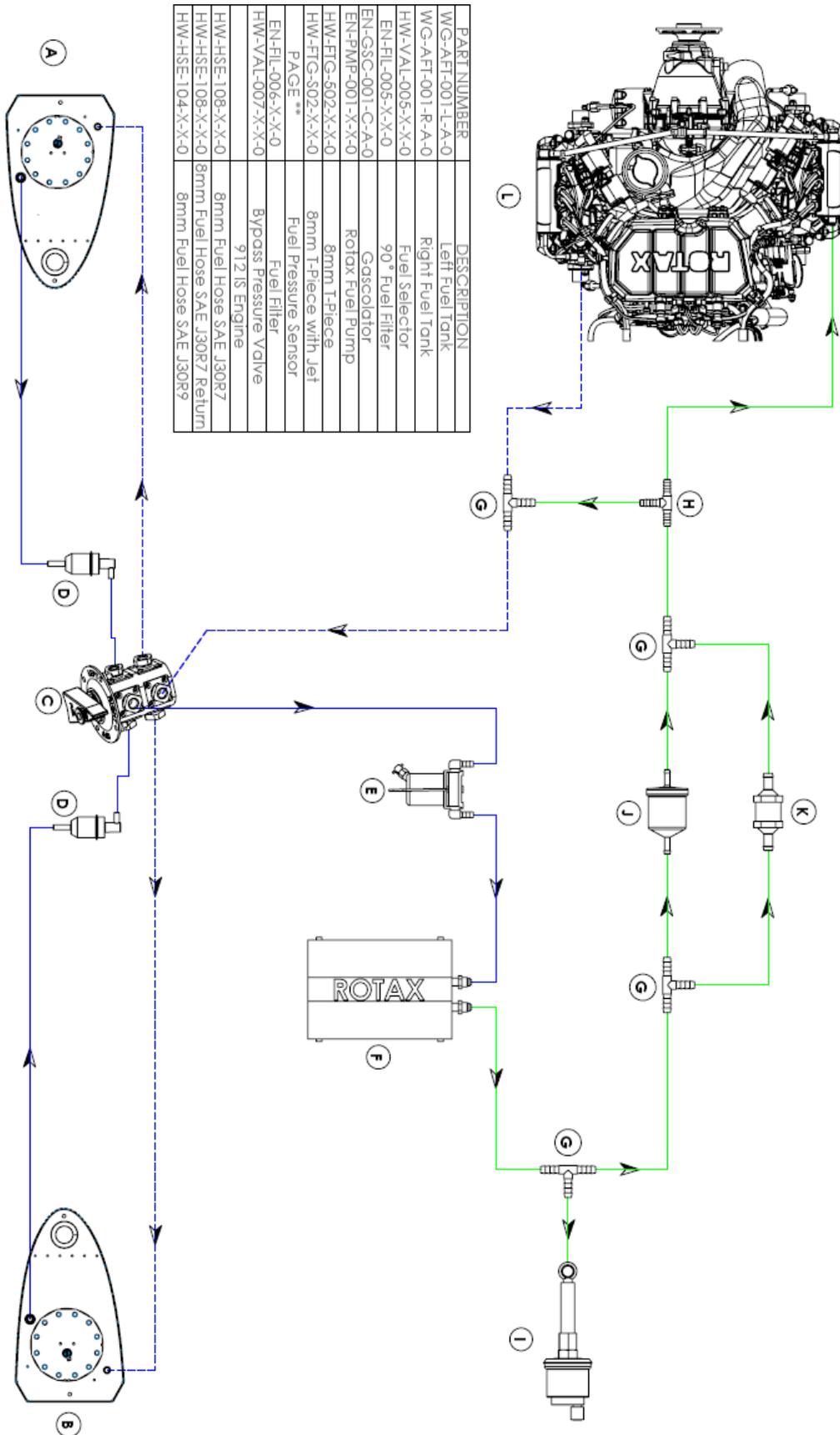
Total volume of the wing tank(s) are:

- RSA
  - 75 litres (73 litres useable)
  - 19.8 gal. (19.3 US gal. useable)
- International, including United States.
  - 150 litres (146 litres useable)
  - 39.6 gal. (38.5 gal. useable)

### WARNING

The fuel pick-up pipe in the fuel tank is situated adjacent to the lower inside wall of the tank. The aircraft should at no time be subjected to a sustained sideslip towards a near empty fuel tank, as it may cause air to be drawn into pickup, as fuel will run to the tip end of the tank. This poses a significant threat when at low altitudes, such as landing.

A diagram of the fuel system is as follows, with a key –



Fuel System Diagram Key – 912 iS			
A	Port (left) fuel tank <i>(International version only)</i>	G	8mm T-piece
B	Starboard (right) fuel tank	H	8mm T-piece with jet
C	Fuel selector (OFF, ON, OFF)	I	Fuel pressure sensor
D	Fuel filter (90° bend)	J	Fuel filter
E	Gascolator	K	Bypass pressure valve
F	Rotax fuel pump	L	912 iS Engine

### 7.15.1 Main and Auxiliary Fuel Pumps

The main and auxiliary fuel pumps are powered via the EMS/ECU. As long as power is available to the EMS/ECU, both fuel pumps can be selected/operated, irrespective of the master switch status.

#### WARNING

At least one fuel pump must be operational at all times during flight for the engine to be operational with no pump operational engine stoppage will occur due to fuel starvation.

## **7.16 Lubrication System**

This information is relevant for the 912 iS. For information regarding the 912 ULS, please see the appendix at the back of this manual.

The engine is provided with a dry sump forced lubrication system with a camshaft driven pump, with an integrated pressure regulator. The pump delivers oil from the oil reservoir, through an oil cooler and oil filter to points of lubrication.

Surplus oil emerging from the points of lubrication gather at the bottom of the crankcase from where it is forced back to the oil reservoir by piston blow-by gasses.

Oil temperature is sensed by a sensor located on the crankcase.

The lubrication circuit is vented at the oil reservoir. The oil reservoir is mounted on the firewall.

The lubrication system has an approximate volume of 3.5 litres (3.7 Quarts/7.4 pints).

## 7.17 Autopilot System

The autopilot system is integrated into / with the EFIS unit.

The EFIS / autopilot inputs data from an electronic compass and AHRS. With this, it controls two servos (one for pitch and one for roll), linked to the aircraft control system.

Power to the servos is controlled via a switch labelled AUTOPILOT, located at the instrument panel. This switch must be on for the autopilot to have any effect.

The autopilot can be engaged by:

- The autopilot engage / disengage button on the control sticks(s)
- Via the EFIS screen interface

The autopilot can be disengaged by:

- The autopilot engage / disengage button on the control sticks(s).
- Via the EFIS screen interface
- A servo reports a slipping clutch or torque overdrive for 1 second, i.e., the pilot overrides the autopilot via force in the control column.
- Removing power to the autopilot servos, at the isolating switch, removing the ability of the controller to control the servos.

## 7.18 Position, Anti-collision, Taxi and Landing Lights

The aircraft is equipped with a landing and taxi light in the leading edge of the wing. The standard option is left wing only, with an optional extra for left and right wing. This is typically a requirement for IFR rated aircraft. The control of these lights are through switches labelled (LAND) and (TAXI). With the dual light option, the TAXI switch is a three-way switch controlling ON-WIG WAG-OFF.

Combination navigation/position lights (red, green and white) and anti-collision lights (white) are fitted to the wingtips, in the standard configuration (red left, green right). A combination position/anti-collision light (white) is fitted underneath the vertical stabilizer.

The white lights on the wingtips and rudder are dual function lights, that can either be on continuously (*position light*), flash (*anti-collision*), or flash at a higher brightness level superimposed on continuous operation, i.e., combination position and anti-collision light.

The method of control of all lights is:

Switch	Light Element				
	Landing	Taxi	Red / Green Wingtips	White Wingtips	White Empennage
TAXI		ON			
WIG-WAG		ON (Flashing)			
LAND	ON				
NAV			ON	ON (Steady)	ON (Steady)
STROBE				ON (Flashing)	ON (Flashing)

## **8 Ground Handling and Servicing**

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8.3	Servicing .....	8-5
8.4	Cleaning and Care .....	8-7

## 8.1 Introduction

This section contains factory-recommended procedures for proper ground handling and servicing of the Sling LSA. It also identifies certain inspection and maintenance requirements, which should be followed at all times. Full details for servicing and maintenance appear in the aircraft maintenance manual. *This document does not replace the maintenance manual.*

## 8.2 Ground Handling

### 8.2.1 Taxiing

When taxiing, it is important to use all controls at their minimum to achieve what is required, such as the throttle and brakes. Speed must be kept to a minimum during all ground operations. Caution must be taken in windy conditions, and the following control inputs must be made, depending on wind direction (*originating from*):

Wind Direction (Originating From)	Control	Action
Front	Elevator	Nose Down
Front Left	Elevator	Neutral
	Aileron	Roll Left
Front Right	Elevator	Neutral
	Aileron	Roll Right
Rear Left	Elevator	Nose Down
	Aileron	Roll Right
Rear Right	Elevator	Nose Down
	Aileron	Roll Left
Rear	Elevator	Nose Down

### **8.2.2 Towing**

If you wish to move the aircraft, other than under its own power, it is best to pull/push the aircraft by holding one or more of the propeller blades, close to the spinner. The rear fuselage/empennage may be pushed down directly above the bulkhead or close to the root on the horizontal stabilizer, directly above the front spar where it attaches to a rib. This for lifting the nosewheel for manoeuvring purposes.

It is also acceptable to push the aircraft backwards by putting pressure on the wing/horizontal stabilizer leading edge, directly over a rib.

#### **CAUTION**

Avoid excessive pressure on the aircraft airframe - especially at or near control surfaces. The skins are thin and minimum pressure should be placed on them. Excessive pressure could lead to the buckling of the skin.

### **8.2.3 Parking**

It is advisable to park the aircraft inside a hangar, or alternatively inside other suitable spaces, with good temperature, good ventilation, low humidity and dust-free.

When parking for extended for extended periods, cover the cockpit canopy, and possibly the whole aircraft by means of a suitable tarpaulin.

When parking the aircraft outside, avoid parking for extended periods of time. Cover the panel/interior with a suitable cover or canopy cover to avoid degradation of the upholstery due to the sun.

### 8.1.1. Mooring

The aircraft should be tied down when parked outside the hangar. Mooring is necessary to protect the aircraft against possible damage caused by wind and gusts.

For this reason, the aircraft is equipped with mooring eyes located on the lower surfaces of the wings and one under the tail.

The mooring procedure is as follows:

1. Fuel Selector ..... OFF
2. Switches..... ALL OFF
3. Master ..... OFF
4. Ignition / Lanes ..... OFF
5. Control Column..... SECURE<sup>(a)</sup>
6. Air Vents ..... CLOSE
7. Canopy..... CLOSE AND LOCK
8. Moor..... THOUGH MOORING EYES<sup>(b)</sup>
9. Chocks..... INSTALL

#### NOTES

- a. Through use of a, for example, safety harness.
- b. Typically, rope will be used to connect the aircrafts mooring eye, with a mooring eye fastened in the ground/concrete.

#### NOTE

In the case of long-term parking, especially during winter, it is recommended to cover the cockpit canopy, or possibly the whole aircraft, by means of a suitable tarpaulin attached to the airframe.

### **8.2.4     *Road Transporting***

The aircraft may be transported after loading on a suitable, aircraft specific trailer, or a flatbed with suitable rigging. It is necessary to remove the wings before road transport. It is suggested that the wings should be securely stored in a cradle of some kind.

## 8.3 Servicing

### 8.3.1 Jacking

Since the empty weight of the aircraft is relatively low, two people are usually able to lift the aircraft.

It is possible to lift the aircraft in the following manner:

- By pushing the rear fuselage section down above the bulkhead, the fuselage front section may be raised, and a support placed under the firewall. The same effect can be achieved by pushing down on the horizontal stabilizer as described under 8.2.2 Towing.
- By lifting the rear fuselage under a bulkhead, the rear fuselage may be raised and then supported under that bulkhead. The support should comprise of a large, flat surface to avoid damage to the under-fuselage skin. The wings should also be gently supported to prevent the aircraft from rolling as its weight shifts to the nose wheel.
- To lift a wing, push from underneath the wing at the main spar only, and use a support with a large surface area again. *Do not attempt to lift the wing by placing force on the composite wingtip.*
- A wheel can be lifted by either lifting the wing, or jacking under the wheel strut where it meets the fuselage.

### **8.3.2 Aircraft Inspection/Servicing Periods**

Periods of checks and contingent maintenance depend on operating conditions and overall condition of the aircraft.

Inspections and servicing should be carried out according to (at least) the following periods:

After first flight	25 flight hours
And thereafter every whichever first.	100 flight hours or annually,
of the	This is stipulated in the latest revision
manufacturer	applicable <sup>(a)</sup> engine/propeller documentation.

**NOTES**

- a. Both the manufacturers' Operators Manual and Maintenance Manual

More detail is supplied in the *Sling LSA Maintenance Manual*.

### **8.3.3 Aircraft Modifications and Repairs**

It is recommended that you contact the aircraft manufacturer prior to making any modifications to the aircraft, to ensure that the airworthiness of the aircraft is not affected. Always use only the original spare parts, produced by the aircraft/engine/propeller manufacturer.

If the aircraft's weight is affected by the modification, a new mass and balance calculation is necessary. This should be completed comprehensively and recorded in all relevant documentation.

### 8.3.4 *Servicing fuel, Oil and Coolant*

This document makes a brief statement on these topics in Section 1. Before carrying out any work, refer to the Rotax Maintenance and Operators Manual, along with the Sling LSA Aircraft Maintenance Manual.

## 8.4 Cleaning and Care

Use efficient cleaning detergents to clean the aircraft, such as regular car wax or degreaser. Detergents with a wax coating will better preserve the paintwork of the aircraft. Oil spots on the aircraft surface **(except for the canopy)** may be cleaned with petrol/gasoline.

The canopy may only be cleaned by washing it with a sufficient quantity of lukewarm water and an adequate amount of compatible detergent. Use either a soft, clean cloth sponger or deerskin. Then use suitable dry polishers/soft cloth to clean the canopy.

Upholstery and covers may be removed from the cockpit, brushed and washed in lukewarm water, with an adequate quantity of detergents. Dry the upholstery before refitting.

#### CAUTION

**Never** clean the canopy under dry conditions or use petrol or chemical solvents.

## **9 Supplementary Information**

9.1	Introduction.....	9-1
9.2	Supplement 02/2010 – Airplanes fitted with a Magnum 601 Ballistic Parachute.....	9-2
9.3	Supplement 04/2012 – Airplanes Fitted with a Rotax 912 ULS Engine.....	9-4
9.4	Supplement 03/2010 – Airplanes Fitted with and Airmaster AP332 Propeller .....	9-16

## 9.1 Introduction

This section contains the appropriate supplements necessary to safely and efficiently operate the aircraft when equipped with various common optional extras not supplied with the standard aircraft.

The supplements included in this manual are –

Date	Supplement No.	Title of inserted supplement
04/06/12	02/2010	Airplanes fitted with a Magnum 601 Ballistic Parachute recovery system
19/10/12	04/2012	Airplanes fitted with a Rotax 912 ULS engine
09/05/19	03/2010	Airplanes fitted with an Airmaster AP332 propeller

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## 9.2 Supplement 02/2010 – Airplanes fitted with a Magnum 601 Ballistic Parachute

### 9.2.1 Introduction

This supplement must be kept with the Pilot Operating Handbook during operation of the airplane.

The information contained in this supplement adds to or replaces information from the standard Pilot Operating Handbook, with regards only to the specific sections addressed herein. Limitations, procedures and information not specifically addressed in this supplement remain as set out in the Pilot Operating Handbook.

This supplement provides information necessary for the operation of an aircraft fitted with a Magnum 601 ballistic parachute.

- The Sling LSA is specifically designed for convenient fitment of the Magnum 601 ballistic parachute recovery system, manufactured by Stratos 07. The system is designed to enable the pilot or passenger to deploy the parachute, in case of an emergency, in such a manner that the aircraft structure is carried under the parachute to the ground. Thus, to ensure that the occupant will not be injured, and the aircraft suffers minimum damage.
- Use of a ballistic parachute system involves inherent risks, and the system should be properly understood by the pilot prior to use.



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## 9.3 Supplement 04/2012 – Airplanes Fitted with a Rotax 912 ULS Engine

### 9.3.1 Introduction

This supplement must be kept with the Pilot Operating Handbook during operation of the airplane.

The information contained in this supplement adds to or replaces information from the standard Pilot Operating Handbook, with regards only to the specific sections addressed herein. Limitations, procedures and information not specifically addressed in this supplement remain as set out in the Pilot Operating Handbook.

This supplement provides information relating to the operation of an aircraft fitted with a Rotax 912 ULS engine.

The Rotax 912 ULS makes use of dual carburetors and is not electronically controlled like the iS version. The ULS has the same power rating as the iS and airplane performance with the two engines materially similar. Better fuel economy, especially in cruise, may be observed with the iS engine.

There are minor differences between the engines at starting and shutdown, and in the case of certain engine related emergency procedures. The instructions in this supplement are the minimum required for the pilot to competently operate the 912 ULS engine. It is the responsibility of the pilot to fully familiarize themselves with the engine Operators Manual supplied by Rotax GmbH. A copy of this document is supplied with the aircraft.

### 9.3.2 *Rotax 912 ULS Engine Operating and Speed Limits*

<b>Engine Start and Operation Temperature Limits</b>	
Maximum Ambient Temperature	50 °C (122 °F)
Minimum Oil Temperature	-25 °C (-13 °F)

<b>Engine Load Factor Limits (<i>Acceleration</i>)</b>	
Maximum	5 seconds at -0.5g

<b>Item</b>		<b>Value</b>
<b>Engine Model</b>		ROTAX 912 ULS
<b>Engine Manufacturer</b>		Bombardier-Rotax GMBH
<b>Power</b>	Maximum take-off	73.5 kW / 100 hp at 5800 rpm, max. 5 minutes
	Maximum continuous	69 kW / 92 hp at 5500 rpm
<b>RPM</b>	Maximum take-off	5800 rpm, max. 5 minutes
	Maximum continuous	5500 rpm
	Idle	1 400 rpm (minimum)
<b>Cylinder head temperature</b>	Minimum	N/A
	Maximum	135 °C (275 °F)
	Normal	75 to 110 °C (167 to 230 °F)
<b>Oil temperature</b>	Minimum	50 °C (122 °F)
	Maximum	130 °C (266 °F)
	Normal	90 to 110 °C (194 to 230 °F)
<b>EGT</b>	Maximum	880 °C (1616 °F)
<b>Coolant temperature</b>	Maximum	120 °C (248 °F)
<b>Oil pressure</b>	Minimum	0.8 bar (12 psi) – below 3500 rpm
	Maximum	7 bar (102 psi) – permissible for short period during cold engine start
	Normal	2 to 5 bar (29 to 73 psi) – above 3500 rpm
<b>Fuel Pressure</b>	Minimum	0.15 bar (5.8 psi)
	Maximum	0.5 bar (7.26 psi)

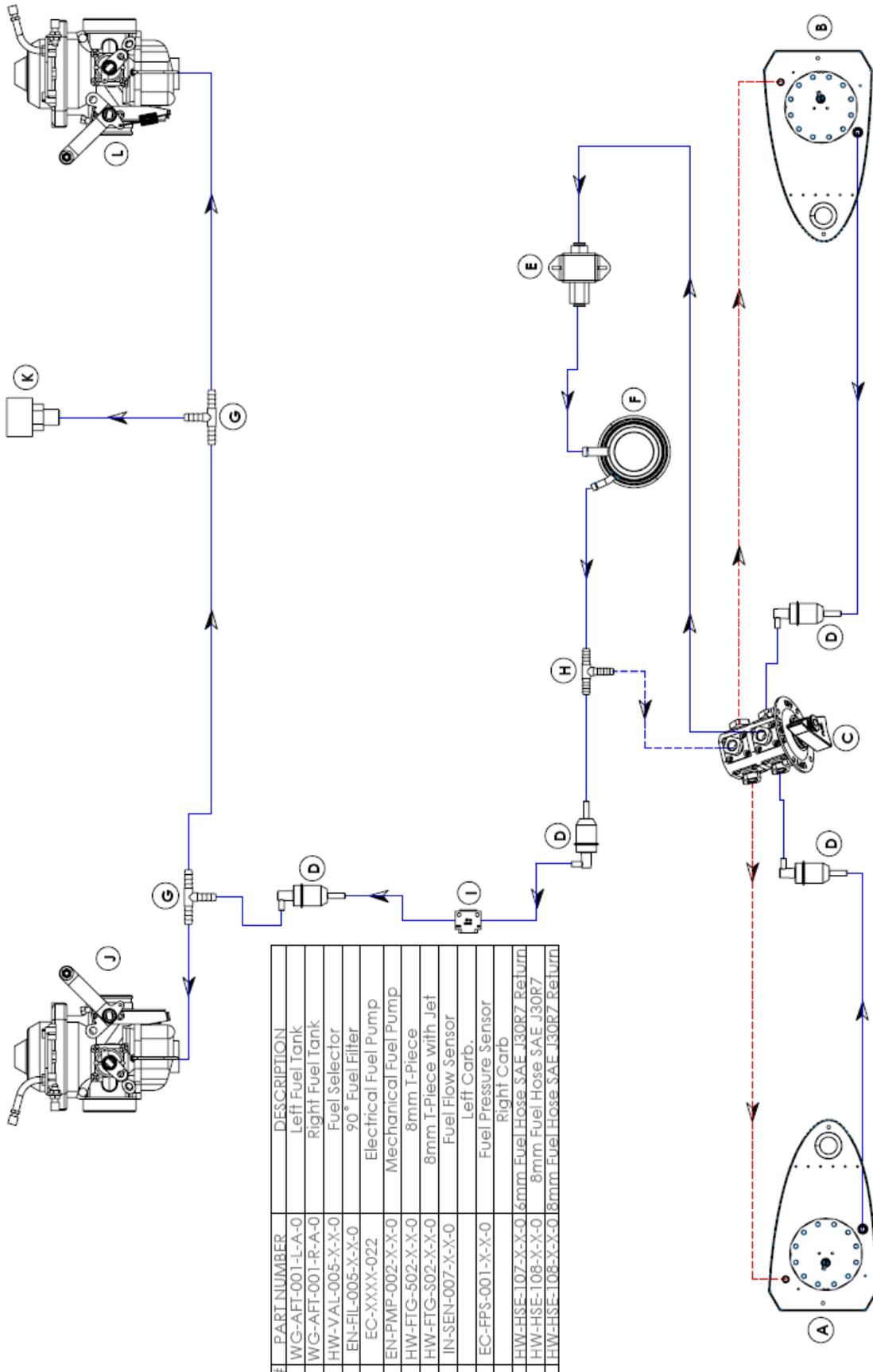
### **9.3.3      *Rotax 912 ULS Fuel, Oil and Coolant Specifications***

Fuel and oil specification are the same as the 912 iS motor.

<b>Coolant</b>	
<b>Item</b>	<b>Value</b>
Cooling System	<i>Mixed – Air and close circuit pressurized liquid. Air cooled cylinders and liquid cooled cylinder heads</i>
Coolant	Ethylene glycol-based coolant mixed 1:1 with distilled water. <i>Applicable for engine S/N without suffix -01 – Waterless Coolant.</i>
Coolant Capacity	Approx. 2.5 litres (5.28 pints)

Refer to the latest revision of the Rotax ULS Operator / Maintenance Manual and to the latest revisions of the Rotax service instruction with regards to the selection of operating fluids.

### 9.3.4 Rotax 912 ULS Fuel System

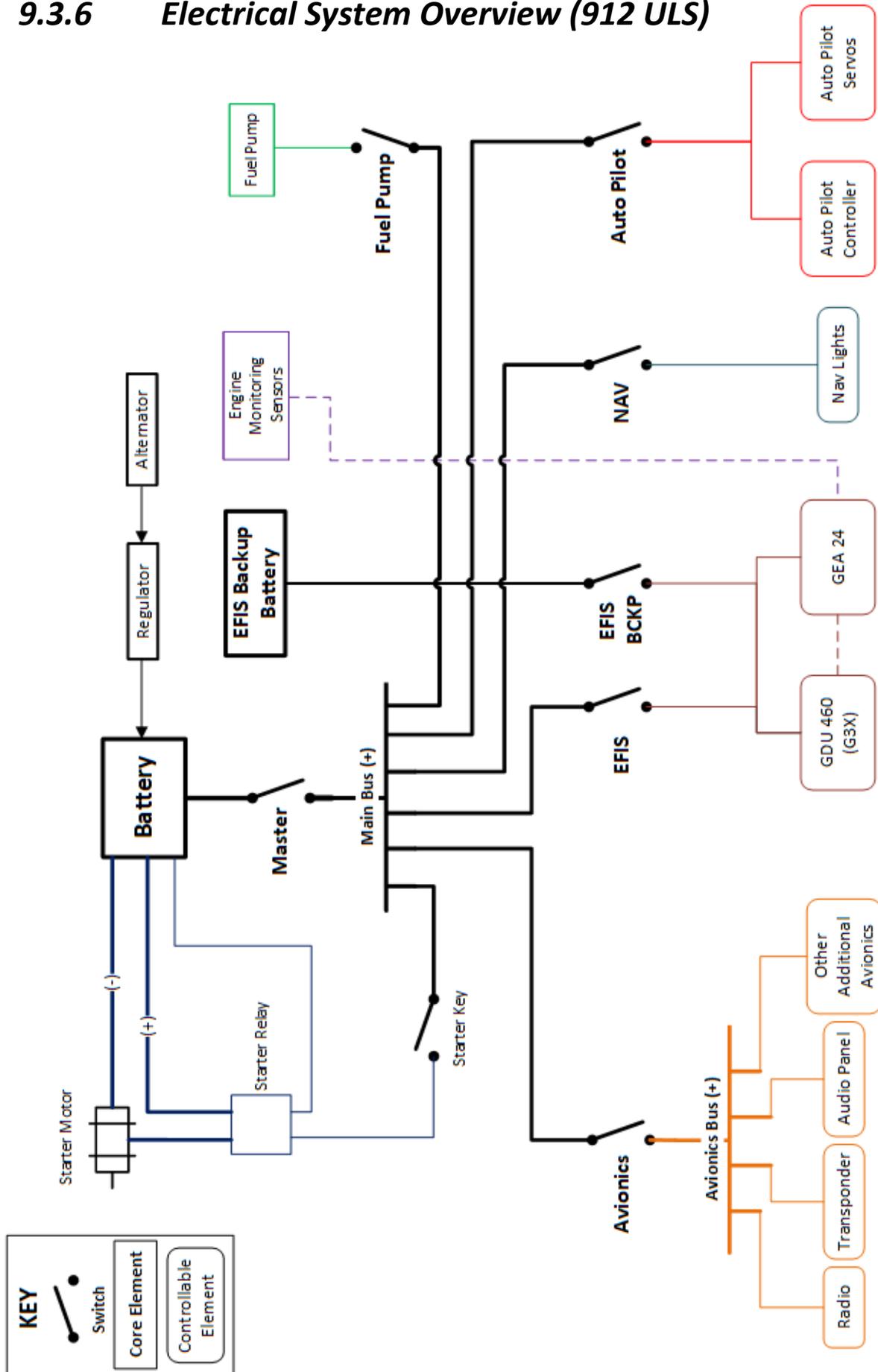


<b>Fuel System Diagram Key – 912 ULS</b>			
<b>A</b>	Port (left) fuel tank <i>(International version only)</i>	<b>G</b>	8mm T-piece
<b>B</b>	Starboard (right) fuel tank	<b>H</b>	8mm T-piece with jet
<b>C</b>	Fuel selector (LEFT, RIGHT, OFF)	<b>I</b>	Fuel flow sensor
<b>D</b>	Fuel filter (90° bend)	<b>J</b>	Port (left) carburettor
<b>E</b>	Electric fuel pump	<b>K</b>	Fuel pressure sensor
<b>F</b>	Mechanical fuel pump	<b>L</b>	Starboard (right) carburettor

### **9.3.5 Electrical Switches**

SWITCH / LABEL	FUNCTION	POSITION
MASTER / STARTER KEY SWITCH	Power disconnected from main bus.	OFF
	Main bus connected to power.	ON
	Engage starter motor.	START
EFIS	Switch power (main bus) to EFIS system on/off.	UP ON  DOWN OFF
EFIS BKUP	Connects EFIS to EFIS back-up battery.	
FUEL PUMP	Switch main fuel pump on/off.	
LAND	Switch landing lights on/off.	
TAXI	Switch taxi lights on/off.	
NAV	Select position (navigation) lights.	
STROBE	Select anti-collision (strobe) lights.	
AVIONICS	Switch power to radio and transponder on/off.	
AUTOPILOT	Switch power to autopilot servos on/off.	
MASTER	Switch power to main bus on/off.	
IGNITION	Switch on key; <i>Mag A, Mag B, Both, Start</i>	

**9.3.6 Electrical System Overview (912 ULS)**



### **9.3.7     *Master and Starter Switches***

The master switch on the 912 ULS equipped aircraft provides the following functionality:

- Connects / disconnects the main battery to the main bus.

The ignition switch on the 912 ULS equipped aircraft provides the following functionality:

- Selection of the magneto (A, B, BOTH)
- Activation of the starter

### **9.3.8     *Electrical Power Generation and Failure***

Unlike the 912 iS, the 912 ULS only has one internal alternator, which is rectified and regulated to charge the main battery. If this alternator fails, the engine will continue to run. The ULS does not make use of an ECU, but uses magnetos and carburetors instead, which is why it can run after an alternator failure. All non-essential equipment must be turned off to ensure that battery is conserved before being able to land. Utilize the capacity of the EFIS backup battery fully, then when it goes flat, switch back to the main battery. This will ensure that all battery resource is used to power all instruments at once i.e., EFIS, Radio, Transponder, Flaps, Trim etc.

### **9.3.9 Emergency Procedures (Alternative)**

#### **9.3.9.1 Air-Start**

1. Fuel Pump ..... ON
2. Fuel Selector ..... CHANGE (*UNLESS 2<sup>ND</sup> TANK DRY*)
3. Throttle ..... CHECK MOVEMENT
4. Throttle ..... MIDDLE POSITION
5. Master ..... ON
6. Magnetos ..... BOTH ON
7. Starter ..... ENGAGE

#### **9.3.9.2 Irregular Engine RPM**

1. Magnetos ..... BOTH ON
  2. Throttle ..... VERIFY POSITION
  3. Fuel Quantity ..... CHECK
  4. Fuel Selector ..... CHANGE (*UNLESS 2<sup>ND</sup> TANK DRY*)
  5. Fuel Pump ..... ON
  6. Oil – Pressure ..... CHECK
  7. Oil – Temperature ..... CHECK
  8. Coolant – Temperature ..... CHECK
  9. EGT – Temperature ..... CHECK
- If engine continues to run rough –*
10. Precautionary Landing ..... AS SOON AS POSSIBLE

**9.3.9.3 Alternator Failure**

An alternator failure is characterized by the charge warning light being illuminated on the instrument panel.

1. Battery / Charge Voltage .... VERIFY FAILURE<sup>(a)</sup>
2. Non-Essential Equipment.... OFF
3. EFIS Back-up..... ON
4. EFIS Screen Brightness ..... MINIMUM
5. Radio Communications ..... MINIMUM
6. Land ..... AS SOON AS PRACTICABLE

**NOTES**

- a. If alternator is operating correctly, the voltage will be above 13V.  
If the charge circuit has failed, this voltage will be below 13V.



**9.3.10.2 Run Up & Pre-Takeoff**

1. Face into wind ..... IF POSSIBLE
2. Oil Temperature ..... ABOVE 50°C
3. Fuel Pump ..... ON
4. Engine..... 4000 RPM
5. MAG A ..... OFF (*2 SEC., NO MORE THAN 180 RPM DROP*)  
..... ON
6. MAG B ..... OFF (*2 SEC., NO MORE THAN 180 RPM DROP*)  
..... ON
7. Fuel Pressure ..... CHECK (*CORRECT AND STABLE*)
8. Engine..... 2500 RPM
9. Fuel Quantity..... VERIFY (*SUFFICIENT FOR PLANNED FLIGHT*)
10. Fuel Selector..... FULLEST TANK
11. Circuit Breakers ..... ALL IN
12. Switches ..... CHECK AND SET AS REQUIRED
13. Instruments ..... CHECK AND SET ALL
14. Controls..... FREE & FULL / CORRECT SENSE
15. Trim ..... SET NEUTRAL
16. Flaps ..... SET STAGE 1 / TAKEOFF
17. Engine Parameters ..... VERIFY (*TEMPERATURES, PRESSURES, VOLTAGES*)
18. Canopy ..... CLOSED / LATCHED
19. Harness ..... SECURE (*CORRECTLY FASTENED AND TIGHT*)
20. Brief Passengers ..... BRIEF

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## 9.4 Supplement 03/2010 – Airplanes Fitted with and Airmaster AP332 Propeller

### 9.4.1 Introduction

This supplement must be kept with the Pilot Operating Handbook during operation of the airplane.

The information contained in this supplement adds to or replaces information from the standard Pilot Operating Handbook, with regards only to the specific sections addressed herein. Limitations, procedures and information not specifically addressed in this supplement remain as set out in the Pilot Operating Handbook.

This supplement provides information necessary for the operation of an aircraft fitted with an Airmaster AP332 variable pitch, constant speed propeller.

Propeller control is via an electronic control unit mounted on the instrument panel.

Power to the propeller/propeller controller is provided via the main bus and activated by a switch labelled PROP, located on the instrument panel.

### **9.4.2 Observed Improvements**

Fitment of an Airmaster AP332 propeller to the aircraft will substantially improve aircraft performance relative to the use of a fixed pitch propeller. General improvement will be witnessed, where the aircraft is fitted with a Rotax 912 ULS or 912 iS engine, in relation to:

<b>Improvements</b>	
1	V <sub>h</sub> will be increased from 116 KIAS to 120 KIAS
2	The aircraft service ceiling will increase to 14,000 ft.
3	Take-off distance on concrete and grass will improve from 120m (395ft.) and 140m (460ft.), to 100m (328ft.) and 120m (394ft.) respectively with the AP332 propeller.
4	Take-off distance (Over 15m, 50ft) on concrete and grass will improve from 230m (755ft.) and 250m (820ft.), to 160m (525ft.) and 180m (590ft.) respectively with the AP332 propeller.
5	Rates of climb will improve at 0, 3000, 6000 and 9000ft. ISA will improve from 800, 600, 500, 400 rpm to 900, 800, 700, 600 fpm.
6	Cruise speeds will not be altered substantially, unless higher power settings are used.
7	Fuel consumption will not be changed unless higher power settings are used.

Reference should be made to the Operators Manual for the Airmaster AP332 Propeller operational guidelines and instructions. These should be incorporated into the normal and emergency procedure for the aircraft as applicable.

### 9.4.3 Propeller Control Failure (VP Only)

The propeller/propeller controller can fail in a variety of modes/ways. The pilot should completely familiarize themselves with the Airmaster propeller operator’s manual, and specifically the section that deals with **Emergency Operation** and **Failure Modes**.

The following immediate actions should be taken in the event of any propeller control failure:

1. Engine Speed ..... PREVENT OVERSPEED
2. Propeller Mode ..... SELECT MANUAL (MAN)
3. Propeller Pitch ..... VERIFY OPERATION  
*If propeller pitch control is still **available** –*
4. Propeller Pitch ..... SET TO REQUIRED  
*If propeller pitch control is **unavailable** –*
5. Propeller switch ..... OFF  
*If failure results in pitch **within** flight range –*
6. Proceed..... WITH CAUTION treat as if it is fixed propeller  
*If failure results in pitch **outside** flight range –*
7. Precautionary Landing ..... EXECUTE

**CAUTION**

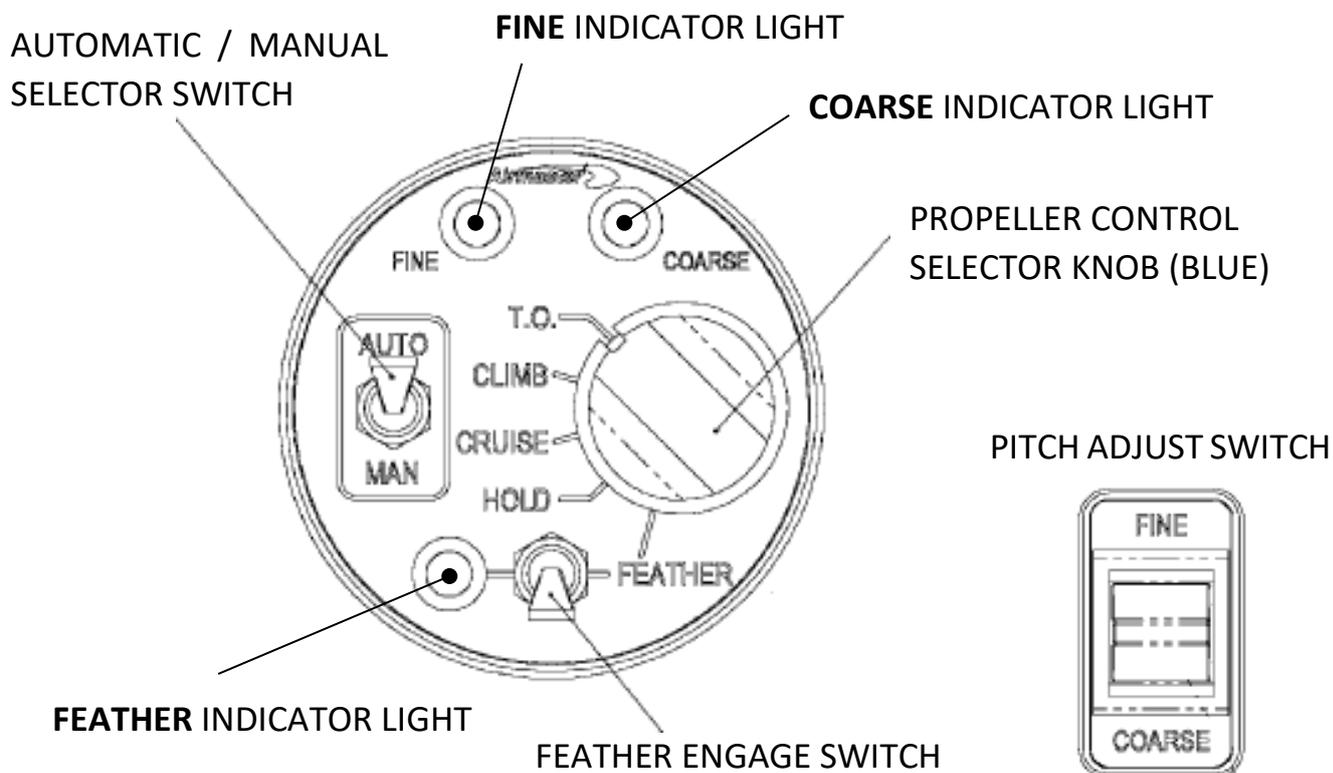
Selection of too fine a propeller pitch, and high throttle settings may result in an engine overspeed.

Selection of too coarse a propeller pitch may result in the engine being unable to maintain the desired engine speed, even at full throttle.

**CAUTION**

If failure occurred with propeller pitch set at any other pitch than the fine pitch limit, full power from the engine/propeller combination may not be available at low speeds. **Consideration should be given to this during approach and landing.**

**9.4.4 Pilot Controls – Propeller**



#### 9.4.4.1 *Operation of the propeller controls*

- The power switch, labelled **PROP**, located on the instrument panel. This switch activates/deactivates the power supply to the propeller control unit and propeller pitch adjustment motor.
- Automatic/Manual [**AUTO/MAN**] selector switch, located on the propeller controller, changes the propeller mode between automatic and manual.
  - **AUTO** – Automatic mode operation allows constant speed governing in pre-set modes i.e. Take-off, climb, cruise and hold.
  - **MAN** – manual mode operation allows direct control over the propeller pitch, allowing the propeller to become a more traditional in-flight variable pitch propeller.
- **Propeller control selector**, the blue rotary knob, allows the pilot to change between pre-set propeller settings. This knob has no effect when manual [MAN] is selected on the automatic/manual selector switch. These pre-set setpoints are:
  - **T.O.** – Use for take-off and landing.
  - **CLIMB** – Use for climbing and any other operations where continuous high-power settings are required.
  - **CRUISE** – Use for cruise and normal operation.
  - **HOLD** – Use for constant speed governing at a pilot selected speed not a part of the options above.
- **Feather engage switch** is active when the AUTO mode is selected on the automatic/manual selector switch, and the propeller control selector is set to FEATHER. Engaging this switch will initiate the automatic feathering of the propeller.

- **Manual propeller control** switch is a toggle button, located separately from the propeller controller unit on the instrument panel. This switch allows:
  - Direct control of the propeller pitch when manual mode (MAN) is selected with the automatic/manual selector switch.
  - Moving the switch up moves the propeller in the fine direction. The fine indicator light should be illuminated orange during this operation.
  - Moving the switch down moves the propeller in the coarse direction. The coarse indicator light should be illuminated orange in this operation.
  - With the automatic/manual switch set to AUTO, and the propeller control selector knob selected to HOLD, the switch (manual propeller control) is used to set a pilot selected propeller governing speed.
    - Actuate the switch to change the propeller pitch in the direction desired. When the desired rpm is reached, release the switch. The propeller/engine will be governed to that speed.
    - Set the desired power with the throttle.

**NOTE**

When power is initially applied to the propeller controller, the speed setting at which the HOLD mode will govern the propeller is set equal to the pre-set CRUISE mode governing speed, until altered by pilot selection.

### 9.4.4.2 *Indicator Lights*

Information conveyed to the pilot by the propeller system is through three lights located on the propeller controller, namely Coarse, Fine and Feather indicators lights. The following table lists the various propeller status indications provided by the lights.

<b>Indicator Light</b>		<b>Propeller Status</b>
<b>FINE</b>	Orange	Pitch decreasing
	Orange Flashing	No speed signal
	Green	Fine pitch limit
	Green Flashing	Pitch motor engaged at fine pitch limit
	Red	Over-current while pitch decreasing
<b>COARSE</b>	Orange	Pitch increasing
	Green	Coarse pitch limit
	Green Flashing	Pitch motor engaged at coarse pitch limit
	Red	Over-current while pitch increasing
<b>FEATHER</b>	Orange	Pitch Increasing in Feather
	Green	Feather pitch limit
	Green Flashing	Pitch motor engaged at feather pitch limit
	Red	Over-current while pitch increasing in feather
<b>ALL</b>	Red Flashing	Open circuit failure
	Rapid-Red Flashing	Controller software fault

When the propeller is in manual mode, many of the indicator lights will still operate.