Pilot Operating Handbook for Gyroplane Cavalon Pro

Document number RSUK0334

Pilot Operating Handbook for Gyroplane Cavalon Pro

Model: _____

Serial number: _____

Registration: _____

Type certificate number: _____

Aircraft manufacturer and type certificate holder:

RotorSport UK Ltd
Poplar Farm
Prolley Moor
Wentnor,
Bishops Castle
Shropshire
SY9 5EJ
England
Tel.: +44 (0) 1588 650769
Fax: +44 (0) 1588 650769

Distribution partner: _____

_____

_____

Owner: _____

_____

_____

This flight manual should be carried on board of the aircraft and must be kept in current, up-to-date status. The latest revisions and version status is available at www.rotorsport.org. Extent and revision status of the manual is recorded in the revision log and the table of content.

This gyroplane may be operated only in strict compliance with the limitations and procedures contained in this manual.

The manual is not a substitute for competent theoretical and practical training on the operation of this aircraft. Failure to adhere to its provisions or to take proper flight instruction can have fatal consequences.

Applicability
This manual is applicable for Cavalon ‘Pro’ models only

REVISION LOG

Issue	Rev.	Change summary	Date	Signature
1	1.0	First formal release	12.04.2015	
2	1.0	TOPP Rotor option added P1-4 para 1.9, P7-5 para 7.8. Vertical CG limit increased to 940, page 2-7 para 2.7.2. 'Red indicates heating failure' added to pitot heat Page 3-11, para 3.9.7. Page 2-5, para 2.6 oil temperature note clarified.	21.03.2016	
	Pilots Flight and Operation Manual Document approval			
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CONTENTS

LIST OF EFFECTIVE PAGES

Page(s)	Rev.	Date
1-1 to 1-8	1.0	16 03 2016
2-1 to 2-12	1.0	16 03 2016
3-1 to 3-11	1.0	16 03 2016
4-1 to 4-16	1.0	12 04 2015
5-1 to 5-6	1.0	12 04 2015
6-1 to 6-2	1.0	12 04 2015
7-1 to 7-12	1.0	16 03 2016
8-1 to 8-10	1.0	12 04 2015
9-1 - 1 to 4	1.0	12 04 2015

Page(s)	Rev.	Date
9-2 – 1 to 2	1.0	12 04 2015
9-3 – 1 to 2	1.0	12 04 2015
9-4 – 1 to 2	1.0	12 04 2015
9-5 - 1 to 2	1.0	12 04 2015
9-6 – 1 to 2	1.0	12 04 2015
9-7 – 1 to 2	1.0	12 04 2015
9-8 – 1 to 2	1.0	12 04 2015
10-1 to 10-4	1.0	12 04 2015

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CONTENTS

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SECTION 1 - GENERAL

1.1 Introduction

This manual is designed as an operating guide for pilots, instructors, and owners/operators, providing information for the safe and efficient operation of this gyroplane. It includes material required to be furnished to the pilot by the competent certification authority. This handbook is not designed as a substitute for adequate and competent flight instruction.

Pilots of this aircraft must hold a proper license including the class rating 'gyroplane', corresponding to the aircraft's registration and operation – eg, an appropriate CPL licence is required for aerial work. It is the pilot's responsibility to be familiar with this handbook, the special characteristics of this gyroplane, and all other information and legal requirements relevant for the operation in his country. The pilot is responsible to determine the gyroplane is safe for flight, and to operate the aircraft with respect to the procedures and limitations provided in this manual.

It is the owner's/operator's responsibility to have this gyroplane registered and insured, according to country-specific regulations. The aircraft owner/operator is also responsible for maintaining the gyroplane in airworthy condition. Maintenance instructions are provided in the Cavalon Pro Aircraft Maintenance Manual (AMM) RSUK0335 and in SECTION 8 of this manual. Note that depending on the kind of operation, type of maintenance activity, or component involved, the competent authority may dictate qualified personnel and/or respective facilities.

1.2 Certification

The Cavalon is designed, tested and certified according to the British Civil Airworthiness Requirements (BCAR) Section T issue 5, and the associated CRI E-01. A UK ICAO compliant Certificate of Airworthiness has been issued for the type.

1.3 Performance Data and Operating Procedures

The legal basis for operating a gyroplane is provided by national law and its respective regulations. The instructions and conditions contained have to be considered when operating the gyroplane.

All documented performance data and operating procedures have been identified within the certification processes for this gyroplane by means of flight test and analysis.

1.4 Definition of Terms

This manual uses **WARNING**s, **CAUTION**s and **NOTE**s in bold capital letters to indicate especially critical and important instructions. Additionally, the colour of the panel (red, yellow, and grey shading) highlights the significance of the instruction. Definitions for each term are given below.

WARNING

A warning means that the neglect of the appropriate procedure or condition could result in personal injury or loss of life.

CAUTION

A caution means that the neglect of the appropriate procedure or condition could result in damage to or destruction of equipment.

NOTE

A note stresses the attention for a special circumstance, which is essential to emphasize.

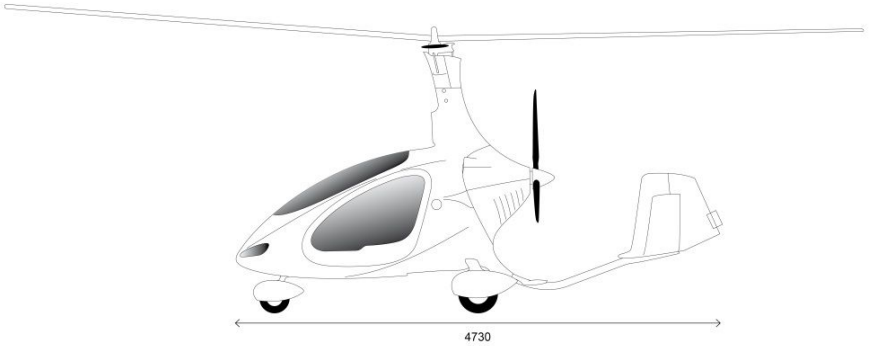
1.5 Important Note

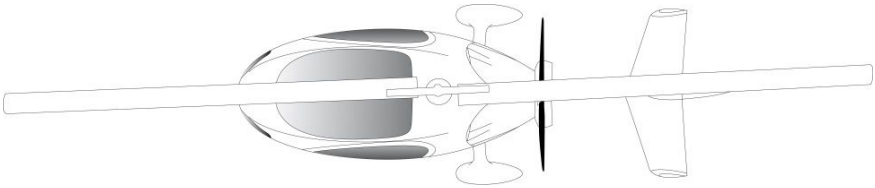
Before each flight pilots must make themselves familiar with the appropriate navigational, weather and safety information pertinent to their planned route.

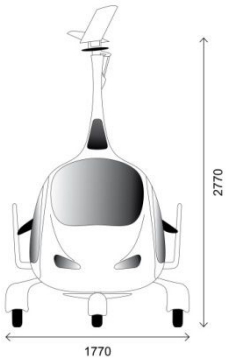
The limitations provided in SECTION 2 of this manual must be respected at all times. Check the manufacturer's web site www.rotorsport.org regularly for flight manual updates, airworthiness directives, service bulletins, or safety information.

Abrupt manoeuvres or flight in heavy turbulence must be avoided as this could lead to rotor speed variations associated with high stress, possible damage to the aircraft, or uncontrollable attitudes.

1.6 Three-view of the Cavalon Pro







1.7 Description

General Characteristics

- Gyroplane with nose gear wheel chassis
- Aircraft structure is a GRP/CRP monocoque
- Two-seat side-by-side configuration (monocoque design)
- Main landing gear with GRP (glass fibre reinforced plastic) spring spar and hydraulic disc brakes
- Extruded aluminium rotor
- Rotor head controlled with push-pull control cables
- Rudder controlled with cables
- Rudder and stabilizer surfaces made of GRP/CRP

1.8 Technical Data

Length: .....4.73 m
Width: .....1.77 m
Height: .....2.77 m
Empty weight:..... 315.0 kg (nominal)
..... (when equipped for night VFR flight) 325.0 kg (nominal)
Payload: ..... 245.0 kg (nominal)
Take-off weight/mass (max.):.....560.0 kg
Usable fuel tank capacity: .....100 ltr

1.9 Rotor

General (RSII RAO (red end cap) or RSII TOPP (Blue end cap))

Type: ..... 2-bladed, fixed pitch, free to teeter
Material: ..... EN AW 6005A T6 aluminium extrusion
Blade profile: ..... NACA 8H12
Rotor diameter..... 8.4 m
Rotor disc area .....55.4 sqm
Rotor disc load ..... 9.5 kg/sqm

1.10 Engine

ROTAX 914F (Certified according to FAR 33 and JAR-E)

- 4-cylinder, four-stroke spark-ignition engine with opposed cylinders with turbo charger
- Liquid cooled cylinder heads
- Air cooled cylinders
- Dry sump forced lubrication with separate oil tank
- Automatic valve adjustment by hydraulic tappet
- 2 carburettors
- 2 electrical fuel pumps
- Electronic dual ignition
- Propeller speed reduction unit, engine mount assembly
- Electric starter (12V 0.6kW)
- Air intake system, exhaust system

1.11 Propeller

Woodcomp sro KW-31 3 Blade (Certified with type authorisation EASA.P.177)

Woodcomp Part number with alternator pulley; KW-31-A-E-3-0-0-I / LP-174-031

Woodcomp Part number w/out alternator pulley: KW-31-A-E-3-0-0-F / LP-174-031

Airscrew with in-flight adjustable pitch made of wooden core with CRP/GRP laminate surface

Model .....KW-31 with Wide-chord blade
Number of blades 3
Diameter ..... 1738 mm
In-flight pitch adjustment ....Electrical by means of Woodcomp CS3-5 controller

1.12 Unit Conversion

Multiply	by	to obtain
kts (knots)	1.852	km/h
km/h (kilometres per hour)	0.54	kts
mph (miles per hour)	1.61	km/h
km/h (kilometres per hour)	0.62	mph
ft (feet)	0.305	m
m (metres)	3.28	ft

Abbreviations and Terminology

ACL Anti-Collision Light
AGL Above Ground Level
ATC Air Traffic Control
CAS Calibrated AirSpeed – indicated speed corrected for installation errors
ccw Counter Clock Wise
CG Centre of Gravity
CHT Cylinder Head Temperature
CRP Carbon Reinforced Plastic
CSP Constant Speed Propeller
DA Density Altitude
DOM Date of Manufacture
DULV Deutscher UltraLeichtflugVerband e.V.
Empty Wt Empty Weight of the gyroplane including oil, cooling liquid and unusable fuel
G / g G-loading as a factor of gravity
GEN Generator
GPS Global Positioning System
GRP Glass Reinforced Plastic
hrs hours
H/V Height-Velocity
IAS Indicated AirSpeed – airspeed values in this manual refer to indicated air speed
KIAS Knots indicated airspeed
ICAO International Civil Aviation Organization
In Hg (Manifold) Pressure, corresponding to inch mercury
ISA International Standard Atmosphere
JNP JahresNachPrüfung – Annual Inspection
LED Light Emitting Diode
LH Left-Hand
LOEP List Of Effective Pages

ltr	Litre
MAP	Manifold Absolute Pressure
MCP	Maximum Continuous Power
MTOM	Maximum Take-Off Mass
OAT	Outside Air Temperature
PA	Pressure Altitude
POH	Pilot Operating Handbook
RBT	Rotor Bearing Temperature
RH	Right-Hand
RON	Research Octane Number
RPM	Revolutions Per Minute
sqm	Square metres
TAS	True AirSpeed – calibrated airspeed corrected for air density
TCU	Turbo Control Unit (engine)
TOC	Table Of Contents
TOP	Take-Off Power
V_A	Design manoeuvring speed
V_B	Design speed for maximum gust intensity
VFR	Visual Flight Rules
V_H	Maximum level-flight speed at maximum continuous power
V_{Hmin}	Minimum level-flight speed
V_{NE}	Never-Exceed Speed – maximum speed that must never be exceeded
VOX	Voice Operated eXchange, means: voice activation (level)
VPP	Variable Pitch Propeller
VSI	Vertical Speed Indicator
V_X	Speed for best angle of climb
V_Y	Speed for best rate of climb and maximum endurance
W&B	Weight and Balance
yrs	years

CONTENTS

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SECTION 2 - LIMITATIONS

This section contains operating limitations, instrument markings and basic placards which are required for safe operation of the gyroplane, including its engine, and standard equipment or systems.

2.1 General

WARNING

The operation of a gyroplane demands professional pilot instruction and dedicated training on gyroplanes. Without a valid license the gyroplane must not be operated.

WARNING

During the entire flight adequate rotor loading must be maintained. Do not perform any manoeuvres resulting in the sensation of feeling light or near weightless.

WARNING

Smoking on board is prohibited!

CAUTION

This gyroplane has been designed and tested for a safe design load of 3g at maximum gross mass (560Kg) within the flight envelope stated in this manual. Flight outside the handbook limits, for example at high speeds in turbulent air, especially in combination with aggressive manoeuvres or a steep turn, could easily create higher loads on the aircraft and are prohibited for that reason.

NOTE

During the certification process all required safe loads have been successfully demonstrated. However, the gyroplane may be exposed to higher loads especially when operated on rough surfaces, such as an unprepared grass strip. In this case it is even more essential to perform a thorough pre-flight inspection and have components and parts replaced, where needed.

NOTE

The choice, selection and use of this particular aircraft for the purpose chosen is at the sole discretion and responsibility of the owner/pilot. RotorSport UK Ltd and AutoGyro GmbH take no responsibility for your decision to fly.

This aircraft is operated under a certificate of airworthiness. This is an ICAO recognised standard. Whilst the manufacturer takes great care to ensure the parts are of appropriate quality, it is impossible to guarantee that a failure cannot occur, and pilot operators must consider this in their flight planning

The Cavalon Pro utilises a certified Rotax 914F engine. Whilst this has an improved reliability from a non-certified engine, it is impossible to guarantee that a failure can never occur. Therefore strict compliance with the engine manufacturer's maintenance schedules, operational procedures and any additional instructions which may be given to you by RotorSport UK Ltd, on behalf of the engine supplier, is essential. The aircraft must always be flown with the risk of engine failure in mind, and must not be flown over any areas where a forced landing cannot be safely executed.

Similarly the aircraft instruments (and other equipment) are certified as part of the aircraft – but may still may fail completely, or part fail such that a gauge may under or over-read, or fluctuate. Good judgement must be used in monitoring instruments, and timely action taken should a reading be in doubt.

2.2 Environmental Limitations

Maximum wind speed or gust intensity..... 40 KIAS
Maximum demonstrated crosswind component for take-off and landing 20 KIAS
Maximum tailwind component for take-off and landing..... 5 KIAS
Maximum demonstrated operating altitude..... 10,000 ft
Temperature..... - 20 to + 40 °C

CAUTION

Care must be used operating a 914F engine at high altitudes, as it is possible to overspeed the engine in level flight at max power. Take care to monitor the engine rpm gauge.

WARNING

Do not consider flying in the likelihood of severe weather. Thunderstorms may develop rapidly with the risk of heavy precipitation or hail, severe turbulence with strong vertical air movements, and lightning strike. If, despite proper flight planning, a thunderstorm should be encountered, consider a precautionary landing to avoid the squall line. A lightning strike may damage the main rotor bearing. Thorough inspection and maintenance after lightning strike must be performed.

2.3 Colour Code for Instrument Markings

Red	Operating limits. Pointer should not enter red during normal operation
Yellow	Precautionary or special operating procedure range
Green	Normal operating range

2.4 Airspeed Limitations and Instrument Markings

Air Speed	Marking		
V_{NE} Never Exceed Speed	Red radial		**87 kts**
	Yellow arc		70 - 87 kts
V_B design speed for max. gust intensity	Green arc		20 - **70 kts**
	Yellow arc		0 - 20 kts

WARNING

The maximum speed V_{NE} must never be exceeded!

WARNING

Depending on installed optional equipment V_{NE} may be lower! Supplemental information in SECTION 9 must be respected!

WARNING

Sudden or large control input in pitch must be avoided at all means, even at airspeeds within green arc. Do not exceed V_B when flying through turbulence, gusts or rough winds!

2.5 Rotor Speed Limitations and Instrument Markings

Rotor Speed	Marking		
Rotor speed limit	Red radial		**610 RPM**
Rotor speed caution range	Yellow arc		550 – 610 RPM
Normal range	Green arc		200 – 550 RPM
Maximum pre-rotation speed	Yellow radial		**220 RPM**

2.6 Power Plant Limitations and Instrument Markings

Engine Speed	Marking	
Maximum engine speed	Red radial	**5800 RPM**
5 minute take-off power regime	Yellow arc	5500 – 5800 RPM
Maximum continuous power	Green arc	1400 – **5500 RPM**
Recommended pre-rotation clutch speed	Green radial	**2000 RPM**
	Yellow arc	0 – 1400 RPM

Engine Oil Temperature	Marking	
Maximum oil temperature	Red radial	**130 °C**
	Yellow arc	110 – 130 °C
Normal range	Green arc	90 – 110 °C
	Yellow arc	50 – 90 °C
Minimum oil temperature	Red radial	**50 °C**

NOTE

Oil temperature is measured in the return feed to the engine – after the oil has circulated through the oil cooler. The oil thermostat opens at 85degC, so the pilot may see lower temperatures indicated in normal use.

Coolant Temperature	Marking	
Maximum cylinder head temperature	Red radial	**120 °C**
	Green arc	50 – 120 °C

Note! Where the aircraft is fitted with a Rotax 914F with serial number pre 4.413.020, the Coolant Temp gauge becomes CHT with a red radial at 135degC.

Engine Oil Pressure	Marking	
Maximum oil pressure	Red radial	**7 bar**
	Yellow arc	5 – 7 bar
Normal range	Green arc	2 – 5 bar
	Yellow arc	0.8 – 2 bar
Minimum oil pressure	Red radial	**0.8 bar**

Manifold Pressure * ROTAX 914 F	Marking	
Maximum manifold pressure	Red Radial	39.9 In Hg
	Yellow Arc	31 - 39.9 Hg
Maximum continuous MAP 35.4 In Hg	Green Arc	0 - 31 In Hg

*Overshooting of the 914 manifold pressure is permissible, provided the pressure stabilises within limits, within 2 secs.

Refer to ROTAX engine operators manual for further MAP information.

Fuel pressure	Marking	
Maximum fuel pressure	Red radial	**1bar**
	Green arc	0.15-1bar

Note! Normal indicated fuel pressure range is 0.35 – 0.8bar.

2.7 Weight and Balance

2.7.1 Weight Limits

Maximum take-off weight (MTOW): ..... 560 kg
Maximum empty weight (MEW): ..... 376 kg

CAUTION

The take-off weight is the total weight of the gyroplane including empty weight, optional/additional equipment, occupants, fuel, and luggage at take-off. The maximum value specified above must never be exceeded.

Maximum weight in RH seat (incl. compartment behind seat): ..... 110 kg
Maximum weight in LH seat (incl. compartment behind seat): ..... 110 kg
Maximum total weight in cockpit (both seats + compartments): ..... 200 kg
Minimum total weight in both seats: ..... 65 kg

NOTE

Pilots in the right hand seat weighing less than 65 kg must carry corresponding ballast during solo operation (which may be located in the baggage compartment, around the occupant in a form such as sheet lead under the seat cushion, or securely restrained on the second seat).

Storage area behind seats

Maximum weight in each storage compartment (2 ea.) ..... 10 kg

NOTE

When loaded, the weight in each storage compartment has to be deducted from the maximum weight in the respective seat.

2.7.2 Centre of Gravity (CG) Limits

The centre of gravity is considered to be within limits if all weight limits above are respected. For details see SECTION 6 of this manual.

For reference, the limits approved during the aircraft UK type approval are 540 to 345mm forward of the mainwheel datum, and 925 to 750 above the CG datum (the mainwheel axle is the 0 CG datum in x and z) when fitted with the RAO rotorsystem II, and 940 to 750 above the CG datum when fitted with the TOPP rotorsystem II.

2.7.3 Demonstrated Structural Load Factors

Demonstrated positive load factor (560 kg)..... + 3 g
Demonstrated negative load factor (560 kg) – structural limit..... - 0.5 g

Important note: the indication of a demonstrated negative load factor represents a structural limit only. In flight, the limitations (see 2.9) have to be respected at all times.

2.8 Flight Crew

Minimum crew is one pilot in the RH seat.

Harness in the LH seat must be fastened and tight, if not occupied.

The LH flight controls must never be restricted by passenger or objects. Passengers must be briefed.

2.9 Kinds of Operation

Day-VFR operation is approved for all Cavalon Pro gyroplanes.

Night-VFR operation is approved for Cavalon Pro gyroplanes when fitted with the required minimum equipment.

Aerobatic flight is prohibited!

NOTE

Manoeuvres involving bank angles of more than 60° are considered to be aerobatic flight.

Low-G manoeuvres are prohibited!

WARNING

Any manoeuvre resulting in a low-G (near weightless) condition can result in a catastrophic loss of lateral/roll control in conjunction with rapid main rotor RPM decrease. Always maintain adequate load on the rotor and avoid aggressive forward control input performed from level flight or following a pull-up.

Excessive side-slip is prohibited!

WARNING

Side slip may be performed only with proper training and within safe boundaries. Use gentle pedal input for initiation and stabilization. Do not rely on airspeed indication in side slip. Never perform abrupt control stick input into the direction of motion. Be aware that excessive side slip particularly in strong/gusty conditions may result in an uncontrollable and unrecoverable attitude.

Flight in icing conditions is prohibited!

NOTE

Icing may occur even at temperatures above freezing!

Operation in strong gusts or wind speeds of more than 40 KIAS is prohibited!

2.10 Fuel

2.10.1 Approved Fuel Grades

Preferred fuel

AVGAS UL91 (ASTM D7547)

Alternate fuel

AVGAS 100 LL (ASTM D910)
MOGAS EN 228 Super or EN228 Super plus (min. RON 95)

NOTE

AVGAS 100 LL places greater stress on the valves seats due to its high lead content and forms increased deposits in the combustion chamber and lead sediments in the oil system.

For operational constraints and maintenance aspects when using preferred fuel and alternate fuel, refer to the engine manufacturer's manual.

NOTE

When refuelling, attach the earth line to the exhaust pipe to prevent static electrical discharges!

2.10.2 Operation with leaded AVGAS fuels

If the engine is operated more than 30% of engine operating time with leaded AVGAS fuels, the following maintenance operations are necessary in addition by latest after every 50 operating hours:

- change of oil filter,
- change of engine oil,
- oil level check, etc.,

according to the most recent engine manufacturer´s maintenance manual

NOTE

When operating primarily on leaded AVGAS fuel, it is recommended to make a change of engine oil every 25 operating hours.

2.10.3 Fuel Tank Capacities

Maximum tank capacity .....103 ltr

2.10.4 Unusable Fuel

Unusable fuel quantity ..... 3 ltr

2.11 Minimum Equipment

The following equipment must be operative for flight under Day-VFR:

- Air speed indicator
- Altimeter
- Magnetic Compass
- Side slip indicator
- Rotor RPM indicator
- Outside Air Temperature (OAT) and Rotor Bearing Temperature (RBT) indicator (both calibrated in °C)
- Engine instruments (oil pressure, RPM, CHT)
- Escape hammer
- Fire Extinguisher
- First aid kit (pilot carry-on)
- Maps, charts, codes required by local regulations

The following additional equipment must be operative for flight under Night-VFR:

- External generator installation (Gen2)
- Instrument and panel lighting
- Cockpit lighting
- Position/navigation/strobe lights fitted on pedestal spacers
- A red anti-collision light fitted on each wheel spat
- Nose-mounted taxi lights
- Underbody-mounted landing light
- Heated pitot-tube and associated LED indicator
- Alternate static pressure system

- Gyroscopic bank and pitch indicator (Aspen EFD1000 PFD)
- Gyroscopic direction indicator (Aspen EFD1000 PFD)
- Vertical speed indicator
- Secondary pressure altitude indicator (Aspen EFD1000 PFD)
- Clock
- Low voltage warning system
- First-aid kit (pilot carry-on)
- Fire extinguisher
- Electric torch for each crew member

2.12 Placards (not forming part of an instrument or engraved on the panel)

In clear view of the pilot on the centre panel:

For an aircraft not equipped for Night-VFR flight

OPERATING LIMITATIONS

Aerobatic Limitations

Aerobatic manoeuvres are prohibited.

Manoeuvres involving a deliberate reduction in normal 'g' shall be avoided.

CG Range Limits (Gyroplane) – refer to Pilots Handbook data.

Airspeed Limitations

Maximum Indicated Airspeed (Vne): 87kts (100mph)

Other Limitations

This aircraft shall be flown by day and under Visual Flight Rules only.

Smoking in the aircraft is prohibited

For an aircraft equipped for Night-VFR flight

OPERATING LIMITATIONS

Aerobatic Limitations

Aerobatic manoeuvres are prohibited.

Manoeuvres involving a deliberate reduction in normal 'g' shall be avoided.

CG Range Limits (Gyroplane) – refer to Pilots Handbook data.

Airspeed Limitations

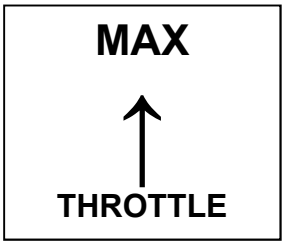
Maximum Indicated Airspeed (Vne): 87kts (100mph)

Other Limitations

This aircraft shall be flown under Visual Flight Rules only.

Smoking in the aircraft is prohibited

Adjacent to left-seat throttle (if fitted)

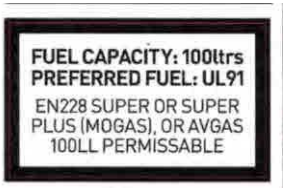


Attached to the seat back angle adjustment bar

Ensure locking pin engaged properly after adjustment

At each storage compartment behind seats:

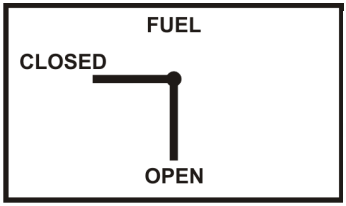
At fuel filler cap:



Attach earth line to exhaust pipe when refuelling

At oil filler access panel:

At fuel shut-off valve: (RED)



Or

At both static ports:

Fitted to the doors inside

Fitted to the doors outside

Fitted to the instrument panel (or marked ,rotor brake interlock release)

Pre-rotator & rotor brake interlock release

GPS placard (where a GPS, Ipad or equivalent device is fitted)
(Placard may be a different shape)

Do not rely on this display. GPS unit not for navigational use. The unit, software & charts are not approved or certified to any national standard. Warning! Charts or software may not be up to date.

By the battery charging point ‘Max 12v 15A ‘ with terminal polarity defined

Near Fire warning lamp: (unless engraved ‘Fire when flashing’)

FIRE WARNING
When flashing
RED

On Circuit breaker panel (unless engraved)

CIRCUIT BREAKERS
Only attempt to reset (once) if essential for continued safe flight

Either side of keel fin top surface

No Step

Fire extinguisher, located beside extinguisher.

Fire Extinguisher

In the event of a cockpit fire, release the clamp, remove this extinguisher and use in accordance with the instructions printed on the extinguisher bottle.
Ensure the cockpit is well ventilated!
In the event of a suspected fire in the equipment or engine bays, DO NOT release or remove the extinguisher. Pull out the safety pin, and squeeze the handgrip together. This will release the retardant into those bays. Only release the grips when the extinguisher is empty or after 20s.
Once used, replace!
Check the extinguisher gauge indicates green before flight!

Emergency hammer; to indicate the hammer location this is fitted to the centre console.

This placard is wrapped around the hammer to define the method of use.

Other

1. If the compass deviation is more than 5° on all headings, then a deviation placard must be present.

For:	N	30	60	Radios off or on?
Set:				
For:	E	120	150	
Set:				Calibrated by:
For:	S	210	240	
Set:				
For:	W	300	330	Date:
Set:				

2. The aircraft is fitted with a permanently attached fireproof plate with the aircraft registration number and serial no. marked on it, on front of the instrument panel.

3. The registration letters are placed high on the tail fin, and are 60cm long, 30cm high. This has been accepted as best practice compliance to CAP523, the CAA standard for aircraft registration. Alternative markings and position of markings is acceptable provided they comply with this standard.

4. Note that all placards must have the same units of measure as the instruments.

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CONTENTS

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SECTION 3 - EMERGENCY PROCEDURES

This chapter contains the check lists and procedures to be executed in emergency situations.

Emergencies due to defects of the gyroplane or its engine are extremely seldom if the aircraft is checked thoroughly before each flight and continuously maintained. If there should occur a case of emergency, the guidelines of this chapter are to be followed in order to manage the emergency. However, these procedures do not replace the pilot's appreciation of the individual situation.

Strict compliance with the engine manufacturer's maintenance schedules, operational procedures and any additional instructions is essential. The aircraft must always be flown with the risk of engine failure in mind, and flight over any areas where a forced landing cannot be safely executed is at the pilots own risk.

3.1 Engine Failure

In case of an engine failure the following action is recommended:

Engine failure during take-off run

- Maintain directional control using sensitive but appropriate pedal input
- With the rotor/stick remaining aft, let gyroplane decelerate. Wheel brakes may be used to assist
- At walking speed level-off rotor disc, use wheel brakes and bring rotor to a stop

Engine failure after lift-off and below 150 ft AGL

- The climb-out should be performed according to the Height-Velocity-Diagram in CHAPTER 5
- When engine failure occurs, and if height permits, immediately lower nose to enter glide attitude and maintain airspeed.
- Continue straight ahead.
- Maintain airspeed until ground is approached, then perform flare.
- If a low level engine failure, with low groundspeed, then an aggressive and immediate flare may be required

Engine failure at or above 150 ft AGL

- Consider wind speed and direction
- Select a suitable landing site
- If time allows, a restart may be attempted, see "Air restart procedure" below
- Perform a landing into wind and/or upslope if possible
- Prior to touch-down switch OFF Main Switch

Engine failure at night

- Consider wind speed and direction
- Both landing lights should be turned on at 400ft or below
- Select a suitable landing site – the landing lights make the ground visible in full dark from around 400ft
- If time allows, a restart may be attempted, see "Air restart procedure" below
- Perform a landing into wind and/or upslope if possible

- Make a faster descent at 60KIAS (~70mph), to allow more time in the flare to make a safe landing.
- Prior to touch-down switch OFF Main Switch

WARNING

Engine failure at high speed, hands-off, will result in a nose drop and right yaw of about 20-25degrees, requiring pilot intervention to raise the nose. At light weight the nose drop will be rapid.

WARNING

Always plan your route to remain within safe gliding distance to areas where a safe forced landing can be performed in case of an engine failure. A landing in high trees or open waters may end fatally.

NOTE

The best engine-off glide ratio is about 1:3 at 50 kts. Depending on a possible headwind the glide may be extended by slightly increasing airspeed. It is heavily recommended to practice your forced landing capabilities regularly, preferably with a qualified flight instructor.

3.2 Air Restart Procedure (if safe! Plan for a forced landing first!)

- Airspeed 50-60KIAS (whilst restart is possible at all permitted airspeeds and altitudes, this airspeed is optimum)
- Check fuel valve OPEN
- Check fuel pump(s) ON
- Check both magnetos ON
- Propeller in FINE pitch
- Throttle slightly open
- With the left hand, turn the Main Switch/Starter key completely to OFF, then START
- If possible, allow engine and oil to warm-up before full power is applied

NOTE

The starter interlock function prevents inadvertent starter engagement. Before attempting an engine start, the interlock must be reset by turning the Main Switch/Starter key to OFF.

3.3 Landing into Trees or High Vegetation

- Assume the surface of the treetops or vegetation as level
- Plan touch-down and flare with minimum ground speed and minimum rate of descent
- As soon as the wheels contact the vegetation bring the rotor disc to level attitude to avoid partial blade tip contact with vegetation
- Shut down engine by switching magnetos OFF and master switch OFF

3.4 Degradation of Engine Power

A gradual decay in engine RPM, accompanied by a rough running engine or even vibration may be an indicator for carburettor icing, even though with a turbo charger this is very unlikely. In this case, continue with a high power setting and change altitude into air which is less susceptible to carburettor icing.

If the situation cannot be corrected be prepared for further loss of power and ultimately engine failure.

NOTE

Carburettor icing is very unlikely with a 914F engine because the turbo pressurisation heats the air before it reaches the airbox and carburettors.

3.5 Evacuating the Aircraft

In normal circumstances occupants should never leave the aircraft while the propeller or the rotors are turning. If abandoning the aircraft in an emergency the pilot should turn off the engine magneto switches and turn the master switch to “OFF” if this can be done without endangering the occupants.

If abandoning the aircraft with either the propeller and/or the rotors turning the occupants should follow a path in line with the nose of the aircraft, to minimise the risk of being struck by either the rotor or the propeller.

Occupants should be briefed before flight on emergency evacuation procedures, including:

- Actions to be taken in the event of a forced landing
- Operation of the seat harness
- Disconnection of any intercom leads or other connections to the aircraft before evacuation
- How to open the doors
- How to safely exit and move away from the aircraft

3.6 Smoke and Fire

Indications of smoke should be treated in the same way as a fire.

NOTE

The fire warning system will illuminate a RED flashing warning lamp on the panel when the special cable in the engine bay has melted due to the effect of high temperatures (fire). This lamp shows solid red when a fault is detected.

In case of fire the following action is recommended:

Smoke or fire on ground

- Both magnetos OFF and master switch OFF to shut-down engine and fuel pumps
- If safe to do so, operate the fire extinguisher (see below notes)
- Evacuate aircraft
- Close fuel shut-off valve
- Extinguish fire and have damage inspected

Fire in flight

- Open ventilation for fresh air
- If safe to do so, operate the fire extinguisher (see below)
- Initiate an emergency landing
- Initiate emergency call, if time and situation permits
- As soon as a power-off landing can be assured, shut down engine by switching magnetos OFF and master switch OFF
- Continue procedure as described in “Engine Failure” and “Smoke or fire on ground”

The Cavalon Pro gyroplane has an in-built Halon gas fire extinguisher system that may be used in two ways:

- By removing the safety clip then depressing the trigger handle with the extinguisher still fitted on its mounting bracket, extinguishing agent is discharged through pipes into the equipment compartment and engine bay behind the cockpit
- By releasing the extinguisher from its mounting bracket then removing the safety clip the extinguisher may be used as a hand-held device. If directed inside the cockpit, ensure adequate ventilation to avoid the risk of asphysxia.
- If the extinguisher is discharged, even partially, it must be replaced.

NOTE

Clear instructions for use of the extinguisher are printed on the extinguisher bottle, and on a placard adjacent to the bottle. Read them before use!

3.7 Off-field Landing

A precautionary landing at a non-prepared site may be performed at pilot's discretion in order to avoid unexpected weather, in case of severe illness of the pilot or a passenger, or if technical defects are suspected, for example sudden and severe rotor vibrations.

- Select a suitable landing site from safe altitude, considering slope, wind speed and direction
- Fly a reconnaissance pattern to check for obstacles, especially power lines, wires, and cables in the approach and go-around path
- Overfly the landing site to check for obstructions such as fences, ditches, rocks, height of vegetation, and select most suitable touch-down zone
- Perform a normal approach and touch-down into wind with minimal ground speed

3.8 Flight Control Malfunction

In case of a flight control failure the gyroplane can be controlled with the remaining primary and secondary controls, including power and trim. An immediate reduction of power, and corresponding reduction in speed may be necessary to avoid pitch oscillations (phugoid) or other effects affecting dynamic or static stability. Navigate to a suitable landing site with wide and shallow turns and approach against the wind

3.8.1 Engine Power Control / Throttle

Throttle jammed open or max

Navigate to a suitable landing site with the power set. If over safe terrain, magneto switches may be used to control power. When within gliding distance to the selected landing site, shut-down engine to perform a power-off landing as per Emergency Procedure "Engine failure".

NOTE

In case of a control cable breakage the carburettor will be automatically set to full throttle position.

Throttle jammed closed

Land as per Emergency Procedure "Engine failure". Residual power may be used to extend the glide.

3.8.2 Rudder Malfunction

In case of a stuck or loose rudder, continue flight to a suitable, preferably wide landing site that allows a landing into the wind. If necessary reduce power to avoid excessive side slip. Align gyroplane prior to touch-down, using engine torque or lateral control input to the side where the nose is pointed.

3.8.3 Rotor Head Control

In case of a rotor head control malfunction, control pitch attitude using careful trim input and power setting. Use rudder for directional control and for shallow turns. In some conditions it may be appropriate to reduce power/speed in order to avoid phugoid effects or a possible negative yaw-roll coupling. Approach landing site with wide and shallow turns.

3.8.4 Trim runaway

Failure of a trim selector switch or pneumatic valve may result in trim runaway (where the trim system runs to one extreme and pushes the control stick accordingly). Although the average pilot is able to resist the out-of-trim stick force and continue to fly the aircraft it may be possible to reduce the stick load by intervention:

(i) High forward stick load required to prevent aircraft nose rising (this will be coincident with a high air-pressure reading) – briefly turn the Flight/Brake selector to “Brake” to deplete system air pressure. If the air compressor is heard to start and the pressure rises again then pull the circuit-breaker marked “Comp” to stop the compressor. Repeat the brief selection of “Brake” to deplete system air pressure as required.

(ii) High aft stick load required to prevent aircraft diving (this will be coincident with low or zero air pressure) – check “Comp” circuit breaker, if activated push to reset then try to trim aircraft nose-up. If unsuccessful then continue to expedited landing. Note: reset the circuit-breaker once only.

(iii) High roll-left or roll-right stick load required to maintain balanced flight (coincident with high air-pressure reading). Pull the “Comp” circuit breaker to prevent further increase in air pressure and attempt to re-trim. If unsuccessful then continue to expedited landing. Do not select “Brake” in an attempt to reduce air pressure as this will disturb the pitch trim (in which the out-of-trim forces are significantly higher)

3.8.5 Pitch oscillation recovery

There are generally two types of pitch oscillation: that caused by pilot over control (‘PIO, Pilot Induced Oscillation’) and that caused by aerodynamic oscillation.
PIO is not generally found on two seat gyroplanes due their inherent stability. It is initiated by the pilot over-controlling the stick. If a situation develops where a divergent aircraft pitching oscillation is occurring in sympathy with fore-aft control stick inputs, firstly stop the control input – do NOT try to control PIO with the stick.
For both situations, smoothly closing the throttle whilst maintaining a level flight attitude will return the aircraft to a stable, slow speed condition very quickly, from which the pilot can recover to normal flight.
Recovery from PIO or aerodynamic oscillation can result in height loss.

3.8.6 Vibration

A gyroplane is subject to a number of out of balance forces which will generate different levels of vibration depending on the engine and rotor rpms, and on loading conditions. Rotors are normally balanced two seated, so a reduction in occupant loading will naturally change the rotor response.

1. Engine and propeller. Vibration in this area will change with engine rpm, and can therefore be affected and isolated by the pilot. The propeller is normally balanced to less than 0.1ips, meaning low vibration. Vibration will increase as the propeller gets dirty, and will also increase if damaged. A sudden change in flight will indicate a fault has developed, either through an impact (loose luggage, bird strike etc. passing through the propeller) or by some mechanical failure. In the event the pilot should make a precautionary landing for evaluation. Propeller damage may also be evident from a change in noise level.
Upon landing, carefully check the propeller for damage, loose bolts or evidence of mechanical failure within the prop or engine. Especially check the engine to engine bearer connections, and the engine bearer to airframe connections.

2. Rotor.
Rotors will vibrate in flight due to tracking errors (side to side stick shake), rotor CG misalignment with the axis of the bearing in the flat plane (oscillatory stick shake), and also in the vertical plane (two per rev shake). The amount of shake will not suddenly change in flight or between flights unless there has been mechanical failure, external influence or rotor strike.
Vibration will increase (and performance decrease dramatically) with dirt build up on the rotor blades, so before any analysis make sure they are clean.
If there is a change in vibration in flight make a precautionary landing and investigate. If on rotor startup, stop and investigate.
Check items:
Rotor impact with tail of aircraft.
Hanger damage e.g. twist or distortion of trailing edge.
Blade bent from ground handling.
If after a recent re-assembly of the rotor, that the blades and hubs are serial-number matched, and that the shim washers are correctly matched to the hub bar and rotor tower.
A reduction in vibration may be caused by increased flexibility between the rotor head and the occupant. This may be control system looseness, so check all system joints for tightness, and also for cracks at the base of the mast. Check security of all fastenings between the rotor and the pilot. Check also for any cracks or other damage to the primary structure; body, tail, keel tube, rotor head, rotor, mast.

3.8.7 OTHER EQUIPMENT FAILURE

Good judgement must be used in monitoring instruments, and timely action taken should a reading be in doubt. If in doubt, make a precautionary landing and resolve the issue rather than continuing a flight.
Actions recommended:
ASI failure: In level flight fly with an engine rpm of 4,200 lightly laden to 5,000 heavily laden which will give approx 45-60KIAS, propeller in mid pitch range. When descending (nose down) throttle back to approx 3,000 to 3,500rpm to prevent overspeed. Continue to your designated landing site, maintaining speed for a flare on landing in the final descent. Leave plenty of space to land in should the flare be prolonged. Experience will aid judgement of the best engine rpm to maintain to match the desired flight speed and payload.
Altimeter failure: In a gyroplane it is reasonably easy to judge height. If in controlled airspace ensure the controlling authority is informed to prevent traffic conflict. Otherwise continue to a safe landing using navigational skills to avoid potential collisions.
Compass failure: Resort to map, aided by GPS if available, fly at a speed to suit navigational requirements or make a precautionary landing if unable to identify position.

Rotor RPM gauge failure: This is not essential for safe flight, and rotor rpm cannot normally be affected in flight unless significant “g” or negative “g” is exerted – and then will only provide an indication of the rpm. If failed in flight, repair on landing
Engine RPM: The engine is rpm self-limiting by propeller pitch in flight. If the indication fails, replace on landing. Use audio cues to establish rpm
Oil pressure, oil temp and CHT/coolant temp. A failure of one gauge can indicate an engine fault or simply a gauge fault. Watching the other gauges will indicate the likely failure mode. For example,

1. Gauge suddenly goes to full scale deflection, other gauges reading normally – likely gauge fault
2. Oil pressure falls to zero, possible loss of pressure. Stop engine, make precautionary landing
3. CHT/coolant temp gradually or suddenly rises above max temp. Possible loss of coolant. Cross-refer to the coolant warning lamp, if this indicates the temperature is OK, then continue with caution. If not, stop engine, make precautionary landing
4. Oil temp suddenly falls to zero, other gauges reading normal – probable gauge failure. Cross refer to oil pressure gauge, if there is pressure there is likely to be temperature.
5. Oil temp rises above maximum, other gauges normal – possible very low oil level, blocked radiator or thermostat. Stop engine, make precautionary landing.
6. Fuel level gauge suddenly falls to zero or FSD. Probable gauge failure, but always cross check to predicted fuel burn. Low fuel light will light as a backup.
7. Fuel pressure gauge gradually reducing – possible blocked filter or no fuel. Turn on back up pump and check if full pressure returns. No pressure probably means no fuel. If engine keeps running it is a faulty indication.

Sudden, large deflections are normally unlikely, with the exception of loss of pressure readings.

3.8.8 Door open in flight.

A door open in flight is NOT catastrophic. The door hinge line is angled to the oncoming airflow such that if left open before take-off, or opened in flight, the oncoming airflow will naturally close the door.

Note, yawing the aircraft such that the open door is downwind will allow the door to open more, but on straightening out the oncoming airflow closes the door. If the yaw is such that the open door is upwind, then the oncoming airflow keeps the door firmly shut.

In the event of this occurrence, fly the aircraft and ignore the open door until it is safe to lock it. This will be either on the ground, by a passenger (if it is on their side) or by slowing and trimming the aircraft at a safe speed that allows the pilot to release hand(s) for the closure task.

3.9 Warning and Caution Lights

3.9.1 GEN or Low Volt Indicator Light

The GEN lamp, when lit, indicates that there is no voltage being supplied from the internal generator/regulator circuit to the battery. The Gen2 lamp, when lit, indicates that there is no voltage being supplied from the external generator to the battery.

Both are normally lit when the engine is stationary or at very low rpm.

These lamps are normally not lit in flight, but may be seen to pulse gently in low light conditions.

The LOW VOLT lamp, when lit, indicates that the available voltage from the battery has dropped below 12v,

If the GEN and GEN2 lamps and the LOW VOLT lamp are on with the engine running at more than 2,500rpm, then it is likely that the charging circuits have failed, and that the aircraft is operating on battery power alone.

If only the LOW VOLT lamp is lit, then the aircraft voltage demand has exceeded supply, and demand must be reduced in order for the lamp to extinguish. NOTE! When lit, this lamp also indicates that the strobes, nav lights, anti-collision lights and 12v socket have been turned off automatically, with automatic reconnection when the supply exceeds demand.

Required Action

If any of the indicators are permanently lit, switch off all unnecessary electrical consumers, it is recommended to perform a precautionary landing within 30 minutes. The battery is expected, if in good condition, to provide 30 minutes* of reserve power to supply the aircraft P2 fuel pump, instrumentation and avionics, after which time this electrical equipment may cease to function. In the event of battery failure the P1 fuel pump is supplied with electrical power directly from the engine's internal generator so the engine may continue to run. However, be prepared for an engine failure.

*depends on condition of battery

Further information:

No power in the cabin indicates either the main circuit fuse has failed, or that the battery has failed and the pump protection relay has opened. In this case the P1 primary fuel pump remains powered by the regulator directly, maintaining fuel supply to the engine. The turbo control unit is not powered in this instance, and will remain in whatever position it was in when power was lost – so mixture and manifold pressure control will be lost. Take care to only use the minimum power required to land safely to prevent engine damage.

In this case the primary (P1) fuel pump will continue to run until the engine's internal generator stops providing electrical energy. If required, fuel supply can be shut off via the fuel shut-off valve.

3.9.2 Low Volt

Battery voltage of the system has dropped below a safe value. Refer to chapter above. Aircraft lights and the 12V power receptacle will be disabled automatically.

3.9.3 BOOST WARN Light 'Boost' (red)

Continuously lit

If continuously lit, the maximum admissible boost pressure was exceeded. Reduce power into normal operating range and consider restricted engine performance or boost control malfunction. Record duration and have maintenance action performed.

Blinking

When blinking, the allowable 5 minutes take-off power time limit has been exceeded. Reduce power into continuous range. Record duration and have maintenance action performed.

3.9.4 BOOST CAUTION Light 'Caution' (orange)

A blinking BOOST CAUTION light indicates a problem with the turbo/boost control, its sensors or the servo. Engine power is degraded and continuous operation may lead to engine damage. Perform a precautionary landing considering reduced engine performance and be prepared for engine failure.

3.9.5 Fire warning

Refer to emergency procedure "Smoke and Fire" above

The Fire Warning system works by constantly checking the resistance of a special cable mounted in both the engine bay and in the battery and fuel pump bay. This cable contains two wires where the insulation between the two wires melts beyond 180degC, creating a short circuit. The cable has a resistor at the end of the cable to give a known standard resistance of the detection loop.

This lamp will flash three times when the keyswitch is turned on. This indicates the system has made a satisfactory self test. The lamp will then normally remain off.

The lamp will light a solid red when a fault has been detected (eg a short circuit to ground or open circuit). A repair is required.

The light will flash brightly if a closed circuit is detected. This indicates that the cable temperature has exceeded 180degC, and therefore that a fire may be present. Action as '3.6, Smoke and Fire'

3.9.6 Low Fuel

The LOW FUEL warning light is triggered as soon as 5 litres or less of useable fuel remain in the tank. Perform a power-on landing at the nearest suitable location and be prepared for engine failure after approximately 10 minutes remaining flight time.

3.9.7 Pitot

The PITOT lamp is coloured green to indicate at night that the power is turned on to the pitot tube heating. Red indicates heating failure.

3.9.8 Fan

The thermo switch of the engine mounted electrical blower has closed, fan is activated. Monitor engine instruments and mind higher electrical power consumption. If possible, reduce engine power and increase speed.

3.9.9 Water Temperature Indication

The water temperature indication illustrates three colour-coded temperature ranges of the engine cooling water:

INDICATION	TEMP.RANGE	CORRECTIVE ACTION
Red light	Above 120 °C	Further reduce power. If condition cannot be corrected, land as soon as practicable.
Yellow light	105 – 120 °C	Reduce power and increase air speed.
Green light	Below 105 °C	Normal operation

3.9.10 Water level

The water level indicates amber when the level is below minimum.

3.10 Parameters out of Limits

PARAMETER	EXCURSION	CORRECTIVE ACTION
Engine Oil Temperature	Upper **limit** or **yellow arc**	Reduce power and increase air speed. If condition cannot be corrected, land as soon as practicable.
	Lower **limit**	Allow engine to warm-up on ground.
	Within lower **yellow arc**	Uncritical because this is the temperature of the oil on return to the engine having passed through the oil cooler. It is known through the flight test program that the oil is far hotter as it leaves the engine. NOTE that the oil temperature sensor is mounted in the engine, not in the oil tank (Cavalon recreational has the sensor in the oil tank)
Cyl. Head Temperature or Coolant Temperature (depending on engine	Upper **limit**	Reduce power and increase air speed. If condition cannot be corrected, land as soon as practicable.

fitment)		
Engine Oil Pressure	Upper **limit** or **yellow arc**	Reduce power. If condition cannot be corrected, have maintenance action performed prior to next flight.
	Lower **limit**	If combined with other indications, such as rising oil temperature or unusual engine behaviour, shut-down engine and perform a power-off landing as per Emergency Procedure “Engine failure”. Otherwise, monitor engine instruments carefully and land as soon as practicable. Have maintenance action performed.
Fuel Pressure	Upper **limit**	Investigate on landing, there is no flight safety effect
	Lower **limit**	This may indicate low fuel, (especially if the indication drops to zero), or filter blockage. The two fuel pumps have their own filters, so turn on pump two and note pressure increase. An increase will indicate blocked P1 post pump filter. No change will indicate a pre pump filter issue. If the engine is running, continue to fly. If insufficient fuel pressure make a precautionary landing.

3.11 Outside Air Temperature and Rotor Bearing Temperature

Outside Air Temperature (OAT) and Rotor Bearing Temperature (RBT) indicators are provided for condition monitoring of the rotor bearing. Both readings should be more or less equal. If, in stabilized conditions, RBT rises suddenly above OAT, have bearing inspected.

OAT is also indicated within the Aspen PFD (where fitted).

3.12 Loss of Visibility

In case of canopy misting, open air vents and windows to ensure proper ventilation. If the situation cannot be corrected or occurs suddenly, such as after a bird strike or canopy icing, maintain safe attitude by visual reference to the sides, using the open sliding window, if necessary.

When at safe height, stabilize the aircraft at 50KIAS and clear the viewing obstruction by using a hand through the sliding window or from the inside.

If forward vision is still impaired or lost, continue flight in a side slip, using the open sliding window for visual reference. Land at the nearest suitable location and align just prior to touch-down.

3.13 Recovery System / Rotor System

This gyroplane is not equipped with a ballistic recovery system. However, its rotor system which is in permanent autorotation serves as such a system. Therefore, the entire rotor system including its rotor head with blade attachments and the corresponding components of the flight controls have to be inspected and maintained carefully.

If any undue vibration or unusual behaviour is experienced a precautionary landing should be considered.

3.14 Rotor Icing

A more than normal or constantly increasing power demand may be caused by an iced-up rotor system. This could ultimately result in a condition where altitude cannot be maintained, even at maximum power. An iced-up rotor system can also cause severe vibration. If any of the signs for rotor icing is evident, carry out a precautionary landing.

3.15 Landing with a Deflated Tyre

Plan to land directly into the wind with minimum rate of descent at touch-down, if possible on a grass runway. Maintain directional control with adequate pedal input. Consider the use of some propeller thrust to increase rudder effectivity. Lower nose gently with the nose wheel pointing straight.

Alternatively, if landing on asphalt is unavoidable, approach normally, with the intent of a zero-speed touch-down directly into wind.

Only if impossible to recover the aircraft from the landing area should it be manoeuvred under its own power, as this could further damage the tire and wheel rim.

3.16 Failure of CSP/VPP Propeller

Noticeable defect:

In case of a noticeable mechanical defect, indicated by sudden vibration or noise, perform a precautionary landing.

Run-away:

Propeller pitch changes without command, usually resulting in unexpected or sudden change in engine RPM and engine manifold pressure.

Run-away to FINE: RPM will increase and propeller pitch will stop in full FINE position. Reduce power if needed, to stay within RPM limits.

Run-away to COARSE: RPM will decrease and MAP will rise until propeller pitch stops in full COARSE position. Reduce power if needed, to stay within MAP limits.

If the circuit breaker has opened, in both cases do not try to re-engage circuit breaker until the cause of the run-away has been determined. Continue according to emergency procedure ‘FREEZE’.

Freeze:

Propeller pitch does not react to pilot input, engine RPM does not change while propeller pitch control is activated. Proceed according to the following table:

Before take off	Do not take-off
During take-off and climb	Try to keep climbing to a safe altitude, return to the airfield and land. If the aircraft does not climb, maintain altitude and return in a flat curve.
During cruise flight	Depending on the prop position, it should be possible to find a speed and RPM to continue the flight to the next possible landing area. Depending on the prop position your descent will look different and a go-around may have reduced climb rate.
During descent	Depending on the prop position (in case of cruise), your descent will look different and a go-around will may have reduced climb rate.
During landing	Continue approach as planned. If the prop changes to cruise and the landing looks too long, keep in mind to cut the engine.

3.17 Alternative Method of Engine Shut-down

If the engine continues running after the magnetos have been switched off use one of the following alternative methods:

Close fuel shut-off valve and starve the engine.

Alternatively

Engage full choke, wait a few seconds and open the throttle suddenly. This normally chokes the engine and causes it to stop

Alternatively

Turn master switch to off to deactivate both primary and secondary electrical fuel pump. The engine will starve after approximately 30 – 60 seconds.

CONTENTS

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SECTION 4 - NORMAL PROCEDURES

This section contains check list items, instructions and procedures for the operation of the gyroplane. However, these procedures do not replace the pilot's appreciation of the individual situation.

4.1 Airspeeds for Safe Operation

Climb ..... 60 KIAS
Best rate of climb / best endurance ..... 50 KIAS
Best range ..... 60 KIAS
Approach ..... 50-55 KIAS

4.2 Preparation for Flight

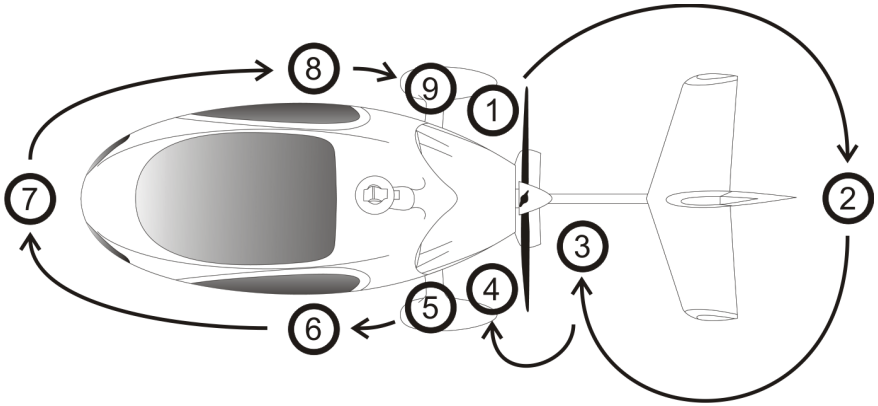
The pilot shall be familiar with the aircraft limitations detailed in SECTION 2 of this manual and shall have performed proper flight planning considering required legal aspects, as well as SECTION 5 'PERFORMANCE' and SECTION 6 'WEIGHT AND BALANCE' of this manual. The use of check lists as provided in this manual is mandatory for a safe operation.

4.3 Daily or Pre-flight Checks

All daily or pre-flight check list items consist of visual checks and do not replace professional mechanical inspection and maintenance. The following check list applies for the standard Cavalon gyroplane.

Note that depending on optional equipment installed the necessary checks may include additional items according to the flight manual supplement provided with the optional equipment. It is advisable for the owner/operator to compile his own check list suitable to his particular configuration.

The pre-flight check is structured into 9 stations which are organized as a clock-wise walk-around to provide a logical flow and sequential order, thus minimizing the risk of left-over or overlooked items.



The following checks must be carried out before each flight. However, if the gyroplane is operated by a single pilot or within an organization where the checks are performed by or under the supervision of qualified personnel, check list items marked with a preceding 'Θ' may be carried out daily, before the first flight of the day.

Before exterior check

Θ Fuel tank drain(s)..... Sample
Θ Snow/ ice (if any)..... Removed
Documents..... Check complete

Exterior check

Station 1 (engine, RH side)
Open upper engine cowling

Θ Before turning prop: MAG switches..... Check OFF
Θ Engine oil level..... Check
Θ Dip stick and oil cap.....Installed and secure
Θ Coolant level..... Check
Oil cooler and hoses..... Clean, no leaks, fittings tight
Exhaust system.....No cracks
External generator.....Secure, V-belt in good condition
Lower engine cowling..... Properly installed, all fasteners locked

Station 2(stabilizer)

Θ Stabilizer general condition..... Check
Stabilizer attachment..... Check
Rudder control cable linkage..... Check
Upper rudder bearing..... Secure, no excessive play
Rotor blades condition and cleanliness..... Check
Blade tips..... Tight
Aft keel tube protection pad.....No excessive wear

Station 3 (keel tube and propeller)

Θ Forward keel tube protection pad ..... No excessive wear
Propeller condition and cleanliness ..... Check
Propeller leading edge and tips ..... No damage
Spinner ..... Tight, no cracks
CSP/VPP propeller ..... Check security

Station 4 (engine, LH side)

Θ Engine frame rear side / welded joints ..... No cracks, no deformation
Oil cooler and hoses ..... Clean, no leaks, fittings tight
Exhaust system ..... No cracks
Lower engine cowling ..... Properly installed, all fasteners locked
Close upper engine cowling

Station 5 (main gear spring spar, LH)

LH Main wheel running surface ..... Check
Air pressure and slip mark ..... Visual check
Θ Brake, disc attachment (4 bolts) and wheel attachment ..... Check
Wheel spat and attachment ..... Check
Θ Main gear spring spar attachment ..... Check
Main gear spring spar ..... No cracks
Θ NAV light ..... Check
Θ Strobe light ..... Check
Anti-collision beacon ..... Check
Mast vibration decoupling element attachment (2x) ..... Check
Rotor flight control ..... No excessive play and secure
Θ Teeter bolt (bolt end) ..... Free to turn
Teeter bolt (nut end) ..... Split pin installed
Fuel filler cap ..... Breather hole clear, and securely fitted

Station 6 (passenger station, LH side)

Θ LH control stick ..... Secure or removed
Θ Monocoque structure condition ..... Check
Seat belts ..... Fastened and tight
Door hinge/s ..... Quick pin installed, no cracks
Door window ..... Check, no cracks
Static port ..... Clean and open

Station 7 (forward fuselage and windshield)

General appearance ..... OK
Pitot cover (if installed) ..... Removed
Pitot tube ..... Clean and open
Rotor tie-down bag (if sufficient brake pressure) ..... Removed
Windshield condition and cleanliness ..... Check, no cracks
Θ Nose wheel condition and air pressure ..... Check
Θ Landing light nose and underbody cleanliness/security ..... Check

Station 8 (cabin, RH side)

Static port ..... Clean and open
MAG switches ..... Check OFF
Rotor brake pressure ..... min. 6 bar
⊙ Throttle lever ..... Check function, full travel
⊙ Brake lever and lock ..... Check function and condition
⊙ Pedals and control cables ..... Check
⊙ RH control stick bolts and nuts ..... Secured
⊙ Monocoque structure condition ..... Check
Loose objects ..... Removed/secured
Door hinge/s ..... Quick pin installed, no cracks
Door window ..... Check, no cracks

Station 9 (main gear spring spar, RH)

Main wheel running surface ..... Check
Air pressure and slip mark ..... Visual check
⊙ Brake, disc attachment (4 bolts) and wheel attachment ..... Check
Wheel spat and attachment ..... Check
⊙ Main gear spring spar attachment ..... Check
Main gear spring spar ..... No cracks
⊙ NAV light ..... Check
⊙ Strobe light, anti-collision light ..... Check
Cooling air intake ..... No obstructions
Mast vibration decoupling element attachment (2x) ..... Check
Gimbal head bolts (2x) ..... Split pin installed
Rotor flight control attachments ..... No excessive play and secure
⊙ Main rotor bearing ..... Check condition
⊙ Pre-rotator assembly and brake ..... Check condition
⊙ Teeter bolt (bolt end) ..... Free to turn
Teeter bolt (nut end) ..... Split pin installed
⊙ Teeter stops ..... Check
⊙ Rotor hub and blade clamping area ..... Check
Blade attachment bolts ..... All installed and fastened
⊙ Inner blade caps ..... Tight

Rotor tie-down bag ..... As required

CAUTION

Teeter bolt must be free to turn by hand!

4.4 Before Boarding

Fuel level and fuel cap ..... Check

Passenger station:
Passenger ..... Briefed and secure
Loose objects..... Removed
Items in storage compartment..... Secure
Seat belts..... Fastened and tight
Door..... Closed and locked

Rotor brake pressure ..... Check/set BRAKE min. 6 bar
Rotor lash bag ..... Removed and stowed

Pilot station:
Loose objects..... Removed
Items in storage compartment..... Secure

WARNING

There is no vertical restraint provided for baggage stowed behind the occupant seats unless a security net is fitted to the provided mounting points. Normally this baggage is restrained by the vertical tapering of the stowage area. It is the pilots responsibility to ensure any item stowed behind the seats, or anywhere else in the aircraft, is secure. If the stowed items could come free in the event of an accident, then suitable restraints must be fitted – for instance, anchored to the seat belt harness lap belt mounting lugs via a suitable strap.

4.5 Before Starting Engine

Pedals ..... Adjusted and locked
Seat belts..... Fastened
Flight controls ..... Free
Altimeter ..... Set to QFE or QNH as desired
Doors..... Check closed and locked

4.6 Starting Engine

Fuel shut off valve ..... Open and guarded
Parking brake..... Set
Cold engine:
Throttle ..... Idle
Choke ..... Fully engaged
Warm engine:
Throttle ..... Idle or slightly cracked
Choke ..... Disengaged
Master switch..... ON

Note GEN indicator light ON (and GEN2 where fitted)

Note LOW VOLT flashing briefly

Note BOOST WARN light and BOOST CAUTION light ON for about 2 seconds and buzz of electrical fuel pump.

Second fuel pump (Pump 2) ..... ON

Note (increased) fuel pump buzz.

Variable pitch propeller ..... FINE
ACL / Strobe ..... ON
Both MAG switches ..... ON
Propeller and area .....“Clear”
Starter (with right hand, left hand on throttle/brake) ..... Engage

Hold starter until engine fires, but for a maximum of 10 seconds. Generally the engine fires immediately. In case of an unsuccessful starting attempt check all preconditions. Wait at least 20 seconds to allow cooling of battery and starter motor before repeated activation.

Oil pressure .....min. 1.5 bar
Second fuel pump (Pump 2) (Confirms function of P1) ..... OFF
When switching fuel pumps on and off, watch the fuel pressure gauge to ensure that the needle deflects to show the pressure change.

Avionics/Radio/Intercom ..... ON
Choke.....slowly disengage

WARNING

Never attempt to start the engine until the area around the propeller is completely clear of any persons or objects.

4.7 Taxi and Run-up

During taxi do not exceed 10 KIAS (~10mph) which is approximately jogging speed and steer with careful pedal input. Use wheel brakes carefully, if needed, but not before throttle lever has been completely pulled to idle. Control stick should always be maintained in forward centre position. When taxiing on uneven ground, use particular caution and hold control stick so as to avoid the blades or control system hitting their mechanical stops.

Carry out engine run-up in an area with least danger to individuals and other airport ground traffic, preferably headed into the wind.

If dark, switch on the nose mounted landing lights.

Warm-up RPM ..... 2000 – 2500 RPM
Oil temperature and other engine indications ..... within limits

At taxi holding position:
Magneto check (at 4000 RPM)..... max. 300 RPM drop
with max. difference between magnetos ..... 115 RPM

Switch ignition/magnetos with right hand while left hand resides on throttle/brake.

Functional check VPP ..... execute (see 9-1.4.3)
Electronic Primary Flight display Observe that gyrocompass matches magnetic compass, and that other indications are normal.
Throttle ..... Idle
Warning and caution indications ..... None
Instruments / altimeter ..... Cross check
NAV and anti-coll lights ..... As required
Second fuel pump (Pump 2) ..... ON
Doors ..... Cross-check closed and locked
Approach and runway ..... "Clear", then line-up

For night flight, use nose landing lights to taxi, and under-body landing light for take-off. Anti-collision, navigation and strobe lamps should be used in accordance with night operational requirements. Instrument panel lighting must be on and dimmed to an appropriate level.

Use the pitot heat either before or during flight as required to ensure the pitot remains clear of ice.

If there is any consideration that the static ports could be blocked, switch from primary (uses the ports either side of the body) to secondary (vents inside the cabin). There is normally negligible difference in level flight between the two ports, as can be seen by switching between the two.

CAUTION

If the canopy is covered in rain drops or fogged up, ensure it is cleared before commencing take-off. Stop and clear the screen if required.

4.8 Take-off Procedure

- Check relative wind
- Maintain control stick in forward position with right hand
- Switch pneumatic mode selector to FLIGHT and return to brake with left hand
- Hold wheel brake without having locking pawl engaged
- While holding wheel brake adjust 2000 RPM with throttle, activate and hold pre-rotator
- Let pneumatic clutch fully engage (stabilization at about 110 rotor RPM).
  If necessary release pre-rotator button momentarily and press again to maintain engine RPM within green arc, respectively prevent engine from stalling!
- Carefully increase throttle (~ 20 R-RPM/sec) to 200 R-RPM – max. 220 R-RPM
- Release pre-rotator button
- Gently move control stick fully aft (stick travel ~ 1 sec.).
  In a strong headwind be prepared to stop movement before nose wheel rises!
- Release wheel brake with throttle unchanged
- Monitor rotor speed and adequately increase throttle to take-off power

WARNING

Before activating the pre-rotator, check area is clear.

WARNING

Prior to releasing the wheel brake, make sure that the control stick is fully aft (assuming rotor has 200rpm minimum), if headwind component allows. A take-off run with flat rotor system may have fatal consequences.

WARNING

With the rotor speed below green arc relative speed must be built-up carefully to allow rotor speed to increase first. If the situation cannot be corrected, abort take-off run.

CAUTION

Do not engage pre-rotator at too high engine RPM or leave engaged at very high rotor RPM as this will lead to pre-rotator drive damage.

CAUTION

Avoid over-torqueing of the pre-rotator drive! Over-torqueing will occur if RPM/power is fed excessively or abruptly. In case of a stalling engine, release pre-rotator button temporarily. Do not yank the throttle control while the clutch is engaged!

NOTE

Perform take-off into the wind and with least possible crosswind component.

NOTE

To avoid unintended engagement in flight the pre-rotator can only be activated with the control stick in its most forward position.

WARNING

In the event of pre-rotator failure, STOP and rectify the fault. Do NOT attempt to pre-spin by hand, as this involves considerable personal risk if the engine is running.

4.9 Take-off Run

- Check min. 5400 RPM for take-off. Otherwise, abort take-off
- Minimize lateral drift by applying appropriate lateral control stick input into cross wind direction
- Maintain directional control i.e. runway alignment with sensitive pedal input
- When nose comes up allow nose wheel to float at about 10 – 15 cm above the runway by a balanced reduction of control stick back pressure
- Maintain attitude until speed increases and gyroplane lifts off
- Allow gyroplane to build-up speed in ground effect

CSP/VPP: With a variable pitch propeller installed, refer to the respective flight manual supplement in CHAPTER 9 for correct power setting and handling procedure.

WARNING

Gyroplanes are fully controllable at very low speeds without exhibiting any signs of wing stall or soft flight controls, as it would be perceived in a fixed wing aircraft. However, operation 'behind the power curve' may have fatal consequences during take-off, initial climb or in any other situation within ground proximity. Always allow aircraft to build-up safe climb speed before allowing it to gain height.

4.10 Climb

- Perform initial climb at safe climb speed and adjust trim
- Set power to maximum take-off power
- Check engine instruments and respect maximum take-off power time limit
- Switch off second fuel pump at safe height
- At safe altitude, the climb may be continued with V_Y and reduced power setting for noise abatement
- When desired altitude is approached, level gyroplane and reduce power

CSP/VPP: With a variable pitch propeller installed, refer to the respective flight manual supplement in CHAPTER 9 for correct power setting and handling procedure.

4.11 Cruise

- Adjust power setting within the maximum continuous power range
- Adjust trim

CSP/VPP: With a variable pitch propeller installed, refer to the respective flight manual supplement in CHAPTER 9 for correct power setting and handling procedure.

4.12 Descent

- Reduce power setting and lower nose
- Adjust trim

CSP/VPP: With a variable pitch propeller installed, refer to the respective flight manual supplement in CHAPTER 9 for correct power setting and handling procedure.

4.13 Approach

- Switch ON second fuel pump (Pump 2)
- Set variable pitch propeller to FINE
- Check all warning and caution indications OFF
- Check all instruments in normal operating range
- Check wheel brake unlocked
- Maintain and trim approach speed
- Control glide angle with engine power
- If at night, turn the landing lights on. Always turn on both landing lamps in case of failure.
- If at night, and it is safe to do so, approach at 60KIAS. The increase in rotor speed will allow a longer, flatter flare and landing.

CAUTION

The landing light circuit breaker (CB) protects both the nose and under-body lights. Should the CB open, turn off both switches before resetting, and after reset turn on the under-body lamp only. This is the higher current draw, but offers best ground visibility. If the CB opens again, repeat with only the nose mounted lamps. If no landing lights will function, then perform a power on, shallow approach as above into a lit airstrip to enable an immediate go-around if a safe landing is not practical.

WARNING

An approach within the gliding distance to the airport or landing site is generally considered to be the safest option.

4.14 Landing

- Align gyroplane with rudder and correct drift with lateral control input, even if this results in a side slip indication
- Maintain approach speed until approximately 5m above runway
- Manage the throttle to maintain the desired approach speed, reducing the throttle to closed (or other appropriate power setting for the conditions) in preparation for the flare.
- Initiate round out to reduce sink rate and let ground approach
- Perform final flare close to ground as speed will decay rapidly
- Let gyroplane settle on main gear with nose wheel slightly above the ground
- Hold nose wheel closely above ground and let it sit down with pedals neutral at the lowest possible ground speed, reducing/closing the throttle as required.
- Maintain aft control stick to reduce speed until walking speed. Wheel brake may be used to assist, if needed

CAUTION

When landing in a strong headwind do not use wheel brake to prevent gyroplane from rollback. In order to compensate for any rollback tendency, flatten rotor disc as required and increase propeller thrust as required.

CAUTION

Touching down with the nosewheel pointing left or right, and with a run-on speed, will cause the wheel to 'grab' in that direction. If left uncorrected the aircraft will try to turn in that direction, possibly resulting in a roll-over. Always lower the nose at low ground speed, with the nosewheel straight.

4.15 Go-around

- Apply take-off power. Counteract yaw tendency and align gyroplane with rudder input
- In horizontal flight, allow gyroplane to gain speed
- Climb with safe or best rate of climb speed and adjust trim

CSP/VPP: With a variable pitch propeller installed, refer to the respective flight manual supplement in CHAPTER 9 for correct power setting and handling procedure.

4.16 After Landing

- Control stick full forward to level-off rotor disc, at latest when rotor speed leaves green arc! Be prepared for reduced rotor drag!
- Use lateral control into wind to maintain rotor disc in level attitude. Adjust lateral control input as rotor speed decays
- Bring pneumatic mode selector to BRAKE position and return to wheel brake with left hand
- Apply rotor brake pressure by using AFT TRIM. Monitor pressure gauge
- Taxi carefully, preferably not above walking speed and mind high centre of gravity when taking turns
- Turn off the underbody landing light when practical to reduce electrical current draw.
- Do not vacate gyroplane until engine and rotor is at a complete stop

WARNING

Mind the spinning rotor and propeller when taxiing close to obstructions or persons. A fast turning rotor is almost invisible, but may contain enough energy to kill a person.

CAUTION

Try to park the blades fore/aft of the aircraft, to avoid high stick loads in roll when taxying. Depress the pre rotator interlock release button & engage the pre-rotator to wind the rotor into the desired position. The use of abrupt pedal inputs to do this during taxiing should be avoided.

NOTE

It is advisable to let the rotor spin down while the gyroplane is at a complete stop. However, in order to vacate the runway, it is possible to taxi while the rotor is spinning down. In this case, be aware of the effects of relative wind on advancing and retreating blade, compensate with lateral control input, and adjust taxi speed carefully as to avoid blade flapping.

4.17 Engine Shut-down

Throttle ..... Idle
Parking brake..... Set
Engine cool-down ..... perform

Oil Temperature above normal range (see 2.6):
min. 2 minutes at 2000 RPM, then idle

Second fuel pump (Pump 2) ..... OFF
Avionics/Radio/Intercom/Lights (except ACL / Strobe) ..... OFF
Both MAG switches sequentially ..... OFF
ACL / Strobe, navigation and landing lights (if installed) ..... OFF
FAN ..... activate if required
Master switch..... OFF and key removed

NOTE

For landing a suitable approach procedure has to be chosen, so the engine cools down sufficiently during descending and later taxiing, as specified by the engine manufacturer. The engine can be shut-off by switching off the ignition; an engine cool-down is not needed.

NOTE

Due to the pusher engine arrangement, a ground engine cool-down is inefficient and may be counter productive. If necessary park into wind so that air is driven naturally into the engine bay air intakes.

NOTE

If the engine is switched off 'hot', for example after an approach with power and short taxi, the engine may refuse to start for the next 15 – 20 minutes.

4.18 Parking

- Install rotor tie-down bag
- Secure gyroplane against rolling using parking brake and chocks, if parked on a slope
- Double check to have master switched OFF and keys removed
- Install protection cover if available or appropriate

NOTE

Avoid long term parking of the aircraft with empty tanks. This will increase the risk of water accumulation in the tanks and will lead to shrinking of the rubber tap seal.

4.19 Special Procedure: Short Field Take-off

A short field take off is conducted in exactly the same manner as a normal take-off, but performed with maximum precision. Therefore, a short field take-off is not so much a procedural thing, but needs practice, experience and mentoring. Apart from environmental aspects such as wind and density altitude, the condition of the gyroplane and its gross weight, the key factors for a short take-off performance are:

- Maximum allowed pre-rotation RPM and no time lost until stick is fully aft (if headwind component allows) and brake is released
- Maximum take-off power is set immediately while stick remains fully aft until nose wheel rises
- Nose wheel held tight above surface and minimum side drift until lift-off
- No over controlling that would result in the nose swinging up and down
- V_Y climb with no side slip

4.20 Special Procedure: Slow Speed Sink and Recovery

- Reduce power to idle and let speed decrease by gently using aft control stick
- Maintain enough forward speed for sufficient rudder effectivity
- Rudder will regain effectivity quickly as soon as airspeed or propeller thrust is increased
- To recover, let nose drop slightly below the horizon and build-up air speed while adding power at the same time

4.21 Flight with Doors Removed

Before flying with removed doors any loose objects must be removed from the cabin or safely stowed.

A possible tail shake (fishtailing) tendency can be minimized by using a small side slip. In case where only one door is removed, perform a small side slip into the direction of the closed door (so that the removed door is on the lee-side).

Removal and installation of doors is described in chapter 9-7

NOTE

When flying with doors removed be aware of strong air stream outside the cockpit.

4.22 Training Engine In-flight Shut-down and Air Restart

The engine should not be stopped in flight deliberately except as part of forced landing training under the supervision of a qualified flight instructor. If possible, allow the engine to cool down at 3000 rpm for about 30 sec before turning it off.

Make sure both magnetos are switched back ON and the master switch/starter key has been turned to OFF and back to ON to be prepared for an immediate engine start-up in case the manoeuvre has to be aborted.

NOTE

Be aware of reduced rudder effectivity (and increased drag) with a stationary propeller. Be prepared to use larger pedal input and more left pedal than usual to keep gyroplane aligned.

After a restart, allow engine and oil to warm-up, if possible, before full power is applied.

4.23 Noise Abatement

A positive attitude towards residents and environmental-friendly flying supports the reputation and acceptance of aviation in general, and gyroplanes in particular. When compared to other airplanes the noise of a gyroplane is sometimes perceived as unpleasant although it meets the same or sometimes more stringent noise emission requirements. This effect can be attributed to the pusher concept where the propeller is exposed to air flow which was distorted by the fuselage. The degree of distortion, and therefore the noise emission of the propeller, is significantly lower at reduced speeds. The best practices to keep noise level low and general acceptance high are:

- Climb with the speed for best rate of climb V_Y as soon as altitude permits
- Especially in climb keep side slip to a minimum to establish a clean configuration. In addition, this guarantees the best climb performance
- For your own safety always maintain safe altitude and avoid unnecessary ‘low-flying’
- When overflying populated areas, look ahead and select the least noise sensitive route
- Repetitive noise is far more irritating than a single occurrence. If you must fly over the same area more than once, vary your flight path
- Avoid blade slap (loud Wop-Wop noise of rotors). Blade slap can occur as a result of inadequate piloting technique or during aggressive manoeuvres, but will not appear in normal flight regime

NOTE

Above procedures do not apply where they would conflict with Air Traffic Control, within the traffic pattern, or when, according to pilot’s judgement, they would result in an unsafe flight path.

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CONTENTS

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SECTION 5 - PERFORMANCE

The following data were determined by flight testing and demonstrated with average piloting skills, with engine and aircraft in good condition, as well as clean main rotor and propeller. The parameters apply to standard conditions (15 °C at sea level and standard pressure) and a gross mass of 560 kg.

Note that a higher airfield elevation, increased temperature and/and low air pressure will have a negative effect on performance.

5.1 Demonstrated Operating Temperature

Satisfactory engine cooling has been demonstrated at outside air temperatures up to 40 °C.

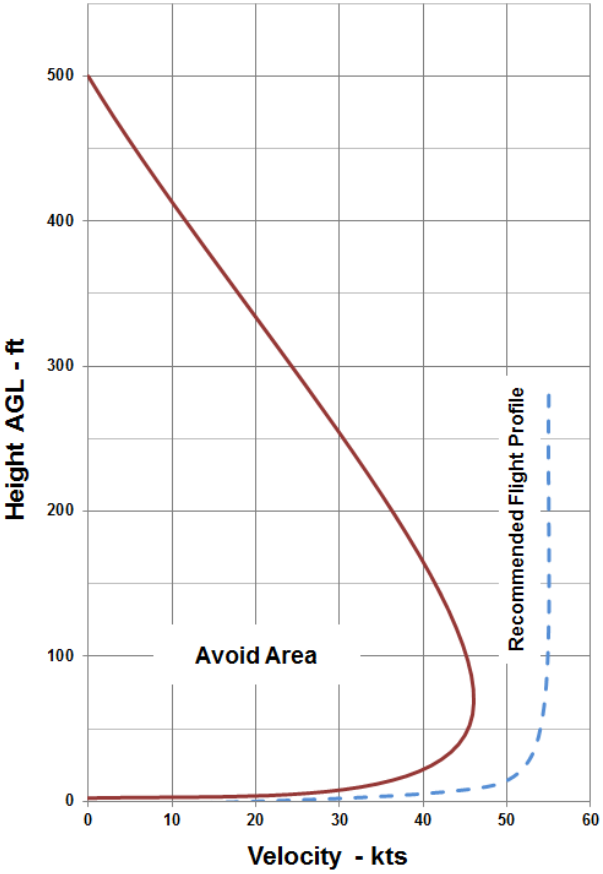
5.2 Airspeed Correction

During flight test the indicated airspeed was adjusted to match actual airspeed by the use of an adjustable bleed valve located behind the instrument panel.
The airspeed was correct within +/-2KIAS from 25-87KIAS.

5.3 Height-Velocity Diagram

The H/V diagram indicates combinations of height and speed (avoid area left side of the red graph) where a safe landing may not be possible in case of an engine failure. Therefore, operation on the left side of the red line must be avoided.

Take-offs and landings should be conducted according to the recommended flight profile, provided as blue dashed line.


Height AGL - ft
500
400
300
200
100
0
0
10
20
30
40
50
60
Velocity - kts
Avoid Area
Recommended Flight Profile

5.4 Speeds

The following speeds are relevant for flight performance. For additional speed limitations refer to SECTION 2 LIMITATIONS of this manual.

Minimum horizontal speed, TOP*	22-25 KIAS
Speed for best angle of climb V_X	50 KIAS
Speed for best rate of climb or maximum endurance V_Y	60 KIAS
Best range speed	60 KIAS
Long range speed**	65 KIAS
Approach speed***	50-55 KIAS
Vmc power-off****	20 KIAS
Vmc power on****	0 KIAS

* Take care! A full power operation at Vmin will result in a very high nose-up attitude with little forward visibility.

** Long range speed is the speed faster than the best range speed which results in a slightly lesser range but represents a good compromise between range and saved air time.

*** Approach speed above 50-55KIAS builds energy in the rotor that results in a long floating landing. Approach speed at 45KIAS results in a very short landing roll, and below 45KIAS requires increasing skill especially at maxTOW.

****Vmc is the minimum controllability speed. At 20KIAS or below, engine off, rudder authority reduces, to negligible below 10KIAS.

5.5 Rate of Climb

Rate of climb, 560 kg, V_Y, MCP	600 ft/min
Rate of climb, 500 kg, V_Y, MCP	750 ft/min

5.6 Take-off and Landing Data

Take-offs and landings have been demonstrated up to a crosswind component of 20 KIAS.

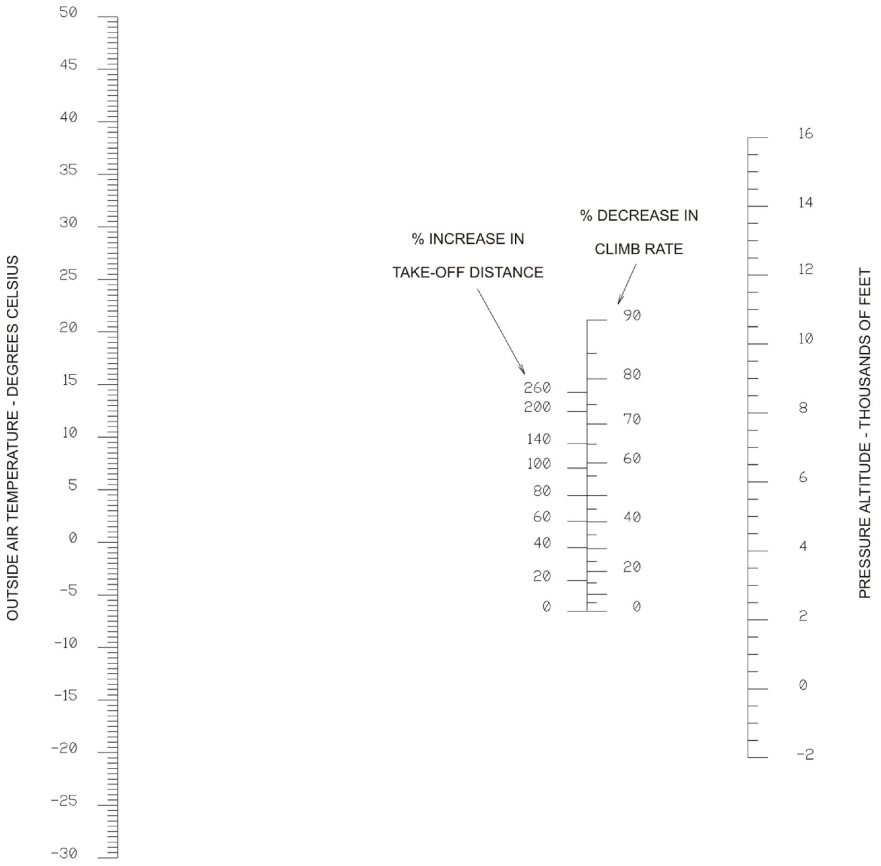
The following data is valid for operation at a gross mass of 560 kg at an even air strip with short grass, no wind, and pre-rotation to 200 RPM. Take-off and landing distances account for a 50 ft obstacle. The take-off distance shown below is the mean of six tests, increased by a factor of 1.5 as required within BCAR Section T para T51 AMC.

Take off distance can be reduced with higher pre-rotation.

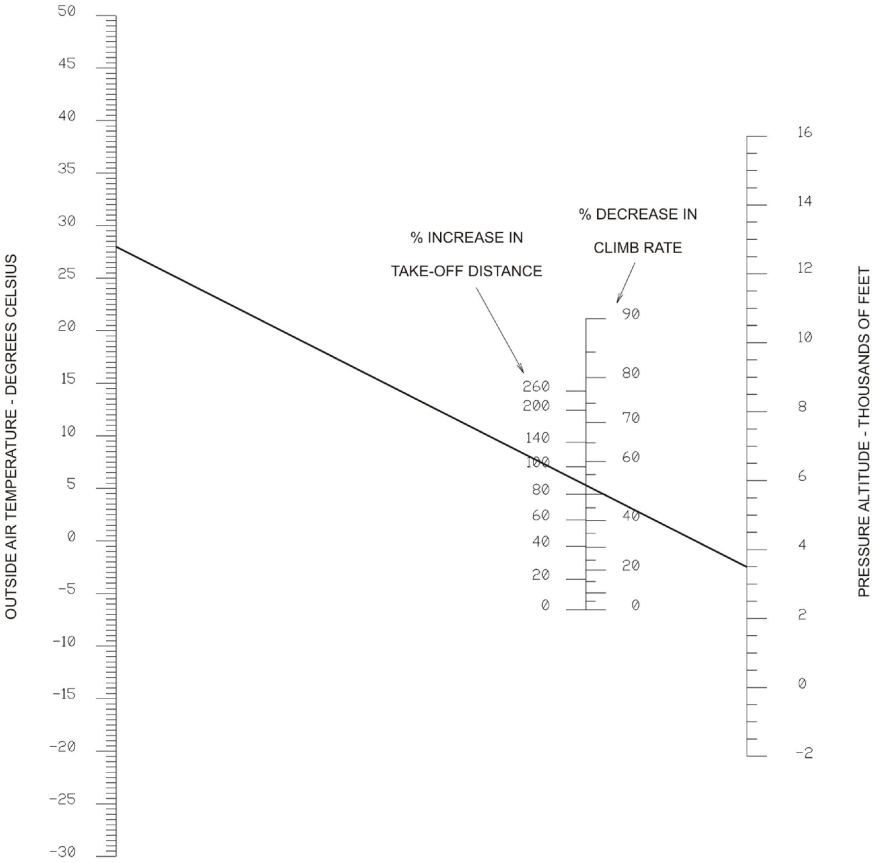
Take-off roll	80 – 120 m
Take-off distance	475 m
Landing roll	0 – 20 m
Landing distance	150 m

5.7 Influence on Take-off Distance and Climb Rate

All flight performance figures presented in this chapter are based on standard atmospheric conditions in sea level. Depending on actual temperature and pressure altitude (elevation) factors on take-off distance and climb rate can be deduced from the following chart.



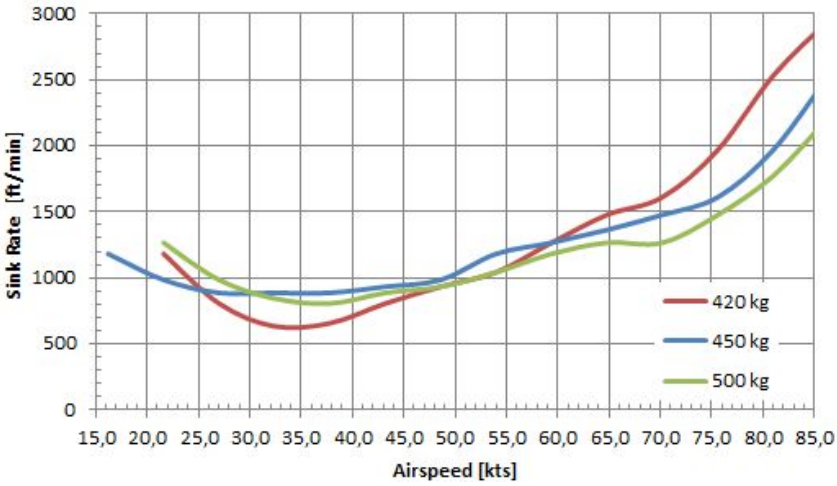
See next page for example.



Example:
Given: Outside Air Temperature 28 °C and Pressure Altitude 3500 ft
Result: 88 % increase in take-off distance and climb rate reduced by 53 %

5.8 Sink Rate and Glide Ratio

The sink rate depending on airspeed with the engine in idle is plotted in the following diagram:



At 560Kg MTOW expect a sink rate of 1050fpm at 35KIAS, 1200 at 43KIAS, 1120 at 52KIAS, 1320 at 61KIAS, 1550 at 70KIAS, and 1600 at 78KIAS.

In case of an engine failure at 560Kg MTOW, expect a glide ratio of 1:3 which corresponds to a vertical distance of 900 m or 0.5 nautical miles for each 1000 ft.

5.9 Additional Performance Data

5.9.1 Fuel Flow

The following fuel flow figures are provided as estimates and do not constitute certified performance. Exact fuel flow will vary with environmental conditions, cleanliness of propeller and rotor, piloting technique (minimum side slip), and power setting. For additional procedures about proper power setting consult SECTION 9 for supplemental data concerning the variable pitch propeller.

Fuel flow at 68 KIAS, 500Kg TOW .....15 ltr/h
Fuel flow at 75 KIAS, 500Kg TOW .....18 ltr/h

5.9.2 Service Ceiling

See SECTION 2 LIMITATIONS

5.10 Sound Exposure Level / Noise Characteristics

There is no noise certificate issued by the UK CAA.

5.11 Effect of rain and dirt

During flight test it was noted that the take–off and climb performance in rain was marginally reduced in rain. Expect up to a 5% reduction in performance.

The most noted effect of rain on take-off is the presence of rain drops over the front windscreen, leading to a partially obscured view. It is highly recommended if operating in wet conditions that the screen is kept very clean, such that rain tends to run off. If practical, wipe before take-off commences. As airspeed increases the rain runs off either side of the screen.

Dirty blades have a significant effect on performance, in both the increase of out of balance forces (stick vibration), and reduction in lift. It is not practical to define a specific performance loss versus level of insect accretion or dirt level – blades should always be cleaned prior to flight, this activity takes only a couple of minutes. Proprietary baby wipes make an excellent field cleaner for rotor blades.

Dirty blades can lead to a 20% performance loss.

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SECTION 6 - WEIGHT AND BALANCE

6.1 General

The gyroplane must be operated within the weight and balance limits as specified in SECTION 2 of this manual. Loading situations outside these limits can result in restricted flight control and can ultimately lead to degraded safety.

6.2 Weight and Balance Record

An initial weighing report and equipment list showing gyroplane configuration, empty weight and centre of gravity is delivered with each gyroplane. This data applies to the gyroplane as delivered from RotorSport UK Ltd. Any changes in the configuration should be performed by a qualified maintenance station and documented. After modifications and at regular intervals a new weighing report and equipment list should be issued.

6.3 Compliance with Weight and Balance

The Cavalon Pro gyroplane is designed in such way that compliance with weight and balance is provided, if

- the gyroplane is loaded within the individual weight limitations for each station as provided in SECTION 2 of this manual, and
- the maximum allowable cockpit loading (both seats and baggage) is respected, and
- the certified maximum take-off weight, representing the total sum of pilot, passenger, baggage, fuel and current empty weight is not exceeded

6.4 Lateral Centre of Gravity

The above requirements in conjunction with 2.7.1 also cover asymmetric lateral load cases. Even with most asymmetric lateral cockpit loading (pilot station loaded with maximum weight while LH station is unoccupied), sufficient control margin and lateral CG within limits has been demonstrated.

However, the resulting cabin attitude in combination with the unusual optical sensation may lead to misinterpretation of flight attitude, height above ground and runway alignment.

Therefore, first solo flights should be performed with adequate ballast on the empty LH seat in order to compensate asymmetric lateral loading. Ballast should be gradually reduced with gained experience.

CAUTION

Ballast must be properly secured and weight and balance must be respected.

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SECTION 7 - SYSTEM DESCRIPTION

7.1 Introduction

This section contains the description of the gyroplane and its basic systems and equipment. Supplemental/Optional equipment is described in Chapter 9 of this manual.

7.2 Airframe and Undercarriage

The load carrying structure of the gyroplane consists of a composite monocoque occupant enclosure which is connected to the rotor tower and keel tube. The composite structure, tower and aft extension carries all loads induced by the crew stations, engine, rotor, undercarriage, stabilizer, and serves as installation platform for additional equipment.

Stabilizer structure with rudder is made of CRP and is bolted to the aft extension of the keel tube. Attachment points for the engine installation are provided by a steel tube ring mount at the rear of the firewall.

The landing gear consists of a steerable nose wheel in a steel fork and two main wheels with hydraulic brake system. Both main wheels are equipped with wheel spats made from GRP and are mounted to the ends of the spring spar, which is made from GRP. The spar is designed to absorb even higher than normal landing loads in case of a hard landing or crash.

WARNING

Cavalon Pro is only supplied in white colour because of the effect of increased temperatures induced by other colours when left in the sun, and the subsequent increase in design super-factors required for composite parts.

Do not re-colour the tail, rudder, suspension bow or body (in the region between the rotor head and suspension bow, and keel attachment)

7.3 Doors, Windows and Exits

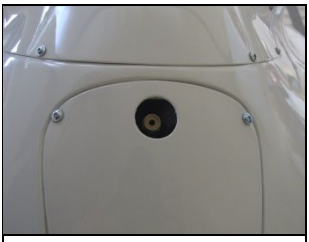
This gyroplane features one large undivided glazed canopy and two hinged doors with locking mechanism at the left hand and right hand side. The locking mechanism can be operated from the inside and outside by moving an aluminium locking lever. The door is properly locked when the lever jumps sidewise into its locking detent.

Two adjustable fresh air vents one on each side and one sliding window per side with pivoting vent are provided for ventilation. The sliding window can be used as viewing hatch in case of emergencies and is wide enough to reach through with a hand.

The gyroplane is embarked and disembarked from each side while the doors are held open by a gas spring. In case of emergency the opposite door may have to be used to disembark the aircraft.

7.4 Fuel System

The fuel system consists of two tanks permanently connected with a large bore crossover tube allowing them to be considered as one large tank, with a single filler port, fuel and ventilation lines, fuel level indicator, and water drain point. The filler port is located at the left hand side of the gyroplane. In order to open the filler cap, lift, then turn the flap, and pull out. Reverse to close cap.



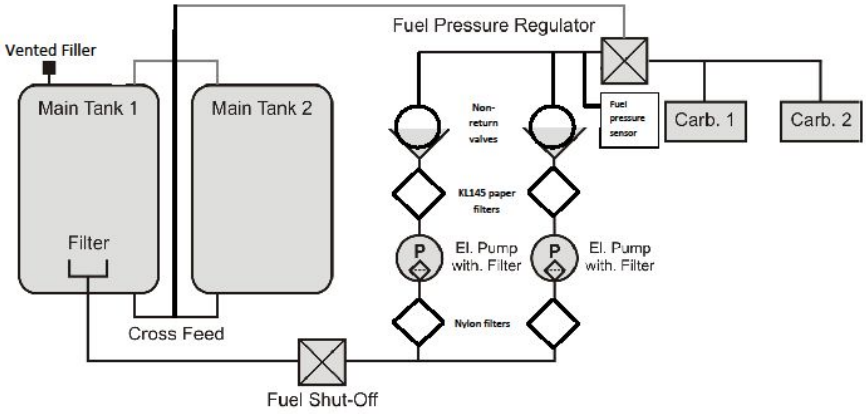
Drain Valve

The tanks are installed behind the seats and have a combined usable capacity of 100 litres. Fuel level can be checked visually using a dip stick which has to be inserted diagonally from the fuel filler port (see 8.5).

The tanks are ventilated by a ventilation line between the tanks then through a precision hole in the filler cap.

A low fuel level sensor is installed. The LOW FUEL warning light is triggered as soon as 5 litres or less of useable fuel remain in the tank.

Fuel system ROTAX 914F:



7.5 Pneumatic System

Aircraft trim, rotor brake and activation of the pre-rotator is controlled by a pneumatic system, consisting of an electrically driven air compressor with filter/dryer, a pressure gauge in the cockpit, solenoid valves, air lines, pneumatic actuators, and the respective cockpit controls.

Trim function

Trimming is effected by varying trim pressure in the pneumatic trim actuator which is installed in parallel with the rotor head tilt for pitch control. Aft or nose-up trimming activates the electrical compressor and increases trim pressure, causing the actuator to retract, and tilting the rotor disc aft. Forward trimming opens the pneumatic valve to reduce trim pressure and allows the rotor disc to flatten, due to the spindle head offset and the gyroplane's weight. The actual trim condition is indicated on the trim/brake pressure gauge in the centre panel of the cockpit.

Pitch trim loads are aided by a trim spring fitted between the rotor head and mast, so that in the event of sudden trim pressure loss the trim forces are easily held by one hand.

Lateral/roll trim works accordingly, using a lateral pneumatic trim cylinder. Lateral trim condition is indicated by a self-dimming LED bar on the instrument panel.

Rotor brake

With the pneumatic mode selector in BRAKE position the operation of the pneumatic trim actuator is reversed so that increased pressure causes the actuator to push the rotor head up (or level) and presses a brake pad against the rotor head disc. In order to increase brake pressure, move the 4-way trim switch on the stick grip to aft. Note that this action will also push the control stick forward. At full brake pressure the control stick will be maintained in its full forward position.

Activation of the pre-rotator

The pre-rotator is activated as long as the respective switch on the control stick head is depressed provided the following pre-conditions are met:

- pneumatic mode selector set to FLIGHT
- control stick in full forward position
- trim pressure less than 3 bar

When activated the pneumatic clutch is activated and engine torque is transmitted through a 90° gearbox and drive to the pinion which is engaged by another small pneumatic actuator into the geared ring of the rotor head. The drive pinion is sliding on a helical gear to provide automatic lock-out in case of rotor RPM overrun. The pre rotator drives shafts feature sliding splined elements to accommodate drive shafts length changes due to rotor head and engine operational movement.

Activation of the pre-rotator in BRAKE position

The pre-rotator can be activated in BRAKE position to park the rotor blades fore-aft for taxi. To do so, the pre-rotator switch and the overdrive/rotor brake interlock release switch in the cockpit panel have to be pressed simultaneously. Avoid prolonged activation of the pre-rotator with rotor brake engaged.

7.6 Power Plant

Engine

There is only one engine variant available, being the ROTAX 914F turbo charged version certified according to FAR 33 and JAR-E. The configuration is a 4 cylinder, horizontally opposed, 4 stroke featuring

- Liquid cooled cylinder heads
- Ram air cooled cylinders
- Dry sump forced lubrication
- Dual breakerless capacitor discharge ignition
- 2 constant depression carburettors
- Hydraulic tappets
- Electric starter
- Internal generator (Alternator) with external regulator
- Reduction gearbox with integrated shock absorber and overload clutch

This turbo charged engine offers a maximum take-off power of 115 horse power. For technical details refer to the engine manufacturer's manual.

Oil system

The oil reservoir with dipstick is accessed through a cover on the left hand side of the fuselage. The cover is held by 3 cam lock fasteners which can be locked or unlocked by a quarter turn. The type of lubrication system requires a special procedure for accurate oil level checking and to prevent overfilling, which is described in SECTION 8 of this manual.

Engine cooling

Engine cooling is provided by ram air cooled cylinders and liquid cooled cylinder heads. Therefore, cylinder head temperature (CHT) indication in the cockpit corresponds to water temperature, or on later engines a direct reading of Coolant Temperature (CT) is provided. Sufficient cooling air flow is provided by a ram air duct. The water cooling system comprises of engine driven pump, radiator with thermo-activated electrical blower fan, expansion tank with radiator cap, overflow bottle, and hoses.

A single, large area radiator is mounted above the engine so that cooling air from the ram air duct passes through the cooler, is directed around the engine's cylinders, and finally escapes through an opening at the lower rear end of the engine cowling. Force cooling is ensured by an electrically driven ducted fan controlled by a thermo switch. A push button in the cockpit allows manual activation temporarily which is typically used to avoid possible heat build-up after shut-down.

For the relevant checking and replenishing procedures, refer to SECTION 8 of this manual and also the engine manufacturer's manual.

7.7 Propeller

The propeller fitted is a Woodcomp KW-31 in-flight adjustable variable pitch design, certified with type certificate EASA.P.177.

The propeller pitch is adjusted by means of a Woodcomp CS 3-5 solid-state controller that can be used in both Manual and Constant-Speed modes. Operation of this propeller is fully described in SECTION 9 of this manual.

7.8 Rotor System

The two-bladed, semi-rigid, teetering rotor system comprises high-strength aluminium extruded rotor blades, a hub bar, and a common teeter hinge assembly.

The rotor blades feature an aerodynamic profile especially suitable for rotorcraft which, in combination with its relative centre of gravity, provides aerodynamic stability by eliminating negative blade pitching moments and flutter tendency. The hollow blade profile is sealed at both ends by plastic blade caps.

The aluminium rotor hub bar is pre-coned to the natural coning angle of the blades and connects the blades firmly to each side using 6 fitting bolts and a clamping profile. In order to compensate for asymmetric air flow in forward flight the blades are free to teeter. The hinge assembly consists of teeter tower, teeter bolt and teeter block.

The rotor system fitted to Cavalon Pro differs from the standard RotorSystem II in that the blade AOI is 0,4deg less. This is identified by the rotor blade assembly part no and black spacers fitted between the hub bar and rotor blade. RotorSystem II TOPP is also permitted for use on Cavalon. TOPP rotors carry blue end caps as opposed to red end caps, and clear anodised spacers instead of black.

The teeter bolt runs in a long Teflon coated bushing in the teeter block (main bearing action), as well as two shorter bushings in the teeter tower (emergency bearing action). The main bearing action is supported by special grease which is applied through a grease nipple on top of the teeter block. Servicing is described in SECTION 8 of this manual.

7.9 Vibration Damping

A certain level of vibration is inherent to any 2-bladed rotor system. In order to reduce vibration levels to a minimum, a vibration decoupling element (comprising two rubber bushes) in the rotor mast isolates rotor vibration from the fuselage.

7.10 Flight Controls

Rotor head and trim control

Pitch and roll of the gyroplane are controlled by tilting the complete rotor head by means of the control stick. Control input is transferred via torsion tube and linkage running below the seats to the base link and from there to the rotor head via push-pull control cables.

The control stick head is ergonomically shaped to fit the pilot's right hand and features control buttons for radio transmission (1), a four-way trim function (2), and activation of the pre-rotator (3).

The trim control works as a classical 4-way beep switch. Pulling the beep switch back increases aft trim or nose-up tendency, while pushing the switch forward reduces back trim pressure, leading to a nose-down tendency. Roll trim is effected by pushing the trim switch to the respective side.

Control stick head

1 – Radio transmission
2 – Trim switch
3 – Pre-rotator

Because of a safety circuit, activation of the pre-rotator is only possible with the pneumatic mode selector in FLIGHT position and the control stick fully forward. This prevents inadvertent activation of the pre-rotator during flight or in BRAKE mode.

The left seat flight controls must never be restricted by passenger or objects. Passengers must be briefed.

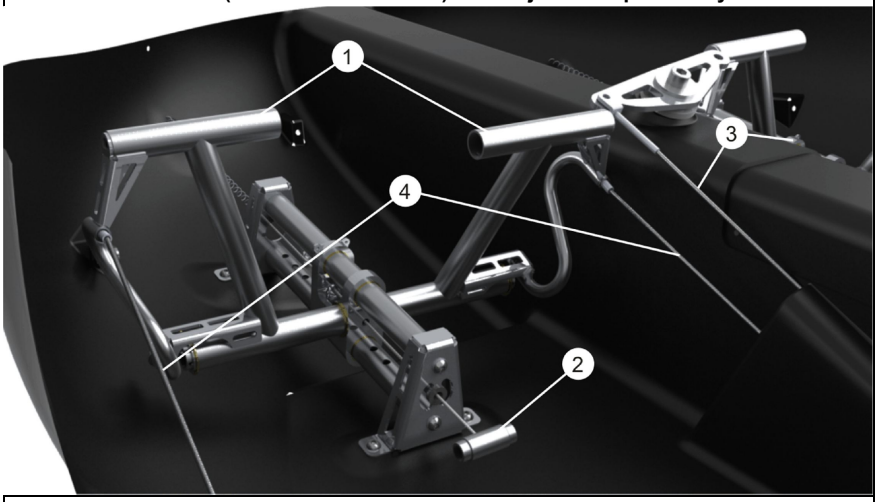
Rudder and front wheel control

The rudder is connected to adjustable foot pedals with steel cables which are routed through the lower fuselage and inside the keel tube. Both pairs of pedals are interconnected. The nose wheel steering is directly linked to pedal/rudder control input by redirected cables.

Both pairs of pedals can be adjusted to suit different leg lengths. A shorter adjustment is achieved by pulling the handle which moves the pedals closer. Pulling the handle while pushing with both feet gently against the pedals allows longer adjustment.

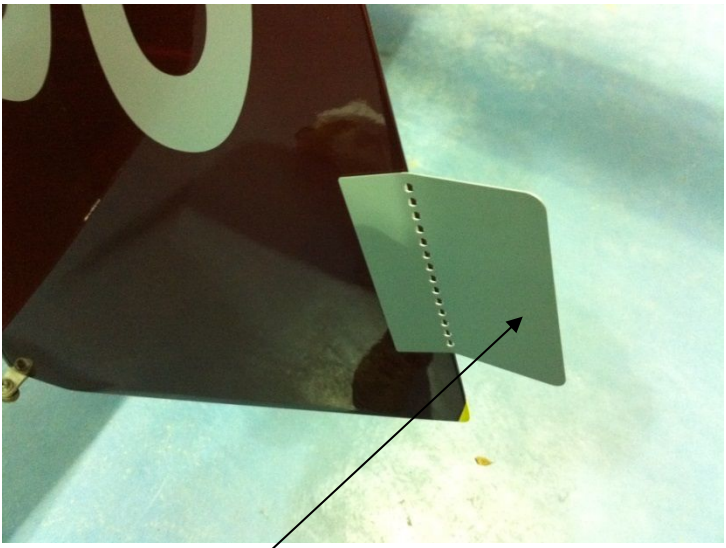
In any case make sure the pedal assembly is properly locked, as indicated by a definite and positive click.

Pedals (left hand side shown) with adjustment possibility



1 – Pedals	3 – Nose wheel steering cables
2 – Adjustment handle	4 – Pedal control cable

The rudder is fitted with a trim tab. This is normally biased to the left, and may be adjusted by the operator to trim the aircraft for straight flight at a desired speed, feet off the pedals. Adjusting it to the left will biase the rudder to the right and vice versa.



Trim tab fitted to the rudder

Throttle and brake panel

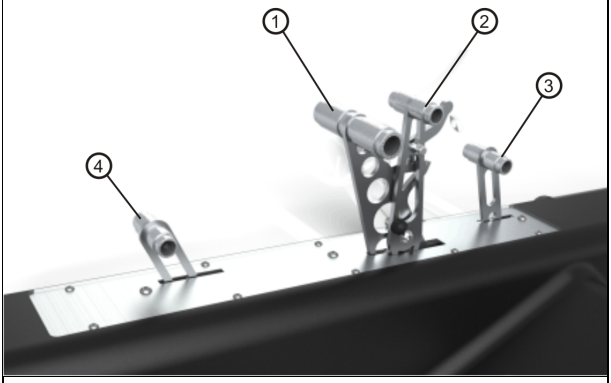
The throttle and brake panel with choke and cabin heat / cabin temp control is located on the left side of the pilot station in the centre panel.

Throttle control (1) is conventional with IDLE in aft (or pulled) and full throttle in most forward position. With the ROTAX 914F engine the boost range is entered by overcoming a small resistance to the front. The throttle lever is linked with cable controls to the carburettors. A mechanical spring applies tension to the control cables and brings the carburettors to full throttle in case of a cable break. The throttle lever has a pre-set friction brake which holds the throttle in the selected position.

Choke (3) is used start a cold engine. In order to do so, pull the choke lever fully to the rear or ON position and be sure to have the throttle in idle position. After starting the engine and a short warm-up, the choke can be slowly disengaged by moving the lever into its forward or OFF position.

The hydraulic wheel brake is actuated by pulling the brake lever (2). A locking pawl mechanism allows setting for use as parking brake. In order to release the parking brake pull the brake lever a little further to let the spring-loaded locking pawl disengage, and then release wheel brake.

Throttle and brake panel



1 – Throttle lever
2 – Brake lever with locking pawl
3 – Choke control
4 – Cabin heating / Cabin temp (if installed)

Do not try to disengage the locking pawl by pressing the small release lever without pulling the brake lever at the same time. Releasing the pawl using the small release lever only will lead to premature deterioration of the teeth. If the teeth are worn the function of the parking brake will be compromised!

The quadrant also features the control for cabin heating / air conditioning system (4). All controls are labelled correspondingly by en-graved text and symbols on the cover plate.

7.11 Electrical System

The 12V DC electrical system consists of an engine-internal electrical generator, a battery, master switch, indicators, switches, electrical consumers, and cabling. With the ROTAX 914F engine an electrical power supply is vital for continued engine operation as this engine variant solely relies on electrically driven fuel pumps.

An additional, externally mounted 40A generator (Gen2) is fitted to Cavalon Pro gyroplanes equipped for Night-VFR operation or those gyroplanes with accessory systems requiring additional electrical power. This is an approved Rotax part.

Turning the master switch to the ON position closes the battery contact and energizes the gyroplane's electrical system. The red LOW VOLT warning light may illuminate is system voltage is below 12v. This is normal, and will go out when the engine is running. A steady indication in flight warns the pilot that the voltage of the system has dropped below a safe value. In this case a safety circuit (load shedding relay) will automatically disable navigation,

anticollision and strobe lights, and the 12V power receptacle. Landing lights are NOT turned off.

Orange GEN and Gen2 warning lights are installed to indicate that the battery is not being charged by that generator.

Turning the keyswitch on (if fitted with a 914UL engine) will also energise the regulator relay, and provide electrical energy from the battery to the primary electrical fuel pump. This relay is to protect the engine fuel supply in the event of a cabin primary fuse failure, or a battery short circuit, enabling engine fuel supply to continue in those circumstances.

Seat heating note. The optional seat heat is actuated by depressing the rocker switch between the seats to either (I) or (II) heat setting (with the switch centred for OFF). The heater element is self regulating to that setting. The seat heating requires considerable energy, and is recommended to be left OFF (or at least reduced to heat setting (I)), once the cabin heater and cabin is up to temperature (around 5 minutes).

Note that the seat heating elements will only work when the LOW VOLT warning LED is OFF, being automatically disconnected when the voltage falls below the LOW VOLT relay threshold.

Warning! High electrical load in flight with low engine rpm may reduce the ability of the charging circuit to replenish the battery, thereby reducing the battery reserve in the event of a charging circuit failure. Illumination of the LOW VOLT warning lamp lights demonstrates that the electrical system voltage has dropped below 12v, and, provided the charging circuit is working, that the electrical demand has exceeded supply. If lit, or intermittently lit, either reduce the electrical load or increase generator circuit output by increasing the engine rpm, as safe or appropriate to do, such that the lamp remains off.'

The power consumption of individual equipment is listed in the following table:

Equipment / System	**Power load**
Internal generator (Gen)	*(-) 240 W*
External generator (Gen2)	*(-) 600W*
Electrical fuel pump P1	21 W
Electrical fuel pump P2	21 W
Pneumatic compressor	124 W (peak) / 103 W
Engine cooling fan	194 W (peak) / 97 W
Cabin heat blower fan	32 W
Heated seats	148W (peak)
Nav/Strobe lights (LED)	102 W (peak) / 34 W
Anti-collison lights	100W (peak) / 20W
Nose (taxi/landing) lights (LED)	10 W
Underbody landing light	113 W
Pitot tube heater	19W
Radio ATR833	7 W (rcv) / 35 W (xmt)
ATC Transponder TRT800H	max. 10 W
Aspen EFD1000 PFD (has an independent 30min battery reserve)	65 W
iPad (used as GPS)	35 W
Instrument lighting	25 W
Cabin light	1.5 W
Clock	1.4 W

12V Accessory socket	Max 67 W
Pneumatics box heater pads (automatically on if box temperature below -10degC)	max 20 W

7.12 Lighting System

All Cavalon Pro aircraft are approved for Day-VFR operation. Those equipped with the necessary additional equipment are approved for Day-VFR and Night-VFR. Refer to SECTION 2.11 of this manual).

7.13 Instrument Panel

Different instrument panel layouts are available, allowing additional equipment to be fitted around the basic (minimum) configurations. The basic instrumentation arrangements are:

- Standard Layout
- Night-VFR Layout

For both layouts provision is made for mounting an iPad or iPad mini for use as a moving map device. For detailed user information and instructions concerning the different moving map systems available for use on the Ipad, please refer to the manufacturer's documentation.

The Ipad is only permitted as an unapproved GPS or as an Electronic Flight Bag (EFB). An EFB means that the Ipad may be loaded with the aircraft manuals and associated documentation. Use of information displayed as an alternative to VFR flight is NOT approved. The pilot is recommended to review the CAA's GA Safety Sense leaflet 25 ¨Use of GPS¨ (downloadable from www.caa.co.uk/safetysense).
It is the operators responsibility to ensure any information and software stored in the Ipad is up to date. The Ipad itself is not supplied by RotorSport, and has not been approved to any airworthiness standard.

NOTE

Any moving map system shall be used for reference only and does not replace proper flight planning and constant oversight and awareness.

Depending on the chosen instrumentation and optional equipment, the depicted panels on the following pages may vary. Note that the standard compass is mounted to the glare shield.

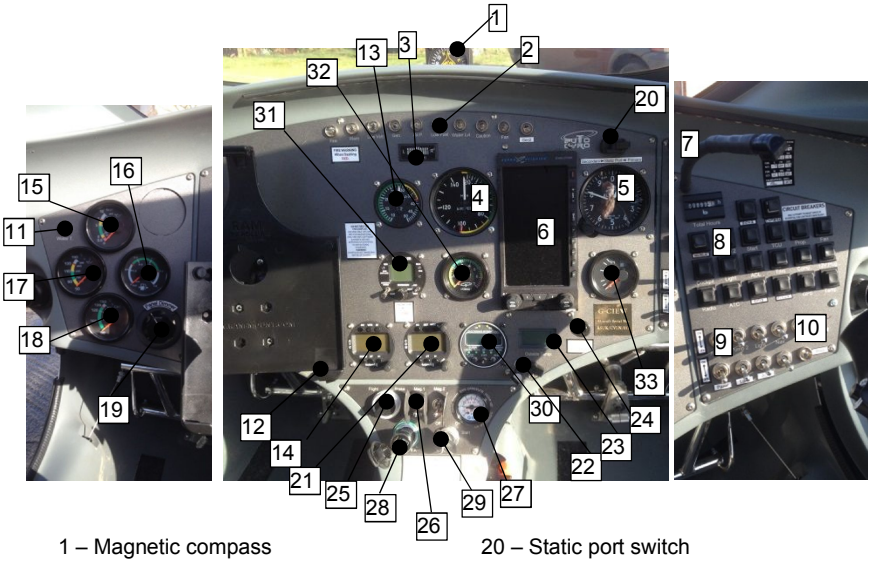
Some hand held GPS units and antennas emit magnetic fields that vary with respect to time and/or levels of battery charge. These may change your compass deviations, so always cross check between the compass headings with your GPS installed and placard accordingly if required

Panel Layout – Standard Day VFR and Ipad

1 – Hour meter
2 – Circuit Breaker Panel
3 – Air outlet
4 – Switches (2nd fuel pump, lights, optns.)
5 – Pre-rotator overdrive/override
6 – OAT indicator
7 – Radio (if installed)
8 – Clock
9 – Trim/brake pressure gauge
10 – Master/starter switch
11 – MAG switches
12 – 12V power receptacle (if installed)
13 – Pneumatic mode selector
14 – ATC transponder (if installed)
15 – RBT indicator
16 – Cooling fan manual activation
17 – Fuel level indicator
18 – CHT/coolant temp & fuel pressure
19 – Oil pressure
20 – Oil temperature
21 – Engine RPM
22 – Rotor RPM
23 – Lateral trim indicator
24 – Warning and Caution Panel
25 – Manifold pressure gauge (if inst.)
26 – Air speed indicator
27 – Attitude Indicator or VSI (if installed)
28 – Altimeter
29 – Water temp (if fitted).
30 – Not assigned
31 – Not assigned
32 – Ipad (if fitted)

For UK operations, a 2/1/4 " vsi may be fitted to position 8, or full size in position 27.

Panel Layout – Day and Night VFR



1 – Magnetic compass
2 – Warning lights
3 – Lateral trim indicator
4 – Air speed indicator
5 – Altimeter
6 – Aspen PFD
7 – Hour meter
8 – Circuit Breaker Panel
9 – Switches (avionic and 2nd fuel pump)
10 – Switches (options)
11 – Water temperature indication
12 – Cooling fan manual activation
13 – Manifold press gauge
14 – ATC transponder (if installed)
15 – Oil pressure gauge
16 – Fuel pressure gauge
17 – Oil temp gauge
18 – CHT or coolant temp gauge
19 – Panel light dimmer
20 – Static port switch
21 – Radio (if installed)
22 – Audio in (if installed)
23 – OAT indicator
24 – Overdrive/rotor brake interlock releas
25 – Pneumatic mode selector
26 – MAG switches
27 – Trim/brake pressure gauge
28 – 12V power receptacle
29 – Master/starter switch
30 – Clock
31 – Propeller controller.
32 – Rotor rpm gauge
33 – Fuel level gauge

7.14 Instrument panel lighting.

The instruments are lit as follows;

- 'ROAD' gauges (CHT/coolant, oil pressure, oil temp, fuel pressure, rotor rpm and fuel level) are lit from within.
- The altimeter and ASI are lit with 'nulite' units fitted between the gauge and the instrument panel.
- Two short pedestal lights illuminate the lower centre panel.
- One flexible stalk mounted pedestal light illuminates the right CB and switch panel.
- The clock is self illuminated, with auto-dimming of leds.
- The propeller controller is self illuminated, with auto-dimming of leds.
- The radio and compass are self lit, with no dimming function.
- The card compass is lit from the units top mounted bulb.
- Most indicator leds self-dim when the panel lights are switched on.
- A row of side-light emitting diodes illuminates the centre panel.
- The dimmer rheostat is mounted on the left panel.

Note! The Aspen EFD1000 PFD (Primary Flight Display) is a certified device with EASA approval IM.210.1D094555 rev A (and also carries FAA and ETSO approvals). It may only be installed and maintained in line with the Aspen manual 900-00014-001. Refer to this manual for all aspects of use.

The RSM (Remote Sensing Module) for the PFD is located underneath the aircraft body.

7.15 Intercom

The standard intercom system features standard headset sockets (TSR Tip Ring Sleeve) with additional XLR-3 socket for active headset power supply. Sockets are provided at the aft console between the crew seats. The intercom amplifier and VOX control is integrated in the respective radio.

An audio in socket is provided in the instrument panel right beside the radio. Audio sources can be connected to the intercom system using a standard 3.5 mm audio jack.

See manufacturer's manual for additional information.

7.16 Pitot Static

Dynamic pressure is picked up by a pitot tube located in the nose section of the fuselage. The tube is connected to the integrated cockpit instruments by a plastic line. The static pressure is measured across two ports, one on either side of the fuselage. An alternate static port is provided by an open vent behind the instrument panel and selection of primary/alternate static source made by a toggle switch on the instrument panel.

Aircraft equipped for Night-VFR have a heated pitot-tube.

7.17 Indicators and Sensors

Rotor speed is measured by a magnetic pick-up, located directly at the geared ring of the rotor head. Rotor bearing temperature is measured by a temperature sensor which is glued into the rotor bearing sleeve.

Other indicators and sensors have been described in the respective paragraphs. For engine related indicators and sensors see the engine manufacturer's manual.

7.18 Seats and Seatbelts

The seats consist of seating surface as an integral part of the monocoque structure and adjustable backrest, upholstered with removable cushions. The cushions consist of a foam core covered with an easily cleanable, water-repellent fabric (or leather).

The backrest hinges are positioned by 2 countersunk Allen bolts on two seating rails. To suit to different leg lengths the backrest hinges can be adjusted by removing the Allen bolts and refitting in a different position on the rails. In addition the backrest angle can be adjusted by modifying the lengths of the telescopic tubes.

An adjustable four point harness is provided for each seat. Make sure that the seat belt is buckled and tight when flying with the left hand seat unoccupied.

7.19 Stowage Capacity

A storage area is located behind each seat with a maximum capacity of 10 kg each.

7.20 Fire-warning system

The Cavalon Pro gyroplane is equipped with a Fire indicator light to alert the pilot that a certain temperature in the rear equipment compartment or the engine compartment has been exceeded, possibly as a result of a fire. The fire indication circuit is based on a special cable routed inside the two compartments. The cable has two integrated wires separated by an insulation layer. At a defined temperature the insulation layer will melt and the embedded wires close contact.

A possible fire (circuit closed with low resistance) will be indicated by a flashing/blinking Fire indicator light in the Warning and Caution Panel. During normal operation (circuit closed with 'normal' resistance) the Fire indicator light will be off. A malfunction of the system (circuit open or shorted to ground) is indicated by a constantly lit Fire indication. At every power-on event the system will perform a lamp test consisting of a series of three flashes.

Indicator Light	System Status
OFF	Normal Operation (normal resistance)
FLASHING	Fire, abnormal temperature (circuit closed)
ON	System Malfunction (circuit open or shorted to ground)

In the event of a fire indication being shown proceed according to emergency procedure "Smoke and Fire" provided in SECTION 3

7.21 Fire Extinguisher System

The fire-extinguisher system is an independent system without electrical control. It is based on a portable Halon-filled extinguisher mounted in such a way that it can propel extinguishing agent through pipes into the equipment compartment and engine bay, or by means of a quick-release clip can be lifted free and used as a hand-held extinguisher.

Use of the Fire extinguisher system is described in Section 3.6 Smoke and Fire.

Instructions are shown on the placards adjacent to and on the fire extinguisher canister.

7.22 Electrical circuit protection

Fuse description	Rating	Protects	Fuse type	Location
Main incoming supply to cockpit	40A	Main positive supply is fed to the starter solenoid from the battery. The supply continues then through the 40amp fuse to the cabin.	Bolt in strip type, MTA S.p.A. “Midival” range 40A rating	Engine bay fuse box, left side within inner firewall
Compressor	10A	Only supplies the pneumatic compressor	CB	Inst. Panel
Regulator relay (Gen1)	2A	Regulator Relay circuit	CB	Inst. Panel
Gen2	2A	Aux generator	CB	Inst. Panel
Primary fuel pump	5A	Fuel pump P1	Blade fuse	Near fuel pump in pump harness
Secondary fuel pump	5A	Fuel pump P2	CB	Inst. Panel
914UL TCU	2A	Engine control unit	CB	Inst. Panel
Cockpit	5A	All electrical gauges (rotor and engine rpm, oil pressure, water and oil temps, fuel gauge) and warning lamps	CB	Inst. panel
Radio	5A	Radio (transceiver)	CB	Inst. panel
ATC	5A	Transponder	CB	Inst. panel
EFIS	10A	Aspen PFD or other display	CB	Inst. panel
GPS	5A	GPS or iPad with navigation software	CB	Inst. panel
Aux	TBA	Auxiliary supply	CB	Inst. panel
Pitot	2A	Pitot heat	CB	Inst. panel
Flarm (where fitted	2A	Flarm anti-collision system	CB	Inst. panel
Lights	16A	Landing lights	CB	Inst. panel

ACL	5A	Nav and Strobe lights	CB	Inst. panel
Start	5A	Starter relay and SMD module	CB	Inst. panel
Prop	16A	Main supply constant speed controller.	CB	Inst. panel
Fan	10A	Power supply to engine cooling fan	CB	Inst. panel
Trim	2A	Supplies power to the stick controls for operating the pneumatic solenoid valves and the compressor relay	CB	Inst. panel
12v plug	5A	Accessory socket	CB	Inst.panel
Temp	16A	Electric seat heating	CB	Inst panel
Rotax regulator	25A	Charging circuit from regulator to battery/aircraft supply	MTA S.p.A. “Midival” range 25A rating	Engine bay fuse box, left side within inner firewall
Starter	100A	Primary supply from battery to starter-solenoid /starter and from starter solenoid to main fuse	MTA S.p.A. “Midival” range 100A rating	Engine bay fuse box, left side within inner firewall
External battery charge point (where fitted)	15A	Protects cable from short circuit when fitting or removing the cowls	Cartridge fuse	Line-fuse near battery
Heater	5A	Cabin heating fan located in nose of aircraft	Cartridge fuse	Line-fuse in centre-console powered from “Heat” CB

Note that the external charging point permits charging via a Ctek charger

CAUTION

Do not reset CB’s in flight unless essential for continued safe flight

7.23 Avionics

Radio.
Option fit is the Funkwerk ATR833 radio for both external and internal communications. The wiring harness terminates in a standard jack plug type connection at each seat, and the antenna may be mounted inside the nose, or underneath the enclosure. Ensure the headsets chosen function correctly before flight, and refer to the radio's User Manual.
The radio EASA approval number is EASA.21O.0193
Transponder.
Option fit is a Funkwerk TRT800H Mode S transponder. The antenna protrudes under the body. Read the User Manual for operational instructions, and take care that the Mode S hexadecimal code and aircraft recognition data is correct!
The Funkwerk TRT 800H carries an EASA approval, approval no. EASA.210.269

Remark; A Radio Operators licence is required to allow use of the radio, and a Radio Installation licence is required for the radio and transponder (one combined licence, renewed annually).

CONTENTS

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SECTION 8 - HANDLING AND SERVICING

This chapter contains guidelines for correct handling and servicing of the gyroplane, as well as manufacturer recommendations helping to keep its performance, reliability and value.

8.1 Maintenance Obligations

It is the owner and pilots responsibility to ensure the aircraft is properly maintained in accordance with the Maintenance Manual, document no. RSUK0335. Failure to do so may invalidate the aircraft Certificate of Validity. Maintenance and inspection tasks must be performed by CAA authorised persons or organisations. Repair processes such as welding or composite layup, or others not documented in the maintenance manual, require prior repair process approval from RSUK/CAA. All airworthiness limitations, inspections and time limits are described in detail in the maintenance manual. However, for owner/operator's information the intervals for mandatory maintenance events are provided as follows:

- 25 hrs: "25 hrs inspection" (one-time / non-recurrent)
- 100 hrs / 12 months (whatever occurs first): "100 hrs inspection"
- 1500 hrs / 5 yrs: "Supplemental inspection"

For engine maintenance and overhaul, refer to the engine manufacturer's manual (Rotax Aircraft Engines, BRP-Powertrain GmbH & Co KG, Austria).

For the propeller maintenance and overhaul refer to the propeller manufacturers manual (Woodcomp Propellers s.r.o., Czech Republic)

Special inspections have to be performed by an authorized and qualified maintenance centre or the manufacturer after operational incidents, which are

- Suspected hard landing
- Rotor contact with obstacle
- Propeller contact with obstacle or external impact
- Bird strike
- Lightning strike

If any of the above cases apply, mark the aircraft as 'unserviceable' and consult the manufacturer or an authorized maintenance and repair station before further operation.

Apart from these obligatory inspections and maintenance tasks, the owner/operator is entitled to perform the preventive and in-between maintenance tasks and checks, as well as exchange of parts and minor repairs, as detailed in UK CAA document CAP393 Section 3 Part 4.

CAUTION

This is a certified aircraft. Maintenance must be approved by an appropriately Licenced Engineer by recording a Certificate of Release to service statement in the aircraft logbooks, as per CAP553 section A6-1 para 11.6.

8.2 General

Whenever possible, park the gyroplane in a place where it is protected from direct sunlight, wind and humidity. High humidity, especially in combination with a salt-laden atmosphere will lead to corrosion and/or composite structure paint blisters. The sunlight's ultra-violet radiation and the heat impact on the GRP/CRP components may lead to a degradation of the materials integrity. The manufacturer will take no responsibility for damage or impaired safety margin due to improper treatment.

8.3 Ground Handling

Experience shows that aircraft may be exposed to much higher loads when operated on ground, than when in flight. Take care not to impose high loads caused by excessive and fast taxying on rough terrain, or hard bouncing of the aircraft over the hangar thresholds etc.

Use caution when handling the gyroplane on ground. Do not push at the rudder or at the outer stabilizers. Avoid excessive bending of the rotor blades as repeated bending ultimately leads to fatigue or damage.

8.4 Cleaning

Care and regular cleaning of engine, propeller, rotor system and fuselage is the basic foundation for airworthiness and reliability. Therefore, the gyroplane should be cleaned after every last flight of the day or more often, if environmental conditions dictate.

In order to protect the gyroplane against dirt, dust, bird soil, and sunlight, the aircraft should be covered with a light plastic tarpaulin or cloth – Covers designed for the aircraft are available from RotorSport UK Ltd. Openings to the engine, service access port and pitot and static ports should be closed after the flight to restrict access by insects, birds etc.

Contamination can be cleaned with clean water, possibly with mild cleaning additives. To clean the rotor it is best to soak contamination with a cloth or towel, wipe with soft or micro-fibre cloth, and rinse thoroughly with water.

A clean canopy aids safe flying. Clean with fresh water for removal of grit etc, without rubbing the grit into the canopy surface. Then use proper plexiglass cleaning sprays such as Plexus with soft lint free cloths to polish and finish the surface inside and out. Read and follow the product instructions.

A good quality polish helps protect the surface finish and reduce surface friction.

Use of RainX or other proprietary rain repellent compound will help rain drops wash away when flying in rain. Read the instructions, and ensure the compound is suitable for use on Plexiglass. It is recommended to check that it does not affect the canopy by applying to a small rearwards area first and checking for any negative reaction.

CAUTION

Do not use gasoline or solvents as cleaning agents for the windshields, as it will destroy them irreparably. Do not let windshields sun-dry after washing as they will stain permanently.

8.5 Refuelling

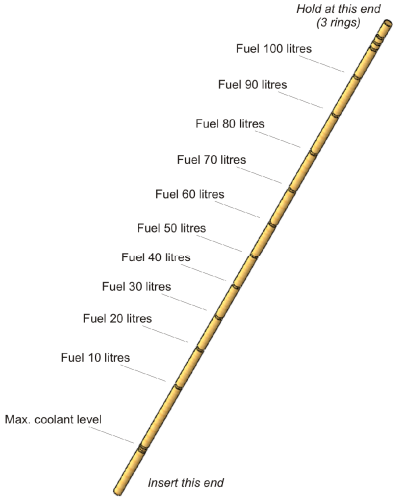
Have aircraft electrically grounded before refuelling by attaching the earth (ground) lead to the engine exhaust pipe. Be aware that most airfield refuelling equipment is laid out for larger diameter tank filler necks and high flow rates. To avoid contamination, use a funnel with strainer and/or filter when refuelling from canisters. In order to top-off both tanks allow flow levels to balance-out.

NOTE

Do not fill to the absolute maximum in order to allow for thermal expansion of the fuel

Fuel level is checked using the dip stick which has to be inserted diagonally from the fuel filler port. Note that the upper end of the stick shows 3 narrow rings as markings. Remove dip stick from tank and read level. Markings are available per 10 litres. Wipe and return dip stick to its holder.

Fuel and Engine Coolant Dip Stick



8.6 Checking of Engine Oil Level

Before attempting to check the engine oil level double check that both magnetos are switched off. The oil level is measured with the aircraft in a level attitude and should be between the marks on the dipstick.

Open oil tank access cover, remove oil reservoir cap and dipstick. Turn the engine by the propeller in the correct sense of rotation until you clearly hear the oil gurgle in the tank. The oil is returned to the oil tank by crankcase pressure, so rotate slowly over when the force to turn the prop is at its highest to return the oil fastest.

Insert cleaned dipstick for measurement. Fill up oil according to the engine manufacturer's specification when required. After completion make sure the dipstick is in place and the reservoir cap is back on securely. Install access cover.

CAUTION

Never attempt to turn the engine against its sense of rotation as this may lead to starter damage.

8.7 Checking of Engine Coolant Level

Between flights, the engine coolant level is checked by verifying the level in the overflow bottle. Insert Fuel and Engine Coolant Dipstick. Coolant level must be visible. Replenish as necessary. The maximum coolant level is marked by 2 narrow rings on the Dipstick.

Before the first flight of the day check coolant level in expansion tank and replenish to maximum. For additional details concerning this pre-flight check and a description of the more comprehensive daily check procedure, refer to the engine manufacturer's manual.

8.8 Tyres and Tyre Pressure

Main wheels .....1.8 – 2.2 bar
(if operating at 560kg take-off weight increase to 2.3 bar)
Nose wheel .....2.0 – 2.4 bar
(2.2 -2.3bar if operating at 560Kg take off weight)
Tyres fitted with green valve caps have been filled with nitrogen.

The mainwheels use Sava 4.00-8C B13 71J 6PR TT tyres and nose wheel tyre is a Tost Aero 400-8. If flying in the winter with a frozen-over or snow covered runway, it is advisable to remove the wheel spats in order to avoid their damage and snow build up inside them. It is the pilot's responsibility to ensure that in the rear part of the spat no snow has built up, which could lead to freezing against the wheels and stopping them from turning. Always use loctite 243 on wheel spat centre screws.

Note that operation of the aircraft on very slippery surfaces requires great care – the aircraft may slide sideways during pre-rotation, take off, or in ordinary ground handling, resulting in high potential for an accident. Use care!

8.9 Lubrication and Greasing

Between maintenance intervals the owner/operator is entitled to do the following lubrication and greasing:

Component	Interval	Application	Type
Teeter hinge	5 hrs (recomm.)	as required	AutoGyro S.VB6007 (WHS2002), or Castrol LM or equivalent
Pre-rotator drive coupling sleeves	as required	as required	AutoGyro S.VB6006 (HHS2000)

CAUTION

Any signs of wear on the teeter tower due to movement of the teeter bolt head indicate a beginning of seizure of the teeter hinge. In most cases the phenomenon is caused by insufficient greasing.

CAUTION

While lubricating teeter hinge (especially with new bush bearings and related close gap dimensions) it may be possible that only very small amounts of lubricant pass through the grease nipples on the rotor. In this case, do not press too hard but better remove the bolt, lubricate the outside and re-install. Use a new split pin!

8.10 Replenishing of Fluids

8.10.1 Engine oil

See engine manufacturer's manual.

8.10.2 Engine coolant

See engine manufacturer's manual and the aircraft maintenance manual.

8.11 Engine Air Filter

The air intake filters need to be replaced or cleaned according to the manufacturer's recommendation. Depending on environmental conditions, such as dust, sand, or pollution the recommended rate of maintenance should be increased as required. Engine cowling must be removed!

8.12 Propeller

Clean regularly as contamination will noticeably decrease its efficiency, resulting in a negative effect on both aircraft performance and noise emission. Use either pure water or add mild cleaning additives. Let contamination soak, then remove with a soft cloth or micro fibre material and rinse thoroughly with water. Check for erosion and damage, especially at the leading edge and blade tips. Check tight fit at the propeller blade root or any unusual sound when tapping the blades, in case of a variable pitch propeller. If in doubt or if damage is obvious, consult RotorSport UK or your aircraft engineer. Minor chips may be repaired. Consult the AMM or propeller MM for detail.

8.13 Battery

The aircraft is fitted with a EP-13 maintenance-free gel electrolyte battery. Maintenance is therefore limited to outside soundness, correct attachment, and cleaning. Check integrity of the battery as leaking fluid contains corrosive sulphuric acid which would lead to extensive damage when contacting the framework and attachments.

Charge the battery only with a charging device which is suitable for gel electrolyte batteries.

CAUTION

The battery must never be deep discharged, as it will be damaged. If so, it might need to be replaced.

8.14 Winter Operation

The cooling system for the cylinder heads of the engine is filled with a mixture of anti-freeze and water, which gives freezing down to -20 °C. Using a hydrometer, check protection temperature of the coolant and add anti-freeze, if necessary.

If temperatures are expected to fall below protection temperature, drain the coolant, and if required for service, refill with pure antifreeze. As anti-freeze ages, renew the coolant every two years. Read the engine manual for the manufacturer's recommendations.

CAUTION

Pure antifreeze is not as good an engine coolant as a 50/50 mix with water. Take care that engine coolant limits are not exceeded. As soon as ambient temperatures permit, drain and refill with the normal coolant mix.

During winter operations the necessary operating temperature for oil and cooling agent may not be reached. This can be compensated by taping some portion of the coolers. Monitor all engine temperatures closely after having the coolers taped and modify, if necessary.

Before each flight inspect all control cables for free and easy movement and sufficient lubrication.

8.15 Removal, Disassembly, Assembly and Installation of the Rotor

In order to transport or park the gyroplane with minimum space requirements, the rotor system can be removed and disassembled, if needed. In order to do so, a second person is needed to assist and help to prevent any damage to the gyroplane or the rotor system.

WARNING

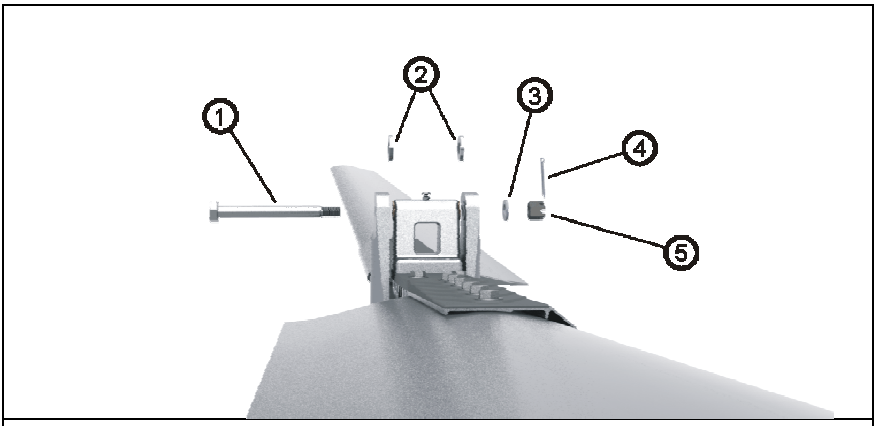
The rotor system must be removed and disassembled for road transport. When handled incorrectly the rotor system can be damaged irreparably. If undetected this may have catastrophic consequences.

CAUTION

When removing or disassembling make sure to mark all parts so that each and every component of the rotor system is reassembled and installed in exactly the same way and orientation. Some rotor blades have loose washers in them which are required as balance weights. Do not remove or restrain if present!

8.15.1 Removal of the Rotor System

1. Secure the gyroplane on level ground by engaging parking brake, adjust the rotor head or teeter tower corresponding to 30deg from fore-aft and pressurize the rotor brake up to maximum. Secure a step ladder to the right side of the aircraft.
2. Remove and discard split pin and unscrew the castellated nut (5). The rotor system has to be tilted onto the black rotor teeter stop.
3. The teeter bolt (1) has to be extracted by using only the hand, not a hammer. If needed tilt the rotor blades carefully onto the teeter stop, in order to prevent the bolt from jamming. Make sure that the rotor stays level in the teeter axis, if not the teeter bolt will damage the Teflon coated bushes, while being pushed out.
4. A supervised second person is required to support the rotor blade at one end.
5. Lift the rotor system carefully out of the teeter tower and be aware of the position of the shim washers (2). Their thicknesses may differ and it is essential that they are reinstalled on the correct side! They are marked with dots to identify the correct side.
6. Remove the rotor system to one side by letting it rest on your shoulder and take care not to collide with stabilizer or propeller.
7. The shim washers and the teeter block in the hub are marked on each side with one or two engraved dots. Directly after the disassembly the shim washers need to be fixed on their respective side with cable ties.
8. The rotor system must not be placed on a dirty or grainy surface, as the blades can scratch and damage easily. The best way is to place the rotor blades centrally onto two stands, supporting the rotor at approximately 2 m distance from the hub.



1 – Teeter bolt	4 – Split pin
2 – Shim washers (2 ea.)	5 – Castellated nut
3 – Outer washer	

Handling of the Rotor System

Do not lift or support the rotor system at its blade tips as the bending moment caused by the weight of the hub assembly may overstress the blade roots. If possible, handle with two persons while holding approximately in the middle of each blade. When supporting the system use two stands each positioned in about 2 metres distance from the hub.

CAUTION

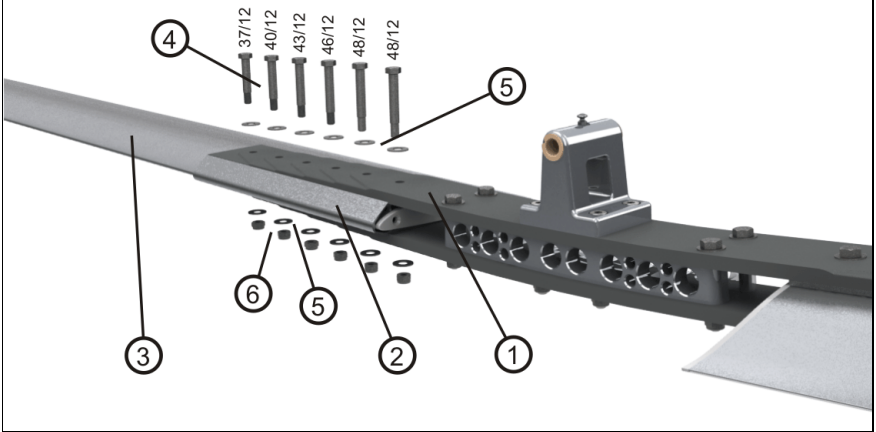
Cavalon is approved with RotorSystem II ROA or TOPP. The RAO rotor has a reduced blade angle of attack, as is easily notable by using black blade to hub clamping profiles, and red end caps. The TOPP rotor has clear anodised (silver) spacers and blue end caps.

CAUTION

The assembled rotor system can be damaged irreparably if handled incorrectly. If the rotor system is lifted in a wrong way, its own weight may overstrain the material.

8.15.2 Disassembly of the Rotor System

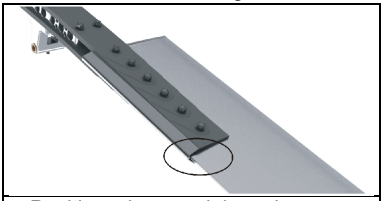
1. To disassemble the rotor system, place it upside down onto a clean surface or stands to support the rotor at approximately 2 m from the hub.
2. Loosen locknuts (6) on the first blade by counter holding the corresponding bolt head to prevent it from turning inside the blade holes.
3. Push out all fitting bolts (4) without any force, but use no more than a gentle tapping if necessary. Tilt the rotor blade up and down to support easy removal of the bolt. Note that fitting bolts have different shaft lengths.
4. Carefully pull the rotor blade out of the hub (1) in radial direction and take off the clamping profile (2).
5. Repeat step 2 to 4 on second rotor blade.
6. **Do not disassemble the rotor hub!**
7. Store and transport rotor blades, clamping profile and rotor hub only in air cushion foil or using other suitable means to prevent bending or surface damage.



1 – Rotor hub	4 – Fitting bolts (as depicted)
2 – Clamping profile	5 – Washer (12 ea.)
3 – Rotor blade	6 – Lock nuts (6 ea.)

8.15.3 Assembly of the Rotor System

1. The rotor blades, clamping profile and rotor hub are labelled with an engraved serial number.
2. Insert the first rotor blade carefully into the clamping profile. Make sure that all serial numbers match.
3. Fit the rotor hub side with the according serial number to clamping profile and blade. Insert fitting bolts without using force so that the bolt end is on top when the rotor system is installed. For re-identification and correct installation position the shaft length is provided in the figure above. Example: 40/12 means shaft length 40mm.
4. Position the washers and the locknut and hand-tighten all nuts.
5. Torque-tighten nuts with 25 Nm from the inside to the outside, using a torque wrench. When doing so, counter-hold bolts to prevent any damage the hub and blade holes.
6. Repeat steps 2 to 5 for the second rotor blade.



Position where serial numbers are engraved (bottom side)

8.15.4 Installation of the Rotor System

CAUTION

During installation make sure to have each and every part of the rotor system installed in exactly the same way and orientation as it was before.

Secure the gyroplane on level ground by engaging parking brake, adjust the rotor head or teeter tower corresponding to 30deg from fore-aft and pressurize the rotor brake up to maximum. Secure a step ladder to the right side of the aircraft.

7. Check correct matching of parts: The rotor hub and the teeter tower are marked with two dots according to the orientation for installation.
8. Lift the rotor blade with a second briefed person (standing either side of the aircraft).
9. Approach with the rotor system from the side to the gyroplane and make sure not to collide with propeller or stabilizer The person fitting the rotor to the aircraft has the hub bar on his shoulder, and climbs the ladder with the rotor across the aircraft. The rotor is then lifted over the teeter tower and lowered into place.
10. The second person can let go, as soon as it is resting centrally in the teeter tower on the teeter stops.
11. Insert teeter bolt by hand in the same orientation as it was before (bolt head should be at that side of the teeter block which is marked with one dot) while matching the shim washers with the corresponding installation positions.
12. Check direction of assembly and shim washers: rotor hub, teeter tower and shim washers are marked on each side either with one or two engraved dots.
13. If the teeter bolt cannot be inserted, tilt the rotor blade along the teeter axis with the free hand.

14. Install washer and castellated nut. Hand-tighten only, 1-2Nm, and secure with a new split pin. Use split pins only once. Make sure that the teeter bolt can be turned easily by hand.
15. Check that the rotor teeters freely to the teeter stops, and grease the hub block grease nipple. Turn the rotor fore/aft and fit tie down bag to secure the rotor.

8.16 Road Transport

If road transport cannot be avoided, transport with minimum fuel, which reduces airframe loads and prevents fuel spilling through vents.

Switch ELT (if installed) off for road transport to avoid false alarms!

Tie-down the fuselage using the following procedure:

- Restrain main wheels (blocks/chocks)
- Put a wooden block below the lowest point of the keel tube and lash keel tube against wooden block. The block should be dimensioned so that the main wheels are half way unloaded
- Lash down both main wheels through the lashing lugs (use rims/axles alternatively)
- Lash down nose wheel through the axle
- For container transport or shipping, use the mast tie-down kit (option)

Furthermore, it is recommended to protect the gyroplane against external exposure. Especially the rotor blades need to be packed carefully, as even the smallest damages may force the replacement of the complete system.

WARNING

The rotor system must be removed and disassembled for road transport. When handled incorrectly the rotor system can be damaged irreparably. If undetected this may have catastrophic consequences.

CAUTION

When wrapping make sure that the bubble or stretch wrap does not cover the painted surface directly. Put a soft layer in between for damage protection and let plastic components breathe. Do not expose wrapped gyroplane or parts to sun radiation or heat in order to avoid paint damage.

8.17 Repairs

IMPORTANT NOTE

Repairs may only be executed by properly licenced aircraft engineers, and in strict compliance with maintenance and repair instructions.

SECTION 9 - SUPPLEMENTARY INFORMATION & SYSTEMS

LIST OF SUPPLEMENTARY INFORMATION

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9.1 Variable Pitch Propeller – Woodcomp KW-31

9.1.1 General

A variable pitch propeller (VPP) manufactured by Woodcomp Propellers s.r.o. of the Czech Republic, is fitted to optimise propeller efficiency, fuel consumption and noise in all flight regimes and power settings. This is achieved by changing the propeller pitch in flight.

The propeller is the KW-31, set up for RotorSport gyroplanes This means that there are internal design features that make the product unique, and it must not be replaced by a propeller other than the part supplied by RotorSport UK Ltd.

The propeller is electrically actuated via slip rings on the engine interface.
WARNING! Cleanliness of this face is important, DO NOT apply corrosion preventative substance to the slip rings! It will prevent them from functioning!

9.1.2 Propeller Function

In this propeller the pitch change is obtained by rotating each blade in bearings at its root. An electrical gear-motor mounted in the propeller hub drives a central boss which rotates the blades simultaneously by means of three trunnion / pin mechanisms.
The propeller has two internal pitch limit stops, electrically and mechanically limiting the pitch angle at the pre-determined FINE and COARSE limits.
These pre-determined limits ensure that the aircraft will still climb at a minimum rate of 250fpm in the full-COARSE setting, and will not over-rev the engine in the climb in the full-FINE setting. **However, it is the pilots responsibility to monitor engine rpm in the cruise and descent to ensure the engine speed is kept within operational limits!**
Note that the propeller requires up to 8 secs to transit from full fine to full coarse pitch.

9.1.3 Propeller Control

Woodcomp provide an electrical constant speed controller (aka propeller governor) for use with the KW-31 propeller and this is fitted in the centre instrument panel of the Cavalon Pro:

Day-VFR panel configuration

Night-VFR configuration

Constant speed controller

The controller is energised with the aircraft master switch so that propeller parameters are always available to the pilot.

9.1.4 Limitations

No change introduced by use of the VPP

9.1.5 Emergency Procedures

Proceed according to generic variable pitch propeller procedure provided in SECTION 3.

9.1.6 Operation

This controller has two modes of flight operation, Manual and Automatic (i.e. Constant Speed Control).

- Manual – the pilot controls the propeller pitch as necessary according to the current flight mode. Full-FINE setting (MIN-pitch) is always used for certain flight regimes, but any intermediate setting up to COARSE (MAX-pitch) may be selected at the pilots discretion.
- Automatic (Constant Speed Control) – the instrument compares engine rpm with a preset value and controls the propeller so that the rpm is always within a defined tolerance.

The propeller controller will automatically switch-off power when the propeller reaches either of the limit stops and will indicate this by illuminating the MAX or MIN LED indicators

In addition there is a menu mode in which pre-set parameters can be examined and adjusted. This mode would not normally be selected by the pilot in regular use. Instructions for this part of the unit are given in the Woodcomp users manual.

9.1.6.1 Operating controls and indicators

The switch and indicator reference numbers in the text below are chosen to coincide with those in the Woodcomp KW-31 User Manual UM-05 EN

Green LED1 “min propeller pitch reached” (manual and automatic modes)

Amber indicator LED2“max propeller pitch reached” (manual and automatic modes)

RPM setting knob 9 (rotary and push)

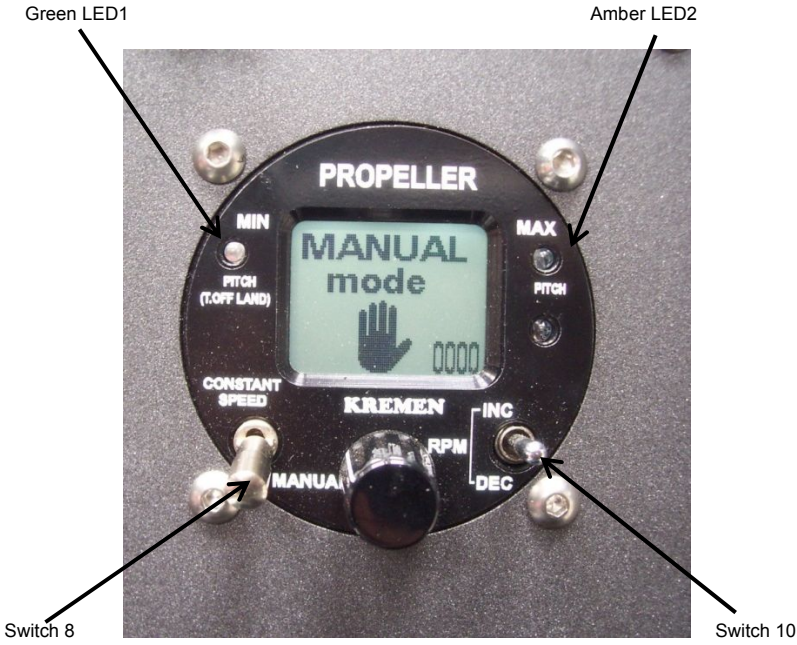
Constant speed/Manual selector switch 8

Propeller control switch 10
In manual mode:
- INC gives rpm increase
- DEC gives rpm decrease

In automatic mode:
- fast switching between take-off and cruise modes

9.1.6.2 LCD Panel Display

In Manual mode



The pilot may switch to Manual mode from Constant Speed mode by pulling the switch 8 out of detent (towards the pilot) and selecting the Manual position.
Use switch 10 to control propeller pitch manually:

RPM-INC - propeller pitch is decreased and rpm increases.
During this pitch change LED1 blinks and then lights when the lower pitch limit is reached
RPM-DEC – propeller pitch is increased and rpm decreases.
During this pitch change LED2 blinks and then lights when the upper pitch limit is reached

In Automatic mode

Switch 8

Switch 10

Rotary/push switch 9

The pilot may switch to Constant Speed mode from Manual mode by pulling the switch 8 out of detent (towards the pilot) and selecting the Constant Speed position.

If switch 8 is in the Constant Speed position you may turn knob 9 to set the required TAKE-OFF rpm.

Preset TAKE-OFF rpm may also be activated by pressing switch 10 to the upper position RPM-INC and holding for 2 seconds (engine rpm is indicated on the display, along with pre-set rpm value for TAKE-OFF)
Alternatively, preset CRUISE rpm may be activated by pressing switch 10 to the lower position RPM-DEC and holding for 2 seconds (engine rpm is indicated on the display, along with display of pre-set rpm value for CRUISE)
Note: Activation of Fast-switching of TAKE-OFF and CRUISE modes is a Menu option. Default for RSUK installations is “activated” and this must not be altered.

During active change of blade pitch, an arrow is displayed; its orientation indicates the direction of blade pitch change; up arrow means decreasing pitch (and increasing engine speed), while down arrow means decreasing pitch (and increasing engine speed).
On reaching end position, LED1 (minimum pitch) or LED2 (maximum pitch) is lit. At the same time, simple arrow (6) on the display changes to an arrow with stop line.

In Menu mode

Switch 8

Rotary/push switch 9

To access the Menu mode (the aircraft must be on-ground with the engine stopped) pull switch 8 from the detent and set to manual mode, the display will show Manual.
Then press switch 9 for two seconds to highlight “Done”. Then move switch 8 to Constant speed mode (Done will stay displayed). After two more seconds the device’s menus may be browsed by use of the rotary knob 9.

When ready to exit the Menu mode, rotate knob 9 anticlockwise until “Done” is displayed. Press knob 9 and the instrument will revert to Constant Speed mode, then to Manual mode if switch 8 is so selected.

Night operation;
The two leds will automatically dim as ambient light fades.
The display may be reversed so that it is darker via the menu.

9.1.7 Placards

There are no placards associated with the constant speed controller, noting that the engine rpm limits are engraved on the instrument panel under the propeller controller (which displays engine rpm).

9.1.8 Manifold Absolute Pressure Indications

The analogue manifold absolute pressure gauge (MAP) has perimeter markings to show normal, warning and limit values in the conventional colours

Manifold Pressure * ROTAX 914 F	Marking	
Maximum manifold pressure	Red Radial	39.9 In Hg
	Yellow Arc	31 - 39.9 Hg
Maximum continuous MAP 35.4 In Hg	Green Arc	0 - 31 In Hg

*Overshooting of the 914 manifold pressure is permissible, provided the pressure stabilises within limits, within 2 secs.

Refer to ROTAX engine operators manual for further MAP information.

9.1.9 Circuit protection

The propeller controller is supplied from the propeller power supply (C/B F5 16A). Manually pulling this circuit breaker (to the “off” condition) will result in loss of controller display together with the propeller remaining at its last pitch setting. Continued flight should be made expeditiously (see 9.1.13 Coping with Malfunctions)

9.1.10 Pilot Training & Experience

These notes assume that the pilot already has some experience of operating a variable pitch propeller. The UK CAA strongly recommend pilots to undergo ’differences training’ before they are allowed to operate aircraft with variable pitch propellers.

9.1.11 Normal procedures – Manual Control

In order to set the propeller to FINE for start-up, take-off and climb use the following procedure:
Select Manual mode

- Push toggle switch in direction for RPM-INC (up position), status indicator MIN- pitch flashes, engine RPM increases
- Keep toggle pushed up until end position is reached (status indicator MIN-pitch steady on)

To manually adjust the propeller to a COARSER setting use the following procedure:

- Adjust propeller pitch and throttle to match engine RPM and manifold pressure according to the power setting table below

CAUTION

When adjusting the propeller do not overtorque (i.e. too high MAP for given RPM) the engine as this may lead to overloading, reduced life time or possible damage.

ROTAX 914F ENGINE

Power setting	Engine RPM	MAP	Fuel flow [ltr/h]
Max. TOP	5800	39.9	33
Max. MCP	5500	35.4	26
75% MCP	5000	31	20
65% MCP	4800	29	17.5
55% MCP	4300	28	12.5

MCP – Maximum Continuous Power
TOP – Take-Off Power
MAP – Manifold Absolute Pressure

NOTE

Above data is valid for standard conditions at sea level. Keep in mind that engine and propeller performance is affected by altitude and temperature. For detailed information refer to the engine manufacturer's and propeller manufacturer's documentation.

Pre-flight inspection - Visual:
Check each of the propeller blades for damage, small nicks or delamination of the rubber edge protector, and security of attachment to hub.
Check the aluminium hub parts (where visible) for cracks or damage and security of attachment to engine
Check the security of the spinner and presence of 9-off attachment screws
Check the fabricated bracket holding the brush carrier for security of attachment and absence of cracks
Check the condition of the two carbon brushes (no pieces broken-off) and security of attachment screws.

Pre-flight inspection - Functional:

- Turn on the master switch and without starting the engine, use the toggle switch 10 to cycle the propeller to MAX-pitch (i.e. full-coarse) then back to MIN-pitch (i.e. full-fine). Verify visually that the two indicator LED's function correctly, and audibly and visually that the propeller blades have changed pitch.

Engine start
Before starting the engine turn on the master switch and using the toggle switch select RPM-INC (i.e. MIN-pitch setting). However, it is likely to be still fine from the previous inspection.

Run-up and power checks
For the engine run-up, the propeller pitch should be kept at MIN-pitch.
Make sure the brakes are applied!

Take-off
For take-off, keep the propeller at MIN-pitch (i.e. full-fine).
Monitor the engine RPM to ensure that the high RPM time limit specified by Rotax is not exceeded.
It is the pilot's responsibility to ensure that the recommended time limit is not exceeded.

Cruise
When the aircraft, in the climb phase, reaches the required cruising level, level-out and adjust the throttle to the desired power level/manifold pressure. Then select the pitch setting required.

Climb
To enter a climb while cruising in at any coarse setting, the following sequence of actions should be carried out:
1. raise the nose to start the climb
2. as the airspeed reduces progressively open the throttle to the desired setting
3. If the climb rate is not sufficient (e.g. below 400fpm) select the MIN-pitch (i.e. full-fine pitch setting
4. Before levelling-out or initiating descent consider the manifold pressure/engine RPM and re-select a coarser pitch when required

CAUTION

Flying at low airspeeds with the propeller set MAX-pitch (i.e. fully-coarse) means that there may be little ram-airflow through the propeller, increasing the chance of engine stall at low or idle rpm. In the unlikely event that the engine does stall set the propeller to MIN-pitch before re-starting.

Descent
When descending, reduce the throttle as normal and when necessary, change the propeller to MIN-pitch (for example, when descending from the overhead to circuit height).
Approach
Keep MIN-pitch selected when landing so that you will be ready for a possible go around.
Engine shutdown
The engine should be at MIN-pitch (i.e. full-fine) for shutdown.

9.1.12 Normal procedures – Automatic Control

The procedures for use of the controller in automatic mode are as above, up to the point of take-off. Thereafter the procedures below should be followed.

Take-off
Select constant speed mode and TAKE-OFF RPM using the central knob (9), ensuring that take off rpm is 5700 or similar.
(Alternatively push toggle switch (10) to RPM-INC and hold for 2 seconds to activate pre-set take-off rpm)
Follow normal pre-rotation and take-off procedure. During take-off the propeller is controlled automatically to prevent engine over-revving, however monitor the engine RPM to ensure that the high RPM time limit specified by Rotax is not exceeded.
It is the pilot's responsibility to ensure that the recommended time limit is not exceeded.
Cruise
When the aircraft, in the climb phase, reaches the required cruising level, level-out and adjust the throttle to the desired power level/manifold pressure. Using the central knob set the desired cruise rpm. Any change of set speed by turning the knob (9) changes the pre-set, the indication CRUISE disappears, and newly set value becomes valid.
(Alternativelypush toggle switch (10) to RPM-DEC and hold for 2 seconds to activate preset cruise rpm). Coordinate this control with the manifold pressure as noted above.
Climb
To enter a climb while cruising in at any coarse setting, the following sequence of actions should be carried out:
1. raise the nose to start the climb
2. as the airspeed reduces progressively open the throttle to the desired setting
3. If the climb rate is not sufficient (e.g. below 400fpm) select any higher rpm up to TAKE-OFF RPM (i.e. full-fine pitch setting) as described above
4. Before levelling-out or initiating descent consider the manifold pressure/engine RPM and re-select a coarser pitch when required

CAUTION

Flying at low airspeeds with the propeller set MAX-pitch (i.e. fully-coarse) means that there may be little ram-airflow through the propeller, increasing the chance of engine stall at low or idle rpm. In the unlikely event that the engine does stall set the propeller to MIN-pitch before re-starting.

Descent
When descending, reduce the throttle as normal and when necessary select TAKE-OFF RPM (for example, when descending from the overhead to circuit height).
Approach
Keep TAKE-OFF RPM selected when landing so that you will be ready for a possible go around.
Engine shutdown

Select Manual control and MIN-pitch (i.e. full-fine for shutdown in the normal way.

9.1.13 Coping with Malfunctions of the VPP

Coping with any malfunction
Manual control of propeller pitch may be selected at any time

Coping with control malfunction
Care must be taken to set an appropriate rpm for the flight conditions, and if at fine pitch, do not descend at more than 70KIAS to prevent engine overspeed.

Coping with a propeller pitch fluctuation
If a malfunction causes the propeller pitch to fluctuate, pull the “Prop” circuit-breaker in the right-hand instrument panel. This will cease power supply to the propeller, causing it to stop in whatever position the supply stopped. Continue safe flight, ensuring there is no engine overspeed, and land when safe to do so. Investigate and rectify.

16A circuit-breaker for VP-prop

Coping with propeller malfunction.
A propeller may malfunction giving the following scenarios:

1. Propeller runs to MAX-pitch (i.e. fully coarse) and stops. (RPM will decrease and MAP will rise. Reduce power if needed, to stay within MAP limits)
Probable cause; controller fault or jammed/internally-failed selector switch. Continue flight with careful monitoring or if in any doubt make a precautionary landing.

WARNING!

- The climb rate will be reduced to 250fpm minimum!
- At fully coarse, the engine will be sustaining increased load at low rpm. Take care as if power is set to idle, it could result in an engine stall.

2. Propeller runs to MIN-pitch (i.e. fully fine) and stops. (RPM will increase and propeller pitch will stop in the ful-fine position. Reduce power if needed, to stay within RPM limits).
Probable cause; controller fault or jammed/internally failed selector-switch. Continue flight with careful monitoring or if in any doubt make a precautionary landing. Note that fully fine could result in engine speed over-run if taken to max power in level or descending flight! Set engine 5000rpm maximum at 70KIAS.

3. Propeller will not make pitch change (determined by no audible effect from engine when at constant power setting).
Probable cause: failed propeller mechanism, controller or cable fault. Follow the appropriate actions in 1. or 2. above and consider the further scenarios in the table below:

Before take-off	Do not take-off
During take-off and climb	Try to keep climbing to a safe altitude, return to the airfield and land. If the aircraft does not climb, maintain altitude and plan to return in a flat curve.
During cruise flight	Depending on the prop position, it should be possible to find a speed and RPM to continue the flight to the next possible landing area. Depending on the prop position your descent will look different and a go around will be at a much reduced climb rate.
During descent	Depending on the prop position (in case of coarse pitch), your descent will look different and a go around will be at a much reduced climb rate.
During Landing	Continue approach as planned. If the prop changes to coarse pitch and the landing looks too long, keep in mind to cut the engine.

4. A propeller blade pitch becomes different to the others. Probable cause, internal mechanical failure. This will result in significant warning vibration. Reduce power and assess vibration with consideration of a precautionary landing. If necessary turn off engine & make immediate precautionary landing.

5. Loss of blade. This will result in severe vibration. Switch engine off and land immediately.

6. Loss of blade tip. This will result in significant vibration. Switch engine off and land immediately.

7. Loss of complete unit. This could result in destruction of the tail or other structural damage. Switch engine off and land immediately.

8. Loss of LED indicator lamps. Probable cause; controller failure or circuit-breaker tripped (16A). Maintain aircraft speed and propeller pitch at around 70KIAS to prevent engine over-speed.

9. 16A circuit-breaker trips - reset once only in flight. Loss of power supply to propeller controller, hence propeller. No pitch change possible, prop will remain at last pitch setting. Make precautionary landing if unsafe to continue the flight.

10. General Note – an increase in vibration from the engine area should always be investigated at the earliest opportunity. Typical causes are (but not limited to): loose engine mounting bolts to airframe or to the engine bearer, loose propeller, incorrect pitch setting blade-to-blade (as set or from mechanism jamming), or blade damage. After the instance of such vibration the engine and airframe should undergo a detailed examination for subsequent damage. Refer to RSUK for guidance.

9.1.14 Handling and Servicing

Refer to the manufacturer's documentation in Woodcomp KW-31 User Manual UM-05 EN.

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9.2 External Lights

9.2.1 General

Depending on customer's configuration the gyroplane can be equipped with optional external lights

- High-brightness LED landing lights
- Red anti-collision beacons
- Navigation and strobe lights

9.2.2 Limitations

No change to standard aircraft

9.2.3 Emergency Procedures

No change to standard aircraft

9.2.4 Normal Procedures

The lights can be switched on or off by respective switches in the centre panel, labelled

- "Land" for under-body landing light
- "Light" for nose landing lights
- "Anti-coll" for the red anti-collision beacons
- "Strobe" for strobe lights
- "Nav" for navigation lights

Note: Due to their small silhouette gyroplanes are easily overlooked, especially if approached directly from behind, such as on approach. It is therefore highly recommended that the navigation and strobe lights are switched on during flight, even in daylight operations.

9.2.5 Performance

No change to standard aircraft

9.2.6 Weight and Balance

No change to standard aircraft

9.2.7 System Description

The high-brightness landing light is mounted in a nacelle under the aircraft's body. (This supplements the nose lights located on the left and right hand side in the nose section).

The anti-collision lighting is provided by one red beacon mounted on each main-wheel spat, supplementing the navigation/strobe lights fitted on each side of the cockpit

9.2.8 Handling and Servicing

No change to standard aircraft

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9.3 GPS/Moving Map Systems

9.3.1 General

Depending on customer's configuration the gyroplane can be equipped with different GPS/Moving Map Systems as optional equipment.

At the point of compiling this manual only the Ipad, mounted on the left panel, and powered from the aircraft electrical system is permitted to be fitted for flight.

NOTE

Any moving map system is to be used for reference only and does not replace proper flight planning and constant oversight and awareness.

9.3.2 through 9.3.6

No change to standard aircraft.

9.3.7 System Description

Refer to the manufacturer's documentation.

9.3.8 Handling and Servicing

Refer to the manufacturer's documentation.

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9.4 ELT (Emergency Locator Transmitter)

9.4.1 General

Depending on customer's configuration or legal requirements the gyroplane can be equipped with an ELT (Emergency Locator Transmitter) as an option. The ELT sends distress signals on 406 MHz and 121.5 MHz in case of a crash or can be activated manually by means of a remote cockpit switch or at the ELT's front panel. These distress signals are received and processed by COSPAS-SARSAT satellite-based search and rescue (SAR) system and by airborne and ground stations. The system is designed to remain permanently attached to the aircraft.

9.4.2 Limitations

No change to standard aircraft.

9.4.3 Emergency Procedures

In case of the following events, manually activate the ELT by switching the remote cockpit switch to 'ON':

- Expected crash landing
- Forced landing in hostile terrain (high vegetation, trees, rugged ground)
- Ditching in hostile water (sea state, temperature, off-shore)

Consider to squawk '7700', if transponder is installed and to make an emergency call.

When on ground, inform ATC, any nearby tower or any station via 121.5 MHz or mobile phone about the emergency, if still possible.

9.4.4 Normal Procedures

During normal operation, the front panel switch of the ELT transmitter must be in 'ARM' position in order to allow automatic activation (g-sensor). In addition, the ELT can be activated by switching the remote cockpit switch to 'ON'. The red visual indicator will be on.

During road transport, shipment, when the aircraft is parked for a longer period or for maintenance operation, the front panel switch of the ELT should be switched to 'OFF' in order to avoid false alarms.

In case of accidental activation, the ELT can be reset either by switching to 'RESET/TEST' on the Remote Control Panel or switching to 'OFF' on the ELT transmitter.

9.4.5 through 9-4.6

No change to standard aircraft

9.4.7 System Description

The ELT installation consists of the following components

- ELT transmitter with visual indicator and mounting bracket
- ELT antenna
- Remote cockpit switch with visual indicator

The ELT transmitter is installed below the left hand seat and can be accessed through the service cover below the seat cushion. The ELT transmitter is connected to the ELT antenna

at the rear part of the rotor mast fairing. A remote cockpit switch with visual indicator is provided in the instrument panel. In order to use the remote cockpit switch or to enable automatic activation, the 3-position toggle switch of the transmitter must be set to 'ARM'.

If ELT is inadvertently activated, use the 'RESET/TEST' position of the rocker switch to stop transmission and reset the unit. The red visual indicator will extinguish when unit is reset.

The ELT system sends distress signals on 406 MHz and 121.5 MHz. The 406 MHz transmission carries digital data which enable the identification of the aircraft in distress and facilitate SAR operation (type of the aircraft, number of passengers, type of emergency). The 406 MHz message is transmitted to the COSPAS-SARSAT satellites and is downloaded to one of the 64 ground stations. The aircraft is located by Doppler effect by the LEO satellites with a precision better than 2 NM (4 km) at any point of the earth.

The 121.5 MHz frequency is no more processed by COSPAS-SARSAT system but is still used by SAR services for homing in the final stage of rescue operations.

In the event of a crash, the ELT activates automatically by means of a g-switch and transmits a sweep tone on 121.5 MHz and the 406 MHz signal.

For further information, please refer to the manufacturer's documentation Note that apart from the initial registration process, recurrent registration may apply.

Remote cockpit switch

ELT transmitter and cockpit switch

9.4.8 Handling and Servicing

The ELT transmitter contains a battery with a limited lifetime. See placard and accompanying documentation. For maintenance and testing, please contact your qualified service partner.

9.5 Removal/Installation of Doors

9.5.1 General

If a flight with doors removed is desired or necessary, the following procedure for removal and installation must be followed. Removed doors must be stored preferably free from humidity and dust. In order to remove or install a door, a second briefed person is desirable to assist and help to prevent any damage to the gyroplane or the door.

NOTE

For flights with doors removed see 4.21.

Removal/Installation of a door:

1. Open door
2. Pull gas spring off the ball joint on fuselage
3. Lower the door, pull quick pins out of the door hinges and remove door
4. Store door at an adequate location dry and clean
5. Remove door seal unless secured
6. Installation of a door: Removal procedure in reverse order

9.5.2 Limitations

See 4.21

9.5.3 Emergency Procedures

No change to standard aircraft

9.5.4 Normal Procedures

No change to standard aircraft

9.5.5 Performance

In section 5 it is noted that performance can be affected when flying with doors removed.

9.5.6 Weight and Balance

No change to standard aircraft

9.5.7 System Description

No change to standard aircraft

9.5.8 Handling and Servicing

No change to standard aircraft

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9.6 Instructor Throttle Lever

9.6.1 General

Depending on customer's configuration the gyroplane can be equipped with optional flight instructor throttle lever. The instructor throttle lever allows an ergonomic left-handed throttle control from the passenger seat (left hand).

9.6.2 through 9-6.6

No change to standard aircraft

9.6.7 System Description

9.6.8 Handling and Servicing

No change to standard aircraft

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CONTENTS

SECTION 10 - SAFETY TIPS

General

This section provides miscellaneous suggestions and guidance to help the pilot operate the gyroplane more safely.

10.1 Low-G Avoidance

Never push the control stick forward to descend or to terminate a pull-up (as you would in an airplane). This may produce a low-G (near weightless) condition which can result in a situation with reduced or lost lateral roll control and significant loss of main rotor RPM. Always reduce power to initiate a descent.

10.2 Side Slip in Gyroplanes

Excessive side slip has to be avoided. Side slip can be safely performed up to the degree which is necessary for proper runway alignment for landing within crosswind limitations. Excessive side slip starts at a point where de-stabilizing effects of the fuselage balance out or even supersede the stabilizing effects of the stabilizer. Pilots new to gyroplanes, especially those with fixed wing experience may not be aware of these physical limitations. When exceeding these limitations, be it by imitating 'professionals' or applying habits and control schemes from fixed wing aircraft, the gyroplane may enter an attitude where it is not recoverable. As the pedal control is sensitive and alignment is key in high-performing gyroplanes, pilots should develop a feeling for side slip and 'automatized feet' in order to maintain aerodynamic alignment and to compensate for power-induced yaw couplings by anticipation as a conditioned reflex.

A note to training facilities and flight instructors: Due to their reduced directional stability, gyroplanes require active control to enter, stabilize and neutralize side slip. Most students perceive natural discomfort in side slip. Depending on the situation, students may erroneously make a wrong control input or freeze, especially when overchallenged, stressed, or surprised by the situation. In our opinion flight training should focus on the necessity of correct alignment, the training of recovery procedures, and the development of the right reflexes. Intentional side slip training as a normal procedure is considered to be critical as there is no instrument to indicate 'safe' boundaries. An experienced pilot may tell from an imminent change in control response when limits are approached. A student, however, may unknowingly or inadvertently overshoot the limits, especially when he is overly focussed on the touch-down zone and coming in too high.

Side slip may be trained within safe boundaries. The student must be briefed

- to use gentle pedal input for initiation and stabilization
- initiate side slip at or below 50KIAS and maintain air speed by using his perception of speed, respectively speed sensation (for want of a working air speed indication)
- not to rely on airspeed indication in side slip
- never to perform abrupt control stick input into the direction of motion (to chase a faulty speed indication)

It is highly advisable that the instructor remains lightly on the controls at all times.

10.3 Flying Low on Fuel Is Dangerous

Never intentionally allow the fuel level to become critically low. Although a gyroplane leaves much more options than a fixed wing aircraft and is easier to control during power-off than a helicopter, a forced landing into unknown terrain always poses unnecessary and unpredictable risk with danger to material, health, or life.

10.4 Do Not Push the Envelope and Remain Easy On the Controls

Avoid abrupt control inputs or accelerated manoeuvres, particularly at high speed. These produce high fatigue loads in the dynamic components and could cause a premature and catastrophic failure of a critical component.

10.5 Strobe Lights On – For Your Own and Other's Safety

If permitted and safe to do so (considering the brightness of modern strobe system and possible effect on nearby people), turn the strobe lights (if installed) on before starting the engine and leave it on until the rotor stops turning. The strobe lights are located near the propeller and provide a warning to ground personnel. Leaving them on in flight is also advisable since the gyroplane may be difficult for other aircraft to see.

10.6 Propellers and Rotors Can Be Extremely Dangerous

Never attempt to start the engine until the area around the propeller is completely clear of any persons or objects. Do not start the engine while standing beside the aircraft as you will easily be struck by the propeller in case of a brake failure or an operating error.

Be sure ground personnel or onlookers don't walk into the propeller or main rotor. Mind the spinning rotor and propeller when taxiing close to obstructions or persons. It is advisable to maintain at least one rotor diameter distance from obstructions or persons when taxiing with spinning rotor. A fast turning rotor is almost invisible, but may contain enough energy to kill a person.

Never let go of the control stick and make sure the rotor blades spin down in level/horizontal attitude until the rotor is at a complete stop. Wind or negligent behaviour on the control stick may cause the blades to flap dangerously low and hit control stops, stabilizer, or people.

10.7 Power Lines and Cables Are Deadly

Flying into wires, cables, and other objects is by far the number one cause of fatal accidents in rotary wing aircraft. Pilots must constantly be on the alert for this very real hazard.

- Watch for the towers; you will not see the wires in time
- Fly directly over the towers when crossing power lines
- Allow for the smaller, usually invisible, grounding wire(s) which are well above the larger more visible wires
- Constantly scan the higher terrain on either side of your flight path for towers
- Always maintain at least 500 feet AGL except during take-off and landing.

10.8 Loss of Visibility Can Be Fatal

Flying a gyroplane in obscured visibility due to fog, snow, low cloud ceiling, or (without proper training) even a dark night can be fatal. Gyroplanes have less inherent stability and much faster roll and pitch rates than airplanes. Loss of the pilot's outside visual references,

even for a moment, can result in disorientation, wrong control inputs, and an uncontrolled crash. This type of situation is likely to occur when a pilot attempts to fly through a partially obscured area and realizes too late that their losing visibility. The pilot loses control of the gyroplane when attempting a turn to regain visibility but is unable to complete the turn without visual references.

You must take corrective action before visibility is lost! Remember, a precautionary landing in a gyroplane will always be safer than a flight with impaired or no visibility.

10.9 Overconfidence Prevails in Accidents

A personal trait most often found in pilots having serious accidents is overconfidence. High-time fixed-wing pilots converting to gyroplanes and private owners are particularly susceptible. Airplane pilots feel confident and relaxed in the air, but have not yet developed the control feel, coordination, and sensitivity demanded by a gyroplane. Private owners must depend on self-discipline, which is sometimes forgotten. When flown properly and conservatively, gyroplanes are potentially the safest aircraft built. But gyroplanes also allow little tolerance for error when flown to their limits. Gyroplanes must always be flown defensively.

10.10 Flying Low over Water is Very Hazardous

Accidents repeatedly occur while manoeuvring low over water. Many pilots do not realize their loss of depth perception when flying over water. Flying over calm glassy water is particularly dangerous, but even choppy water, with its constantly varying surface, interferes with normal depth perception and may cause a pilot to misjudge his height above the water.

MAINTAIN SAFETY ALTITUDE AT ALL TIMES

10.11 Conversion Pilots Constitute High Risk When Flying Gyroplanes

There have been a number of fatal accidents involving experienced pilots who have many hours in aeroplanes or helicopters but with only limited experience flying gyroplanes.

The ingrained reactions and habits of an experienced aeroplane pilot can be deadly when flying a gyroplane. The aeroplane pilot may fly the gyroplane well when doing normal manoeuvres under ordinary conditions when there is time to think about the proper control response. But when required to react suddenly under unexpected circumstances, the pilot may revert to their aeroplane reactions and commit a fatal error. Under those conditions, their hands and feet move purely by reaction without conscious thought. Those reactions may well be based on the greater experience, i.e., the reactions developed flying aeroplanes.

For example, in an aeroplane the reaction to an engine failure would be to immediately and considerably push forward with the stick. In a gyroplane, application of excessive and sudden forward stick, especially in a climb, could result in a low-G situation or, if the engine failure occurred during initial climb, a reduction of rotor RPM combined with a high sink rate with the consequence of a hard landing or impact.

Aeroplane pilots may also underestimate pedal work. Pedal control in a gyroplane is important as it has the highest rate response with the smallest static and dynamic damping effect of all other controls. On top of that, power-yaw coupling is much more predominant than in an average aeroplane. Being used to the high directional stability of an aeroplane, a conversion pilot may neglect proper pedal work and, which is much worse, assume side slip

limits at the pedal stop. Very much like helicopters, gyroplanes cannot be flown by control position or control force, but solely by resulting attitude. That means that the pilot together with their built-in senses and programmed reflexes represents a vital part in the active control feedback loop.

Helicopter pilots, on the other hand, may underestimate the characteristics of gyroplanes and the necessity for proper training. The simplicity of design may lead them to the assumption that gyroplanes are easy to fly throughout the envelope. Helicopter pilots may also confuse throttle control (push for power) with the control sense of a collective pitch (pull for power) in a stress situation.

To develop safe gyroplane reactions, conversion pilots must practice each procedure over and over again with a competent instructor until hands and feet will always make the right move without requiring conscious thought. AND, ABOVE ALL, HE MUST NEVER ABRUPTLY PUSH THE CONTROL STICK FORWARD.

10.12 Beware of Demonstration or Initial Training Flights

A disproportionate number of fatal and non-fatal accidents occur during demonstration or Initial training flights. The accidents occur because individuals other than the pilot are allowed to manipulate the controls without being properly prepared or trained.

If a student begins to lose control of the aircraft, an experienced flight instructor can easily regain control provided the student does not make any large or abrupt control movements. If, however, the student becomes momentarily confused and makes a sudden large control input in the wrong direction, even the most experienced instructor may not be able to recover control. Instructors are usually prepared to handle the situation where the student loses control and does nothing, but they are seldom prepared for the student who loses control and does the wrong thing.

Before allowing someone to touch the controls of the aircraft, they must be thoroughly trained concerning the sensitivity of the controls in a gyroplane. They must be firmly instructed to never make a large or sudden movement with the controls. And, the pilot-in-command must be prepared to instantly grip the controls should the student start to make a wrong move.

10.13 Practicing Off-Field Simulated Engine Failures

Pilots: Besides the legal aspects, never train off-field simulated engine failures on your own!

Instructors: Always check an area for wires or other obstructions before simulating engine failures. Consider go-around path and the suitability for an actual engine off touch-down. Cut the throttle smoothly and keep control of engine idle RPM to avoid actual engine starvation.

11.0 APPENDIX

LIST OF APPENDICES

Operator Registration Form
Incident Reporting Form

This form is supplied to enable the new owner to register the change of ownership, so that he/she may receive any service or other information relating to the aircraft. The information is stored on a computer, and is only used within RotorSport for the above purpose.

If the new owner does not register, then they will not be automatically updated, which may lead to unsafe flight or an un-airworthy aircraft.

Return this form to:
RotorSport Sales and Service Ltd, Poplar Farm, Prolley Moor, Wentnor, Bishops Castle, Shropshire, SY9 5EJ
Or email info@rotorsport.org, or fax 01588 650769

Aircraft type	Aircraft serial No.
Aircraft Registration No.	Aircraft Engine No.
Logbook Aircraft hours	Logbook Engine hours

Old owners name and address

Signature & date

New owners name and address

Email:

Signature & date

RSUK Office use only

Date entered onto database	Acknowledgement sent (date)	Job completed by:

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This form is supplied to enable the owner/operator to inform (anonymously if needed) RotorSport UK Ltd of any incident, accident or other field or service failure that they feel appropriate. The owner must also, of course, inform the relevant authorities if that is appropriate – eg Air Accident Investigation Branch etc.
Depending on the incident information supplied, a corrective action is investigated and, if needed, supplied back to the customer(s)

The information given is stored on a computer, and is only used within RotorSport for the above purpose.

Return this form to:
RotorSport Sales and Service Ltd, Poplar Farm, Prolley Moor, Wentnor, Bishops Castle, Shropshire, SY9 5EJ
Or email info@rotorsport.org, or fax 01588 650769

Aircraft type	Aircraft serial No.
Aircraft Registration No.	Aircraft Engine No.
Logbook Aircraft hours	Logbook Engine hours
Pilot name	Passenger name

Incident (please include extra sheets as needed, and be as precise as possible)

Incident location and date	Aircraft loading condition (inc fuel)

Weather conditions	Sheet of

Reporting persons name and address

Email:

Signature & date