

# Pilot's Operating Handbook

## ***PS-28 Cruiser***

equipped with Dynon EFIS D100 / EMS D120



**Airplane Registration Number:**

**Airplane Serial Number:**

This Pilot's Operating Handbook is  
EASA approved under

Restricted Type Certificate No.:                   EASA.A.546

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## RECORD OF REVISIONS

Rev. No.	Affected pages	Revision name	Approved	Date
1	i, v, vii, viii, 2-8, 2-12, 3-14, 4-3, 4-5, 4-6, 4-11, 4-12	BRS moved to Supplement, specification of engine speed at airplane waiting	EASA AFM Approval 10041100	21. 8. 2012
2	i, v, vii, viii, 1-5, 2-4, 2-6, 2-7, 6-3	Supplementation of maximum empty weight value, correction of max. fuel pressure limit value	EASA AFM Approval 10049423	05 June 2014
3	i, v, vii, viii, ix, 1-4, 2-6, 2-7, 2-8, 4-6, 4-9, 4-11, 5-2, 7-3, 7-4, 8-5	Substitution pages for aircraft with CT measurement acc. to Rotax service bulletin SB-912-066UL and SB-912-066.	EASA AFM Approval 10055978	2015-12-11

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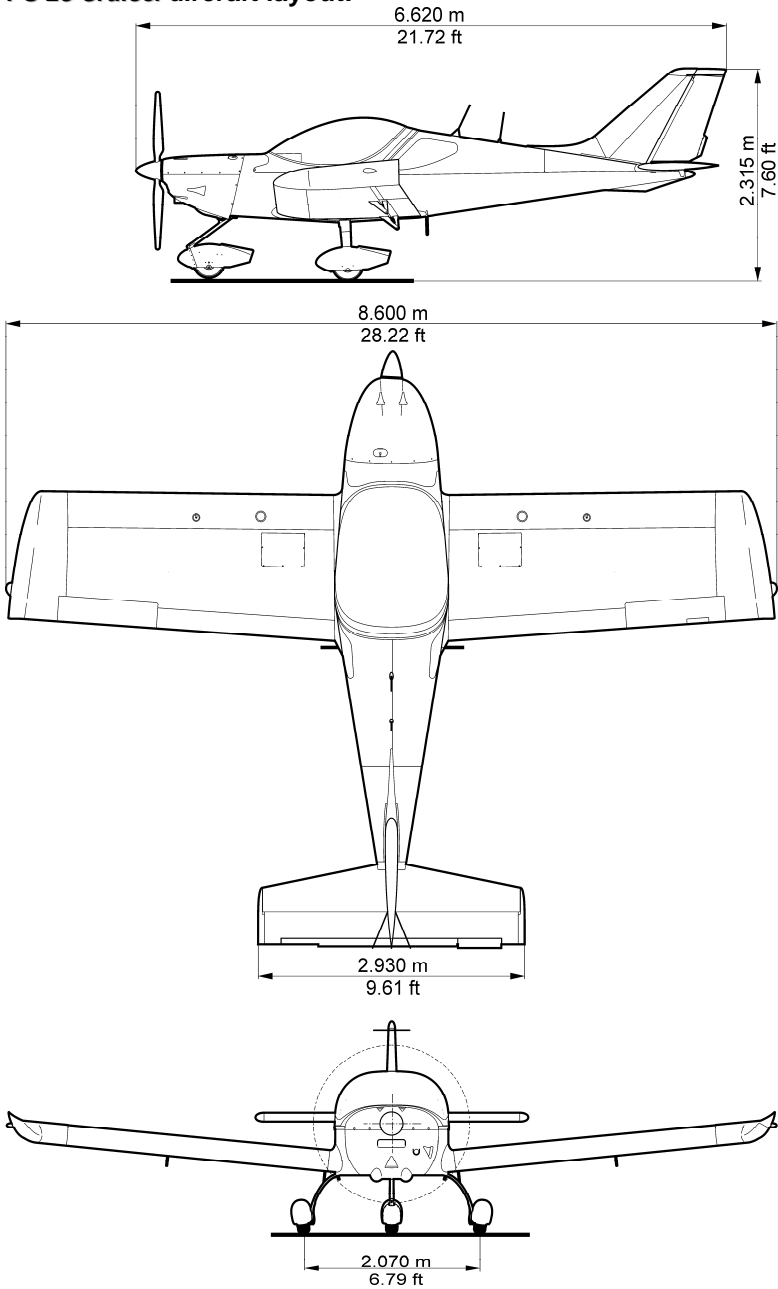
## LIST OF ABBREVIATIONS

ADI	Attitude direction indicator	
AGL	Above Ground Level	
ALT	Altitude or Altimeter	
ATC	Air Traffic Control	
ASI	Airspeed Indicator	
bar	Pressure unit	(1 bar = 14.5037 psi)
BEACON	Anti-collision beacon	
°C	Temperature in degree of Celsius	(°C = (°F - 32) / 1.8)
CAS	Calibrated Airspeed	
CDI	Course deviation indicator	
C.G.	Center of Gravity	
CHT	= CT	
COMM	Communication transceiver	
CT	Coolant Temperature displayed as „CHT“	
EFIS	Electronic Flight Information System	
ELT	Emergency Locator Transmitter	
EMS	Engine Monitoring System	
°F	Temperature in degree of Fahrenheit	(°F = (°C x 1.8) + 32)
ft	Foot or feet	(1 ft = 12 in = 0.305 m = 305 mm)
fpm	Vertical speed in feet per minute	(1 fpm = 0.0051 m/s)
GPS	Global Positioning System	
hp	Power unit	(1 hp = 0.7457 kW)
IAS	Indicated Airspeed	
IC	Intercom	
IFR	Instrument Flight Rules	
in	Inch	(1 in = 25.4 mm)
ISA	International Standard Atmosphere	
KCAS	Calibrated Airspeed in Knots	
kg	Kilogram	(1 kg = 2.205 lb)
KIAS	Indicated Airspeed in Knots	
km	Kilometer	(1 km = 1000 m = 0.54 NM = 0.621 SM)
km/h	Speed in kilometers per hour	(1 km/h = 0.54 knots = 0.621 mph = 0.278 m/s)
knot	Speed in NM per hour	(1 knot = 1.151 mph = 1.852 km/h = 0.514 m/s)
KTAS	True Airspeed in Knots	
kW	Power unit	(1 kW = 1.341 hp)
L	Liter	(1L = 0.22 UK gal = 0.264 US gal)
lb	Pound	(1 lb = 0.454 kg)
lbf	Force unit	(1 lbf = 4.448 N)
m	Meter	(1 m = 1000 mm = 3.28 ft = 39.37 in)
mm	Millimeter	(1 mm = 0.03937 in)
MAC	Mean Aerodynamic Chord	
max.	Maximum	
min.	Minimum or minute	
mph	Speed in statute miles per hour	(1 mph = 0.87 knots = 1.61 km/h)

MTOW	Maximum TakeOff Weight	
m/s	Speed in meters per second	<i>(1 m/s = 196.8 fpm = 1.944 knots = 3.6 km/h)</i>
N	Newton - force unit	<i>(1 N = 0.225 lbf)</i>
NM	Nautical mile	<i>(1 NM = 1,852 m)</i>
OFF	System is switched off or control element is in off-position	
ON	System is switched on or control element is in on-position	
OAT	Outside Air Temperature	
POH	Pilot's Operating Handbook	
psi	Pressure unit - pound per square inch	<i>(1psi = 0.0689 bar)</i>
rpm	Revolutions per minute	
s or sec	Second	
SM	Statute Mile	<i>(1SM = 1,609 m)</i>
TAS	True Airspeed	
US gal	US gallon	<i>(1 US gal = 0.83 UK gal = 3.785 L)</i>
V	Volt	
VFR	Visual Flight Rules	
VMC	Visual Meteorological Conditions	
VSI	Vertical Speed Indicator	
VTU	Vertical tail unit	
V <sub>A</sub>	Manoeuvring airspeed	
V <sub>FE</sub>	Maximum flaps extended speed	
V <sub>NE</sub>	Never exceed speed	
V <sub>NO</sub>	Maximum structural cruising speed	
V <sub>S</sub>	Stall speed with wing flaps in retracted position	
V <sub>S1</sub>	Stall speed with wing flaps in takeoff position	
V <sub>SO</sub>	Stall speed with wing flaps in extended position	
V <sub>X</sub>	Best angle of climb speed	
V <sub>Y</sub>	Best rate of climb speed	



**PS-28 Cruiser aircraft layout:**



**Main airplane dimensions:**

Wing span .....	8.600 m
Length .....	6.620 m
Height .....	2.315 m
Wing area .....	12.30 m <sup>2</sup>
Wing loading .....	49 kg/m <sup>2</sup>
Cockpit width .....	1.170 m

**Flight control surfaces travel:**

Rudder.....	30°	±2° to each side
Elevator .....	+24° / -24°	±2°
Aileron .....	+15° / -15°	±1°
Flaps.....	0° to 30°	±1°
Aileron trim .....	+20° / -20°	±2°
Elevator trim .....	+22° / -28°	±2°
Anti-balance tab .....	+25° / -19°	±2°

**Engine:**

Manufacturer .....	BRP-Powertrain GmbH&Co.KG
Model number.....	912 S2 / ULS2
Maximum power rating .....	73.5 kW at 5,800 RPM
Cooling .....	liquid and air
Type.....	4-stroke, 4 cylinder, horizontally opposed, spark ignition engine with one central camshaft-push-rod-OHV

**Propeller:**

Manufacturer .....	WOODCOMP s.r.o.
Model number.....	KLASSIC 170/3/R
Number of blades .....	3
Diameter .....	1,712 mm
Pitch setting.....	17.5 ±0.5°
Type.....	three composite blades, ground adjustable

## 2.11 Fuel

### Fuel volume:

Wing fuel tanks capacity .....	2x 57 L
Total fuel capacity .....	114 L
Unusable fuel .....	2x 0.5 L
Total usable fuel .....	113 L
Maximum allowable difference in fuel tanks .....	30 L

### Recommended fuel type:

**NOTE**

*Refer to the ROTAX Operator's Manual, section 2.4 Fuel, and Rotax Service Instruction SI-912-016*

### MOGAS

European standards	- min. RON 95, EN 228 Super, EN 228 Super plus
US standard	- ASTM D4814
Canadian standards	- min. AKI 91, CAN/CGSB-3.5 Quality 3

**CAUTION**

*Fuels that contain more than 5 % ethanol blend have not been tested and are not permitted for use.*

### AVGAS

US standard- AVGAS 100 LL (ASTM D910)

AVGAS 100 LL places greater stress on the valve seats due to its high lead content and forms increased deposits in the combustion chamber and lead sediments in the oil system. Thus it should only be used in case of problems with vapor lock or when other types of gasoline are unavailable.

## 2.12 Engine operating speeds and limits

Engine Model:		ROTAX 912 S2 / ULS2
Engine Manufacturer:		BRP-Powertrain GmbH
Power	<i>Max. takeoff:</i>	73.5 kW at 5,800 rpm (max. 5 min.)
	<i>Max. continuous:</i>	69 kW at 5,500 rpm
	<i>Cruising (75%):</i>	51 kW at 5,000 rpm
Engine speed	<i>Max. takeoff:</i>	5,800 rpm (max. 5 min.)
	<i>Max. continuous:</i>	5,500 rpm
	<i>Cruising (75%):</i>	5,000 rpm
	<i>Idling:</i>	1,400 rpm (minimum)
Oil pressure	<i>Minimum:</i>	0.8 bar below 3,500 rpm
	<i>Maximum:</i>	7 bar cold engine starting
	<i>Normal:</i>	2 - 5 bar above 3,500 rpm
Oil temperature	<i>Minimum:</i>	50 °C
	<i>Maximum:</i>	130 °C
	<i>Normal:</i>	90 - 110 °C
Coolant temperature displayed as „CHT“	<i>Maximum:</i>	120 °C
Exhaust gas temperature (EGT)	<i>Nominal:</i>	800 °C
	<i>Maximum:</i>	850 °C
	<i>Max. takeoff:</i>	880 °C
Fuel pressure	<i>Minimum:</i>	0.15 bar
	<i>Maximum:</i>	0.4 bar 0.5 bar*
Engine start, operating temperature	<i>Minimum:</i>	-25°C
	<i>Maximum:</i>	50 °C
Limit of engine operation at zero gravity and in negative “g” condition		
	<i>Maximum:</i>	5 seconds at max. -0.5 g

\* Applicable only for fuel pump from S/N 11.0036.

## 2.13 Engine instruments markings

Rotax 912 S2 / ULS2 73.5 kW (98.6 hp)	Minimum Limit (red line)	Caution Range (yellow arc)	Normal Operating Range (green arc)	Caution Range (yellow arc)	Maximum Range (red line)
Engine speed RPM	-	0-1,400	1,400-5,500	5,500-5,800	5,800
Oil Pressure	0.8 bar	0.8-2 bar	2-5 bar	5-7 bar	7 bar
Oil Temperature	50 °C	50-90 °C	90-110 °C	110-130 °C	130 °C
Coolant Temperature displayed as „CHT“	-	to 50 °C	50-120 °C	-	120 °C
Fuel Pressure	0.15 bar	-	0.15-0.4 bar 0.15-0.5 bar*	-	0.4 bar 0.5 bar*
Manifold Pressure	-	-	10-35 inHg	-	-

\* Applicable only for fuel pump from S/N 11.0036.

## 2.14 Other limitations

- **No smoking on board of the aircraft!**
- **Approved for Day VFR flights only.**
- **Flight in rain**

When flying in the rain, no additional steps are required.

Aircraft qualities and performance are not substantially changed.

However **VMC must be maintained!**

- ***Minimum instruments and equipment list for Day VFR flights:***
  - Airspeed indicator
  - Altimeter
  - Compass (is not required by CS-LSA)
  - Fuel quantity indicator
  - Tachometer (RPM)
  - Engine instruments as required by the engine manufacturer :
    - *Oil temperature indicator*
    - *Oil pressure indicator*
    - *Coolant temperature indicator*
  - Safety harness for every used seat

***WARNING***

*IFR flights and intentional flights under icing conditions are PROHIBITED!*

***WARNING***

*Minimum 6 L of fuel quantity allows approximately 15 minutes of safe operation!*

**WARNING**

*Physically check the fuel level before each takeoff to make sure you have sufficient fuel for the planned flight.*

**WARNING**

*In case of long-term parking it is recommended to turn the engine several times (Ignition Switch - OFF!) by turning the propeller. Always handle by palm the blade area i.e. do not grasp only the blade edge. It will facilitate engine starting.*

## 4.2 Engine starting

### 4.2.1 Before engine starting

1. Flight controls - free & correct movement
2. Canopy - clean, close and lock
3. Safety harness - fasten
4. Brakes - fully applied
5. **PARKING BRAKE** - use

### 4.2.2 Engine starting

1. THROTTLE - **IDLE**
2. **CHOKE** - cold engine - **ON** (*fully pulled and hold*)  
- warm engine - **OFF**
3. **FUEL** selector - **LEFT** or **RIGHT** (*in accordance with fuel tanks filling*); check correct position - green mark (see Chapter 7.11)
4. **MASTER BAT** - ON
5. **EMS** - ON
6. **FUEL P** - ON
7. Propeller area - clear
8. Ignition Switch - hold **START**  
after engine is starting - **BOTH**

After engine is running:

9. **MASTER GEN** - ON
10. **AVIONICS** - ON
11. **FUEL P** - OFF
12. Other switches - ON as necessary
13. **CHOKE** - gradually release during engine warming up
14. THROTTLE - maintain max. 2,500 rpm for warming up

**CAUTION**

- *The starter should be activated for a maximum of 10 sec, followed by 2 min pause for starter cooling.*
- *As soon as engine runs, adjust throttle to achieve smooth running at approx. 2,500 rpm.*
- *Check if oil pressure has risen within 10 sec. and monitor oil pressure. Increase of engine speed is only permitted at steady oil pressure readings above 2 bar.*
- *At an engine start with low oil temperature, continue to observe the oil pressure as it could drop again due to the increased flow resistance in the suction line. The number of revolutions may be only so far increased that the oil pressure remains steady.*
- *To prevent impact load, start the engine with throttle lever in idle position or at the most up to 10 % open.*

**4.2.3 Engine warm up**

Prior to engine check block the main wheels using chocks. Initially warm up the engine to 2,000 rpm for approximately 2 min, then continue to 2,500 rpm till oil temperature reaches 50 °C. The warm up period depends on ambient air temperature. Check temperatures and pressures.

**4.3 Taxiing**

1. Flaps - retracted (0°)
2. **PARKING BRAKE** - release
3. Brakes - function check at taxiing start

Apply power and brakes as needed. Apply brakes to control movement on ground. Taxi carefully when wind velocity exceeds 20 knots. Hold the control stick in neutral position.

**NOTE**

*During the airplane waiting maintain the engine speed within the range from 2,100 to 2,300 rpm.*

**For hot temperature conditions:**

- *Restrict engine running at ground to the shortest time only*
- *Avoid or limit taxiing in downwind or "wind blowing from the right side" position if possible*
- *In case the CHT (which indicates the CT actually) is close to the limit, reduce the temperature by turning the airplane in a head-wind or "wind from the left side" position and set rpm to 2,100-2,300.*



**WARNING**

Takeoff is prohibited if:

- Engine is running unsteadily, roughly or with vibrations
- Engine instrument values are beyond operational limits
- Aircraft systems (e.g. brakes, controls or avionics) working incorrectly
- Crosswind velocity exceeds permitted limits  
(see Section 5 Performance, 5.7 Demonstrated wind performance)

## 4.5 Climb

1. THROTTLE - **MAX**  
(max. 5,800 rpm for max. 5 min,  
max. continuous power 5,500 rpm)
2. Airspeed -  $V_x = 55$  KIAS  
-  $V_y = 62$  KIAS
3. Trims - as necessary
4. Engine gauges - within limits

**CAUTION**

*If the cylinder head temperature or oil temperature and/or coolant temperature approaches or exceeds limits, reduce the climb angle to increase airspeed and possibly return within limits. If readings do not improve, troubleshoot causes other than high power setting at low airspeed.*

**4.6 Best angle of climb speed ( $V_x$ ):** 55 KIAS

**4.7 Best rate of climb speed ( $V_y$ ):** 62 KIAS

## 4.8 Cruise

Refer to Section 5, for recommended cruising figures.

## 4.9 Descend

1. Optimum glide speed - 60 KIAS

## 4.10 Approach

1. Approach speed - 60 KIAS
2. THROTTLE - as necessary
3. Flaps - takeoff position (12°)
4. Trims - as necessary
5. Safety harness - fasten

### **CAUTION**

*It is not advisable to reduce the engine throttle control lever to minimum on final approach and when descending from very high altitude. In such cases the engine becomes under-cooled and a loss of power may occur. Descent at increased idle (approximately 3,000 rpm), airspeed 60-75 KIAS and check that the engine instruments indicate values within permitted limits.*

## 4.11 Normal landing

### 4.11.1 Before landing

1. EMS - display main screen
2. THROTTLE - as necessary
3. Airspeed - 60 KIAS
4. Flaps - landing position (30°)
5. Trims - as necessary

### 4.11.2 Landing

1. THROTTLE - **IDLE**
2. Touch-down on main wheels
3. Apply brakes - as necessary  
(after the nose wheel touch-down)

### 4.11.3 After landing

1. Flaps - retract (0°)
2. THROTTLE - engine RPM set as required for taxiing
3. Trims - set neutral position

#### 4.11.4 Engine shut down

1. THROTTLE - **IDLE**
2. Instruments - engine instruments within limits
3. Ignition Switch - **OFF**
4. Switches - OFF
5. **MASTER BAT & GEN** - OFF
6. **FUEL** selector - **OFF**

#### **CAUTION**

*Rapid engine cooling should be avoided during operation. This happens above all during aircraft descent, taxiing and low engine rpm or at engine shutdown immediately after landing.*

*Under normal conditions the engine temperatures stabilize during descent, taxiing and at values suitable to stop engine by switching the ignition off. If necessary, cool the engine at engine speed within the range 2,100 to 2,300 rpm to stabilize the temperatures prior to engine shut down.*

#### 4.12 Short field takeoff and landing procedures

None

### 4.13 Balked landing procedures

1. THROTTLE - **MAX**  
(max. 5,800 rpm for max. 5 min,  
max. continuous power 5,500 rpm)
2. Airspeed - min. 60 KIAS
3. Flaps - takeoff position (12°)  
(max. airspeed for flaps using is 75 KIAS)
4. Trims - as necessary
5. Climb - after reaching 62 KIAS
6. Flaps - retract (0°) at safe altitude  
(max. airspeed for flaps using is 75 KIAS)
7. Trims - as necessary

### 4.14 Aircraft parking and tie-down

1. Ignition Switch - **OFF**
2. **MASTER BAT & GEN** - OFF
3. **FUEL** selector - **OFF**
4. Parking brake - as necessary
  
5. Canopy - close, lock as necessary
6. Secure the airplane

**NOTE**

*It is recommended to use parking brake for short-time parking only, between flights during a flight day. After ending the flight day or at low temperatures of ambient air, do not use parking brake, but use the wheel chocks instead.*

**NOTE**

*Use anchor eyes on the wings and fuselage rear section to fix the airplane. Move control stick forward and fix it together with the rudder pedals. Make sure that the cockpit canopy is properly closed and locked.*

### 4.15 Noise characteristics

The noise level in accordance with requirements of the CS-36, Am.2 (ICAO Annex 16, Volume I, Chapter 10 - 10.4 b) has been established as  $64.4 \pm 1.2$  dB(A)

# **SECTION 5**

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## 5. PERFORMANCE

The presented data has been computed from actual flight tests with the aircraft and engine in good conditions and using average piloting techniques.

If not stated otherwise, the performance stated in this section is valid for maximum takeoff weight 600 kg and under ISA conditions.

The performance shown in this section is valid for aircraft equipped with **ROTAX 912 S2 / ULS2** engine with maximum power 73.5 kW and **WOODCOMP KLASSIC 170/3/R** three composite blades ground adjustable propeller with pitch setting  $17.5 \pm 0.5^\circ$ .

### **CAUTION**

*Airspeed values are valid for standard AVIATIK WA037383 pitot-static probe.*

The elevator and aileron trim tabs are electrically actuated by buttons on the control stick. Elevator and aileron trim position indicators are displayed on the EMS main screen. Only the smaller elevator trim position indicator is displayed on the EFIS main screen. Aileron trim tab position can be checked visually from cockpit by view to the right.

**NOTE**

*EFIS and EMS main screens are shown in Section 9, Supplement No. 2.*

## **7.4 Instrument panel**

**NOTE**

*Actual Instrument panel layout and Description of instrumentation and controls in the cockpit are shown in Section 9, Supplement No. 2.*

## **7.5 Engine**

ROTAX 912 S2 / ULS2 engine with maximum power 73.5 kW is installed in this aircraft. Rotax 912 S2 / ULS2 is a 4-stroke, 4-cylinder, horizontally opposed, spark ignition engine with one central camshaft-push-rod-OHV. Liquid cooled cylinder heads and ram air cooled cylinders.

Dry sump forced lubrication. Dual contactless capacitor discharge ignition. The engine is fitted with an electric starter, AC generator and mechanical fuel pump. Prop drive via reduction gear with integrated shock absorber.

For information about engine performance, speeds and limits see:

- *Section 2, chapter 2.12 “Engine operating speeds and limits” in this POH*
- *Rotax “Operator’s manual” for engine type 912 series*

### **Engine controls**

#### ***Throttle and Choke***

Engine power is controlled by means of the THROTTLE lever and the CHOKE lever which are positioned in the middle channel between the seats side by side. Both levers are mechanically connected (*by cable*) to the flap on the carburetors. Springs are added to the throttle push rods to ensure that the engine will go to full power if the linkages fail.

### ***Carburetor preheating***

The heated air is streaming from a heat exchanger to the carburetor through the airbox. The control lever is installed on the middle panel.

### ***Ignition switch***

Ignition switch must be on **BOTH** position to operate the engine. For safety remove the key when engine is not running.

#### **NOTE**

*Ignition system is independent of the power source and will operate even with Master switches and/or breakers OFF.*

## **Engine instruments**

EMS screen displays all “Engine Instruments” as follows:

- engine speed
- manifold pressure
- oil pressure and temperature
- exhaust gas temperature
- coolant temperature displayed as „CHT“
- fuel pressure

For information about engine instruments range and markings see:

- *Section 2, chapter 2.13 “Engine instruments markings”.*

## **7.6 Propeller**

Standard **WOODCOMP KLASSIC 170/3/R** three composite blades ground adjustable propeller is installed. The propeller diameter is *1,712 mm*.

#### **NOTE**

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



**Oil volume:**

Minimum ..... 3.3 L  
Maximum ..... 3.8 L

**8.5.3 Approved coolant grades and specifications**

**Recommended coolant type:**

*(refer to the Rotax Operator's manual section 2.2 Operating speeds and limits and section 2.3 Coolant, Rotax Installation manual - Cooling system, Rotax Service Instruction SI-912-016)*

**New cylinder head design**

Only one type of coolant is permitted:

- Conventional coolant based on ethylene glycol (mixture with 50% of water)

**NOTE**

*With the change to a new cylinder heads design (applicable for 912 ULS2 engines from S/N 6 781 410 inclusive and 912 S2 engines from S/N 4 924 544 inclusive, or on all engines with type designation followed by suffix-01, or on all engines which have been later equipped with the new cylinder heads design of P/N 413185 at cylinder head position 2/3), no longer the Cylinder Head Temperature is measured, but the Coolant Temperature.*

*The Coolant Temperature is indicated on EMS-D120 screen further using the abbreviation „CHT“.*

**CAUTION**

*Waterless coolant are not allowed to use for Rotax engines with new cylinder head design.*

**Type of coolant used by aircraft manufacturer:**

- see Section 9, Supplement No. 02

**Coolant liquid volume:**

It is approximately..... 2.5 L

## 8.6 *Cleaning and care*

Use efficient cleaning detergents to clean the aircraft surface. Oil spots on the aircraft surface (*except the canopy!*) may be cleaned with petrol.

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

### **CAUTION**

*Never clean the canopy under "dry" conditions and **never** use petrol or chemical solvents!*

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

### **CAUTION**

*In the case of long term parking, cover the canopy to protect the cockpit interior from direct sunshine.*

## 8.7 *Assembly and disassembly*

Refer to the *PS-28 Cruiser* aircraft Maintenance manual and the aircraft Assembly photo manual.

## 8.8 *Aircraft inspection periods*

Periods of overall checks and contingent maintenance depends on the condition of the operation and on overall condition of the airplane.

Inspections and revisions should be carried out in the periods listed in:

- *PS-28 Cruiser aircraft Maintenance manual* for aircraft maintenance.
- *Rotax engine Maintenance manual* for engine maintenance.
- *Woodcomp KLASSIC propeller manual* for propeller maintenance.

### **NOTE**

*Aircraft maintenance should be made in accordance with AC 43.13-1B.*