



# INSPECTION CHECKS

**APPLICABLE TO THE INSPECTION OF LAA AIRCRAFT FITTED WITH ROTAX 912, 912S, 912iS AND 914 ENGINES TO CHECK SUITABILITY FOR USE OF UNLEADED MOGAS CONTAINING UP TO 5% ETHANOL**

**LAA/IC-ULM-ROTAX 4 STROKE**  
Issue 5

A/C Type:

Reg:

Engine Model:

This checklist is to be completed by a suitably approved LAA inspector. LAA inspectors are only acceptable for carrying out this task if their LAA approval includes the ability to carry out LAA Permit renewal inspections on the aircraft concerned. This checklist should be used in conjunction with LAA Technical Leaflet TL2.26 Procedures for use of E5 Unleaded Mogas to EN228'. Check the website for the latest issue.

Item	Description	Inspector's Signature
1	Check that engine type is one of those listed below: Rotax 912, 912S, 912iS or 914. (Delete as appropriate)	
2	Check that the engine's fuel system is installed in accordance with the Rotax 'Installation Manual' for the engine type concerned, in particular:	
	Fuel filter of approx. 0.1mm mesh size situated between tank and fuel pump inlet.	
	Coarse fuel filter (finger strainer) fitted to each tank outlet.	
	Fuel tank fitted with provisions for draining.	
	Fuel cock fitted between engine and tank(s).	
	For the 912 and 912S:  Fuel flow through mechanical pump or electric pump is not less than 35 litres per hour.  A vapour return line must be fitted, to circulate a small amount of surplus fuel and any vapour back to the fuel tank, via a restrictor orifice of around 0.35mm diameter. Refer to Rotax 912/912S Installation Manual for details. See note 1.	
	For the 912iS and 914:  Twin electric pumps are fitted, free of vibration and preferably near the fuel tank to gain advantage of a cool location and also in a low position (preferably below the fuel tank) to minimise chance of vapour lock. Attaching fuel pump(s) to engine not permitted. Installation of the fuel pumps in the engine compartment is not recommended since the fuel pumps are not of fireproof construction.  A large bore fuel return pipe must be fitted, to re-circulate surplus fuel and any vapour back from the fuel pressure control unit to the tank. Refer to Rotax 912iS and 914 installation manual for details. See note 2.	
3	Check that the installation is configured in such a way as to make vapour-lock problems unlikely, in particular:	
	All the fuel lines on the suction side of the fuel pump must be insulated from heat in the engine compartment, routed well clear of hot engine components, coolant pipes etc. Rotax recommend that temperatures in vicinity of fuel lines, float chamber etc do not exceed 36 degrees C. See note 3.	
	'S bends' (local high-points and low-points) in fuel pipe runs should be avoided wherever possible as these will tend to trap vapour bubbles.	

4	Check that each fuel tank is not made of a material likely to be chemically attacked by components within unleaded Mogas fuel containing 5% ethanol. Whilst metal tanks, and those moulded using polythene are reputed to be satisfactory with unleaded fuel containing up to 5% ethanol, some tanks laminated using epoxy, polyester or vinylester resins are known to be attacked. Consult the aircraft kit manufacturer and/or carry out a sample test (two weeks duration suggested) to check for signs of the surface becoming 'gummy' when in contact with fuel containing as close to 5% ethanol as possible .	
5	Check that fuel tanks are not treated with a 'sloshing sealant' likely to be chemically attacked by components within unleaded fuel containing up to 5% ethanol, detach from the tank inner surface and block the fuel outlet. If in doubt, immersion test over a two-week period and check condition.	
6	Check that fuel system components such as rubber or plastic pipes, seals in fuel cocks, sight gauge tubes, fuel tank floats, filters, etc, are not made of a material likely to be chemically attacked by unleaded fuel containing 5% ethanol. Any fuel system components manufactured for the automotive industry since around 1990 or so are likely to have been made compatible with E5 unleaded fuel. If in doubt, test components in a jam jar of fuel containing as close to 5% ethanol as possible and observe results after appropriate period (two weeks).	
7	Check carburettor ice protection provisions, heat muffs, carb heaters etc. If reliance is placed on 'undercowl temperature' for carb ice protection, ensure that under cowl temperatures are not being accidentally reduced due to loose or worn baffles, air seals etc. It is recommended that a carburettor heater is fitted to 912, 912iS and 912S engines – see note 4.	
8	Check that fuel level is visible in sight-gauges. Unleaded fuel, being almost clear in colour, may be hard to see in sight-gauges that have become stained with age, in which case sight- gauge tubes will need to be replaced. A card marked up with diagonal close-pitched lines inserted behind the gauge will help to show up fuel level due to refraction effect – fuel in the sight-gauge appears to alter the angle of the lines. Alternatively, a thin vertical line has the same effect – it appears to 'broaden' with fuel in front of it (mercury thermometer effect)	
9	Carry out engine ground run using unleaded Mogas fuel to BS EN 228, 95 RON (Min) containing not in excess of 5% ethanol and check that running and instrument indications are normal. Mixture strength should not need adjusting. Note that it is normal to find a slightly different grey exhaust pipe deposit with unleaded fuel than with leaded fuel which may give a false impression of changed mixture strength. Check fuel system for leaks and filter(s) for contamination	
10	Fit cockpit placard regarding E5 unleaded Mogas fuel use (available from LAA).	
11	Fit placard adjacent to each filler specifying: 'E5 Unleaded Mogas BS EN 228, 95 RON (MIN)'	

**After completion, this checklist is to be signed, dated and stapled into the aircraft's airframe logbook, together with the LAA TL2.26. The inspector is to add declarations in the engine and airframe logbooks stating:**

***'This aircraft/engine has been checked in accordance with the procedures in TL 2.26 issue \_ and may be run on unleaded petrol to BS EN 228, 95 RON (MIN) containing no more than 5% ethanol in accordance with the operating procedures and special operating limitations in TL2.26'***

### **DECLARATION BY LAA INSPECTOR**

I declare that the aircraft, registration **G-**\_\_\_\_\_, has been checked against items 1 to 11 listed above and has been found to comply in all respects.

Name:	Signed:	Insp. No.:	Date:
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## **NOTES**

### *Note 1:*

Skydrive Ltd (tel 01926 612188) can supply a suitable Tee-piece including the required restrictor orifice.

In the event that the aircraft is not already fitted with a vapour return line, and the manufacturer has no option available for adding one, normal LAA modification procedures apply regarding the approval of the modification.

It may be necessary to add an extra inlet connection to the fuel tank to accomplish the modification.

If the aircraft is fitted with more than one fuel tank, a ganged type fuel selector valve will be required to be fitted to allow the vapour return line to feed back to the same tank as fuel is being drawn from. Andair Ltd (tel. 01705 473945) can supply ganged fuel selectors of this type. Alternatively the aircraft must be placarded to the effect that when flown with 'full tanks', the pilot must initially select whichever fuel tank is the one into which the return flow feeds, otherwise the return flow will overflow the already full tank.

Typical bleed-back flow rate with a 0.35mm diameter orifice is 3 litres per hour.

### *Note 2:*

A large bore return pipe is essential for the 914 installation, matching the size of nipple provided on the fuel pressure regulator. It is essential to avoid an excessive pressure drop in the return pipe otherwise the fuel pressure may over-ride the fuel pressure regulator, especially when both electric pumps are functioning. The return flow rate is typically 200 litres per hour.

### *Note 3:*

If in doubt, temperature measurements can be made using temperature sensitive labels (eg part number 555-392 from RS Components – [uk.rs-online.com](http://uk.rs-online.com) – provides a multi-pack of labels, each label covering the range 37 to 65 degrees C). Alternatively Skydrive Ltd tel 01926 612188 can supply a low-cost self-contained battery-powered continuous-readout electronic thermometer with panel-mounting digital display intended for use in measuring carburettor body temperature but equally suitable for measuring undercowl air temperatures.

### *Note 4:*

Skydrive Ltd , tel. 01926 612188 can supply carburettor heater kits for the 912 and 912S.