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		Compiled : I Rickard
		Approved : F Donaldson

TITLE : Fuel Valve Replacement

APPLICABILITY : All Europa variants
Mod Type : Retro-fit

1. Introduction

This modification describes replacing the Europa supplied fuel selector valve with the Andair FS20-2 (or FS20-7) fuel valve. This selector valve is approved for use in certified aircraft and complies with CS-VLA 995 and FAR 23.995.

The benefits of fitting this fuel selector valve are;-

- 1) Smoother operation. The Europa supplied valve may become stiff to turn over time.
- 2) A positive guard preventing accidental selection of "OFF".
- 3) High quality engraved facia plate.
- 4) Versatile configuration allowing use of most piping systems.
- 5) Versatile accessories allowing mounting in a more accessible position.

The disadvantage is greater cost.

Europa Classic

- 1) The Europa supplied selector valve is mounted inside the centre tunnel and cannot be easily seen. The selector valve is mounted on two bolts attached to the fuselage floor with epoxy and floc. The Andair FS20-2 selector valve can be installed slightly forward of the position of the Europa selector valve using the bracket described below.
- 2) Improved access to the fuel selector valve can be achieved by installing the Andair valve, with the optional extension, just below the top surface of the tunnel. See Picture 1. It is important that the valve is recessed into the tunnel's top surface and not simply on top as this is where the pilot's elbow rests.

Europa XS

- 1) The Europa supplied selector valve is mounted on the left side of the centre tunnel mounted on a reinforcing plate bonded into the skin. The Andair valve can be installed in this position by drilling new mounting holes. See picture 2
- 2) Improved access to the fuel valve can be achieved by installing the Andair valve, with the optional extension, just below the surface of the tunnel. See Picture 3 and Drawing 1
- 3) Other locations are possible but not recommended. See picture 4



Classic installation



Picture 2 XS XS Standard position

Picture 1 Classic improved



Picture 3 XS improved



Picture 4 XS less accessible

2. Parts List

Qty	Part No.	Description	Source
1	FS20x2 XXX	Fuel selector valve	Andair Ltd
4	Facia bolts	Facia plate mount bolts	Unit 1, Dunsbury Business Park, Fullood Road, Havant, Hampshire, PO9 5AX
3	FPA9011	Sytec elbow 1/8NPT - 8mm	Demon Tweeks
3	Mount Bolts	Bolt, nuts, washers 6mm	A/S, LAS, Europa
1	Bracket	1.5mm aluminium 6061 T6	Scrap box
3	AN525-10R5	Bolts	A/S, LAS, Europa
3	MS21047-3	Anchor nuts	A/S, LAS, Europa
6	TAPK36BS	Rivets	A/S, LAS, Europa

Andair provide a useful configuration guide at <http://www.andair.co.uk/system/index.html>.

Study this carefully to ensure you obtain the correct tube connectors for your fuel system's pipe work.

The recently introduced FS20x7 valve is also suitable. This has the selector orientated to point 45 degrees left and right with "Off" to the rear. To fit this valve you must ensure you have sufficient space below the valve as the outlet is situated on the bottom.

The pipe runs can be improved by the use of "elbow" fittings on the two pipes from the tank outlets. An example is the Sytec fitting FPA9011 available from Demon Tweeks.

List of related drawings

Drawing No.	Title / Description	Issue
Drawing 1	Classic & XS, section and plan	1
Drawing 2	Classic bracket	1
Drawing 3	XS bracket	1



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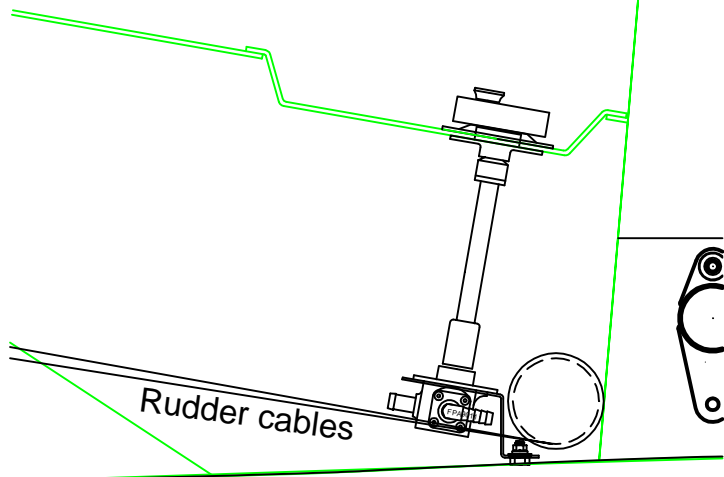
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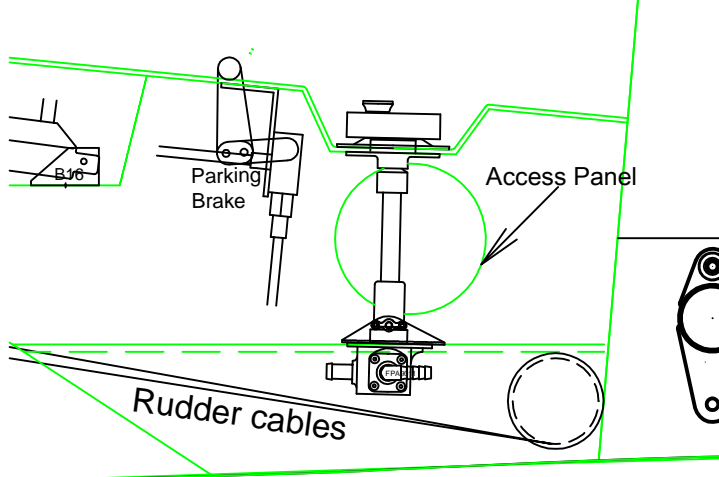
Classic

Elevation



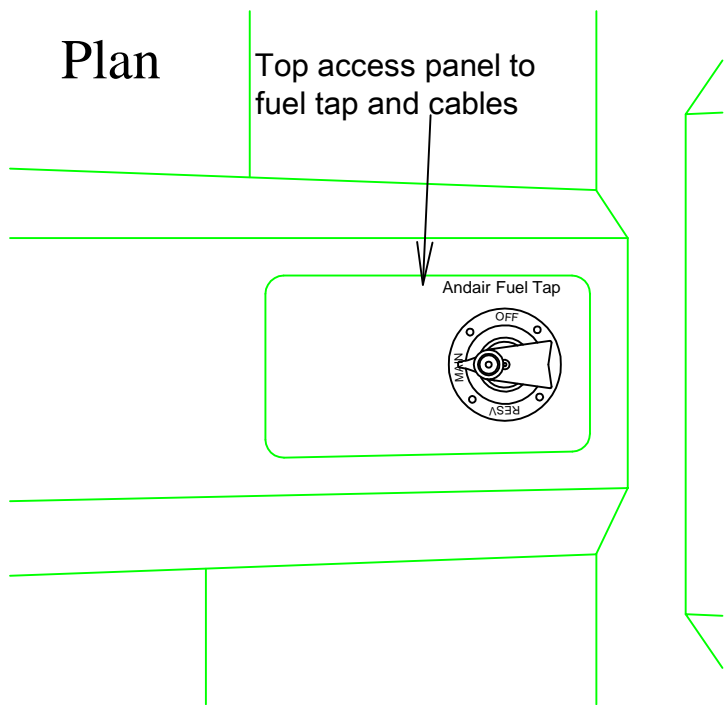
XS

Elevation



Plan

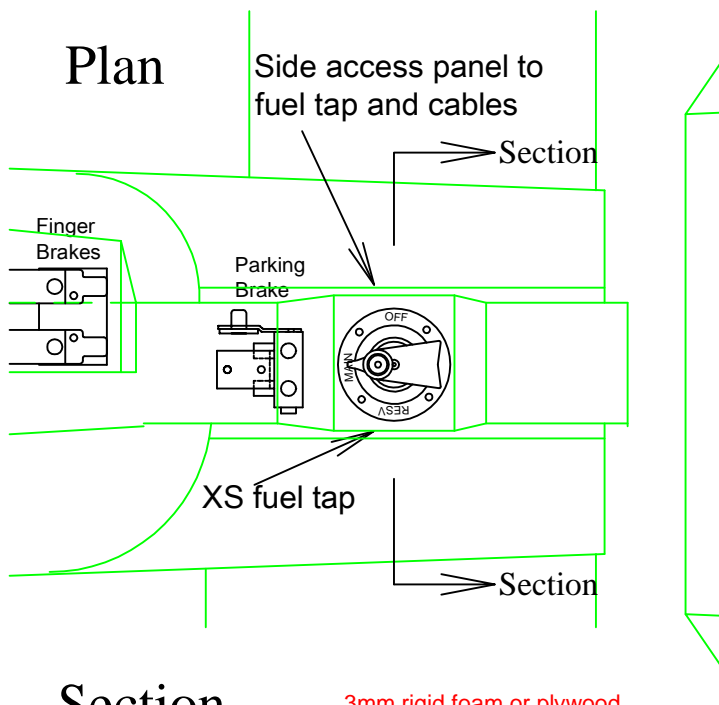
Top access panel to fuel tap and cables



Andair Fuel Tap

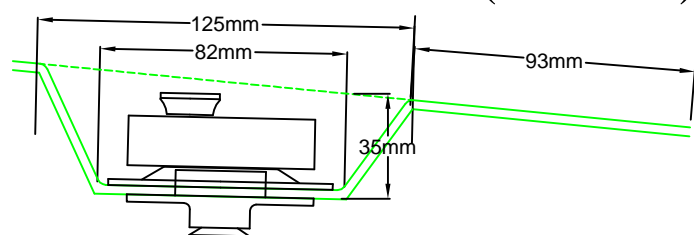
Plan

Side access panel to fuel tap and cables



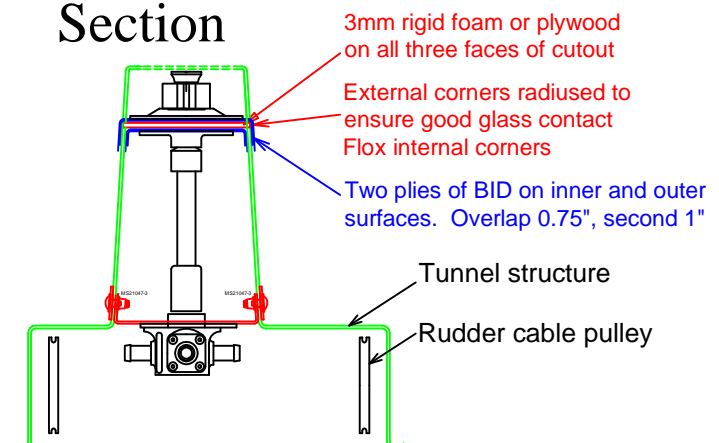
XS fuel tap

XS Cutout detail (scale x2)



Cut the base of the recess parallel to the aircraft centre line

Section



3mm rigid foam or plywood on all three faces of cutout

External corners radiused to ensure good glass contact
Flox internal corners

Two plies of BID on inner and outer surfaces. Overlap 0.75", second 1"

Tunnel structure

Rudder cable pulley

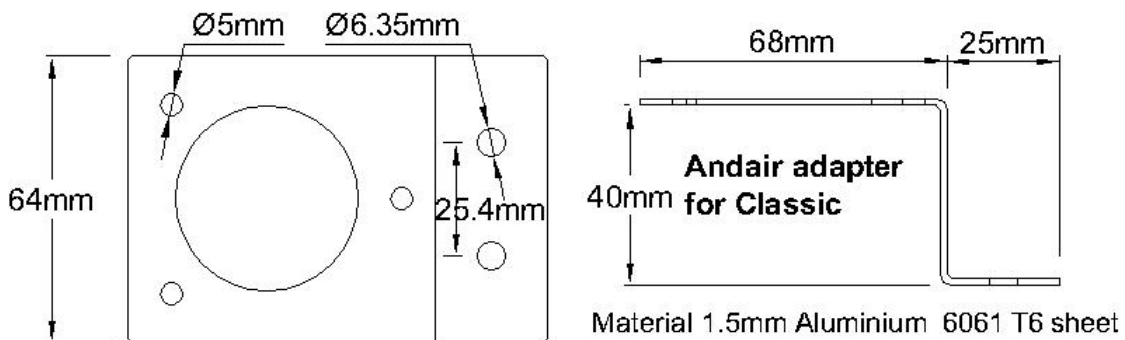
Andair Valve FS20-2

Drawing Sheet
1 of 1
Scale 1 : 5

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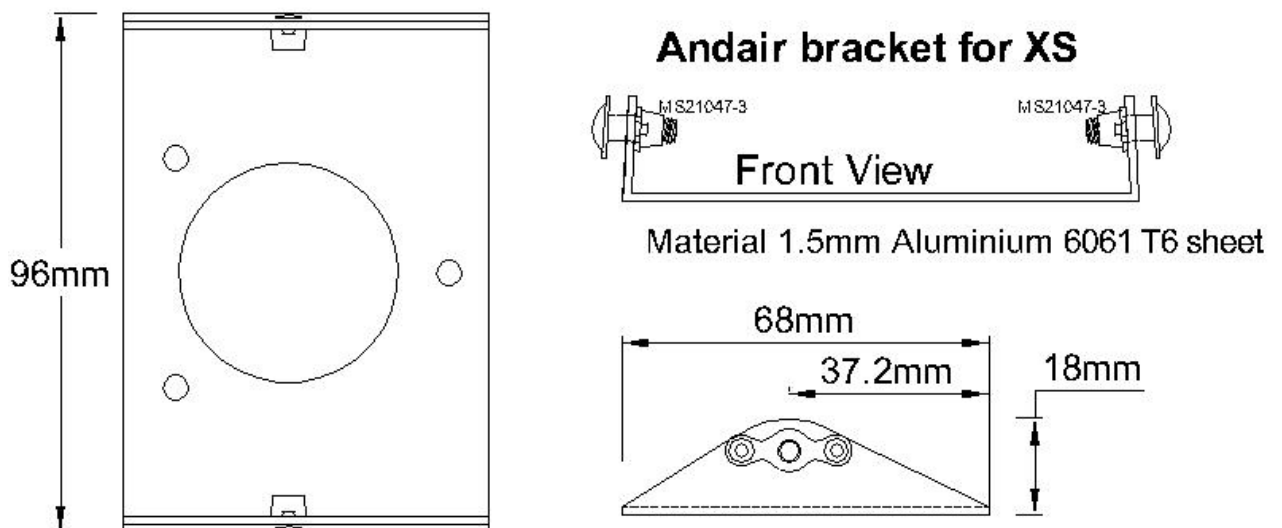
3. Action

- 3.1 **General** – Ensure the selector valve is isolated from the tank, or the tank is empty, before starting work. Ensure a fire extinguisher is to hand during all work. For the exact location of the selector mounting holes see the Andair instructions.
- 3.2 **Classic** – Original position. The Andair selector valve can be installed slightly forward of the position of the Europa selector valve using the bracket shown below which will attach to the existing mounting bolts. Also see Drawing 1. .



Drawing 2 Classic mounting bracket

- 3.3 **Classic** – Improved access. The selector valve is installed as show in Drawing 1 with the addition of the extension unit. The mount bracket is used bent to the correct angle. Make a "tray" to fit the existing cut-out using 5 layers of BID. Drill the tray for three securing bolts (shown in Picture 1). Install three MS21047-3 captive nuts on the centre tunnel for these bolts using TAPK36BS rivets. Follow the Andair mounting instructions and ensure the extension tube is cross drilled and the roll pins inserted.
- 3.4 **XS** - Standard position. Check the orientation and use the Andair template to drill three new holes through the mounting plate used for the Europa supplied selector valve.
- 3.5 **XS** Improved access. The mount bracket is made from folded sheet aluminium is shown below. Alternately the bracket can be constructed from plywood and aluminium angle. Check the width of the lower tunnel is the 96mm given and correct if required. Note the mounting bolts are on the centre line of the selector valve (not the bracket). This allows the bracket to be self aligning.



Drawing 3 XS mounting bracket

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- 3.6 The selector valve is installed as show in Drawing 1. Cut the recess in the top of the tunnel to the dimensions shown. (On a Monowheel aircraft the selector may need to be a little further aft to avoid the tunnel bulkhead). Shape the plywood (or foam sandwich) infill pieces to close the hole. Remove the foam between the exposed edges of the tunnel by 3mm and fill with epoxy and flox. Set the infill pieces in place against the wet epoxy and flox. Flox the two joints between the pieces. Peel ply over the joints. When the epoxy and flox has cured and any excess has been removed, use epoxy and flox to fill any remaining voids and cover (inside and out) with two plies of Bid. Depending on the exact position the access hole in the port side may need to be reshaped slightly.
- 3.7 Follow the Andair mounting instructions and ensure the extension tube is cross drilled and the roll pins inserted. When everything is aligned drill through the tunnel walls for the AN525 bolts.
- 3.8 Check the selector valve for smooth operation. Any stiffness will normally be caused by misalignment of the extension shaft. Check that the valve can be operated, one handed, from the normal seated and strapped in position.
- 3.9 Check for leaks in the fuel system.

4. Weight and Balance

	Weight (lb/kg)	CG (in/mm)	Moment
Existing A/C			
Weight Added	+ 0.2 lb	+64.50 in	+ 12.9 in/lbs
Post Mod A/C			

The change in weight due to the selector valve is very small, some 0.2lbs. If other changes to the aircraft are made a full weight and balance must be completed.

Amend the aircraft weight and balance schedule accordingly.

5. Flight Test and Special Instructions

Before the modified aircraft may be flown:-

- 5.1 An LAA inspector must check the installation complies with this modification.
- 5.2 A basic fuel flow check must be carried out. A detailed description of how to perform this check is given in the Appendix (below). The table below gives the maximum fuel flows for each engine type and the minimum fuel flows that must be recorded during the check.

Rotax Engine model	Maximum fuel flow Litres / hr	Min flow to be recorded: Litres / hr
912	24	30.00
912S	27	33.75
914	33	41.25

- 5.3 With the above found to be satisfactory, a logbook entry must be made, giving the modification number and recording the flows achieved.
- 5.4 Your inspector must sign form LAA-MOD 1 and issue a Permit Maintenance Release (PMR).
- 5.5 Return the form LAA-MOD 1 to LAA Engineering.
- 5.6 Prior to the first flight following this modification check that full power is available for 2 minutes. Remove the upper cowling to aid cooling and chock or tie down the aircraft before conducting this check.

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Appendix Fuel System – Basic flow check

One of the most common causes of engine failures on homebuilt aircraft is inadequate fuel flow leading to fuel starvation or vapour lock.

The purpose of the fuel flow check is to ensure that there is at least a 25% surplus of fuel flow available over and above the maximum amount required by the engine at full throttle and maximum rpm, without allowing the carburettor inlet fuel pressure to drop below the minimum recommended by the engine manufacturer.

Below is listed the maximum fuel flows for the Rotax 912, 912S and 914 engines along with the minimum fuel flows that must be recorded during the fuel flow check.

Rotax Engine model	Maximum fuel flow Litres / hr	Min flow to be recorded: Litres / hr
912	24	30.00
912S	27	33.75
914	33	41.25

Procedure

It is acceptable to conduct this check with the engine-off and with the electric pump running only. The required set-up for carrying out the test is as shown in figures 4 or 5 depending on engine type. A test set consisting of the gauge and taps needed is available as a loan item from the Europa Club.

For the 912 / 912S engine, start the electric pump running and open the stop tap fully then, with the hose end over the measuring container, progressively open the other tap until the fuel pressure drops to 0.15 bar (2.2 psi) which is the minimum fuel pressure required to operate the 912 series engines safely. The fuel flowing into the measuring container is the excess capacity of the fuel pump and fuel system. Shut the stop tap and empty the measuring container ready for the flow check.

Now, re-open the stop tap and start timing as you do so. Double check that the fuel pressure is set correctly at 0.15 bar. Repeat the flow check using the reserve side of the fuel tank. Collect at least 2 litres for accurate results. Calculate and record the results.

For the 914 engine, apply an air pressure of 0.5 bar (7.25 psi) to the airbox port of the regulator – a mountain bike fork pump with a pressure gauge on it may be used for this. With the hose end over the measuring container, switch on one pump and start timing as you do so. Repeat the flow check using the reserve side of the fuel tank. Repeat the test using the second electric pump on both sides of the tank. Collect at least 2 litres for accurate results. Calculate and record the results.

To calculate the fuel flow in litres per hour: $(\text{Litres collected} / \text{seconds}) \times 3600 = \text{litres} / \text{hr}$.

The fuel flows recorded should be well in excess of the minimum figures stated. If they are not, it is likely that some restriction does exist within the fuel system and this must be investigated before further flight.



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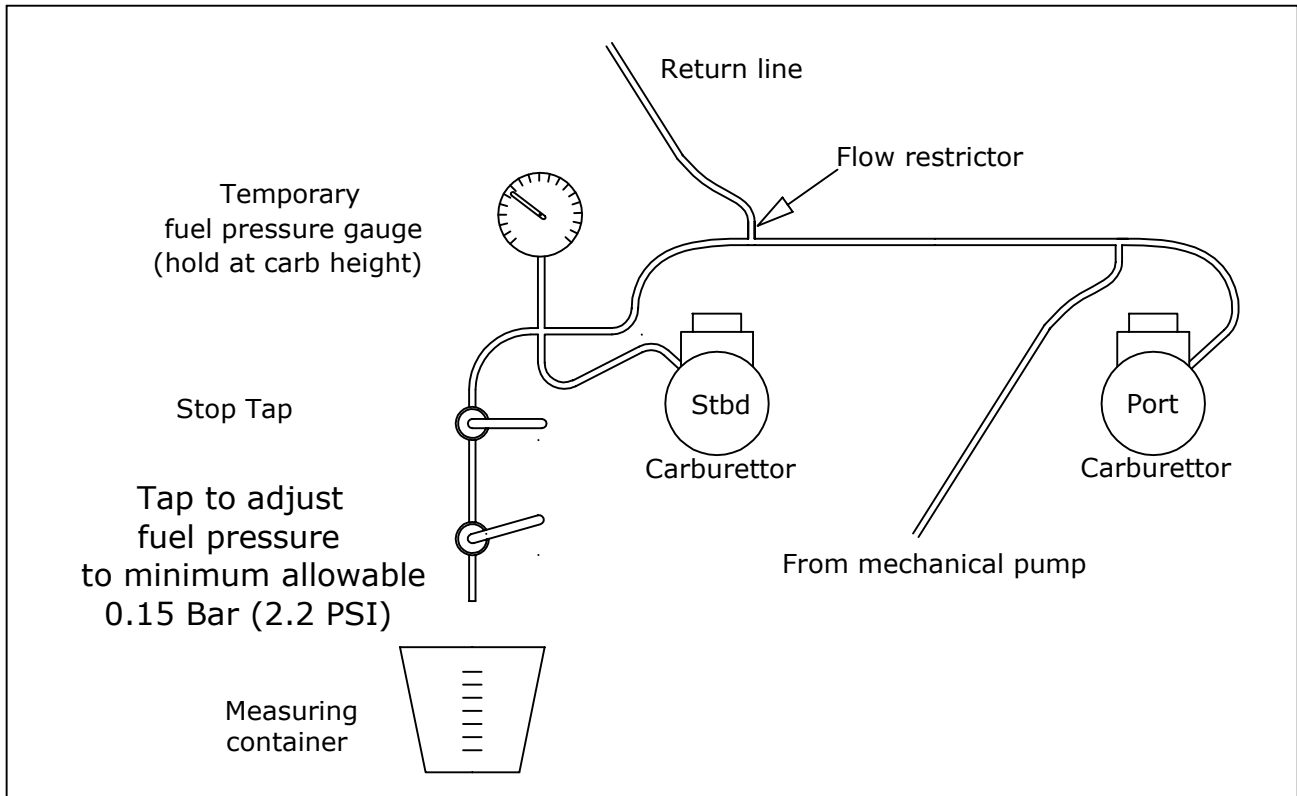


Figure 4. Fuel Flow set-up for Rotax 912/912S engine installation

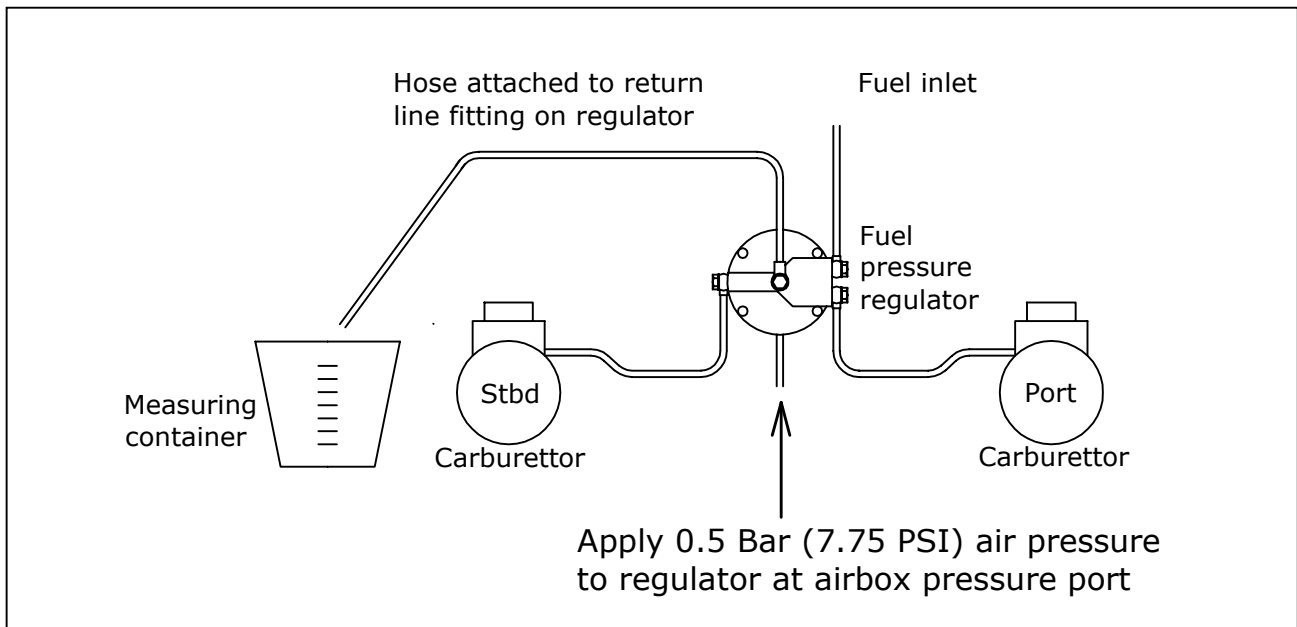


Figure 5. Fuel Flow set-up for Rotax 914 engine installation

Approved:	F Donaldson B.Tech C.Eng FRAeS Chief Engineer	Signed	
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