9 Windscreen Frame and Throttles

Before mounting the cowlings and firewall, the windscreen support frames and the throttles should be installed. These parts position the rear edge of the cowlings.

9.1 Windscreen Frame

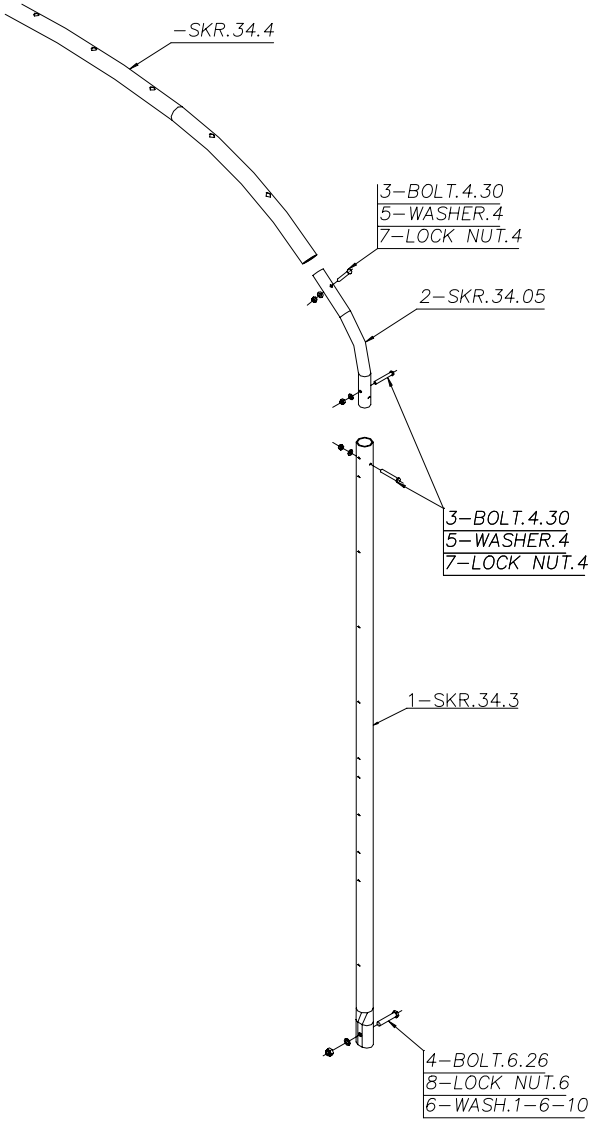

Figure 175; cabin uprights.

a) Attach the bottom of the cabin uprights ***tu34*** to the middle of the fuselage lower side members ***tu16*** using an L-bracket slid inside the slightly flattened bottom end of the tube, with the tube orientated towards the outside of the aircraft, Figure 176 and Figure 177.

b) If a floor is fitted, the saddle washer may be discarded. A hole must be drilled up through the floor, to allow the L-bracket to sit on top of the floor.

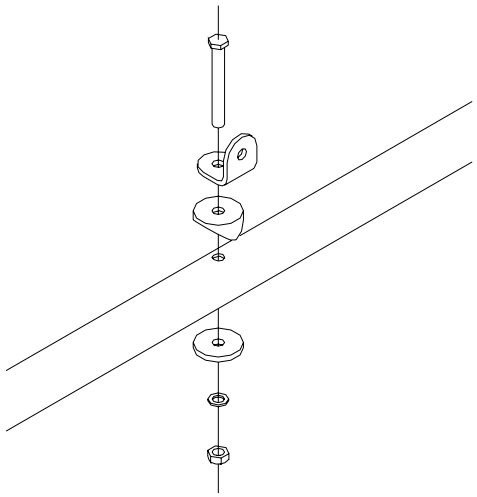

Figure 176; bottom of windscreen side tubes tu34.

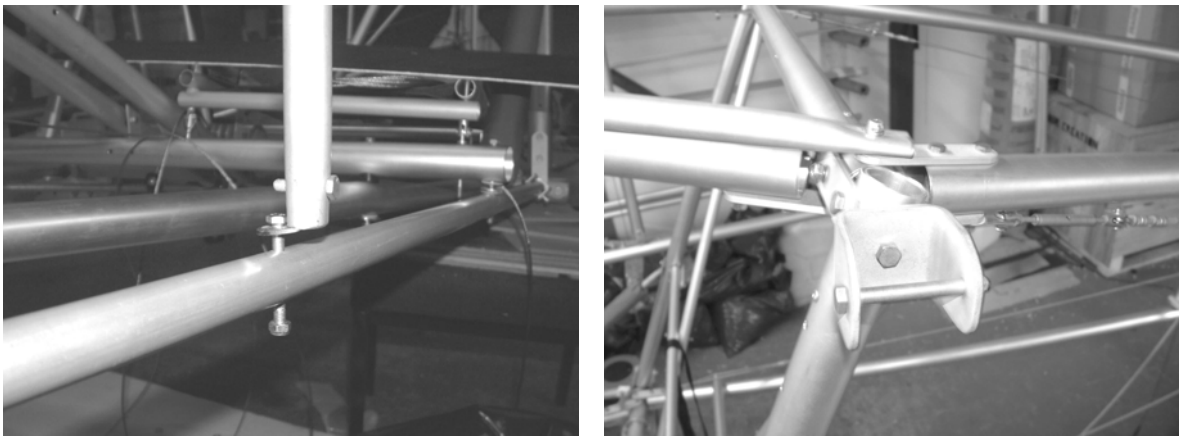

Figure 177; bottom and rear ends of windscreen support frame.

c) At the rear of the ***tu34*** support frame, the tubes are flattened to fit onto the bolt end protruding upwards from the fuselage at the trailing edge attachments, Figure 177.

These need to be quite flat to fit well, which is best accomplished by cutting off the underside to leave only the upper piece of the end, Figure 178. Drill a small hole either side and hacksaw up to them, then dress the ends with a file ensuring no sharp corners are left.

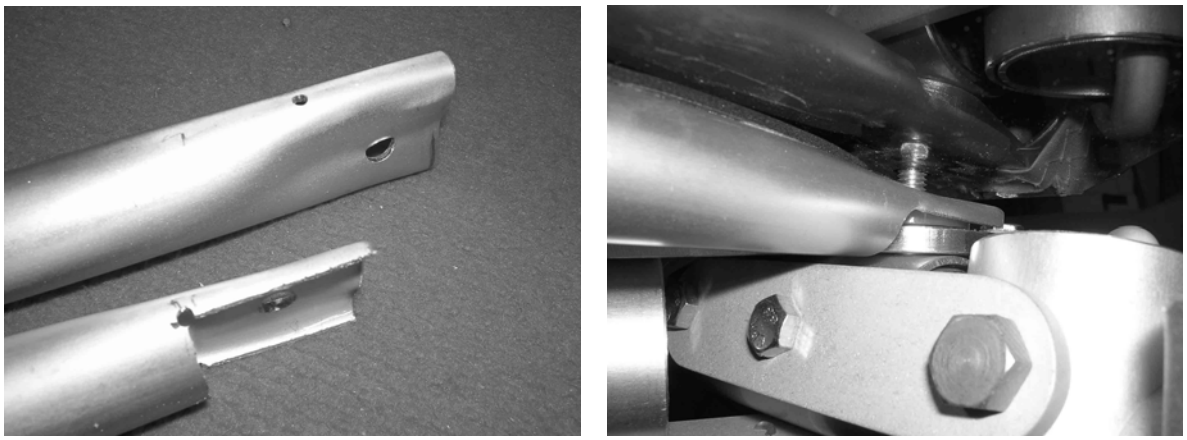

Figure 178; cut-off rear end of windscreen support frame.

d) Slip one of the large diameter heat-shrink rings over each leading edge, and fit the covered wings to the fuselage.

e) Ensure that the ***tu34*** tubes curve around the leading edge with around 3-5mm of clearance, and that the curves of the top tubes match the curve of the large innermost wing battens, maintaining around a 5mm gap, to get a good fit between the Lexan windscreen and the wing.

*It may be desirable to tweak the curve of the top **tu34** tubes to get a good fit. **Take care not to kink it, which can happen if you flatten it too much then try to bend it again.***

It may also be necessary to tweak the curved piece which joins the upright tubes to the curved upper tubes, slide it up or down inside the vertical tube to get the best position, and to re-drill the holes which secure it.

In the correct position the tubes should be centred, with the centres of the tops of the tubes around 900mm apart, so that the upper curved tubes are run parallel back to the rear attachments.

The cabin uprights will then lean slightly outwards from their bases.

Figure 179; clearance between tu34 and leading-edge of wing.

f) Measure the positions of the ***tu34*** tubes relative to the centre of the aircraft.

g) Mark the positions for the heat-shrink rings to centre them on the ***tu34*** tubes.

h) Remove the wings, and heat-shrink the rings into position.

i) Secure the **tu34** tubes at the same positions they held whilst the wing was fitted.

These can be held in place by a tube, such as a piece of plastic drainpipe or similar, Figure 180. Pieces of string, wood etc. may also be used, the aim is to securely locate the tubes.

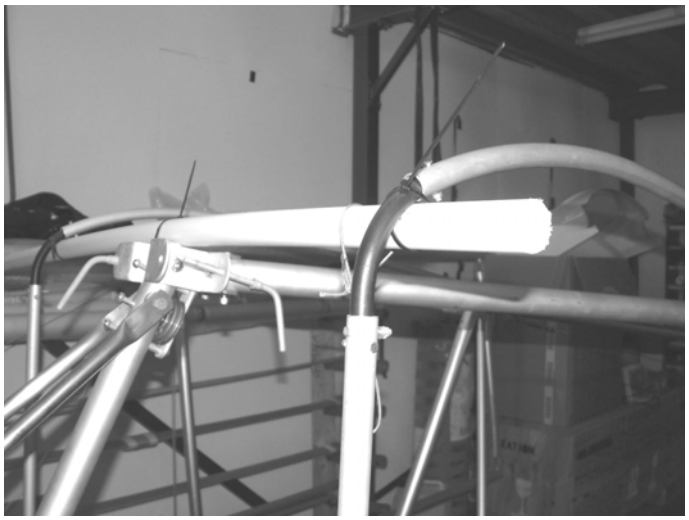

Figure 180; holding the frame in position.

9.2 Throttles

The throttle assembly consists of a torque-tube supported by pivot bolts through mounting plates on either side of the fuselage. Friction is provided by clamping two nylon washers against either side of the plates. Curved levers hook around the bottom of the instrument panel.

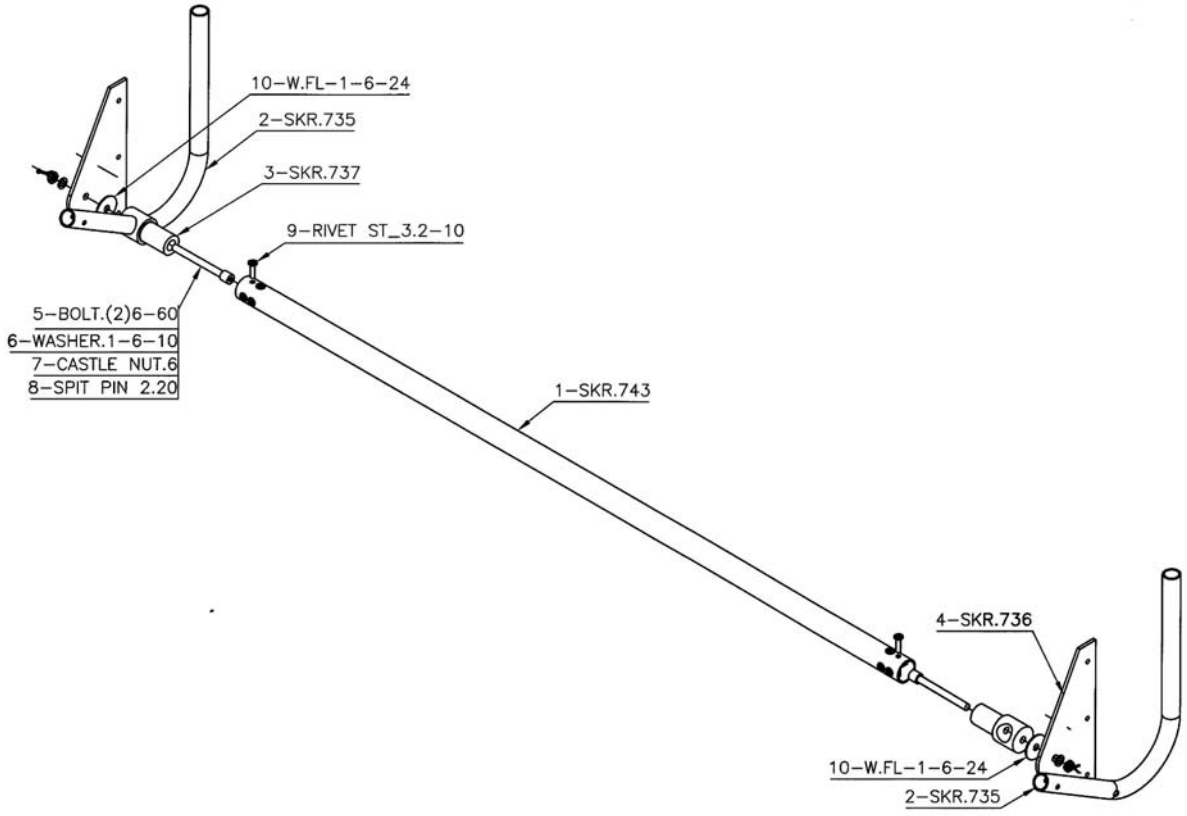

Figure 181; dual throttle parts.

Figure 182; port throttle lever assembly.

a) If a Jabiru is fitted the hole for the cable attachment on the port lever should be 40mm from the pivot.

   If not in place then drill a 5mm hole at this location.

b) If a Rotax 582 is fitted the hole should be at 65mm from the pivot.

   If not in place then drill a 5mm hole at this location.

c) The standard Rotax 912 hole position is at 85mm from the pivot.

d) The torque-tube should be cut 795mm long.

e) Rivet the port lever pivot into the torque-tube using eight 3.2 x 10mm steel rivets.

   Do not drill within 12mm of the end of the tube. There should be two rings of four rivets each, Figure 183.

f) Verify the alignment of the levers before riveting the starboard lever in place.

The top of the port lever should be very slightly offset ahead of the top of the starboard lever so that when the throttles are mounted to the aircraft the port throttle lever will contact the full throttle stop slightly before the starboard lever. The full throttle stop is formed by the lip of the dash board, not fitted yet, but a line between the cabin uprights will serve to mark its position.

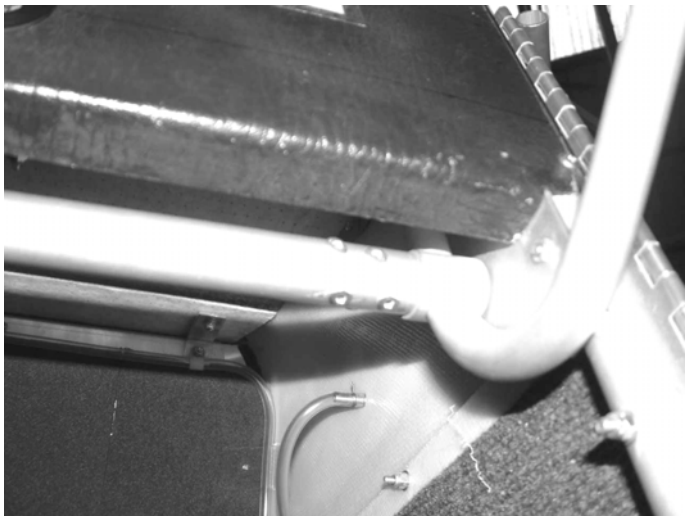

Figure 183; throttle torque-tube rivets.

g) Assemble the mounting plates onto the torque-tube pivot bolts and temporarily bolt in position to the cabin uprights ***tu34***.

The top two holes line up with holes on the cabin uprights. Check that the right holes are being used – the top hole is 410mm up from the lowest hole in the cabin upright.

This position can be lowered if a deeper instrument panel is desired. However, note the need for the throttle torque-tube to clear the aileron torque-tube, and the effect on clearance between the instrument panel and tall pilots' knees.

h) Mark the position of the angle stop pieces, Figure 185, which should be cut from one of the lengths of angle included in the kit.

The port lever should contact the stop fractionally before the starboard lever.

On the Rotax 912 and Jabiru the throttle levers should contact these with the forward part of the lever vertical in relation with the cabin frame.

On the Rotax 582 the throttle stop will have to be long enough to leave space for the fittings on the end of the throttle inner cables. Check these now and position the stops accordingly at 90° to the throttle lever.

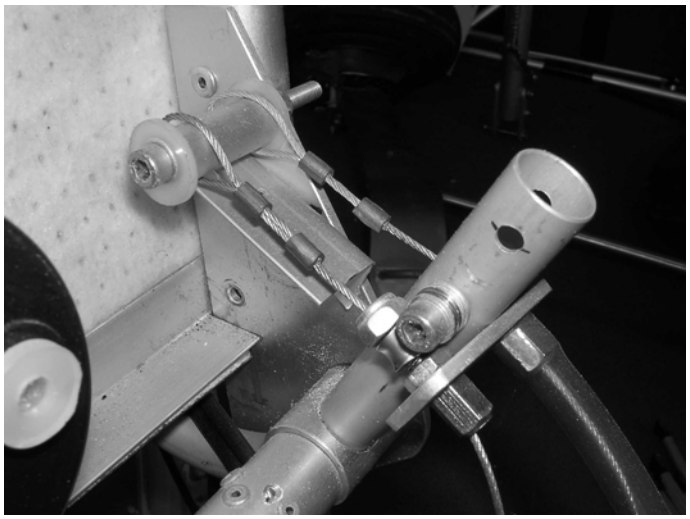

Figure 184; 582 throttle cable attachment.

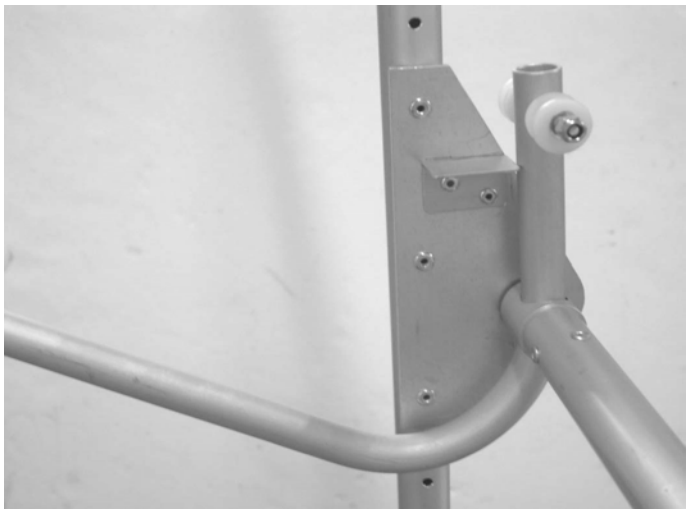

Figure 185; completed port throttle lever, looking outwards.

i) Remove the throttle assembly if necessary and fix the stops in place with two 3.2mm steel rivets.

Take care that the rear most rivet is sufficiently far forwards to not foul the cabin frame.

j) If a Rotax 582 is fitted drill a 6mm hole in the port mounting plate level with the hole in the lever for the cable connections.

The mount for the inner cables will be fitted here later.

k) If a Jabiru is fitted then file a notch in the port side plate to allow clearance for 5mm bolt through the throttle cable attachment hole when the throttle lever is moved fully rearwards.

l) The portion of the throttle levers above the cable attachment holes and stop positions may be cut off.

m) If required, adjust the end float on the torque-tube using plastic washers.

n) Rivet the plates into position to the cabin uprights ***tu34***, again checking that the correct holes are used.

If using the standard position, fix rivets in the top two holes on each side, then drill through the lower hole 4mm to accept the lowest of the three rivets.

o) Adjust the throttle friction by tightening the lock nuts on the port side torque-tube spindle.

The starboard side should be done up just enough to remove any play.

p) Once the friction has been set, lock the two friction nuts together at both ends.

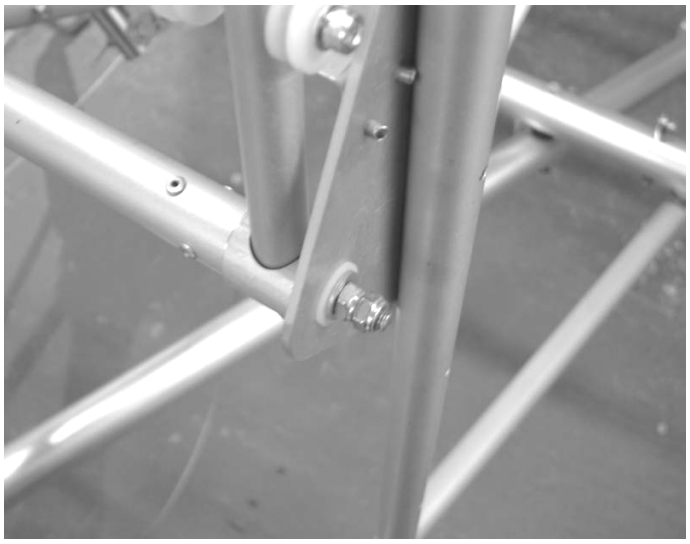

Figure 186; port throttle lever, looking inwards from front.

q) The ends of the bolts should be cut off to prevent fouling with the glass fibre fairing, just leave a couple of threads showing.

r) Drill the golf balls to fit over the ends of the throttle levers, but do not glue them on yet.

A flat, wood type drill works well.

The balls will be fitted later, when the levers have been cut to length in situ to match the dash board positioning.

s) Check that the spacing and centralisation of the parts holding the tops of the cabin uprights has not been disturbed by the fitment of the throttles.

10 Cowling and Firewall

10.1 Cowling

Be careful when handling the cowlings not to scratch them or to stress them, for instance by picking them up by only one corner, as this can result in visible stress crazing.

When drilling holes in the fibreglass, drill very gently to avoid cracking the gel coat. The application of tape around hole positions before drilling is useful to reduce the risk of cracking and scratching if the drill should slip.

Masking tape is useful in any location where a hole needs to be marked and drilled, or where you might slip and scratch the cowlings. Masking all the cowling edges is a good start.

A very useful tool indeed for working the fibreglass parts is a Dremel type mini-drill, fitted with cutting discs or abrasive wheels. Just the excuse you need to go and buy one! For the Jabiru engine, which has quite a bit more fibreglass trimming than the Rotax engines, one of these tools is strongly recommended.

UKMOD: The inside of the cowlings must be painted with the fire resistant intumescent paint supplied. This will require at least two coats. For best results use a small foam roller – such as is found in DIY shops for painting household radiators.

a) The five parts of the cowlings are held together with 5mm pan head bolts.

   The threaded clips are used only on the forward upper and lower parts which need to be removable for inspection. The aft parts are secured with plain nuts and threadlock, or Nylocs if you prefer.

   Even spacing of the bolts looks best, it is worth determining and marking the bolt positions before drilling any holes.

   Do not drill more holes than you have bolts and clips (where necessary) for.

b) First attach the lower front part of the cowling to the side panels.

   Use two bolts and threaded clips on each side about 6" apart.

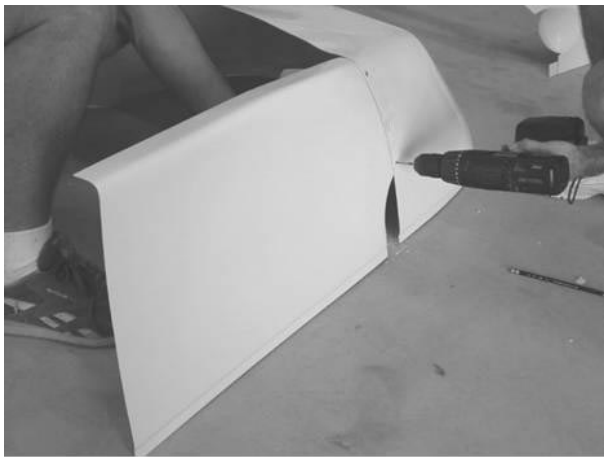

Figure 187; attach side panels to lower front piece.

c) Then attach the upper front part of the cowling, followed by the upper rear part of the cowling, Figure 188 and Figure 189.

Space the bolts about 6" apart. Make sure they are evenly spaced.

Use threaded clips on the upper front to lower front join, and on the upper front to upper rear join, but just nuts between the upper and lower rear parts.

On the 912 compare the bolt positions on the front upper to front lower pieces to the carburettor positions. Do not position the bolts over the carburettors, as they will foul them when the cowling is fitted.

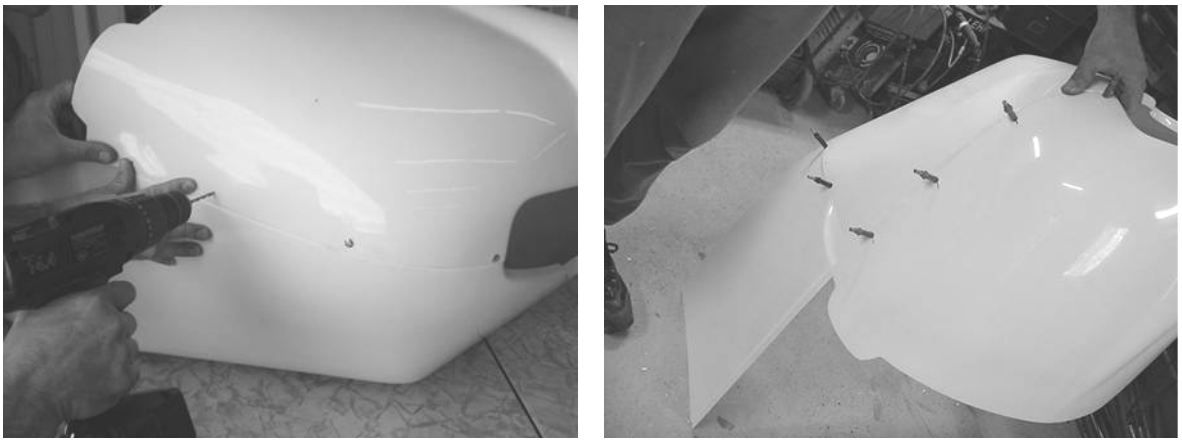

Figure 188; attaching upper front piece.

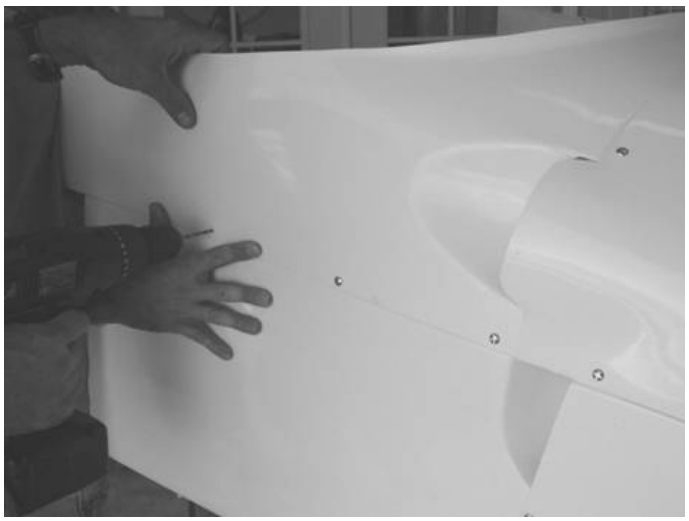

Figure 189; upper rear piece.

d) If you have your propeller hub and spinner fit these to the engine, including the prop-spacer.

Ensure the assembly is fitted with all the parts it will use when it is ready to fly, to get a realistic reference. The blades themselves can be omitted if they do not affect the position of the spinner.

On the Jabiru the spinner will need to be cut to fit around the prop. Fit the prop to the engine, with the spinner backplate on the front of the prop. Protect the prop with masking tape, and carefully shape the holes in the spinner with at least 2mm clearance from the prop. Note that the positions of the predrilled holes for the spinner to backplate bolts set the position of the spinner.

Leave fitting the captive nuts until the engine can be spun on the starter, to confirm the hole alignments.

The spinner will need finishing with filler and sand paper, followed by painting.

e) Otherwise, in the case of the standard 912 installation a wooden disc can be used as a reference.

Cut a disc the same size as your spinner if you know its diameter, or of the standard 225mm diameter for a Kiev prop spinner, from wood, MDF or similar.

Take the propeller spreader plate from the engine box and centre it on the disc. Use the plate as a drilling jig and drill 3 evenly spaced 8mm holes to locate the disc on prop flange.

Mount the disc on the propeller hub, leaving a 35mm space between the front of the prop boss and the rear of the disc, Figure 190.

The disc must be held firmly in position, perpendicular to the prop-shaft. Use spacers or nuts behind the disc to allow the securing nuts to be done up tightly.

Figure 190; using a disc to help centre the cowling.

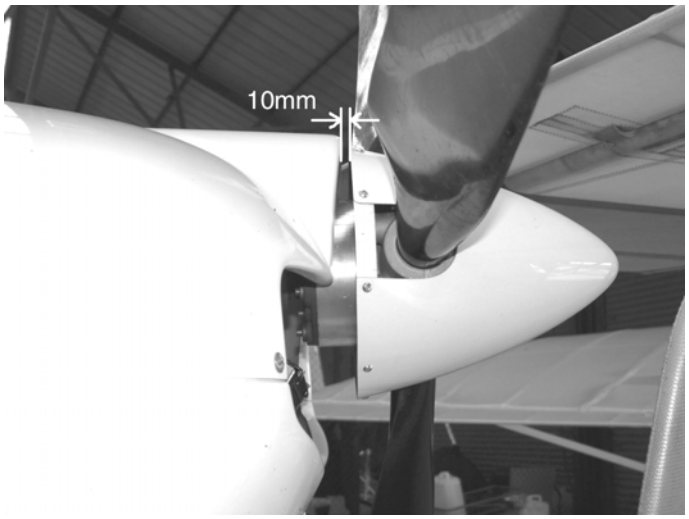

Figure 191; the finished effect.

f) Fit the cowling over the engine and airframe.

g) Position the cowling with a minimum clearance of 10mm behind the rear edge of the spinner.

> *Or for the 912 wooden disc method, pressed against the disc touching the disc at the top. This will result in the top of the front of the cowl being 35mm forwards of the engine prop-boss and leave clearance for the spinner.*

h) Support the cowling with packing materials on the engine to centre the cowling on the spinner or disc, both horizontally and vertically.

> *Foam packaging wrapped repeatedly around the hub or prop-spacer can be used to get a well-centred cowling, allowing the cut-out in the front of the cowling to fit over the packaging.*
>
> *The cowling will tend to sag a little, so it should be well supported whilst aligning it.*

i) Use spring-clamps or similar to hold the rear cowling edges in position against the cabin uprights ***tu34***.

> *Protect the cowling from marking by the clamps, using tape or similar.*

j) If the bolt holding the bottom of the cabin uprights ***tu34*** to the angle bracket forces the side of the cowling outwards, the bottom of the cabin uprights ***tu34*** should be pinched a little flatter, or the bolt changed for one with a thinner head. Alternatively a hole may be drilled in the cowling when the alignment has been finally determined to allow the bolt to pass through and help secure the cowling.

> *Note that the door hinges will increase the space available for this bolt head.*

k) If the floor prevents the cowling from fitting, or distorts the cowling when it is being fitted, the floor edges should be sanded to fit.

> *Remember to varnish them when fitting is complete, before the final fitting of the cowling.*

l) Make sure the cowling is not touching any part of the engine. If it is you must reposition the cowling.

m) Manipulate the cowlings until satisfied with the symmetry and the fit at the propeller spinner and the positions where the lower rear parts of the cowling attach to the airframe.

Spacer washers may be helpful on these attachments and those slightly further forward where the cowlings will attach to the bolts through the ends of the rudder pedal support bar.

Note that on the Jabiru the cooling ducts will need to be fitted to the engine. These can be trimmed at the front, but try to leave some clearance between the front starboard cylinder and the cowling. Also, ensure that the cowling does not sit too low for the ducts to fit beneath it: if the prop is centred in the hole in the upper cowling it should be about right. Another guide is to ensure that the lower edge of the upper cowling is no lower than 5cm below the top of the outermost cooling fin on the front starboard cylinder

n) With the final position determined, mark and drill out the holes in the lower rear cowling for the bolts holding the cabin uprights ***tu34*** to the horizontal tubes, using a 6mm drill bit, Figure 192. Secure temporarily.

o) If necessary, make small adjustments to the positions of the two rear mounting holes to achieve a nice, symmetrical cowling. Try to avoid strange distortions.

p) Once the alignment is correct, drill the holes for the bolts at the end of the rudder pedal support bar, forward of the rear mounting holes at the cabin uprights ***tu34***.

Use the tube as a guide and drill down from the top, through the fibreglass side panel.

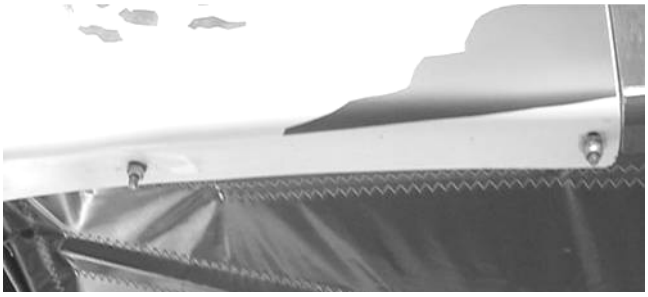

Figure 192; securing bolts at bottom of side panels.

q) Ensure that the lower ends of the cabin uprights ***tu34*** are installed in their final configurations, including floor etc., as this will affect the positions of holes drilled up the side of the cowling.

r) If door sills are to be fitted, check their fitting now as they fit between the cowling and the cabin uprights.

s) Drill holes through the cowling through the existing holes in the cabin uprights ***tu34*** .Temporarily bolt in place.

If a better bolt spacing is desired it is permissible to drill new holes through both the cabin uprights and cowling sides.

At least one more bolt or rivet should secure the top half of each side, and at least two more each side should be used on the bottom half.

If using rivets, do not rivet them yet! The cowlings may need to be removed while fitting the firewall.

t) Cut the fibreglass behind the cabin uprights ***tu34*** so that it is even with the back side of the tube. Sand to finish, but protect the tubes with plenty of tape first.

Figure 193; cut the cowl and sand flush with the cabin uprights.

u) If using 2-piece doors, position the lower door hinges between the rear cowling edges and the cabin uprights ***tu34***.

These should be fitted so that the top edge is level with the bottom of the dash board lip. The position is usually correct when the hinge rests against the top of the bolt holding the bottom of tu34.

Remember that the doors open outwards and forwards, so the hinge "bulge" needs to be on the outside when finished.

v) Mark the hole positions on the hinges through the holes in the cowling side and drill the hinges to suit.

10.2 Firewall

Note that for the Rotax 912 / 912S engine installations the main sides firewall panels are supplied pre cut, and only requiring slight trimming / filing to fit.

For the Rotax 582, Jabiru 2200 and other engines the firewall will be different, including the outline as the cowlings are positioned differently depending on the engine type. For these other engine types, a rough paper pattern is supplied. Transfer this oversize to cardboard and use this to determine the actual shape required.

A pattern for the Jabiru firewall upper part is supplied, but may need extending towards the rear depending upon the precise location of the cowlings.

The standard pattern for the main firewall part is close to that required for the Jabiru, but the holes for the lower engine mounts and lower engine mount braces will require enlarging downwards for the Jabiru.

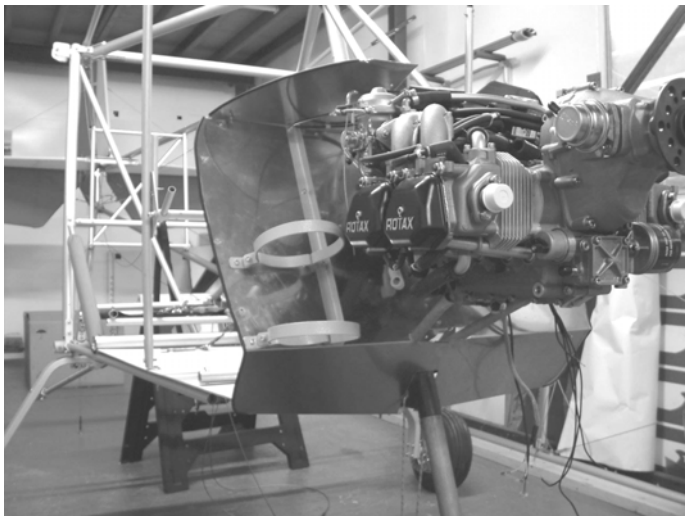

Figure 194; firewall from front, with oil tank mounts.

a) Use the paper template, supplied with the kit, to draw the shape of the lower parts of the firewall onto a piece of cardboard.

b) Use the cardboard as a template to check the fit of the firewall, before transferring the final pattern to the piece of 1mm aluminium sheet supplied with the kit.

   See below for fitting the firewall pattern before fitting the firewall material itself.

c) Cut the firewall out of the aluminium sheet using a tin snips.

   A round file and/or a flap-wheel are useful tools for shaping the firewall.

Figure 195; mark and cut out the firewall.

d) Carefully bend the firewall over the edge of your workbench, or similar, as indicated on the paper template. The main bend in the fire wall should be 75 degrees. Bend the bottom 1" at a 45 degree angle in the same direction.

Figure 196; firewall halves in position, cowl removed for clarity.

e) It may be necessary to remove at least some parts of the cowling to fit the firewall.

> *As the cowling is still relatively unsupported and flexible, take care to ensure that the firewall and cowling are positioned together properly. This will require replacing the parts of the cowling which are removed, in order to ensure that they all fit together properly. What you are trying to avoid is building in any unsightly distortions or asymmetry into the finished cowling shape.*

f) Temporarily fit the firewall to the fuselage.

The firewall halves should overlap in the middle.

Apply tape to the tubes etc. where the firewall will touch, to prevent it scratching them.

The firewall should fit snugly behind the top engine mounts, and the upper bend should be level with the bottom of the lower engine mount supports.

g) Position the firewall in front of the fibreglass angles on the cowling.

The fibreglass angles have proven awkward and may have been omitted on your cowlings. If the angles are supplied separately, they may be glued to the cowling after the firewall has been fitted.

Ideally the firewall should be tight against the fibreglass angles. However, if this causes distortions in the cowling the angles may be removed by scoring and breaking them off, and repositioned using Epoxy adhesive or fibreglass to glue and/or reinforce the angles.

If no angles are supplied, or as a better method if desired, a thin fibreglass strip (glassfibre kits are available from Halfords) may be used to secure the firewall edge to the cowling when fitting is complete. Three small bolts or rivets should be used each side through the firewall and the glassfibre to provide a mechanical link. The glassfibre will bond very securely to the glassfibre cowling.

h) Slide the firewall halves apart until they are against the fibreglass cowlings.

Refit the cowlings if they have been removed.

i) Trim any high points until a good fit is achieved.

Note that the rubber edging strip should be applied around the firewall where it touches the central tubes, so remember to allow for this when trimming the firewall to fit. Glue it on with super-glue. Edging is not required between the firewall and cowling if glassfibre and RTV sealant are going to be used to fix the firewall in place (see below).

Note that for the Rotax 582 engine a hole will be required to clear the electric starter motor, Figure 197. The hole should be covered with an aluminium cover, which can be made by cutting up an aluminium baking tray.

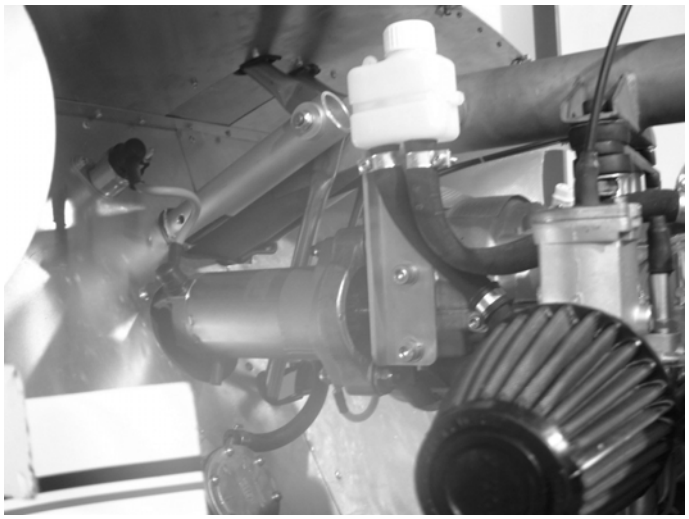

Figure 197; hole in firewall for electric starter, Rotax 582.

j) Mark the overlap of the two halves of the firewall with a marker.

k) Remove the firewall.

l) Drill holes in the overlap for rivets. Do not rivet it at this point.

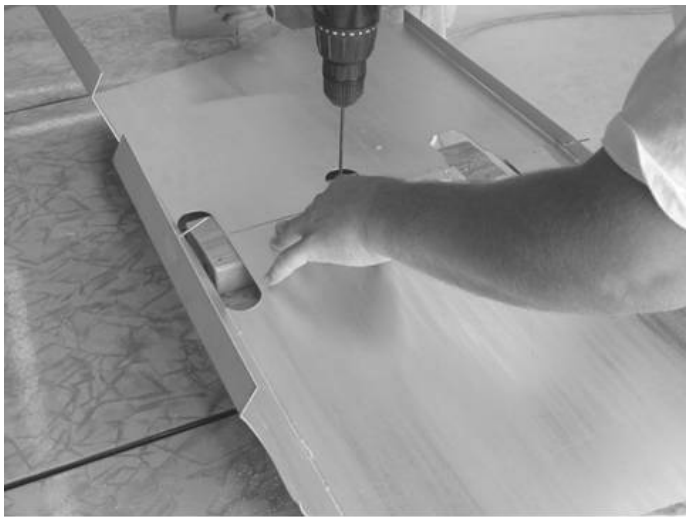

Figure 198; drilling the halves for rivets.

m) Reinstall the firewall halves on the airplane, in front of the fibreglass angles, and rivet the halves together.

n) The bottom of the firewall attaches to the two bolts protruding beneath the covering, Figure 199.

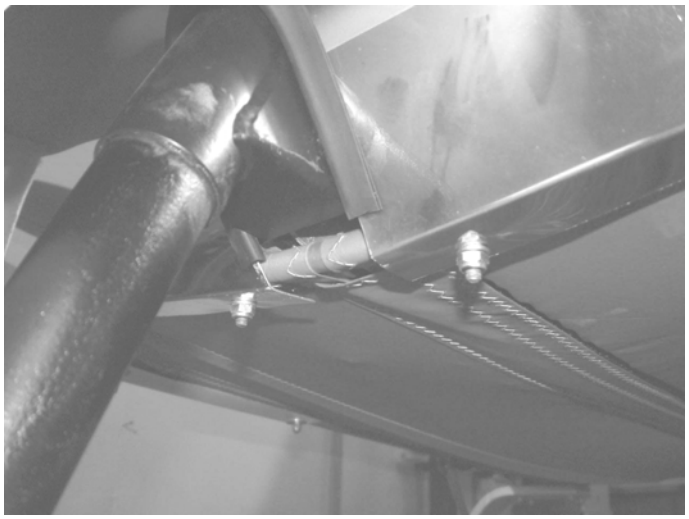

Figure 199; bottom of firewall.

o) Attach the fibreglass angles to the firewall using 4mm bolts.

As mentioned above, the angles can be relocated if they cause visible distortions in the cowling.

The angles on the port side bear some of the loads applied by the throttle cables. It is advisable to reinforce them with epoxy adhesive or similar.

p) Locate a piece of light gauge aluminium angle from the kit and cut it to the same width as the top of the firewall.

q) Attach it to the rear of the top of the firewall with five or so rivets.

The top of the angle piece should be facing to the front of the aircraft.

r) The firewall support bracket (UKMOD) should be used to brace the firewall to the engine mount immediately in front of the top of the nose-leg, Figure 200.

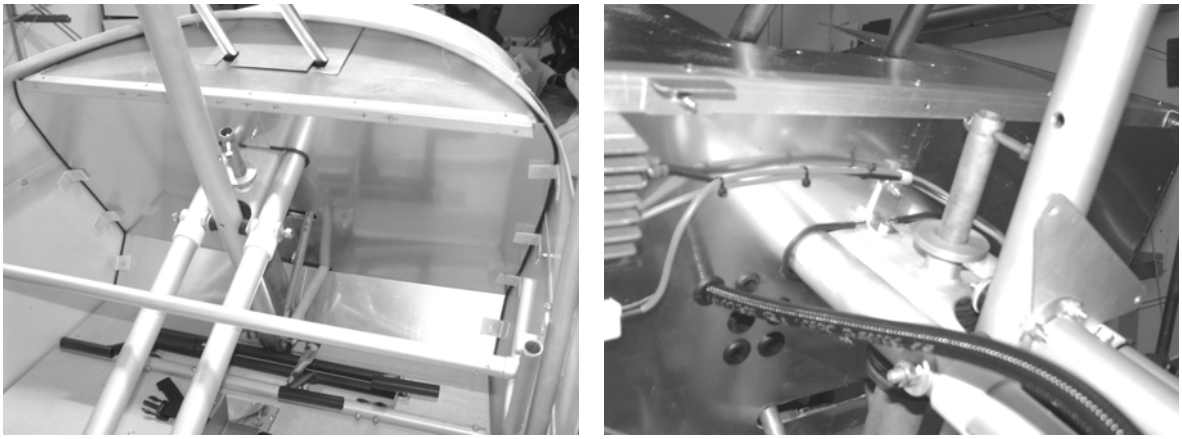

Figure 200; UKMOD firewall, brace to engine mount visible in right-hand picture.

s) The firewall on UK spec aircraft continues upwards and forwards to meet the upper cowling, Figure 200.

t) Use the template to trial fit a cardboard template, then cut out the upper part of the firewall from the aluminium sheet.

Rubber edging should also be used around the upper firewall to prevent chafing against cowling, glued on with super-glue.

u) Drill and rivet (5 rivets are adequate) the upper part of the firewall to the aluminium angle, with the front of the firewall tucked under the upper cowling.

If desired, a pair of jubilee clips can be placed on each of the engine mount braces where they pass through the upper firewall, and used to hold it up against the cowling.

v) Rivet or bolt the central covering plate to the upper firewall.

Tweak the tab on the front part to lie flat against the underside of the upper cowling.

w) Once satisfied with the fit of the upper firewall and the cowling, secure the tab at the front of the upper firewall to the cowling with a couple of small countersunk rivets, installed from the top.

x) Additional small plates should be made from the off-cuts of the aluminium sheet to cover the remaining holes in the firewall. Secure each with rivets or bolts as required.

y) For a nice finishing touch the edge of the firewall can be sealed to the cowling using high temperature RTV silicone sealant.

z) Apply a thin layer of fire resistant acoustic foam to the top surface of the upper part of the firewall, where the forward part of the dashboard will sit on it.

aa) When the aircraft is complete, apply the thicker fire resistant acoustic foam behind the firewall on the cockpit side.

This will reduce the noise and heat from the engine. A good way to fit it is to first cut it into strips.

Do not install it at this stage, as you will have to cut it away to fit other parts later.

11 Engine Ancillaries

11.1 Rotax 912

11.1.1 Standard Exhaust welding

If the aircraft has been supplied with the engine package, then the exhaust will be supplied pre manufactured for fitting in the Skyranger. If you have sourced the engine yourself and the exhaust has standard Rotax components, then you may follow the procedure below :

a) A pre-cut and welded system is available if you do not want to weld it yourself.

b) The front upper and lower parts of the cowling should be removed for fitting the exhaust, however they must be refitted to check that the exhaust maintains a good clearance from them, before the exhaust is finally welded.

c) Read the engine installation manual for advice and requirements for the fitting of the exhaust.

d) Use a bungee cord or similar to temporarily secure the muffler below the engine and insert a piece of wood 10mm thick to set the proper spacing.

The muffler is located 10mm below the oil line connection on the bottom of the crank case, and 10mm in front of/beneath the lower engine support tubes.

The exhaust outlet should be downwards, on the left side of the aircraft.

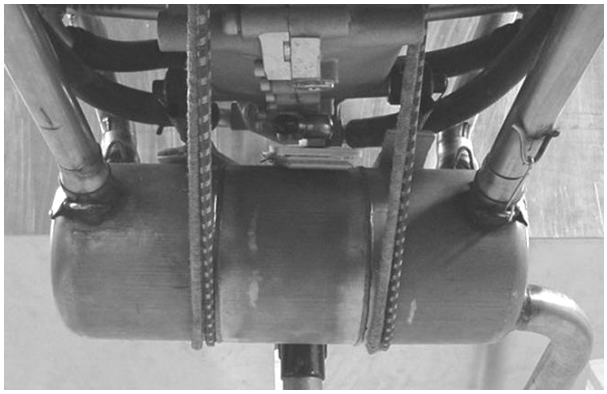

Figure 201; exhaust suspended in position, viewed from front.

e) With the muffler held in place you will be able to make measurements for the exhaust tubes.

f) Weld the exhaust pipes that come from the engine in place, taking care not to let them interfere with the radiator lines that will be installed in the future.

Use a competent welder, you need accuracy and good technique.

g) Secure the exhaust with exhaust springs.

Use string to pull the springs on, not pliers which damage the springs.

h) With the firewall and fibreglass cowling installed to position the slot in the cowling correctly you can weld the exhaust outlet onto the muffler. You may need to elongate and/or enlarge the slot to maintain a good clearance.

11.1.2 Standard Exhaust fitting

a) If you have a Rotax mild steel exhaust (rather than the Rotax stainless or optional CKT exhaust system) paint it with high temperature paint before fitting.

b) Insert the exhaust pipes into the muffler and secure with springs.

A touch of Copaslip high temperature grease should be applied to the ball joint ends of the exhaust pipes.

Use string to pull the springs on, not pliers which can scratch and severely weaken the springs.

c) Offer the exhaust up to the engine and bolt on loosely.

d) Centre the muffler side-to-side by reference to the engine mounts and the ridges on the muffler.

Note the oil line fitting is off-centre.

e) Check that the muffler is 10mm clear of the oil line connection.

f) Check that the exit pipe is 10mm clear of the cowling, trim the cowling if required.

g) Tighten up the exhaust mounting bolts.

h) If any part of the exhaust can be touched by, or get too close to, the cowling it may be protected by a piece of aluminium sheet riveted to the inside of the cowling.

Figure 202; engine viewed from starboard and port sides.

11.1.3 CKT Exhaust system fitting

The CKT exhaust is fitted in the same manner as the standard exhaust, but a couple of points should be observed:

a) Position the cabin heater jacket towards the port side, with the angled outlet towards the rear.

b) Position the exhaust itself biased towards the port side of the aircraft.

c) Use the adjustable manifold pipe on the forward starboard cylinder.

d) Adjust the exhaust pipe to point downwards and slightly rearwards, and trim the lower lip of the cowling to clear it if necessary.

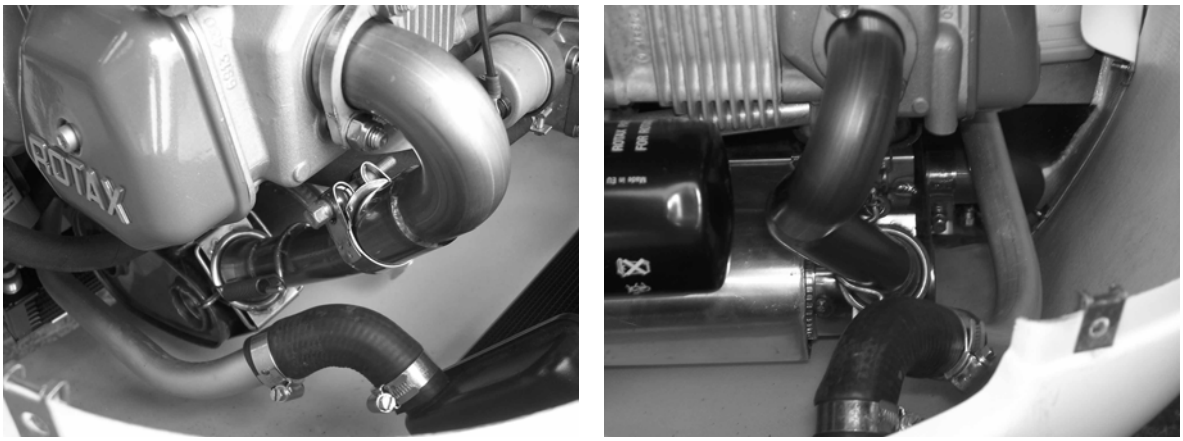

Figure 203; stainless steel exhaust with cabin heater jacket.

e) The CKT exhaust is a little wider than the standard Rotax. It is important that the placing of the oil tank, cooler and pipes does not give rise to a ‘bottleneck’ where the starboard water pipe has to pass around the edge of the exhaust can. If so it can give rise to the exhaust being positioned to port of the optimum position and can in the extreme give rise to interference between the starboard rear down pipe and one of the rubber water pipes that runs under the engine. This in turn can cause the water pipe to burn through and loss of coolant. There should be a minimum clearance between the starboard rear downpipe and the rubber water pipe of 10mm.

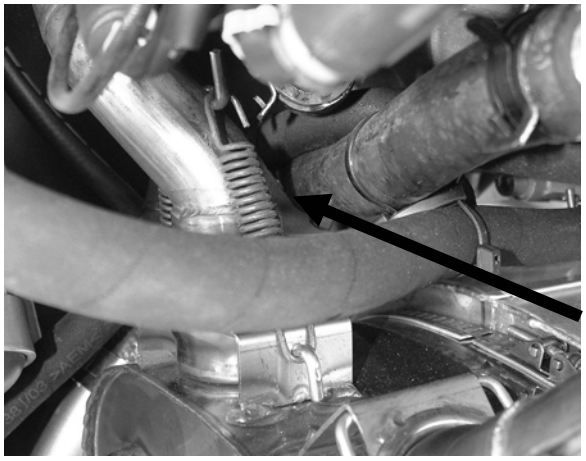

Figure 208; Exhaust / water pipe interference.

f) If this cannot be achieved without interference with the oil tank / oil cooler hoses, starboard metal water pipe, then they may require some repositioning. For maximum clearance the oil tank should be as far to starboard as possible – if necessary the 'cheek' on the cowling may need to be trimmed. The tank should sit high in the brackets. The oil cooler should be positioned far enough to starboard so that the fitting and flexible hose tucks under the corner of the oil tank. The following pictures illustrate a good installation with more than enough clearance.

Figure 209; Starboard hose CKT exhaust

g) On 912S engines fitted with the CKT exhaust it is possible for the exhaust to move slightly due to the high acceleration experienced when the engine is started or shutdown. To prevent the possibility of this causing the above problem the fitment of a spacer bracket is recommended, as illustrated in the pictures. Use one of the M10 bolts that come with the engine to secure it to the transit bracket in the box, to secure the spacer bracket to the engine. See picture below.

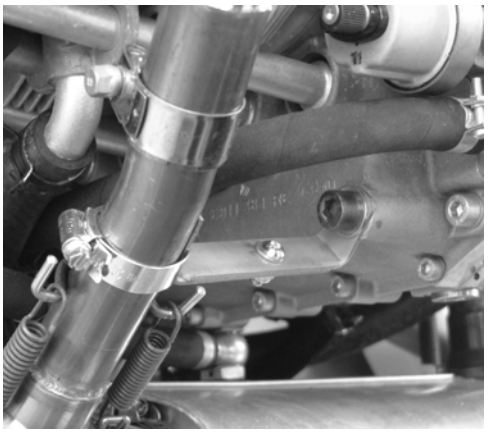

Figure 210; CKT exhaust steady.

11.1.4 Oil cooling

Note that the engine may contain some oil, be prepared for this when removing caps etc.. Ensure that all oil hoses are properly rated for use within an engine compartment.

a) Mount the oil tank on the starboard side of the firewall by a pair of clamps, Figure.

Trim the cowl lip a little to allow the oil tank to be tucked into the side of the cowling as much as possible without touching it.

The lower clamp mounts onto the firewall along the top of the fold line. A piece of aluminium angle should be mounted (and riveted or bolted) to run from the fold line up to the angle piece along the top of the firewall at the position of the bolts holding the inner ends of the two oil tank clamps. This stiffens the firewall.

Use penny washers on the bolt ends behind the firewall.

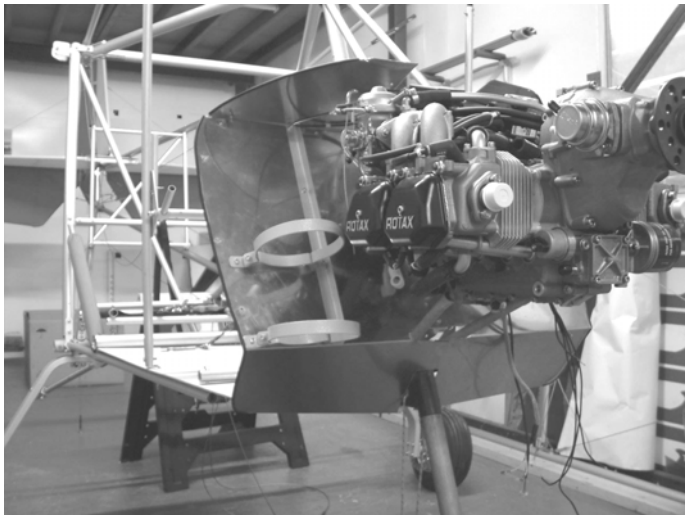

Figure 211; oil tank mount.

b) Mount the oil cooler onto the firewall at the bottom of the starboard side, Figure, using two long lower brackets and one shorter upper bracket, Figure .

Ensure that the oil pipes will not foul the oil tank or anything else where they stick upwards from the oil cooler. On the stainless steel exhaust the cooler may need to be positioned quite low and away from the centreline to keep the oil pipes clear of the oil tank and the exhaust.

Trial fit the brackets and mark the positions for the rivets.

Note that the top and bottom plates of the oil cooler do not contain oil: check that this is the case by inspection. Drill the rivet holes very carefully, using a depth stop on a pillar drill, or a very slow speed on a hand drill. Do not slip and drill into the next cross-bar down in the oil-cooler!

Rivet the brackets to the oil cooler and the firewall, using 4mm diameter steel rivets.

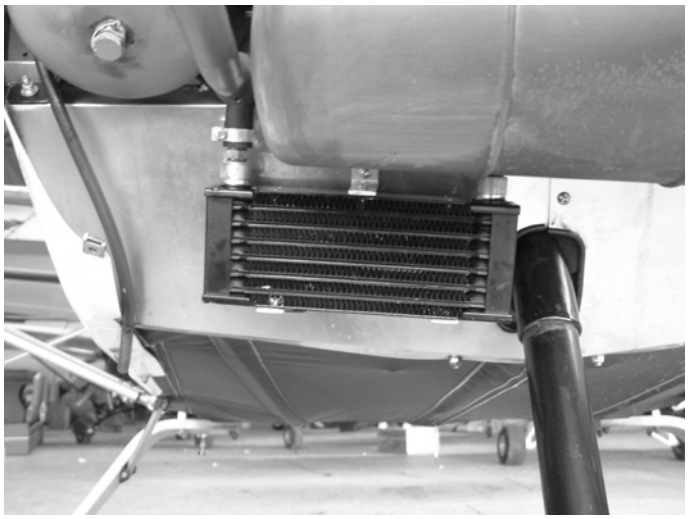

Figure 212; oil cooler position on firewall.

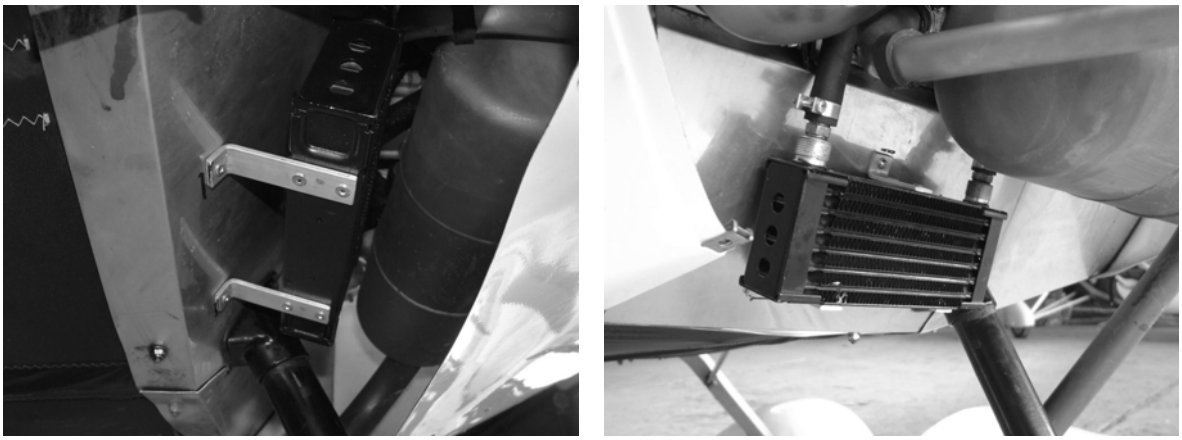

Figure 213; oil cooler lower and upper brackets.

c) Install the hose from the port side of the oil cooler to pass under the starboard cylinders to fit onto the oil pump inlet at the front of the engine.

d) Install the hose from the starboard side of the oil cooler straight up to the outlet side of the oil tank (the almost vertical one which curves over, closest to the filler cap), Figure.

Figure 214; oil pipe routing.

e) Install the hose from the sump connection beneath the engine passing beneath the lower cylinder head water pipes, but above the exhaust pipes, to connect with the inlet on the oil tank (the angled one towards the side of the tank, furthest from the filler cap).

f) Check that the oil pipes do not come close to or contact any part of the exhaust, or anything else which may chafe or otherwise affect them.

Use cable ties to secure them to the water pipes etc. when these have all been fitted.

11.1.5 Water cooling

a) The water radiator should be fitted to the lower cowl, keeping it as low as possible, Figure .

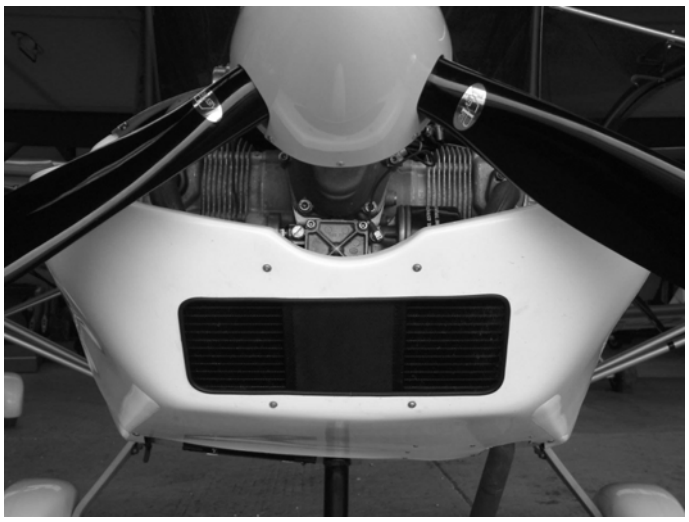

Figure 215; water radiator position.

b) The radiator is secured by four simple angle brackets, Figure . The brackets are bolted to the front of the cowling, 2 above and 2 below the radiator.

The two lower ones are fitted with the cowling bolt highest to keep the radiator low (exactly the same orientation as the upper ones in fact!).

Figure 216; radiator mounting bracket.

c) Fit the starboard water pipe assembly as shown in Figure .

The rubber elbows are supplied loosely fitted. Adjust their position by rotation and sliding the tubes in and out as required.

The rearmost bend should have even clearance between the oil tank and the exhaust, and be clear of the firewall.

An anti-chafe rubber ring is supplied fitted to the aluminium pipe. Position this as required to prevent contact with the closest structure during starting, when engine shake is at its greatest.

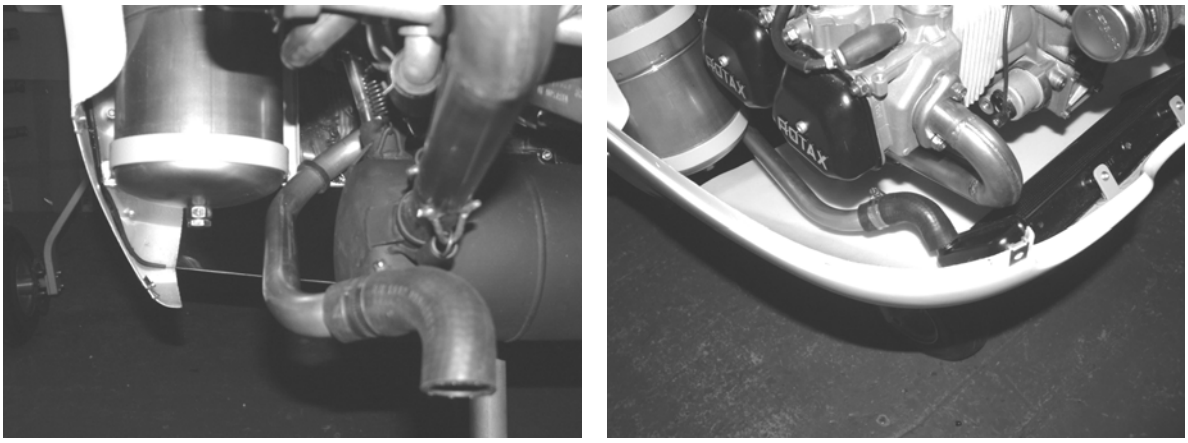

Figure 217; starboard water pipe.

d) Remove the port-side carburettor inlet manifold, Figure.

e) Remove the rubber water hoses between the expansion tank and the elbows on the port-side cylinder heads.

f) Remove the elbows from the port-side cylinder heads and swap them over between the front and rear cylinder heads.

This will change the outlet angles and allow the expansion tank to be rotated clockwise a little.

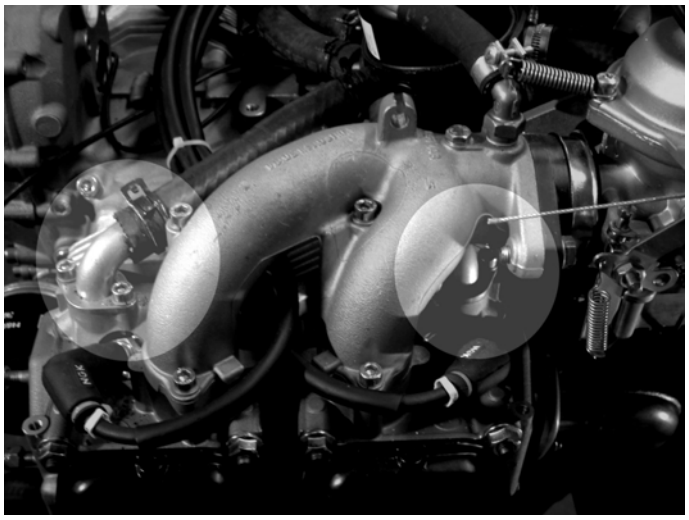

Figure 218; water pipe attachment elbows to left of, and under, inlet manifold.

g) The water temperature gauge should be installed in the front port water pipe on top of the engine, Figure.

The sensor for this is actually the CHT sensor from the front port cylinder head. Unscrew this and screw it into the water temperature fitting, using a touch of sealant on the threads.

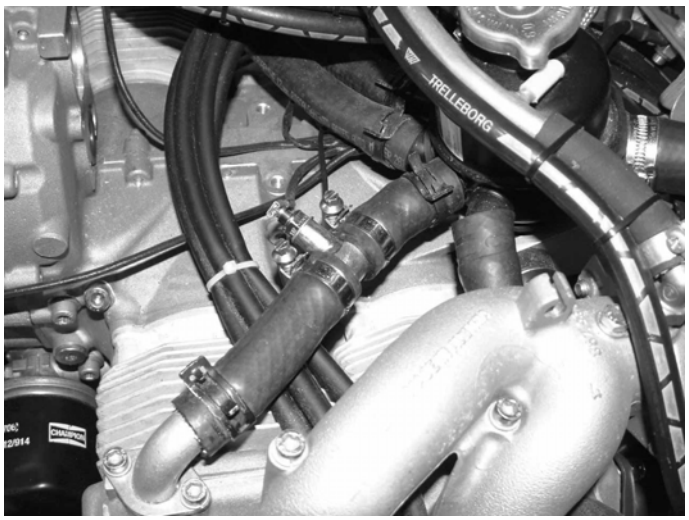

Figure 219; water temperature sensor.

h) Refit the hoses.

The hoses may have to be repositioned slightly to effect maximum rotation of the expansion tank.

i) Fit the rubber elbow on the port water pipe assembly to the expansion tank, passing between the carburettor and the upper engine mounting plate.

Trial fit the inlet manifold and carburettor to check the positioning of the rubber elbow.

The elbow may touch the engine mounting plate. In this case position an additional piece of rubber hosing to prevent wear.

j) When satisfied with the positioning, refit the manifold using a torque setting of 10Nm (1kgm, 7ftlb) on the 6mm diameter bolts.

k) The intake manifold balancing tube, crossing the engine in front of the carburettors, must be curved forward more than its standard position to allow more room for the expansion tank in its new position.

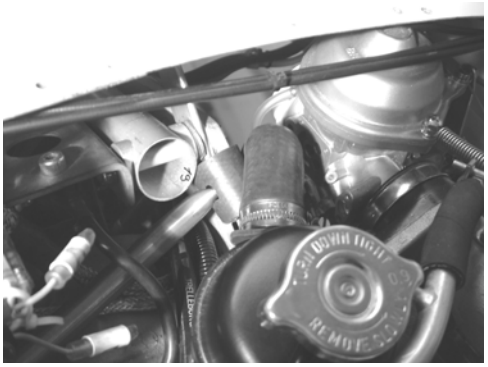

Figure 220; expansion tank and rubber elbow.

l) Fit the elbow at the front of the port water pipe assembly to the radiator.

It is supplied trimmed slightly to give maximum clearance from the exhaust. Make sure it is pushed home fully.

Before tightening the jubilee clips rotate the elbows and piping to ensure best fit/maximum clearance.

m) Be aware that the fixed pipes running underneath the engine are secured with spring clips that have sharp 'ears'. Make sure that the water pipe cannot rub against these and fret. Rotate them to move the ears out of the way if required, and stabilise the pipe in the middle of its run with a long cable-tie threaded through a small piece of fuel tubing and attached between the water hose and the fixed hoses beneath the engine.

Figure 221; port water hose.

n) The stainless steel exhaust with the optional cabin heater jacket has a slightly different port side water pipe, Figure, although it is still routed between the port carburettor and the port engine mount in the same manner as the standard water pipe.

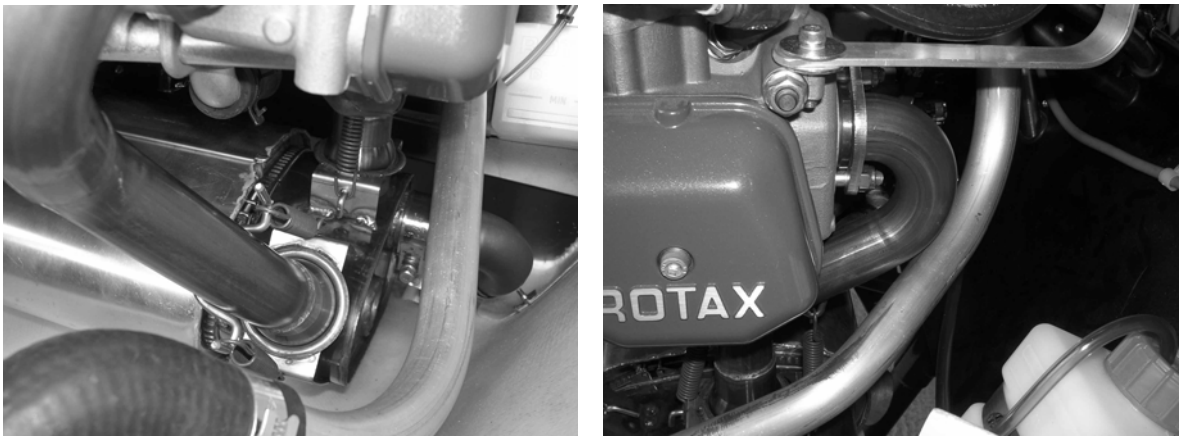

Figure 222; water pipe routing for stainless steel exhaust with optional cabin heat jacket.

o) The water overflow tank should be mounted on the port side of the firewall by bending the securing strap around the indent in the tank and securing it to the firewall with two rivets, Figure. An optional different style of overflow bottle may be supplied with integral bracket. Note that either type should have an overflow pipe through the cap. This should be routed down the side of the tank with its end expelling downwards.

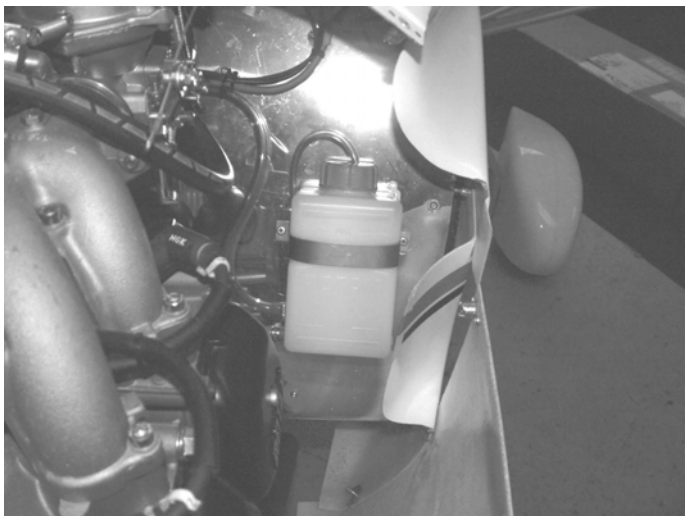

Figure 223; overflow tank.

p) Finally, check the tightness of all the jubilee clips.

11.2 Rotax 582

11.2.1 Rotary valve oil

a) Mount the reservoir above the engine, Figure and Figure.

Use a piece of angle aluminium bolted to the engine.

Secure the reservoir with a cable tie through a hole in the aluminium.

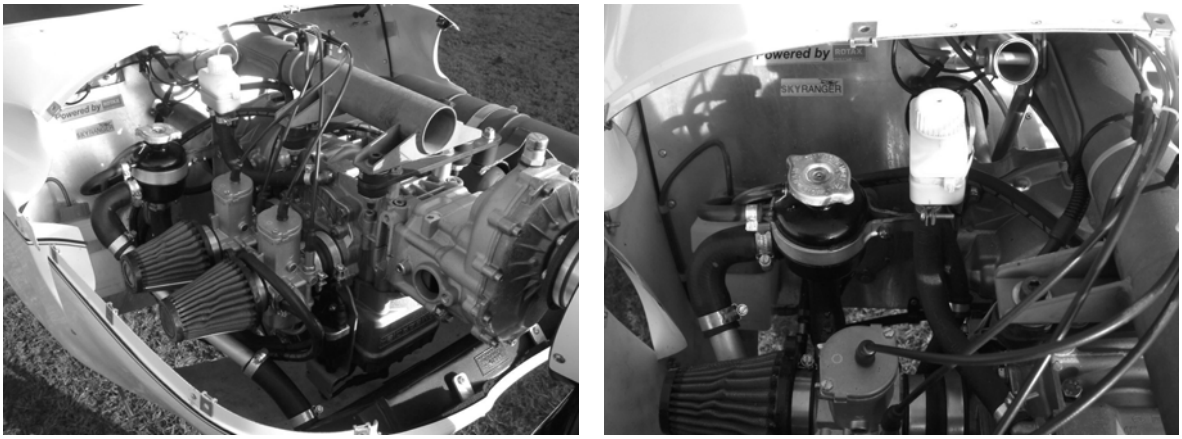

Figure 224; rotary valve oil reservoir.

11.2.2 Fuel pulse-pump

a) Mount the fuel pulse-pump on the starboard side of the firewall, Figure 225204.

The pump is spaced off the firewall.

b) Connect the pump as per the Rotax 582 Installation Manual.

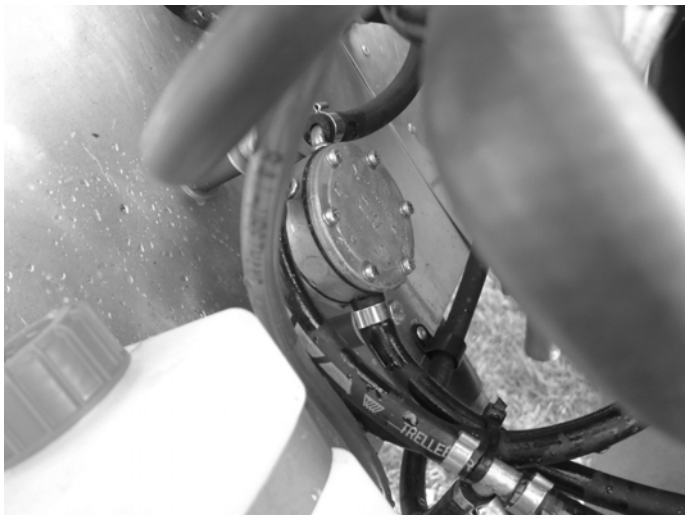

Figure 225204; fuel pump mounted on firewall.

11.2.3 Water cooling

Refer to the Rotax 582 installation manual for diagrams of the cooling system.

a) Mount the radiator on the front of the lower cowling.

The cut-out should be slightly smaller than the radiator itself.

b) Use 4 L-brackets to secure the radiator to the cowling, Figure.

These are similar to those used for the 912 radiator.

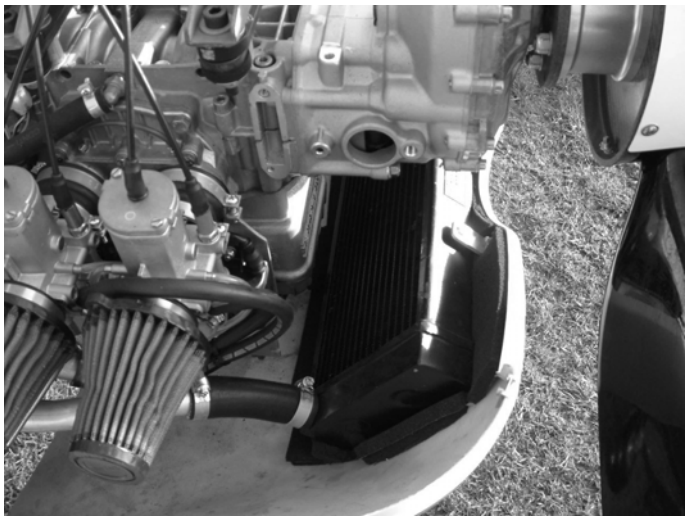

Figure 226; radiator in position.

c) Mount the overflow bottle to the firewall.

Mount it on the starboard side of the firewall so that it is not more than 250mm below the expansion tank cap.

Position the connection on the side.

The overflow bottle can be secured with an aluminium strip riveted to the wall on either side.

Make sure the small pipe from the overflow bottle cap is led overboard.

Figure 227; expansion tank and overflow bottle.

d) The expansion tank should be mounted to the same bolts as hold the rotary valve oil reservoir.

Use a piece of aluminium strip, attached to the upper bolt, Figure.

e) Connect the expansion tank to the radiator, cylinder head and water pump as shown in the Rotax installation manual.

The bottom tube from the tank goes to the cylinder head.

The large tube on the side goes to the radiator via an aluminium tube.

The next tube up on the side goes to the water pump.

The little tube on the side of the filler neck goes to the overflow bottle.

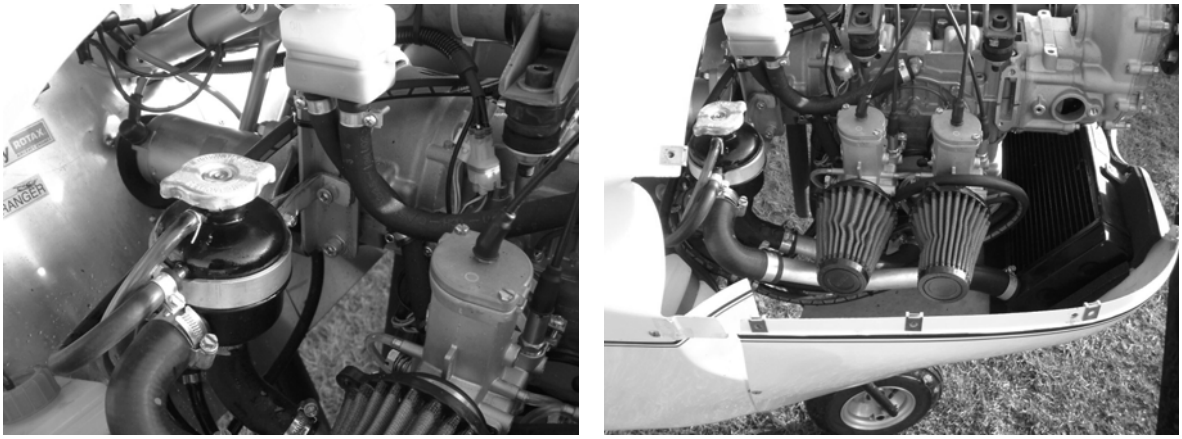

Figure 228; expansion tank and radiator starboard pipe.

f) Connect the other side of the radiator to the water pump inlet, visible in Figure on the front of the pump, opposite to the tube passing around the back of the engine.

11.2.4 Exhaust

Refer to the Rotax 582 installation manual for further details of the exhaust system installation, such as grease, springs and EGT sensors.

a) Mount the manifold to the engine, projecting horizontally.

b) Mount the curved pipe pointing rearwards, held on with exhaust springs, Figure.

Figure 229; manifold, pointing rearwards.

c) Loosely attach the after-muffler to the expansion chamber using the mounting plate and clamping bands, Figure.

The after-muffler sits immediately beneath the arms of the mounting points on the expansion box.

The outlet should point downwards.

d) Fit the expansion box to the manifold pipe, and secure the expansion box to the engine mount intermediate plates using rubber vibration mounts with washers and Nyloc nuts.

Secure all the exhaust connections with exhaust springs.

e) Arrange the exhaust so that the outlet points downwards and the exhaust is clear of surrounding structure, then tighten the mounting bands and clamps.

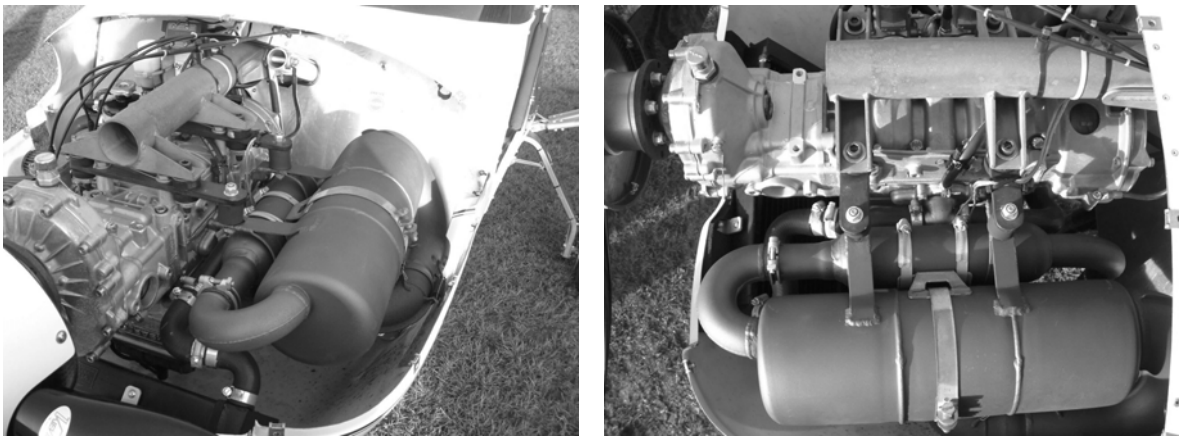

Figure 230; 582 exhaust routing.

Figure 231; connections to the expansion box.

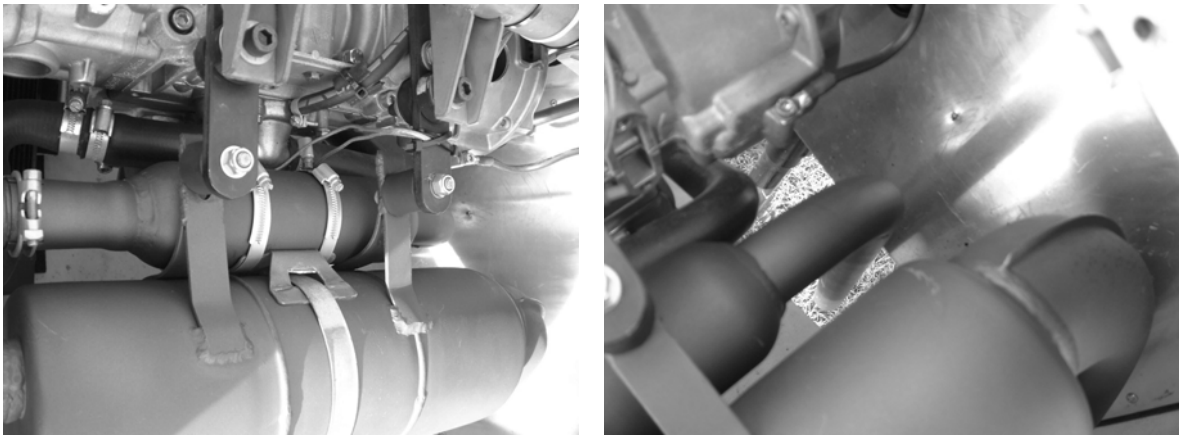

Figure 232; after-muffler and outlet pipe.

11.2.5 Air filters

a) Fit a pair of K&N air filters to the carburettors.

11.3 Jabiru 2200

Read the Jabiru supplied manuals in conjunction with this manual.

11.3.1 Cooling ducts

a) Fit the Jabiru supplied cooling ducts to the engine.

Figure 233; Jabiru 2200 with cooling ducts fitted.

b) Trim them to fit with the top cowling, leaving a gap to be bridged by the rubber strips supplied with the Jabiru.

c) Fit the coil cooling vent pipes as per the Jabiru manuals.

d) Cut a small hole in the front of the lower cowling to match the finned oil sump, Figure.

Around 100mm wide by 80mm deep is sufficient. Do not make this hole much larger, as it will adversely affect the cylinder head cooling.

e) A grill may be fitted over this hole if desired.

Figure 234; grill over oil sump air intake.

11.3.2 Air Box

a) Secure with epoxy glue or glassfibre the air outlet to the top of the Jabiru carburettor heat airbox.

This should point inboard and downwards to make an easy curve for the pipework to the carburettor itself.

Cut the hole as neatly as possible.

The airbox may be painted to improve its appearance if desired.

b) Fit the Jabiru air box to the port side of the firewall.

Get it as close to the side of the cowling as possible whilst allowing enough access to the carb heat cable fitting to connect the cable later.

Use 8 4mm bolts to hold the airbox against the firewall.

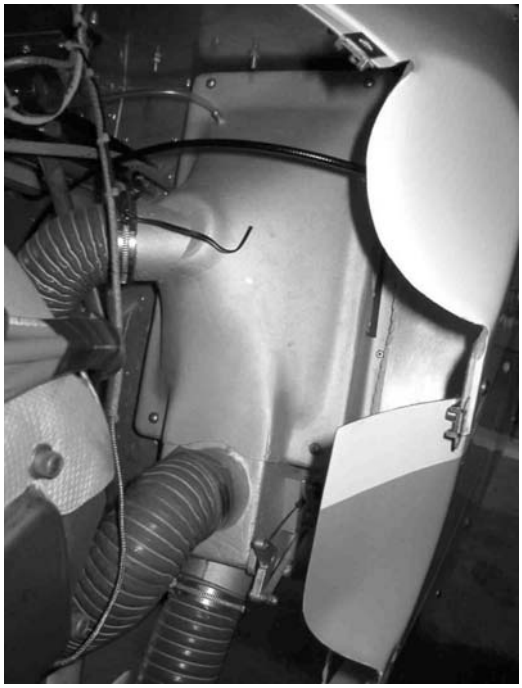

Figure 235; Jabiru air box.

c) Fit the NACA inlet duct to the port side lower cowling, Figure.

Bed the inlet onto the cowling using the RTV sealant supplied for the firewall.

Three bolts or rivets will then suffice to hold the duct in place, the number of rivets shown in the photo is very secure!

It may be necessary to build up the diameter of the pipe connection to match the supplied SCAT hose using some self-adhesive foam tape or similar.

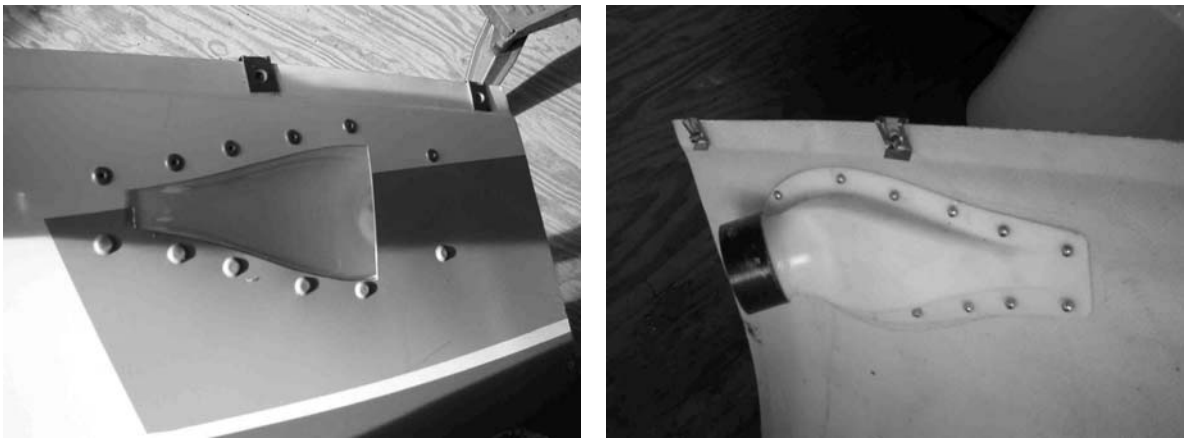

Figure 236; NACA inlet duct.

11.3.3 Fuel Overflow Vent

a) Connect the fuel overflow vent pipe to the small connection on the fuel pump.

b) Direct the pipe out of the bottom of the cowling.

11.3.4 Oil Cooler

a) Mount the oil cooler onto the firewall at the bottom of the starboard side using spacer tubes on two lower mounting bolts and riveting the upper mounting bracket as shown in Figure.

Ensure that the oil pipes will not foul the lower engine mounts or anything else where they stick upwards from the oil cooler.

Drill a hole in the oil cooler upper flange for the centrally positioned mounting bracket and rivet the bracket to the oil cooler and the firewall, using 4mm diameter steel rivets.

Trial fit the brackets and mark the positions for the rivets.

Drill the rivet holes in the bracket and firewall and trial fit the cooler.

Cut spacer tubes for the lower two mounting bolts so that they cause the cooler to stand off the firewall by around 1".

Drill holes in the firewall for the lower two bolts, note that they may have to be angled up slightly to allow access above the floor inside the cabin.

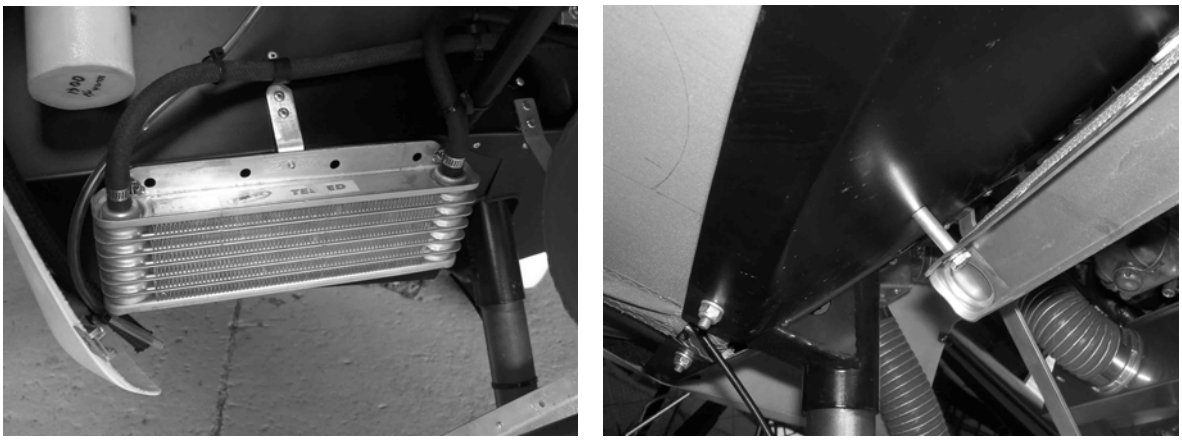

Figure 237; oil cooler mounts.

b) Fit the oil cooler adapter between the crankcase and the oil filter.

This simply screws on in the same manner as the oil filter itself, with the side with the O-ring against the smooth crankcase side.

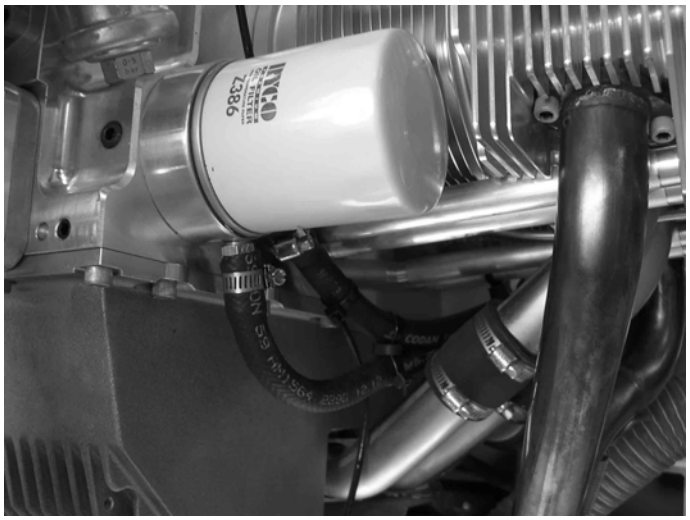

Figure 238; oil cooler adaptor between oil filter and crankcase.

c) Connect the oil cooler to the oil cooler adapter with two lengths of oil hose.

Route the hose above the intake manifolds on the port side of the engine, then down the port lower engine mount and along the firewall.

Ensure that the hoses are secured with cable ties through short pieces of fuel tube to prevent them chafing against adjacent parts of the engine and mounts.

Use P-clips to secure the oil hoses to the firewall.

11.3.5 Oil Overflow Bottle

a) Mount the oil overflow bottle clamp to the starboard side of the firewall using rivets, and secure the bottle in place with cable ties.

b) Connect the overflow pipe to the dipstick and the bottle.

c) Connect the overboard discharge pipe to the bottle and direct it out of the bottom of the cowling.

It may be secured with a cable tie through the cowling lip, along with the fuel overflow vent pipe.

Figure 239; oil reservoir bottle.

11.3.6 Exhaust

a) Fit the hot air intake to the rear of the exhaust muffler using the large Jubilee clips, with the outlet pointing rearwards and biased towards to the port side.

b) Mount the exhaust beneath the engine, secured by exhaust springs.

Orientate the outlet pipe to exit beneath the aircraft.

Interesting angles for the exhaust pipes are standard with the Jabiru exhausts!

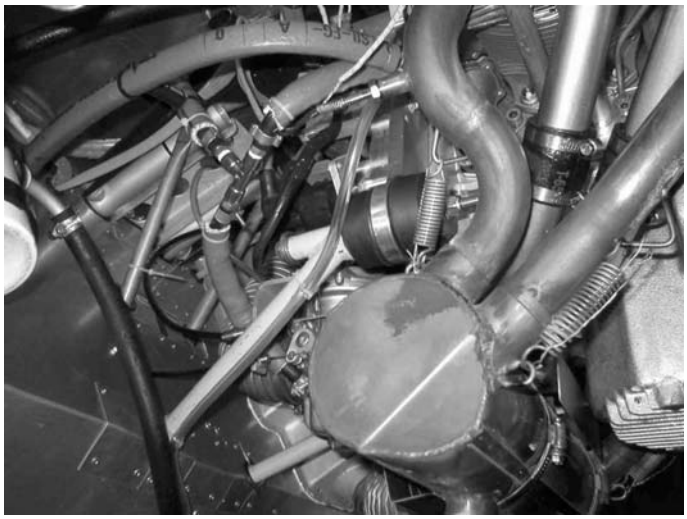

Figure 240; Jabiru exhaust beneath engine.

11.3.7 SCAT hoses

a) Connect the SCAT hose between the air box top connection and the carburettor.

Secure all SCAT hoses with Jubilee clips at both ends.

b) Connect the SCAT hose between the airbox middle connection and the hot air intake.

c) Connect the SCAT hose between the airbox bottom connection and the NACA inlet duct when the cowling is fitted.

11.3.8 Cowl Reinforcement

a) Cut out holes in the lower cowl to fit around the exhaust pipes.

Note that the Jabiru supplied pipes have an interesting offset as standard. The cutouts should be large enough to prevent any chance of contact between the cowl and the exhaust pipes.

b) Cut a length of aluminium strip to fit across the rear edge of the lower cowling to stiffen it.

c) Cut another strip to brace the first strip in the middle. Attach it to the firewall with two bolts or rivets, and to the lower cowl using a threaded clip as per the cowling join.

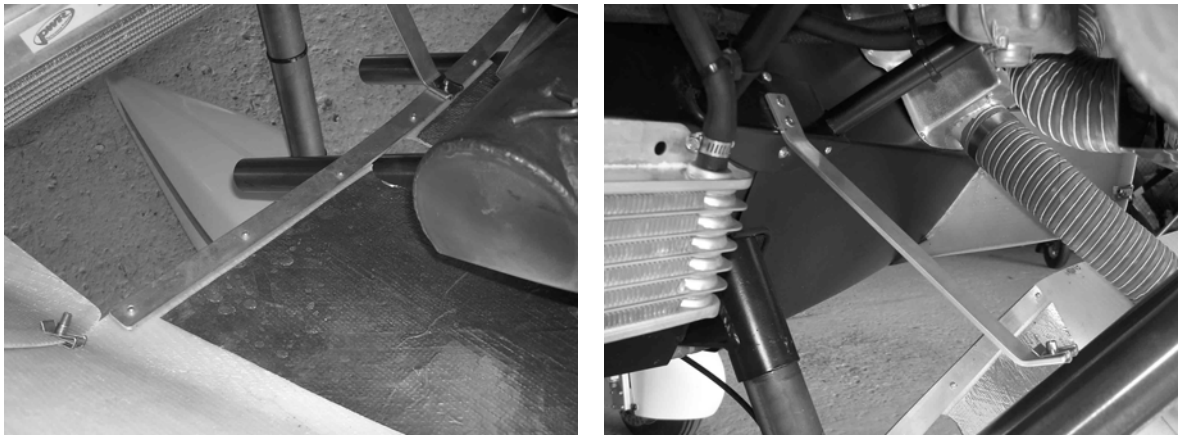

Figure 241; lower cowl rear edge bracing.

d) Fit self-adhesive reflective foil to the front and bottom of the lower cowl and to the top of the upper cowl.

This keeps the cowls cool, which prevents them distorting under air-loads when hot.

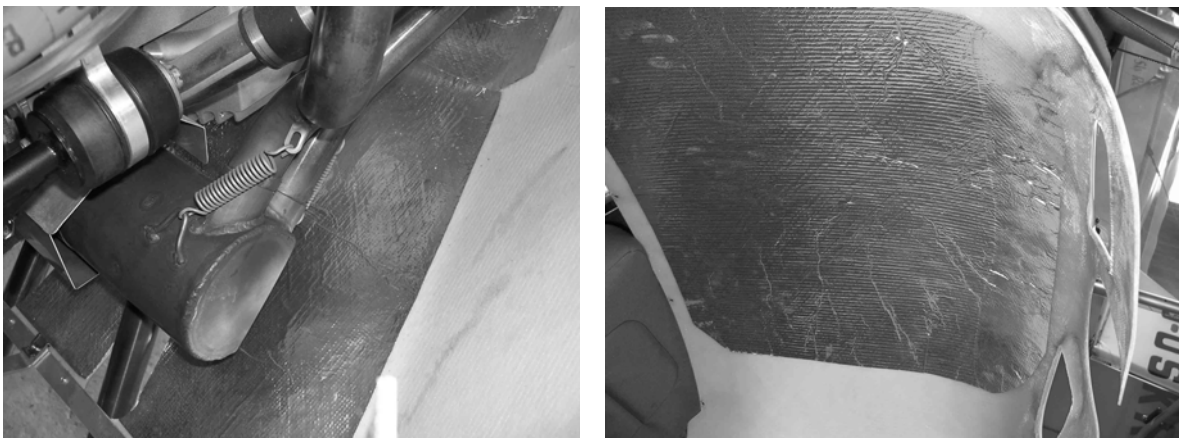

Figure 242; heat reflective foil applied to cowlings.