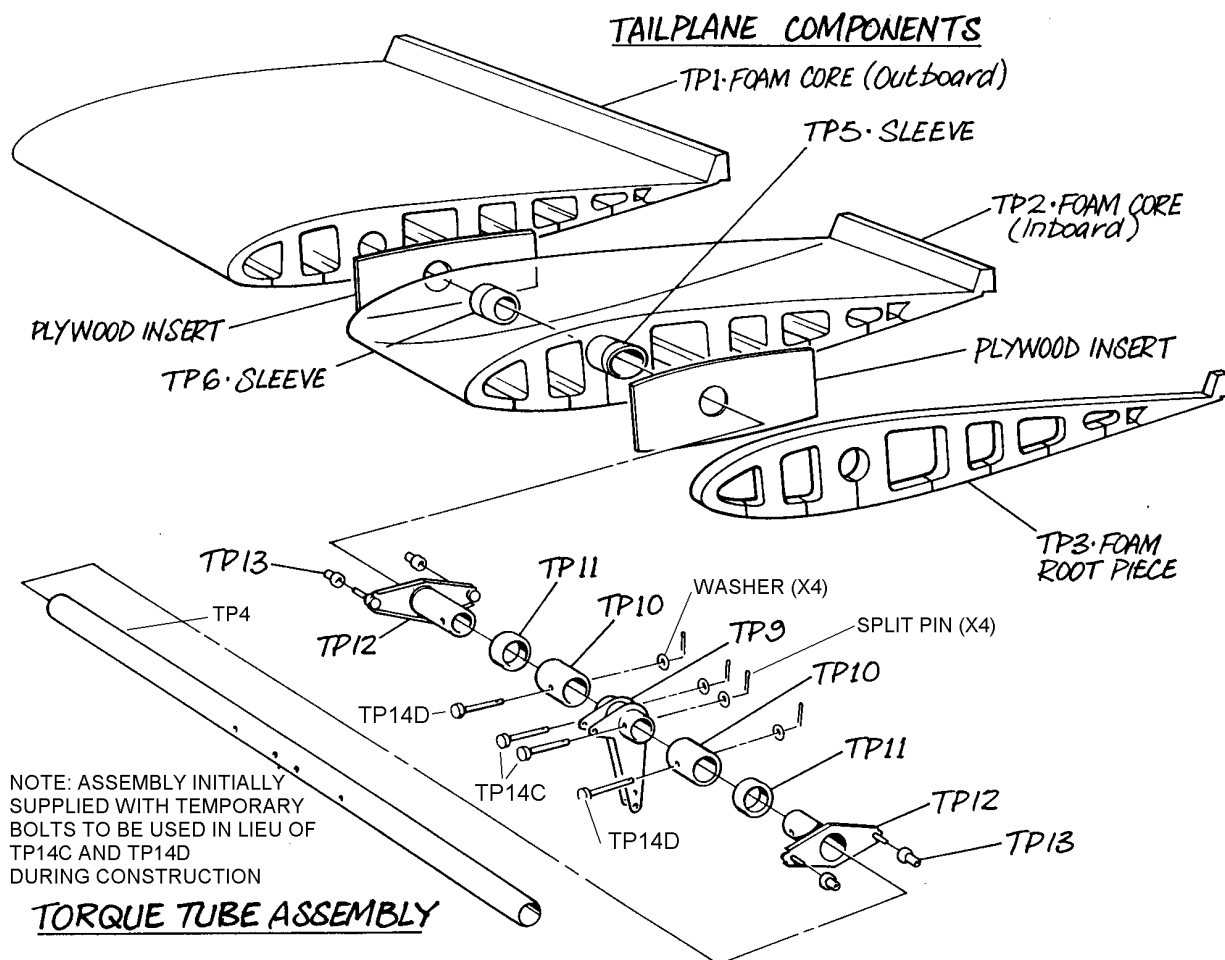


3. Tailplanes

Overview

This chapter will take you through the preparation of the tailplane foam cores, laying up the skins and ribs and removal of the anti-servo tabs before hinging them in place. You will also install the support tubes with which they are mounted onto the fuselage. The following instructions describe the building of one tailplane side but doing both together is just as easy.

The exploded view below shows the various components which make up the tailplane and its operating torque tube.





The foam core

Set your tailplane inboard and outboard foam blocks on a flat bench in its foam jig block with the undersurface uppermost (this is the surface with all the slots in it).

You'll notice that the cores are quite flexible, due to the slots in the surface so, to make them rigid, mix up some rapid epoxy and apply 2 or 3 dabs in each slot, except the rearmost one, placing the dabs about 10 cm (4") from the ends and one in the middle. You can use dry micro here if you're not in a hurry to lay up the skin. Make sure the core is sitting properly in its jig block until the epoxy has properly cured. You can leave the narrow root core "un-dabbed". Leave to cure undisturbed.

Mask each side of the slot first or you'll need to scrape away an excess from the surface. If you leave blobs proud of the surface you'll end up with bumps in the skin.

Pressure relief holes

To prevent the air in the tailplane inflating it up like a balloon when flying at altitude, or due to daily pressure variations, all the lightening holes need to be vented to atmosphere. All that is needed is a small hole through all the lightening hole walls allowing air to pass between them. To allow air to escape to the outside you will make a hole in the rear close-out rib after it has been laid up and cured right at the end of this chapter.

Using a hot piece of welding rod or similar, make a hole through all the lightening holes into the pivot hole in both inboard and outboard cores. Ensure also that the rearmost cavity of the outboard core is vented. Make sure that the vent holes into the pivot hole are in a place where they won't be covered by the TP5 and TP6 pivot tubes later, so aim your welding rod to be at least 5cm (2") from a chord-wise cut line.

Tailplane tip

Put the inboard (TP2) and narrow root (TP3) cores aside for now and with the outboard (TP1) core removed from the jig block, hacksaw off about 10cm (4") of the jig block 'tip'. You will need to chop off the same amount from the other jig block so you may as well do this now.

The outboard core can now be replaced in the jig block with approximately 10cm (4") of foam overhanging to ease making the tip shape. (Ref. figure 2).

Shaping the tip

Step 1

Using a fine felt tip pen, mark a line on the outboard core 5.5cm (2 3/16") from the tip and then apply masking tape along the inboard edge of the line to highlight it. Do this on both sides.

Step 2

The tip shape, in plan view, will be the same as half the tailplane's aerofoil section at the masked line and figure 1 gives all the co-ordinates to be plotted for this shape. Plot these points directly onto the foam core, or make a template from card, then 'join the dots'. Mark both top and bottom surfaces the same, then using a hacksaw blade cut the tip shape, keeping the blade as square as possible to the core. See figure 1.

Co-ordinates for tip shape.

mm along chord from L.E.	mm from masked line
0	0.0
10	12.5
20	19.0
30	23.0
40	26.5
50	29.5
100	40.0
150	46.5
200	51.0
250	52.0
300	51.0
350	47.5
400	42.0
450	37.0
500	31.0
550	26.5
T E	0.0

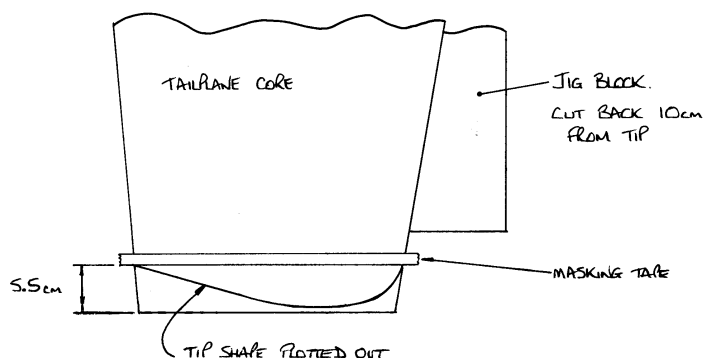


Fig 1. Plan view of tailplane tip.

Step 3

Ensuring that the core is positioned snugly in its jig block, mark a line on the tip end from the leading edge to the trailing edge, equidistant between the top and bottom surfaces. This line will give you a useful reference when shaping the tip.

Step 4

Remove the lightening hole cores and cut short pieces from them to blank off the tip. Make these foam plugs about 5cm (2") long except the one nearest the trailing edge which needs to be about 10cm (4") long. Do not throw the remaining pieces away, save them for use later. Apply small blobs of rapid epoxy to the fatter end of each plug and push them back inside until they poke out a bit from the tip. Avoid getting epoxy at the tip end as this could create problems when shaping the tip. See fig2A. Allow them to cure then sand each plug off flush. Now, using a sanding spline and 40 grit paper, shape the tip to form a radius between the masking tape line and the chord centre line. See figure 2B. Leave the trailing edge block area for now, this will be removed at the glassing up stage. Repeat the process on the other side and you should end up with a pleasing tip shape.

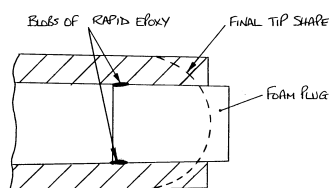


Fig 2A. Section through lightening hole.

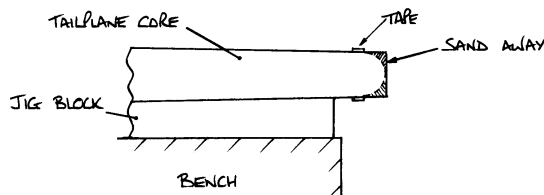


Fig 2B. View looking at leading edge.



The outboard rib

Put the outboard core somewhere safe and replace it in the jig block with the smaller, inboard core TP2.

Step 1

Mark a line 25mm (1") from the outboard edge starting from the 'forward face' of that funny shaped hole nearest to the trailing edge, all around the leading edge and back to the opposite point on the other surface. See figure 3.

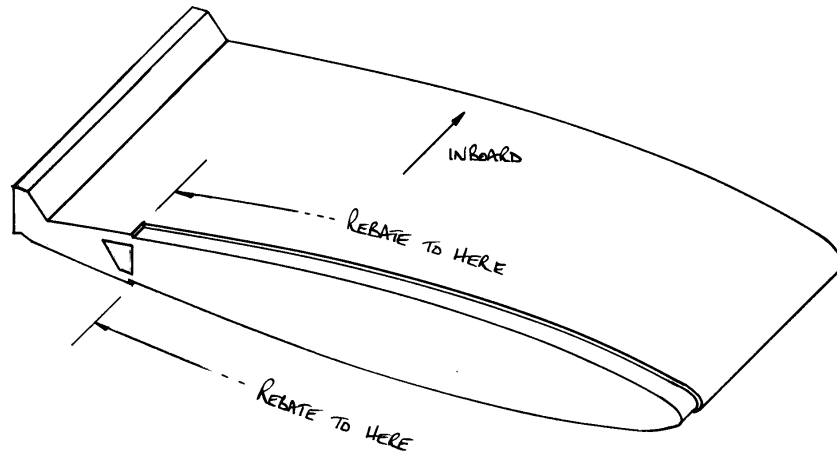


Fig 3. Tailplane inboard core TP2.

Carefully sand a rebate down about 2mm (3/32") to allow for 4 plies of 'bid' which will go here.

Hint: Use two mixing sticks, one as a feeler gauge to check for the correct depth. See figure 4.

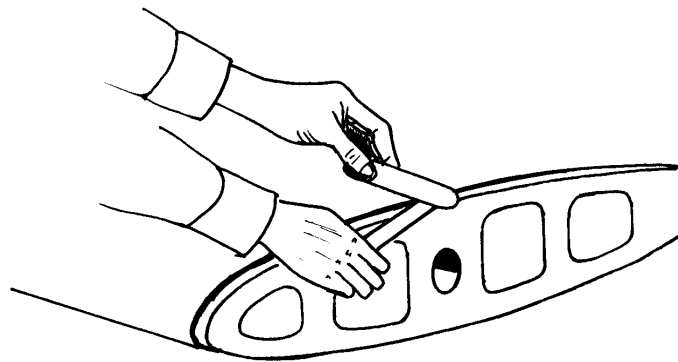


Fig 4. Using mixing stick as depth gauge.

Then sand the rebated corner only with a radius of about 5 or 6mm (1/4") (see figure 5). This will help the cloth go around the corner during laying up.

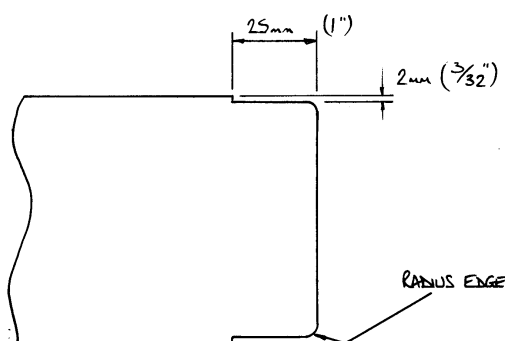


Fig 5. Outboard end of TP2.

Step 2

Seal the lightening holes at both ends, as you did at the tip, except for the round hole and the rearmost oddly shaped hole, sanding them flush as required. As the holes are tapered do the outboard rib face first.

Step 3

Find the short support tubes TP5 and TP6 (one each per side of the torque tube assembly) and roughen their outside surfaces with 40 grit paper and cut shallow grooves in them with a hacksaw blade, to act as a key for adhesive. Remove the cylinder of foam from the core, spread rapid epoxy around the outsides of the support tubes and position them into the inboard core as shown in figure 6.

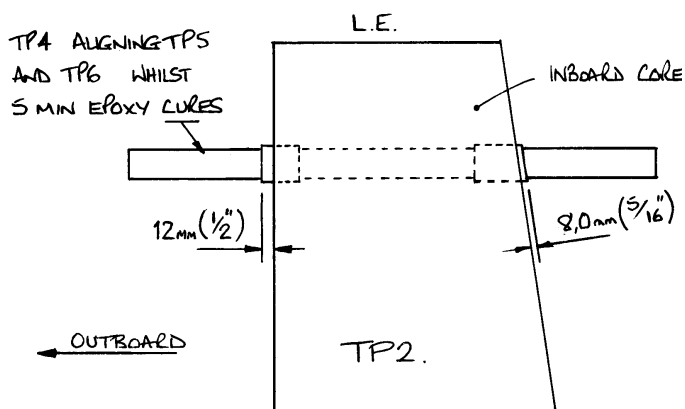


Fig 6. Locations of support tubes TP5 and TP6.

Note: The TP14C and TP14D pins are a light interference fit in their holes. It is important, when working on the torque tube assembly, that this interference fit is retained. Therefore the assembly is initially supplied with temporary 3/8" bolts, which are slightly smaller in diameter than the pins, and these temporary bolts should be used for all construction operations until you need to finally assemble all the parts together. Cut the threads off the bolts leaving the plain diameter, and chamfer the ends for easy insertion.

Position TP5 8mm (5/16") proud of the foam face and ensure that the angle on the tube matches the angled foam face. This can be done by eyeball.



TP6 should be positioned to protrude 12mm (1/2") from the core surface. Run TP4 all the way through the support tubes as in figure 5 to align them with each other during cure. Take care not to get adhesive on your TP4 tube. Glueing the tubes together will not make your day!

You can remove TP4 when the epoxy has well and truly cured.

Using your knife, cut a triangular trough in the foam all around the TP6 tube to be about 6mm (1/4") deep and wide for a floc corner.

Step 4

Take your four 20cm x 13cm (8" x 5") pieces of 4mm plywood and mark the centre points of each piece then, using a 44mm (1 3/4") hole-saw, cut a hole to allow the TP5 and TP6 tubes through with a little clearance. Trim the width of *one of these pieces per side* to follow the tailplane profile along the rebate line then radius these sides but chamfer the ends (see figure 7).

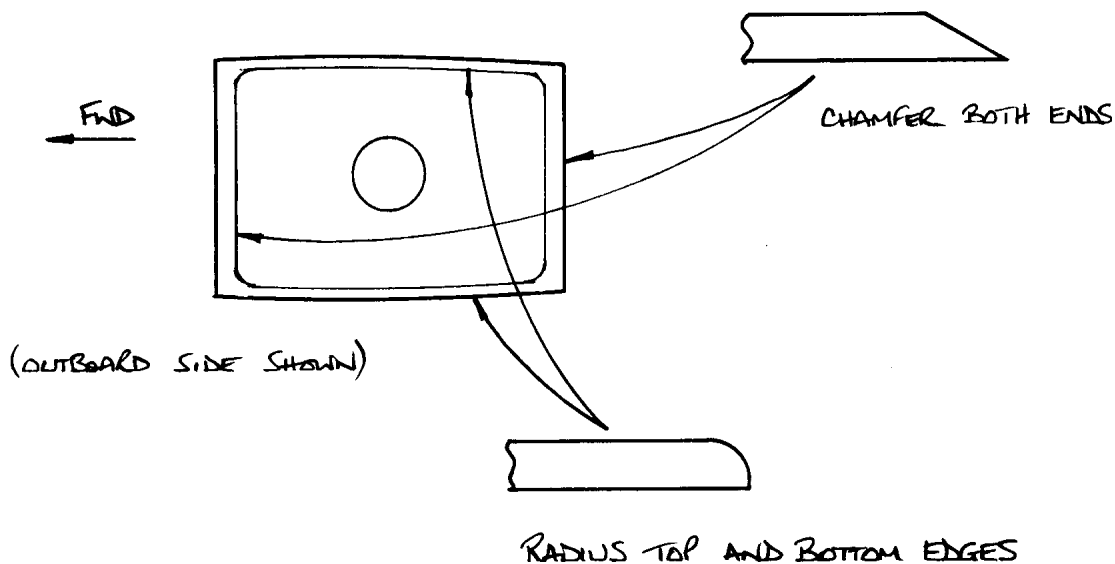


Fig 7. Edge shapes of plywood reinforcement.

These TP7's should now match the profile of the foam core with its 2mm rebate. There should be a small clearance (about 2mm) between the tube and hole.

It is an idea to mark the orientation on these pieces for reference after you have put them down and had a quick cup of coffee. They will be handed so make sure you do one for starboard and one for port.

Laying up the outboard rib

Before we start this layup it is important to get the foam core prepared and positioned to make life easier later on.

This layup will cover the outboard face of TP2 and run onto the rebated area so it's not a bad idea to mask the foam surface next to the rebate with sheets of paper to prevent epoxy drops sticking to it. To ensure that the TP6 tube is not disturbed from its alignment with TP5 during layup or cure install the TP4 torque tube making sure this too is properly masked and the gap between it and TP6 is sealed to prevent epoxy getting in.

Cut 8 pieces of 'bid' at $\pm 45^\circ$, 70cm x 15cm (28" x 6"), four plies are used on each tailplane, and cut some strips of peel ply also.

Stand the core on its end to ease working on the rib layup using the foam core from the root end or a couple of pieces of wood to keep the TP5 tube clear of the table. (See figure 8.)

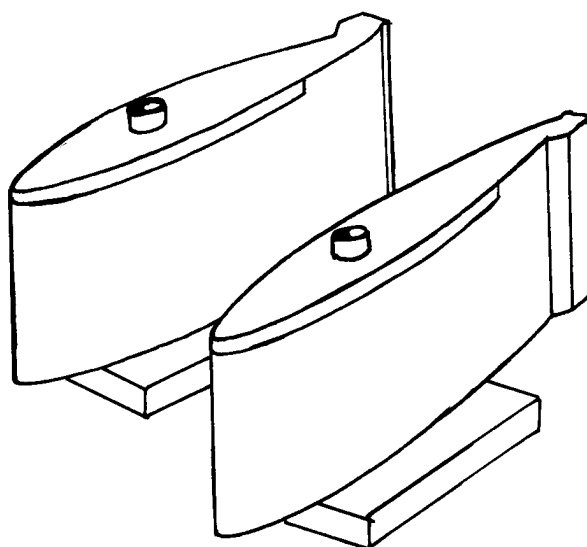


Fig 8. Cores stood on end to ease access.

Step 1

Mix up some dry micro and fill any gaps around the lightening hole plugs and any dents in the core then squeegee the entire layup area with micro slurry.

Fill the trough around the TP6 tube with flox then layup two plies of 'bid' at $\pm 45^\circ$, wetting out each in turn and scissor trimming the cloth to butt the step in the rebate (see figure 9). It doesn't matter if the cloth is slightly short of the rebate in places but it *must not be too long and be proud of the tailplane surface*. Take the cloth aft as far as the rear of the rebate on the edge as well.

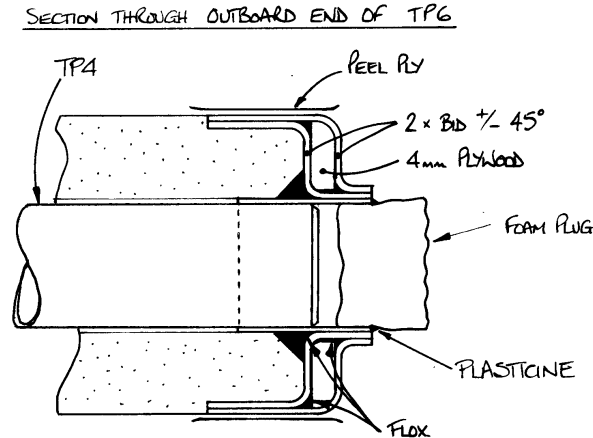


Figure 9. Section through outboard end of TP2.

Cut a cross in the cloth at the point where the TP6 tube wants to poke through, laying the flaps onto the tube's sides.

Step 2

Next mix some wet floc and coat the plywood reinforcement on both sides. Place onto the two plies of 'bid', removing any excess that oozes out, but making sure that there are no gaps between the plywood and layup, then lay 2 plies of 'bid' at $\pm 45^\circ$ over the plywood and up to or just short of the rebate as before.

Step 3

Apply the peel ply strips onto the flanges of the rib and over the areas between the lightening hole plugs to ease preparation for subsequent bonding (see figure 10) and allow to cure.

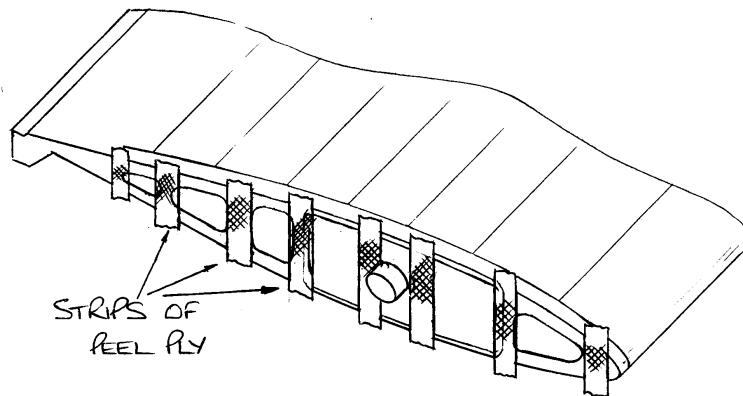


Fig 10. Peel ply added in preparation for bonding later.

Outboard rib layup summary

2 plies 'bid' +/-45°
4mm plywood (flox each side)
2 plies 'bid' +/-45°

Step 4

When the layup has cured completely, remove the peel ply and masking tape. Remove TP4 and make sure any epoxy is cleaned out of the TP6 tube carefully with a scraper, but don't try and use a solvent, it won't dissolve cured epoxy but it will the foam.

IMPORTANT: *Before bonding the outboard and inboard cores together the outboard rib should be inspected and signed off. This is a requirement in the UK.*

Joining the cores together

You will need the outboard core TP1 and the large upper jig block in this operation. The lightening holes are not required to be plugged so their cores may be discarded, except for the trailing edge one, which will be used after removal of the anti servo tab.

Step 1

Enlarge the circular hole in the outboard core, if necessary, to allow TP6 to enter and, laying them in the jig block with the slots uppermost, push the two cores together.

Mark the outboard core where the plywood rib reinforcement is and sand the foam away here until the cores fit snugly together. There will be a gap at the trailing edge where there is no glasscloth.

Hint: *Use a hacksaw blade or something similar as a straight edge across the rebate you are sanding to help you see how much you have sanded away.*

Mask the rib flanges with tape. It's a good idea also to lay a strip of thin polythene in the jig block where the cores will join to stop any stray micro from gluing your cores to the jig during this next step.

Make sure you have some weights available; 1 - 2kg. sand bags are ideal.

Step 2

Mix up about 25g of epoxy and use this to make some not too wet micro, it should not slump or be too dry.

Apply the micro in blobs to the outboard core on the ribs between the lightening holes, but don't put any too near the outside edges to help stop any oozing out.

Squeeze the cores together in the jig block keeping pressure applied until the micro has squidged down. The cores are only being bonded together at this stage. Don't fill the troughs and gaps now, these will be filled when you do the skin layups.

Check along the leading edge and trailing edge for straightness and apply weights to correct any misalignment and to hold the cores in place.

Wipe away any micro which oozes out the top and allow to cure completely.

First skin layup (bottom surface) preparation

Prepare the tailplane core by attaching the 35mm foam root piece TP3 with rapid epoxy blobs and sand any nib off the leading edge. If any of the glue is proud of the surface, don't try to sand it down, but carefully depress it.

Apply a single strip of peel ply to the core (you could use thin double-sided tape) positioned as in figures 11 and 12, so that one edge almost covers the slot. This will help prevent epoxy building up in the slot and also prepares the laminate for the trailing edge spar layup later. Trim the peel ply's width, if necessary, so that it doesn't extend further forward than the vertical face of the spanwise hole.

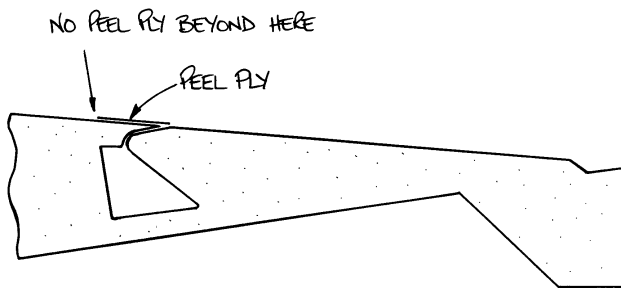


Fig 11. Scrap section through tailplane and anti-servo tab.

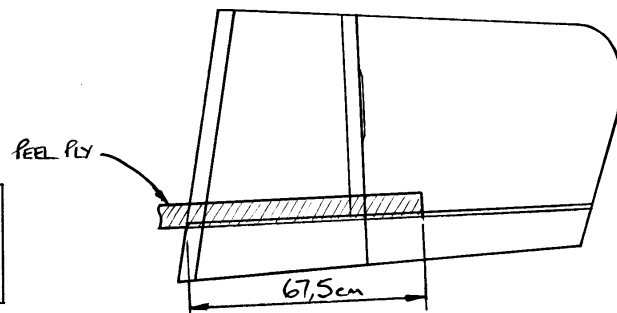


Fig 12. Tailplane underside.

Also attach peel ply, with double sided tape, to the trailing edge groove and to the edge of TP3 foam, making sure it doesn't encroach onto the foam core TP2. See figures 13 & 14.

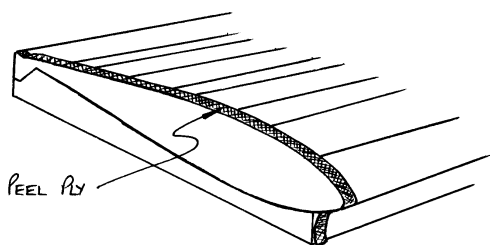


Fig 13. Peel ply cover TP3 foam piece.

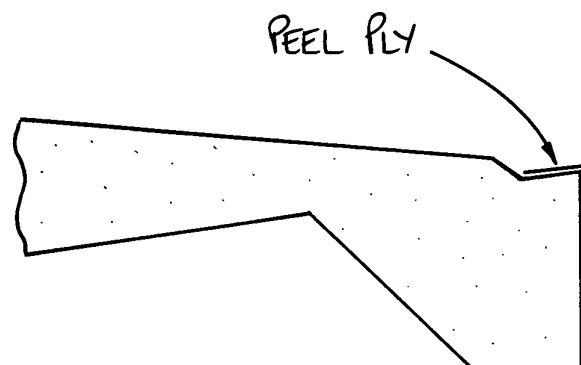


Fig 14. Peel ply in trailing edge joggle.

To give you a reference to trim to during the layup, stick a strip of masking tape 2 - 3cm back from the leading edge on the underside, full span as in figure 15.

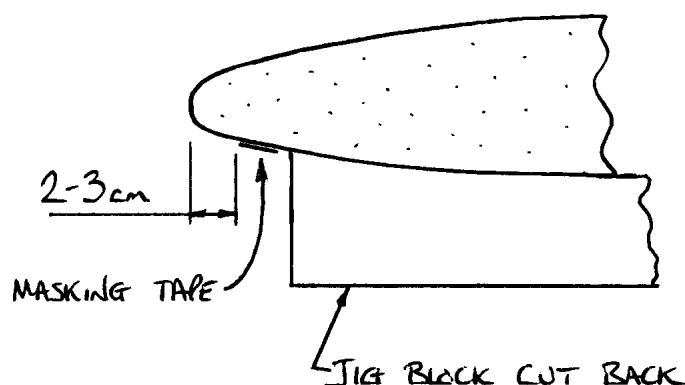


Fig 15. Masking tape marker for trimming L.E. cloth.

Saw off about 5cm of the jig block leading edge so that you can see the masking tape. Your foam cores should fit perfectly in the jig block, but if there is any discrepancy first make sure that you are using a flat bench.

The cores were cut on a flat surface, but if some distortion is apparent, more than likely due to internal stresses in the foam, weight down then glue the jig to the bench with small blobs of rapid epoxy and also glue the core to the jig. You will end up with small chunks of foam torn out of your core, but these can be easily repaired come the next layup. If you have to glue the jig to the bench make sure that it is positioned such that it allows you to work on the underside of the leading edge and that you can reach all around the core for scissor trimming during layup.

Finally cut 2 full width lengths of 'uni' 150cm (60") long (2 plies per tailplane) and get yourself ready for the goopy bit.

First skin layup

Step 1

Mix up some dry micro to block up the slots and fill any dents. Also block up the gap at the rib joint area. There is no need to fill the slots up, just squeegee enough in to make a smooth surface, then micro slurry the whole uppermost surface around to the leading edge masking tape, but do not get micro on the peel ply tapes or the glass rib.

Now mix some flox, not so runny that it slumps, and fill the trough of the rib. If the flox is too wet it will be easily disturbed and you will end up with a dent in your tailplane surface which will cause a strength loss and need filling later. If you have trouble smoothing the flox down try laying a piece of kitchen film over it, smooth it down with your squeegee then carefully remove the film to end up with a perfect surface.

Brush the whole foam surface with epoxy, avoiding any areas of flox or micro.

Step 2

Using the core glue line as a 0° reference, lay the first ply of 'uni' at 30° to it (see figure 16). You will find the cloth is not wide enough to cover the whole surface so scissor trim the excess off and use the triangular shaped 'scrap'. You may find it easiest to position the cloth so that the 'scrap' piece is laid at the root end for both plies as shown.

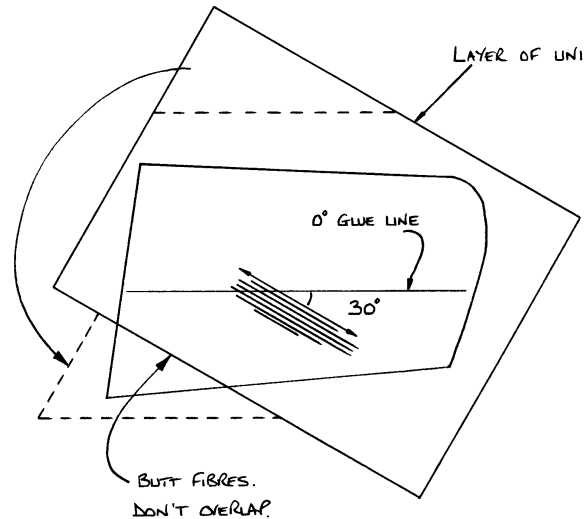


Fig 16. Arrangement of cloth for skin layup (first ply).

Butt the 'scrap' piece to the main ply, do not overlap, and trim all around so there is about a 1cm overhang at the root and trailing edge. Wrap the leading edge around and scissor trim to just short of the masking tape line. The tip needs to be trimmed to about 2cm beyond the chord centre line.

Squeegee this ply until properly wetted out taking care not to depress the floc in the area over the rib.

Step 3

Lay the next ply of 'uni' to cross the first, 30° the other way to the 0° reference, butting the 'scrap' piece to it to cover the whole surface. Wet out and trim as before and then finally add strips of peel ply to cover the trimmed ends of the leading edge and tip and butt joints in the top ply.

Also lay a strip of peel ply on the trailing edge side of the rearmost slot running from the root to where the peel ply ends under the laminate. See figure 17.

Allow to cure, knife trimming the root and trailing edge when appropriate.

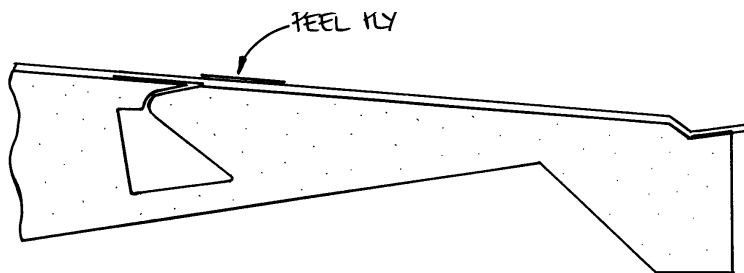


Fig 17. Section of anti-servo tab showing peel ply location

First skin layup summary

- 1 ply 'uni' 30° to glue line
- 1 ply 'uni' 30° other way to glue line

Second skin layup (top surface)

Preparation

Remove the peel ply from the external surfaces and trim the tip trailing edge as in figure 18.

If you are doing both tailplanes together you can now simply swap their jig blocks when turning them over as the aerofoil sections are symmetrical.

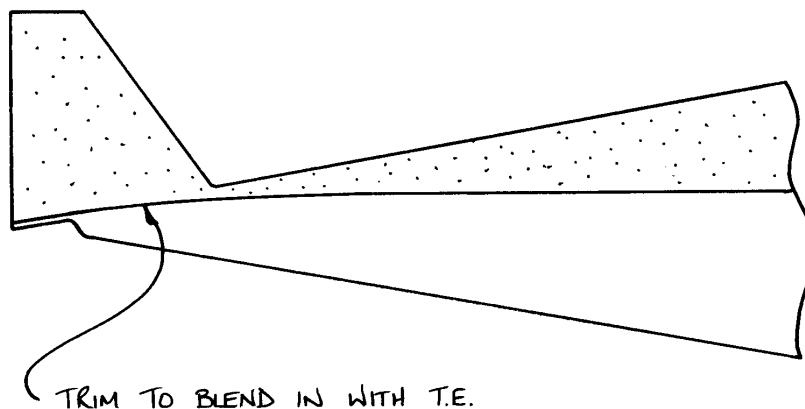


Fig 18. Trim line of skin at tip trailing edge.

Step 4

With the foam side up sand away any bumps on the leading edge and tip and feather the last 10mm down to allow a smooth transition from foam to laminate (see figure 19). Be careful not to sand into the foam though.

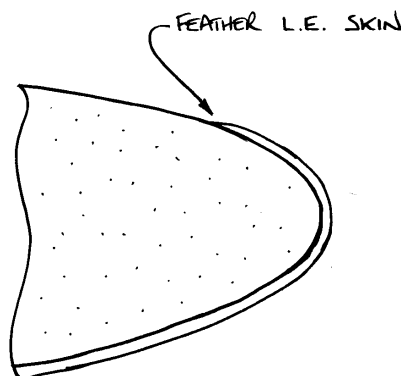


Fig 19. Tailplane leading edge detail.

Hacksaw away the trailing edge block as in figure 20 and then sand with a 40 grit spline to run the core surface in flush with the trailing edge.

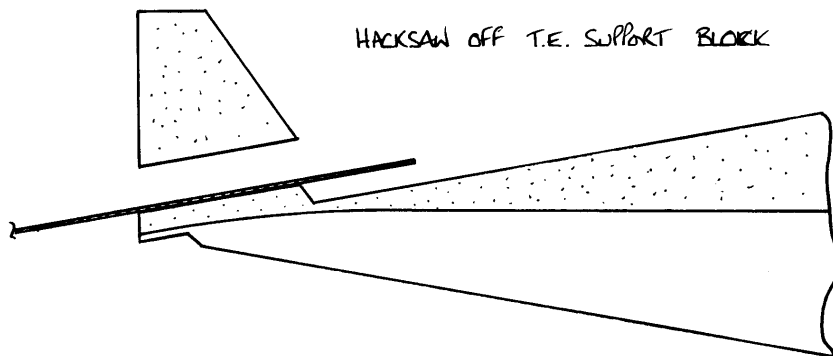


Fig 20. Removing trailing edge support block.

Remove the peel ply strip over the whole length of the trailing edge leaving a ready to glass to surface as in figure 21.

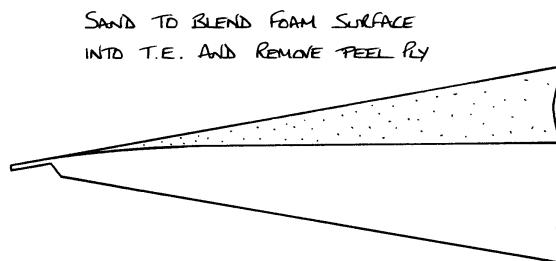


Fig 21. Trailing edge foam blended to glassfibre joggle.

Scoop out a 5-6mm (1/4") deep trough in the foam at the tip trailing edge, as you did on the rudder, to make a floc corner . See figure 22.

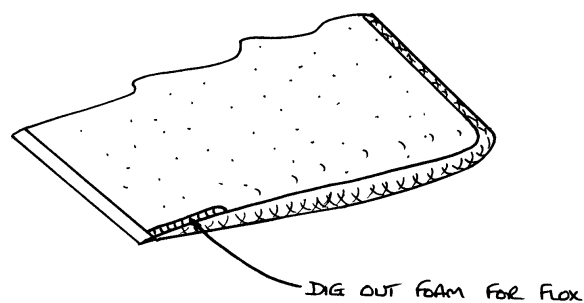


Fig 22. Tip trailing edge.

Cut 2 full width plies of 'uni' 150cm (60") long for each tailplane and enough peel ply strips for the tip and leading edge. Also lay a strip of peel ply over the edge of TP3 and hold in place with double sided tape.

It's time now to layup the second skin.

Second skin layup

Step 5

Mix up some floc and fill the rib joint area and the tip trailing edge trough. Now make some dry micro and fill the gaps and any dents in the foam. Next micro slurry the whole surface, taking care not to get micro on the floxed areas, peel ply or the glass.

Paint the foam surface and peel ply now with epoxy, brushing over the glass of the previous layup by about 2cm (3/4") (tip and leading edge).

Step 6

Lay the first ply at 30° to the 0° reference glue line, wet out and scissor trim to overlap onto the cured skin and back 2cm (3/4") on the underside. See figure 23. As on previous layups trim any overhangs to about 1cm (1/2").

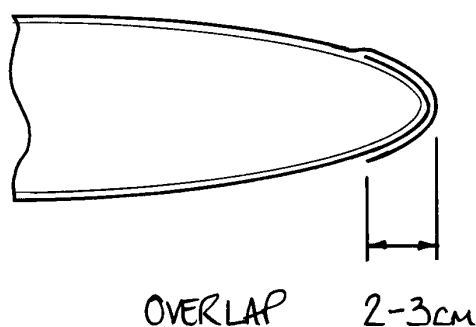


Fig 23. Detail of leading edge skin overlap.

When the first ply has been thoroughly wetted out and squeegeed lay the next ply 30° the other way to the glue line. Squeegee this ply thoroughly then peel ply the leading edge and tip and wipe away any drips now. This will save a bit of sanding and scraping later. Allow to cure, knife trimming at the appropriate time.

Second skin layup summary

- 1 ply 'uni' 30° to glue line
- 1 ply 'uni' 30° other way to glue line

Step 7

Trim the trailing edge close to the other skin's edge and the root close to the foam. Sand off the remainder, the trailing edge to the first skin trailing edge line and the root to the foam surface. See figure 24. At this point, round off the tip trailing edge as sharp corners are easily damaged.

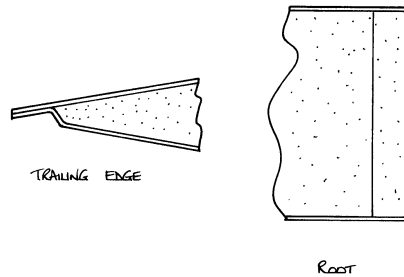


Fig 24. Trimming of skins at trailing edge and root.

Step 8

Remove the TP3 foam. You may find it easier if you run a knife blade between the skin and foam first but make sure it doesn't go deeper than 35mm. Crack the foam out in pieces not forgetting to tear off the strips of peel ply and hey presto, you have nicely prepared bonding surfaces for the root close-out flanges in 5 seconds!

Step 9

Cutting off the anti-servo trim tabs

Set the tailplane so the top surface is uppermost. This is the surface *without* the slots in the foam. Mark out the anti-servo tab as per figure 25.

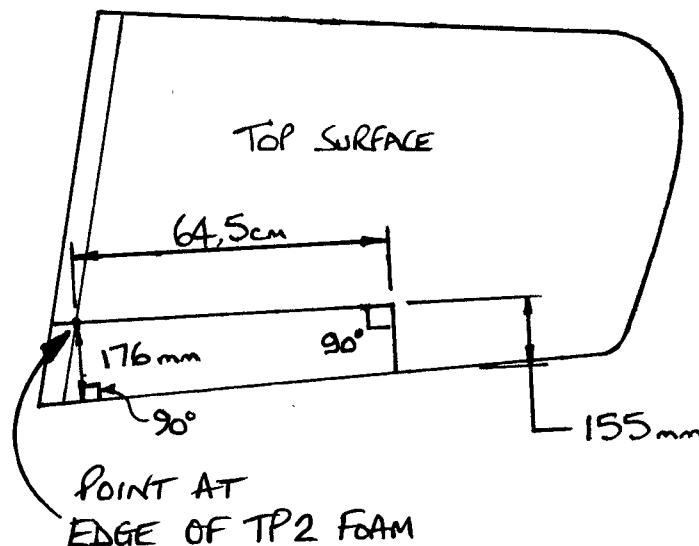


Fig 25. Marking out cut lines for anti-servo tab removal.

Flip the tailplane over and mark the bottom surface as per figure 26. To mark the tab tip line align an engineer's square up with the slot line and the tab tip line previously marked on the top surface.

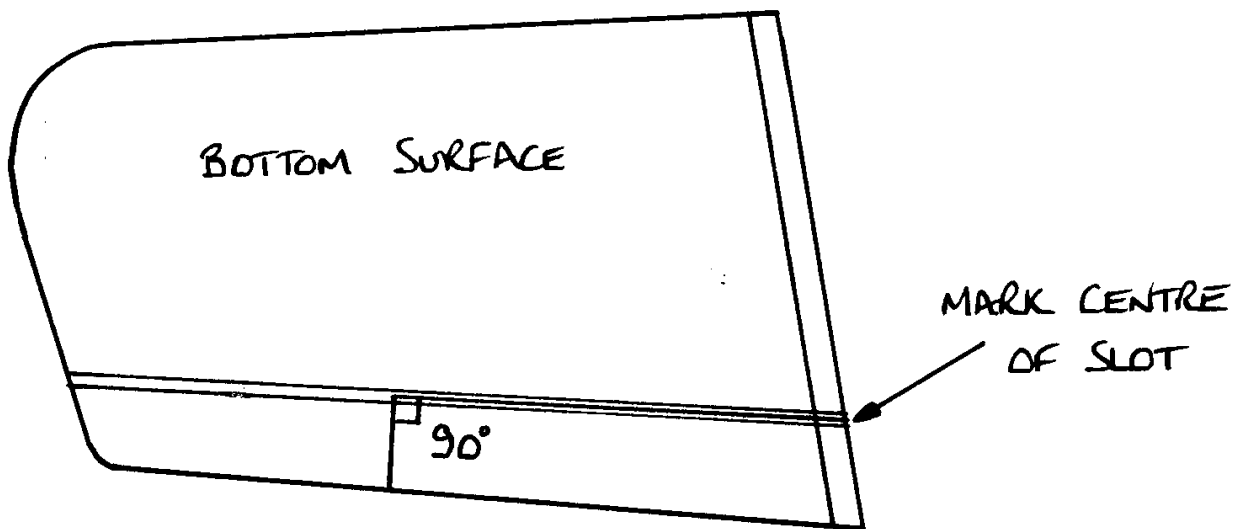


Fig 26. Cut lines for anti-servo tab removal.

Cut the top surface skin with a hacksaw blade or knife erring on the tab side of the line if anything. Be careful not to go too deep and damage the tab's leading edge. See figure 27.

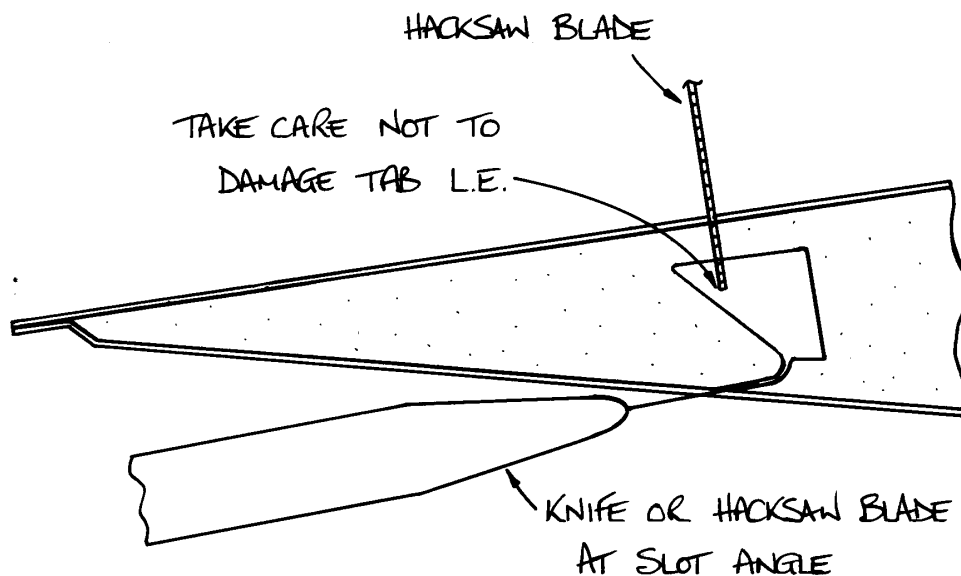


Fig 27. Removal of anti-servo tab.

Hint: Stop your cuts just short of the root to begin with so you don't end up with the tab flapping about until you are ready for it to come off.



Cut the underside skin with a knife at an angle along the marked line trying to allow just the tip of the blade through the glasscloth. (figure 27).

When the tab has been separated from the tailplane, remove the foam from the trailing edge as indicated in figure 28 and strip off the peel ply.

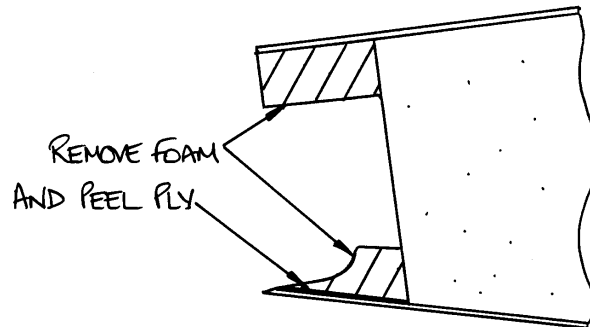


Fig 28. Partial section of tailplane trailing edge.

Remember the two pieces of 4mm plywood you cut and put holes in and didn't use? Well you'll need them now. Once you've found them make a rib reinforcement for each tailplane root much as you did for the outboard rib. These pieces will require a radius or chamfer on the two edges that will sit in the root rib radius and around the hole and a chamfer on the other two edges on the other side to allow for an easy run out for the glasscloth that will be laid up over it. Make sure the pieces lay flat onto the root surface.

Dig out the foam in the tailplane's trailing edge, at the tab tip cut line (ref. figure 31), to a depth of about 10-15mm (1/2") to allow for a close-out rib to be laid up. Bung up the hole left in the corner with foam.

Radius the foam 5 or 6mm (1/4") at the trailing edge spar face to root corner and cut a trough for a flox corner around the TP5 tube similar to, or even slightly deeper than the one you did for the TP6 tube. To reduce the chance of misalignment between TP5 and TP6 re-insert TP4, mask off the end of TP5 to prevent epoxy getting in and bonding TP4 to it. Mix some flox and fill the prepared trough, making sure it's not proud of the foam's surface, then cover with small patches of peel ply and allow to cure.

After cure, carefully remove TP4 and plug TP5 with a piece of foam, sealing around its edge with plasticine to keep epoxy out. Stick strips of masking tape on all the glass edges next to the bare foam to keep them clear of micro. Don't forget to remove the peel ply.

Close-outs

Cut out and remove a wedge of foam from one side of the outboard rib's trailing edge, the wedge being about 20mm (3/4") wide and 20 mm deep, leaving about 5-6mm (1/4") of foam still attached to the top and bottom skins. Save this wedge or make another to fit. Round off the rear-most portion of the exposed rib to the trailing edge.

You should now be just about ready for the rear close-out and root rib reinforcement layup so cut pieces of 'bid' at +/- 45° to the following dimensions:

Per tailplane:

2 off - 71cm x 10cm (28" x 4")-rear close-out.

2 off - 15cm x 10cm (6" x 4") - tip rib

4 off - 80cm x 20cm (32" x 8") - root reinforcement

4 off - 15cm x 5cm (6" x 2") -hinge reinforcements

2 off - 7cm x 2.5cm (2-3/4" x 1") -rib bracket.

Mix up some dry micro and make a *small* radius on all foam to glass corners. See figure 29.

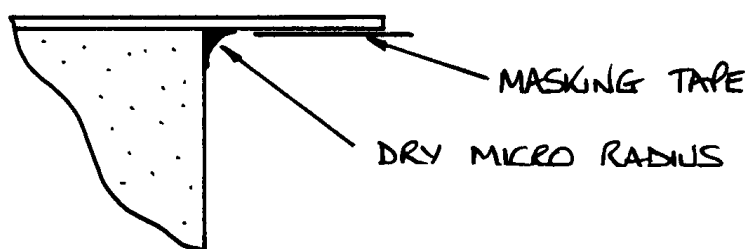


Fig 29. Detail of glassfibre/foam corner.

Fill any dents and gaps next then, with micro slurry, cover all exposed foam surfaces, making sure not to contaminate the flox around TP5. Don't forget to strip away the masking tape afterwards. Now brush the foam and all glass edges with epoxy.

Layup the two rib bracket plies to lap onto the rib by at least 15mm (5/8") and around onto the foam of the trailing edge close-out for about 40-50mm (2"). See figure 30.

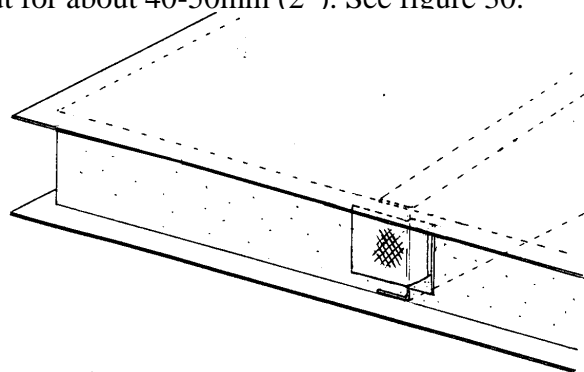


Fig 30. Glasscloth bracket in place before inserting wedge.



Coat the foam wedge with micro slurry then insert it to squeeze the glass cloth bracket against the rib. Push the wedge in until it is flush with the foam surface.

Note: You will find access to the layup area is made easiest by securing the tailplane so that it's standing on its tip leading edge.

Lay in the first ply, consisting of one root rib piece, one trailing edge piece and one tip rib piece. Use a brush to stipple the epoxy through the cloth. It isn't important which part you layup to start with or in which order the layup is done but do each part sequentially so that overlaps are sandwiched between subsequent plies. See figure 31.

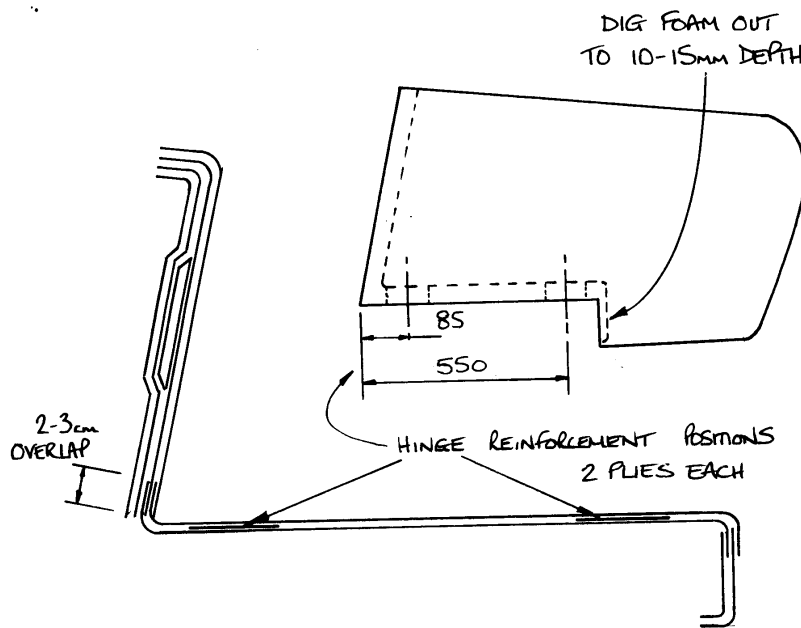


Fig 31. Schematic section of T.E. close-out layups.

The trailing edge close-out should have no overlaps, all overlaps should be on the root and on the tip as a build up of plies on the trailing edge could restrict movement of your tab.

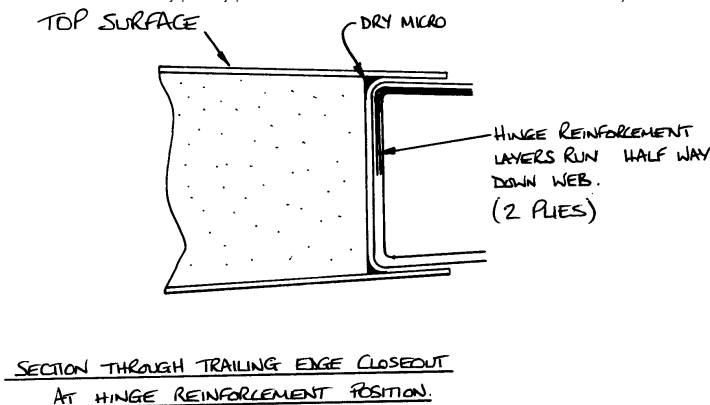


Fig 32. Section through T.E. close-out at hinge position.

Between the two trailing edge plies, lay in two plies of 'bid' in both hinge positions as in figures 31 & 32. Keep the radii where the hinges go small otherwise you may find your hinges won't fit.

An important point to note is that as you wrap the trailing edge piece around into the root the corner of the skins will not be covered completely and if you cut the root ply short of the trailing edge rib it again will leave these corners uncovered.

To remedy this cut the root plies such that their webs don't wrap around onto the trailing edge spar but the flanges do continue all the way to the trailing edge. See figure 33.

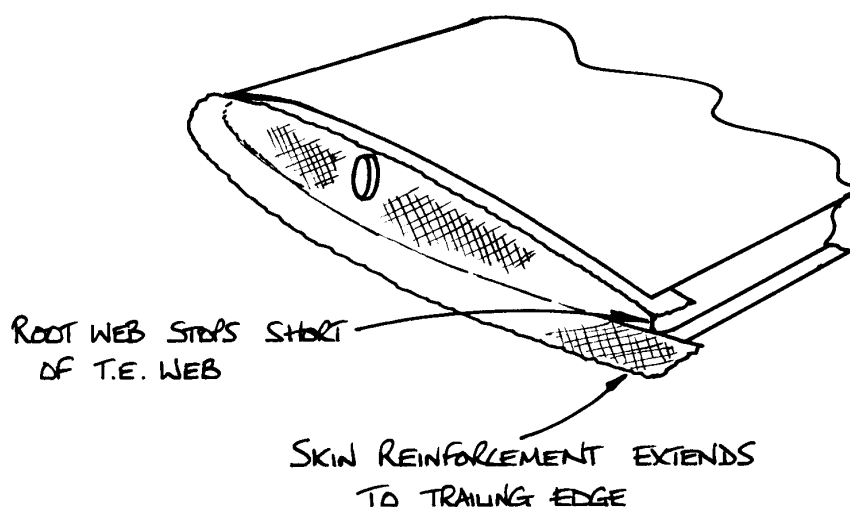


Fig 33. Root close-out trimming.

Your 4mm plywood reinforcement pieces should be set in place on the root with flox after the second ply has been wetted out. Fill any gaps that are left around the wood with flox and also spread a thin layer of flox over the wood before laying on the next ply of glasscloth.

After the fourth and final ply of cloth is laid onto the root rib, trim around the hole to remove the excess that laps up onto the foam plug and remove the plug now. You can leave it in for removal after cure but it may make life a little more difficult later.

Leave to cure then trim.



Close-out layup summaries

Remember these layers are interlinked

Inboard rib

2 plies 'bid' +/-45°
4mm plywood (flox each side)
2 plies 'bid' +/-45°

Rear close-out / hinge reinforcement

2 plies 'bid' +/-45° rib bracket
1 ply 'bid' +/-45° full length
2 plies 'bid' +/-45° at hinge positions
1 ply 'bid' +/-45° full length

Tip rib

2 plies 'bid' +/-45°

Finally, after cure, drill a small hole (3mm - 1/8" will do) through the rear close-out face into the rearmost lightening hole each side of the rib to ensure venting of air to the outside world.