
4. Anti-servo / trim tab

Overview

The function of the anti-servo/trim tab on the Europa is, as its name suggests, twofold. The anti-servo part of it provides a positive feedback force to the pilot from the all-flying tailplane (which would otherwise be too sensitive) and which increases with increased stick movement. The neutral (trim) position of the tab relative to the tailplane can be altered from the cockpit, thus providing aerodynamic trim.

This section will take you from the laying up of the tab leading edge, the attaching of the hinges on the tab's upper surface and setting up back onto the tailplane to the addition of the trailing edge Flettner strips. Flettner strips are triangular sectional strips attached to the trailing edge of the anti-servo / trim tabs which eliminate the possibility of oscillations in pitch which could occur without them.

Preparation

To prepare your tabs for the leading edge layup, sand the edge of the glass to feather it in to the foam leading edge and remove the foam as in figure 1.

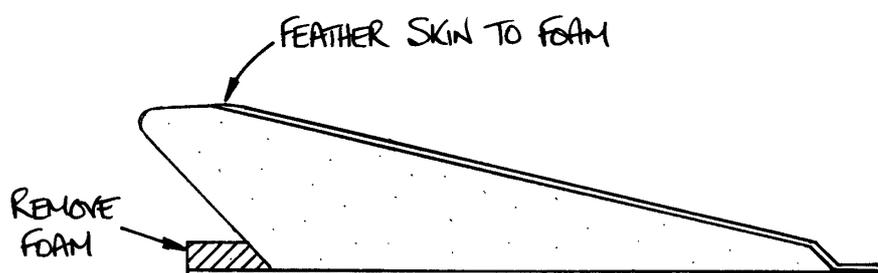


Fig 1. Section through tab.

Sand off any foam nibs from the tab's leading edge and round off the foam edge at its root. See figure 2.

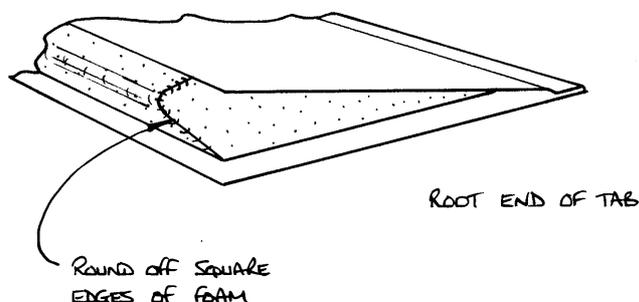


Fig 2. Root end of tab.



Cut plies of 'bid' at +/-45° to the dimensions below and then get yourself prepared for the following quick layups.

(Per tab):

- 2 off - 65cm x 10cm (26" x 4") -leading edge.
- 2 off -16cm x 10cm (6.5" x4") - root rib.
- 2 off -16cm x 5cm (6.5" x 2") - tip rib.
- 4 off -15cm x 5cm (6" x 2") - hinge reinforcements.

Leading edge and root rib layup only

You will be laying up just the leading edge, hinge reinforcements and root ribs at this stage. Refer to figure 3 and mark the positions for the hinge reinforcements on the flange side of the tab. Set the tab with its trailing edge in two foam blocks with vees cut in them so the leading edge is uppermost and easy to work on.

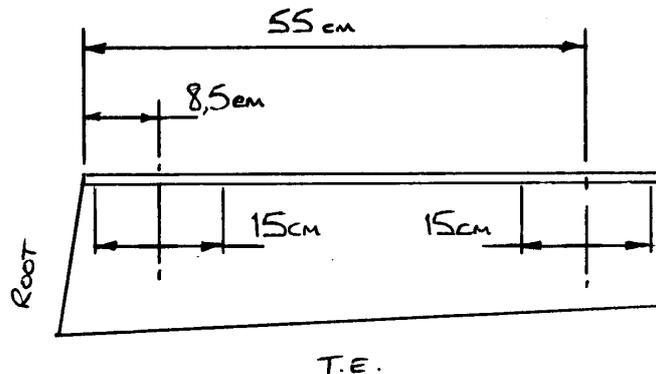


Fig 3. Hinge reinforcement locations flange side up.

Step 1

Dry micro any dents as required then micro slurry the foam as normal then brush epoxy over the slurred foam and about 2 cm over the leading edge skin and the inside of the skin that is exposed.

Lay your first ply of cloth over the tab for the leading edge and pull the cloth widthways to adjust it to the correct length. Then lay the cloth around onto the glass of the lower surface to make an overlap of about 2 cm. Progressively push the cloth down into the leading edge trough and make sure that you get the cloth right down into the bottom of the vee. See figure 4. This is very important if you want to get your hinges on easily.

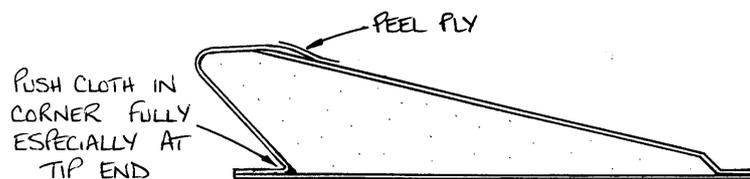


Fig 4. Section through tab.

Wrap the leading edge ply around into the root area about 2-3 cm then wet out the complete ply. Next position the hinge reinforcement plies (2 at each location) in the vee and so that they cover the flange but stop short of the leading edge.

Now lay in the first root ply overlapping the cloth wrapped around from the leading edge but don't wrap this ply around onto the leading edge. Wet this ply out then repeat the process with the remaining pieces. Peel ply the leading edge overlap, the areas where the hinges will go and also the area of the root where the tab drive plate will be bonded to later (refer to fig 15), then leave to cure.

Layup Summary

- 1 ply 'bid' +/- 45° - L.E., and root .
- 2 plies 'bid' +/- 45° - Hinge positions.
- 1 ply 'bid' +/- 45° - L.E., and root.

Step 2

When the layup has cured, trim the excess off then cut out the corners of the tip foam for a flox corner all around. See figure 5.

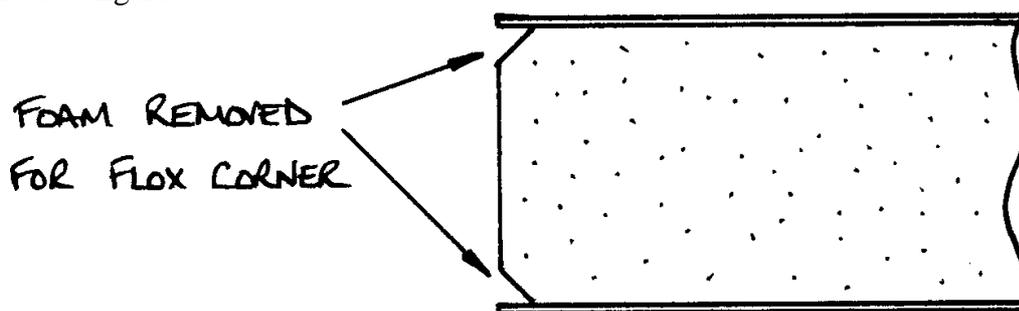


Fig 5. Section through tab at tip end.

Mix up some epoxy and make some into not too wet flox and fill the prepared corners. Lay 2 plies of 'bid' over the tip oriented at +/-45° to the chord centreline and leave to cure then trim. You have now completed your tab and it's ready to be hinged to the tailplane.



Attaching the hinges

The hinges will be permanently attached to the tabs with rivets then attached to the tailplane trailing edge with screws.

Cut 2 lengths of MS20001-3 hinge 100mm (4") long and 2 lengths 75mm (3") long. As with the rudder always cut your hinge wire separately and about 15mm (½") longer than the hinge allowing for safetying the wire by bending each end and always cut halfway through a lug so the ends are well supported. See figure 6.

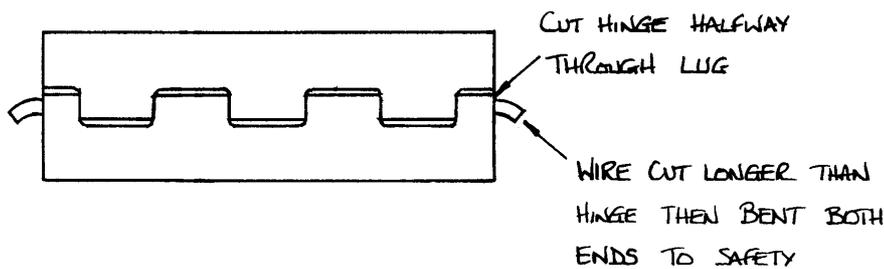


Fig 6. Typical hinge safety technique.

Step 1

Mark the hinge positions and cutouts onto the outside skin of your tab on the upper surface as in figure 7.

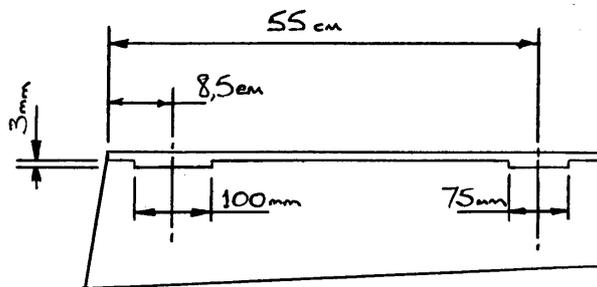


Fig 7. Hinge cutout locations.

Cut these areas away then sand the corners off to about 45° to allow room for the hinge wire. See figure 8.

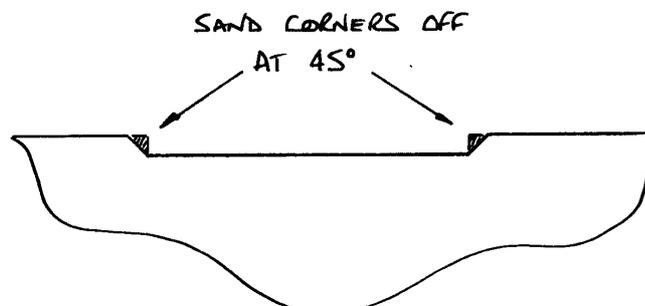


Fig 8. Typical hinge cutout.

Step 2

Mark the hole centres for the TLPK 424 BS pop rivets as in figure 9.

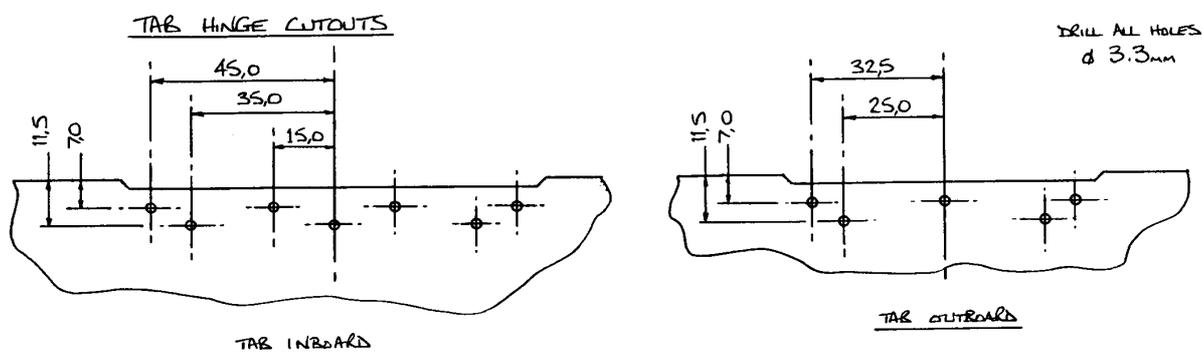


Fig 9. Rivet hole positions on tab.

Clamp the hinges to a straight edge of sufficient length making sure they are in line with each other, as in figure 10, and in their relevant positions.

Offer the hinges up to the tab slots to ensure they fit snugly. You may have to make some minor adjustments to the cutouts with your sanding block to enable the hinges to fit properly.

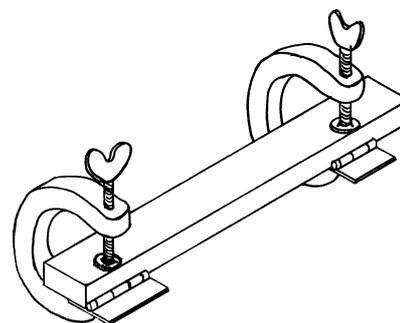


Fig 10. Hinges clamped to straight edge.

When you are happy with the fit hold the hinges in position with their flaps against the glassfibre and drill through with a 3.3mm drill. Use a cleco to hold the hinge in place then drill the other hinge in a similar manner. With one cleco in each hinge drill the remaining holes inserting extra clecos as you go to hold them firmly.

Step 3

Remove the clecos and roughen the hinge flaps with coarse sandpaper to give a good 'key' for bonding. Countersink the holes with a drill bit to accept the rivet heads using a rivet as a depth gauge. *Don't go too deep.* Clean any swarf from the hinge and tab.

Mix a small quantity of epoxy and mix with floc to make a paste then coat the jointing area. Before the epoxy has gone off attach the hinges and rivet them up. Remove any excess adhesive and unclamp the straight edge. Also take care that no epoxy oozes into the hinge.

Step 4

Now position the tab in its correct place relative to the tailplane, lining up the root and tip areas. It won't lie in line yet because the lower lip of the tailplane rear spar has not yet been trimmed but you will still be able to mark the hinge positions. Cut out the hinge slots in the tailplane as in the tab. Sand the corners of the slots away at about 45° and adjust them until the hinges will fit.

Step 5

Mark the positions of the bolt hole centres as in figure 11.

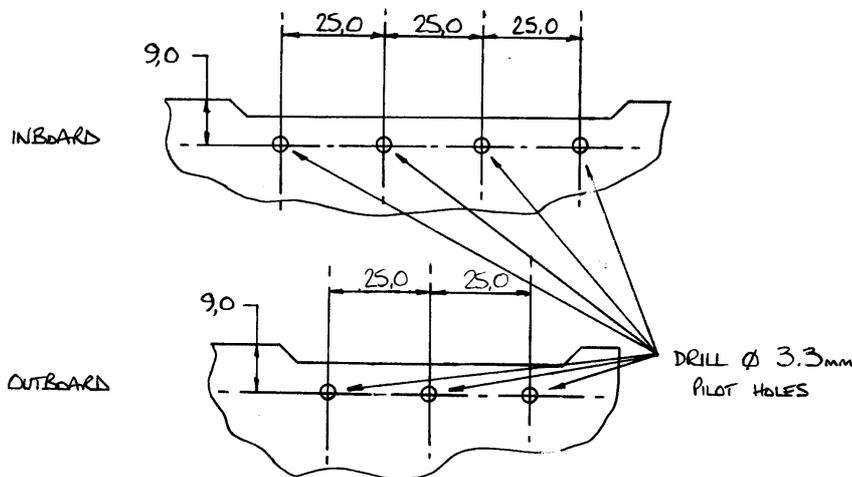


Fig 11. Hinge cutouts on tailplane with hole positions.

Drill through the glassfibre only at first with a 3.3mm pilot drill then hold the tab in place and drill one hole through each of the hinge flaps. Use clecos to hold the hinges in place, then drill the remaining holes out to 4.8mm (3/16"). Hold the hinges in place with an AN525-10R8 screw and an MS 21042-3 nut in each, then carefully open the remaining holes out to 4.8mm.

Remove the tab and get rid of any swarf and burrs before replacing it to trim the tailplane trailing edge bottom flange and tip close-out as required to allow free and sufficient movement as shown in figure 12.

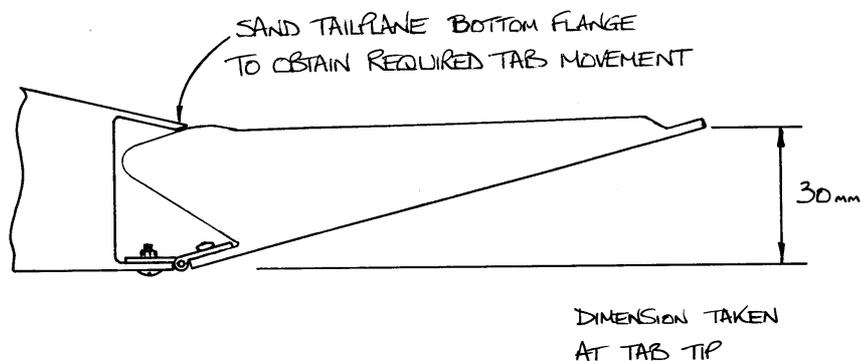


Fig 12. Required down movement of tab (shown inverted).

Tab drive pins

Step 3

In this step you will bond the drive pins TP16P and TP16S to the tailplanes' anti-servo/trim tabs.

Remove the tab from one tailplane only and make the template as detailed in figure 13 from alloy or plywood. Non critical dimensions are not shown.

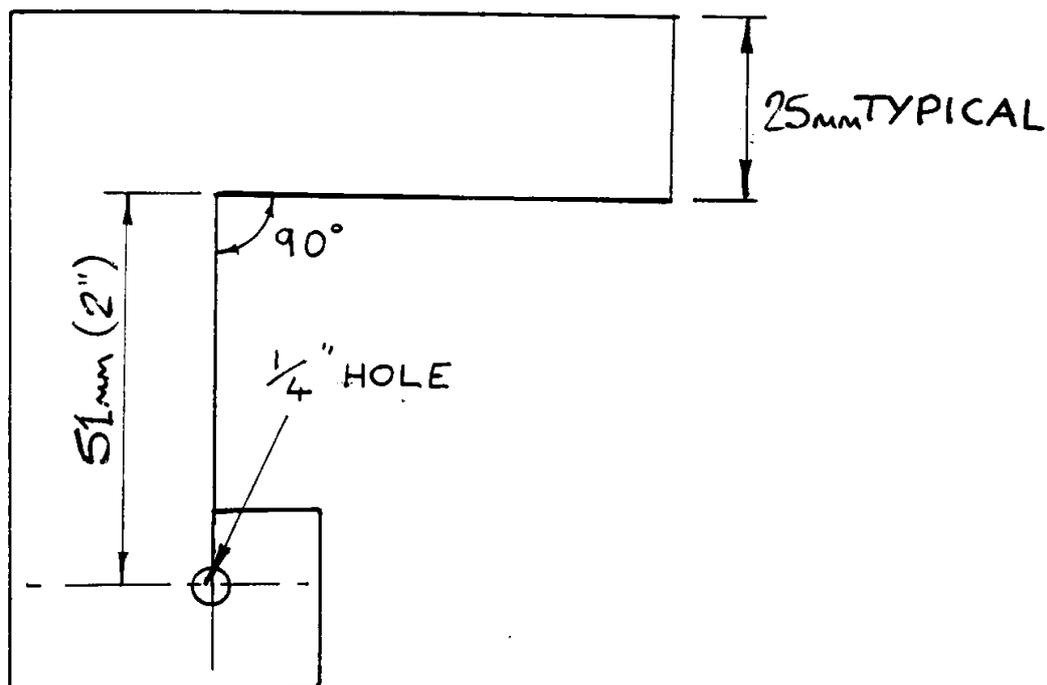


Fig 13. Tab drive pin setting template - not to scale

Due to inevitable built-in differences between port and starboard tailplanes one tab drive pin should be set up using the template and the other pin aligned to the installed pin in a second operation. Firstly, drill a few holes through the plates of the drive pins to aid bonding and make them lighter.

Referring to figures 14 and 15, and using your template, align the drive pin TP16P or TP16S so that the pin is in line with the hinges. As the tab's root rib is angled relative to the aircraft centreline a fillet of dry flox is required behind the TP16s to align them correctly. Allow the flox to squeeze through the holes to give a good key then cover the plate with peel ply then allow to cure ensuring alignment is not disturbed.

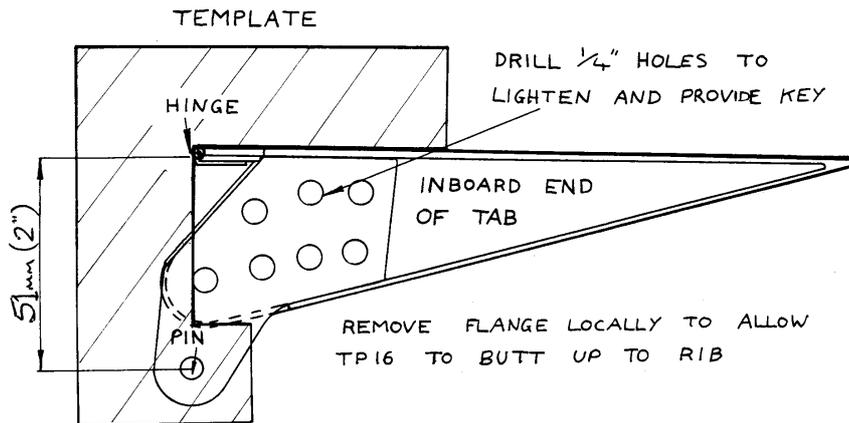


Fig 14. Positioning drive pin in root of hub.

Remove the peel ply, then layup 3 plies of 'bid' at $\pm 45^\circ$ over the TP16, extending this layup around the leading edge of the tab and the top and bottom flanges then peel ply all the edges.

Note: Apply flox around the plate's edges to avoid air bubbles.

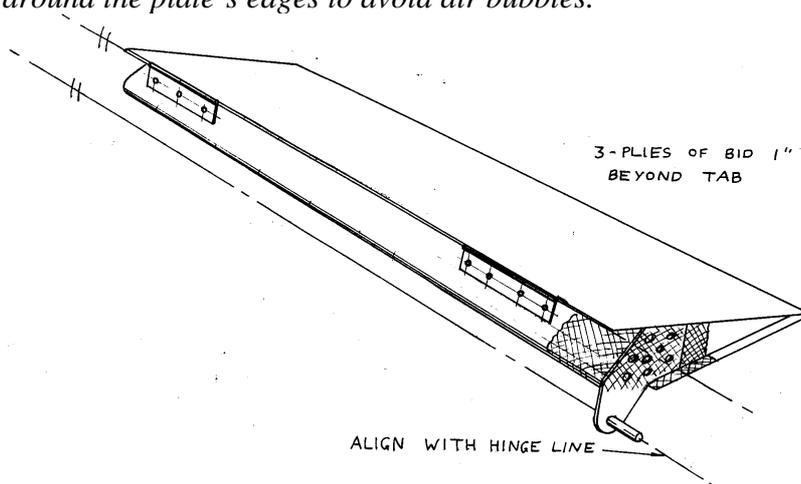


Fig 15. Tab with drive pin attached.

To attach the second drive pin re-install the tab you removed onto its tailplane, then disassemble the torque tube assembly and put both tailplanes together on your torque tube, pushing them together so the tab drive pin ends are as close as they can be to each other. Ensuring that the tailplanes and tabs are at the same angles of incidence to each other, install the second drive pin to the tab with flox then, using a short piece of 1/4" bore tube or one of the TS06 bushes to link both pins, align the second pin to the first and allow to fully cure before separating the tailplanes to do the layup over the plate as before.

Note: Label all the parts of the torque-tube assembly including notes on orientation to each other part so re-assembly is straightforward.

Flettner strips

The Flettner strips to be attached to the anti-servo / trim tabs are shown in figure 16.

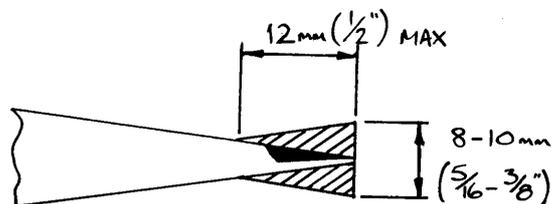


Fig 16. Attachment of Flettner strip.

Initially, fill the trailing edge trough with dry micro and allow it to cure then sand it to continue the line of the skin.

Make the Flettner strip from pieces of any lightweight material, balsa probably being the most suitable.

They should span the entire length of the tab but you can taper the ends down so that they don't end abruptly.

Bond them in place on both upper and lower surfaces with epoxy, also painting them with epoxy to seal them if they are made from wood.



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