EUROPA CLUB

AIRCRAFT MODIFICATIONS

IMPROVED TP5 & TP6 SLEEVE RETENTION

Standard Modification 10672

Issue 2: April 2022

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Based on an original concept by Nigel Graham

EUROPA CLUB AIRCRAFT MODIFICATIONS

These modifications created by Europa Club members are separate from those issued by the factory but have been approved by Light Aircraft Association (LAA) Engineering as Standard Modifications. See also LAA Technical Leaflet TL 3.06 and the Europa Type Acceptance Data Sheet (TADS) 247 Europa. These modification documents can be considered as build instructions and should be carried out in consultation with your LAA inspector before submitting the paperwork to the LAA for final approval. Most modifications add weight. Beware of incorporating too many at the expense of performance and payload. When following these instructions read at least three times, measure twice, cut once.

IMPROVED RETENTION OF TP5 & TP6 SLEEVES

Several Europa builders have commented upon the difficulty of getting a good bond between the stainless steel of the TP5 and TP6 sleeves and the resin-glass rib layups on each end face of the TP2 foam. Epoxy resin does not seem to bond well to stainless steel, and the relatively short lengths of the sleeves projecting from the foam does not ensure good a good mechanical joint, despite the flox corner. The longer parts of the sleeves within the foam are effectively unsupported as the foam has little strength.

This modification encases both TP5 & TP6 in a laid-up tube of BID. Not only does this provide a much greater surface area for the resin/steel bond but also it traps both sleeves completely and so provides a secure mechanical location of their relative positions. The central part of the BID tube between the steel sleeves is made to be a loose fit on the TP4 torque tube so that working loads are only taken through the sleeves as intended. The whole tube is bonded into the TP2 foam core, and the layups forming the ribs at the outboard and inboard faces of TP2 can easily make a good bond with the outside of the BID tube. An additional convenience is that there is no need to use the torque tube TP4 to confirm alignment during these layups. When assembling the outer tailplane core TP1 onto TP2, the end of the BID tube provides a spigot upon which TP1 can locate. The BID tube protects the foam core from damage in service by TP4 during tailplane rigging/de-rigging, and (if capped at the inner end) from potential rodent attack during storage.

The dimensions in this document are taken from my own kit components and are only given as a guide; you will need to establish the correct dimensions for your own situation by careful measurement. Use only wax as the release agent; grease has been suggested elsewhere but its use is strongly discouraged as it is likely to contaminate the layups. Great care must be taken to ensure that no epoxy resin can bond to the torque tube TP4.

This modification was originally devised by Nigel Graham, who has given permission for his work to be used as the basis of this document. He found that his version of the modification added only 48 grams per side.

Be sure you fully understand the instructions before proceeding. If you have any queries about this modification, or suggestions to improve the modification, please contact LAA Engineering.

Following completion of the work, an LAA inspector must check that the installation complies with the installation instructions and, if satisfied with the work done, sign a completed LAA Mod 1 form, a copy of which must then be sent to LAA Engineering — a scan of the signed Mod 1, sent to engineering@laa.uk.com will be acceptable.

Rowland Carson

Construction of BID tube to retain TP5 & TP6

Establish distance between sleeves

Before starting any work, mark the outside of each TP5 & TP6 to identify port and starboard. This can be done indelibly with an engraving point in a Dremel tool. Also mark a point on the outside surface of each TP5, anywhere around the circumference at the angled end, for location later. A light stroke with a hacksaw blade, aligned along the length of the sleeve, gives a good effect. Repeat the following procedure for each tailplane half, as there may be slight differences in component sizes. Insert the sleeves TP5 and TP6 into the TP2 foam core to their correct positions. Slide a steel rule in from the TP6 end to just touch the inner end of TP5, but without disturbing its position. Note the dimension at the outer edge of TP6, sighting across the end of the sleeve to avoid parallax errors. (I measured 247.5mm port and 248mm starboard.) Remove the sleeves and measure the length of TP6. (Both mine were 38mm.) Now subtract the length of TP6 from the first dimension to get the distance between the inner faces of the sleeves (209.5mm and 210mm in my case).

Preparation for Layup

Figure 1 shows the relative positioning of all the elements. Refer to it for clarification of any of the written instructions.

Support the torque tube TP4 in a way that allows free access to about half of the length. (If you have already constructed the recommended jig for tailplane alignment, you could use that, with a suitable hold-down.) Slide TP5 onto TP4, angled end first, far enough inboard to allow room for all the planned layup to be supported by TP4. If TP5 covers the outboard drilling in TP4, that should be suitable. Wrap several layers of masking tape around TP4, angled to lie flush with the angled end of TP5. This will probably be easier to do with several short lengths, or with narrow strips. Make a mark on the masking tape opposite the previously-made mark on TP5, so that you can easily put it back in exactly the same position.

Remove TP5. Apply wax to TP4 as a release agent, covering just the area around where TP5 will sit. (If you wax TP4 all the way out to the end now, TP5 will tend to pick it up as you slide it on again, with danger of contamination of its outer surface.) Use a good-quality clear furniture wax, and choose one free of silicones, which are notoriously hard to remove. If it doesn't state "silicone-free" on the tin, assume that it does contain some silicone compounds and avoid using that brand. Ensure that a thin coat of wax is applied right up to and onto the masking tape.

If you haven't already done so, roughen the outer surfaces of TP5 & TP6 to improve the bond. A hacksaw blade or tungsten-carbide file works well. Do not be tempted to use power tools, which could quickly generate enough heat to deform the relatively thin sleeves. Then degrease both sleeves, allow them to dry and thereafter only touch them with clean gloves or clean tissues. Slide TP5 onto TP4 to abut with the masking tape and align the marks. Carefully remove any wax "shavings" that built up ahead of TP5. Now wax the remaining length of TP4.

Cut a strip of newspaper about 600mm long to the exact width of the spacing between the sleeves (as determined above). It's easier to get straight edges if you choose a broadsheet page without sharp folds. Carefully wrap it around the TP4 tube, abutting tightly against the end of TP5. Once the first full turn is on, the wax will provide enough stickiness to make winding on the rest easier. To secure the end of the final turn, use a thin smear of clear fast-setting glue such as "UHU". Spray adhesive could be used, but take care not to let the overspray contaminate any of the workpieces. This layer of newspaper provides a small clearance between the torque tube and the BID tube, ensuring that when complete the loads are taken only by the sleeves.

Slide TP6 onto TP4 to abut with the edge of the newspaper, watching out for wax shavings as before.

Cut another strip of newspaper about 600mm long. The width must be greater than 50mm, and at least enough to cover the remaining length of TP4. Only one edge needs to be perfectly straight this time. Butt the good edge against TP6, wrap it around and secure it as for the first piece.

Check again that the distance between the inner ends of TP5 and TP6 is correct.

To prevent the layup adhering to the newspaper, use cling film (known as "Reynolds Wrap" in some places). It would be very difficult to place the film wrap so as to cover completely the newspaper but not overlap onto the sleeves, so instead it is easier to cover everything then remove the unwanted film on the sleeves. Your nearest kitchen may not have in stock a roll wide enough to cover the entire length, but it's fine to use two widths with an overlap in the middle. Ensure the cling film extends over the masking tape at the TP5 end, and at least 50mm beyond TP6 at the other end. Stretch the film quite well so that it is taut over the newspaper as well as the sleeves and apply several turns. Take care not to pull so hard that you displace the sleeves, particularly TP5 — check its alignment with the mark on the masking tape. Once the whole assembly is covered in cling film, check again the distance between the inner ends of the sleeves.

The film over the sleeves is not required and must be removed. To cut the cling film precisely, use a short length of round steel bar with a cleanly-faced end, and carefully roll it around the edges of TP5 and TP6. The edge of the sleeve and the edge of the bar will together act like scissor blades, cutting through the cling film exactly at the desired line. **Before** starting to peel the film off the sleeves, take a small amount of wax on a fingertip and make a tiny fillet of wax against each end of both sleeves. This will help prevent epoxy resin finding its way onto TP4. Now unwind and discard the excess film covering the sleeves, and make one more final check of the distance between the inner ends of the sleeves.

Lamination

The TP5/6 sleeves are about 41mm diameter, giving a circumference of about 129mm. The BID should wrap around between 2 and 3 times, so a length of between 260mm and 390mm will be needed — I used 300mm. The width should be enough to cover all of TP5, and extend at least 50mm beyond TP6. I found that about 380mm was about right. Cut a piece of BID at 45° to these dimensions, making sure the weave is square before marking out. On a piece of polyethylene sheet, mark out a rectangle the same size. Turn it over so the ink is on the underside and will not get smeared by the resin then carefully transfer the cut BID onto it without distorting its shape.

Cut out a piece of peel-ply slightly larger all-round than the BID.

Wet out the BID with resin and squeegee off, in the direction of the weave, to remove any excess. Observe the marked-out lines to make sure the BID does not get out of shape. Lift the wetted-out glass on the plastic sheet. Position it correctly and carefully wrap it around the prepared sleeves on the torque tube, unwrapping the polyethylene as the BID goes on. Stipple out any bubbles with a brush.

Wrap the peel-ply around the whole layup for as many turns as will take up resin, but leave the end free for easy removal. Leave to cure undisturbed in the usual way.

When fully cured, it should be possible to slide the assembly off the torque tube TP4. If this proves difficult, TP4 may be gently warmed to soften the wax. Use a hot-air gun or hair-dryer, but be careful not to get TP4 hot enough to soften the epoxy resin, or your previous work will be wasted (if the resin softens, alignment of the sleeves may be lost). Direct the hot air inside TP4 from the end opposite to the layup, and with your fingers continuously monitor the rate of temperature increase along the length of TP4. Remove the heat when you can just feel TP4 beginning to warm up adjacent to the layup, and try removing the layup again. If you secure TP4 to make this easier, be careful not to distort the tube, or damage the cross-drilled holes in any way. You will probably find that the layup is easiest to loosen first by twisting and then sliding off.

Remove the newspaper and cling film from inside the layup. Use tweezers, a long needle or a small screwdriver to loosen the first turn, and then use snipe-nose pliers to coil up the paper so that it collapses in upon itself, and can be removed. With any luck most of the cling film will come with it. But you will probably need to poke around with lengths of wire or other improvised tools to get the last bits out. Trim the ends of the layup to size — flush with TP5 at the root, 50mm proud of TP6 outboard — and smooth off with your favourite Permagrit tool. Clean any remaining wax from the insides of the sleeves with a suitable solvent.

If you wish to prevent rodent access to the foam beyond the BID tube, you can form a shallow closeout (10-15mm) of the usual type with 2 layers of BID in the 50mm of BID tube projecting beyond TP6. Form the closeout over a 12mm thick disc of foam sized to fit loosely into the BID tube and covered with peel-ply or cling film for easy removal. Drill a 3mm hole in the closeout after curing, to allow air pressure equalisation. Obviously this closeout will prevent the torque tube from being inserted beyond the end of the BID tube; this is potentially only an issue during the setting of the tailplane tab drive pins when you slide the tailplanes as close together as possible on the bare torque tube. I found that TP4 protruded about 45mm beyond TP6 when the tabs touched at the trailing edge. You may address this either by using a suitably long piece of 0.25" bore tube to reach between the two tab drive pins, or by making the BID tube extend slightly further beyond TP6 than the 50mm I have suggested here.

Assembly

Leave the peel ply in place until ready to fit the BID tube assembly into the TP2 foam core.

Breather holes should have already been made between each of the spanwise holes in the foam core, but inserting the BID tube will completely fill the hole it occupies and cut off the air vent path between the forward and rear parts of TP2. To restore the air path, use the same bent rod, heated as for making the originally specified breather vents, to create a semicircular trough joining the vents on each side of the hole for TP5/TP6. Insert the bent-over hot end into one of the existing holes and rotate the shaft 180° until the end enters the opposing hole. To avoid the danger of the trough being blocked by flox slumping into it, it should be made on whichever will be the upper side of TP2 during curing of the flox around the BID tube. Don't make the trough so deep that it breaks out through the upper surface.

The hole in TP2 is correctly sized to accept TP5 and TP6 as a push fit, so it needs to be enlarged slightly to allow for the thickness of the layup. It is important to enlarge the hole concentrically. Using a caliper, measure the diameter of the layup over TP5 or TP6 once the peel-ply is removed. Check in several places and use the maximum value. Cut a circular hole the same size in a piece of card to act as a template. Place it on each face of TP6, concentric with the existing hole, and draw around it. Now wrap fine sandpaper around one of the circular foam cores taken out of TP2, and use this to gradually enlarge the hole, working inwards equally from each face of TP2. Add extra layers of sandpaper (or plain paper under the sandpaper) around the foam cylinder as needed to reach the desired diameter, watching the drawn circle to make sure that the enlargement remains concentric.

Try the assembly in the hole as you approach the correct size until satisfied with the fit. You will find it much easier to cut the chamfer for the flox corners on each face of TP2 before fitting the BID tube than afterwards, so do that now. Plug the ends of the BID tube with foam to prevent epoxy getting inside. Abrade the outer surface of the BID tube lightly before applying flox to the area between the sleeves. Just a thin coating is needed on the sleeve areas as that will mostly get wiped off on insertion. Slide into TP2, position the ends of the sleeves as specified in the manual, wipe off the drips, and allow to cure.

If you overshoot while enlarging the hole in TP2 and the BID tube becomes a sloppy fit, all is not lost. You can set up TP4 on the tailplane alignment jig and prop everything into the right position with the BID tubes fitted to TP4 and TP2. You can check various levels and measurements to ensure correct alignment. Note, however, that the foam cores may differ very slightly in dimensions,

so take that into account, for example when measuring diagonals to confirm squareness. Do a complete assembly dry, then once satisfied with the alignment remove the TP2s and coat the BID tubes with flox as above, before re-assembling and re-jigging to the correct position.

From this point on, proceed according to the manual, including the flox corners around the exposed ends of the BID tube. When using the supplied PLY0 pieces to make the reinforcements TP7 (outboard) & TP8 (root) for the tailplane ribs, you will need to make the central hole slightly larger than specified in the manual, to accommodate the extra thickness of the BID tube. I found that a 46mm (1 13/16") holesaw gave a good fit. Later, when laying up the well cut into the tailplane around the pip-pin, take care not to increase the thickness of BID against the TP6 sleeve so much that the pins are prevented from going fully home.

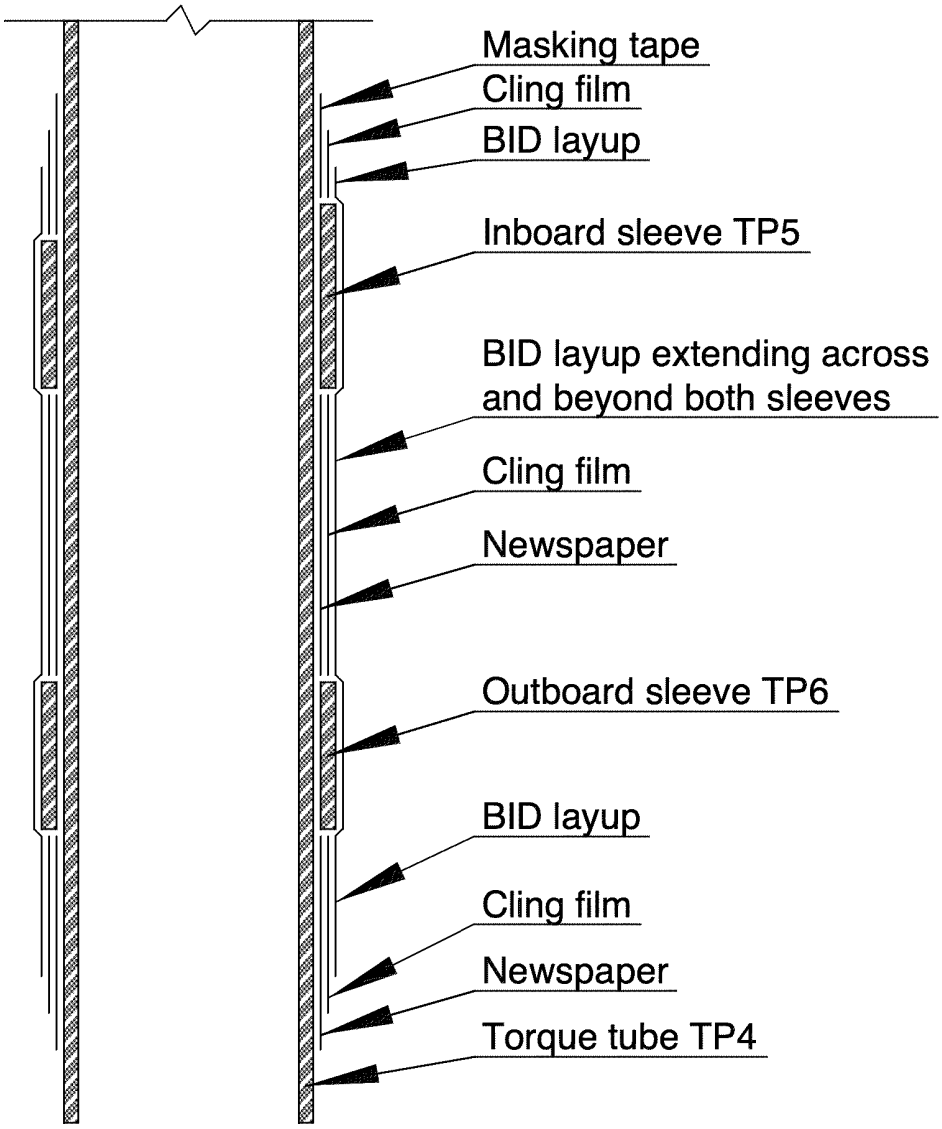
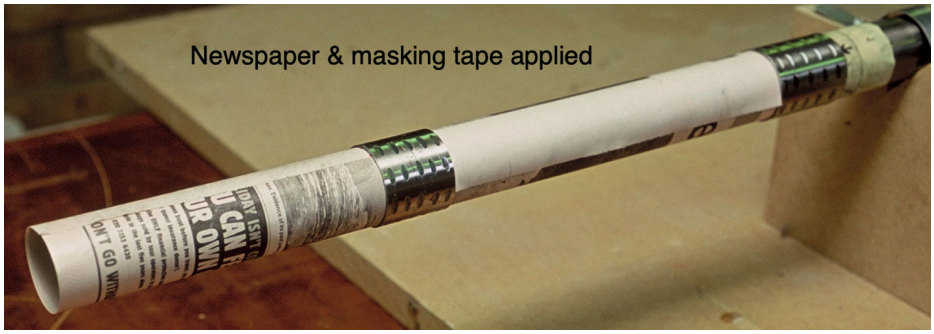
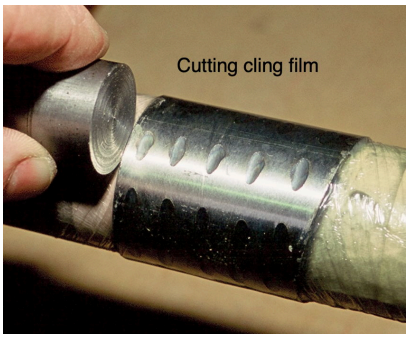
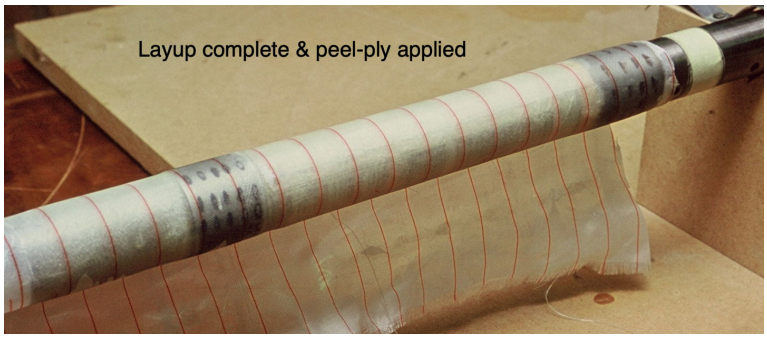


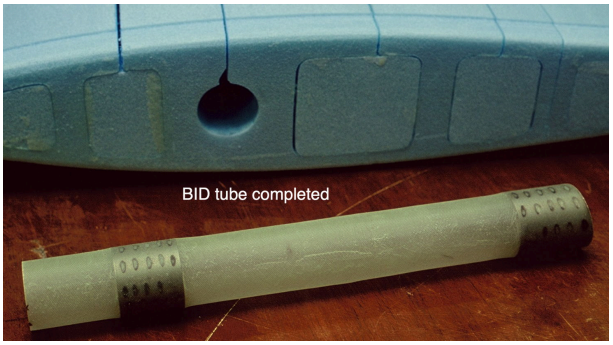
Figure 1: Layup scheme (Diagrammatic only; not to scale)

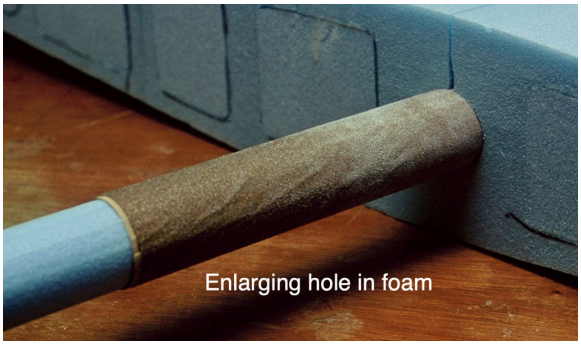
The photos on the following page illustrate some of the stages in applying this modification to my Europa XS, LAA project 247-13482.

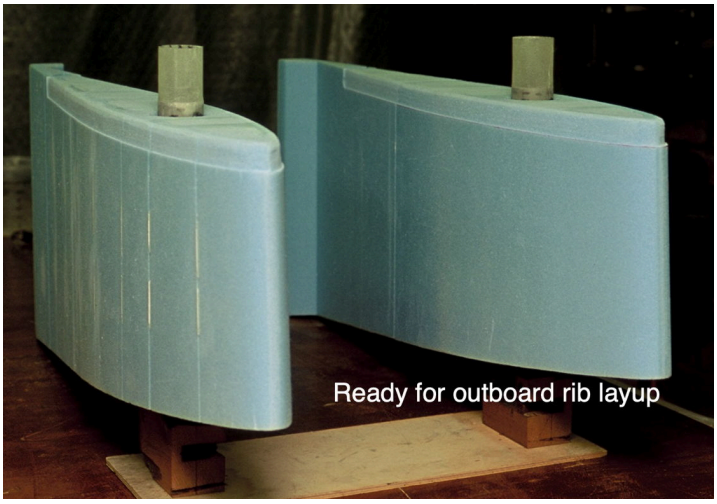

Newspaper & masking tape applied


Cutting cling film


Layup complete & peel-ply applied


BID tube completed


Enlarging hole in foam


Ready for outboard rib layup


STBD
Outboard rib completed