Wing rear attachment reinforcement

Classification: Mandatory

Applicability: All Europa Classic aircraft fitted with Styrofoam core wings.

Compliance: Within 10 flying hours after August 1, 2007, or before next Permit renewal, whichever is the sooner.

Introduction

The investigation into the accident with Europa G-HOFC revealed that in the rear attachment of one wing, the pin had not been fitted centrally in the hard-point laminated into the wing root rib for the purpose. The aluminium strips making up the hard point had also not been fitted directly one in front of the other, leading to variable edge distance in the tapped hole in the three strips. These features could have led to reduced strength in the rear wing attachment.

The design review of the wing rear attachment following the accident encompassed the sockets and the fuselage where they are mounted. Due to the potential for builder variations of the fuselage side reinforcement behind the sockets this modification requires that this area of the structure is upgraded to the same standard as the Europa XS and Europa Classic aircraft with Mod 52 (Gross Weight Upgrade to 1370lb) fitted.

This modification introduces a new wing rear-attachment pin with a longer threaded portion and a Nyloc nut and load spreading washer added behind the inboard flap hinge-plate to react the tensile load in the pin and so increase the tolerance to incorrectly constructed hard points. In addition, a tie-bar is incorporated to efficiently react tensile loads between the wing rear attachments. The tie-bar forms part of optional Mod 52, however, unless all the other features of Mod 52 are installed, no increase in maximum gross weight will be permitted.

The following description assumes modification to a finished wing and fuselage. It is also assumed that the following work is to be carried out by the original builder or similarly experienced person. If you are unfamiliar with the techniques required to carry out the work, seek skilled help.

The materials required for this modification are:

2 x W24/7 pins
2 x M12 Nyloc nuts
2 x M12 thick washers
SP Systems Ampreg 20 epoxy resin system
Interglass 92125 bi-directional glasscloth (‘bid’) or alternatively XE481 ‘biaxial’ cloth
Flox
Micro
Styrofoam
Peel-ply

Additionally - for aircraft not fitted with Mod 52.

Interglass 92145 uni directional cloth ('uni')
2 x W34 End fittings
2 each W35 and W35A Gusset plates
1 x W36 Tie-bar tube
4 x EUR044 bolts, 4 x EUR046 plain nuts, 4 x MS21042-4 nuts, 4 AN960-4 washers
10 each AN3-12A bolts, MS21042-3 nuts, AN960-10 washers
1 PLY-12, 16 x 25 x 355mm plywood.
1 x EUR049 3mm PVC foam, 250 x 50mm

These materials are available through Europa Aircraft, however, acceptable alternative structural epoxy resin systems may be used. Some suitable alternatives are Schueffler L285/H286, West Systems 105/205 and Aeropoxy PR2032/PH3660. The use of materials other than those listed above will require approval from Europa Aircraft.

Action

Step 1 – Wing rear pin hole location

The wing rear pin hole is described in the build manual to be located centrally both horizontally and vertically in the hard-point on the wing root rib. Because the metal strips in the hard-point are relatively narrow, it is important that the hole centre in the horizontal plane is accurate to within 1.6mm (1/16") of the vertical centre of the hard-point. If the hole centre falls outside of this tolerance, contact Europa Aircraft for a repair scheme.

Step 2 – Wing pin removal

Set the wing upside-down, suitably protected against scratching the paintwork and steadied against rocking whilst being worked on.

Before the wing rear pin is removed, measure and note the distance from the edge of the pip-pin hole to the hard point on the root rib (see figure 1).

This will aid setting up the replacement pin later.

The pin has been bonded in and will require gentle heat to soften the adhesive.

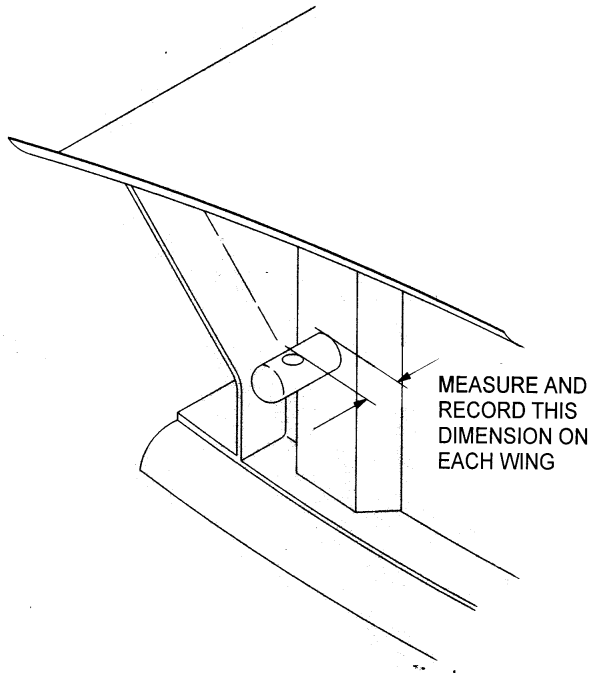

Fig 1. Measuring pip-pin hole distance from hard-point

First insulate the rib and wing structure around the pin with wet newspaper or rags then add a heat reflective layer of thin metal or even aluminium foil leaving just the pin exposed through it.

Gently heat just the end of the pin (60°C / 140°F, just too hot to touch, is all that is required) with a heat gun or large soldering iron whilst periodically applying an un-screwing turning force until it starts to move. A stud remover or pipe wrench will work well for this. Direct the heat gun parallel to the root rib rather than at it and allow time for the heat to transfer along the pin. Remove the heat source as soon as it is possible to begin turning it. Take care not to over-heat the fibreglass wing root rib or surrounding structure as this could lead to delamination damage.

Visually check the threaded hole that there are no signs of it having broken out of the edge of any of the three aluminium strips forming the hard point. See figure 2. If it is discovered that the hole does break out of the edge of any of the plates, contact Europa Aircraft for the appropriate repair scheme.

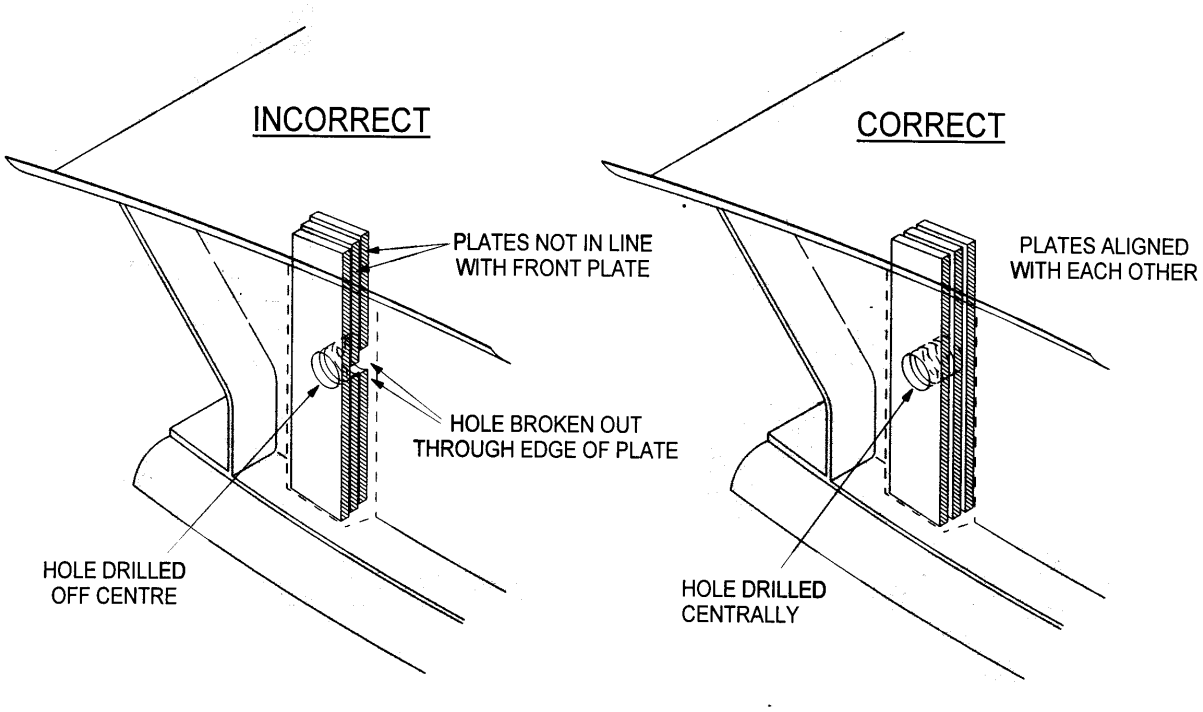

Fig 2. Hidden detail of wing rear attachment hard-point depicting incorrect manufacture

Step 3 – Access to pin threaded end

If necessary for better access, remove the bolts attaching the inboard flap hinge arm to the wing mounted hinge plate and swing the arm out of the way. You will be drilling a 57mm (2 ¼") diameter hole (small instrument size) in the wing underside, deep enough to gain access to the threaded end of the pin. A hole-saw is the ideal tool for this. Make sure that the pilot drill is set only just longer than the hole saw itself.

Mark out the centre of the hole according to the drawing in figure 3.

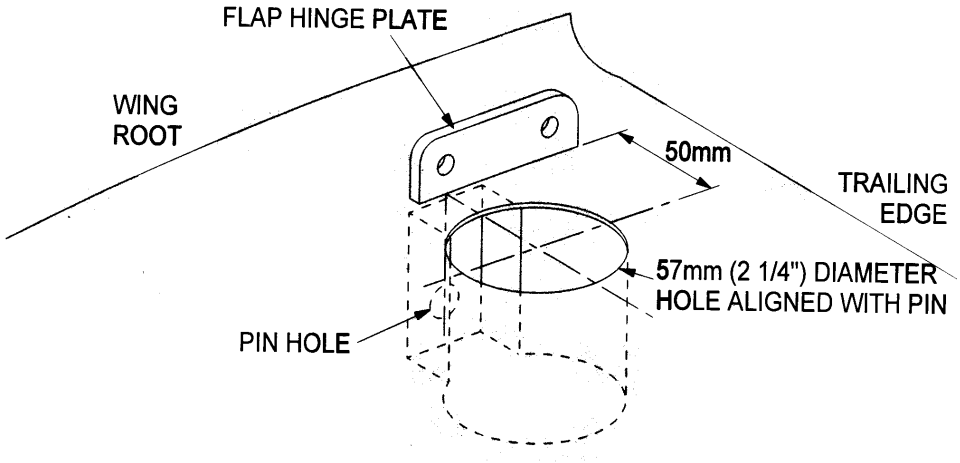

Fig 3. Dimensions of cavity for access to threaded end of pin

Taking care not to damage the flap hinge plate and the root rib lay-up, cut through the lower skin and drill down about 3 or 4cm (1-1/2”), remove the piece of skin then dig out the foam down to the depth of the cut. Repeat drilling with the hole saw as necessary until you reach a depth of approximately 2cm (3/4”) deeper than the pin hole. Don’t drill any deeper than this and be sure not to allow the pilot drill to go into the upper skin. You should end up with a neat hole with a flat base.

Now dig a channel in the foam about 4cm (1-1/2”) wide to expose the root rib as shown in figure 3. The edge of the flap hinge plate should be visible through the rib lay-up; check that the washer does not overhang the end of the flap hinge plate. If it does, consult Europa Aircraft for advice on how to proceed.

Step 4 – Wing pin installation

Initially, check that the new pins fit the sockets in the fuselage and that the pip-pin can be inserted without difficulty.

Carry out a trial installation of the pin in the wing before bonding it in. Screw the pin into the hole until the pip-pin hole is the correct distance from the root rib based on your previous measurements. On wings from aircraft that are fitted with Mod 52 – Gross weight upgrade to 1370lb, expect to see exposed a small length of the pin’s thread. The thread pitch is 1.75mm (0.070”), so each half turn will adjust the hole position by 0.875mm (0.035”). Try both pins in each hole to select the one that best matches the original pin hole position; it is quite likely that an exact match will not be achieved.

With the pins installed dry, rig the wings and check that the pip-pin can be installed through both pin and socket together. If you find difficulty in aligning the pin’s pip-pin hole it may save time to remove the pin, file narrow flats (max 3mm / 1/8” wide) for a 9mm or 3/8” spanner, parallel to the pip-pin hole and at the very end of the threaded portion then re-install it.

Adjust the wing pin as required for best fit. It may be necessary to apply gentle forward or aft pressure to the wing tip to align the pip-pin holes for pin insertion; this is normal.

Identify each wing pin to ensure that it goes back into the same wing and mark a line on the pin and another line on the root rib to aid final positioning on reassembly. Noting the number of turns required, remove the pin from the wing.

Ensuring that everything is clean, apply a coat of Loctite 243 onto both the thread of the pin and that of the hole then screw the pin into the wing to its pre-determined position. With minimum delay, rig the wing to the fuselage and check that the pip-pin can be inserted. While the Loctite is still setting, the pin can still be turned slightly to correctly align the pip pin hole. Allow the adhesive to cure before de-rigging to be sure that the pin is not disturbed.

Step 5 – Nut and washer installation

After the Loctite has cured, de-rig the wings and set each of them again upside-down. Mix up a small quantity of epoxy resin adding flox to make a stiff mix. Apply a generous amount of the flox onto the threaded end of the pin then install the large washer onto the threaded end of the pin but don't push it hard against the root rib. The pin and wing root rib are not quite square to each other so the flox is required as a 'liquid shim'.

Screw on the Nyloc nut until just before the edge of the washer contacts the root rib. It is important that the washer remains in full contact with the nut and that a wedge of flox remains between it and the root rib to take up the slight misalignment between the two. Allow to cure undisturbed.

Step 6 – Wing skin repair preparation

The largest ply of the repair lay-up covering the cut away portion of skin will extend onto the wing by at least 125mm (5"), so remove paint and surface filler from the skin for approximately 150cm (6") around the cut-out where possible. Use 40 grit abrasive paper to provide the appropriate surface preparation for bonding.

Carefully sand the skin surrounding the cut-out to taper it down evenly from 45mm (1.75") out from the cut-out edge to reveal the top three plies. You should be able to see faint lines that delineate the plies at 15mm intervals. See figure 4.

Fashion blocks of Styrofoam that will fit into the cavity with as few gaps as possible. See figure 4.

Step 7 - 1st inspection

Before it is covered up, the work including skin preparation must be inspected. An appropriate inspector (PFA in the UK) must check the work done and, if satisfied, an entry must be made in the aircraft logbook. In addition one of the paper placards at the end of this bulletin must be signed and dated by the inspector. The placard is to be placed on the wing root rib after final inspection and then covered with a single ply of glassfibre with clear resin so that it remains visible.

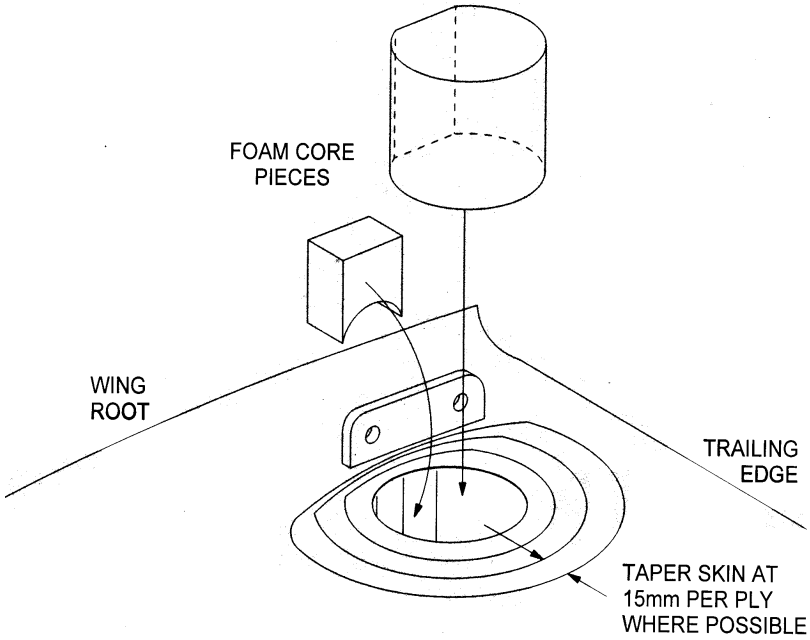

Fig 4. Skin sanded in preparation for lay-up and foam core pieces made.

Step 8 – Foam core replacement

Bond in the foam plugs with epoxy, mixed with micro balloons if available, leaving the foam slightly proud of the surface.

Note: *Don't be tempted to fill any large gaps with micro. If you do, there is the danger that the blob of epoxy might exotherm (heat up uncontrollably) due to the insulating properties of the foam. It's better to pack in small pieces of foam instead.*

After cure, cut off the excess foam and sand it to be flush with the skin, taking care not to damage the flap hinge plate.

Cut 4 pieces of 'bid' (***or*** 2 pieces of 'biax') at ±45° per wing measuring 180mm x 180mm (8" x 8") and 1 piece of 'bid' at ±45°, measuring 230mm x 230mm (9" x 9").

Mask the flap hinge plate and surrounding area of wing and flap against resin contamination.

Step 9 - Wing skin repair lay-up

Paint the scuffed area of skin with epoxy resin then apply four plies of 'bid' over the foam at ±45° to the span, lapping the first ply onto the prepared skin by 100mm (4") where possible and wetting it out fully. Subsequent plies should overlap 15mm *less* than the previous ply. If using 'biaxial' cloth only two plies are laid, the second ply overlapping 30mm less than the first ply. See figure 5.

Lay-up the final ply to extend a further 2-3cm (1") beyond the first ply, then cover the entire area with peel-ply and leave to cure.

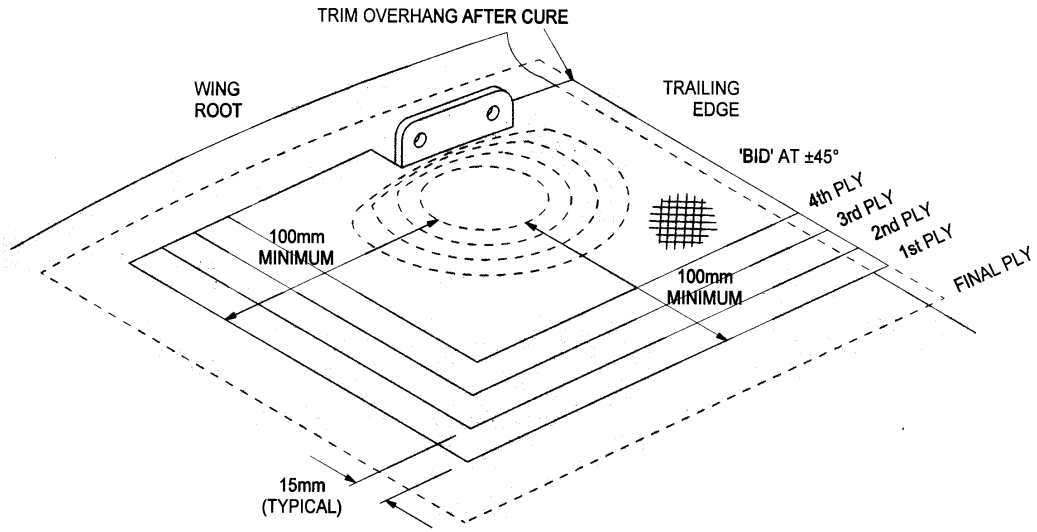

Fig 5. Lay-up showing first 4 plies of 'bid'

Aircraft not fitted with Mod 52 –(Gross Weight Upgrade to 1370lb (621kg))

Step 10 - Tie-bar

A general arrangement of the tie-bar assembly and associated parts is shown in figure 6.

The W26 rear sockets will remain in place, however the bolts that secure them will need to be replaced with longer ones to attach additional internal structure.

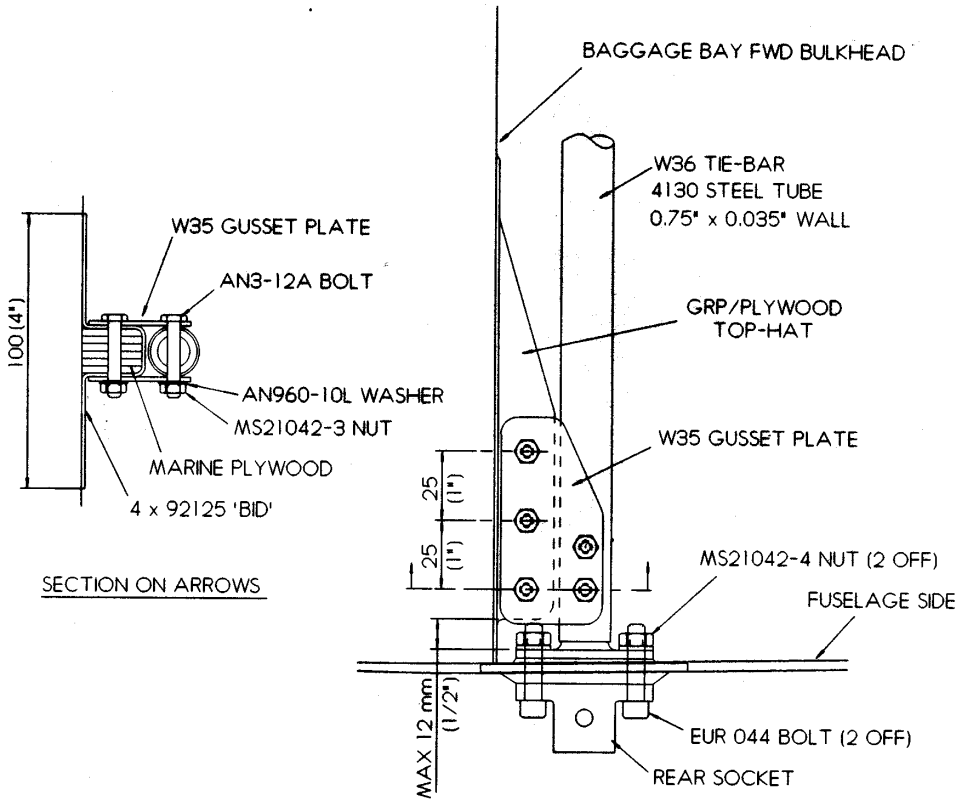

Fig 6. Top and sectional view of tie-bar and socket (port side)

The GRP top-hat stiffener behind each socket is no longer required and a portion needs to be removed to allow access to the nuts that are hidden within it. Cut away as much of the top-hat stiffener as practical, taking care not to damage the remaining structure, using a saw blade, and finish off with a small sanding block.

In Tri-gear aircraft, the forward, upper part of the front, outboard main gear support ribs will need to be cut away locally to give access to the wing rear socket retaining bolts. These ribs and the front, inboard ribs will also need to be cut away locally to allow the tie-bar through.

Remove the nuts from the bolts securing the sockets, but leave the sockets in place on the fuselage sides. The sockets will be held in place only with adhesive, so be careful not to knock them loose.

Mark a centre line across the face of the W34 end fittings then drill one ¼" hole through the flange of each, centred ¾" (19mm) from the flange centre. Next locate the W34 in place behind the wing rear socket using one of the AN4 socket attachment bolts. Rotate it on the bolt until the centre-line aligns with the vacant hole then spot through the hole with a ¼" drill. Remove W34 then drill the second hole on the bench. Temporarily attach the W34 fitting inside the fuselage using two EUR044 bolts and EUR046 plain nuts for now.

As the fuselage side is at a slight angle to the aircraft centre line where W34 sits, a shim of epoxy and flox will be required on assembly. Take this into account when positioning W34 at this stage. Mark a line across the top of the centre tunnel (and the ribs in Tri-gear aircraft) in the baggage bay to represent the ¾" diameter steel tube tie-bar which will be fitted between the W34 fittings.

It will be seen that it is necessary to cut a slot in the centre tunnel. Cut this slot and adjust its size to leave a clearance around the tube of approximately 3mm (1/8").

In Tri-gear aircraft, cut slots in the main gear ribs as required, but rather than a narrow slot as in the central tunnel, chamfer the slot sides at a 45° angle where possible. This affords better access for the tie-bar and will make installation of new plywood to reform the ribs easier.

Again, temporarily install the W34 fittings, with the tie-bar and insert the EUR044 bolts in each side. The excess thread on the EUR044 bolts will need to be cut off, but ensure that at least two threads protrude through the nut.

Step 11 - Gusset Plates

In addition to reacting the tensile/compressive loads it is necessary to provide sideways stiffness for asymmetric loads. This is done via two plywood blocks laminated onto the baggage bay front bulkhead, which are connected to the tie bar by means of gusset plates. Refer to figure 6.

Make up two plywood blocks according to figure 7. As each aircraft is bound to be slightly different, the width of the blocks must be determined by measurement.

Scuff sand the bulkhead where the plywood blocks fit and the surrounding 5 cm (2”). Using rapid epoxy spread over the entire bonding face, bond the plywood block on to the bulkhead, as far outboard as possible, but allowing space for the shortened EUR044 bolt and aligning it with the tie-bar. Remember to allow 2.5 mm (0.1”) between the block and the tie-bar for the thickness of glass fibre which will go over the block.

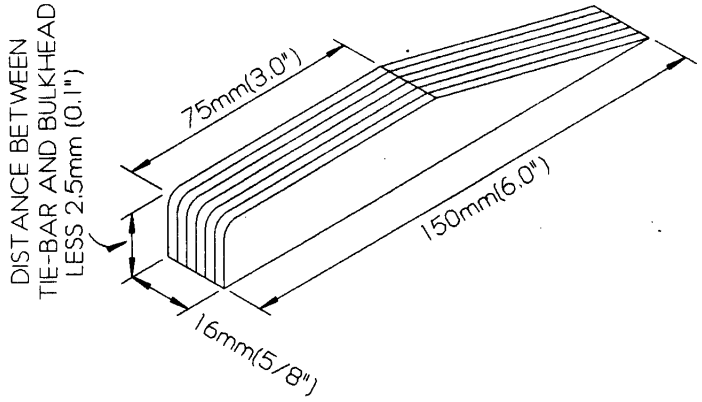

Fig 7. Plywood block for gusset plates.

Once secure, remove the tie-bar and W34 fittings and layup four plies of ‘bid’ at ± 45° over the plywood block, lapping onto the bulkhead all around as shown in figure 6. Make fillets with flox in the corners first to prevent the formation of air bubbles. Cover with peel ply and allow to cure.

After cure, remove the peel ply and reposition the tie-bar assembly. Position a gusset plate on top of the plywood block and tie-bar such that its outboard edge is no further than 12mm (0.5”) from the flange of W34 and, using the two holes as a guide, drill right through the tie-bar centre-line with a 4.8 mm drill. Install an AN3-12A bolt in each hole after drilling to ensure alignment for the next hole.

Now mark a line on the upper gusset plates which is central to the plywood block, then mark the centres for three holes, each 25mm (1”) apart and 13mm (½”) from the edge of the plate. Drill right through with a 4.8mm drill.

Next, install two W35 gusset plates to each end of the tie-bar, one above and one below, bolting them to the tie-bar with AN3-12A bolts and MS21042-3 nuts with an AN960-10 washer under it. Drill through the lower gusset plate with the last 3 holes and install AN3-12A bolts in these also. Don’t add the nuts to these bolts yet as you’re just about to remove the assembly again.

Step 12 - Final assembly of tie-bar

Initially remove all components identifying where they were fitted for re-assembly. Clean away any burrs and swarf caused by drilling.

Prepare each side of the slot in the central tunnel of the cockpit module for a glass fibre layup by removing the upper skin and foam to expose about 10mm (3/8”) of the lower skin. See sectional diagram in figure 8.

The tie-bar can now be installed for the last time. For the final installation of the tie-bar assembly make a stiff mix of flox and spread this on the flat face of the W34 fittings to form a shim to take up the uneven gap between them and the fuselage sides. With the tie-bar in place, fit the assembly into the fuselage and install the EUR044 bolts and MS21042-4 nuts.

Do not tighten the bolts at this point just tighten them enough to prevent movement of the W34 fittings. Scrape away any excess flox from around the W34s.

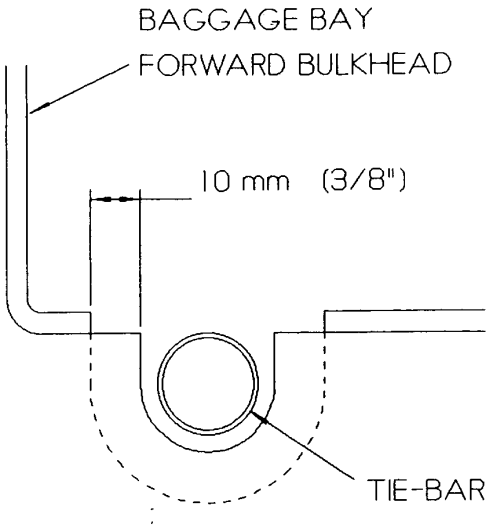

Fig 8. Section through baggage bay centre tunnel.

Install the gusset plates with the AN3-12A bolts and MS21042-3 nuts and AN960-10 washers.

Step 13 - Central tunnel slot closure

The final task to be done is to close the slot in the tunnel, tying the tie-bar into it in the process. Cut pieces of 3mm foam to fit into the slot across the top and down the angled side. The side pieces may be in two pieces each to take it around the tie-bar. Scuff sand the bonding areas each side of the slot.

Layup

Layup 2 plies of 'bid' at ± 45° on plastic sheeting at least 30cm x 20cm (12" x 8"). Cut a strip to fit into the slot and lay it to join the inner skins together. Drape it over the tie-bar, cutting it to allow it to go around the tie-bar at the sides. See figure 9.

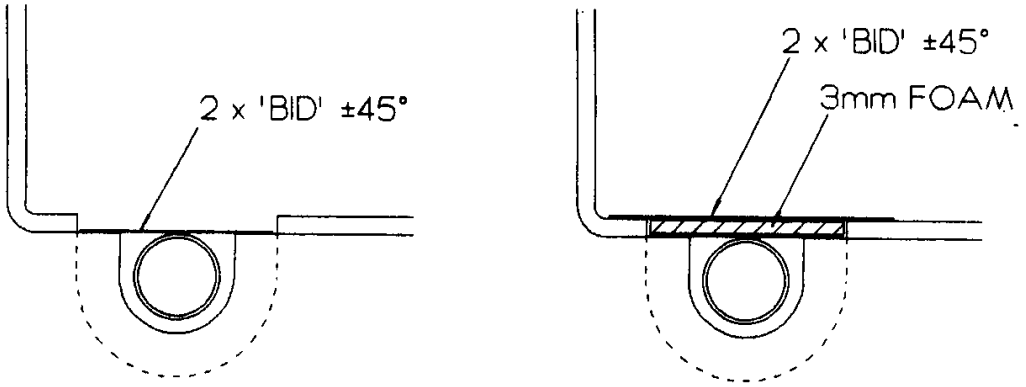

Fig 9. Section through tunnel detailing lay-up sequence.

Apply a layer of flox to the underside of the 3mm foam pieces and lay them in place over the first layup.

Next, coat the upper portion of foam with flox and finally layup 2 plies of 'bid' at ± 45° over the foam lapping onto the surrounding glass fibre and the tie-bar by about 20mm (3/4").

Cover with peel ply and allow to cure.

Step 14 - Tri-gear main gear ribs

Using ¾" plywood, make pieces to fit into the ribs where they have been cut away to accommodate the tie-bar.

Bond these pieces in place using flox then layup over them with 3 plies of 'bid' at ± 45° lapping the first ply onto the existing ribs by at least 5cm (2"), the subsequent plies being 12mm (½") shorter each time. Immediately layup 3 plies of 'uni' along the top of the ribs and down each side 25mm (1") with the fibres oriented along the ribs. Overlap the existing 'uni' plies by at least 5cm (2").

All Aircraft

Step 15 - Final inspection

The wing rear attachment modification is now complete and must be inspected before filler and paint is applied. An appropriate inspector must check the work done and, if satisfied, an entry must be made in the aircraft logbook. In addition, the paper placard for the appropriate wing, signed and dated by the inspector, must be placed on the wing root rib and covered with a single ply of glassfibre with clear resin so that it remains visible.

Step 16 - Finishing

Apply filler and paint to repair the surface finish according to the Finishing chapter of the Europa Build Manual. If re-painting of a large area is required, remove all the previously applied paint to minimise any weight increase.

Check the procedure in your country, but before the modified aircraft may fly in the UK, a PFA inspector must check the work done and, if satisfied, an appropriate entry must be made in the aircraft logbook and a Permit Maintenance Release (PMR), signed by the inspector.

Appendix 1

Alternative method of accessing the threaded end of the wing pin

Instead of obtaining access from the bottom skin of the wing it is possible to gain access via the flap close out. Before using this method check that there is at least 1mm (0.040") clearance between the leading edge of the flap and the flap close out. If this technique is used a ratchet ring spanner will be required to adjust the nut. When using this method follow the text for the underwing method except where described below.

Alternative Method - step 3 - Access to pin threaded end

The following text assumes that the wing is positioned leading edge down with the lower portion of the flap close out horizontal. Disconnect the flap drive as appropriate for monowheel or trigear aircraft, and swing the flap out of the way.

Referring to figure 10, cut away the skin of the flap close-out as marked. Remove the skin on the sloping section first with a dremel, and dig out the foam underneath until the surface is approximately flush with the horizontal skin. At this stage use a 2 ¼" hole saw and continue the cut 85mm (3 ½") down. The cut should be angled at approximately 15° from the vertical towards the pin - see photo - figure 11.

Next complete steps 4 and 5 on pages 4 and 5.

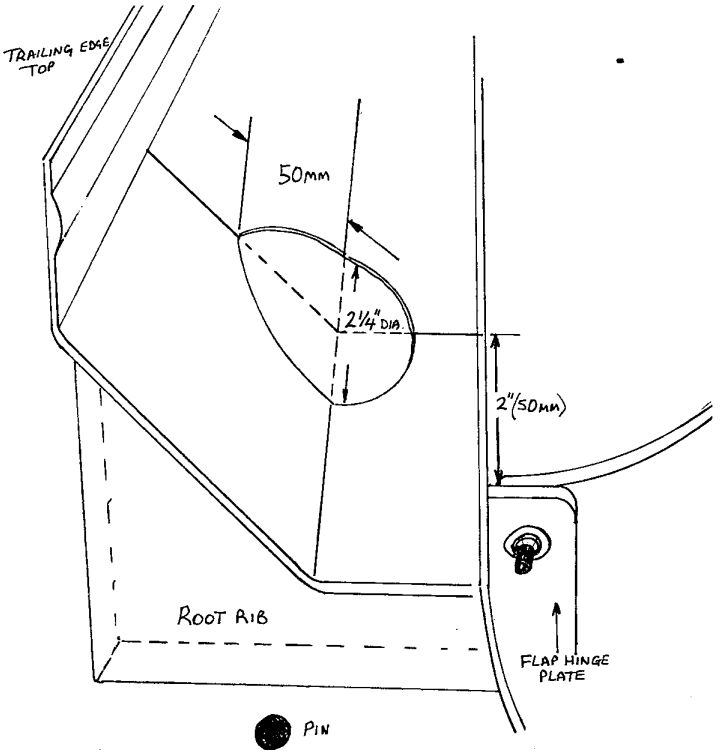

Fig 10. Access hole position in flap close-out.

Dig out the foam as necessary and repeat drilling with the hole saw until approx 20mm (3/4") past the pin hole.

Fig 11. Drilling angle.

Alternative method - Step 6 - flap close-out skin repair procedure

Referring to figure 12 and using the same technique as in the standard method, taper the skin. Make and fit foam blocks to fill the hole with as few gaps as possible.

Now complete steps 7 and 8 on pages 5 and 6, but do the repair procedure according to the Alternative Method - step 9.

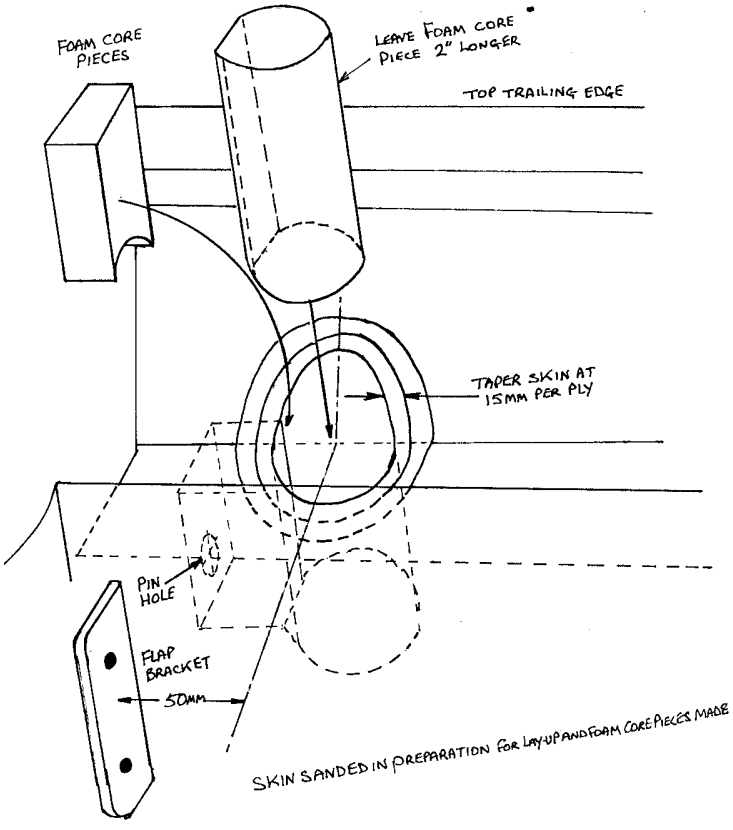

Fig 12. Foam plug and tapered skins.

Alternative method - Step 9 - flap close-out skin repair lay-up.

Referring to figure 13 layup 3 plies of 'bid', lapping the first ply over the skin by 80mm (3 1/4"), the second by 15mm (5/8") less than the first, and the third 25mm (1") greater than the first. Peel ply all over and allow to cure.

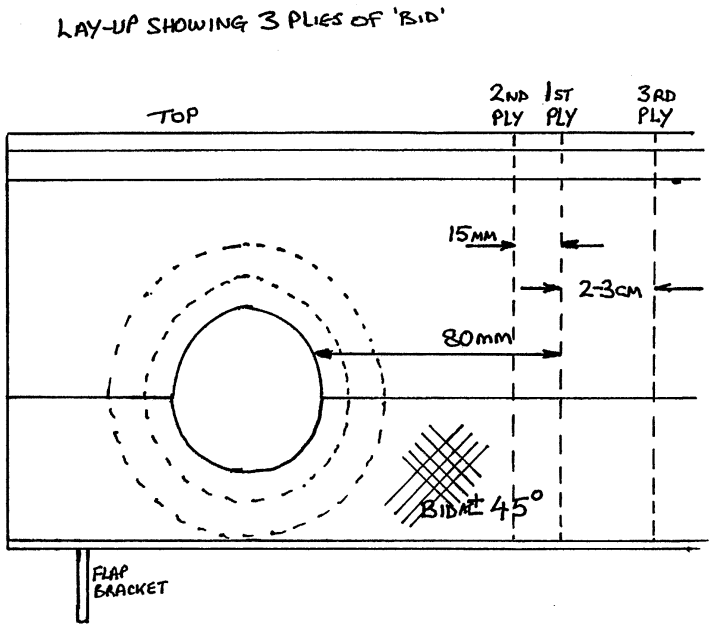

Fig 13. Repair skins - dimensions

Return to standard underwing instructions, step 10 on page 7..

EUROPA MOD 74 INSTALLED
1st. DATE: INSP No:
SIGNATURE:
2nd. DATE: INSP No:
SIGNATURE:

EUROPA MOD 74 INSTALLED
1st. DATE: INSP No:
SIGNATURE:
2nd. DATE: INSP No:
SIGNATURE:

Appendix 2

CAUTION

Mod 74 / Mod 52

The fitting of Mandatory Mod 74 to those aircraft that have not had Mod 52 incorporated requires the fitting of a tie bar between the two wing rear pick-up sockets.

Should you want, at some time in the future, to fit Mod 52 to increase the maximum all up weight of the aircraft you would need to change the sockets to a modified design that incorporates a "swivelling" feature.

The dimensions of the new socket are different from the existing socket in respect of the distance from the pip pin hole to the outside end of the socket.

The effect of this is that incorporation of Mod 52 after incorporation of Mod 74 would need the adjustment of the wing pin changing, and would therefore require the wing bottom skin to be opened up again.

If you think that you may wish at some time in the future to incorporate Mod 52 we would advise you to fit the new wing rear pick up sockets at this time in addition to the rest of the Mod 74.

The method of fitting these sockets is detailed in the Mod 52 leaflet, which can be accessed on our website www.europa-aircraft.co.uk.

The kit required is **Mod 74 Extras,** which comprises:-

W26A	Body	2 off
W26B	Socket	2 off
W26C	Barrel	2 off
EUR045	Bolt	2 off
MS21042-3	Nut	2 off

This kit will be available from Europa at a price of £138.00 plus VAT and delivery.