EUROPA

MODIFICATION NUMBER 43

MODIFICATION TO TAILWHEEL

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***Note**: The information in this manual refers to aircraft built to Europa manufacturing manuals. Any modifications may alter the applicability to your aircraft.*

List of Revisions

Issue	Revision	Pages affected	Date
7	-	-	May 2002
8	New format – minor change	All	January 2018
9			
10			
11			
12			
13			

Classification

Highly Recommended

Applicability

All monowheel Europas prior to XS model

Compliance

As required

Effect on the Empty Weight and CG:

You will need to amend your weight and balance schedule

Starting with your aircraft A.P.S weight and balance calculate in accordance with the following refer back to your Operators Manual to remind yourself of the method if necessary:

	Weight (lb)	Arm (inches)	Moment (lb.in)
A.P.S.	xxxxx	xxxxx	xxxxx
Old tailwheel removed,	-7.2	174	-1253
	new weight	————————	new moment
Now add new tailwheel	10.2	200	+2040
New aircraft A.P.S.	New total weight	Calculate c. of g.	New moment

For an average Europa weighing approx. 780 lb., this will give a change in A.P.S. c.g. of 3/4"to the rear.

You can of course re-weigh the aircraft if you wish.

Finally, annotate the aircraft records - Mod 43 incorporated.

Introduction

This modification has been introduced to incorporate a different tailwheel for the monowheel Europa, now incorporated in the XS model, giving improved ground handling characteristics.

The existing tailwheel is directly coupled to the rudder to provide positive steering on the ground. This system was initially considered necessary as it was not possible to use differential brakes to aid steering. Although this system works well when the tailwheel is on the ground, only small movements of the rudder pedals are required to keep the aircraft straight. Foot loads during this phase may also be relatively high. As soon as the tailwheel is lifted from the runway, larger movements of the rudder may be required, and the foot loads are quite light. This transition from tailwheel steering to rudder only steering can be quite sudden.

The new tailwheel arrangement allows full rudder deflection to be used with the tailwheel on the ground, making the transition from tailwheel on the ground to tailwheel up more progressive, the foot loads changing little.

The new tailwheel is positioned under the rudder, approximately 75 cm (30") aft of the original, which increases the effectiveness of steering. The tail itself is set slightly higher than before, improving visibility and reducing the amount of rotation required on lifting the tail during take-off. This, in turn, reduces the total gyroscopic precession effect when the tail is raised, and so reduces the tendency to swing. Foot loads are reduced, and turning in small spaces is improved.

There will be a small rearward change in the c.g caused by the removal of the old tailwheel and substitution by the new one - details are given at the end of this leaflet.

The tapered steel tailwheel spring is mounted to the rear fuselage floor approximately 15 cm (6") forward of the rearmost close-out. The spring passes through the close-out, about which it pivots. Due to the loads being taken by the rear fuselage area, extra reinforcement is required.

A general view of the tailwheel assembly is shown in Figure 1.

Study all instructions fully before commencing work on this Mod.

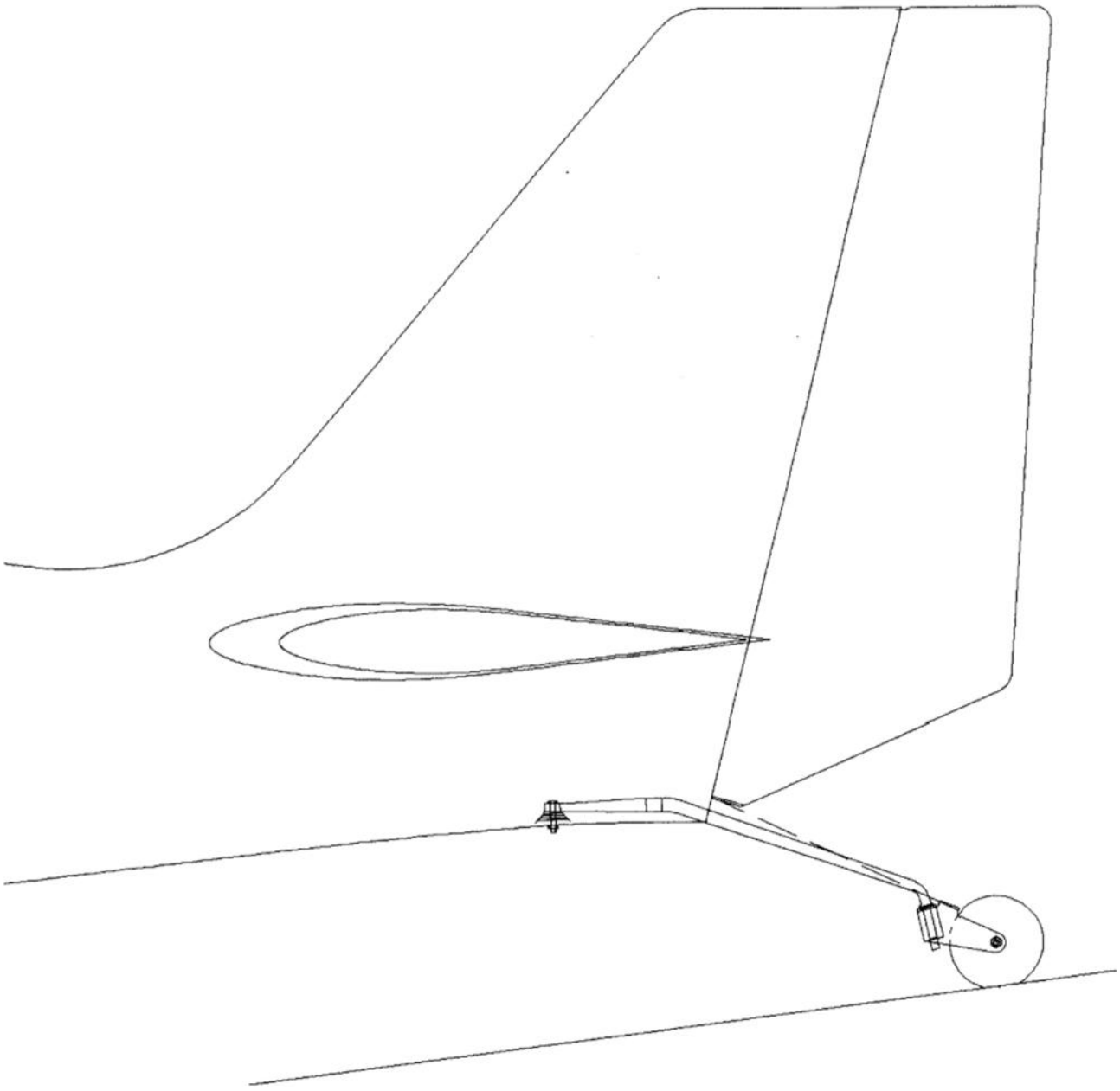

Figure 1 General View of Tailwheel

Action

Note: *The fin and its rear close-out must be installed before the new tailwheel assembly is fitted. If you have yet to install the rear bulkhead, the metal insert shown in the build manual, along with its reinforcements will not be required. Use the template at the end of this document for the revised lower area of the rear bulkhead.*

Preparation

Cut an access hole in the rear fuselage side between the rear bulkhead and the rear close-out. See figure 2 for dimensions and position. The cut out circle of 130 mm (5") diameter will become the access panel, so cut it out carefully. Make only one access hole: the side you make it will depend on whether you use your right or left hand when applying the reinforcing layups.

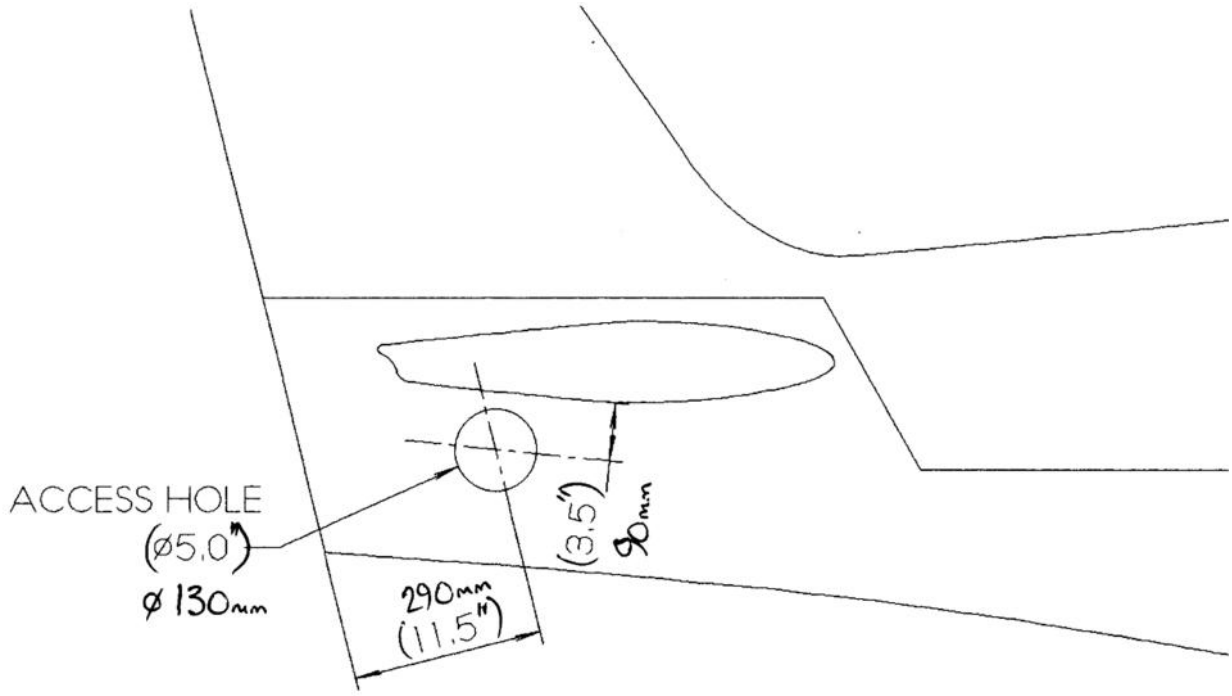

Figure 2 Access hole dimensions and position

A flange for fitting the access panel will be required, but not attaching it until later will give improved access into the rear fuselage.

Using this access hole, remove the four nuts holding the existing tailwheel to the rear bulkhead.

To remove the steering arm, cut the rudder cables just forward of the tailplane mass balance weight. Remove the split pin and castellated nut at the top of the existing tailwheel spindle. The tailwheel can now be removed from the mounting. Withdraw the four mounting bolts and, using an electric heat gun on the main fitting casting, soften the Redux so that it can be levered off.

The rudder cables will be extended by additional new cables. Retain all cable for use later. Remove the rudder and its push-rod.

Reinforcement

Scuff sand the area where the reinforcements will be, and clean out all the dust.

Remove the inside skin and the foam around a diameter of approximately 80 mm (3") centred on the position where the tailspring attachment bolt will pass through the fuselage bottom - this will be “approximately” 160 mm (6 1/4") forward of the close-out front face.

Taper the inside skin and foam, and layup 3 plies of ‘bid’ onto the exposed outer skin and lapping 30 mm (1.181") onto the surrounding inside skin - see Figure 3. Note that this layup can be carried out at the same time as the one defined below.

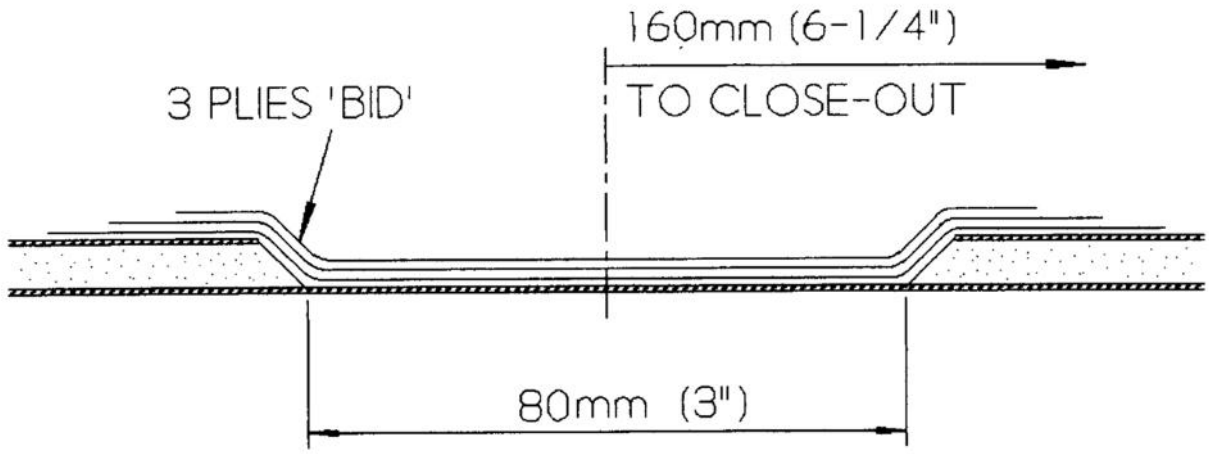

Figure 3 Reinforcement of bottom skin at tailwheel spring front attachment bolt position

Reinforcements between bulk head and close-out

To establish the size and shape of the required reinforcement layups, make templates from paper or plastic sheet, laying them in place to check for fit. Reinforcement of the area between the rear close-out and the rear bulkhead, and to the rear of the close-out, is required to take the tailwheel loads. See Figure 4.

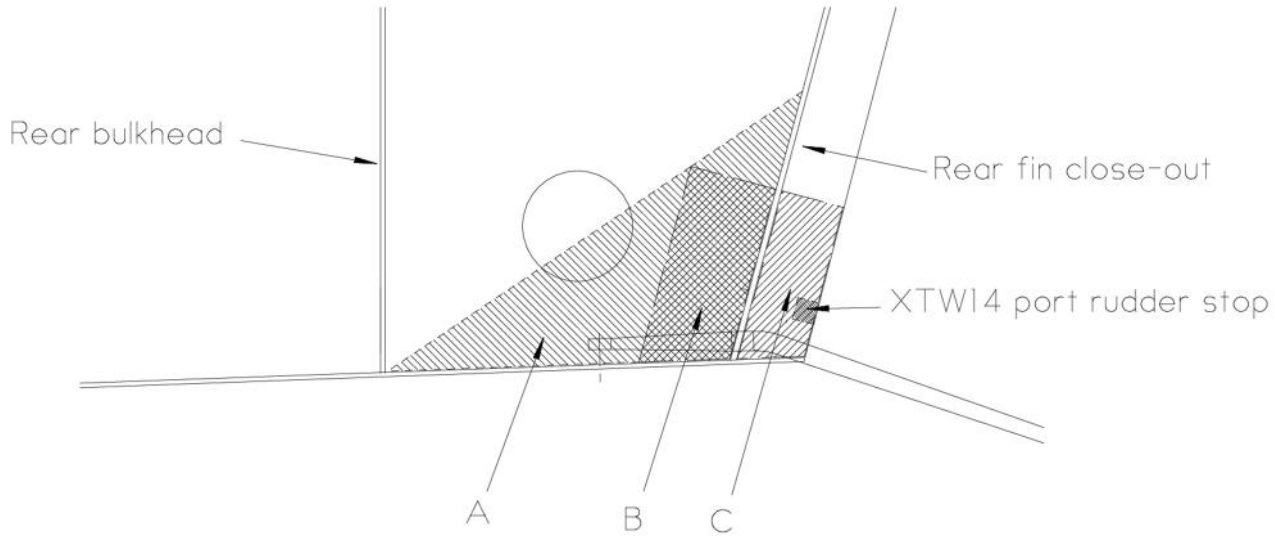

Figure 4 Reinforcement layups

Make a triangular shaped 3 ply 'bid' layup which covers the lower 300 mm (12") of the rear close-out and runs forward and down to the base of the rear bulkhead. The datum edge of this layup should be the diagonal edge. Layup A in Figure 4. This layup should lap onto the close-out full width and onto the floor. Make a similar 3 ply layup to cover the other side overlapping the first layup on the rear close-out and floor.

The next layup (layup B in Figure 4) is a 3 ply 'bid' layup which covers the lower 200 mm (8") of one side of the rear close-out, lapping onto the floor. The final layup in this area is a mirror image of this one, overlapping the rear close-out and floor as before. Peel ply the edges of cloth and allow to cure.

Onto the aft face of the rear close-out, layup 3 plies of 'bid', covering the lower 200 mm (8") of the close-out, lapping onto the fuselage side and floor (layup C in Figure 4). In between the 2nd and 3rd ply set in the XTW14 port rudder stop plate 1.75" above the fuselage bottom, with its rear edge flush with the rear edge of the fuselage, as shown in Figure 4. Another 3 ply layup, a mirror image of the previous one, should be applied, overlapping it on the close-out and floor. Peel ply the cloth edges and allow to cure.

A 2 ply 'bid' layup is sufficient to repair the original tailwheel shaft hole. Taper the inside skin down to reduce the step, then layup a 100 mm (4") diameter patch. Fill and sand the outside to blend in with the existing skin.

Layup summary

3 pieces 130 mm (5") diameter - bottom skin inner to outer skin joint.
3 x triangle from bottom of rear bulkhead to 300 mm (12") up at close-out one side.
3 x triangle from bottom of rear bulkhead to 300 mm (12") up at close-out other side.
3 pieces 250 x 200 mm (10" x 8") – close-out front face to one side and floor.
3 pieces 250 x 200 mm (10" x 8") - close-out front face to other side and floor.
3 pieces 250 x 200 mm (10" x 8") - close-out rear face to one side.
3 pieces 250 x 200 mm (10" x 8") - close-out rear face to other side.
2 pieces 100 mm (4") diameter - original tailwheel hole cover.

Spring installation

Mark a horizontal line onto the rear face of the close-out 25 mm (1") up from the outside skin. Drill a 23 mm (7/8") hole centrally onto this line for the tailwheel spring to pass through. The hole should be cut parallel to the rear fuselage bottom, not square to the close-out face.

Insert the tailwheel spring rod through the hole in the rear close-out so that the parallel portion immediately ahead of the bend is in the hole. This should position the hole through the flat end of the spring approximately 165 mm (6 1/2") forward of the close-out front face.

Set the fuselage so that it is level and referring to Figure 5 position the spring so that the bottom of the threaded portion is 235 mm (9.25”) below the bottom of the rear fuselage.

Measure the gap between the underside of the flat at the forward end of the spring rod and the fuselage floor. A pad made up from pieces of 3 mm plywood with 2 plies of ‘bid’ between each is required underneath the flat end of the spring rod. Allowing 3 mm (1/8") for a steel support pad XTW15, which will go on the top of the fibreglass pad, and 3.75 mm (0.15") for each layer of plywood with the two plies of ‘bid’, prepare the necessary number of layers to fit in the fuselage underneath the spring fixing hole. You should expect a pad thickness of at least 20 mm (3/4)".

A sectional view of the forward fixing point is shown in Figure 6.

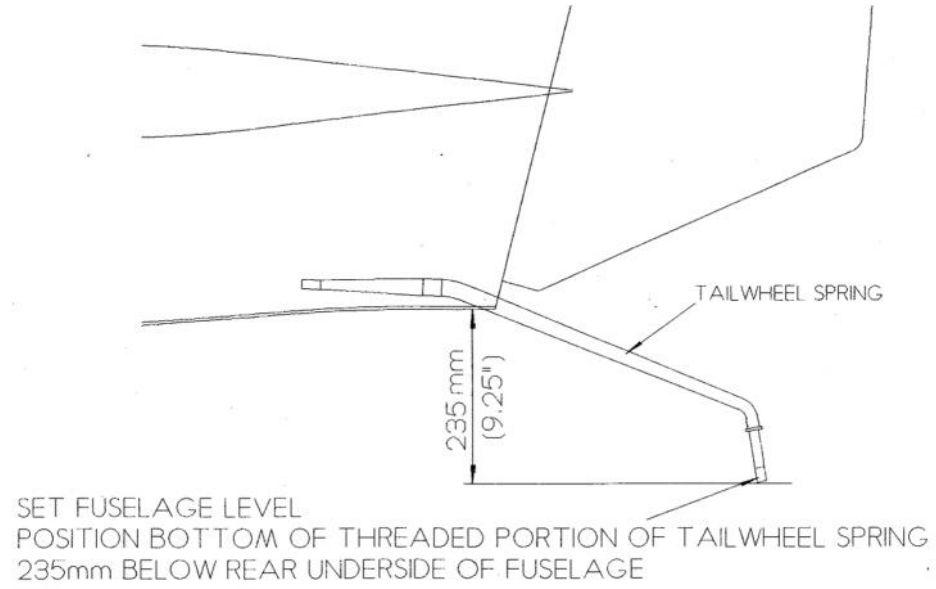

Figure 5 Positioning tailwheel spring rod

To enable easy laying up of the glassfibre plies between the plywood pad pieces, arrange the pad to be chamfered fore and aft. Each piece should be chamfered as required on the sides also to fit the curve of the fuselage bottom. See figure 6.

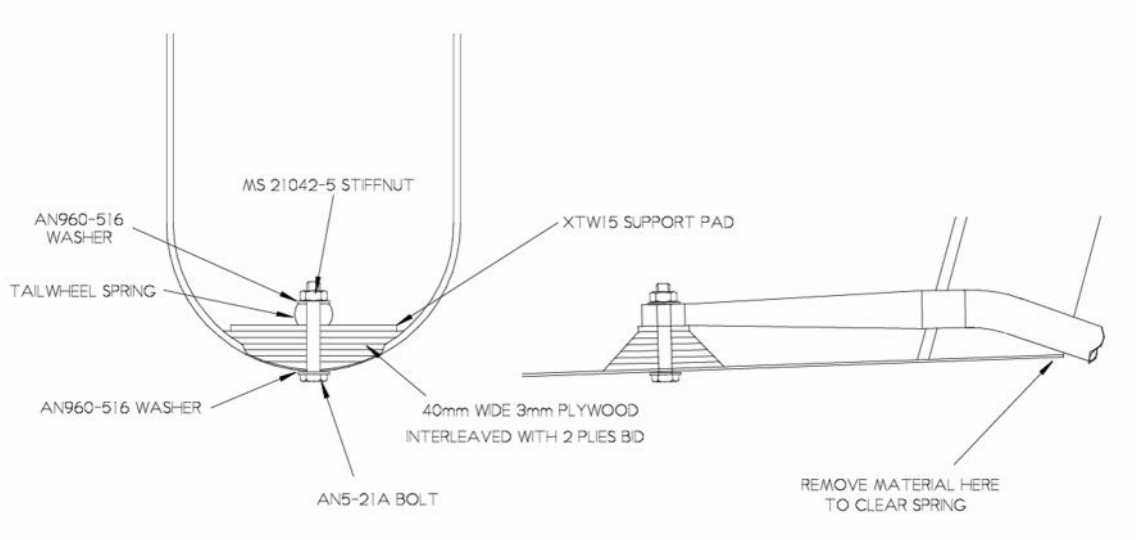

Figure 6 Spring rod forward mountings

Having ensured that the plywood pieces fit in place within the fuselage, and that the tailwheel spring rod fits with clearance beneath it to allow for adhesive and glass fibre, prepare the area for bonding.

Apply the plywood pieces with flox, laying up 2 plies of 'bid' over each piece, lapping onto the surrounding fuselage skin by at least 50 mm (2") all around. Double check the positioning of the

pad, then finally bond on top the 3 mm thick steel plate. Insert the spring rod to ensure that the pad and rod surfaces mate properly. Peel ply the glass fibre edges and to allow to cure fully.

After cure, position the spring rod as before and, holding this position, carefully drill through the pad using the hole in the spring rod as a guide. Install an AN5-21A bolt with an AN960-516 washer under the head from the bottom, securing it with an MS21042-5 stiff nut and another AN960-516 washer. Using Redux, or alternatively flox, bond the spring to the rear close out where it passes through the 23 mm (7/8") diameter hole.

Rudder horn

The rudder is driven directly by the rudder cables which are attached to a horn bolted to its base. From the same horn, cables run to the tailwheel for steering.

Installation

Mark a line on the rudder at 90° to the hinge flange and 13 mm (1/2") below the end of the lower hinge - see figure 7.

Carefully saw off this portion of the rudder, then remove the exposed foam core to a depth of 15 mm (5/8"), making sure that all foam pieces have been removed from the resulting glass fibre flanges.

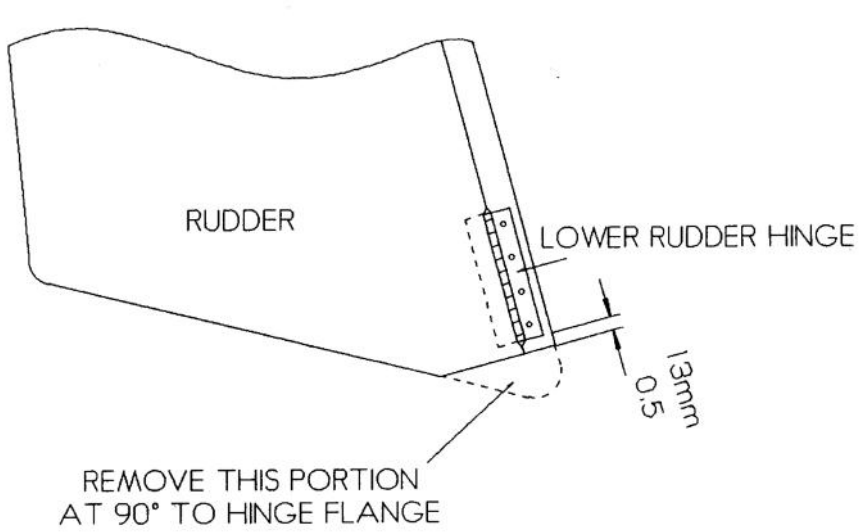

Figure 7 Lower rudder modification for rudder horn

Layup 4 plies of 'bid' onto the foam and lap up onto the flanges all around, including the leading edge, cover with peel ply and allow to cure. See Figure 8.

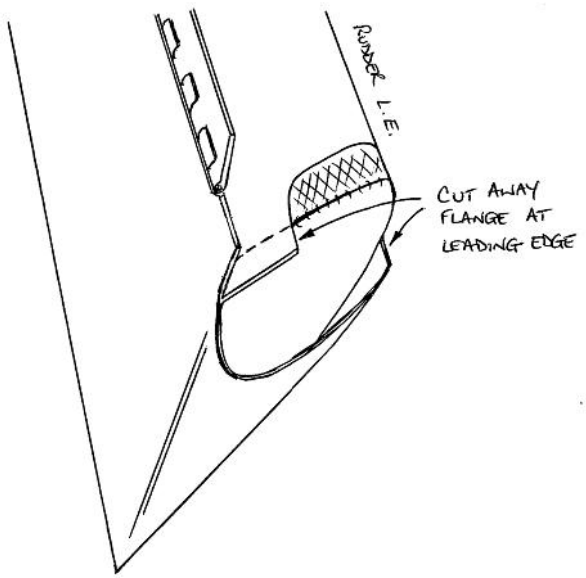

Figure 8 Layup at leading edge

After cure, remove the peel ply and trial fit the nut plate XTW12 into the base of the rudder. Trim the edges if required until it can fit properly into the glass fibre rib. Drill through the holes of the nut plate into the glass fibre with a 4.8 mm drill then, removing the plate, enlarge the holes in the glass fibre to allow the anchor nuts to enter.

Attach three MS21047-3 anchor nuts to the upper side of the nut plate XTW12 using TLPK429BS pop rivets. Scuff sand both sides of the nut plate for bonding then flox the plate in place to the base of the rudder ensuring that flox does not squeeze into the anchor nuts.

Carefully mask or block the holes for the bolts with masking tape, plasticine or modelling clay to prevent epoxy from entering. This can be cleared away later before inserting the attachment bolts.

Next, having made a flox fillet all around, layup 4 plies of 'bid' over the plate and up onto the flanges, including the leading edge as before. Peel ply the layup and allow to cure.

After cure, remove the peel ply and drill open the bolt holes. Be careful not to drill right through into the thread of the anchor nut of course.

Using AN970-3 washers as spacers/shims between the rudder base and TW09 rudder horn on the hole nearest to the hinge and the rearmost hole attach the horn to the rudder. The long horn should be orientated to starboard.

The vacant mounting hole is used for cable attachment. This bolt can only be installed when the rudder is in place on the aircraft as the control cable must be attached to it. The cable from the left rudder pedals attaches above the horn, and the cable to the tailwheel is fastened below it. See Figure 9.

With the horn attached to the rudder with the two bolts only, and having trial fitted the cable attach bolt with its spacers, bolt the rudder to the fin.

Note: *The lower hinge bolts will probably be too short due to the extra layups on the hinge flange four AN525-10R10 bolts are provided*

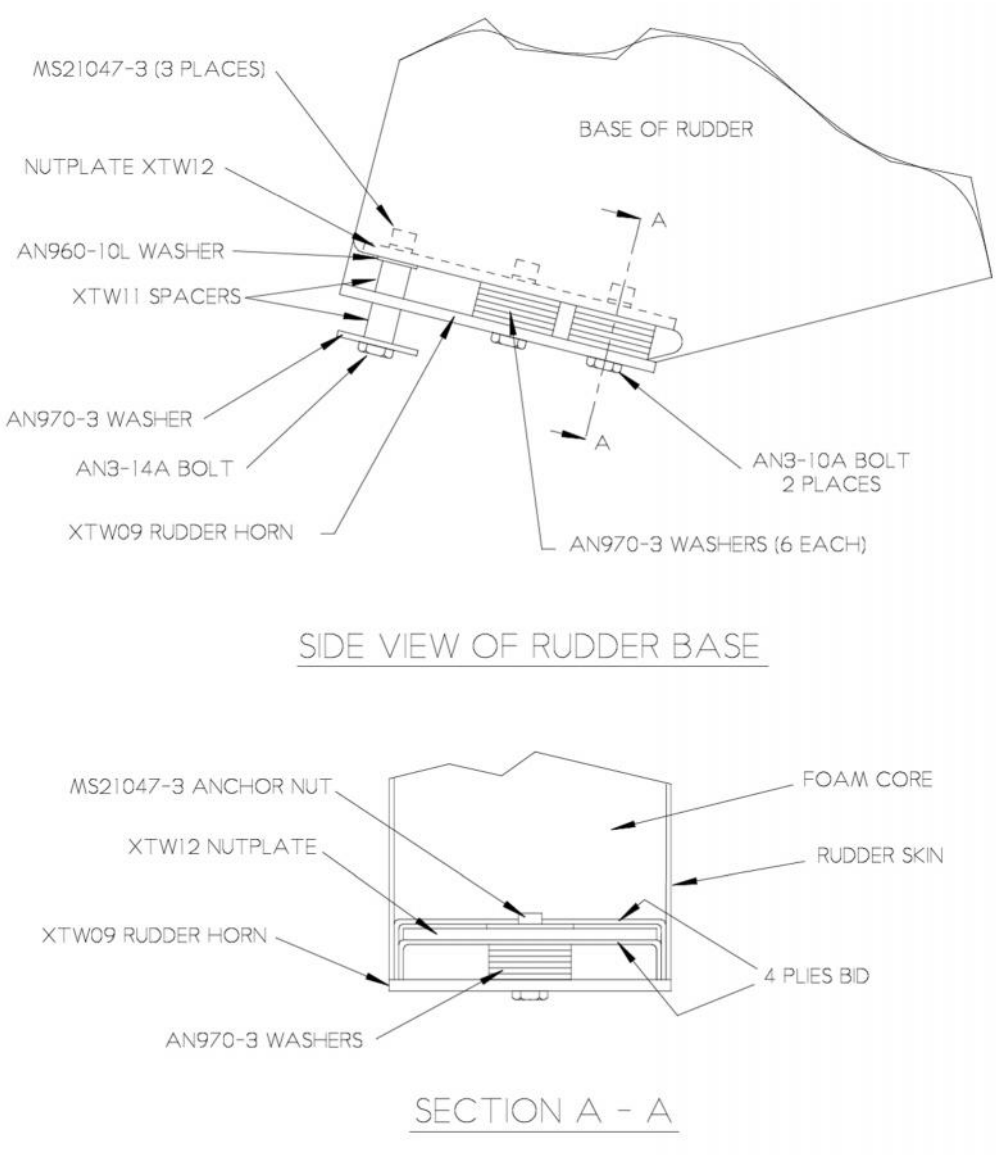

Figure 9 Cable Mountings

Tailwheel

The tailwheel is supplied complete with bushes already installed and reamed. It may be necessary, before installing the fork onto the spring rod, to clean up the pivot shaft and thread, as scale may have formed on it during the hardening process.

Slide the tailwheel fork onto the spring rod, then secure it with an AN310-8 castle nut and EUR036 washer. Tighten the nut sufficiently only to eliminate play, but still allowing the fork to pivot. A split pin is required to lock the nut, so using a 3.3 mm (1/8") drill bit, drill through the threaded portion of the rod between two of the nut's castellation's. Take care with your aim to emerge the other side between castellation's also. The spring rod is made from hardened steel which will make drilling quite tough. A new masonry bit is recommended for this operation.

Tailwheel stop

Through the slot in the fork pivot housing, push a 20 mm long 4 mm diameter roll pin into the pre-drilled hole in the spring rod shaft. The roll pin should be pushed in such that it doesn't quite touch the pivot housing at the other side - see Figure 10. You can push the pin back for disassembly through the grease nipple hole. Check that the tailwheel fork is free to rotate either side of neutral until the end of the slot contacts the roll pin. Recover the grease nipple from the old tailwheel and fit it to the new tailwheel fork.

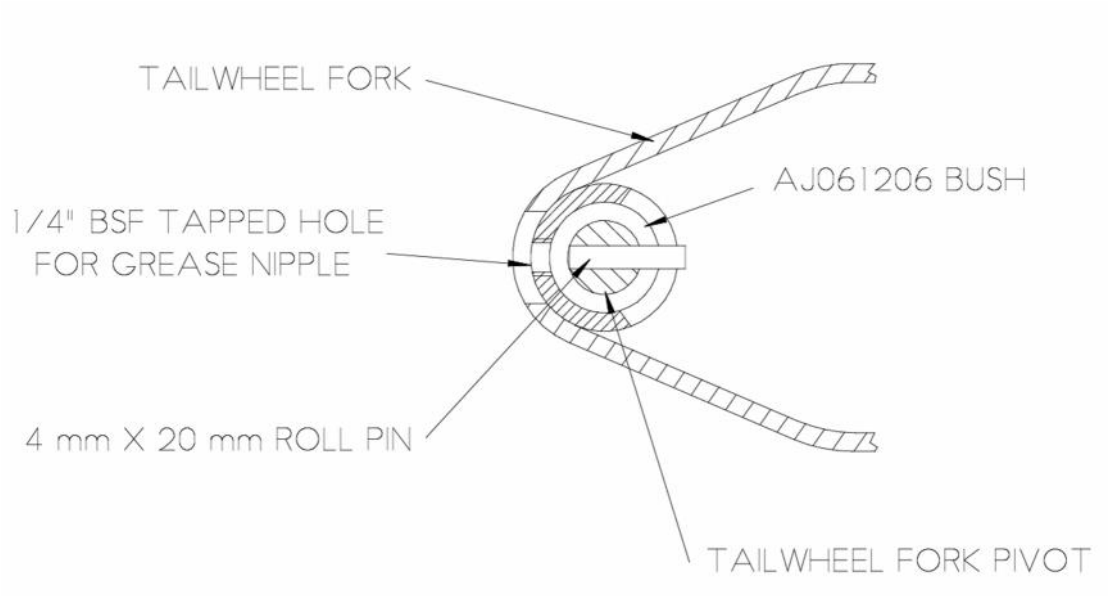

Figure 10 Section showing position of roll pin stop

Tailwheel

To space the tailwheel away from the sides of the fork spacers XTW08 are provided. Insert the spacers into the bearing hole each side and slide the tailwheel between the arms of the fork to line up the holes. The 3/8" x 4 1/2" bolt through the tailwheel should have on it at each end spacers XTW13 with EUR033 washers each side of them. These spacers provide a means with which to secure the tailwheel onto the trailer, and for the attachment of a ground handling steering arm. Secure the bolt with a 3/8" Nyloc nut. See Figure 11.

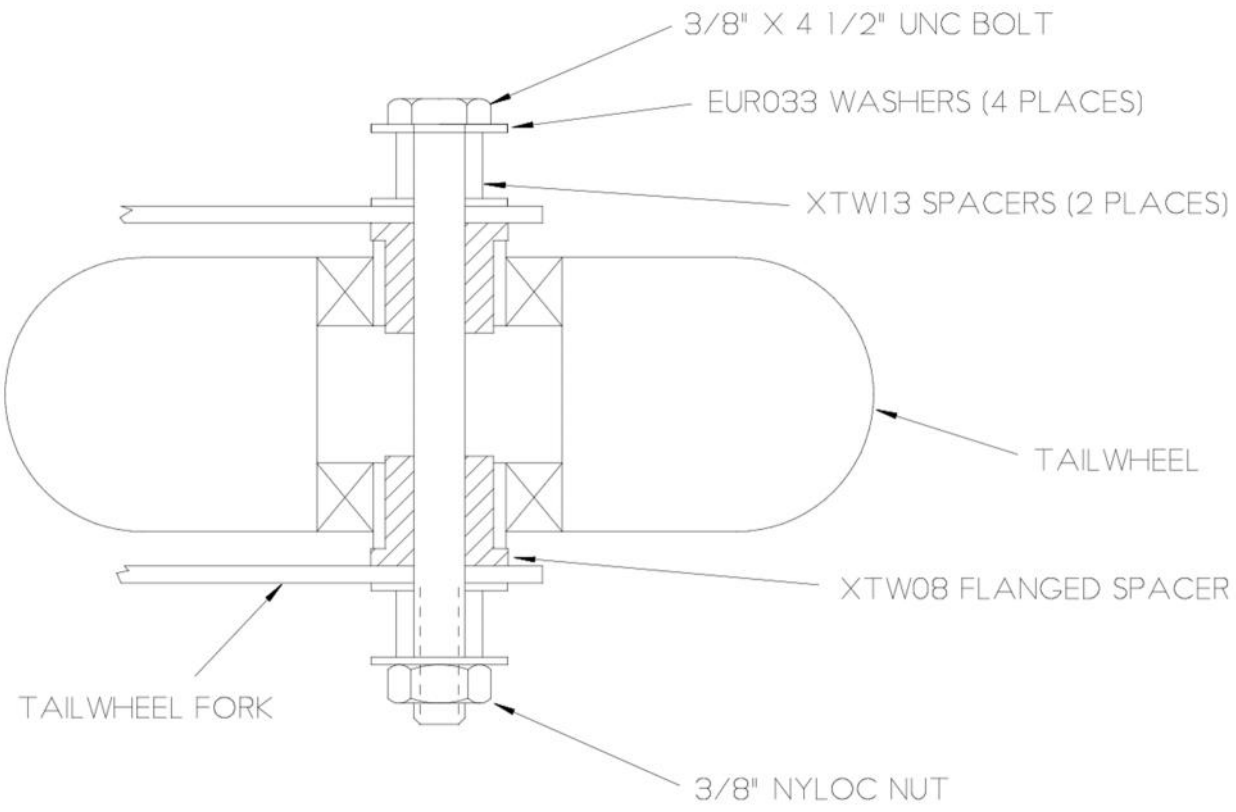

Figure 11 Section through tailwheel axle

Cables

Each rudder cable runs from the CS21 horn on the rudder pedal shaft, under a pulley and attaches to the rudder operating horn at the base of the rudder. Each existing cable will be extended by swaging on a thimble at the aft end where it was cut, and fitting to that thimble another one with the new cable swaged onto it. These new cables will terminate at the rudder horn.

Cable length adjuster (optional - not supplied)

Whilst carrying out this operation you may wish to incorporate an adjustment feature - two 16 s.w.g. HS30TF aluminium plates 12 mm (1/2") wide with a series of 4.8 mm (3/16") holes drilled at 12 mm (1/2") intervals with AN3 bolts trapping the thimbles between the plates would be suitable.

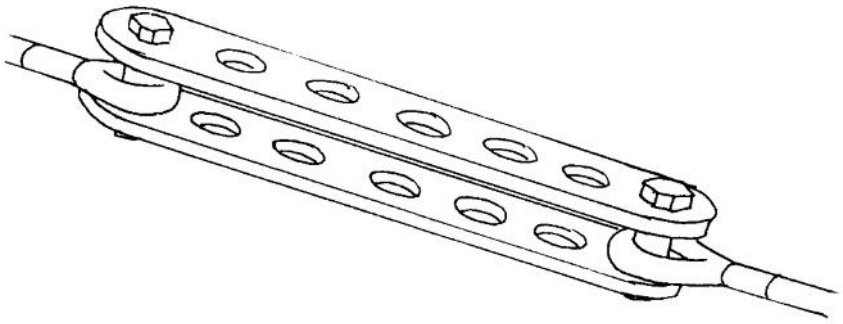

Figure 12 Cable length adjuster

Port cable

The port cable will require a 1/4" hole in the rear bulkhead about 35 mm (1 3/8") to the port side of centre and a similar height from the floor as measured at the centre.

Make a simple fairlead from a short piece of the plastic cable sleeving. This should be bonded in place once the exact run of the cable has been established - don't forget to slide it onto the cable before fitting the thimbles.

Another hole for the cable is required through the rear close-out. Judge where this should be using the position of the cable attaching bolt on the horn as a guide.

Run the cable through both holes and adjust their positions as necessary for the cable to run in a straight line between pulley and operating horn.

Starboard cable

Cut a hole through the rear bulkhead for the cable at the same level as the port cable but within 20 mm (3/4") of the side wall.

The starboard cable will emerge through the fuselage side approximately 330 mm (13") forward of the rudder operating horn. Sighting through the access hole, and using the port cable also, judge the height at which the cable should run to maintain a straight line from the pulley to the horn and

cut a small hole through. The final hole will be a slot, wide enough for a fairlead made from a short piece of cable conduit to be bonded into.

Rear thimbles

To establish the cable lengths, set both rudder pedals to their neutral positions where the uppermost tube of both pedals are in line with each other. Fix the pedals into this position ensuring they are unable to move. With the rudder straight, crimp on a thimble to each cable end so that it aligns with its horn attaching bolt. It's difficult to crimp cables to be an exact length so ensure that they are slightly longer rather than shorter. It's always possible to shorten the cable with an adjuster. See the Rudder System chapter in the build manual.

Cables to tailwheel

The cables between the rudder horn and the tailwheel steering arm are made in two pieces which have a spring between them. The spring acts to take out shocks from the tailwheel.

Make up two cables 130 mm (5") long with AN100-C4 thimbles at each end using two 28-2-G Nicopress sleeves at each end to secure them. The cables should be measured as shown in Figure 13.

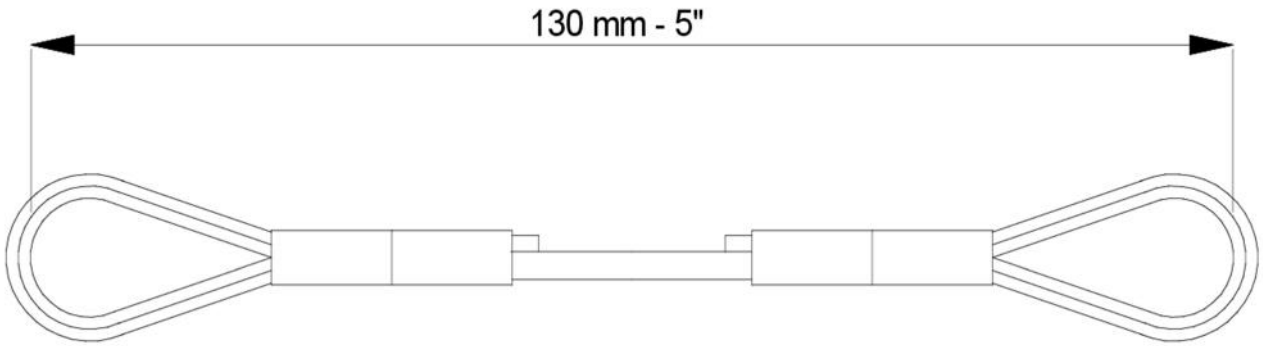

Figure 13 Cable length measurement

Hold the left rudder pedal back against its return spring, or disconnect the spring temporarily to enable the cable to be pulled aft easily. With the steel spacer XTW11 through the thimble of the cable install the AN3-14A bolt with an AN970-3 washer and another XTW11 steel spacer already on it into the left hole in the base of the rudder. Ensure also that one of the 13 cm (5") cables you previously made is attached to the lower portion of the bolt.

On the end of the horn protruding on the starboard side of the rudder attach the right rudder cable as detailed in Figure 14.

Attach the second 130 mm long cable to the lower part of the attaching bolt in preparation for fitment to the tailwheel steering arm.

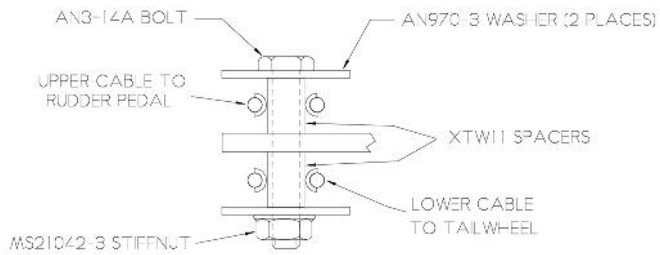

Figure 14 Detail of starboard cable fixing

Tailwheel steering cables

The length of these cables, which link the springs to the tailwheel steering arm, is determined by the amount of pre-compression of the springs. The springs should be pre-compressed approximately 10 mm when tailwheel and rudder are in their neutral position. The cables are connected to the tailwheel steering arm via steel wire rings. Install the rings to the two holes of the steering arm.

To install the springs into the short cables attached to the rudder horn, remove one spring hook from the spring, thread it through the thimble of the cable having first slid the spring and its remaining hook onto the cable. The axes of the two hooks should be at right angles, not parallel, to each other.

Now make up cables to run between the spring and the rings on the tailwheel steering arm such that the spring is compressed by 10 mm ± 2 mm from its relaxed length when the rudder and tailwheel are at neutral. Use two 28-2-G Nicopress sleeves to secure each thimble.

Rudder stops

Port rudder stop

The rudder is prevented from excess movement to port by the small protuberance on the port side of the rudder horn contacting the fuselage rear edge flange and the reinforcing plate XTW14. It may be necessary to file the flange and plate locally to obtain the necessary movement, which should be between 30° and 32°.

Movement to starboard is limited by the horn contacting a steel stop (Part no. XTW10) mounted to the fuselage side just below the lower rudder hinge - see Figure 15.

The protruding blade must be cut and filed to contact the rudder horn when the rudder reaches its maximum movement to starboard.

The lowermost bolt fastening the hinge secures the top of the stop, and to facilitate variations in this position the upper hole in the stop has not been drilled.

Remove the lowermost rudder hinge bolt and set the rudder to be at 30° to 32° to starboard. With the stop XTW10 in position but with the oversized blade just underneath the rudder horn, mark a line on the blade where the horn front edge is. Cut and file the blade and, with it now aligned with the horn, drill through the flange and bolt the stop to it using an AN525-10R8 bolt and MS21042-3 nut with an AN970-3 washer under it.

Finally, drill through the upper part of the stop's flange where the hinge bolt hole is and secure the stop with the hinge bolt.

Figure 15 Tailwheel drive cable

Access hole flange

The flange for attachment of the access panel is made up of a ring split into two pieces to enable inserting them through the hole to fit them.

To make the ring, layup 4 plies of 'bid' on a flat surface to make a disc 150 mm (6") diameter. Cut a 100 mm (4") hole in the centre of the disc to make the ring, then cut the ring in half. Bond the split ring to the inside skin of the fuselage centred on the access hole using flox. Drill four equispaced 4.8 mm holes in the flange and rivet MS21047-3 anchor nuts in place using TAPK33BS rivets.

You will require holes in the access panel to match the anchor nut holes. Fasten the panel using four AN525-10R8 bolts.

Drain hole

Drill a drain hole 3 mm (1/8") diameter just forward of the rear close-out, positioning it at the lowest point (tail down) on the inside fuselage bottom skin.

Outrigger leg length

The change in the deck angle brought about by this Mod means that the outrigger legs will now be too short, and the aircraft would 'teeter' unacceptably. To correct this, it is necessary to fit new outrigger legs. Remove and discard the original legs, and substitute the new legs. The total length of the new leg is 372 mm (14 5/8"'). The assembly should be carried out using the method given in Chapter 9 of the Build Manual. You should have 310-315 mm of exposed leg between the upper and lower fittings.