
8. Wings

Introduction

The wings are delivered with the bottom skins and the top leading edge skins premoulded and assembled to the spar. The building work required comprises reinforcing some rib-to-skin and spar-to-skin joints with 'bid', fitting the W18 flap mounting plates, (the inboard W18 plate is already installed), fitting the aileron control system, and in the port wing fitting the pitot/static system. The trailing edge top skin is bonded on after the ailerons and flaps have been fitted. Also, the diamond shaped glassfibre moulding, which must be cut in half, provides the wing tip trailing edge close-out.

Some of the metal parts supplied have been punched or nibbled out and require their edges to be smoothed off with a file. Take care that no scratches are left on the metal's surface or edges as these could lead to cracking after a while in service. If you have to do any marking on aluminium parts don't use a scribe or even a lead pencil. Carbon from pencils has been known to lead to cracks developing!

Some parts may have a protective coating of plastic on them which needs removal before installation.

Items that get painted when the aircraft is sprayed include W18, FL1, FL2 and FL3.
Items that should *not* be painted are XA2, FL9, FL10, FL12, and W17,

It is advisable to protect your metal parts from corrosion. Anodising is suitable for light alloy parts as is painting them with Zinc Chromate. If you decide to anodise, specify you want the parts chromic anodised to DEF STAN 03-24 (sealed). However, if the anodised part is required to be subsequently bonded or painted, specify unsealed. Don't use sulphuric or hard anodising. Alternatively there is a process called "Alodine", which is carried out at home, and involves pre-cleaning followed by the Alodine treatment itself; this gives a protection similar to anodising.

Remember, keeping your working area clean and tidy especially just before lay-up will give you the best chance of making a neat job of your aircraft components.



Please note that these instructions include cloth cutting dimensions and quantities for the building of *one wing* at a time.

Flap mounting plates

Referring to figure 1 (at the end of this chapter) for position, cut three slots just wide enough to allow the W18 plates to be inserted, with the rear of the slots abutting the rear close out. Note that the outer two W18 plates are fitted on the inner side of the inner rib, and the outer side of the outer rib respectively - the ribs are joggled to aid location.

Scuff sand 10 cm (4") wide on the ribs, rear close out and bottom skin around the slots. Mask the W18 plates as shown in figure 2 to act as a reference line and save cleaning epoxy off them after lay-up. To give a good key scuff sand the unmasked portions of the W18 plates with 60 grit paper.

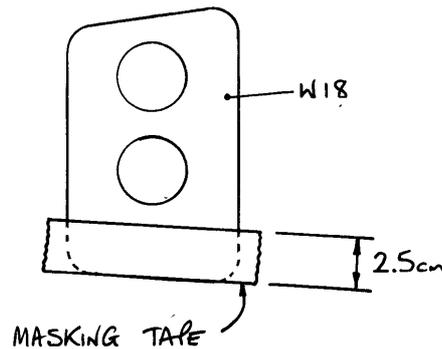


Fig 2. W18 flap plate masking.

Temporarily position each W18 plate against the rib and hold in place with a "G" clamp. Figure 3 shows the correct fitting dimension. Drill 2 holes the same diameter as cocktail sticks (small diameter wooden pegs) through the plate and rib and then use them to hold the plates in place.

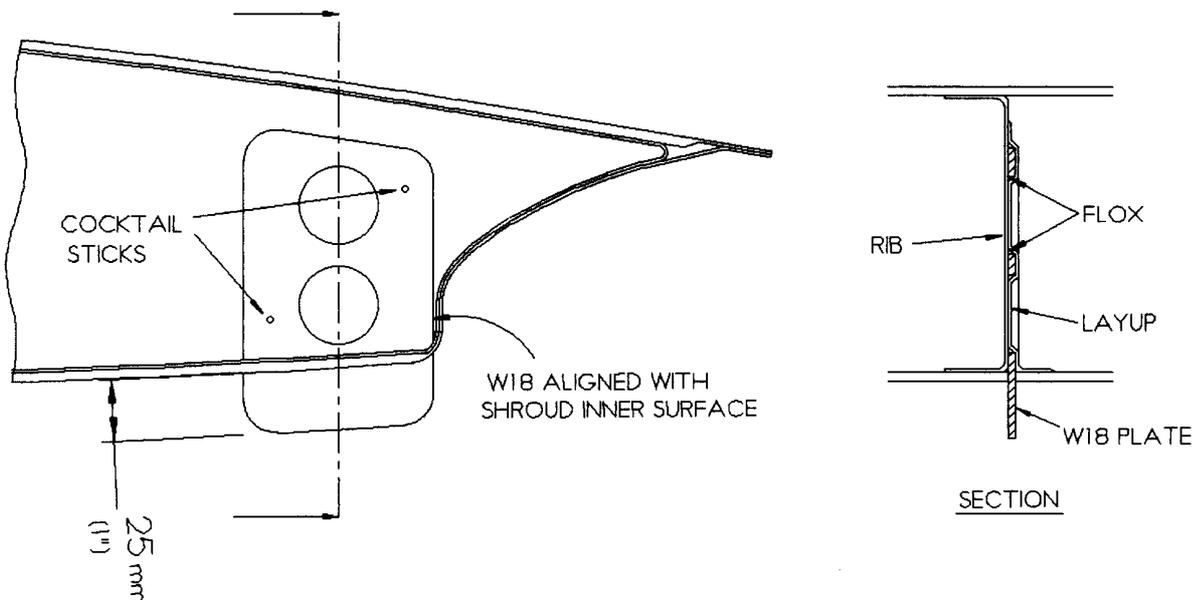


Figure 3. W18 flap plate position.

Skin reinforcement

Referring to figures 4, 5, 6 and 7 for the areas to be reinforced, scuff sand the skins, spar, rear close out, and appropriate ribs a generous 2.5 cm (1") wide from the corners.

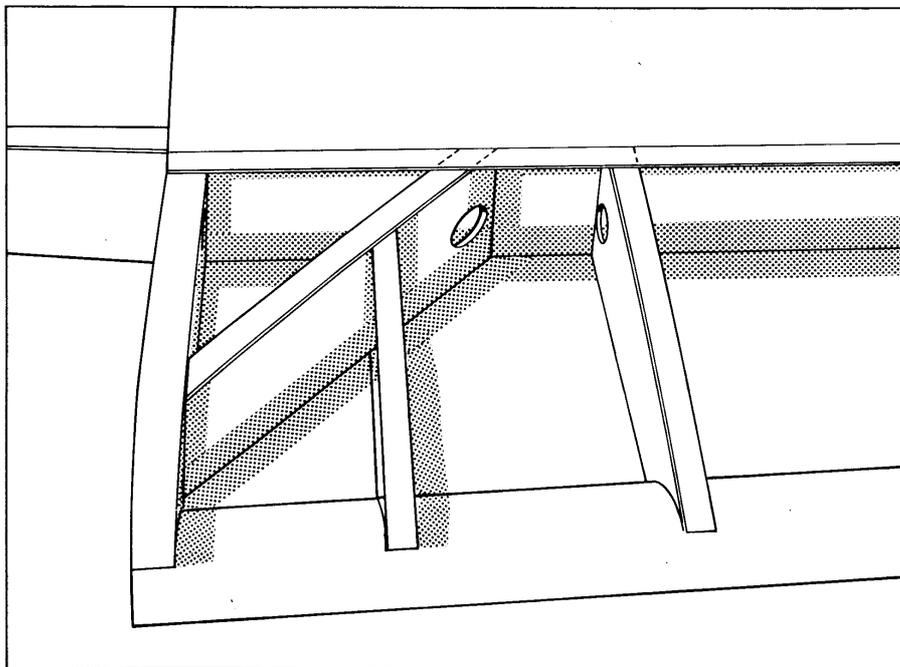


Fig 4. Wing reinforcement positions - root.

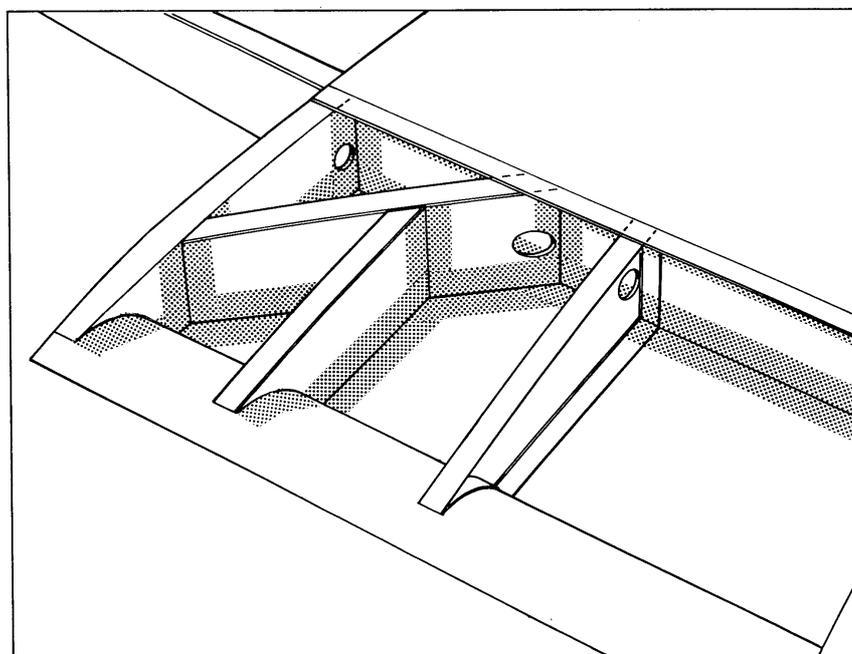


Fig 5. Wing reinforcement positions - root.

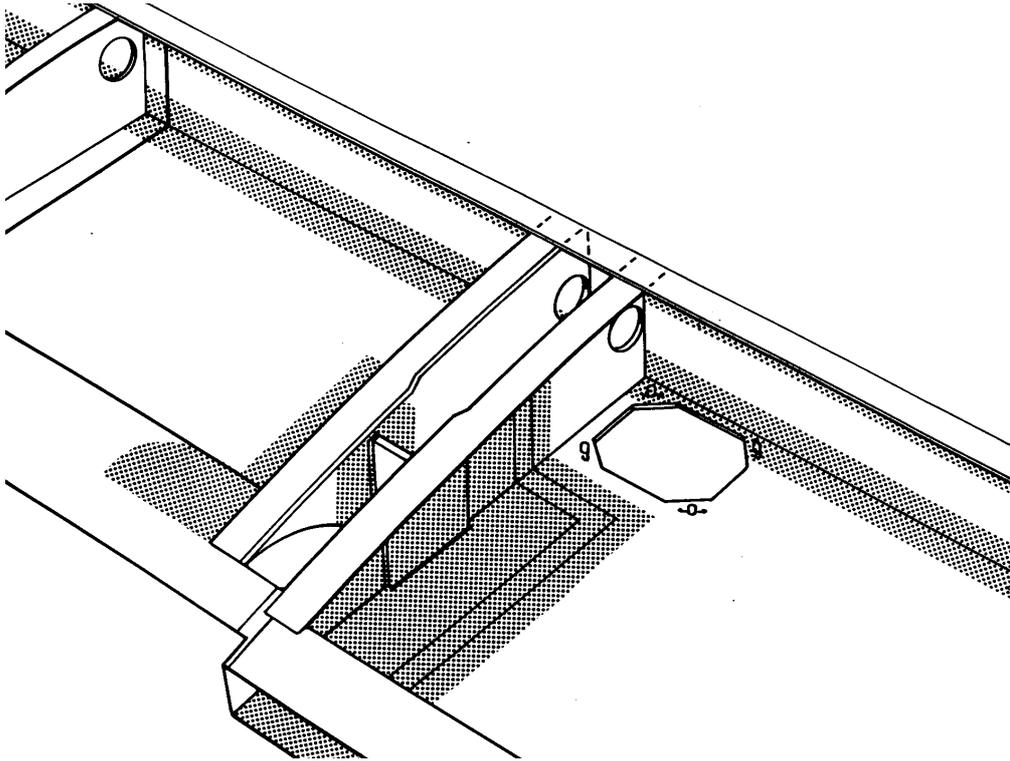


Fig 6. Wing reinforcement positions - flap outer / aileron inner hinge area.

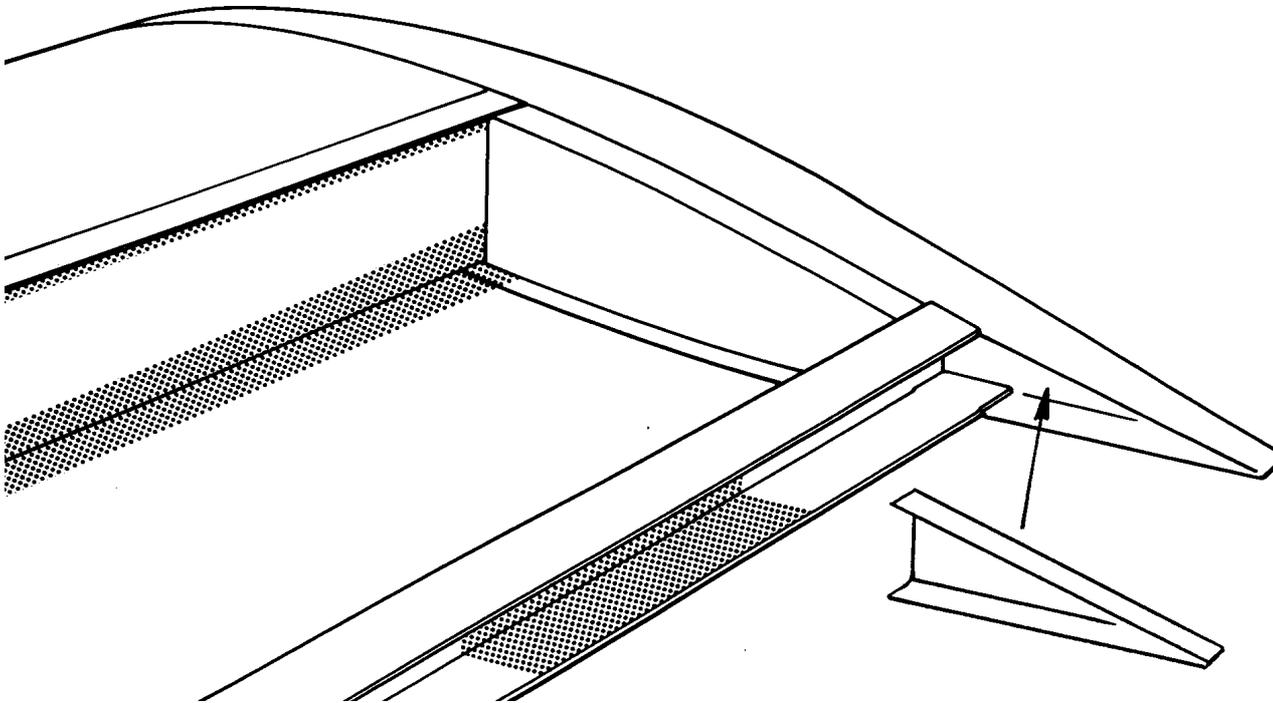


Fig 7. Wing reinforcement positions - outboard aileron hinge.

Cover the four bolts protruding through the rear of the spar (which will later be used to mount the aileron bellcrank) with masking tape.

Lay-up 2 plies of 'bid' on thin polythene sheet, the full width available from the roll, at $\pm 45^\circ$. Cut 2" wide strips from this lay-up.

Apply a fillet of flox to the inside corners of the joints between the spar and the top and bottom skins, and between those ribs shown on figure 1 (on the side opposite to the flange) and the bottom skin.

Apply the 'bid' strips to the joints treated with a flox fillet, removing the plastic sheet as you lay them in the corners.

Temporarily stiffen the areas where the aileron closeouts will be reinforced, in the positions shown in figure 1, with wood - 50mm x 25mm (2" x 1") would be suitable. Lay-up two plies of 'bid' as reinforcement for the aileron hinges, on the inside of the aileron close-out, as shown in figure 8.

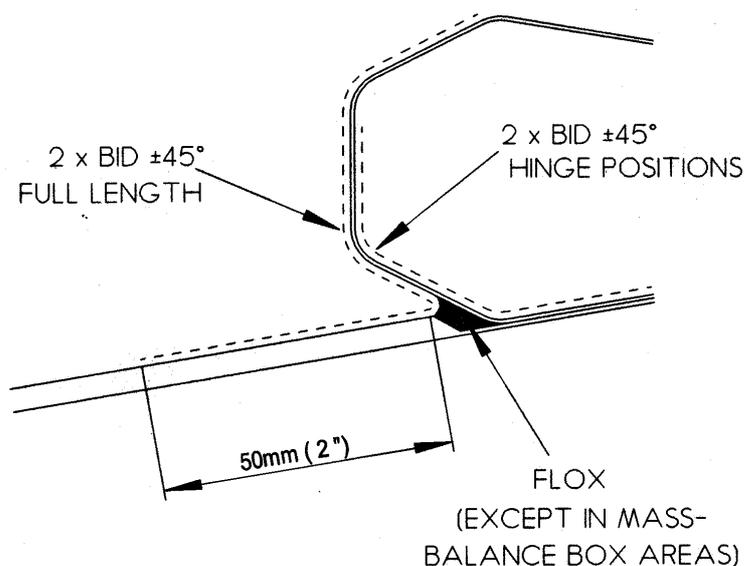


Fig 8. Detail of aileron hinge reinforcement plies.

Also lay-up two plies of 'bid' from the skin and around the outside of the aileron close-out full length, as shown in figure 8. A fillet of flox will be required, as shown, to avoid air entrapment.

W18 plate installation

Cut 3 pieces of 'bid' at $\pm 45^\circ$ 33 x 20 cm (13" x 8")

Cut 3 pieces of 'bid' at $\pm 45^\circ$ 28 x 18 cm (11" x 7")

Cut 3 pieces of 'bid' at $\pm 45^\circ$ 23 x 15 cm (9" x 6")

Mid hinge W18 plate

Coat one side of the W18 plate with wet flox and position it using the cocktail stick spigots. Shape the flox which oozes out into fillets around the outside of the plate and around the inside of the two bored holes, adding extra flox as necessary.

Lay-up 3 plies of 'bid' over the plate, lapping them 100, 75 and 50 mm (4", 3" and 2") respectively onto the rib and the bottom skin. The plies should extend onto the rear close out. Peel ply and allow to cure.

Outer W18 plates

Temporarily assemble two TGW21 plates with an OR6 block between them, using AN525-10R32 bolts and standard 10-32 UNF nuts. Refer to the flap outer hinge assembly shown in the A3 fold out drawing at the end of chapter 9. This assembly is to act as spacer between the W18 plates when they are bonded onto the wing ribs. Protect the assembly from epoxy contamination with masking tape.

Fit the TGW21/OR6 spacer assembly between the two W18 plates underneath the bottom skin, holding it in place with a "G" clamp, then repeat the flox and lay-up procedure as for the mid hinge W18 plate. Peel ply all the edges and allow to cure.

Cut a piece from the 3 mm thick plywood provided so that it fits between the outrigger double rib, aligned with the front edge of the W18 plates. The height of the plywood should be such that its top is slightly lower than the top face of the adjacent ribs. Lay-up 3 plies of 'bid' onto the front and rear faces of the plywood, lapping them onto the ribs at either side by 5 - 6 cm (2"). See figure 9.

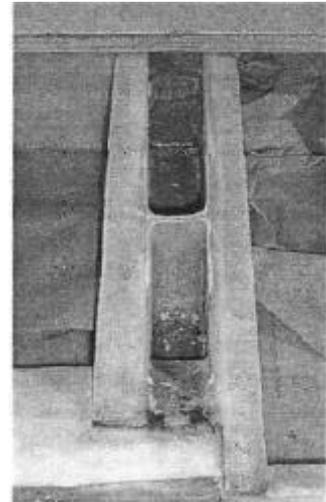


Fig 9. Outrigger rib plywood reinforcement.

Root rib to spar tang reinforcement

If you look at the outside of the root rib you will see that there are two areas where metal plates have been built in, with reinforcing plies over them terminating between the plates and the spar. It is now necessary to lay-up extra plies from the spar to overlap the existing rib plies. These plies are made from 'bid' and laid up at 45°. There are 3 plies aft of the spar, and 3 plies forward. See figure 10. Note that the first ply extends beyond the inner spar bush centre by 50 mm (2"), and should be cut to clear the bush. The second ply is 45 mm (1.7") short of the bush centre. The third ply is to stop 70 mm (2.7") short of the bush centre. All the above layups should be extended on to the upper and lower flanges.

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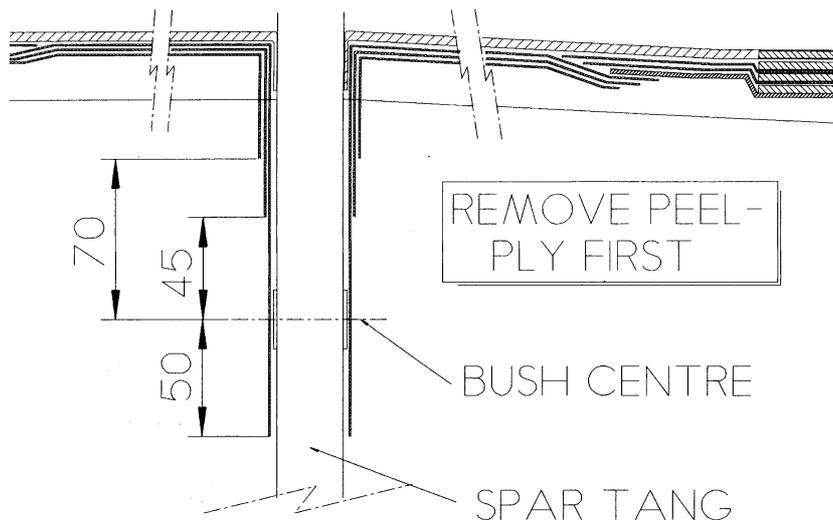


Fig 10. Section through wing root rib and spar.

Note: Remove the peel ply covering the jointing area first and scuff sand thoroughly.

Aileron bellcrank access panel

To allow access to the aileron bellcrank for inspection and maintenance an access panel needs to be made in the bottom wing skin.

You will find that a portion of the skin underneath the bellcrank has been joggled inwards to provide for the panel to be flush.

To make each panel you will need a piece of perspex or lexan 3 mm (1/8") thick (not supplied). You may use plywood if you wish; the panel need not be transparent. Cut and shape it to match the joggle in the wing skin, being careful not to crack it. Tape it temporarily into position and drill 4 holes, one in each corner, through the panel and the wing, with a 5 mm drill. See figure 11.

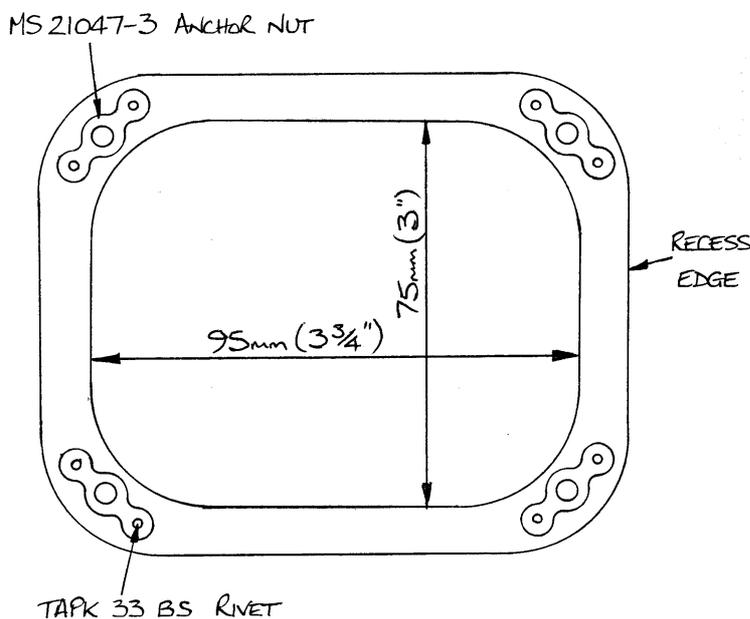


Fig 11. Aileron bellcrank access hole.

Remove the panel and place MS21047-3 anchor nuts as shown, holding them in place with AN525-10R8 bolts. Drill 2.8 mm (3/32") holes for the anchor nut TAPK33BS rivets. Spin a larger drill bit in your fingers to countersink these holes to accept the rivets, Finally, rivet the anchor nuts to the inside of the flange.

Aileron controls

Aileron bellcrank

Make up the aileron bellcrank assembly (part nos. W11, W12, W13 , W14 and W15 as in figures 12 and 13). If you intend to paint these parts, do this before assembly.

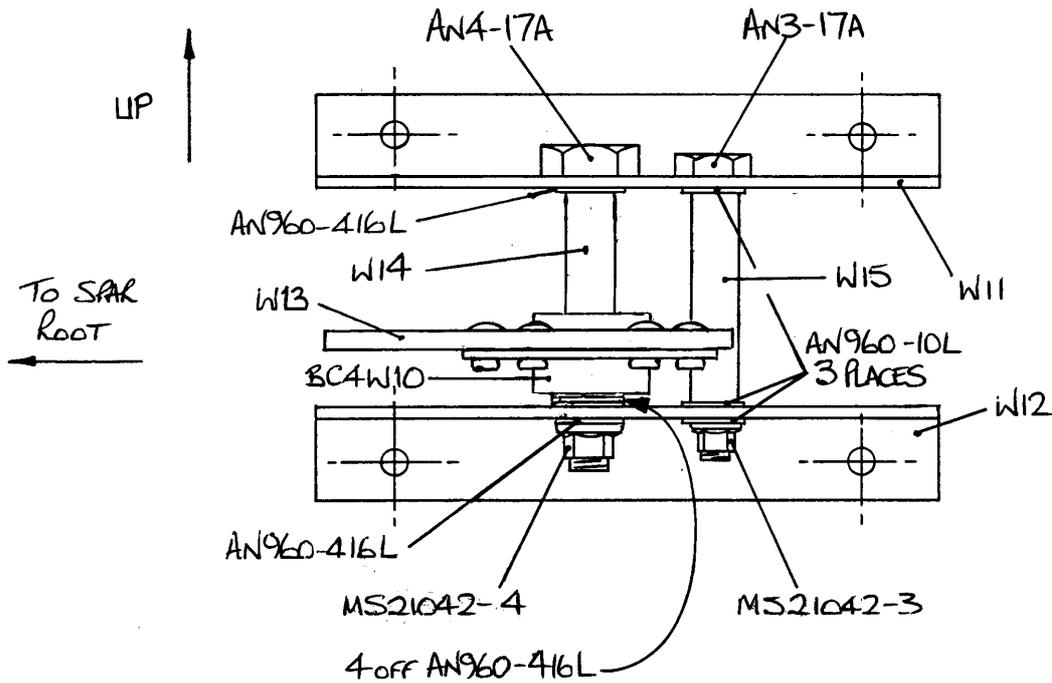


Fig 12. Bracket assembly looking at T.E. as installed (stbd).

Initially attach a BC4W10 bearing to a W13 bellcrank with six AN470-AD4-7 solid rivets or TLPD435BS pop rivets, noting that these sub-assemblies are handed port and starboard. Now attach the bracket assembly to the rear face of the spar onto the four bolts which are already positioned, using MS21042-3 nuts and AN960-10L washers.

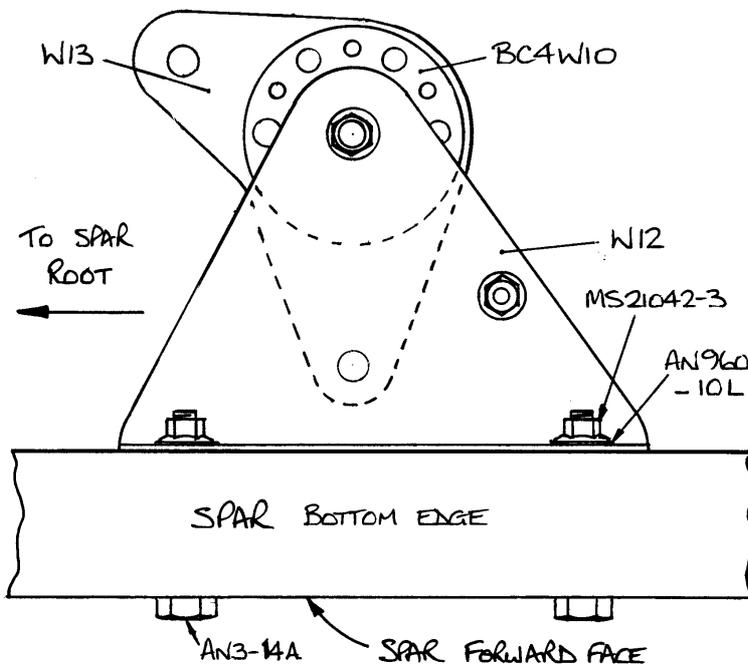


Fig 13. Bellcrank bearing assembled on spar (stbd).

Attach two rod end bearings to the bellcrank as shown in figure 14.

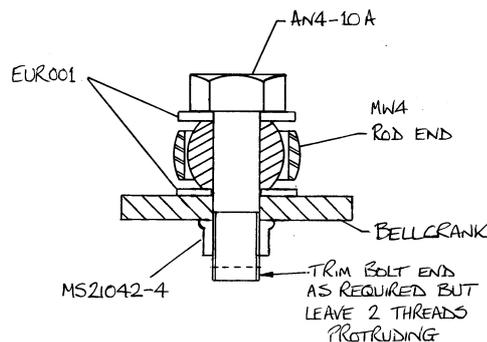


Fig 14. Attachment of rod-end bearing to bellcrank.

Lateral push-rod

Cut the 1" o.d. light alloy tube (part no. TU1) to a length of 1.92m (75.6") and file the ends square. The rest is not used and can be scrapped. Mark the positions for the rivets according to figure 15. Push in a W17 insert and drill each hole with a 3.3 mm drill, inserting a TLPD419BS rivet to act as a spigot before drilling the next hole. After drilling, remove the W17, clear out all swarf, replace the W17 and pull up the rivets. Do this operation for both ends of the lateral push-rod.

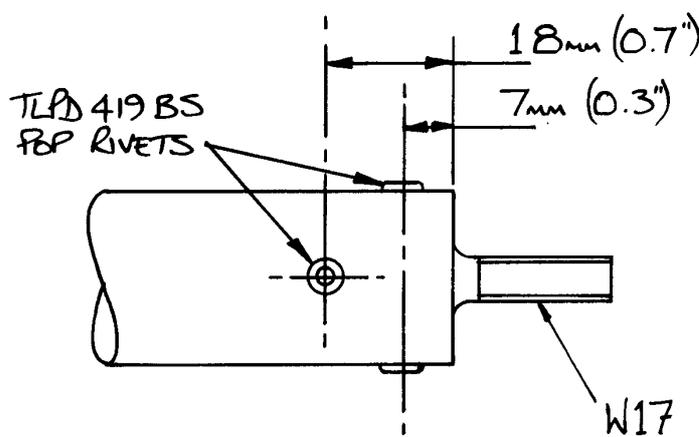


Fig 15. Pop rivet positions in lateral push rod.

Aileron quick -connect bellcrank

Before riveting the bearings to the W16 bellcranks mark out and file away a portion of the flange as shown in figure 16.

This will enable the bellcrank to pass the pivot bolt of the mating fuselage bellcrank during rigging and de-rigging.

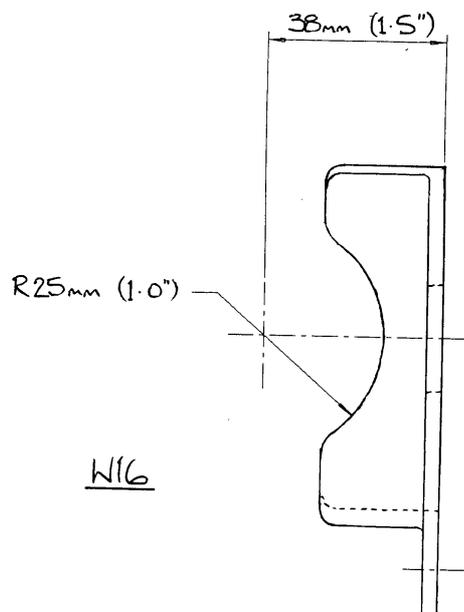
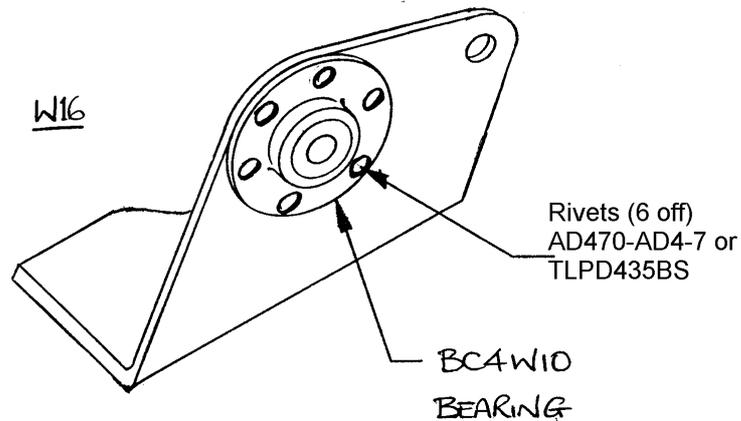


Fig 16. Cut out dimensions for W16 bellcranks.



The two bellcranks W16P and W16S require BC4W10 bellcrank bearings riveted to them. Each bearing is attached to the outside of the 'L' shaped bellcrank using six AN470-AD4-7 or TLPD435BS rivets. See figure 17. The edge of the large hole in the bellcrank may need chamfering to enable the bellcrank bearing's flange to sit flat onto it.



Hint: Put the rivets in with their heads on the bellcrank flange side as these sides will be visible on Fig 17. Quick-connect bellcrank with BC4W10. your de-rigged Europa.

Mounting bellcranks to wing spar

Because the port spar is in front of the starboard spar when the wings are rigged the port wing's quick connect bellcrank has to be mounted on the spacer S03 to bring it in line with its corresponding bellcrank in the fuselage. The starboard wing's bellcrank is mounted directly to the spar.

The mounting hole for the quick-connect bellcrank has been pre-drilled by the factory. The hole will have been covered over with cloth during wing construction. Refer to figure 18 to establish the position of the hole. Carefully drill through the cloth at the front and back of the spar to re-open the hole to 1/4" dia.

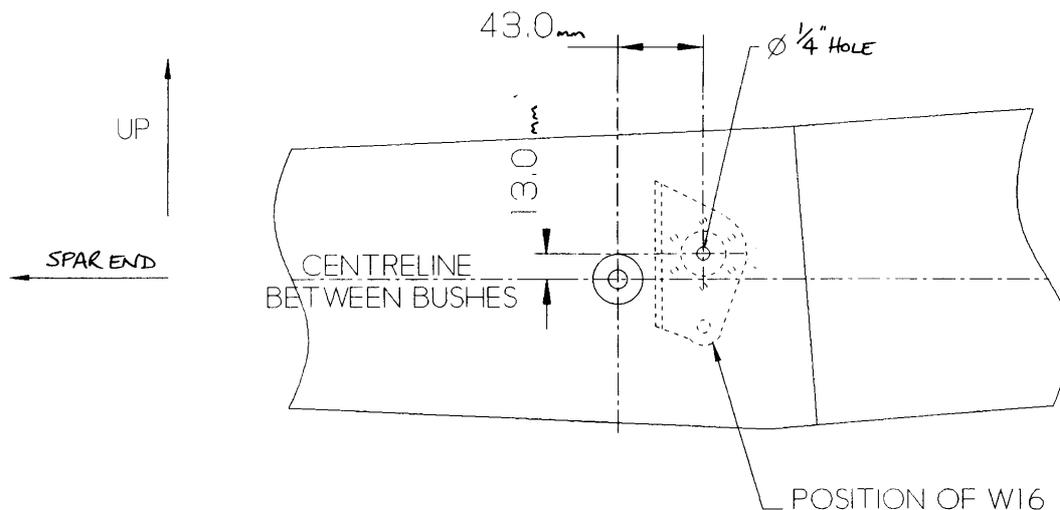


Fig 18. Hole position on spar for quick-connect bellcrank W16.

Using a 19 mm (3/4") diameter counterboring tool such as a spade or flat cutter (see figure 19), counterbore the hole from the front face of the spar on the starboard side to a depth of at least 5 mm (0.2") and on the port side to a depth of up to 16 mm (0.6"). This allows the bolt head to be below the surface of the spar and so not interfere with the adjacent structure.

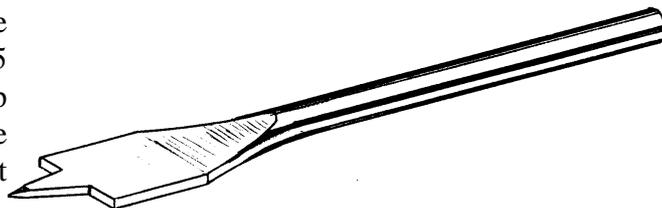


Fig 19. Spade cutter.

Starboard wing

Slide an AN4-20A bolt, with a EUR001 washer on it, through the hole in the starboard spar from the front so that the head enters the counterbore. Place on the bolt two EUR001 washers, the W16S bellcrank, another EUR001 washer and finally screw on an MS21042-4 nut. The counterbore hole will be later filled with flox, but leave it for now as this will leave open the possibility for fine adjustment after final assembly.

Port wing

Fitting the W16P bellcrank is essentially a repeat of the starboard side except that an AN4-31A bolt is required and the S03 spacer is placed on the bolt shank before fitting the two EUR001 washers and the bellcrank.

Fit a rod-end bearing to the quick-connect bellcrank as you have already done for the aileron bellcrank.

Slide the lateral push-rod into position and screw it into the rod-end bearings at both ends, with AN316-4R locknuts, equalizing the thread engagement. Check carefully that there is clearance through all rib holes and that there is no fouling of the lateral push-rod through its full stroke, filing the ribs as necessary to achieve this. Once you are satisfied that the installation moves freely, tighten the locknuts.

Pressure equalization

It is necessary to ensure that all parts of the wing are vented to atmosphere to prevent pressure differentials building up when the aircraft changes altitude.

The leading edge ribs have already been vented to the wing tip, and thence to the trailing edge. The inboard section of the trailing edge is vented via the lateral push-rod clearance holes. The venting is completed by connecting the wing tip to the inboard section: to do this simply drill a hole 5 mm (3/16") diameter through the rib outboard from the aileron push-rod.



Pitot/static

If you refer to figure 20 for position you will see that a section of the lower skin has been indented to allow for the fitting of a pitot/static head. The head is fitted similarly to the aileron bellcrank access door, with two MS21047-3 anchor nuts riveted to the inner skin.

A drawing of the holes required in the wing for the pitot/static is given at figure 22. Transfer this drawing to the indent and cut out the oval hole, remembering that the pitot/static head must point forwards, and must be at right angles to the spar, not the wing leading edge. Drill the two mounting holes as shown in figure 22.

Temporarily fit the pitot/static in position using AN525-10R8 bolts screwed into the MS21047-3 anchor nuts. Attach the anchor nuts using TAPK33BS rivets.

After finally fixing the pitot/static head into place, the next job is to run the plastic tubing back to the wing root. Figure 20 shows the route in the wing, and figure 21 shows the correct position for the tubes to exit through the root rib.

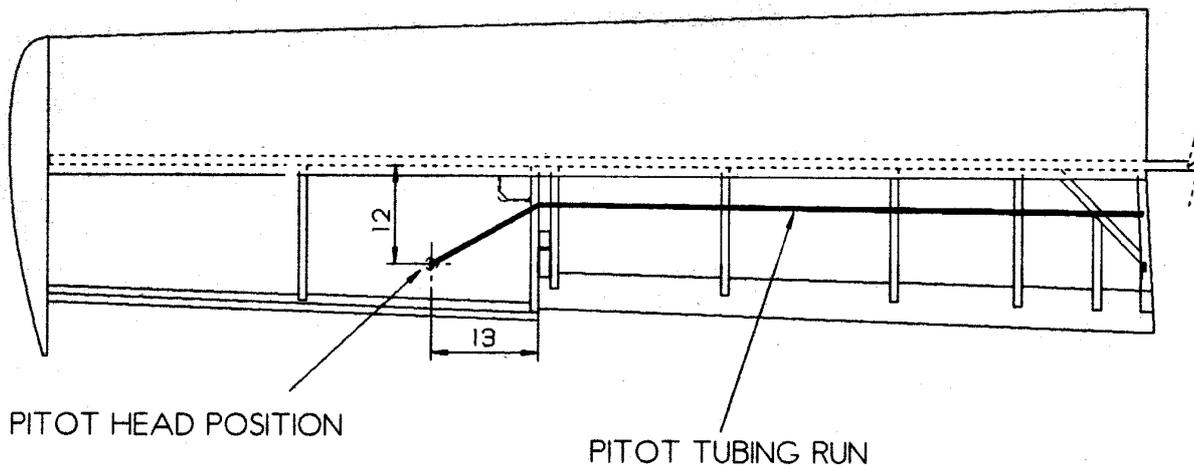


Fig 20. Route for pitot/static lines.

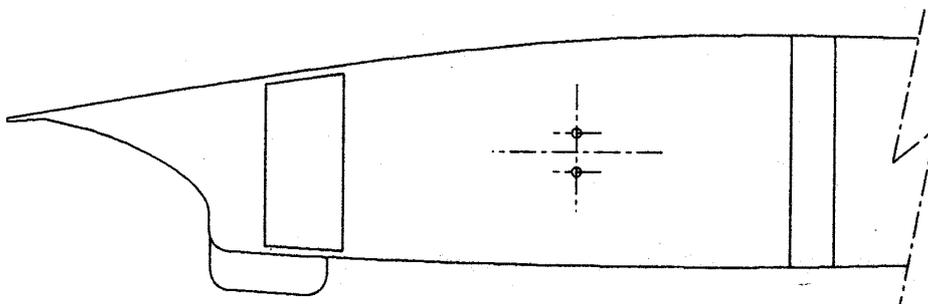


Fig 21. Pitot/static tube position at root rib.

Use a 10.2 mm (3/8") hole saw, and keep the holes near the bottom skin. Fit the grommets (P/N 543-204) and then thread the tubing through. Take care that there is no possibility of the tubing touching any of the aileron control system. As extra security, lay-up a single ply patch over the tubing midway between ribs.

Where the tubing exits the wing at the root, allow about 12 cm (5") of slack and fit one tube with a plug fitting (P/N PMC 22-02) and the other with a socket fitting (P/N PMC 17-02). For now connect the plug and socket to keep the system free from dirt ingress. This is one reason for having one plug and one socket - it keeps the system clean when the aircraft is on the trailer. It also prevents the pitot and static lines being incorrectly connected when rigging the aircraft.

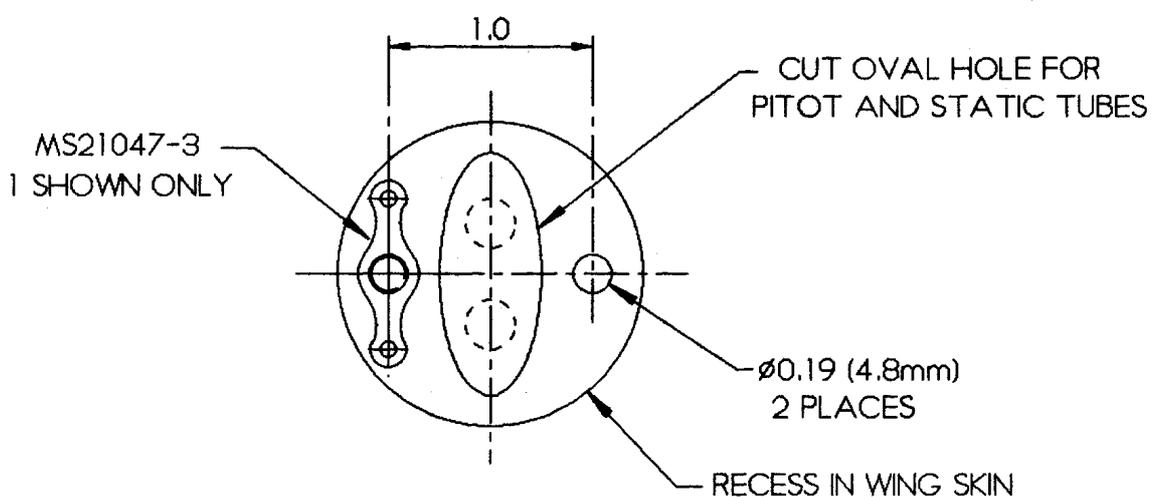


Fig 22. Pitot/static tube mounting details.

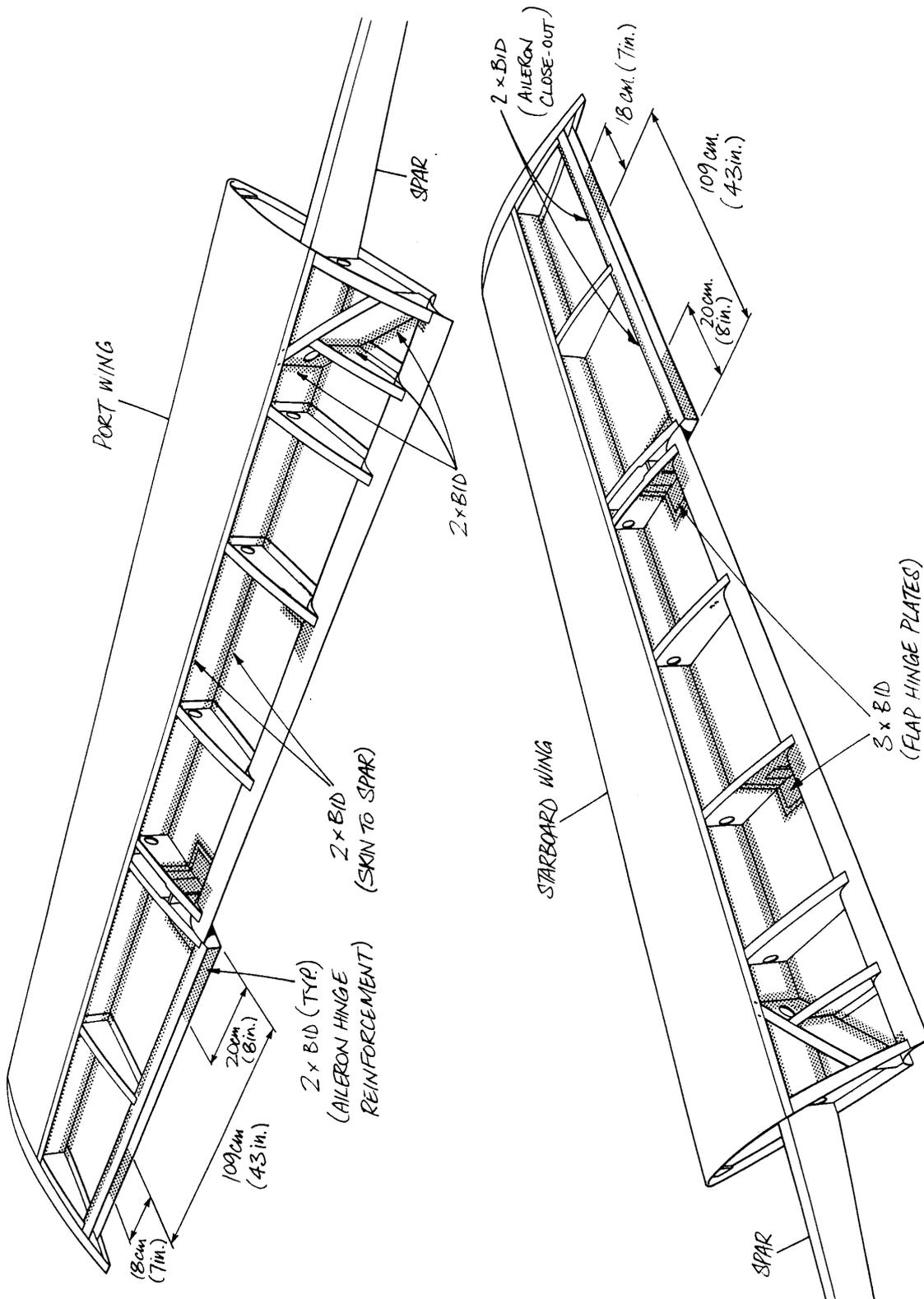


Fig 1. Wing reinforcements.