CHAPTER 8 - FITTING AND SETTING WINGS TO FUSELAGE

8 FITTING AND SETTING WINGS TO FUSELAGE

8.1 PREPARING THE REAR SPARS

STEP 1

Rub a straight edge across the top of the root end of the spar's surface to make a shiny mark at the top dead center of the spar tube. Carefully re-mark rubbing with a thin felt marker. On this top dead centre of the **rear spar** measure ¾" in from the spar tube end and scribe a small cross. Centre punch the mark and drill a hole and ream to 5/16", or drill a 1/8" pilot hole and enlarge as necessary to fit the pilot of a step cutter. Carefully open out the hole - with the step cutter - to 5/16" diameter. Proceed using very small cuts until a 5/16"bolt just enters the hole. (The lower surface is not drilled at this step).

Material must be removed from the root end of the rear spar so that there will be no interference when the wings are folded. S*ee Drawing 8.1. and figures 8.1.3a/b/c.*

STEP 2

Using a flexible rule, measure (around the circumference) 15/8" from the top dead center of the spar **on the front face** and mark a line parallel to the spar axis. Along this line make another mark ¾" from the end of the spar tube. Center punch the cross, and using dividers mark a 5/8" diameter circle. From the circumference of the circle, mark lines - parallel to the spar axis - out to the spar end. Remove the material within the marking out by drilling and sawing. Finish all cut edges to a fine finish with emery cloth.

STEP 3

On the rear face of the rear spar, mark a line 1½" down from the top dead center and another ¾" in from the end of the spar. Center punch, and using a 1 3/8" diameter hole cutter carefully cut a 1 3/8" diameter hole (this hole may alternatively be marked out with dividers and the waste removed with hand tools). From the circumference of the 1 3/8" diameter hole, mark out to the spar tube end to the profile shown in *Drawing 8.1*. Remove the waste and dress the cut edges as before.

Take care not to remove more material than necessary. Some adjustment of the cut-out profile might become necessary at a later stage in wing fitting.

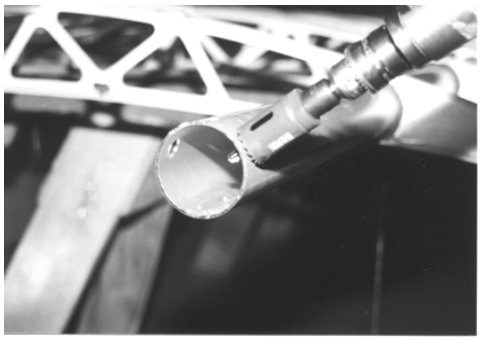
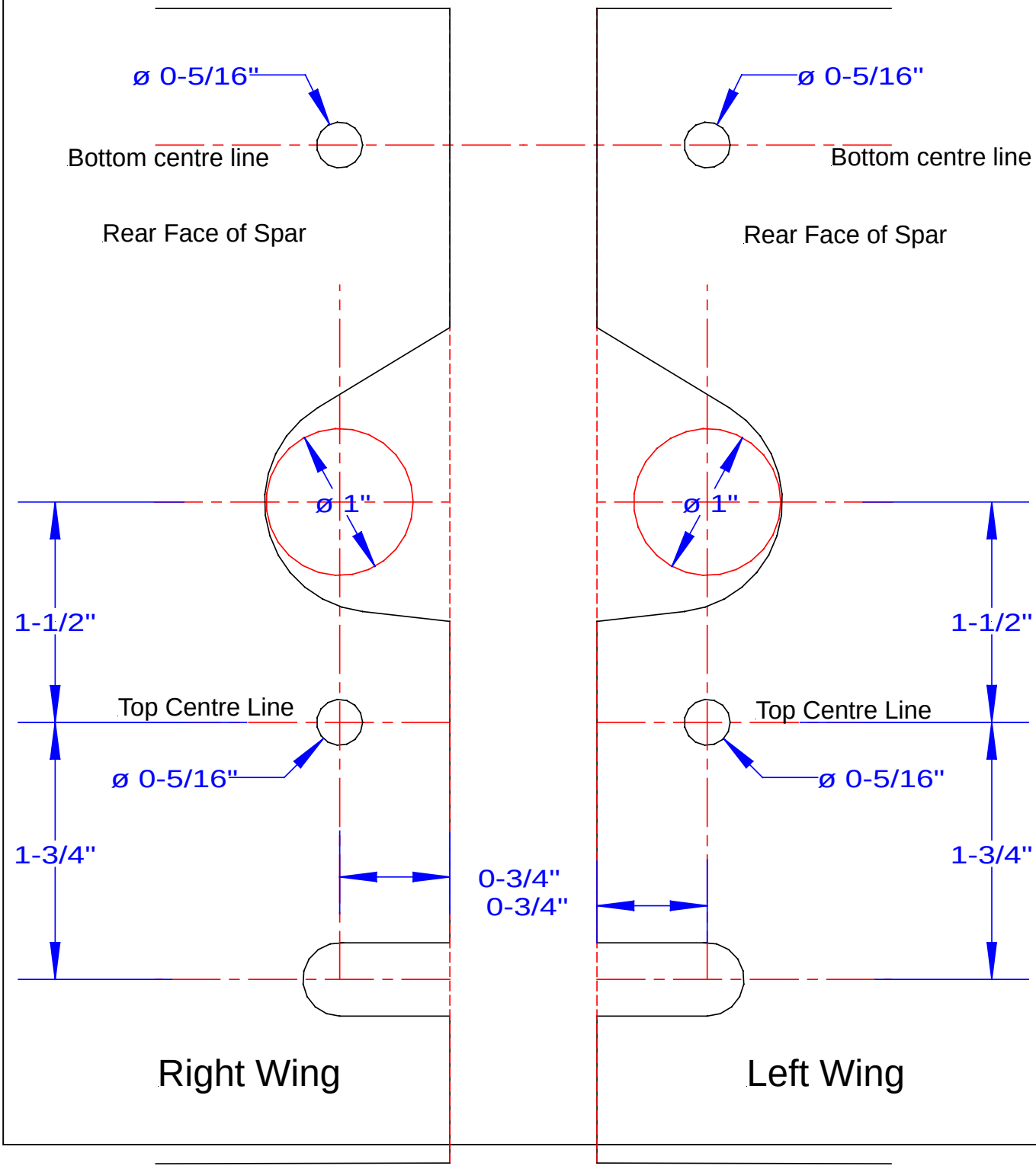


Figure 8.1.3a

DRAWING 8.1

Marking out for Spar cutouts



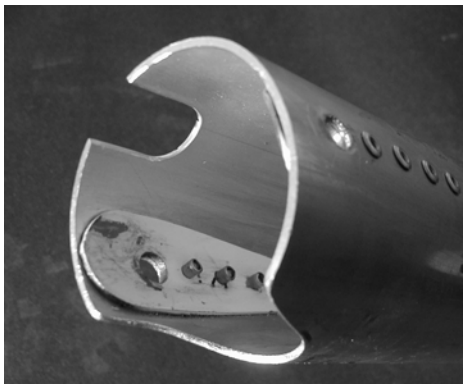


Figure 8.1.3b

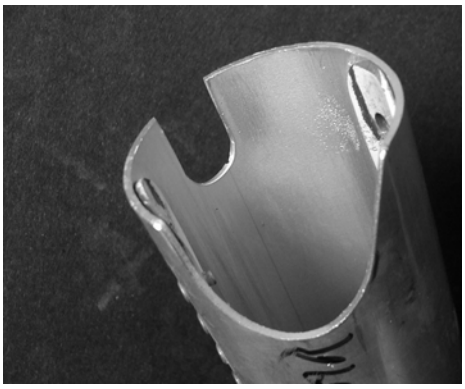


Figure 8.1.3c

Above figures show finished spar ends with cutouts, holes and the wing doublers in place.

STEP 4
Repeat Steps 1 to 3 for the other wing.

STEP 4
Ream the fuselage rear carry through tubes (where the rear spar mates with the fuselage) with a 5/16" reamer. Take great care to ensure the hole is not oversized or bell-mouthed.

8.2 FITTING THE LIFT STRUTS TO THE FUSELAGE

STEP 1
With the lift strut (W-0110/0120) removed from the wing, slide the strut onto the fuselage-mounting bracket. It may be necessary to remove some of the powder coating from the bracket and/or the lower end of the strut itself. Fit the strut to the fuselage with the bolt supplied (W-0180), then swing it fully rearward ensuring that there is no interference or binding at the pivot point. Do not remove any more material than necessary to achieve free rotation.

8.2.1 FITTING THE LIFT STRUT ATTACH BRACKETS TO THE WING SPARS.

Step 1
With the wings upside down on sawhorses measure 98" from the root end and place a mark on the spars both front and rear. Place the lift strut attach brackets onto the spars. Loosely attach them with hose clamps. Lay the lift struts on the wings making sure you have the correct strut with the wing. Attach the lift struts to the attach brackets. (The bolt you use for this should not be used in final assembly.) Measure again the 98" to the center of the bolt you use to attach the strut to the bracket, at this time tighten the hose clamps. The wing is now ready to mount to the fuselage.

STEP 2
Repeat Steps 1 for the other lift strut.

8.3 INSTALLATION AND SET UP OF THE WING

The next stage is to complete the fitting of the wings to the fuselage. If the landing gear is not fitted the fuselage must be weighted to prevent it tipping when only one wing is attached.

STEP 1

Level the fuselage left and right and also fore and aft, by levelling the headrack front and rear carry through tubes. Adjust the support under the tail and gear (if fitted) to achieve level; this will prevent the wing swinging under gravity when only the rear pivot bolt is fitted.

STEP 2

When you come to drilling the front spar bolt holes, the actual bushing will be obscured by the spar tube itself, so to facilitate the finding of and drilling of the front spar (and to save moving the wing too often), secure a 6" steel rule over the centre of each (2) of the front spar location bushings on the fuselage headrack, so that the exact centre of the bushing can be located from the rule i.e. the edge lies across the centre and a mark is made on the rule to show the other axis centre, see *Figure 8.3.2*. Use masking tape to secure the rules – it is important that the rule cannot move once secured, however you will need to lift the bushing end of the ruler over the spar (when fitted) to show the centre point of the bushing.

Figure 8.3.2

CAUTION: Be careful when fitting or removing the wing, and *always* use at least 2 people. Serious damage (to people and the aircraft) can occur if the procedure is not kept under strict control.

STEP 3

With an assistant holding the wing tip, mount the rear spar to the rear carry through tube on the fuselage, and the lift strut to the fuselage-mounting bracket. Make sure that the fuselage is secure otherwise the frame may tip over.

STEP 4

Select or prepare a 5/16" drill bit with flutes no longer than 2 ¼" from the tip. A bit with longer flutes will make the top hole elongated when you drill the bottom hole.

STEP 5
Center the rear spar pre-drilled hole on the rear bushing and insert the prepared 5/16" drill until it bottoms on the lower inside face of the spar tube (thus pinning the spar in place). Check that the drill flutes do not protrude through the top hole – if they do, the top hole will be unacceptably damaged during the lower hole drilling operation.

STEP 6
Insert the W-0180 bolt in the lift strut/ fuselage attachment point to pin the lift strut in place.

STEP 7
With the tip supported, carefully and slowly swing the wing fully to the rear. If it will not swing freely, it means there is interference that must be removed (carefully, small adjustments at a time).

STEP 8
Swing the wing forward so that the front spar is over the front spar attachment bushing.

STEP 9
With the wing tip supported, drill through the lower rear spar with the drill that was previously inserted in the hole. **Do not remove the drill while it is still turning, as this will cause unacceptable damage to the top hole.** Remove the drill by hand while inserting a 5/16" bolt from underneath. Once this is done replace this bolt with the W-0190 bolt supplied, inserted from the top.

STEP 10
Repeat Steps 3 to 9 for the other wing.

STEP 11
To make sure both wings are perpendicular to the centreline of the fuselage, measure out 100" from the root end of the rear spar and make a mark on the top centre of the tube. To ensure that both wing reference points are the same, lay a straight edge across the front and rear spar tubes and rub the spar surface to find the top dead centre at the 100" mark. *See Drawing 8.3.*

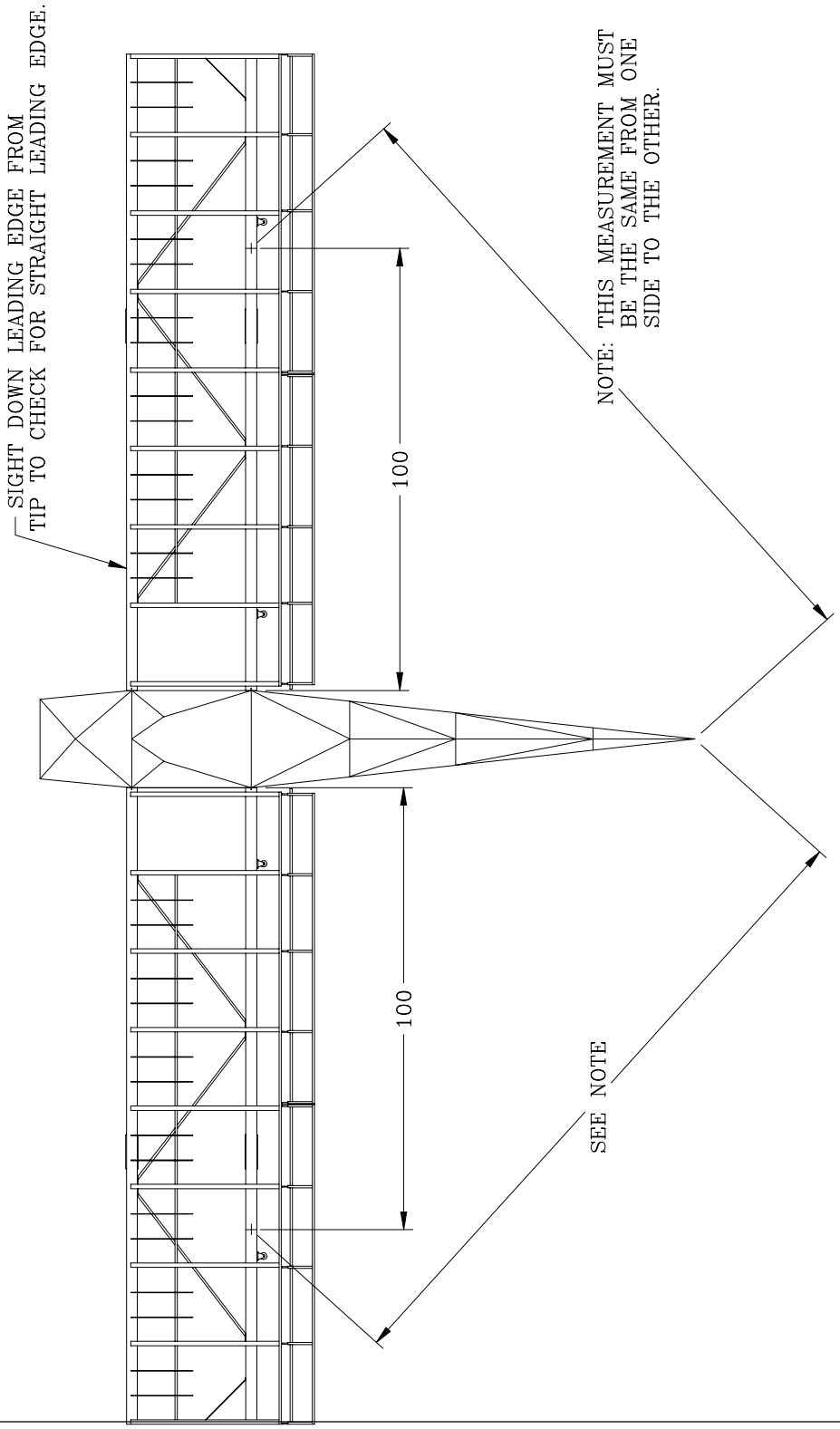
STEP 12
Swing the wing forward so that the front spar is over the front spar attachment bushing.

STEP 13

Using bar clamps secure a stiff wooden lath across the fuselage head rack and to one rib on each wing. This way the wings won't move when you are taking measurements to set the front spar mounting holes. *See Figure 8.3.13.*

Figure 8.3.13 *(view from front of cockpit toward left wing)*

DRAWING 8.3


SIGHT DOWN LEADING EDGE FROM
TIP TO CHECK FOR STRAIGHT LEADING EDGE.
NOTE: THIS MEASUREMENT MUST
BE THE SAME FROM ONE
SIDE TO THE OTHER.
100
100
SEE NOTE

STEP 14
Make a mark on the vertical fin sternpost in line with the top of the fin plug-in. *See Figure 8.3.14.*

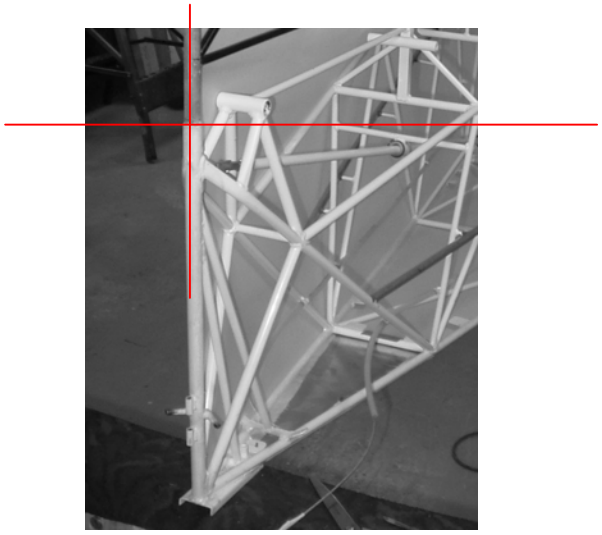


Figure 8.3.14

STEP 15
Each wing is measured from the mark on the fin sternpost to the 100" mark on the wing. Adjust the position of the wings until both measurements are identical. Drop plumb lines from the front spar at ribs 1 and 8 of each wing and sight through. Adjust the clamping of the wings until all 4 plumb lines are in line and the 2 measurements from the sternpost to the 100" marks are identical, this will guarantee both wings are perpendicular to the fuselage centreline. **This is important – take your time and get it right**.

STEP 16
Once the wings are properly located and clamped, the next operation is to drill the front spar mounting holes. First refer to the placement of 2 x 6" rules at Step 2; the rule should indicate the exact centre of the mounting bushing. Mark this position on the spar. Remove the rule.

STEP 17
Centre-punch the mark made in Step 16 and carefully drill the spar. The finished size is 5/16". Drill slightly undersize and ream to finished dimension. If care is taken the 5/16" hole in the mounting bushing will draw the reamer into perfect alignment. Drill through the lower face of the spar tube 5/16" utilising the mounting bush as a guide. Spars are held in place by the W-0200.0 clevis pins, which are secured with the safety pins W-0200.1.

8.4 INSTALLING WING JOINT DOUBLERS

The doublers, W-0210, are 4130 steel parts that fit inside each spar (one top and one bottom) and enable the spars to react better to flight and ground loads. Fit the doublers with their wider part towards the spar end (insert narrow end first); *see Figure 8.4.1.*

NB: root rib will *not* be fitted at this time

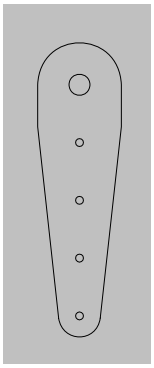


Figure 8.4.1 ***Drawing 8.4.1***

STEP 1
Remove the wings from the fuselage.

STEP 2
The doublers are pre-drilled; *see Drawing 8.4.1 above*. Ream out the large hole to 5/16" and the small rivet holes to No.30 then deburr all holes.

STEP 3
The spars require matching rivet holes to be drilled, the easiest way to achieve this is to place the doubler on the outside of the spar with the wing bolt used to position the large hole, and then align the rivet holes along the spar centre line. Drill the last one, Cleco in place, then drill the other holes. Do this for all 8 doubler positions. Deburr spar holes on completion. Although the doublers should all be identical it is a good idea to number them, so that they can be fitted in the position where they were used as the template.

STEP 4
Remove the powder coating from the convex side of the doubler and abrade the inside of the spar tube with 100-grade emery cloth.

STEP 5
Apply a generous coating of epoxy to both mating faces then use bolt and Clecos to hold doublers in place. Secure with W-0210 rivets – ensure each rivet is properly seated before it is set. Clean up excess adhesive on bolt, clecos, spar and doublers with acetone or MEK. *See Figure 8.4.1* of finished spar end (the root rib will not have been fitted at this stage).

STEP 6
When the wing is reassembled to the fuselage it will no longer fit, the doublers will have reduced the inside dimension of the spar. Using a dial caliper, measure the inside dimension of each spar (i.e. between the doublers) and modify its corresponding head rack mounting bushing. Remove material from the **bottom** of each mounting bushing until the overall length is 0.010" shorter than the inside dimension between the doublers. Finally, slightly round both front and rear edges of the mounting bushing to correspond with the inner radius of the doublers.

***Note*:** It is important to remove the excess material from the bottom of the tube **only** otherwise the angle of attack of the wing will be adversely affected.

8.5 FITTING WING TANK(S)

The following procedure is used for both wing tanks. Remember that the outlets are on the opposite side of the tanks. Remove just enough material from the front of the tank to see the scribe line on the tank. The tanks should not protrude above the rib caps. With the wing laying right side up, make a bed of silicone glue on the tank, where it touches the wing spars, and set them in place.

STEP 1

Temporarily locate the root rib on the spar tubes and place the fuel tank between rib 8 and the root rib (rib 9). Make sure the tank nestles closely with the webs of each rib. You will need to modify the root rib slightly to allow the fuel outlet to pass through the rib; sufficient space should be allowed for the fuel tubing to fit snugly on the outlet nipple and be tightened down with a hose clamp (F-106A). Mark the position of the root rib (note: this rib is centred nominally at 141½" from the tip, but please ensure that rib 9 is positioned in exactly the same position on both wings.) on the spar tubes with a felt marker.

Remove the end rib and the tank. Abrade the root rib location areas on both spars and the ends of the 3 tubes produced at Step 1, then thoroughly clean with acetone or MEK to the standard previously described. Reassemble the tank, supports and rib. Adjust the support tube lengths so that they lie flush with the outside of the web cap.

In the centre of each fuel tank cap, drill a ¼" hole for the fuel tank breather tubes.

STEP 2

Do not proceed with the following step until the wing has been located to the fuselage.
Mix sufficient epoxy adhesive and proceed to bond the root rib and tank support tubes into position, *see figure 8.5.6.*

Figure 8.5.6

STEP 3

After the epoxy has set and cured, (24 hrs), further secure the tank by applying silicon sealing compound between the tank and rib caps and around the edges of the cut outs in the rib webs. **Do not allow the sealant to get onto the outside surfaces of the rib cap strips – this will prevent bonding of the fabric.** (Dow 739 Sealant is supplied in the kit).

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8.6 FITTING WING TRAILING EDGE

The wing trailing edges are pre-formed light alloy W-0295.

STEP 1

Using a fine saw cut away the top and bottom rib cap strips in line with the rear face of the rib web. Radius the cut edges so that they will conform to the inside radius of the metal trailing edge.

STEP 2

Fit metal trailing edge and temporarily secure in position with masking tape. Mark the position of each rib cap strip on the top front edge of the trailing edge i.e. 2 marks 1" apart, coinciding with the edges of the cap strip.

STEP 3

The trailing edge section may need trimming to length (dependant on how good a fit the tank was): mark if adjustment required, line up to the outside edges of spar caps on ribs 1 and 9.

STEP 4

Check that the rib cap ends fit snugly into the trailing edge and mark any that require further work.

STEP 5

Trim ends of trailing edge section as required. Adjust spar caps as required.

STEP 6

Refit the trailing edge section and make a mark on the exact centreline of each rib web ¼" back from the forward edge of the trailing edge section on both top and bottom. Making sure that the trailing edge is fitting tightly to the spar caps, drill 1/8" diameter holes no more than 3/8" deep, i.e. into the rib web. Carefully countersink the holes in the trailing edge material.

STEP 7

Mark the inside face of the trailing edge section where the rib web and cap strips abut with a fine line felt marker.

STEP 8

Abrade the inside face of the trailing edge section marked in Step 7 with 100 grade emery cloth and thoroughly clean to the same standard previously called for prior to epoxy bonding.

STEP 9

Mix and apply a generous coating of epoxy adhesive to the rear face of the spar webs and where the trailing edge section will overlap the rib cap strips. Secure the trailing edge section in position with masking tape and rivet in place. Remove any extruded adhesive from the rear trailing edge face to rib web joints at Ribs 2, 4, 5, 7 & 9. **Do not over-set the rivets. Stop when the metal section is pulled down and when you feel the tail of the rivet begin to expand.** Finally, apply a fillet of adhesive all round the joints **except the where the rear face of the trailing edge joins the rib webs of Ribs 2, 4, 5, 7 & 9,** and dress to a neat radius as previously described.

STEP 10
To enable water to leave the bays, make drainage holes in the trailing edge in the inboard rear corner of each bay.

8.7 PREPARATION OF TRAILING EDGE FOR CONTROL SURACE HINGES

Hinge bearing brackets for the aileron are attached to Ribs 5, 7 & 9 and those for the flap are fitted to Ribs 2 & 4. The brackets are fitted in pairs on either side of the rib material (i.e. ¼" apart). To achieve this, the trailing edge has to be slotted both sides of the affected rib. Details of bracket installation are given in Chapter 9 – Ailerons and Chapter 10 – Flaps respectively.

STEP 1
Locate ribs 2, 4, 5, 7 and 9 and mark out a slot from about ¼" from the top (wing) surface to the bottom of the rear face (the widest face) of the trailing edge approximately 3/32" wide so that the inside face aligns with the outside face of each rib web. *See figure 8.7.2*

STEP 2
Chain drill the slot with a 3/32"drill, join the holes using a small round file and finally file to the marked lines, or use a Dremel type drill with slot cutting attachment**. Be careful: do not attack the rib material.** It is essential that the inside face of each slot aligns with the rib web face **otherwise the hinge brackets will not fit snugly to the webs and difficulty will be experienced when fitting the aileron and flap.**

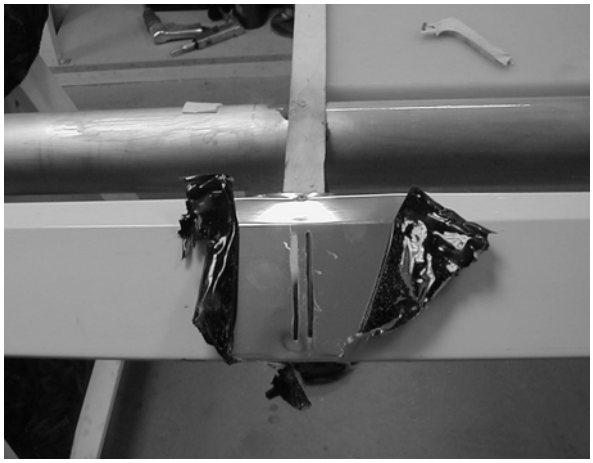

Figure 8.7.2

Trailing edge installed and slits cut for hard points. Cut these slots in the W-0295 material after the trailing edge of the wing is completely installed.

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