CHAPTER 16
REVISION LIST

The following list of revisions will allow you to update the Lancair IV construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shown and "R" to remove the pages.

Page(s) affected	Current Rev.#	Action	Description
16-1	0	None	No changes
16-2	B13	R&R	Added part numbers.
16-3 thru 16-5	0	None	
16-6	B17	R&R	Edited text before and in step A1.
16-7	B17	R&R	Added <cradles> to step A2.
16-8 thru 16-10	5	R&R	Changed Figure 16:B:1, 2, & 4 Changed Steps B1 - B6 Renumbered Steps B5 & B6
16-11	0	None	
16-12	B17	R&R	Added text to step C3.
16-13 thru 16-14	0	None	No changes
16-15	B17	R&R	Rewrote C5, edited fig.
16-16	B7	R&R	Revised
16-17 & 16-18	5	R&R	Clarified Step C12 & Figure 16:C:7:b
16-19 thru 16-21	0	None	No changes
16-22	5	R&R	Changed Step D5 & Figure 16:D:3
16-23 thru 16-24	0	None	No changes
16-25	B17	R&R	Added text, Added text to Figure.
16-26	B17	R&R	Removed E1, modified Figure.
16-27	B17	R&R	Removed page due to improved part.
16-28	B17	R&R	Added text to NOTE, modified figure.
16-29	B13	R&R	Edited Fig. 16:F:1.
16-30	0	None	No changes.
16-31	5	R&R	Changed Step F3.
16-32	B7	R&R	Revised Fig. 16:F:4
16-33 & 16-34	0	None	
16-35	B13	R&R	Cleaned up Fig. 16:F:7.
16-36	5	R&R	Clarified Figure 16:F:8.

CHAPTER 16
MATING WING TO FUSELAGE

REVISIONS

From time to time, revisions to this assembly manual may be deemed necessary. When such revisions are made, you should immediately replace all outdated pages with the revised pages. Discard the out dated pages. Note that on the lower right corner of each page is a "revision date". Initial printings will have the number "0" printed and the printing date. All subsequent revisions will have the revision number followed by the date of that revision. When such revisions are made, a "table of revisions" page will also be issued. This page (or pages) should be inserted in front of the opening page (this page) of each affected chapter. A new "table of revisions" page will accompany any revision made to a chapter.

ARROWS

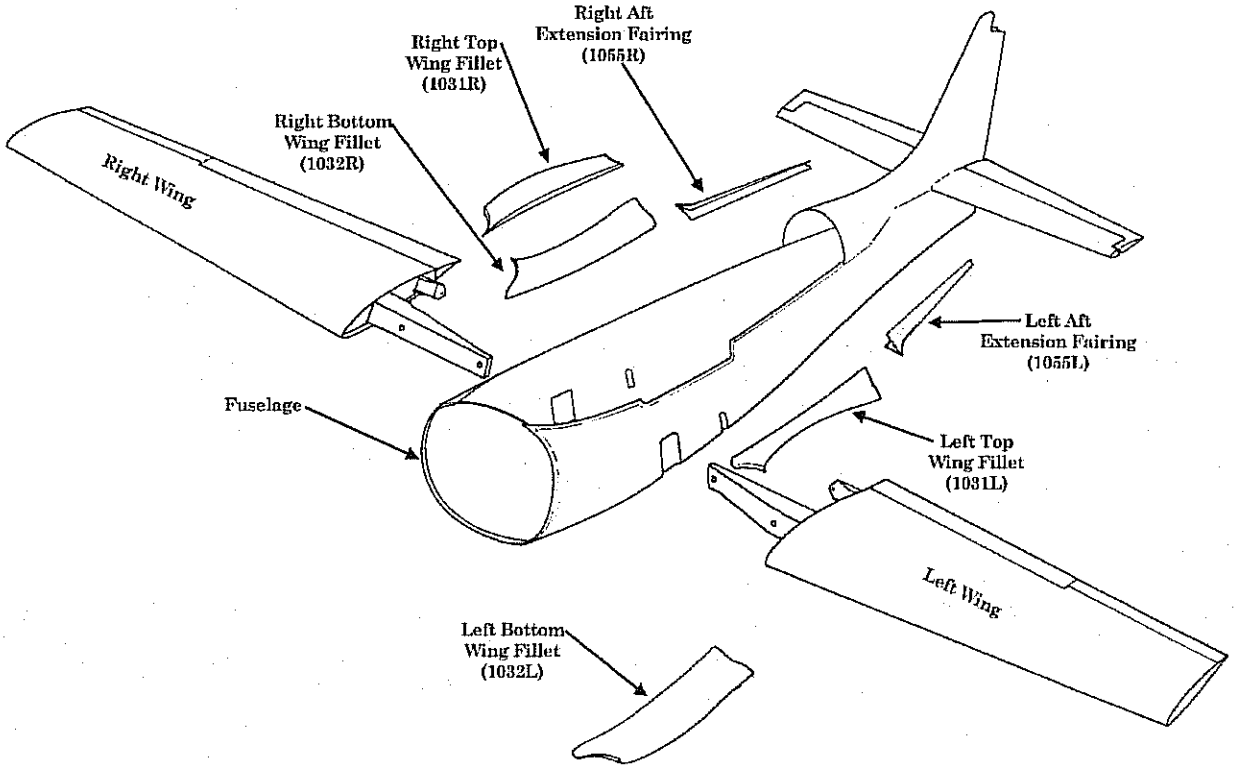
Most drawings will have arrows to show which direction the parts are facing, unless the drawing itself makes that very obvious. "A/C UP" refers to the direction that would be up if the part were installed in a plane sitting in the upright position. In most cases the part shown will be oriented in the same position as the part itself will be placed during that assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows.

CONTENTS

1. INTRODUCTION

When you complete this chapter, your Lancair IV will look like a true airplane and you'll see light at the end of the tunnel. Mating the wings to the fuselage is surprisingly easy but you do need quite a bit of room. A 35' x 25' shop or hangar gives you adequate room to insert both wings into the fuselage.

Joining Wings and Fuselage
Figure 16:i:1



Also in this chapter you will be installing the premolded wing root fairings between the wings and the fuselage.

2. SPECIAL PARTS, TOOLS, AND SUPPLIES LIST

A. PARTS

Left wing assembly
Right wing assembly
Fore and aft spar shear panels
Bottom fuselage assembly
Left top wing fairing
Left bottom wing fairing
Left fairing T.E. cap
Right top wing fairing
Right bottom wing fairing
Right fairing T.E. cap
1/2" thick Clark foam
1" thick Clark foam

B. TOOLS

Saber saw
Dremel tool
Spring clamps
Cleco pliers
Clecoes
Transit
Water level
Carpenter's (bubble) level

C. SUPPLIES

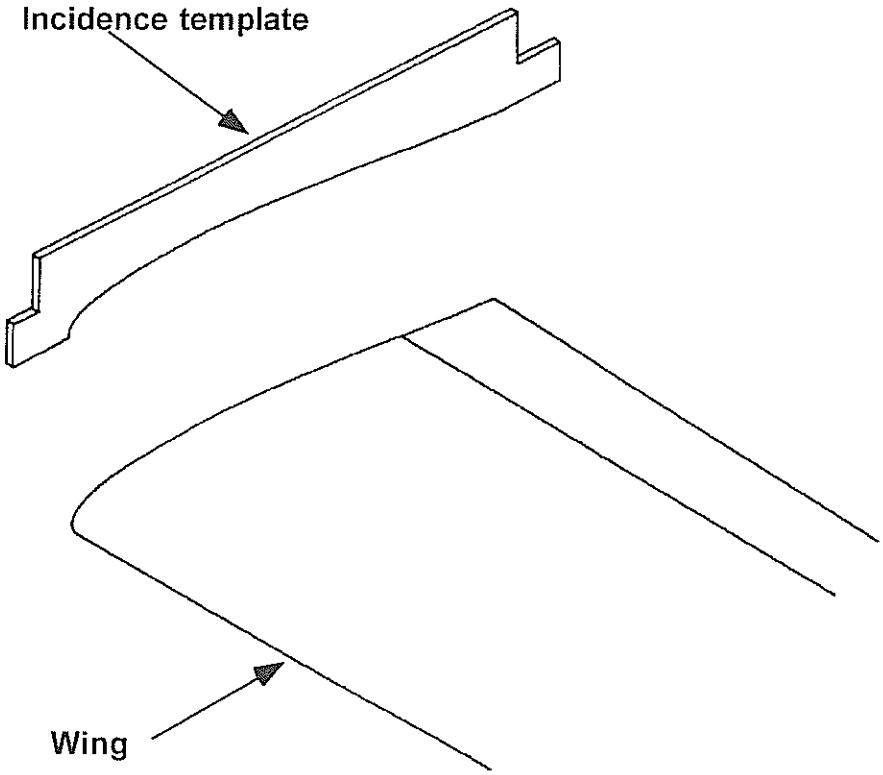
Bondo
5/8" thick plywood
Epoxy
Flox
Micro
Mixing cups
Paint brushes
Paper towels
Fiberglass

3. CONSTRUCTION PROCEDURE

A. INCIDENCE TEMPLATES

To find the correct wing incidence a plywood template is temporarily bonded to each wing as a level reference.

Wing incidence template
Figure 16:A:1

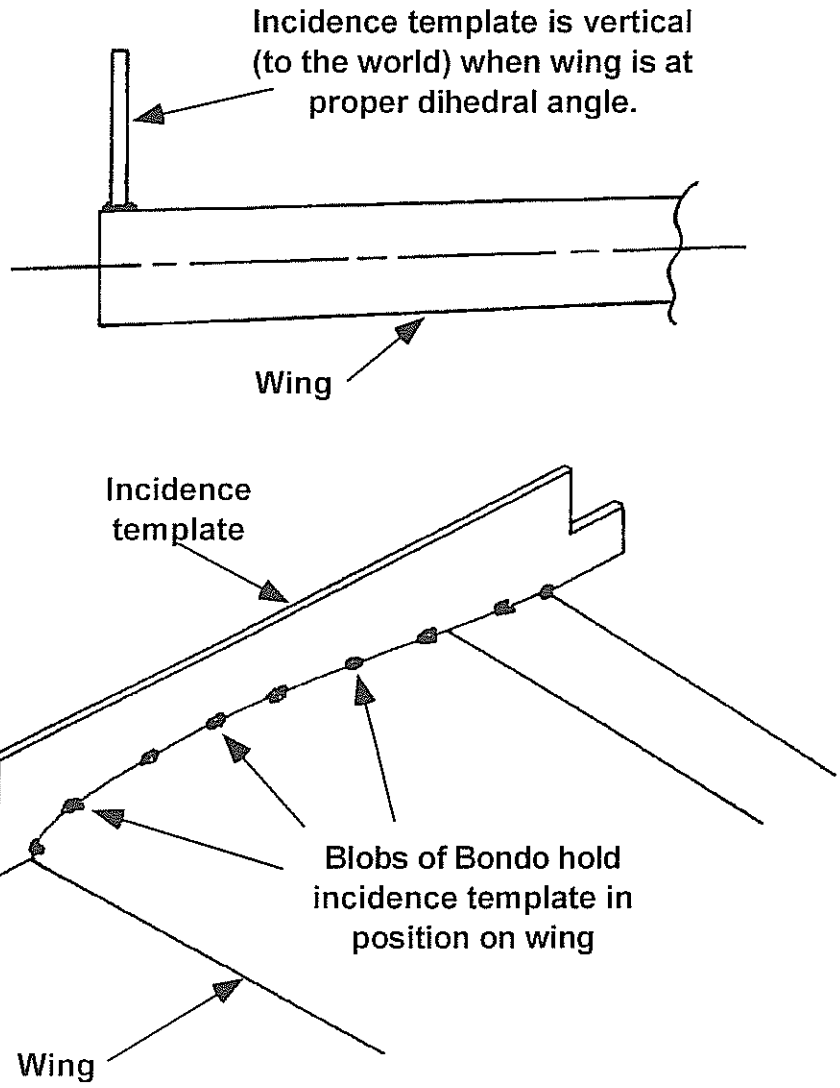


With some modification, your BL 25.5 wing cradle(s) can be used as a wing incidence template. Use the template on blueprint # A-109 to mark a line on the cradles indicating the proper incidence angle.

A1. Trim the top edge of the cradle to the incidence line, or glue some blocks on the line to set a level on.

A2. Use Bondo to secure the cradles (incidence templates) to the top wing skins at BL 25.5. The templates should fit the contour of top wing skin fairly close but due to builder differences, a small discrepancy (1/8" gap in an area) is acceptable.

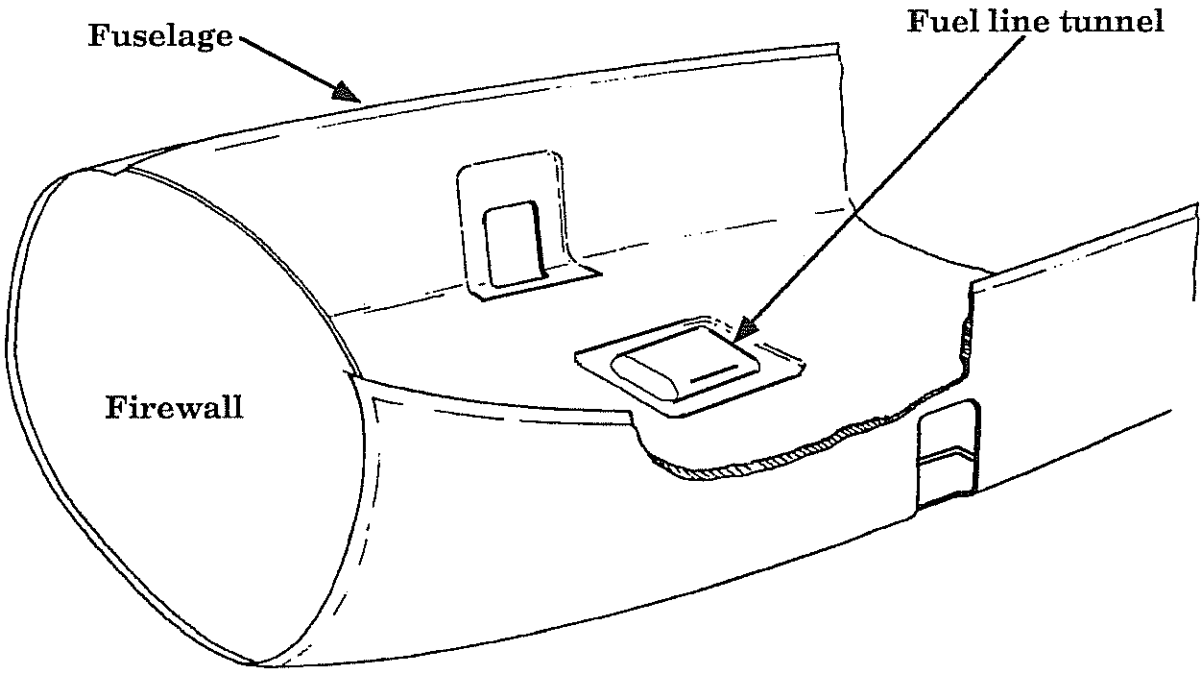
Securing incidence templates in position
Figure 16:A:2



B. FUEL LINE TUNNEL

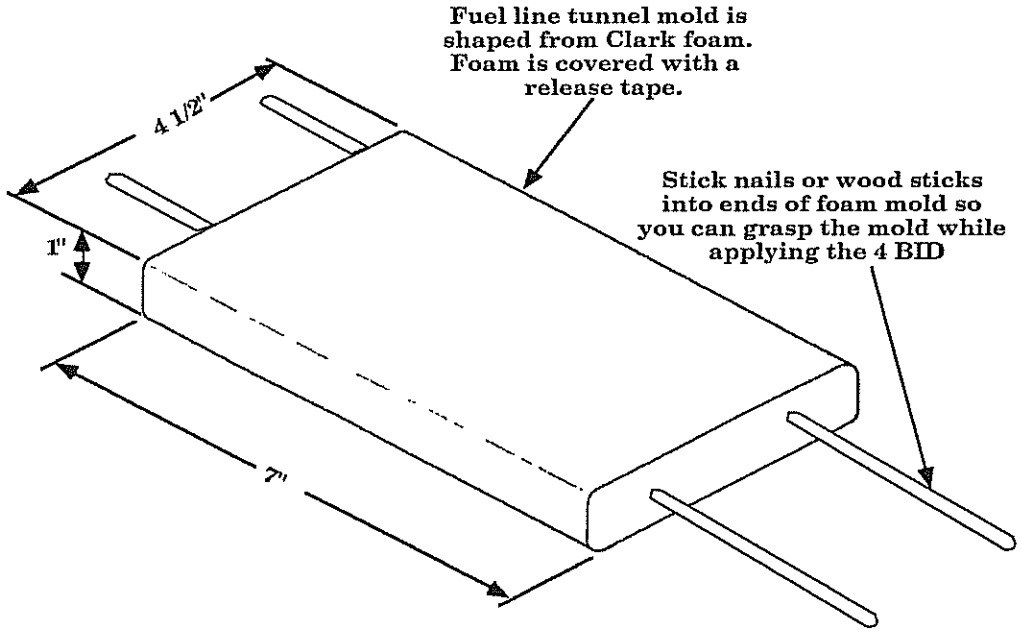
The fuel lines from both wings must pass under the main wing spars at the center of the fuselage. A fiberglass tunnel is formed in this area to provide better protection for the lines.

Fuel line tunnel
Figure 16:B:1



B1. Cut a piece of 1" thick Clark foam as shown in Figure 16:B:2. Round the long edges for easy glassing.

Mold for fuel line tunnel
Figure 16:B:2



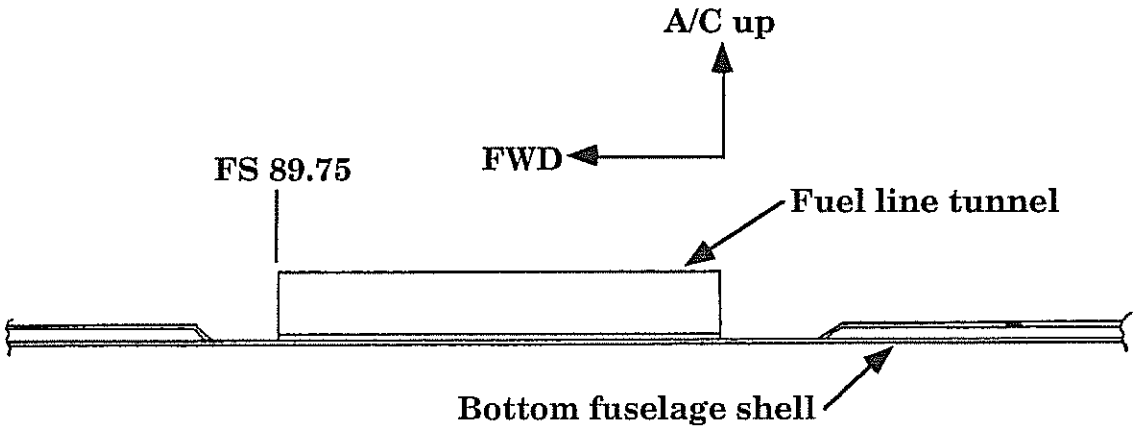
B2. Apply release tape to the tunnel mold. One layer of duct tape works well.

B3. Apply 4 BID to the fuel line tunnel mold.

B4. When the 4 BID has cured, remove the tunnel from the mold. The easiest way to do this is to dig out the foam with a screwdriver or narrow chisel, then scrape and roll the duct tape off the inside of the tunnel. Trim the tunnel to 7" in length.

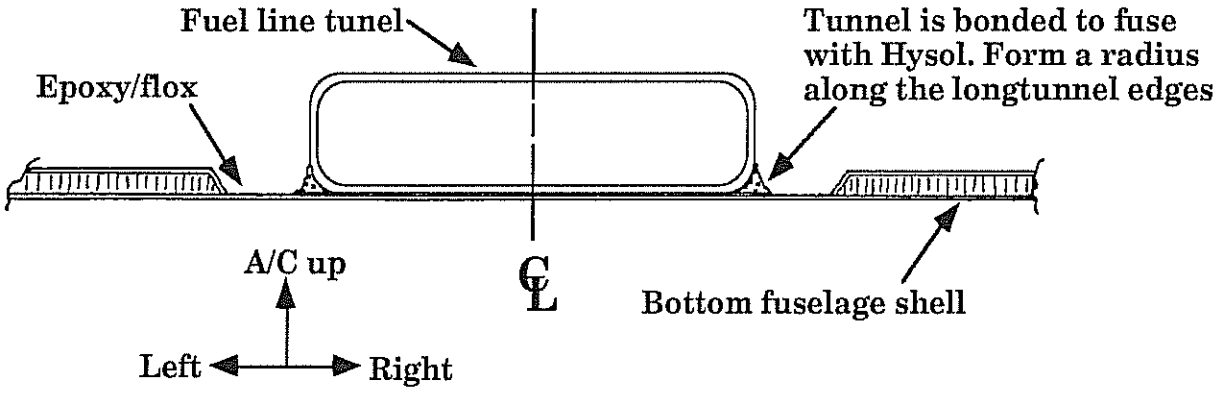
B5. Position the fuel line tunnel in the fuselage, centered on BL 0, with its forward edge at FS 89.75. Mark the location of the tunnel on the bottom fuselage shell.

Positioning fuel line tunnel
Figure 16:B:3



B6. With 40 grit, sand the fuel line tunnel and the areas of the bottom fuselage shell where the tunnel will be bonded. Clean these areas with MC.

Bonding in fuel line tunnel
Figure 16:B:4

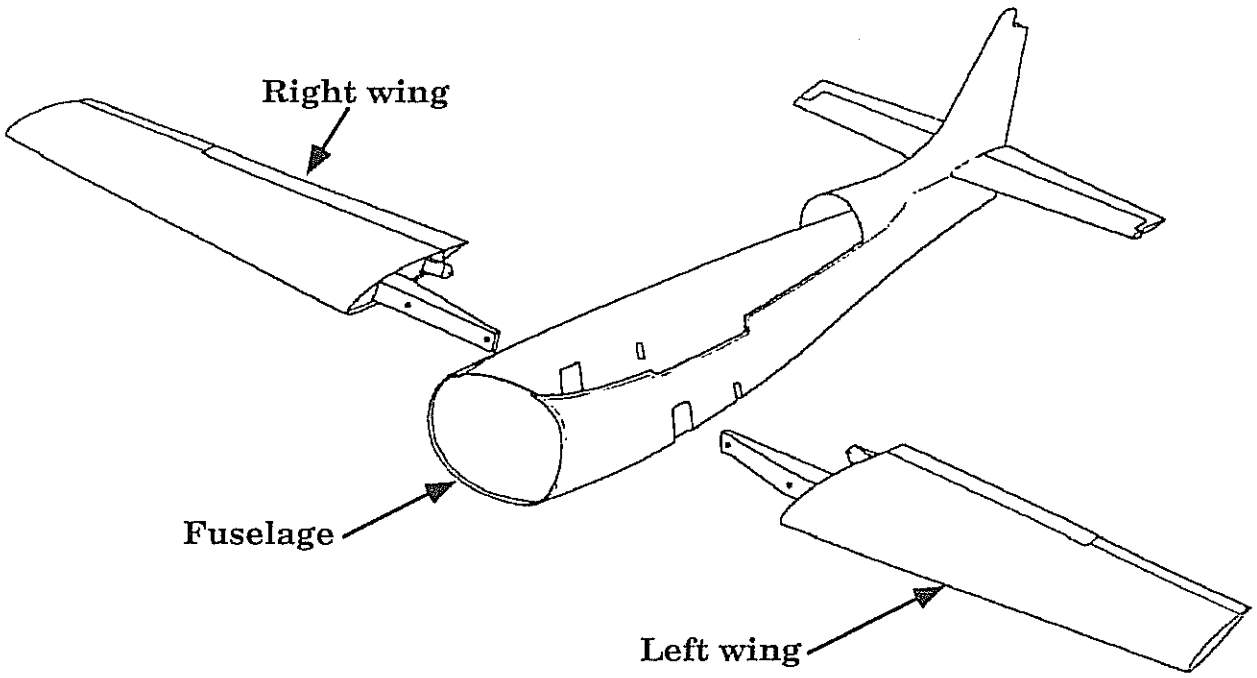


B7. Bond the fuel line tunnel to the bottom fuselage shell with Hysol. Form a radius in the Hysol along the edges of the tunnel where it meets the fuselage shell. There is no need to reinforce the bond with fiberglass yet. This will be done when you install the main spar shearbox.

C. MATING WING TO FUSELAGE

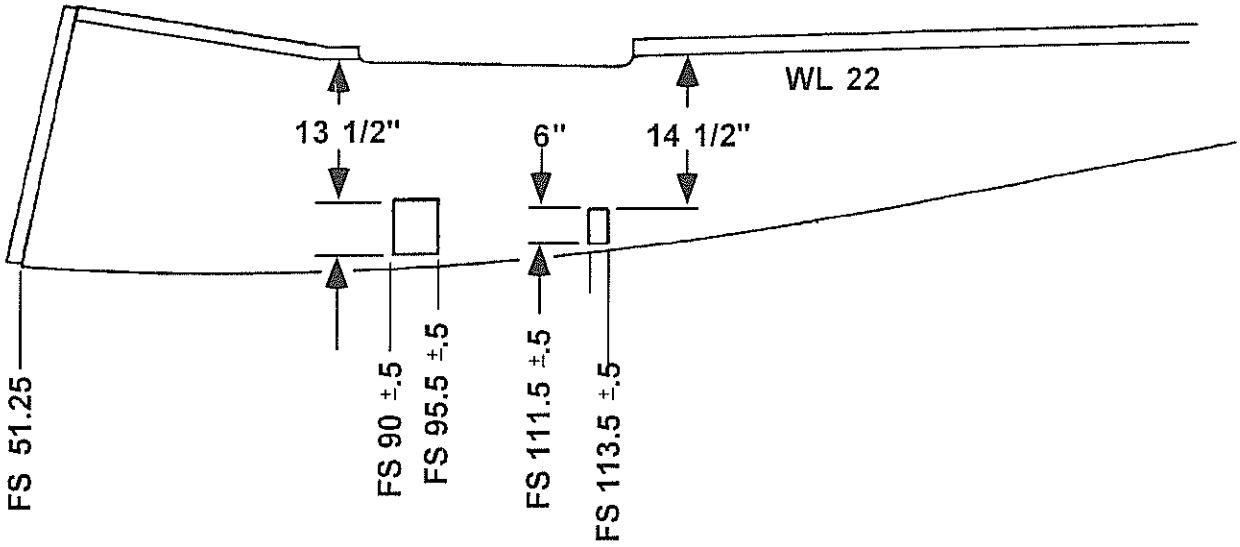
The Lancair IV wings are set to a *positive* 1.6° incidence. This means that the L.E. of the wing is higher than the T.E. Don't confuse this condition with the horizontal stabilizer which was mounted with negative incidence. Recheck your fuselage to be sure is has not strayed from level.

Mating wing to fuselage
Figure 16:C:1



C1. Holes need to be cut through both sides of the fuselage so the main and rear wing spars can slide into position. Mark the location of the spar holes on the fuselage as shown in Figure 16:C:2.

Spar holes in fuselage
Figure 16:C:2

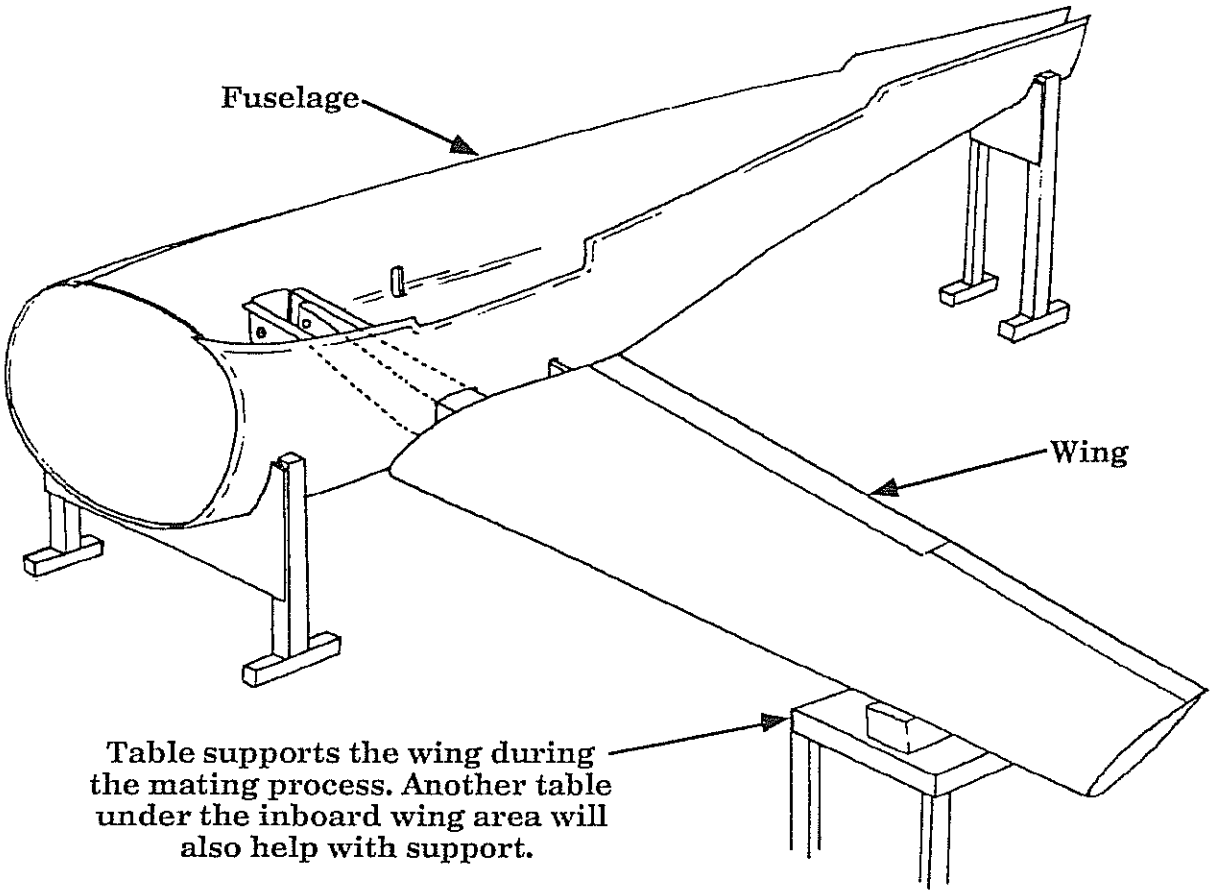


C2. Cut out the four spar holes in the sides of the fuselage.

C3. Slide the two wings into the fuselage so the main spar bolt holes align with each other. This step requires more than one person, so enlist a helper or two to handle those big wings. The forward face of the right main spar should be located at FS 90 and the wings should be centered so that the inboard ends of the top wing skins are approximately equa-distant from the fuselage sides at the rear spar. The BL 0 location of the wing assembly will usually be to the left of the centerline mark on the floor. This is because the fuselage is not symetrical. Use two tables and some blocks of foam to hold the wings in position. Slide the main spar bolts through the bushings to hold the wings at the proper dihedral.

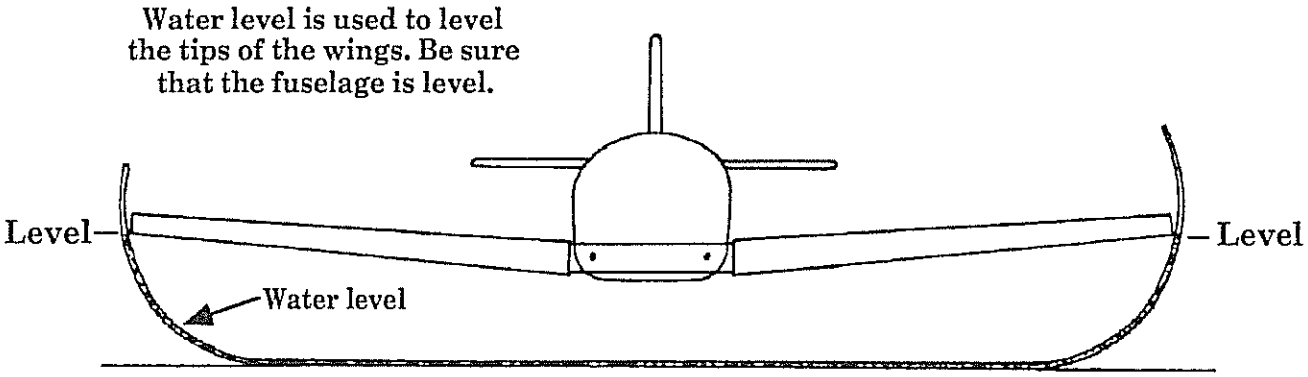
Locating wing spars

Figure 16:C:3



C4. The wing tips should be level with each other. Use a water level or a transit to adjust the height of the wings. See Figure 16:C:4.

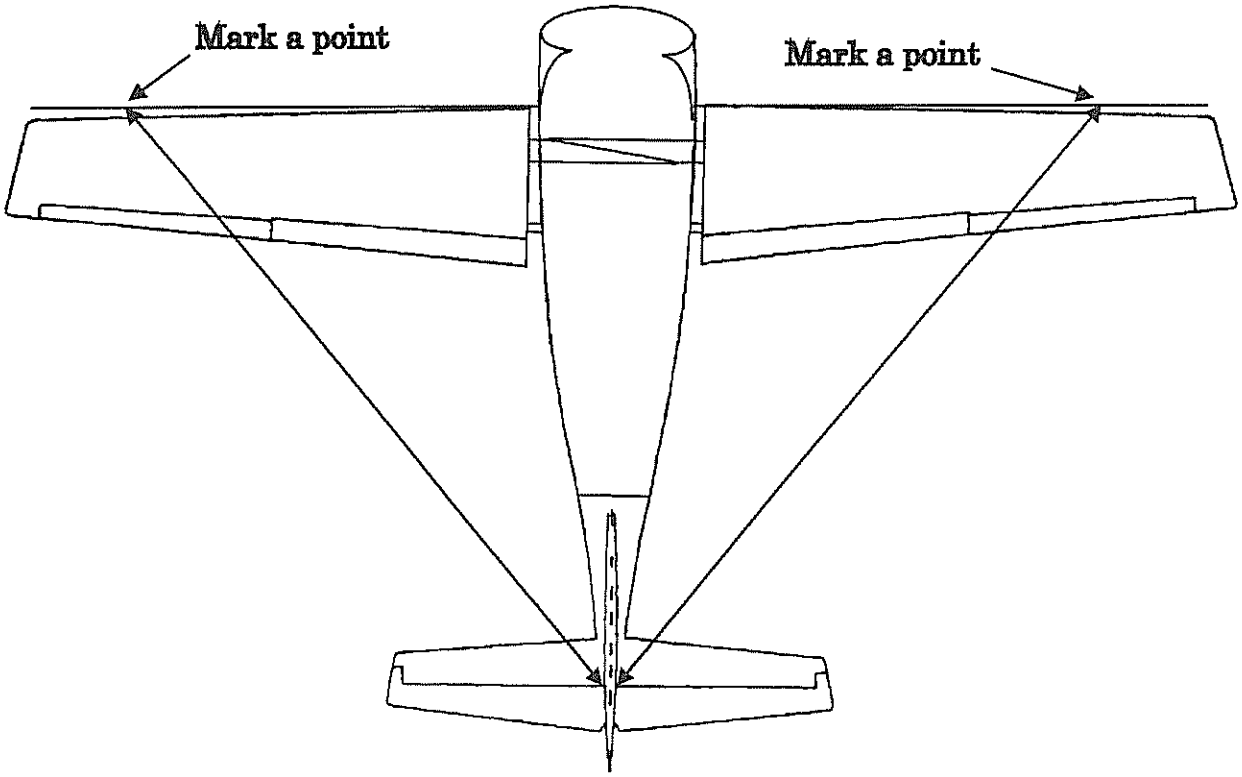
Leveling wings
Figure 16:C:4



C5. Now for the fine tuning of wing placement. Check the alignment of the fuselage centerline with the centerline on the floor. Draw a reference line on the floor perpendicular to the fuselage centerline near the wing's leading edge. Confirm that your line is perpendicular by using triangulation. Mark two points on the wing L.E. equa-distant from the fusealge centerline. Use a plumb bob at both points to align the wing leading edge with the line drawn on the floor.

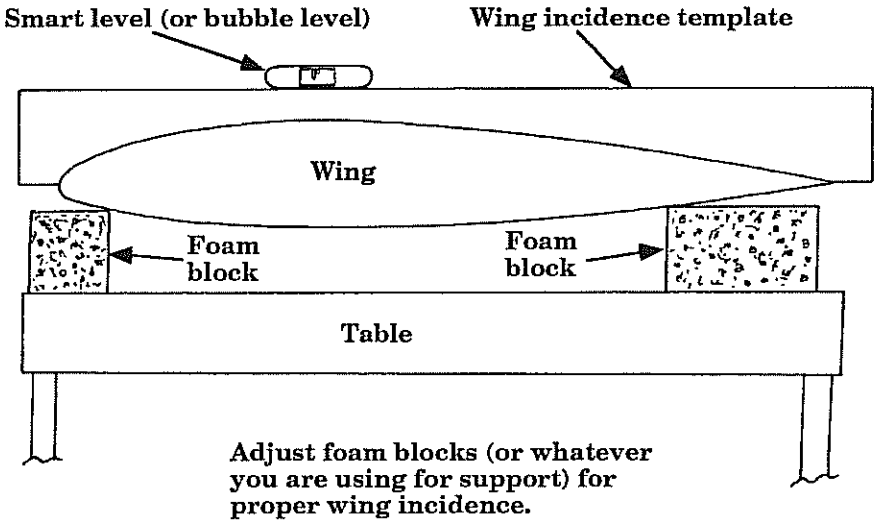
Setting wing sweep

Figure 16:C:5



C6. - To set the wing incidence, place a Smart Level (a bubble level will also work) on the top edge of the incidence template. **When the Smart Level reads "0°", then the wing is set to the proper incidence. DON'T ADJUST THE WING SO THE SMART LEVEL READS 1.6°. THE POSITIVE INCIDENCE HAS BEEN BUILT INTO THE INCIDENCE TEMPLATE.** Check both wings to make sure there is no discrepancy between the incidences, both should be equal. Adjust the foam blocks under your wing to hold the proper incidence.

Setting wing incidence
Figure 16:C:6



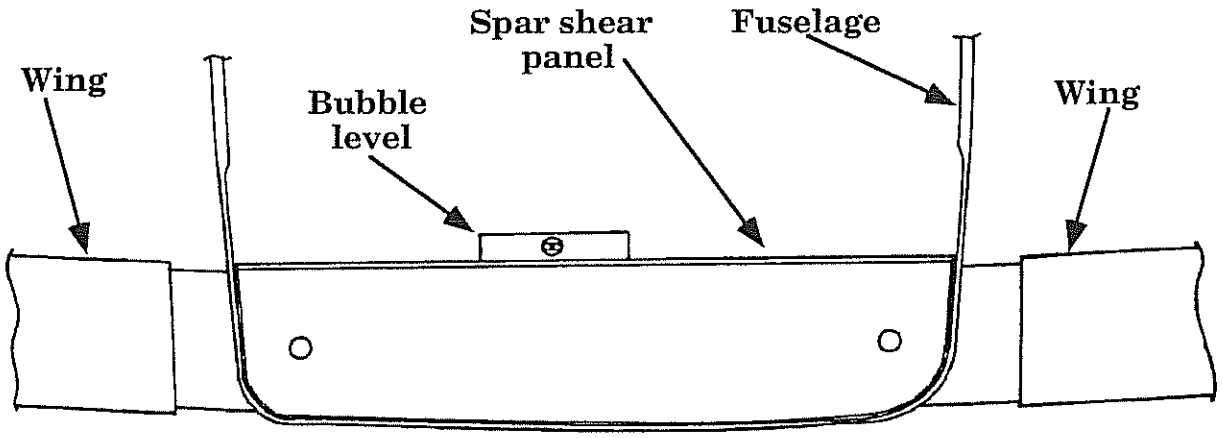
C7. The two spar shear panels were provided in your "A" kit and are matchdrilled with the main wing spars. To ease the job of trimming these panels to fit in the fuselage, it is highly recommended that you cut a cardboard template to find the final shape of these panels. Make this template accurate, taking into account the spar bolt locations and the 8 3/8" panel height. Don't get in a hurry and trim the shear panels way off the target. Take it slow and steady.

NOTE: Be sure the forward shear panel is forward of the main spar. Otherwise, the spar bolt bushings will not line up. You can double check the Forward (F) and Aft (A) part numbers on the shear panels by looking for the seatbelt reinforcement on the aft panel. This reinforcement is a 12" wide, increased BID area running the full height of the aft panel (in the center).

C8. Cut the shear panels to match the cardboard templates. The main spar bolt bushings should all line up when the shear panels are properly trimmed. Slide the AN12-75A through the bushings to assure yourself or proper alignment. A perfect fit of the shear panels is hard to achieve and is not required. If you end up with a few 1/8" gaps between the panels and the fuselage, this is acceptable.

Fitting spar shear panels

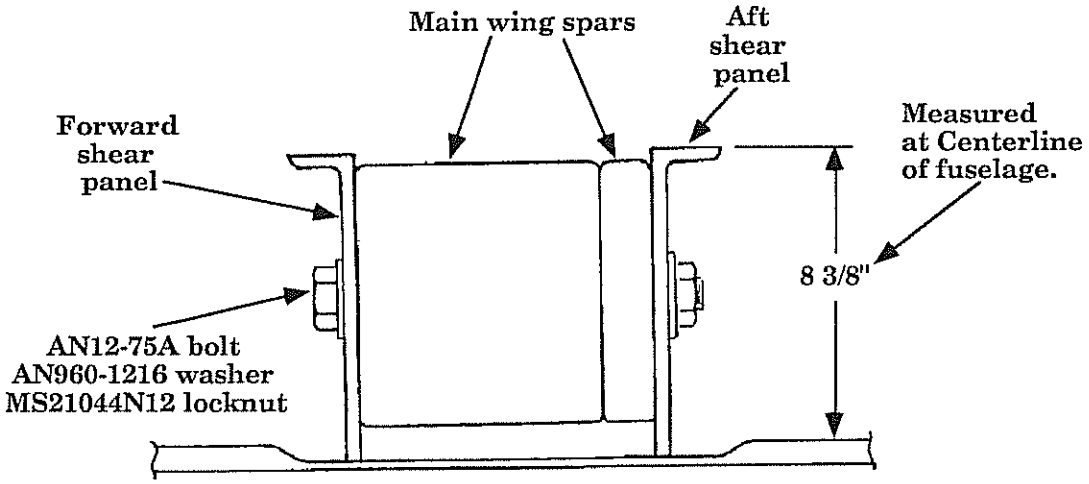
Figure 16:C:7:a



Top of shear panels should be level. Seats will mount to the shear panel flanges later in construction.

Fitting spar shear panels

Figure 16:C:7:b

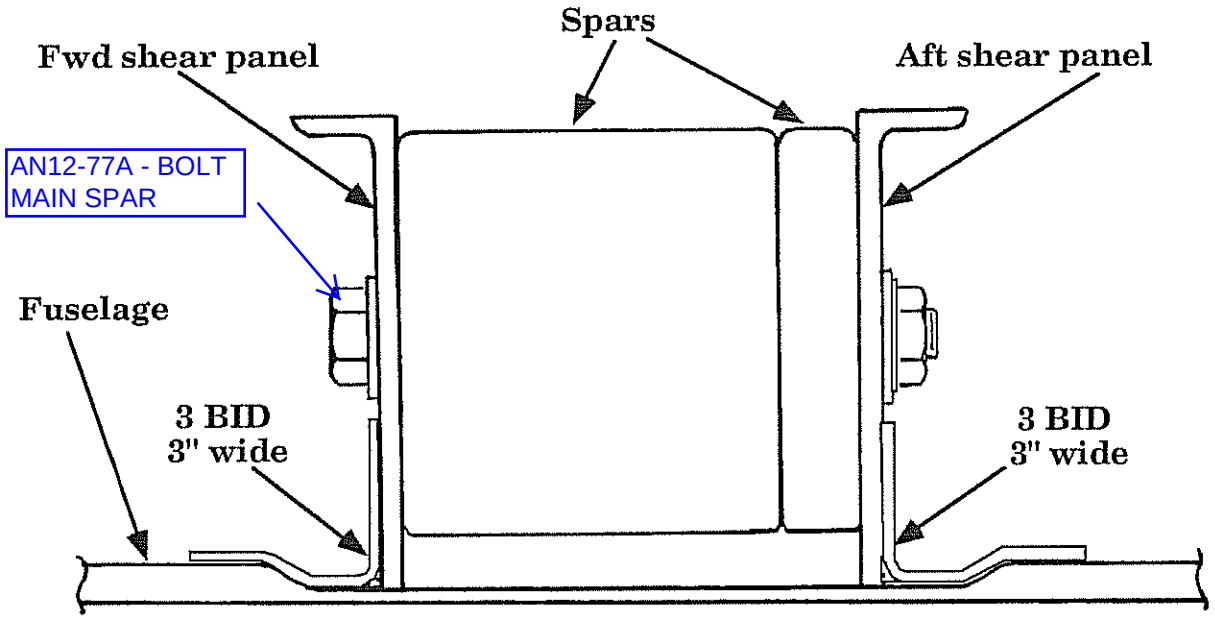


Note: The wing spars need only to be high enough to clear the fuel line tunnel. The 8 3/8" shear panel height can vary up to 1/4".

C9. When satisfied with the fit of the spar shear panels, use 40 grit to sand them where BID tapes will be applied. Also sand the bottom fuselage shell where the panels are located. Clean these bonding areas with MC.

C10. Bond the shear panels to the bottom fuselage shell with a thick epoxy/flox mixture. Form a 1/4" radius with the excess flox around the shear panel/fuselage junction. Use the AN12-77A main spar bolts and their MS21044N12 locknuts to hold the panels in proper alignment during bonding. The locknut should just be snug for this step. Any more pressure would make wing removal and installation difficult. Be sure not to get any flox on the main spars. This would also make removal difficult.

Bonding shear panels in position
Figure 16:C:8

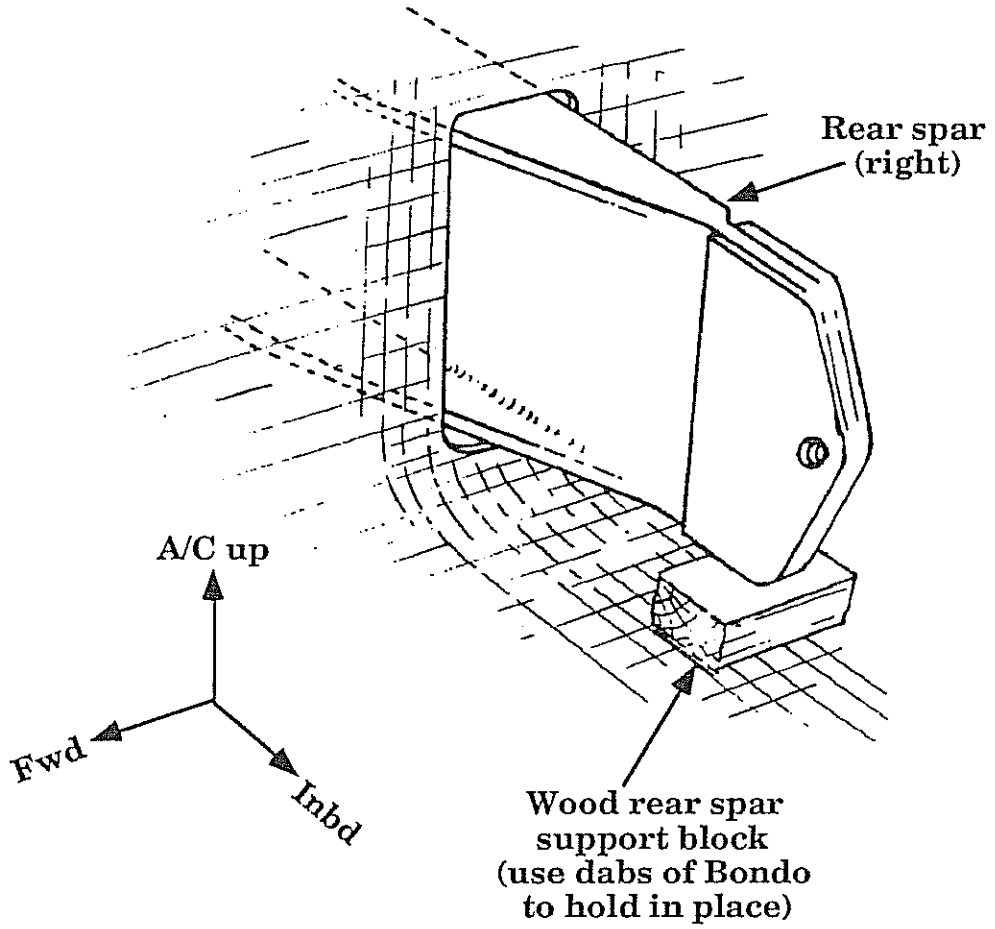


C11. When the shear panels have cured in position, sand the flox radius smooth and clean with MC.

C12. Secure the shear panels to the bottom fuselage shell with 3 BID, 3" wide laminates. Notice that the spar sides (the sides of the panels that the spars rest against) of the shear panels are not secured to the fuselage with BID. This would interfere with the spar fit and is engineered into the design.

C13. The rear spars will be bolted to the forward face of the gear box later in construction. For now, wood temporary supports will hold the rear spars in position at the proper wing incidence. This way, you can continue with the construction of the wing fairings without waiting for the gear box. See Figure 16:C:9.

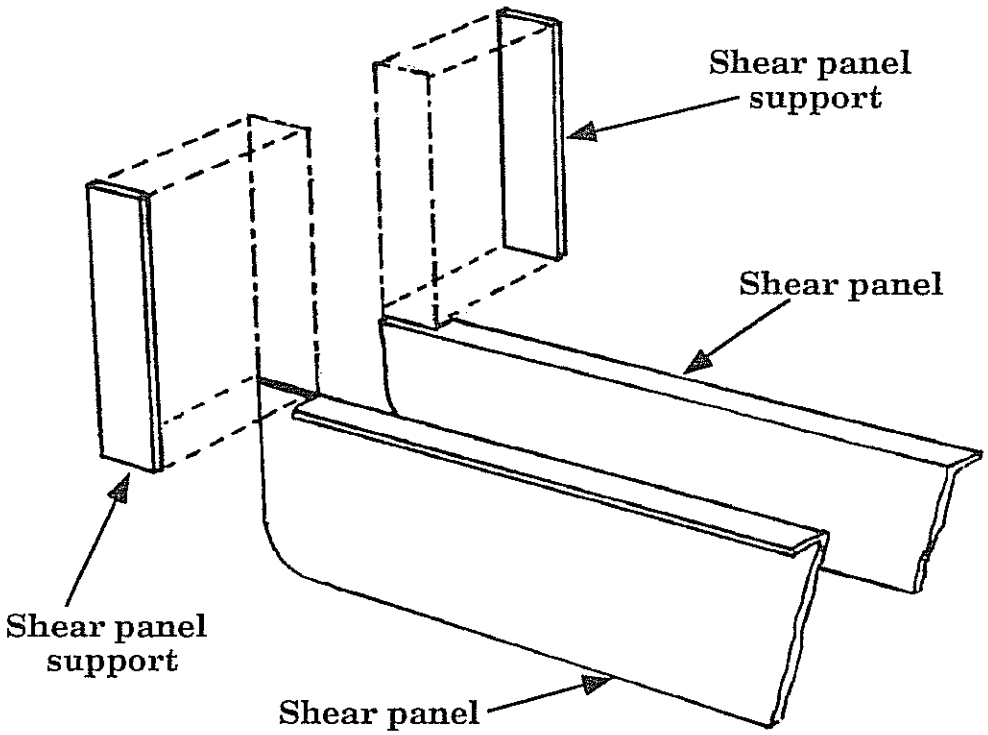
Supporting rear spars
Figure 16:C:9



D. SHEAR PANEL SUPPORTS

The shear panels must be reinforced with two brackets on each side of the fuselage.

Shear panel supports
Figure 16:D:1

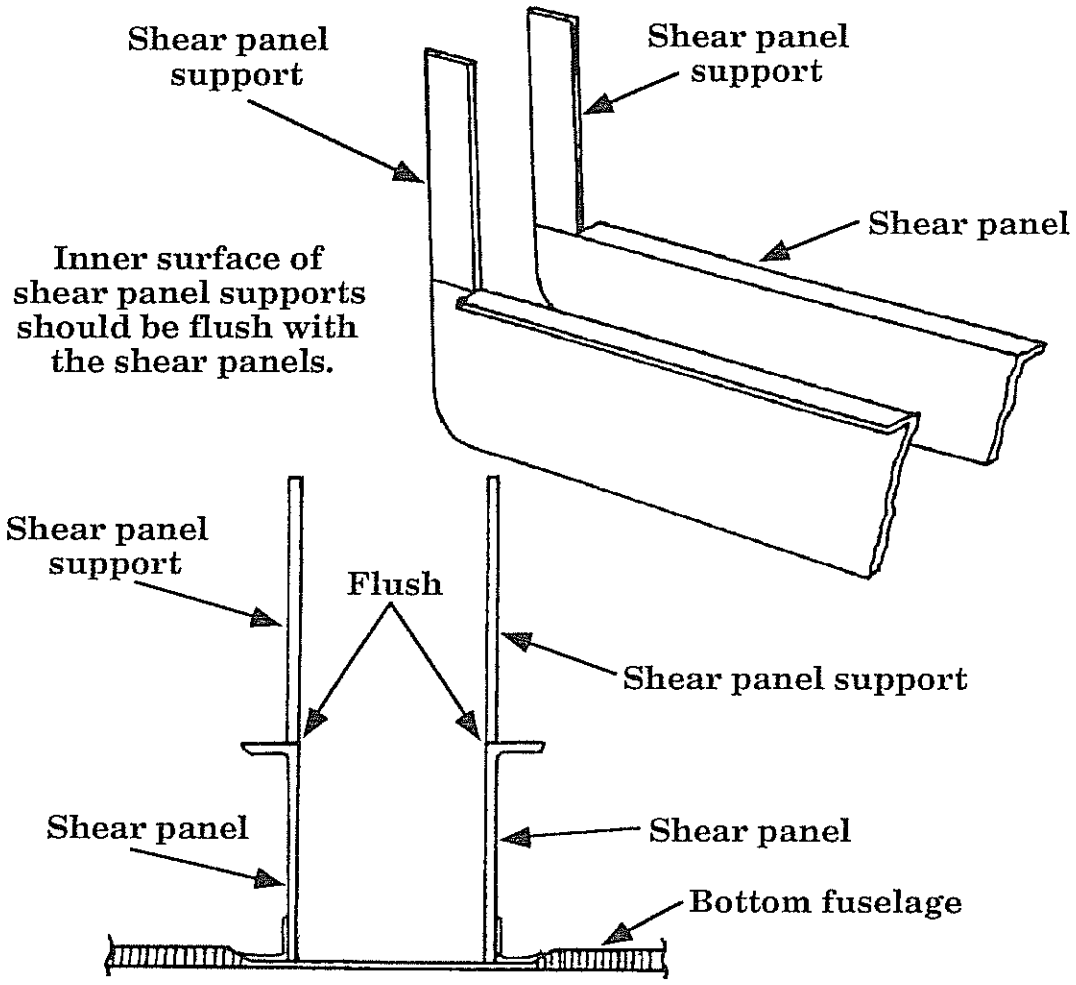


Note: four shear panel supports are required.

D1. Using the templates on Blueprint A109, cut the shear panel supports from 1/4" thick, 2 ply per side prepreg. Notice that there are templates for the forward supports and aft supports. Although the drawings in this section may show the supports as being identical, there are slight differences in size.

D2. Fit the shear panel supports at the locations shown in Figure 16:D:2.

Support locations
Figure 16:D:2



D3. With 40 grit, sand both sides of the shear panel supports. Clean the supports with MC.

D4. Sand the areas of the fuselage sides and shear panels where the shear panel supports will be mounted. Clean these areas with MC.

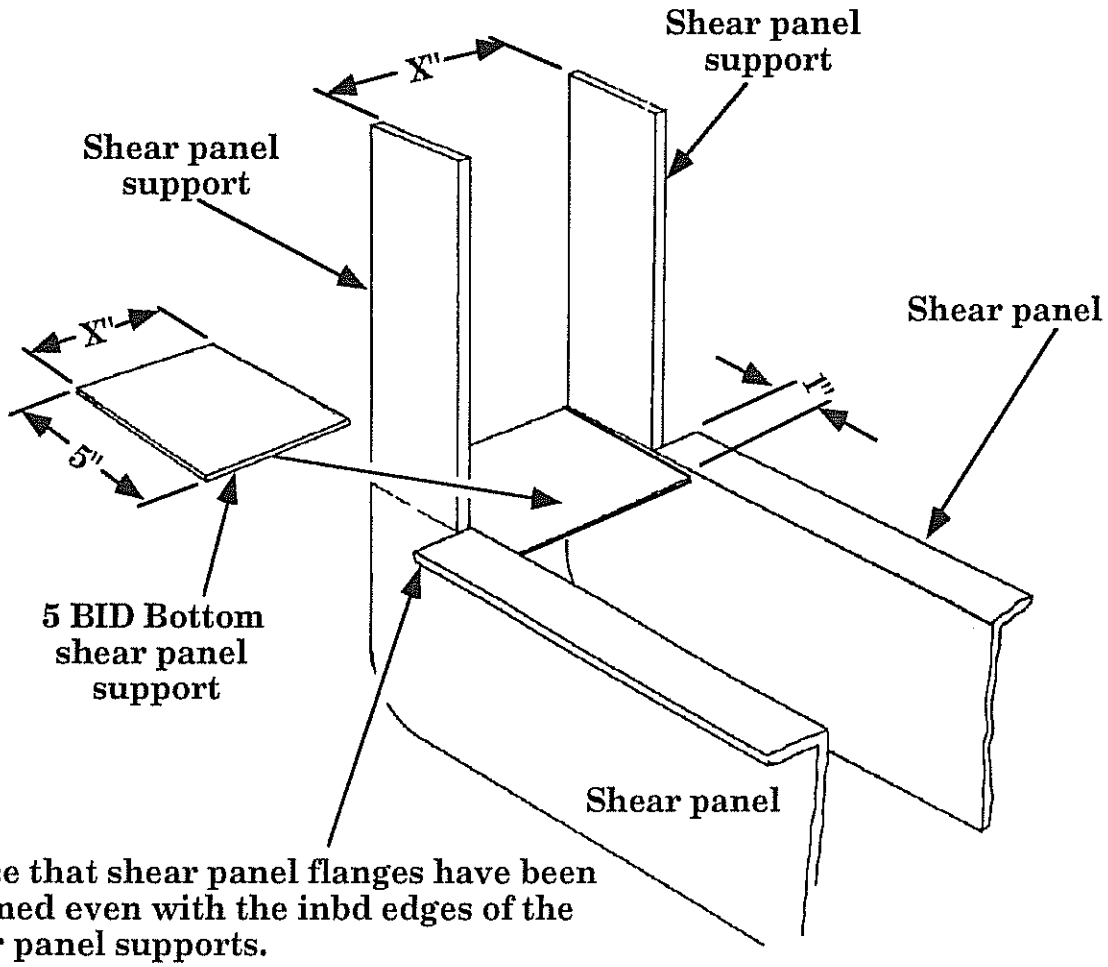
D5. Bond the supports to the shear panels and fuselage with an epoxy/micro mixture. Form micro radii with the excess micro. Don't apply the BID to the shear panel supports until you have installed the small fiberglass section described in the next few steps. Trim the shear panel flanges even with the inboard edges of the supports as shown in Figure 16:D:3.

D6. Apply release tape to a flat surface in a 8" by 12" section.

D7. Lay up 5 BID on the flat release surface you just made. When the BID has cured, remove it from the flat surface.

D8. Cut two pieces from your 5 BID piece to fit between the shear panel supports on the left and right ends of the shear panels. See Figure 16:D:3.

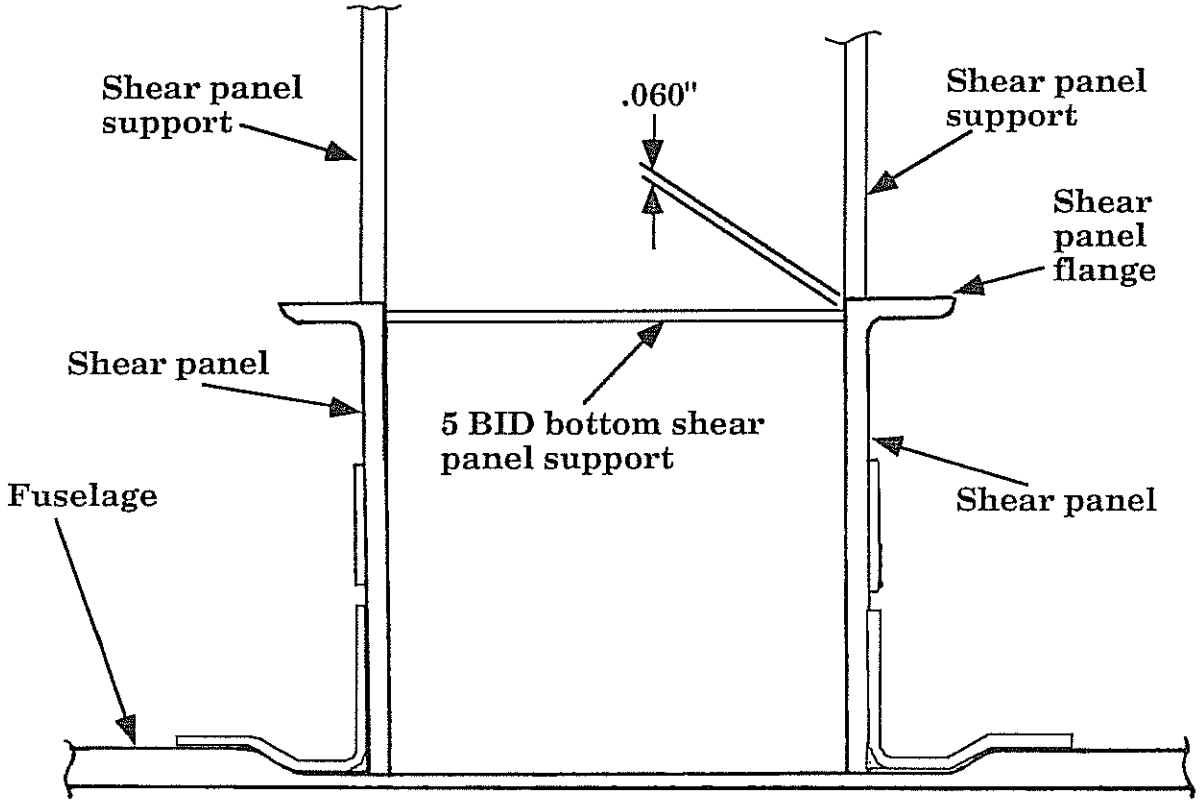
Bottom shear panel support
Figure 16:D:3



D9. Sand the top surfaces of both the 5 BID pieces and clean with MC.

D10. Bond the 5 BID pieces into position with an epoxy/flox mixture. Be sure the bottom supports are mounted about .060" below the level of the shear panel flanges. The pieces will be reinforced with the same 6 BID that secures the shear panel supports to the fuselage sides.

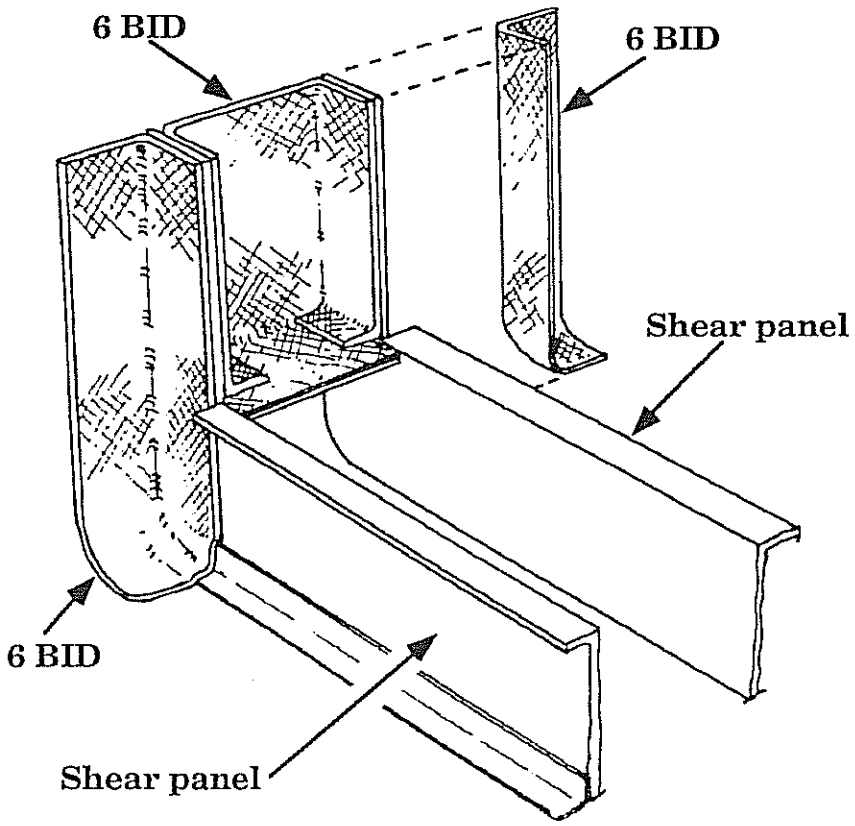
Height of bottom shear panel support
Figure 16:D:4



Mount bottom shear panel support .060" below the level of the shear panel flanges.

D11. Secure the shear panel supports to the shear panels and fuselage with 6 BID as shown in Figure 16:D:5. Notice that this BID also secures the bottom shear panel supports.

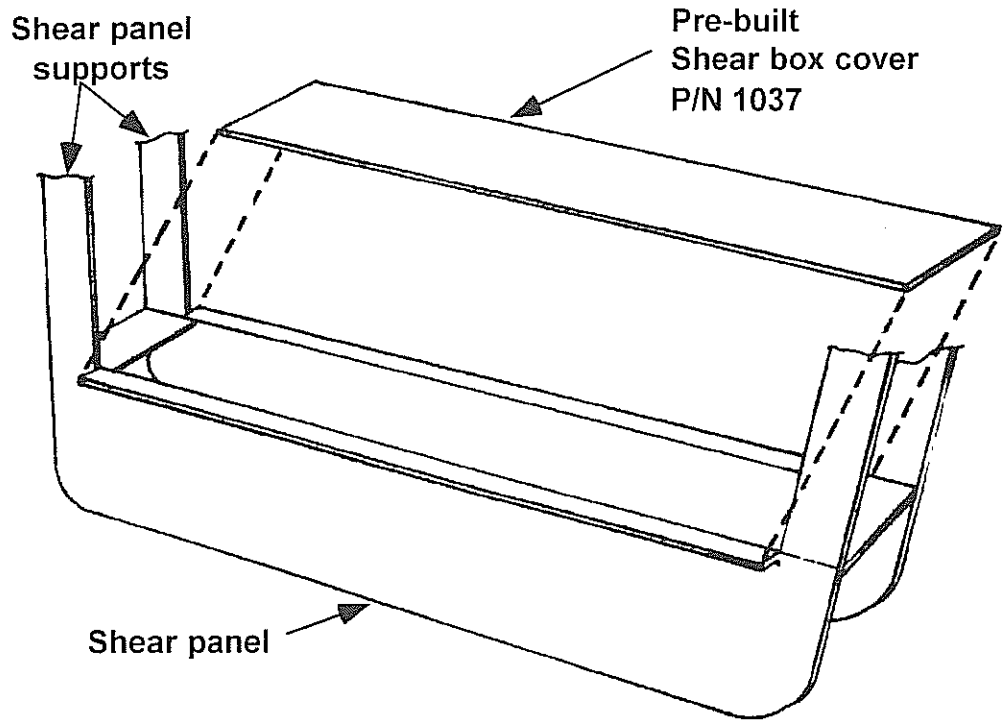
Securing shear panel supports
Figure 16:D:5



E. SHEAR BOX COVER

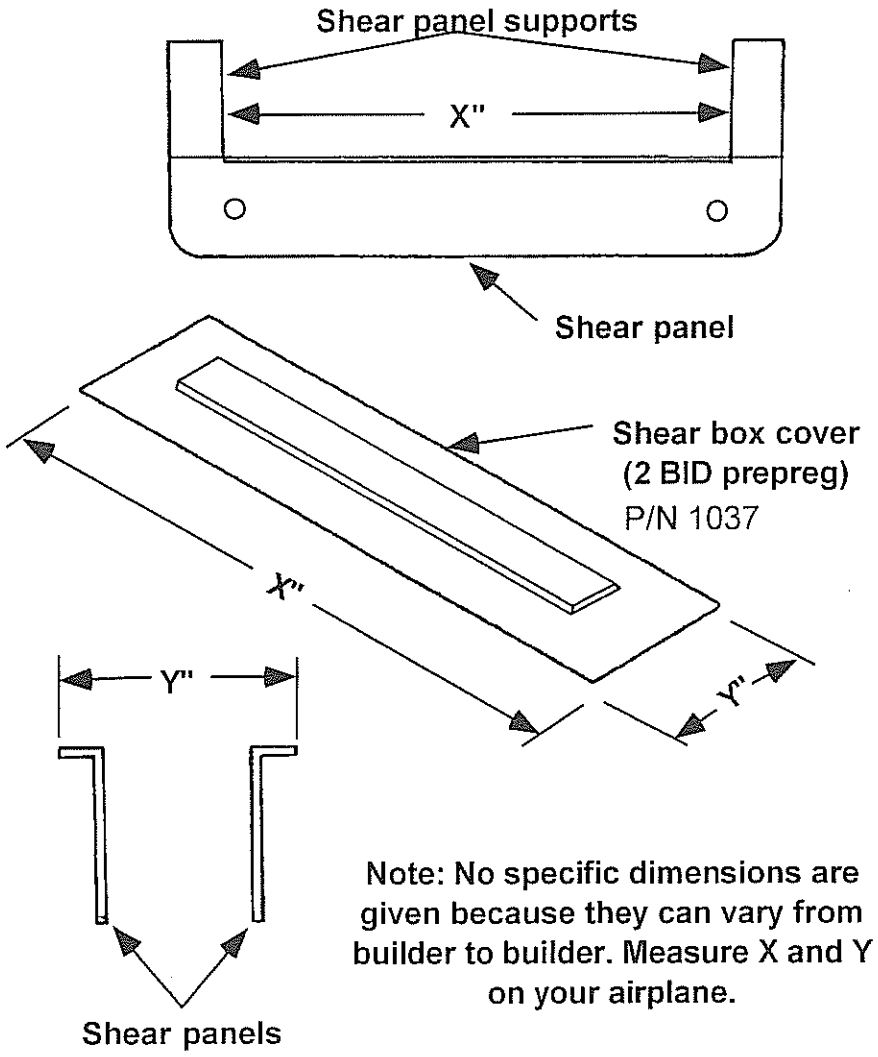
A prepreg shear box cover is used to isolate the cockpit from the elements. The cover is bonded to the shear panel flanges to avoid air leaks that would result from making the cover removable. This is a premolded part #1037.

Shear box cover
Figure 16:E:1



E1. Use the dimensions in Figure 16:E:2 to cut the shear box cover from 2 BID per side, fiberglass prepreg panel. The cover should rest on the shear panel flanges and the bottom shear panel supports. This will completely isolate the cockpit from the spar area and provide a flat surface for later mounting of the seats.

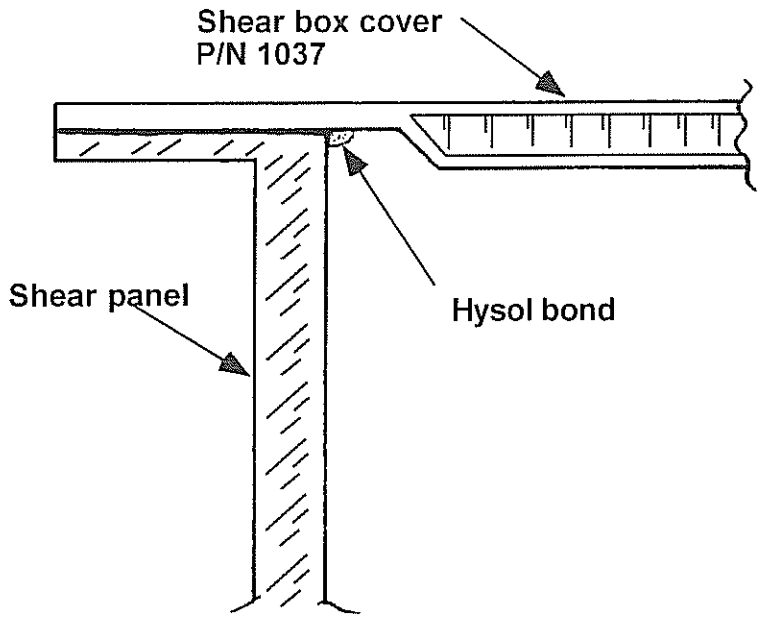
Cutting shear box cover
Figure 16:E:2



Due to revisions, this page has been removed.

NOTE: The shear box cover is bonded in position with Hysol. Although the process is described in the next few steps, DON'T bond the cover in position at this time. Wait until you have installed the jack points and seat belt bolts and are ready to install the seats. The longer you have access to the shear box area the better.

Bonding shear box cover in position
Figure 16:E:4

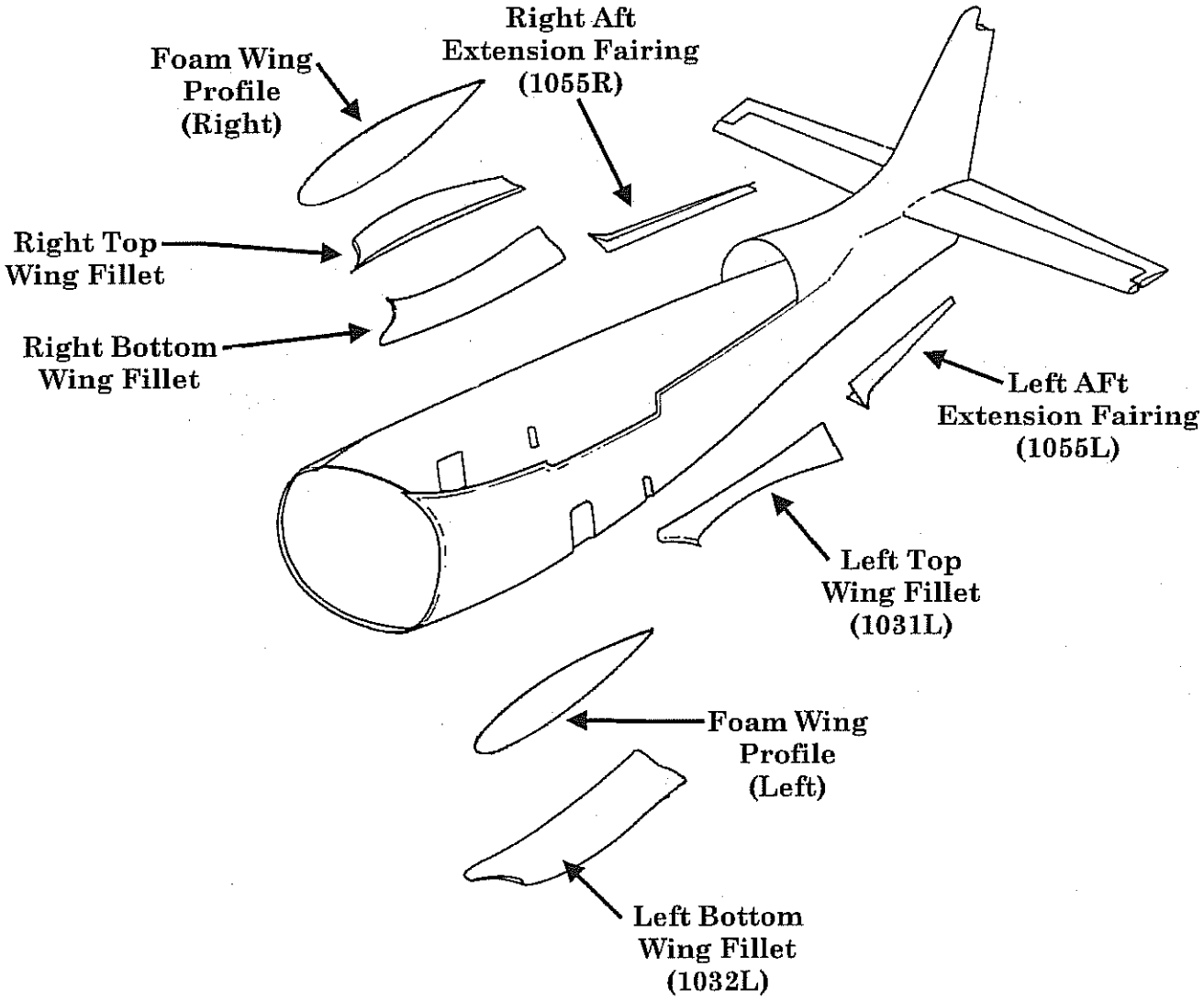


E5. Bond the shear box cover in position with Hysol. As usual, mix a little flox in with the Hysol to give it more body. To avoid air leaks, be sure there is Hysol squeezeout all around the bonding area.

F. WING ROOT FAIRINGS

Wing root fairings help smooth the airflow between the wings and fuselage. Premolded fairings are provided in your Lancair IV kit. There are three premolded pieces in each fairing, a bottom half, top half, and T.E. cap.

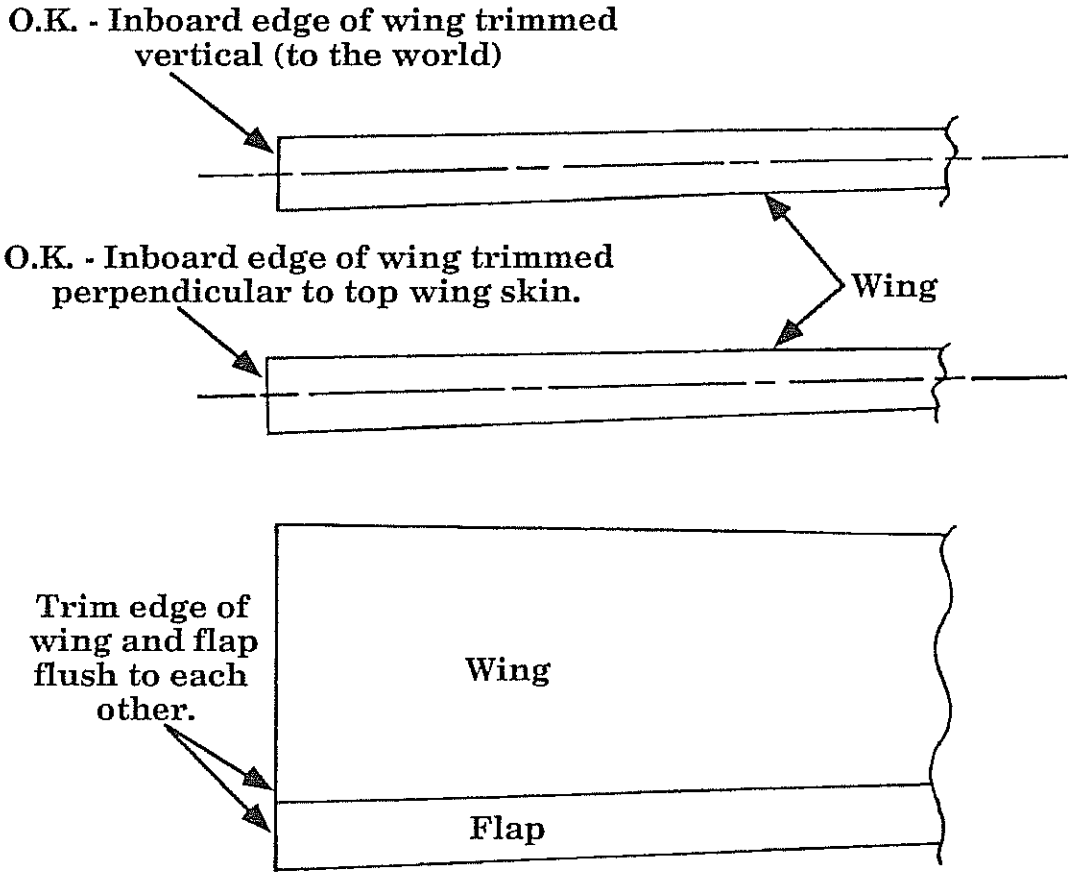
Wing Root Fairing
Figure 16:F:1



NOTE: The aft fairing parts are installed in Chapter 19.

F1. Before fitting your wing fairings, you should check that the inboard edges of your wing are flat and straight. It doesn't matter if your inboard edges are vertical to the world or at any other angle, but for appearance sake, the inboard edges should be straight. This is also a good time to trim the inboard ends of your flaps flush with the wing skin.

Trimming inboard edge of the wings
Figure 16:F:2



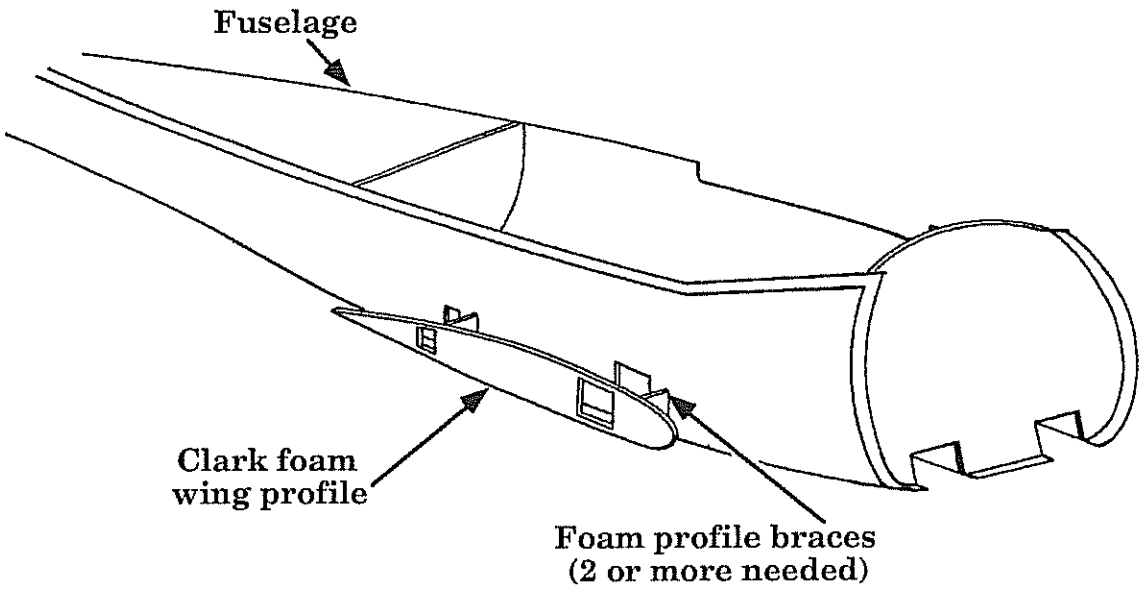
F2. Slide the wings into the shear box and insert the main spar bolts. When the rear spar is resting on it's wooden support, the wings should be at the proper incidence. Recheck the incidence anyway with the incidence template just to be sure. You wouldn't want to align the wing fairings with an improperly aligned wing.

Note: You may want to hold off on installing your wings until you have made the foam wing profiles described in the next few steps. This way, you can slip the profiles into position without cutting them in pieces to fit around the main and rear spars.

F3. Cut two pieces of 1/2" thick Clark foam shaped 1/4" larger than the wing profiles at BL 25.5. These foam profiles will be used to hold the wing fairings in the proper shape when the wing is removed. Use your old plywood BL 25.5 wing cradle or profile as a template to cut the foam (but remember to cut them 1/4" larger all around). Apply 2 BID to the inboard surface of the left wing profile. This 2 BID will reinforce the foam in the area where people may step on the fairing when entering the aircraft.

F4. Cut smaller pieces of 1/2" thick Clark foam that will hold the wing shaped pieces 5/8" inboard of BL 25.5. If you have already installed the wings, you will have to carefully cut the foam profiles in three pieces (each) to fit around the spars. Use Bondo to bond the small braces to the fuselage and the foam wing profiles. Also use a little Bondo to secure the profile pieces together again if you had to cut them. The small foam braces will be removed after the fairings are built. See Figure 16:F:3.

Securing foam wing profiles
Figure 16:F:3

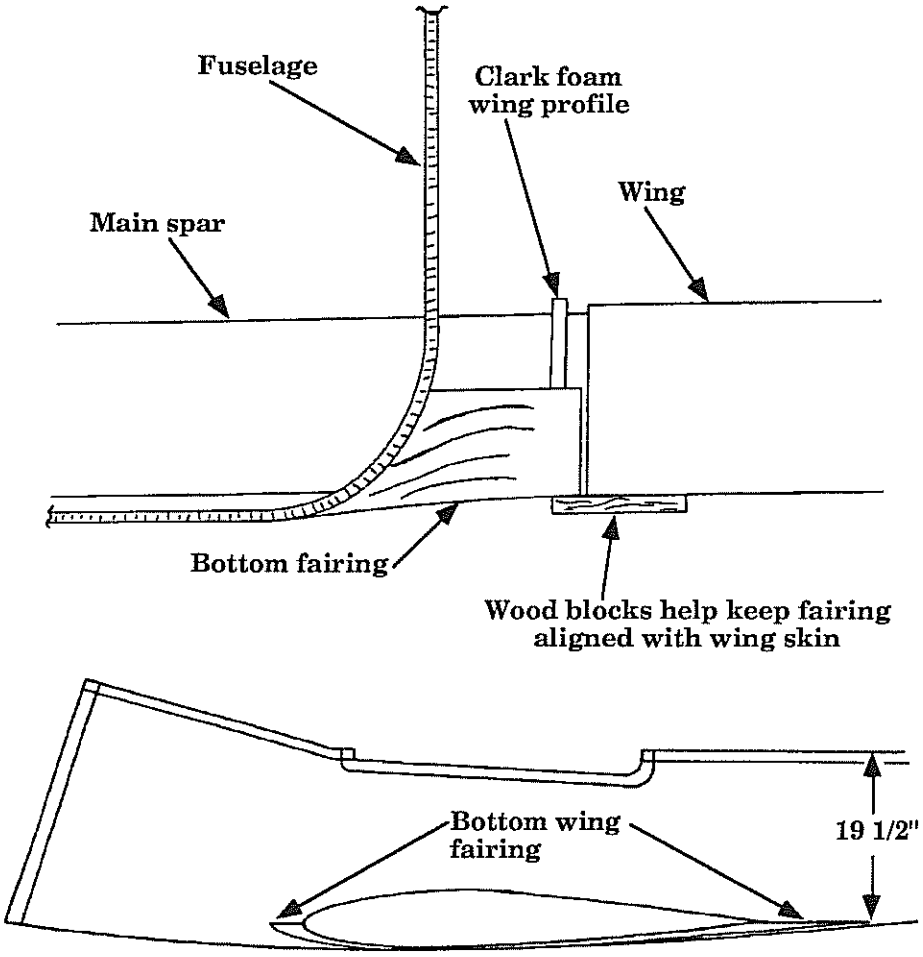


F5. Trim the bottom half of the wing fairings to the scribe marks. As usual, it is a good idea to trim the skins a bit larger than the scribe marks indicate so you have some extra skin to "trim to fit" later.

F6. To position the bottom fairings, align the contours with the wing airfoil at BL 25.5. The leading edge of the bottom fairing must be flush with the wing L.E.. If the trailing edge of the fairing does not line up with the wing T.E., this can be easily be corrected later. To help hold the fairing in the proper position, you can temporarily bond pieces of tongue depressors to the bottom wing skin, forming a cradle to support the fairing. Some sanding of the foam wing profiles will be required for a good fairing fit. The T.E. of the fairings should be 19 1/2" below the top of the WL 22 joggle.

Positioning bottom wing fairing

Figure 16:F:4

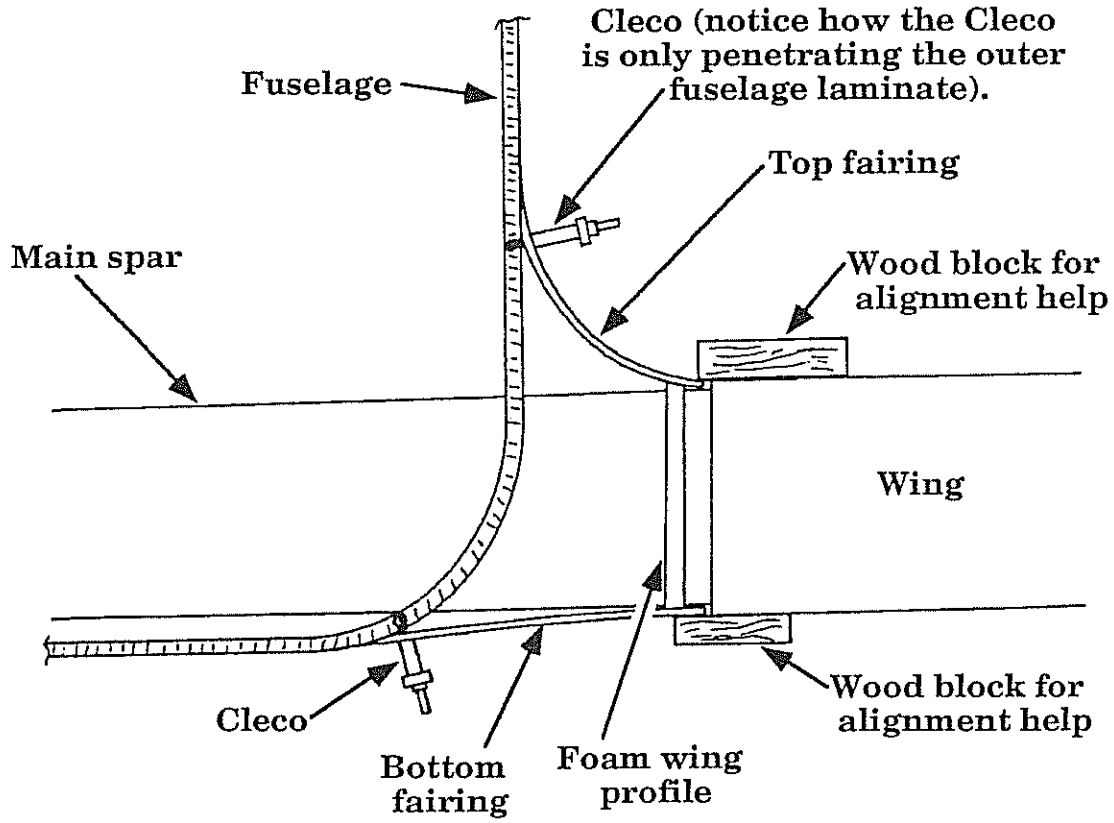


Note: Be sure BOTH wing fairing T.E.'s are equal distances from the top of the WL 22 joggle. The 19 1/2" dimension can vary + - 1/2", but keep the left and right fairings equal.

F7. Use a few clecoes to hold the bottom fairing against the fuselage. Drill the cleco holes only through the fairing and the *outer* laminate of the fuselage skin. Don't drill totally through the fuselage skin.

F8. Trim the top wing fairings to the scribe lines and fit them to the bottoms. Again, the L.E. fit is most important. The T.E. can easily be modified later. The foam wing profiles will have to be sanded for proper fit of the top fairings. When satisfied with the fit of the fairings, use a few clecoes to hold the top fairings in place, again only drilling through the outer laminate.

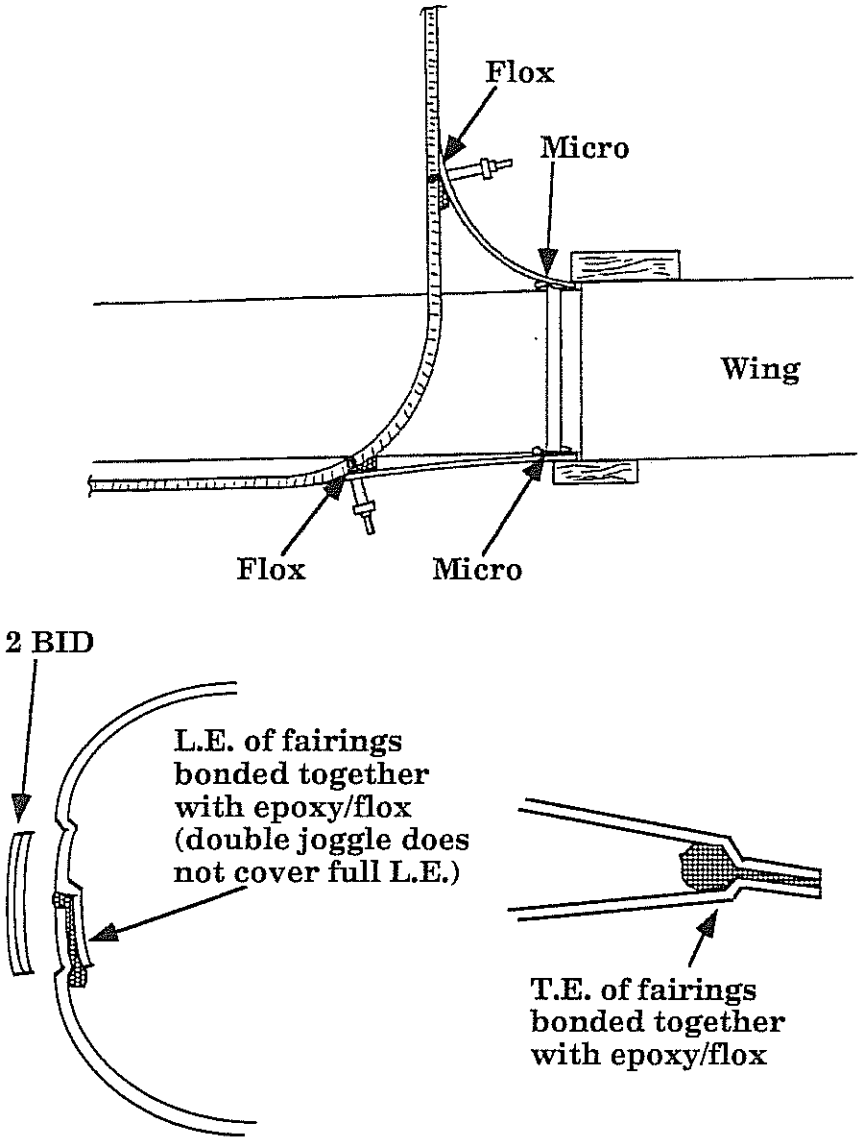
Positioning top wing fairing
Figure 16:F:5



F9. Remove the top and bottom fairings and use 40 grit to sand the areas where they will be bonded to the fuselage. Clean these areas with MC.

F10. Bond the bottom and top wing fairings to the fuselage with a thick epoxy/flox mixture. The fairing L.E. joggle is also bonded together with epoxy/flox. The T.E. of the fairings are also bonded together with epoxy/flox. Use an epoxy/micro mixture to bond the fairings to the foam wing profiles. A few more clecoes may be necessary to hold the fairings against the fuselage. Apply 2 BID to the L.E. joggle, overlapping onto the fuselage by 1 ".

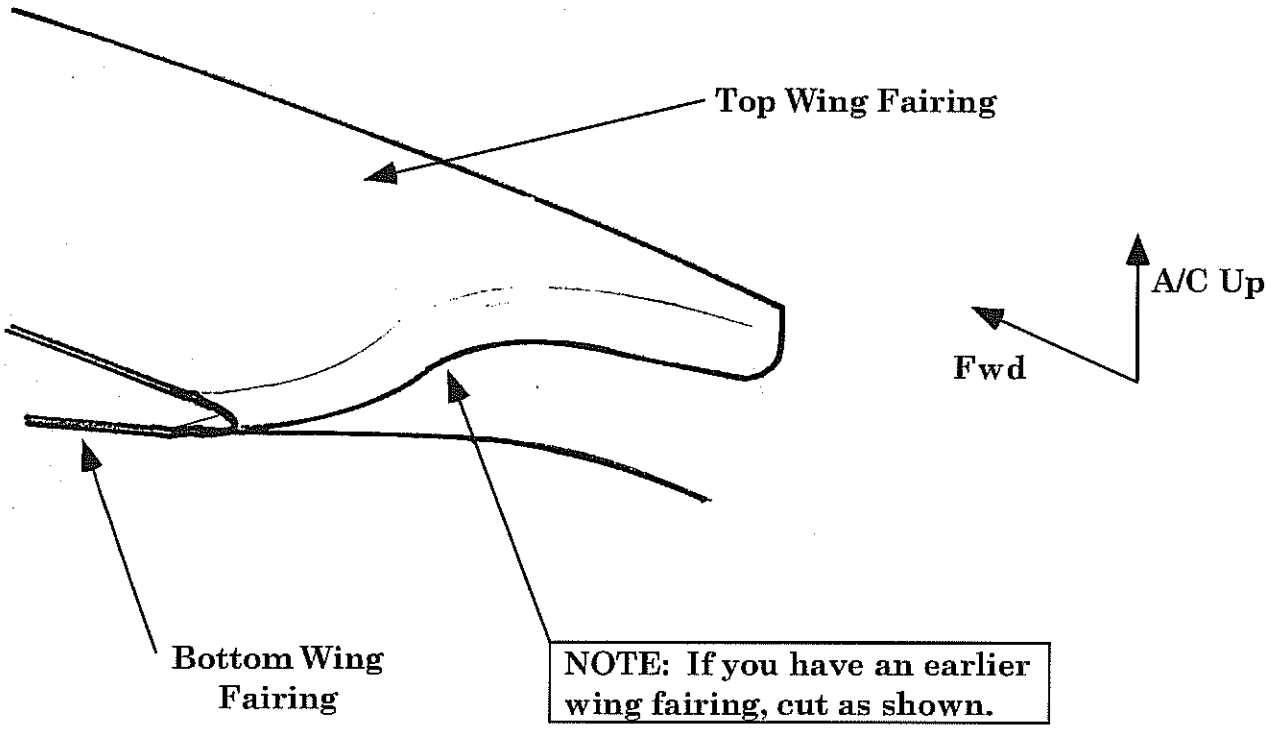
Bonding fairings in position
Figure 16:F:6



F11. If needed, cut the fairing T.E.'s so they are even with the wing T.E.'s as shown. (The later model wing fairings come trimmed with the joggle.)

F12. Later in the construction, the extension fairings are installed at the aft edge of the wing fairings.

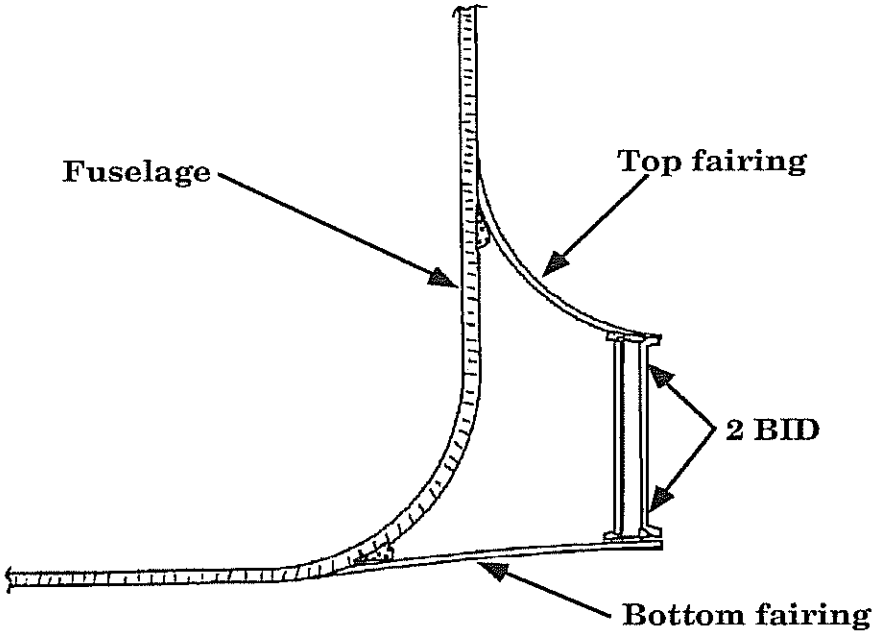
Installing the Fairing T.E. Cap
Figure 16:F:7



F13. The wing fairings should now be stiff enough so you can safely remove the wings without losing proper alignment. Apply two BID to the outer surface of the foam wing profiles, wrapping onto the inner surface of the top and bottom fairings. The fairings are now structurally complete.

F15. The wing fairings should now be stiff enough so you can safely remove the wings without losing proper alignment. Apply two BID to the outer surface of the foam wing profiles, wrapping onto the inner surface of the top and bottom fairings. The fairings are now structurally complete.

Glassing the foam wing profile
Figure 16:F:8



Notice that this shows the left fairing with the 2 BID reinforcement on the inboard side of the foam.

F16. To clean up the fairings cosmetically, grind down the fairing edges where they join the fuselage. Add some micro to these areas and sand a smooth transition between fairings and fuselage. The L.E. and T.E. of the fairings can also be sanded, cleaned and smoothed out with micro.

F17. From inside the fuselage, reach into the wing fairings and remove the foam braces that you installed in Step F4.