

Chapter 9 Wing Fairings

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Click here to view a photo summary of this chapter.

9.1 Introduction

This chapter covers installing the wing fairings to the fuselage. Wing fairings help smooth the airflow between the wings and the fuselage. It is important that the left and right fairings are built so they are identical. Fitting the wing fairings does not have to be exact from builder to builder, but the left and right fairings on an airplane should be carbon copies of each other.

Premolded fairings are provided in the Lancair ES kit. There are two premolded pieces for both the left and right fairings, a bottom half and a top half.

The Lancair ES wings are set to a positive 2.0° incidence. This means that the L.E. of the wing is higher than the T.E. The incidence for the Fastbuild kit is determined by the shear box in the fuselage, which is set at the factory.

Steps to Completion

- Trim the wings to WS 25.5.
- Turn over the airplane.
- Slide the wings into place and bolt up.
- Pre-fit the top and bottom fairings.
- Pre-fit the ribs.
- Assemble the ribs and webs on a table.
- Install the top fairings to the fuselage.
- Install the assembled ribs/webs to the top fairings.
- Install the bottom fairings to the fuselage.
- Create the access openings.
- Install the BID for the seat belt attachment.

Caution!

Before starting the fuselage layups for the fairings, you need to complete the 9-BID reinforcement for the rear seat belts. Refer to Chapter 15 *Assembling and Installing the Seats* on page 15.1 for the seat belt BID and fit information.

A Word about Sanding and Cleaning

The instructions in this chapter refer to preparing a surface or preparing a bonding area. When we recommend preparing a surface or a bonding area, we expect each of the following steps to be completed every time.

1. Sand the area using 40-grit sandpaper.
2. Vacuum all sanded areas.
3. Clean all sanded surfaces with Acetone.



9.2 Parts List

Blueprints needed for this chapter include:

- 3110 – Incidence templates

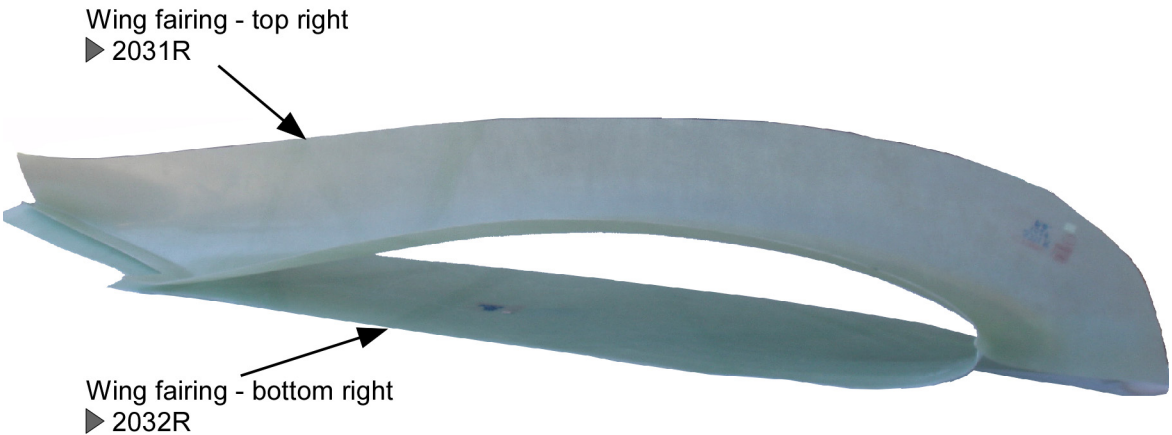
Wing to Fuselage Assembly

Item	Part Number	QTY	Description
1)	2031L	1	Wing fairing – top left
2)	2031R	1	Wing fairing – top right
3)	2032L	1	Wing fairing – bottom left
4)	2032R	1	Wing fairing – bottom right
5)	AN12-77A	2	Bolts 3/4 (for main spar)
6)	AN960-1216	2	Washers 3/4 (.765) (for main spar)
7)	AN364-1216A	2	Nuts, elastic stop 3/4-16 (for main spar)
8)	AN8-20	2	Bolts 1/2 x 20 x 2 (for attach bracket)
9)	AN960-816	2	Washers 1/2 (for attach bracket)
10)	AN365-820	2	Nuts (for attach bracket)
11)	AN426A3-5	10	Rivets (to secure the nutplates to the flanges)
12)	MS21069-06	4	Nutplates (access panels)
13)	MS24693-S26	10	Screws (access panels)

Additional parts

Item	Part Number	QTY	Description
1.	PH-250		1/4” phenolic for attaching to wing fairing ribs

Figure 9.2.0.1 Right wing fairings – left-side fairings are identical to the right.



9.3 Construction Procedures



Before starting the wing fairings, complete the 9-BID reinforcement for the rear seat belts in Chapter 15 *Assembling and Installing the Seats* on page 15.1.

9.3.A Mating the Wings to the Fuselage

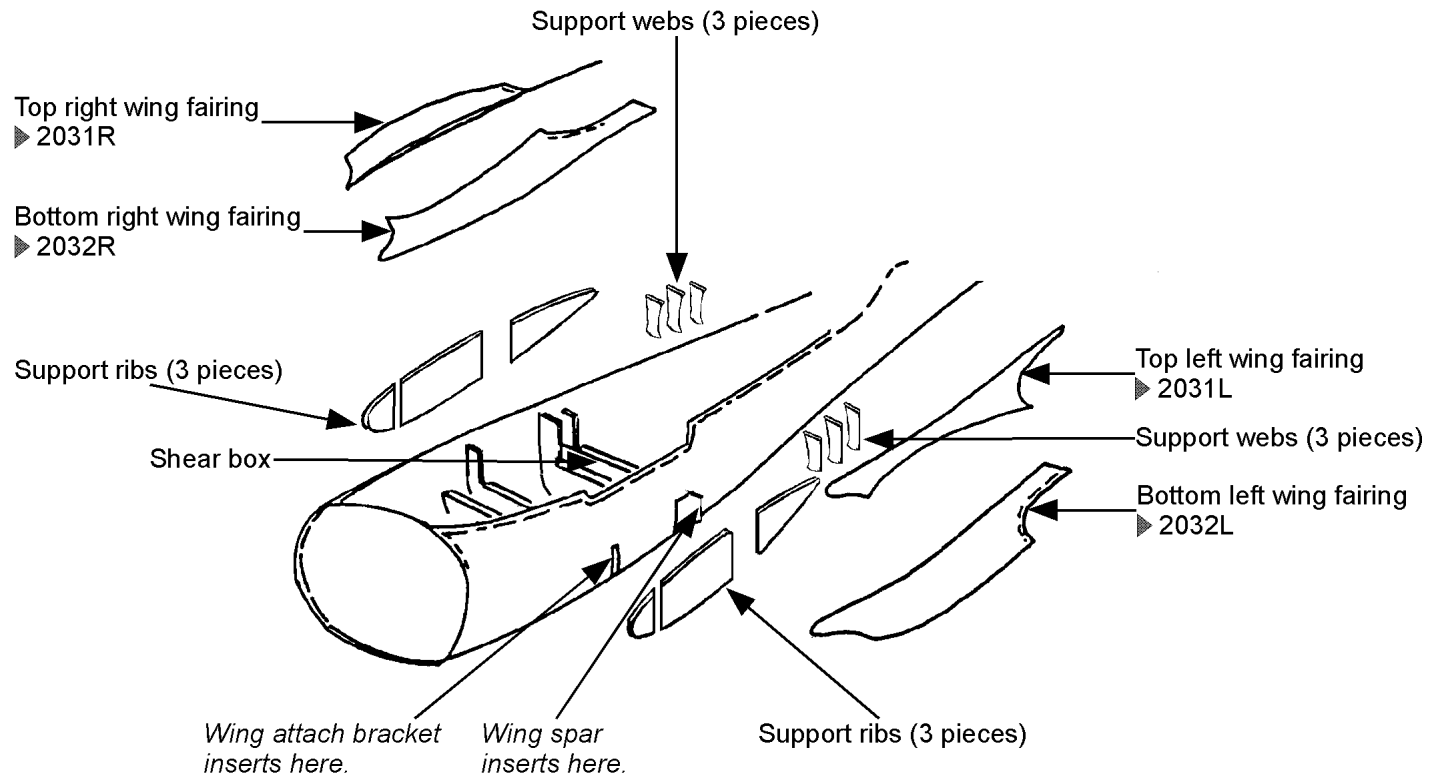
The Lancair ES wings are set to a positive 2.0° incidence. This means that the L.E. of the wing is higher than the T.E. The wing incidence is set at the factory.

Checking the wing incidence is optional. If there is reason to believe that the wing incidence has strayed from this setting, refer to the following sections of this manual:

- Recheck the fuselage for level. See 6.3.C *Setting the Bottom Fuselage to Level* on page 6.6.
- Verify the wing incidence using section 9.3.E *Wing Incidence Templates* on page 9.15.

Continue with section 9.3.B *Preparing for the Wing Fairing Pre-Fit* on page 9.4.

Figure 9.3.A.1 Wing fairing parts



9.3.B Preparing for the Wing Fairing Pre-Fit

In this section the wings are installed so you can perform a pre-fit of aligning the wing fairings to the fuselage.

Checking the Inboard Edge of the Wing

Before you pre-fit the wing fairings, check that the inboard edges of the wings are flat and straight.

Steps...

1. Check the inboard edges of the wings. The inboard edges should be vertical to the world.
2. Trim the inboard ends of the flaps flush with the inboard edge of the wing skin.

An easy method is to lay the wings back into the cradle and trim to the inboard face of the BL 25.5 cradle.

The photo in Figure 9.3.B.2 is an example of the inboard edge of a well-trimmed wing and flap.

Turning the Fuselage Upside Down and Installing the Wings

It can be a difficult task to fit the bottom fairings on the underside of the aircraft. At some point during the construction it is a good idea to turn the aircraft upside down to do the finish work on the underside of the fuselage. It is much easier to fit the bottom fairings with the fuselage upside down but it can be done either way. The wings must be on for fitting the fairings.

If the wings are installed, remove the wings

Steps...

1. Turn the fuselage over.
2. Reinstall the wings and bolt them in place.
Slide the wings into the shear box. Insert the main spar bolts (AN12-77A) and the wing attach bracket bolts (AN8-20) to hold the wings in place.
The main spar bolts use AN960-1216 washers with AN364-1216A nuts. The attach bracket bolts use AN960-816 washers with AN365-820 nuts.

Figure 9.3.B.1 Mating the wing to the fuselage

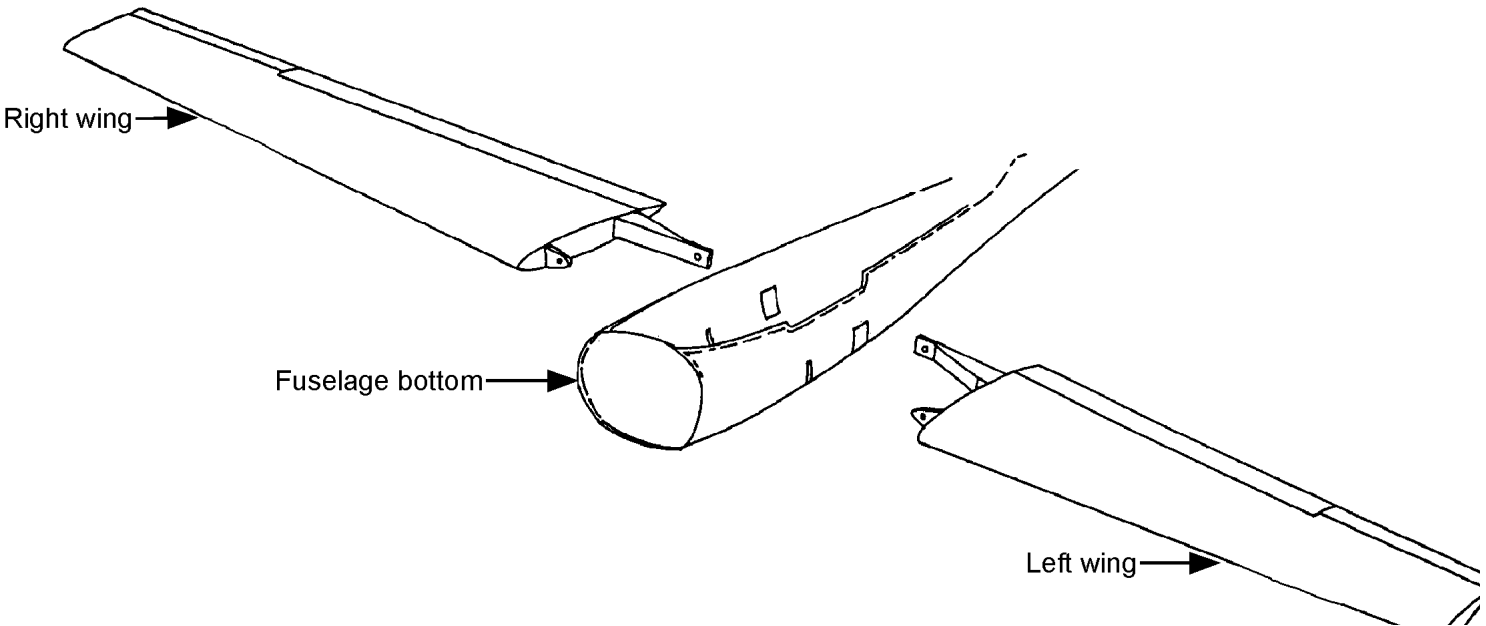
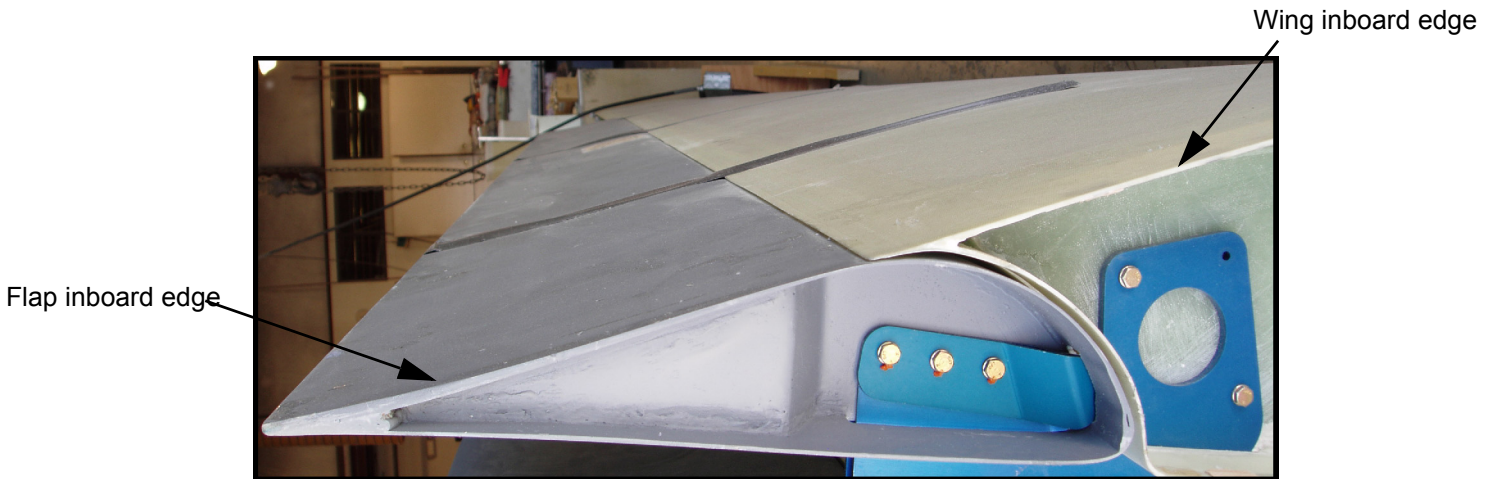


Figure 9.3.B.2 Trimmed inboard edge of flap and wing



9.3.C Pre-fitting the Top and Bottom Wing Fairings



Pre-fit the top and bottom wing fairings. In addition, the L.E. and T.E. of the fairings will be matched.

Steps...

1. Lay the bottom wing fairings on the lower wing skins. Tape the fairings to the fuselage and the wing skin.
2. Slide the top wing fairings into position so the contour of the wing fairing fits the contour of the wing skin. Tape the top fairing in place.

The wing fairings should form a natural transition between the fuselage and the wing skin.

3. Match the L.E. of the bottom wing fairing to the L.E. of the top wing fairing and trim the leading edges of the bottom wing fairings and the top wing fairings so they meet at the chord line.
4. Drill a few cleco holes through the wing fairing and fuselage to help locate and hold the wing fairings in place. Drill *only* through the outer laminate of the fuselage skin.

WARNING: Do *not* drill all the way through the fuselage. The only exception is where the fuselage has been de-cored, then you can drill all the way through.

5. Trim the inboard edges of the top and bottom wing fairings to give at least 1" (25 mm) of contact area between the wing skin and the fuselage skin. Also trim the bottom and top wing fairing T.E. to fit each other.

WARNING: When trimming the wing skin or wing fairing do not cut through the spar!

See Figure 9.3.C.13 Figure 9.3.C.13 *Wing fairing L.E. and T.E. finishing* on page 9.11.

6. Trim the outboard edges of the top wing fairings to BL 25.5.



Click here to review a picture of the bottom fairing in place.

Figure 9.3.C.1 Pre-fitting and trimming the top and bottom wing fairings

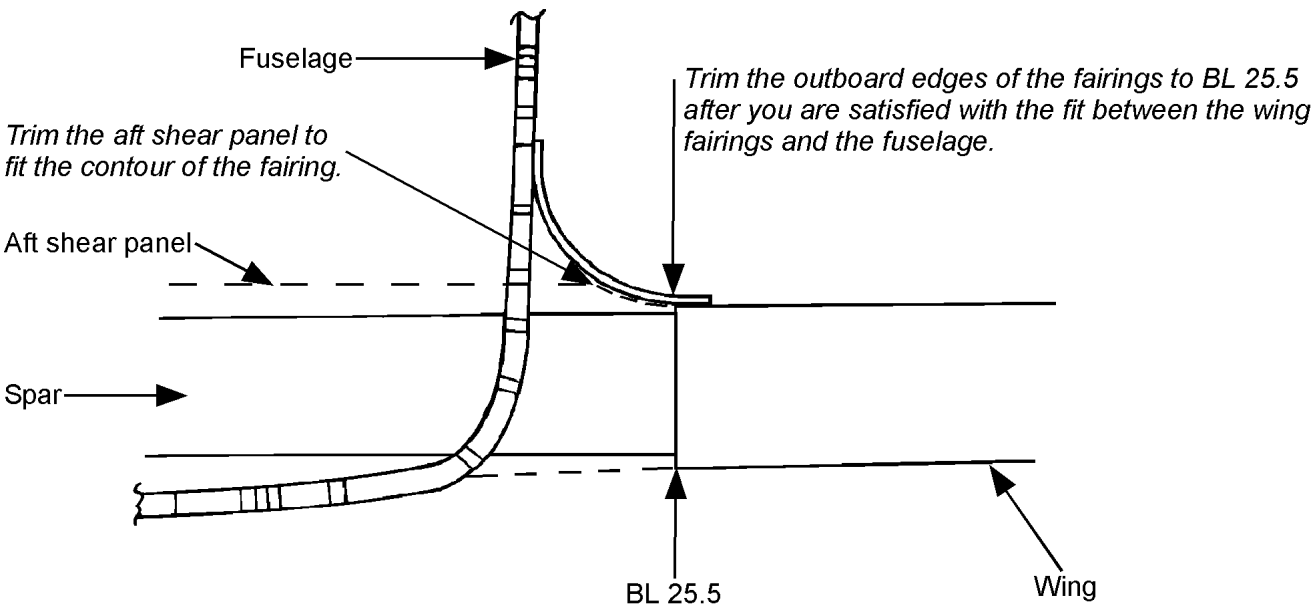
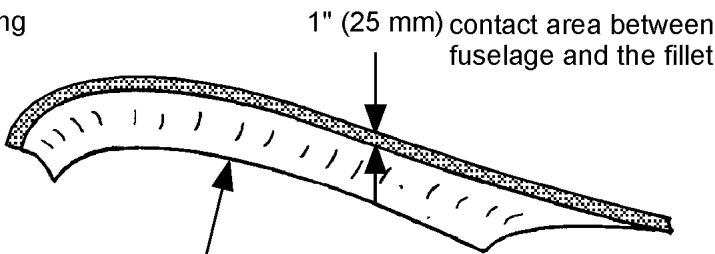


Figure 9.3.C.2 Top wing fairings – alignment to the fuselage

▣ = Contact area between fuselage & wing fairing



The outboard edge will be trimmed later just short of BL 25.5.

Trimming Tips...

- Only trim a little at a time until a good fit is achieved.
- An easy method of trimming the fairing is to shine a light from underneath the wing. This allows a view of the edge of the wing skin through the wing fairing. Draw a line at this location. Remove the fairing and trim to this line.
- Later both the T.E. and L.E. of the top wing fairings should be trimmed at the chord line. Hold off on trimming the T.E. and L.E. of the wing fairings until you have completed matching them.
- Later the wing fairing is trimmed so only a 1/8" (3 mm) gap exists between the wing skin and the wing fairing, just shy of BL 25.5.

An easy and alternate trimming method...

- Draw a line on the wing skin 2" (50 mm) outboard of BL 25.5.
- Rest the wing fairings on the wing skin and draw another line 2" (50 mm) inboard of the previous line on the bottom wing fairing.
- Trim the wing fairing to this line.
- Glue support blocks in place along the wing skin at BL 25.5 to align the fairing.

Now the fairings should fit properly. Check that the left and right fairings look the same from behind the aircraft.

Fairing Alignment Tips...

- Find a common reference point on the left and right wing fairings. Measure the distance from the top of the fairing to the joggle on the top edge of the fuselage. The distance must be the same on both sides. See Figure 9.3.C.4 for the location of measuring this distance.
- In addition, stand at a distance in front or behind the aircraft. Do the top wing fairings look aligned? Once the alignment is satisfactory, proceed to the next step.

Figure 9.3.C.3 Aligning the top wing fairings to the wing skin at BL 25.5

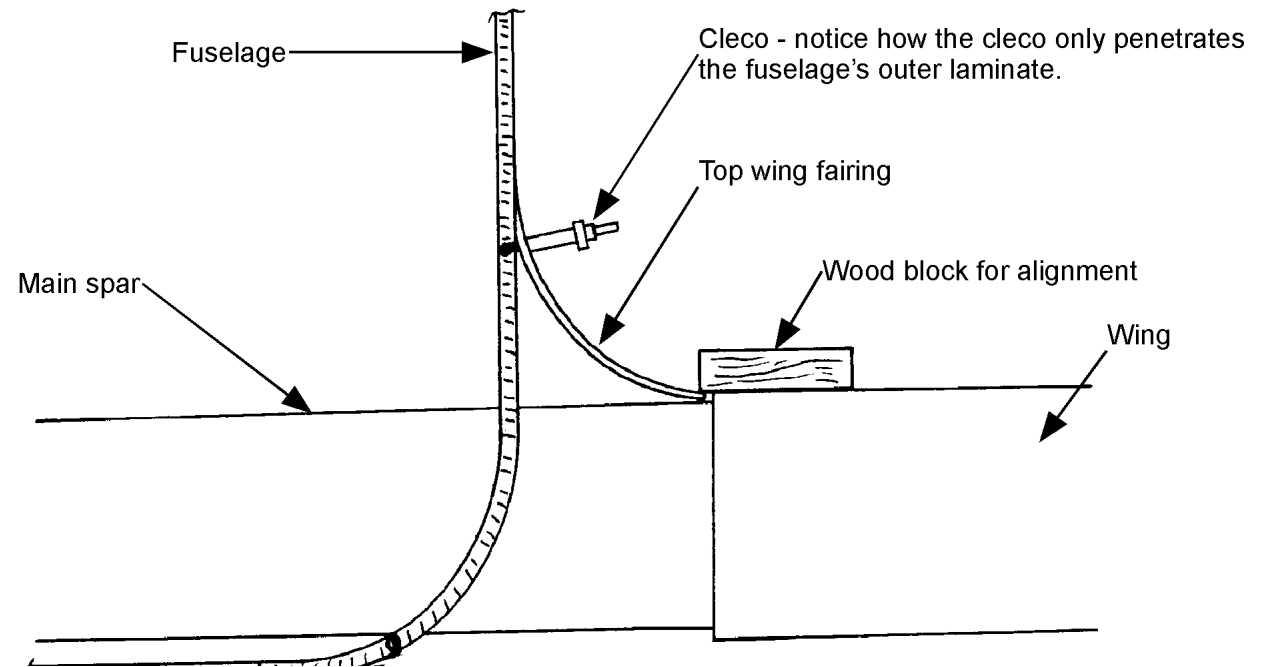
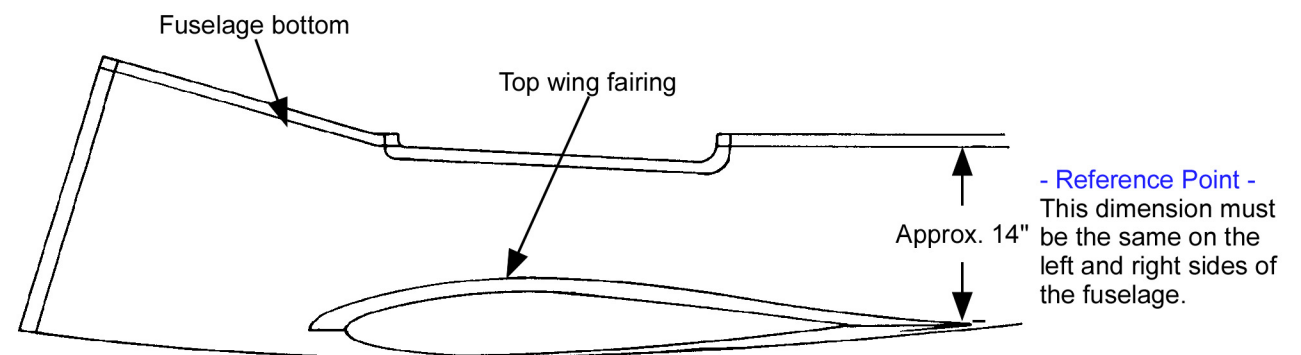


Figure 9.3.C.4 Positioning the top wing fairings



Cutting and Fitting the Parallel Support Ribs

The wing fairing support ribs are installed parallel with the fuselage, and will be bonded to the wing fairings.

Steps...

1. Make a pattern of the inboard end of the wing.
Use cardboard and the inboard end of the wing as the template. The pattern will have three sections. See Figure 9.3.C.6.

The patterns also need to include the openings and holes for the lines and controls that will exit the end of the inboard wing, plus the opening for securing the seat belt bolt.

Click here to review the openings in the wing fairing support ribs. Each opening is identified.

Click here to review the seat belt bolt location.

2. Pre-fit the patterns to the wing fairings that are fitted to the fuselage.
3. Cut the wing fairing support ribs out of 2-BID, 1/4" (6 mm) prepreg.
Tip: Cut patterns 2 and 3 as one piece leaving a small section connected. See Figure 9.3.C.10.

Mark the locations of the openings on the support ribs.

4. Pre-fit the support ribs to the wing fairings that are still fitted to the fuselage.

Now you will create the support webs that are installed at a right angle between the support ribs and the fuselage.

Figure 9.3.C.5 Location of support ribs for pre-fit to fairings

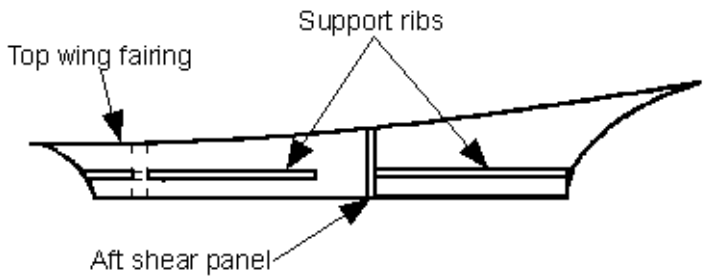
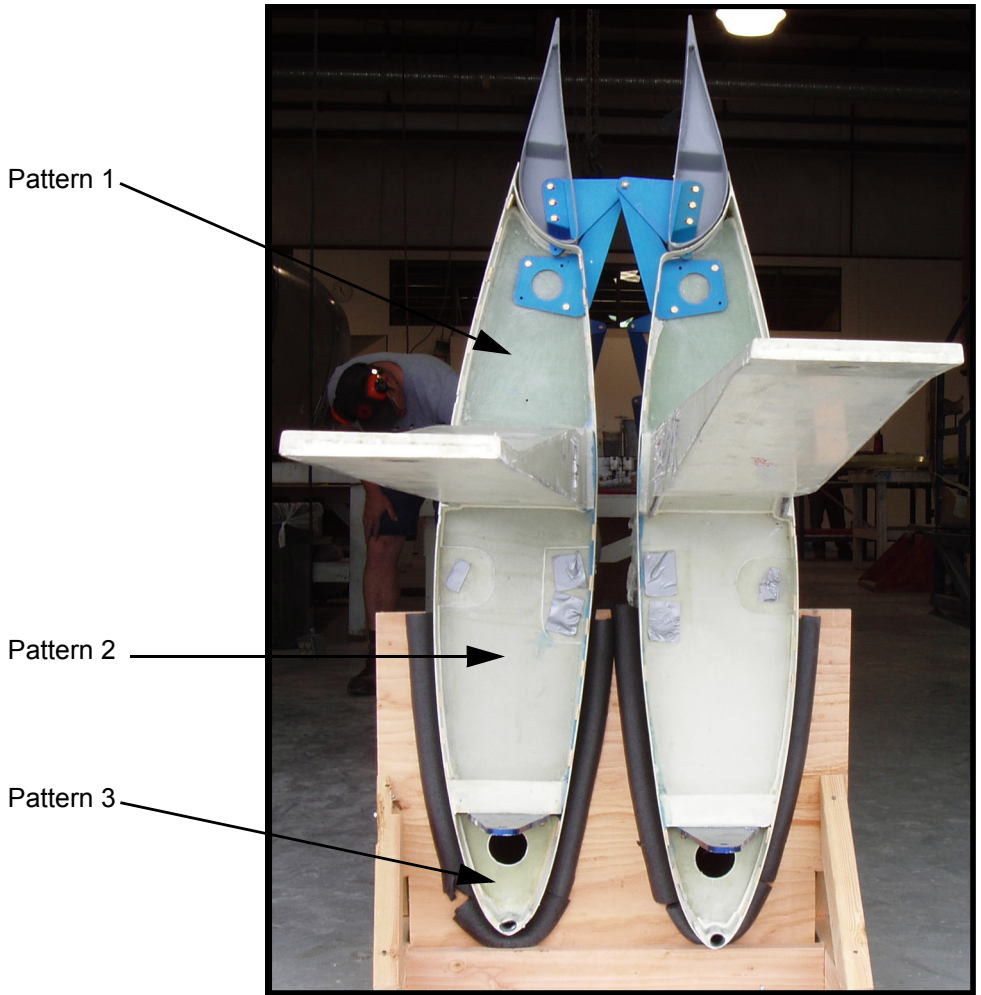


Figure 9.3.C.6 Pattern locations for support ribs



Cutting and Fitting the Right-angle Support Webs

The wing fairing support webs are installed at a right-angle to the fuselage, and to the support ribs that were installed in the last section. Again the patterns must be made using the same material as was used for the support ribs.

Steps...

1. Make the patterns using cardboard and use the following fitting and location information to determine the size of the support webs.
There will be three patterns and each support web pattern must fit the wing fairings and the fuselage.
Support web placement:
 - The aft web is located 10" (250 mm) aft of the shear spar.
 - The middle web is located 1" (25 mm) forward of the wing spar.
 - The forward web is located 1" (25 mm) aft of the wing attach bracket. Also leave about a 2" (50 mm) gap between the bottom wing fairing and the web for a fuel line and fuel return line passageway.
2. Cut the webs out of 2-BID, 1/4" (6 mm) prepreg.
3. Pre-fit the support webs to the wing fairings that are still fitted to the fuselage.

It is not necessary to extend the webs all the way to where the top fairing meets the fuselage. See Figure 9.3.C.8.

Next you assemble the support ribs and the support webs.

Figure 9.3.C.7 Wing fairing support web placement

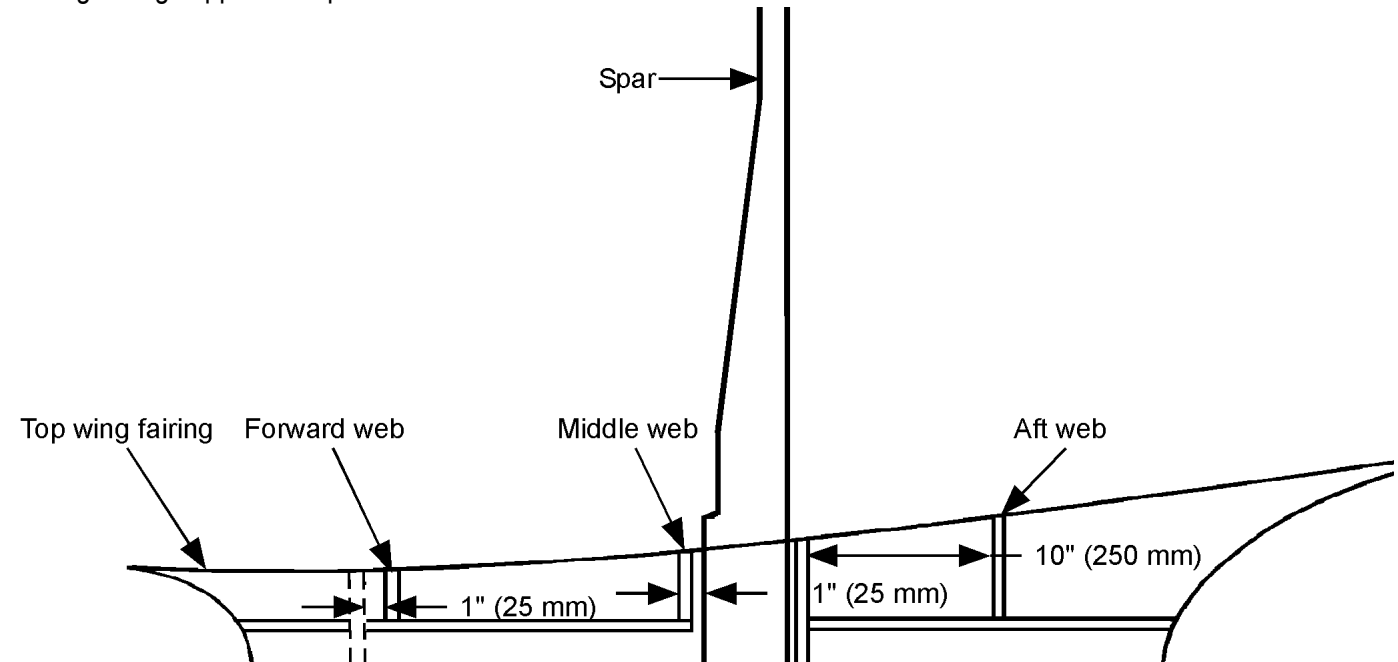
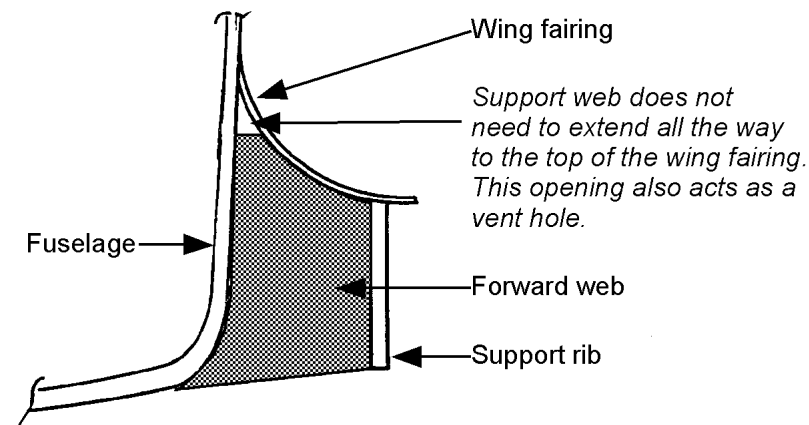


Figure 9.3.C.8 Side view of the forward web



Assembling the Support Ribs and Webs



In this section you will assemble the support ribs and webs on a table. As you work, pre-fit often. After each web is bonded to a rib, pre-fit to the fuselage.

Steps...

1. Remove between 1/8" to 1/4" of core around the perimeter of each rib and web.
2. Prepare all bonding surfaces for the BID tape that will secure the ribs and webs.
3. Pre-fit each web to the fuselage and the wing fairings.
Figure 9.3.C.9 provides a view of the completed support ribs and webs when assembled on your work table.
4. Fill one end of each support web's de-cored edge with micro.
5. Install the filled end of the webs to the ribs with a thick epoxy/micro mixture.
6. Secure the support webs to the support ribs using a 2" (50 mm) wide 2-BID along each rib-to-web inside joint. Refer to Figure 9.3.C.9.

When you are done, you should have two pieces.

- The forward and middle support ribs with the forward and middle support webs attached.
- A support rib with the aft support web attached.

See Figure 9.3.C.10 as a reference.

Figure 9.3.C.9 Assembling the support ribs and webs

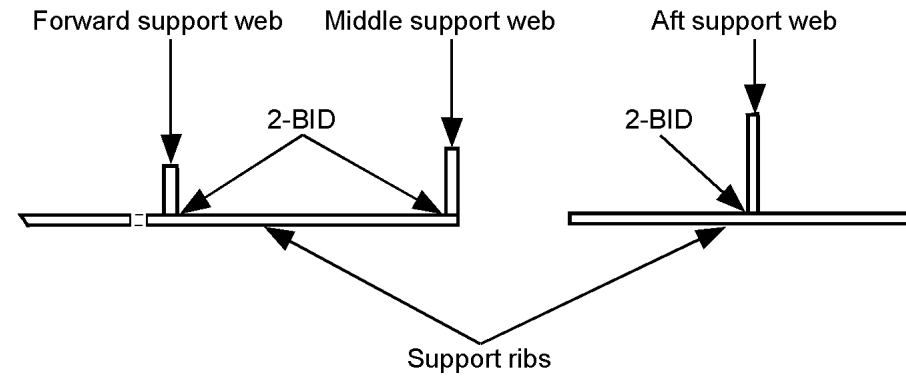
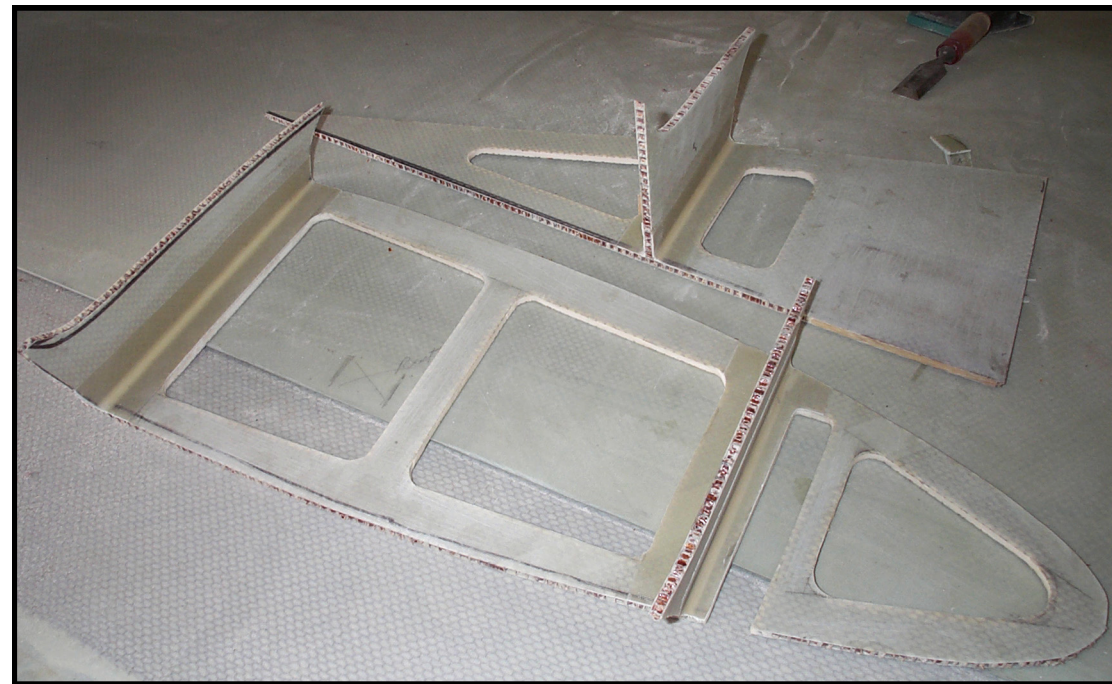


Figure 9.3.C.10 Support ribs and webs ready to install



Bonding the Top Fairings


Steps...

1. Remove the top fairings.
2. Prepare all the bonding surfaces of the top fairings and the fuselage.
Make sure you sand the wing fairings where the support ribs and webs will be bonded.

3. Remove from 1/8" to 1/4" (3-6 mm) of core in the bottom of the wing fairings.

4. Put the top wing fairings back in place. Hold the wing fairings in place by gluing wood blocks between the wing skin and the wing fairings.

Go easy on the instant glue when securing the wood blocks to the wing fairings since the wing fairings will need to be removed one last time.

 Click here to review the wood shims used to hold the wing skins and the wing fairings in place.

5. Check the alignment of the left and right top wing fairings.

Before the wing fairings are bonded in place, check that the left and right sides are correctly aligned.

6. Bond the top wing fairings to the fuselage with a thick epoxy/flox mixture.

Installing the Ribs-and-Webs Pieces

Steps...

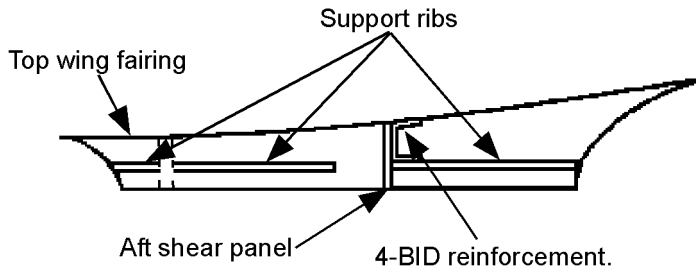
1. Bond the support ribs and webs pieces in place with a thick epoxy/micro mixture.

It is important that the support ribs are vertical, and will be parallel to the center line of the fuselage. If a fuselage center line needs to be set, see Chapter 6 *Fitting the Top Fuselage Shell* on page 6.1.

2. Secure the support ribs to the top wing fairings with 2" (50 mm) wide 2-BID along both the inboard and outboard edges. See Figure 9.3.C.12.

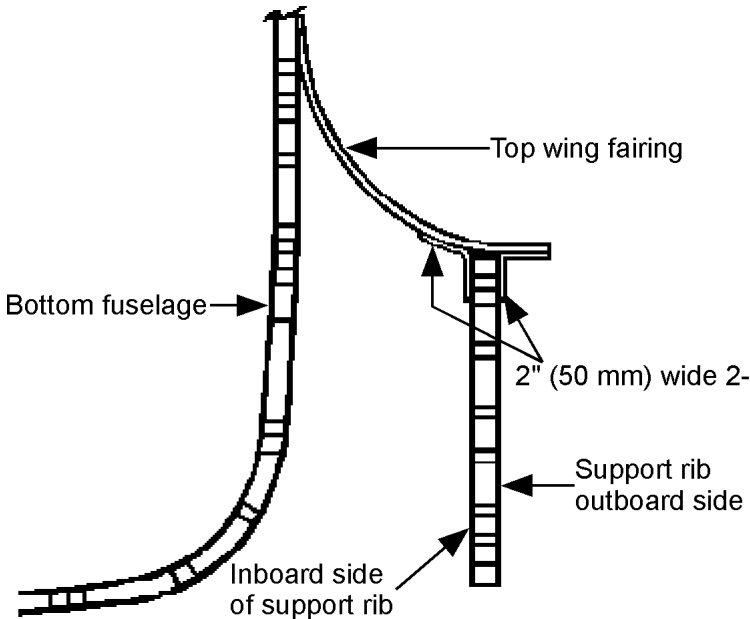
- Forward support web – secure to fuselage and wing fairing with BID on aft side of web.
 - Middle support web – secure to fuselage and wing fairing with BID on forward side of web.
 - Aft support web – secure to fuselage and wing fairing with BID on forward side of web
3. Secure the support rib to the fuselage's shear panel with 4-BID.
The 4-BID extends 1" (25 mm) onto the support rib and 1" onto the fuselage. See Figure 9.3.C.11Figure 9.3.C.11.

Figure 9.3.C.11 Top view of securing the support rib with 4-BID



Extend 1" (50 mm) onto the fuselage and the support rib.

Figure 9.3.C.12 Side view –securing support ribs with 2-BID




Bonding the Bottom Fairings

Bonding the bottom wing fairings is similar to the steps of bonding the top wing fairings. But, in addition, the L.E. and T.E. of the fairings will be matched.

Steps...

1. Lay the bottom wing fairings on the lower wing skins.
2. Trim the support ribs-and-webs to accommodate the bottom wing fairing.
3. Finish up the fairings by working on the L.E. and T.E. These can also be sanded, cleaned and smoothed out with micro.
 - There is not much contact area for bonding in the L.E. Hold the leading edges together with duct tape during bonding.
 - The T.E. and L.E. need to be bonded using flox.
4. Install the bottom wing fairing with an epoxy/flox mixture. Refer to Figure 9.3.C.13.
5. Secure the L.E. and T.E. with 2-BID.
6. Make smooth transitions on the L.E. and T.E. by filling any gaps with flox.

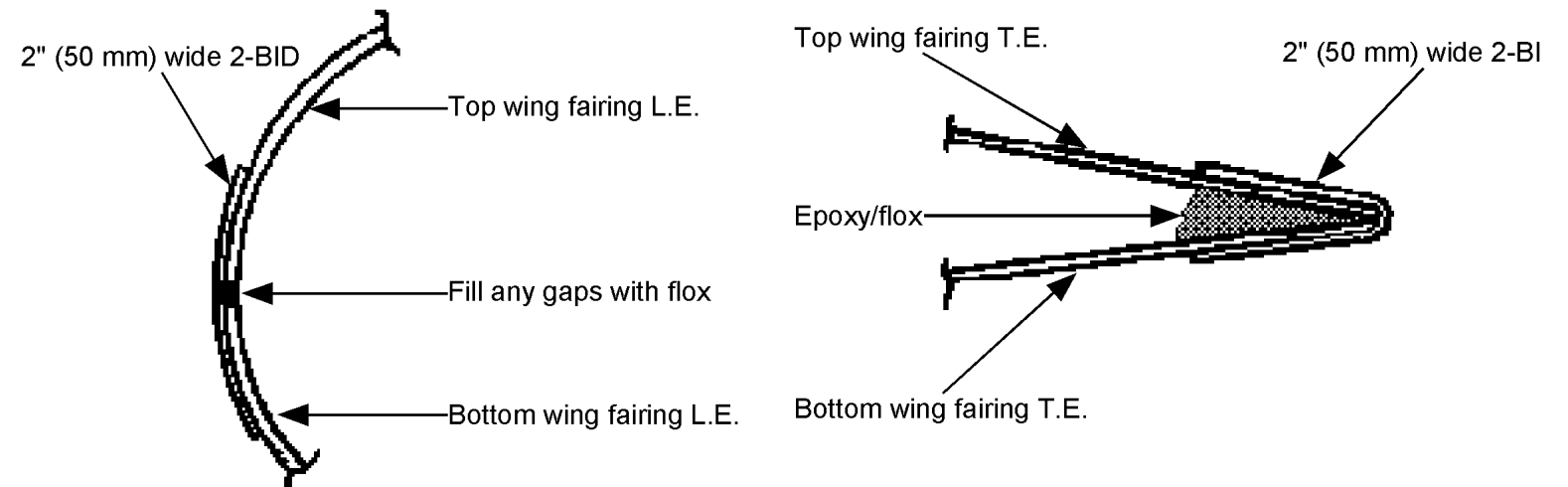
 [Click here to review the picture of the bonding process.](#)

Cleaning up the Fairings

Now clean up the fairings where they join the fuselage.

1. Grind down the fairing edges where they join the fuselage.
2. Add some micro to these areas and sand a smooth transition between the fairings and the fuselage.

Figure 9.3.C.13 Wing fairing L.E. and T.E. finishing




Installing the Phenolic Hardpoint

Now a section from the aft support rib is removed and a phenolic hardpoint is installed in its place. This hardpoint is where the split bearing block for the flap torque tubes will mount. See Chapter 13, section 13.3.A *Installing the Flaps' Torque Tube* on page 13.4 for more information.

Steps...

1. Remove the outboard laminate and core from the aft support web at the location shown in Figure 9.3.C.14. A piece of 1/4" (6 mm) phenolic will be inserted at this location.
2. Cut a 5" by 4" piece of 1/4" (6 mm) phenolic.
3. Sand and clean the piece of phenolic.
4. Install the phenolic hardpoint with an epoxy/flox mixture.

 Click here to review the picture of the hardpoint.

Reinforcing the Support Ribs

Steps...

1. Reinforce the support rib by extending the 4-BID onto the wing fairing and the shear panel.
The 4-BID reinforcement extends 1" (25 mm) past the phenolic onto the fairing support rib, wing fairing and the aft shear panel. See Figure 9.3.C.15 for details.
2. Reinforce the remainder of the rib with 2" (50 mm) 2-BID.
Snug the 2-BID up against all sides of the 4-BID.
3. Continue to apply 2" (50 mm) 2-BID along the fairings and rib seam.
Make sure the BID extends 1" (25 mm) onto the top fairing in the L.E. and T.E. areas.

Figure 9.3.C.14 Location for installing the phenolic hardpoint

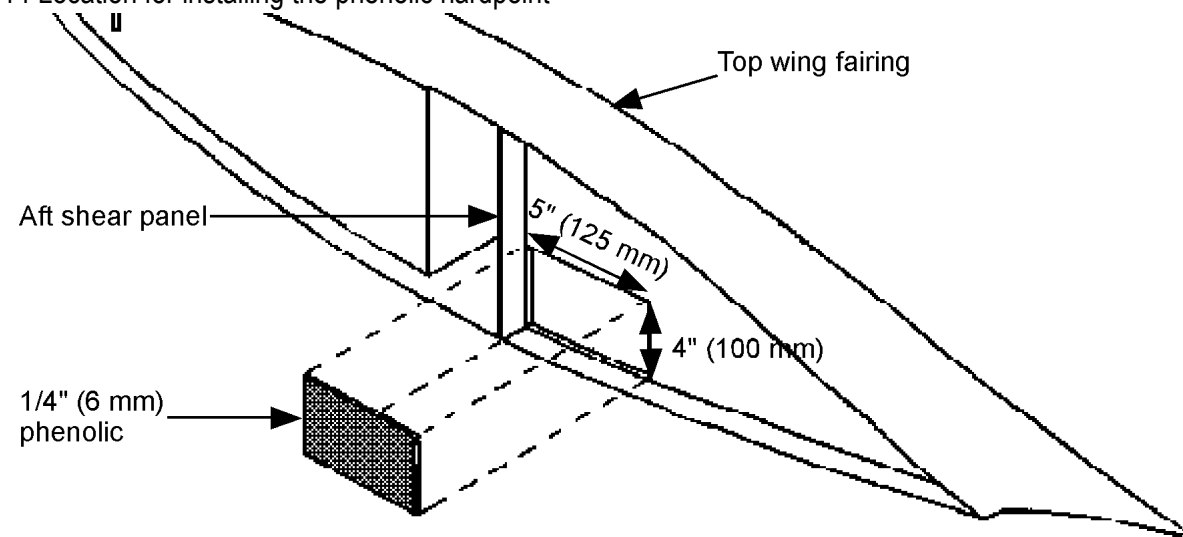
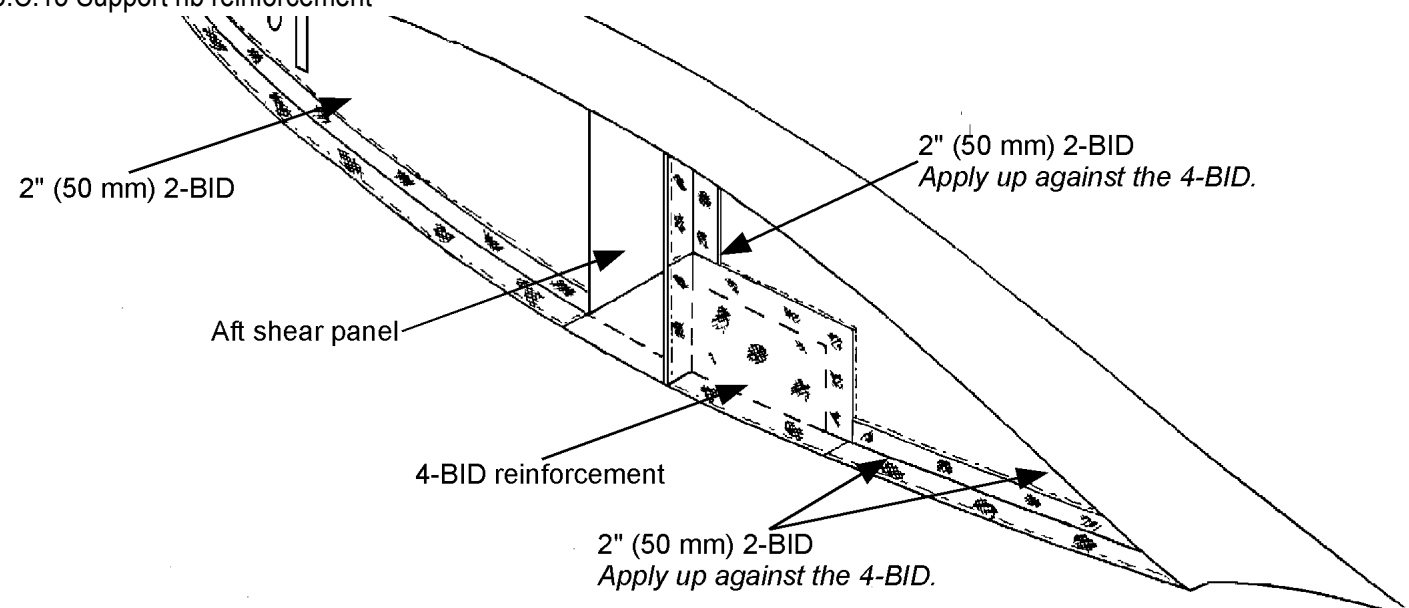


Figure 9.3.C.15 Support rib reinforcement



9.3.D Creating Access Openings

Within each wing fairing a forward access panel opening needs to be created and a seat belt bolt access hole.

- Forward access panel – provides access for the fuel line and the fuel return line access.

In this section the access panel and the opening is cut out. Then an access panel cover is made and installed.

Steps...

1. Measure 1" (25 mm) in front of the forward end of the main wing spar entrance hole. Make a mark on the bottom fuselage.
This will be the aft edge of the fuel line access panel.
2. Drill 1/4" (6 mm) pilot holes. Remove the areas of the bottom wing fairing and the fairing support ribs for the access hole as shown in Figure 9.3.D.1.

The exact size of the opening is not critical. We suggest the following dimensions:

- Fuel line access panel – 6" x 7" (150 mm x 180 mm)
3. Measure 3" (75 mm) back from the aft end of the main wing spar entrance hole. Make a mark on the fuselage.
 4. Drill a hole just large enough to remove the seat belt bolt.


 Click here to review the picture of all access openings.

Figure 9.3.D.1 Wing fairing access panel and opening locations

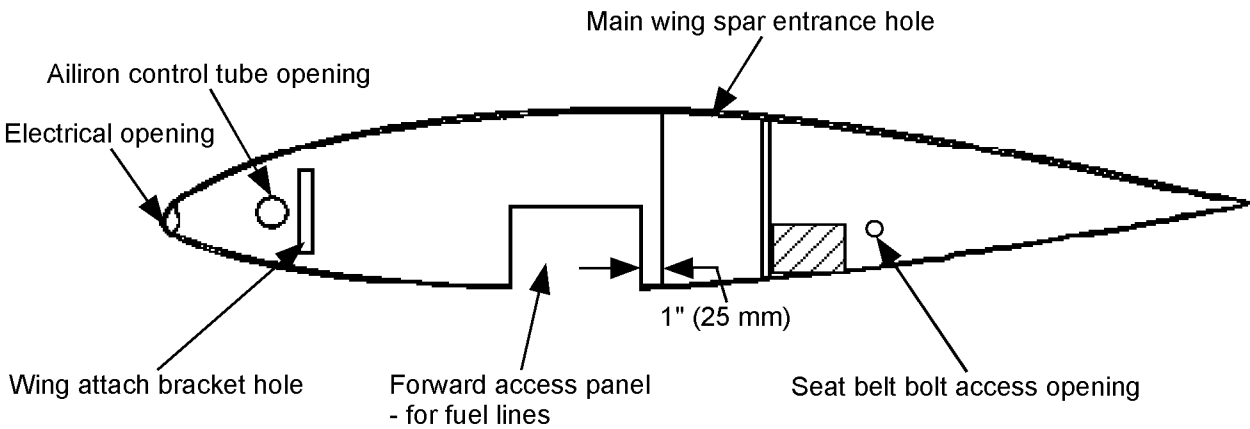
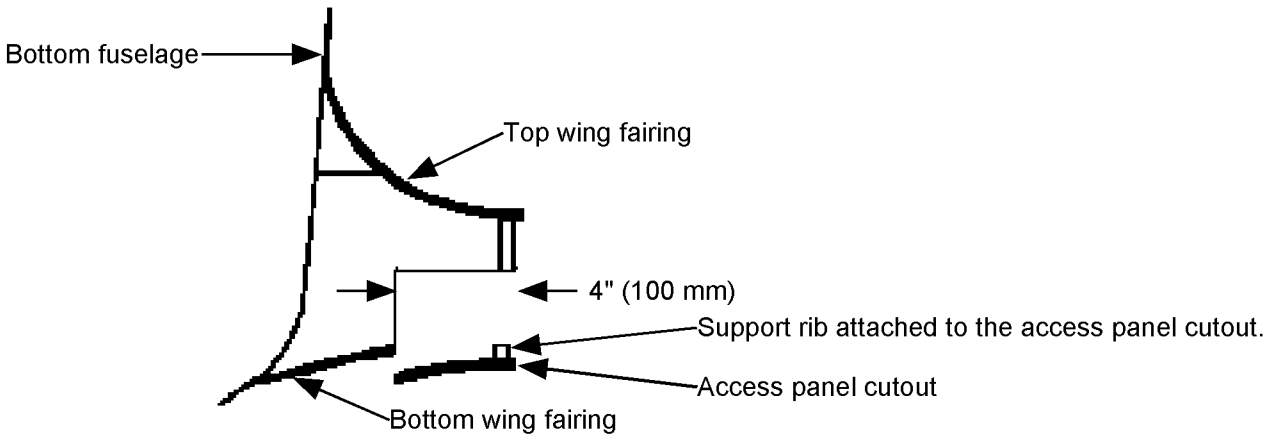


Figure 9.3.D.2 Cross section of the wing fairing access panel cutout for the fuel lines



5. Cut no more than 4" (25 mm) deep into the wing fairing for the fuel line access panel. See Figure 9.3.D.2.
Leave approximately 1/4" (6 mm) of the wing fairing support rib bonded to the access panel as shown in Figure 9.3.D.3. This helps the access panel hold its shape.
6. Form a 4-BID mounting flange above the access panel by applying release tape to the opening.
Do this by tacking the access panel in place with instant glue and tongue depressors. Then lay up the 4-BID flange on the inner surface of the wing fairing as shown in Figure 9.3.D.3.

Steps after cure...

1. Remove the access panel after the 4-BID flanges have cured.
2. Trim the flange to a 5/16" width.
3. Secure the access panel to the wing fairings.
 - Secure the nutplates (MS21069-06) to the flanges using rivets (AN426A3-5).
 - using the hardware specified in Figure 9.3.D.4. Use the rivets to secure the nutplates to the flanges.

We recommend using a micro release to clean up the edges around the access panel. This can be done anytime.


 [Click here to review a picture of the completed wing fairings.](#)

Figure 9.3.D.3 Access panel mounting flange

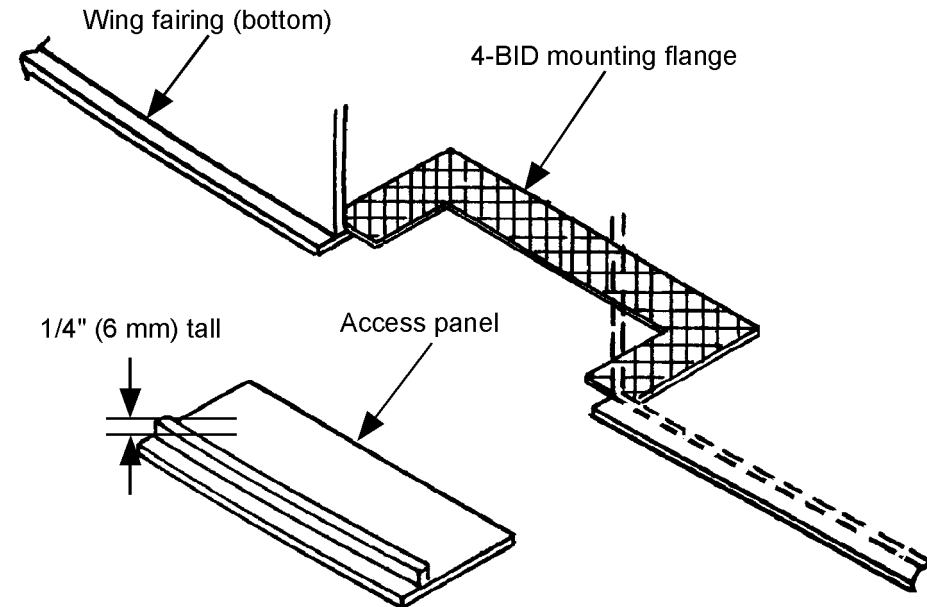
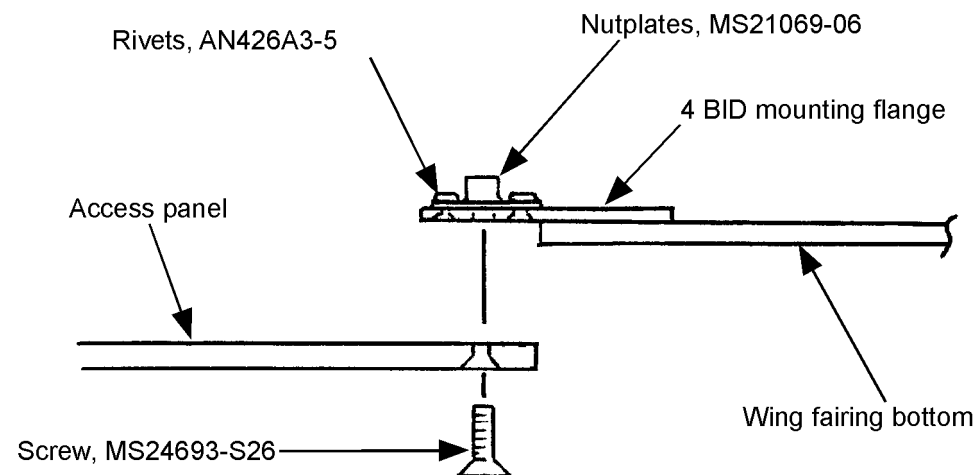


Figure 9.3.D.4 Securing the access panel



9.3.E Wing Incidence Templates

The Fastbuild ES kit contains the bottom fuselage with the shear box already installed. The wing incidence of $+2.0^\circ$ is pre-built into the shear box at the factory. The instructions on this page can be used to recheck the incidence.

Checking the Wing Incidence

To find the correct wing incidence, use blueprint 3110 to create a plywood template, also known as an incidence board. The incidence board is temporarily bonded to each wing as a level reference.

Steps...

1. Cut two plywood incidence templates from a $5/8''$ (15 mm) thick plywood. Particle board also works fine. Use blueprint 3110 and locate the template A-3110 to use as the pattern.

Note: If this is not a Fastbuild kit then the wing cradles can be used, specifically BL 25.5 wing cradle, as the wing incidence template. The wing cradles will require some modification. Use the template on blueprint 3110 to trim the top edge of the cradle to the proper incidence angle.

2. Secure the incidence templates to the top wing skins at BL 25.5 using Bondo.

The templates should closely fit the contour of the top wing skin. Due to builder differences a small discrepancy of up to $1/8''$ (3 mm) gap in an area is acceptable.

3. Place a Smart Level on the top edge of the incidence template. When the level reads 0° the wing is set to the proper incidence.

WARNING: Do not adjust the wings so the Smart Level reads 2.0° . The positive incidence has been built into the incidence template.

Check both wings! It is important to have consistency from the left wing to the right wing.

Figure 9.3.E.1 Wing incidence template

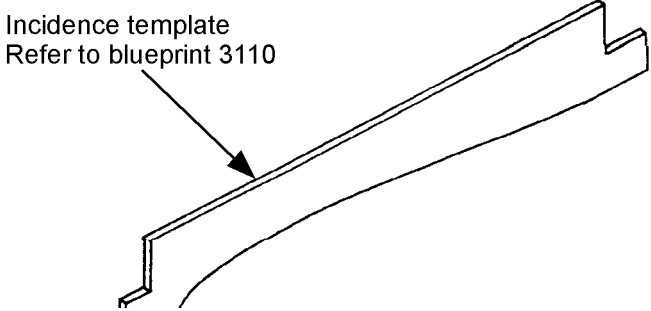


Figure 9.3.E.3 Incidence template angle to the wing

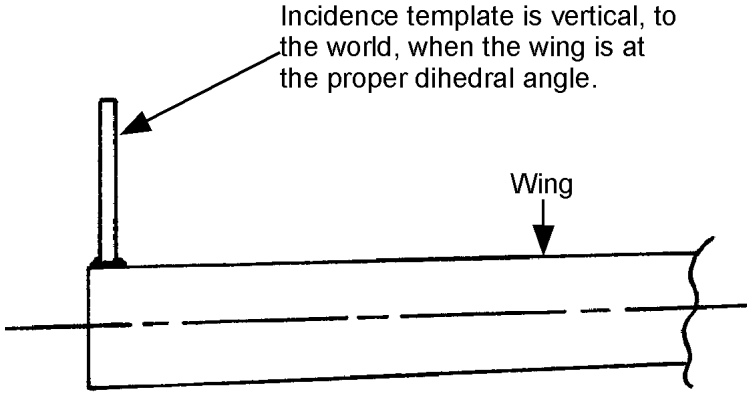


Figure 9.3.E.2 Securing the incidence template to the wing

