

Chapter 5 Installing the Windows and Windshield

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5.1 Introduction

There are three windows and the windshield to install in the top fuselage shell of your ES. A protective film was applied to all windows by the manufacturer. This is a water based protectant and should be left on the windows until you have completed the airplane to avoid nicks and scratches.

The drawings in this chapter all show a single generic view of a typical window installation. All side windows and the windshield are installed in the same manner, bonded from the inside of the top fuselage shell.

Steps to Completion

- Trim the top fuselage shell for the windows and bevel all the edges.
- Pre-fit each window and trim as necessary.
- Bond the windows in position.
- Install the windshield.

Before You Start

Make sure you read the tips on plexiglass in *Handling Plexiglas* on page 5.3.

Plan on leaving one window out so it is easier to install the door. Once the door is complete you can come back to this chapter and complete the final window.

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.

5.2 Parts List

Windows

Item	Part Number	QTY	Description
4)	CAN-LT-ES	1	Windshield
5)	WS-A-03L	1	Left rear window
6)	WS-A-03R	1	Right rear window
7)	WS-F-03R	2	Right front window

The window in the door is pre-installed in the ES kit.

Supplies

We also recommend that you have the following supplies on hand before starting this chapter.

- wooden blocks
- tongue depressors
- electrical tape
- bolts and large area washers purchased at a hardware store
- caulking tubes are available from West Marine Supply at www.westmarine.com.



Revisions

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Installing the Windows and Windshield

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5.3 Construction Procedures

Handling Plexiglas

The following list contains the do's and don'ts of how to handle plexiglas. This list is compiled from years of experience.

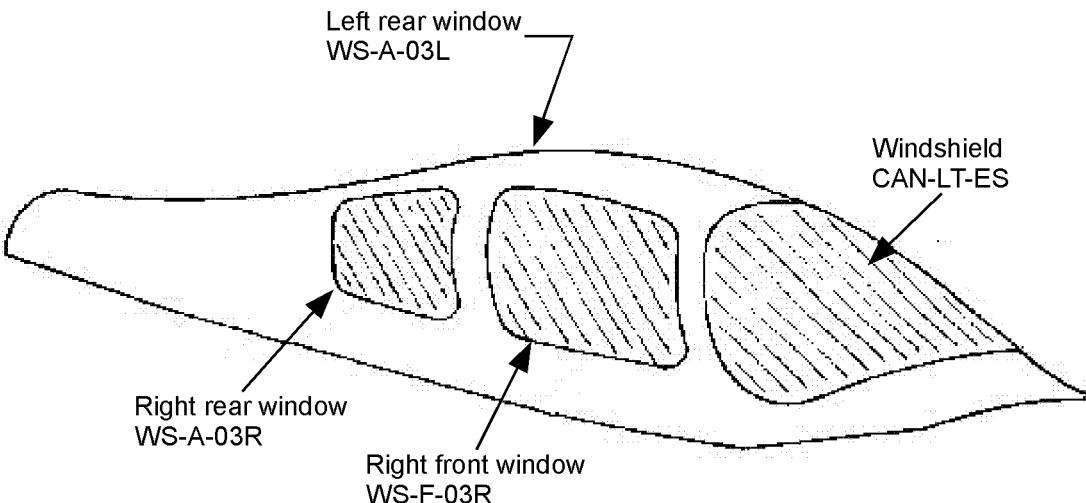
Do....

- Leave the protective barrier over as much of the window and as many of the windows as possible, for as long as possible.
- Cut the plexiglass with a band saw or an angle grinder. The band saw should have a fine tooth blade and be set on low speed.
- Always keep the plexiglass held firmly against the working surface when cutting or trimming. An old piece of carpet on your work bench lessens the danger of scratching the plexiglass.

Do Not....

- Do not cut plexiglass with a reciprocating glade, like a saber saw.
- Do not drill holes through plexiglass. It's too easy to crack.
- Do not clean plexiglass with Acetone. They may not seem to affect the surface, but these chemicals dry out the plexiglass and cause later discoloration. Cleaning should be done with isopropyl (rubbing) alcohol.
- Do not clean the plexiglass window with rubbing alcohol in the bonding areas after sanding. The plexiglass may absorb the rubbing alcohol if sanded. Never clean the edges. The edges are rough and may absorb the rubbing alcohol.

Figure 5.3.0.1 Overview of the ES windows



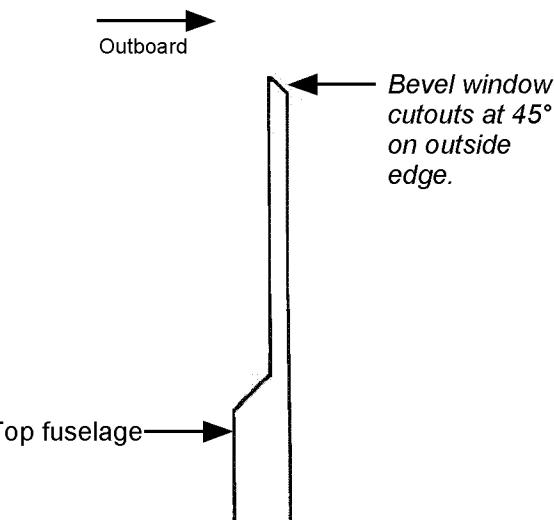
5.3.A Preparing the Top Fuselage Shell

The outlines for the windows are scribed into the top fuselage shell. Since the Lancair ES top fuselage shell is made in the same mold as the Lancair IV (pressurized and non-pressurized versions), some fuselage shells will have two sets of scribe lines, an inner and an outer. The ES uses the outer scribe lines. The windshields of the pressurized and non-pressurized versions of the Lancair IV and the ES are also the same size and use the same scribe lines.

Steps...

1. Trim the top fuselage shell to the window scribe lines.
Trim the top fuselage shell to the outer scribe line around each window opening. A drum or flapper wheel sander works well for sanding the radius in the window corners.
WARNING: Be careful as you trim. The edges of the fuselage shell are sharp!
2. Place the top fuselage shell upside down on a low bench. Now you can easily reach the inside surface around the window areas.
3. Bevel the edges around the window cutouts to about 45°. Later, after the windows are installed, you will need to do some more careful trimming of these edges.

Figure 5.3.A.1 Beveling the window cutouts in the top fuselage shell



5.3.B Preparing the Windows

The windows provided in your kit are oversized and must be trimmed down before bonding them to the top fuselage shell. Review *Handling Plexiglas* on page 5.3 before you start this section.

Steps...

1. Set each window into its respective location.

The windows should be equally oversized around the window cutouts. The windows must be 1" (25 mm) larger than the cutouts. This will provide a 1" wide bond between the windows and fuselage.

2. Remove the protective barrier from the windows in the area that will be bonded. This will prevent the protectant from contaminating the bonds.
3. Trim the window in areas where there is more than 1" (25 mm) of bonding area.

For cutting large areas of plexiglass, a band saw works well. For the smaller trimming jobs, use an angle grinder with a 40-grit abrasive wheel. And be careful! The plexiglass is tough stuff, but if you try to cut too fast, or drop a window on the floor, the plexiglass can break.

4. Carefully locate the windows in the top fuselage shell.
5. Use instant glue to bond a few temporary wood locating blocks (1/2" x 1/2" x 1/2") (12 mm x 12 mm x 12 mm) to the fuselage. These blocks will hold the windows in place and leave your hands free for other work.
6. Clamp the window against the fuselage using 3/16" (5 mm) diameter bolts.

A hardware store variety works well.

7. Drill 3/16" (5 mm) diameter holes every 4" (100 mm) around the perimeter of the windows.

The holes should be centered about 1/4" (5 mm) away from the edges of the plexiglass. Do not drill through the plexiglass!

8. Perform a trial clamping run of each window without adhesive. This allows you to figure out the proper lengths of the bolts.

- Insert the bolts from inside the fuselage.
- Use large area washers on the inside.
- Use small washers and nuts on the outside surface to snug up the bolts.

There will be some areas with gaps around the perimeters of the windows, especially around the windshield. These gaps will be filled with adhesive during the actual installation. Because of the differences in ply thickness, it would be impractical to try to get a perfectly even recess around all the windows. Do not grind away fiberglass thickness to get a window to fit flush!

Figure 5.3.B.1 Fitting the against the outside of the top fuselage shell

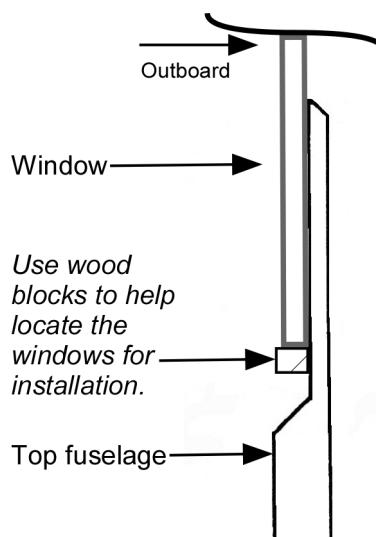
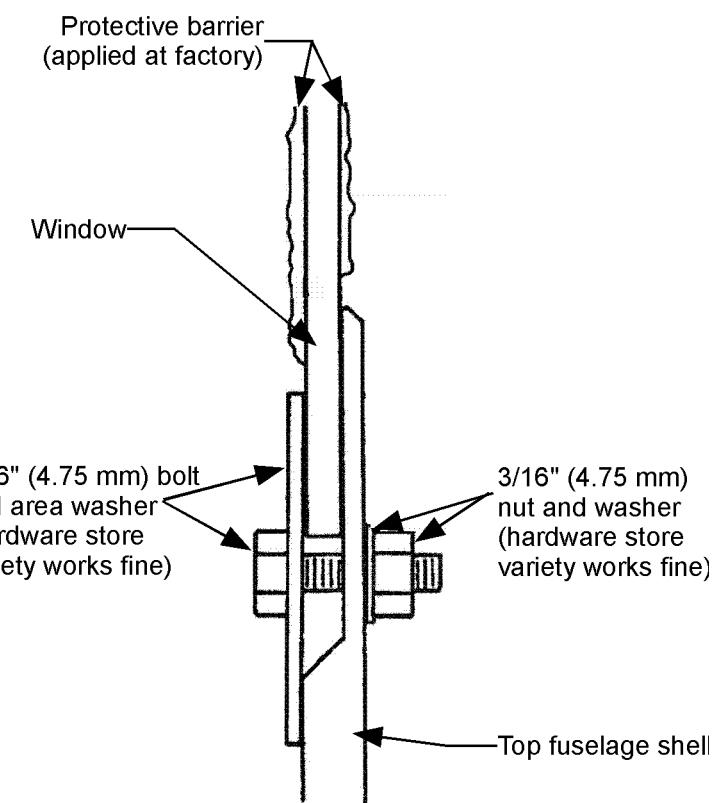
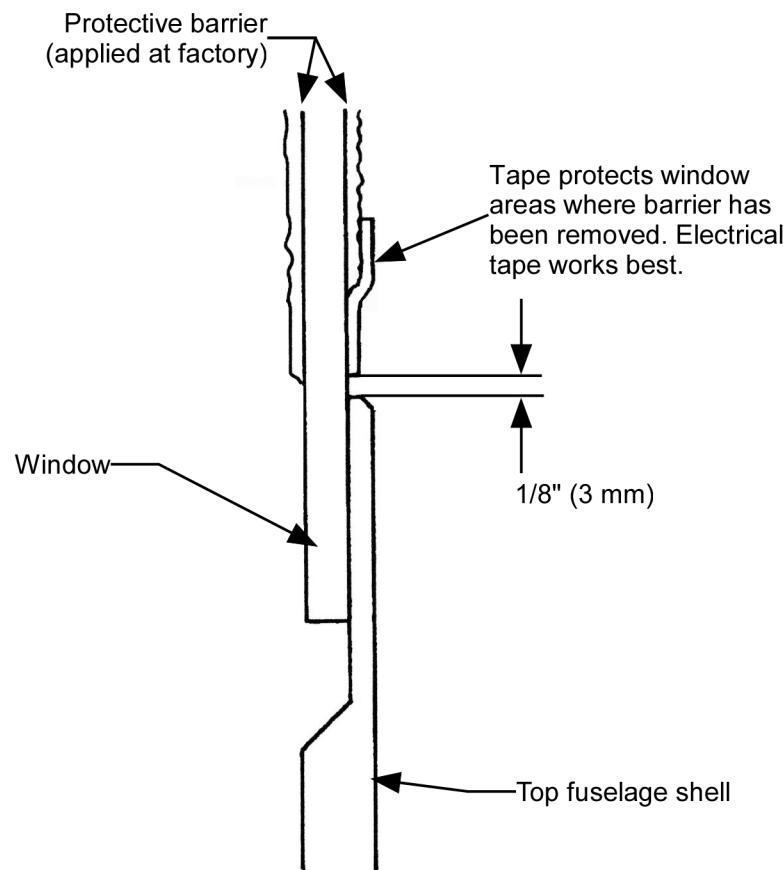


Figure 5.3.B.2 Clamping the windows in place



9. Draw a reference line on the outer surface of the window showing the edge of the window cutout in the fuselage. You will use this line to trim away the protective material from the windows.
10. Remove the windows from the top fuselage shell.
11. Peel away the protective material from both the inner and outer surfaces of the windows in the bonding areas as shown in Figure 5.3.B.3. There should be a 1/2" (12 mm) clear space between the protective material and the bonding areas. Use the reference line you drew in step 9 as a guide for removing the material.
12. Apply a layer of 1/2" (12 mm) wide tape to the outer surface of the windows, covering the narrow clear areas between the protective barrier and the edges of the fuselage cutouts. Electrical tape works well for this job because it provides better protection than masking tape. The edge of the tape should be placed 1/8" (3 mm) back from the cutout edges. After the windows have been glued in the tape will be removed, leaving a crisp, clean edge around the windows. So treat the tape application carefully and make the corners smooth and round.
13. Clean the bonding areas of the windows with alcohol. Clean right up to the protective tape.
14. Using 40-grit sandpaper, sand the bonding areas of the windows. Sand thoroughly so no glossy areas remain. Be careful while sanding up to the tape edges not to damage the tape. If you do damage the tape, replace it before bonding in the windows.

Figure 5.3.B.3 Taping windows to protect from adhesive



5.3.C Installing the Windows

The windows are bonded in position with Hysol structural adhesive. The bond is reinforced using a 2-BID from behind, meaning, inside the fuselage.

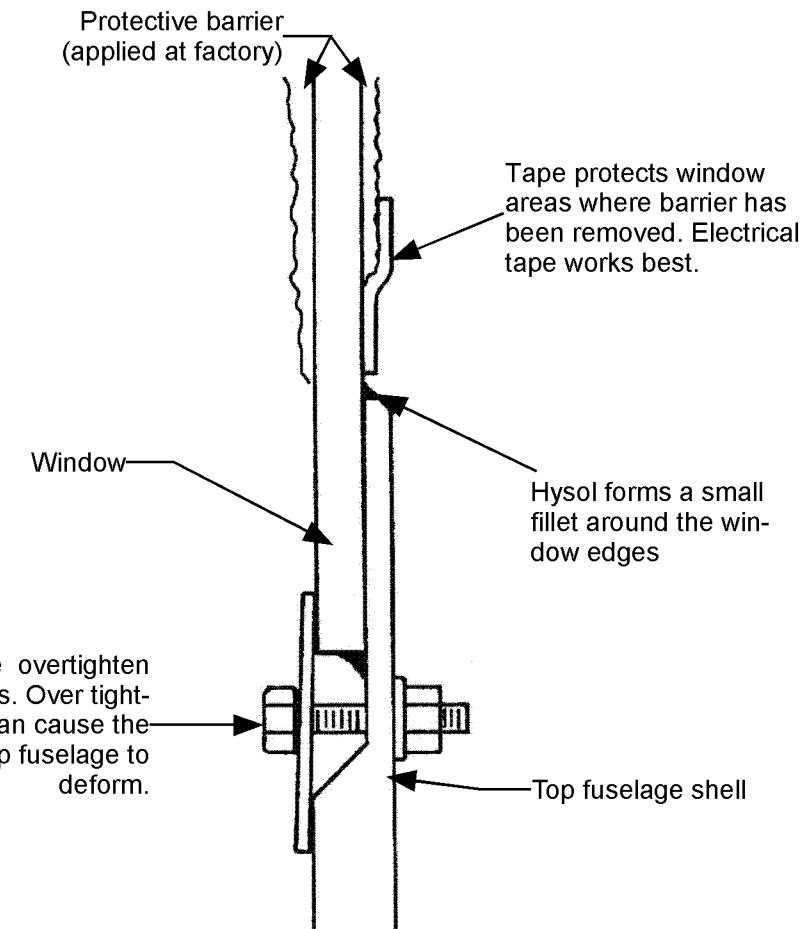
Steps...

1. Sand the inside surface of the top fuselage shell with 40 grit in the areas where the windows will be bonded.
2. Clean all bonding areas on the fuselage with Acetone.
3. Bond the windows to the fuselage with Hysol. A little flox mixed in with the Hysol helps with consistency.
4. Snug up the clamping bolts just enough so you get a squeezeout, but not so the outer surface of the fuselage is deformed. If there is still Hysol squeeze-out but no skin deformation, snug up all the nuts just a bit more and recheck.
5. Scrape off the excess Hysol using a modified tongue depressor and form a small radius around the perimeter of the fuselage cutout.

Scrape away enough Hysol so the edge of the tape is visible. Don't let any drips or your fingers touch unprotected plexiglass.

While the windows are curing in position, you should place the top fuselage shell in position on the bottom fuselage and secure with a few clecoes. This will hold the top shell at its proper width and prevent undo stresses on the windows.

Figure 5.3.C.1 Bonding and clamping the windows



Steps after cure...

1. After the Hysol has cured, remove the top fuselage shell from the bottom and put it back on the low workbench.

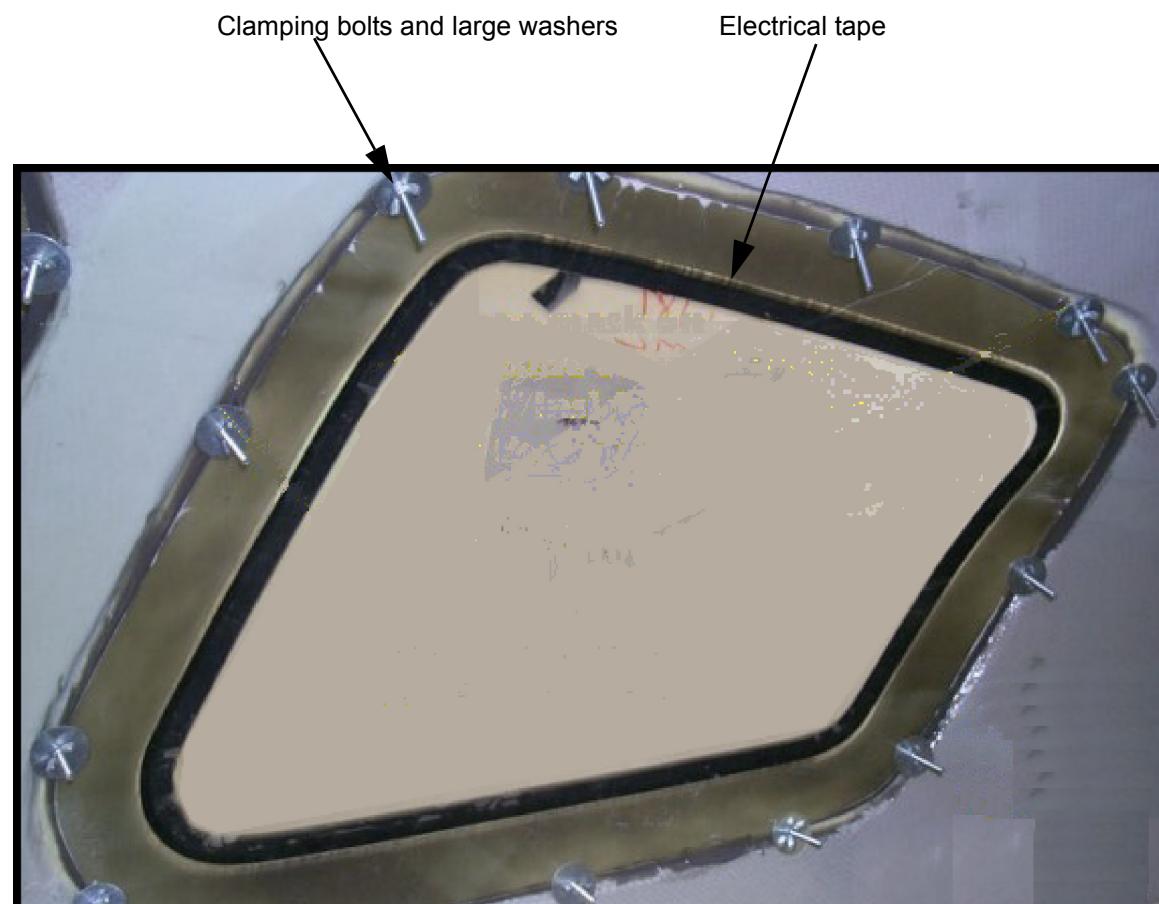
Tip: Leave the windows bolted in place until the Hysol has gone through its full cure time of 5-7 days at room temperature. This will eliminate the possibility of the windows pulling away from the fiberglass. When windows pull away it looks like an air bubble in the laminate.

2. Remove the clamping bolts from around the windows.
3. Sand, using 40 grit, the inner surface of the windows and the top fuselage shell where the 2-BID reinforcement will be applied.

Remember, there should be no glossy surface left in the plexiglass area that will receive the laminates. It is highly suggested that you apply a layer of protective tape to the inner surface of the windows around the perimeter of the fuselage cutouts (just like you did on the outer surface before bonding). This tape will keep wayward epoxy or fiberglass off the clear unprotected surface. Align the edge of the inner tape with the edge of the outer tape.

4. Clean the plexiglass where the BID tapes will be applied using alcohol.
5. Clean the carbon fiber areas of the fuselage with Acetone.

Figure 5.3.C.2 Reinforcing the window-to-fuselage bond



Reinforcing the Window-to-Fuselage Bond

Steps...

1. Fill the area between the edges of the plexiglass and the fuselage core with a thick epoxy/micro mixture as shown in Figure 5.3.C.3.

It is not necessary to fill the entire depression when the distance from the edge of the windows to the beginning of the fuselage core is greater than 3/4" (20 mm). Simply apply a micro radius around the window edge for a smooth BID transition. This micro will also fill the bolt holes in the fuselage.

2. Apply 2-BID, 3" wide strips to reinforce the bond between the windows and the fuselage shell.

It is impossible to do these layups in one piece for each window, so segment the layups and overlap them by 1" (25 mm).

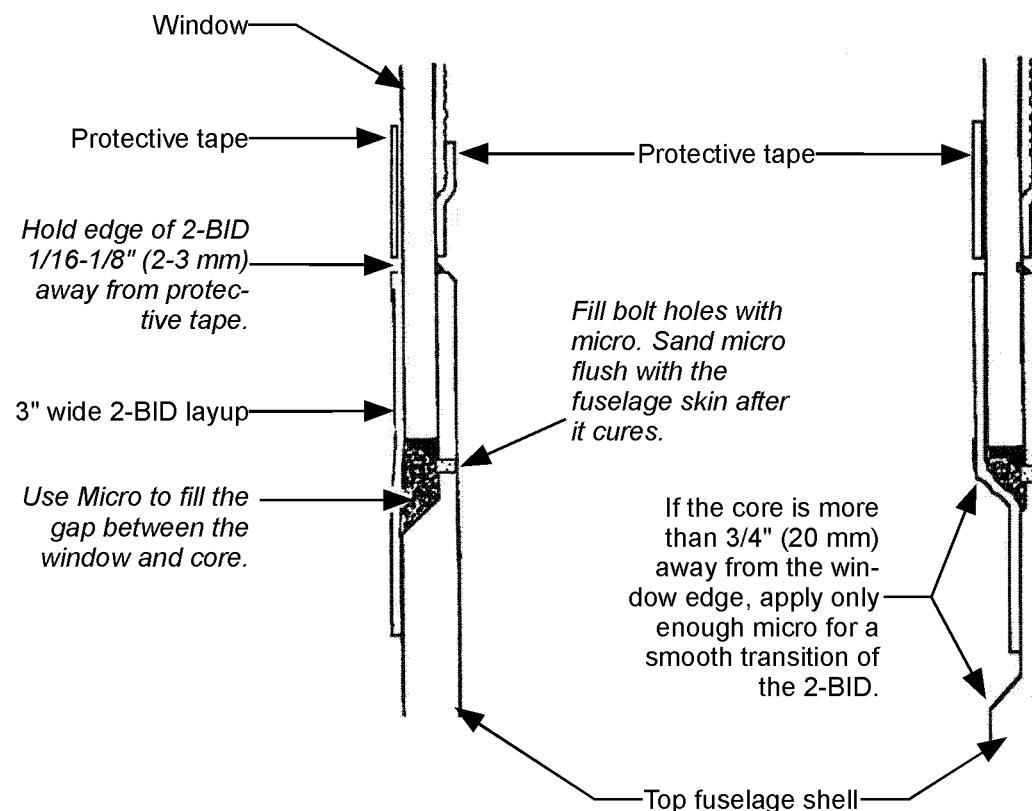
- Using the protective tape as a reference, carefully position the edges of the 2-BID layups in a straight line, about 1/16-1/8" (2-3 mm) away from the edge of the protective tape.
- Working with a gentle touch on the fiberglass, it's fairly easy to get a good straight edge and save yourself some tricky sanding later.
- Another time saving suggestion is to use peel ply on these laminates for a smooth finish in case you decide to paint around the windows at a later time.

3. Finish the outer edges of the window cutouts by beveling the edges with a folded piece of 80-grit sandpaper.

WARNING: Be very careful not to scratch the unprotected plexiglass.

You can also apply a small amount of epoxy/micro around the edges of the windows. The micro is much easier to sand than Hysol. Another round of applying protective electrical tape before sanding is worth the effort. It is possible to sand through the electrical tape, but it offers some protection which is better than nothing.

Figure 5.3.C.3 Reinforcing the window-to-fuselage bond



5.3.D Installing the Windshield

Installing the windshield is completed using the same method as the other windows.

Figure 5.3.D.1 View of installing the windshield from inside the fuselage

