# CHAPTER 8
# 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 |
|---|---|---|---|
| 8-1 & 8-2 | 1 | None | |
| 8-3 | A9 | R&R | Added part number to parts list. |
| 8-26 | 3 | R&R | Changed Step C2<br>Added note after Step C2 |
| 8-27 thru 8-28 | 1 | None | |
| 8-29 thru 8-30 | 7 | R&R | Corrected Step C6 |
| 8-31 thru 8-50 | 1 | None | |
| 8-51 | 8 | R&R | Blueprint A205 was A-204 |
| 8-62 | 3 | R&R | Added note before Step H1 |
| 8-63 thru 8-69 | 1 | None | |
| 8-70 | A9 | R&R | Edited Trim Tab Actuator Arm, Fig. 8:H:8 |
| 8-71 | A9 | R&R | Edited Trim Tab Actuator Arm, Fig. 8:H:9 |
| 8-72 thru 8-74 | 1 | None | |
| 8-75 thru 8-76 | 3 | R&R | Changed Step I10 - I12<br>Corrected Figure 8:I:4<br>Changed Step I13 |
| 8-77 thru 8-79 | 1 | None | |
| 8-80 | A11 | R&R | Edited Fig. 8:J:2. |
| 8-84 | 7 | R&R | Corrected Figure 8:J:4 |
| 8-85 thru 8-87 | 1 | None | |
| 8-88 | 7 | R&R | Changed Figure 8:K:2 |
| 8-89 | 1 | None | |
| 8-90 | A10 | R&R | Fig.8:K:4 revised and part #'s changed. |
| 8-91 thru 9-109 | 0 | None | |

# CHAPTER 8
# AILERONS

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 When such revisions are made, you should immediately replace all outdated pages with the revised pages. Discard the outdated pages.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 particular assembly step. However, time goes on and changes are made, so careful attention should be paid to the orientation arrows. That old cartoon of the guy agonizing over the plans for his canoe, built one end up, one end down, should not happen in real life. Especially to you.

## CONTENTS

## 1. INTRODUCTION

The ailerons of the Lancair IV use a high aspect ratio, having a short chord and long span. This makes for a thin cross section and not much room to work in the ailerons. You should always be aware of the narrow aileron and work more accurately than you have before; no oversized micro radii on these spars and ribs.

The Lancair IV uses a MAC S9 servo for electric roll trim. The roll trim servo is provided in the kit and is installed inside the aileron. Yes, the installation is tight, but the positive roll trim control is worth the extra effort during construction.

The aileron counterweights are totally enclosed in the wing, causing no airflow disruption when the ailerons are deflected. This method of counterweighting is obviously very aerodynamic, but again, care must be taken during construction because of the tight quarters in which to work.

The 1/4" thick, blunt trailing edge of the ailerons should be kept that way, blunt. This is an aerodynamic feature meant to increase roll response and lighten stick forces.

All drawings in this chapter show the left aileron. The right aileron is identical except for the lack of a trim servo.

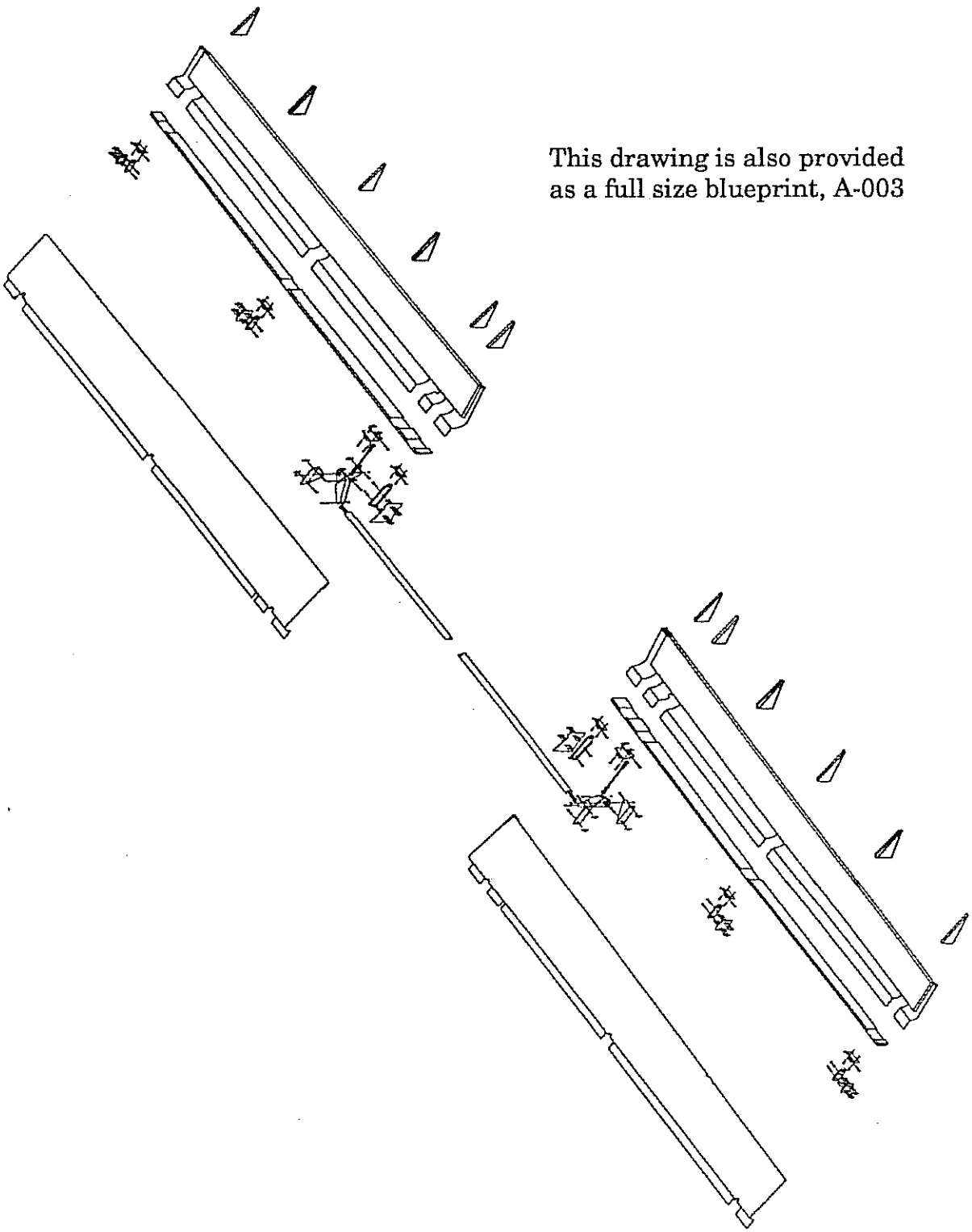
## 2. PARTS LIST, TOOLS AND SUPPLIES

### A. PARTS (refer to Figure 8:1, or see separate full-size blueprint, #A-003)

1 Left top aileron skin
1 Right top aileron skin
1 Left bottom aileron skin
1 Right bottom aileron skin
2 Bearing block, outbd
2 Bearing block, middle
2 Bearing block, inbd
6 Bolt, AN3-6A
6 Bolt, AN4-6A
16 Lock nut, AN365-1032A
18 Nut plate, K1000-3
2 Nutplate, K1000-4
80 Rivet, AN426A3-5
2 Hinge, outboard
4 Hinge, mid/inbd
12 Bolt, AN3-10A
24 Bolt, AN3-5A
24 Washer, AN960-10
2 Aileron bellcranks
2 Bellcrank bracket set (top & bottom)
2 Bolt, AN5-13A
2 Lock nut, AN365-524A
2 Actuator Arm (aileron)
2 Push rod, threaded, 1/4-28x5"
2 Push rod, 1 1/4" Dia. 6061-T6 Al. tube
4 Rod end bearing, F34-14
4 Rod end bearing, F35-14
4 Check nut, AN316-4
4 Check nut, AN316-5
4 Rod end, 490HT-11P
4 Insert, aluminum, EL6B
8 Rivet, AN470A4-24
24 Rivet, MSC-34
22 Screw, MS24693-S26
22 Nutplate, MK1000-06
12 Weights, lead, half-round
24 Washer, AN960-10L
2 Locknut, AN365-428A
4 Washer, AN960-416
2 Washer, AN960-516
1 Extruded hinge material, 8"
1 Trim tab actuator arm, TT-01
1 MAC S9 servo kit

## Exploded view of ailerons

Figure 8:i:1



This drawing is also provided as a full size blueprint, A-003

**B. TOOLS**

String line
Dremel™ tool with ball bit
Saw to cut phenolic
Drill motor with the following bits:
- 3/16"
- #12
- #40

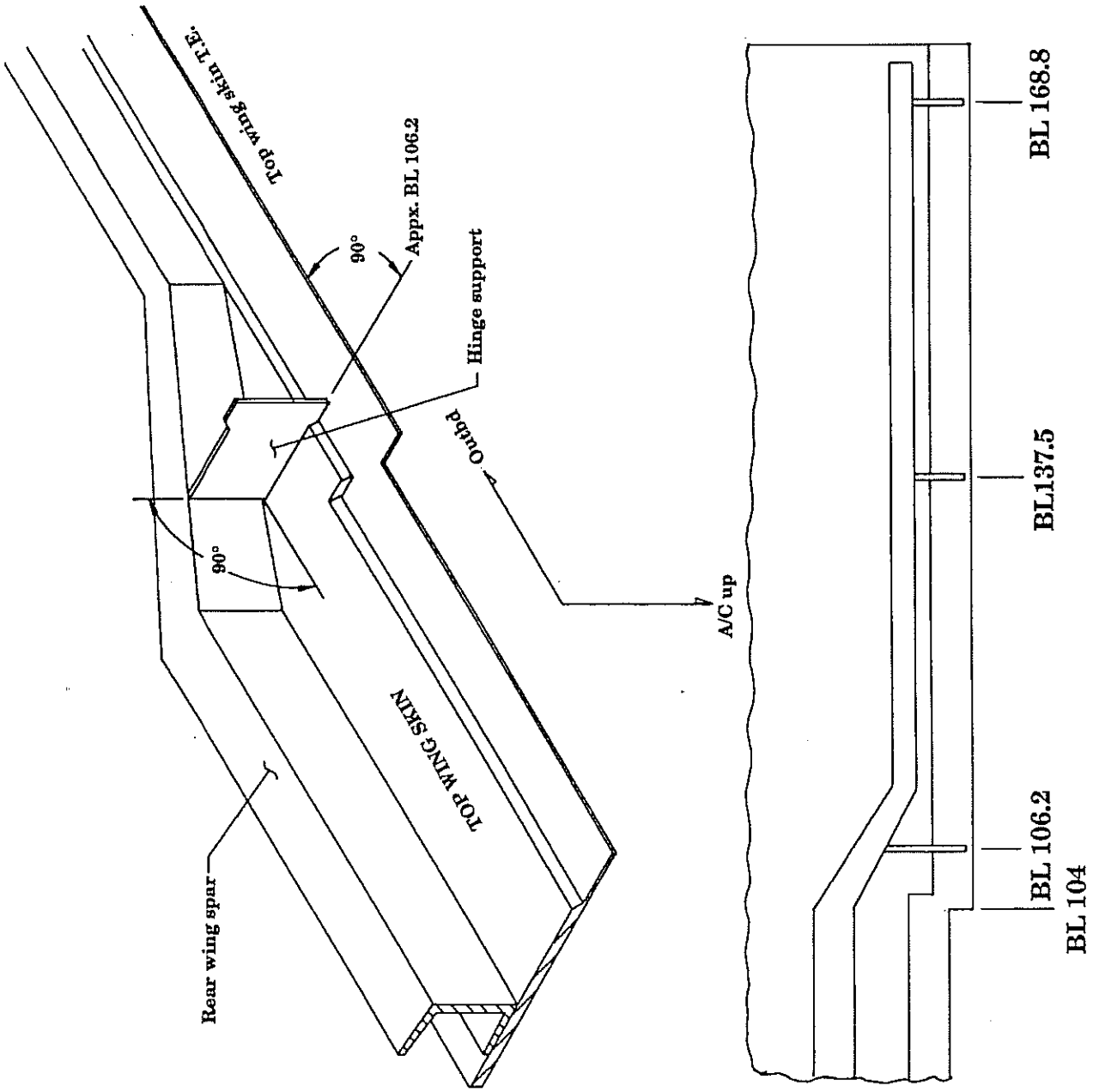
100° Countersink
#40 grit sandpaper
Tape measure
C-clamps, small, 3 or 4
Straight edge, 4' - 6'
Clecoes and tool
Spring clamps
Smart-Level or equiv.
90° drill attachment (to get into a tight spot)

C. **SUPPLIES**

Micro-balloons
MC
Instant glue
Release tape
BID material
Flox
Bondo™
Straight wood for aileron T.E. support
Phenolic, 1/8" thick
2 ply per side E-glass prepreg panel
Duct tape
Hysol™ structural adhesive
Safety wire

A1. Cut the supports from 1/8" thick phenolic using the templates provided on Blueprint A-204. Custom fit the supports to your wing at the locations given in Figure 8:A:2. Notice that the supports are located so they are perpendicular to the TOP wing skin. The supports are NOT located true vertical. Also, the supports are perpendicular to the top wing skin T.E., not parallel to the butt line.

**Aileron hinge supports**
Figure 8:A:2



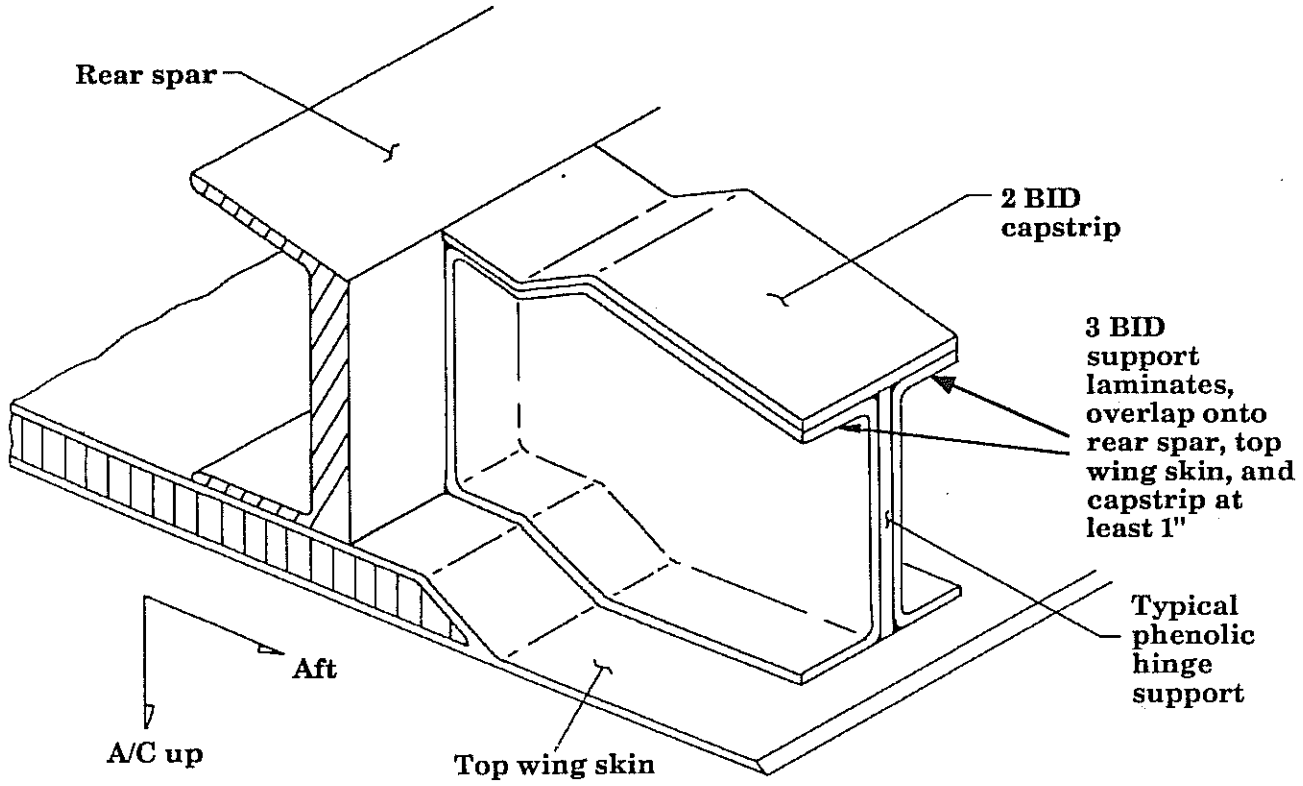
A2. The phenolic supports should be thoroughly sanded with 40 grit and cleaned with MC before bonding them in position. Also sand the areas of the inside top wing skin, and the aft face of the rear spar, where the supports will be located and glassed.

A3. Bond the supports in position with flox and form a small radius in the corners. Again, be sure the supports are 90 degrees to the top skin and the T.E. A drop of instant glue at the top and bottom of the support will help hold it in position while the flox cures.

A4. When the flox has cured, custom sand the supports so the bottom wing skin will rest in position. Mark the location of the supports on the inside surface of the bottom wing skin in preparation for capstrips.

A5. Remove the bottom wing skin and apply a release tape to it's inside surface where the capstrips will be located.

**Hinge support capstrips**
Figure 8:A:3



A6. Apply the 2 1/2" wide, 2 BID capstrips to the inside surface of the bottom wing skin. Build up a small bead of flox on the edge of the support that will be bonded to the capstrip. Carefully lay the bottom wing skin in position and weight it just as you would when closing out the wing. Obviously, this weighting is most important in the aileron area. Be sure the T.E. of the bottom wing skin is straight where the aileron will be located.

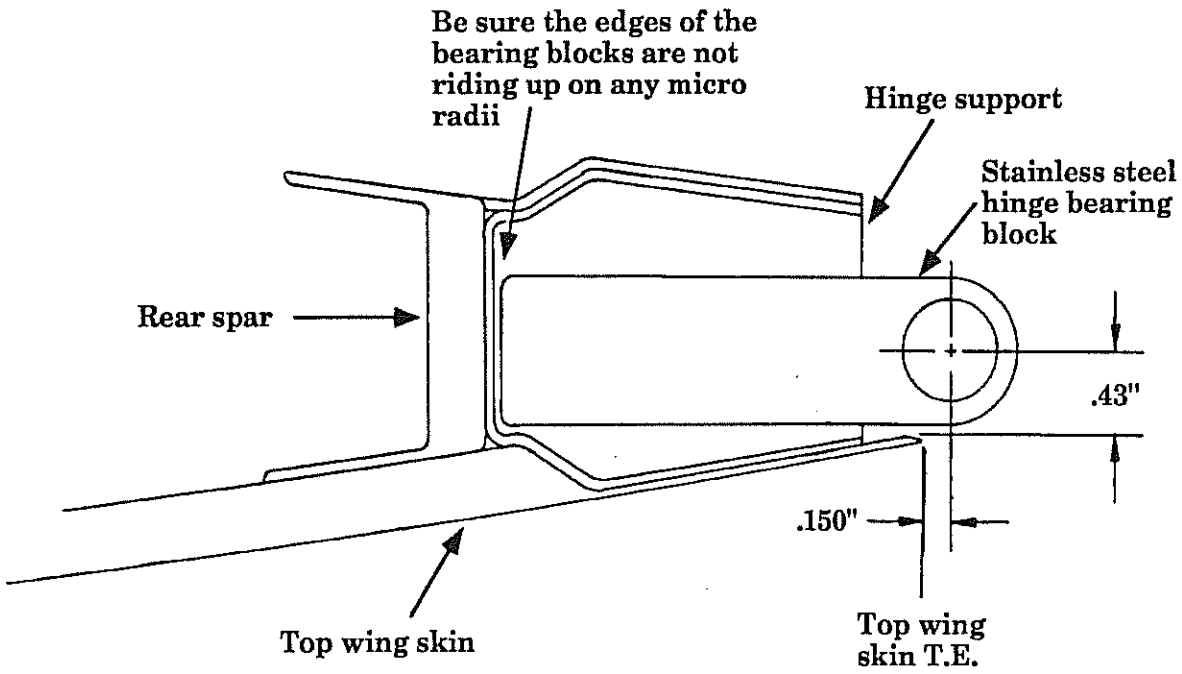
A7. When the capstrip has cured, remove the bottom wing skin. Sand the support sides, under the capstrips, and the aft face of the rear spar where the 3 BID support laminates will be applied. Clean all areas with MC. Form a small radius between the supports and the capstrips by grinding the excess flox or adding a little micro.

A8. Apply the 3 BID support laminates to both sides of each hinge support. Be sure the 3 BID overlaps at least 1" onto the top skin, the aft face of the rear spar, and the bottom of the capstrips you have just formed. See Figure 8:A:3.

A9. Position the three hinge bearing blocks on their respective supports so the center of the bearing is .43" above the top wing skin T.E. The center of the hinge bearings should be located .150" aft of the top wing skin T.E. Don't trust the top wing skin T.E. to position the *middle* hinge bearing. Use a string line to adjust the middle hinge bearing (see Figure 8:A:4:b) so it is in line with the outboard and inboard bearings. This alignment is much more important than the distance from the top wing skin T.E. Be sure the hinge bearing blocks are resting flat on the supports, not riding up on a micro radius. Temporarily secure the hinge bearing blocks in position with a few drops of instant glue.

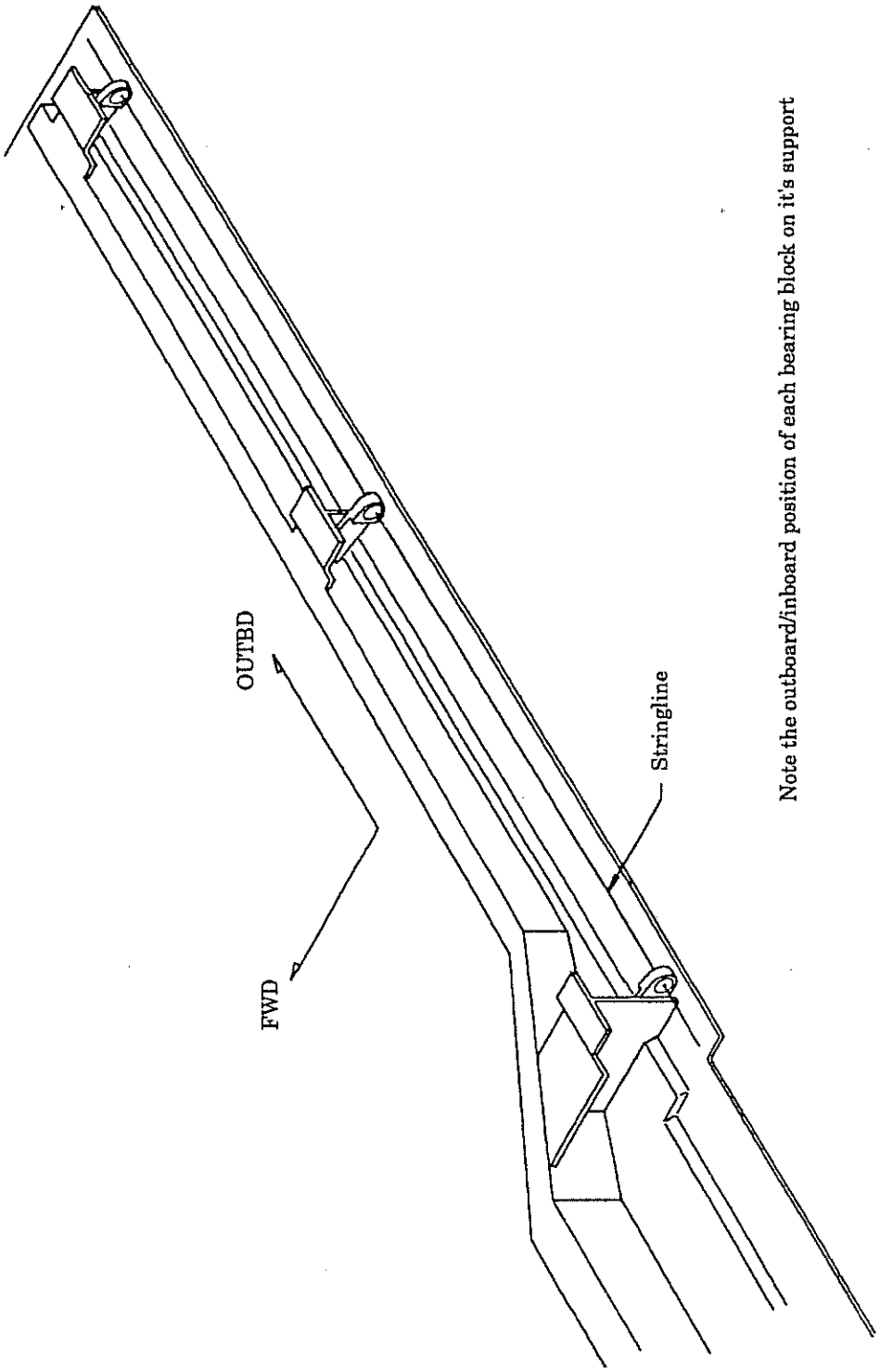
**Locating hinge bearing blocks**

Figure 8:A:4:a



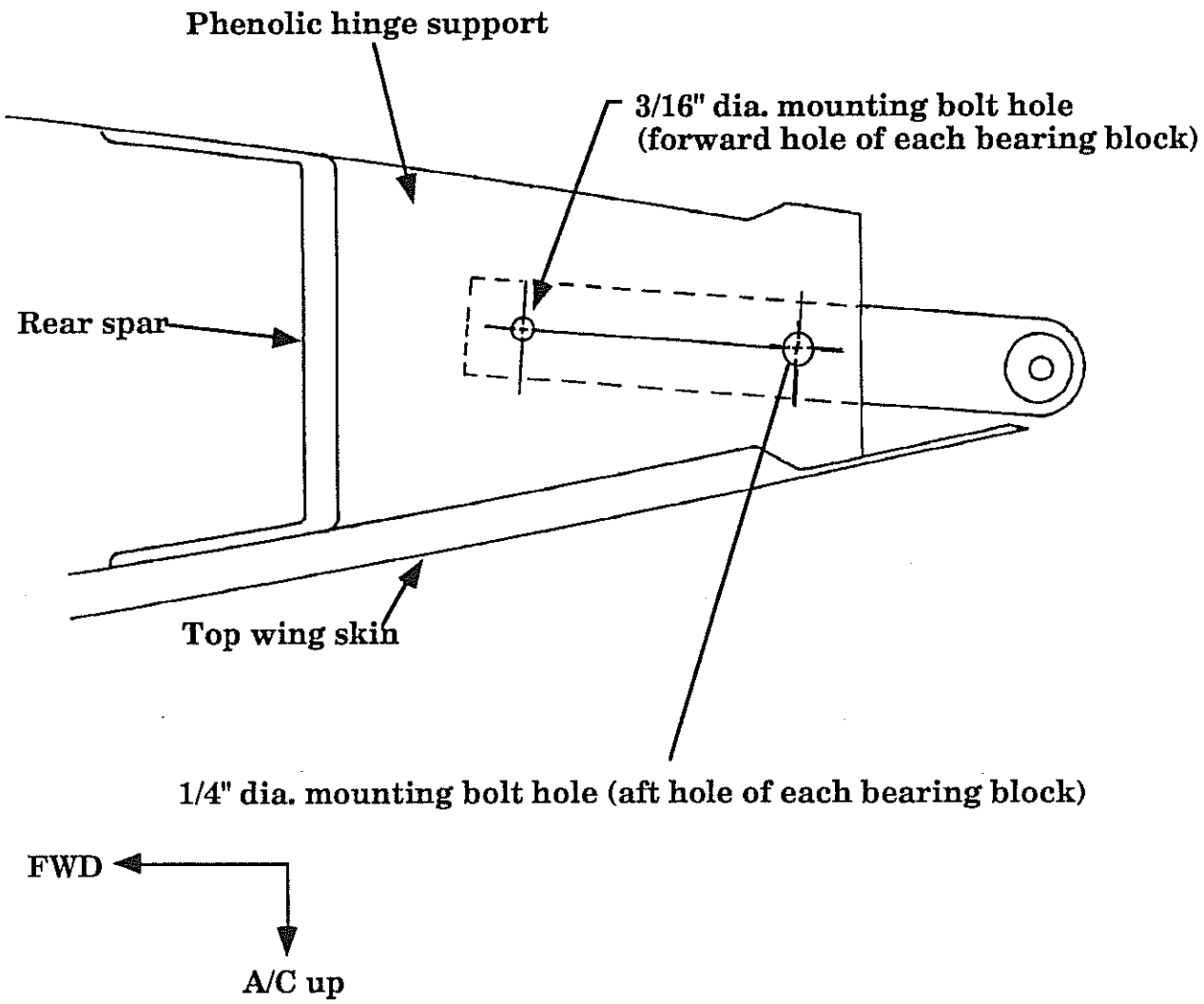
## Locating hinge bearing blocks

Figure 8:A:4:b

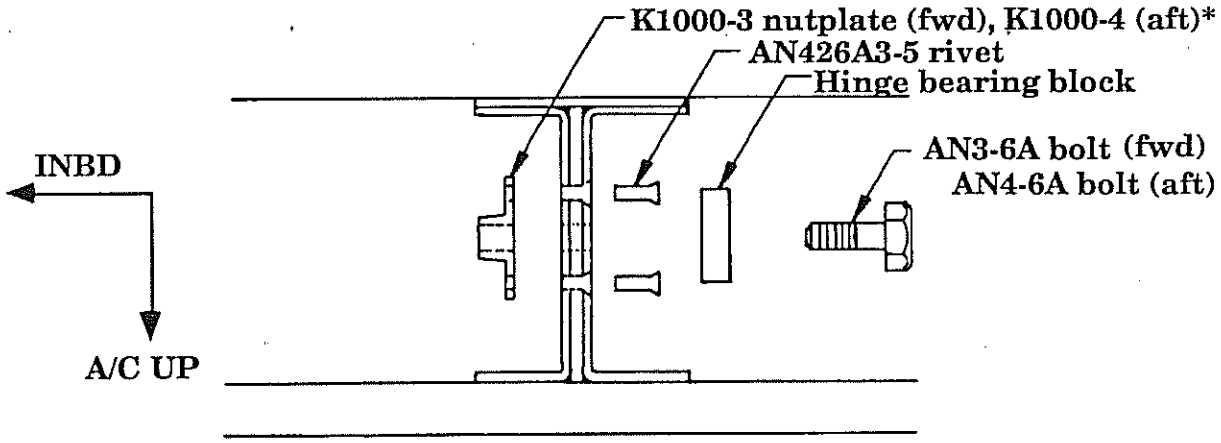


A10. Drill the two mounting bolt holes through each hinge support. Use the hinge bearing blocks as drill guides . Notice that the forward mounting hole of each bearing block uses a 3/16" dia. bolt and the aft hole uses a 1/4" dia. bolt. These mounting bolt holes should be tight tolerance for the bolt, so it is best to drill undersized holes and ream them out to the proper diameter. It is a good idea to mark the blocks so you will know which one goes where in the future. See Figure 8:A:5:a &b.

**Mounting hinge bearing blocks**
Figure 8:A:5:a



**Mounting inboard hinge bearing block**
Figure 8:A:5:b




*** Remember that this drawing is showing the INBOARD hinge bearing block. The middle and outboard blocks are secured to their supports with locknuts, not nutplates. See Figure 8:A:6.**

A11. On the inboard hinge support (BL 106.2), K1000-3 and K1000-4 nutplates are used to secure the hinge bearing blocks to the hinge supports. Position the nutplates on the inboard side of the BL 106.2 support. Use a couple drops of instant glue to tack the nutplates in their proper positions.

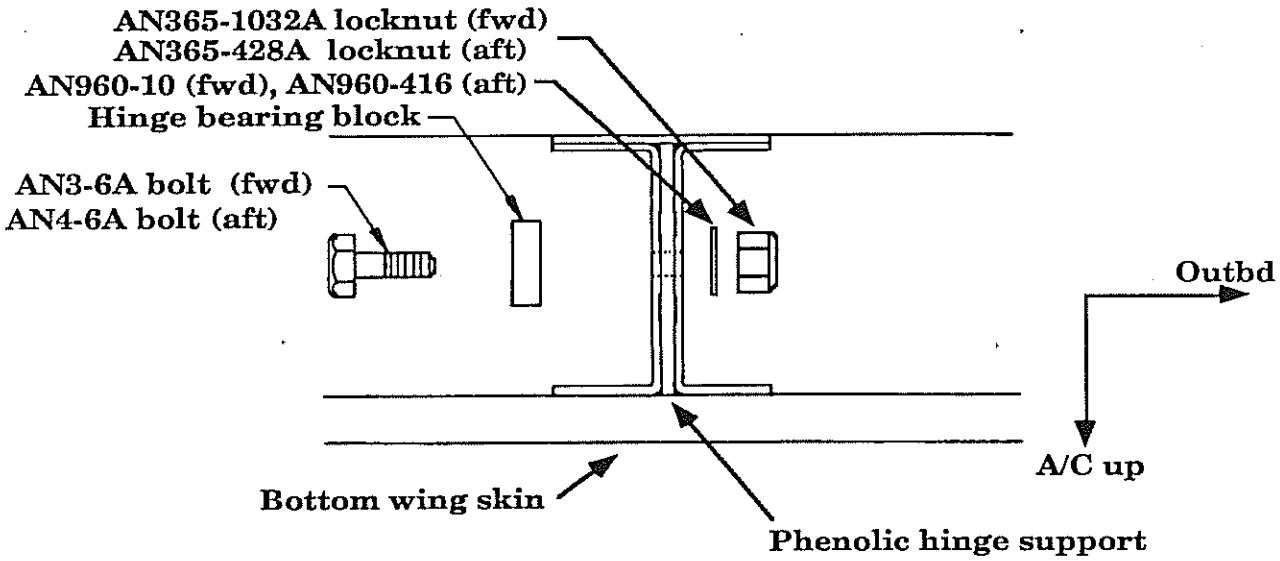
A12. Remove the inboard bearing block from it's support and scrape off the excess instant glue. Using the holes in the K1000-3 & 4 nutplates for guides, drill #40 holes through the inboard hinge support for the rivets. Countersink the support and install the nutplates using AN426A3-5 rivets.

A13. Reinstall the inboard bearing block using AN3-6A and AN4-6A bolts.

A14. On the middle and outboard brackets, nutplates are not necessary. Remove the bearing blocks and carefully scrape off the instant glue from the blocks and supports. Install the bearing blocks with AN3-6A bolts, AN960-10 washers and AN365-1032A locknuts securing the forward mounting holes, and AN4-6A bolts, AN960-416 washers, and AN365-428 locknuts securing the aft mounting holes.

## Mounting middle & outboard hinge bearing blocks

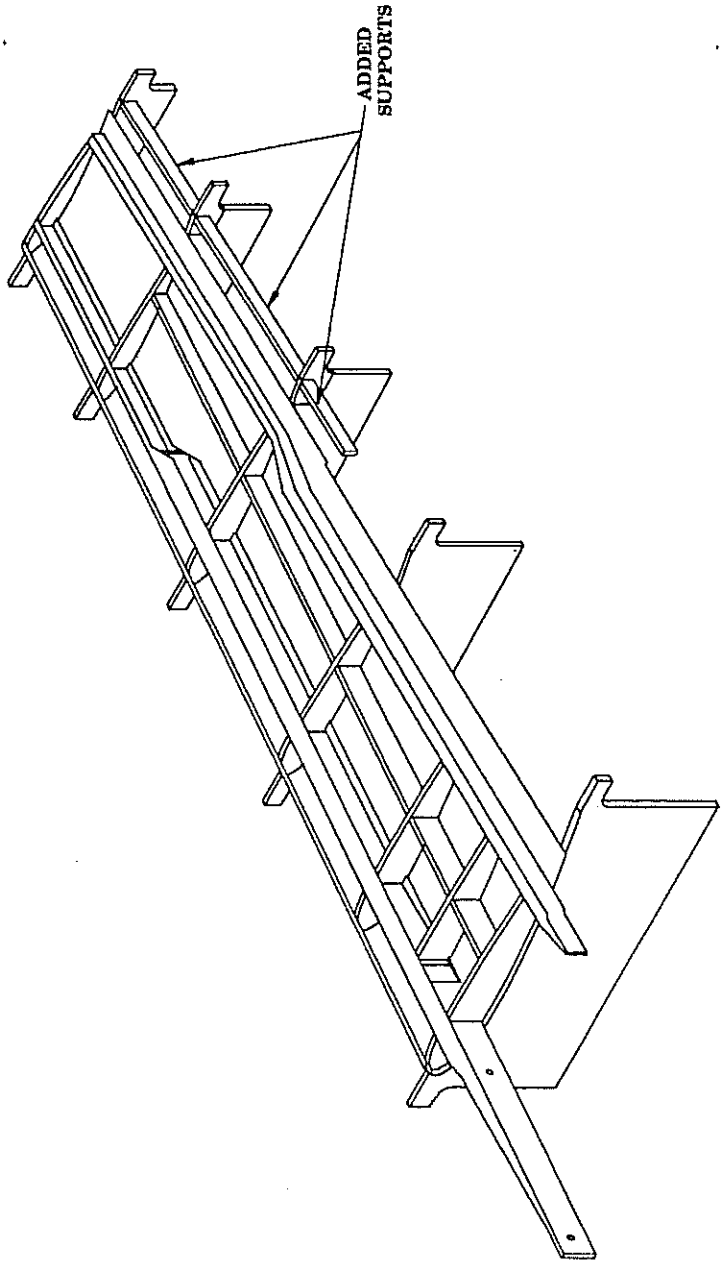
Figure 8:A:6



## B. WING JIG MODIFICATIONS FOR AILERONS

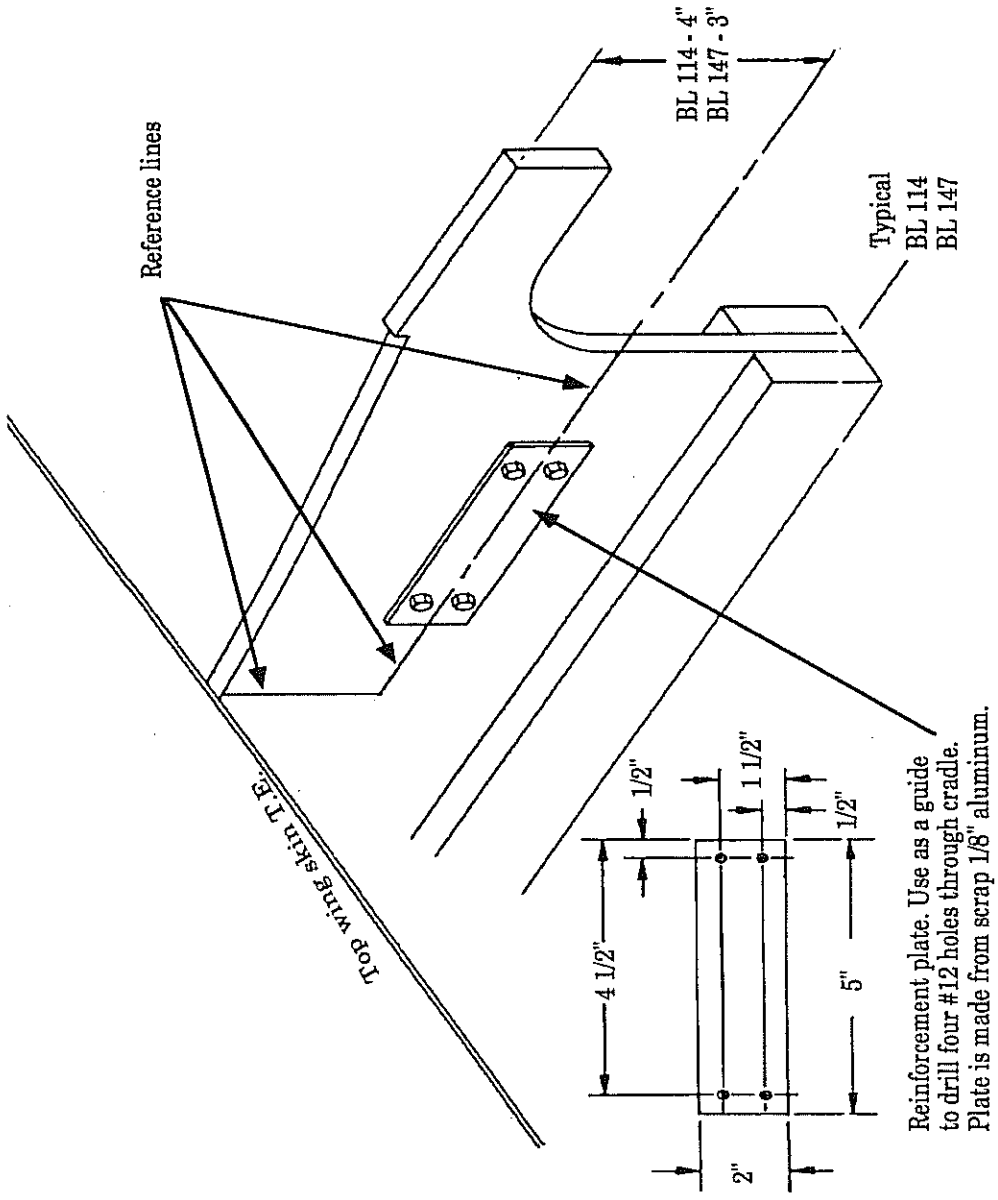
Like the flaps, the ailerons are built on the wing jig while the wing is in position. Slight modifications to the wing jig must be made to accommodate the unique aileron shape. To keep the aileron straight, a support must be added to the wing jig under the trailing edge.

**Wing jig mods for aileron construction**
Figure 8:B:1



B1. The first modification of the wing jig is cutting out square areas in the BL 114 and BL 147 jig cradles so the aileron can be swung through it's full range of travel later in construction. Draw reference lines on the BL 114 and BL 147 cradles as shown in Figure 8:B:2. Do not make any cuts yet.

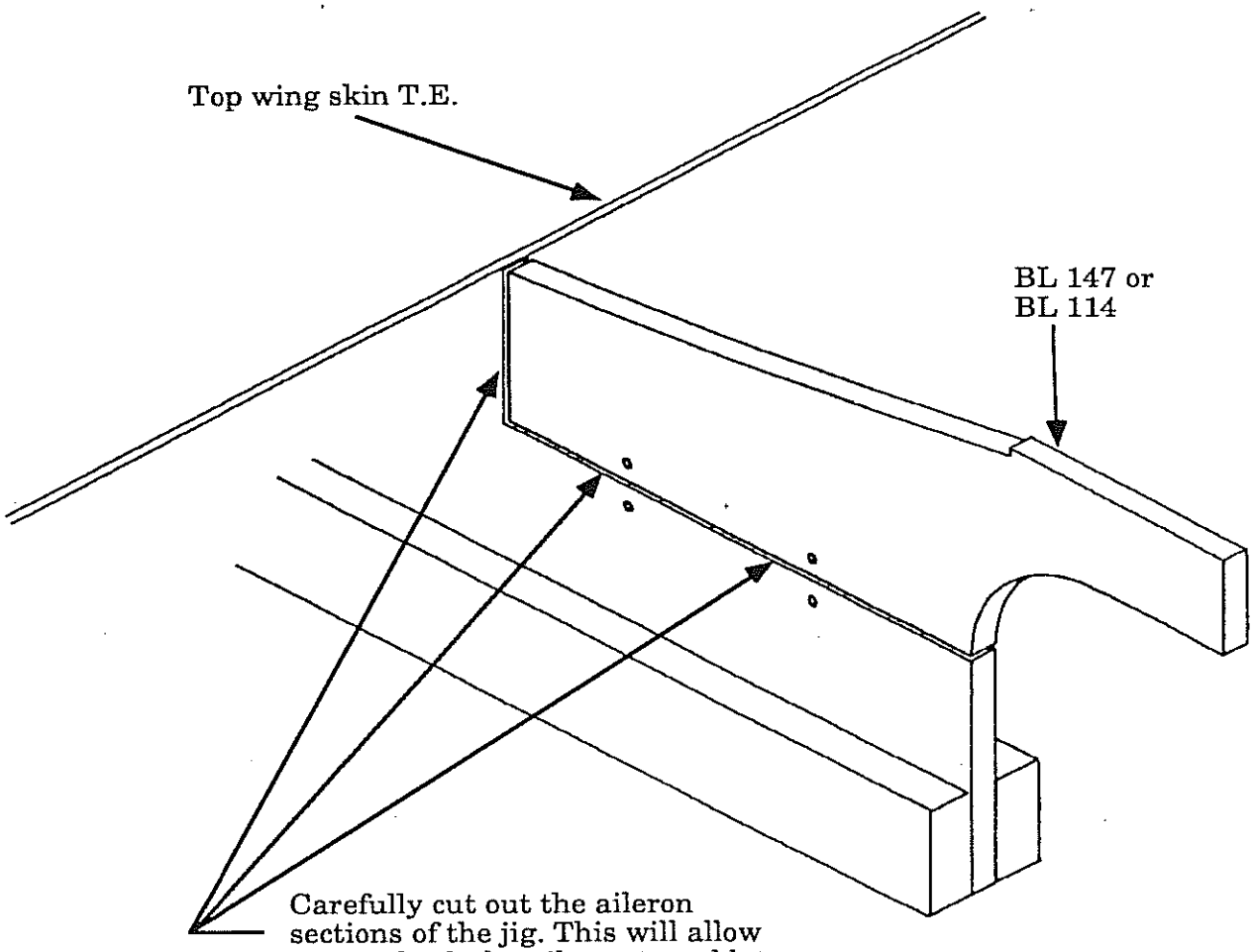
**Aligning reinforcement plates on cradles**
Figure 8:B:2



B2. Center the two aluminum reinforcement plates on the bottom reference line. Drill four #12 holes through each reinforcement plate and jig cradle as shown in Figure 8:B:2.

B3. Now you can use the reference lines to carefully cut out the aileron sections from the cradles.

**Installing reinforcement plates and finishing cut**
Figure 8:B:3



B4. Secure the reinforcement plates to the jig cradles with AN3-10A bolts, AN960-10 washers, and AN365-1032 locknuts.

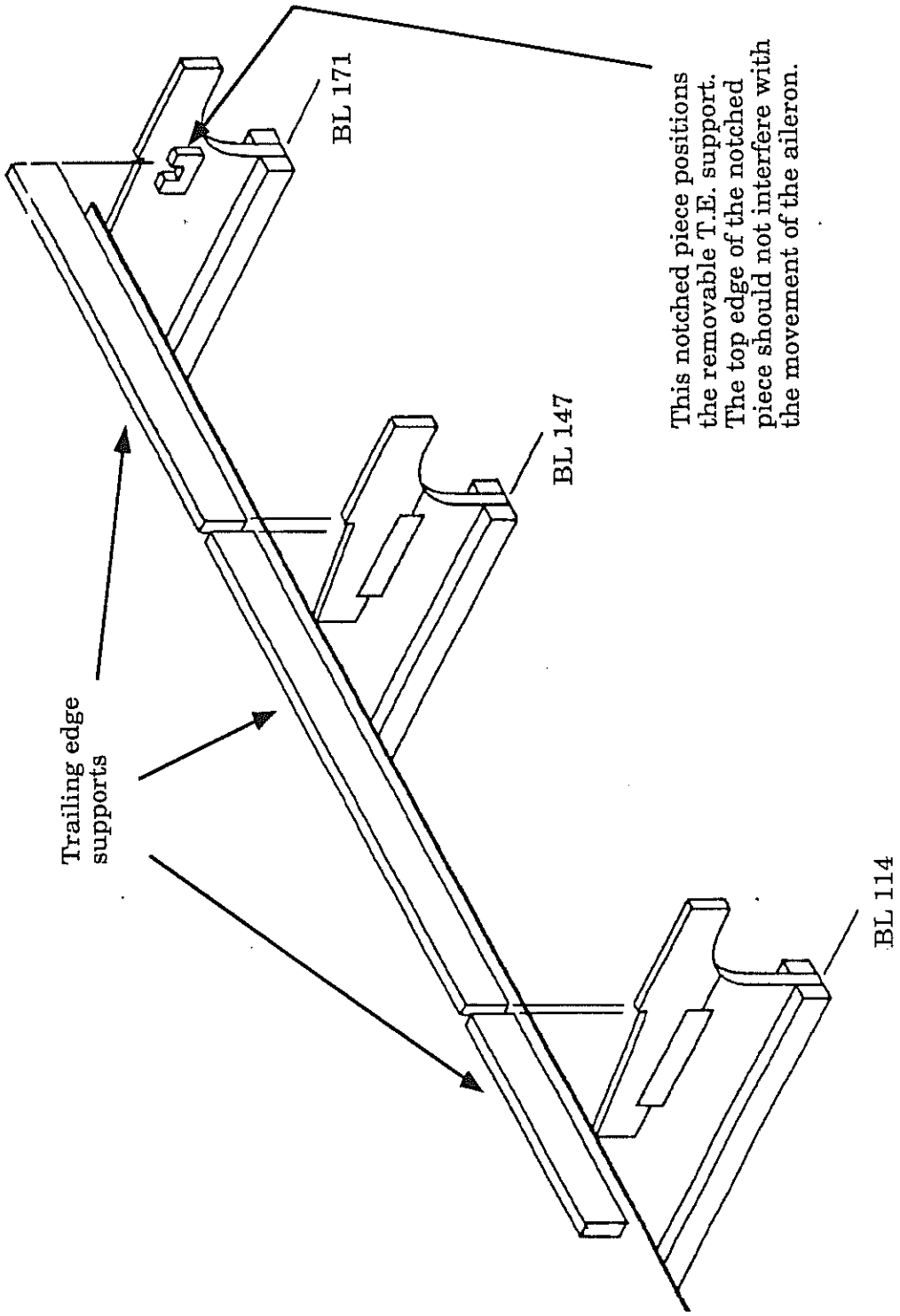
B5. Reinstall the aileron sections of the cradles by bolting them to the reinforcement plates. The jig cradles should have the exact same contour as before you cut out the sections.

B6. The aileron T.E. support is made from the same 1"x4" (or 1 1/2" x 2 1/2" or whatever straight piece you have handy) material that you used for the flap T.E. support. Cut two lengths of the 1x4 to fit between the BL114 and BL 147 cradles, and between the BL 147 and BL 171 cradles. Another 10" long support is mounted inboard of the BL114 cradle. If you're building one wing at a time, it is best not to make a one piece full length trailing edge support, because this would entail notching the cradles. You want to keep these cradles in good shape, especially if you're building only half the wing at a time.

**Note: If you're building both wings at the same time, you can go ahead and notch the BL 114 and BL147 cradles for a one piece trailing edge support. This will save you the hastle of trying to keep three T.E. supports aligned to each other.**

## Aileron T.E. support

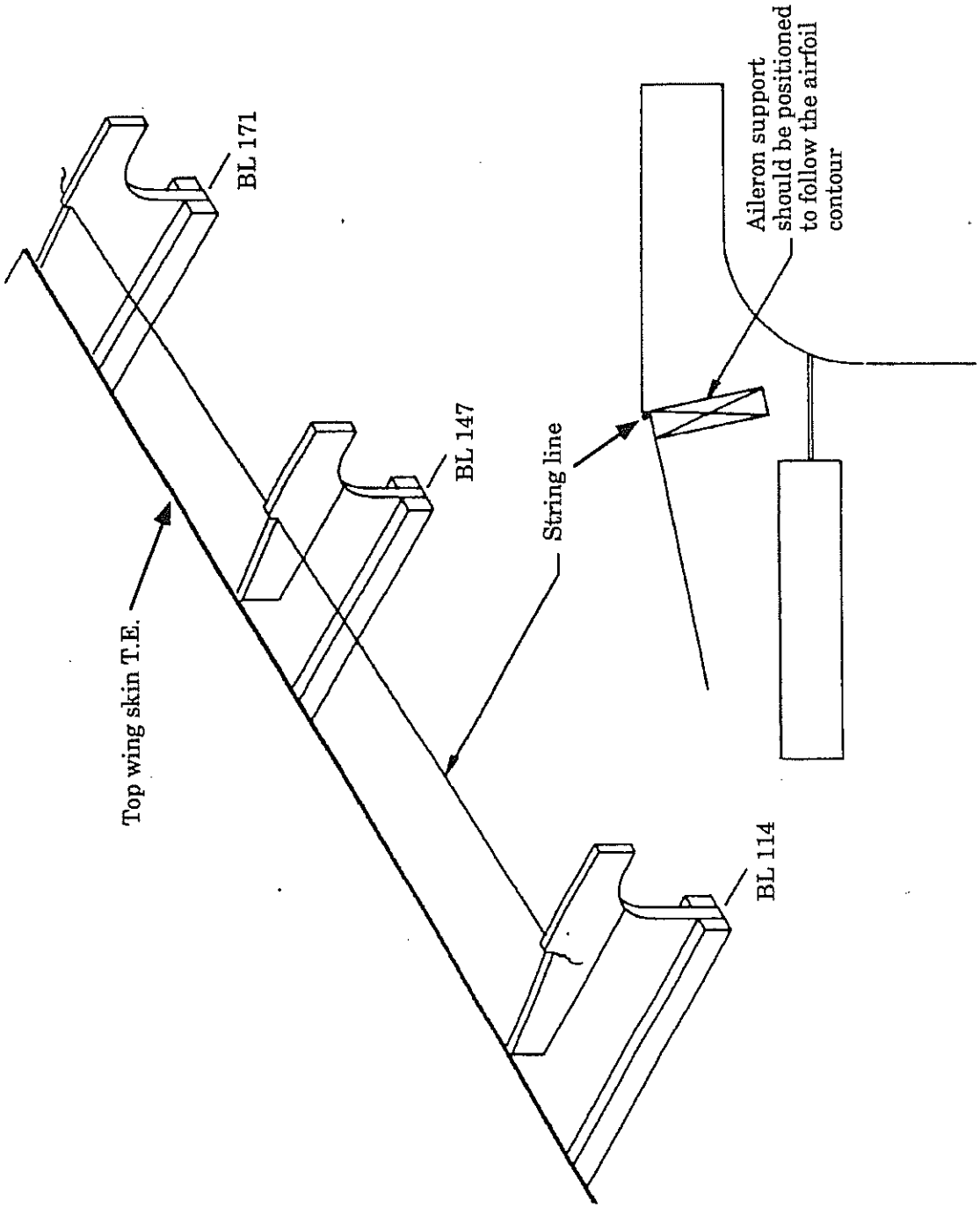
Figure 8:B:4



B7. The aft edge of the supports should be located at the aileron T.E. Use a long straight edge to be sure the supports are straight to each other. If the flap trailing edge support gets in the way, you can cut it off, it is no longer needed if your flap has been closed. See Figure 8:B:5.

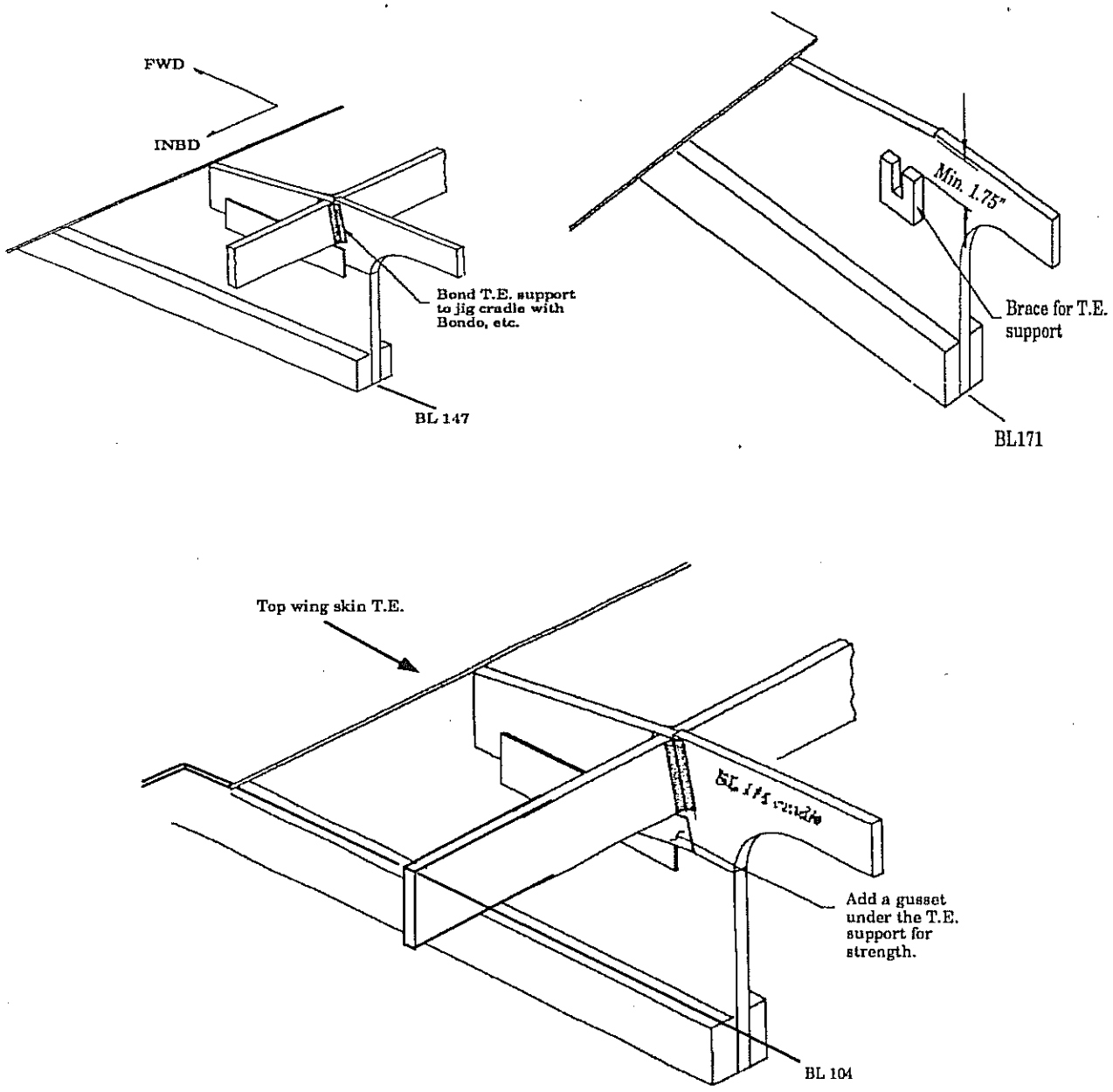
## Locating aileron T.E. support

Figure 8:B:5



B8. Bond the supports to the BL 114 and BL 147 jig cradles with instant glue and/or Bondo. Support the 1x4 on the BL 171 cradle by gluing three 1"x1" pieces to the inboard face of the cradle. These 1x1 pieces will form a slot for the T.E. support to rest in (another method is to just bond a slotted piece of 5/8" thick plywood to the BL 171 cradle). MAKE SURE that the three supports are even with each other so you won't end up with an aileron that bends at the BL 147 and/or BL 114 cradle. The aileron should not rest on a corner of the T.E. support. Angle the supports so they follow the contour of the jig cradles. See Figure 8:B:6.

**Securing T.E. supports to jig cradles**
Figure 8:B:6



B9. By removing the reinforcement plate bolts you can now lift the T.E. supports and two sections of the jig cradle as one piece (it's an awkward piece, so be careful not to break the T.E. supports loose). You should reinforce the bond between the short, inboard T.E. support with a couple gussets to prevent the piece from being broken off.

## C. POSITIONING TOP AILERON SKIN

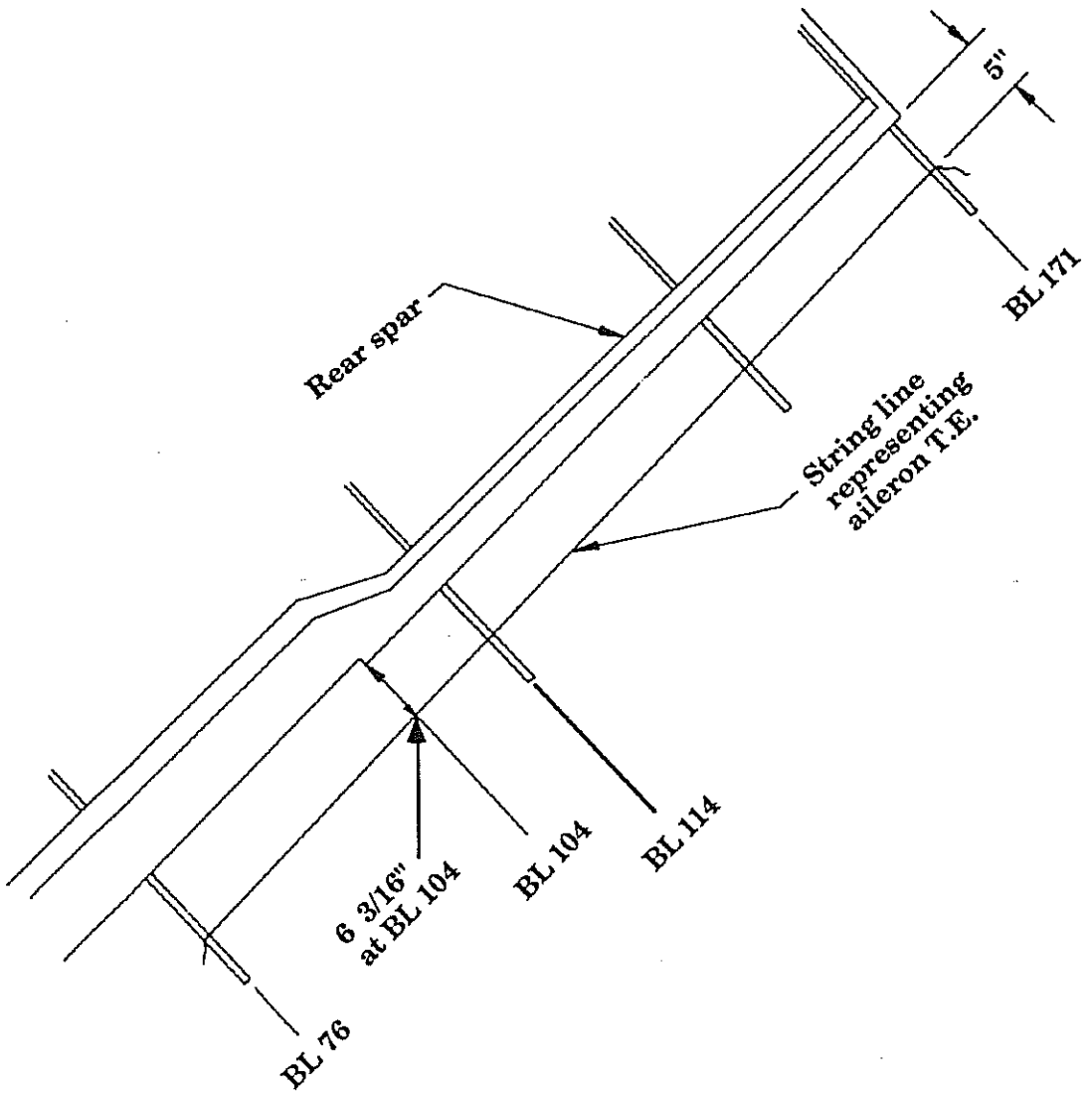
When you first trimmed the T.E. of the top wing skin in the aileron area (Section A. of Chapter 7), we said the trimming must be done accurately. Now you will see the need for this accuracy.

You should remove the flaps while building the ailerons, as the flaps would only get in the way.

C1. Be sure the T.E. of the top wing skin has been trimmed 6 3/16" forward of the wing T.E. (the string line) at BL 104, and 5" forward of the wing T.E. at BL 171. Of course, the top wing skin T.E. should be straight between these two points. Refer to Figure 8:C:1.

**Trimming top wing skin T.E.**

Figure 8:C:1



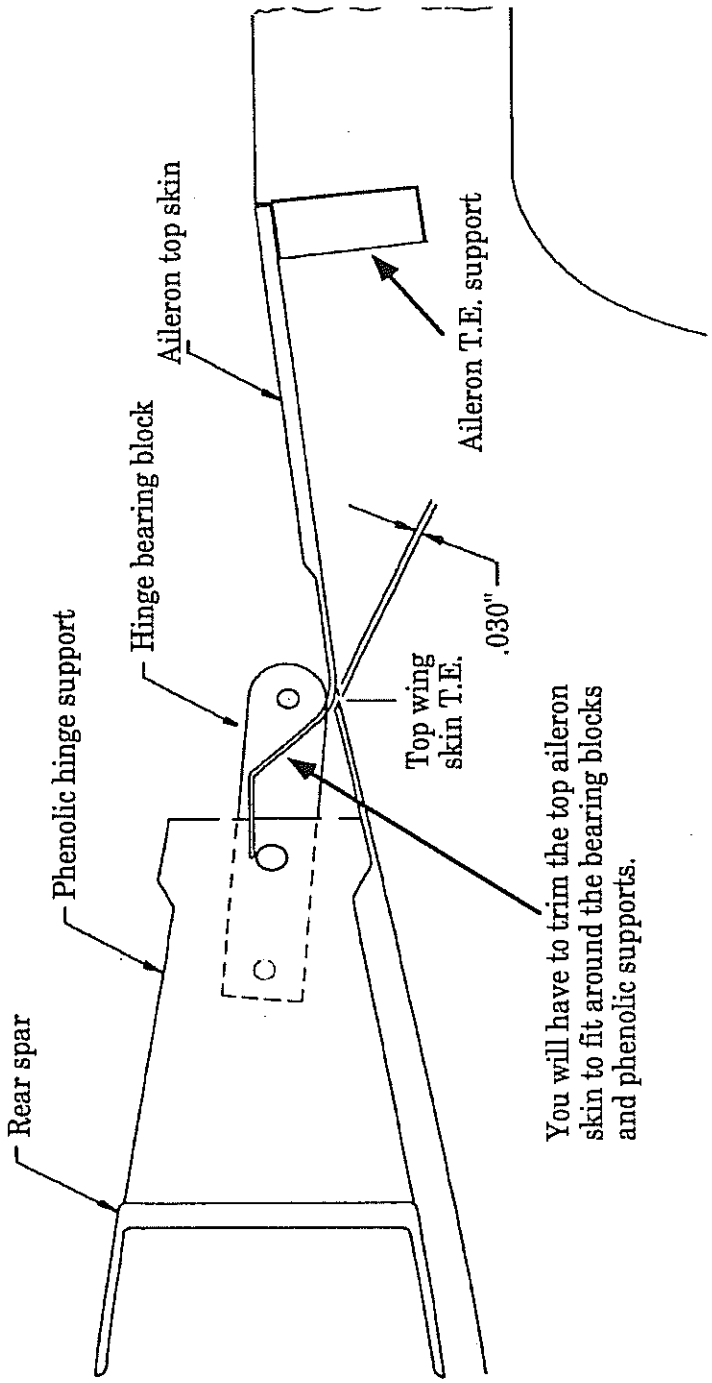
C2. There is a scribe mark on the outer surface of the top aileron skin at BL 104. Use this reference mark to position the aileron spanwise on the wing jig.

Note: Some early production aileron skins will not have the scribe marks at BL 104. Position these skins so the excess carbon fiber is equal on both the outboard and inboard ends of the aileron.

C3. Proper fore/aft positioning of the top aileron skin is important for aileron geometry. You will use the top aileron skin positioning guides provided in the kit to obtain this geometry. First you must trim the top aileron skin around the hinge locations so you can push the skin forward until there is a .030" gap between the top wing skin T.E. and the aileron. This .030" gap will get the top aileron skin close to it's final position. The guides will dictate that final position in the next step.

## Positioning the top aileron skin on wing jig

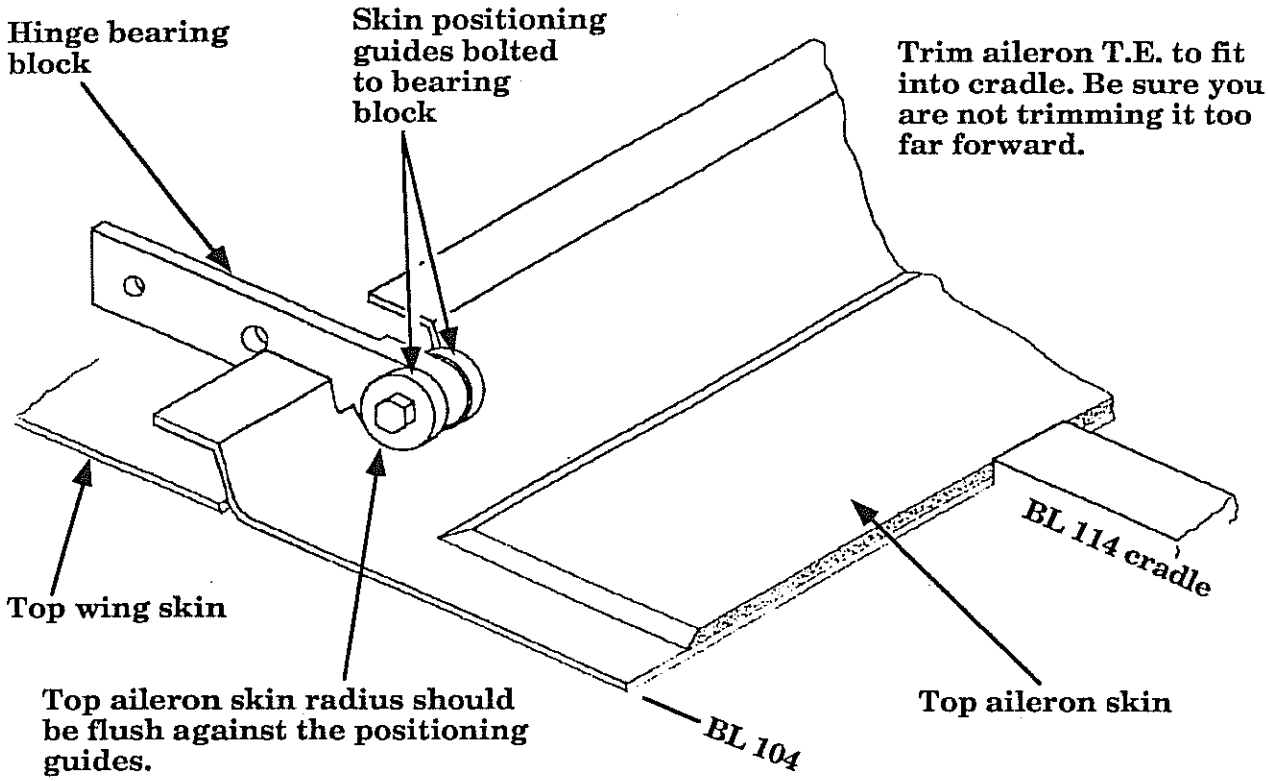
Figure 8:C:2



C4. Bolt the aileron skin positioning guides on both sides of each hinge bearing block, as shown in Figure 8:C:3. These guides will properly position the top aileron skin radius with the hingeline. Adjust the aileron skin fore/aft if necessary so the guides are flush against the inside radius. You can now trim the aileron skin T.E. so it will rest in the jig cradle.

**Positioning the top aileron skin w/ guides**

Figure 8:C:3




**Note: The aileron skin positioning guides are also used at the middle and outbd hinge locations.**

C5. When satisfied with your top aileron skin location, use a few small dabs of Bondo to hold the top aileron skin to the wing jig cradles and the aileron T.E. support. You can now remove the skin positioning guides.

C6. You should hold off on trimming the ends of the ailerons to length until the ailerons have been closed out. The excess material on the outboard end of the top aileron skin acts as a support for the aileron during construction by resting on the BL 171 jig cradle. Details on trimming the end of the ailerons will be given in Section I. of this chapter.

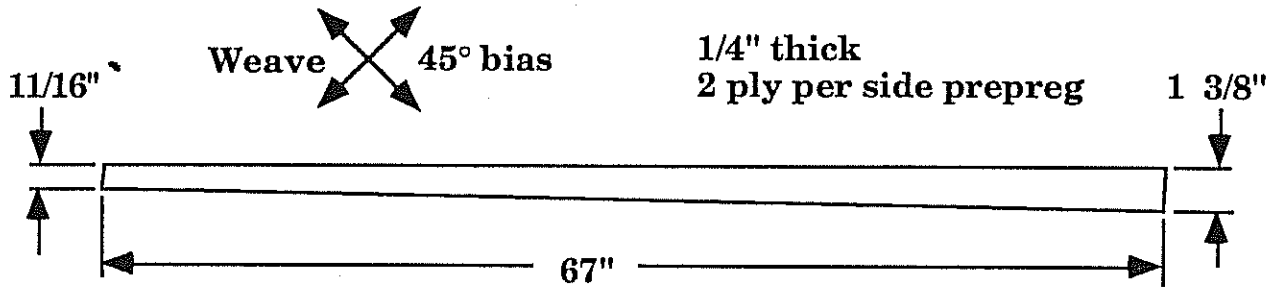
## D. INSTALLING AILERON SPAR

The aileron spars are installed using the same method as the elevator spars. A 3 layer duct tape spacer is inserted between the aileron hinges and the spars while the spars are microed in place. This spaces the spars aft so you can add the 2 BID to the forward spar faces without changing any of your aileron dimensions.

D1. Cut the aileron spars from the 2 ply per side E-glass prepreg panel. As usual, cut the spar on a 45° bias. Refer to Figure 8:D:1.

**Cutting aileron spar from prepreg panel**

Figure 8:D:1

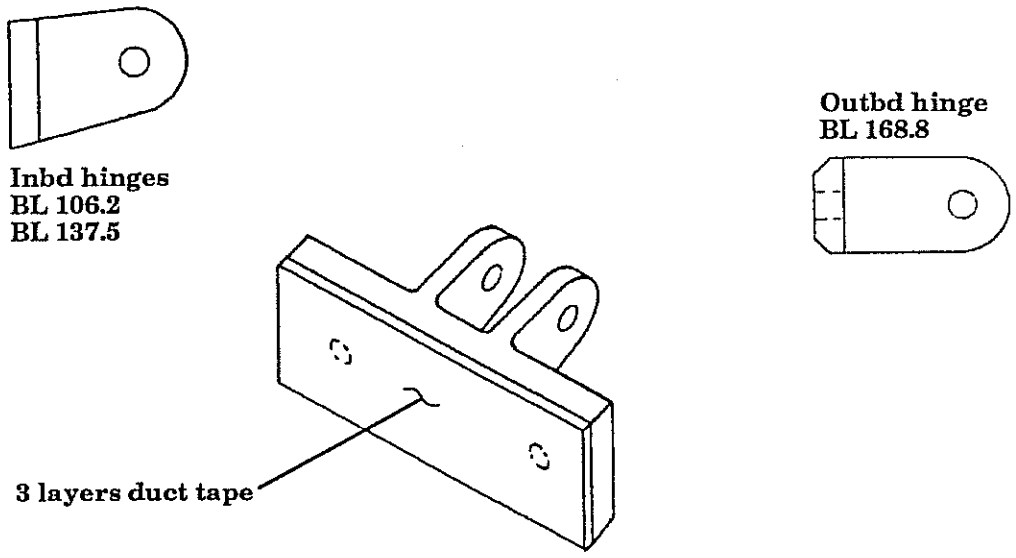



**Make two aileron spars**

D2. Bolt the aileron hinges to their respective hinge bearing blocks. There are two sizes of aileron hinges. The outboard hinge is smaller due to the decreasing height of the aileron spar. The middle and inboard hinges are identical. See Figure 8:D:2 for views of both hinge types.

D3. Apply 3 layers of duct tape to the aft faces of all aileron hinges. Refer to Figure 8:D:2.

**Duct tape spacers on aileron hinges**
**(Hinges shown right side up)**
Figure 8:D:2



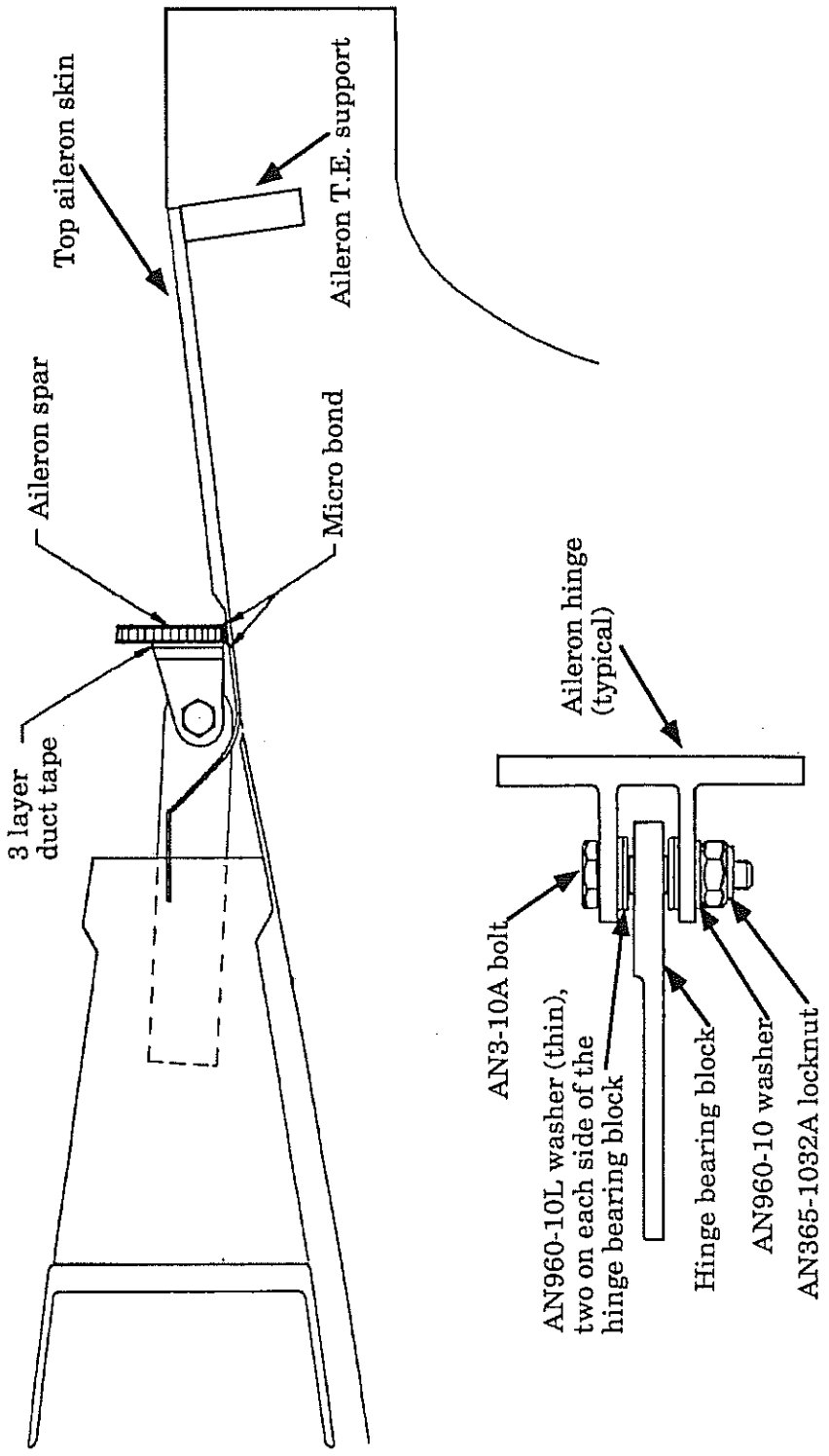

D4. Rest the spars flat against the aft faces of the aileron hinges. The spar faces should be within a few degrees of true vertical. For now, the ends of the aileron spar should be aligned with the ends of the aileron at BL 104 and BL171. Later the spar will be trimmed flush with the inboard and outboard aileron ribs. Mark the outline of the spar on the top aileron skin. Remove the spar and sand the area of the top aileron skin where the spar will be bonded.

D5. Rout 1/8" of core from the bottom of the aileron spar.

D6. With MC, clean the areas of the spar and top aileron skin that will be bonded. Refer to Figure 8:D:3.

## Bonding in the aileron spar

Figure 8:D:3



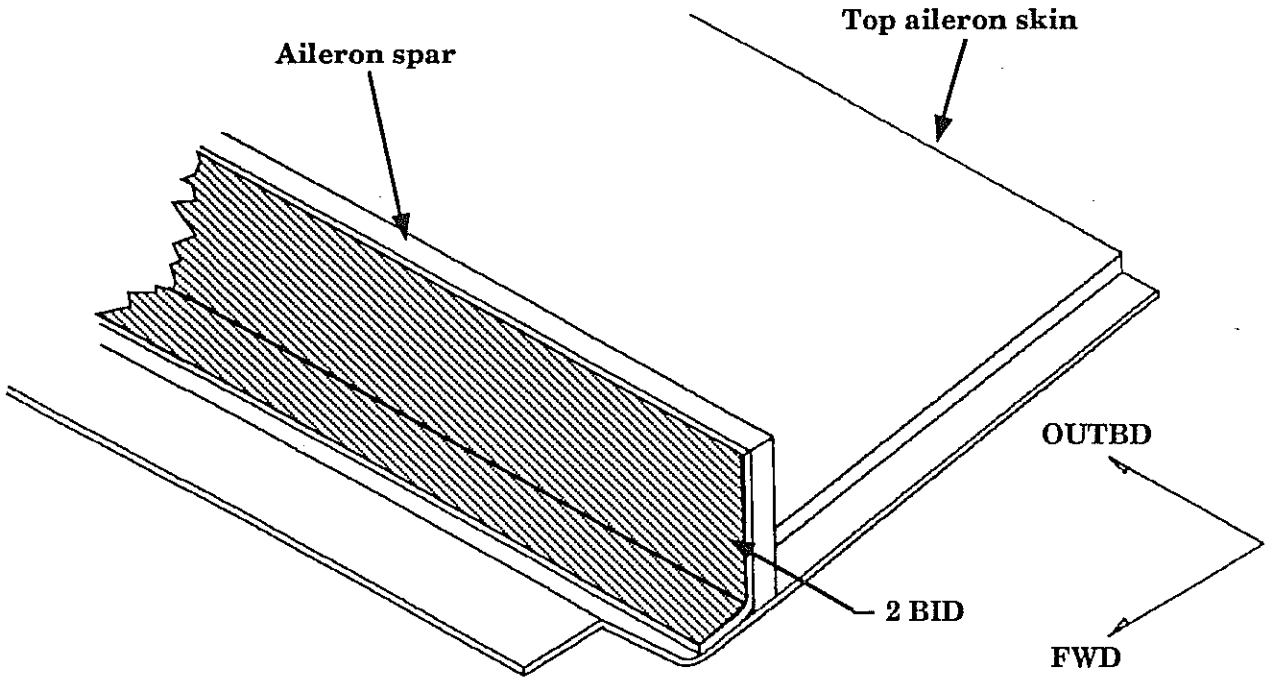
D7. Bond the spar to the top aileron skin with micro. Clamp the spar flat against the aft faces of the aileron hinges while the micro cures. To hold the spar against the top aileron skin, use only a few pounds (3 to 5) of weight. It is important to position this weight ONLY over the BL 114, BL 147 and BL 171 jig cradles. If you center the weight between the cradles, where the top aileron skin is unsupported, you risk warping the aileron permanently. Either way, double check that your aileron is straight directly underneath the aileron spar location.

D8. After the micro has cured the aileron spar in position, remove the clamps, hinges and weights.

D9. Sand the forward face of the aileron spar and the top aileron skin 1" forward of the spar. Clean the spar and skin with MC.

D10. Apply 2 BID to the forward face of the aileron spar, overlapping 1" onto the top aileron skin. Be sure the 2 BID covers the entire forward face of the aileron spar. You can now remove the 3 layers of duct tape from the aft faces of the aileron hinges. Refer to Figure 8:D:4.

**Applying 2 BID to forward face of aileron spar**
Figure 8:D:4



D11. Glass to glass areas must be formed on the aft side of the aileron spar for the aileron hinge mounting areas and the actuator arm mounting area. Remove the aft laminate and core of the aileron spar where indicated in Figure 8:D:5. Sand the aft face of the aileron spar, including the core removal areas, and the aileron skin 1" behind the spar. Clean the sanded areas with MC.

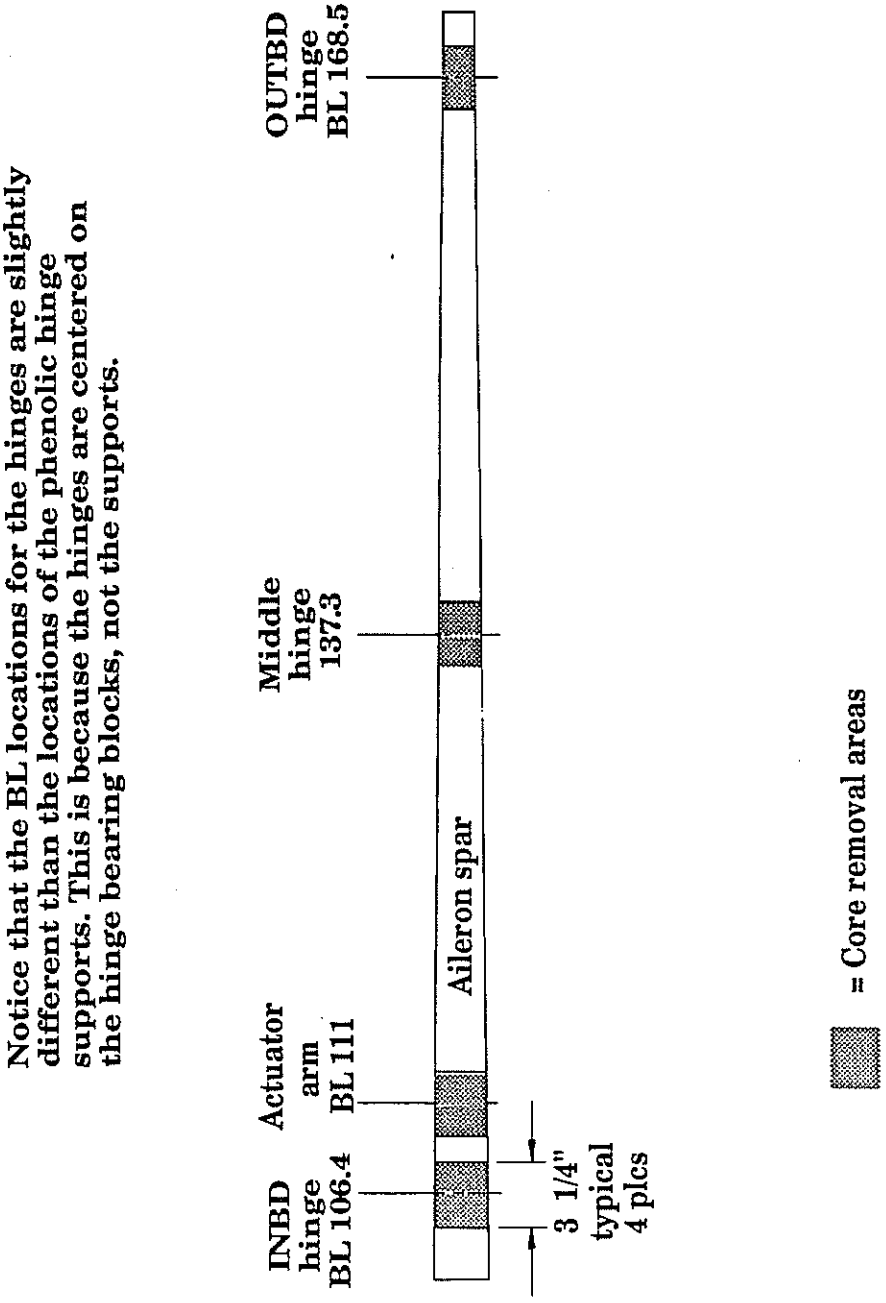
D12. Fill the exposed core in the hinge and actuator arm mounting areas with micro.

D13. Apply 2 BID to the aft face of the aileron spar, overlapping 1" onto the aileron skin. See Figure 8:D:6.

D14. Apply an additional 4 BID patch to the hinge and actuator arm mounting areas, overlapping 1" onto the top aileron skin and the areas of the aileron spar that still contain core. See Figure 8:D:6.

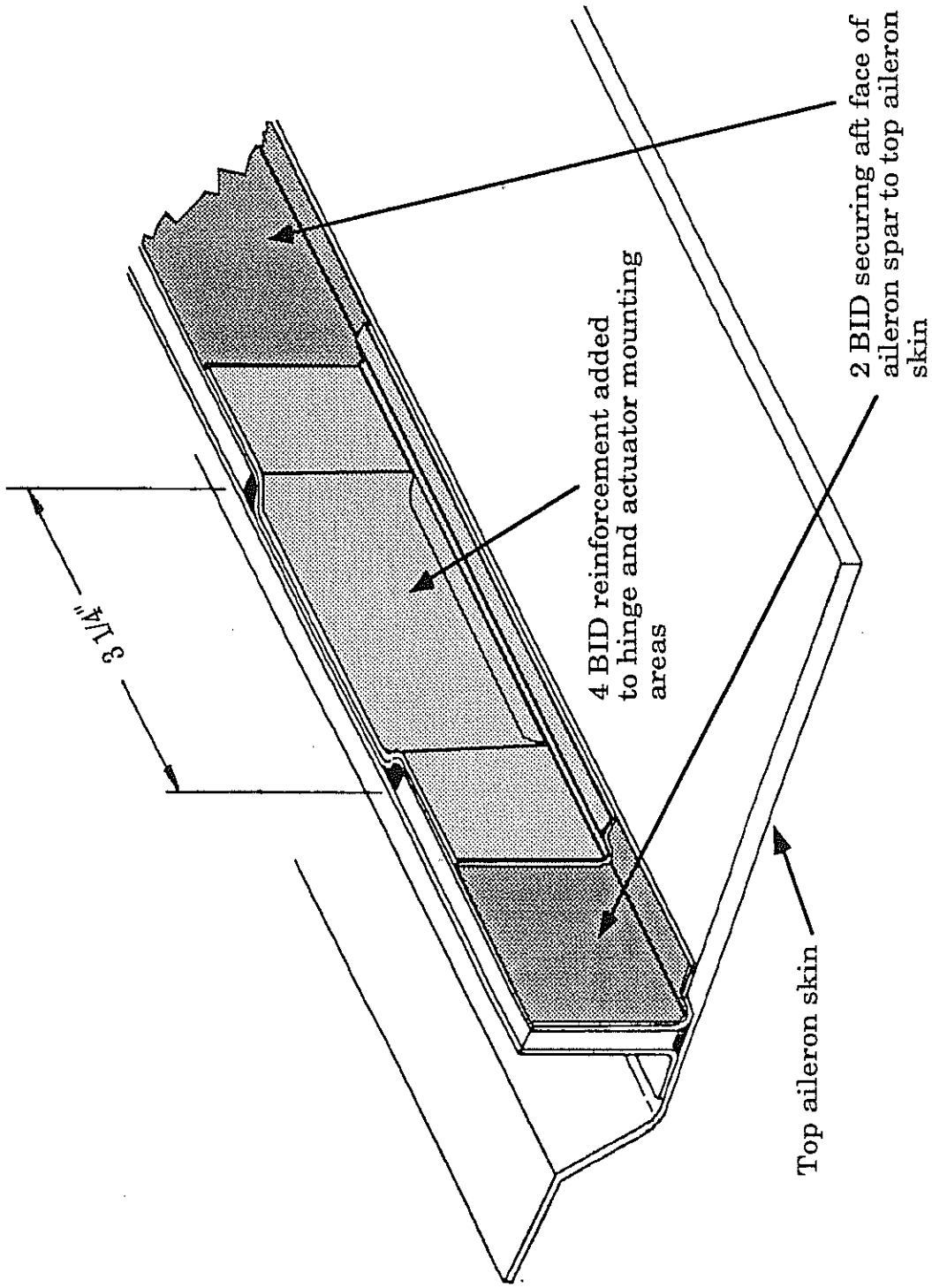
## Core removal area for actuator arm and hinges

Figure 8:D:5



## 4 BID hinge and actuator arm area reinforcements

Figure 8:D:6

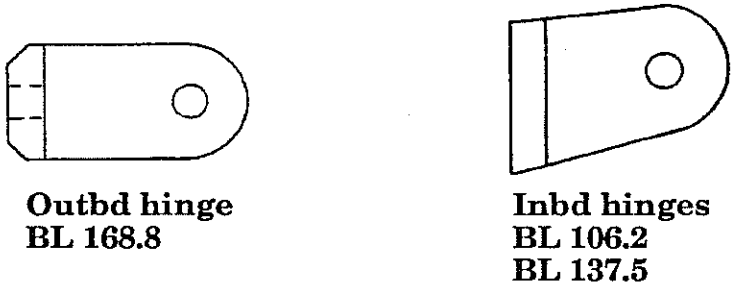


D15. Trim away the excess glass from the aileron spar. The inboard and outboard ends of the spar will be trimmed to final length after installation of the aileron ribs. The final spar height will be determined when the bottom aileron skin is fit in Section G.

## E. MOUNTING AILERON HINGES AND ACTUATOR ARM

For each aileron there are three hinges bolted to the aileron spar. Again, the outboard aileron hinge is slightly smaller due to the decreasing aileron spar height. The middle and inboard aileron hinges are identical.

**Aileron hinges**
Figure 8:E:1



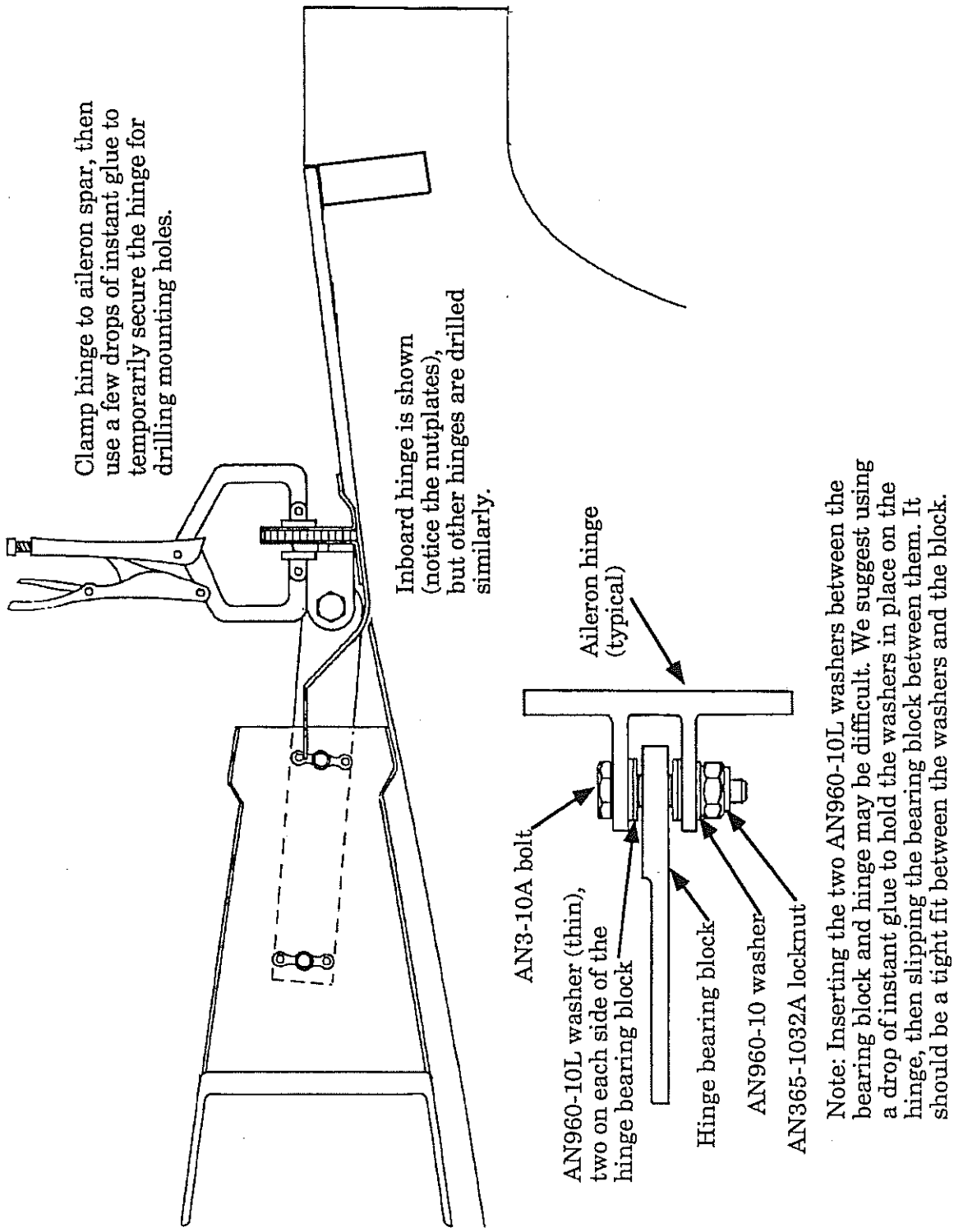
**Outbd hinge**
**BL 168.8**

**Inbd hinges**
**BL 106.2**
**BL 137.5**

E1. The 3 layer duct tape spacer you used to position the spar should roughly equal the thickness of the 2 BID used to secure the forward face of the spar to the top aileron skin. Try sliding the aileron hinges in place, then sliding the AN3-7A hinge bolts through the hinges and hinge bearings. The aileron hinges should rest flat against the aileron spar and the hinge bolts should slide easily through the hinges and hinge bearings. If one hinge bolt doesn't want to slide into place easily, chances are that all the hinge bolts will be the same way. This is probably due to a difference in thickness of the 3 layer duct tape spacer and the 2 BID laminate. The best way to fix this hinge/bearing misalignment is to break the top aileron skin free from the wing cradle, adjust the skin fore/aft, and insert the hinge bolts. Clamp the aileron hinges to the aileron spar and weight the aileron skin back down on the jig. The mismatch should never be over a few thousandths of an inch. Don't reattach the aileron skin to the cradle with Bondo yet, you'll be removing and reinstalling the aileron in the next step.

## Positioning aileron hinge

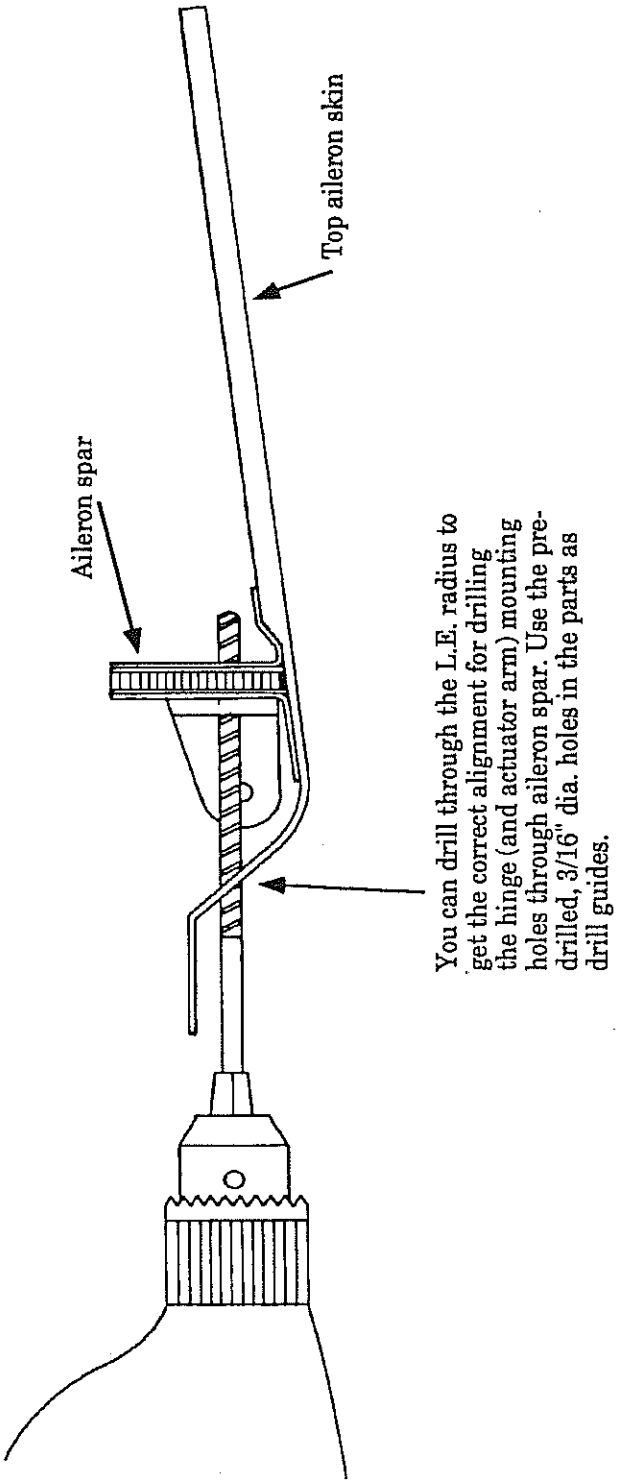
Figure 8:E:2



E2. Use the predrilled mounting holes in the aileron hinges as guides to drill through the aileron spar for the AN3-5A mounting bolts. Use a #12 drill. For ease of drilling, it is suggested that you use a few drops of instant glue to hold the hinge in position on the aileron spar, then remove the aileron from the wing. You can drill through the leading edge radius of the top aileron skin to get a straight shot at the predrilled mounting holes. Refer to Figure 8:E:3.

## Drilling hinge mounting bolt holes

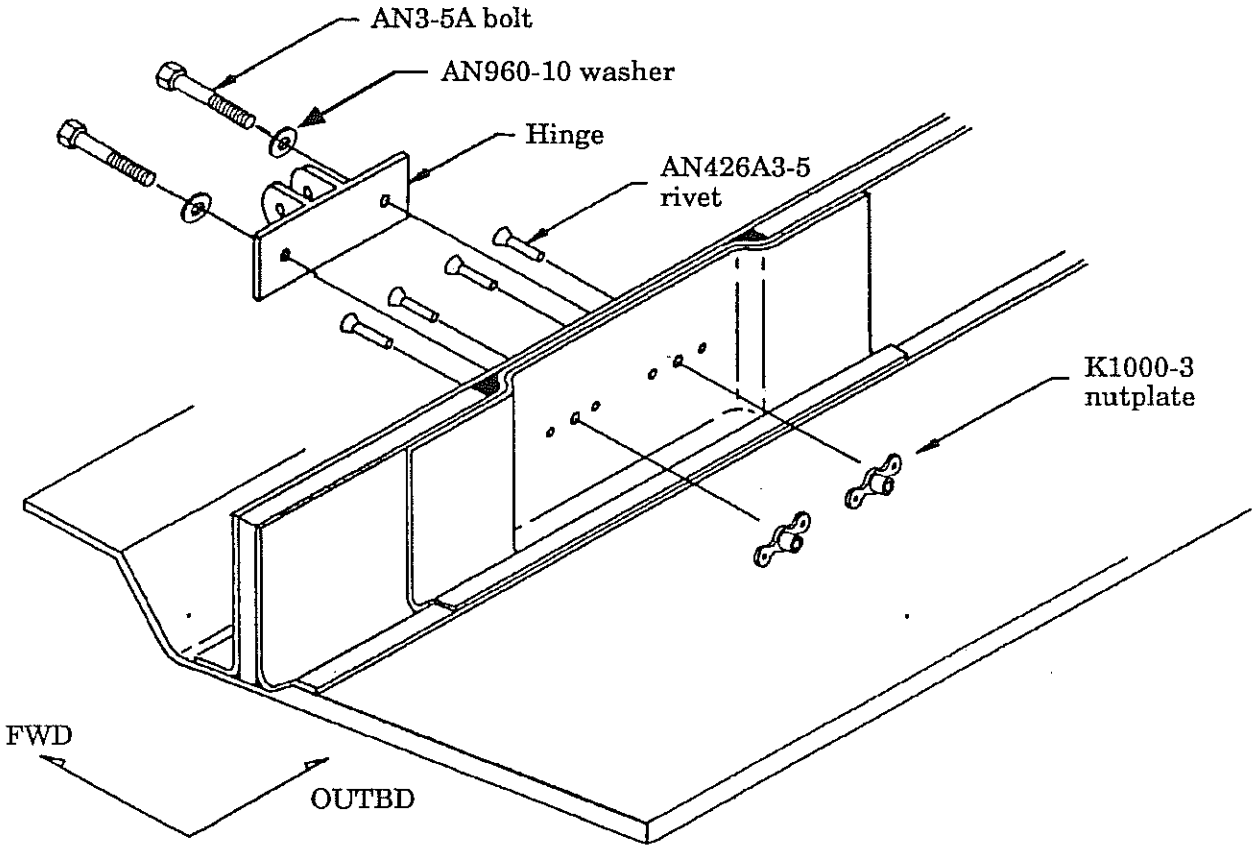
Figure 8:E:3



E3. K1000-3 nutplates must be installed on the aft face of the aileron spar at each hinge mounting bolt hole location. There are two methods of installing the aileron hinge nutplates to the spar:

Method #1: If you're very handy with a countersink and rivet gun, you can go ahead and mount the nutplates using AN426A3-5 rivets as shown in Figure 8:E:4. Unfortunately, it's nearly impossible to properly countersink and squeeze the nutplate rivets due to the leading edge radius of the top aileron skin.

**Method #1 of installing aileron hinge nutplates**
Figure 8:E:4

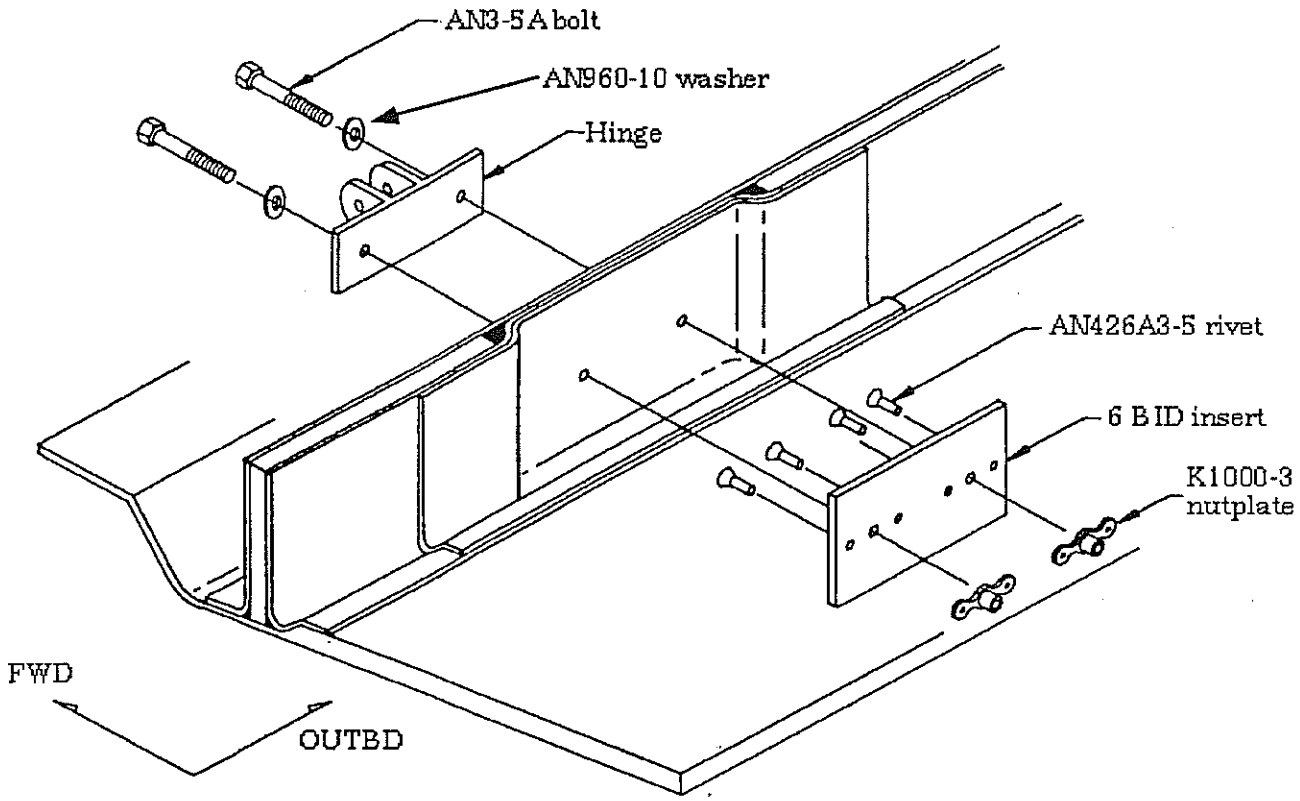


Method #2: An easier method of mounting the nutplates to the aileron spar is to rivet the nutplates to a small piece of the 6 BID E-glass sheet, then bond the piece to the aileron spar. Use the aileron hinges as guides to cut three pieces of the 6 BID E-glass sheet for each aileron. Also use the mounting bolt holes in the hinges as guides to drill two #12 holes through each 6 BID piece. Center the nutplates on these holes and secure the nutplates to the 6 BID piece with AN426A3-5 rivets. Sand the 6 BID pieces and clean with MC. Use the hinge mounting bolts to line up the 6 BID nutplate pieces on the aft face of the aileron spar. Bond the 6 BID pieces to the spar with flox. Be careful not to get flox in the nutplate threads. Refer to Figure 8:E:5.

NOTE: When you bond the 6 BID nutplate piece to the spar, be sure to have the aileron hinges bolted to their hinge bearing blocks. This will assure that the hinges are perfectly aligned with the bearings in the future. A slight misalignment may cause the hinges to bind and restrict freedom of aileron movement.

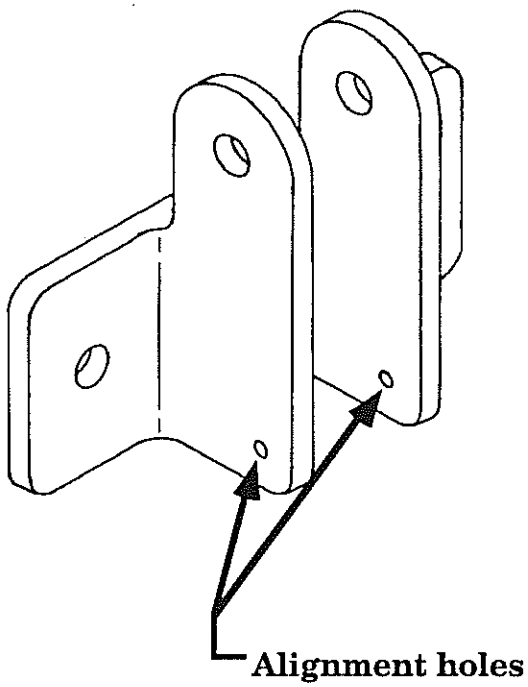
## Method #2 of installing aileron hinge nutplates

Figure 8:E:5




E4. Now you can mount the aileron actuator arm to the aileron spar. Placement of the actuator arm is important (isn't everything?) for proper aileron deflection. Two small alignment holes are drilled in each actuator arm. These alignment holes should be centered on the aileron hinge line. Refer to Figure 8:E:6.

**Aileron actuator arm**
Figure 8:E:6

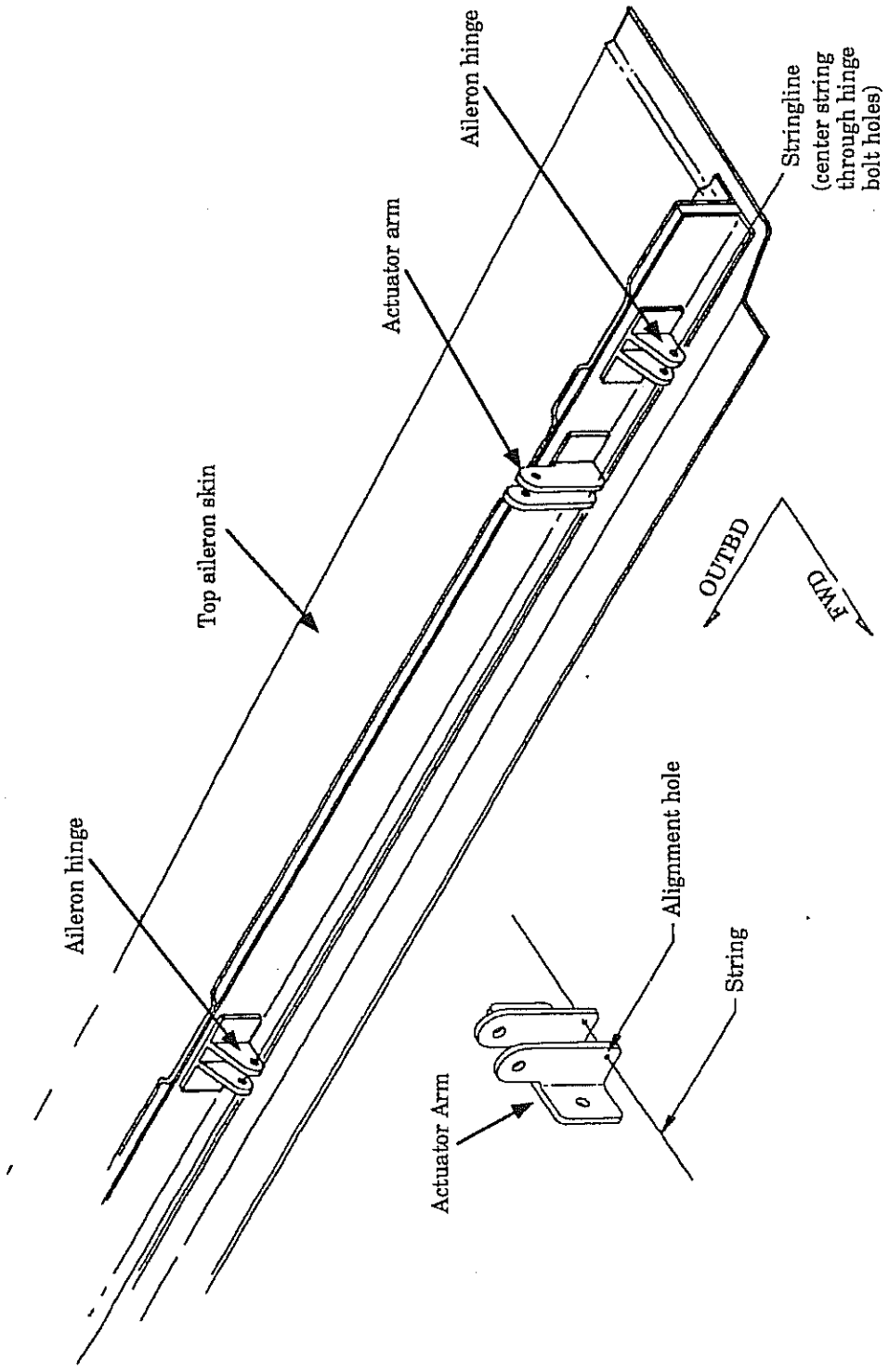



E5. Bolt the aileron hinges to the aileron spar.

E6. Pull a string line through the center of the hinge bolt holes. Position the aileron actuator arm between the inboard and middle hinges and thread the string line through the alignment holes. Be sure the string runs through the center of the hinge line.

## Aligning actuator arm with hinge line

Figure 8:E:7



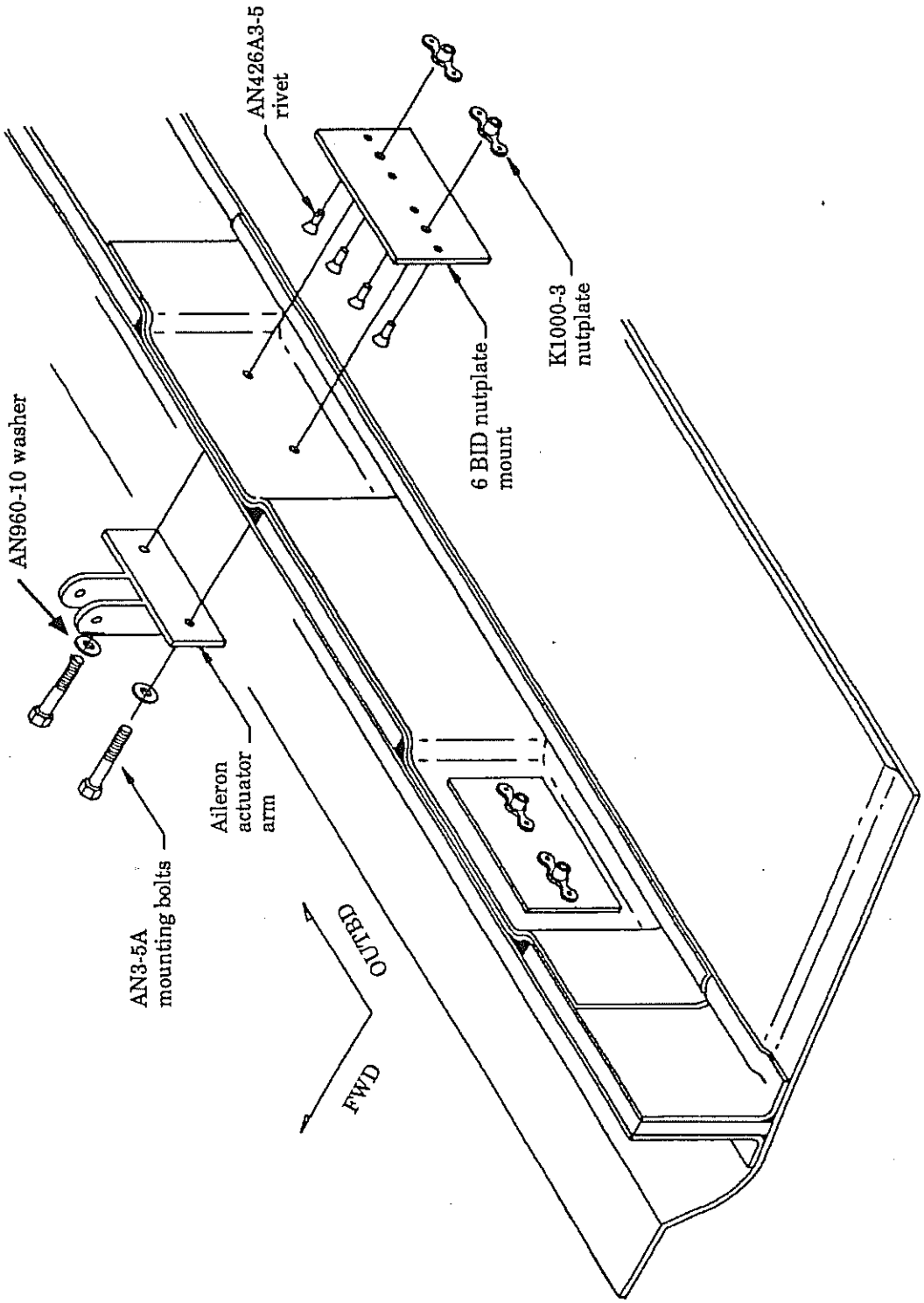
E7. Pull the string taught and adjust the actuator arm so the string runs through the center of the alignment holes. The aft face of the actuator arm should rest flat against the aileron spar. When the actuator arm is located properly, use a few drops of instant glue to temporarily secure it to the aileron spar.

E8. Use the actuator arm pilot holes as guides to drill through the aileron spar with a #12 drill bit. Again, it is okay to drill through the aileron L.E. to attain a straight drill angle on the actuator arm.

E9. Remove the actuator arm from the aileron spar and rivet two K1000-3 nutplates on the aft face of the spar using either method of nutplate mounting described in Step E3.

## Aileron actuator arm mounting

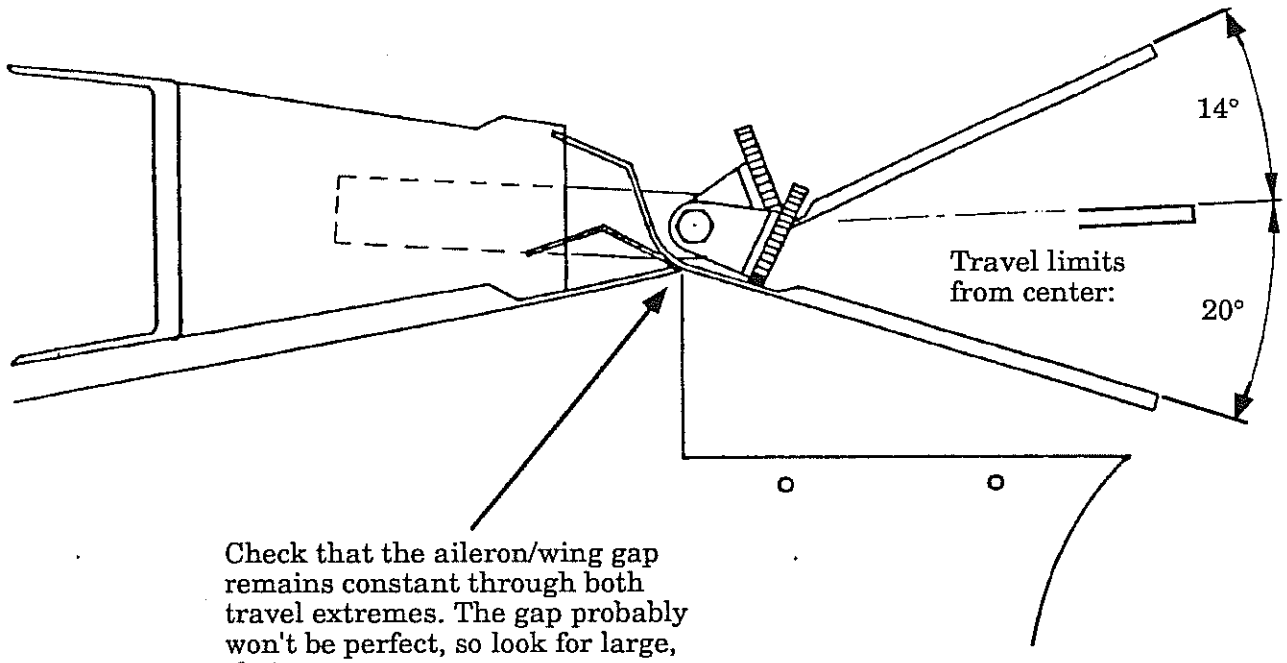
Figure 8:E:8



E10. Reinstall the hinges and actuator arm. Now you can remove the reinforcement plates and the section of the jig under the aileron, then check that your aileron moves smoothly throughout it's travel. You'll have to trim the outboard end of the aileron to BL171 so the outboard wing cradle (BL171) will not interfere with aileron movement. You can also trim the inboard end of the aileron parallel to BL104 (final trimming of the aileron ends will be described later in this chapter).

**Checking aileron travel**

Figure 8:E:9



## F. INSTALLING AILERON RIBS

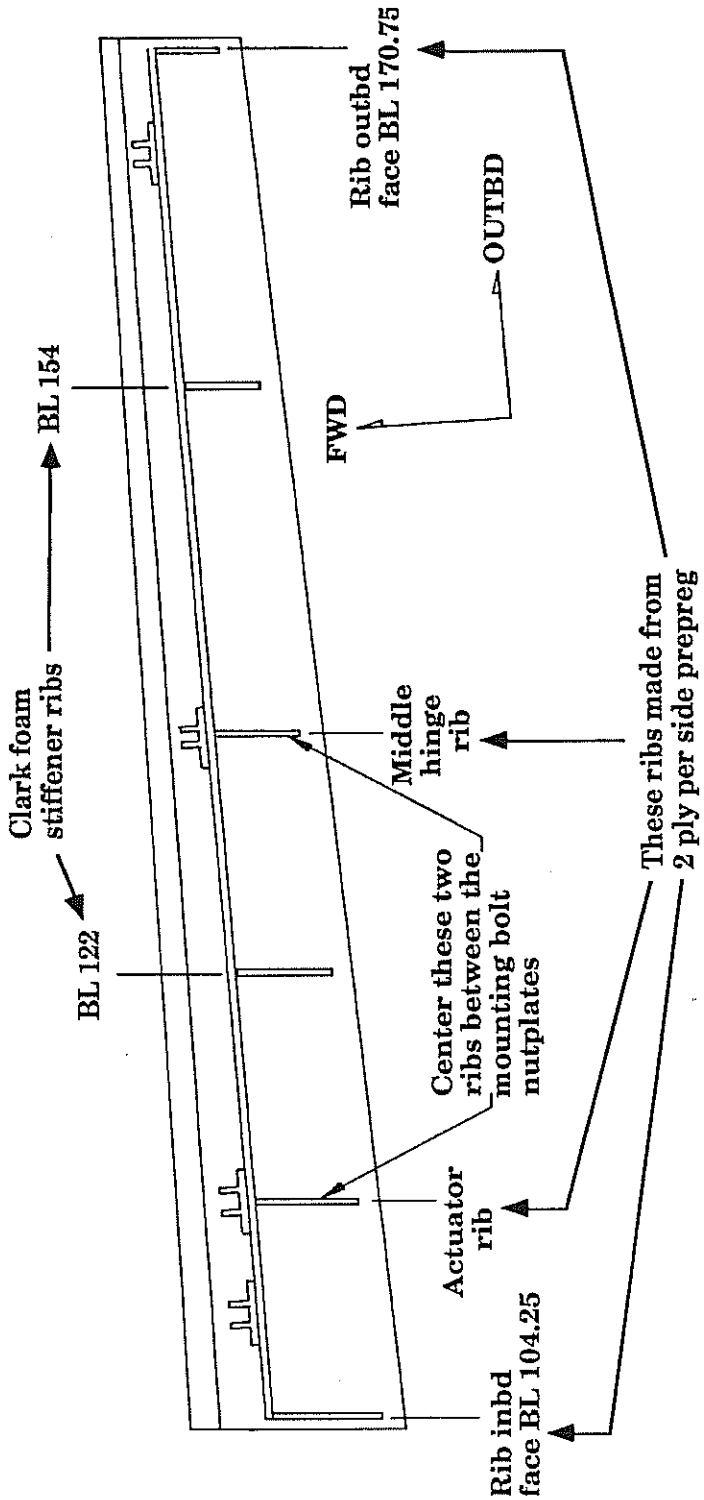
There are six ribs in each aileron, one supporting each hinge, one behind the actuator arm, and two foam stiffener ribs. They are small but necessary parts of the aileron structure, so take care in cutting out and working with these pieces.

F1. Use the templates provided on Blueprint A-20**S** to cut the six aileron ribs. Four of the ribs are made from 2 ply per side E-glass prepreg and the other two ribs are Clark foam. As always, cut the four prepreg ribs on a 45° bias to the weave. Cut the ribs a bit bigger than the templates so you can trim them to fit.

F2. Custom fit the aileron ribs at the locations given in Figure 8:F:1. The inboard and outboard aileron hinge ribs are located 1/4" in from the edges of the aileron. The actuator arm rib and middle hinge rib are centered between the mounting bolt holes. All ribs are oriented 90° to the top aileron skin, not true vertical.

## Locating aileron ribs

Figure 8:F:1



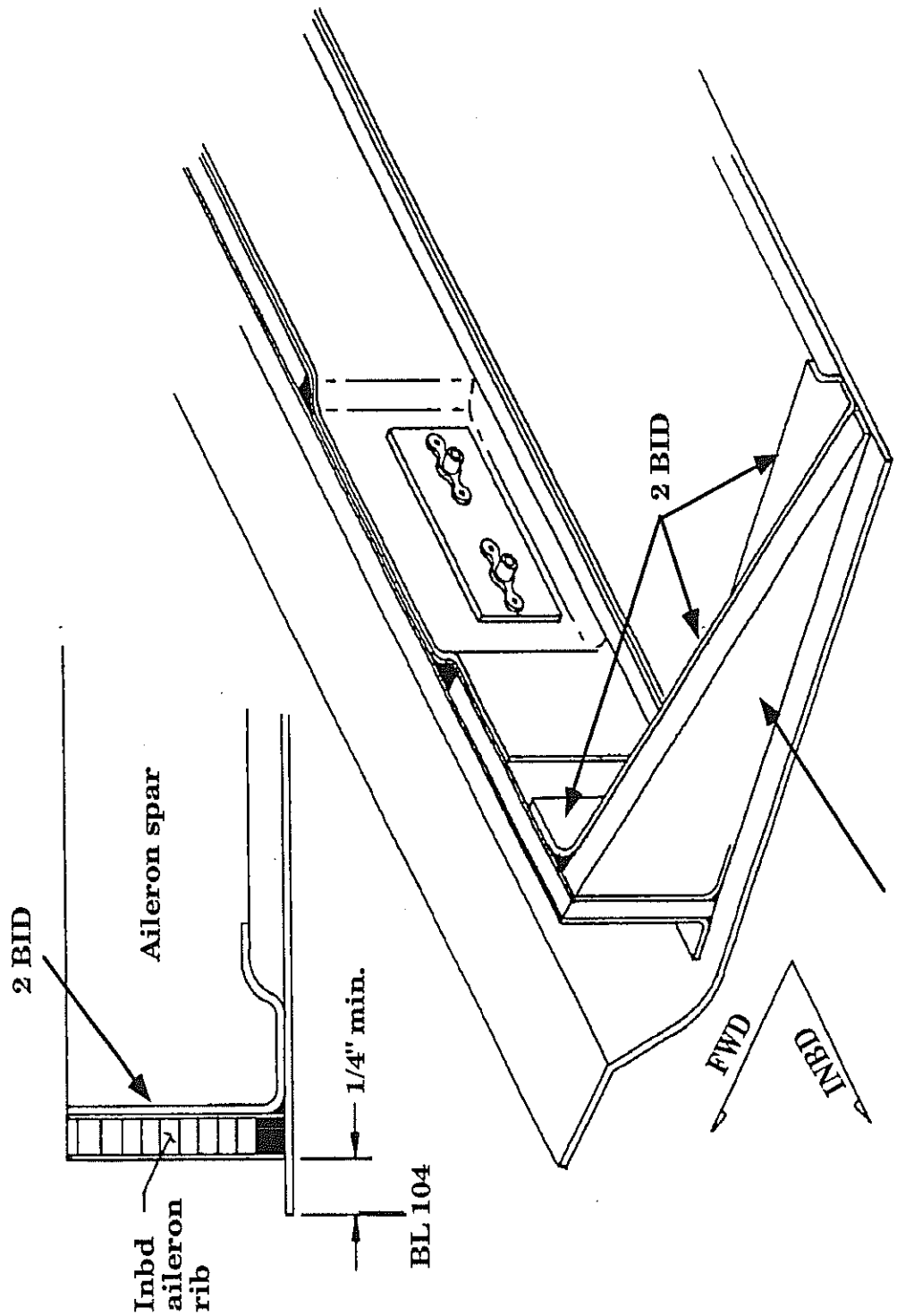
F3. Sand both surfaces of the four prepreg aileron ribs and the areas of the top aileron skin where the ribs will mount. Remove the core from the four prepreg ribs to form a 1/8" deep trough where the ribs will bond to the top aileron skin and the spar. Clean all bonding surfaces with MC.

F4. Bond the ribs in position with micro. Form a 1/8" micro radius where the ribs join the top aileron skin and the spar.

F5. Trim the aileron spar flush with the inboard and outboard ribs. Refer to Figure 8:F:2.

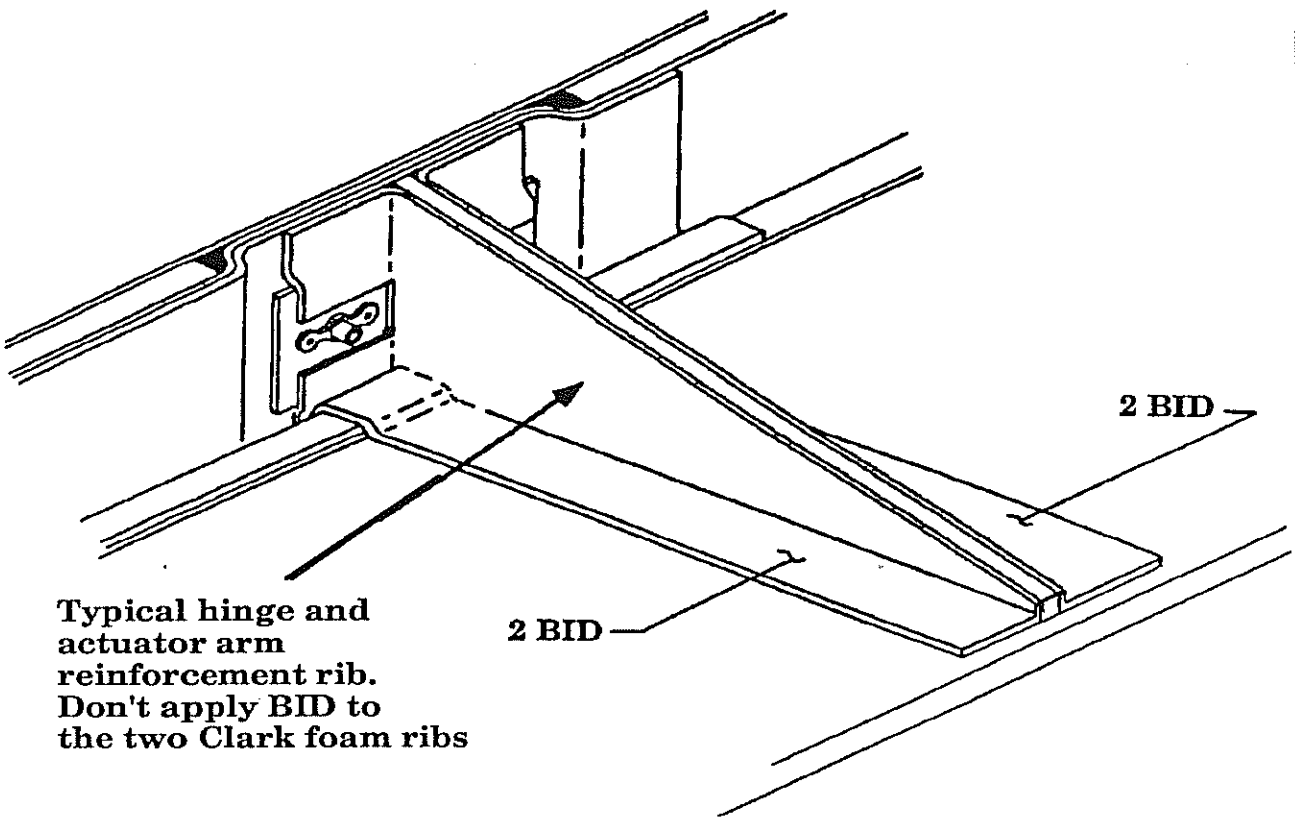
## Trimming aileron spar flush to ribs

Figure 8:F:2



F6. Apply 2 BID to both sides of the middle hinge and actuator arm ribs, covering the entire side of each rib and overlapping 1" onto the top aileron skin and spar. Refer to Figure 8:F:3. Secure the end ribs to the top aileron skin with 2 BID as shown in Figure 8:F:2. There are no BID tapes necessary to secure the Clarkfoam stiffener ribs.

**Securing aileron ribs with 2 BID**
Figure 8:F:3

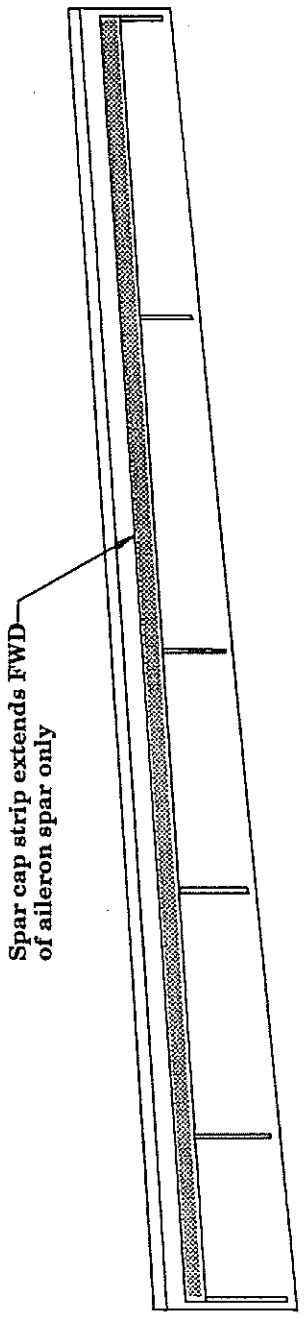



F7. Trim away the excess glass from the ribs. The ribs should be close to their final size, but additional trimming may be done in the next section, "Aileron Capstrips".

## G. AILERON CAPSTRIPS

A capstrip is needed only on the aileron spar. A flox release is done on the ribs to get a close fit for final bonding.

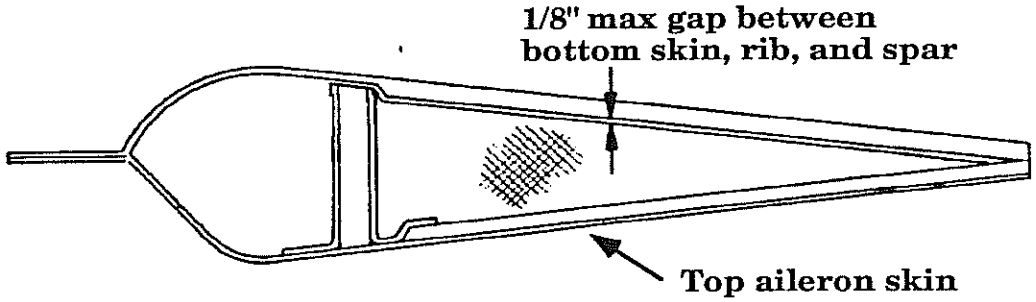
**Aileron Capstrips**
Figure 8:G:1



G1. Sand down the aileron spar and ribs until the bottom aileron skin L.E. flange rests flush on the top aileron skin L.E. flange and the top and bottom trailing edges touch. This is a good time to thrim the bottom aileron skin T.E. flush with the top skin T.E. You should be able to press on the bottom aileron skin and feel a slight give before hitting the ribs and spar. You can also lay the bottom wing skin in position and check the height of the aileron.

**Fitting the bottom aileron skin**

Figure 8:G:2




G2. Lay a straight edge on the aileron spar and be sure the spar is straight. Sand if necessary.

G3. Grind out the core to form a 1/8" - 1/4" deep trough in the spar and ribs.

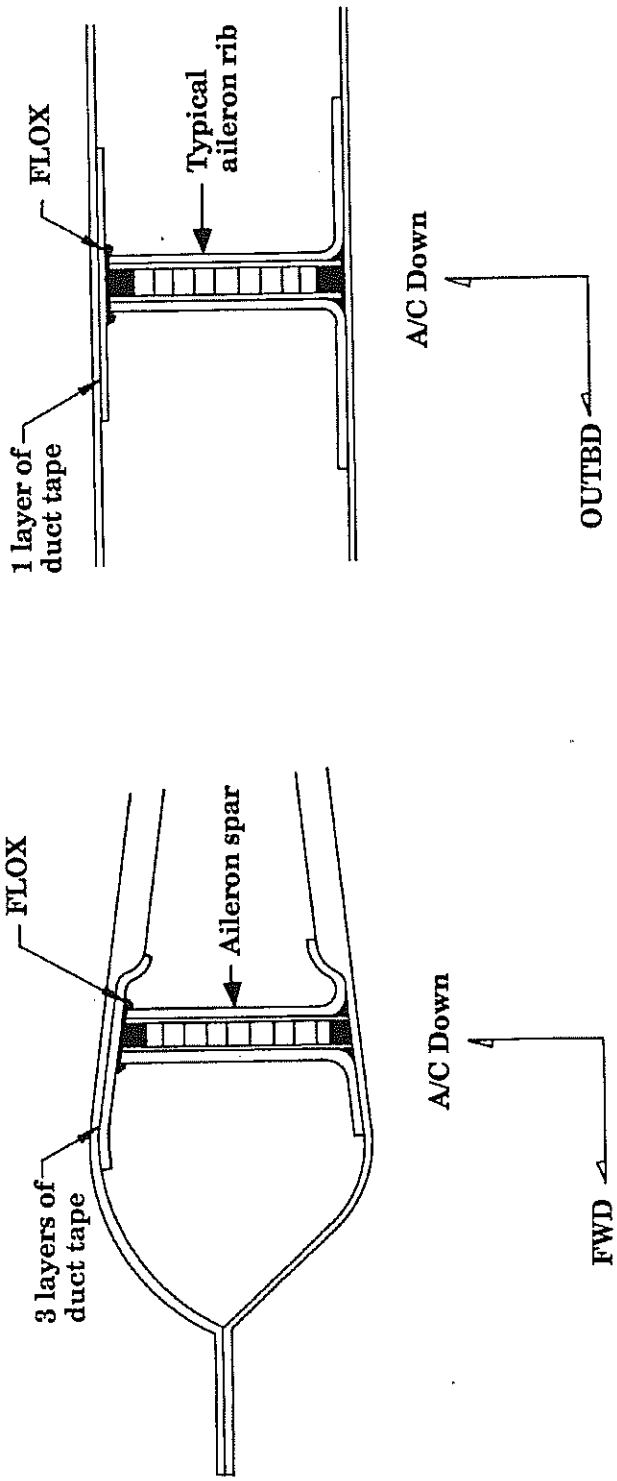
G4. Apply 3 layers of duct tape to the inside of the bottom aileron skin, centered where the skin contacts the aileron spar. You need only apply one layer of duct tape as a release over the hinge rib and actuator rib areas.

G5. Fill the troughs in the aileron spar and ribs with a sticky epoxy/flox mixture. The flox should be mounded 1/4" above the spar and ribs.

G6. Position the bottom aileron skin on the top. Treat this procedure as you would when you close the aileron for the last time. Be sure the bottom aileron skin is straight when the bottom and top skin flanges and T.E.'s are resting against each other.

## Flox release on aileron spar and ribs

Figure 8:G:3



G7. After the flox has cured on the aileron and spar ribs, remove the bottom aileron skin.

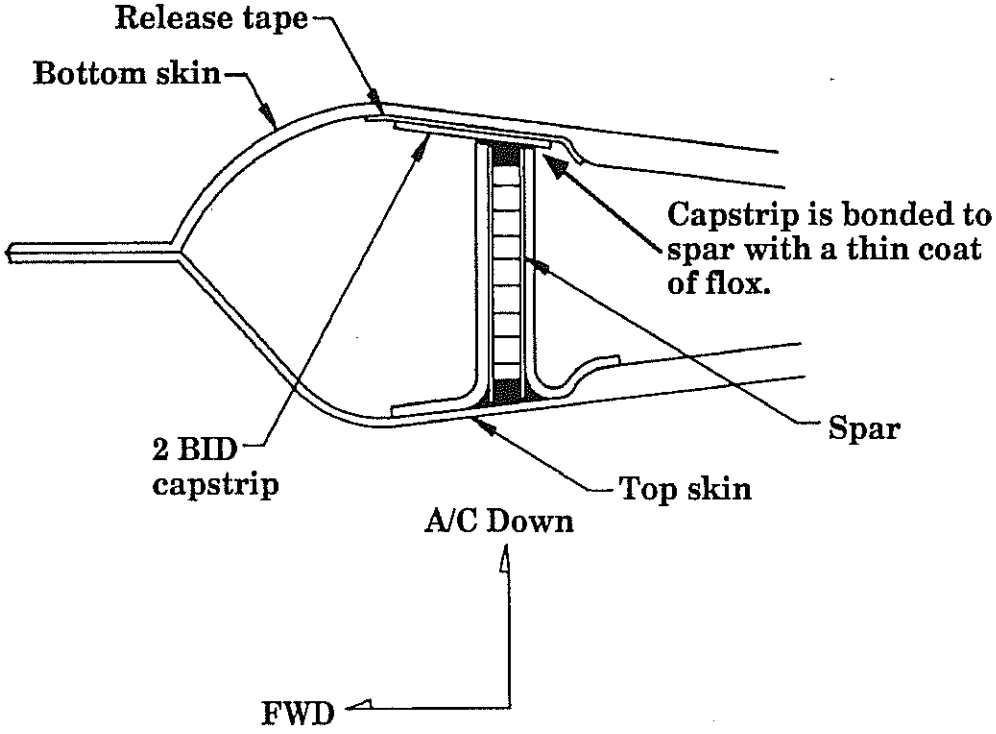
G8. Sand the excess flox until it is flush with the sides of the aileron spar and ribs.

G9. Remove all of the duct tape from the inside of the bottom aileron skin. Reapply one layer of duct tape on the bottom aileron skin where it will contact the aileron spar.

G10. Prepare the top of the aileron spar for the capstrip by sanding with #40 grit and cleaning with MC.

G11. Apply a 2 BID, 1 1/2" wide capstrip to the inside of the bottom wing skin where it will contact the aileron spar. Referring to Figure 8:G:4, notice that the spar capstrip is not centered on the spar. Only 1/4" of the capstrip should extend aft of the spar. Apply a thin coat of flox to the top of the aileron spar. Carefully lay the bottom aileron skin in position on the top skin and weight it appropriately. Don't use so much weight that the aileron can sag between the hinges.

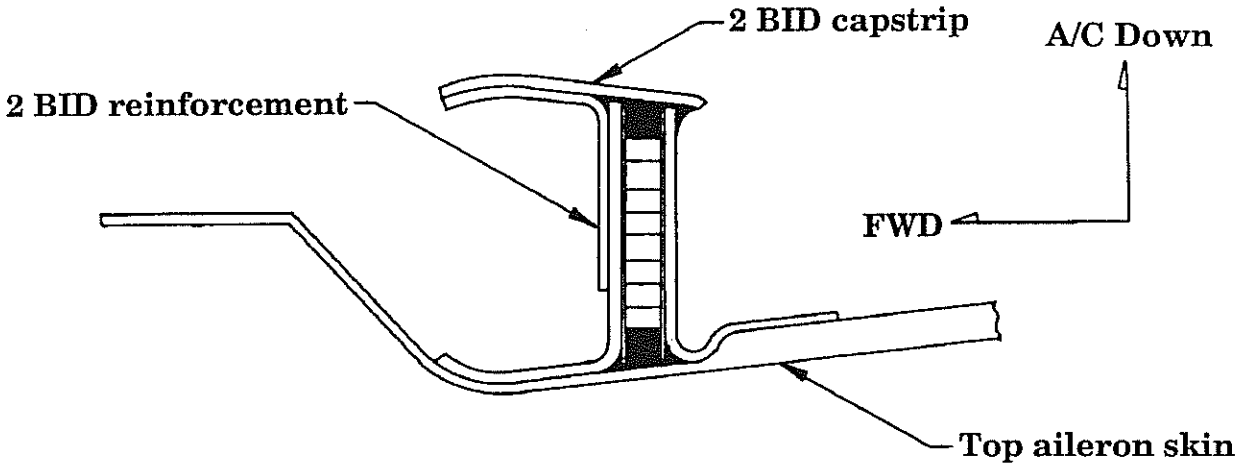
**Aileron spar capstrip**
Figure 8:G:4



G12. After the capstrip has cured in position, remove the bottom aileron skin. Trim the capstrip to 1 1/2" wide.

G13. Sand the aileron spar and under the capstrip where the 2 BID capstrip reinforcement will be applied (refer to Figure 8:G:5). There should be very little flox squeezeout under the capstrip, so you'll probably have to add a small amount of micro to form a 1/8" radius under the capstrip.

**2 BID capstrip reinforcement**
Figure 8:G:5



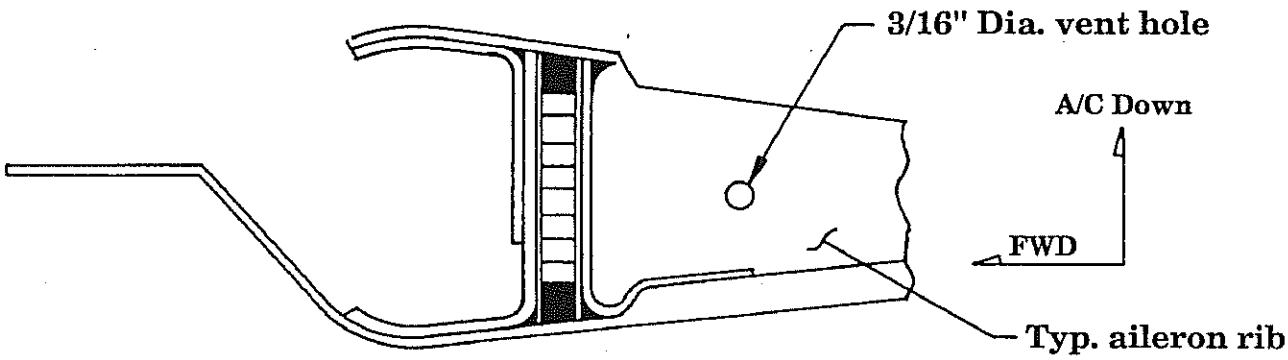

G14. Secure the capstrip to the aileron spar with a 2 BID, 2" wide reinforcement. Trim the 2 BID reinforcement around the hinges and actuator arm so it will not interfere with the flat surface these parts must bolt to.

G15. Trim the excess 2 BID reinforcement even with the edges of the capstrip.

G16. Now is a good time to drill 3/16" diameter vent holes in each of the aileron ribs. Drill the holes 1" aft of the aileron spar, centered heightwise on the ribs. Refer to Figure 8:G:6.

## Aileron vent holes

Figure 8:G:6

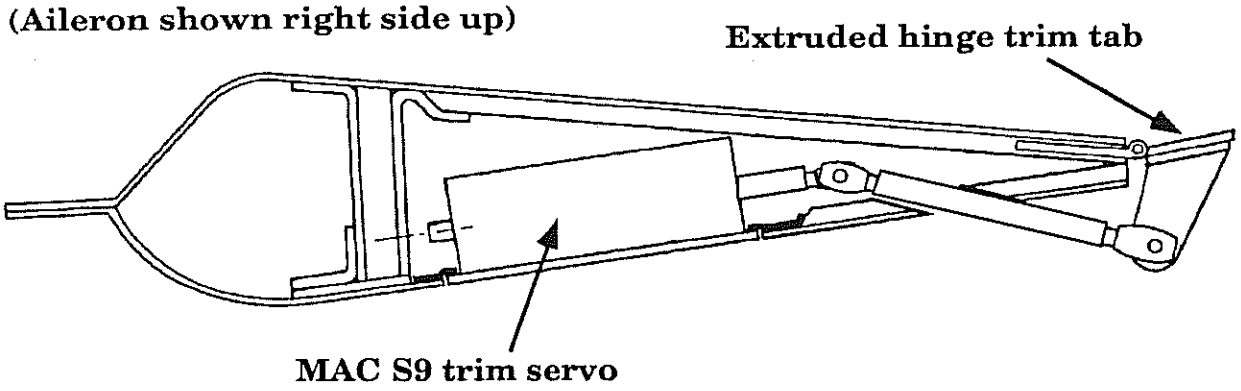



**WARNING:** ALL INTERNAL BAYS MUST BE VENTED. Failure to vent these bays could result in excessive internal pressure at high altitudes and cause structural damage that could result in component failure.

## H. INSTALLING ROLL TRIM SYSTEM

The MAC S-9 electric servo is installed in the left aileron for roll trim control. The servo is connected to a simple, extruded hinge trim tab that is bonded into the trailing edge of the aileron.

**Electric roll trim system**
Figure 8:H:1



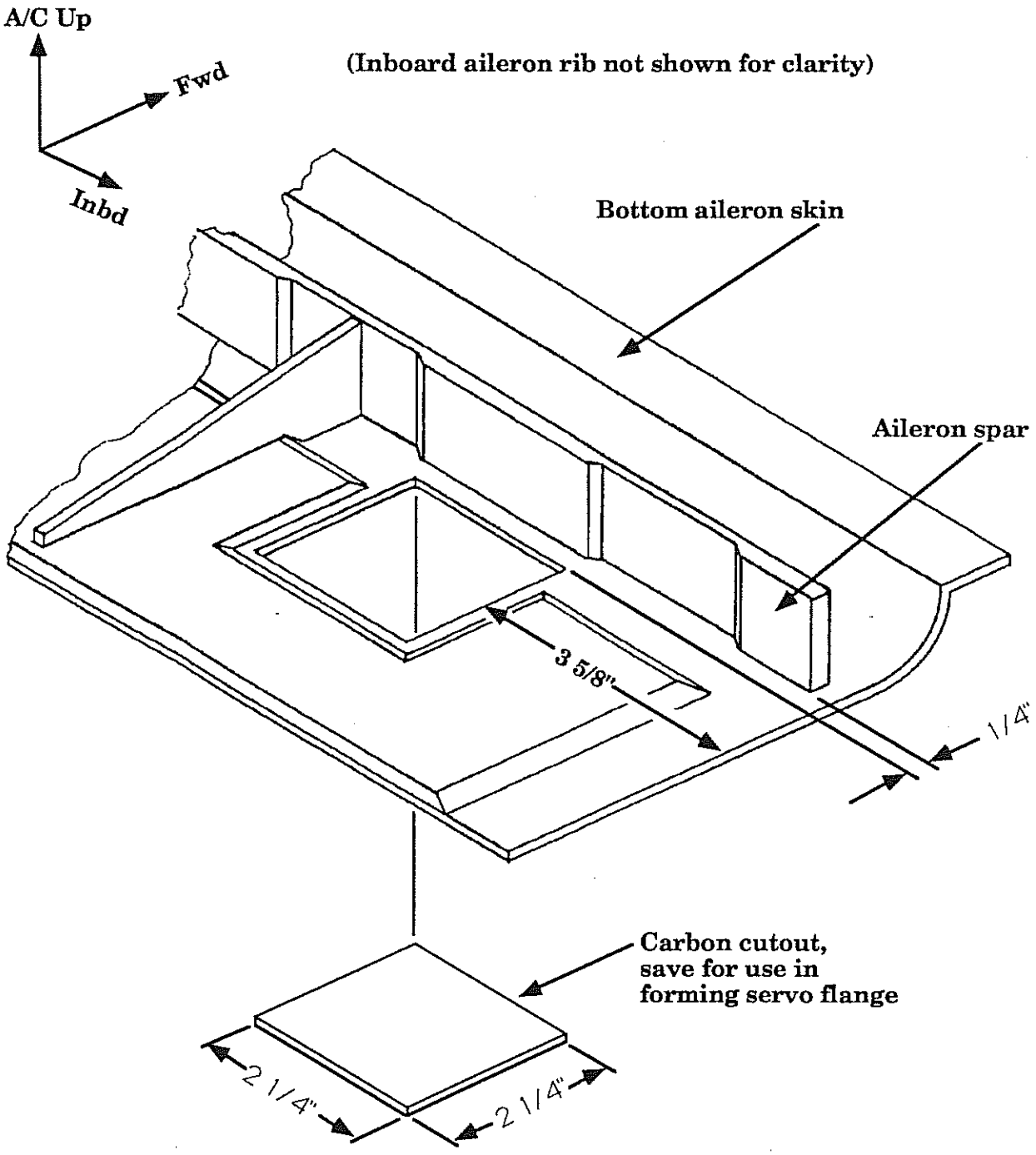

This method of roll trim is more simple than and just as reliable as a cable/pulley/spring system and weighs much less.

Note: On later production aileron skins, the trim tab joggle and flange are already formed in the bottom left skin. This eliminates the need to form a 4 BID fiberglass flange. If you have the newer skins, skip over the servo cutout and flange construction steps.

H1. Mark out the trim servo opening in the bottom aileron skin. Since you have done the releases for the capstrips, you should be able to locate the bottom aileron skin accurately, just as it would be positioned after aileron closeout. Use the dimensions in Figure 8:H:2 to locate the cutout area. The actual location of the servo is not critical as long as it is perpendicular to the T.E. of the aileron.

## Locating servo cutout in bottom aileron skin

Figure 8:H:2




NOTE: The ribs and spar are shown in this drawing to show the orientation of the servo cutout. Because your wing is built upside down, the bottom aileron skin will not be bonded into place yet. For locating the servo cutout, transfer the locations of the spar and ribs to the inside surface of the bottom ail. skin.

H2. Cut out the servo opening in the bottom aileron skin. If you take care and make a thin, clean cut, you won't have to refill the gap between servo flange and aileron skin later.

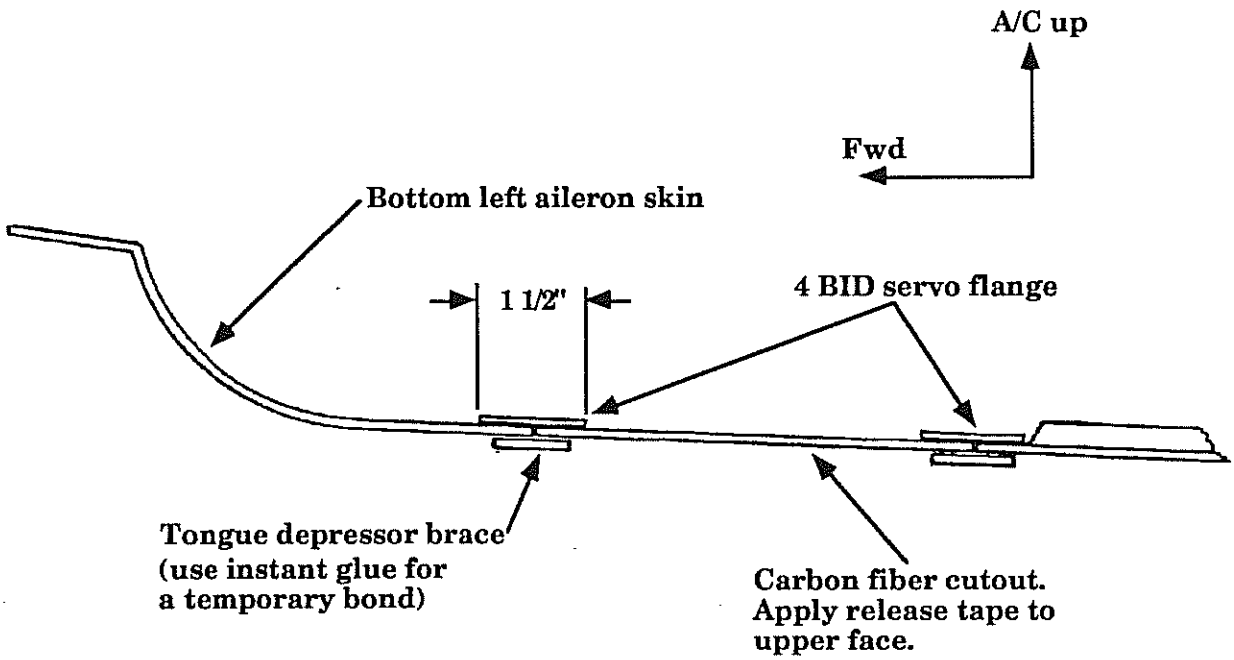
H3. Apply release tape to the inside surface of the square you have just cut out. You will use the cutout to form a 4 BID flange on which to mount the servo.

H4. Replace the cutout to it's original position in the bottom aileron skin. Hold the cutout in place using pieces of tongue depressors tacked to the outside surface of the skin with instant glue.

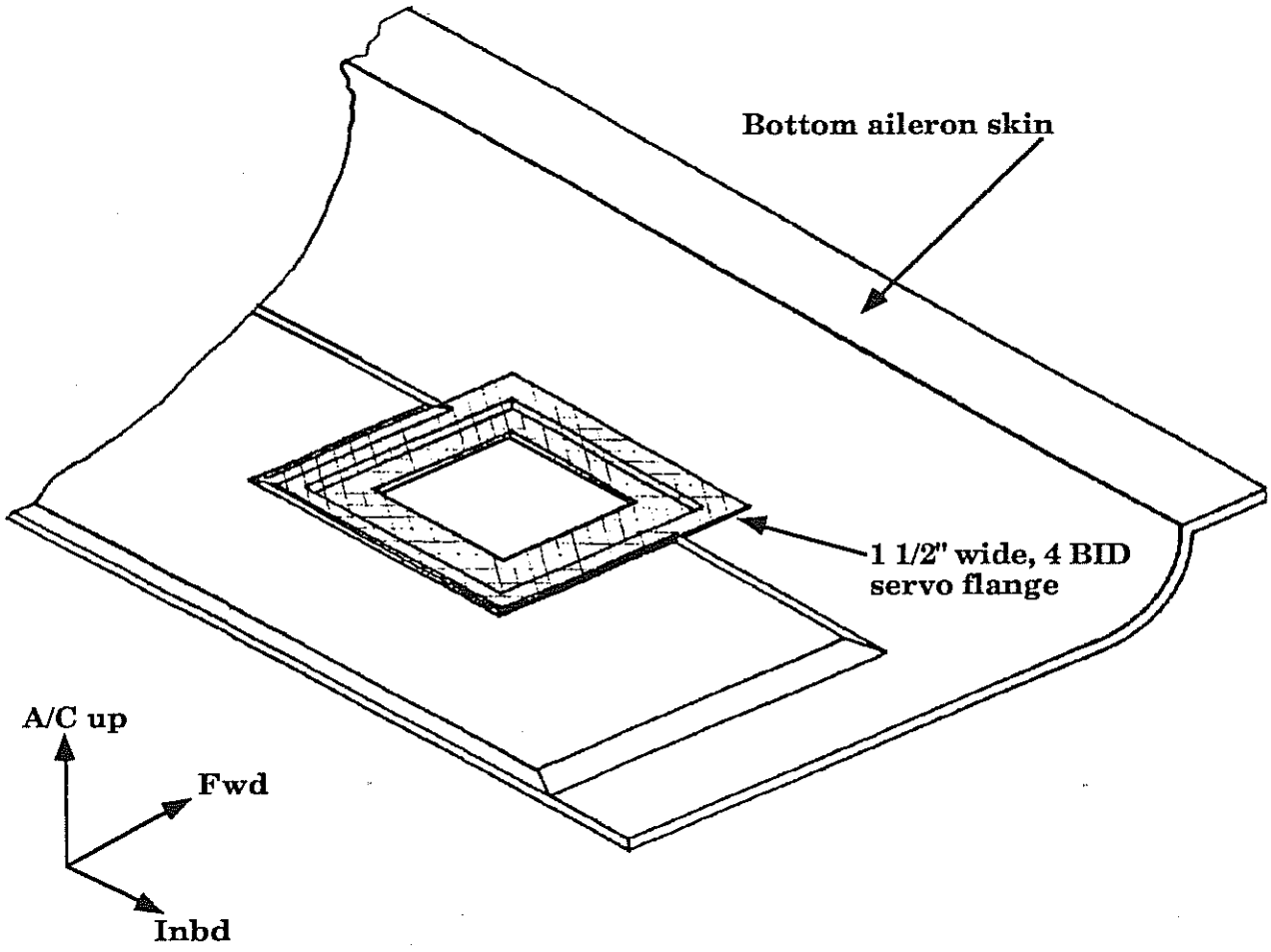
H5. Sand and clean the areas of the bottom aileron skin where the 4 BID servo flange will be applied. See Figure 8:H:3:a & b for flange location.

**4 BID servo flange location**

Figure 8:H:3:a



**4 BID servo flange**
Figure 8:H:3:b

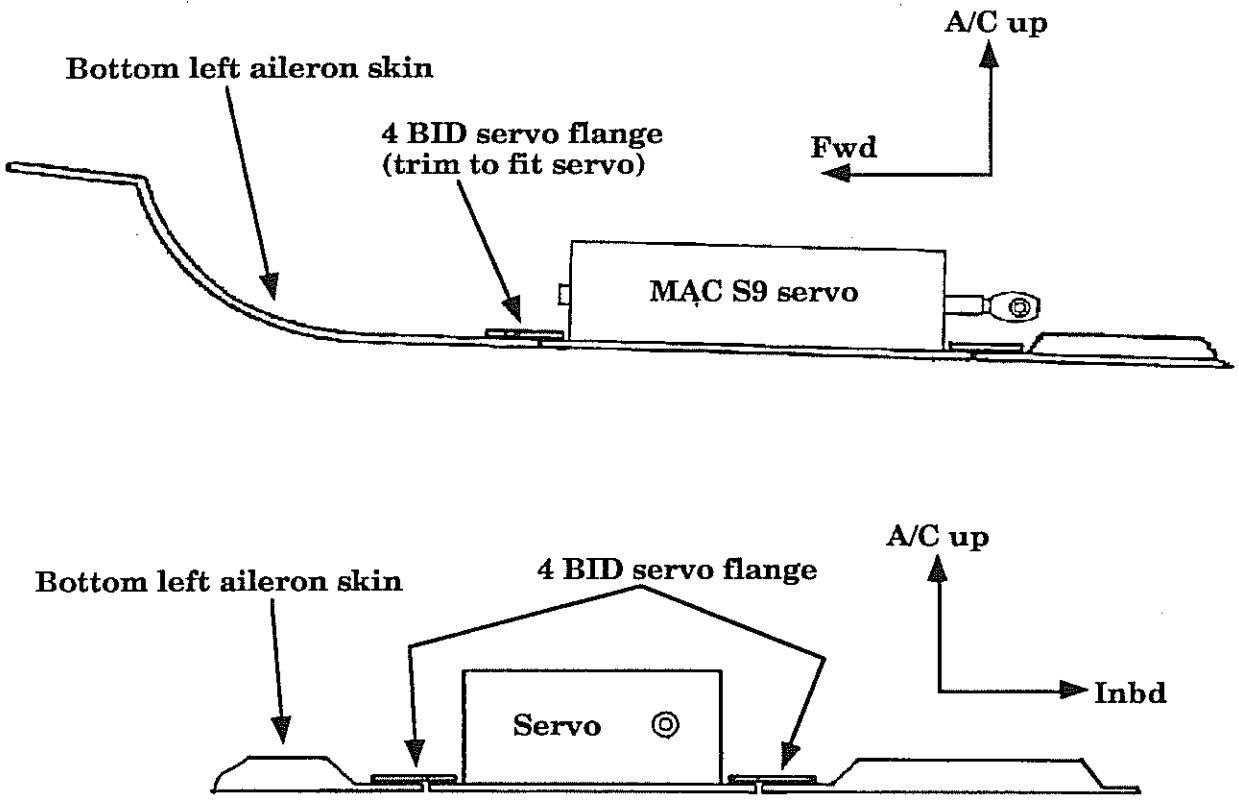



H6. Apply the 4 BID, 1 1/2" wide servo flange to the bottom aileron skin. You should be overlapping onto the cutout/release tape at least 1/2" all around the opening.

H7. After the 4 BID has cured, remove the cutout from the bottom aileron skin.

H8. Trim the 4 BID servo flange so the servo can be slid into position. You will end up trimming away most of the flange at the front and rear edges. A small notch in the flange is also required for the servo wires.

**Trimming servo flange**
Figure 8:H:4



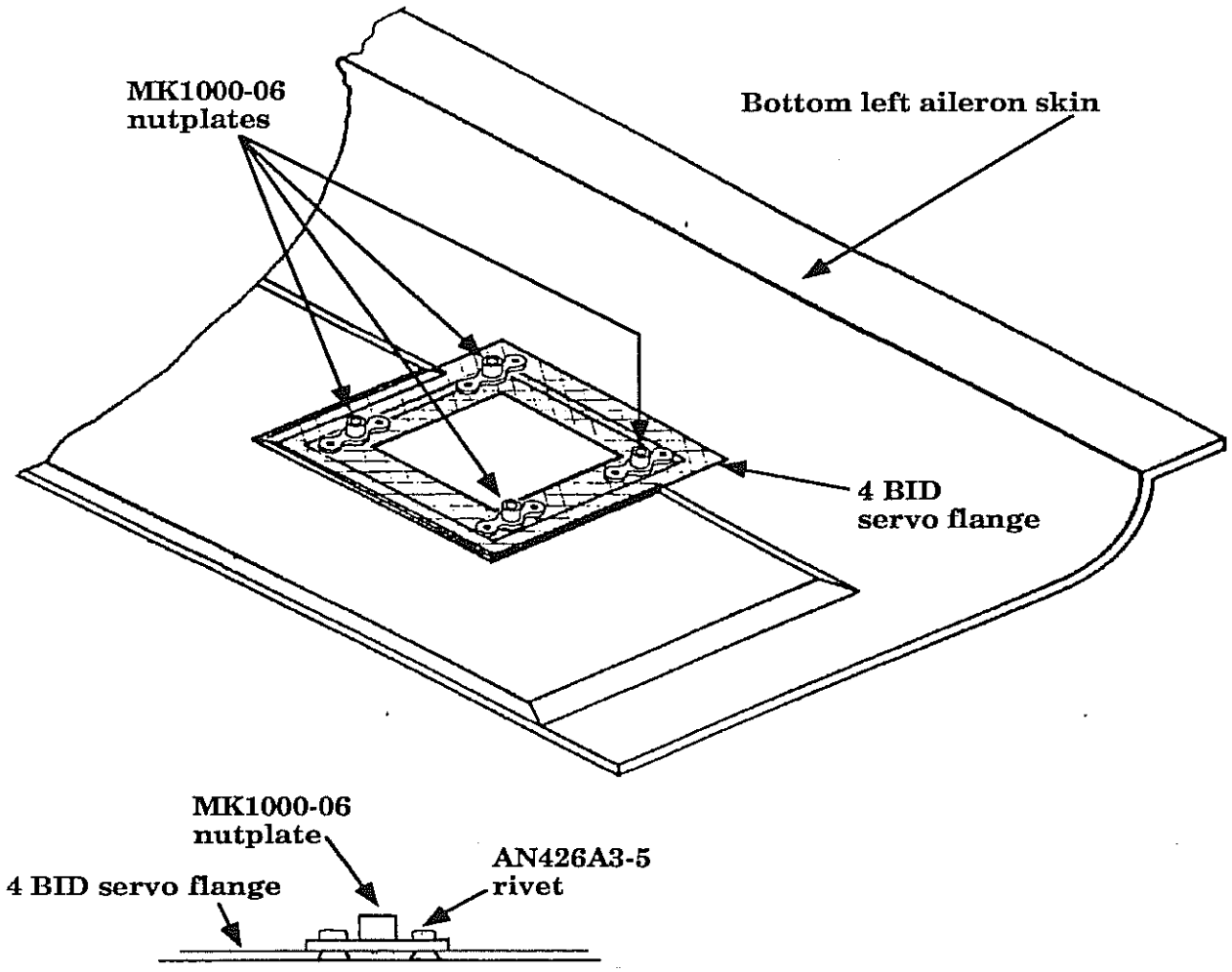

H9. Grind a small clearance hole in the aileron spar for the threaded servo rod. **Otherwise, at full throw, the servo rod will bind against the spar, causing damage to the servo gears.** You can accurately find the location of the clearance hole by placing a piece of masking tape on the aft face of the spar while holding the servo against it's 4 BID flange. Connect the servo to a nine volt battery to run it just until it touches the masking tape on the spar. The servo is tough, but be careful not to bind it against the spar, just run it so it touches. Run the servo the other way and remove it from the flange. You should see an impression where the servo rod has touched the masking tape. Use this as a reference to grind the clearance hole through the aileron spar.

H10. Place the servo into it's flange. Use the mounting holes of the servo as guides to drill four #29 holes through the 4 BID servo flange. The mounting holes of the servo will also have to be drilled out to the #29 size.

H11. Remove the servo and install four MK1000-06 nutplates where you have drilled the mounting holes. Mount the nutplates to the flange using AN426A3-5 rivets. Countersink the flange so the rivets are flush.

## Securing servo nutplates to flange

Figure 8:H:5







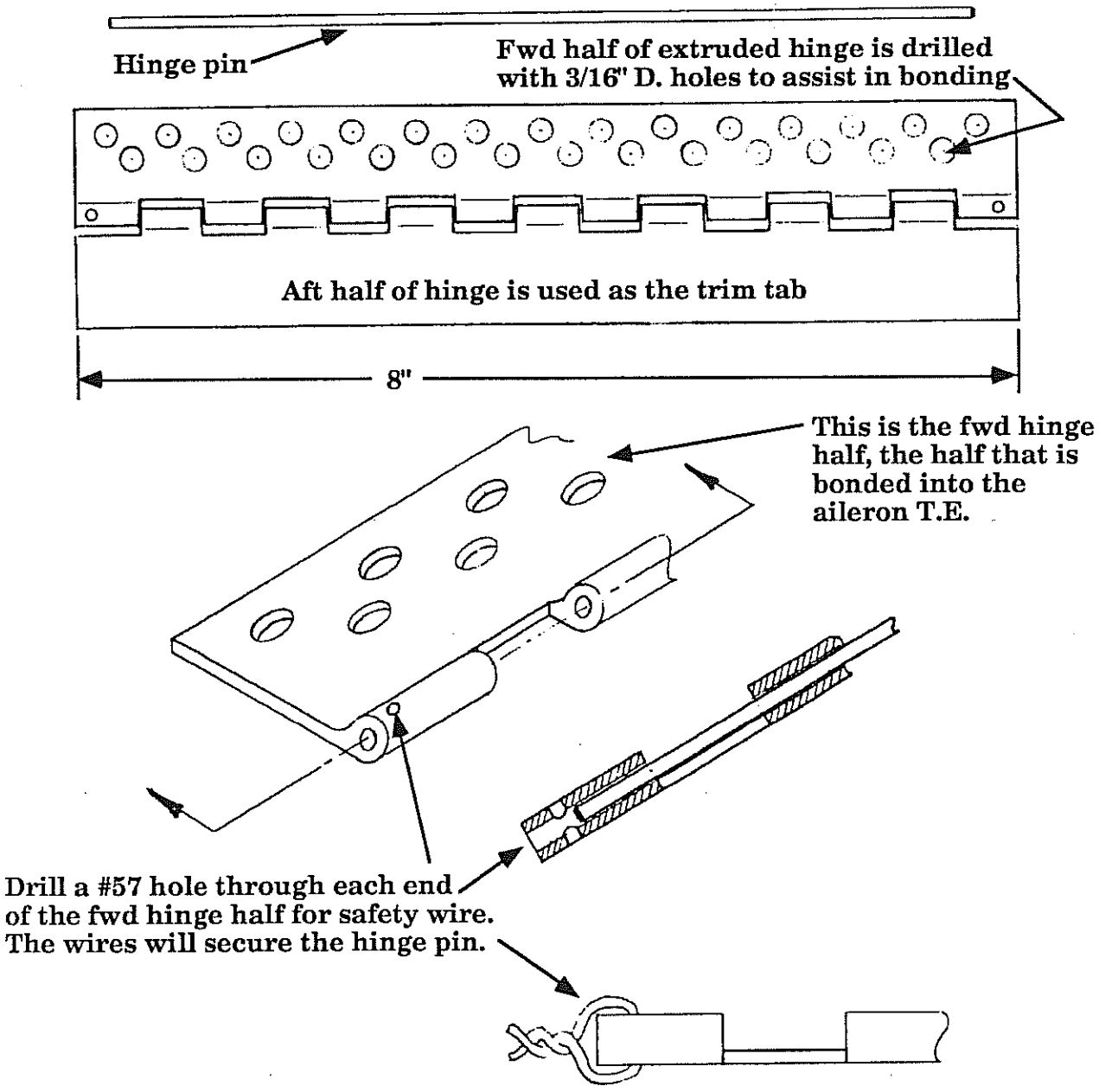
H12. The trim tab is cut from the extruded hinge material supplied in the kit. Cut an 8" length of hinge as shown in Figure 8:H:6.

H13. Drill numerous 3/16" dia. holes in one half of the trim tab hinge. These holes will strengthen the mechanical bond when the hinge is potted into the aileron T.E.

H14. To retain the hinge pin, drill a #57 hole through each end of the forward hinge half (the half that will be bonded into the aileron T.E.). Shorten the hinge pin just

enough so you can thread .040" safety through each hole. When the wire pieces are twisted and clipped, they will retain the hinge pin and make it removable for later maintenance.

**Extruded hinge trim tab**
Figure 8:H:6

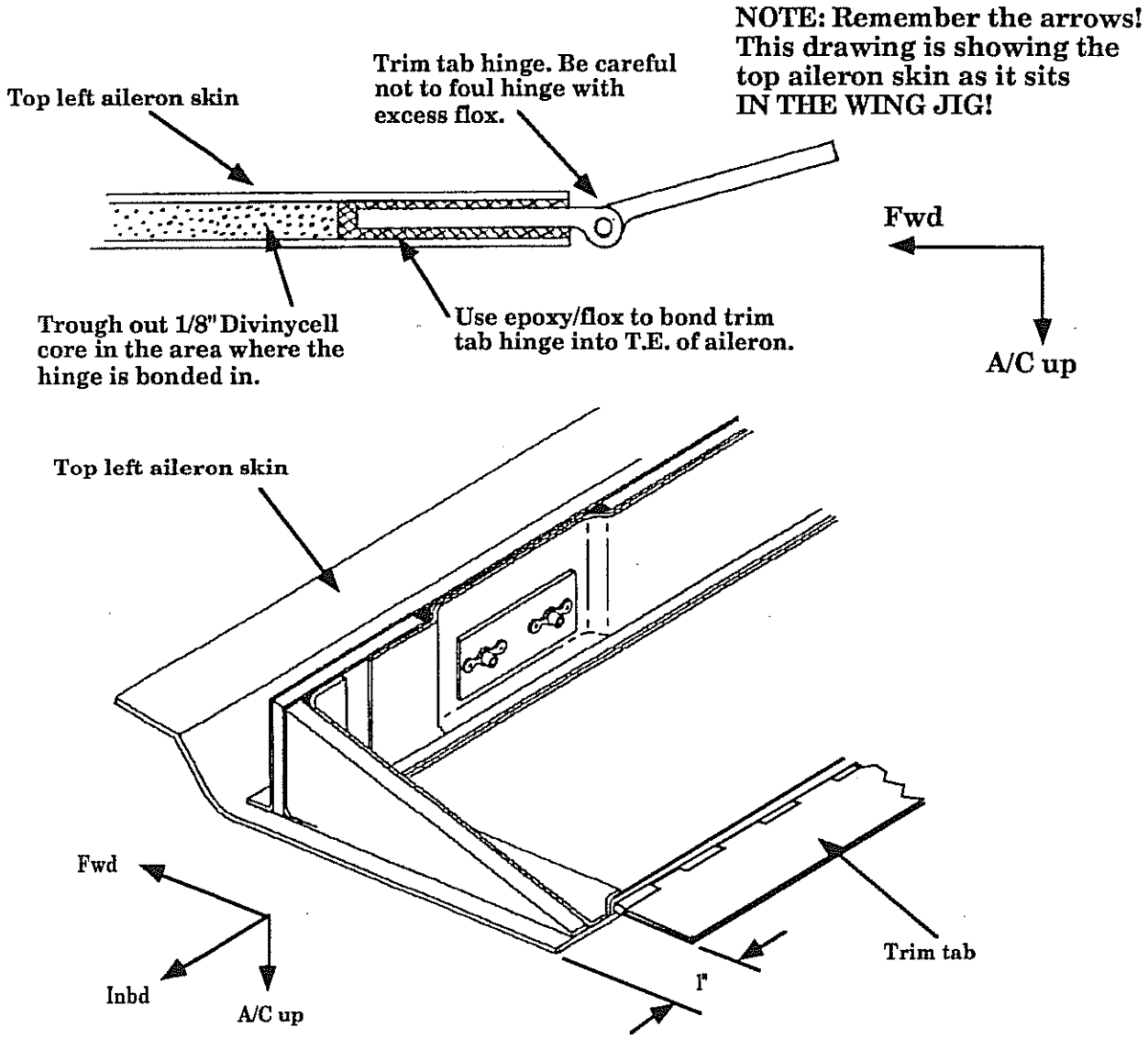


H15. With 40 grit, sand the half of the trim tab hinge which you have just drilled. Clean this half with MC.

H16. Rout out the core of the top aileron skin where the trim tab hinge will be mounted. You'll notice that the core of the aileron is not the standard Nomex honeycomb but a foam-like Divinicell. Clean the routed area with MC.

H17. Use epoxy/flox to bond the trim tab hinge into the top aileron skin T.E.. Be sure not to get flox into the hinge pin area.

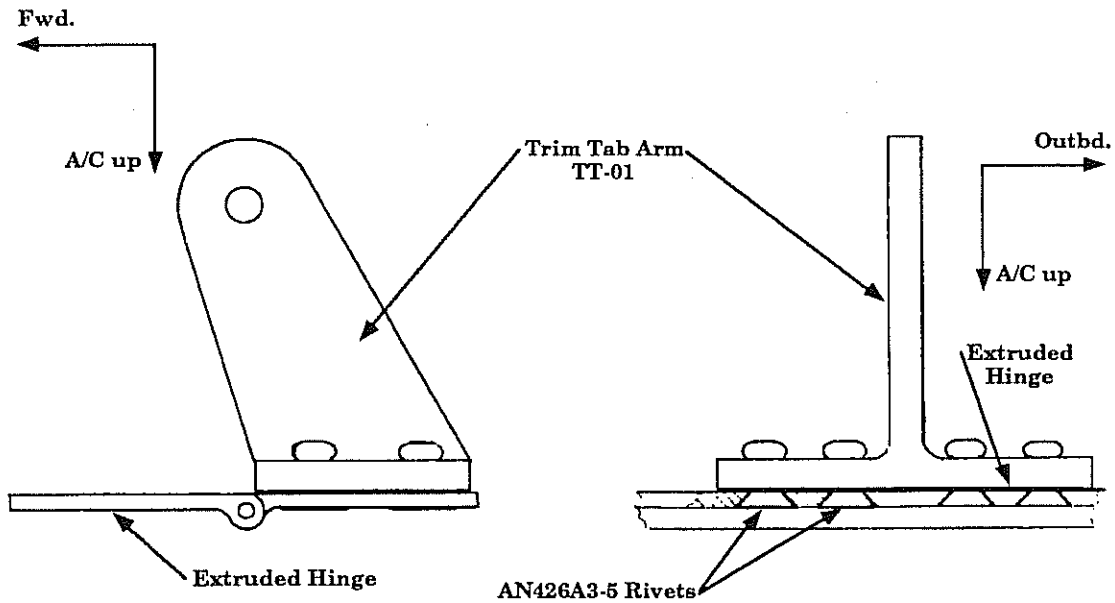
**Bonding trim tab hinge into aileron T.E.**
Figure 8:H:7

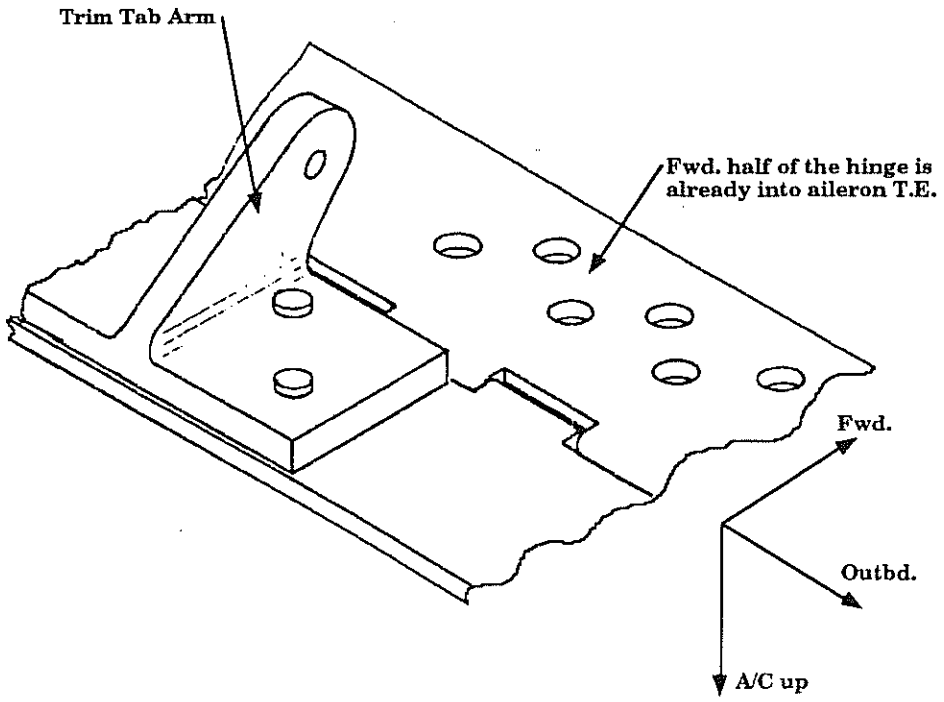


H18. The trim tab should be positioned on the bottom surface of the trim tab hinge in line with the threaded servo shaft(this position will also be perpendicular to the aileron T.E.). Use AN426A3-5 rivets to secure the trim tab arm to the trim tab as shown in Figure 8:H:8.

## Securing Trim Tab Arm to Tab

Figure 8:H:8



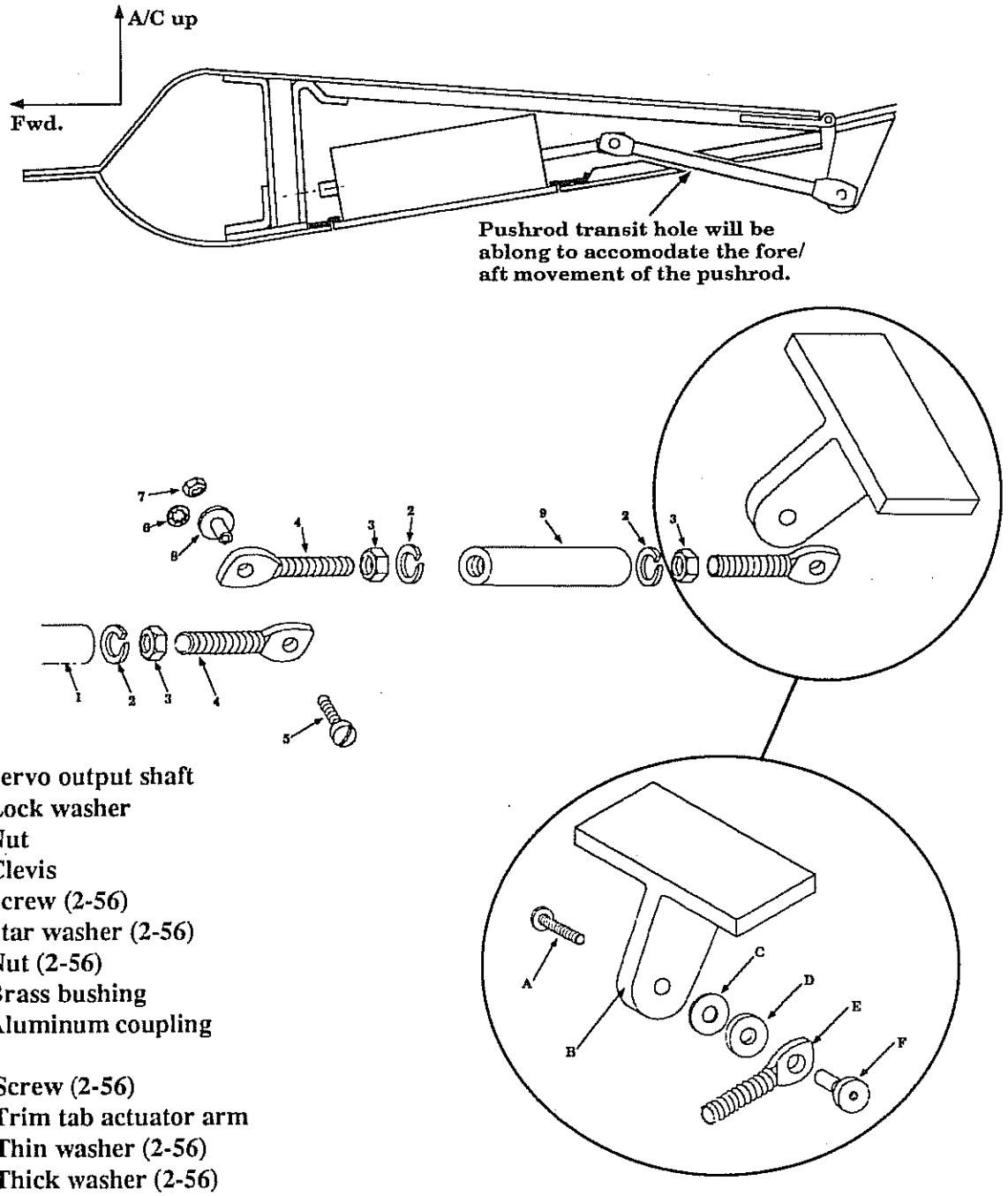



H19. Grind a pushrod transit hole in to the bottom aileron skin. The exact location of this hole may be hard to find because the bottom aileron skin has not been bonded in place. It is probably best to hold off on connecting the aileron servo to the tab until the aileron has been closed out.

G20. Connect the trim tab arm to the servo using the pushrod hardware provided in the MAC servo box.

## Connecting Trim Tab to Servo

Figure 8:H:9



H21. The two wires for the trim servo are routed forward of the aileron spar to the outboard end of the aileron. Drill a 1/8" dia. hole through the aileron spar just forward of the servo. Thread the two white wires of the servo through the spar hole and add wire and connectors as necessary (they are not included in the kit) to extend these wires out to the wing tip area. Here the wires will be routed into the cockpit through the plastic electrical tube you installed back in Chapter 6.

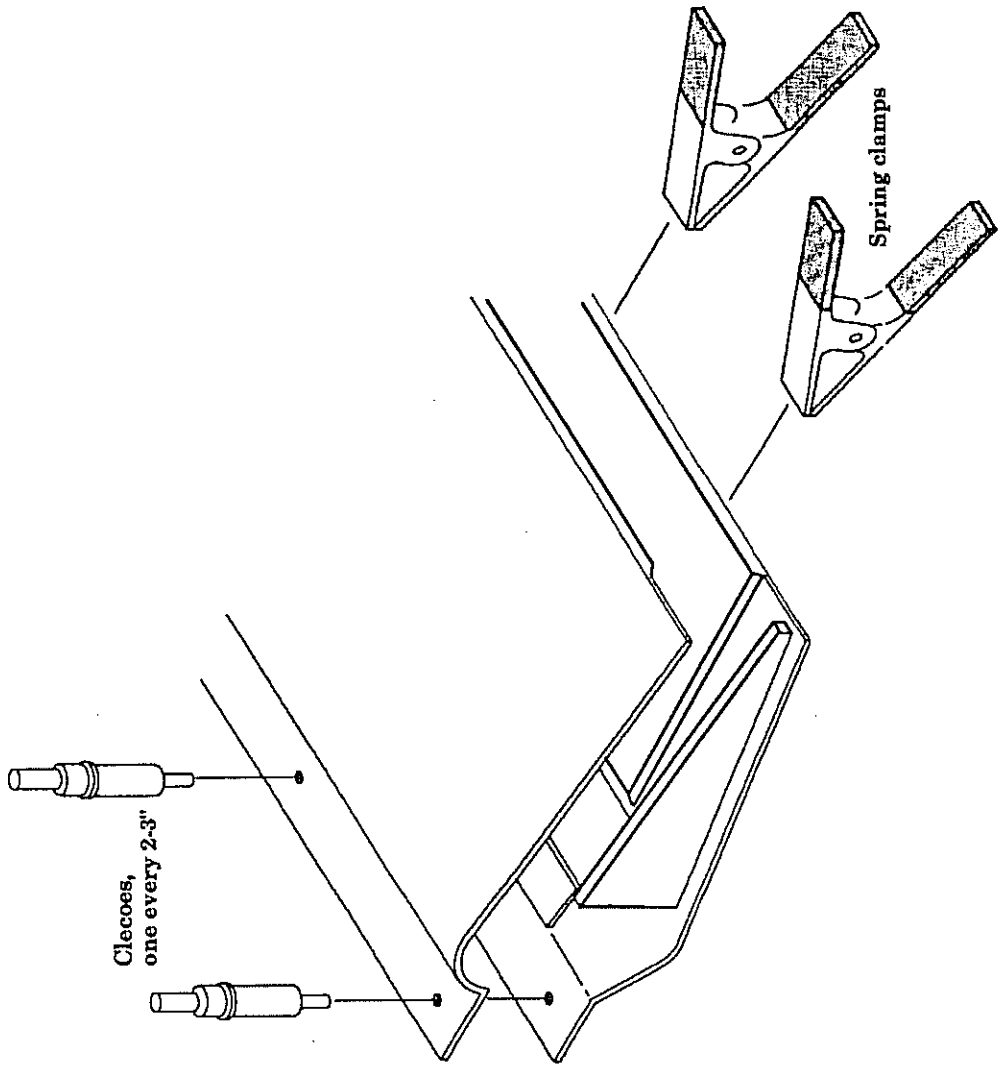
## I. CLOSING AILERON

The aileron is closed using Hysol™ structural adhesive. If you've paid attention to detail when installing the capstrips, aligning the hinges, trimming the wing skins, etc., closing out the aileron should be a simple matter of gluing the halves together.

Before you rush headlong into closing the aileron, do a mock closeout, complete with weights and clecoes (refer to drawing 8:I:1). Check that the ailerons are straight lengthwise and chordwise when weighted. If the weights distort the aileron while the Hysol is curing, the aileron will be distorted forever.

**Trial fit of bottom aileron skin**

Figure 8:I:1



I1. Locate the aileron by bolting the hinges to the hinge bearing blocks. Be sure the wing is properly positioned in the cradles.

I2. Sand the spar capstrip and the tops of the ribs (which have no capstrips but have been fitted with a flox release) with 40 grit. Sand thoroughly leaving no glossy bonding surfaces.

I3. Sand the bonding areas on the inside surface of the bottom aileron skin with 40 grit.

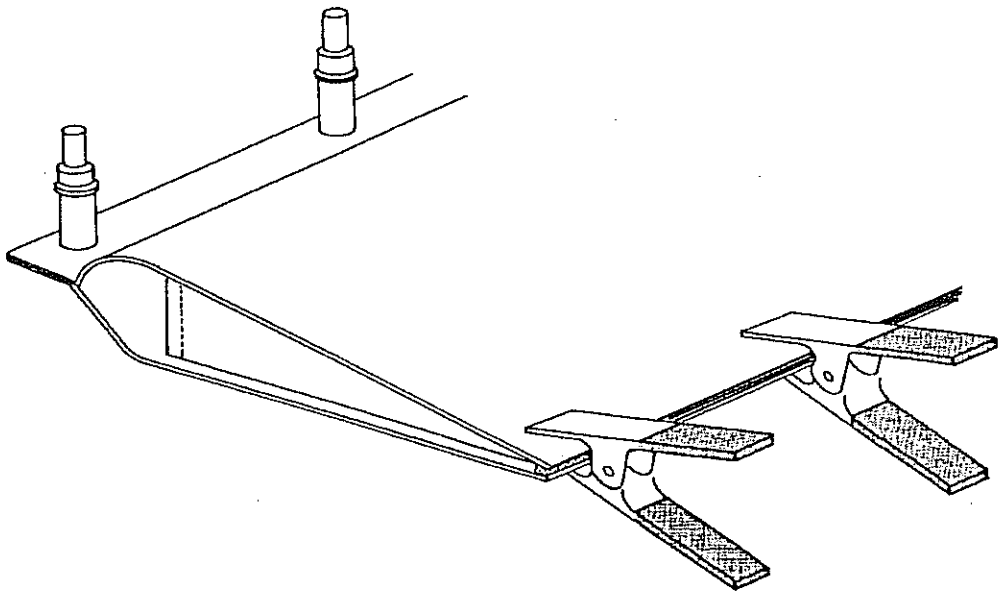
I4. Clean all bonding surfaces with MC.

I5. Cover the hinges and hinge bearing blocks with duct tape to protect them from Hysol squeezeout.

I6. Apply a thin coat of Hysol (no flox added) to all bonding surfaces. Then mix in a small amount of flox with the Hysol (1 tablespoon flox per 2 ounces of Hysol). Apply a thicker coat of the flox enriched Hysol to the capstrip and ribs, mounding the Hysol slightly in the center of the capstrips to avoid air bubbles.

I7. Carefully lower the bottom aileron skin into position and cleco the L.E. flanges together. Weight the skin down as you have done before and clamp the T.E. joggles together. Check again (and again) that the aileron is straight. Use a string line to be sure the aileron T.E. is straight with the flap T.E.

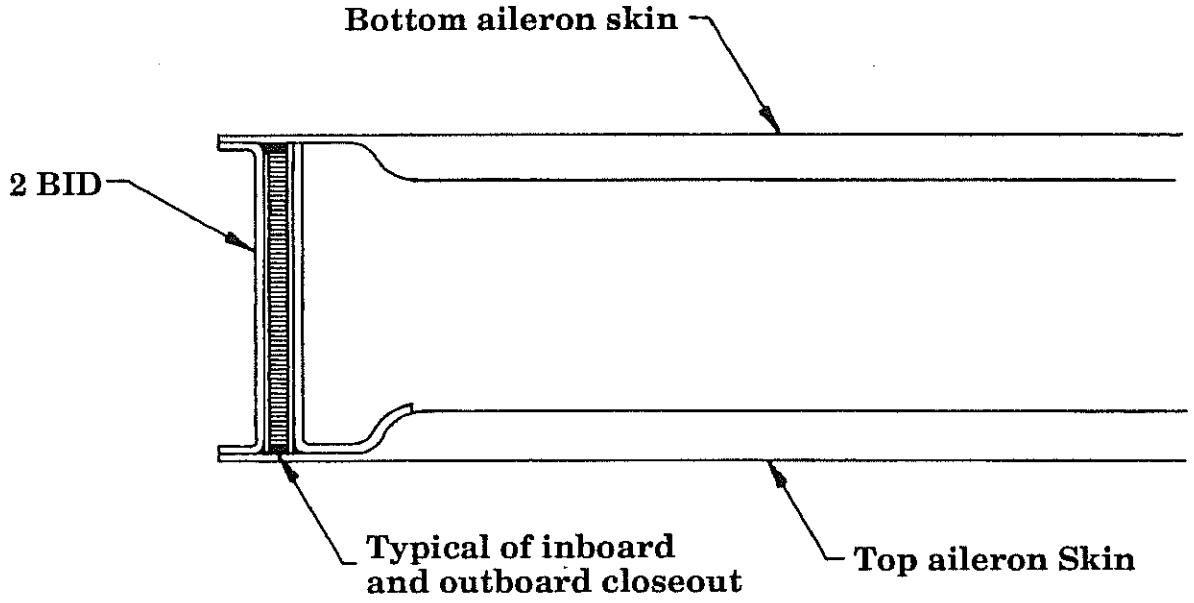
**Closing out aileron**
Figure 8:I:2



I8. After the Hysol has cured, remove the weights and clamps. Remove the section of jig under the aileron and check that the aileron moves freely through it's travel range.

I9. Apply 2 BID to the inboard and outboard ends of the aileron as shown in Figure 8:I:3.

**Closing out ends of aileron**
Figure 8:I:3

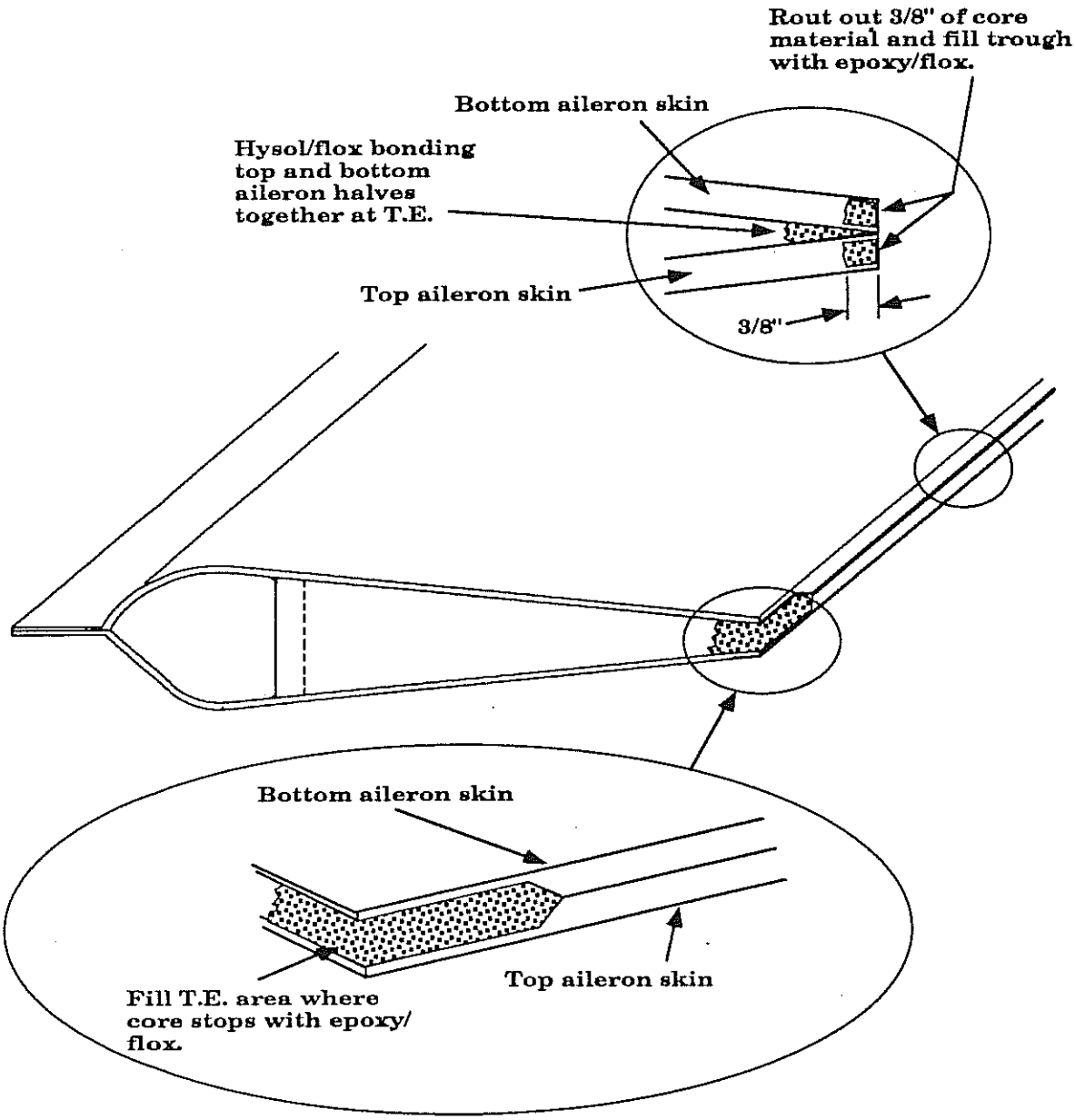



I10. Grind out a 1/4 - 3/8" deep trough in the T.E. of both top and bottom aileron skins. These troughs will be filled with epoxy/flox to complete the bond between the two skins.

I11. Paint a thin coat of epoxy into the T.E. troughs you just formed. The epoxy will help the flox bond better.

I12. Fill the T.E.'s of the top and bottom aileron skins with a thick epoxy flox mixture. Use a tongue depressor to tamp the flox down into the troughs.

## Filling T.E. joggle with epoxy/flox
## Figure 8:I:4

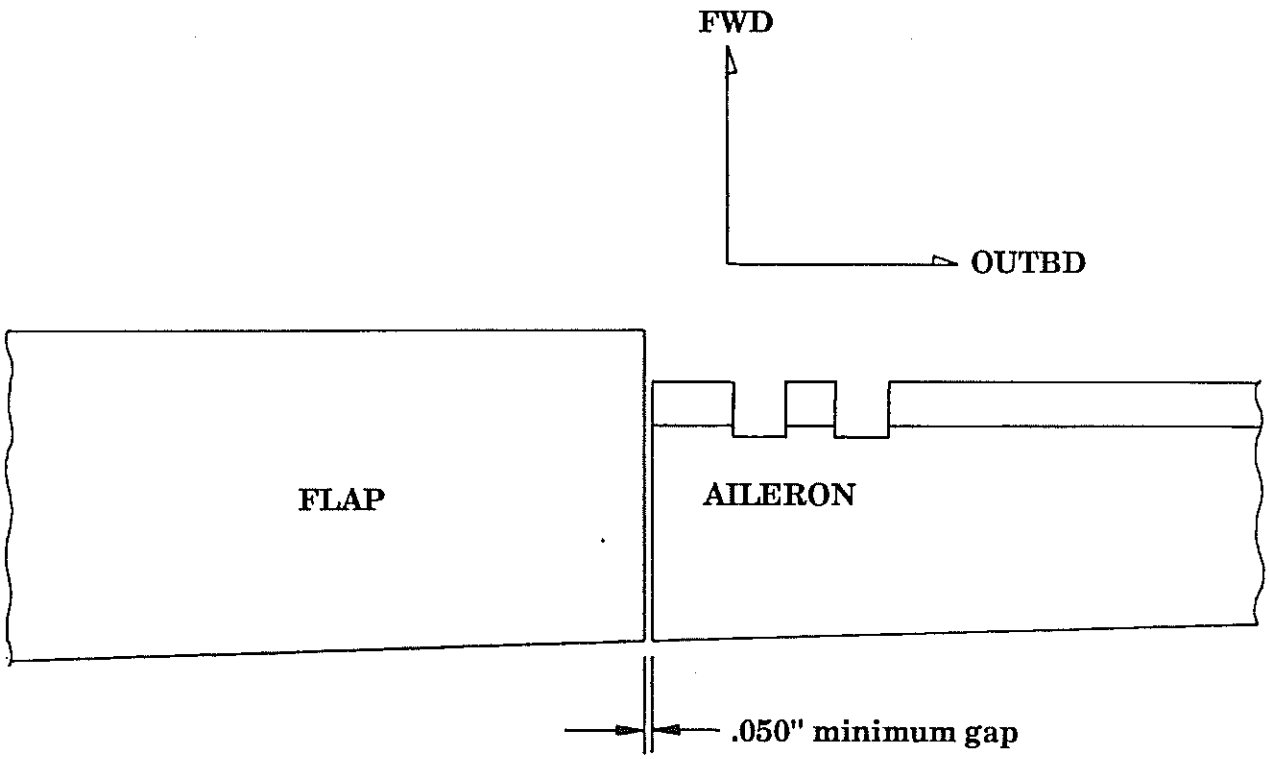



I13. After the flox has cured, carefully sand it flush with the aileron T.E.. The thickness of the aileron T.E. should be a constant 1/4" (+ - 1/16").

I14. Sand or add to the inboard end of the aileron to attain an even, 1/8" gap between the aileron and flap. This gap is wider than the standard .050" because of the

geometry difference between flap and aileron. The outboard end of the flap can be customized at this point to get the proper gap. When the aileron is moved to it's full "down" travel limit, the flap should have come no closer than .050" to the aileron during transit from "retracted" to "extended". Final sanding of the outboard end of the aileron will be done after the wing tips are installed. Refer to Figure 8:I:5.

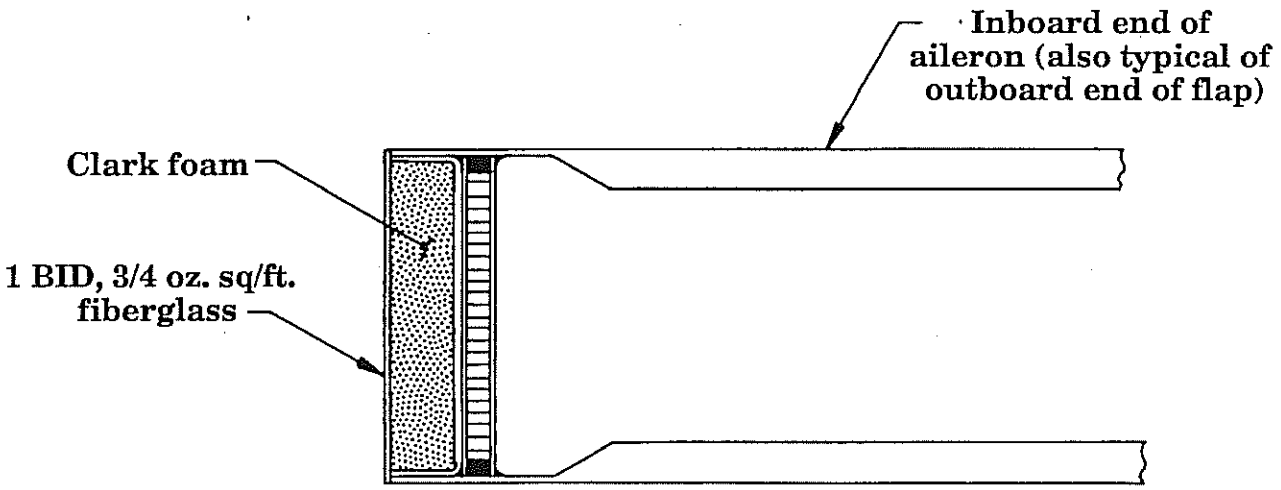
**Gap between flap and aileron**
Figure 8:I:5




I15. You can now finish off the inboard end of the aileron and outboard end of the flap. We've found the best and lightest method of doing this is to fill the area between the inboard rib and the inboard edge of the aileron with a Clark foam rib. Bond the Clark foam rib to the inboard aileron rib and sand the Clark foam flush with the inboard edge of the aileron. Paint a light coat of very thin micro to the sanded face of the Clark foam. Apply 1 BID of light (3/4 oz./sq. ft.) fiberglass cloth to the sanded face of the Clark foam. Use this closeout method for the outboard end of the flap. The inboard end of the flap and outboard end of the aileron will be closed out later in construction.

## Closing out aileron and flap ends

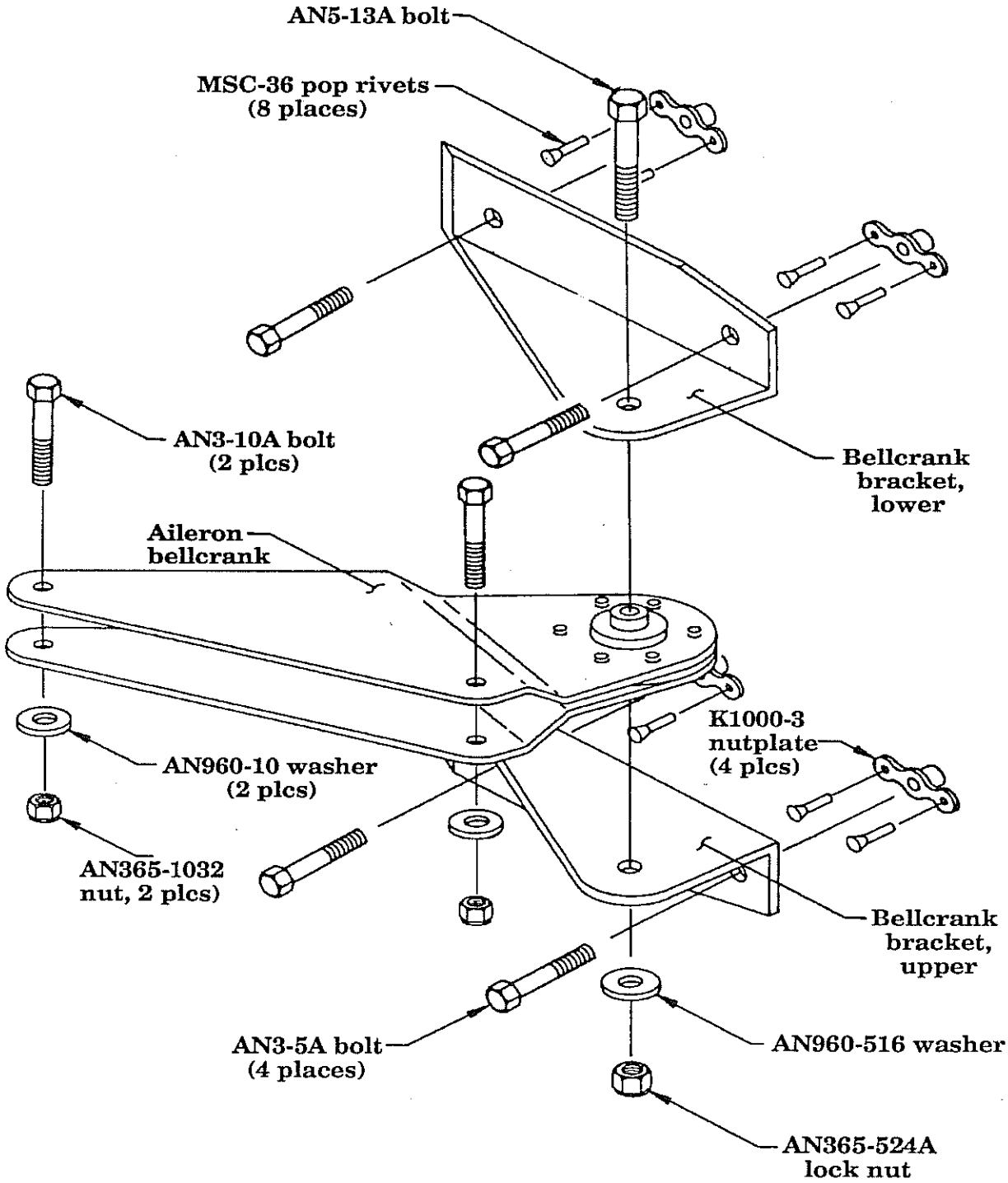
Figure 8:I:6



## J. AILERON BELLCRANK INSTALLATION

### Bellcrank Assembly

Figure 8:J:1



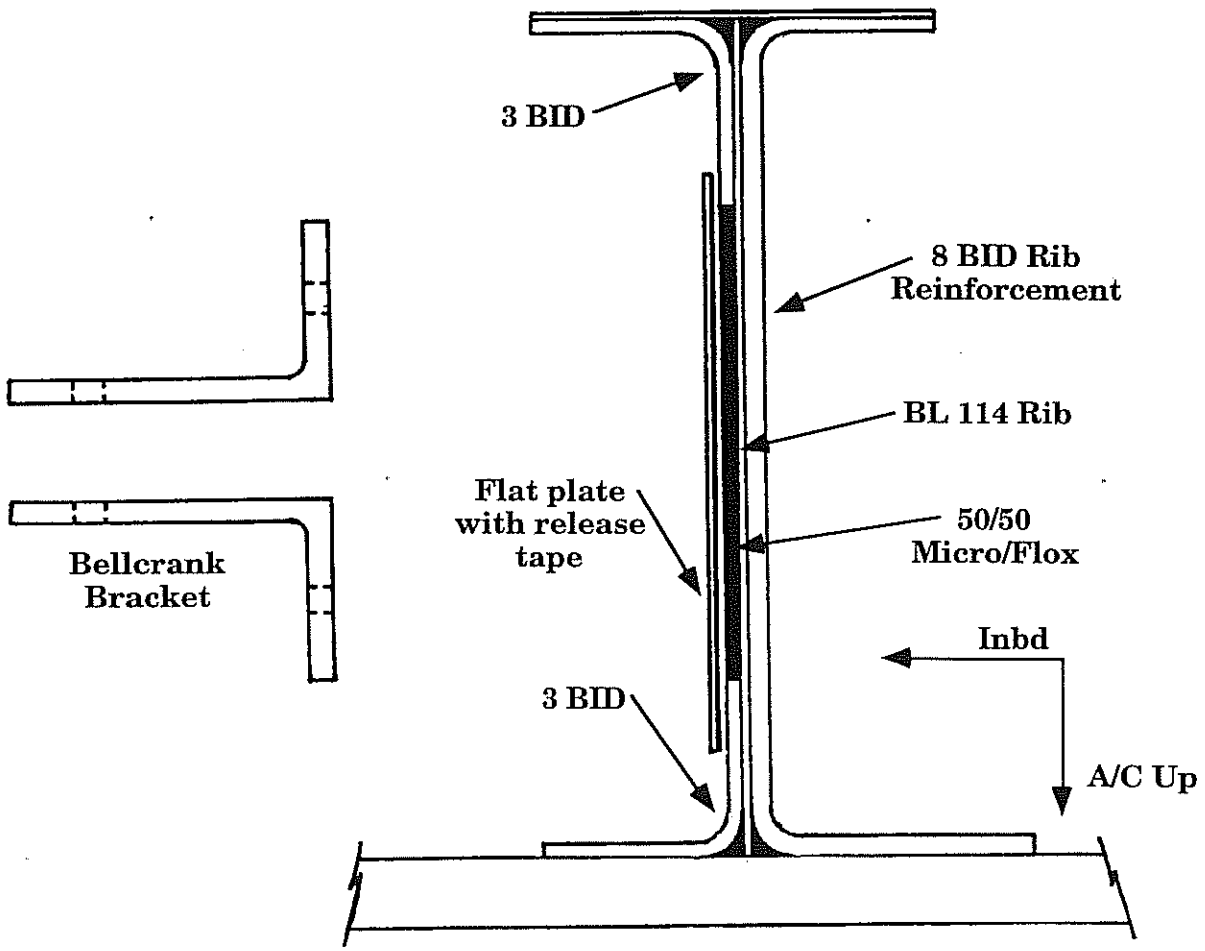
J1. Bolt the bellcrank between the two bellcrank brackets as shown in Figure 8:J:1. Notice that the bellcrank brackets are mirror images of each other, the bottom bracket on the left aileron bellcrank is used as the top bracket on the right aileron bellcrank.

J2. Before you bolt the bellcrank assembly to the BL 114 rib you must have a flat surface on the rib for the brackets to mount. Cut a scrap piece of 1/8" thick aluminum or steel to fit on the inboard face of the BL 114 rib forward of the rear spar cap and aft of where the plastic electrical tube transits through the rib. See Figure 8:J:2.

J3. Cover the flat aluminum with release tape and make sure the aluminum doesn't ride up on the radii where the rib joins the capstrip and the top wing skin.

## Use a Release to Form a Flat Surface on BL 114 Rib

Figure 8:J:2



J4. Sand the inboard side of the BL114 where you will perform the release. Clean the rib with MC.

J5. Apply a thin 50/50 micro/flox mixture to the area of the release. Clamp the aluminum release plate in position on the rib. Two things to watch out for in this step:

Don't use too much micro/flox, a thin, .040" coating is fine.

Don't clamp the aluminum release plate too tightly, you may bend or warp it so the resulting surface would be uneven.

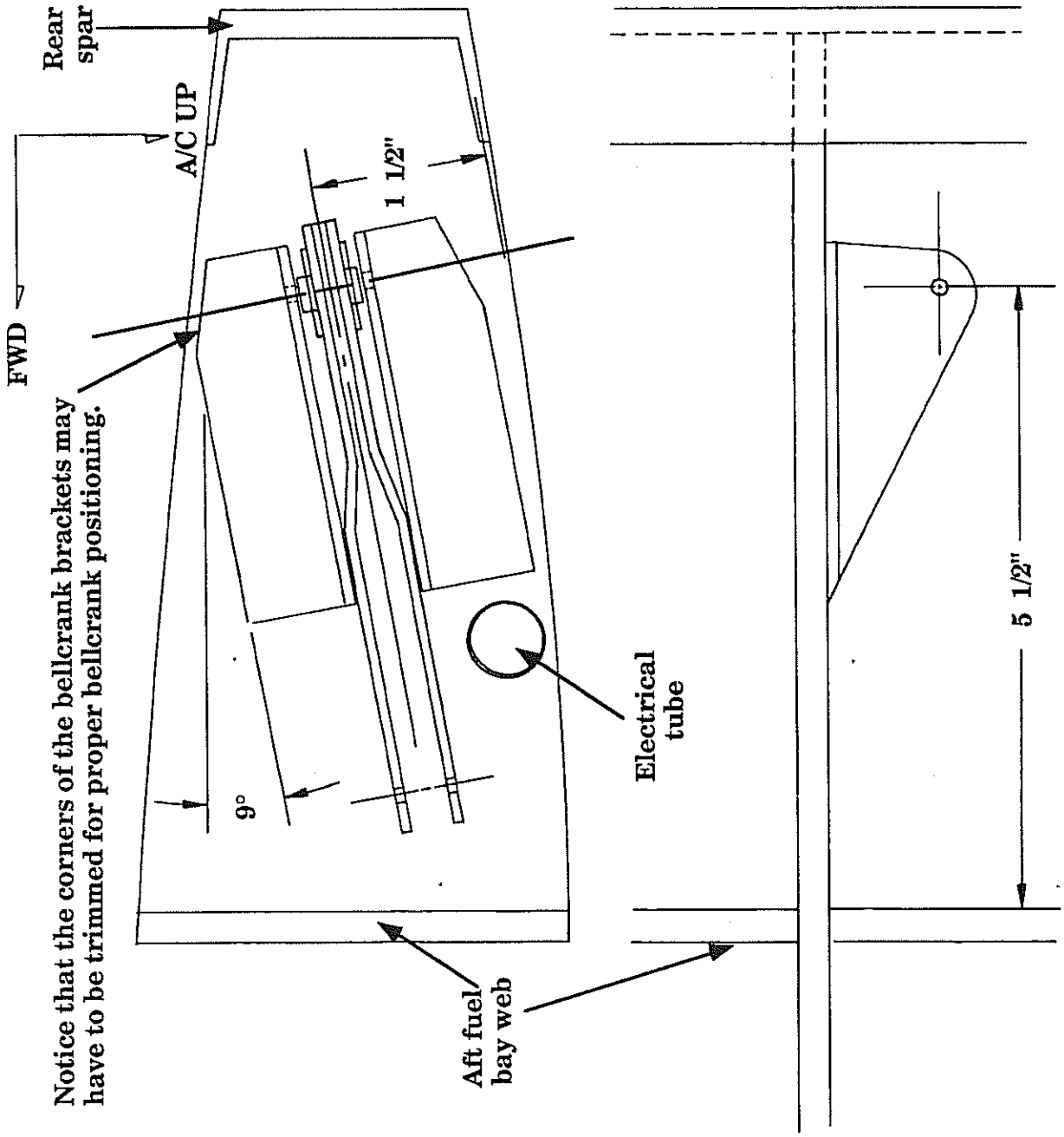
J6. Remove the excess micro/flox squeezeout from around the edges of the release plate.

J7. When the micro/flox has cured, pop off the aluminum release plate. This is easier said than done, so take your time, tap the outboard side of the BL114 rib to help the plate release, and pry the edges of the plate up with a wood chisel. It'll come off, just be patient.

J8. Now you should have a flat surface on which to mount the aileron bellcrank brackets. With bellcrank still bolted between the two bellcrank brackets, position the assembly on the BL114 rib so the center of the bellcrank bolt is 5 1/2" aft of the aft face of the fuel bay web. To position the assembly this far back on the rib, you'll have to trim the corners of the bellcrank brackets as shown in Figure 8:J:3. How much you'll have to trim these corners will depend on the individual airplane, but the goal is for the brackets to rest on the flat surface, not a radius. On later Lancair IV kits, the corners of the bellcrank brackets are already trimmed.

## Locating aileron bellcrank assembly

Figure 8:J:3



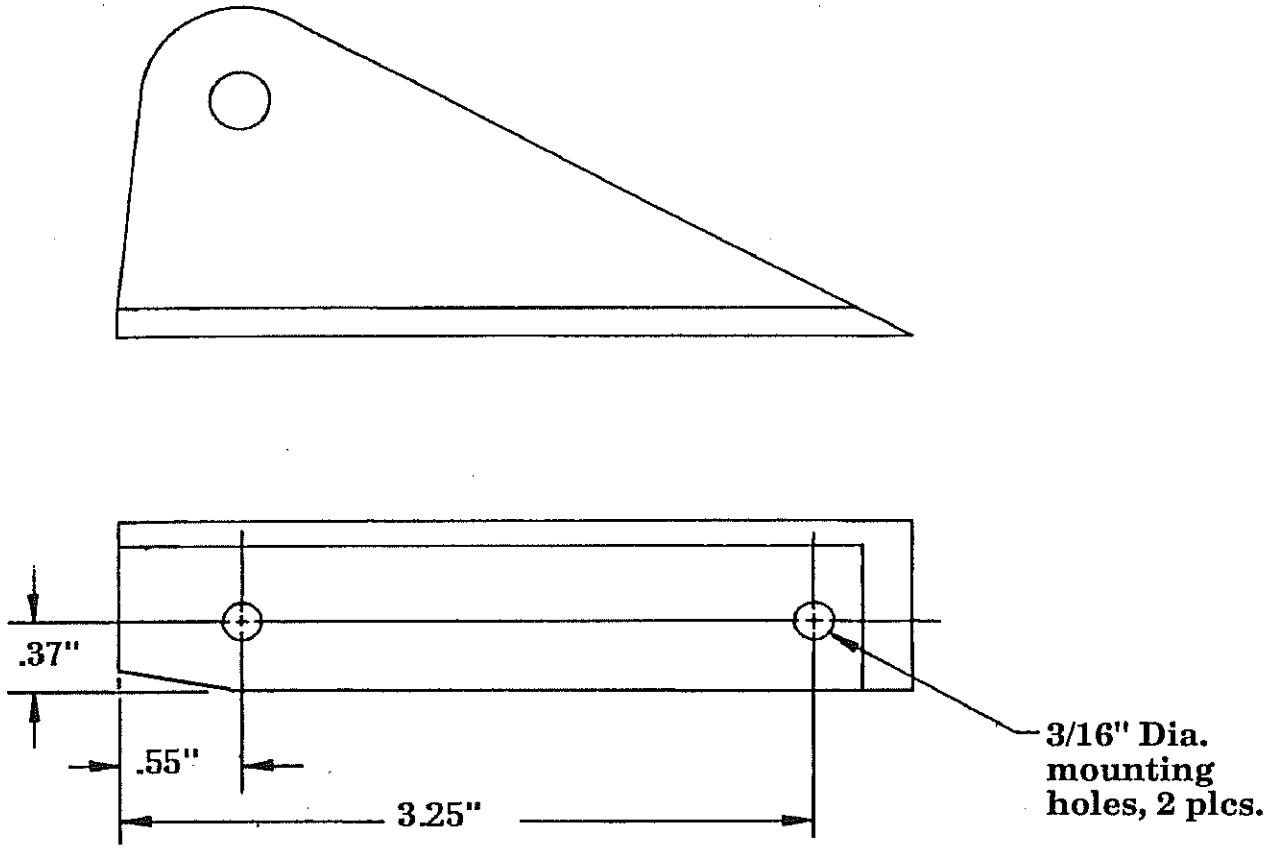
J9. The aileron bellcrank assembly must be angled 9° off horizontal. Be sure to angle the assembly the correct direction, so the short aileron pushrod (the one that connects the bellcrank to the aileron actuator arm) exits the BOTTOM of the wing.

J10. The vertical location of the bellcrank assembly is measured from the center of the bellcrank to the inside surface of the top wing skin. This dimension is 1.5", but can vary ±.10" depending on builder differences. Use a few drops of instant glue on the bellcrank brackets to hold them in position on the BL 114 rib.

WARNING: It is very important that nothing interferes with the aileron bellcrank's freedom of movement. The black plastic electrical tube is routed under the bellcrank (or over the bellcrank when the wing is right side up) and must be properly secured to the top wing skin to avoid interference. If the electrical tube interferes with the bolt that secures the long aileron pushrod to the bellcrank, the tube must be repositioned and resecured to the top wing skin. Refer to Section J of this chapter to find the travel movement and limits of the aileron bellcrank.

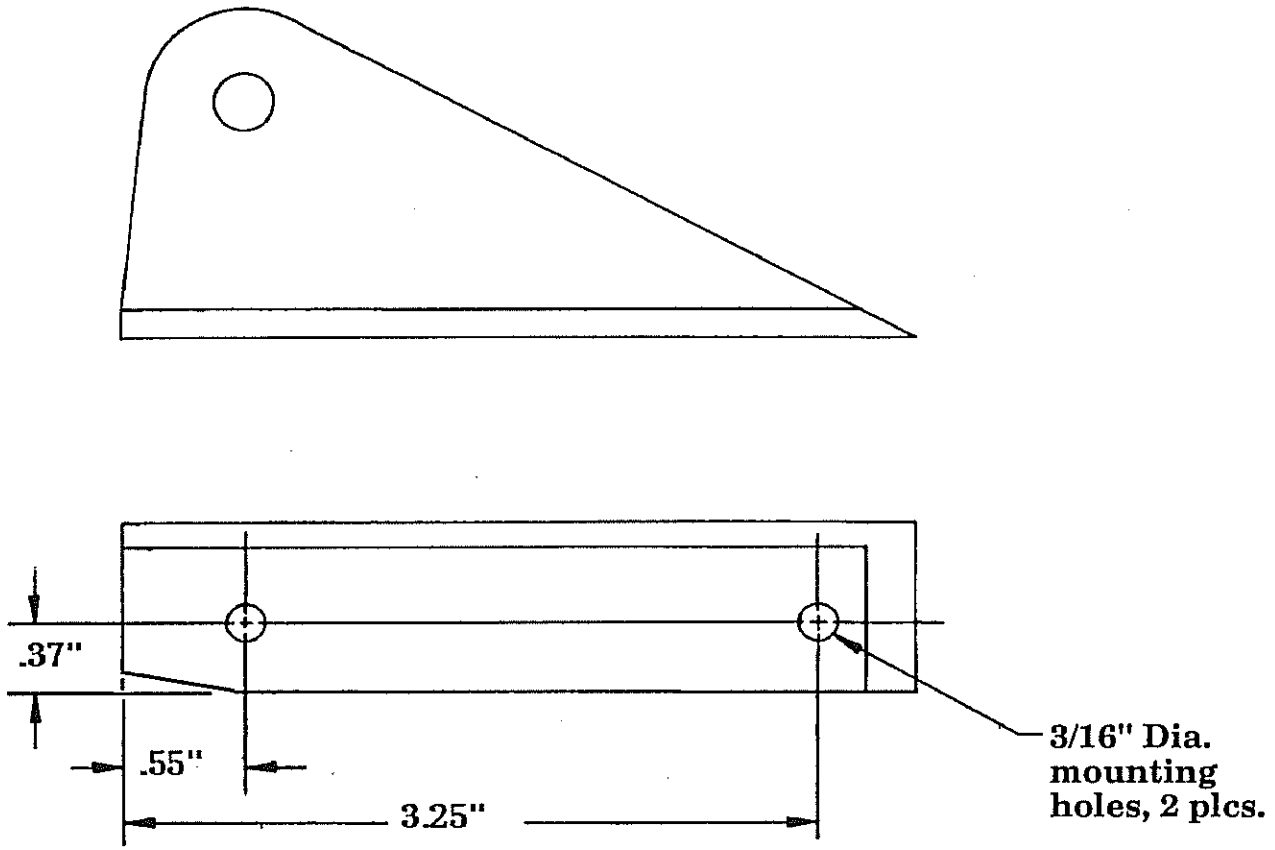
J11. Remove the aileron bellcrank from the brackets. Use a 90° drill attachment to drill two 3/16" mounting bolt holes in each bellcrank bracket. Refer to Figure 8:J:4 for hole placement. It is suggested that you remove the bellcrank brackets from the rib and drill the mounting bolt holes through the brackets first (using a drill press or just hand drill), then reposition the brackets on the BL 114 rib. The holes in the brackets are then used as guides to drill through the BL 114 rib and a cleaner, tighter tolerance hole results.

**Bellcrank bracket mounting bolt holes**
Figure 8:J:4



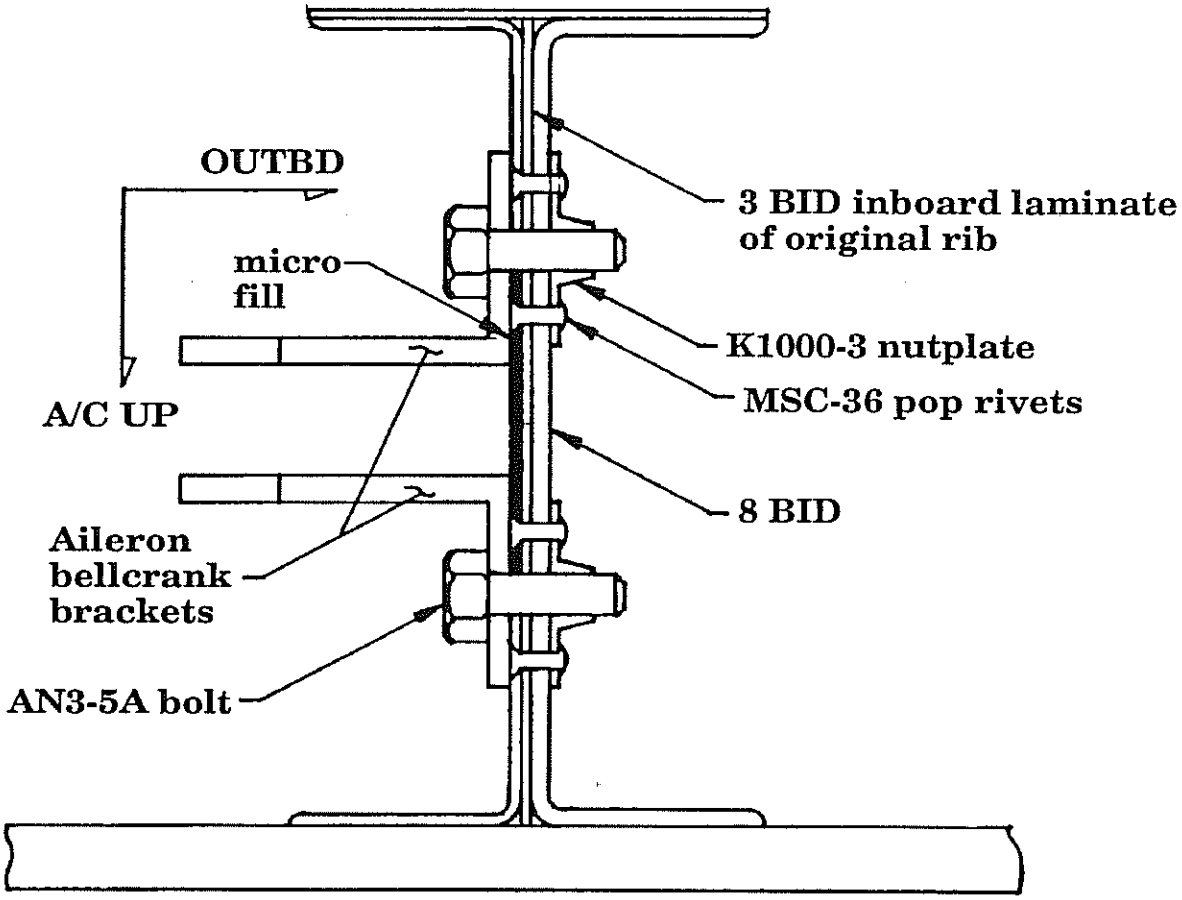

J12. Again, remove the bellcrank brackets from the BL 114 rib. Use MSC-36 pop rivets to secure a K1000-3 nutplate to the BL 114 rib at each mounting bolt hole location. The nutplates, of course, mount on the outboard side of the BL 114 rib. To assure yourself that the nutplates will never loosen up on the rib, apply a small dab of Hysol adhesive around the nutplate flanges. Don't get Hysol in the threads of the nutplates.

**Bellcrank bracket mounting bolt holes**
Figure 8:J:4




J12. Again, remove the bellcrank brackets from the BL 114 rib. Use MSC-36 pop rivets to secure a K1000-3 nutplate to the BL 114 rib at each mounting bolt hole location. The nutplates, of course, mount on the outboard side of the BL 114 rib. To assure yourself that the nutplates will never loosen up on the rib, apply a small dab of Hysol adhesive around the nutplate flanges. Don't get Hysol in the threads of the nutplates.

**Bolting bellcrank brackets to BL 114 rib**
Figure 8:J:5




J13. Reinstall the aileron bellcranks and bellcrank brackets.

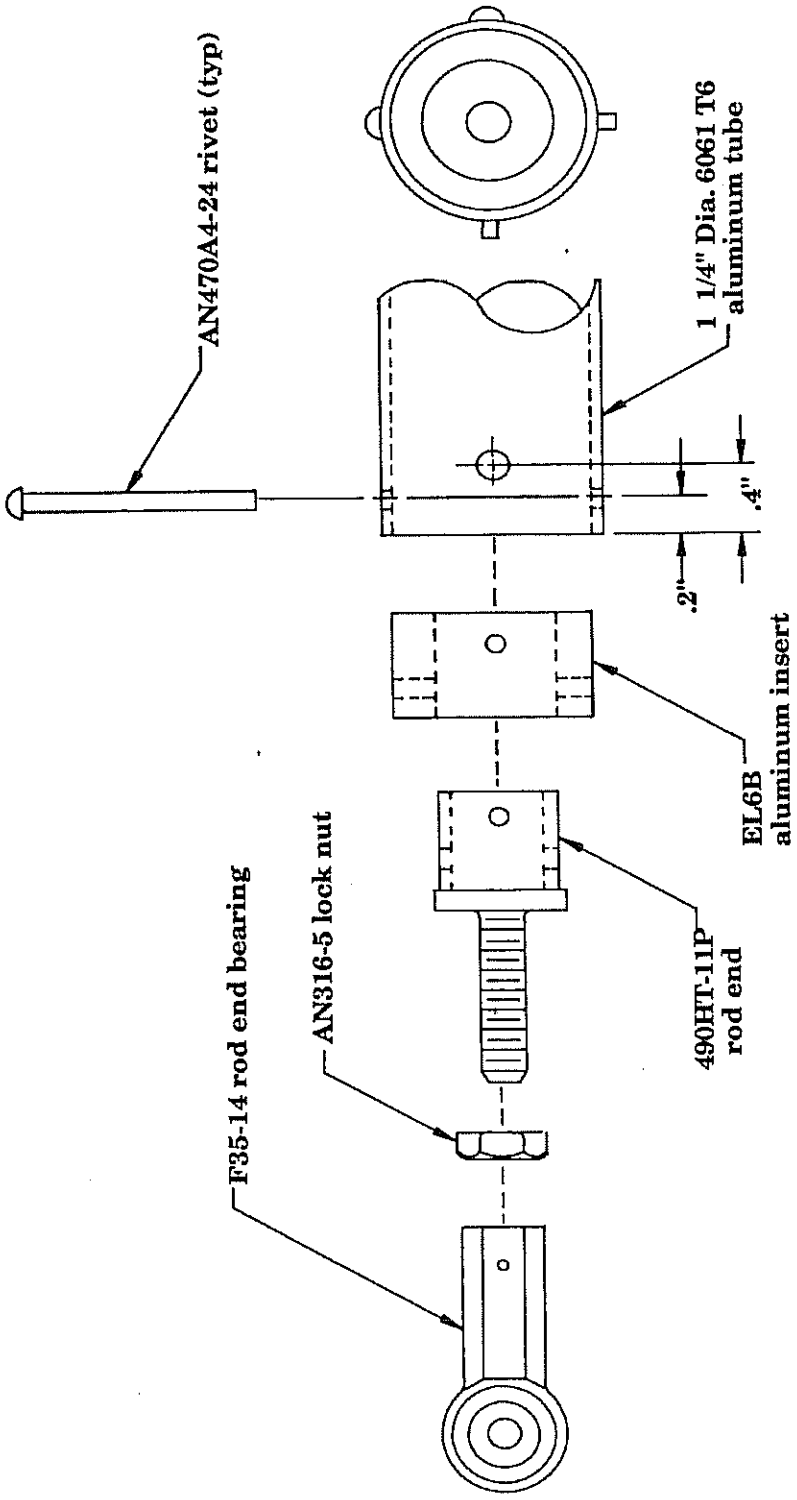
## K. AILERON PUSHRODS

There are two aileron pushrods in each wing, one long, one short. The long pushrod will connect the aileron bellcrank to another bellcrank mounted in the fuselage later in construction. The short pushrod connects the aileron bellcrank to the actuator arm mounted on the aileron spar. Since you won't know the exact length of the long pushrod until you construct the fuselage, you will only rivet the outboard rod end to the pushrod at this time.

K1. The long aileron pushrod is made from 1 1/4" Dia., 6061 T6 aluminum tube. There are two 8' lengths of this tube included in your kit, one for each wing. Use two AN470A4-24 rivets to secure the 490HT-11P rod end to the long aileron pushrod. Notice that the rod end must first be slipped into an EL6b aluminum insert, then the insert slipped into the 1 1/4" dia. pushrod. See Figure 8:K:1 and review the "Rod End Hints" in Chapter 7 Section K.

## Aileron pushrods

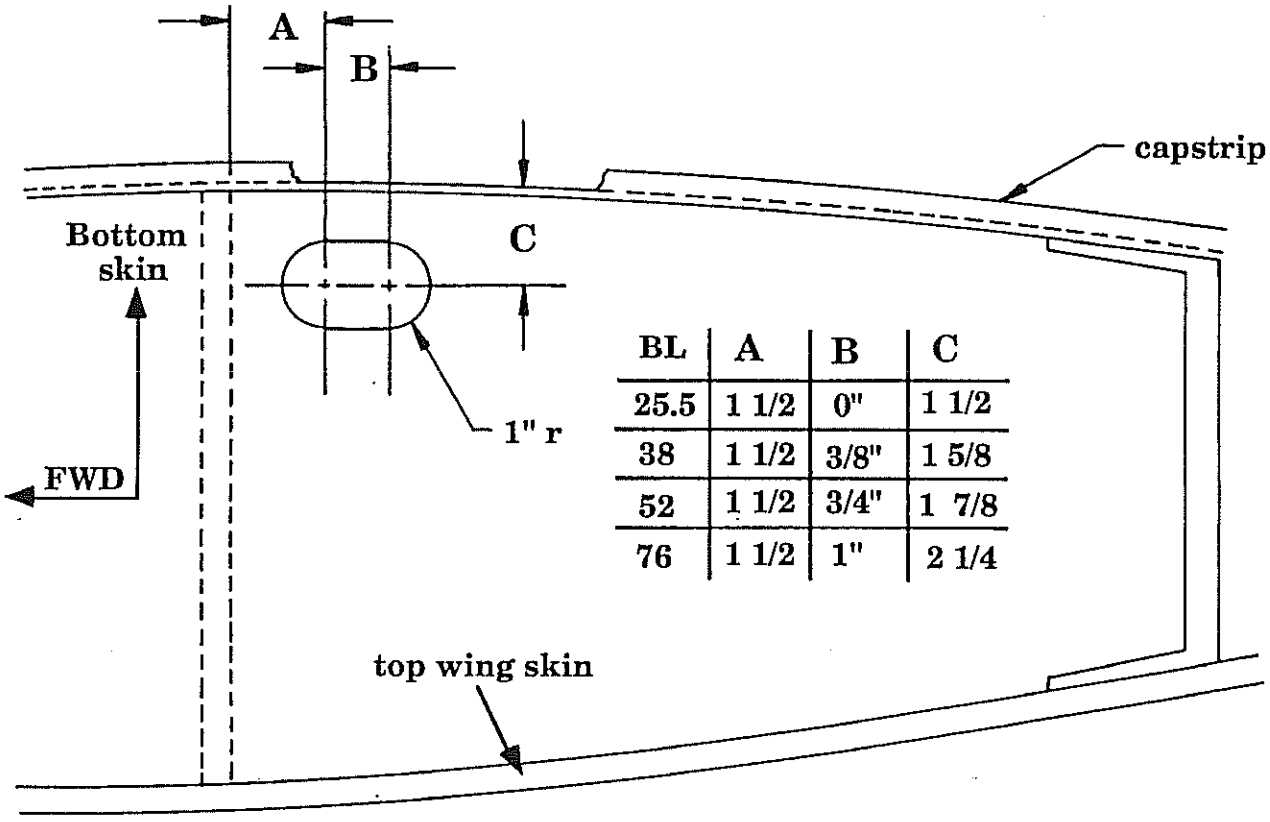
Figure 8:K:1



K2. The long pushrod runs from the aileron bellcrank to a bellcrank which will be installed in the fuselage later in construction. The pushrod will exit at the bottom of the BL 25.5 rib. Grind a 1 1/2" Dia. exit hole in the BL 25.5 rib, as shown in Figure 8:K:2, centered 1 1/2" aft of the fuel bay web and 1 1/2" below the bottom skin. This hole will be clearanced to a larger, oblong shape when you mate the wing to the fuselage, but for now the 1 1/2" exit hole will do fine.

**Finding the clearance hole centers for the long pushrod**

Figure 8:K:2




| BL | A | B | C |
|---|---|---|---|
| 25.5 | 1 1/2 | 0" | 1 1/2 |
| 38 | 1 1/2 | 3/8" | 1 5/8 |
| 52 | 1 1/2 | 3/4" | 1 7/8 |
| 76 | 1 1/2 | 1" | 2 1/4 |

K3. Clearance holes must be drilled through the BL 38, BL 52 and BL 76 ribs for the long aileron pushrod. Use the table of dimensions in Figure 8:K:2 to find the location and size of the clearance holes in these three ribs.

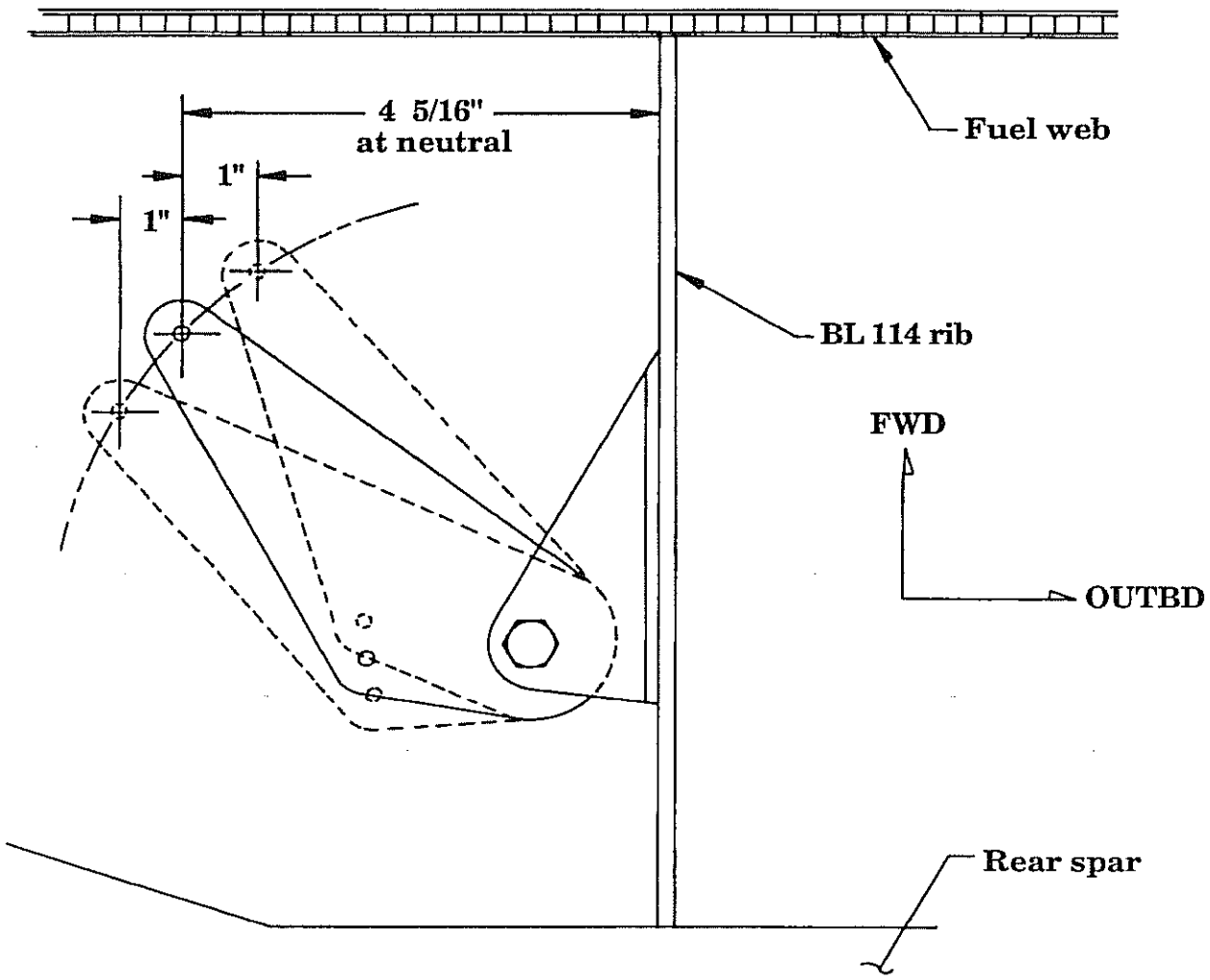
K4. Grind out the clearance holes in the BL 38, BL 52 and BL 76 ribs, centered on the reference marks you made in Step K3.

K5. Slip the long pushrod through the clearance holes and connect the rod end bearing

to the aileron bellcrank with an AN3-10A bolt. There's no need to use the AN365-1032A locknuts yet, as you will be removing and installing the pushrod a few more times.

K6. If necessary, expand the holes to accommodate the movement of the long pushrod throughout the given aileron bellcrank travel. Refer to Figure 8:K:3 for the bellcrank travel range.

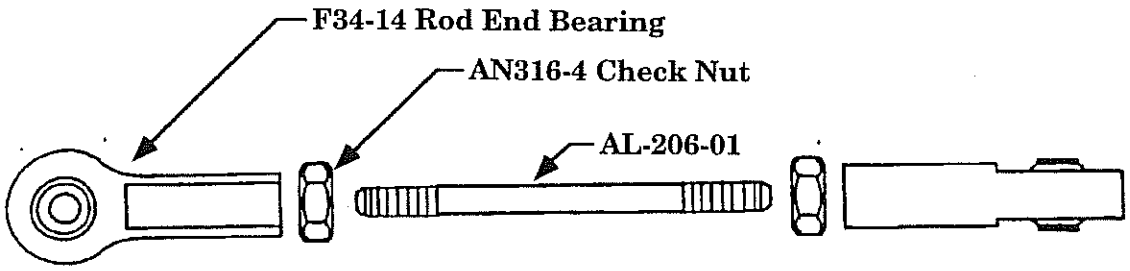
**Aileron bellcrank travel range**
Figure 8:K:3




st er

K7. Thread an AN316-4safety nut and F34-14 rod end bearing onto each end of the short pushrod.

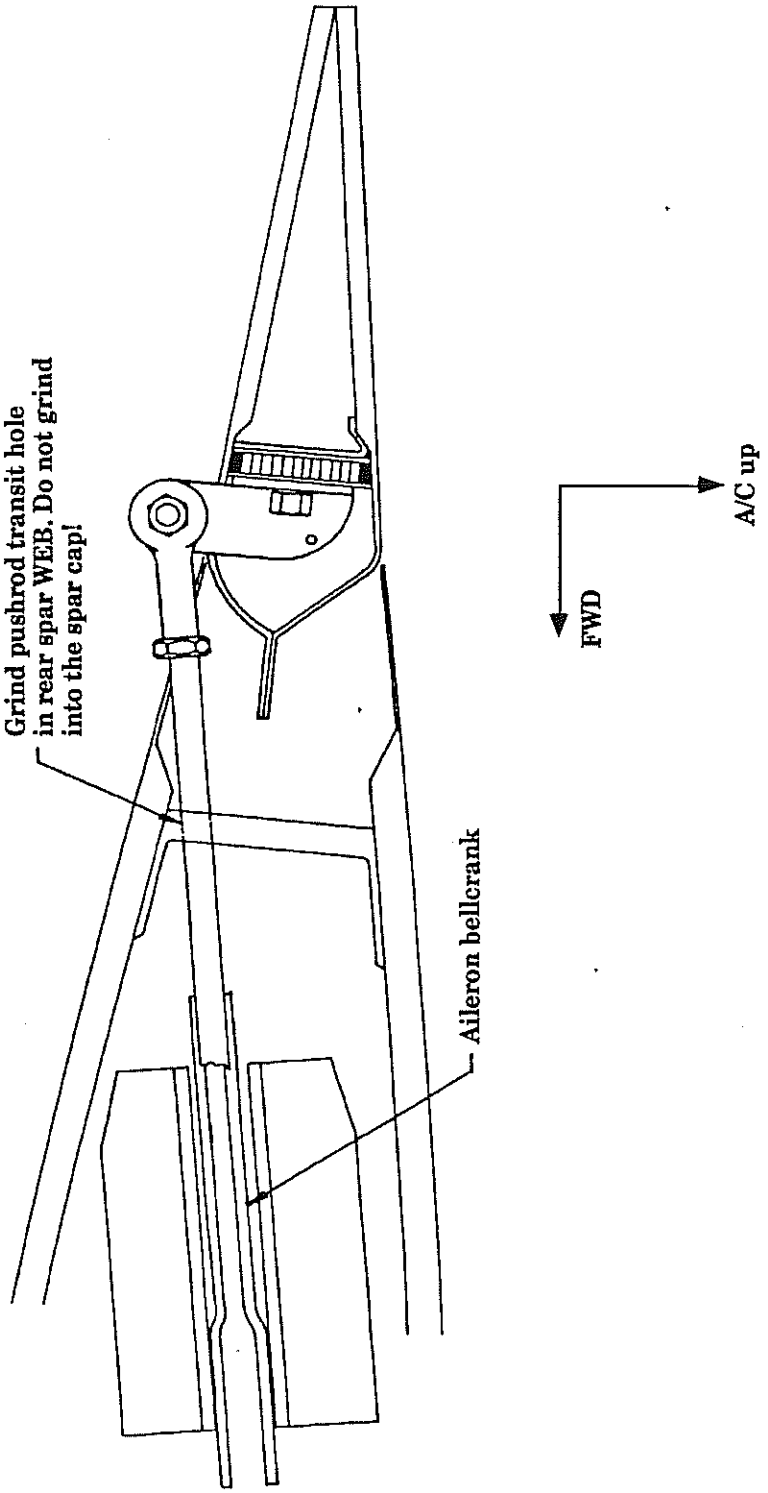
**Short Aileron Pushrod**
Figure 8:K:4




K8. Drill a 3/16" hole through the rear spar web for the short pushrod to transit. Run a string line from the bell crank bolt hole for the short pushrod to the actuator arm mounted on the aileron spar. The string line will show you which way to bias the hole in the rear spar while providing clearance for the short pushrod. Enlarge the hole until you can connect the aileron actuator arm to the bell crank with the short pushrod. To avoid too large of a hole in the rear spar web, make sure that the material clears just enough so the threaded rod will fit through WITHOUT the rod end bearing or safety nut installed.

## Short aileron pushrod

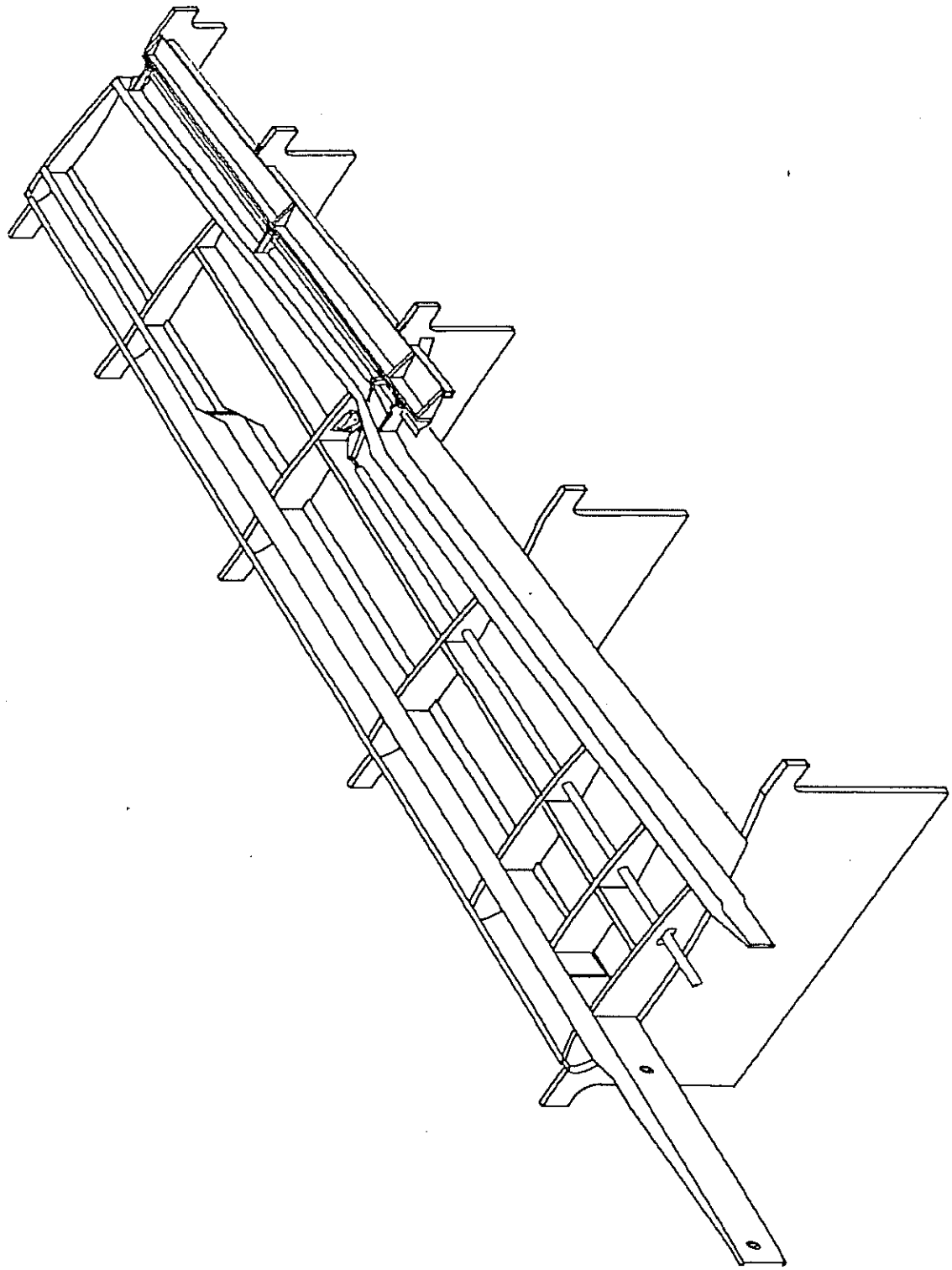
Figure 8:K:5



K9. Bolt both the long and short aileron pushrods to the bellcrank. Bolt the short pushrod to the actuator arm. With the aileron hinges connected, you should be able to move the aileron to it's travel limit. Watch the pushrods for any signs of pushrods rubbing on ribs and/or the rear spar. Grind or sand as necessary so the pushrods have at least 1/8" clearance from all other parts of the wing structure during the entire aileron travel.

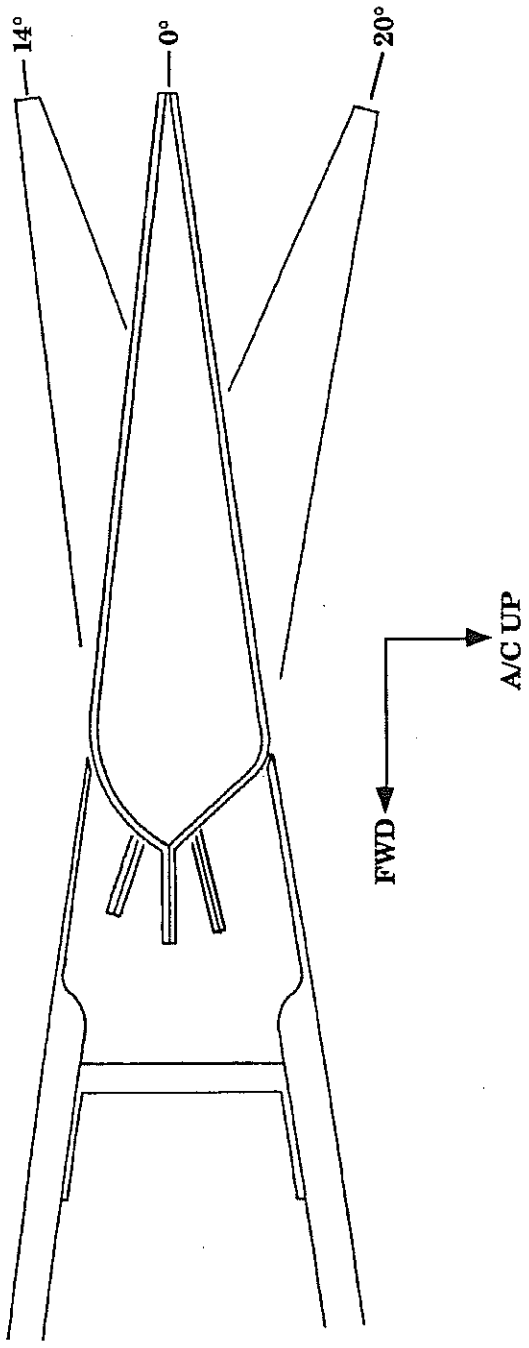
## Pushrods installed in wing

Figure 8:K:6



K10. Travel limits for the aileron are 20° up and 14° down. PLEASE keep in mind that your wing is upside down, so you will actually adjust the aileron throw so the aileron will move 20° down and 14° up, when the wing is sitting in the jig.

**Travel limits of the aileron**
Figure 8:K:7



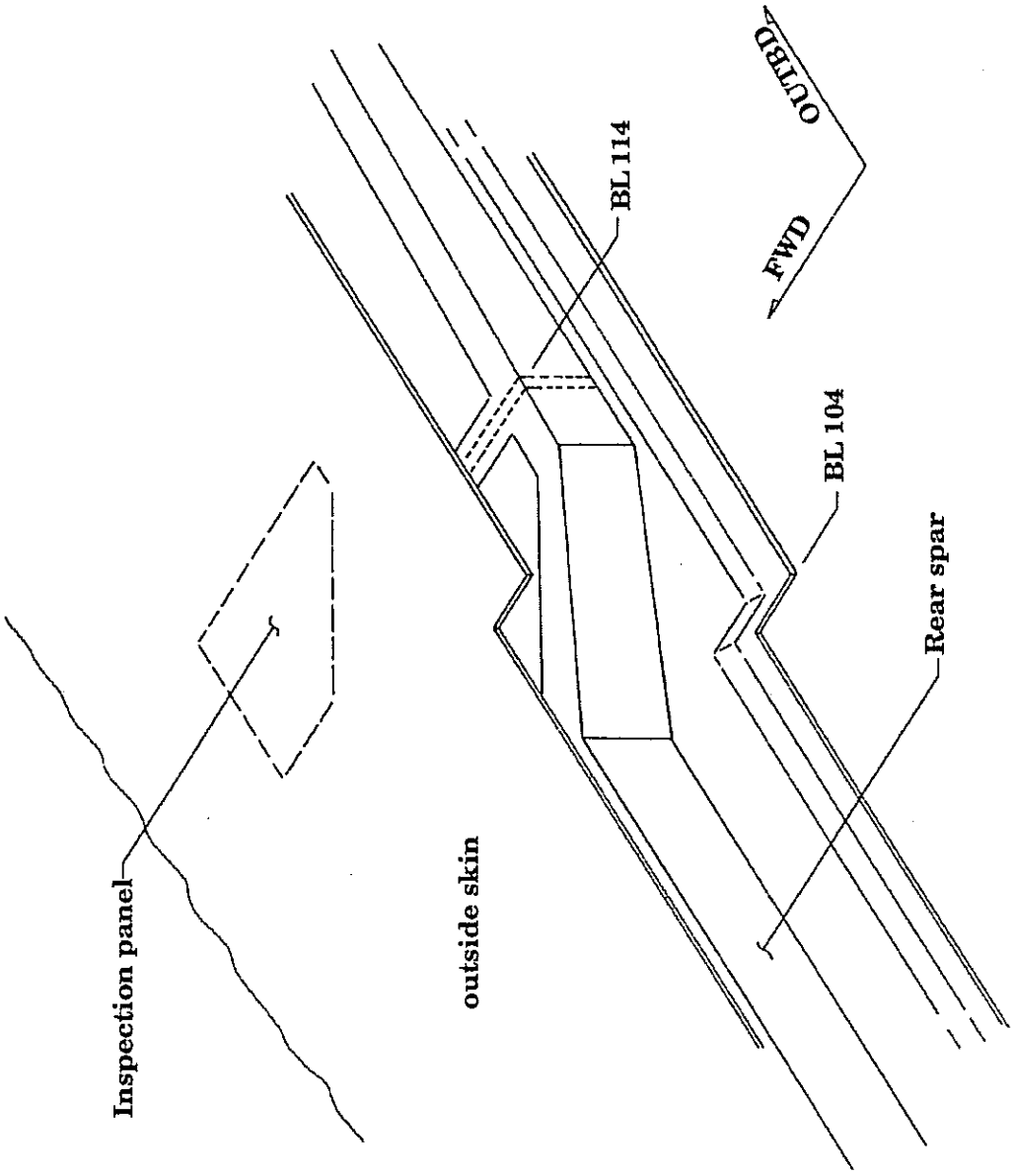
K11. Adjust the aileron pushrods so that when the long pushrod moves 7/8" - 1" either way from neutral, the aileron will move to it's proper travel limit. The easiest way to do this is to set up your aileron control system (in only one wing) where you think it's correct. Position the aileron in the neutral position. Make a reference mark on the long aileron pushrod where it exits the BL 25.5 rib. Pull the long pushrod inboard 1" using the reference line as a gauge. The aileron should move to it's 20° "up" position (the aileron T.E. will move down because the wing is upside down). Now push the long pushrod 1" outboard. The aileron should move to it's 14° "down" position.

## L. BELLCRANK INSPECTION PANEL

There is a glass to glass area molded into the bottom wing skin for an inspection panel. The only regulating factors on the size of the inspection panel are the size of the glass to glass area and the proximity of the rib and fuel bay capstrips.

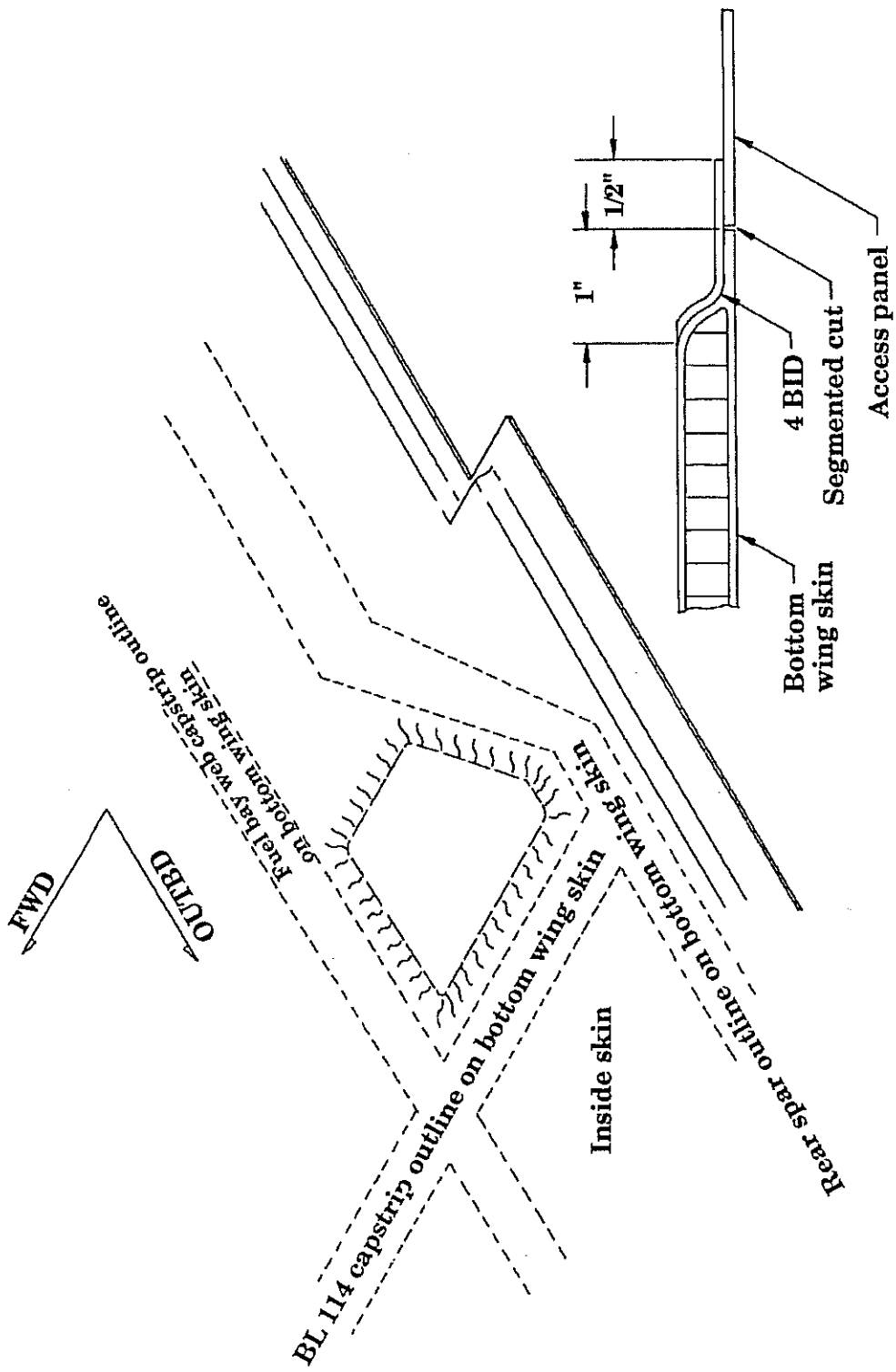
**Inspection panel area on bottom wing skin**

Figure 8:L:1:a



## Inspection panel area on bottom wing skin

Figure 8:L:1:b



L1. Place the bottom wing skin in position and carefully mark where the BL 114 rib capstrip, rear spar and the aft fuel bay web capstrip are located. Remove the bottom skin again and check that these capstrips do not lay onto the glass to glass area. If they do, you can trim up to 1/4" max off the capstrips.

L2. Mark the outline of the inspection panel on the inside surface of the bottom wing skin. Cut through the line leaving just enough uncut to hold the panel in position, 2" cut for every 1/4" uncut should do fine. Keep in mind that the piece you cut out of the wing will be your panel, so make a nice cut.

Note: The process of cutting out and making a flange for this aileron bellcrank access panel is the same process used to make the trim servo inspection panel in the elevator and the flap bellcrank access panels.

L3. Sand the area 1" surrounding the inspection panel and clean with MC.

L4. Cover the inspection panel with plastic release tape.

L5. Lay a 4 BID flange around the inspection panel. The BID tapes should overlap the panel by 1/2" and the wing skin by 1".

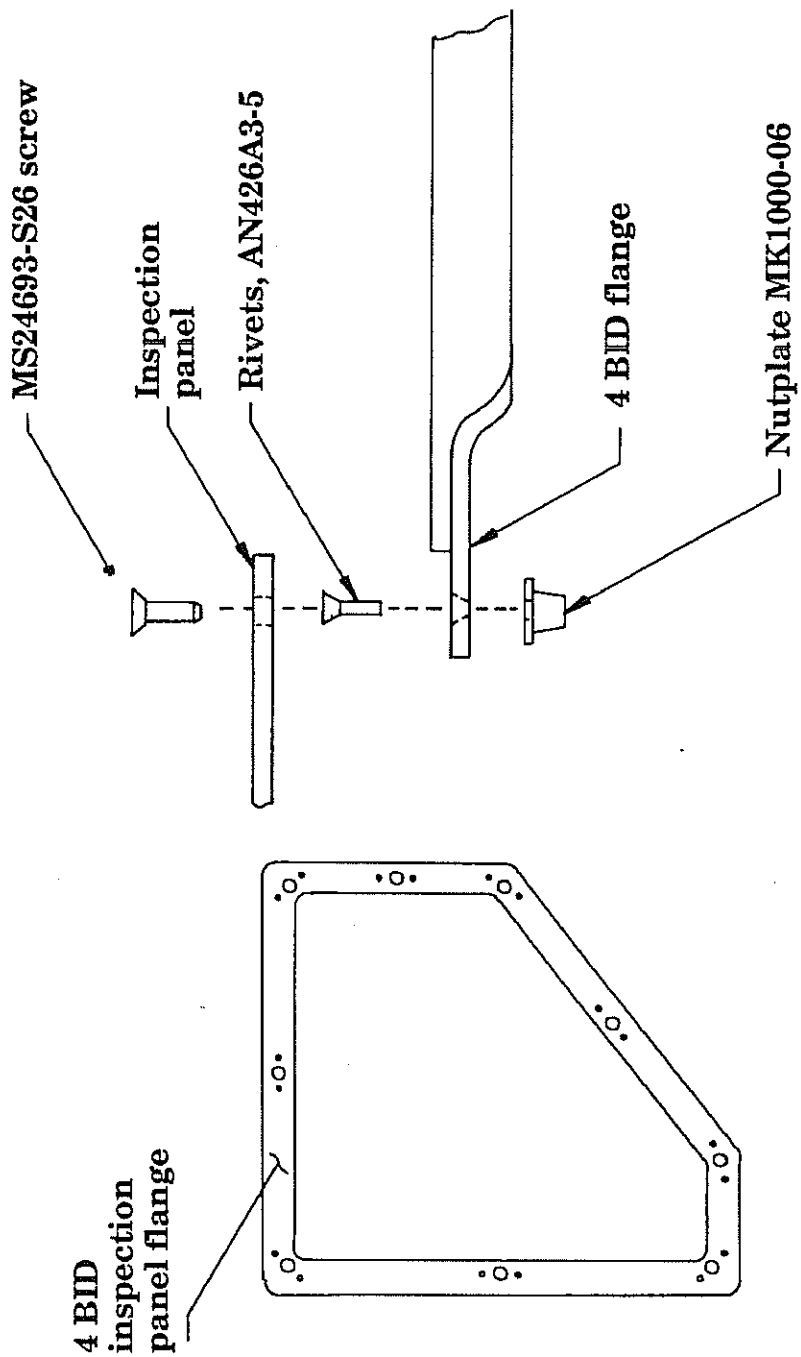
L6. After cure, carefully cut through the remaining carbon fiber so the inspection panel can be popped free.

L7. Sand the edges of the panel straight and smooth out the radius in the corners. Also trim the flange straight and smooth out the edges and radii.

L8. Place the inspection panel in position and drill through the panel and the flange for the MS24693-S26 mounting screws where indicated in Figure 8:L:2.

## Location of access panel screws

Figure 8:L:2



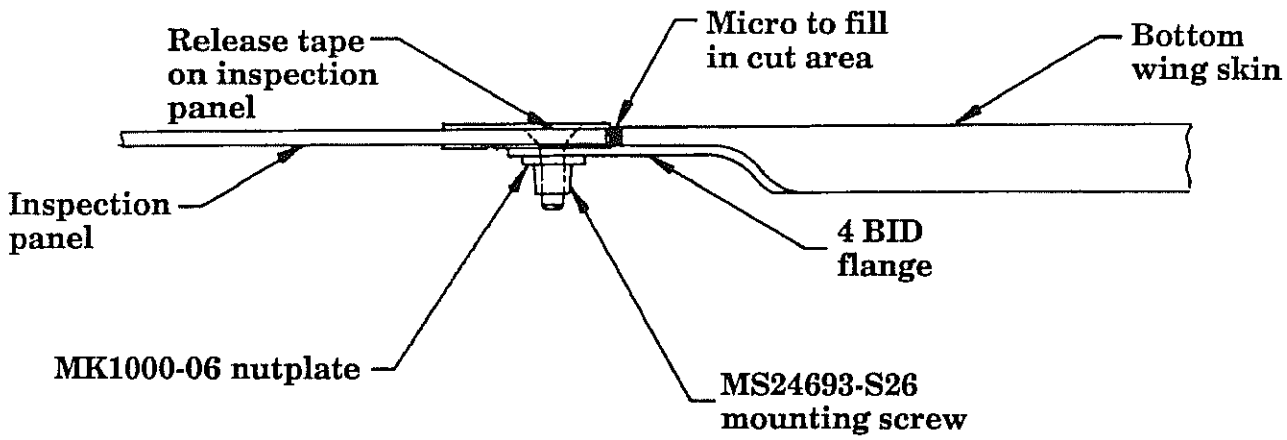
L9. Install MK1000-06 nutplates for the inspection panel mounting screws. Use AN426A3-5 rivets to secure the nutplates in position.

L10. Countersink the inspection panel for the MS24693-S26 screws.

L11. If the width of the inspection panel cut is more than you desire, you should do another release to fill it up. Apply release tape around the edges of the access panel. Screw the access panel back in position and cover the screws with release tape.

**Second release to fill excess width**

Figure 8:L:3




L12. Fill the gap with micro and allow to cure.

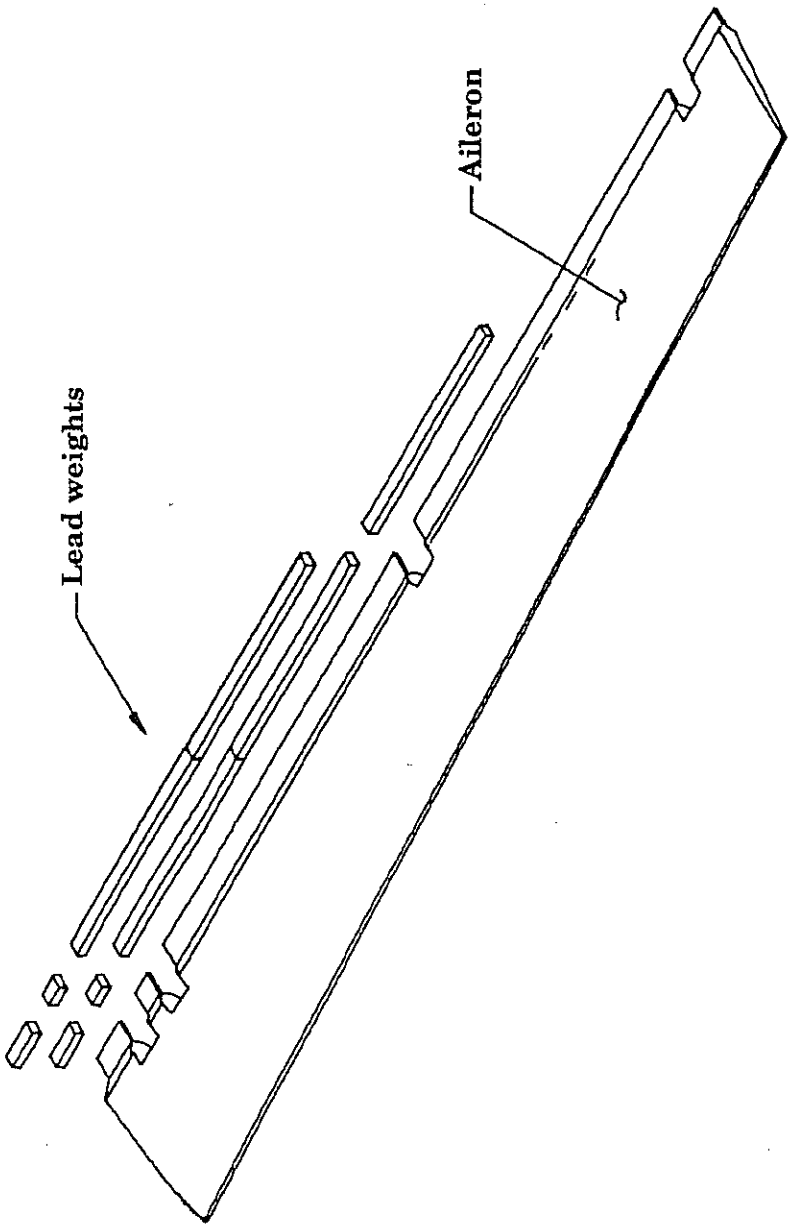
L13. After cure, sand the micro flush to the access panel. Remove the panel. Now the gap is too close for primer and paint, but a careful sanding of the panel will take care of this.

## M. BALANCING AILERONS

Like the elevators, the ailerons are 100% mass balanced with lead weights. Since there is no counterweight arm to mount the lead in, half-round lead weights are bonded to the L.E. flange of the aileron. These weights are provided in the kit. This counterweight system has no drag penalty and is simple to build.

**Balancing aileron**

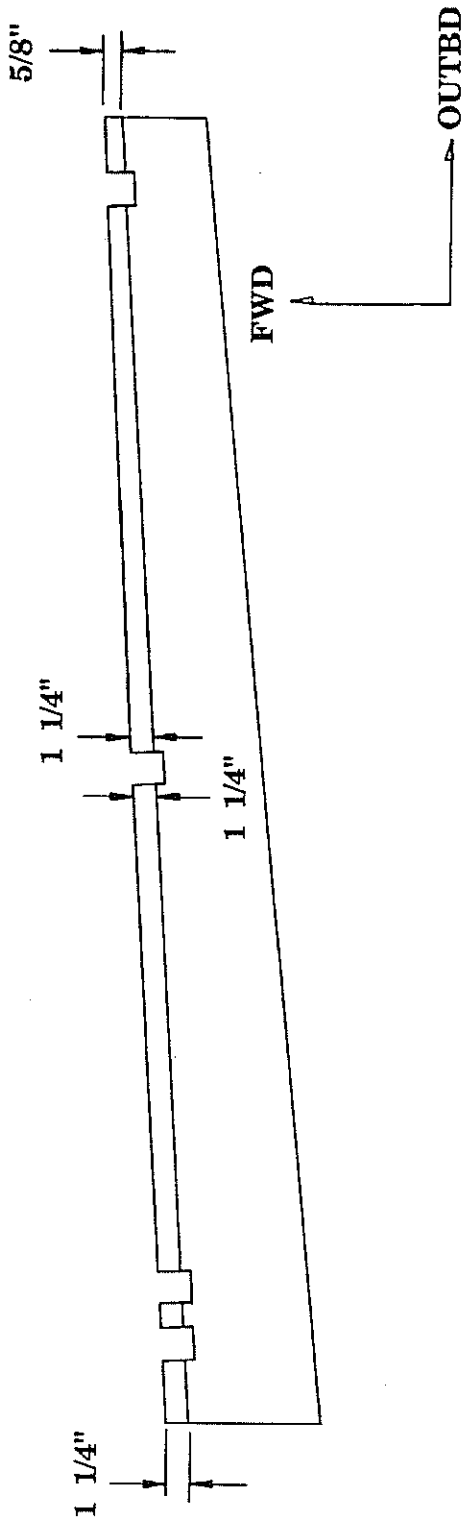
Figure 8:M:1



M1. Trim the aileron L.E. flange to 1 1/4" wide between BL 104 and the center aileron hinge. At the center hinge, the flange width should start decreasing, going down to 5/8" at the tip.

## Trimming L.E. flange

Figure 8:M:2

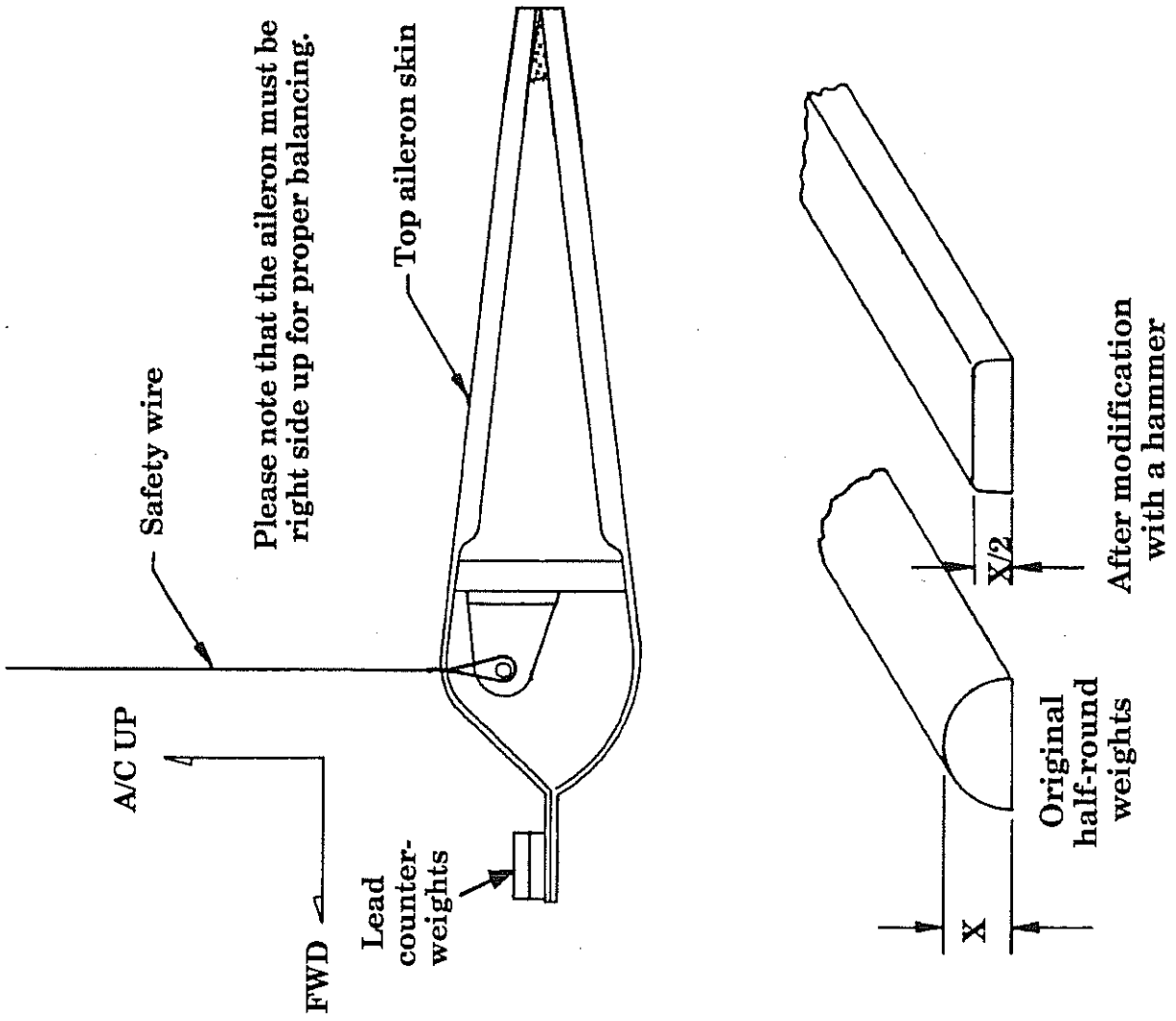


M2. Suspend the aileron with safety wire by inserting the hinge bolts into the aileron hinges and threading the wire around the bolts. Attach the three wires to a straight board (or a length of steel or angle iron) so the aileron hangs level underneath. Support the straight board at each end with sawhorses. It is important that the aileron hang level for proper balancing, and be top skin UP.

M3. It will take about six half-round weights to balance each aileron. The weights should be flattened with a hammer (a carpenter's hammer with the rough striking surface works well) to half their original thickness.

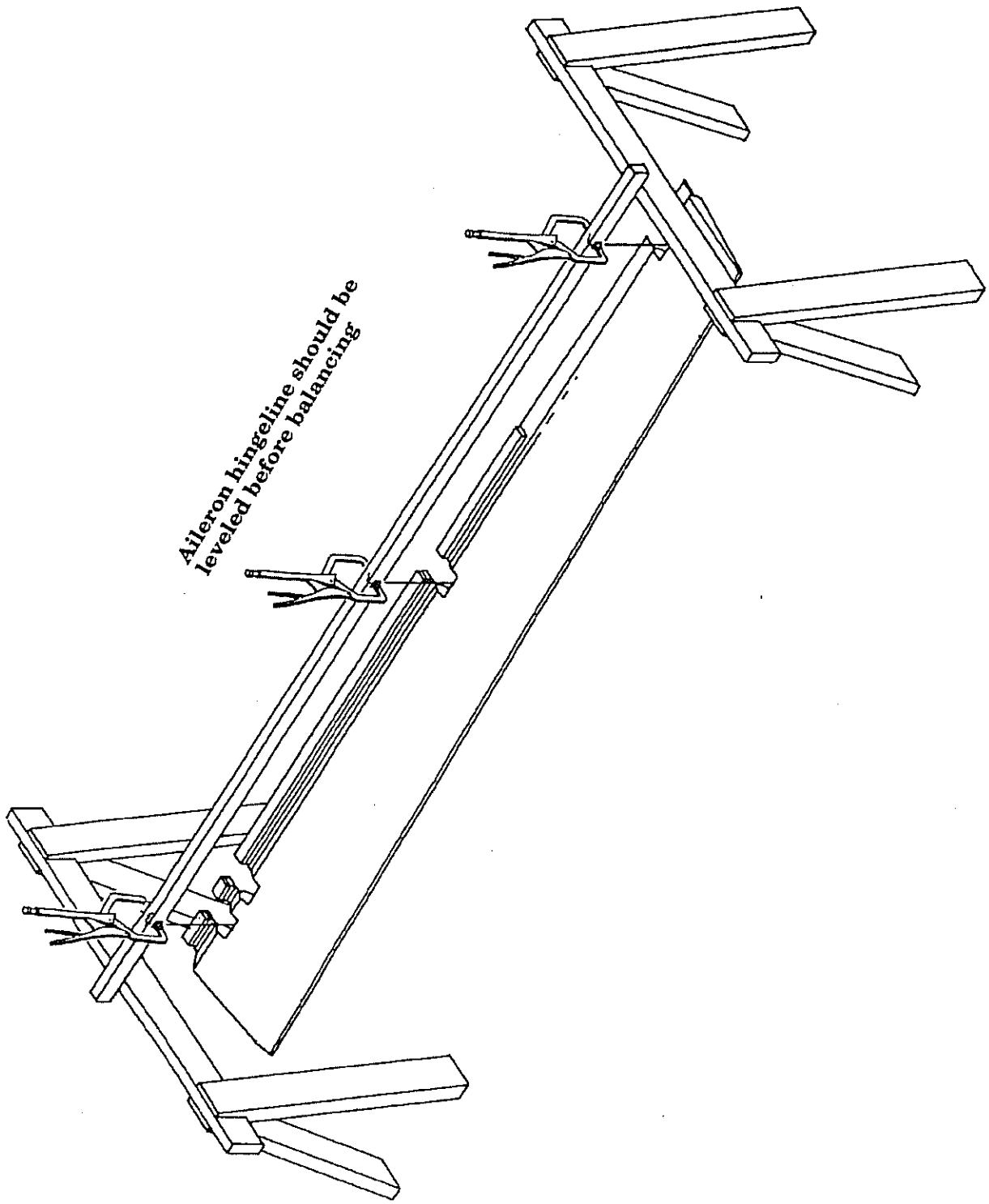
**Suspending aileron for balancing**

Figure 8:M:3:a



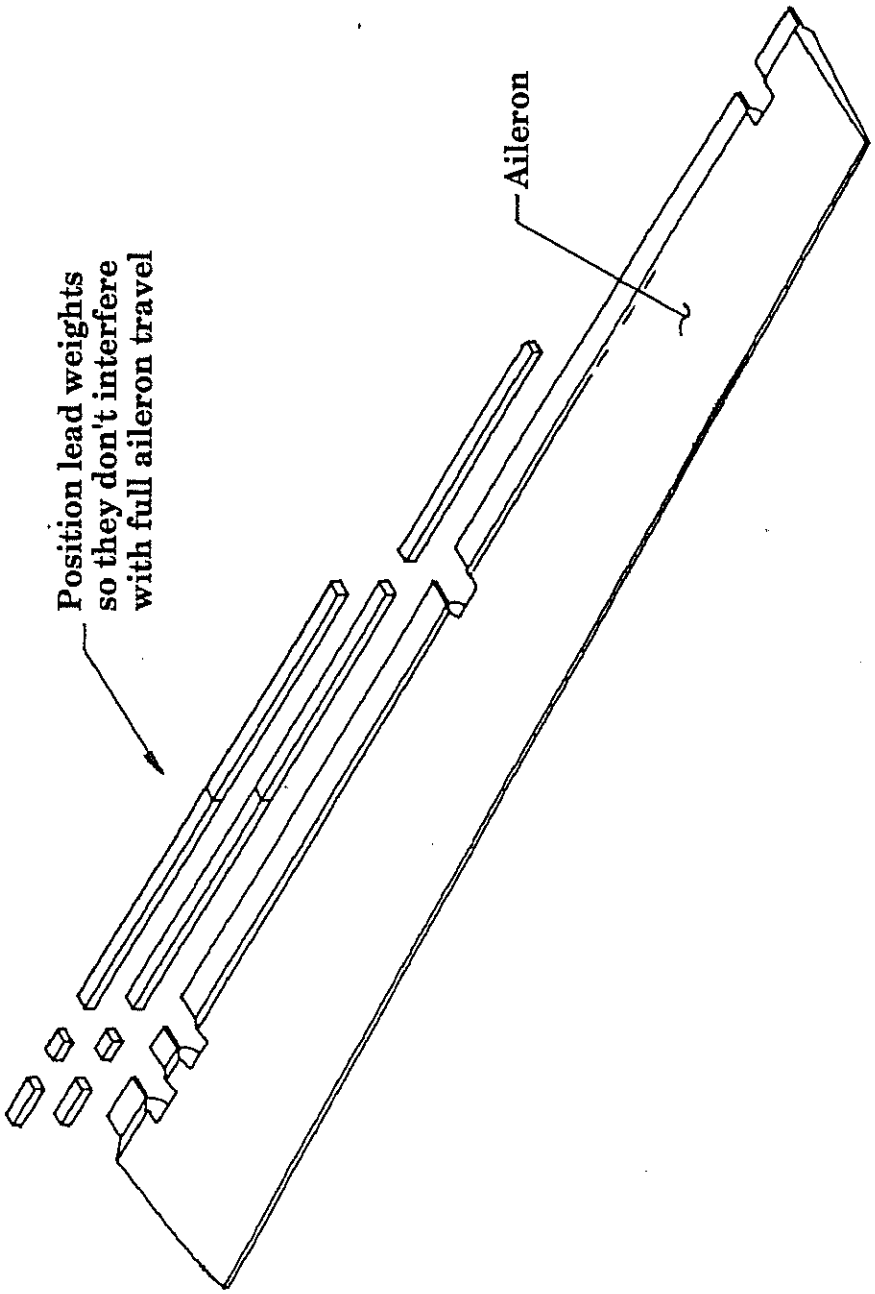
## Suspending aileron for balancing

Figure 8:M:3:b



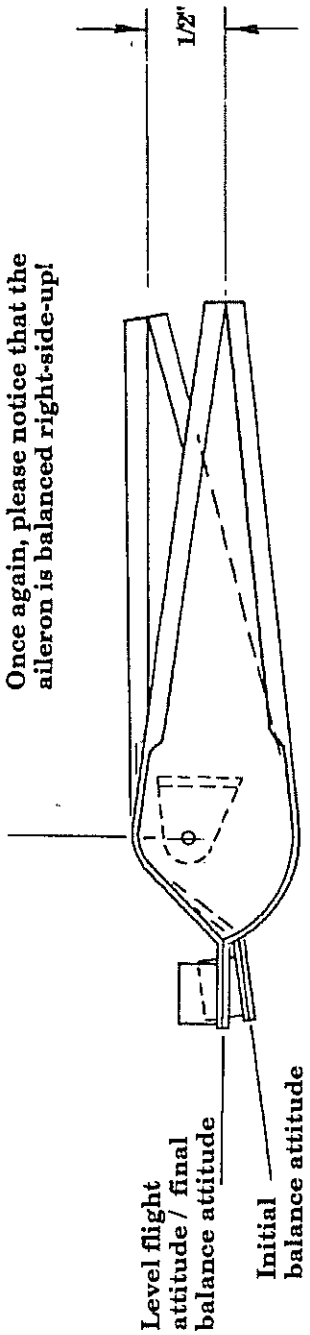
M4. Position the lead weights on the aileron L.E. flange as shown in Figure 8:M:4. This will require cutting a couple of the weights. Be sure to position the weights as far forward on the L.E. flange as possible to take advantage of the moment arm. Use instant glue to secure the weights to the flange.

**Initial positioning of lead weights**
Figure 8:M:4



M5. The aileron should be overbalanced so the trailing edge is about 1/2" higher than level. This will allow for the added weight of primer and paint. After you have finished the aileron, you can do a final balance by drilling holes through the flange and lead weights. **The aileron must not be underbalanced!**

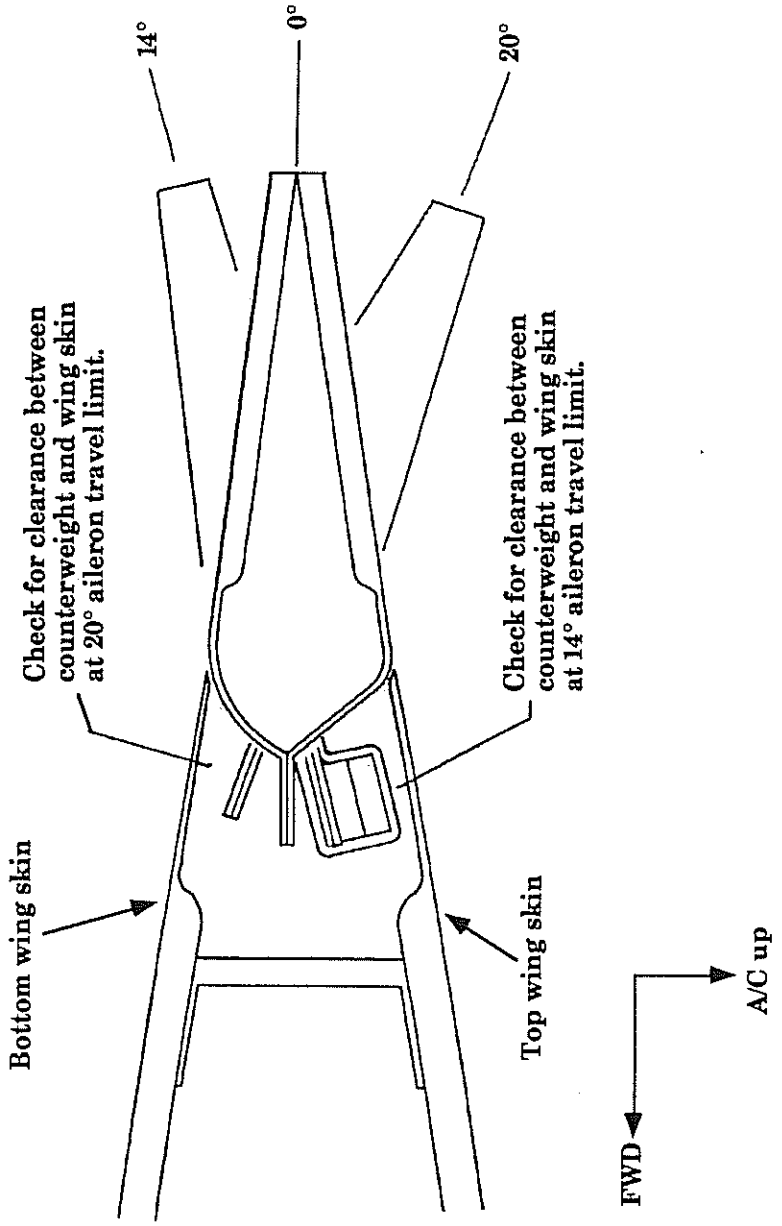
**Balancing ailerons**
Figure 8:M:5



M6. When satisfied that you have enough lead attached to the L.E. flange, use instant glue to temporarily hold the lead in position, then install the aileron on the wing. Rotate the aileron through it's travel range and check that the lead counterweights do not strike the inside of the top wing skin before the aileron has reached it's full travel. Lay the bottom wing skin in position and again check the aileron for freedom throughout it's travel range. Sand or file a radius on the lead weights or aileron L.E. flange if either interferes with the aileron's travel limits.

**Checking for counterweight clearance**

Figure 8:M:6



M7. Secure the lead counterweights to the aileron L.E. flange with flox and 2 BID. There's no need to remove the lead weights from the flange, just push the flox into the gaps and crevasses so the cloth will lay nicely over the rough lead surface. Extend the 2 BID for a distance of 1" onto the surface of the top and bottom aileron skins. Refer to Figure 8:M:7.

**WARNING: Be sure you have sanded and cleaned the surfaces you are bonding to. Failure of the counterweights (falling off!) could be extremely dangerous.**

**Securing counterweights to flange**
Figure 8:M:7