

# CHAPTER 8 FAST-BUILD AILERONS

## REVISIONS

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 When such revisions are made, immediately replace all outdated pages with the revised pages.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

## ARROWS

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



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# 1. INTRODUCTION

This chapter applies to the new LIV fast build wing kit. The ailerons are prebuilt and closed at the factory. The remaining items to be completed are: Trim tab installation, counterweight installation, and body work.

The Lanciar 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 you have 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 the chapter show the left aileron. The right aileron is identical except for the lack of a trim servo.



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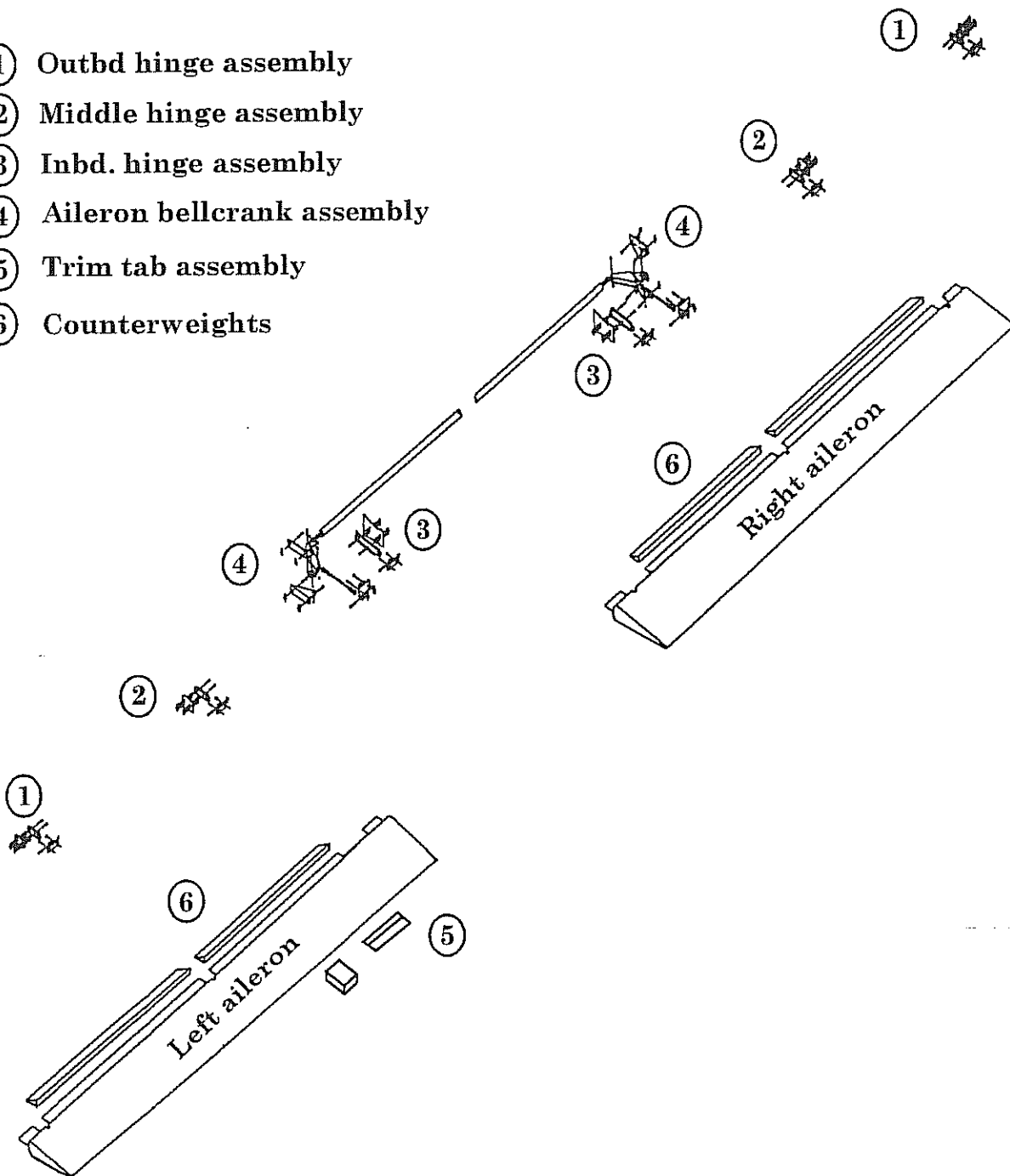
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# Ailerons, Exploded View

Fig. 8.I.1.

- ① Outbd hinge assembly
- ② Middle hinge assembly
- ③ Inbd. hinge assembly
- ④ Aileron bellcrank assembly
- ⑤ Trim tab assembly
- ⑥ Counterweights

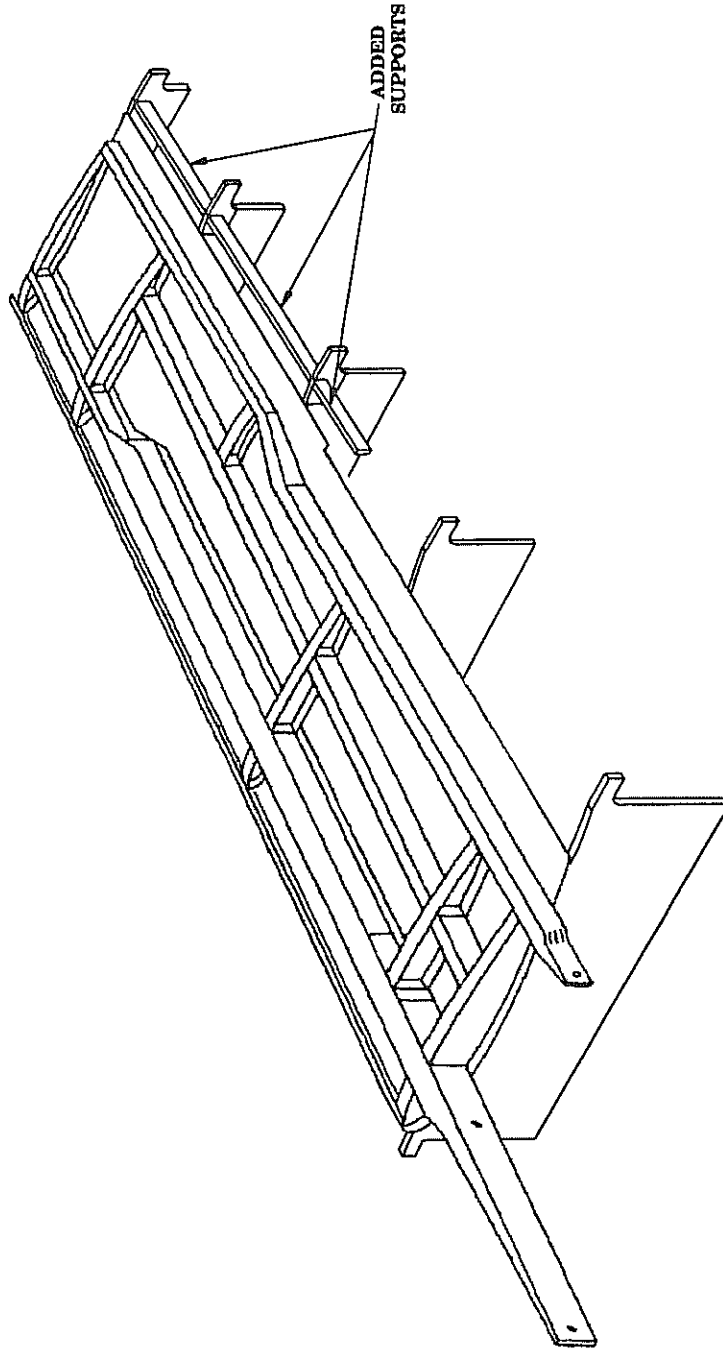


## A. WING JIG MODIFICATIONS FOR AIERONS

In order to swing the ailerons while in the wing jig, it is necessary to remove a portion of the three outboard cradles.

### Wing Jig Mods for Aileron Construction

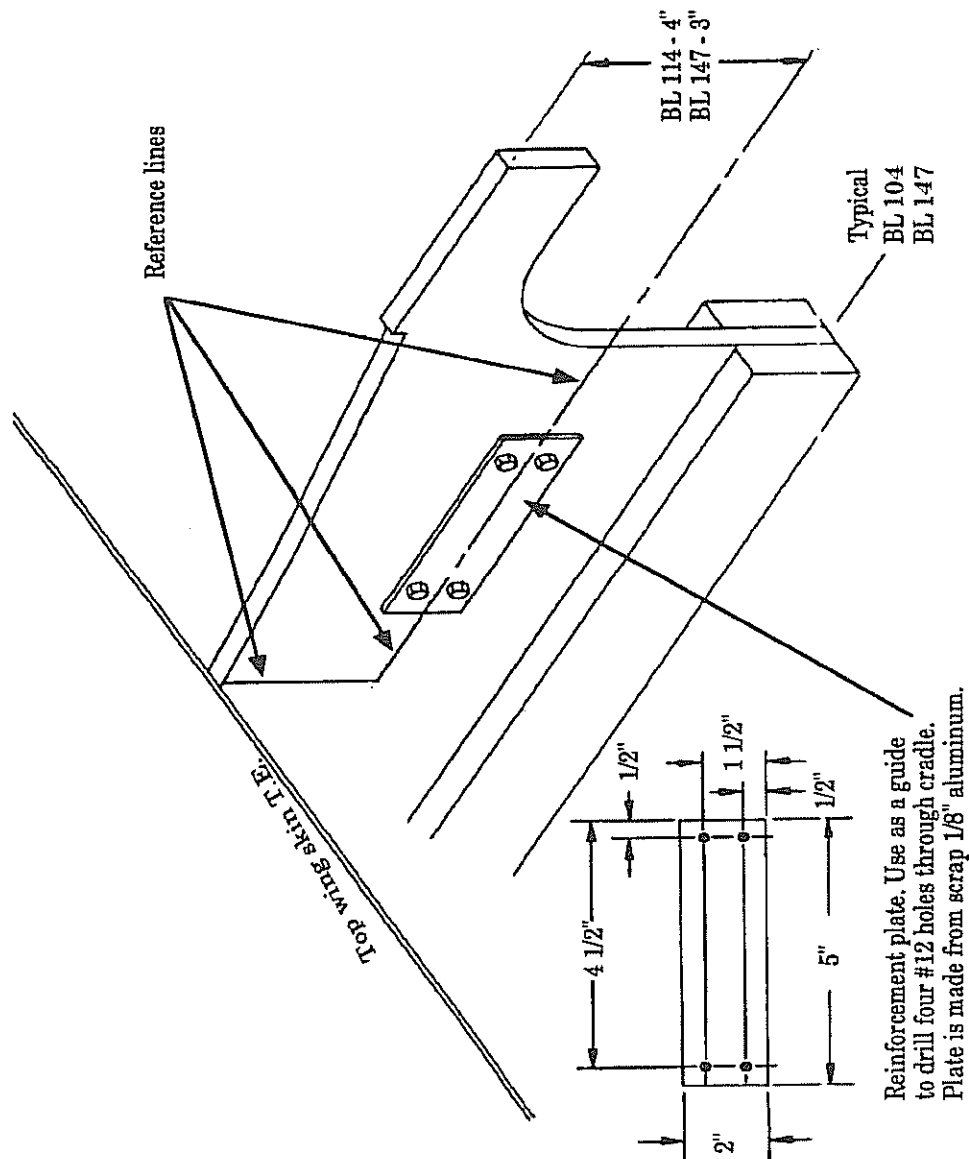
Fig. 8:A:1.



- A1. The first modification of the wing jig is cutting out square areas in the BL 104, BL 147, and BL171 jig cradles so the aileron can be swung through its full range of travel later in construction. Draw reference lines on the three cradles as shown in Fig. 8:A:2. Do not make any cuts yet.

### Aligning Reinforcement Plates on Cradles

Fig. 8:A:2.

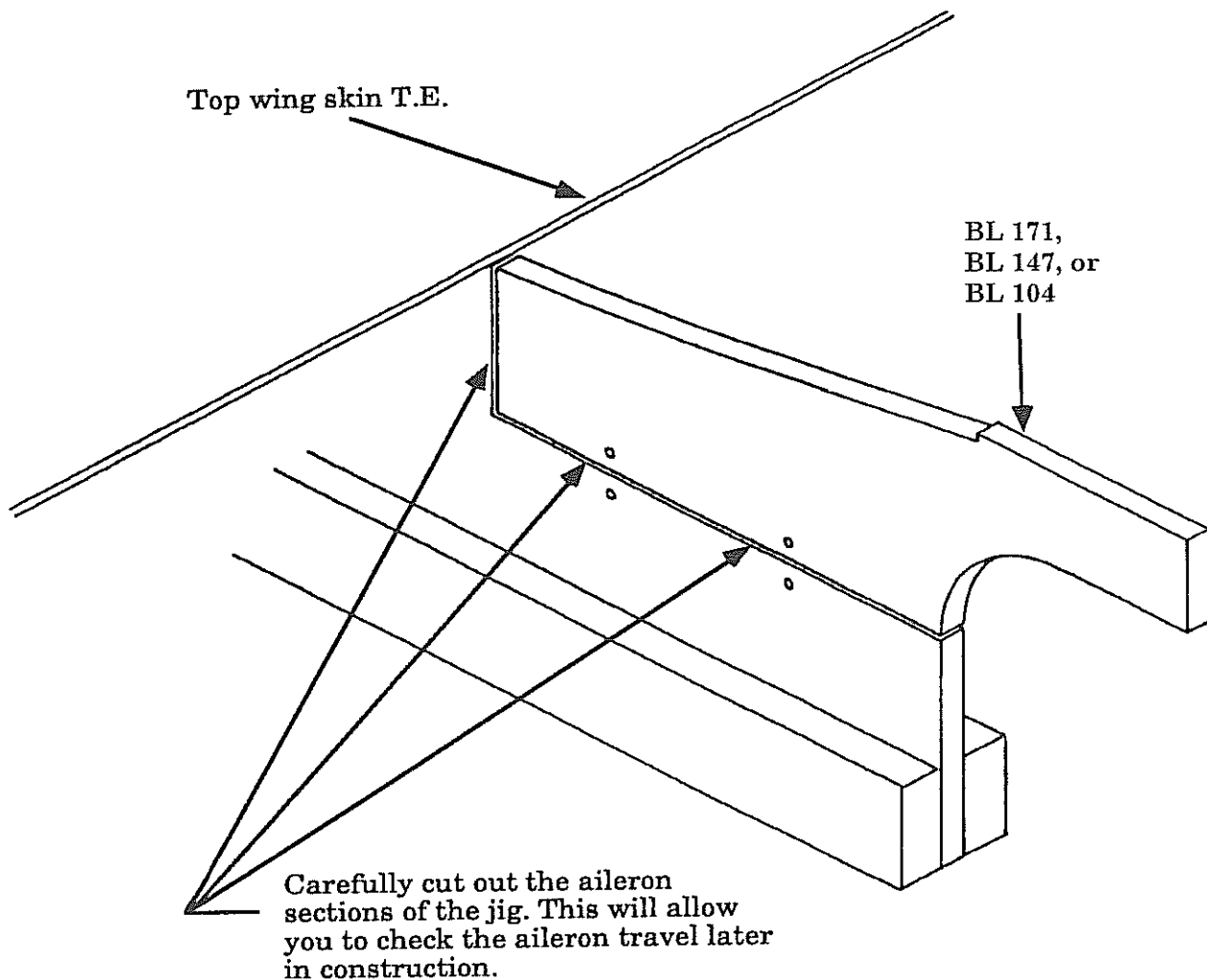


- A2. Center the two aluminum reinforcement plates on the bottom reference line. Drill four #12 holes through each reinforcement plate and jig cradle as shown in Fig. 8:B:2.

- A3. Now you can use the reference lines to carefully cut out the aileron sections from the cradles.

### Installing Reinforcement Plates and Finishing Cut

Fig. 8:A:3.



Note: Remove the angle iron supports from the trailing edge.

- A4. Secure the reinforcement plates to the jig cradles with AN3-10A bolts, AN960-10 washers, and AN365-1032 locknuts.
- A5. 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.

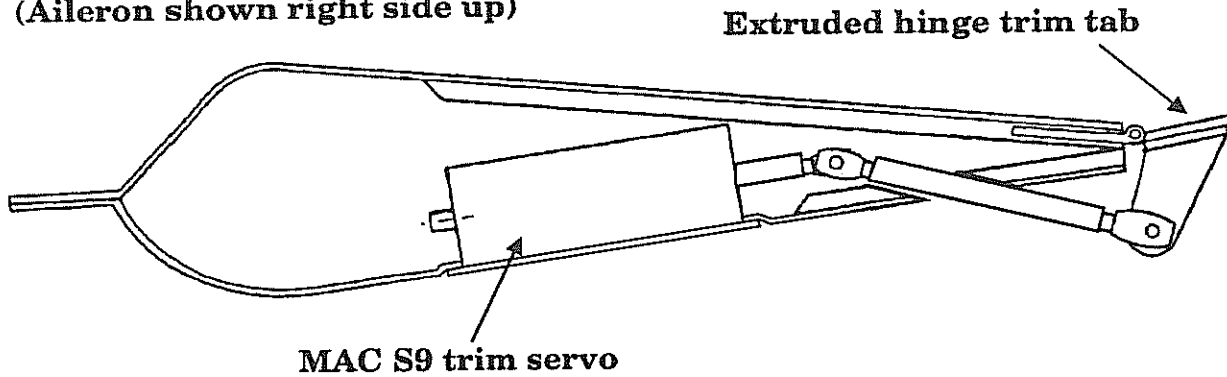
## B. INSTALLING THE ROLL TRIM SYSTEM

The MAC S9 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

Fig. 8:B:1.

(Aileron shown right side up)



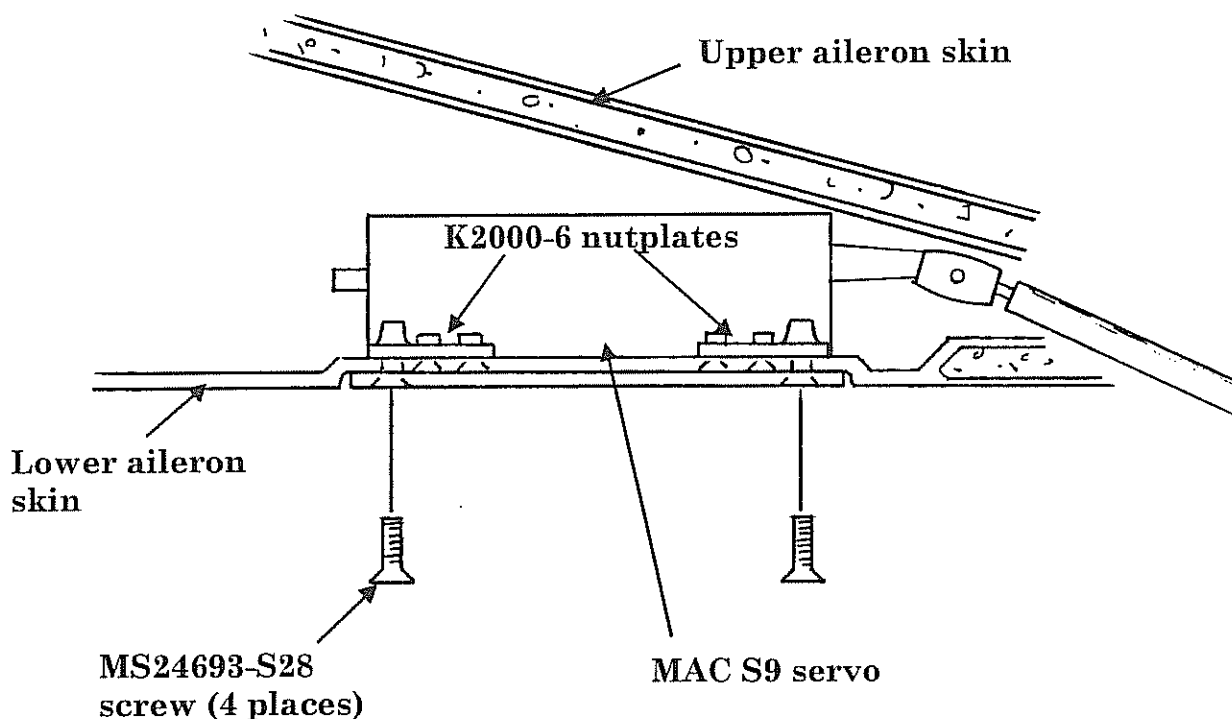
This method of roll trim is more simple than and just as reliable as a cable/pulley/spring system and it weighs much less.





## Servo Installation

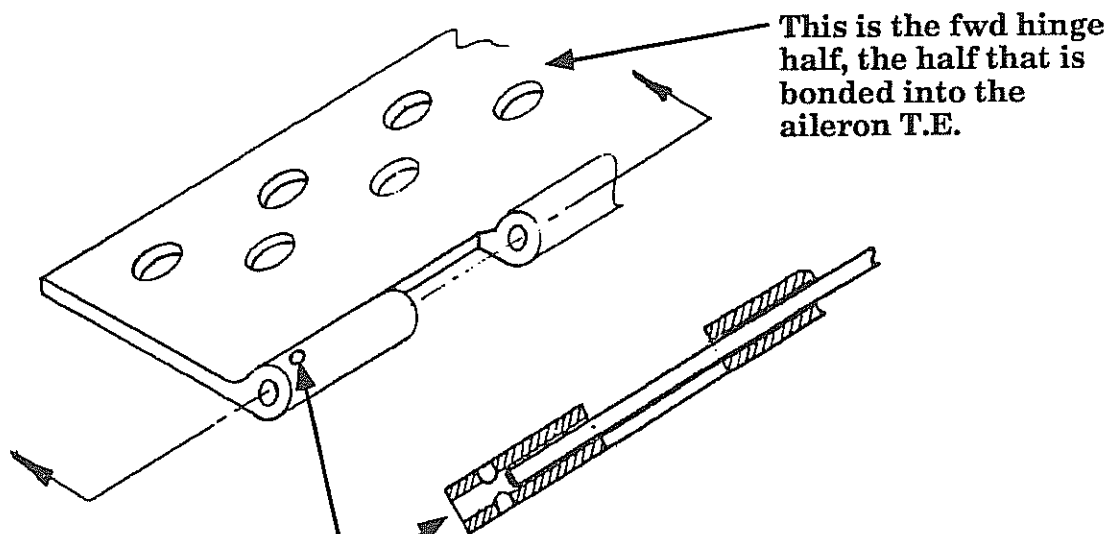
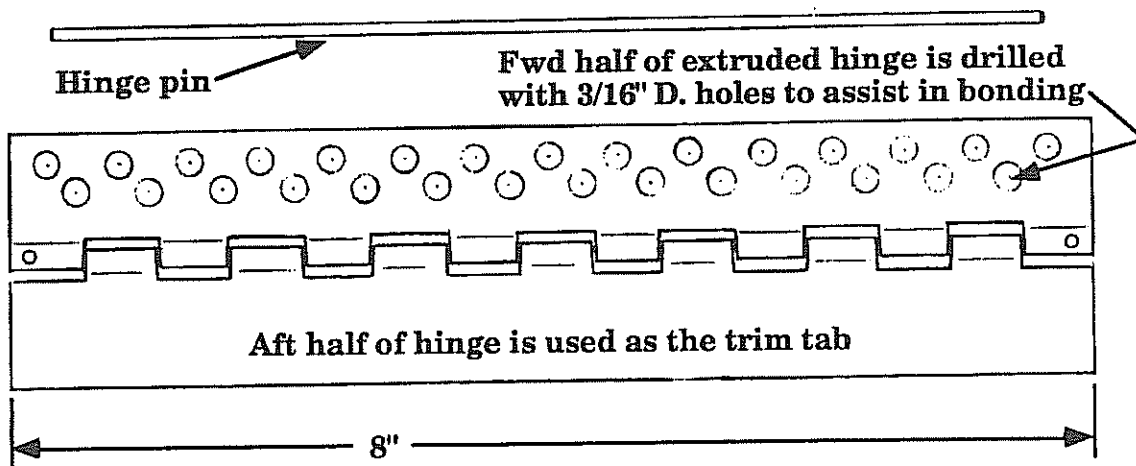
Fig. 8:B:2.



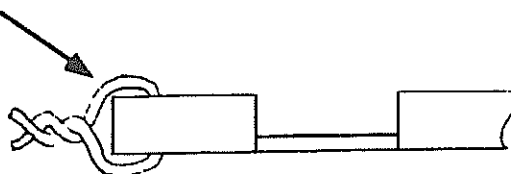
- B1. Install the servo motor as shown in Fig. 8:B:2.
- B2. The trim tab is cut from the extruded hinge material supplied in the kit. Cut an 8" length of hinge as shown in Fig. 8:B:3.
- B3. Drill numerous 3/16" dia. holes in one half of the trim tab hinge. These holes will strengthen the mechanical bond when the hinge is potted into the aileron T.E..
- B4. 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 wire 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

Fig. 8:B:3.



Drill a #57 hole through each end of the fwd hinge half for safety wire. The wires will secure the hinge pin.



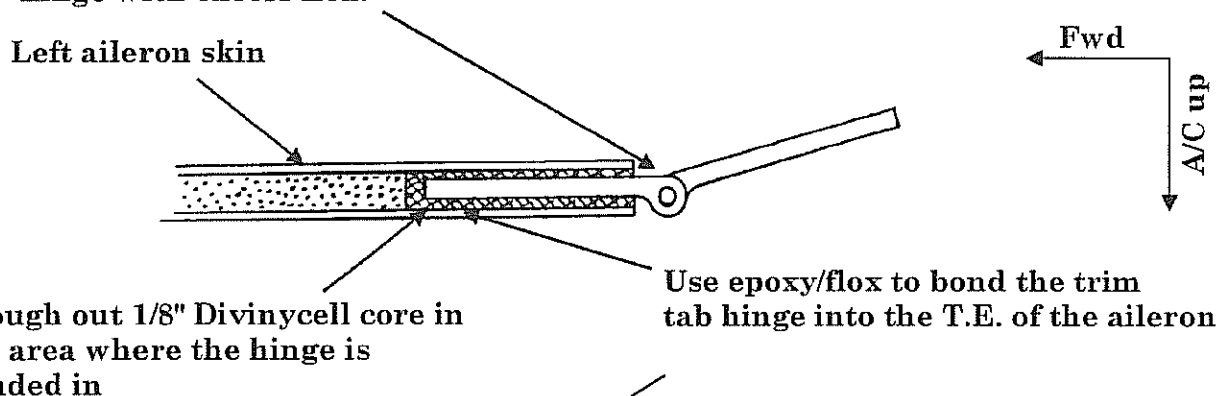
- B5. With 40 grit, sand the half of the trim tab hinge which you have just drilled. Clean this half with MC.
- B6. Rout out the core of the top aileron skin where the trim tab hinge will be mounted. You'll notice that the core of the aileron is not the standard Nomex honeycomb, but a foam-like Divinicell. Clean the routed area with MC.
- B7. 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 the Trim Tab Hinge Into the Aileron T.E.**

Fig 8:B:4.

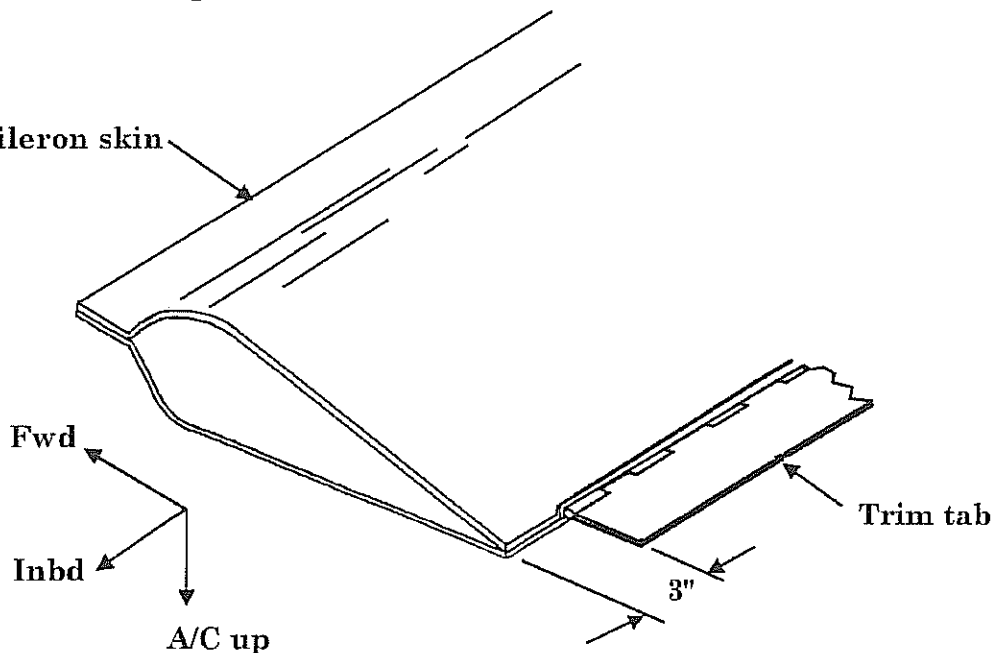
Trim tab hinge. Be careful not to foul the hinge with excess flox.

**NOTE: Remember the arrows! This drawing is showing the aileron skin as it sits IN THE WING JIG!**



Trough out 1/8" Divinycell core in the area where the hinge is bonded in

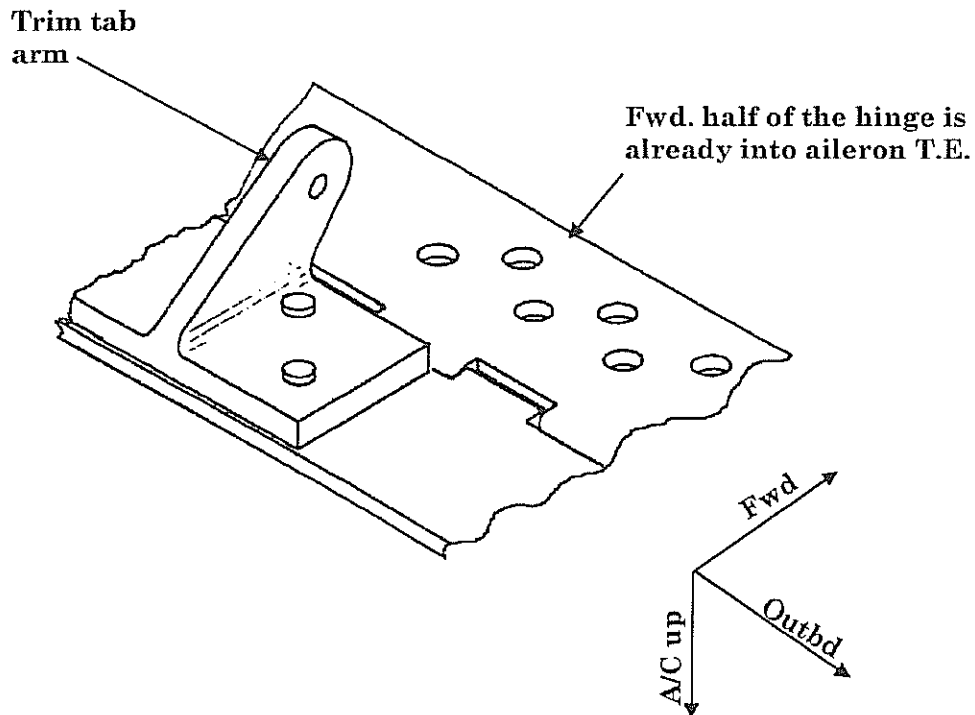
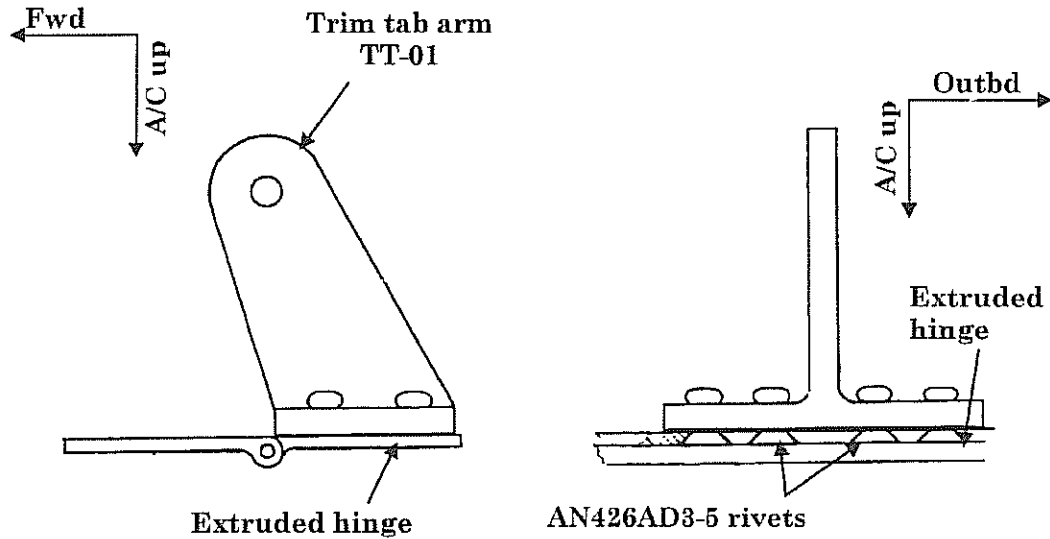
Left aileron skin



- B8. 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 AN426AD3-5 rivets to secure the trim tab arm to the trim tab as shown in Fig. 8:B:5.

### Securing the Trim Tab Arm to The Tab

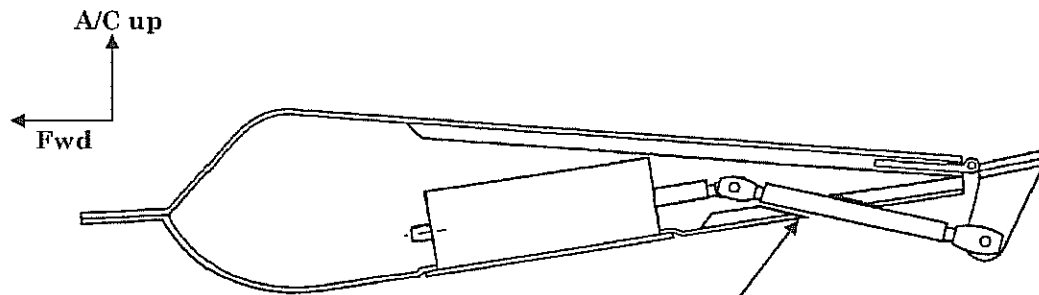
Fig. 8:B:5.



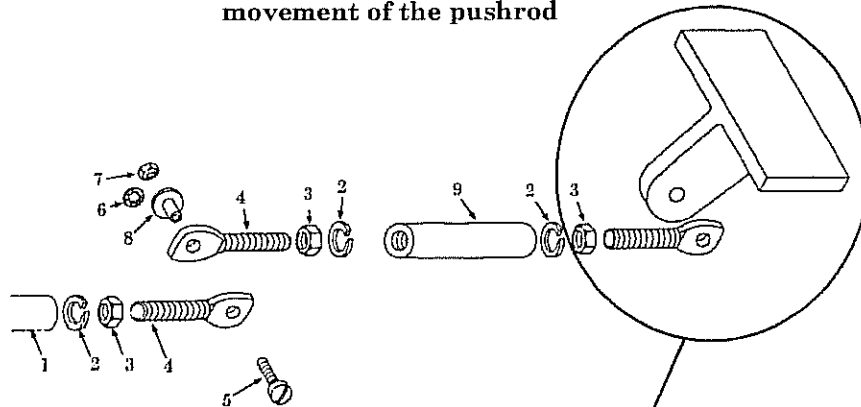
- B9. Grind a pushrod transit hole into the bottom aileron skin. The exact location of this hole may be hard to find because the bottom aileron skin has not been bonded in place. It is probably best to hold off on connecting the aileron servo to the tab until the aileron has been closed out.
- B10. Connect the trim tab arm to the servo using the pushrod hardware provided in the MAC servo box.

### Connecting the Trim Tab to the Servo

Fig. 8:B:6.



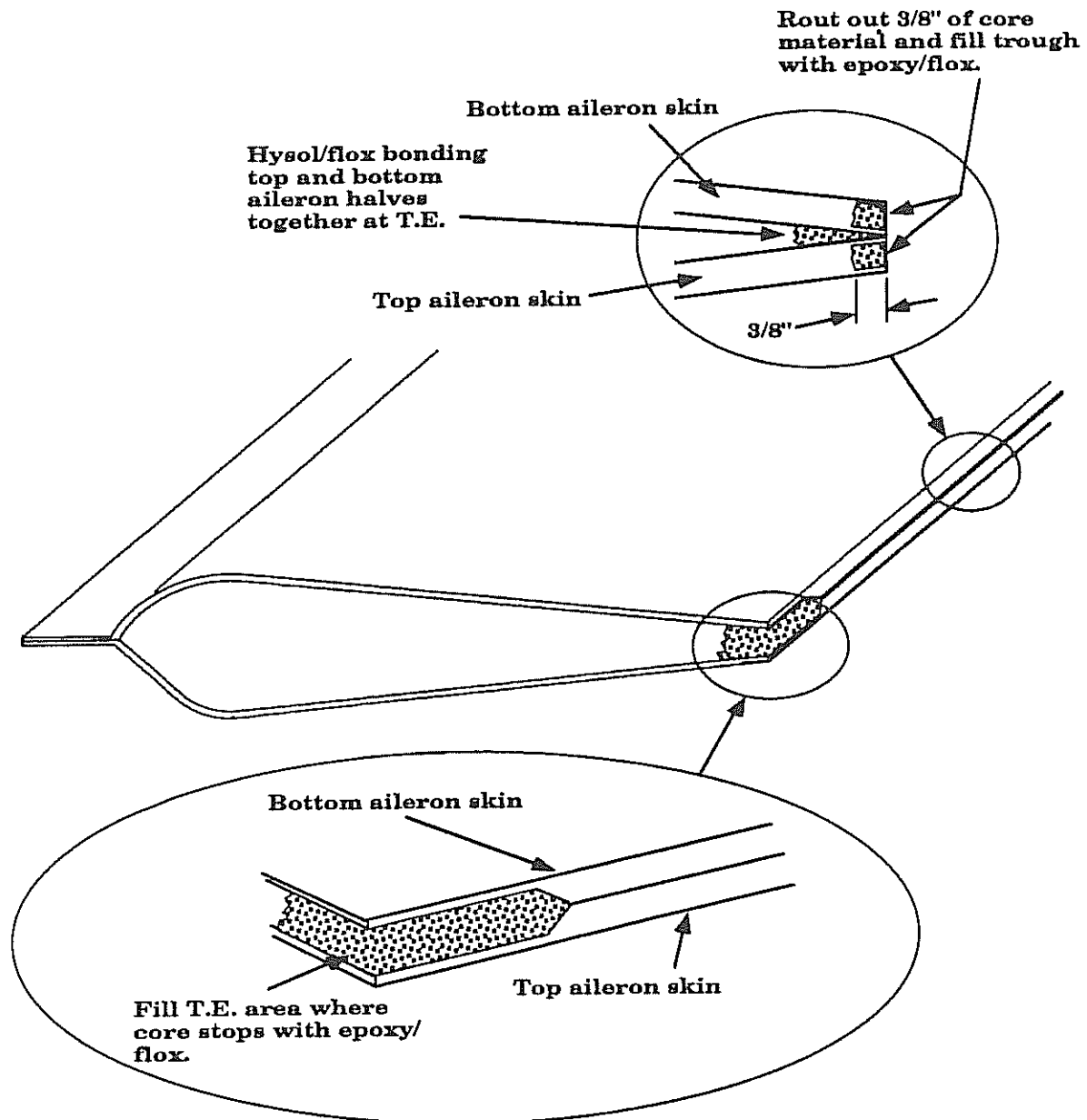
Pushrod transit hole will be oblong to accommodate the fore/aft movement of the pushrod



- 1 - Servo output shaft
  - 2 - Lock washer
  - 3 - Nut
  - 4 - Clevis
  - 5 - Screw (2-56)
  - 6 - Star washer (2-56)
  - 7 - Nut (2-56)
  - 8 - Brass bushing
  - 9 - Aluminum coupling
- 
- A - Screw (2-56)
  - B - Trim tab actuator arm
  - C - Thin washer (2-56)
  - D - Thick washer (2-56)
  - E - Clevis
  - F - Brass bushing (double stepped)
  - G - Locknut (2-56)

## Filling T.E. Joggle with Epoxy/flox

Fig. 8.B:7.



- B11. The two wires for the trim servo are routed forward through the aileron leading edge. 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 in the leading edge of the wing.

- B12. 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.
- B13. Paint a thin coat of epoxy into the T.E. trough you just formed. The epoxy will help the flox bond better.
- B14. 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.
- B15. 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").



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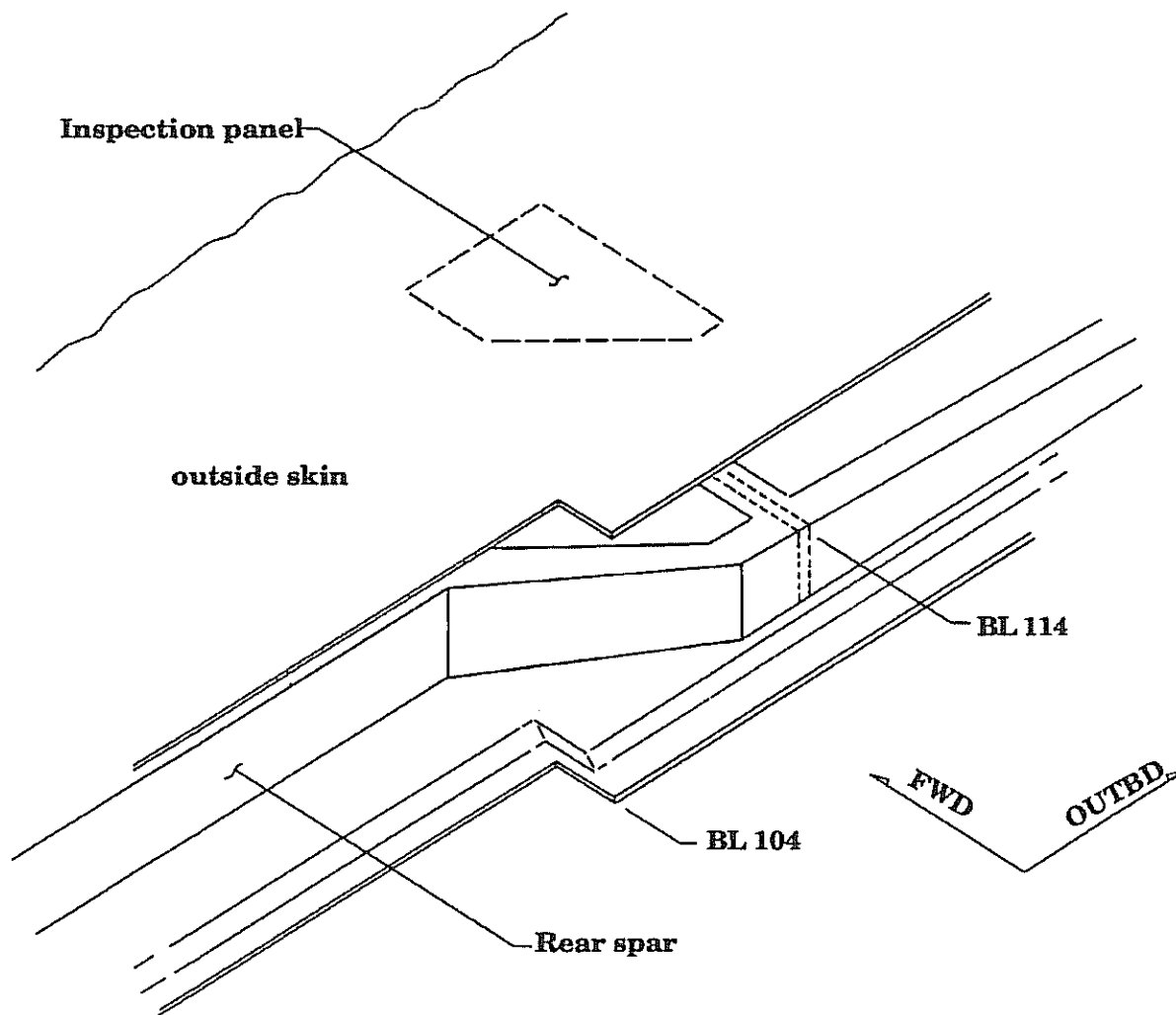
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### C. BELLCRANK INSPECTION PANEL

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

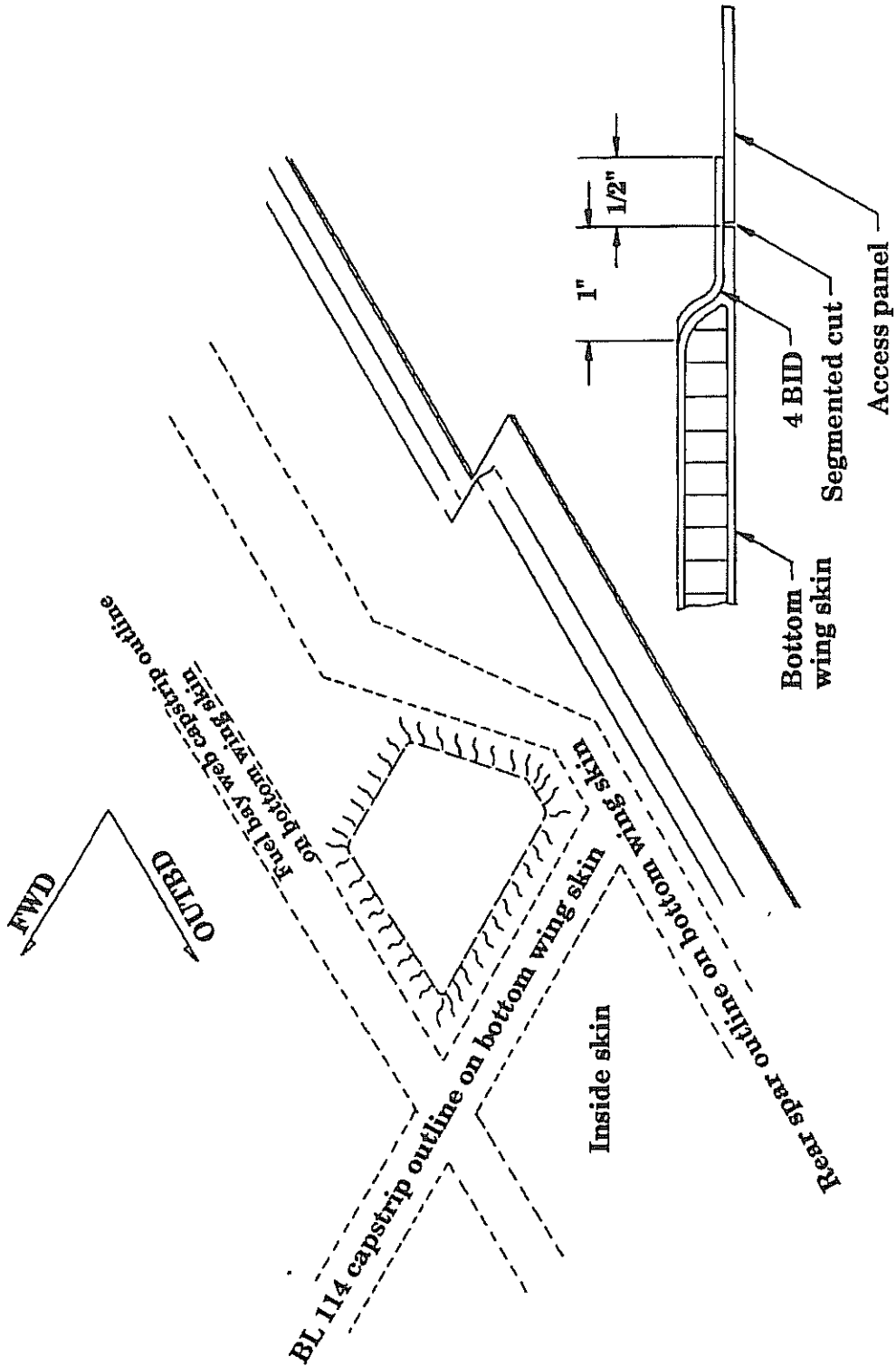
Fig. 8:C:1.





# Inspection Panel Area on Bottom Wing Skin

Fig. 8:C:2.





- C1. 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" off the capstrips.
- C2. 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.

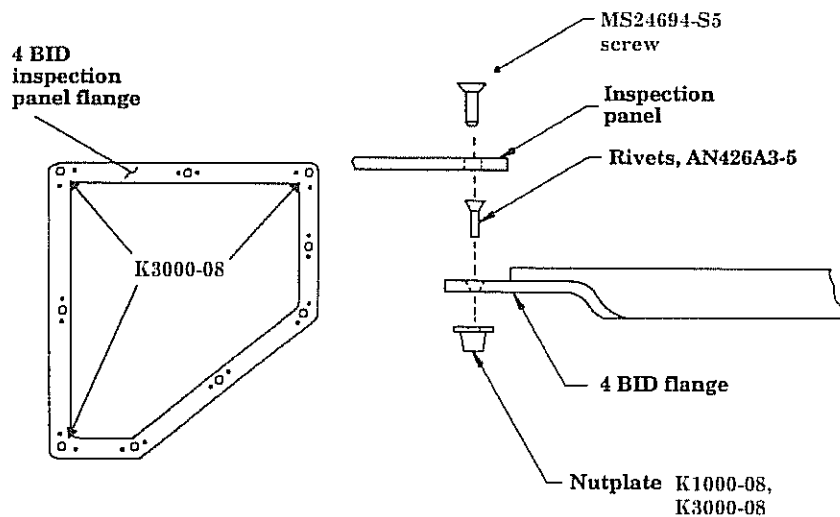
NOTE: The process of cutting out and making a flange for this aileron bellcrank access panel is the same process used to make the trim tab servo inspection panel in the elevator and the flap bellcrank access panels.

- C3. Sand the 1" area surrounding the inspection panel and clean with MC.
- C4. Cover the inspection panel with plastic release tape.
- C5. 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".
- C6. After cure, carefully cut through the remaining carbon fiber so the inspection panel can be popped free.
- C7. 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.
- C8. Place the inspection panel in position and drill through the panel and the flange for the MS24693-S26 mounting screws where indicated in Fig. 8:C:3.



## Location of Access Panel Screws

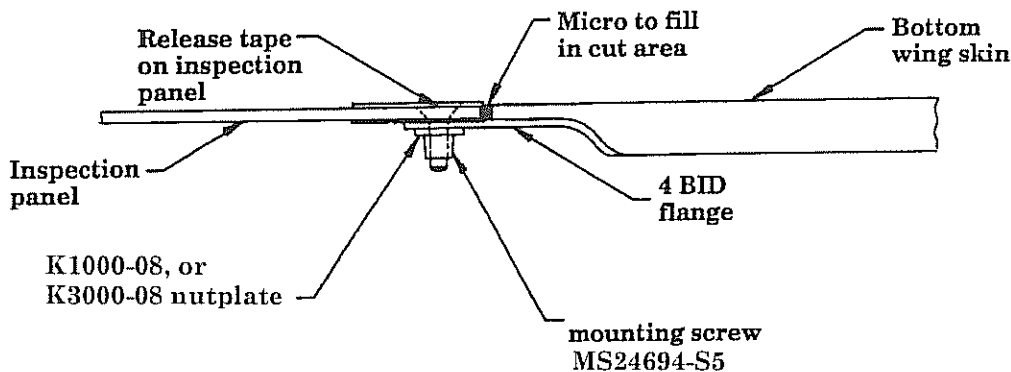
Fig. 8:C:3.



- C9. Install K1000-08 and K3000-08 nutplates for the inspection panel mounting screws. Use AN426A3-5 rivets to secure the nutplates in position.
- C10. Countersink the inspection panel for the MS24694-S5 screws.
- C11. 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

Fig. 8:C:4.



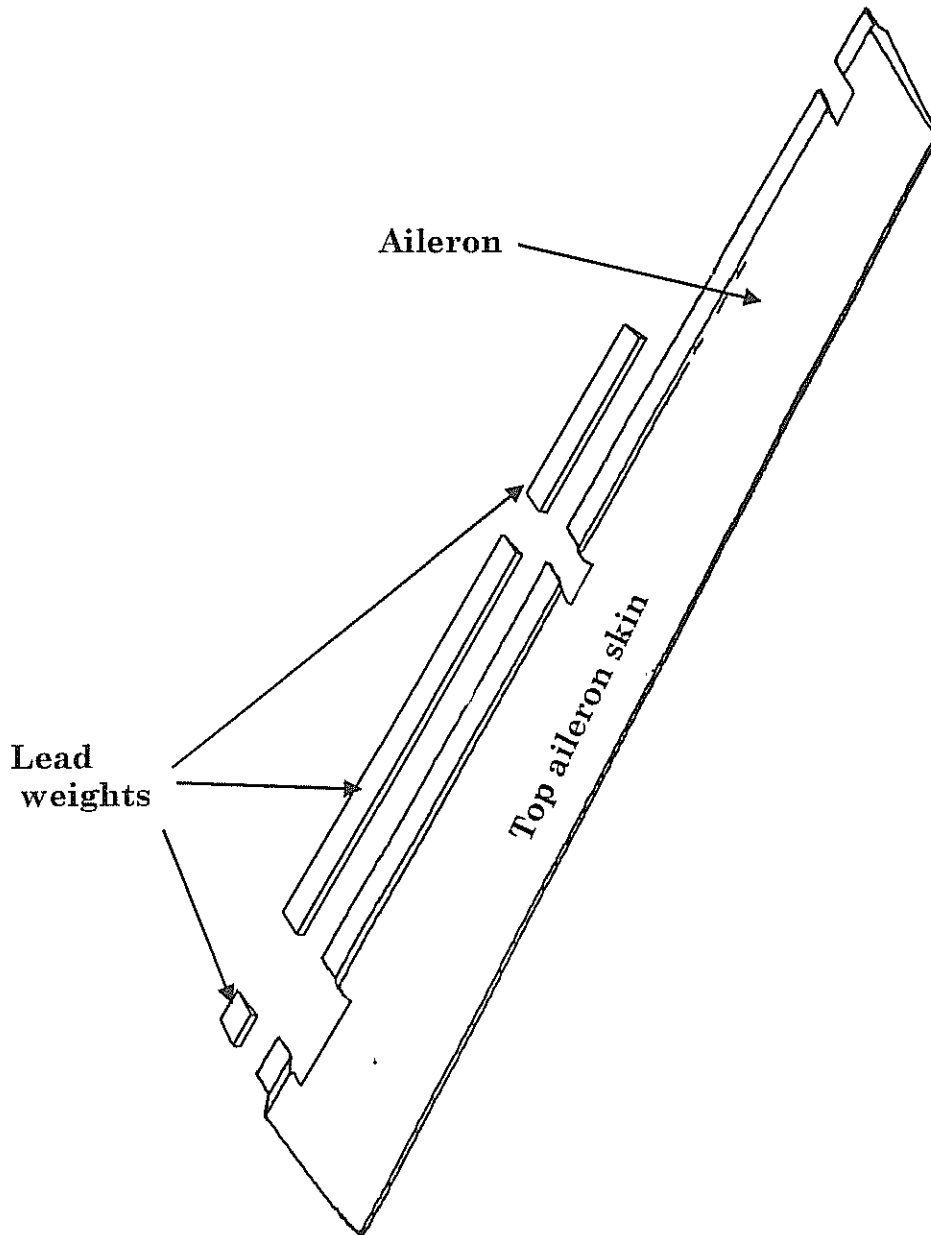
- C12. Fill the gap with micro and allow to cure.
- C13. After cure, sand the micro flush to the access panel. Remove the panel. Now the gap is too close for primer and paint, but a careful sanding of the panel will take care of this.

## D. BALANCING THE AILERONS

Like the elevators, the ailerons are 100 percent mass balanced with lead weights. Since there is no counterweight arm to mount the lead in, premolded 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. The left aileron will typically require a little more weight as it contains the roll trim system.

### Balancing the Aileron

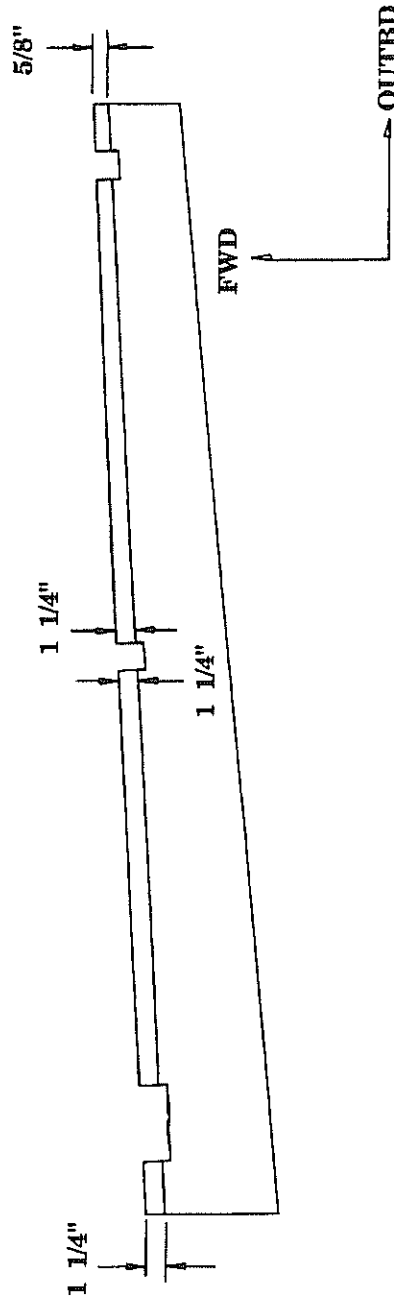
Fig. 8:D:1.



- D1. 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. Use a long board sander to sand it nice and straight.

### Trimming L.E. Flange

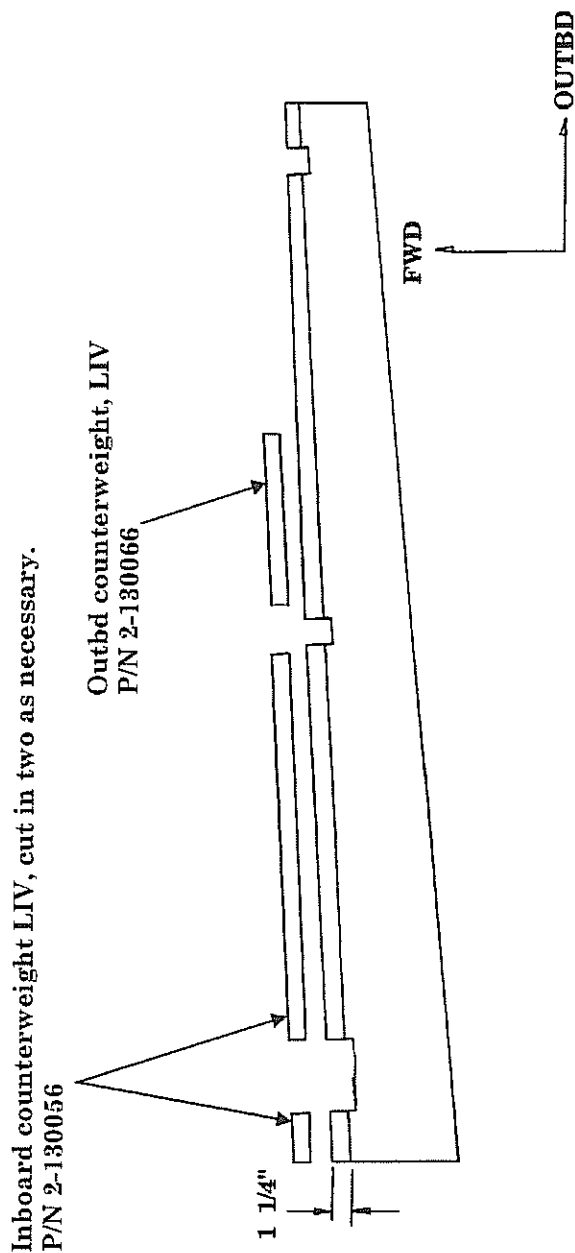
Fig. 8:D:2.



✓
⊗

## Trimming the L. E. Flange

Fig. 8:D:2:a



- D2.. 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.

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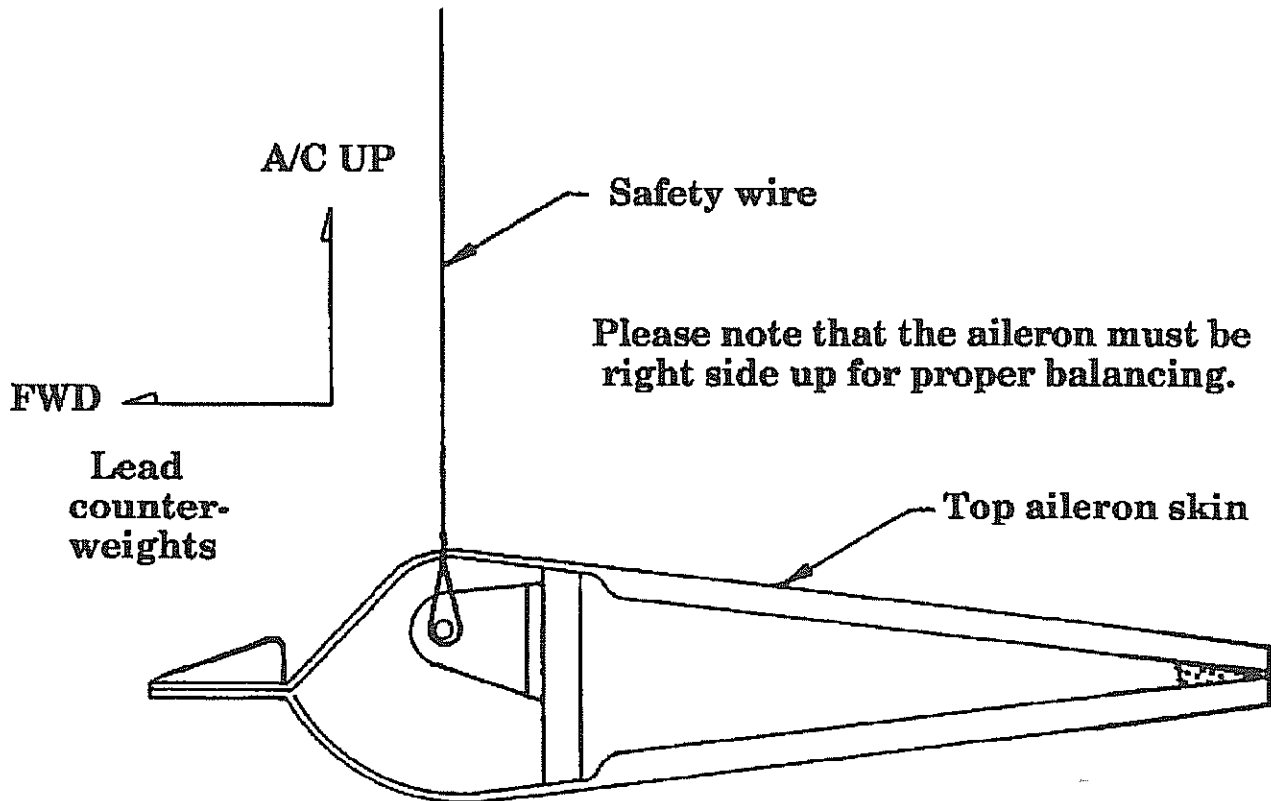
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- D3. You have been supplied with two aileron counterweights per side. Cut the inboard one in two as shown in Fig. 8:D:2:a.

### Suspending the Aileron for Balancing

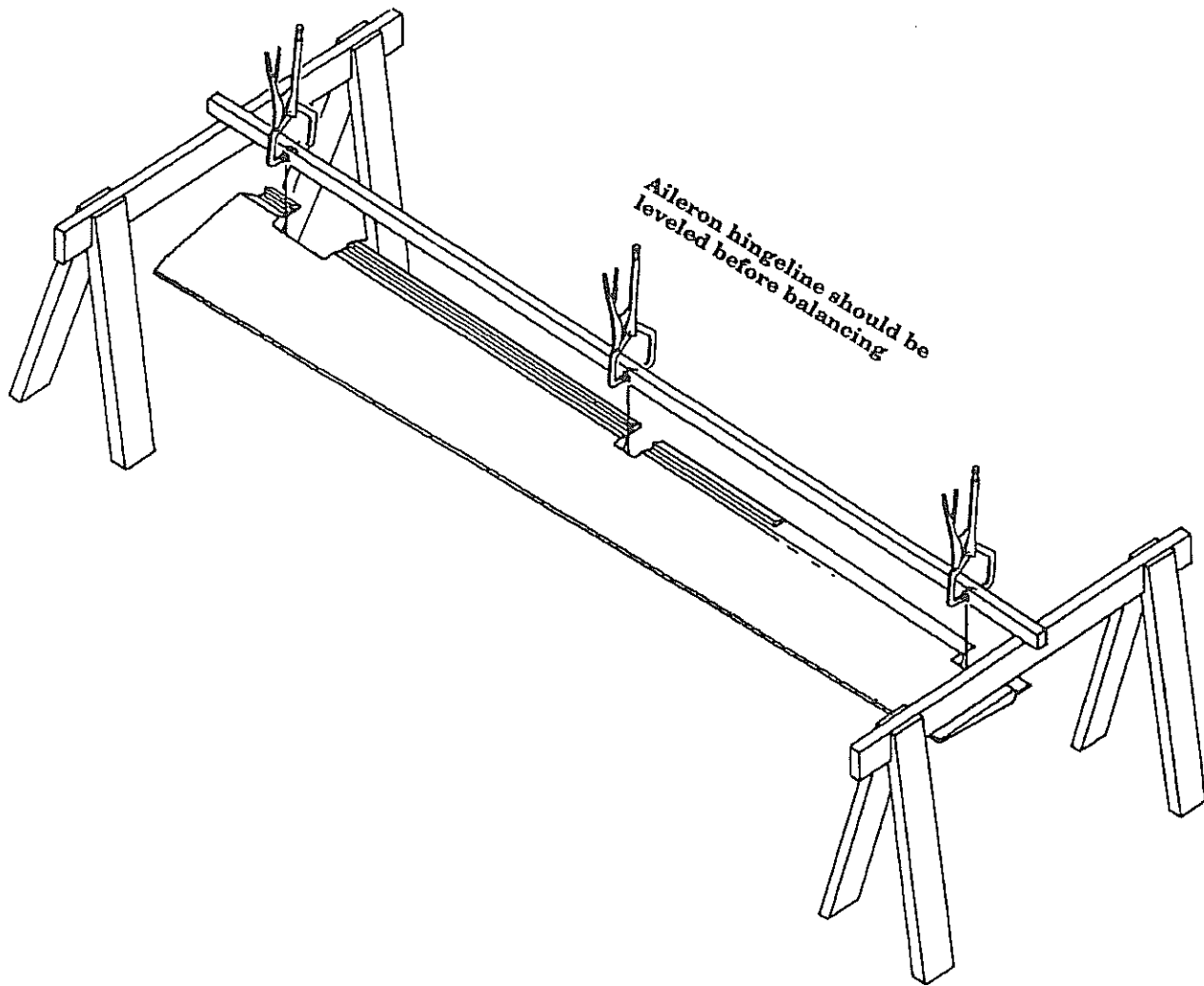
Fig. 8:D:3.



- D4. Position the lead weights on the aileron L.E. flange as shown in Fig. 8:D: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.

# Suspending the Aileron For Balancing

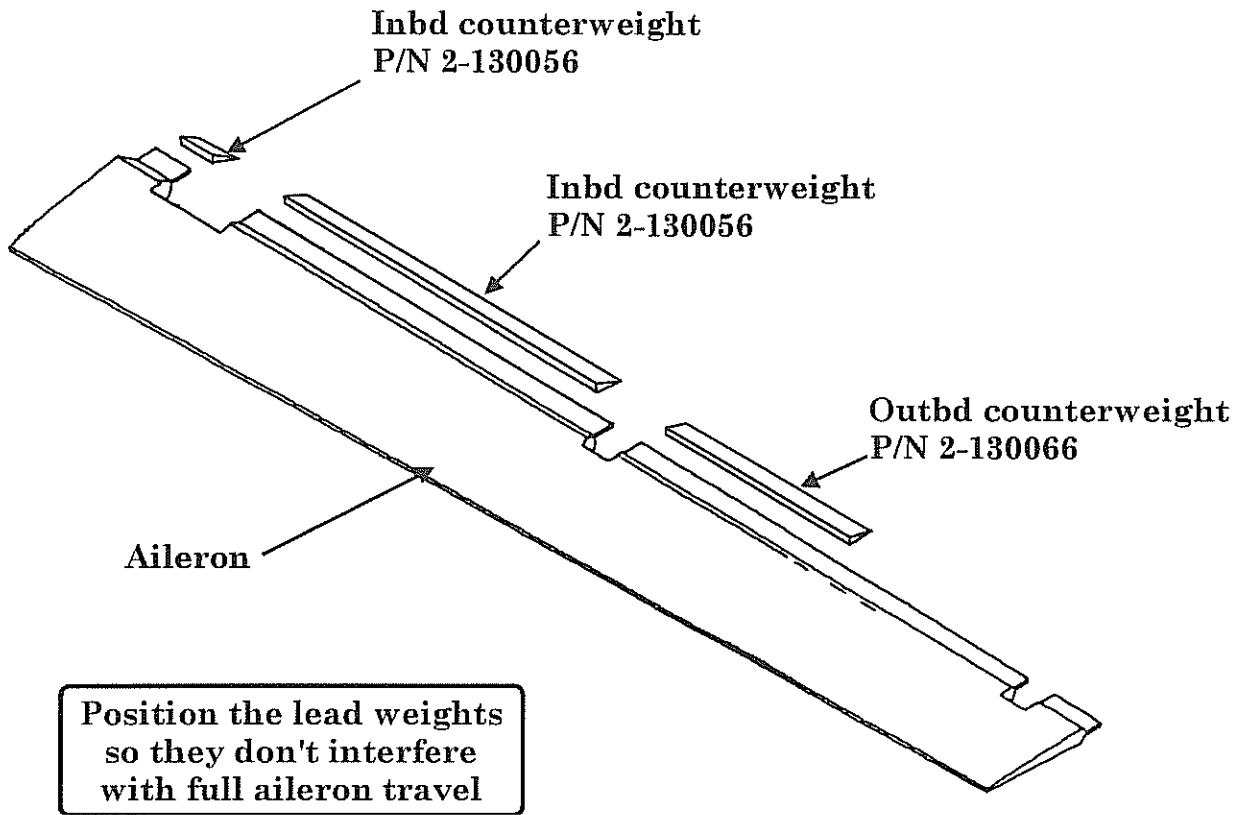
Fig. 8:D:3:a





## Initial Positioning of Lead Weights

Fig. 8:D:4.

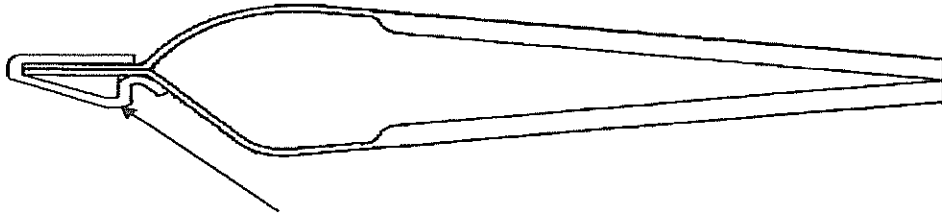


- D5. The aileron should be overbalanced so the trailing edge is about 1/2" higher than level. This will allow for the added weight of primer and paint. After you have finished the aileron, you can do a final balance by drilling holes through the flange and lead weights. **The aileron must not be underbalanced.**

## Balancing the Ailerons

Fig. 8:D:5.

Use instant glue to test counterweight positions and to hold the lead for glassing

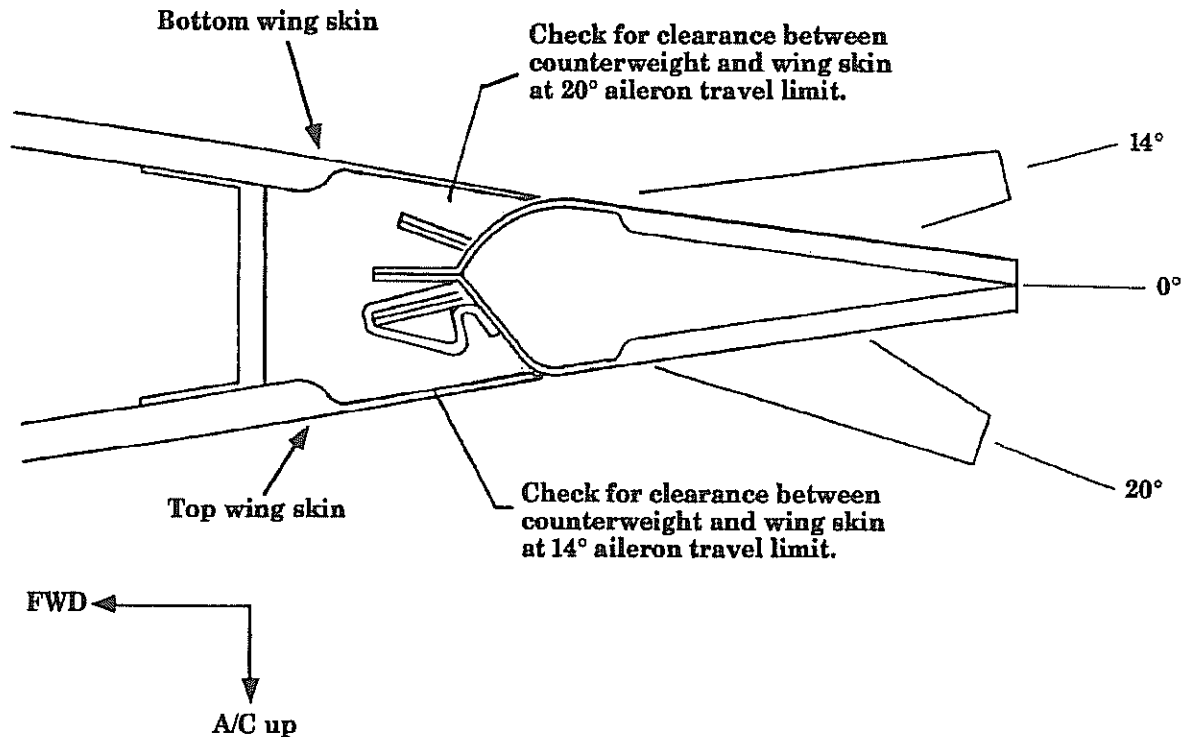


2 BID securing lead counterweights to aileron L.E. flange

- D6. 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 its travel range and check that the lead counterweights do not strike the inside of the top wing skin before the aileron has reached its full travel. Lay the bottom wing skin in position and again check the aileron for freedom throughout its 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

Fig. 8:D:6.



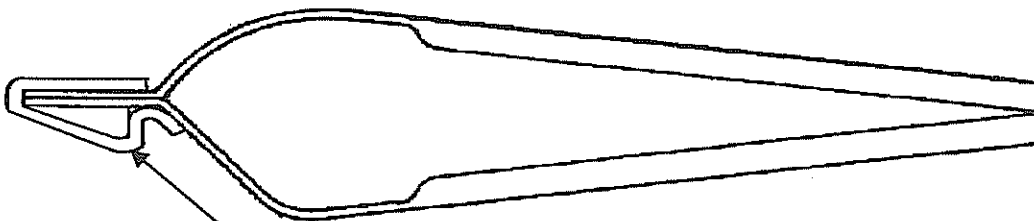
- D7. Secure the lead counterweights to the aileron L.E. flange with floc and 2 BID. Remove the counterweights, pile epoxy/floc onto the flange and sink the counterweights into the floc. Let cure, and again check for clearance. Extend the 2 BID for a distance of 1" onto the surface of the top and bottom aileron skins. Refer to Fig. 8:D: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 the Flange

Fig. 8:D:7.

Use instant glue to test counterweight positions and to hold the lead for glassing



2 BID securing lead counterweights to aileron L.E. flange

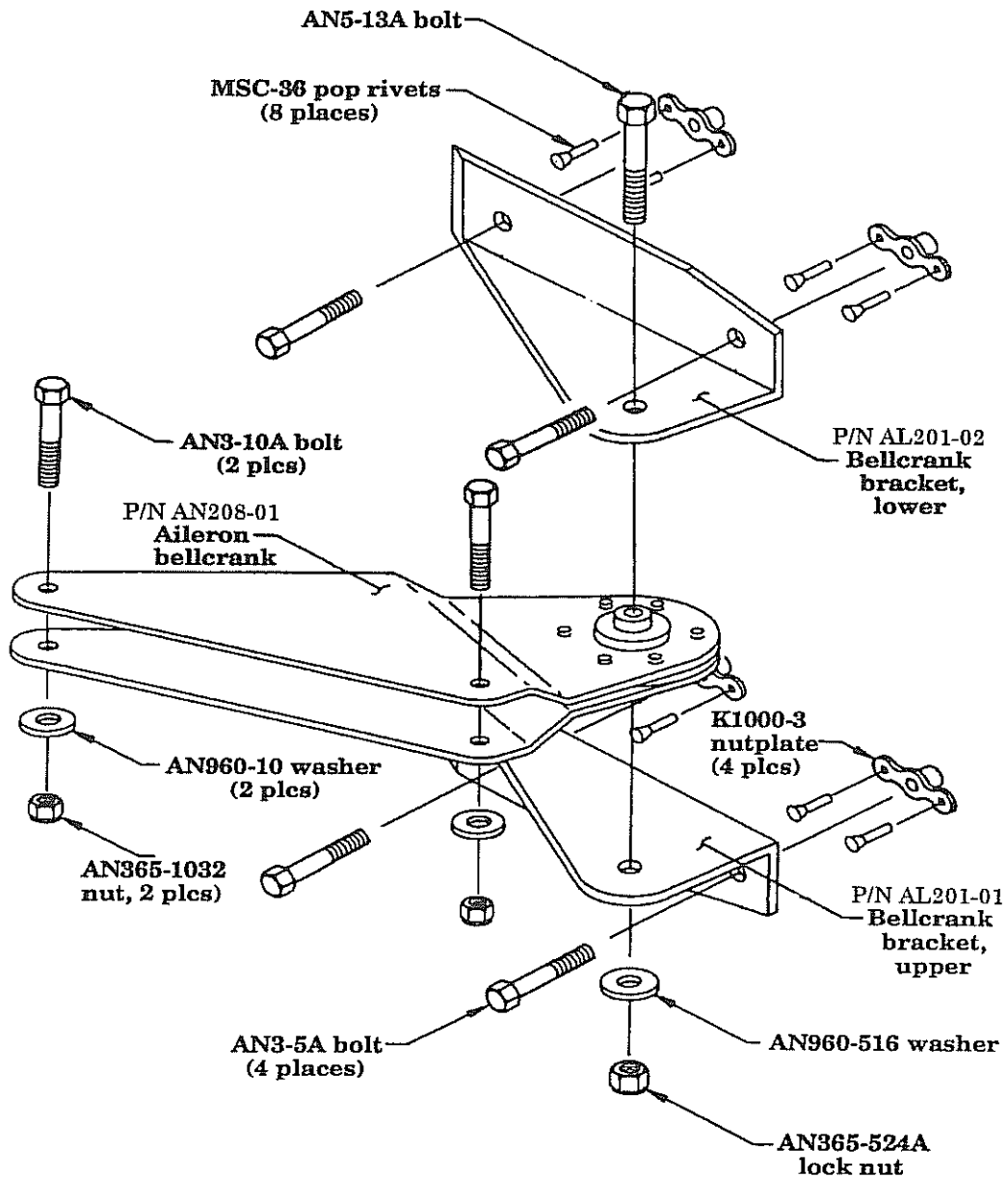


## E. REFERENCE SECTION

The components of the reference section have been pre-installed at the factory. The following information is provided in case you should require replacement parts.

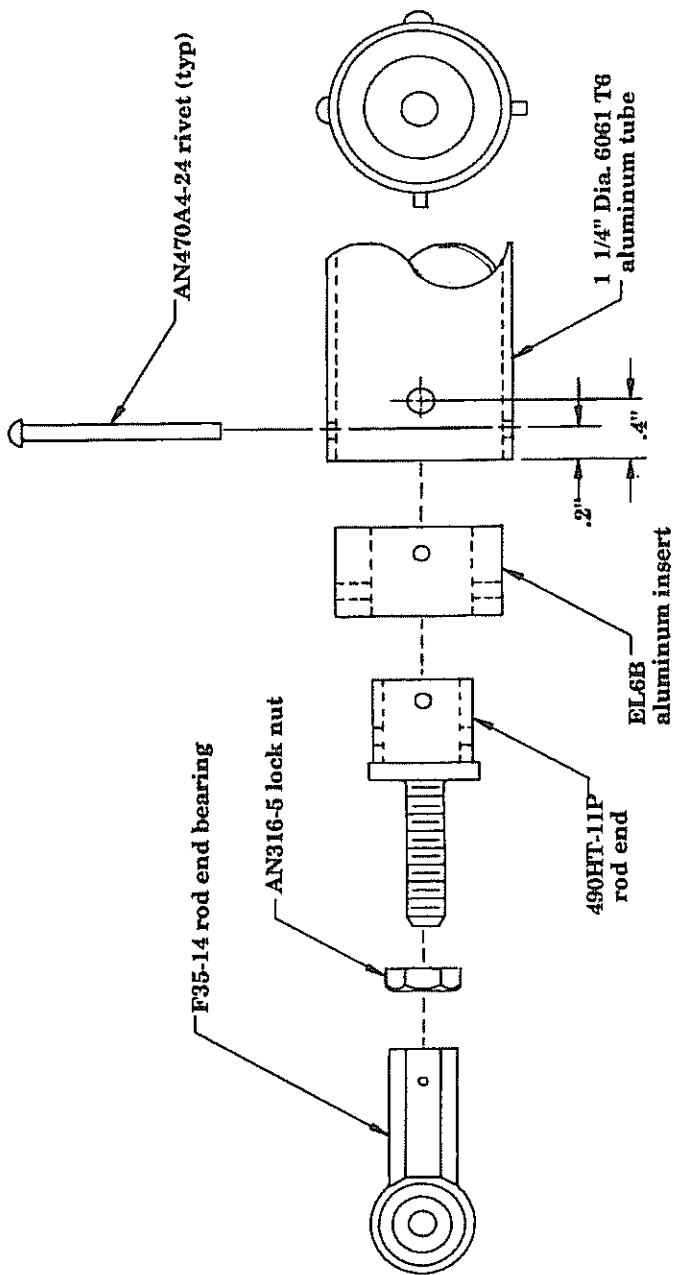
### Bellcrank Assembly

Fig. 8:E:1.



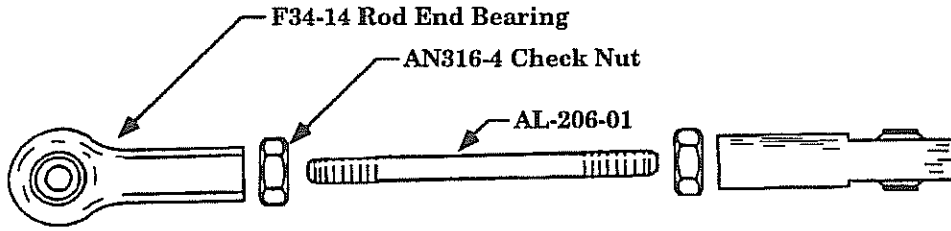
# Aileron Pushrods

Fig. 8:E.2.



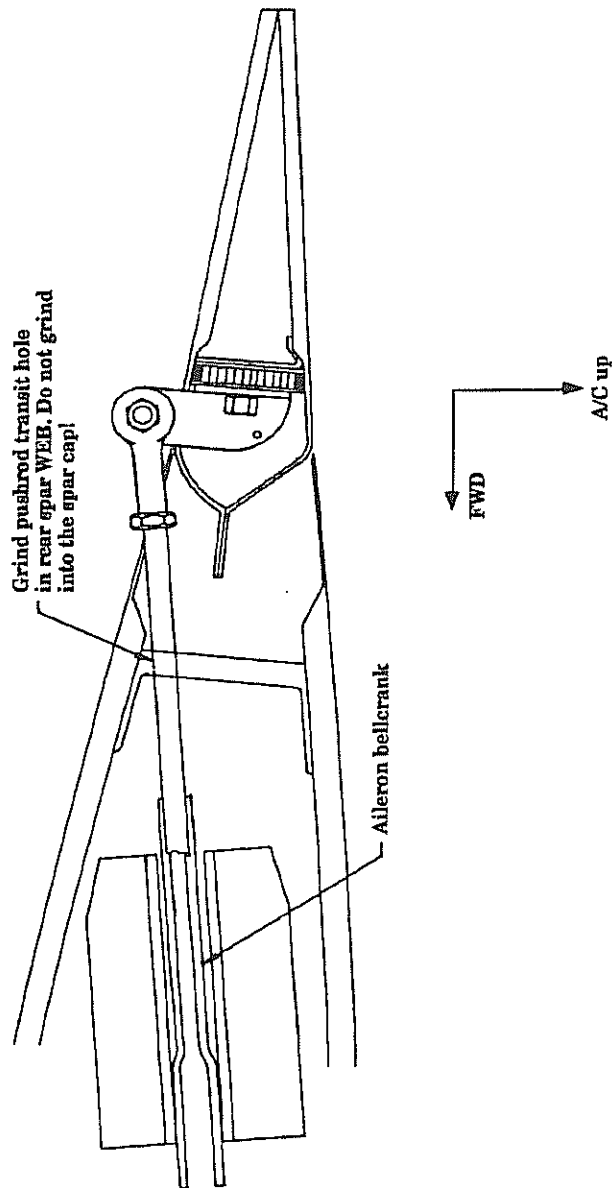
# Short Aileron Pushrod

Fig. 8:E:3.



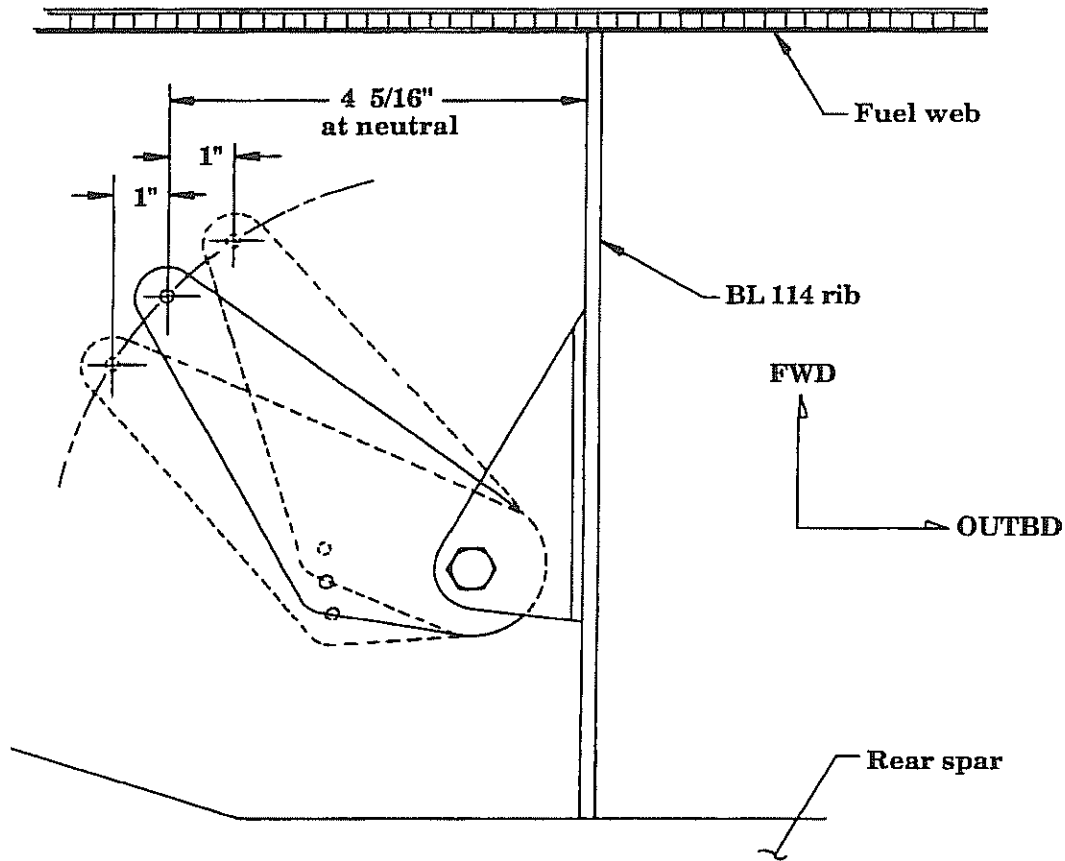
# Short Aileron Pushrod Installed

Fig. 8:E:4.



## Aileron Bellcrank Travel Range

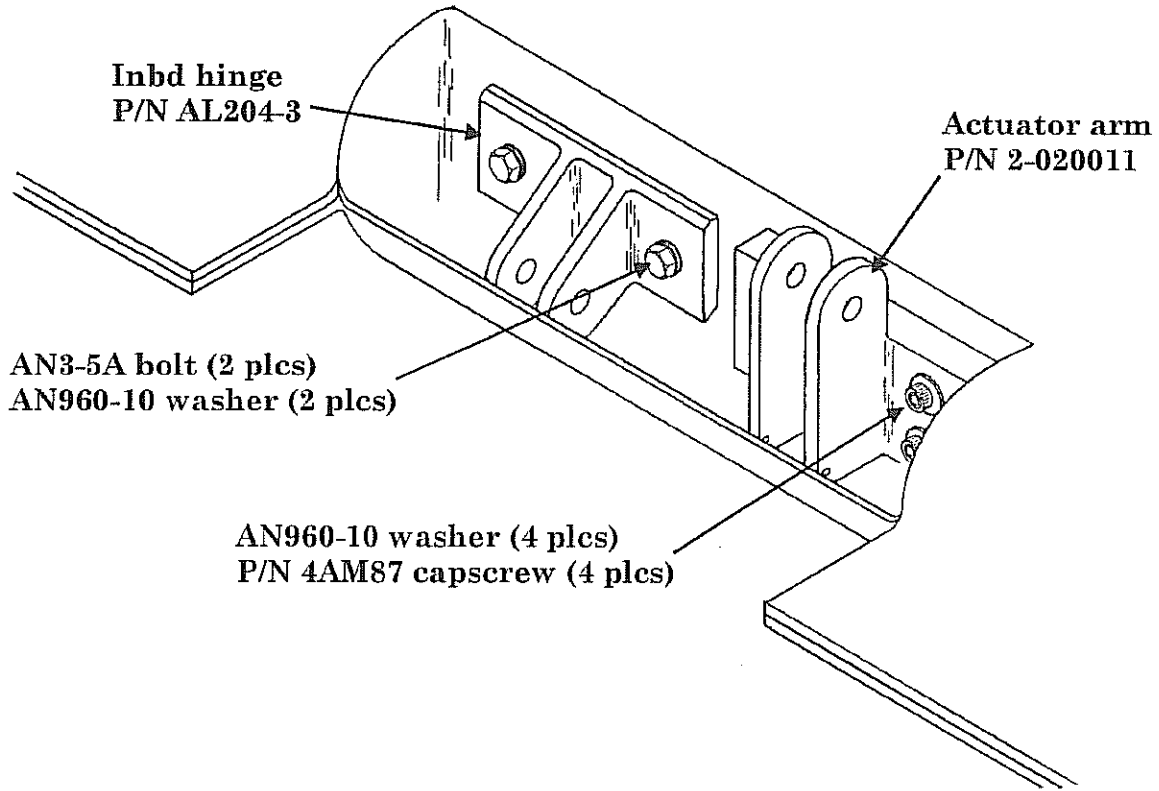
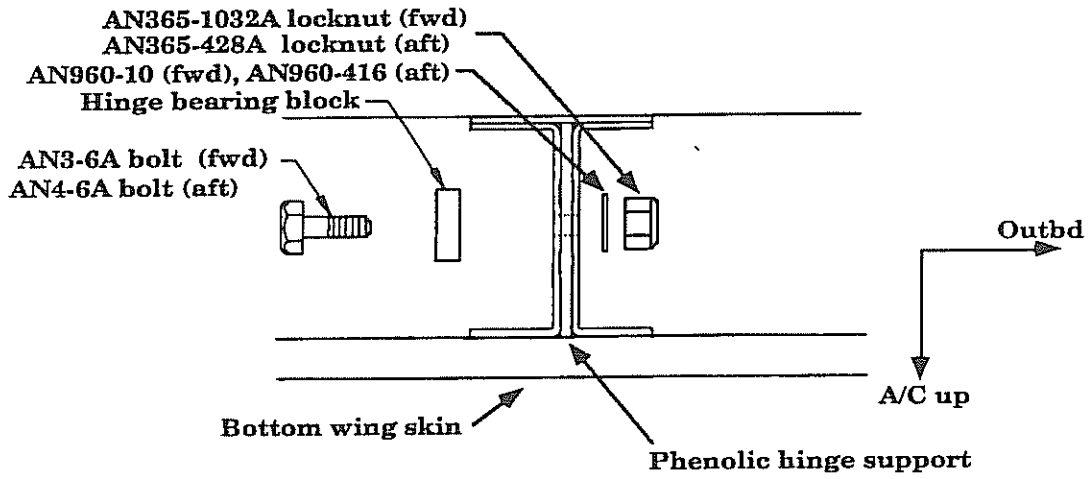
Fig. 8:E:5.



Adjust the aileron pushrod so that when the long pushrod moves  $\frac{7}{8}$ " - 1" either way from neutral, the aileron will move to its 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 its 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 its 14° "down" position.

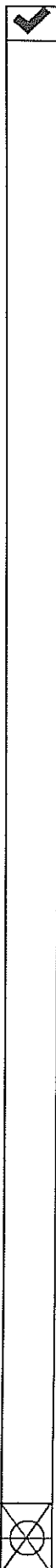
# Mounting Middle/outboard Hinge Bearing Blocks

Fig. 8:E:8.



**Check:**

- \*Sufficient thread in all rod ends
- \*Check that all check nuts have been tightened.
- \*Check that all other hardware is secured properly.



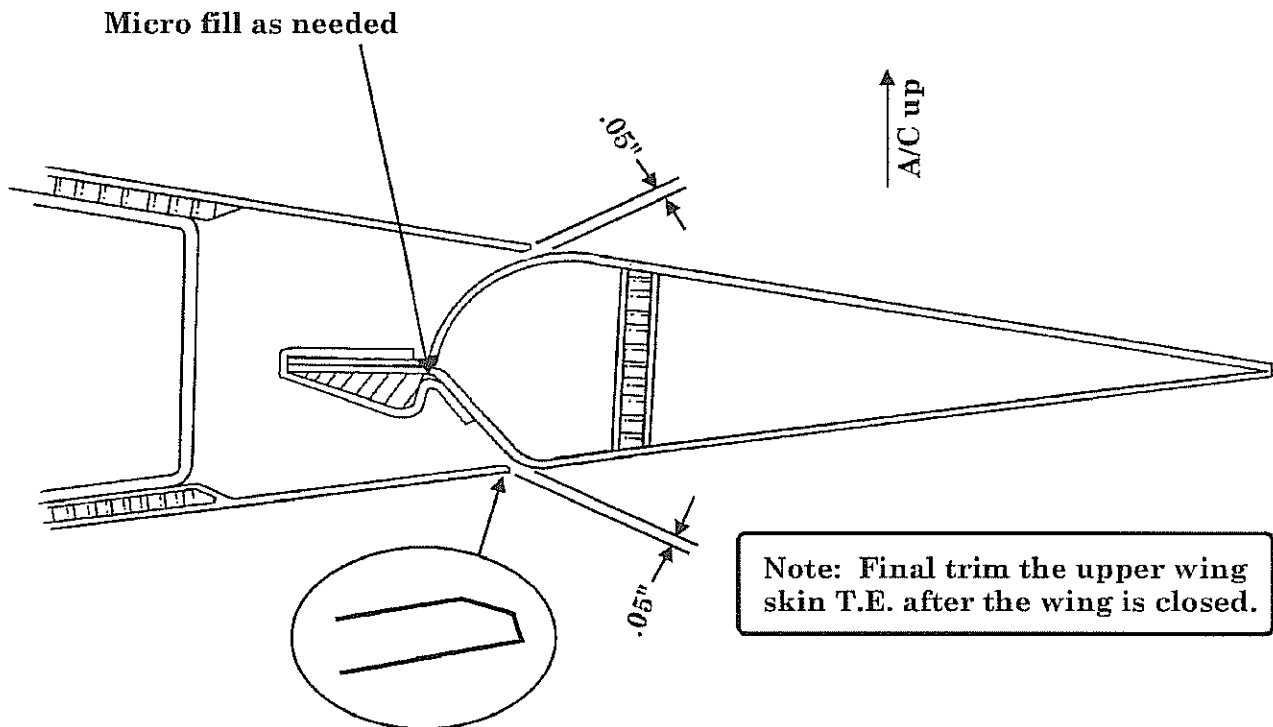


## F. FINAL TRIM AND BODY WORK

The wing skin trailing edge has been rough trimmed at the factory. In this section you will do the final trimming of the wing skins, and body work the ailerons as necessary.

### Trimming the Wing Skin

Fig. 8:F:1.



- F1. Trim the trailing edge of the wing as necessary. There should be an even .05" gap as shown.