

# CHAPTER 2: MAIN (FWD) WING SPAR COMPLETION

## REVISIONS

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 When such revisions are made, you should immediately replace all outdated pages with the revised pages.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

## Arrows

Most drawings will have arrows to show which direction the parts are facing, unless the drawing itself makes that very obvious. "A/C UP" refers to the direction that would be up if the part were installed in a plane sitting in the upright position. In most cases the part shown will be oriented in the same position as the part itself will be placed during that 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.

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## 1. INTRODUCTION

The purpose of this chapter is to complete the installation of the center main spar assemblies and wing attach points. The steps we need to perform are:

1. Locating the aluminum inserts in the spars
2. Installation of secondary attachment bolts
3. Installation of aileron disconnect idler arm
4. Installation of primary landing gear attachment plate.



**2. DRAWING LIST**

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3. **SPECIAL PARTS, TOOLS & SUPPLIES LIST**

**A. Parts**

- Bottom Butterfly with Fwd & Aft Ctr Spars
- Aluminum mounting plates
- Aileron Idler Arm assemblies



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**MAIN (FWD) WING SPAR COMPLETION**



**B. Tools**

- Pencil
- Adhesive measurement syringes or balance scale or Epoxy Dispensing Pump
- Small weigh scale (should be capable of measurements as fine as .1 oz)
- Rubber gloves or protective hand coating
- Watch or clock
- Drill motor
- Drill bits:
  - 1/4"
  - 3/8"
  - 1/2"
  - #12
  - #30
- Sanding block
- Measuring tape
- Spotlight (or similar bright light source)



**C. Materials & Supplies**

- Hysol 9339 Structural Adhesive (supplied in kit)
- Mixing sticks - tongue depressors (supplied in kit)
- Mixing dish or cup (supplied in kit)
- #36 & #80 grit abrasive paper
- Paper toweling or cloth pieces
- Wax and silicone remover (available at auto body or paint shop)
- Methylene Chloride (MC) cleaner
- Epoxy, flox, micro, BID glass cloth



#### 4. PROCEDURE

##### A. Locating Inserts

The Lancair wing is composed of C-section spars. The main spars (fwd) carry most of the loads. The aft spars carry primarily twist and landing loads. There are six pre-molded spars installed; two in each wing (outbd main in front and outbd aft), and the center main and center aft. The three main and the center aft spars all have aluminum inserts bonded within their shear webs at strategic locations depending on the particular spar (see the darkened areas on Figure 2-1).

**IT IS ABSOLUTELY MANDATORY THAT THE ACTUAL POSITIONS OF THE INSERTS CIRCLED BE VERIFIED ON YOUR OWN PARTICULAR SPARS.**

1. This can easily be achieved by placing a spot light on one side of the web and position it to shine through the web. In a dimly lit room, it is very easy to see where the aluminum actually is positioned. **CLEARLY MARK THE POSITION OF EACH ON THE SURFACE OF THE SPARS FOR FUTURE REFERENCE. WHEN DRILLING FOR THE BOLTS, BE ABSOLUTELY SURE THAT YOU ARE DRILLING SOLIDLY THROUGH THE ALUMINUM INSERTS AND WILL MAINTAIN AT LEAST 3/8" CLEARANCE FROM THE EDGES OF THE ALUMINUM INSERTS. 1/4" SIDE CLEARANCE IS SUFFICIENT FOR THE CTR AFT SPAR (1/4") ATTACH BOLTS.**

#### Spar Insert Locations

Figure 2-1

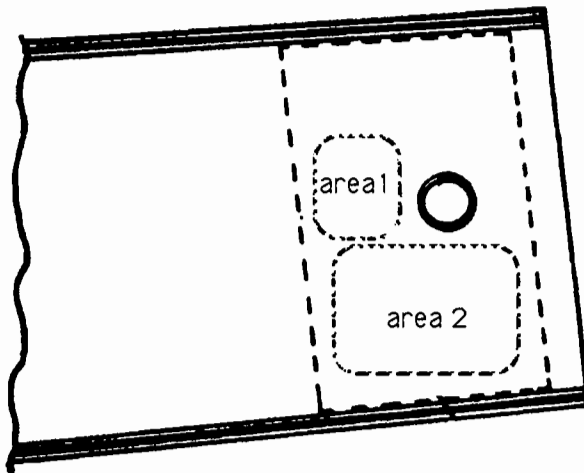


2. Referring to figure 2-2, you need to determine locations for two 1/4" flat-head machine screws in the area of the BL-48.25 attach bushing at each end of the Ctr Main Spar. The purpose of these machine screws is to help spread the load from the aluminum web inserts into the E glass web itself.

The exact location of the screws are not critical, and they do not need to align with the 1/4" bolts on the fwd spar web even though figure 2-4 shows them as being in relative alignment. *What is most important is that you solidly enter through the aluminum inserts. BE SURE that you have at least 1/4" of aluminum around all of the screw locations.* The area above the insert can be used, but you are going to have an aileron rod going through there, and there might be interference between the two.

### Secondary Screw Locations in Spar Web/Aluminum Insert

Figure 2-2

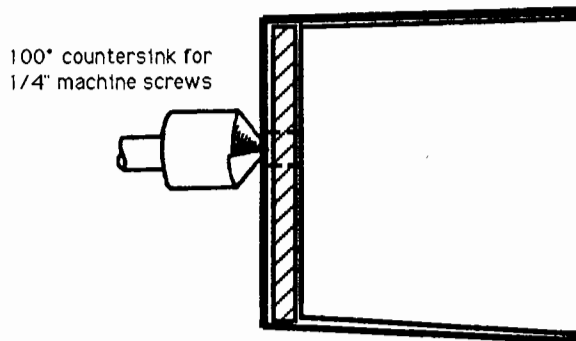


BE SURE TO LEAVE AT LEAST 1/4" OF ALUMINUM AROUND ALL HOLES, AND DRILL AS STRAIGHT AS POSSIBLE THROUGH THE BEAM.

3. Drill the holes in the locations you have selected, drilling as straight and perpendicular to the surface as possible. **DO NOT USE ANY OIL OR LUBE WHEN DRILLING THESE HOLES.**

### Countersinking Secondary Screw Holes

Figure 2-3

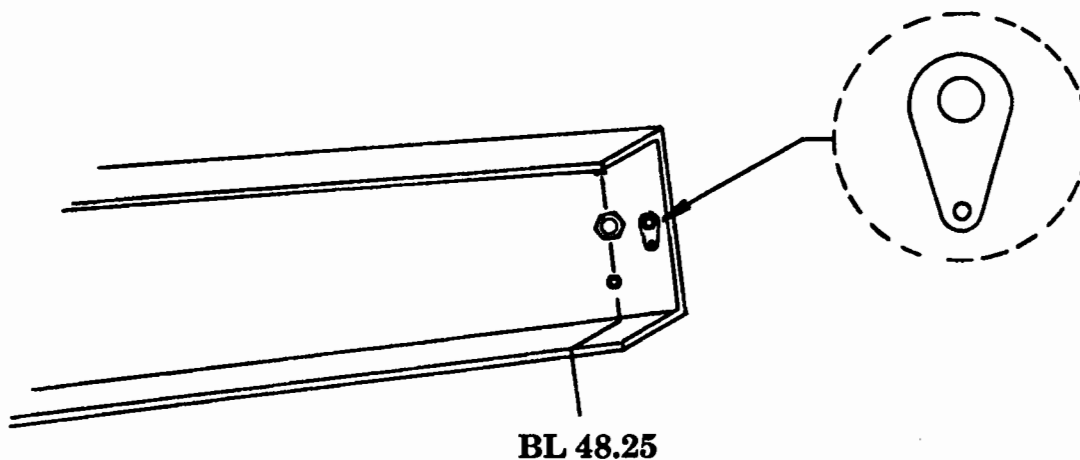




4. Referring to figure 2-3, countersink the holes in the fwd face of the spar to accept the flat head 1/4" machine screws. The proper countersink is 100°.
  
5. Purchase or make from scrap aluminum two small fab washers as shown in figure 2-4. Insert the 1/4" machine screws (MS24694-S103) through the front of the spar, and place one of the washers under a screw at each end of the spar. This will serve as a safety wire position for the main 1/2" attach bolt at those locations. Tighten in place using 1/4-28 locking nuts (AN364 or AN365-428).

### Secondary Screw Locations on CTR Main Spar

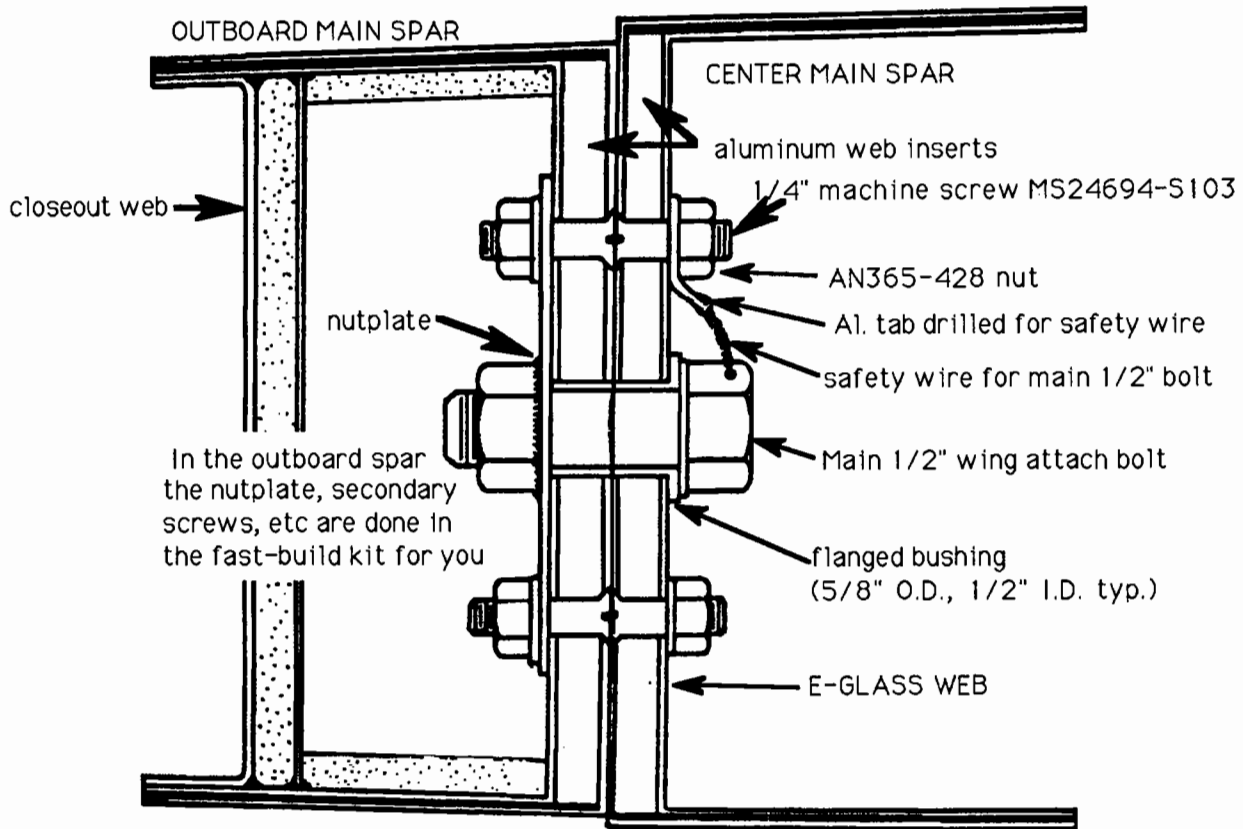
Figure 2-4



6. Figure 2-5 shows the connection of the outboard main spar to the center main spar at the BL-48.25 area and figure 2-6 shows the connection of the spars at the BL-17.75 area, with all of the appropriate hardware.

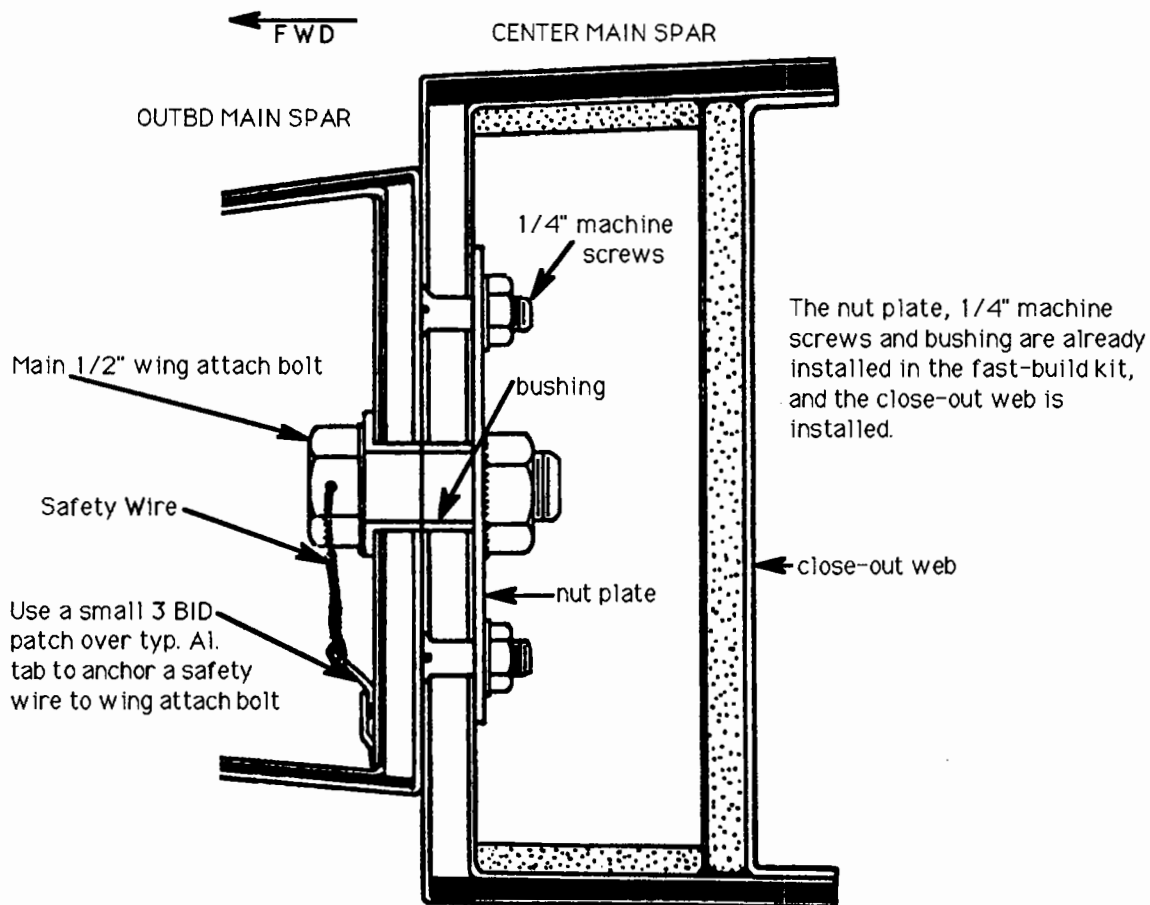
### BL-48.25 CROSS SECTION

Figure 2-5



## BL-17.75 CROSS SECTION

Figure 2-6



7. Use a 3 BID layup to attach the aluminum tabs to the outboard main spar in the location shown. This will be used as an anchor to safety wire the 1/2" main wing attach bolt.
8. Referring to figure 2-7, drill a 1/2" hole in each of the side braces for the fuel line, if you want the line to run through the front part of the wing. Some builders prefer to route the fuel lines through the trailing edge portion of the wing, and if you choose this route, then don't bother to drill these two holes.



9. Using the dimensions given in the inset of figure 2-7, drill the 1/4" hole for the control stick attach point in each of the control stick attach brackets on the main spar.

**NOTE:** It is not necessary, but perhaps a little easier, to install as much as possible into the ctr main spar before installing the belly pan/spar assembly into the fsfg. To install the Main Gear Mounting Plates (GM4) and the aileron idler arm assembly at this time, proceed with the following instructions.



## B. MAIN GEAR PRIMARY & SECONDARY ATTACH POINTS

Main Landing Gear Primary Attach Points - The main landing gear will attach to both the ctr fwd and ctr aft spars with their aluminum attach plates. The ctr main spar has receiving "hard points" (GM12) installed to accept the aluminum mounting plates (GM4). Refer to figure 2-7.

Main Landing Gear Secondary Attach Points - these are simply phenolic blocks glassed into position where the over center links pivot (figure 2-7). The over center pivot bolt will attach through this secondary point.

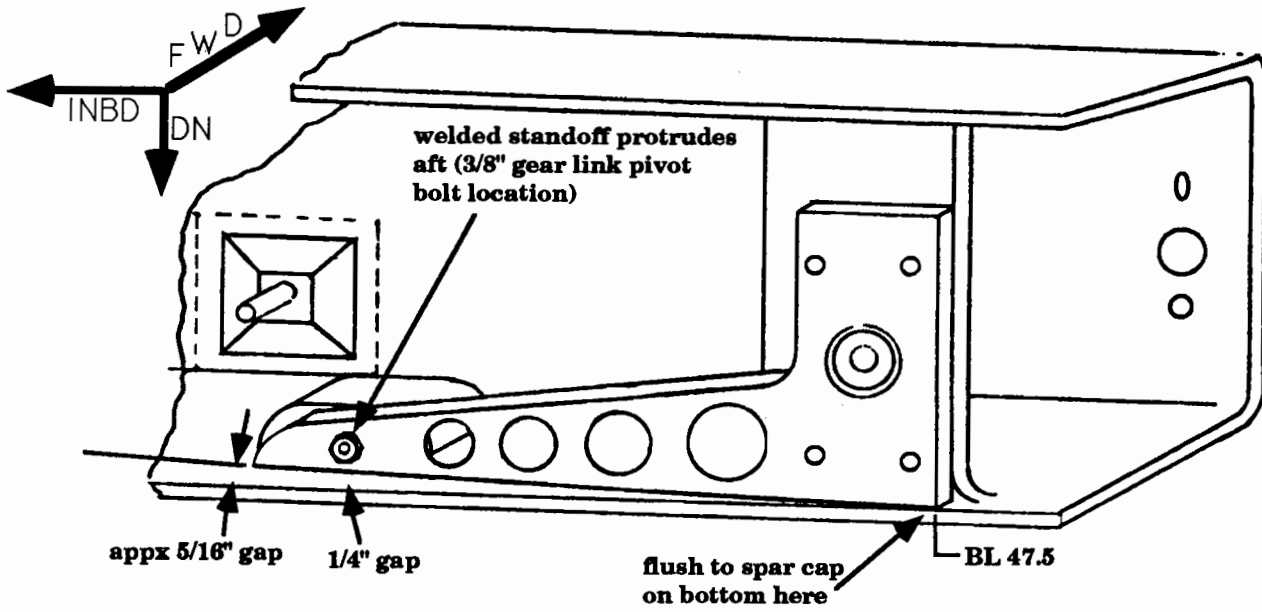
1. Select the GM4 main gear alignment brackets. These machined aluminum parts will establish the proper alignment of the main gear pivot point with the over-center link pivot point. They will be mounted to the GM12 phenolic which has been bonded into the center main spar.
2. Position the GM4 bracket per figure 2-8. The lower edge of this bracket at the wide end will rest on the lower spar cap, but the narrow end which has the short standoff welded onto it will **NOT** rest on the bottom spar cap. This end must be raised off the bottom spar cap in order to allow for adequate clearance of the 3/8" bolt and nut which will mount at this location (if the GM4 bracket were mounted flat to the bottom spar cap, the nut of the 3/8" bolt which mounts the over-center links would not have sufficient clearance on the fwd side of the secondary phenolic attach point). The GM4 bracket should be lined up at the large end with BL 47.5, then raised **at the narrow end, about 5/16"**, so that you have a gap between the lower spar cap and the bracket, at the point below the standoff, of 1/4".

**NOTE:** The welded standoff with the 3/8" hole in it protrudes **AFT**.

3. When the fit looks correct, use a 1/4" drill bit and drill through for the four 1/4" mounting bolts at the primary attach point. These four bolts may be permanently set at this time. They should be set with the nuts on the **AFT** side to afford more clearance between the ctr main spar web and the GM12 primary attach point (the aileron push rod will pass through there and the bolt head will require less space than the nut and washer end).
4. Drill through for the 3/8" bolt at the secondary attach point. This obviously requires a 3/8" drill bit. Be careful not to rock the drill bit back and forth while drilling since that would elongate the hole in the GM4 alignment bracket.

# ALUMINUM MOUNTING PLATE

Figure 2-8



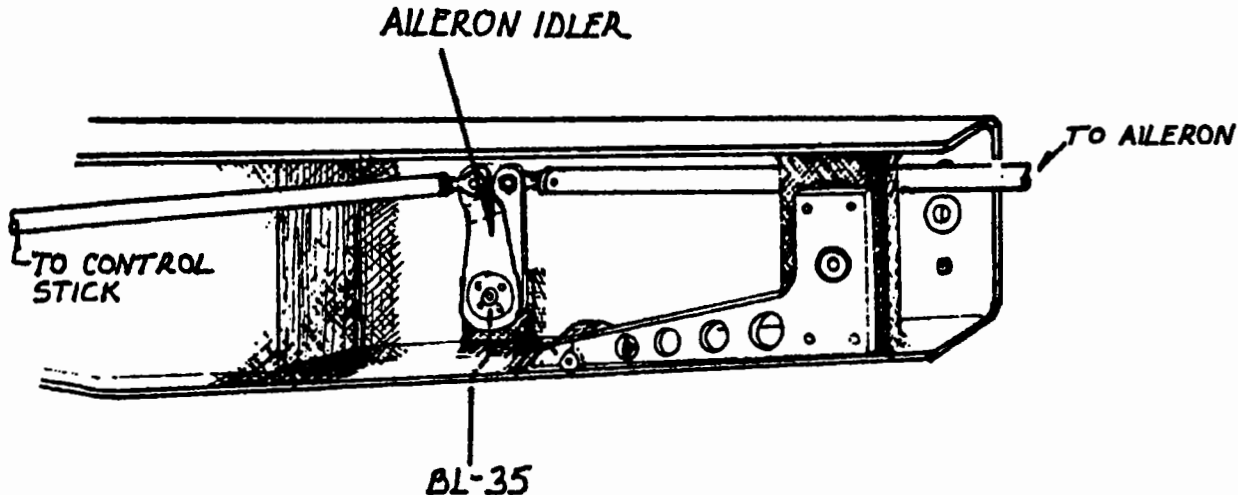
### C. Aileron Disconnect Idler Arm

Referring to figure 2-7, you will see an aileron idler arm pivot point. This is a pivot location for the aileron idler arm. It serves as a disconnect point when removing the outboard wings. It is already installed in the proper location, with an AN4-13A 1/4" bolt glassed in position so that, when mounted, the idler arm can be as close to the spar web as possible and still provide adequate clearance for the outboard aileron push rod with nut and washer.

You may, at this time, build and install the idler arms. There are two assemblies required, one per side. We have provided the flat plate stock with the center bellcrank bearing holes (0.755" dia.) already drilled. The same stock material (with 0.755" holes punched) will also be used to make the outboard aileron bellcranks and the elevator idler arms.

#### Aileron idler arm installation

Figure 2-9



1. Using the pattern shown in figure 2-11, cut the idler arms out with either a band saw or sabre saw with metal cutting blades.

**Note:** There are 4 pieces which, except for the bends, have the same contour. The two pieces without bends can be made directly off the drawing dimensions of figure 2-11. The two pieces which DO have bends will obviously net out a slightly smaller dimension than the 2-3/4" dimension shown. This is OK as long as the left side matches the right side. This will provide a very slight increase in aileron displacement relative to stick travel.

Also note that a second push rod (AL3) pick up hole is shown 7/16" below the top hole. This is generally preferred as it will lighten the aileron stick forces somewhat and still provide a crisp roll rate.



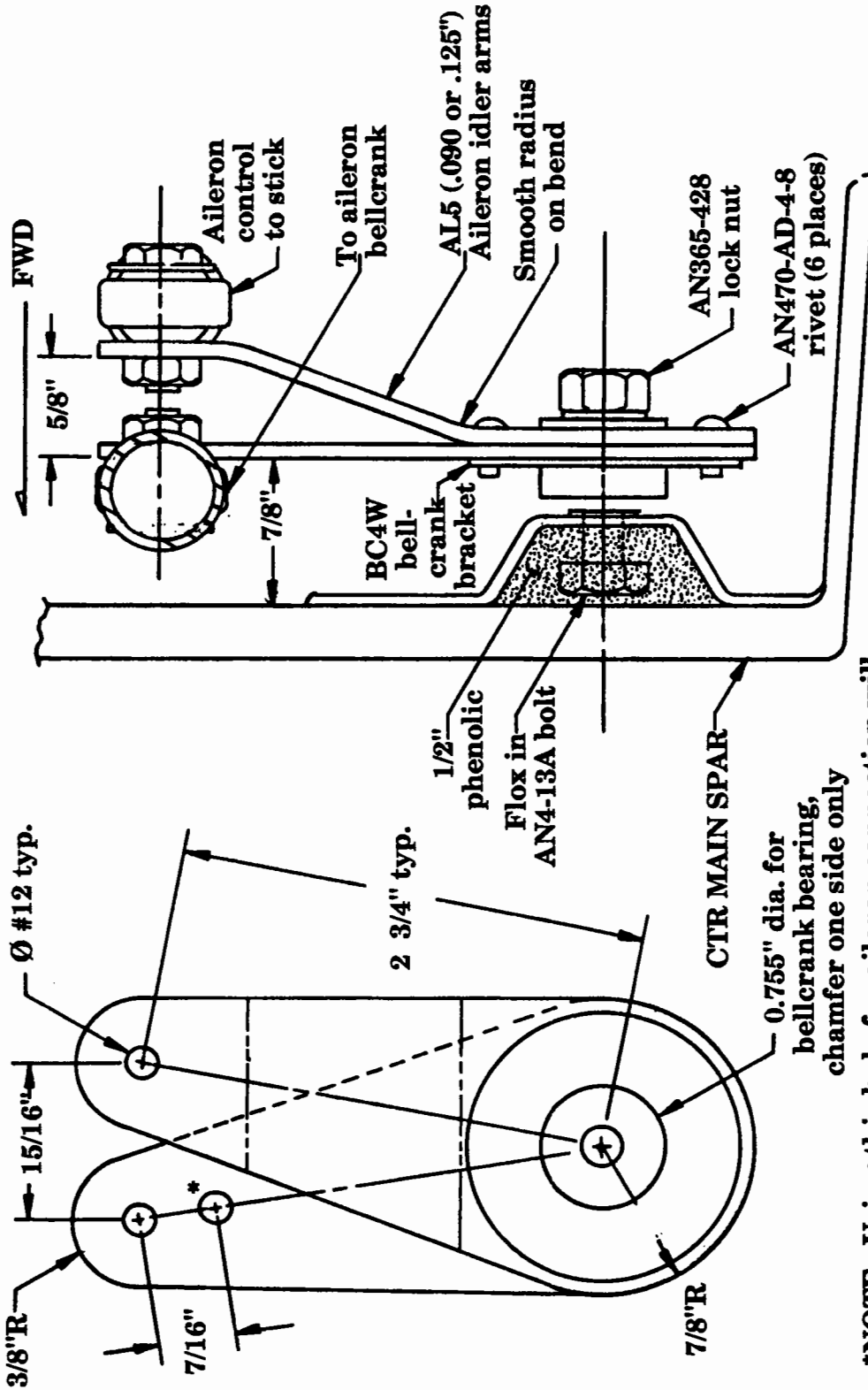
**WARNING: Do not simply place the 0.090" aluminum in a vise and bend it over. This would result in too sharp of a radius and a resultant crack which would then result in failure of the aileron controls.**

**THE MINIMUM RADIUS FOR THESE BENDS IS 1/2". BEND THE ALUMINUM OVER A SUITABLE MANDREL, SUCH AS A PIECE OF 1" PIPE OR SIMILAR. BE SURE THAT THERE ARE NO SCRATCHES OR NICKS. FILE, SAND AND POLISH IF REQUIRED.**



# Full-size pattern for aileron idler arm

Figure 2-10

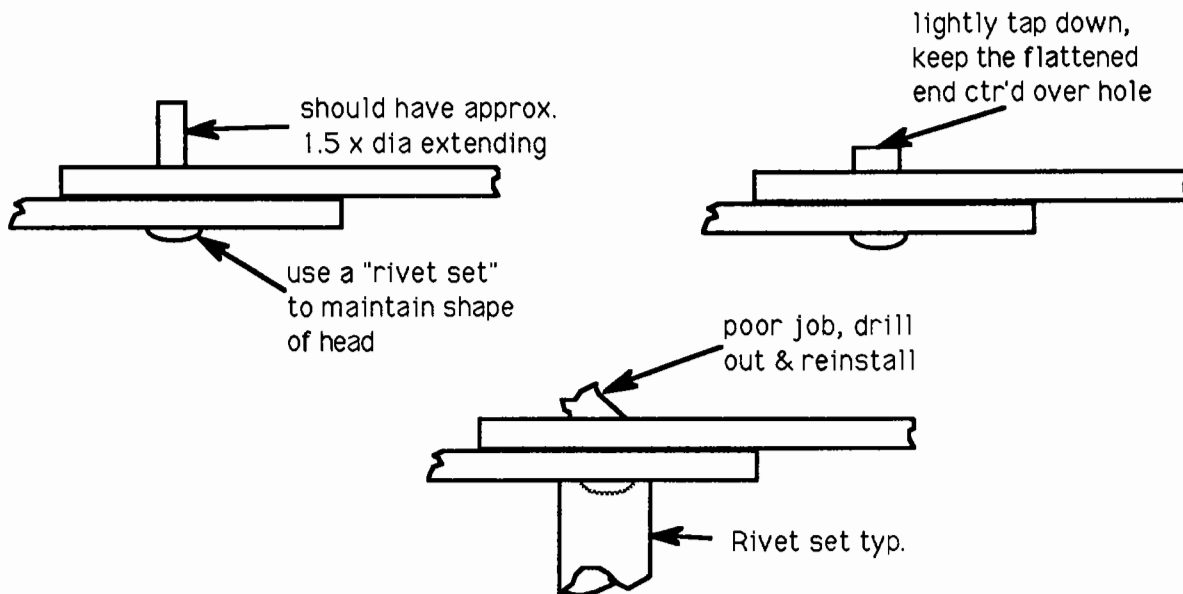


**\*NOTE:** Using this hole for aileron connection will produce a lighter "feel" and is generally preferred.

2. With the pieces cut, file all edges smooth and sand (220-320 grit) any file marks out.
3. Drill the two #12 holes per figure 2-10.
4. Position the BC4W10 bellcrank bearings on the idler arms using the 0.755" hole as a centering hole for the bearing. You may need to slightly radius the hole to accept the idler arm. The bearing should lay flat against the first idler arm.
5. Clamp the assembly together firmly (**but remember, no nicks**) and, using the bellcrank bearing flange as a drill guide, drill the 1/8" (#30 bit) rivet holes through every other hole in the flange, giving you 6 locations. You'll find it best to drill just one hole first, then set the rivet before drilling the next hole. This method will cause the bellcrank to stay in good alignment with the drilled holes.
6. Install the AN470AD-4-8 round head rivets. See figure 2-11 for proper look of the finished rivet. The rivets are easiest installed using a rivet squeezer. A rivet set with a hammer will also work satisfactorily. The AN470AD-4-20 rivets can be cut down to size.

### RIVET FINISHING

Figure 2-11



The main spar/belly pan assembly is now as complete as necessary for installation into the fuselage, which is covered in the next chapter.

**NOTE:** It is entirely possible to perform several assembly area installations virtually at the same time, or in a different sequence from that shown here. However, it is recommended that you review the entire manual before doing so, to prevent the possibility of closing off an area before everything is in it, etc.