Report No. 81012

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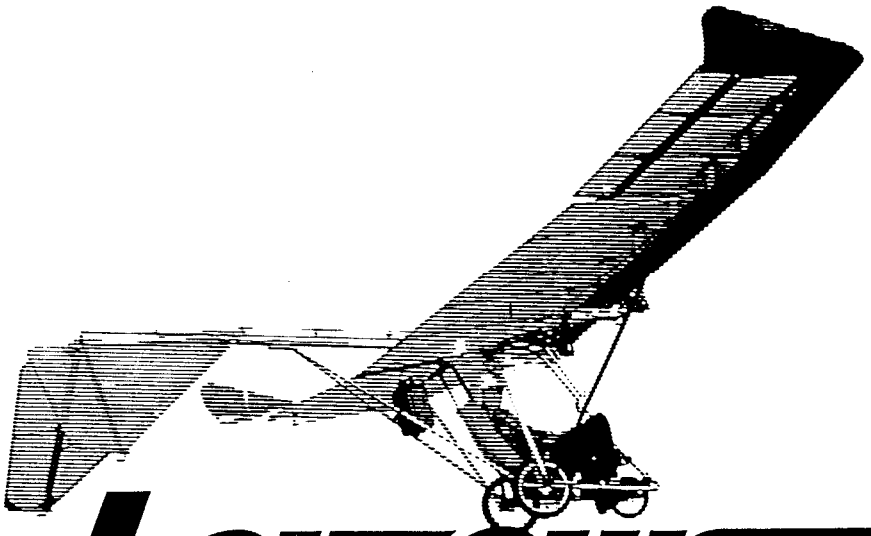


Lazair™ Microlight Aircraft

series III

ASSEMBLY MANUAL

SECTION 1

INTRODUCTION AND GENERAL CONSTRUCTION TECHNIQUES

1.1 INTRODUCTION

At the time this edition of the Lazair Assembly Manual was prepared, over six hundred Lazairs were already assembled and flying. Most of these were constructed by people who had never built an airplane (or anything like it) before. Some of these people assembled their Lazairs from the kit in less than a hundred hours, while others spent over two hundred and fifty hours to accomplish essentially the same task.

Contrary to what you may think, the major cause of this wide disparity in build time is not the relative skill levels of the individual builders, but the care with which the builders assembled their aircraft. If you wish, you can follow the assembly instructions and simply drill, bolt, and rivet the various components together. If you do this, you will create an aircraft which will not only fly, but will fly very well. However, if you wish to invest just a bit more time — time to file the odd component to make it fit perfectly or look better, time to polish the tubing (or at least remove the manufacturer's markings), or the time to use a centre punch before drilling a hole — you can have an airplane of which you will be truly proud. Not only that, you will have an airplane which will be even more enjoyable to fly — wings will fit on and off easier, controls will be lighter and smoother, and you will have that invaluable feeling that comes when you know everything on your airplane is as it should be.

The quality of the end product will be very much a function of your attitude toward assembling the kit. If you approach the building of your Lazair as a method of obtaining an airplane easily, cheaply, and quickly, then you Lazair will probably reflect that attitude.

On the other hand, if you look upon the building of an airplane as an enjoyable as well as rewarding task, then you will probably discover, as most builders have, that building a Lazair is *almost* as much fun as flying it.

1.2 USING THIS ASSEMBLY MANUAL

We do *not*, as you might have expected, suggest that you read the Assembly Manual from cover to cover before starting construction. To do so would probably leave you with the mistaken impression that building the Lazair is considerably more difficult and complicated than it actually is. As you progress through the assembly of the Lazair in a step-by-step sequence, with the individual components spread out in front of you, the written instructions and the accompanying drawings should be relatively easy to understand. If any particular instruction is not obvious the first time you read it, study the drawings and try to orient yourself so that you can see your partially completed assembly from the same vantage point as the drawings. In some cases, it may be helpful to read ahead one or two steps to better understand the instruction you are working on.

The illustrated parts catalogue (provided with the kit) contains complete exploded views of all the assemblies on the aircraft. Keeping it open at the appropriate page while you're working will facilitate identifying and orienting components properly.

1.2.1

As you are probably aware, your kit is a Series III Lazair which has been designed to be flown *without* a nosewheel (see the March '83 Lettair Newsletter for details of other changes incorporated into the Series 3). However, since the Lazair now has brakes as well, it is possible to inadvertently put it up on its nose by the simultaneous application of brakes and power without pulling back on the stick to keep the tail down. This should not be considered a fault of the

airplane, but it is characteristic of virtually all taildraggers and something you should know if you are planning to fly one. However, to facilitate learning to fly the Lazair, we have included a nosewheel with your kit. We suggest that you install the nosewheel when you assemble the kit, then later, when you have logged sufficient time to convince yourself that it is unnecessary, remove it.

1.3 TOOLS

Following is a list of the basic tools required to assemble the Lazair:

- Electric Drill
- Drill Bits — (inches) 1/16, 7/32, 15/64, 3/16, 1/4 1/8, 9/32, 5/16, 1/2
- Blind Rivet Gun
- Flat File
- Half Round File
- Felt Tip Marker
- Measuring Tape
- Two C-Clamps or Locking Pliers
- Framing Square
- Plumb Bob
- String
- Small Knife
- Wrenches — 3/8", 7/16"(2 ea)
- Nutdriver — 3/8"
- Screwdriver
- Centre Punch
- Hacksaw
- Tin Snips
- Hammer
- Soldering Iron
- 12 inch Ruler
- Allen Wrench — 5/32", 1/4"
- Masking Tape
- PVC Electrical Tape
- Torque Wrench
- Spirit Level

In addition to the tools listed, you will also need a saw to cut the plywood for the wing saddles and a heat source for shrinking the wing covering. A 20,000 BTU propane heater may be rented for this purpose and will do the job very quickly, but an ordinary dry iron can also be used.

For drilling several of the holes in the control system, the use of a drillpress is recommended. However, these holes may be drilled with a hand drill provided that you are extremely careful and the alignment is correct. Enlist the aid of a friend to sight the drill position when the alignment is critical.

You may find that some of the fittings with predrilled or prepunched holes have holes which appear too small. This has been done to ensure a good fit if the AN bolts are at the low end of their tolerance limit. If necessary, run a drill through the holes in the fittings to allow the bolts to fit in easily.

1.4 WORKING WITH ALUMINUM ALLOYS

1.4.1 Before each component is installed, all sharp corners, burrs and sharp edges should be removed by filing or sanding. This not only helps to prevent injuries and improve the appearance of the airplane, but it also reduces the possibility of fatigue failures.

1.4.2 For marking the aluminum, use a felt tip marker -- the one's marked "permanent" are best. These marks may be removed later with lacquer thinner. *Never* use a scriber on aluminum except for marking a cutting line.

1.4.3 When drilling holes, keep the drill bit perpendicular to the surfact to be drilled, and always use a sharp drill to prevent wandering. Remove all drill shavings from between mated parts before riveting. It is helpful to centre punch holes before starting to drill them.

1.4.4 Where a hole size or location is very critical (e.g. for wing strut bolts, control system components, etc.) it is best to drill an undersize hole first, then ream it with a drill of the required size.

1.5 RIVETS

1.5.1 Two types of rivets are supplied in the Lazair kit -- aluminum and stainless steel. Always use the aluminum rivets unless there are specific instructions to use stainless steel.

1.5.2 For all rivets (both aluminum and stainless steel) use a 1/8 inch or number 30 drill. Earlier editions of this manual indicated that a 9/64 inch drill should be used for aluminum rivets, but the rivet design has since been changed slightly so they will now fit in a 1/8 inch hole.

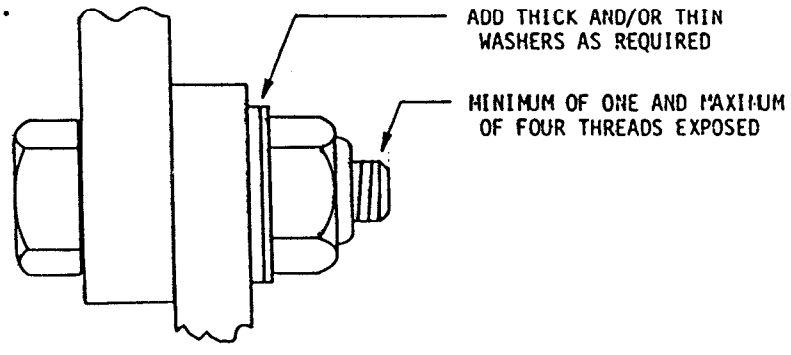
1.5.3 Wherever possible, rivet holes should be at least 1/4 inch away from the edge of the material to be riveted.

1.5.4 The Avex aluminum rivets supplied with the Lazair kit are superior to the more common type of blind rivets in many ways, but they are not easy to remove because the steel mandrel is harder than the surrounding aluminum. If a rivet must be removed, drill through the head only, then push the remainder of the rivet through the hole. This will avoid enlarging the hole.

1.6 BOLTS, NUTS, AND WASHERS

1.6.1 The bolts supplied in your Lazair kit are the Air Force - Navy Aeronautical Standard type, commonly known as AN bolts. To facilitate identification of bolts in the kit and in the manual, the extraneous prefixes and suffixes have been dropped so that a typical AN3-14A would be identified in the kit as a 314. Note that the first digit specifies the diameter in sixteenths of an inch, while the remaining digits specify the length in inches and/or eighths of an inch. For example our 314 would be 3/16 inches in diameter by 1 4/8 = 1 1/2 inches long, and a 45 would be 1/4 inch diameter by 5/8 inches long.

1.6.2 In many places in the text and in the exploded views you will notice a requirement for washers under the nut or under the head of the bolt. Occasionally a washer is required as a bearing surface, but in most cases washers are used as shims to compensate for the bolt length. Washers should be used as required so that when the nut is properly tightened, one to four threads are visible past the nut. Washers are provided in two thicknesses, 1/32 inch (W3T and W4T) and 1/16 inch (W3H and W4H) for this purpose. Use washers as recommended in the manual and in the parts catalogue initially, then add or delete *if necessary* to achieve the correct number of exposed threads as described above.



1.6.3 The nuts provided in the kit are AN type 365 elastic stopnuts. These nuts have a nylon insert which grips the threads on the bolt and eliminates the need for a lockwasher, lockwire or cotter pin *if they are used correctly*. They must not be used in applications where components move or rotate in such a way that they would tend to unscrew the nut. It is also essential that the bolt is clean and free from any grease or oil which could degrade the gripping ability of the nylon. Since the gripping ability of the nylon is progressively degraded every time a nut is put on and removed, *it is recommended that elastic stopnuts not be used more than three times*. Never clean out an elastic stopnut with a tap as this would render the nylon useless.

1.6.4 When tightening a nut, hold the bolt with a wrench and turn the nut with another wrench. Do *not* turn the bolt. Turning the bolt tends to enlarge the hole and removes the corrosion protection (cadmium plating) from the bolt.

1.6.5 In a few locations, where a nut and bolt may be subjected to rotation, bolts with a drilled shank and castle nuts are provided so that the nuts may be locked with a cotter pin. When using these nuts, they should be tightened as indicated in the manual, using washers as described in paragraph 1.6.2 to ensure that the hole for the cotter pin is properly aligned with one of the slots in the nut. Note that bolts with a drilled shank are designated with a DS suffix (e.g. 35DS) and the castle nuts have a C prefix (e.g. CN3).

1.7 NYLON PLUGS

1.7.1 Although the nylon plugs which are used in the aluminum alloy tubes are machined after molding, they can sometimes be difficult to insert because of the tolerance on the inside diameter of the tubing. If a plug appears too large to fit into the tubing, sand or file it as required to achieve a good tight fit before trying to hammer it into the tube. If you get a plug half way in and it won't go any further, stick the end of the tubing into a bucket of ice until the nylon shrinks enough to be driven in.

1.7.2 Unless otherwise specified, all bolts should be inserted so that the head of the bolt is facing the direction of flight, or upwards, depending on the plane of the hole.

SECTION 2

WING SADDLE CONSTRUCTION

2.1 GENERAL CONSTRUCTION AND USE

Before starting construction of the wing it is essential that a pair of wing saddles be available to hold the wing in working position. The type of saddle described below is recommended because it can be used either in the high position (as shown) or in the low position, with the extension (item 4) removed.

2.1.2 The materials for the saddles are not part of the Lazair kit and should be obtained locally. With the exception of item 2, all parts are cut from 3/4 inch plywood. Particle board may be used, but plywood is preferable because it is stronger. Item 2 can be made from spruce, pine or any other available softwood.

2.2 CONSTRUCTION DETAILS

2.2.1 Cut items 1, 3, 4, and 5 from 3/4 inch plywood to the dimensions shown in the table.

2.2.2 Cut item 2 from a piece of 2 x 2 inch (approximately) softwood.

2.2.3 Cut the D-cell contour in item 5 using the full-size template provided.

2.2.4 Fasten items 1, 2, and 3 together with 2 inch nails.

2.2.5 Bolt the remainder of the assembly together using 3/8 by 2 inch bolts, nuts and washers as shown.

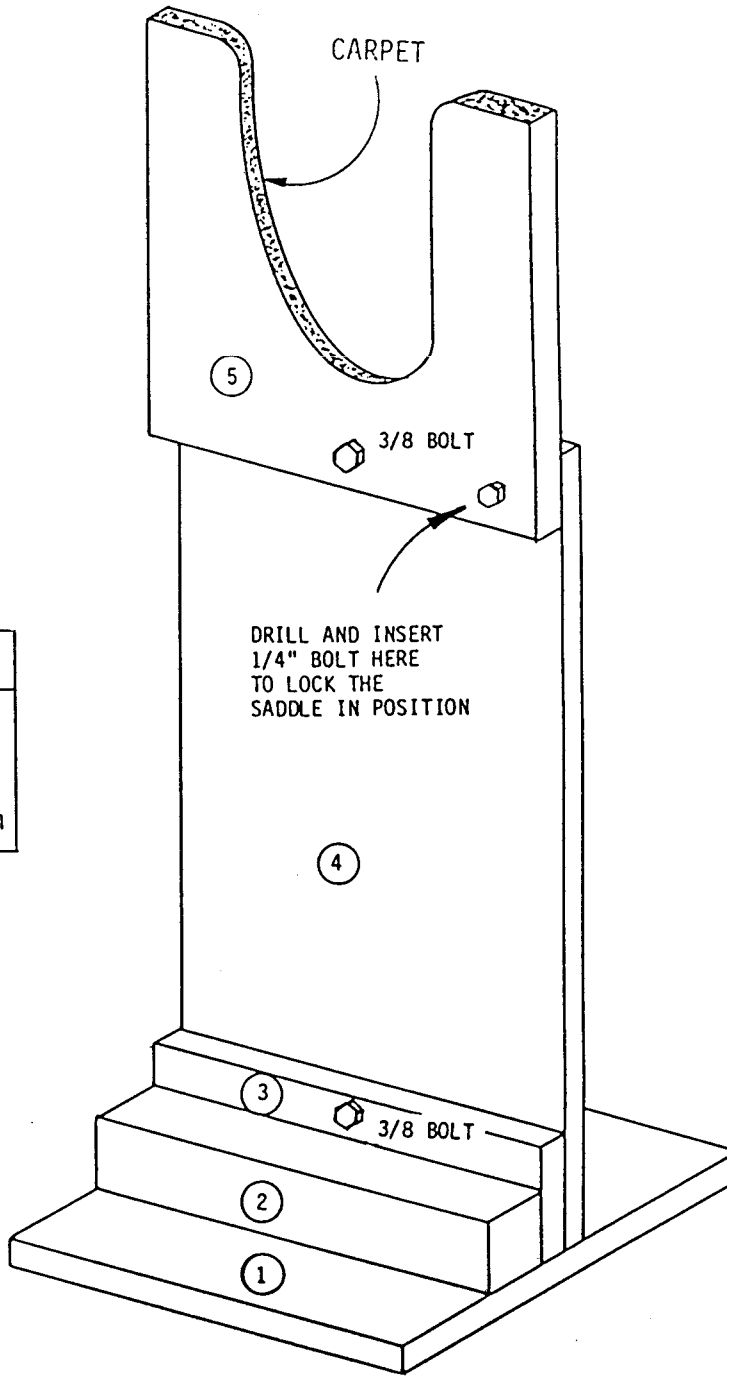
2.2.6 Line the contour of item 5 with a one inch wide strip of carpet material. If staples or nails are used to hold the carpet in place be sure thay are driven in far enough to avoid scratching the D-cell.

MATERIAL SIZES

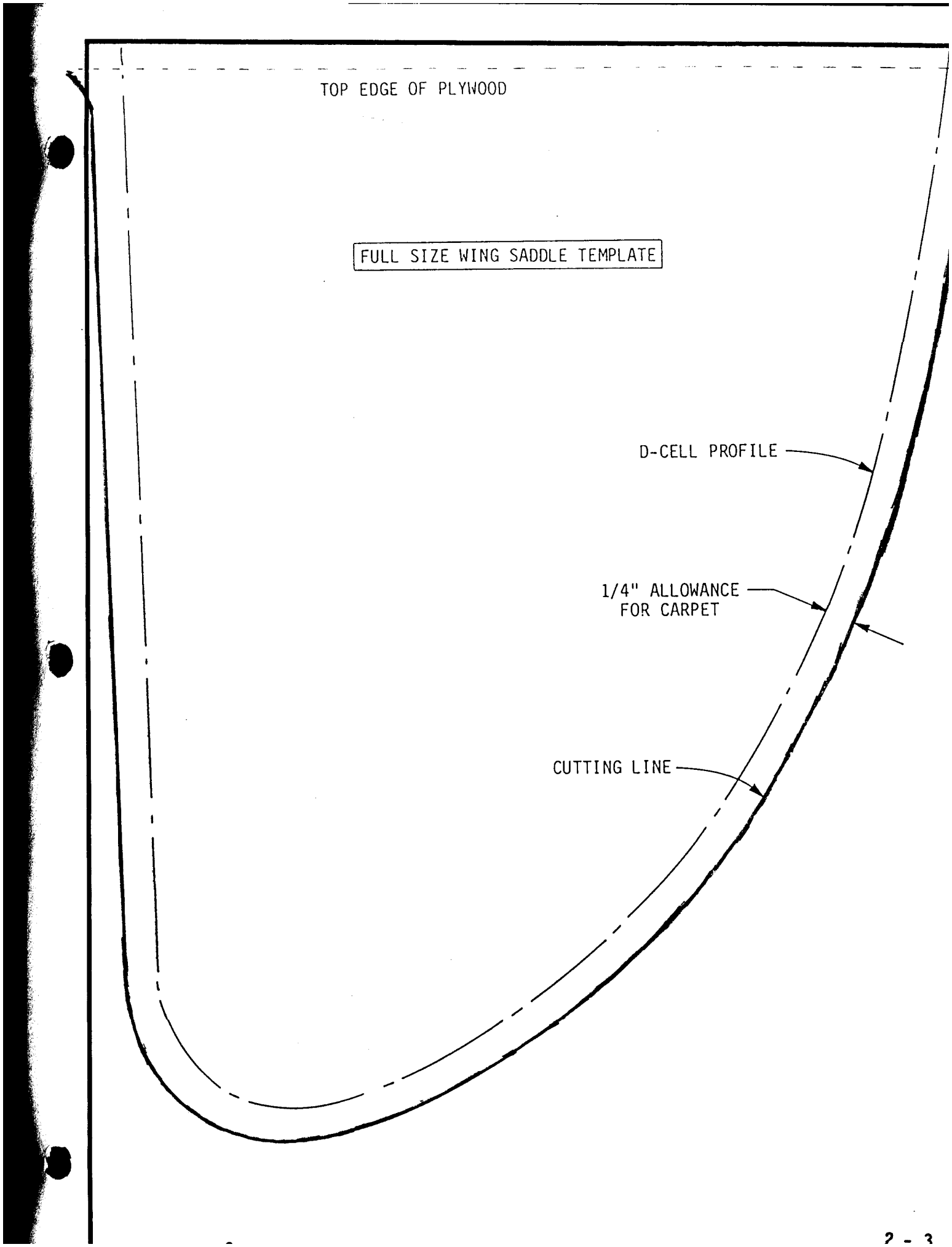
ITEM	SIZE (INCHES)
1	12 x 14
3	12 x 4 1/2
4	12 x 36
5	12 x 14

BOLT HOLE POSITION

ITEM	HOLE POSITION
3	3" from bottom
4	3" from bottom and 1" from top
5	1 1/2" from bottom



2.2.7 To convert the saddle to the low position, remove item 4 and bolt item 5 directly to item 3. Note that item 5 can pivot about the bolt if the nut is loosened and the locking pin is removed. This feature is required to set up the washout measurement as described in section 3.4.


TOP EDGE OF PLYWOOD
FULL SIZE WING SADDLE TEMPLATE
D-CELL PROFILE
1/4" ALLOWANCE
FOR CARPET
CUTTING LINE

SECTION 3

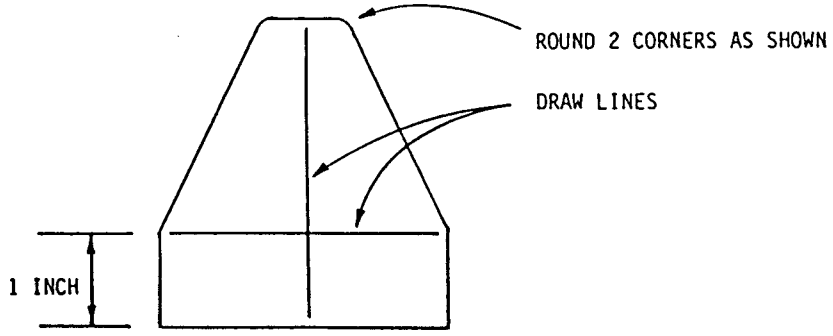
WING ASSEMBLY

NOTES:
1. *The instructions are written for the left wing. For the right wing, use parts with suffix R rather than L (except for gussets GBR which are the same for both left and right wing).*
2. *Terms such as front, rear, leading edge trailing edge, fore, aft, top, bottom, etc., refer to the wing in its normal flying orientation,* not *as positioned in the saddles.*

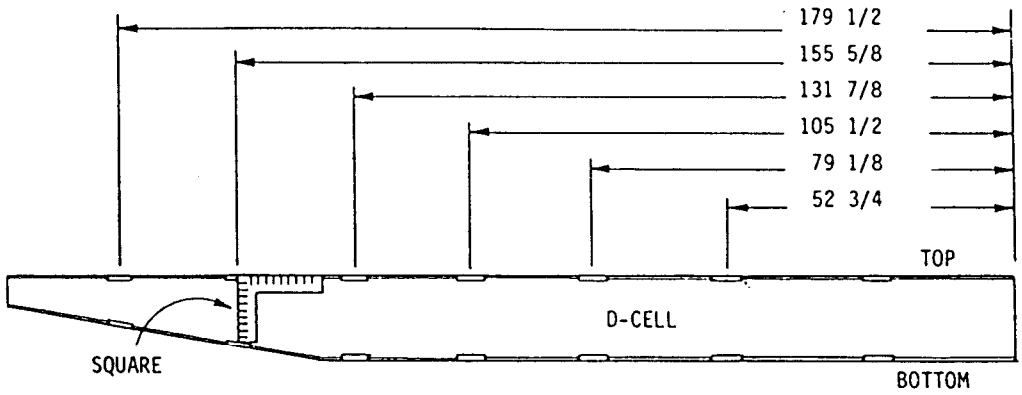
3.1 RIB GUSSET ATTACHMENT

3.1.1 Place the D-cell in the high saddles.

3.1.2 Round the two corners on all gussets marked GBR with a file as shown in the figure below. Mark the centreline on each GBR and draw a line 1 inch from the bottom edge as shown.



3.1.3 Mark the locations of the GBR's on the D-cell as shown. Measure the locations on the upper (straight) surface of the D-cell and use a square to project to the lower surface. Note that the 131 7/8 inch dimension is critical and should be held within ± 1/16 of an inch. A tolerance of ± 1/8 inch is acceptable for the others.



NOTE: All dimensions are from the root of the D-cell to the centreline of the GBR gussets.

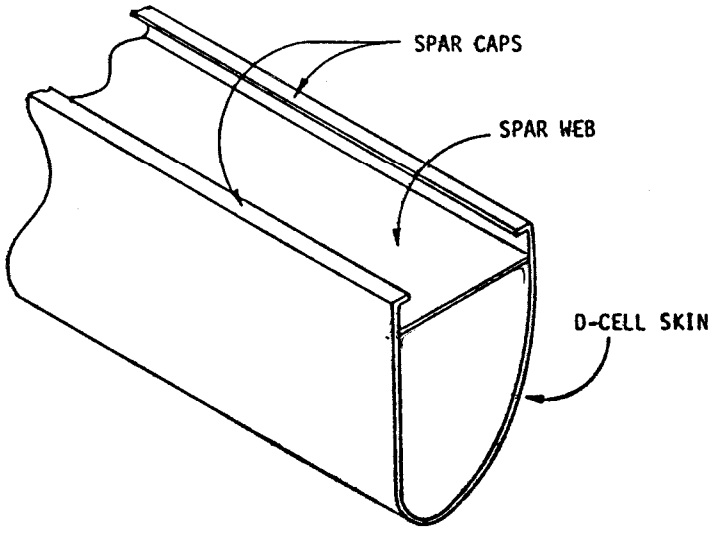
3.1.4 Insert the GBR's under the D-cell skin to a depth of one inch at the locations specified. At some locations it may be necessary to drill out a rivet to insert a GBR.

3.1.5 Drill and rivet the GBR's in place using 3 rivets in each. Position the rivets along the existing rivet line on the D-cell. Remember to clean out the drill shavings between mated surfaces before riveting.

3.2 D-CELL ROOT RIB INSTALLATION

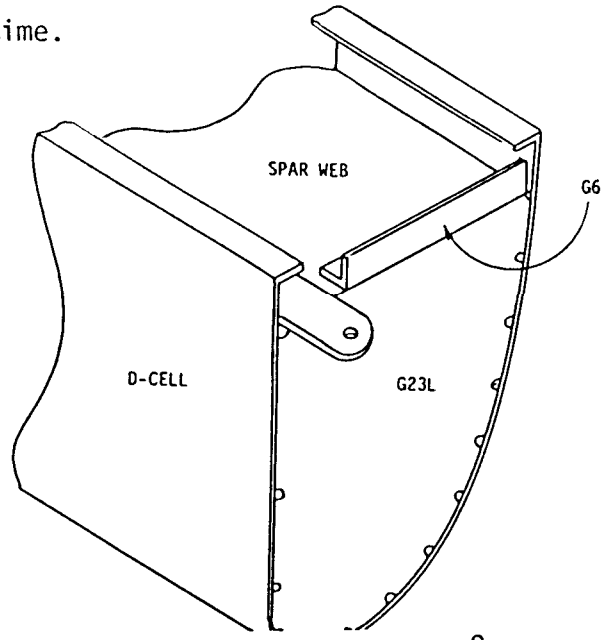
3.2.1 Make sure the tabs on the D-cell root rib G23L are bent at 90^{o}.

3.2.2 Insert G23L into the end of the D-cell (tabs first). Make sure all tabs are inside the skin of the D-cell and the outer surface of G23L is flush with the end of the D-cell.

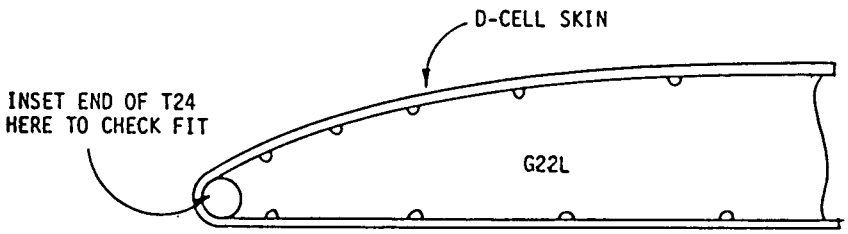


3.2.3 Drill and rivet G23L to the D-cell skin. Put one rivet in each short tab and three rivets in each long tab. Do *not* rivet to the spar web at this time.

3.2.4 Fit angle gusset G6 to the spar web as shown. G6 should be positioned so that it forms a smooth continuation of G23L. Rivet G6 to the spar web and G23L with six equally spaced rivets.



3.2.5 Make sure the tabs on the D-cell tip rib G22L are bent at 90° and fit G22L into the D-cell (tabs first). Cut or file the opening at the leading edge of G22L as necessary to provide a 1/2 inch diameter hole for T24 to be inserted later.

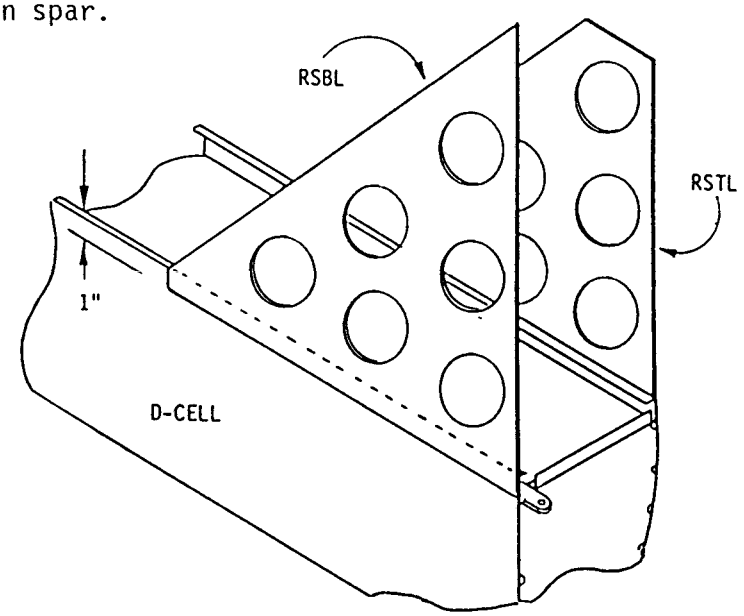


3.2.6 Drill and rivet G22L to the D-cell skin and spar web. Use two rivets in each short tab and one inch rivet spacing in the long tabs.

3.3 REAR SPAR BOX ASSEMBLY

3.3.1 Fit rear spar top RSTL to the D-cell (at the G23 end) so that the bottom of RSTL is one inch ahead of the edge of the D-cell skin. Note that RSTL goes on the outside of the D-cell skin. Clamp RSTL in place with C-clamps or vice-grips with cardboard pads

to avoid scratching the aluminum. Be sure that one edge of RSTL is flush with the end of the D-cell and the other edge is parallel to the main spar.



3.3.2 Drill and rivet RSTL to the D-cell. Put the first rivet 1/2 inch from the end of the D-cell and use one inch spacing for the remaining rivets.

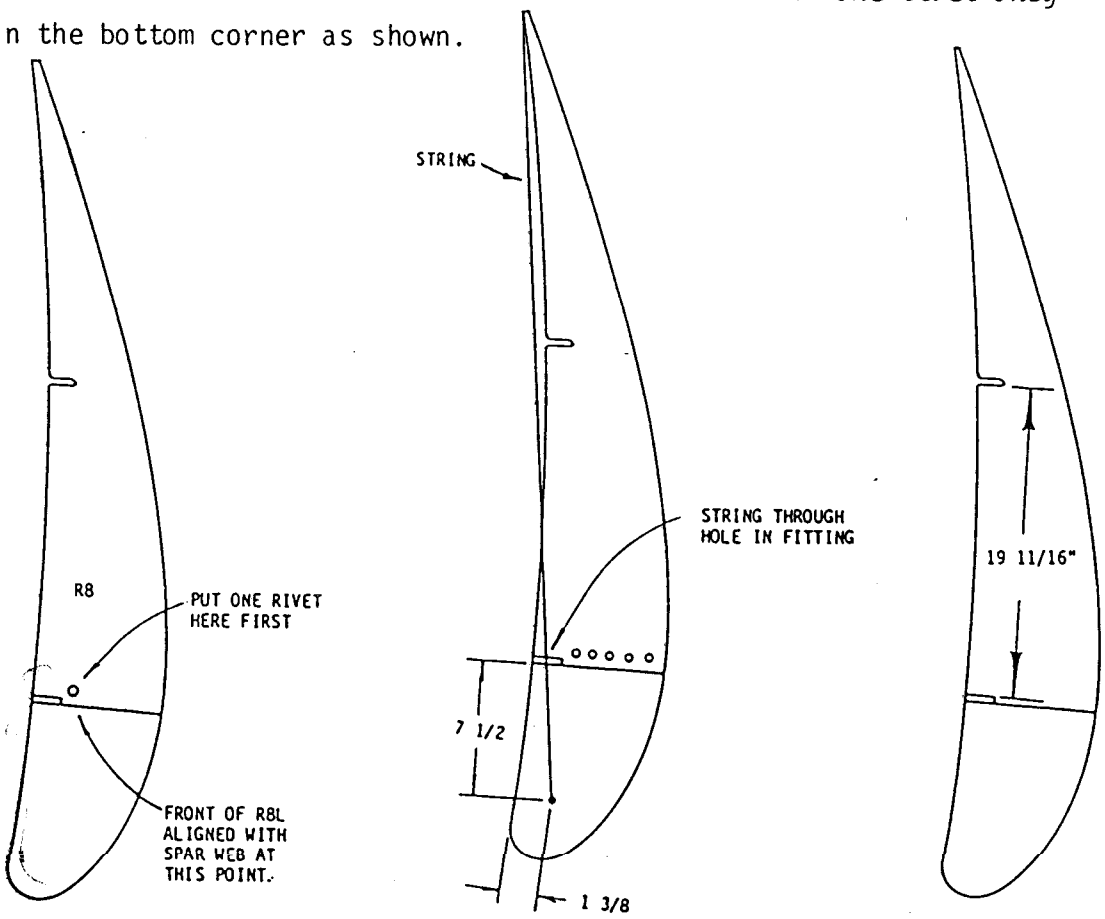
3.3.3 Similarly clamp, drill and rivet the rear spar bottom RSBL to the D-cell.

3.3.4 Remove all part numbers from the inner surfaces of RSBL and RSTL with lacquer thinner (these will become inaccessible when the spar box is complete).

3.3.5 Remove the D-cell from the saddles. Change the saddles from the high to the low position and replace the D-cell in the saddles.

Note: If your shop has sufficient ceiling height (in excess of 8 feet) you may prefer to leave the wing in the high saddles until all the ribs are installed (end of section 3.4). You might also find it convenient to revert to the high saddles for the installation of the aileron bellcrank assembly in section 3.7.

3.3.6 Position the root rib R8L as shown. Make sure the front edge of R8L is aligned with the spar web, and the bottom of R8L is in line with the bottom of the D-Cell. Rivet R8L to G6 with *one rivet only* in the bottom corner as shown.



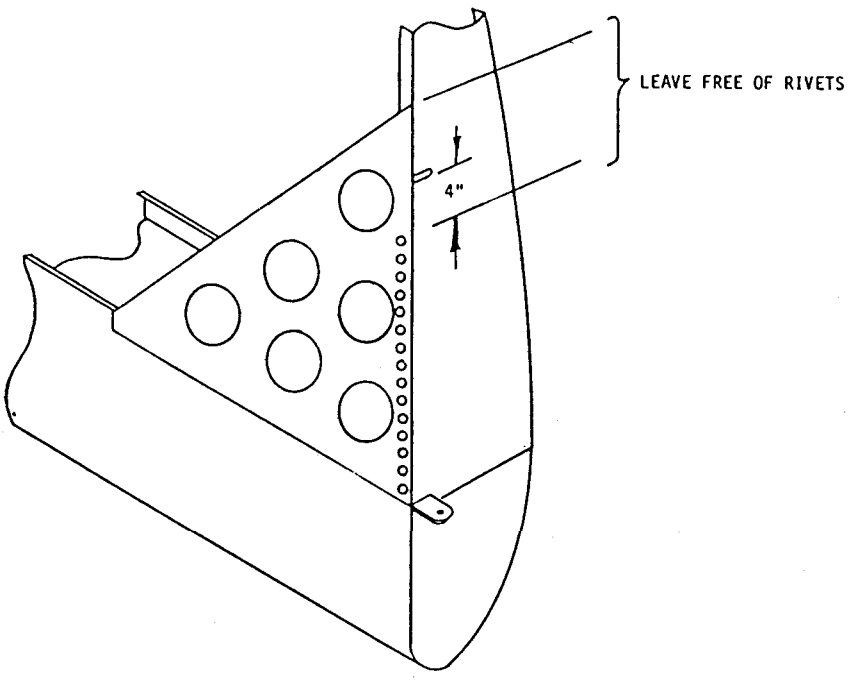
3.3.7 Put a mark on G23L 7-1/2 inches ahead of the spar web and 1-3/8 inches above the bottom of the D-cell. Tape a string to this mark, pass it through the hole in the wing attach fitting and tape it to the bottom of R8L at the trailing edge. Adjust the position of R8L so that the string is straight and passes through the centre of the hole in the wing attach fitting.

3.3.8 Rivet R8L to G6 with five more rivets with a one-inch rivet spacing.

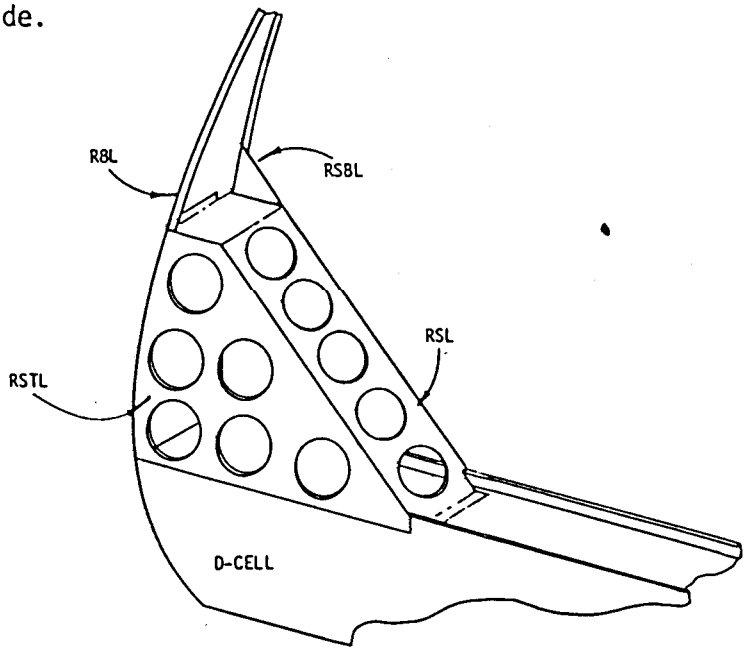
3.3.9 File the slot in R8L to obtain a spacing of 19-11/16 inches between the front wing attach fitting and the slot. Note that this measurement is made between the *rear* surface of the front wing attach fitting and the *leading* edge of the slot.

3.3.10 Rivet RSTL to R8L with a one-inch rivet spacing. Make sure that R8L is parallel to the edge of RSTL. Use clamps if necessary. Leave two inches at the trailing edge of RSTL free of rivets.

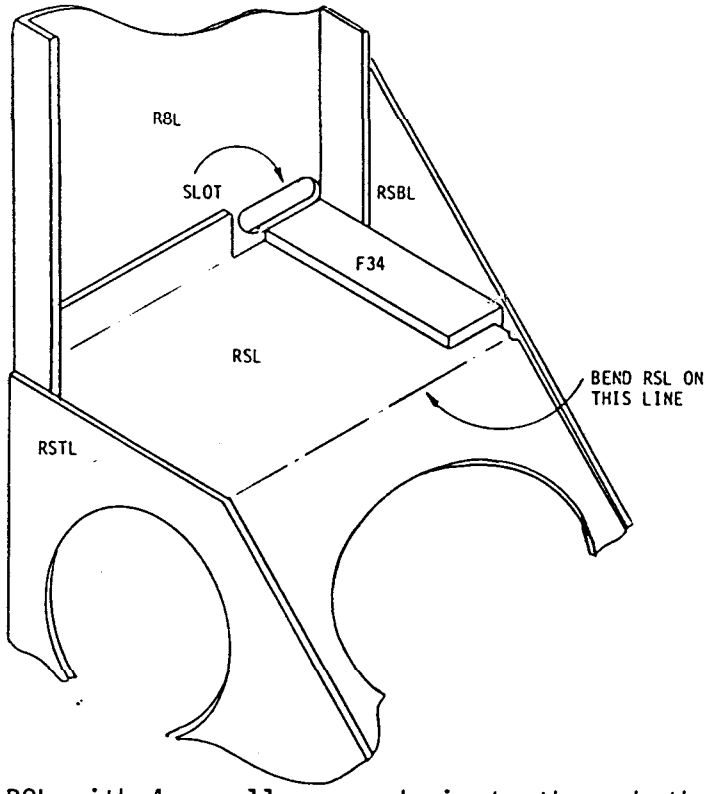
3.3.11 Rivet RSBL to R8L with one-inch rivet spacing. Leave the rear corner free of rivets as shown to allow for the insertion of G12 later.



3.3.12 Fit RSL between RSTL and RSBL. Bend RSL as necessary using RSTL as a guide.



3.3.13 Insert one flange of F34 between RSL and RSBL as shown. Make sure that the exposed surface of F34 is flush with the forward edge of the slot in R8L and is 19 11/16 inches from the rear surface of the wing attach fitting (as established in step 3.3.9). *Make sure that the exposed surface of F34 is parallel to the spar web.*



3.3.14 Rivet RSL to R8L with 4 equally spaced rivets through the rear tab of RSL.

3.3.15 Rivet RSTL to RSL with one-inch rivet spacing. Rivet the short section of RSL (the trailing edge) first, making sure that the surface of RSL is parallel to the main spar web. *Before riveting along the hypotenuse of RSTL, make sure that the foreward tab of RSL is positioned tightly against the spar web.* Note that the surface of RSL might not be flush with the edge of RSTL and RSBL. This condition is normal.

3.3.16 Rivet RSBL to RSL along the hypotenuse only. Do not put any rivets within 5 inches of F34.

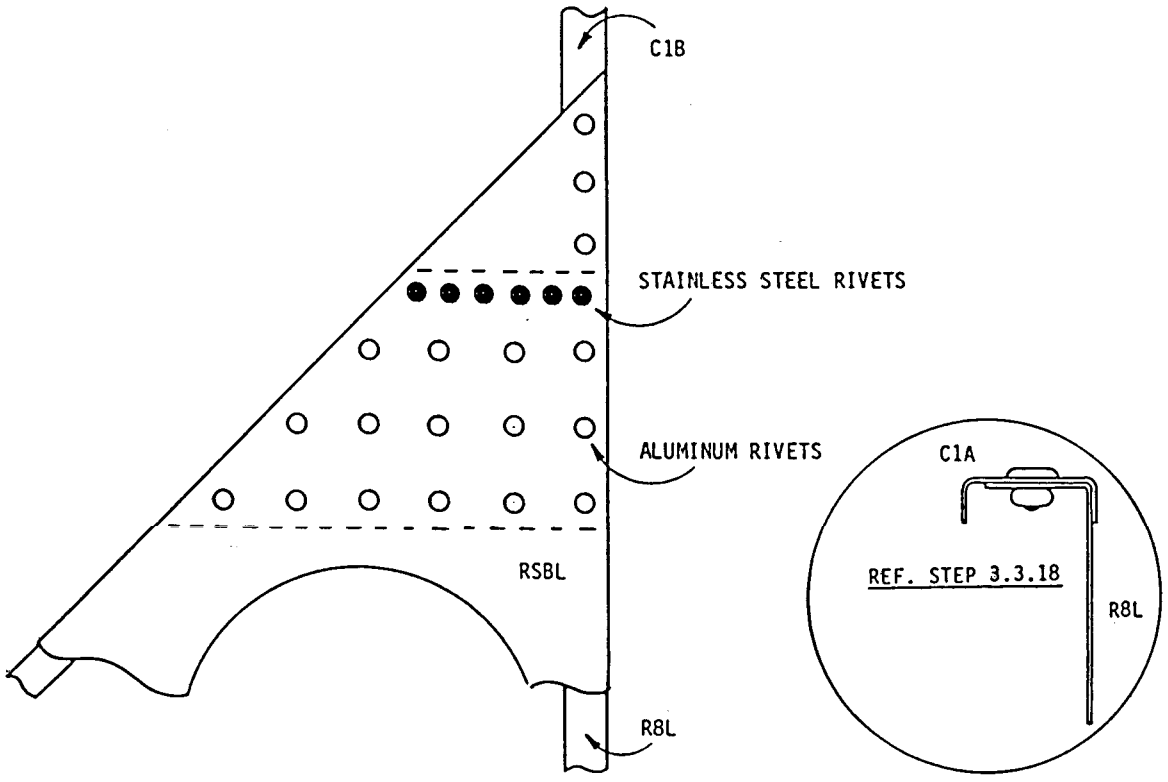
3.3.17 Rivet RSL to the main spar web with 6 equally spaced rivets.

3.3.18 Position capstrip C1A on the top edge of R8L so that the trailing edge of C1A is 57 5/8 inches behind the leading edge of the D-Cell, as shown in the figure at the bottom of the page.

3.3.19 Rivet C1A to R8L with a two-inch rivet spacing. Put the first rivet 1/2 inch from the leading edge of C1A and do not put any rivets within 2 1/4" of the trailing edge of C1A. Make sure that C1A and R8L are squeezed tightly together while riveting.

3.3.20 Similarly rivet C1B to the bottom of R8L so that the trailing edge of C1B is 57 5/8 inches from the leading edge of the D-cell. Do not rivet within 2 1/4 inches of the trailing edge nor within 3 1/4 inches of the leading edge of C1B.

3.3.21 Fit a G12 gusset under the free corner of RSBL. Recheck the position of F34 (as in step 3.3.13) and rivet as shown. Note that the rear row of six stainless steel rivets should go through RSBL, G12, and F34. The remaining 18 rivets are aluminum.



3.3.22 If the hypotenuse of RSBL and/or RSTL projects beyond the surface of RSL, bend it inward slightly (using a block of wood and a hammer) so that the edge of the aluminum cannot contact the tedlar wing covering.

Note: You may have noticed that the corner of the spar box projects slightly above the plane of the wing covering. This is normal.

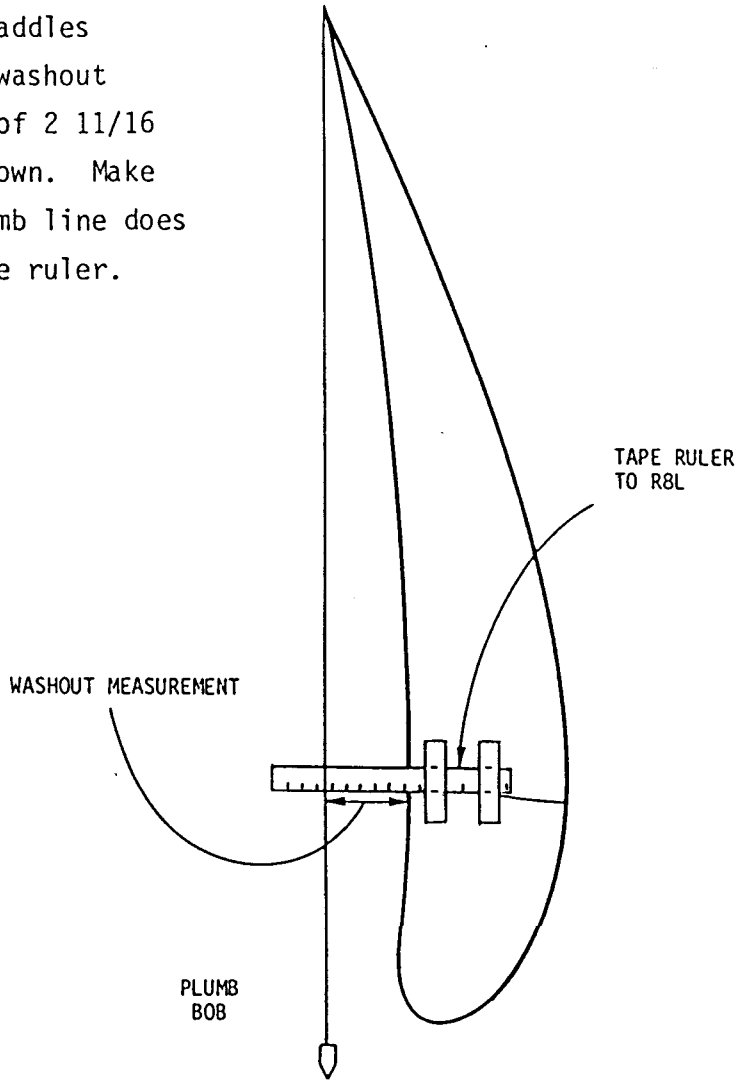
3.4 RIB ATTACHMENT

A WORD ABOUT WASHOUT

Washout (or twist) in a wing is a method used to improve the stability of an aircraft during a stall. By twisting the wing, the wing root has a higher angle of attack than the tips. Therefore, as the aircraft begins to stall, the wing root stalls first, and the tips keep flying. It should be obvious that it is important to build exactly the same amount of washout into both wings.

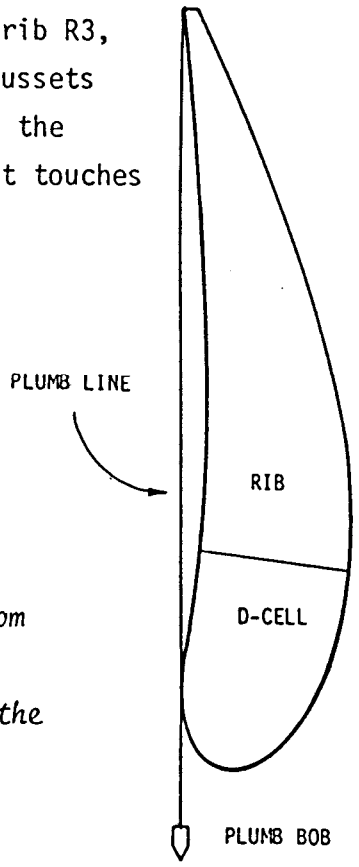
The amount of washout in the Lazair is controlled by measuring the distance between a plumb line (dropped from the trailing edge) and the bottom of the D-cell at the main spar. This distance will be referred to as the washout measurement.

3.4.1 Adjust the saddles to obtain a washout measurement of 2 11/16 inches as shown. Make sure the plumb line does not touch the ruler.

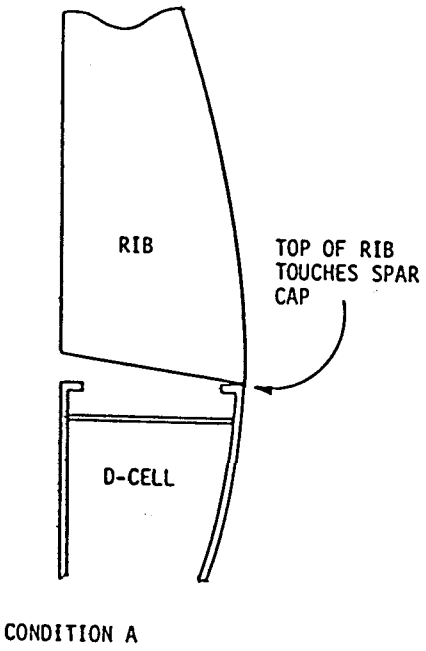


NOTE: *During the next three steps, make sure the wing does not move in the saddles, thereby changing the washout measurement. If the D-cell is not a tight fit in the saddles, it may be necessary to use some small wooden wedges or shims between the saddles and the D-cell. If there is any doubt,* recheck the washout measurement.

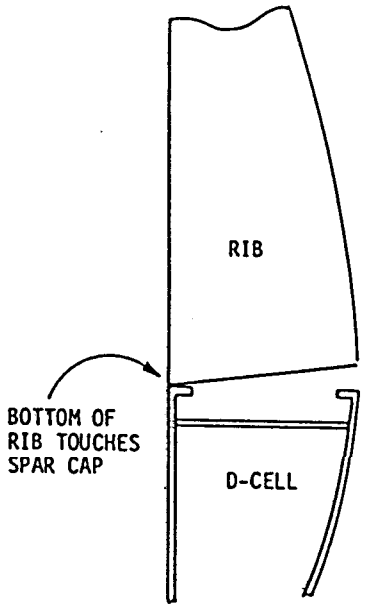
3.4.2 Tape the plumb line to the trailing edge of rib R3, and insert the rib between the appropriate gussets (131 7/8 inches from the wing root). Adjust the position of the rib until the plumb line just touches the bottom of the D-cell as shown.



NOTE: *You will notice that either condition A or condition B (as shown below) will exist. Either the top corner or the bottom corner of the rib will touch the spar cap The corner which touches the spar cap is the one which is riveted first.*

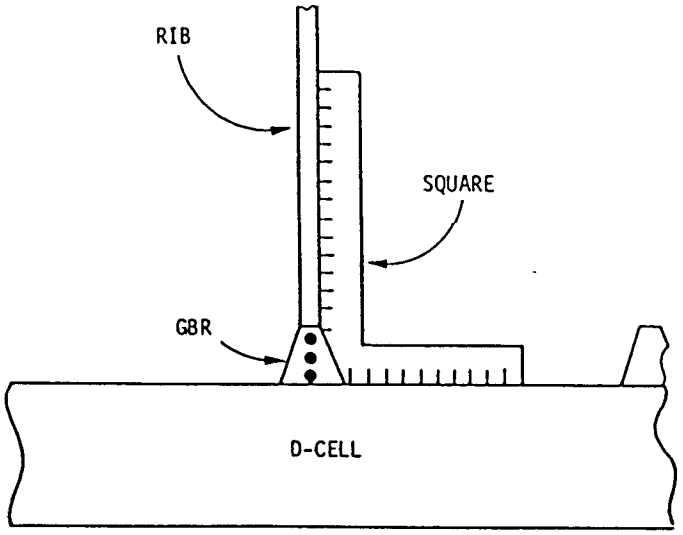


CONDITION A



CONDITION B

3.4.3 Rivet one corner of R3 to the GBR gusset with 3 rivets as shown. While drilling and riveting, hold a square against the side of the rib to ensure that it is perpendicular to the D-cell.



3.4.4 Again adjust the position of R3 so that the plumb line just touches the D-cell as in step 3.4.2. Temporarily use an aileron rib (RA) as a wedge under the unriveted corner of R3 to hold R3 in position. Rivet the remaining side of R3 through the GBR.

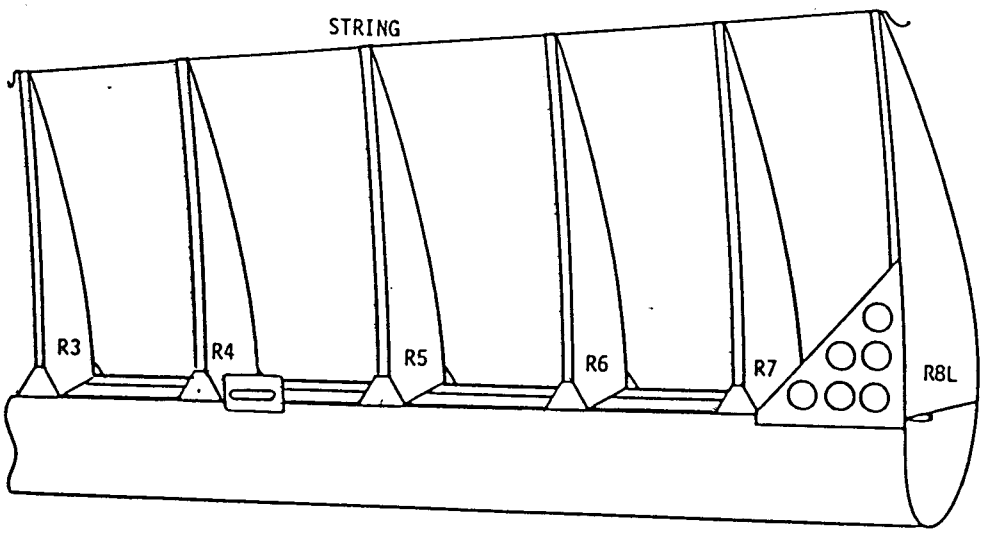
3.4.5 Trim the trailing edge of R3 so that it is 33 1/2 inches from the spar web. Use tin snips to cut the aluminum and a knife to cut the foam.

3.4.6 Trim the trailing edge of R8L, if necessary so that it is 48 inches from the spar web.

3.4.7 Tape or tie a string from the bottom of the trailing edge of R8L to the bottom of the trailing edge of R3.

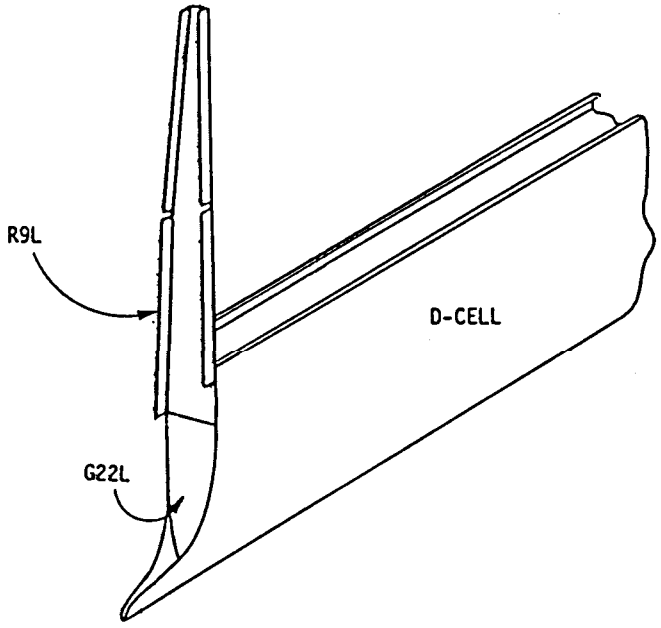
3.4.8 Insert rib R4 (105 1/2 inches from the root) so that the bottom of R4 just touches the string. Rivet R4 in place using the same riveting sequence as for R3.

3.4.9 Similarly rivet R5, R6 and R7 in place. Sight down the trailing edge to ensure that it is straight.

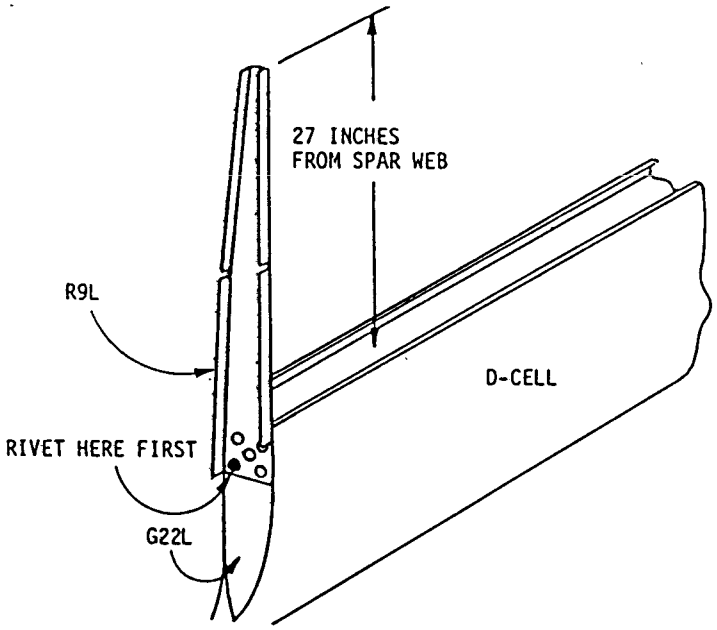


3.4.10 Trim the trailing edge of ribs R4 to R7 so that they just reach the string.

3.4.11 Position the tip rib R9L as shown. Note that the tabs are oriented toward the wing tip.



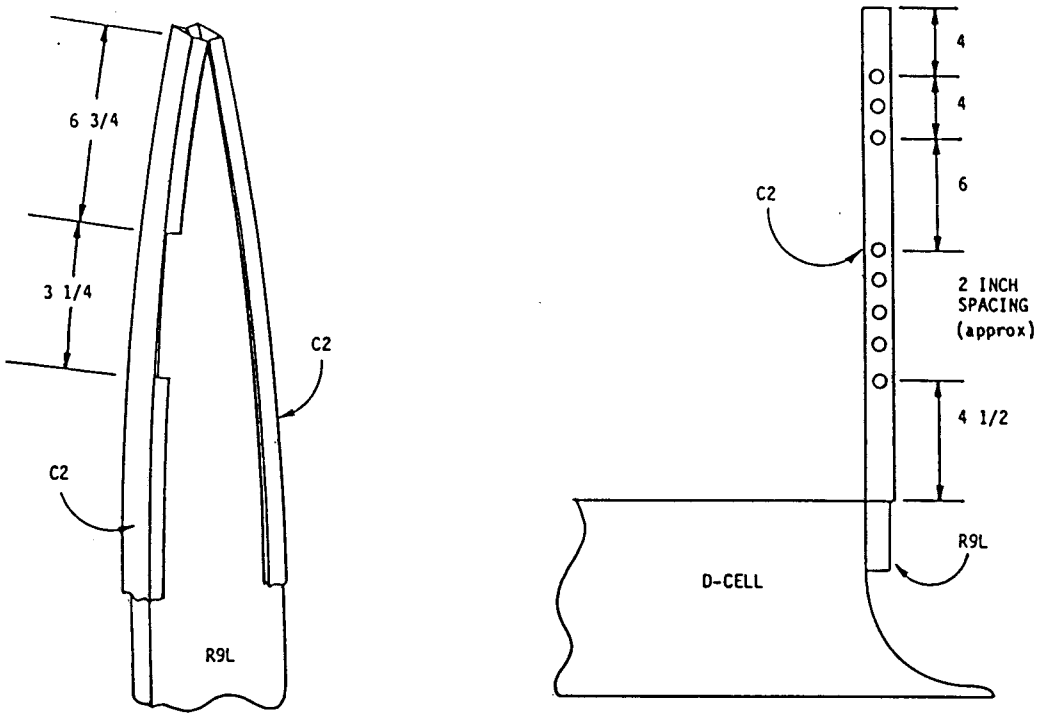
3.4.12 Adjust the position of R9L until the trailing edge of R9L is 27 inches from the spar web and the bottom edge of R9L is in line with the bottom edge of the D-cell. Rivet R9L to G22L with *one rivet only* in the bottom corner as shown.



3.4.13 Adjust the wing saddles for a washout measurement of 5 5/8 inches (refer to figure for step 3.4.1).

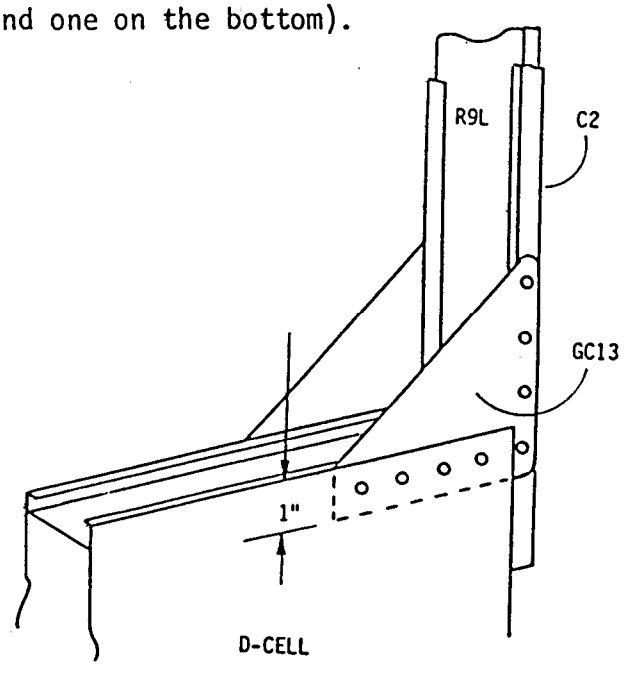
3.4.14 Move the plumb line to R9L and adjust the position of R9L so that the string just touches the bottom of the D-cell (refer to the figure in step 3.4.2). Rivet R9L to G22L with 4 more rivets as shown in the figure above.

3.4.15 Remove a 3 1/4 inch section of the lip from a capstrip C2 as shown. Note that this section is removed from the *bottom* capstrip only on the *aileron side* of R9.



3.4.16 Rivet capstrips C2 in place (top and bottom) using the rivet pattern shown above.

3.4.17 Round the two exposed corners of two GC13 gussets and insert one inch under the D-cell skin as shown (use one GC13 on the top of the wing and one on the bottom).



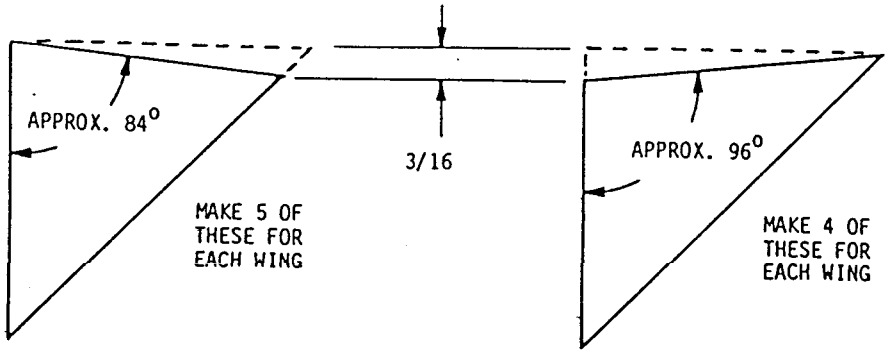
3.4.18 Rivet the GC13's to the D-cell with 4 rivets. Use a square to keep R9L perpendicular to the D-cell and rivet the GC13's to R9L with 4 rivets.

3.4.19 Tie or tape a string from the bottom of R9L to the bottom of R3, 10 inches ahead of the trailing edge.

3.4.20 Install and rivet the two short ribs R1 and R2 in place. Do not trim the length of R1 and R2 at this time.

3.5 TRAILING EDGE ATTACHMENT

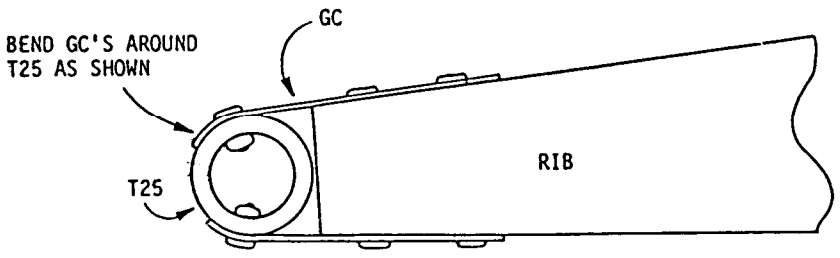
3.5.1 Trim GC gussets as shown. Round the corners of all GC gussets.



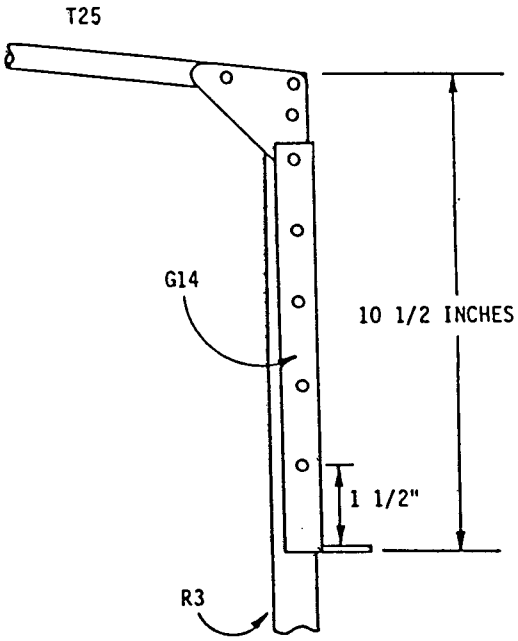
3.5.2 Put the trailing edge T25 in place and hold it temporarily with tape. Check that the distance from the spar web to the rear of the trailing edge (T25) is 48 1/2 inches at the root and 34 inches at R3. Sight along T25 to make sure that all the ribs have been properly trimmed and T25 is straight.

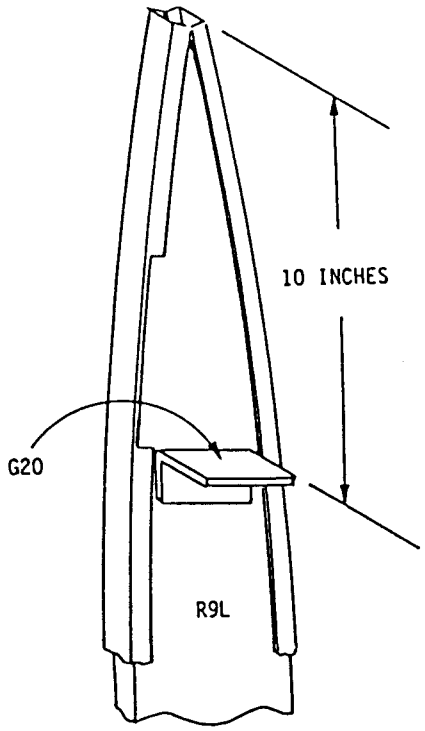
Rivet T25 in place using a GC top and bottom at each rib. For each GC use two rivets into T25 and two rivets into the rib capstrip. Use the 84° modified GC's at the root rib (R8L) and the 96° GC's at R3. Leave out the forwardmost rivet on R3 to allow G14 to be fitted later.

When all the GC's have been riveted in place, tap them with a hammer to form a smooth contour over T25.



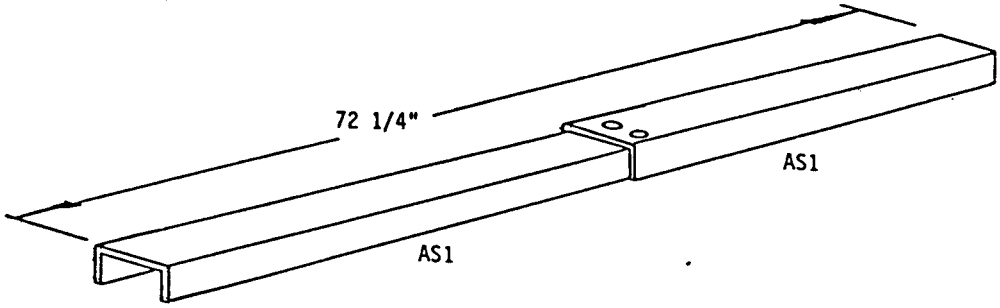
3.5.3 Round the corners on G14 and fit it over R3 as shown. Rivet G14 to R3 with 5 rivets top and bottom. Do not rivet within 1 1/2 inches of the tab on G14.





3.5.4 Rivet angle bracket G20 on the aileron side of R9L as shown with 2 rivets.

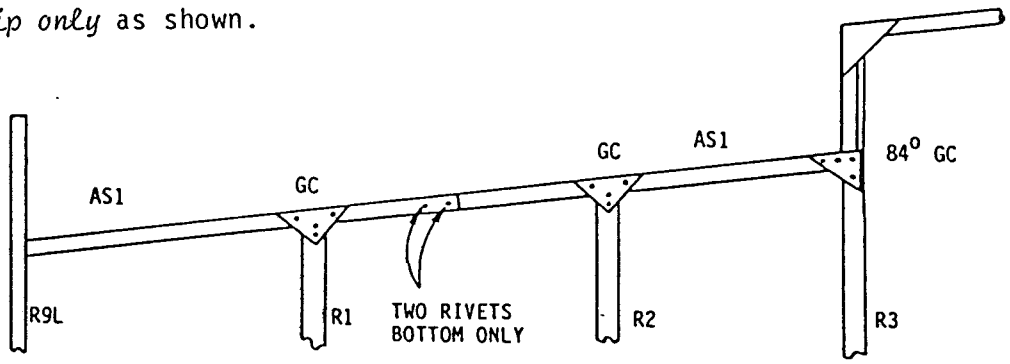
3.5.5 Splice ~~two~~ AS1's together to obtain a total length of 72 1/4 inches. Make sure the two pieces form a straight line. Use two rivets in the web. Do not put any rivets in the lip.



3.5.6 Using a string or a straightedge between the tabs of G14 and G20, trim R1 and R2 to length.

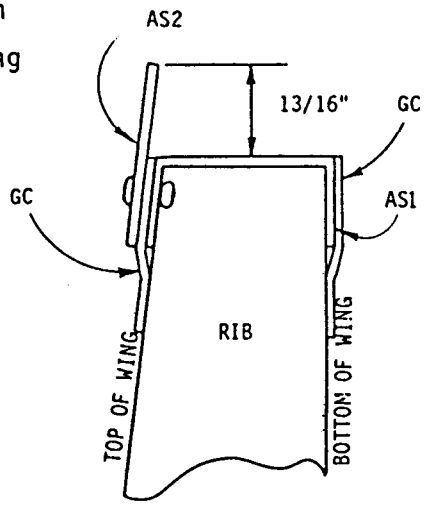
3.5.7 Fit the spliced AS1 assembly over G14, G20, R1, and R2. Make sure that the AS1 assembly is straight, is centred on R3 and R9L, and covers the tabs on G14 and G20 completely. R9L may be moved slightly if necessary to obtain the correct spacing between R9L and R3. Rivet the AS1 assembly in place with two rivets into G14 and two into G20.

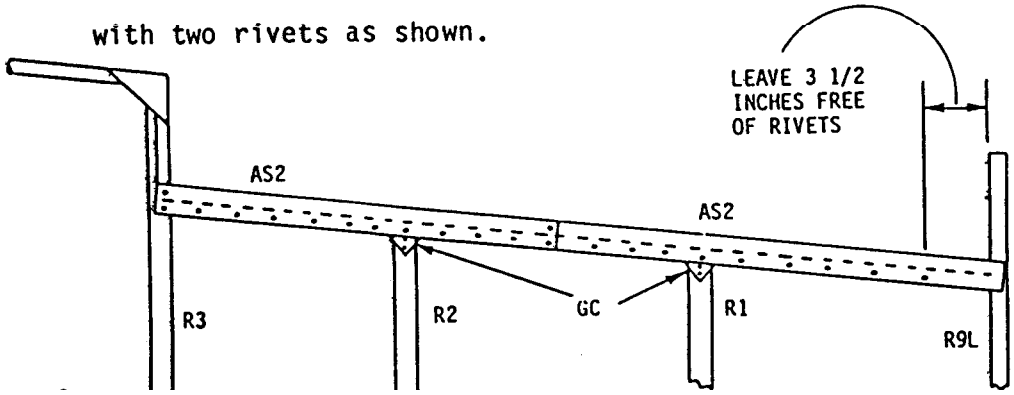
3.5.8 Rivet the AS1 assembly to R3 with a modified (84^{o}) GC gusset *on the bottom of the wing only*. Do not rivet on the top of R3. Make sure AS1 is straight and install two rivets *in the bottom lip only* as shown.



3.5.9 Rivet the GC gussets to the ribs R1 and R2, top and bottom. The GC's should be positioned such that the rear edges of the GC and the AS1 are flush. The *lower* GC's can be riveted to the AS1's at this time.

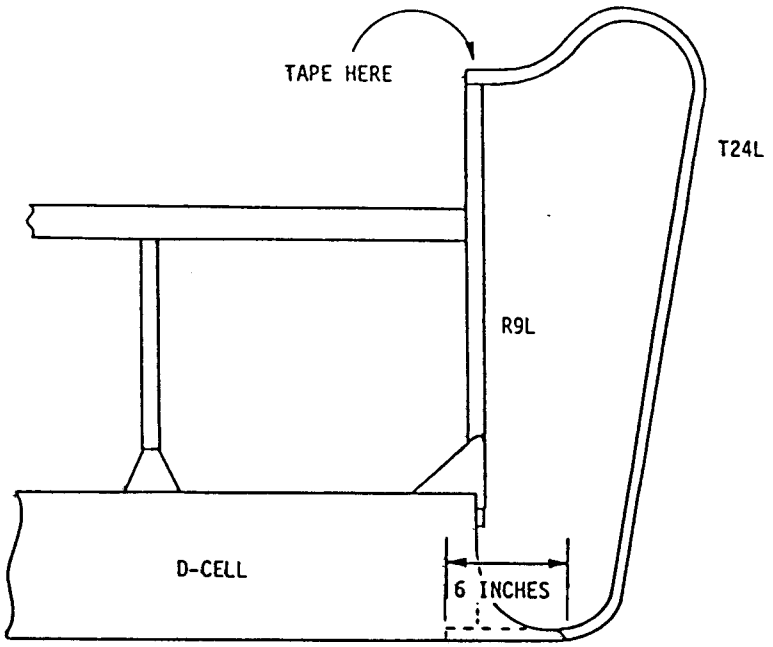
3.5.10 Round the corners on two AS2's and clamp them to the lip of the AS1's on the top of the wing only. The AS2's should extend 13/16 inches behind the web of the AS1's. Sight the trailing edge of the AS2's and make sure it is a straight line. Rivet the AS2's to the AS1's with a 3-inch rivet spacing. Start at the junctions of the R1 and R2 ribs with AS1 and AS2. Use three rivets holding each AS1, AS2 and GC together. Work outwards from the gussets, in both directions, to prevent wrinkles in the AS2's. Check frequently to ensure that the AS2's are straight. Do not rivet within 3 1/2 inches of R9L. Rivet the inboard end of AS2 to R3 with two rivets. Rivet the overlap of the AS2's with two rivets as shown.





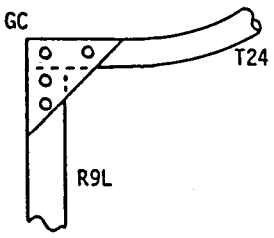
3.6 WING TIP ASSEMBLY

3.6.1 Insert the leading edge of the tip bow T24L through the hole in G22L to a depth of 6 inches *from the end of the D-cell skin.* Tape the trailing edge of T24L in place as shown.



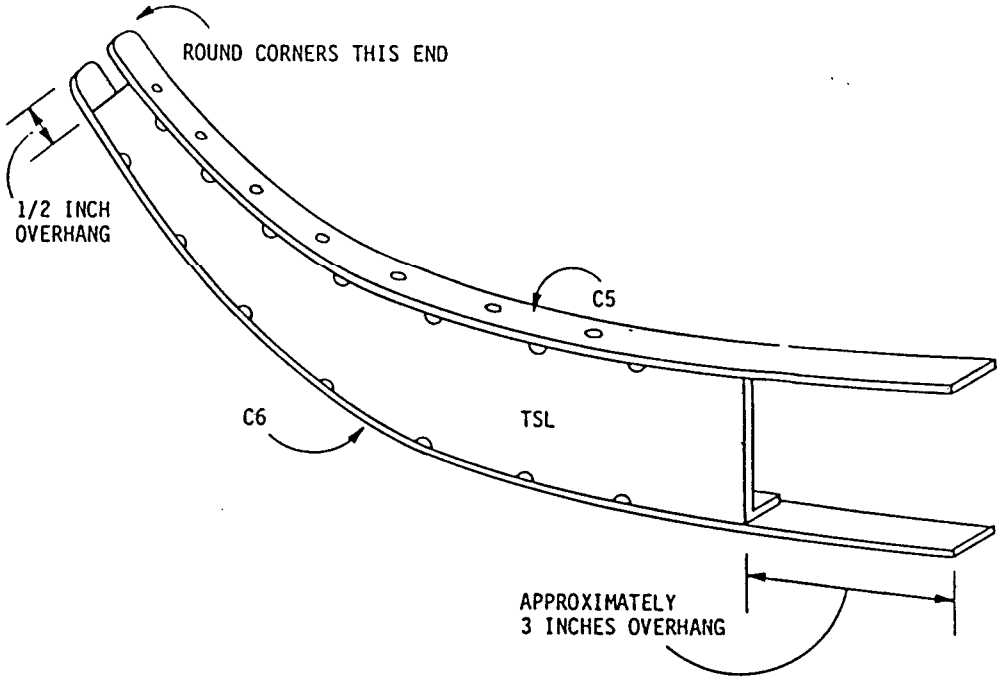
3.6.2 Rivet the leading edge of the tip bow in place with 4 equally spaced rivets through the leading edge of the D-cell skin.

3.6.3 Rivet the trailing edge of T24L in place with two GC gussets (one top, one bottom), and 4 rivets per gusset.



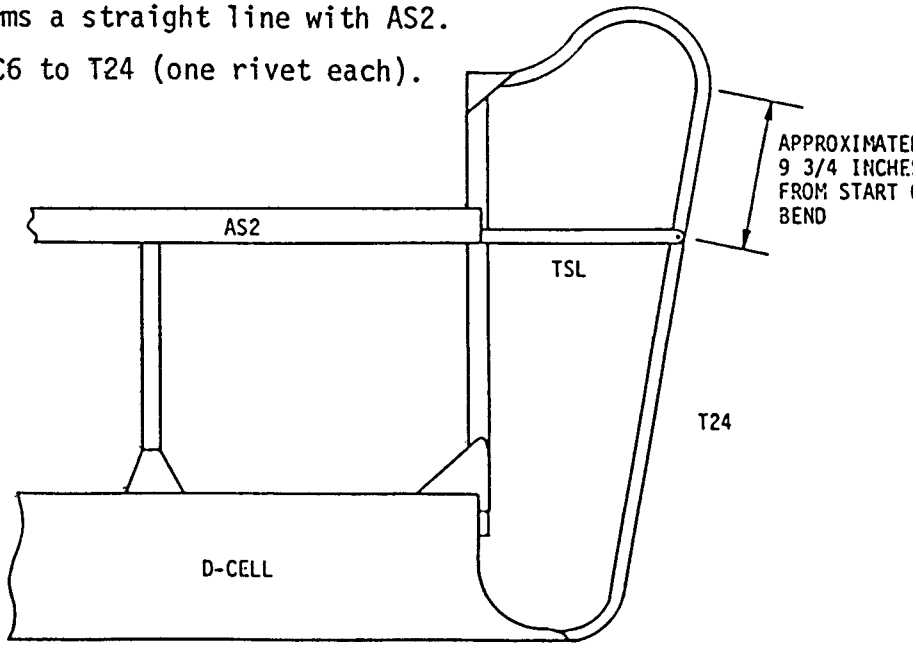
3.6.4 Round the corners on one end of capstrip C5 and rivet it to the inside curve of tip spar TSL as shown. The rounded end of C5 should extend 1/2 inch beyond the narrow end of TSL.

3.6.5 Use one rivet in each tab of TSL. Do not rivet the tab nearest the wide end of TSL.

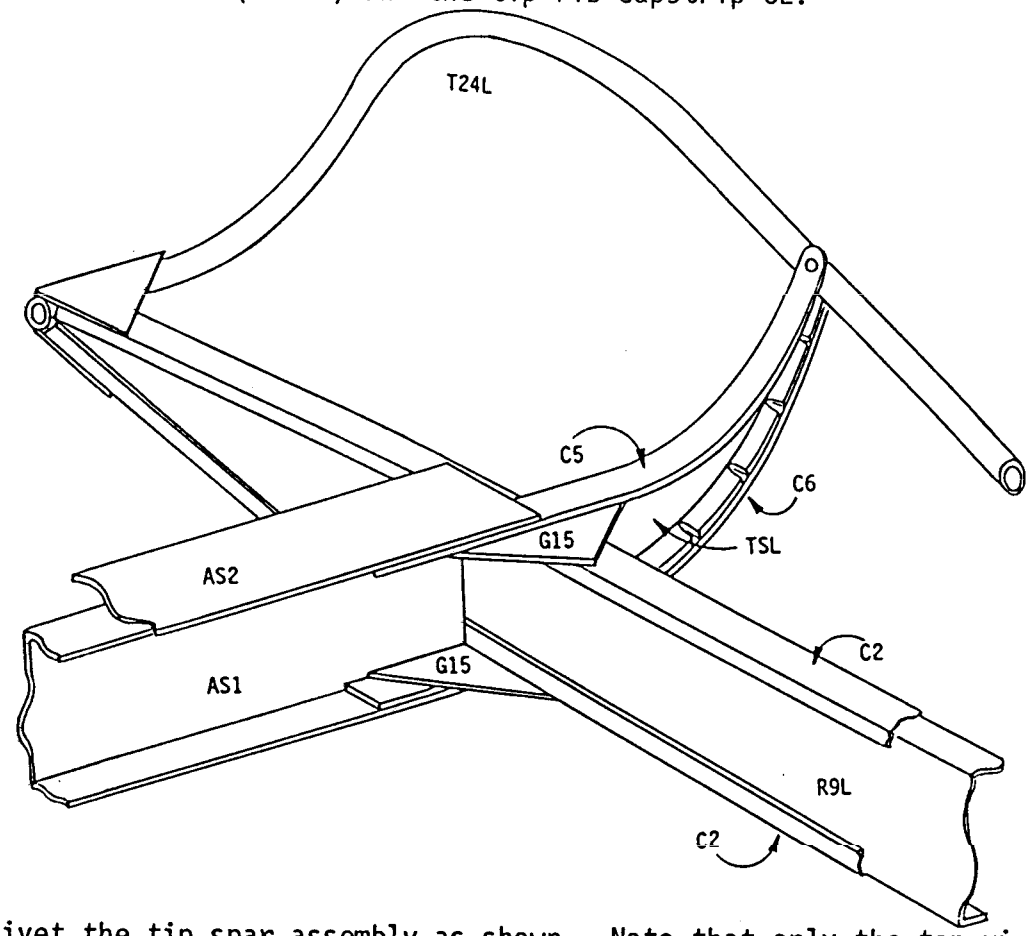


3.6.6 Round one end of capstrip C6 and rivet to the outside curve of TSL as shown. Rivet as in step 3.6.5 above.

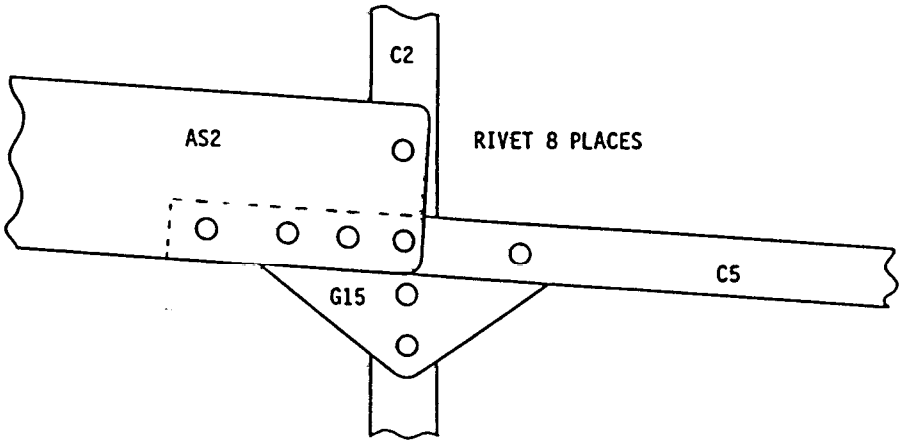
3.6.7 Fit TSL into position as shown. The leading edge of C5 should be in line with the leading edge of AS2 and the 3 inch extensions of C5 and C6 should be inside the flanges of AS1. Sight along the leading edge of AS2 and adjust the position of the TSL assembly so that it forms a straight line with AS2.
Rivet C5 and C6 to T24 (one rivet each).



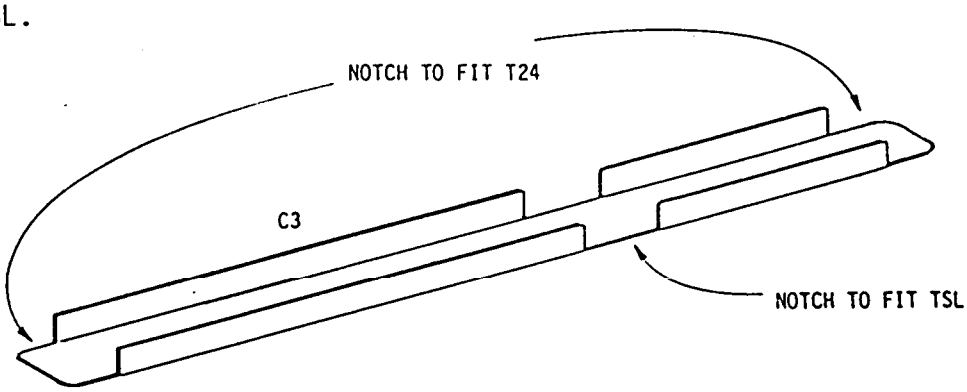
3.6.8 Insert two G15's (one top, one bottom) as shown. The G15's should fit between C5 (or C6) and the tip rib capstrip C2.



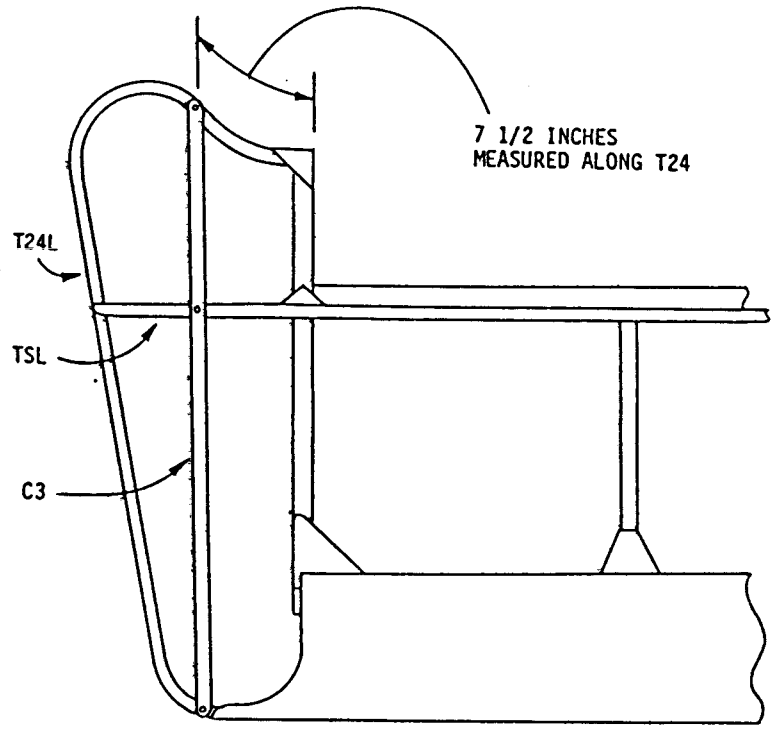
3.6.9 Rivet the tip spar assembly as shown. Note that only the top view is shown. The bottom should be riveted in the same way except that there is no AS2 on the bottom.



3.6.10 Cut and notch a tip capstrip C3 to fit on the bottom of the wingtip. Position C3 as in step 3.6.11 to locate the notch for TSL.



3.6.11 Rivet C3 as shown. Use one rivet each end into T24 L and one into TSL.



NOTE: *The tip gussets (G25) and capstrips C4 shown on drawing E will be installed after the wingtip is covered.*

EXPLANATORY NOTE

If you are relatively unfamiliar with the Lazair flight control systems, you could probably proceed with the installation of the aileron control linkage without question. However if you have assembled one of the earlier models, you may find the next few pages a bit surprising because this part of the control linkage has changed considerably, and a few words of explanation may be helpful.

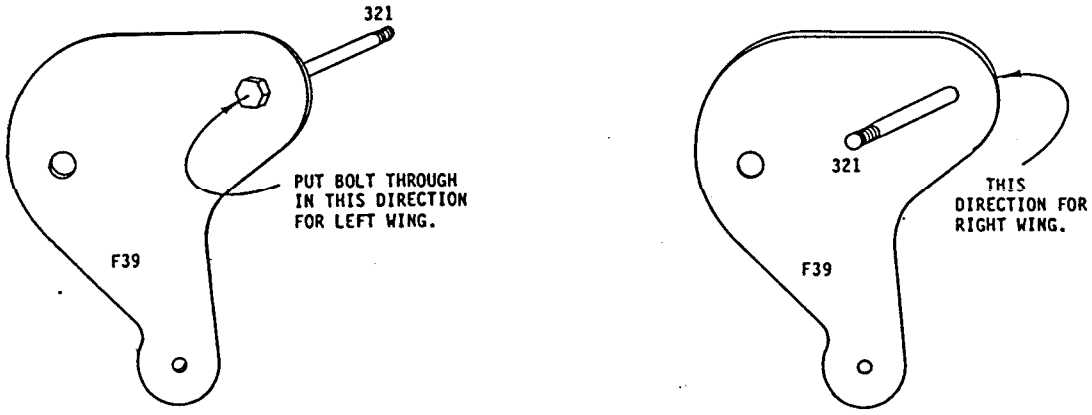
On earlier models (with the overhead control stick) the aileron linkage was connected from the stick, up the fron tube, over the pilot's head to a control horn, then via a pushrod through the wing to a bellcrank. On the Series III Lazair with the lower mounted stick, the ailerons are controlled through a torque tube from the bottom of the stick to a horn under the seat. Pushrods are connected from this horn *along the lift struts* to a wing mounted bellcrank. This intermediate bellcrank is used to invert the direction of the pushrod movement, and also provides increased differential travel to reduce the adverse yaw caused by aileron drag. In addition to the changes in system configuration, anyone who has assembled a Lazair previously will notice that the bellcranks are now doubled to essentially create a box section rather than the previous flat plate, thereby improving rigidity.

Although this new control linkage may seem at first glance to be somewhat more complex, you will find it can be assembled quite easily and when properly installed and adjusted will provide extremely precise roll control with *very* light stick forces.

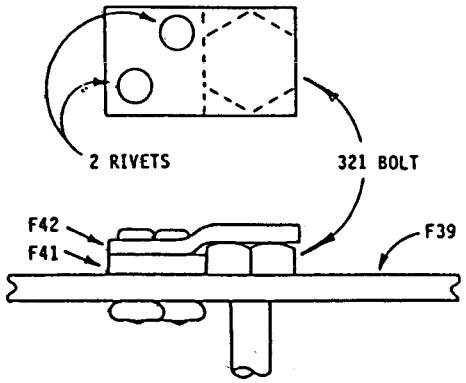
To disassemble the aircraft for transportation or storage, the lift strut and aileron pushrod are disconnected at the inboard end *only* and the strut and pushrod may then be folded against the bottom of the wing.

3.7 AILERON BELLCRANK INSTALLATION

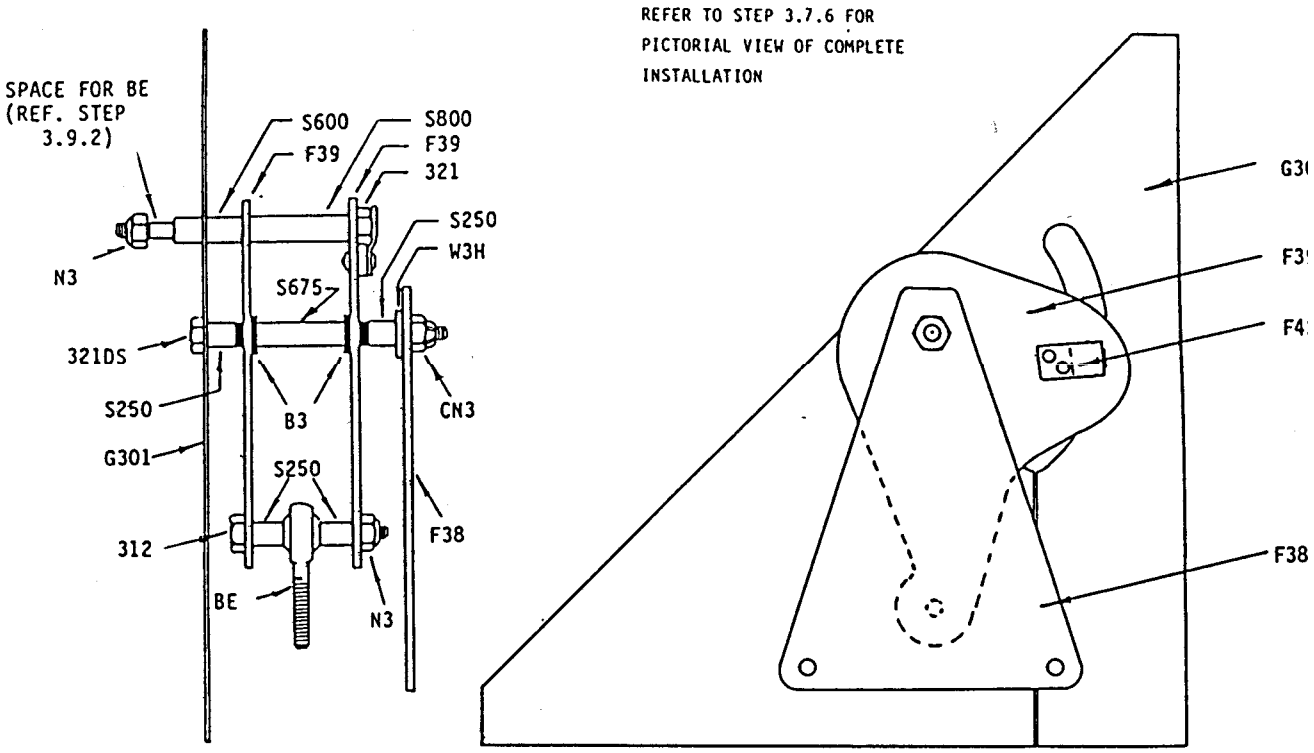
3.7.1 Push a 321 bolt through the hole in one bellcrank F39 as shown.



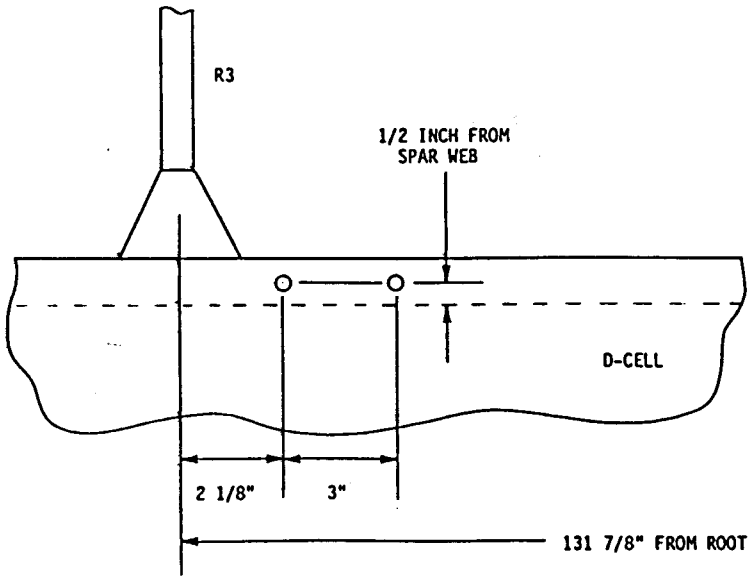
3.7.2 Rivet F41 and F42 to F39 to hold the 321 bolt in place and prevent it from turning. Use two rivets as shown. It may be necessary to bend F42 slightly to allow it to sit flat on F41.



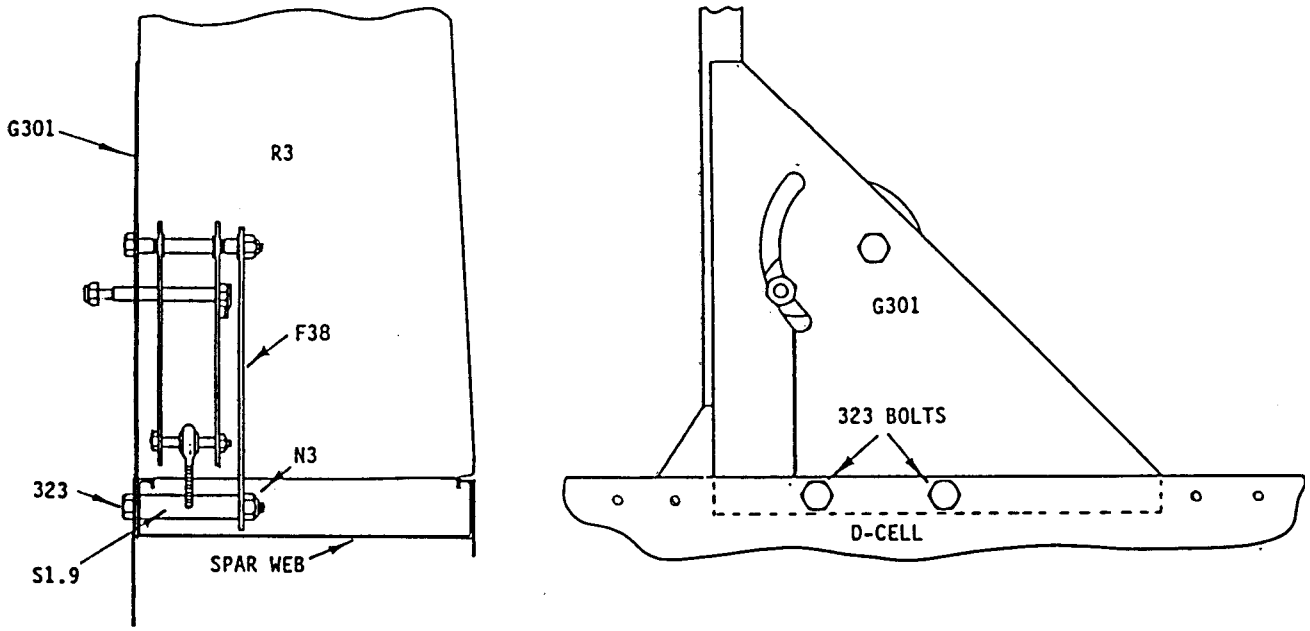
3.7.3 Complete the left aileron bellcrank assembly as shown below. Note that the B3 bushings are installed with the large diameter shoulder on the inside of the F39 bellcranks. Tighten the N3 nut on the 312 bolt securely. Do not tighten the CN3 nut on the 321DS bolt. Do not tighten the N3 nut on the captivated 321 bolt.
Note that the captivated 321 bolt and the S600 spacer fit through the semicircular slot in G301.



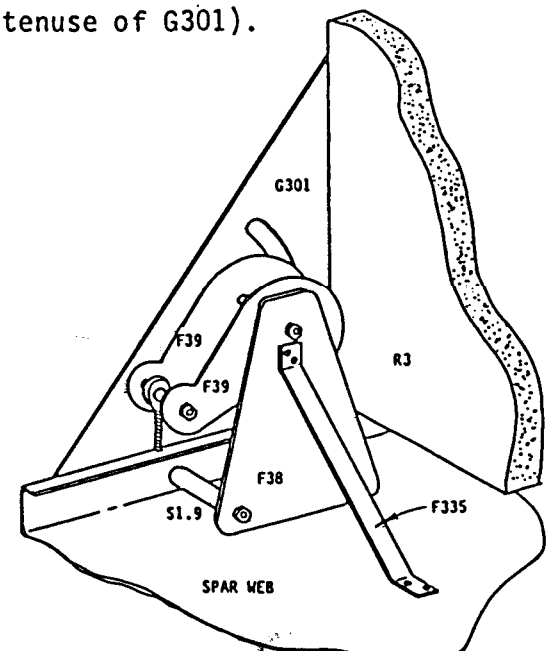
3.7.4 Drill two 3/16 inch holes through the spar cap on the *bottom* of the wing as shown. It may be necessary to drill out one or two rivets to locate these holes properly.



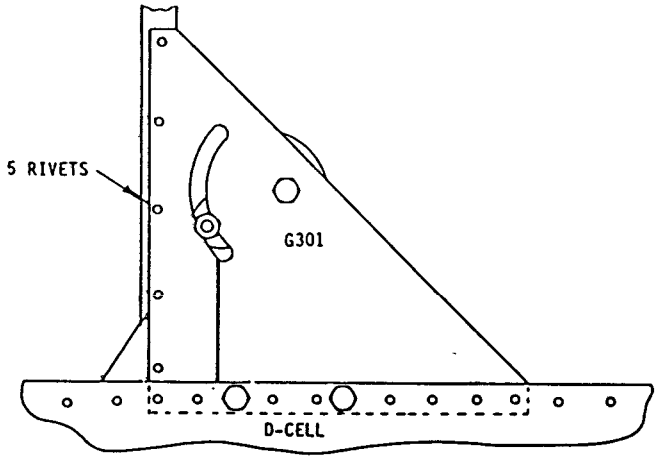
3.7.5 Position G301 and F38 as shown. Drill out any rivets in the spar cap which are under G301. Do not remove the rivets holding GBR to R3. Slip G301 under the D-cell skin until the holes are properly aligned. Bolt the bellcrank assembly to the spar cap using 323 bolts and S1.9 spacers as shown.



3.7.6 Drill two 1/8 inch holes in each end of bellcrank bracket F335 and rivet it to F38 as shown. Adjust the position of the bellcrank assembly so that G301 is in plane with the bottom surface of the wing and rivet F335 to the spar web (the position can be checked by holding a straightedge between the bottom of R3 and the D-cell across the Hypotenuse of G301).

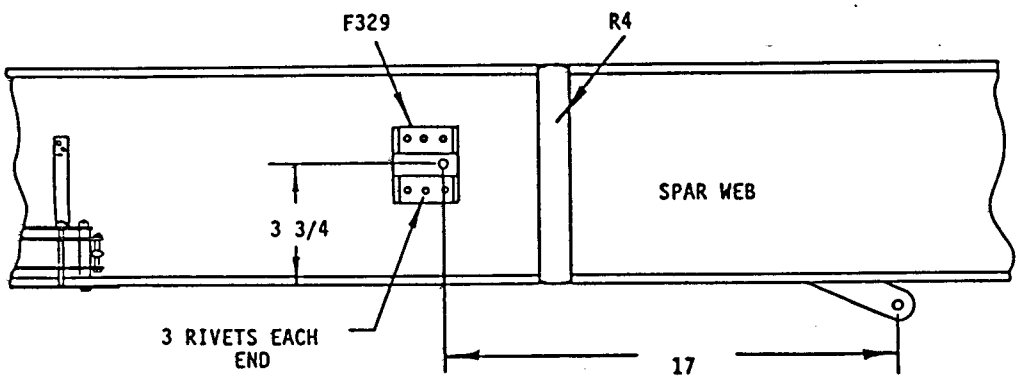


3.7.7 Rivet G301 to the bottom capstrip of R3 with 5 equally spaced rivets. Rivet G301 to the spar cap with a 1 inch rivet spacing.

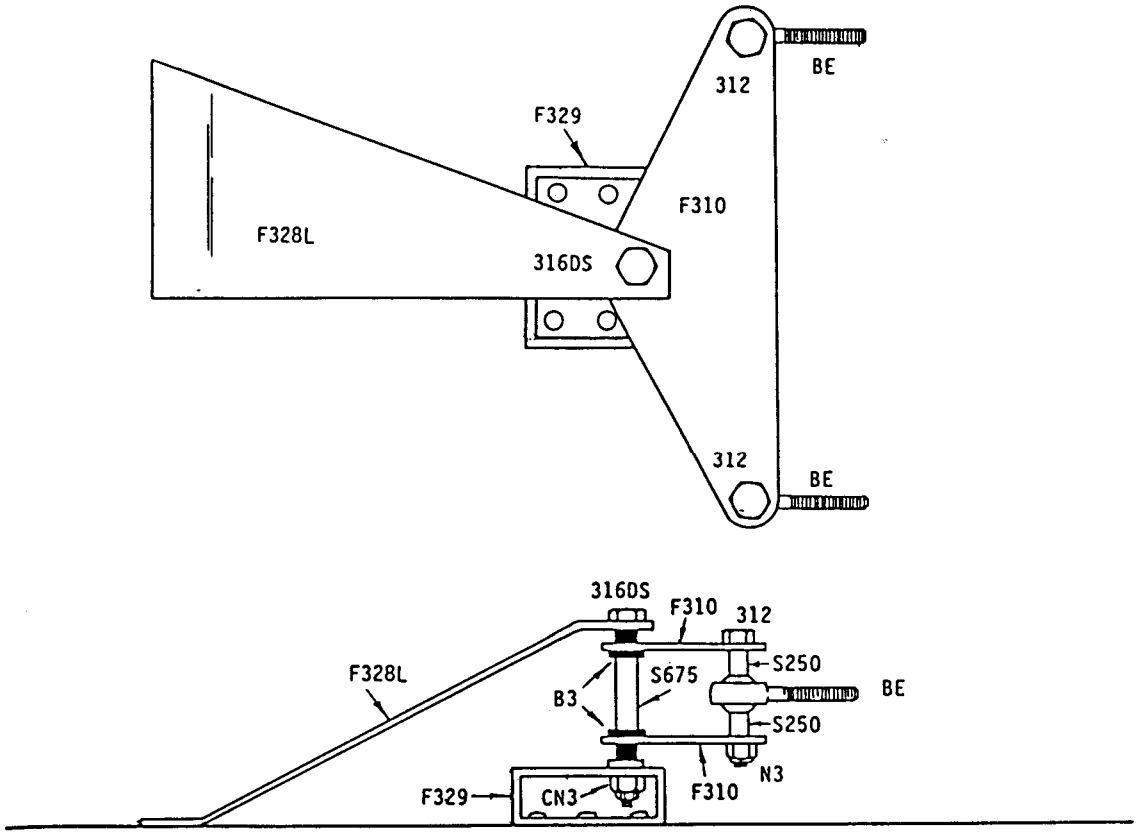


3.7.8 Tighten the castle nut on the 321DS bolt until the bellcrank assembly will just rotate under the force of gravity. Lock the nut with a CP23 cotter pin. Bend the tails on the cotter pin around the nut in opposite directions.

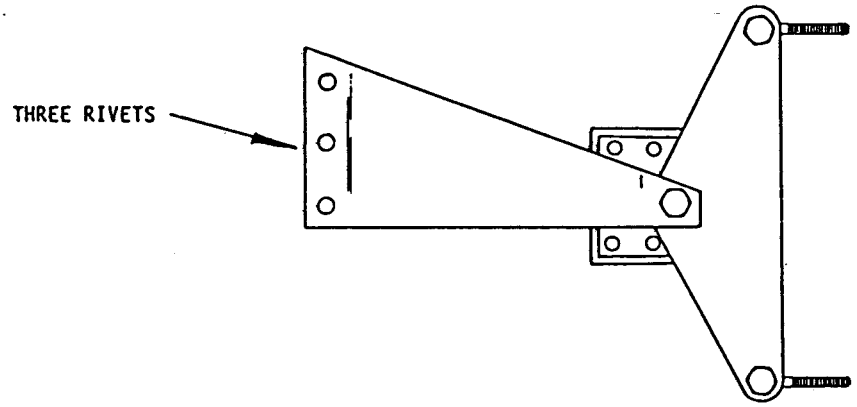
3.7.9 Rivet the intermediate bellcrank mount F329 to the spar web as shown. Note that the measurements are made to the centre of the hole in the mount. Note also that the mount is oriented so that the end with the hole faces inboard. Use 3 rivets in each end of F329.



3.7.10 Complete the intermediate bellcrank assembly as shown and bolt it onto the F329 mount. Tighten the CN3 nut on the 316DS bolt to allow the bellcrank to rotate with about the same friction as the F39 assembly (step 3.7.8) and lock the nut with a cotter pin.

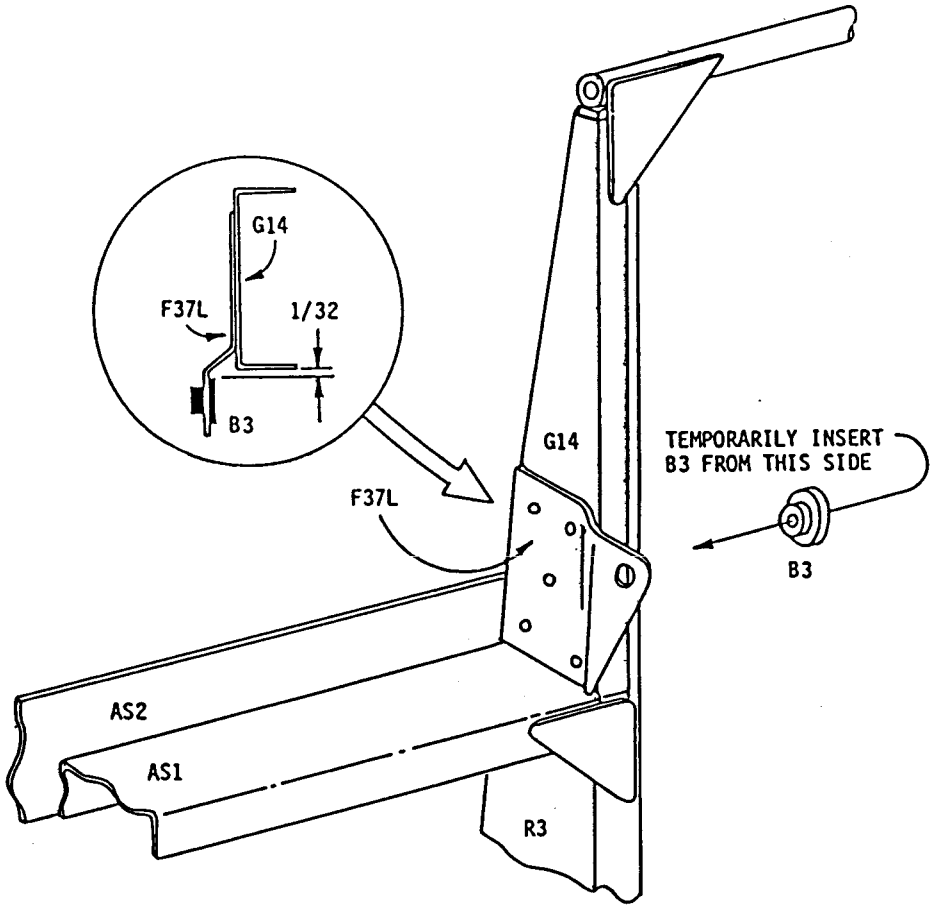


3.7.11 Rivet the bellcrank support F328L to the spar web with 3 rivets as shown. Make sure that the end of F328L is perpendicular to the spar caps and make sure the 316DS pivot bolt is perpendicular to the spar web.



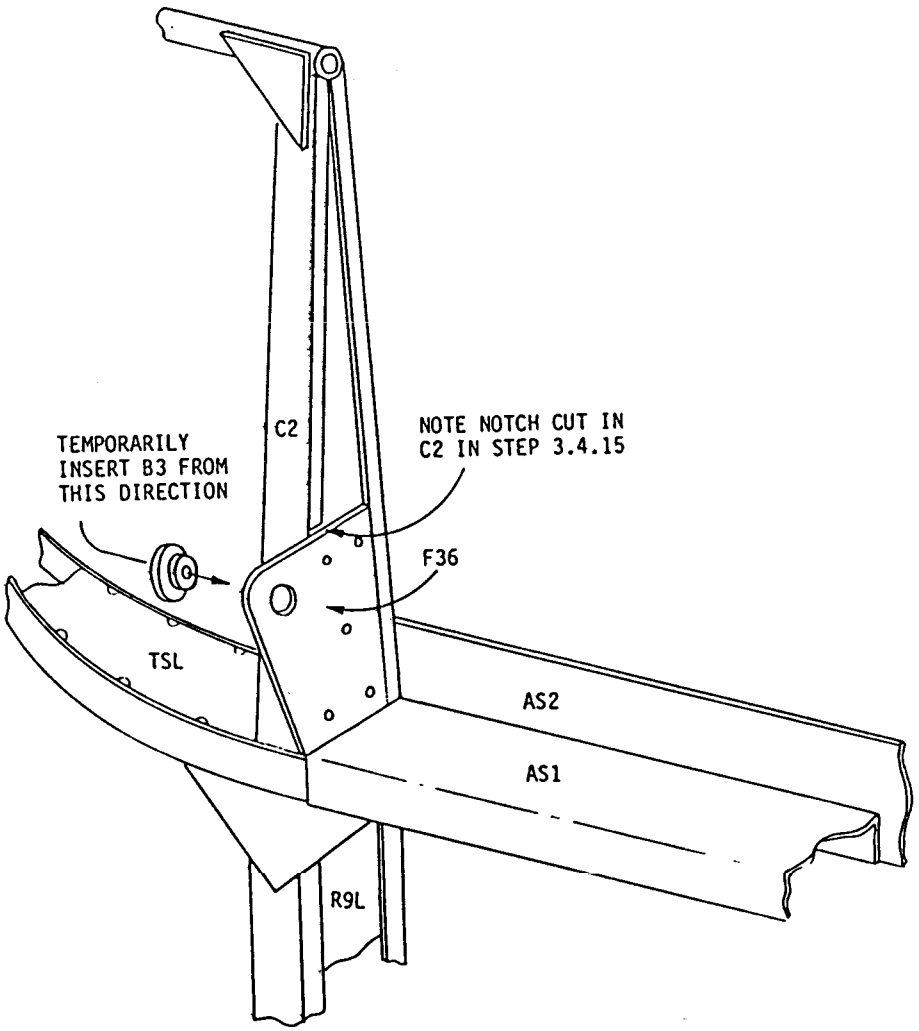
3.8 AILERON ASSEMBLY AND INSTALLATION

3.8.1 Position the inboard aileron hinge F37L as shown. Make sure the leading edge of F37L is tight against the AS1. Temporarily install a bearing B3 in the hole in F37L as indicated (in service, B3 is inserted on the aileron side of F37L, but is used here as an aid in positioning F37L). Position F37L so that the edge of the flange on the B3 is approximately 1/32 of an inch below the bottom of G14.

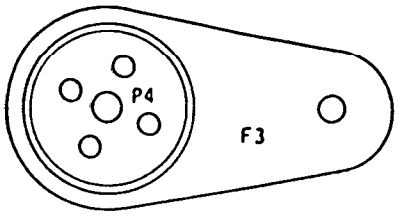


3.8.2 Position the outboard aileron hinge F36 as shown. Make sure the leading edge is tight against AS1. Temporarily install a B3 as in step 3.8.1 and position F36 for a 1/32 inch clearance between

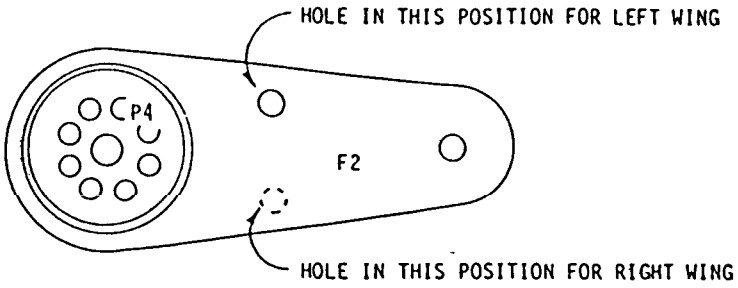
B3 and the C2 capstrip on R9L. Rivet F36 to R9 *with one rivet only.*



3.8.3 Temporarily bolt an aileron torque tube plug P4 to aileron hinge horn F3 with a 34 bolt and N3 nut as shown. Rivet P4 to F3 with 4 rivets, with the rivet head on the F3 side of the assembly. Remove the 34 bolt.

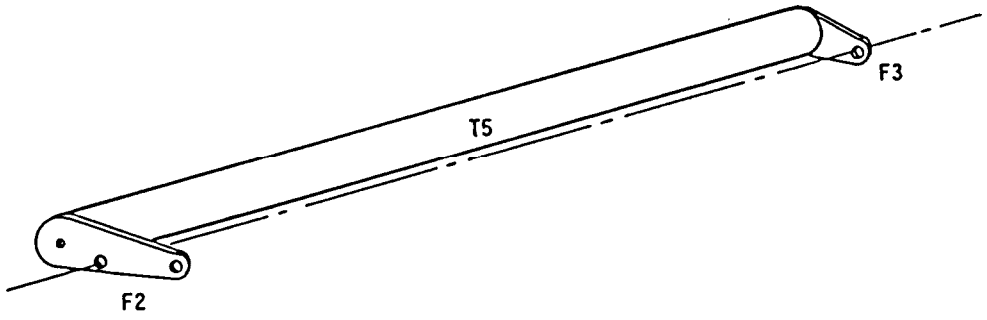


3.8.4 Similarly rivet a P4 to an F2 with *eight* rivets. Note the orientation of the hole in F2.



3.8.5 DELETED

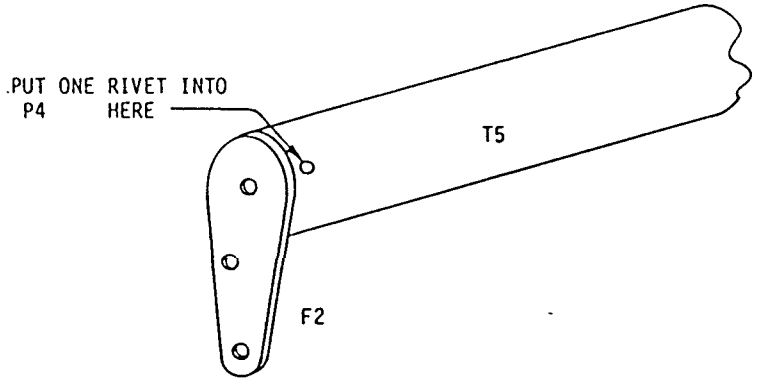
3.8.6 Insert the P4's attached to F2 and F3 into the ends of aileron torque tube T5, but do not rivet at this time. Orient F2 and F3 so that the two hinge holes are in line as shown.



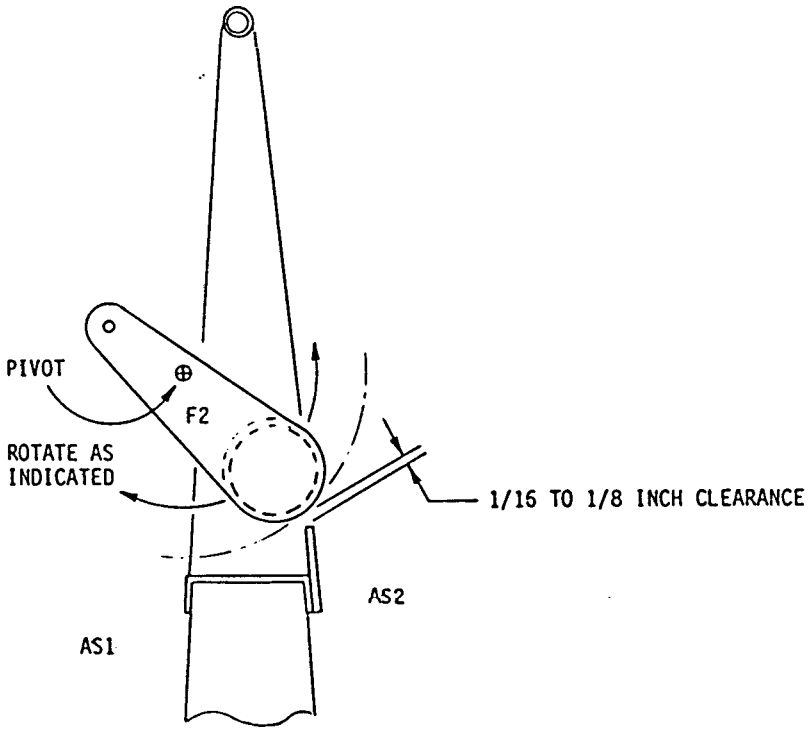
3.8.7 Insert B3 bearings into F36 and F37 *from the aileron side.* Position the aileron torque tube assembly (T5, F2 and F3) between F36 and F37 and temporarily insert two 35 bolts as hinge pins. Note that the F2 end of T5 goes inboard (next to F37). Note also that the hole in F2 nearest T5 is the one used for the hinge pin.

3.8.8 Trim the length of T5 as necessary so that the T5 assembly fits properly between F36 and F37 with at least 1/16 of an inch of clearance at both ends. When the end clearance is correct, rivet

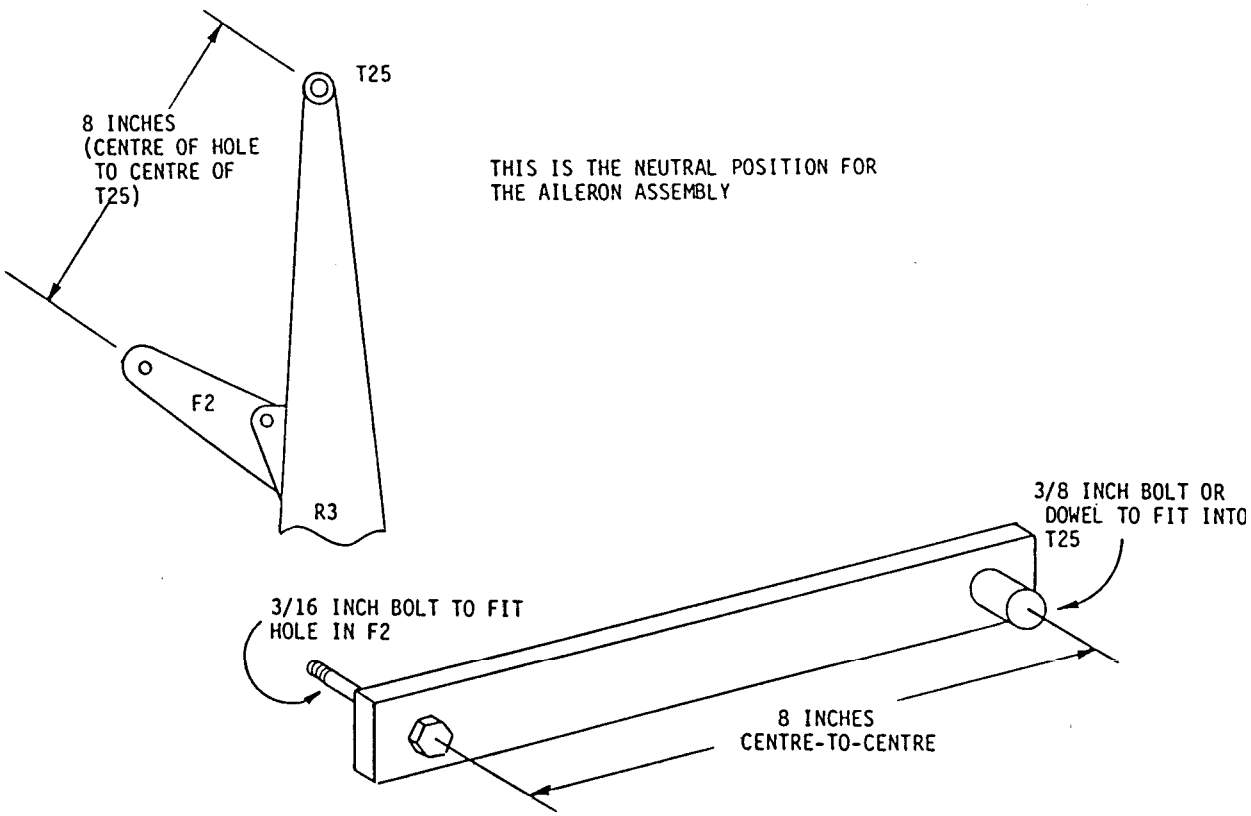
F2 in place *with one rivet only as shown.* Do not rivet F3 at this time.



3.8.9 Swing the T5 assembly on its hinges and make sure that T5 does not touch AS1, and the minimum clearance between T5 and AS2 is 1/16 to 1/8 of an inch. Move F36 or F37 slightly if necessary to obtain proper clearance. When clearance is correct, remove the T5 assembly and rivet F36 and F37 in place with four more rivets in each as shown in the figures for steps 3.8.1 and 3.8.2.

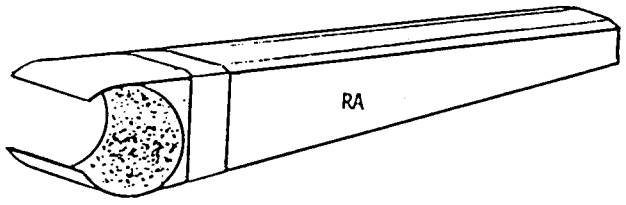


3.8.10 Re-install the T5 assembly and put in the hinge pins. Clamp the position of F2 as shown. A piece of wood and two C-clamps may be used, but it is recommended that a tool be made of wood, plastic or metal as shown in the diagram. Wrap tape around the 3/8 inch dowel pin to make it a tight fit in T25.

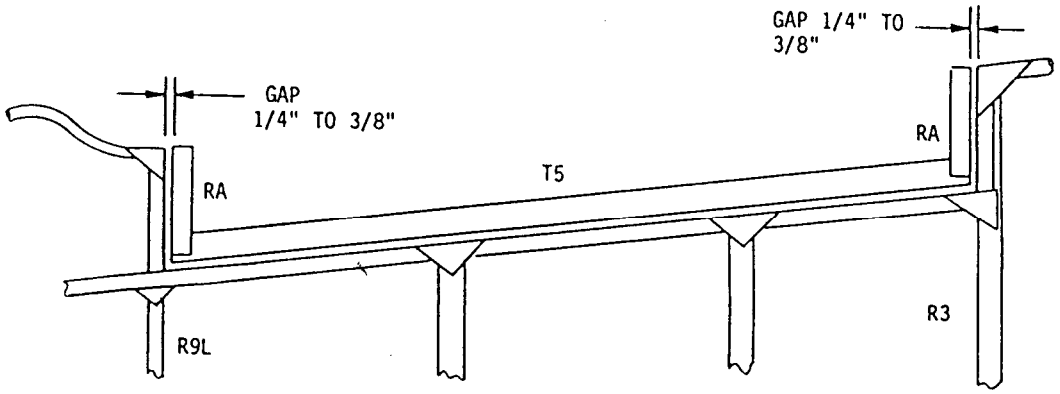


3.8.11 Sight T5 from behind the trailing edge and make sure that it is parallel to AS1/AS2. Rotate the F3 on the end of T5 if necessary. When T5 and AS1/AS2 are parallel, fix F3 in position with one rivet through T5 and the P4 tab (as was done for F2 in step 3.8.8).

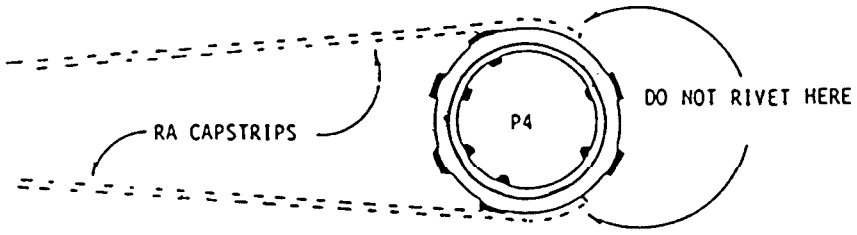
3.8.12 Flatten the capstrips on the aileron ribs RA and bend them to fit around T5. Round the corners of the capstrips with a file.



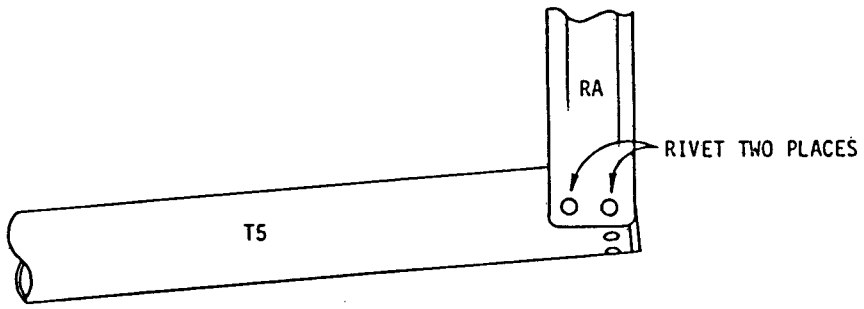
3.8.13 With the T5 assembly clamped in the neutral position, fit the two end ribs on the aileron as shown. Trace around the RA on T5 to mark the location of the capstrips.



3.8.14 Remove RA's. Remove the T5 assembly. Rivet both P4's to T5 with a 3/8" rivet spacing except where the rivet head would interfere with the RA capstrips.



3.8.15 Re-install the T5 assembly. Clamp it in the neutral position and put the end aileron ribs into position again as in the figure for step 3.8.13. Make sure that the RA's are parallel to R9L and R3 with the gap as shown in the figure. Rivet the RA's to T5 with two rivets through each capstrip. Some of these rivets should also go through the P4's.

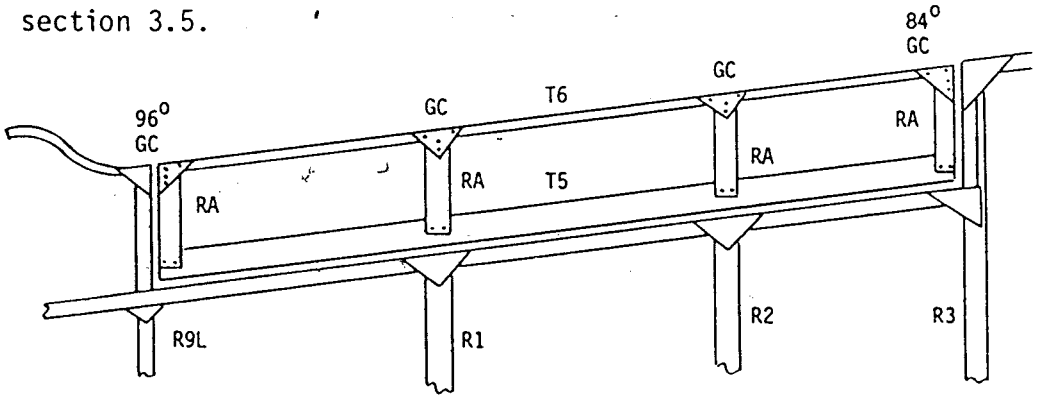


Rivet F36

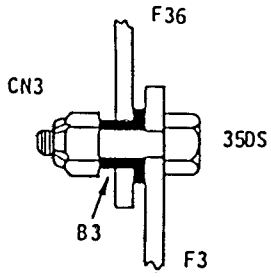
3.8.16 Run a string or a straightedge between the end RA's and fit the two intermediate RA's in place (similar to the installation of ribs R4 to R7 in section 3.4). Sight along ribs R1 and R2 to make sure the aileron ribs are directly in line with them. Rivet the RA's in place with 2 rivets in each capstrip.

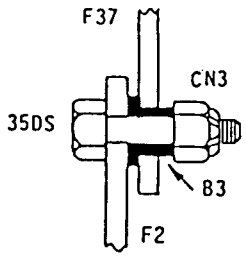
3.8.17 Fit the aileron trailing edge T6 in place. Trim the RA's as necessary so that T6 is in line with T24 and T25, and T6 is straight.

3.8.18 Attach T6 using GC gussets similar to the attachment of T25 in section 3.5.



3.8.19 Make sure the aileron hinges are assembled as shown. Tighten the nuts sufficiently to clamp the B3's to the F2 or F3. Check that rotation takes place between the F36 (or F37) and the B3. If not, ream the hole in F36 (or F37) slightly.
Use a CP23 Cotter pin to fix the CN3 nut in place. Bend the ends in opposite directions around the nut.





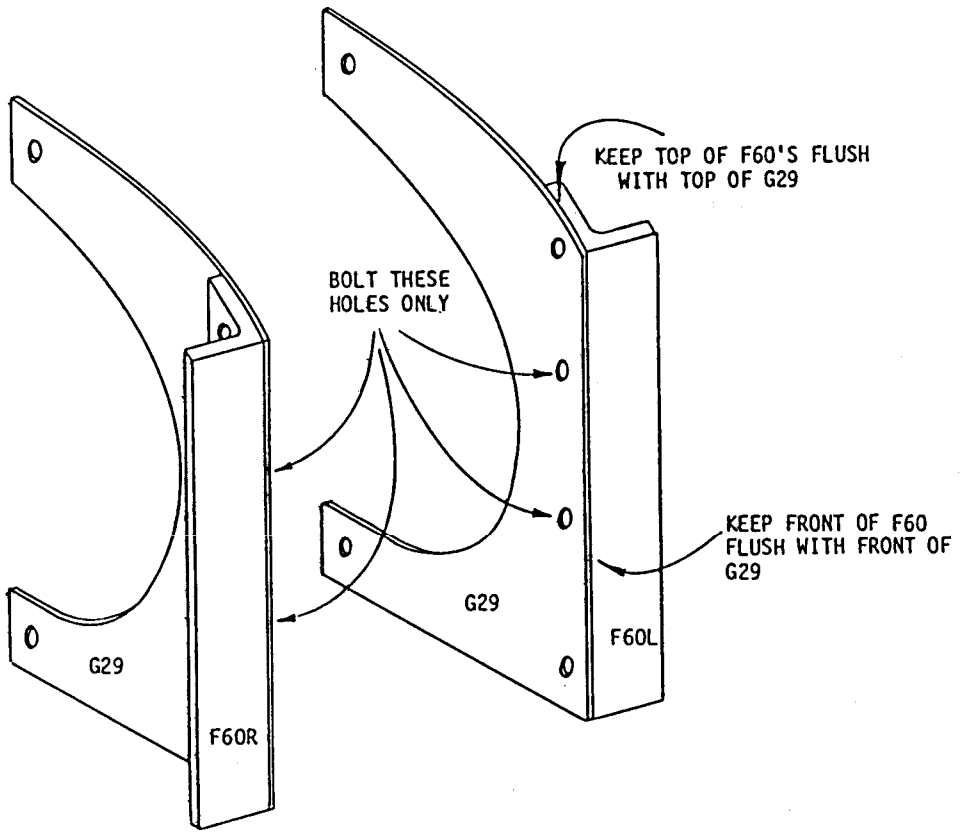
SECTION 4

NACELLE ASSEMBLY

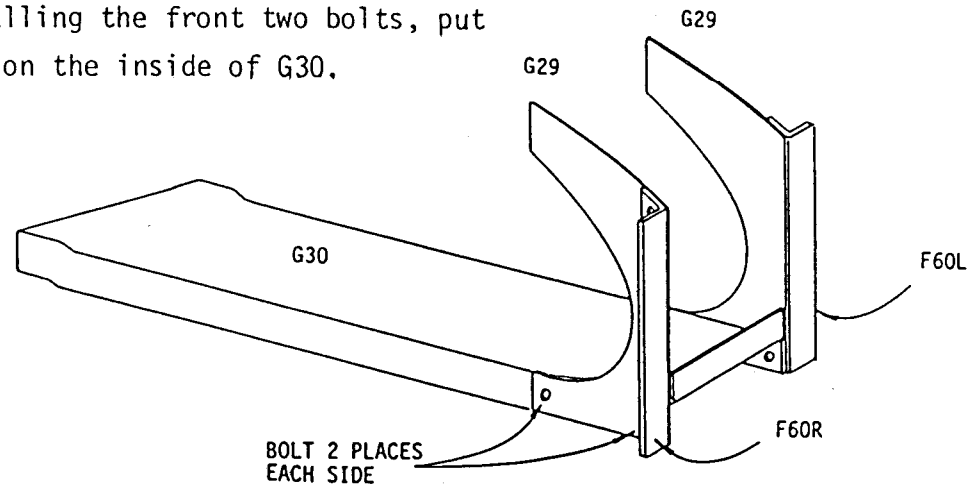
4.1 BASIC ASSEMBLY

NOTE: Two nacelles are required (one for each engine). The two nacelles are identical except for the location of the F51 clip (step 4.3.3). The nacelle front angles (F60L and F60R) are designated left and right with respect to their position on each nacelle (i.e. each nacelle uses one F60L and one F60R).

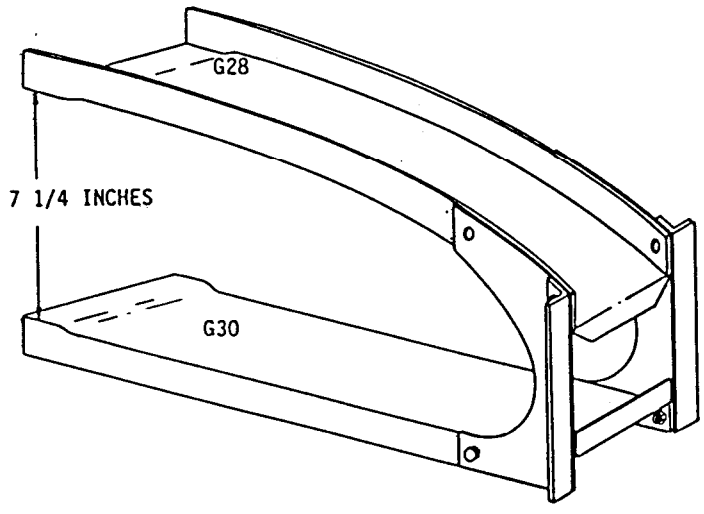
4.1.1 Clamp left and right nacelle front angles (F60L and F60R) to side gussets G29 as shown. Using the G29's as a template, drill the four mounting holes in each of the F60's. Bolt the F60's to the G29's with two 34 bolts in the middle two holes only. Make one left assembly and one right assembly for each nacelle as shown. Insert the bolts so that the head is on the F60 side of the assembly.



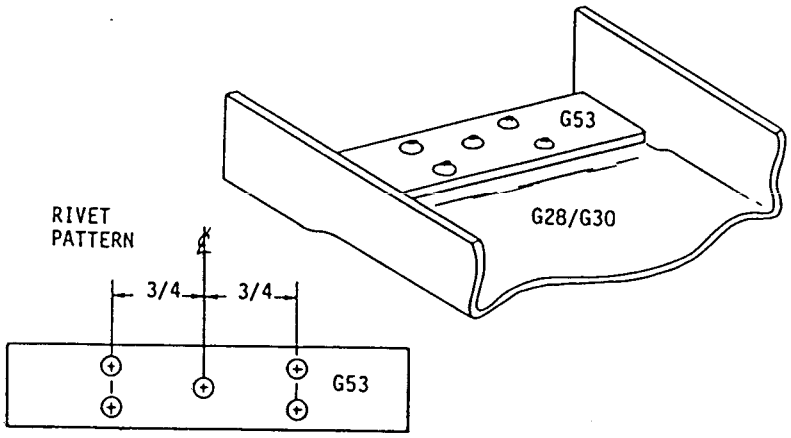
4.1.2 Clamp the nacelle gusset assemblies to the nacelle bottom (G30) as shown below. Make sure the bottom edges of the G29's are flush with the bottom edges of the G30. Make sure the front surface of the bent-up tab on G30 is flush with the front surface of the G29's and F60's. Using the G29's as templates, drill and bolt all four mounting holes. Use two 35 bolts with W3H washers in the front holes and two 34 bolts with W3H washers in the rear holes. When installing the front two bolts, put the heads on the inside of G30.



4.1.3 Clamp the nacelle top (G28) in place as shown below. Some force may be necessary to align both sides correctly. Make sure that the front surface of the bent-down tab on G28 is flush with the front edge of the G29's and F60's. Make sure that the top edge of the G28 is flush with the top edges of the G29's. Drill and bolt *the front holes only.* Adjust the spacing between the two rear mounting surfaces to 7 1/4 inches as shown and tighten the bolts.



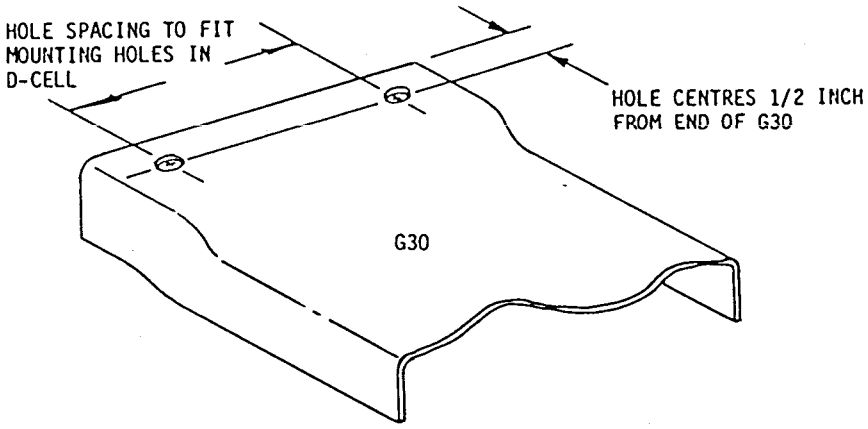
4.1.4 Fit the Nacelle Doublers G53 into G28 and G30 and rivet in place as shown. Make the edge of G53 flush with the trailing edge of G28/G30.



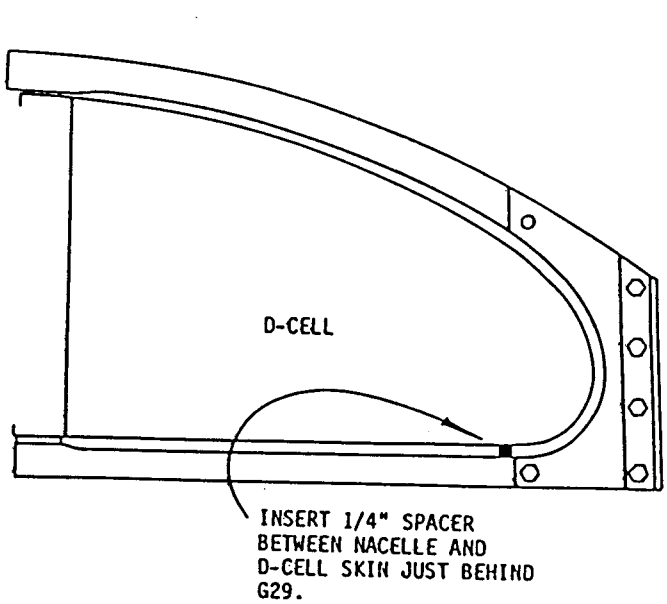
4.2 NACELLE - TO - WING FITTING

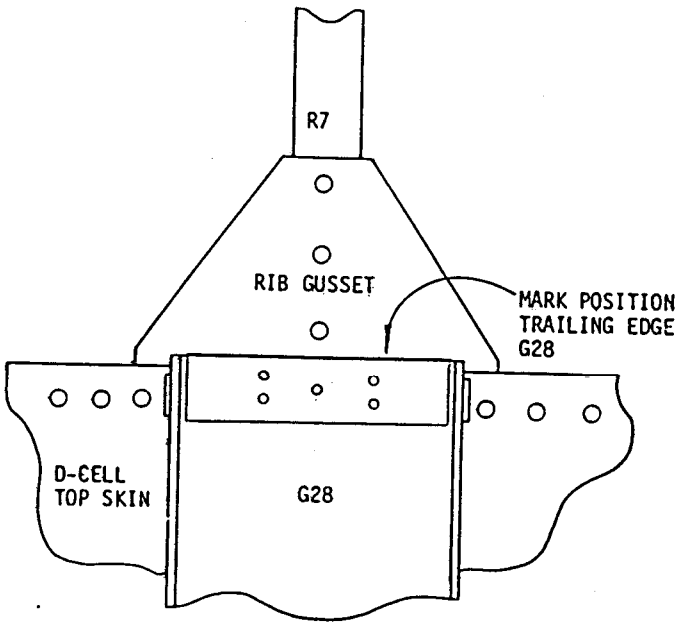
NOTE: *The hole spacing on the nacelle-to-wing mounting holes is nominally 3 inches. However, manufacturing tolerances can cause this measurement to vary as much as ± 1/32". Therefore, to ensure that the nacelle mounting bolts can be inserted and removed easily without resorting to oversize holes, it is recommended that each nacelle be custom fitted to the particular wing on which it will be used. After fitting, nacelles should be identified as left or right.*

4.2.1 Measure the hole spacing on the bottom nacelle mounting holes on the D-cell. Mark and drill corresponding holes 3/16" diameter in the nacelle bottom (G30) as shown.



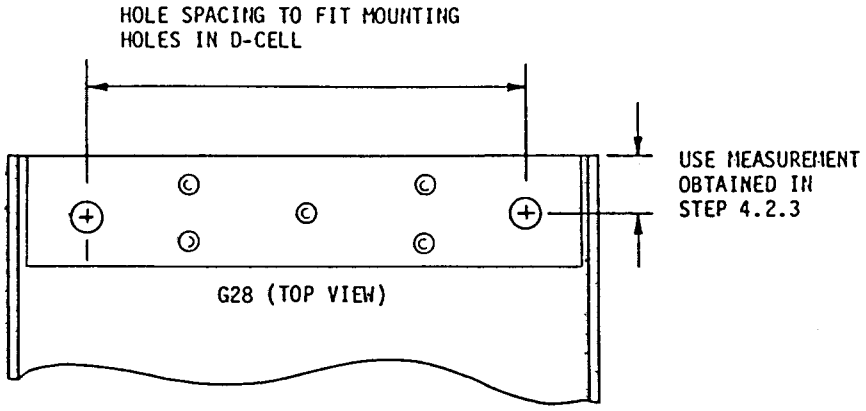
4.2.2 Bolt the nacelle onto the D-cell with two 35 bolts. Temporarily insert a 1/4 inch spacer (tube, dowel or a strip cut from 1/4 inch plywood) between the nacelle and the bottom of the D-cell at the location shown. Push the nacelle firmly against the spacer and mark the location of the trailing edge of the nacelle top on the gusset used to mount the R7 rib.



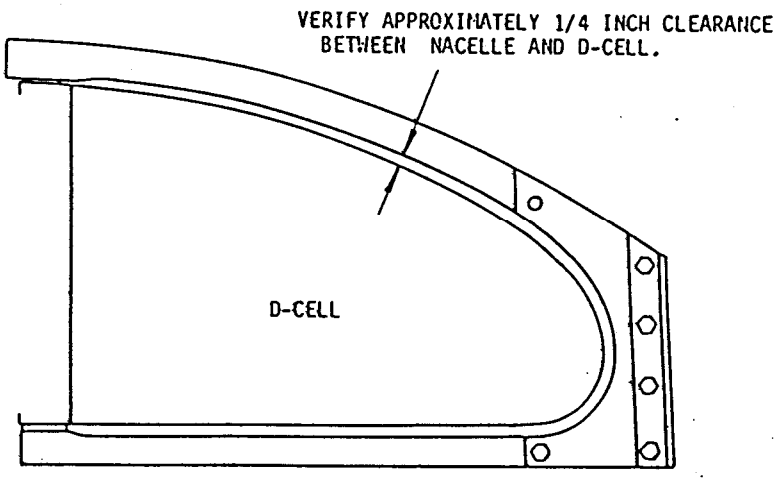


4.2.3 Measure the distance from the line drawn in step 4.2.2 to the centres of the nacelle mounting holes in the top of the D-cell. Note that this measurement might not be the same for both mounting holes. Transfer these measurements to G28.

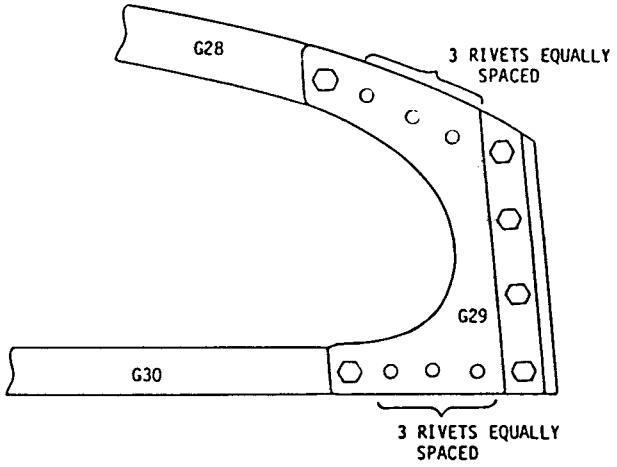
4.2.4 Measure the distance between mounting hole centres on the D-cell. Locate and drill corresponding mounting holes (3/16" diameter) in the G28.



4.2.5. Bolt the nacelle in place (use two 35 bolts with W3H washers in the top) and verify that there is approximately 1/4 inch clearance between the nacelle and the D-cell. Drill and bolt the top corners of the G29's to the G28, using two 34 bolts with W3H washers.

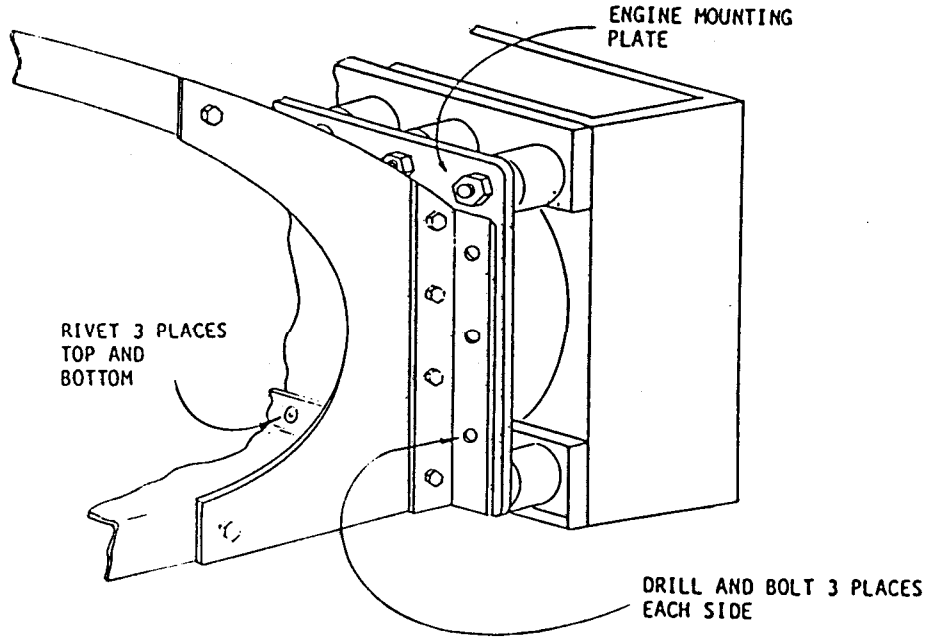


4.2.6 Remove the nacelle from the D-cell. Drill holes and install six rivets on each side of the nacelle as shown.

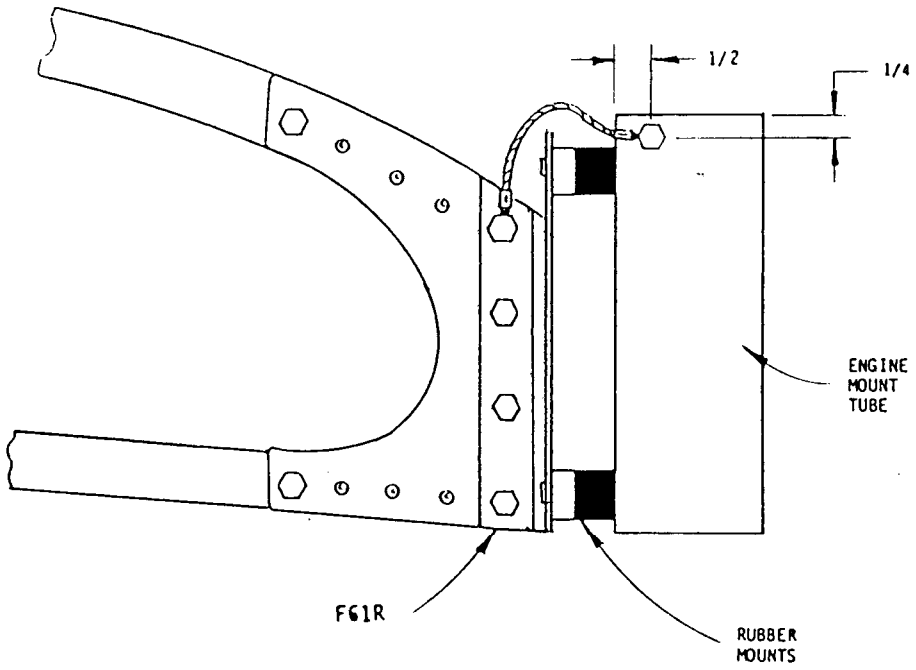


4.3 ENGINE MOUNTING

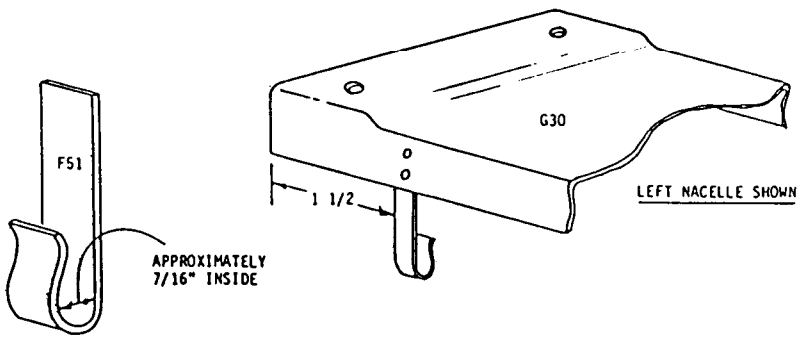
4.3.1 Clamp the nacelle to the engine mounting plate as shown. Centre the nacelle laterally on the mounting plate and make the bottom of the F60's flush with the bottom of the mounting plate as indicated in the figure. Using the F60's as a template, mark and drill the engine mounting plate. Bolt the mounting plate to the nacelle using six 35 bolts with W3H washers under the nuts. Drill and rivet the tabs on G28 and G30 to the mounting plate using three stainless steel rivets in each.



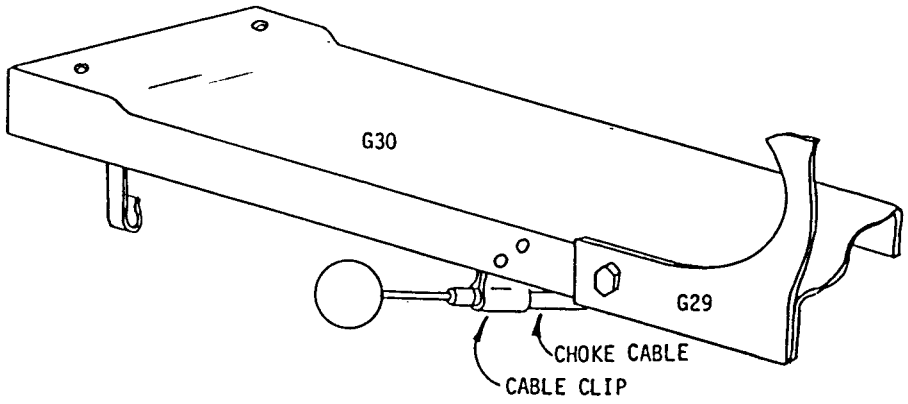
4.3.2 Drill two 3/16 inch holes in each engine mount tube as shown and bolt the ground cables (cable G) in place. *Note that there are two cables per engine.* Use four 34 bolts with W3T washers under the heads. Make sure the cables have enough slack to allow the engine to move on its rubber mounts, and make sure the cables do not rub on the top of the engine mounting plate.



4.3.3 Bend the fuel line clips (F51) as shown. Rivet an F51 to the *inside* flange on each nacelle bottom (G30) using two rivets as shown. Note that the inside flange is on the right side of the left nacelle and on the left side of the right nacelle.

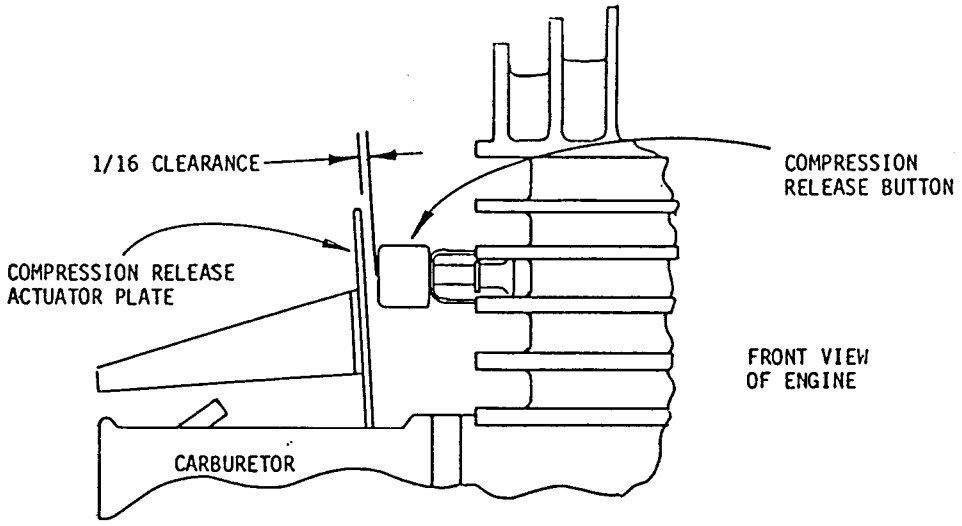


4.3.4 Route the choke cable under the nacelle and rivet the choke cable clip to the G30 flange ahead of the F51, just behind the G29 as shown. Twist the clip slightly to aim the choke cable toward the cockpit without causing a sharp bend in the cable:



NOTE: *The Rotax engines included with your Lazair kit have been fitted with a semi-automatic compression release to facilitate engine starting. The compression release is activated (pushed in) any time the choke is closed and is released (pushed out) automatically as soon as the engine fires. To check the operation of the compression release actuator, it will be necessary to pull the compression release out manually.*

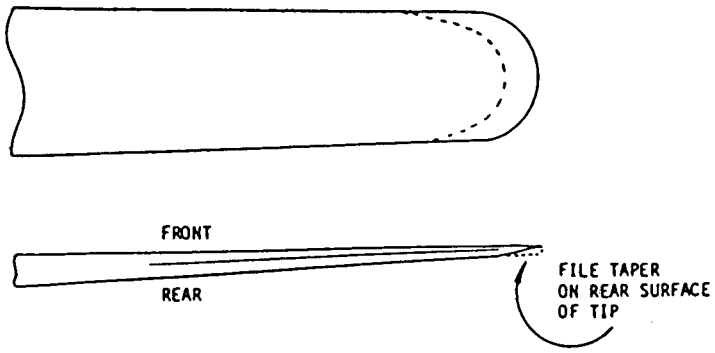
4.3.5 Operate the choke cable and verify that it moves the choke butterfly from full open to fully closed. Check that when the choke is closed, the compression release is pushed in. When the choke is open *and the compression release is pulled out* there should be approximately 1/16 inch clearance between the compression release button and the actuator plate as shown below. Bend the plate slightly if required to achieve the correct clearance.



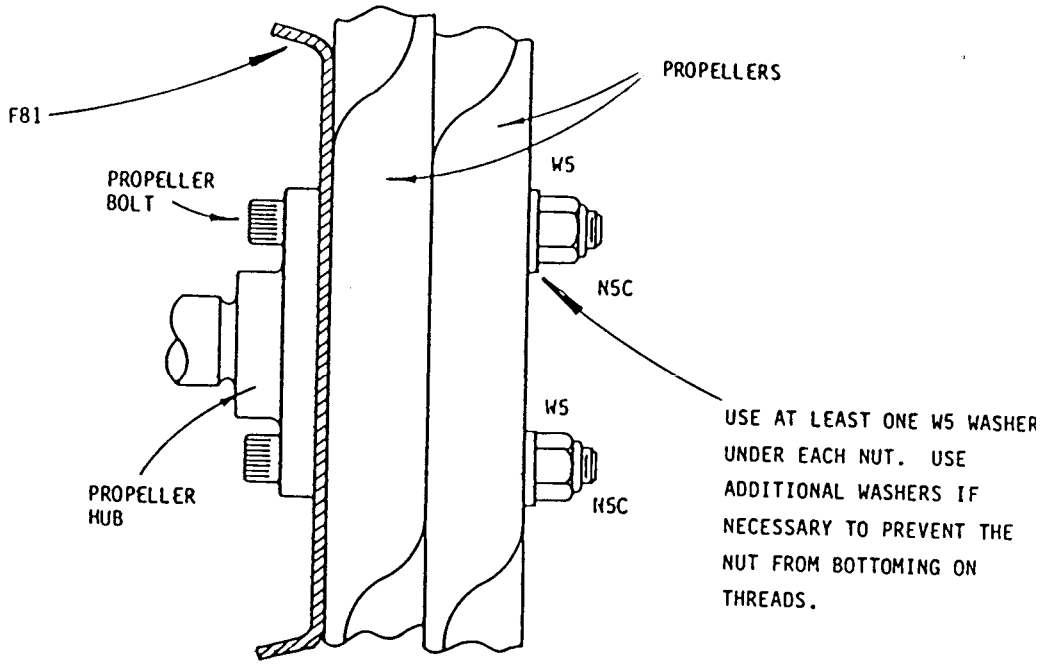
4.4 PROPELLER MOUNTING

NOTE: To achieve the required thrust with a very small propeller diameter, two propellers are used on each engine. Although the original intention was to mount the two propellers at 90 degrees (in a four bladed configuration), tests have shown that the same thrust can be obtained with one propeller mounted directly on top of the other. This configuration may look unorthodox, but it facilitates propeller mounting and reduces aerodynamic drag when gliding. In June 1983 a ground adjustable propeller was introduced. Although it provided some increase in performance, structural problems have resulted in its withdrawal and a return to the bi-blade.

4.4.1 Remove the mold flash from all four propellers with a file or sandpaper. For optimum propeller performance, file or sand the tips and trailing edges to a sharp edge as shown, then sand the propellers to a smooth finish using 400 or 600 wet-or-dry sandpaper.



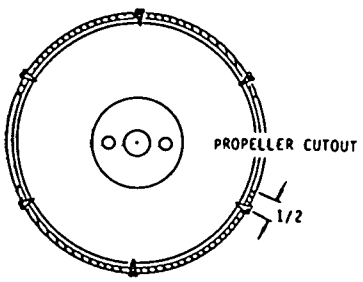
4.4.2 Bolt two propellers onto each propeller hub as shown. Tighten the two propeller nuts with a torque of approximately 16 foot pounds. Note that the F81 spinner mounting flange is part of the spinner kit.

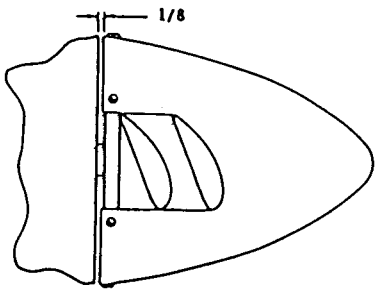


4.4.3 If the spinners are to be painted, they should first be fitted as described below, then lightly sanded with No. 400 sandpaper before painting.

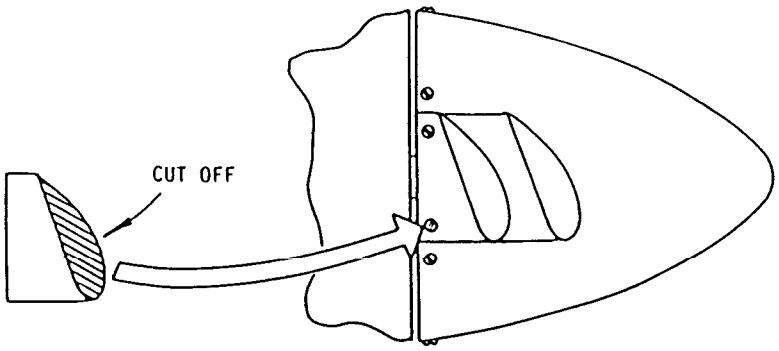
4.4.4 Position the spinner over the propeller and mounting flange. Cut a slot in a sheet of 1/8 inch thick metal, plastic, cardboard or other material and insert it between the spinner and the engine crankcase to act as a spacer.
Hold the spinner tightly against the spacer to ensure that the space is the same all the way around the spinner.

4.4.5 Drill holes and secure the spinner to the flange using six sheet metal screws located as shown. Drill holes through both the spinner and the flange with a No. 40 (or 3/32") drill first, then enlarge the holes *in the spinner only* using a No. 28 (or 9/64") drill.





4.4.6 Cut the two small fillers to fit between the propeller and the crankcase as shown above and secure each filler to the mounting flange with two screws.

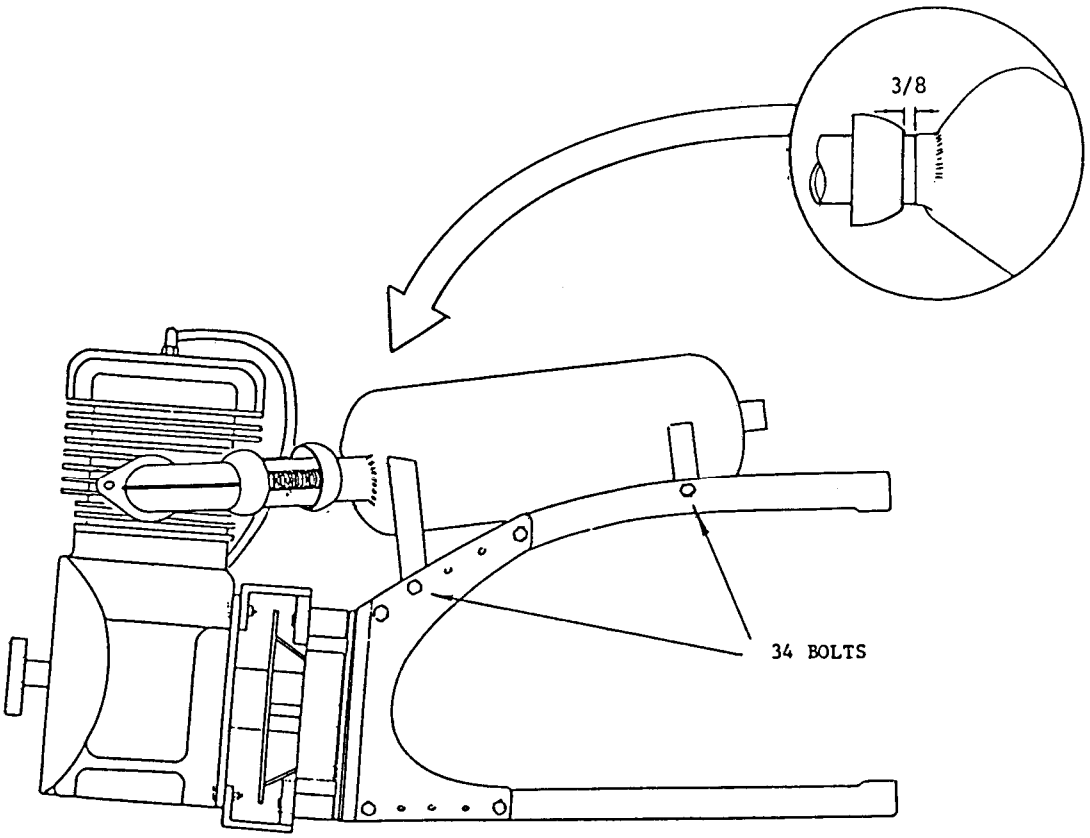


4.4.7 After the spinners have been installed and you are satisfied that they fit properly, the mounting screws should be removed one at a time and reinstalled with Loctite or similar thread locking compound.

4.5 MUFFLER INSTALLATION

4.5.1 Fit the exhaust pipe onto the engine. Make sure the exhaust gasket is properly seated and tighten the nuts on the flange.

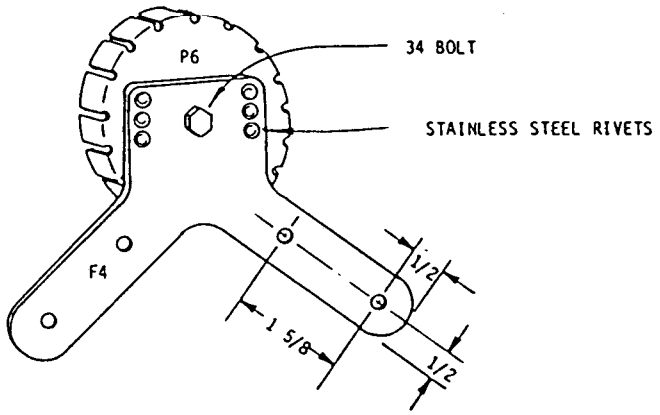
4.5.2 Fit the end of the exhaust pipe into the muffler and position the muffler on the nacelle as shown. Adjust the position of the muffler to allow a gap of about 3/8 of an inch between the muffler inlet and the first rib on the exhaust pipe as shown in the inset.



4.5.3 Drill and bolt the muffler mounting legs to the nacelle using four 34 bolts and N3 nuts. Use W3H washers under the nuts for the rear legs only.

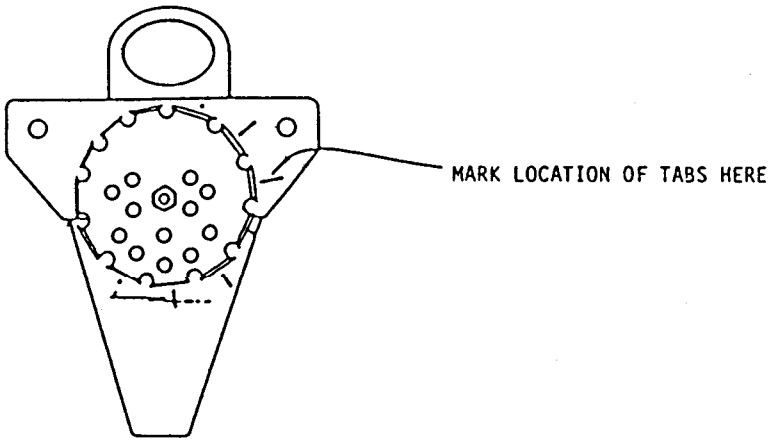
5.1 BOOM ASSEMBLY

5.1.1 File and/or sand the edges of the stabilizer Y bracket F4 to remove all tooling marks. Drill four 3/16 inch holes as shown below. Bolt the F4 to rear fuselage plug P6 as shown using a 34 bolt, N3 nut and W3T washer. Install 6 stainless steel rivets as shown.

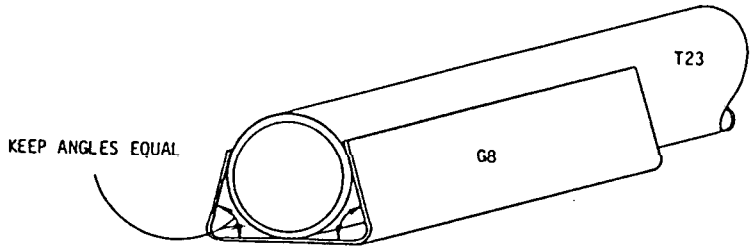


5.1.2 Set the P6 assembly aside for now.

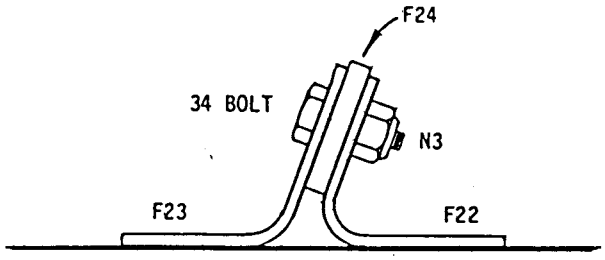
5.1.3 Mark the location of the tabs on the outside of the front assembly and insert the front assembly into the end of the boom. Rivet the front assembly into the boom with one stainless steel rivet into each tab.

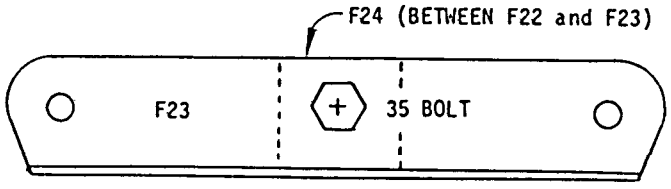


5.1.4 Bend the sides of fuselage doubler G8 so that it will fit tightly over the boom. Make sure the two angles are equal (bend G8 while it is removed from T23 to allow for springback).

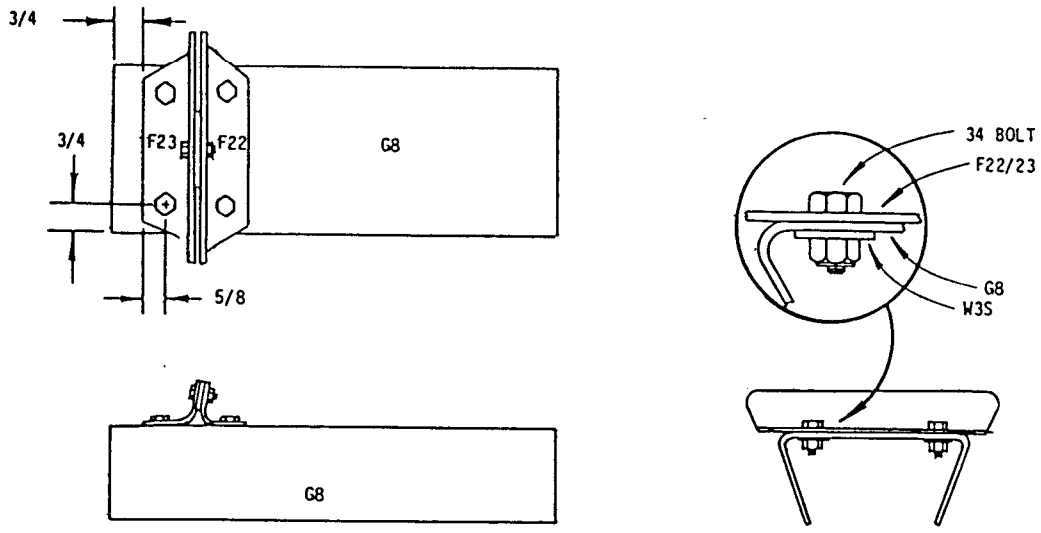


5.1.5 With Rear Spar Brackets F22 and F23 positioned *on a flat surface*, clamp them together using F24 as a spacer as shown. Make sure that F24 is centred laterally. Drill F24 and F22 using the centre hole in F23 as a guide, and bolt together as shown.

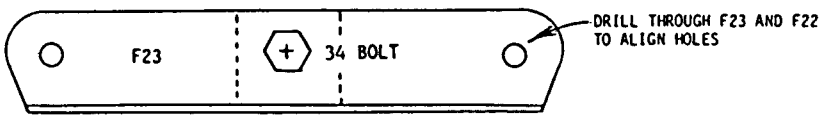




5.1.6 Drill 3/16 inch holes and bolt the F22 and F23 to G8 as shown. Use 34 bolts with W3S washers under the nuts (inside the G8). Make sure that the F22 and F23 are centered laterally on G8 and perpendicular to it.

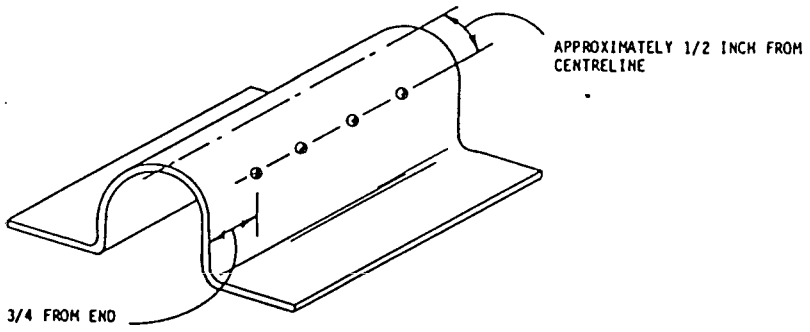


5.1.7 Using a 3/16 inch drill, drill the outboard holes through F23 and F22 to ensure proper alignment.

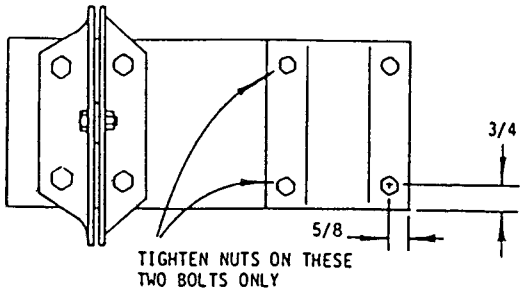


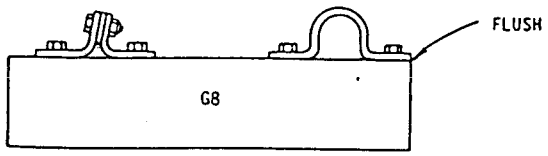
5.1.8 *Carefully* ream the holes in F22 and F23 to 1/4 inch diameter. Make sure the holes are perpendicular to F22. Remove all burrs and sharp edges from the holes.

5.1.9 Drill 8 holes 1/8 inch in diameter in downtube clamp F53 as shown (4 holes on each side). Use 3/4 inch spacing.

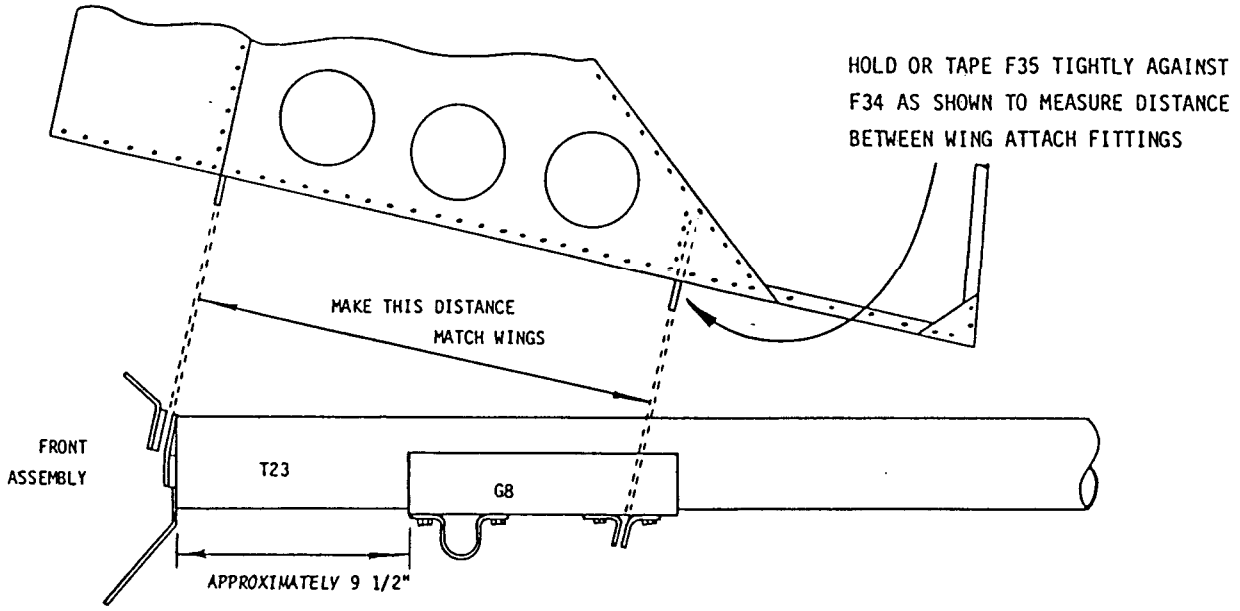


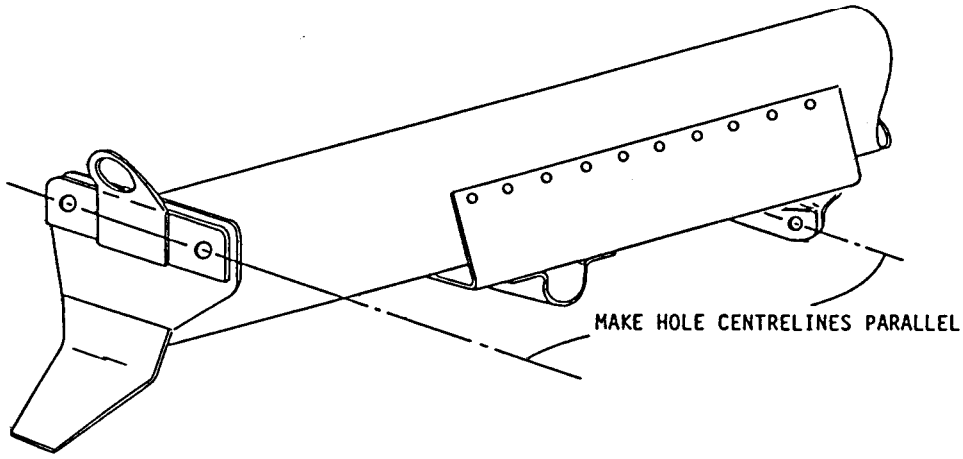
5.1.10 Install F53 on G8 as shown. Use four 34 bolts with W3H washers under the nuts. Leave the nuts on the bolts nearest the end of G8 finger tight only.





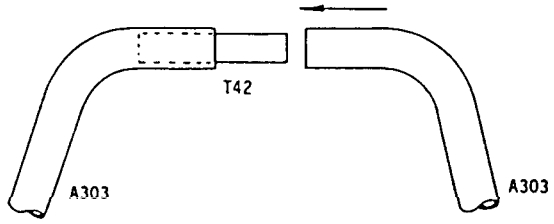
5.1.11 Position G8 on the boom as shown on next page. *Make sure the distance between wing fittings matches the wings.* This measurement is critical if wings are to fit on and off easily. Make sure the holes in F22 and F23 are parallel to the holes in the front fitting. Rivet G8 to the boom with one rivet through the bottom of G8. *Recheck the wing fitting distance* and move G8 if necessary. When the distance is correct, rivet G8 to the boom with a 1/2 inch rivet spacing in the bottom of G8. Rivet G8 to the boom with a rivet spacing of 1/2 inch, 3/8 inch from the top edge of G8 on both sides.


HOLD OR TAPE F35 TIGHTLY AGAINST
F34 AS SHOWN TO MEASURE DISTANCE
BETWEEN WING ATTACH FITTINGS
MAKE THIS DISTANCE
MATCH WINGS
FRONT
ASSEMBLY
T23
G8
APPROXIMATELY 9 1/2"

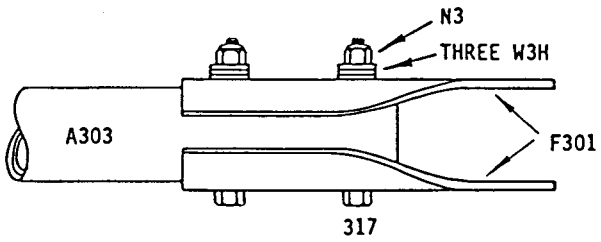

MAKE HOLE CENTRELINES PARALLEL

5.2 A-FRAME ASSEMBLY

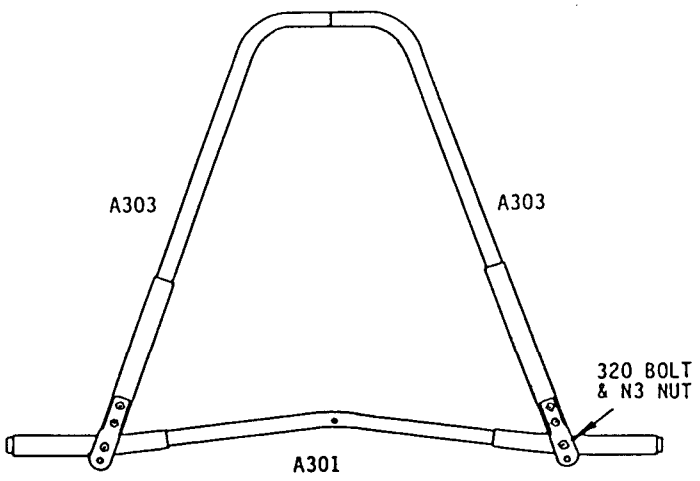
5.2.1 Join the two A303 Downtubes with a T42 splice as shown. Do not rivet at this time.



5.2.2 Bolt the four F301 axle attach fittings to the two legs of the downtube assembly as shown. Note that fittings F300 and F301 appear very similar, but the F301's are shorter. Note also that the bolts will be a very tight fit in the holes and it will probably be necessary to run a 3/16 inch drill through the complete assembly before inserting the bolts. Do not tighten the nuts at this time. Note that three W3H washers are to be placed under the N3 nuts on the 317 bolts. This will allow for the later installation of the F338 brake cable bracket.

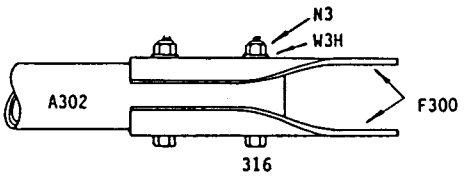


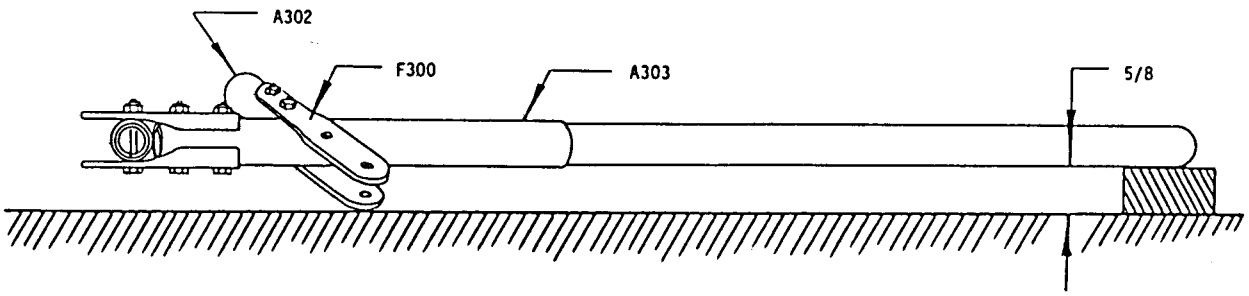
5.2.3 Bolt the A301 axle assembly in place as shown. Make sure that all the bolts in the A-Frame are with the heads on the same side. The side of the A-Frame with the bolt heads is the *forward* side. The 320 bolts will appear to be too long but the additional length is required to accommodate the T329 trailing arms which will be installed later. Do not tighten the nuts at this time.



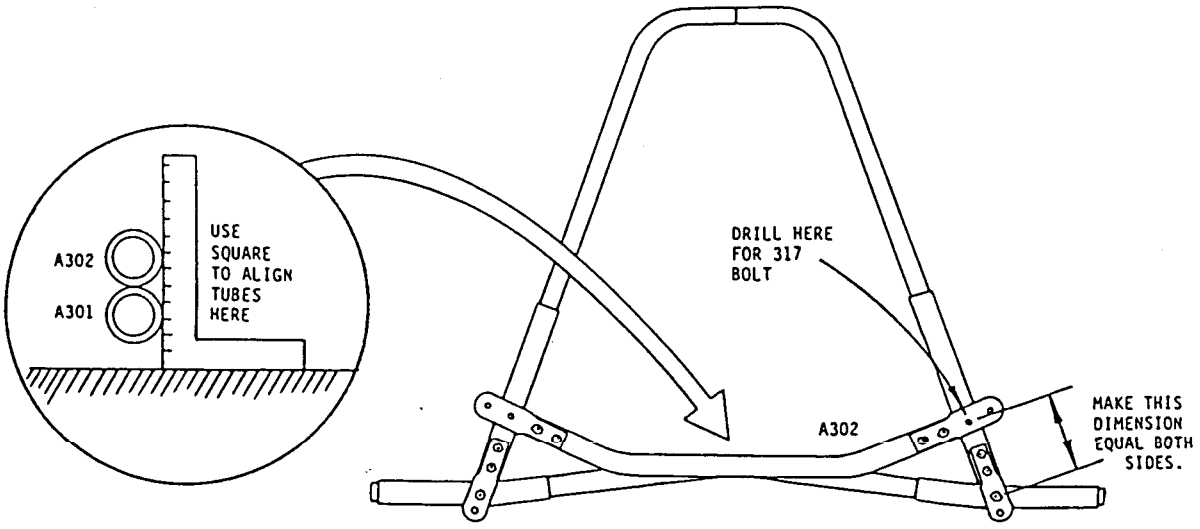
5.2.4 Position the assembled A-Frame on a flat working surface. Push the top part of the A-Frame down firmly onto the working surface to ensure that the A-Frame forms a flat plane, and tighten the nuts on the 317 bolts.

5.2.5 Insert a 5/8 inch shim under the top end of the A-Frame. Fit the A302 lower tube into position as shown below and in step 5.2.6, and bolt the four F300 strut attach fittings in place. Note that A302 can be installed two ways. If it is put in backwards (left and right reversed) it should be obvious because the F300's will not fit flat against the downtubes. Make sure the bolts are inserted with the heads on the forward side of the A-Frame.

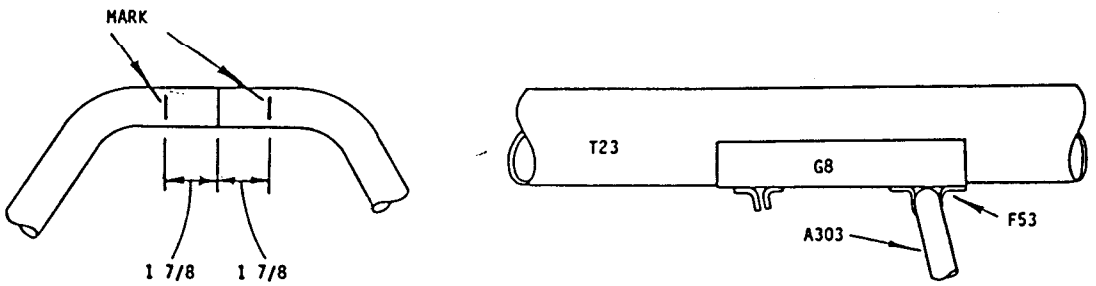




5.2.6 Position the A302 assembly as shown. Use a square to ensure that A302 is exactly above A301. Make sure that the ends of A302 are equidistant from the bottom of the A-Frame as indicated, and drill the two holes in the rear side of the downtubes for the 317 bolts. Put short bolts in these holes to pin the joint temporarily, then turn the A-Frame over and drill the two holes through the forward side of the downtubes. Remove the short bolts, run a drill completely through the holes and install *one* of the two 317 bolts (with a W3H washer under the nut).

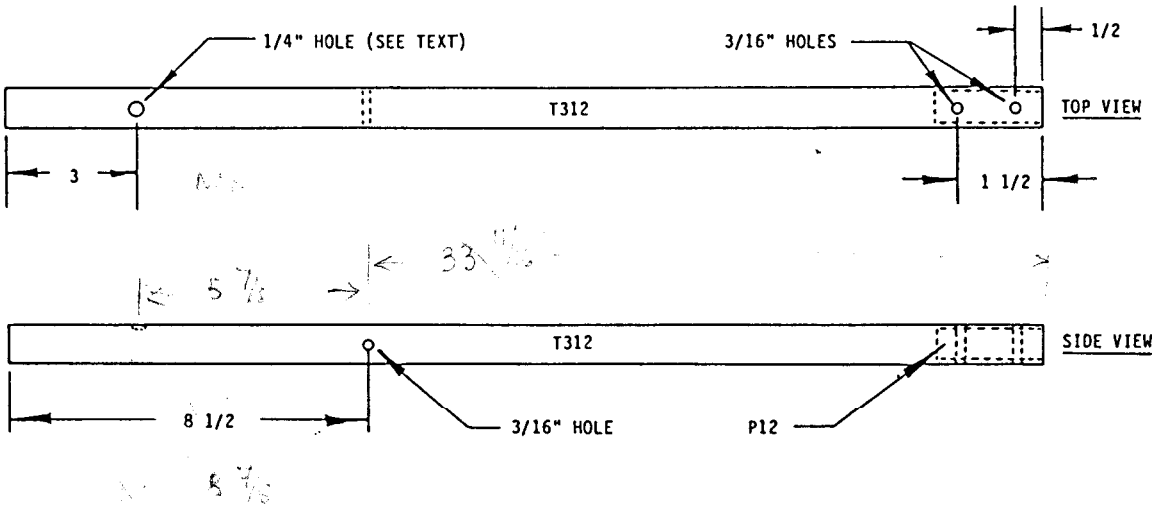


5.2.7 Mark both downtubes as shown. Remove one downtube, then reassemble the A-Frame with the junction of the downtubes inside the F53 downtube clamp. Tighten all the bolts on the A-Frame securely (with the exception of the 320 bolts as indicated in step 5.2.3) and tighten the forward bolts in F53.

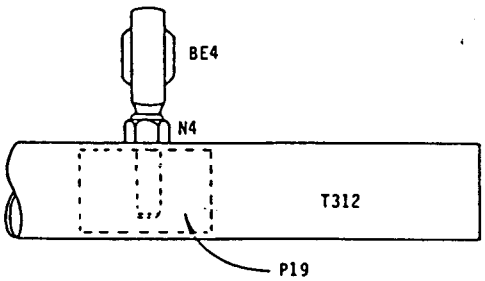


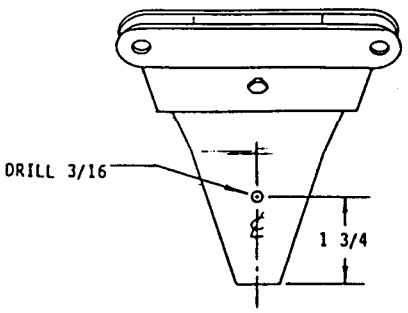
5.3 COCKPIT ASSEMBLY

5.3.1 Insert a P12 plug in one end of front tube T312 (flush with the end of the tube) and drill three 3/16 inch holes and one 1/4 inch hole as shown. Note that the 3/16 inch holes go completely through the tube while the 1/4 inch hole is drilled through *one side of the tube only*. Use a drillpress if possible and *make sure that the two 3/16 inch holes through the plug and the 1/4 inch hole are parallel and in line. Make sure that the remaining 3/16 inch hole is perpendicular to the other holes.*



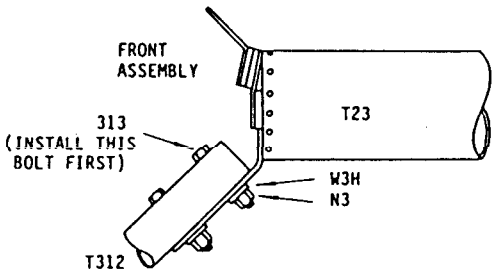
5.3.2 Put an N4 nut on a BE4 rodend as shown and screw the nut on as far as it will go. Insert a P19 plug into the open end of T312, align the threaded hole in the plug with the 1/4 inch hole in the tube, and screw the rodend into the plug. Do not tighten the nut at this time.

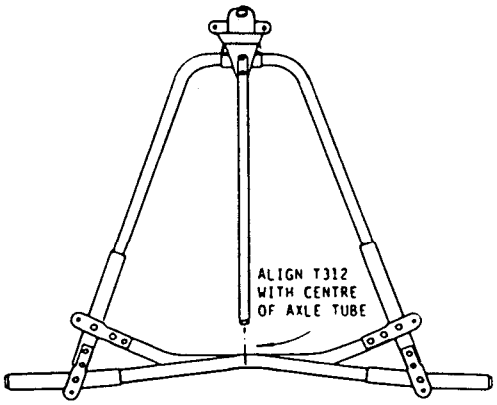




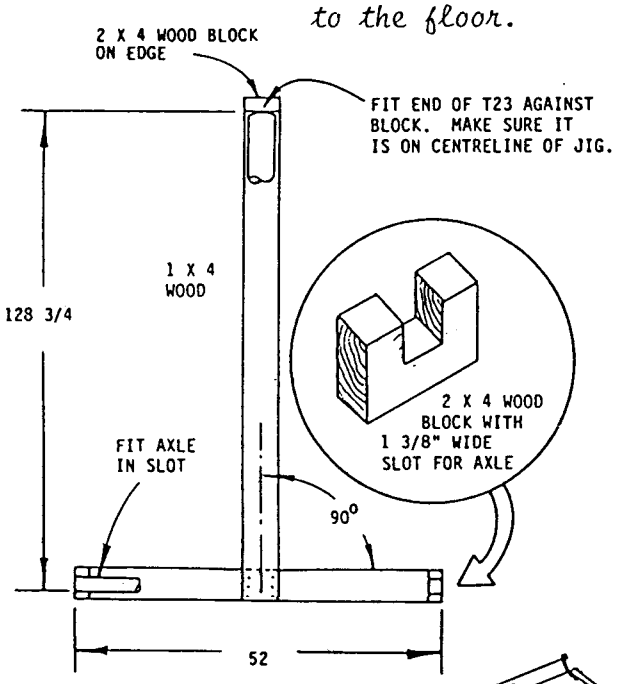
5.3.3 Drill a 3/16 inch hole in the front assembly as shown. Make sure the hole is on the centre line of the fitting.

5.3.4 Bolt T312 onto the front assembly with one bolt (note that the rodend on T312 should face forward). Align T312 as indicated, then drill the second hole in the front fitting and install the other 313 bolt, washer and nut.

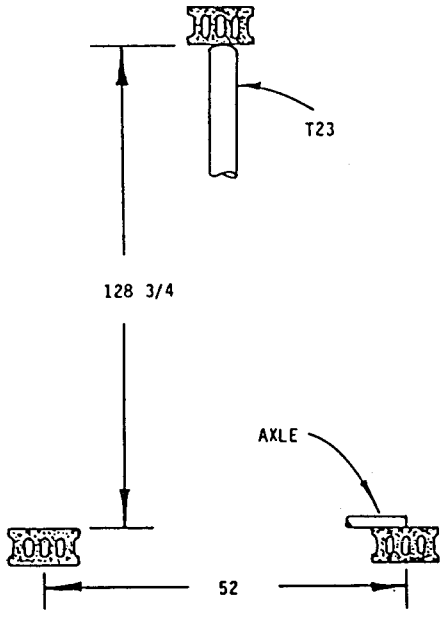




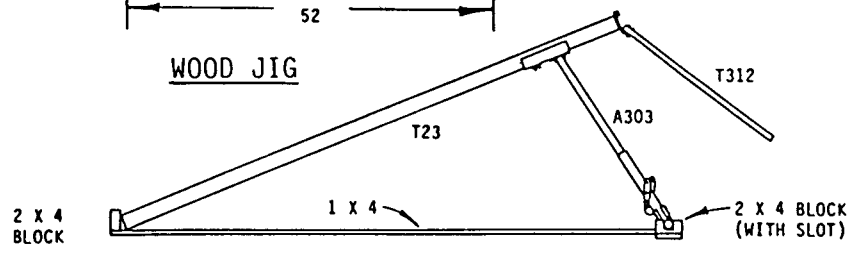
NOTE: To facilitate the next stages of assembly, it is recommended that some form of jig be constructed. The wooden jig shown on the left is more rigid but the concrete block jig on the right can work equally well if you are careful. Or, if you have a wooden floor in your shop you could nail wooden blocks directly to the floor.



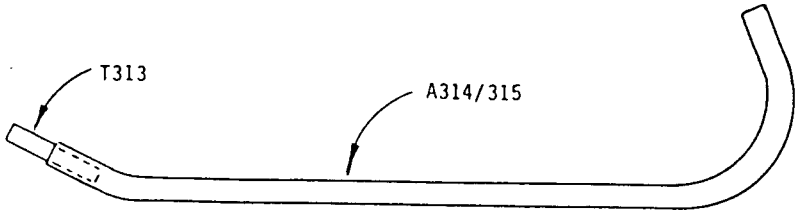
WOOD JIG



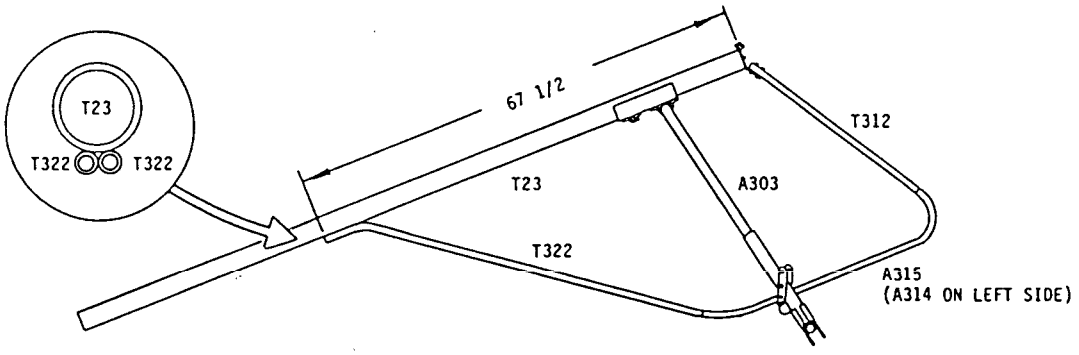
CONCRETE BLOCK JIG



5.3.5 Insert a T313 splice tube into the end of side tubes A314 and A315 as shown. Tap the T313's with a wooden block to seat them in the A314/315.

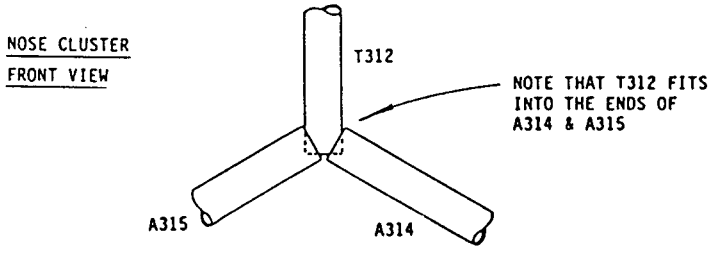


5.3.6 Slide a T322 rear fuselage brace over the T313's and position the tubes as shown. Tape the tails of the T322's temporarily but *tightly* to the bottom of T23 in the position indicated. Tape the junctions of A314/315 and T322 to hold the ends of the tubes tightly together.

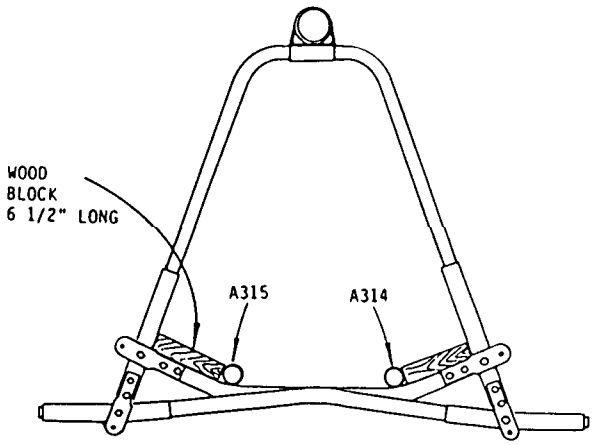


NOTE: To avoid having to disassemble the fuselage later, now is a good time to install the seatbelt. Slide the loops in the ends of the seatbelt halves over the front of A314 and A315 and slide them back almost to the junction of T322. Normally the half of the belt with the buckle and size adjustment is installed on the right side, but you may put it in the other way if you prefer.

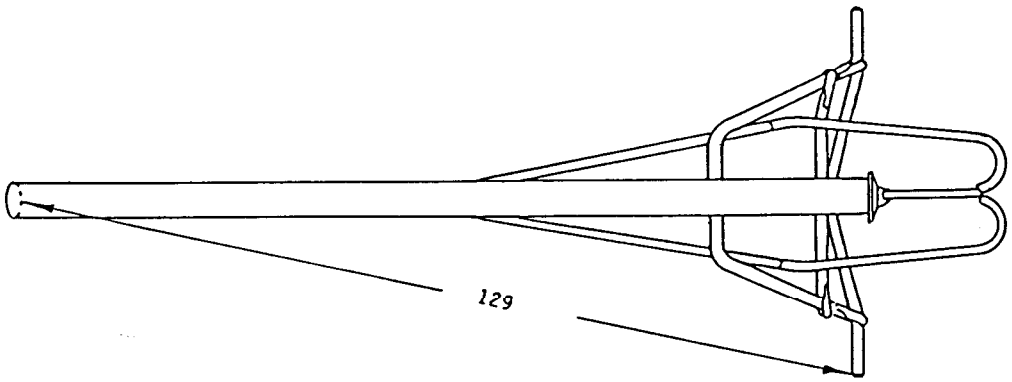
5.3.7 Temporarily tape the nose cluster together as shown.



5.3.8 Cut two wooden blocks (1 X 1 or 2 X 2) 6 1/2 inches long and tape them to the top of the lower tube A302 as shown to define the lateral position of A314 and A315.

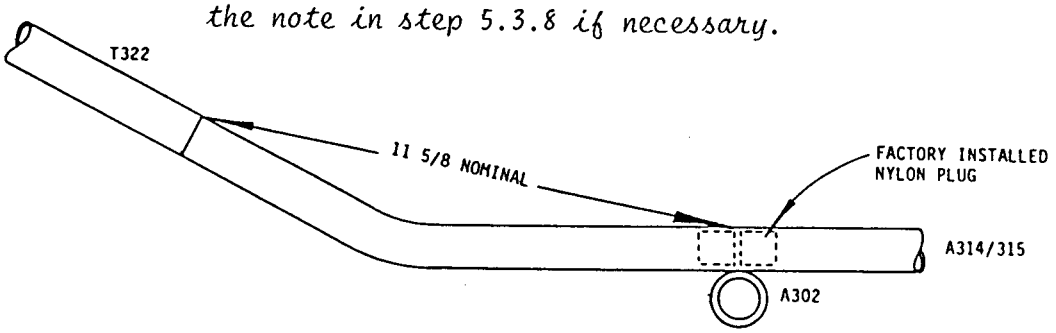


NOTE: *If you are not using a jig as recommended, set the angle between the A-Frame and the boom so that a direct measurement from the bottom rear of T23 to the end of A301 (the axle tube) is 129 inches (measured to the rear side of A301). If you are using a jig, you may wish to use this measurement as a double check. A tolerance of plus or minus 1/4 of an inch on this measurement is acceptable if the measurements on the left and right side are equal within 1/8 of an inch.*



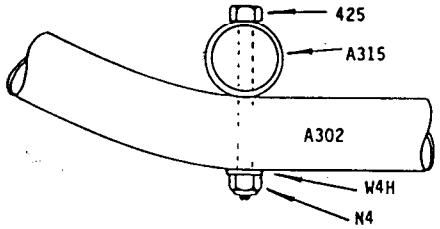
5.3.9 Make sure all the fuselage tubes are aligned properly, then drill and bolt the A314 and A315 to A302 as shown.

NOTE: *Before drilling, check that the position of the bolt hole is approximately 11 5/8 from the junction of A314/315 and T322 as indicated. If this is not correct within plus or minus 3/4 of an inch, the hole might not go through the nylon plug in A314/315. Recheck the location of the T322's on T23 and the measurement in the note in step 5.3.8 if necessary.*

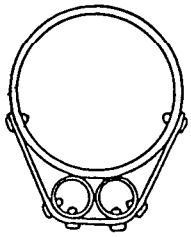


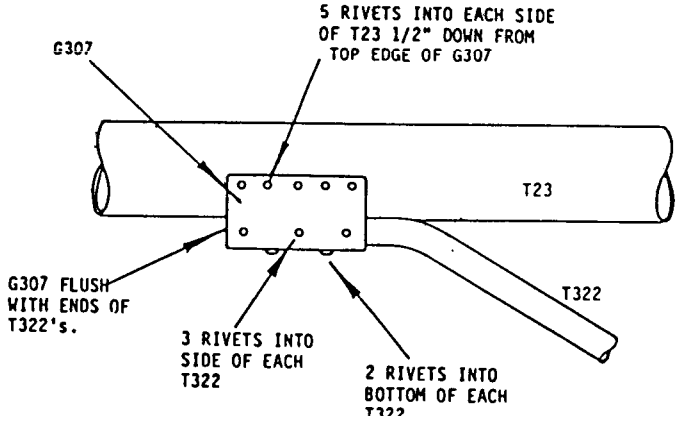
Make sure the bolt hole is vertical and passes through the centre-line of both tubes. Having a friend sight the drill can help considerably when drilling these holes.

FRONT VIEW

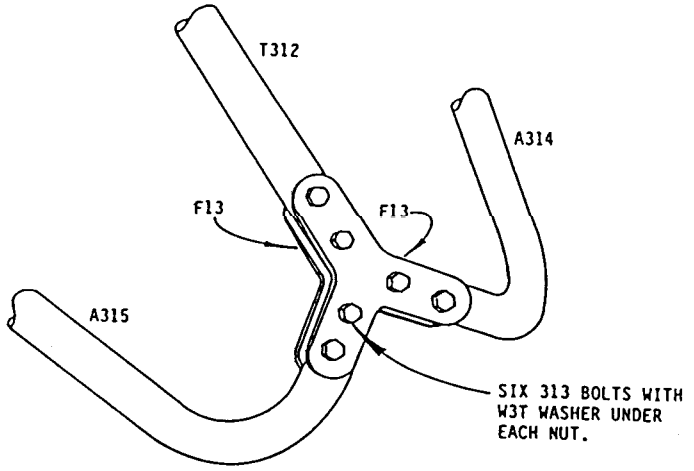


5.3.10 Install G307 on the ends of the T322's and rivet in place with 20 stainless steel rivets as shown. Make sure the T322's are held tightly together and positioned directly below T23. The use of a large C-clamp to hold the parts in place while drilling is recommended.



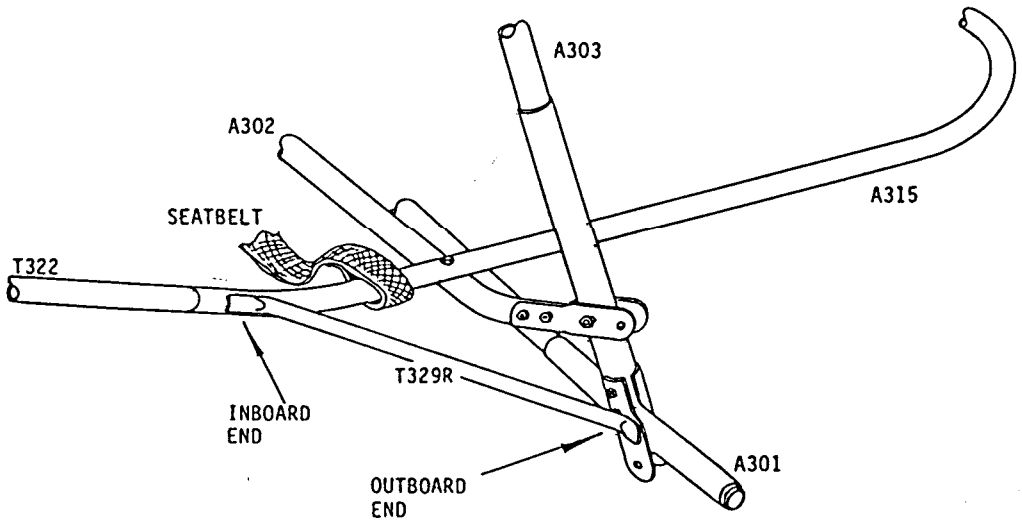


5.3.11 Drill and bolt the nose cluster together using F13's as shown. Do not overtighten the nuts on these bolts as the tubes do not have plugs in them.

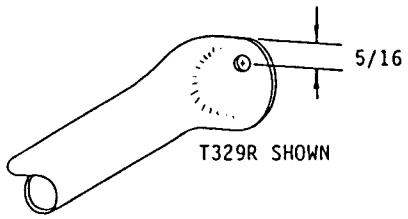


5.3.12 To improve the appearance of your Lazair, you may, if you wish, form the F13's to conform to the tubing since the F13's are made of a relatively ductile alloy. To do so, carefully hammer the edges of the F13's over the tubes using a wooden mallet or a hammer and a wooden block. The internal corners may be formed by using a length of wooden dowel or broomstick and a hammer.

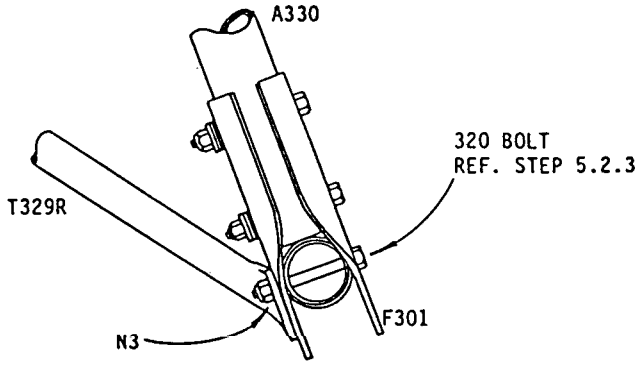
5.3.13 Hold the T329L/R trailing arms in position as shown below to check the fit and help identify the inboard and outboard ends.



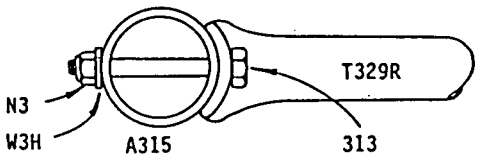
5.3.14 Drill a 3/16" hole in the top corner of the outboard end of T329L/R as shown.

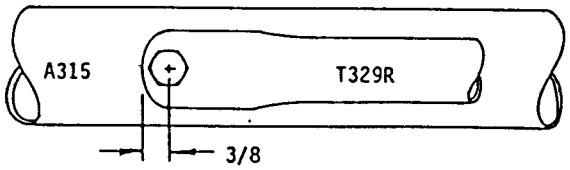


5.3.15 Fit the trailing arms into position as shown in step 5.3.13 and bolt as shown below.



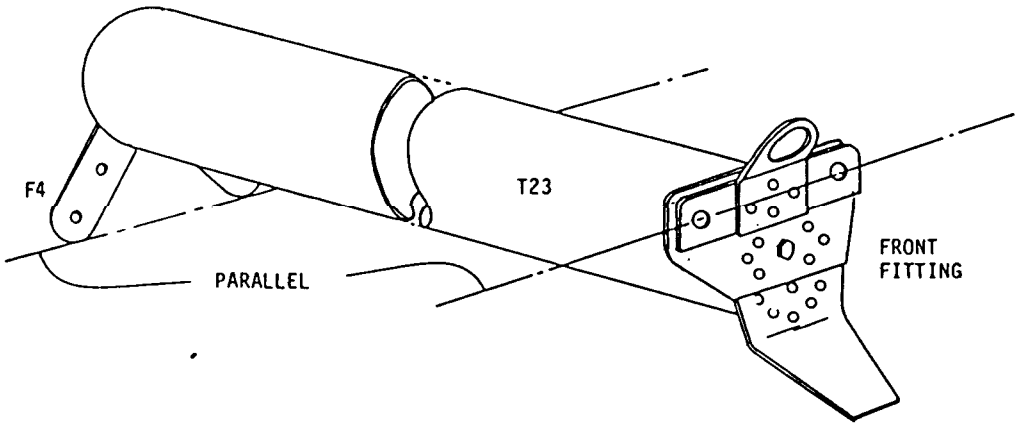
5.3.16 Tape the inboard end of the trailing arms to A314/A315, then drill and bolt as shown.





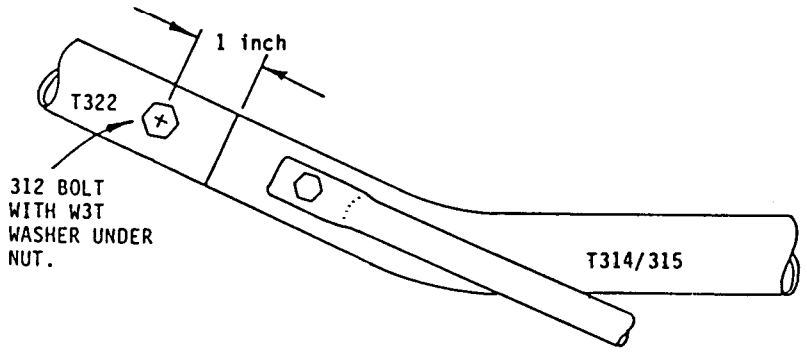
5.3.17 Make sure that the A303 downtubes are pushed together tightly at the top and the A-Frame is centred in F53 (Ref. Step 5.2.7). Drill the downtubes and rivet to F53 with 8 stainless steel rivets using the holes drilled in F53 in Step 5.1.9.

5.3.18 Fit the F4/P6 assembly (Ref. Step 5.1.1) into the end of T23. Rotate P6 until the bottom of F4 is parallel to a line through the holes in the front fitting as shown.



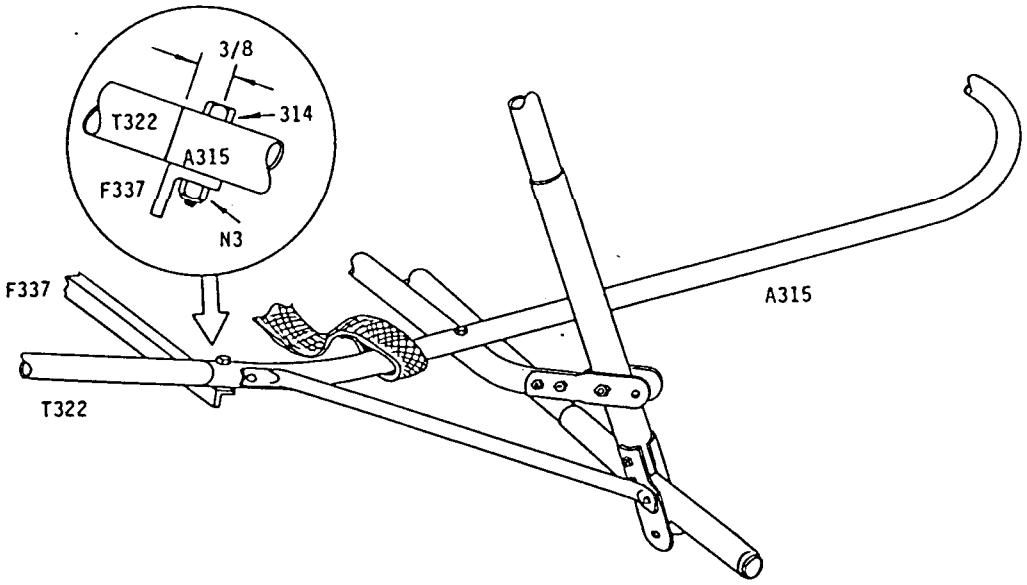
5.3.19 Rivet P6 to T23 with one stainless steel rivet into each tab on P6.

5.3.20 Ensure that the T322's are butted tightly against T314/315. Drill horizontally through the T322's and T313's and bolt as shown.

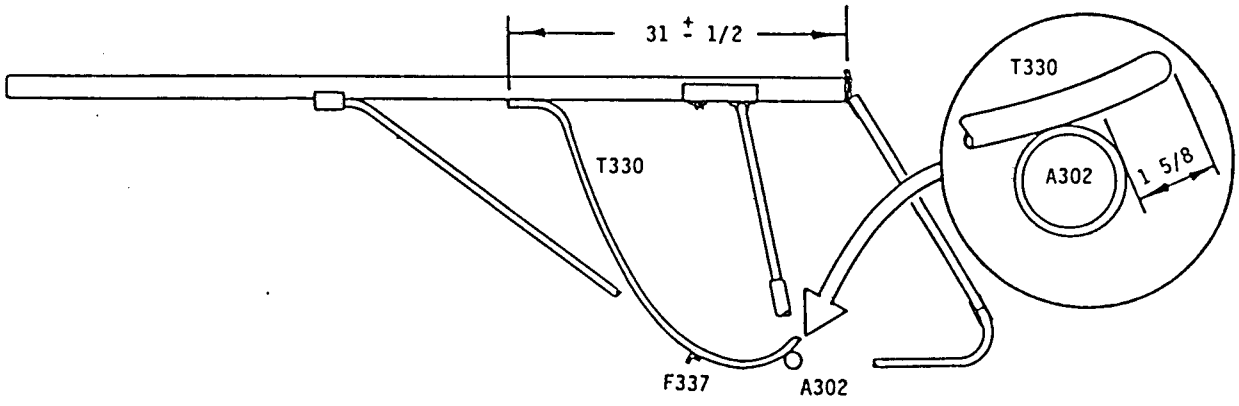


5.4 SEAT INSTALLATION

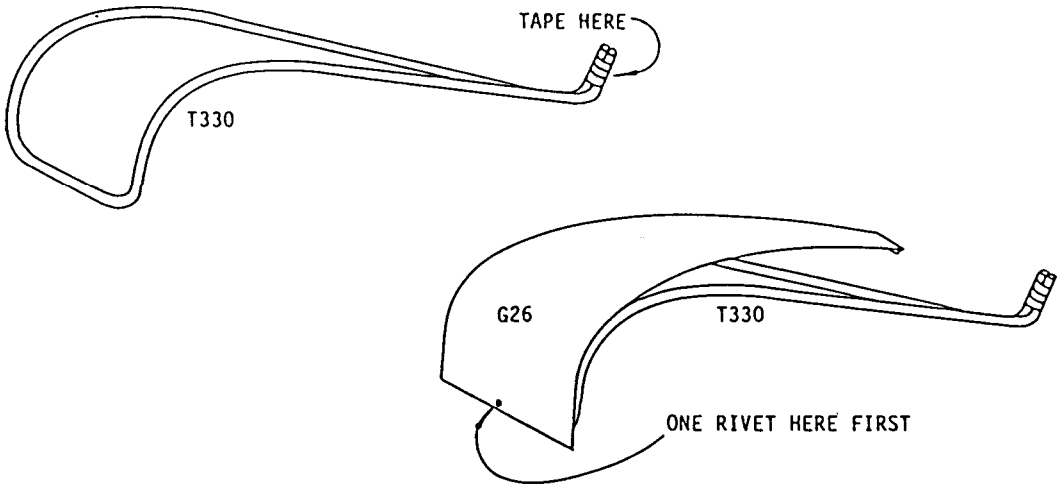
5.4.1 Drill 3/16 inch holes and bolt the seat support angle F337 to the side tubes A314 and A315 as shown.



5.4.2 Set seat tube T330 into position as shown. T330 may be bent slightly, if necessary, to make it touch F337 and A302. When bending T330, bend it very gradually and check the fit frequently. Be sure both sides are bent equally.

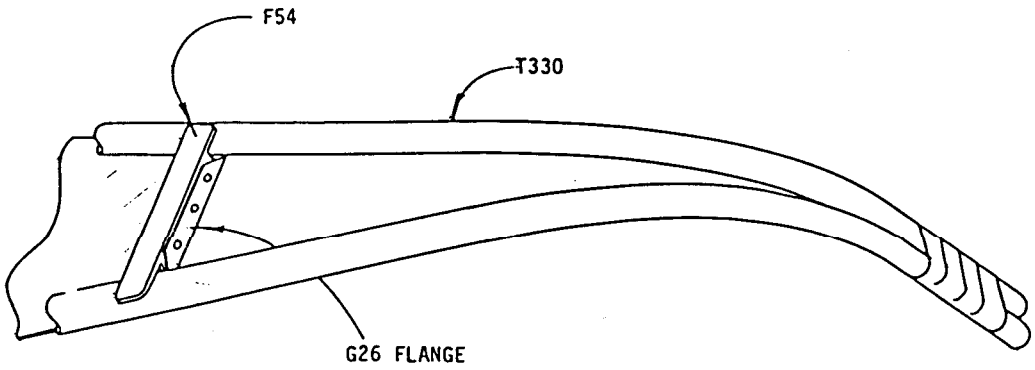


5.4.3 Remove T330 from the fuselage and position it on your work table as shown at left below. Tape the tails together as indicated to keep them aligned properly.

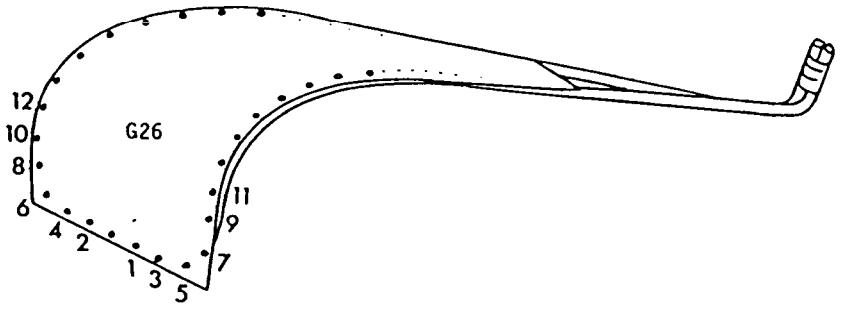


5.4.4 Put the seat skin (G26) in position as shown at right above. Note that the flange on the top edge of G26 should face forward (or downward with the seat positioned as shown). Make sure that G26 is even with the front edge of T330 and is centered properly, then put in one rivet as indicated.

5.4.5 Round the corners of seat spreader F54. Turn the seat over and install F54 as shown. Use three equally spaced rivets to attach F54 to G26. *Do not rivet F54 to the seat tube at this time.*



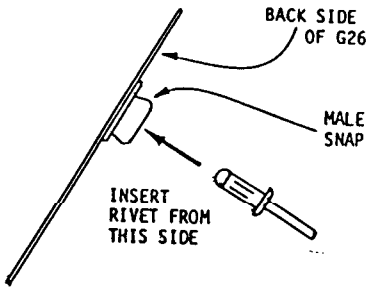
5.4.6 Rivet the seat skin to T330 with a rivet spacing of 2 inches. Install the rivets in the sequence shown below. You may find it helpful to tape the skin in position before riveting. After about 16 rivets have been put in, the tape on the tails of T330 may be loosened to let the tails spread about an inch apart while the rest of the rivets are put in.

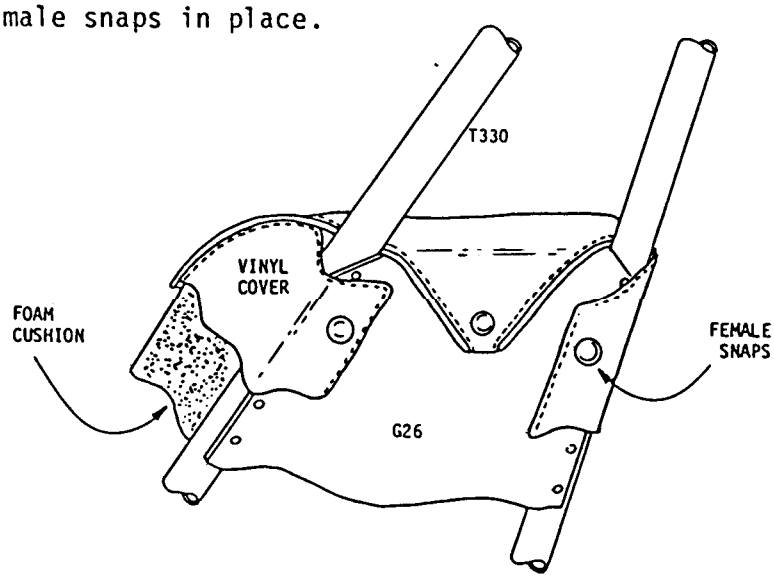


5.4.7 Rivet seat spreader F54 to T330 with one stainless steel rivet in each end.

5.4.8 Trim the front corners of G26 to conform to T330.

5.4.9 Fit the foam seat cushion into the seat. Fit the vinyl seat cover over the cushion and pull it tight. Mark the location of the three top female snaps on G26 as shown. Remove the cover and cushion and rivet the three male snaps in place.



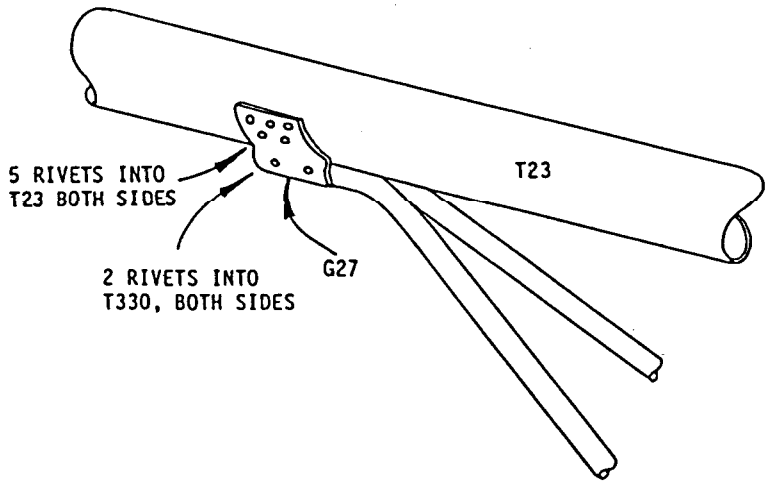


5.4.10 Refit the cushion and cover and snap the top in place. Pull the rest of the cover tight and locate and rivet the balance of the male snaps.

5.4.11 If there are any large bulges or wrinkles in the seat cover, they should be eliminated by relocating one or two of the snaps. However, small wrinkles will disappear quickly with use and exposure to the heat from the sun.

5.4.12 When the cover has been properly fitted, remove the cover and cushion to protect them from damage during the balance of the assembly.

5.4.13 Remove the tape from the tails of T330 and put the seat into the fuselage as in step 5.4.1. Clamp the tails of T330 to the fuselage tube T23 with seat clamp G27, and rivet as shown.

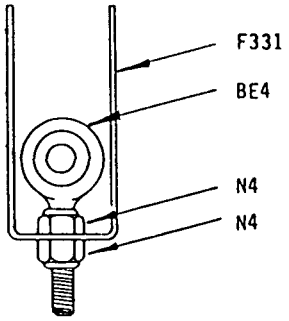


5.4.14 Centre the seat between A314 and A315 and rivet the seat skin G26 to A302 with 5 equally spaced stainless steel rivets.

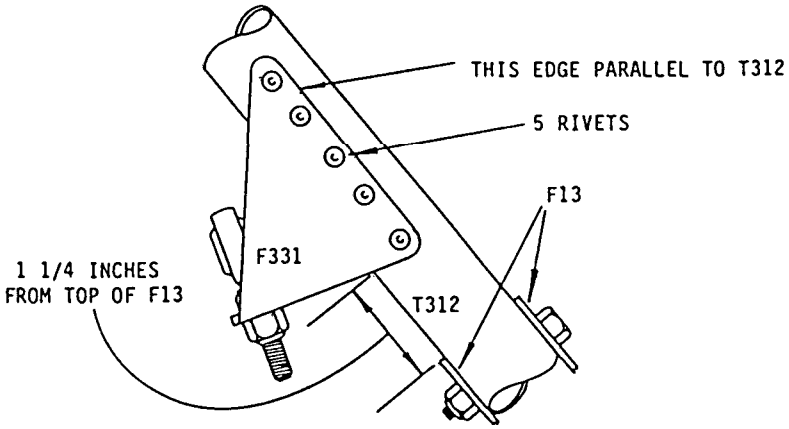
5.4.15 Rivet G26 to F337 with 5 equally spaced stainless steel rivets.

5.5 CONTROL LINKAGE INSTALLATION

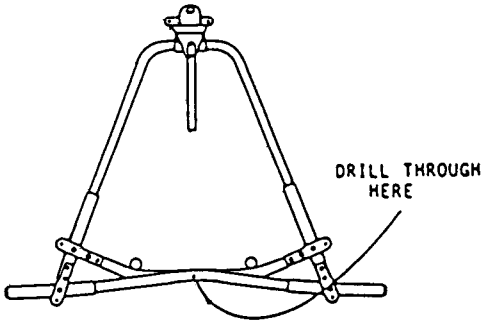
5.5.1 Put an N4 nut on a BE4 rodend (backwards as done previously) and fit the rodend into an F331 bracket as shown.



5.5.2 Rivet the F331 to T312 as shown. Sight the position of F331 from above and in front of T312 to make sure it is properly aligned before riveting.

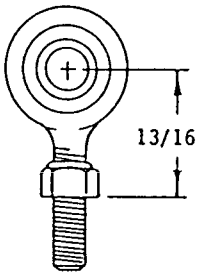


5.5.3 Run a 3/16 inch drill through the centre hole in the A301 axle tube, and extend the hole straight through A302, then ream the hole using a 1/4 inch drill.

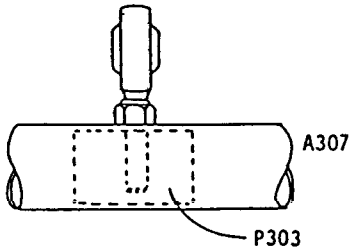


NOTE THAT THIS HOLE MUST BE DRILLED CAREFULLY TO ENSURE SYMMETRICAL STICK TRAVEL (REF. STEP 5.5.14).

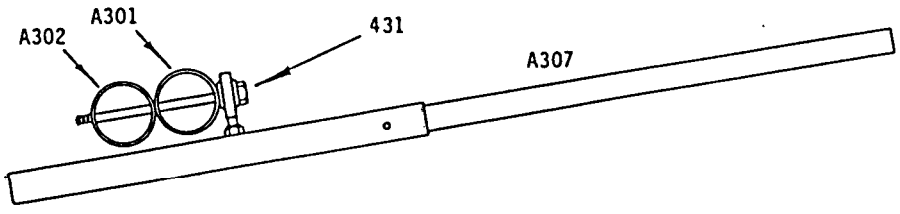
5.5.4 Put another N4 on another BE4 as shown. When measuring to the centre of the hole in the rodend, make sure the ball is properly oriented in the socket.



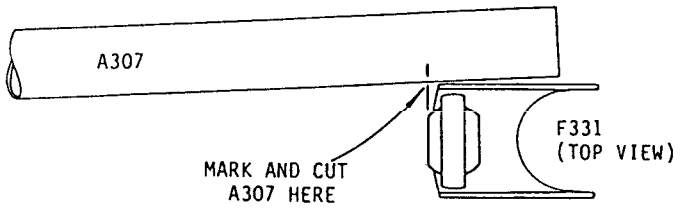
5.5.5 Put a P303 plug into torque tube A307 so the tapped hole in the plug is aligned with the 1/4 inch hole in the tube, and install the BE4 as shown.



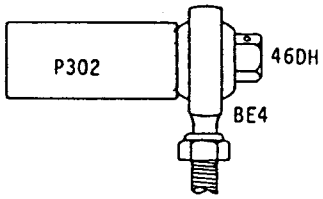
5.5.6 Temporarily install the A307 torquetube assembly as shown. Do not put a nut on the 431 bolt at this time.



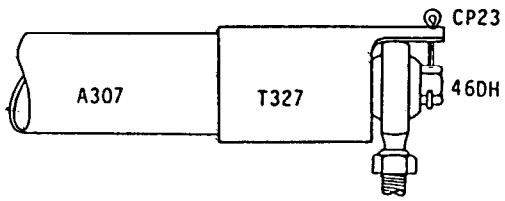
5.5.7 Position the forward end of A307 beside the BE4 rodend in the F331 bracket. Mark the A307 opposite the face of the rodend. Remove A307 and cut it off at the mark.



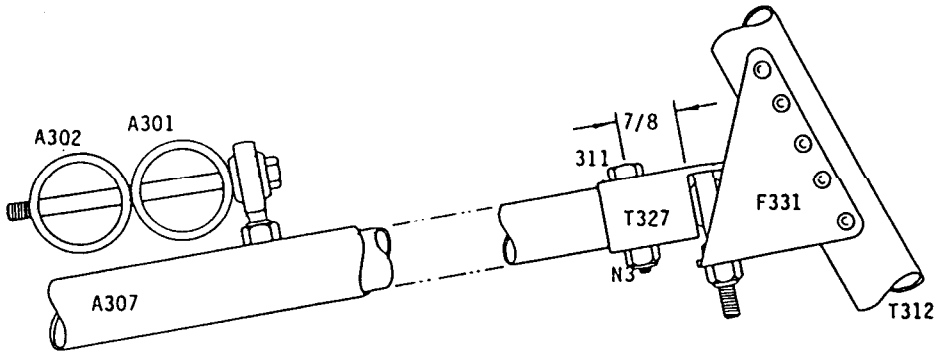
5.5.8 Remove the BE4 rodend from F331 and bolt it to a P302 plug as shown. Tighten the 46DH bolt securely.



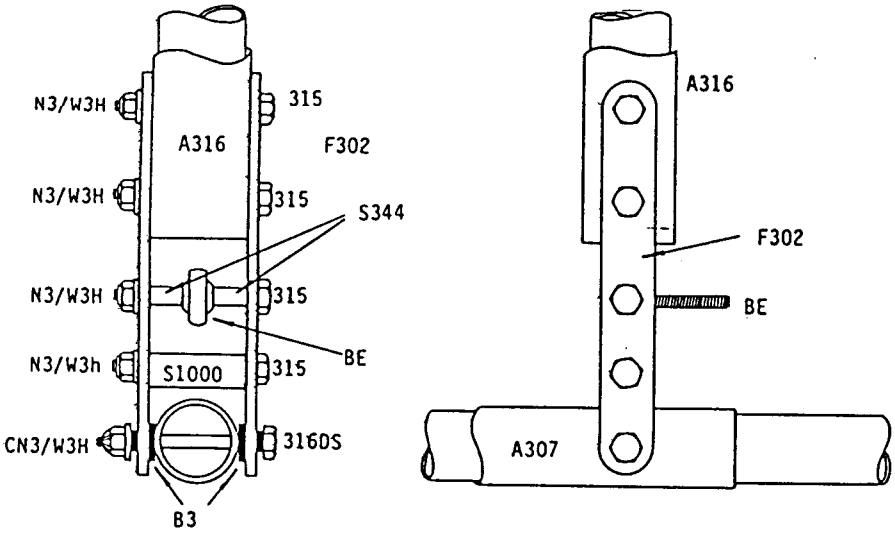
5.5.9 Put a T327 locking tube over the end of A307, and insert the P302 plug into the end of A307. With the end of the plug flush with the end of the tube, run a 1/16 inch drill through the hole in the head of the 46DH bolt to drill a corresponding hole in the tab of the T327, and pin with a CP23 cotter pin.



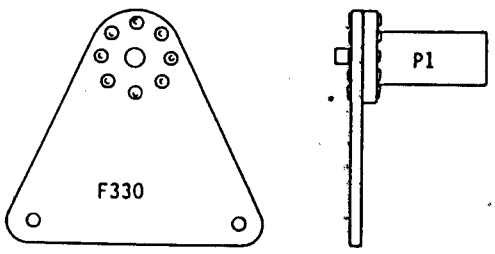
5.5.10 Reinstall the torque tube assembly in the aircraft as shown below and check that it moves freely from side to side. Drill and bolt A307, T327 and P302 as shown.



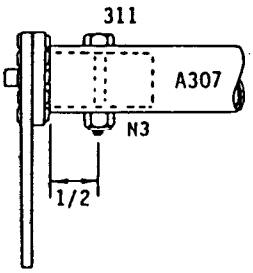
5.5.11 Assemble the control stick on A307 as shown. Tighten the CN3 castle nut until the stick moves with just a bit of friction and install the CP23 cotter pin.

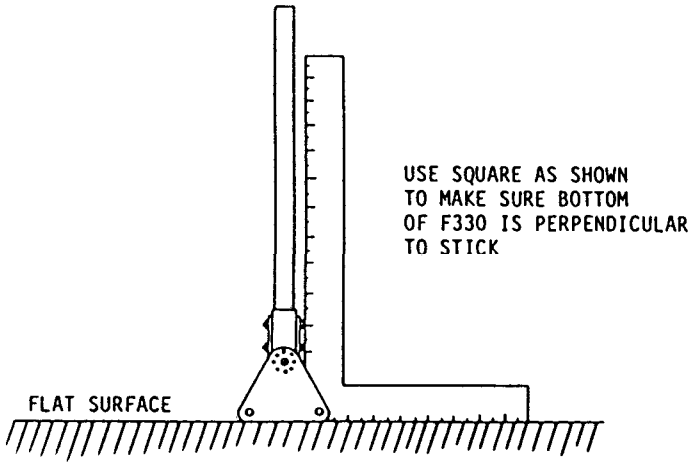


5.5.12 Rivet the aileron control horn F330 to a P1 plug with 8 stainless steel rivets.



5.5.13 Remove the stick and torque tube assembly, insert the P1 into the open end of A307 and drill and bolt as shown, then reinstall the assembly in the airframe.

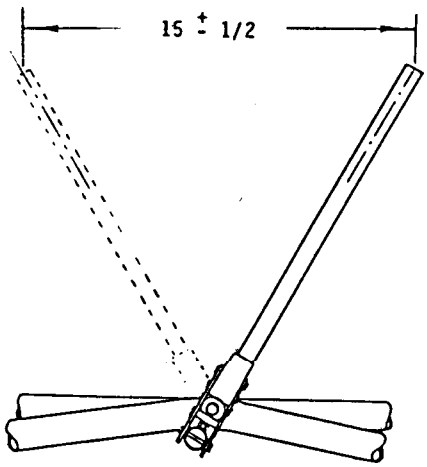




5.5.14 Check and adjust the stick limit stops as follows:

(a) Stick Lateral Movement

Move the control stick from side to side and check the total movement as indicated. Total stick travel may be adjusted (if necessary) by screwing the BE4 rodend in or out as required. One complete revolution of the rodend will change the total stick travel by approximately one inch. Be sure to tighten the locknut on the BE when the adjustment is complete.

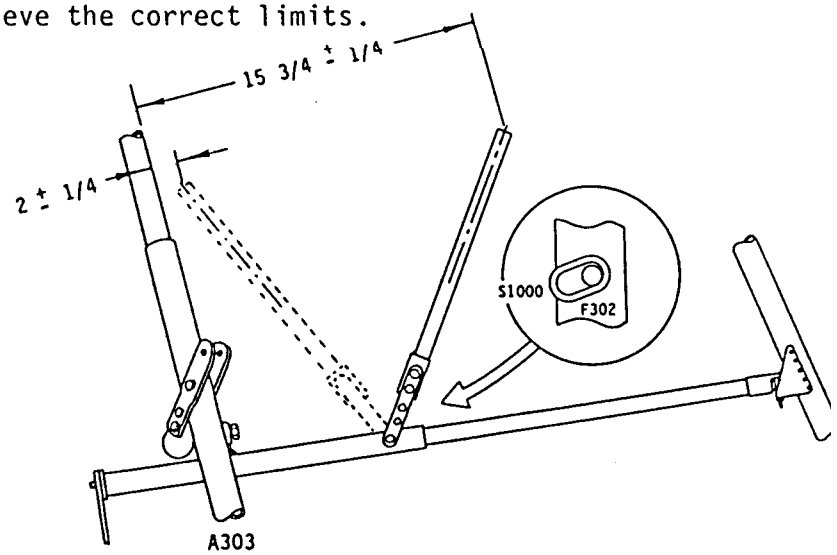


NOTE THAT IF THE STICK MOVES SIGNIFICANTLY FURTHER IN ONE DIRECTION THAN IN THE OTHER, A SMALL SHIM CUT FROM SCRAP ALUMINUM MAY BE RIVETED TO THE BOTTOM OF A301. A 1/16 INCH SHIM WILL CHANGE THE STICK TRAVEL BY ABOUT 1 1/2 INCHES.

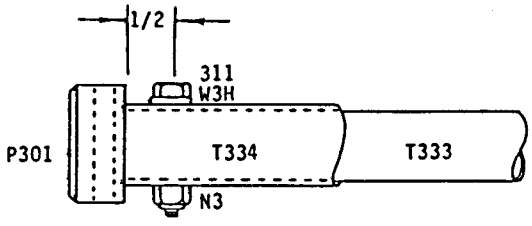
(b) Fore/Aft Movement

Fore/Aft limit stops are adjusted by the location of the S1000 stop on the stick assembly. Position S1000 as required to allow the stick movement as indicated below, and tighten the bolt and nut securely to clamp S1000 in place. Note that it may be necessary to squeeze S1000 in a vise and install it as shown in the inset to achieve the correct limits.

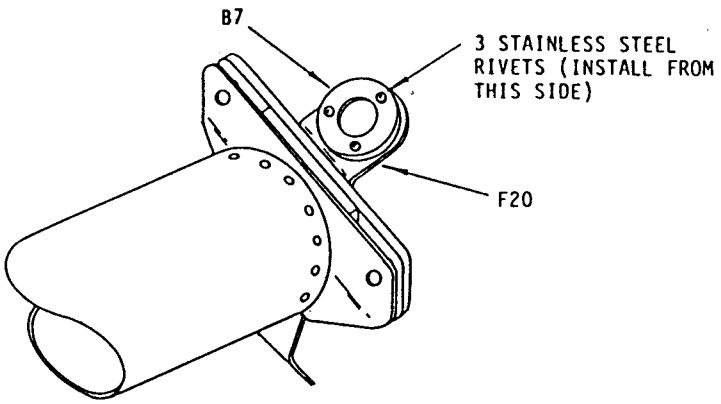
Note that the stick position is measured from the front *plane* of the A-Frame (this is not a direct measurement from the A303 downtube).



5.5.15 Drill and bolt a P301 mixer plug, T333 torque tube and T334 doubler as shown. Note that the bolt should be parallel to the 1/4 inch hole in the plug. Note also that the washer is installed under the *head* of the bolt.

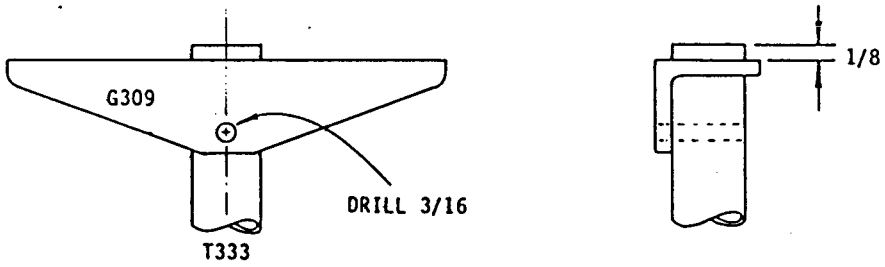


5.5.16 File or sand the inside of a B7 nylon bushing if necessary so it will fit easily over T334. Install B7 on F20 (F20 is part of the front fitting) as shown. Make sure the hole in B7 is concentric with the hole in F20.

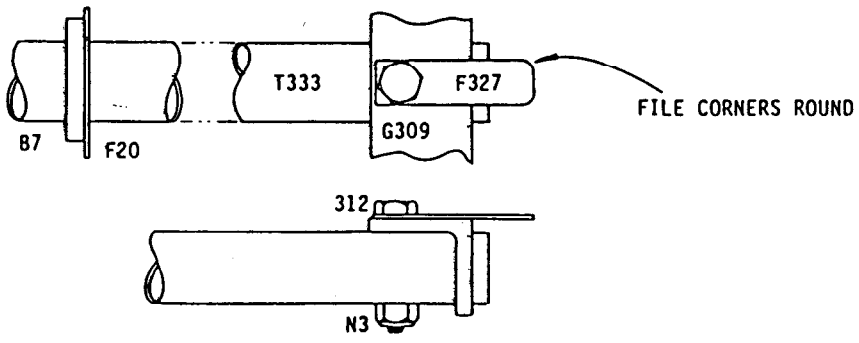


5.5.17 Install a P302 plug and the G309 ruddervator control horn on the other end of T333 and drill as shown. Before drilling, lay the assembly on a flat surface and put a 1/4 inch rod or a long bolt through the hole in P301 to *make sure that the G309 is parallel to the hole.*

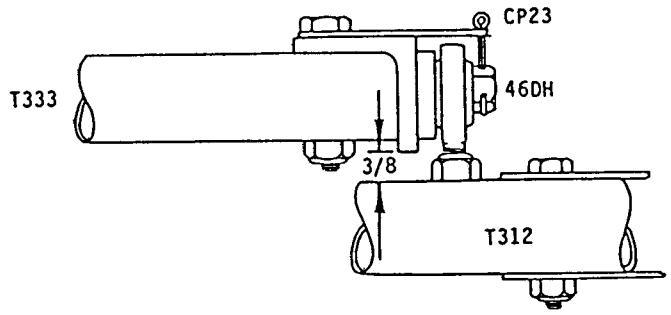
You might also find it helpful to squeeze the end of the T333 *slightly* with vise-grips so that P302 will not fall out. Do not install a bolt at this time.



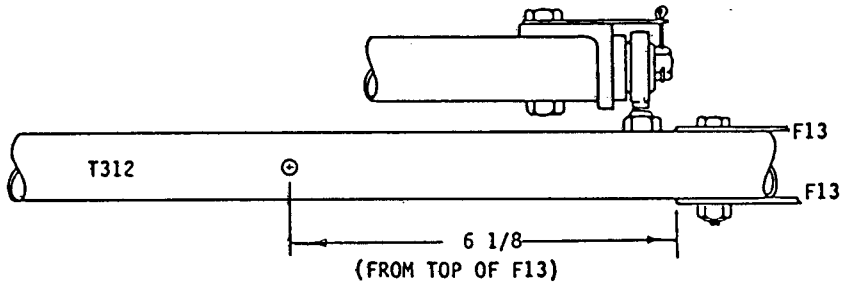
5.5.18 Remove G309 (after marking T333 so that G309 may be reinstalled the same way), and fit T333 through B7. Reinstall G309 and bolt as shown, with an F327 lockplate under the head of the bolt.



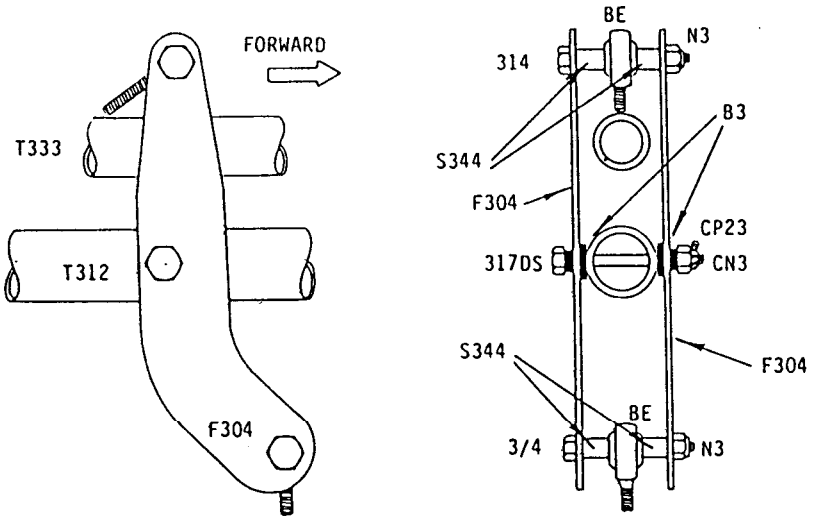
5.5.19 Bolt the end of the T333 assembly to the rodend in T312 (installed in Step 5.3.2) as shown. The clearance between the bottom edge of G309 and T312 should be as close as possible to 3/8 of an inch as indicated. If necessary, screw the rodend in or out to achieve this clearance. An F324 may be used as a feeler gauge to check this clearance. Drill a 1/16 inch hole in the end of the lockplate as shown and pin the 46DH bolt with a CP23 cotter pin. If the hole in the bolt head cannot be aligned with the axis of the cotter pin, you can drill a new hole through the bolt head or use lockwire in lieu of the cotter pin.



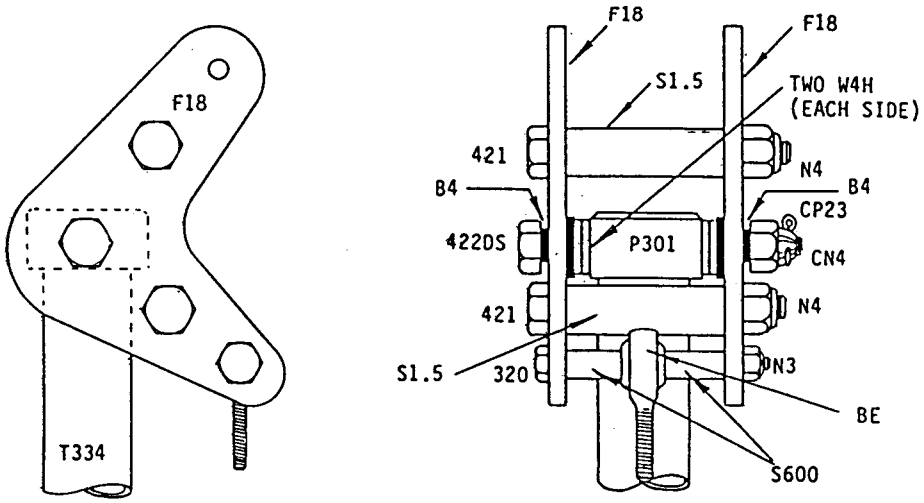
5.5.20 Drill a 3/16 inch hole through T312 as shown. Make sure the hole is horizontal (parallel to A302) and goes through the centreline of T312.



5.5.21 Assemble the ruddervator control bellcrank on T312 as shown. Adjust the CN3 nut until the bellcrank moves with just a bit of friction and no play, then lock the nut with a CP23 cotter pin.



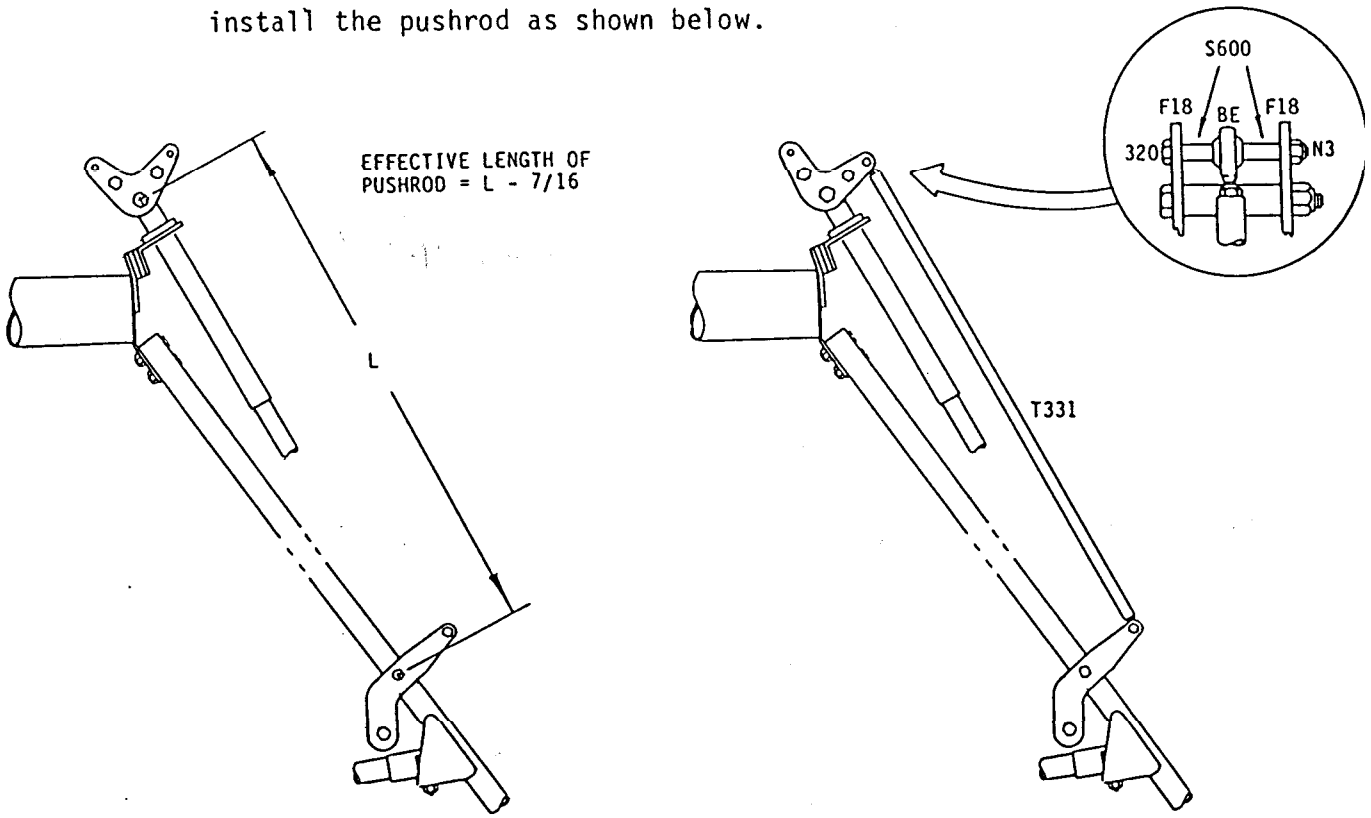
5.5.22 File or sand the edges on the F18 mixer plates (some may be marked F19 as these parts are identical) and assemble the mixer on the mixer plug P301 as shown. Adjust the CN4 nut as was done for the other bellcranks, and lock with a cotter pin. Note that the two legs on the F18 are similar but not identical. The more pointed leg faces forward.



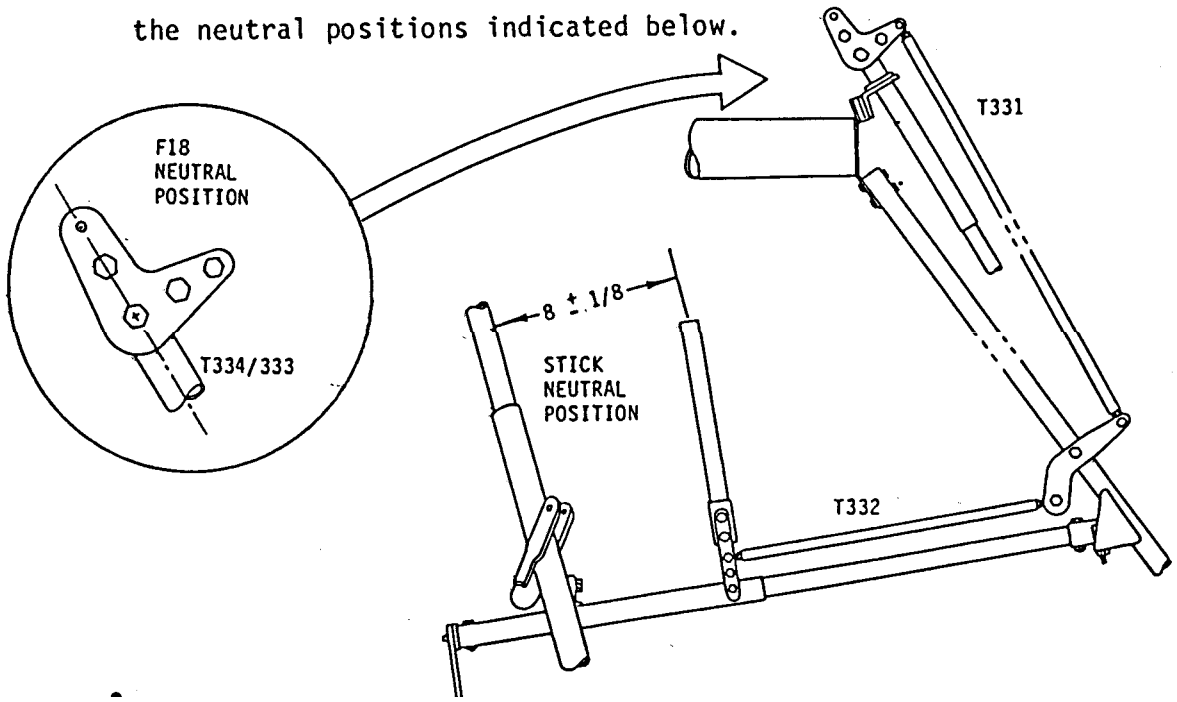
5.5.23 *Assemble the T331 pushrod to interconnect the F18 mixer bellcrank to the F304 elevator control bellcrank as follows:*

To determine the *effective length* of the pushrod, carefully measure the distance between the centre of the 422DS pivot bolt (installed in Step 5.5.22) and the centre of the 317DS pivot bolt in T312 (installed in Step 5.5.21). The effective length of the pushrod should be 7/16 of an inch *less* than this measurement. Therefore

when cutting T331 tube to length, make it 1 13/16 less than the measured bolt-to-bolt distance. After T331 is cut, rivet the P3 plugs in place as in Section 3.9.1, then measure the hole-to-hole spacing between the BE rodends and adjust if necessary to achieve the correct effective length. Make sure the locknuts are tight and install the pushrod as shown below.



5.5.24 Measure, cut, fit and adjust the T332 pushrod using the standard procedure in Section 3.9.1 with the stick and mixer bellcrank in the neutral positions indicated below.

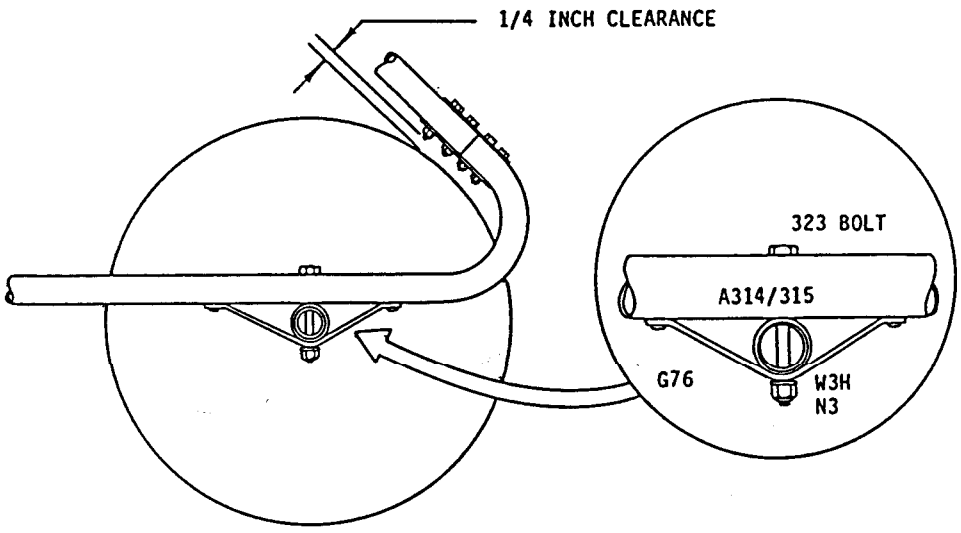


5.5.25 Remove any burrs and sharp edges from the top of the control stick, and slide the stick grip in place. Wetting the inside of the stick grip with water will allow it to slide on more easily.

5.6 NOSEWHEEL AND RUDDER PEDAL INSTALLATION

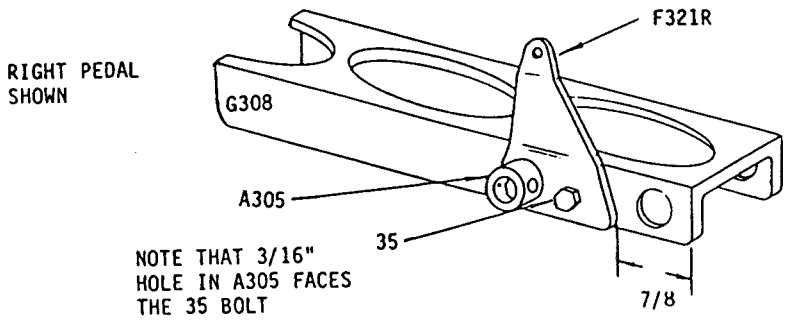
NOTE: The following instructions have been written with the assumption that you will be installing the nosewheel, at least temporarily as suggested in 1.2.1. If you do not intend to fly the aircraft with the nosewheel installed, it should be used as a gauge for locating the axle (Step 5.6.1), then removed before the rudder pedals are installed. The two T47 collars should also be omitted.

5.6.1 Slide the nosewheel over the nosewheel axle A306 and fit a T47 collar on each side of it. Fit the axle into position on the fuselage as shown, and drill two 3/16 inch holes for the 323 bolts as shown. *Make sure the predrilled holes in A306 are parallel to A314/315*, and the clearance is about 1/4 of an inch as indicated in the figure. Check also that the nosewheel axle is parallel to the main axle. Before putting nuts on the 323 bolts, drill a 3/16 inch hole in the centre of the two G76 Gussets, and bend them to fit around the nosewheel axle as shown. Install the G76's, tighten the nuts, and rivet the G76's to A314/315 with one stainless steel rivet in each end.

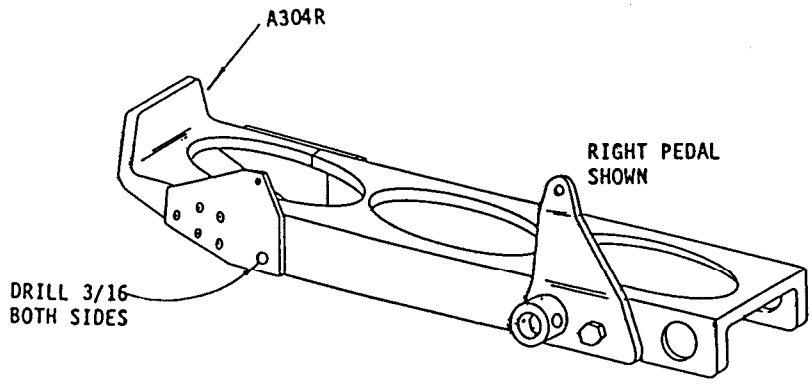


5.6.2 Centre the nosewheel on its axle and rivet the T47 collars in place with two rivets each, allowing about 1/32 of an inch sideplay in the nosewheel.

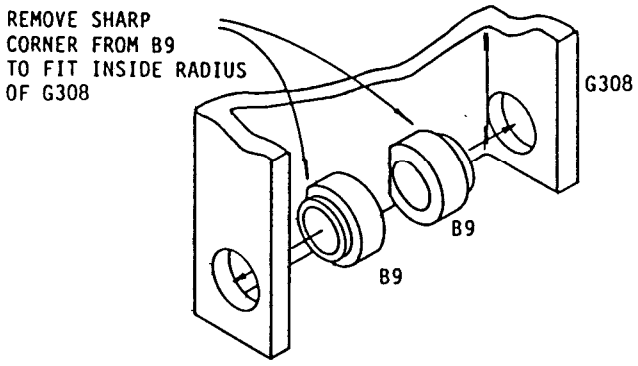
5.6.3 Assemble the two rudder pedals as shown. *Be sure to make one left and one right.* Note that the F321L/R horn is mounted on the inboard side of the pedal. Note also that the upper bolt is part of the A305 assembly.



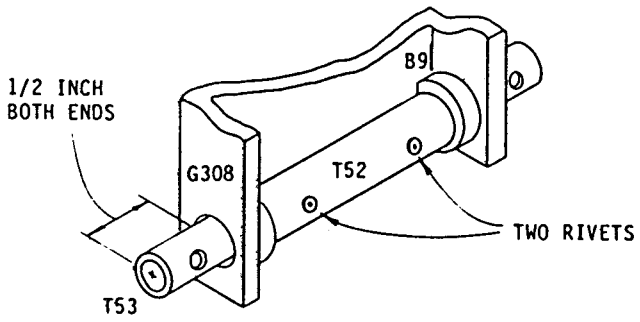
5.6.4 Before installing the rudder pedals, drill the 3/16 inch holes for attaching the brake pedals (A304L/R) as shown, but do not install the brake pedals at this time.



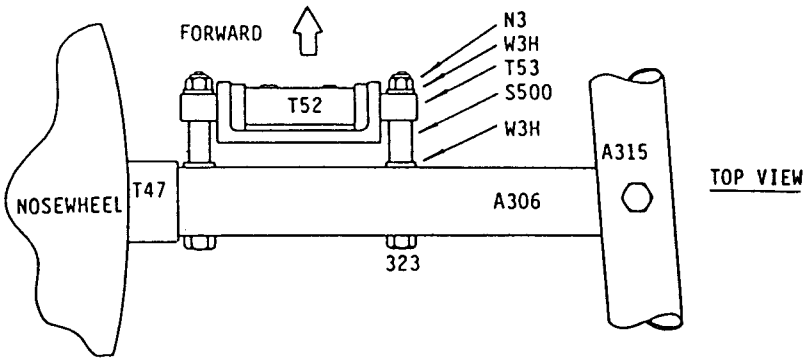
5.6.5 Fit the B9 Rudder Pedal Bushings into the holes in the rudder pedals (from the inside) as shown. Check that the B9's fit flush against the sides of G308 and file the B9's as indicated in the figure if necessary.



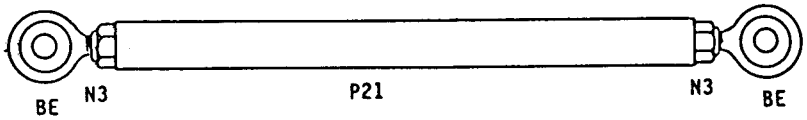
5.6.6 Install the T53 Rudder Pedal Axles and T52 sleeves and rivet as shown. Before riveting make sure that the pedals rotate freely on the axles and trim the T52's to length if required. Locate the rivets so that they are approximately in line with the predrilled holes in T53.



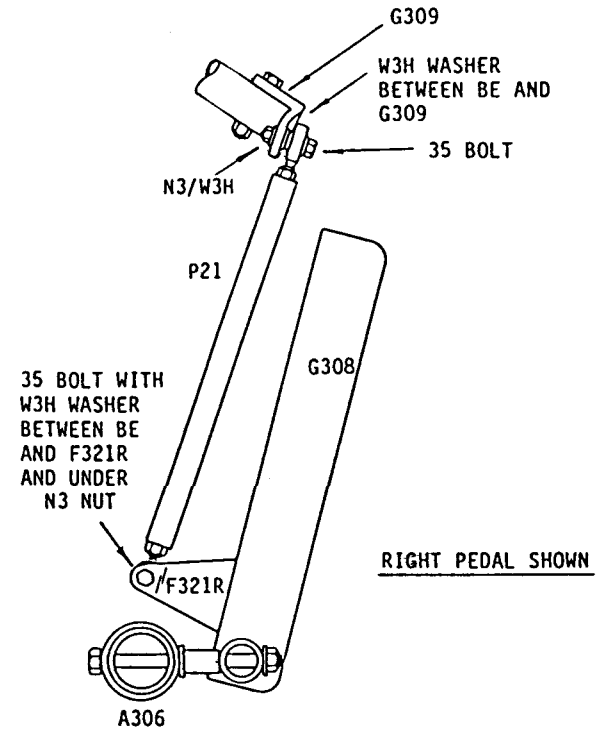
5.6.7 Mount the rudder pedals on the nosewheel axle as shown. Note that for clarity the F321R horn and A305 are not shown in the figure, but should be on the *inboard* side of the pedal.



5.6.8 Make up two pushrod assemblies as shown. Leave approximately 3 threads exposed on each rodend and do not tighten the locknuts at this time.



5.6.9 Install the pushrods as shown. Note that the lower rodends are on the inboard side of the F321 horns. Do not tighten the nuts on the G309 at this time.



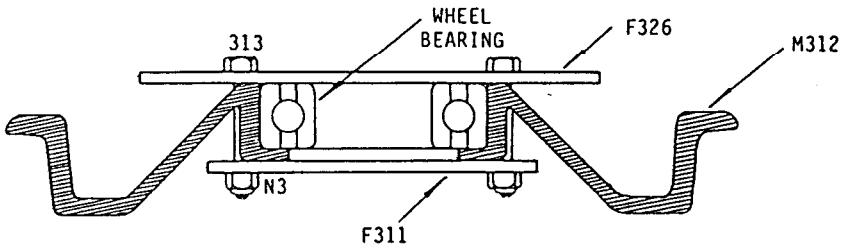
5.6.10 Note that there are two possible rudder pedal control stops provided by (a) the interference between G309 and T312 and (b) interference between the rudder pedals and A314/315. When properly adjusted the initial control stop should be provided by G309/T312 with the pedal on A314/315 used as a secondary stop to prevent overstressing the control linkage.

Adjust the length of the P21 pushrod assemblies so that when G309 just makes contact with T312, there is about 3/16 of an inch clearance between the rudder pedal and A314/A315. If necessary, the P21 pushrods may be shortened by trimming up to 1/8 of an inch off each end.

5.6.11 When the rudder pedal linkage is adjusted, check that all bolts have been properly installed and tighten all nuts securely.

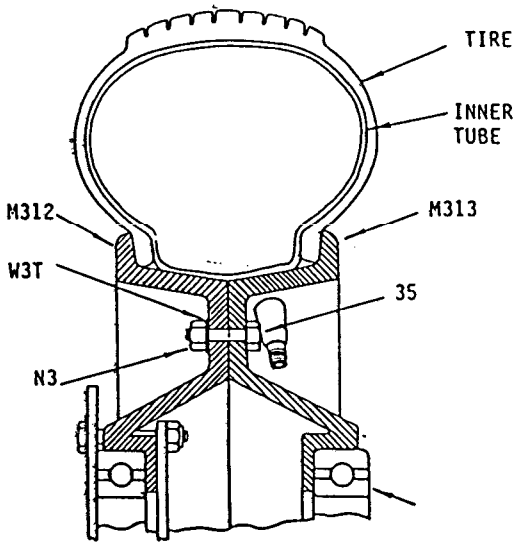
5.7 WHEEL AND BRAKE ASSEMBLY

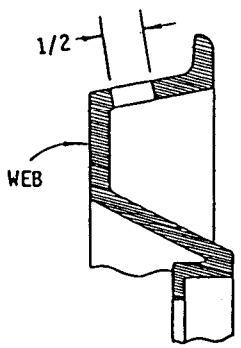
5.7.1 Assemble a wheel bearing, brake disc (F326) and backup disc (F311) on each inboard hub half (M312) as shown. Tighten nuts alternately and *evenly* to avoid distorting the brake disc.



5.7.2 Drill a 1/2 inch valve stem hole in each M313 outboard hub half as shown at right below. Drill the hole midway between two bolt holes as close to the vertical web as possible.

To assemble each wheel, fit the inner tube inside the tire and inflate it slightly to remove the wrinkles, then deflate it sufficiently to permit assembly of the wheel hubs. Fit the valve stem through the hole in M313 and fit the hub half inside the tire. Fit M312 into the tire making sure the bolt holes are aligned and *the inner tube is not pinched between the two webs*. Bolt the hub halves together with 35 bolts and a W3T washer under each nut. Install the bolt nearest the valve stem first, then the one opposite the valve stem, then the remaining bolts. Check frequently to make sure that the inner tube is not being pinched.





5.7.3 When the wheels and tires are assembled, inflate them to about 5 PSI and bounce them on the floor a few times to seat the inner tube, then inflate them to 16 PSI.

NOTE: The optimum tire pressure will depend on the pilot weight and the condition of the airfield. However, the wheel hubs are designed for low pressure tires.

TIRE PRESSURE SHOULD NOT, UNDER ANY CIRCUMSTANCES, EXCEED 18 PSI.

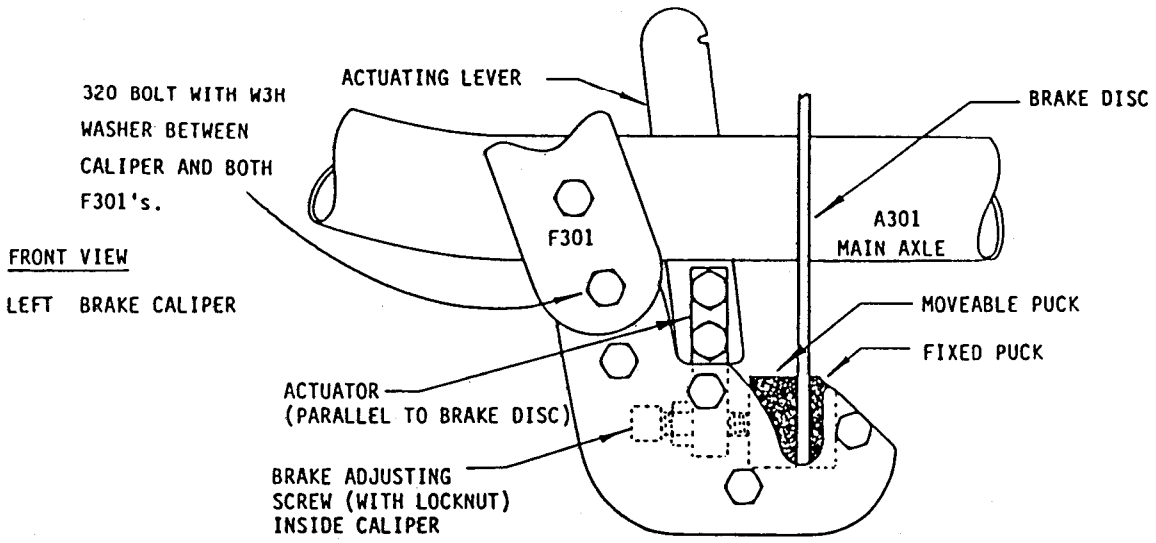
5.7.4 Slide a T335 wheel collar over each end of the A301 main axle and put on the wheels. Note that if the wheel bearings are a tight fit on the axle now, they will be a lot tighter two years from now when you want to remove a wheel to fix a flat tire. If necessary, file or sand the axle tube slightly so that the wheels will slide on and off easily. Before the final installation of the wheels, coat the axle liberally with grease.

NOTE: Although the brake calipers are attached by a single bolt (and they can, therefore, pivot) they are not floating *calipers. This eliminates the caliper slides which are a frequent source of problems in many disc brake systems. However, to function properly, the wheels must be precisely located relative to the brake calipers. The following procedure should be used to properly position the wheels and calipers.*

5.7.5 Inspect each brake caliper, and make sure that the actuator lever moves freely and the moveable puck slides easily in the bore. Slide the puck back out of the way, hook the caliper over the brake disc on the wheel as shown, and slide the wheels onto the axle. Note that the brake actuating lever should be *behind* the axle.

NOTE: The brake adjusting screw has been set at the factory and should not require readjustment except to compensate for wear. When the brake pucks become sufficiently worn to require adjustment, the adjusting screw should be set so

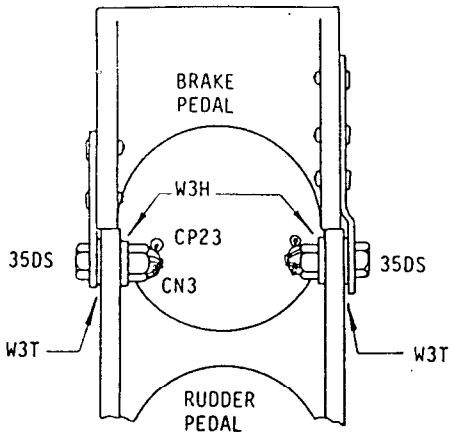
that when the brakes are applied, the actuator is parallel to the brake disc as shown. The cable adjuster (to be installed in Step 5.7.10) should be used to calibrate the brake system during installation or to compensate for cable stretch but should not be used to compensate for puck wear.

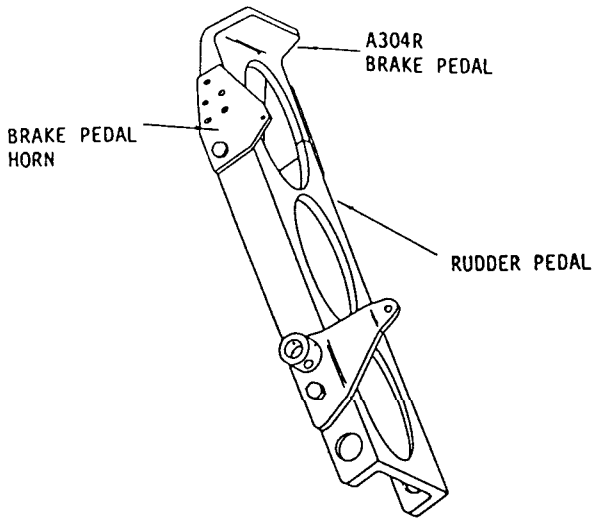


5.7.6 Fit the top of the caliper between the F301 fittings as shown above, and install the 320 bolt. Install a W3H washer under the nut but do not tighten the nut.

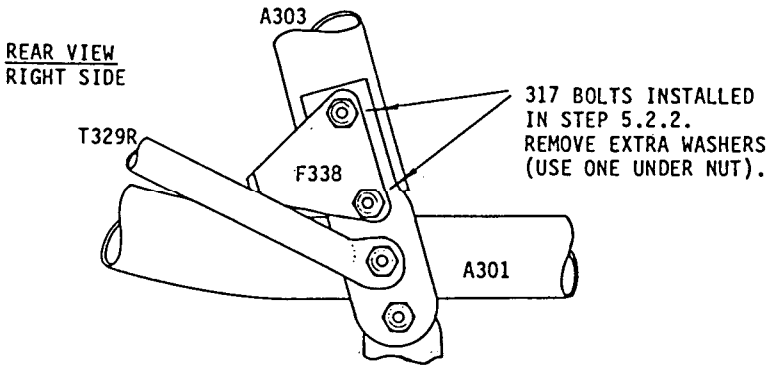
5.7.7 Squeeze the brake actuator to pinch the brake disc tightly between the two pucks, then tighten the nut on the 320 bolt to clamp the caliper in place. The wheel and caliper will now be approximately in the correct position. The final adjustment will be made later.

5.7.8 Install the brake pedals on the rudder pedals as shown. Tighten the nuts until the pedals will just fall under their own weight and install the CP23 cotter pins.

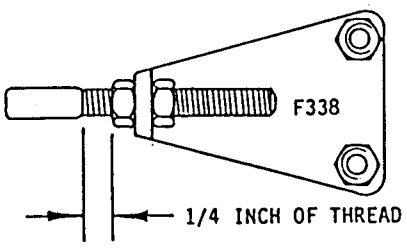




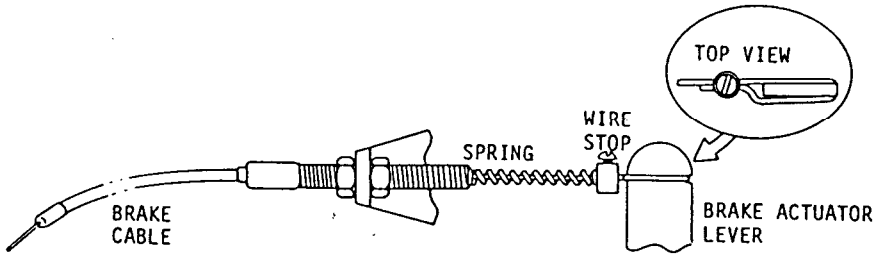
5.7.9 Install the F338 brake cable anchor on the rear side of the downtubes as shown. Notice that the bent tab on F338 with the 5/16 inch hole in it faces toward the rear.



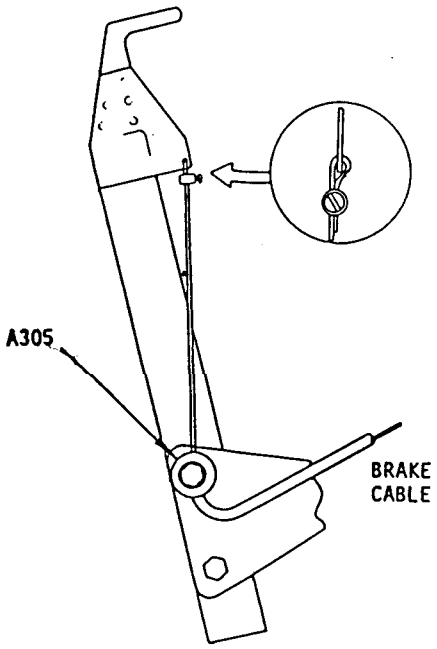
5.7.10 Install the brake cable adjuster in the F338's as shown and tighten the nuts.



5.7.11 Put a wire stop and a brake return spring on each inner brake cable and feed it through the cable adjuster. Hook the end of the cable onto the actuator lever as shown and tighten the wire stop securely.



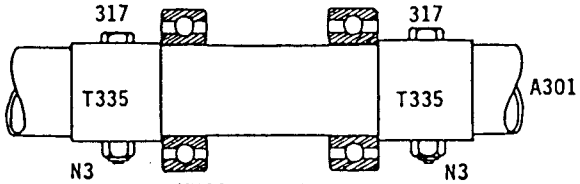
5.7.12 Feed the free end of the brake cable through the A305 cable retainer on the rudder pedal, then fit a wire stop over the inner cable, and feed the cable through the small hole in the brake pedal horn. To obtain the correct cable length, squeeze the lever on the caliper to apply the brakes. With the pedal in the fully retracted position, pull the inner cable tightly through the horn and bend it as shown. Slide the wire stop into position and tighten it securely.



5.7.13 Loosen the nuts on the 315 bolts which clamp the calipers in place, then press the brake pedal firmly, and tighten the nut securely.

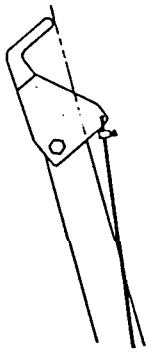
5.7.14 While pressing on the brake pedal to locate the wheel, hold the inboard T335 collar tightly against the wheel bearing and drill and bolt it in place as shown. Note that unless you have a very small drill, it will be necessary to deflate the tires for this operation. Slide the outboard T335 collars onto the axle, push tightly against the wheel bearing, then drill and bolt.

DRILL HOLES
VERTICALLY THROUGH
T335 AND A301



WHEEL BEARINGS

5.7.15 To perform the final calibration of the brake system, pull back on the pedals to release the brakes completely. If necessary adjust the cable adjusters to make sure the *moveable* puck does not contact the disc. Spin the wheel and gently tap the caliper sideways until the fixed puck *almost* touches the disc. Adjust the cable adjuster so that the brakes are fully released when the brake pedal is released, and fully applied when the toe pad is approximately in line with the surface of the rudder pedal as shown.



PEDAL POSITION
WITH BRAKES FULLY APPLIED

Note that as with virtually all disc brake systems there will probably be some residual drag when the brakes are released. If the wheel will coast for several revolutions after being spun by hand, the brake drag can be considered acceptable.

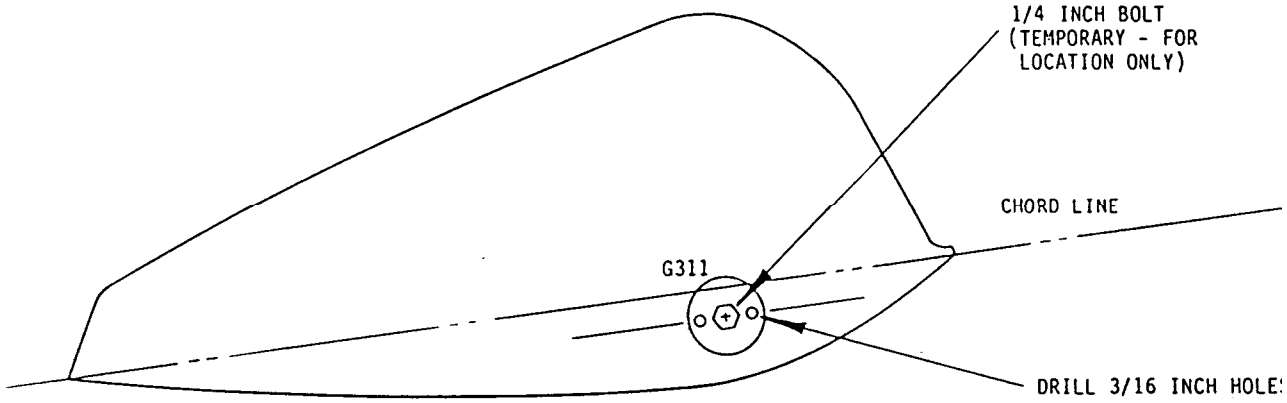
5.7.16 Make sure all nuts are tightened and cut off any excess cable at the brake pedal.

5.7.17 Tie the brake cables to A307 at a point near the control stick using a tie wrap. Position the cables so they do not interfere with the movement of the control stick and make sure there are no sharp bends in the cables.

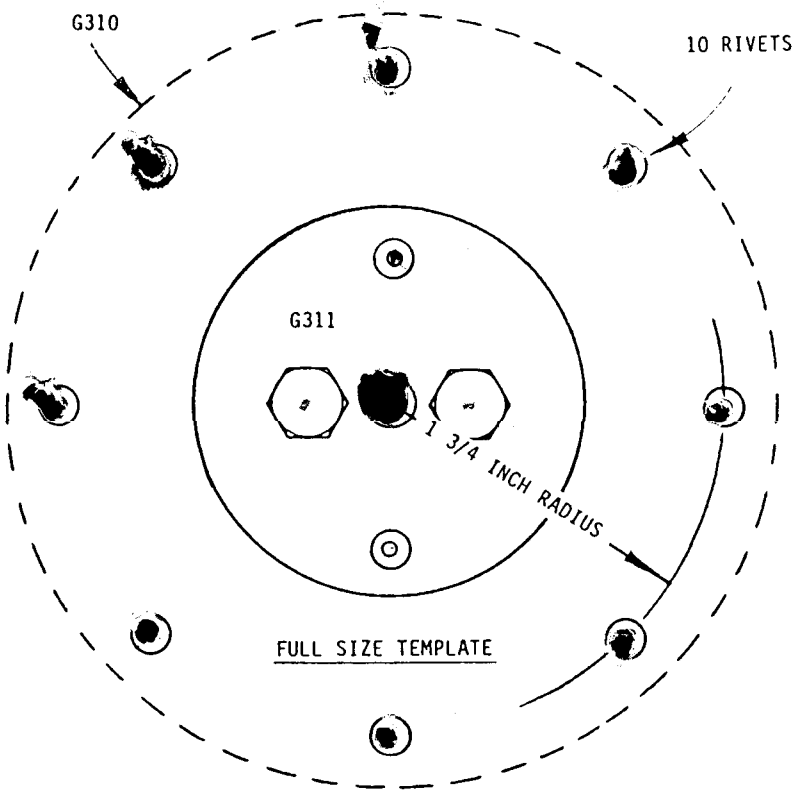
5.8 WHEELPANT ASSEMBLY AND INSTALLATION

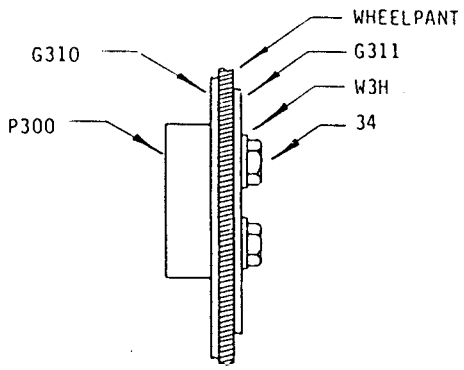
NOTE: Before the wheelpants are permanently installed on the aircraft, they should be degreased, lightly sanded with No. 400 wet or dry sandpaper, and painted as required to match your Lazair. However, because of the possibility of scratching the paint during installation, it is recommended that the wheelpants be fitted as described below before painting.

5.8.1 Using a G311 small tuit as a template, drill the two 3/16 inch mounting holes in the outboard side of each wheelpant as shown. Use a 1/4 inch bolt through the predrilled hole in the wheelpant to locate the tuit, and rotate the tuit so the two 3/16 inch holes are on a line parallel to the chord line of the wheelpant.



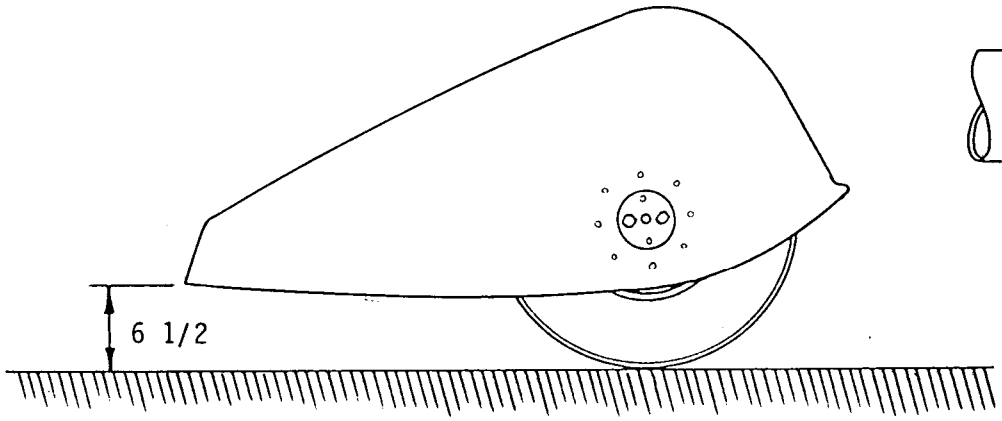
5.8.2 Check the fit of the P300 wheelpant mount plugs in the ends of the A301 main axle. To facilitate assembly, the plugs should fit tightly enough to stay in place. If necessary squeeze the *end* of the axle tube *slightly* to obtain a tight fit with the plug. Bolt the plug, a small tuit (G311) and a large tuit (G310) to the wheelpant as shown. Drill and rivet the wheelpant-on-tuit sandwich as shown.
The rivet pattern may be laid out using the 1 3/4 inch rivet circle radius, or by using the full size template provided on the next page.

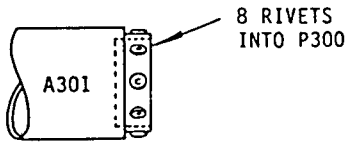




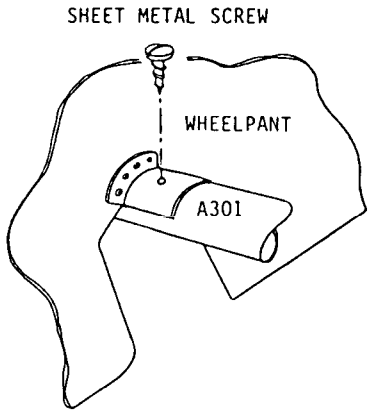
NOTE THAT THE P300 PLUG AND G310 TUIT ARE INSTALLED INSIDE THE WHEELPANT.

5.8.3 Install the wheelpants on the aircraft and tap the P300 plugs into the ends of the axle tube. Adjust the position of the wheelpants so that with the T23 boom level, the trailing edge of the wheelpant is 6 1/2 inches from the floor. Without moving the P300 plugs, carefully unscrew the 34 bolts and remove the wheelpants. Rivet the P300 plugs in place with eight stainless steel rivets in each as shown.





5.8.4 Reinstall the wheelpants. Drill the tab on the inboard fittings with a 3/32 inch drill and install the sheet metal screws as indicated.



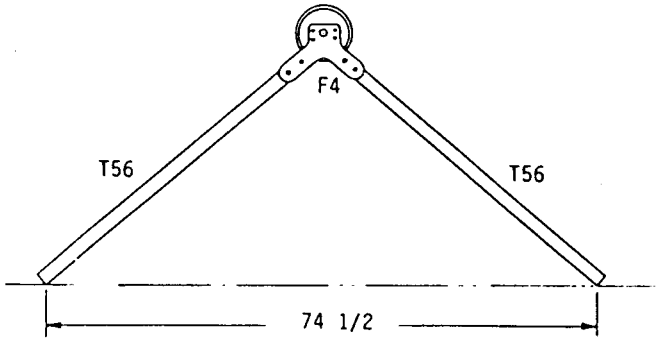
5.8.5 To prevent scratches or damage to the wheelpants, it is recommended that they be removed and stored in a safe place until the tail assembly has been completed.

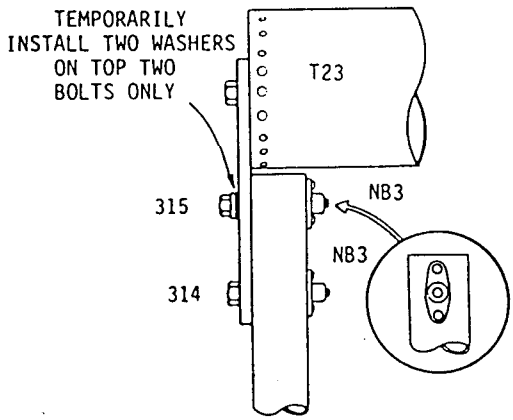
SECTION 6

TAIL ASSEMBLY

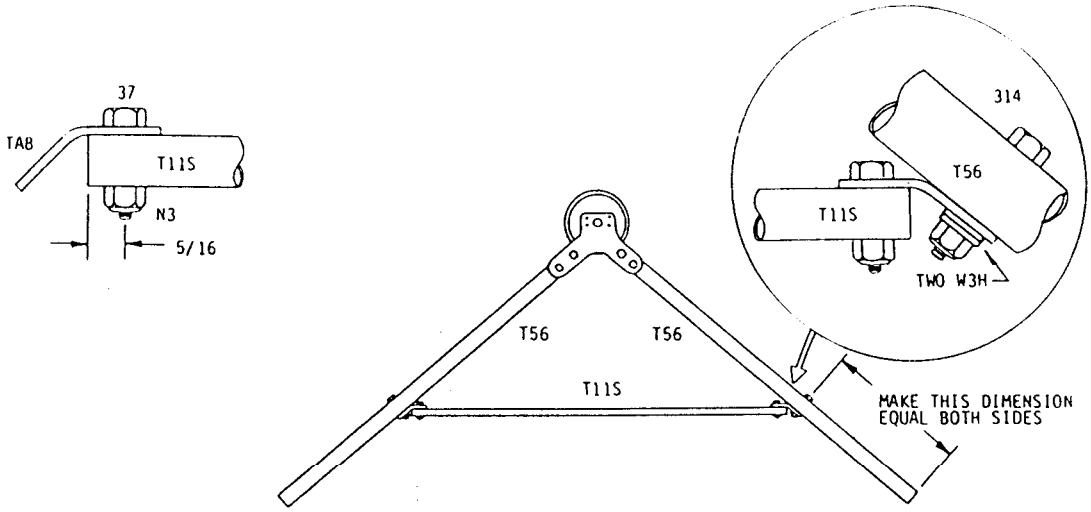
6.1 STABILIZER ASSEMBLY

6.1.1 Insert P8 plugs into one end of each of the two rear stabilizer tubes, T56. Clamp the plugged end of the T56's to F4 as shown below. Make sure there is a gap of 3/16 of an inch between the end of each T56 and the boom T23. Using F4 as a template, drill 3/16 inch holes in the T56's (and P8's) and bolt the T56's in place using the hardware shown. Note that NB3 nutplates are used as nuts. After tightening the bolts, drill and rivet the nutplates to the T56's as indicated. Note that two bolt sizes are used.





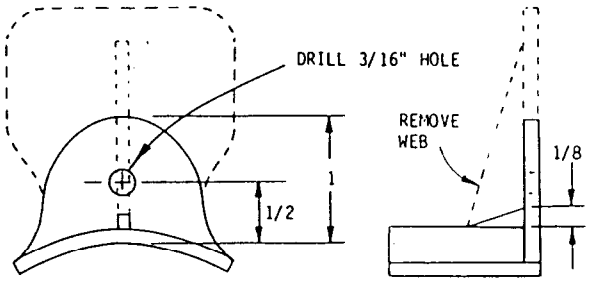
6.1.2 Bolt a TAB to each end of the spreader T11S as indicated. *Make sure that the two bolt holes are parallel to each other.* Bolt the spreader to the T56's as shown.



6.1.3 Modify two F32 pushrod guides as shown in the figure. These will be referenced as F32C and F32D as indicated. Locate the 9/32 inch holes using the upper dimples in the F32. Chamfer the edges of the 9/32 inch holes with a larger drill (do this by hand so the drill doesn't grab suddenly and make an oversize hole).

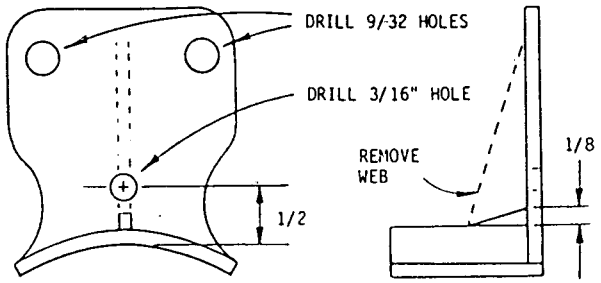
F32C

MAKE ONE ONLY

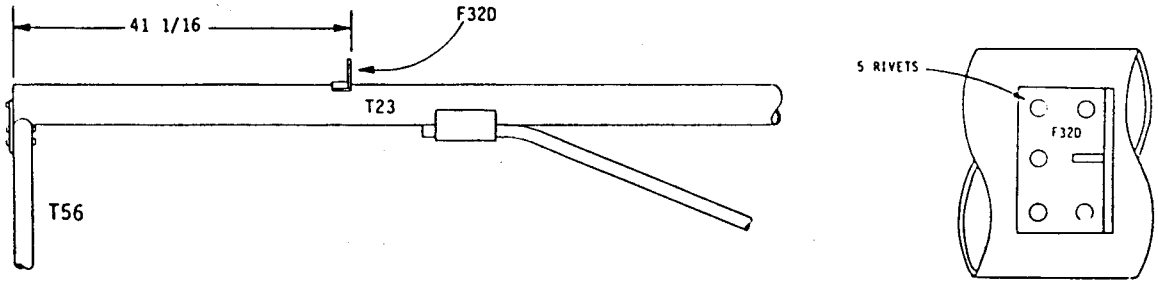


F32D

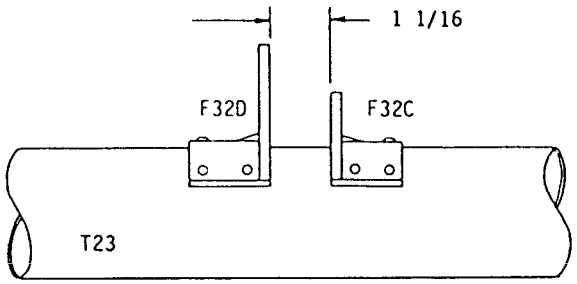
MAKE ONE ONLY



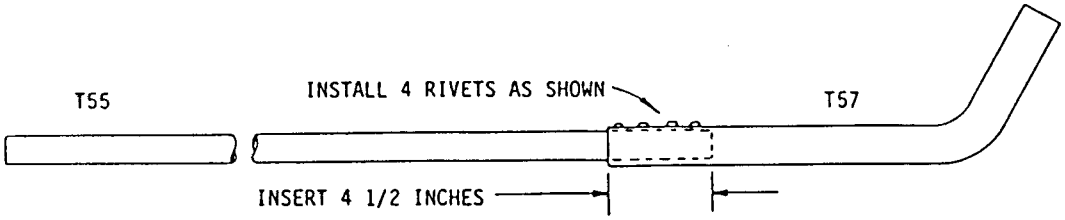
6.1.4 Mount the F32D to the boom with five rivets as shown. Make sure the top edge of F32D is parallel to the axle.



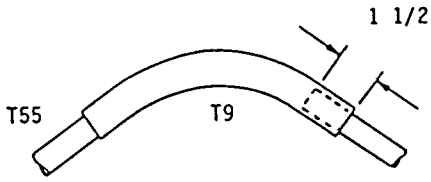
6.1.5 Using a bolt or drill to align the 3/16 inch holes, locate F32C as shown below and rivet it to the boom with 5 rivets



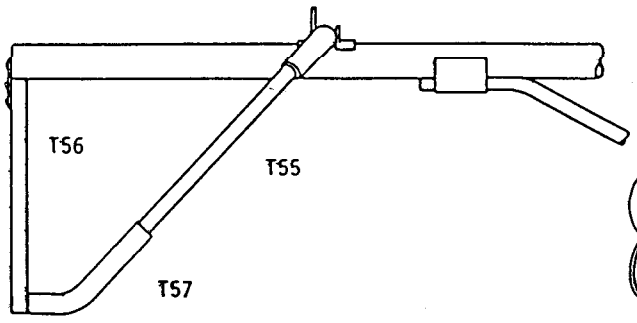
6.1.6 Rivet a T57 Stabilizer Outboard Tube to one end of each T55 Stabilizer Front Tube as shown.

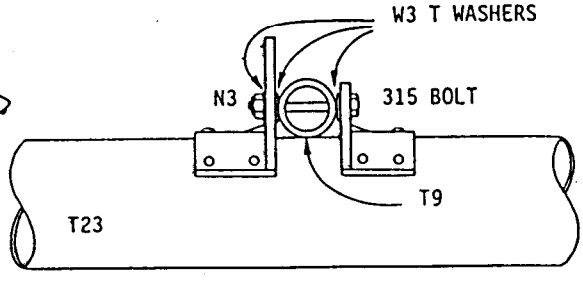


6.1.7 Insert the free end of each T55 into the T9 Bent Stabilizer Tube to a depth of 1 1/2 inches as shown. *Do Not* rivet to T9 at this time.



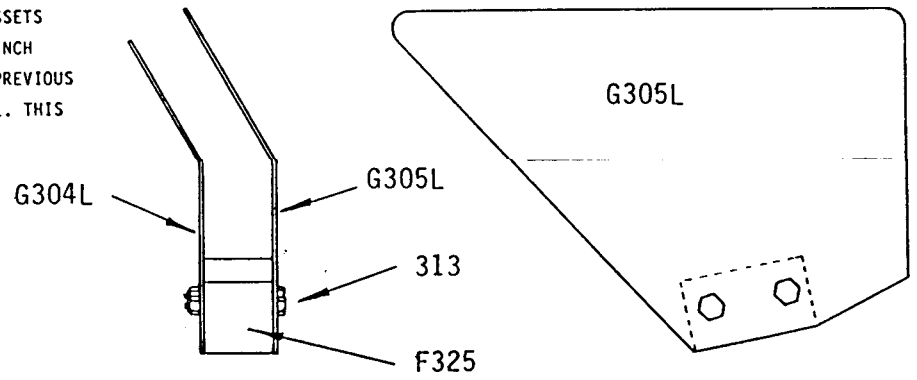
6.1.8 Fit T9 between F32C and F32D. Rotate the T55's in T9 so that T55, T57 and T56 form a flat plane and tape the T57's to the T56's as shown below. Drill and bolt T9 to the F32's as indicated.



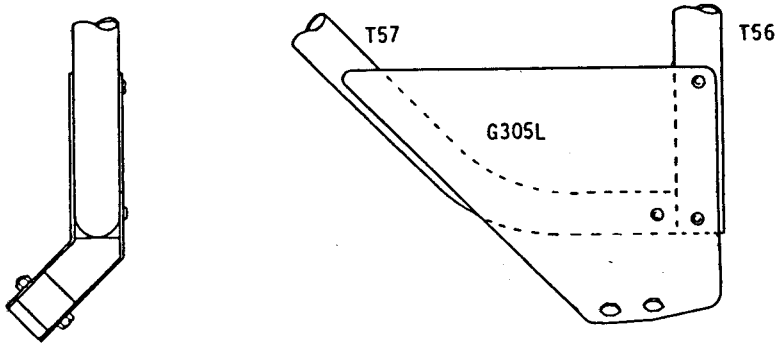


6.1.9 Make up two tailwheel gusset assemblies by temporarily bolting the gussets to the F325 tailwheel mount block. Note that the figure shows the left assembly. Use G304R and G305R for the right assembly.

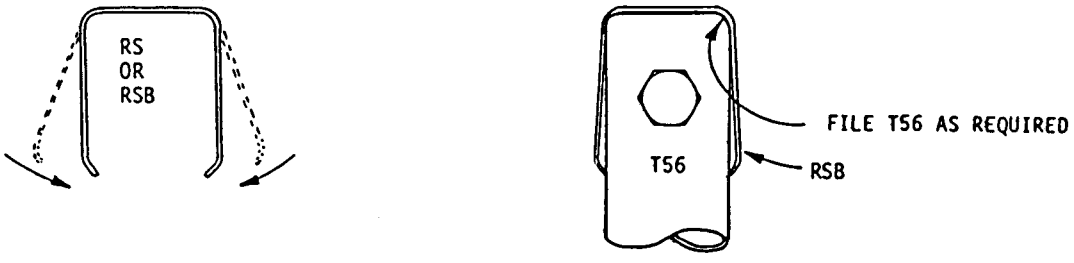
NOTE: SOME G304/305 GUSSETS MAY HAVE AN EXTRA 3/16 INCH HOLE TO ACCOMODATE THE PREVIOUS (NON-PIVOTING) TAILWHEEL. THIS HOLE SHOULD BE IGNORED.



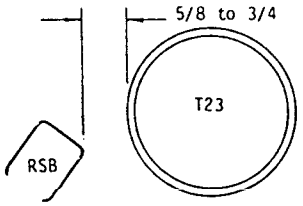
6.1.10 Fit the gusset assembly over the T56/T57 junction as shown and rivet in place with one rivet only through G305 into T57 and two rivets into T56. The balance of the rivets will be installed later (Step 6.1.13).

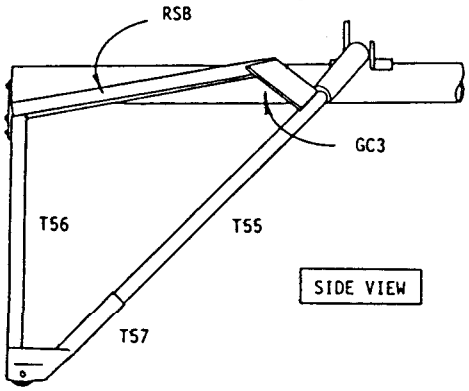


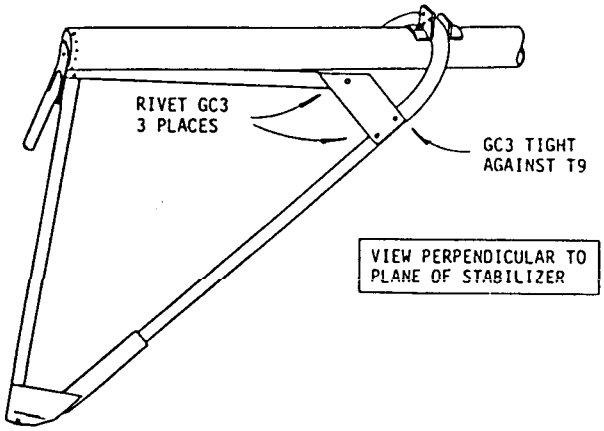
6.1.11 Bend the sides of stabilizer ribs RS and RSB by hand if necessary so that the sides are parallel as shown at left. File the top corners of T56 to allow RSB to fit tightly as shown at right.



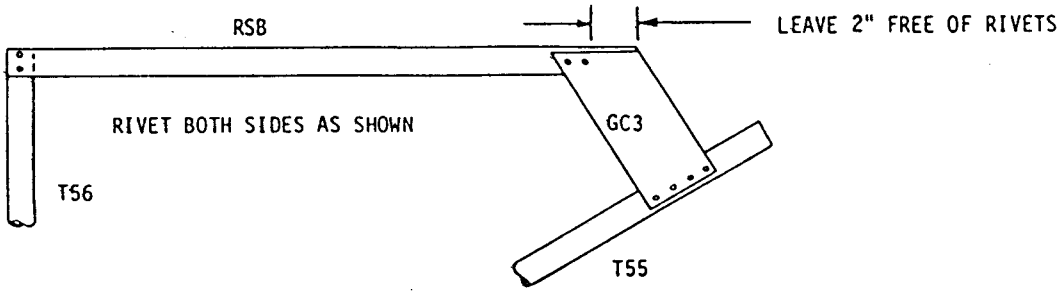
6.1.12 Round the corners on GC3 gussets. Assemble RSB and GC3 as shown. With the aid of a friend (or a few sticks of wood and half a roll of masking tape) hold RSB and GC3 in place while you sight the stabilizer from several feet away. *Make sure T56, T55 and RSB form a flat plane.* RSB should be positioned tightly against the top of T56 at one end (as shown in the figure for step 6.1.11) and 5/8 to 3/4 of an inch from the Boom at the other end. When all the components are properly aligned, put two rivets through GC3 into T55 and one into RSB as indicated. Put one rivet through RSB into T56. Then remove the stabilizer and place it *on a flat surface* before continuing.



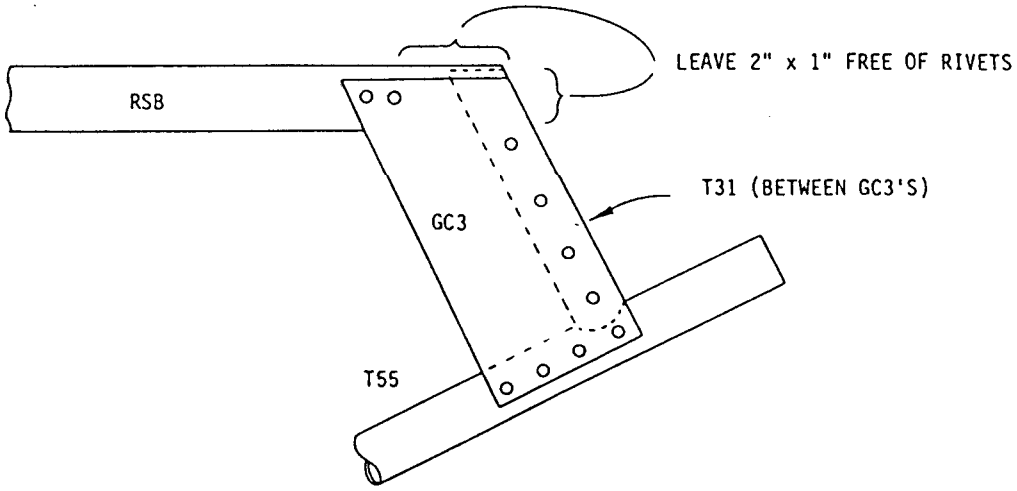




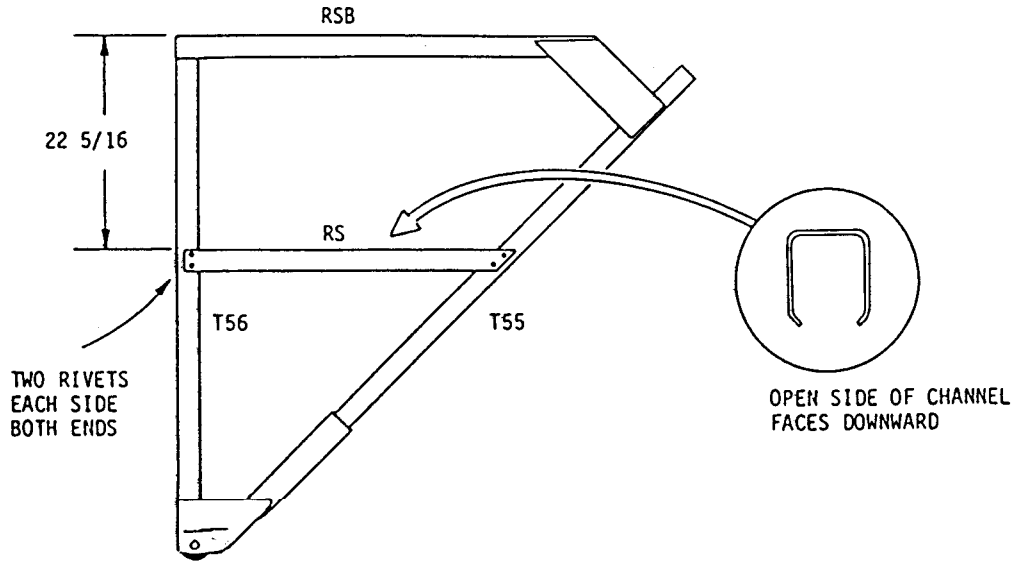
6.1.13 With the stabilizer on a flat surface, complete riveting as shown below. Turn the stabilizer over and rivet another GC3 in place on the bottom surface. Make sure RSB is riveted to T56 on each side. RivetG304 and G305in place with a total of 8 rivets into T56 and 6 rivets into T57 through each gusset.



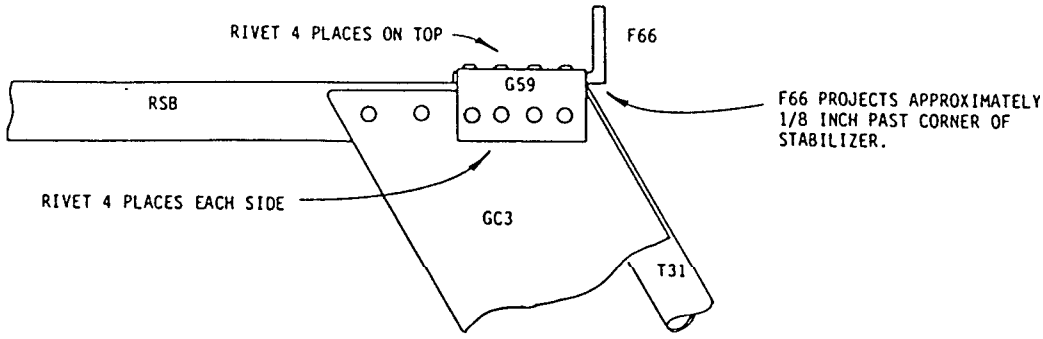
6.1.14 Cut and file the ends of short stabilizer tube T31 to fit between T55 and RSB and between the GC3's. Rivet in place as shown (both sides).



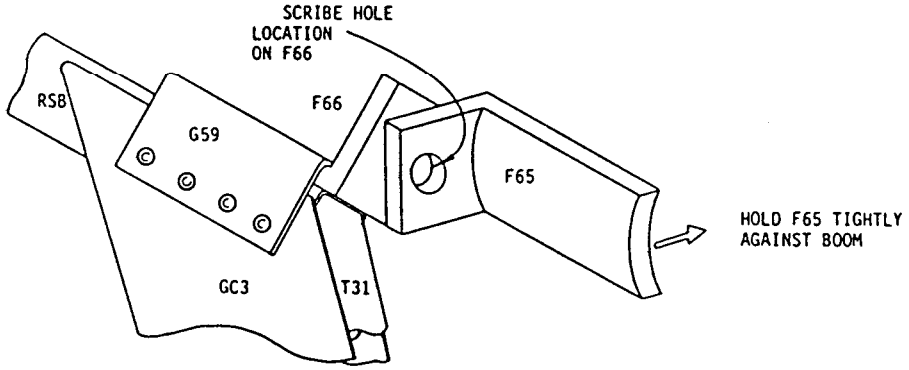
6.1.15 Cut and file the ends of stabilizer rib RS to fit T56 and T55. Rivet in place as shown. Make RS parallel to RSB.



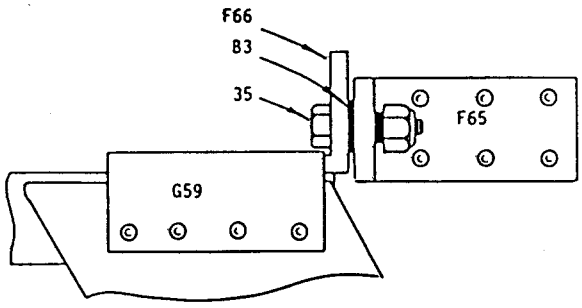
6.1.16 Rivet the Stabilizer half of the hinge F66 to the forward corner of each stabilizer using clamp G59 as shown.



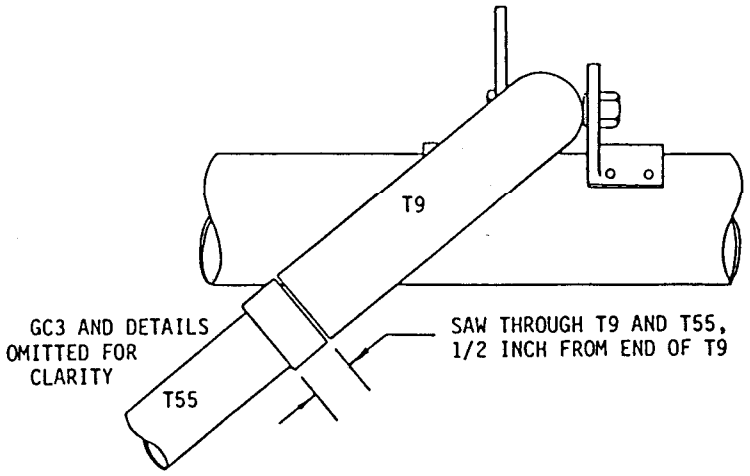
6.1.17 With the Stabilizers installed on the aircraft, hold the boom half of the Stabilizer hinge F65 in position as shown and mark the location of the Pivot Hole in the F66's. Note that the Pivot Hole need not be in the centre of F66, but it should be located such that there is sufficient space for the head of the 35 bolt as shown in step 6.1.18. Drill a 3/16 inch Pivot Hole in F66.



6.1.18 Bolt the hinge halves together using a 35 bolt and B3 bearing as shown. Make sure that the bearing is clamped securely to F66 and F65 rotates on the bearing. Enlarge the hole in F65 slightly if necessary. Rivet the F65's to the boom with 6 stainless steel rivets in each as shown.

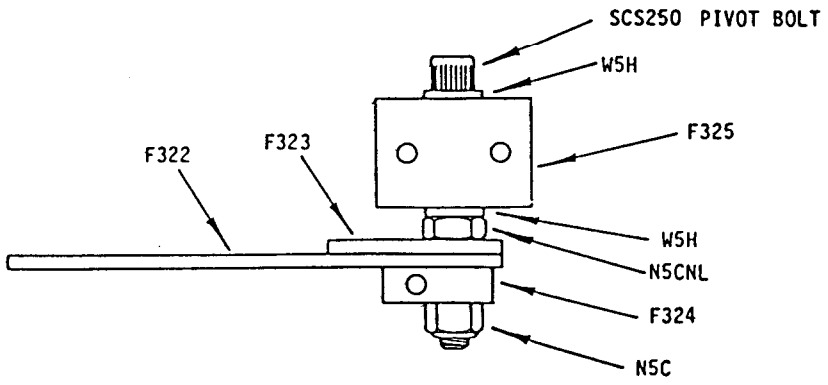


6.1.19 With the Stabilizer in place, saw through T9 and both T55's as shown. Make sure that the saw cut is perpendicular to the axis of T55. This allows the Stabilizers to be folded for storage or transit.

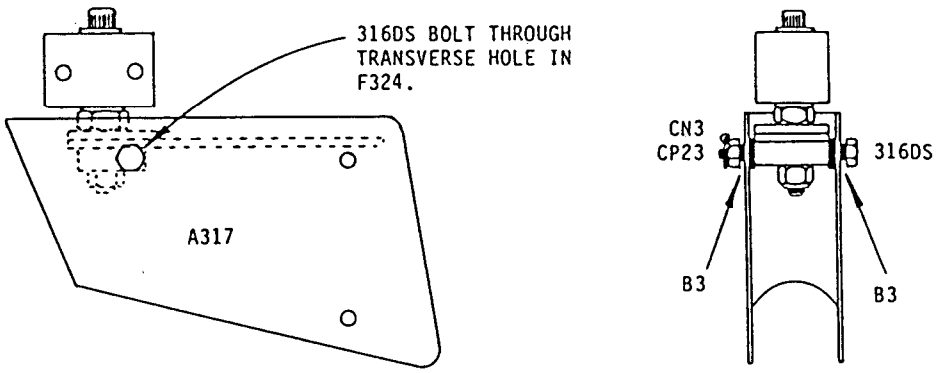


6.1.20 To check that the tail folds properly, remove the T11S spreader. Remove the two *top* bolts (315's) holding the T56's to F4 and loosen the two bottom bolts (314's) — see the figure in step 6.1.1. The tail should now fold, using the 314 Bolts as hinge pins.

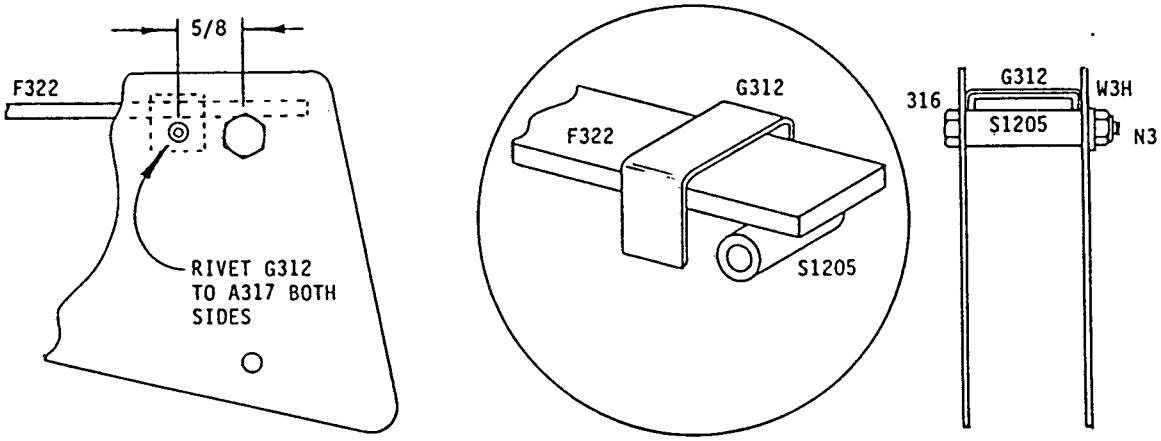
6.1.21 Remove the F325 tailwheel mount blocks from the aircraft. Grease the SCS250 pivot bolt and assemble the two tailwheel spring and pivot assemblies as shown. The nut between F325 and F323 should be adjusted so that F325 will rotate freely on the bolt but there is little or no end play. Then, while holding this nut with an open end wrench, the other nut (on the end of the bolt) should be tightened to clamp F322, F323 and F324 securely. It may require several attempts to adjust both of these nuts to achieve the required freedom of rotating for F325.



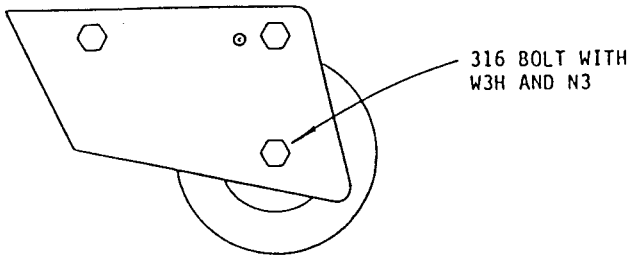
6.1.22 Fit each spring and pivot assembly into a tailwheel pant (A317) as shown. Adjust the CN3 so that A317 will move freely, and pin the nut with a CP23 cotter pin. Make a left and right assembly by inserting the two 316DS bolts in opposite directions. (The left assembly is shown in the figure).



6.1.23 Install the S1205 spacer with a 316 bolt (below the F322 leaf spring). Install the G312 stop and rivet in place as shown to retain the spring. Note that the spring should not be *clamped* by G312 (about 1/16 of an inch play is acceptable).



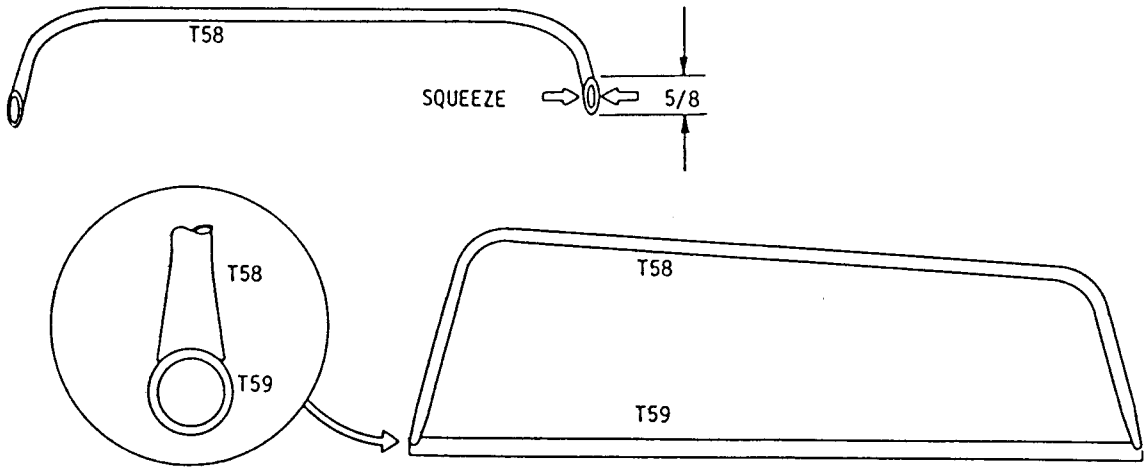
6.1.24 Install the tailwheel and axle assembly with a 316 bolt as shown.



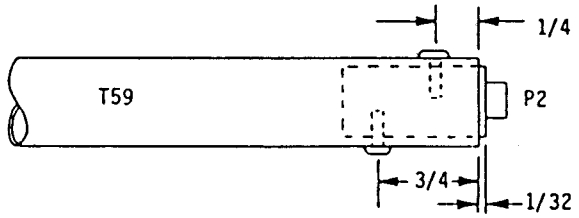
6.1.25 Reinstall the F325 mount blocks on the aircraft. Check that the tailwheel assembly rotates freely on its pivot bolt. Press down on the top of the tail and check that the tailwheel springs deflect.

6.2 RUDDERVATOR ASSEMBLY

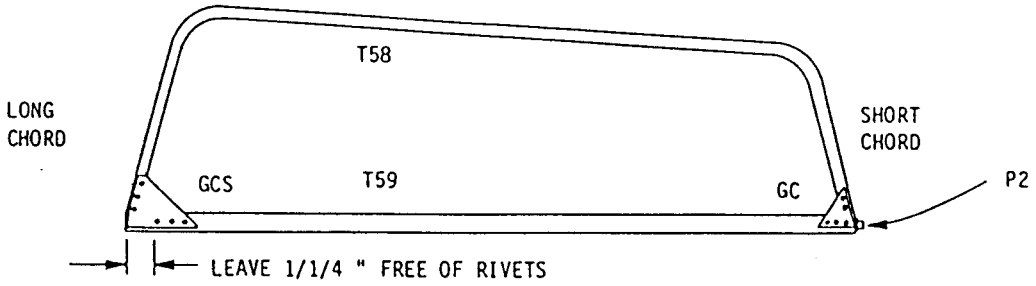
6.2.1 Squeeze the ends of the bent ruddervator tube T58 as shown, then file the ends to fit the torque tube T59.



6.2.2 Insert a P2 ruddervator hinge plug into one end of each torque tube T59 and rivet as shown.

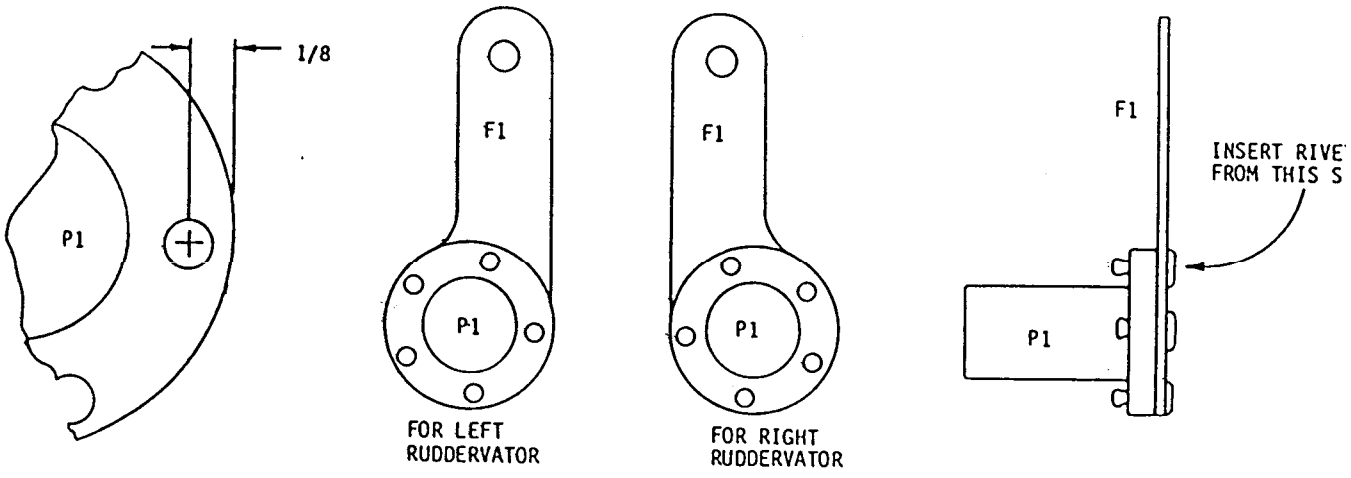


6.2.3 Fit T58 to T59 as in step 6.2.1. Trim GC gussets as required to fit as shown, and round the corners of the GC and GCS gussets. Rivet the gussets in place as shown (both top and bottom). Use five rivets in each GC and six in each GCS. Build the ruddervator on a flat surface and make sure that T59 is rotated such that the rivets installed in step 6.2.2 do not interfere with the GC gussets. Note that the end of the ruddervator with the shorter chord is joined to the end of T59 containing P2.

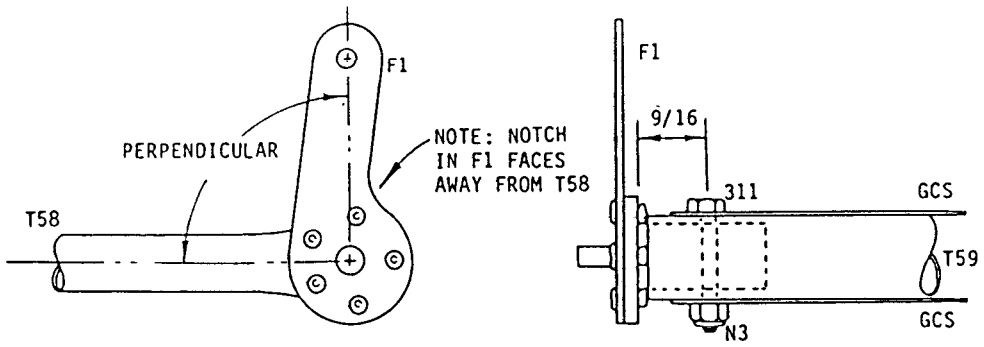


6.2.4 Sand or file the edges of Ruddervator Horn F1 to remove tooling marks, and drill out the hole in the large end to 1/4 inch diameter. Fit F1 over the stud on the end of the Ruddervator Plug P1 and Rivet in place with 5 Stainless Steel Rivets as shown.

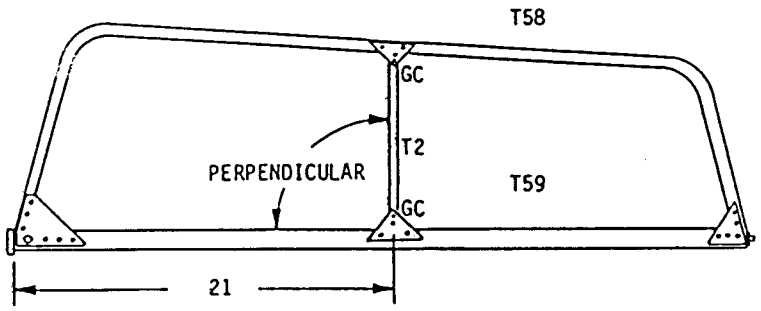
NOTE: *It is possible to install the rivets very close to the edge of P1 and leave enough space for the end of T59 to fit inside the rivet pattern. However, it is easier to install the rivets as shown below and allow the end of T59 to butt against the end of the rivets as shown in the figure for Step 6.2.5.*



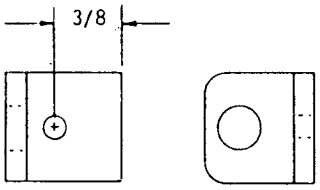
6.2.5 Insert P1 into the open end of T59 and bolt in place as shown. Note that the head of the bolt is on the top surface of the Ruddervator (the side from which F1 projects).



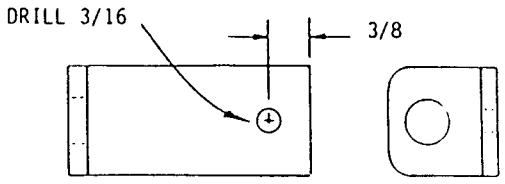
6.2.6 Rivet ruddervator rib T2 into position as shown, using four GC gussets. Trim T2 to length if necessary to keep T58 and T59 straight. Use four rivets in each GC.



6.2.7 Round the corners on Ruddervator Hinges F5 and F64 as shown and remove all burrs and sharp edges from the predrilled 3/8 inch holes. Drill 3/16 inch mounting holes as indicated.

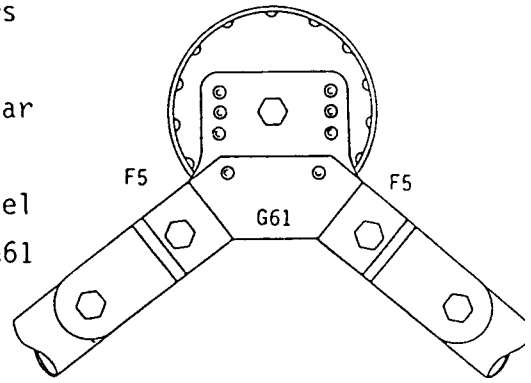


F5

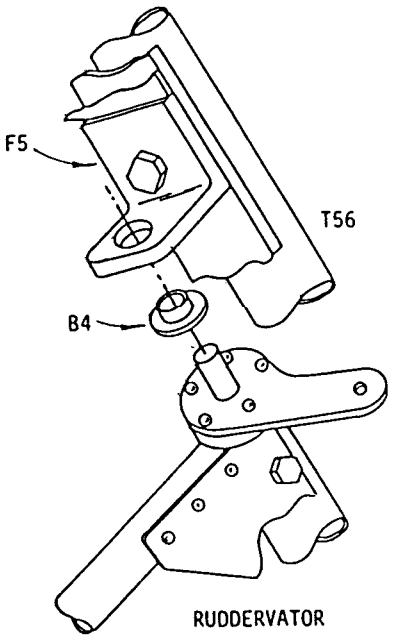


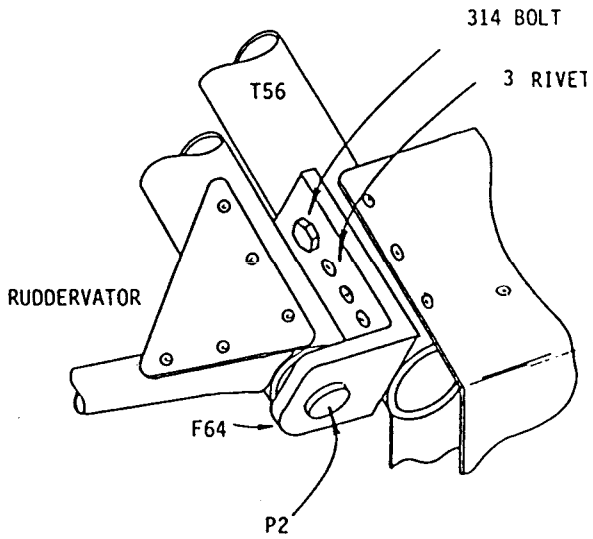
F64

6.2.8 Bolt the F5's in place using the two top bolts on F4 (remove the two washers installed in step 6.1.1). Make sure the surface of the F5's is perpendicular to the axis of T56 and rivet the hinge lock G61 in place with 2 stainless steel rivets as shown. Make sure that the G61 is tight against the F5's to prevent them from rotating.



6.2.9 Fit the top of the ruddervator into F5 with a B4 Bearing as shown at left below. Make sure the B4 is properly seated, then fit the F64 over the end of P2 and locate it as shown at right below. Make sure the ruddervator fits properly (T59 is parallel to T56 and there is no end play), then mark the location of F64. Remove the ruddervator and bolt and rivet F64 to T56 as shown.

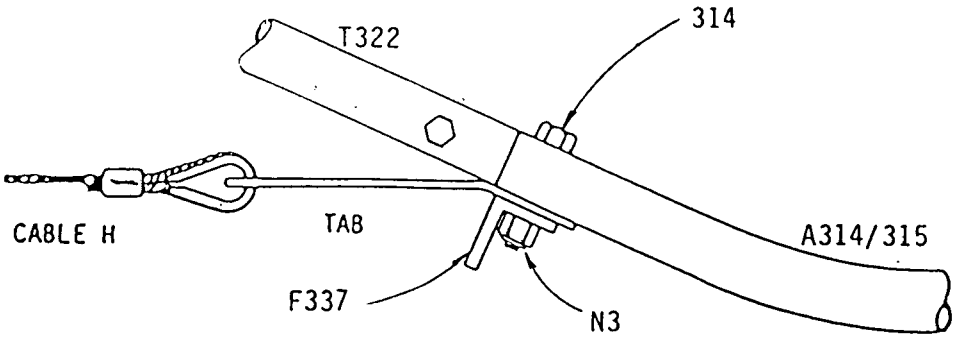




6.2.10 Reinstall the ruddervators (it will be necessary to remove the bolts in the F5's) and check that they move freely but without excessive end play.

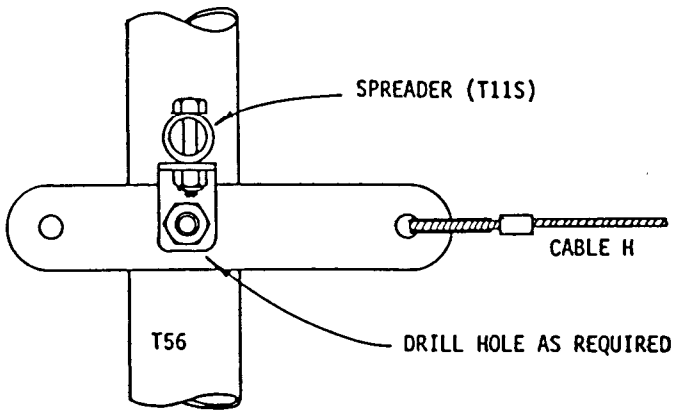
6.3 DRAG CABLE INSTALLATION

6.3.1 Install the Cable H Assemblies on the bolts at the junction of the T322's and A314/315 as shown. Do not tighten the nuts at this time.



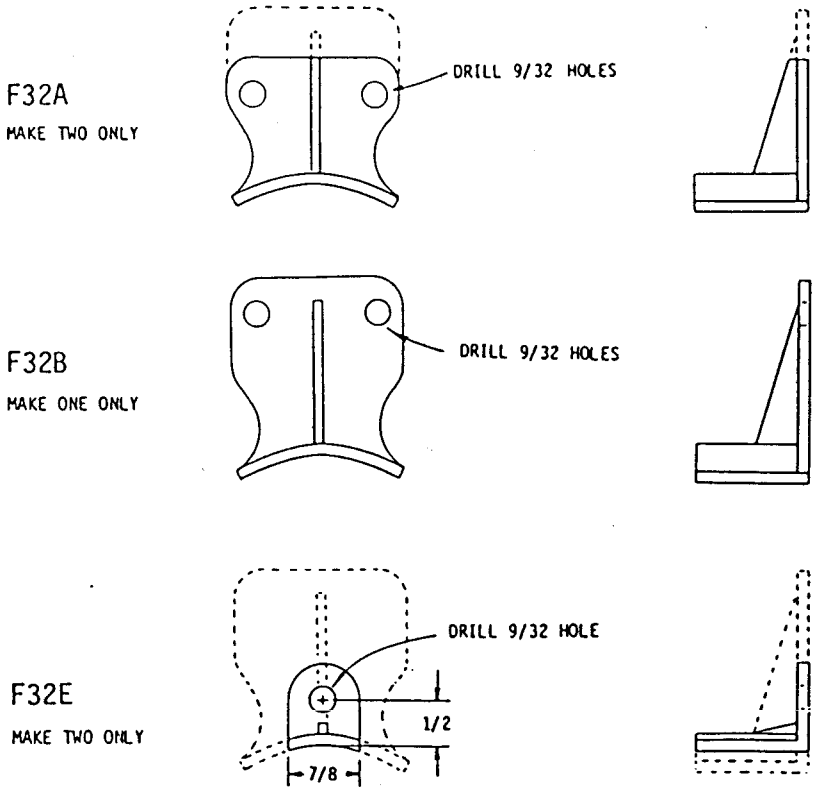
6.3.2 Pull the cables tight and make sure there are no kinks or tangles. Note that the cables are crossed (so that one runs from the right front to the left rear, and one from the left front to the right rear).

6.3.3 Pull the cables into position and mark the location for the holes in the rear cable tabs. Drill the tabs and bolt to the T56's as shown using the 314 bolts which hold the spreader in place. Note that the cables should be tight enough to be free of bends but there should not be any appreciable tension in the cables at this time. Do not cut the ends off the tabs until after final adjustment of cable tension in Section 7.

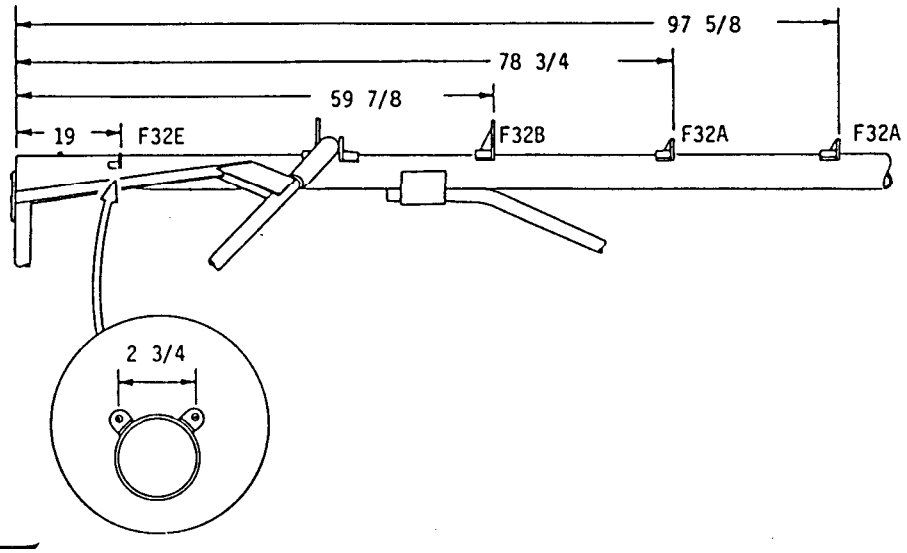


6.4 RUDDERVATOR PUSHROD INSTALLATION

6.4.1 Make F32A's, F32B, and F32E's as shown. Drill holes in the F32B in the top dimples and in the F32A's in the bottom dimples. Chamfer the holes as in step 6.1.3.

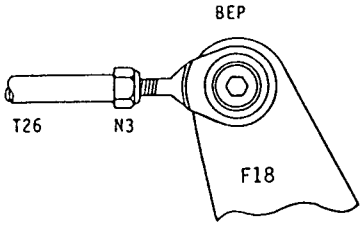


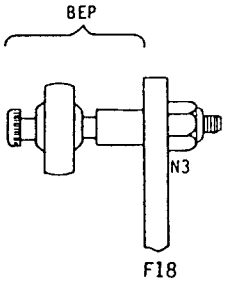
6.4.2 Rivet the F32's in place as shown. Use five rivets each in the F32A's and F32B, and three rivets in each F32E. Note that the F32A's and F32B are on the top of the boom in line with F32C and F32D. The F32E's are mounted with 2 3/4 inches between hole centres as shown in the inset.

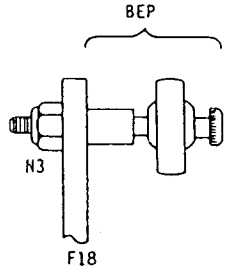


6.4.3 Insert the ruddervator pushrods T26 through the holes in the F32's. Put nuts on two BE rodends (nylon end first as in step 3.9.1) and thread the BE's into the ruddervator end of the T26's.

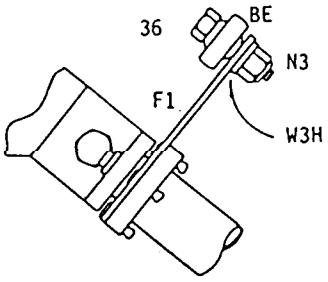
6.4.4 Similarly, put nuts on the BE's which are part of the pinned rod end assemblies (BEP) and thread the BEP's into the mixer end of the T26's. Insert the BEP pins through the holes in the F18 mixer plates and put on N3 nuts as shown. Be careful to avoid overtightening the nuts and distorting the aluminum alloy shoulder standoff on the BEP's.







6.4.5 Bolt the BE RodEnds to the F1 Ruddervator horns as shown using 36 Bolts and N3 Nuts with W3H washers.



6.4.6 Check that the ruddervator controls work smoothly and without excessive play. The final adjustment of the control linkage is described in section 7.

6.4.7 Set the control stick to neutral using the position of the F18 mixer bellcrank as a reference (as defined in the figure for Step 5.5.24). Check that both ruddervators are at or near their neutral position (aligned with the stabilizer). Adjust the length of the T26 pushrod assemblies if necessary.

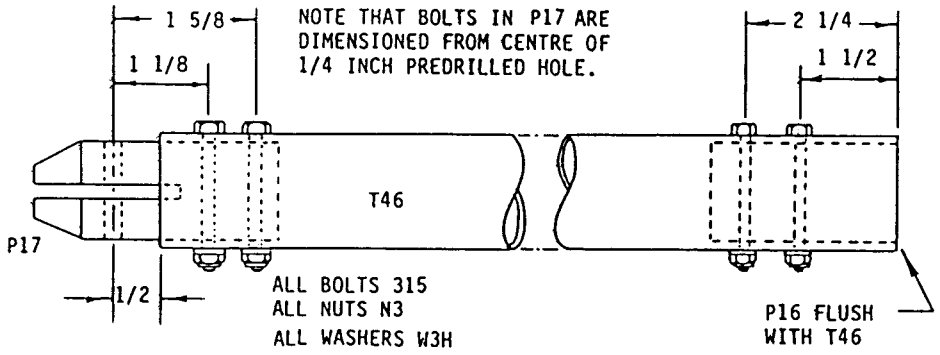
6.4.8 Coat the T26 pushrods with vaseline where they pass through the F32 guides to reduce the squeaking. Check that the ruddervator controls work smoothly without excessive force and without excessive play. Final calibration of the control system is described in Section 7.

SECTION 7

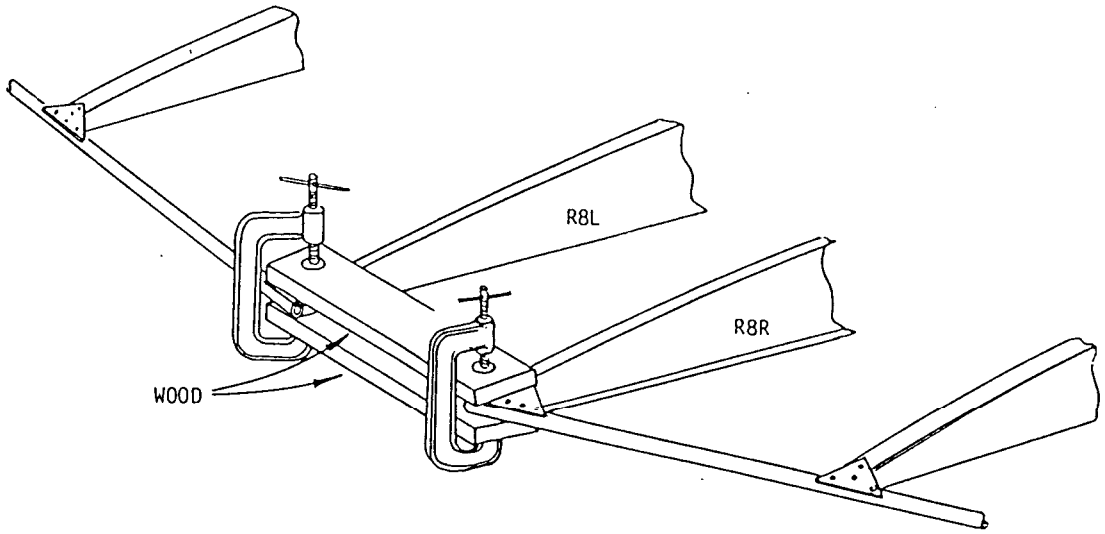
WING TO FUSELAGE MATING

7.1 WING AND STRUT INSTALLATION

7.1.1 Assemble the two lift struts as shown below. Note that all four bolts should be parallel to the 1/4 inch predrilled hole in P17.

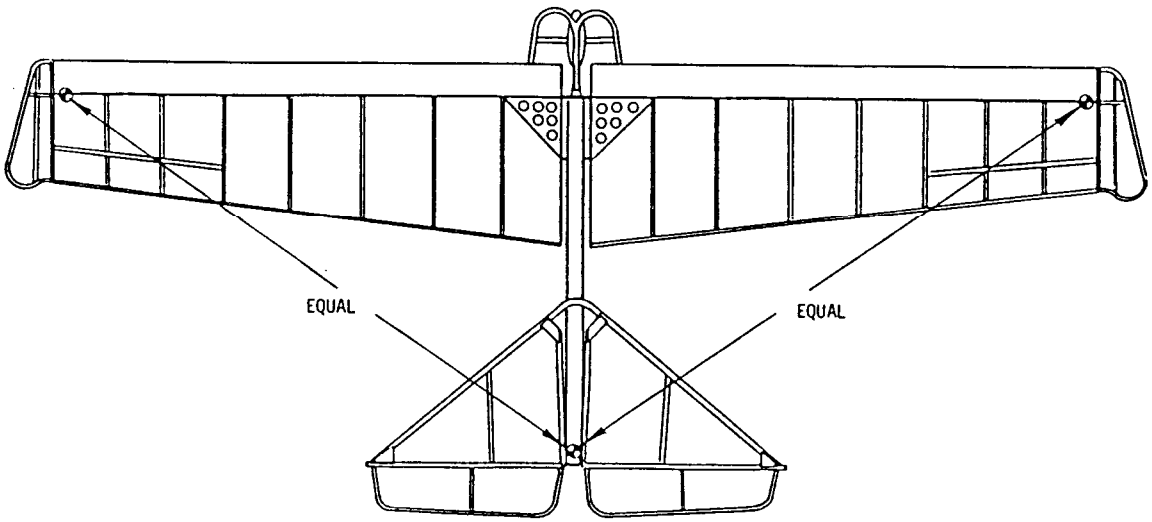


7.1.2 With the aid of at least one assistant, fit the wings onto the fuselage. Secure the wing roots with a 46 bolt through each forward wing attach fitting. Support the wing tips so that both wings are approximately level. Sight along the leading edge and adjust the fore/aft position of one wingtip until the leading edge is straight. Clamp the trailing edge of the wing with two C-clamps and two pieces of wood as shown to maintain the correct separation between the wings at the trailing edge.

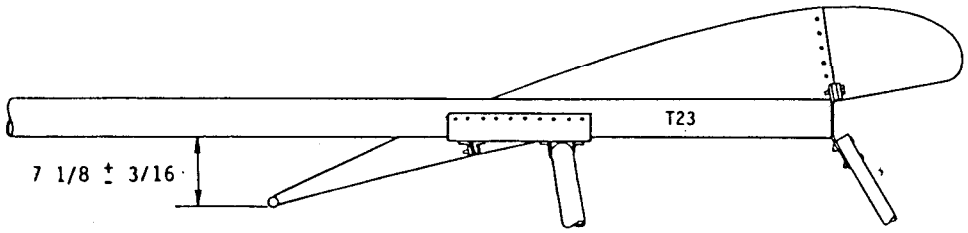


7.1.3 Install the F35 rear spar fittings between F22 and F23 and pin with a 46 bolt. Make sure the outboard end of the F35 goes through the slot in the root rib and fits against the F34.

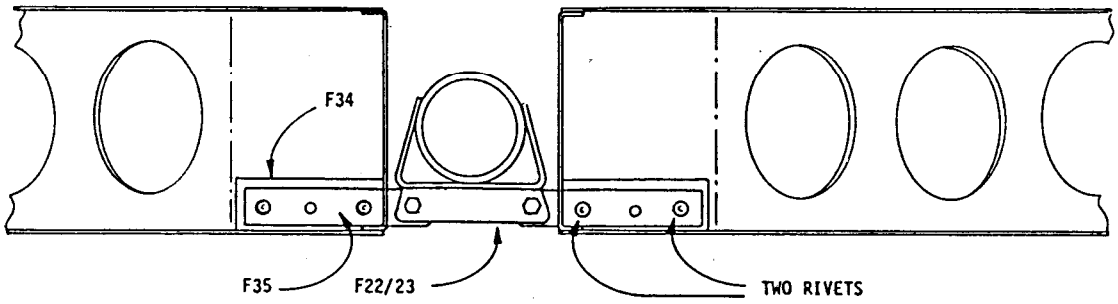
7.1.4 Put a mark on the top of each D-cell (equidistant from the centreline as shown). Put another mark on the top of the boom near the tail. Measure the distance from each mark on the wing to the mark on the tail. Adjust the position of the wing so that this distance is the same for the left and right wing. Note that with the trailing edges clamped (as in step 7.1.2) the two wings will move together and the leading edge will remain straight. Mark the position of the ends of the F35's on the F34's.



7.1.5 For both wings, set the wing-to-boom angle of incidence at ten degrees by making the bottom of the trailing edge at the wing root 7 1/8 inches below the bottom of the boom. Note that this is the *vertical* distance (not a direct measurement from the boom to the trailing edge).



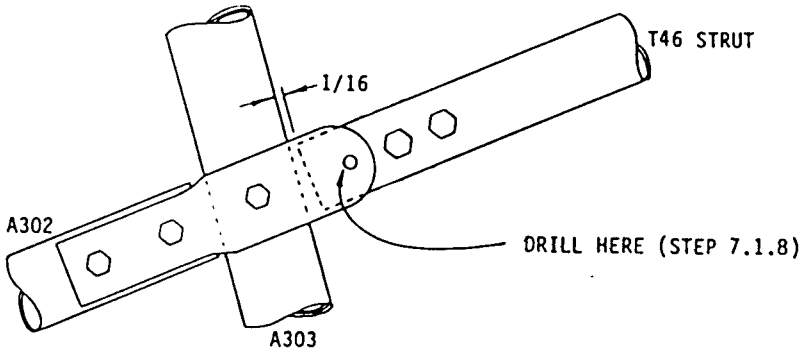
7.1.6 Make sure the F35's are still on the marks as in step 7.1.4 and temporarily rivet the F35's to the F34's with two rivets each as shown.



7.1.7 Recheck the position of the wings as in steps 7.1.4 and 7.1.6. Drill out the centre hole in each F35 to 3/16 inches and bolt with a 35 bolt. Drill out the rivets installed in step 7.1.6 *one at a time* and replace with 35 bolts.

NOTE: DO NOT FORGET STEP 7.1.7

7.1.8 Slide both struts onto the strut fittings on the wings and pin with a 414 bolt through P17. Fit the inboard end of the struts between the F301 strut fittings on the fuselage. Temporarily insert a 1/16 inch thick shim between the end of the strut and the side of the downtube. Position the strut so that the hole in the F301 fittings is on the center of the strut, and clamp the strut between the F301's with a large C-clamp (do not cover the hole in the F301's with the clamp).

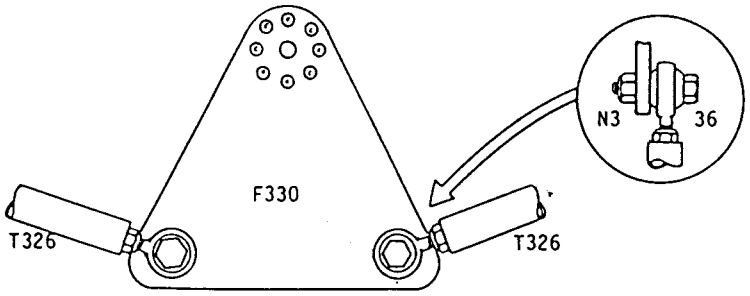


7.1.9 Using a 3/16 inch drill, drill through the strut (T46 and P16) using the hole in the F301's as a guide. Drill approximately half way through from each side to ensure that the hole is aligned with the F301 at both ends. Feed the 3/16 inch drill all the way through both F301's and the strut, then carefully enlarge the hole with a 1/4 inch drill, and insert a 417 bolt.

7.2 AILERON LINKAGE INSTALLATION

7.2.1 Assemble the two inboard aileron pushrods using T326, P3's, BE's and N3's as described in Section 3.9.1. Note that T326 is the correct length as supplied, and trimming is not required. Install the P3 plugs flush with the ends of T326.

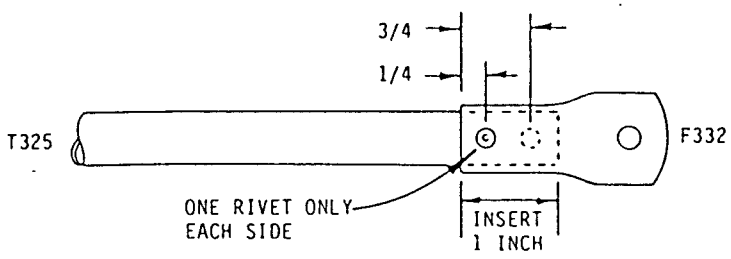
7.2.2 Install the two T326 pushrods on the F330 horn as shown.



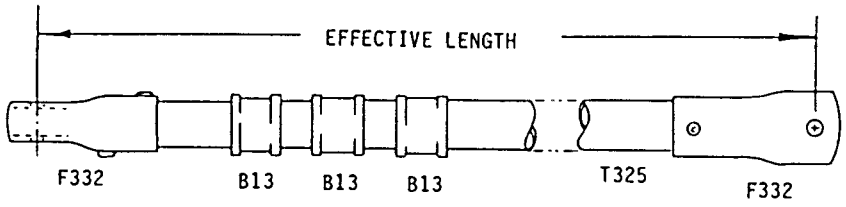
NOTE THAT THE PUSHRODS ARE INSTALLED ON THE REAR SURFACE OF F330

7.2.3 Clamp or tape the ailerons in the neutral position. Clamp, tape, or employ a friend to hold the control stick in the neutral position. While holding the T326 pushrod and the T324 pushrod in line behind the strut, carefully measure the *effective length* of the pushrod required to interconnect them (this is the distance from the centre of the hole in the rodend on T324 to the centre of the hole in the rodend on T326). Cut the long pushrods (T325) 1 3/8 inches *less* than the measured effective length. Note that the left and right side could differ slightly, so they should both be measured.

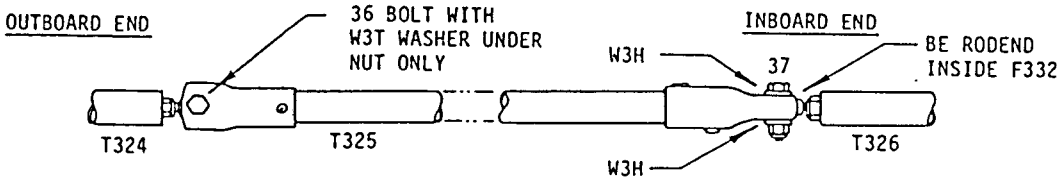
7.2.4 Fit an F332 pushrod fork over *one* end of T325 and rivet as shown.



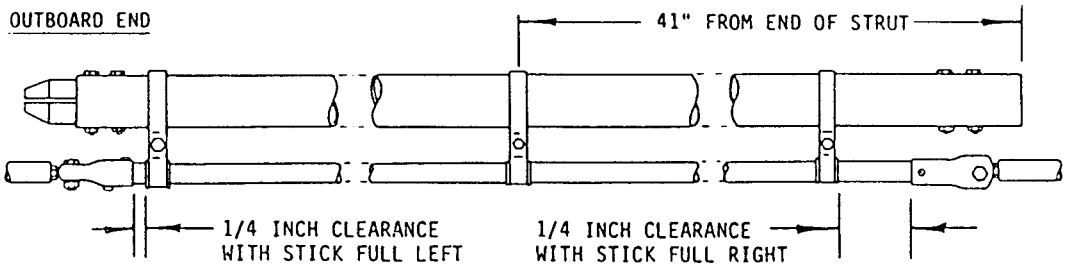
7.2.5 Slide three B13 bushings onto each T325, then install and rivet the other F332 fork. Make sure the hole-to-hole spacing is equal to the "effective length" measured in Step 7.2.3 and be sure the two F332's are perpendicular to each other as shown.



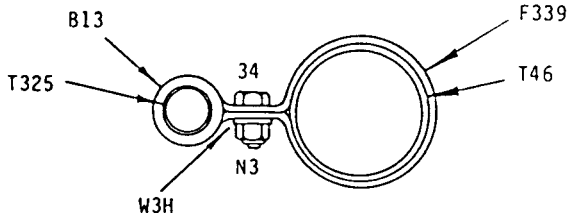
7.2.6 Install the T325 pushrod assembly on the aircraft as shown. Rotate the pushrod so the outboard (36) bolt is horizontal and the inboard (37) bolt is vertical and tighten the locknuts on the BE rodends.



7.2.7 Fit three F339 clamps around each strut (open the clamps only as much as required to fit over the strut) and clamp the T325 pushrod in place as shown. Locate the inboard and outboard F339 clamps so that when the control stick is in its limit positions (maximum left/right deflection) there is about 1/4 of an inch of clearance between the F332 forks and the B13 bushings. Make sure the T325 pushrod is directly behind the strut (and parallel to it) and tighten the clamps securely.



LEFT STRUT AND PUSHROD SHOWN



7.2.8 Move the stick and verify that the ailerons and the control linkage move freely and without excessive play. The final calibration check of the aileron control system is in Section 7.5.

7.3 DRAG CABLE ADJUSTMENT

7.3.1 Push down on the nose of the aircraft to lift the tail off the ground. Stand several feet behind the aircraft and sight the spreader (T11S) and the main axle for parallelism. Remove the cable from the *higher* end of the spreader. While holding the outboard corner of the stabilizer, pull the cable to produce

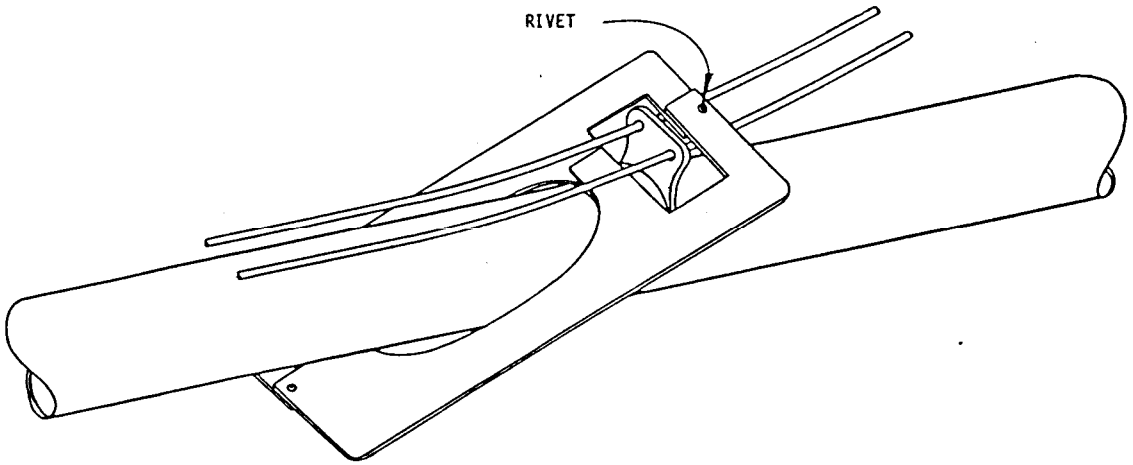
a tension of approximately 10 pounds in the cable, then drill and bolt the cable tab to T56 as in step 6.3.3. If you don't trust the calibration of your arm muscles, a fish scale may be used to pull the cable and measure the tension (the kind of scale used for *weighing* fish — not the kind they're covered with).

7.3.2 Remove the other cable from T56 and again raise the tail off the ground and sight the spreader. Adjust the tension in the cable as required to make the spreader parallel to the main axle. Clamp the cable tab to T56 until the tension is correct, then drill and bolt as before. Cut the excess length off the cable tabs and file the ends smooth.

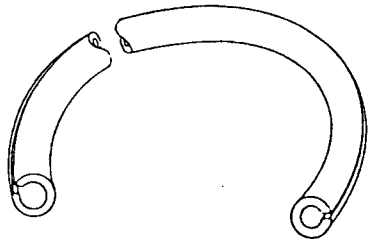
Note that if you cannot get sufficient tension in the cables, the front cable tab may be shortened.

7.4 GAP COVER INSTALLATION

7.4.1 Cut out the two pieces of .020 aluminum alloy which form the mid gap cover with tin snips. File the outside edges smooth and file the inside (curved) edges to a knife edge (to facilitate installation of the tube gap in step 7.4.3). Fit the mid gap cover halves around the boom (on top of the wing) as shown. Allow a gap of 1/4 of an inch between the gap cover and the boom on both sides and rivet the two halves of the mid gap cover together with two rivets (one 1/4 inch from the leading edge and one 1/4 inch from the trailing edge).

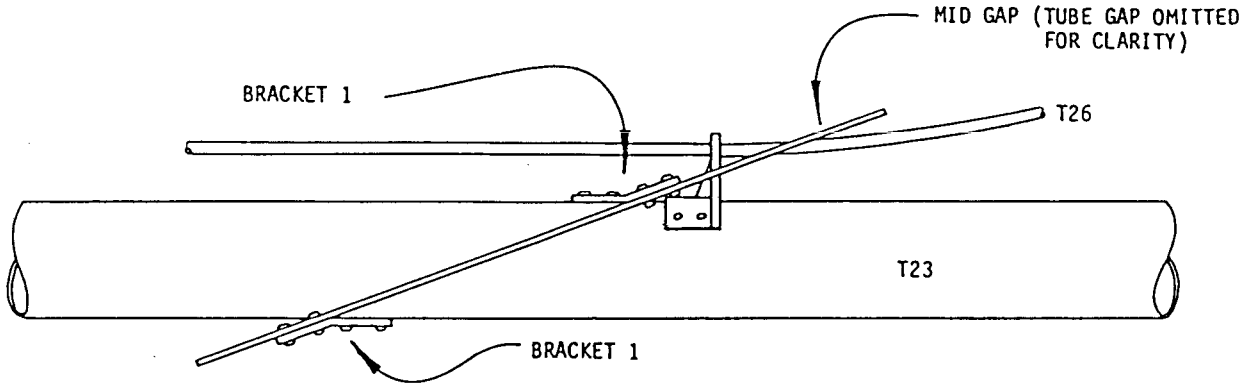


7.4.2 Using a razor knife or other sharp instrument, slit the Tube Gap as shown. If the tube gap has a natural curve, put the slit on the outside of the curve.



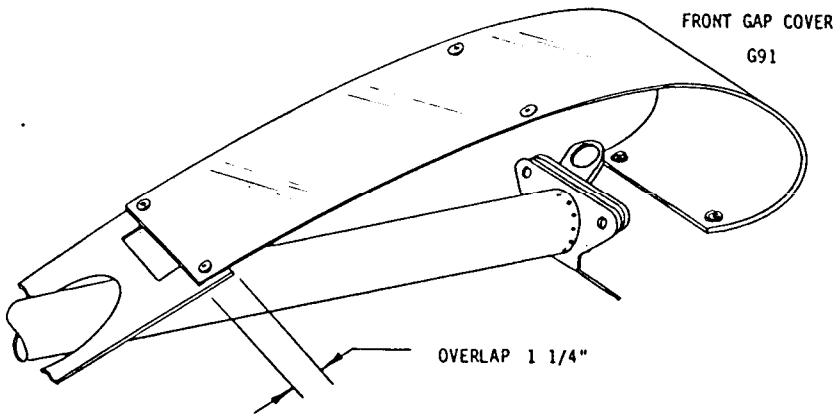
7.4.3 Fit the tube gap onto the inside edge of the mid gap cover and press into place. Position the tube gap so that the ends are under the boom.

7.4.4 Make sure the mid gap cover fits properly on top of the wings and rivet it in place using two Bracket 1's as shown. For each bracket 1 use two rivets into the mid gap cover and two rivets into T23.



NOTE: *The male snaps used for attachment of the front and rear gap covers should be installed* AFTER *the wings have been covered as in Section 9. Preliminary bending and fitting of these covers may be done as described in the following instructions before the wings are covered to lessen the possibility of damaging the wing covering material.*

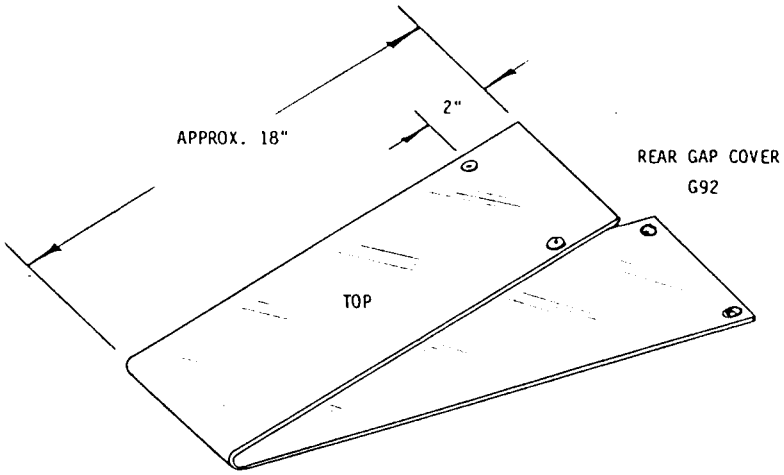
7.4.5 Fit the front gap cover G91 in place and bend it to wrap around the leading edge of the wing. Position the front gap cover so that it overlaps the mid gap cover by 1¼ inches and is centered (with an equal overlap on each wing).



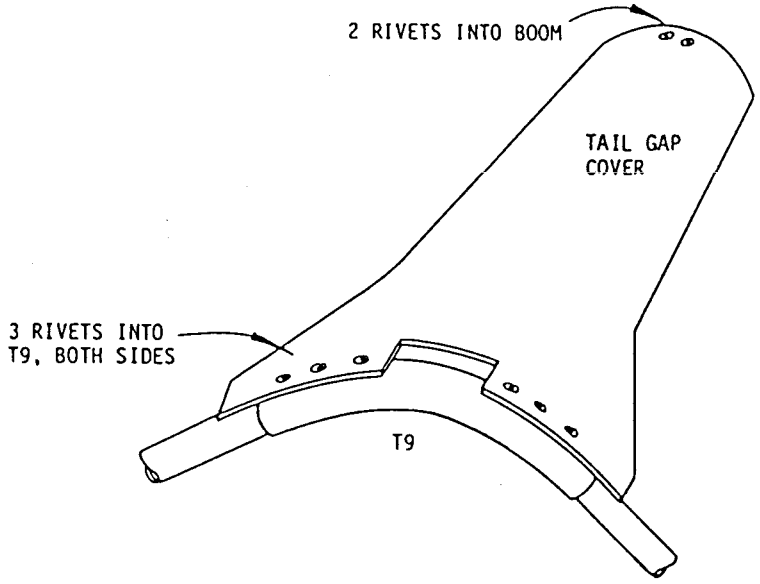
7.4.6 Tape the front gap cover in place temporarily with masking tape and drill 1/8 inch holes for installing the two aft male snaps only. Note that holes have been provided in the female snaps (part of G91) to facilitate proper alignment. Push a 3/32" drill through the hole in the snap and drill through the mid gap cover, RST L/R, and R8 L/R. *Do not* install the male snaps and do not drill the remaining holes for mounting the snaps until the wings have been covered.

7.4.7 Remove the front gap cover and enlarge the two holes in *the mid gap cover only* to 5/8 of an inch in diameter to provide clearance for the male snaps. (You may find it easier to postpone this operation until sometime when the wings are removed—but don't forget to do it).

7.4.8 Bend the rear gap cover G92 to fit over the trailing edge (using a piece of ½ inch tubing as a mandrel). Locate the bend so that the top (leading) edge of the rear gap cover will fit under the trailing edge of the mid gap cover approximately 1½ inches. *Do not drill any holes for the snaps at this time.*



7.4.9 Cut out the tail gap cover with tin snips and file the edges smooth. Bend it to form a smooth curve so that when in place it will touch T9, RSB and the two GC3's. Rivet in place as shown. Apply weatherstrip to the bottom of the edges of the tail gap cover where it contacts the stabilizer.



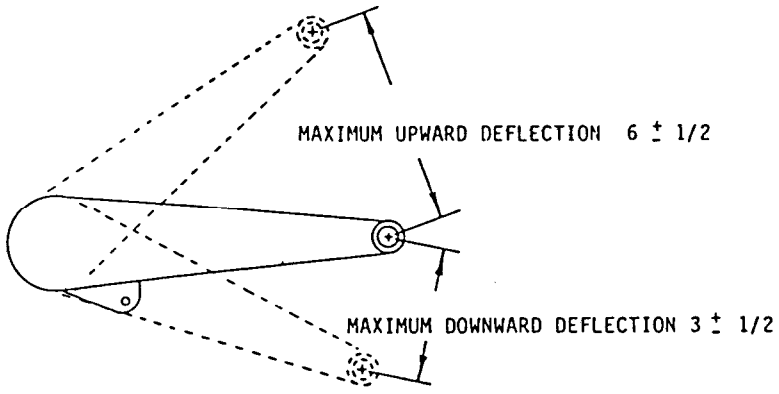
7.5 FINAL CHECKS AND ADJUSTMENTS

7.5.1 Aileron Balance

Set the stick in the neutral position (both fore/aft and laterally). Check that the ailerons are both in the neutral position (aligned with the adjacent ribs). Adjust the length of the T326 (inboard) pushrods if necessary.

7.5.2 Aileron Travel

Move the stick as far as possible to the left and check that the aileron deflection is within the limits shown in the figure. Move the stick as far as possible to the right and check that the aileron deflection is within the limits. Aileron deflection may be adjusted as described in Step 5.5.14(a).



7.5.3 Ruddervator Balance

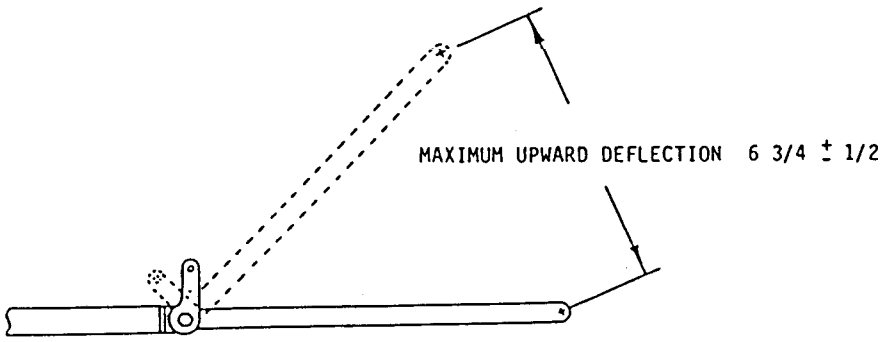
With the stick in the neutral position adjust the position of the rudder pedals so they are parallel to each other. Move the stick slightly if necessary so that one ruddervator is in its neutral position (aligned with its stabilizer). The other ruddervator should be at or very near its neutral position. If necessary, adjust the length of one T26 pushrod or one P21 pushrod to balance the ruddervator system. (Checking the positions of the F18 mixer bellcrank and the G309 bellcrank with the ruddervators in neutral should indicate which pushrod requires adjustment).

7.5.4 Ruddervator Downward Travel

Push the stick as far forward as possible while maintaining the rudder pedals in neutral. The downward deflection of the ruddervators should be such that they *almost* touch each other. Adjust the length of pushrod T331 as required to achieve the correct downward deflection.

7.5.5 Ruddervator Upward Travel

Pull the stick back as far as possible while maintaining the rudder pedals in neutral. The upward deflection of the ruddervator (measured from the neutral position and measured at the location of the maximum chord) should be within the limits shown in the figure. If necessary, adjust the position of the stick stop (Ref. Step 5.5.14(b) to achieve the required upward deflection. Note that if the stick stop is moved it will be necessary to recheck (and readjust) the ruddervator downward deflection as in step 7.5.4 above.



7.5.6 Balance (Centre-of-Gravity) Check

NOTE: THIS CHECK SHOULD BE CARRIED OUT AFTER THE WING AND TAIL HAVE BEEN COVERED AS IN SECTION 9.

Flight testing has shown that the Lazair is very tolerant of changes to the position of the centre of gravity. However, for comfortable hands-off flying at a reasonable air speed, and for assurance that there is no gross error effecting the C of G, the check outlined below is recommended. With the C of G positioned as defined, the Lazair should trim out hands-off at approximately 25 to 28 mph indicated airspeed. With the seat positioned as indicated in the Assembly Instructions, the pilot sits very near the centre-of-gravity, so reasonable differences in pilot weight do not have an appreciable effect on the position of the C of G. However, there will be some slight effect from such trivial things as the position of the pilot's feet or even the type of shoes he is wearing. Minor in-flight trim adjustments can be made by just moving the position of your feet. Also, there will be an effect from the weight of the fuel, so it is recommended that the following check be made with the fuel tank approximately half full.

With the aircraft on the ground and the pilot sitting in the seat in the "normal" (or most comfortable) seating position, raise the tail until the boom is level (use a spirit level on top of the boom). Hold the aircraft in this position with a bathroom scale under the tail(at F4). The reading on the scale should be between 23 and 29 pounds. If the aircraft meets this requirement it is adequately balanced for the first test flight (if possible, the first flight should be made by an experienced Lazair pilot who is capable of recognizing any unusual flight characteristics). Fine tuning of the balance is best done by test flying the aircraft and adjusting the C of G for hands-off trim at the power setting and airspeed preferred by the pilot.

Note that for weight and balance calculations, the C of G limits are 12 to 15 inches aft of the wing leading edge.

7.5.7 Final Inspection

Before being covered, the aircraft should be inspected for overall workmanship and to make sure it is complete. Be sure all nuts are tightened securely (especially those on the pushrods if control adjustments were necessary). Check for free and proper movement of control surfaces and make sure that bearings and hinges operate properly as defined in step 3.8.19. Anytime the aircraft is assembled for flight, make sure the proper hardware is used as tabulated below. Note that any nuts which must be removed to disassemble the aircraft should have washers under them to prevent damage to the aluminum alloy tubes and fittings. Note also that the bolts holding the nacelles onto the wing should be the drilled head type and should be lockwired.

LOCATION	BOLT TYPE	QTY	WASHER
Inboard wing attachment, Front	46	2	W4T
Inboard wing attachment, Rear	46	2	W4H
Inboard strut attachment	417	2	W4H
Outboard strut attachment	414	2	W4T
Aileron pushrods (inboard end)	37	2	W3H
Naçelles to wing, Top	DH35	4	N/R*
Nacelles to wing, Bottom	DH36	4	N/R *

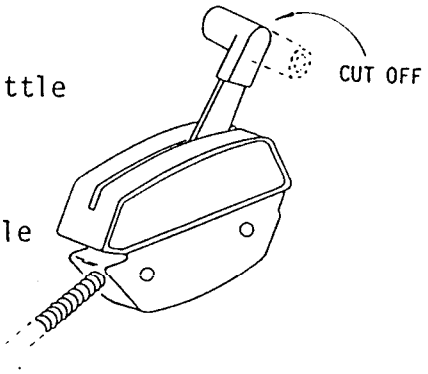
* G53 used as washer

SECTION 8

POWER SYSTEM INSTALLATION

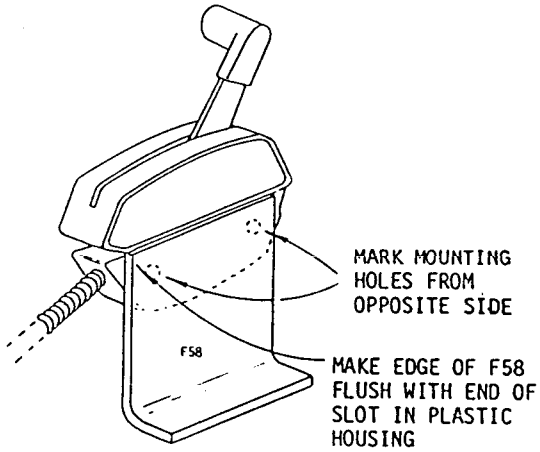
8.1 THROTTLE QUADRANT INSTALLATION

8.1.1 Saw off part of the "T" handle on one throttle lever as shown and sand smooth.

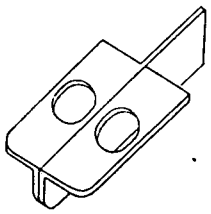


8.1.2 Remove the opposite side from the "T" handle on the other throttle lever. *Be sure to make one left and one right.*

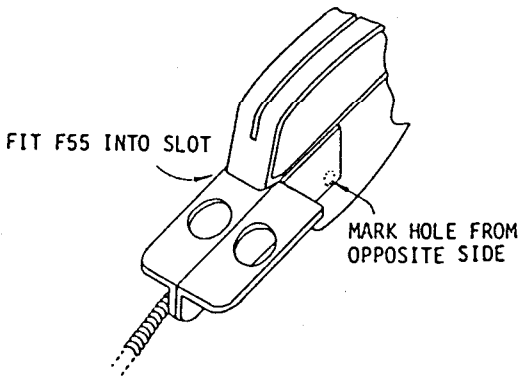
8.1.3 Position the mounting bracket F58 on the throttle lever assembly as shown. Mark the location of the two mounting holes using the plastic housing as a template and drill 3/16 inch holes in F58.



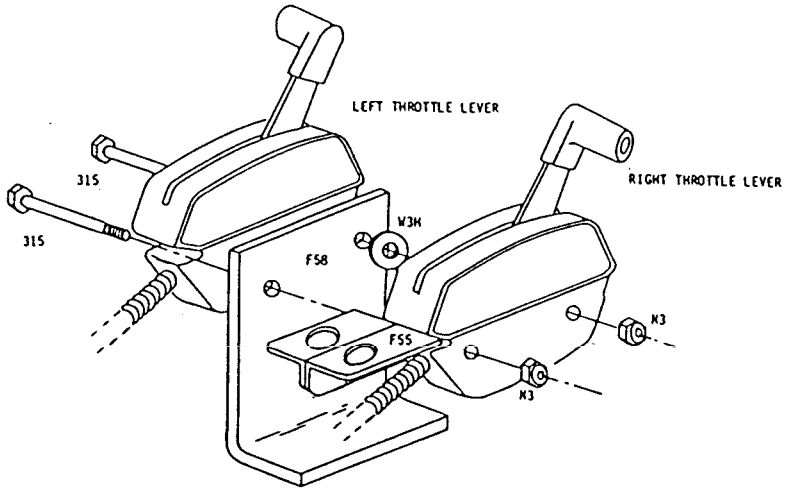
8.1.4 Round the corners of magneto switch plate F55 as shown.



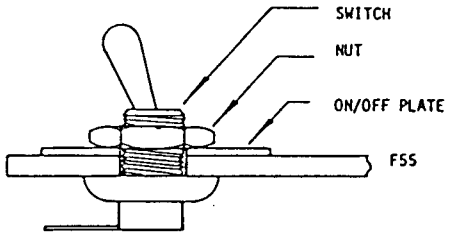
8.1.5 Fit F55 into the slot in one of the plastic throttle housings as shown. Mark and drill the 3/16" mounting hole in the F55.



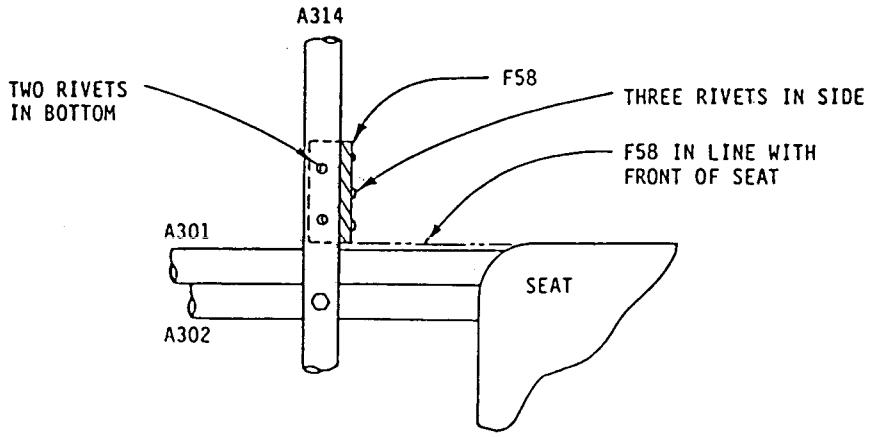
8.1.6 Bolt the throttle quadrant assembly together as shown. Do not forget the W3H washer between the two plastic housings.



8.1.7 Install the two magneto swithces in F55 as shown. Note that the lug on the switch points toward the rear of F55.

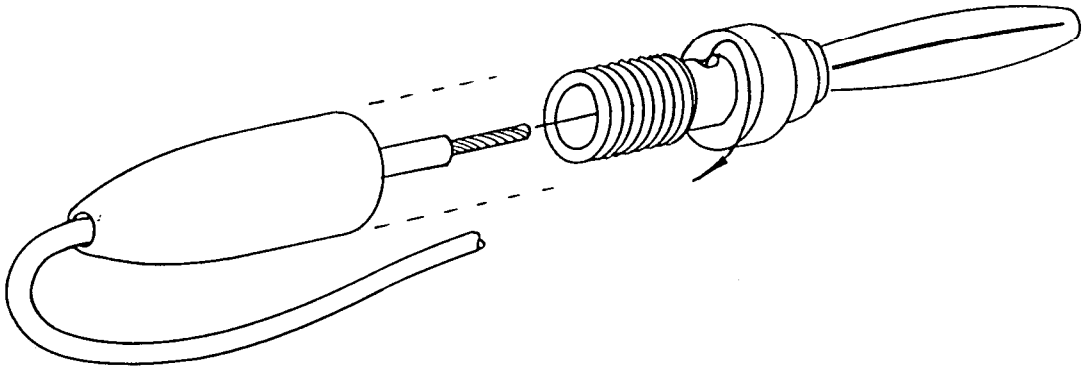


8.1.8 Rivet the throttle quadrant assembly to A314 so that the rear edge of F58 is in line with the front of the seat. This position is an average one for most people. You can, however, position F58 up to an inch either side along A314, as long as it is comfortable for you. Use three stainless steel rivets into the side of A314 and two into the bottom of A314.

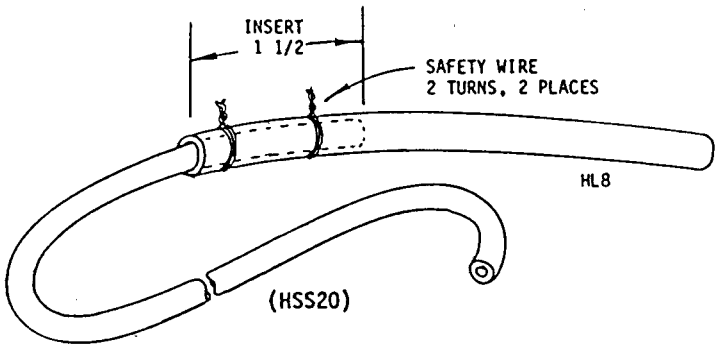


8.2 CABLE, WIRE AND FUEL LINE INSTALLATION

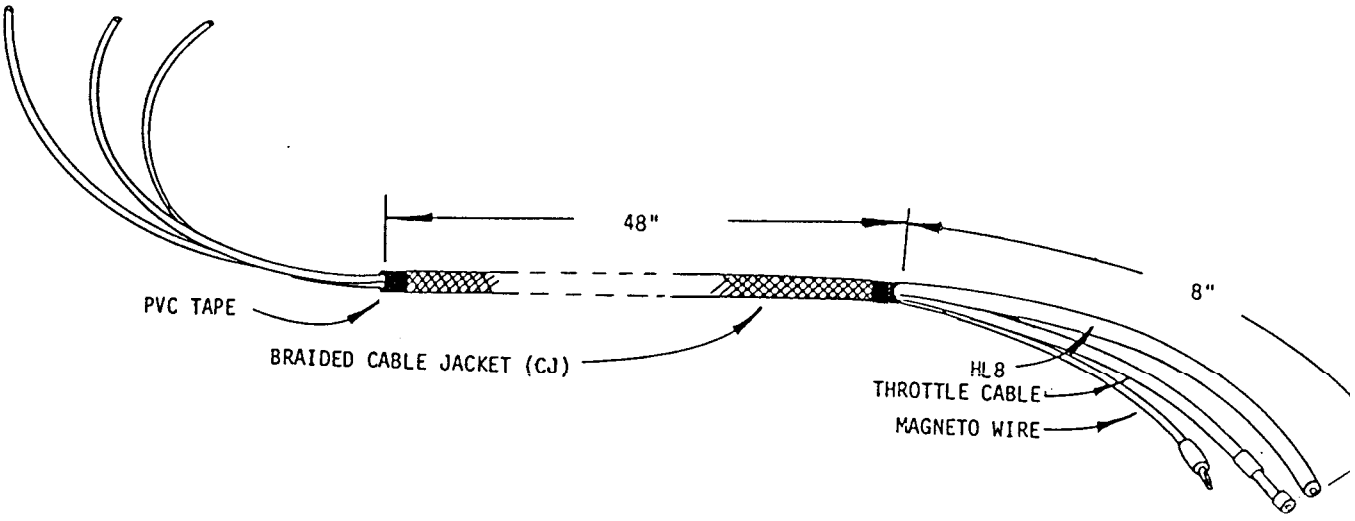
8.2.1 Cut two magneto wires 9 inches longer than the throttle cable outer jackets (note that the left and right throttle cables are not the same length). Strip 1/2 inch of insulation from one end of each wire and attach banana plugs as shown. Although the banana plugs are designed to be solderless, it is recommended that the wire be soldered to the plug.



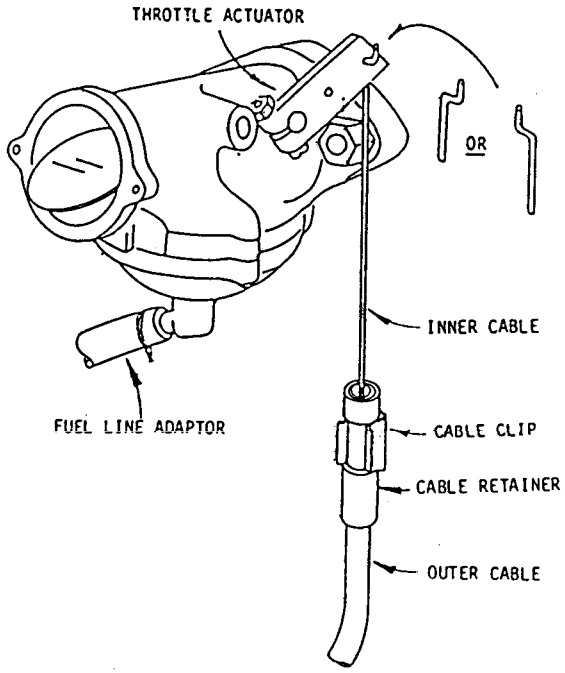
8.2.2 Cut the fuel line (HSS20) into two equal lengths and attach a fuel line adaptor (HL8) to each as shown. Twist the safety wire tight and bend it flat against HL8.



8.2.3 Make up the left and right cable assemblies as shown.



8.2.4 Oil the throttle cables with light oil. With the aircraft assembled and the engines mounted on the wing, connect the throttle cables as shown. Note that the inner throttle cable may be inserted into the throttle actuator in either of two ways. Use the orientation which puts the least twist in the cable. Use the outermost hole in the throttle actuator. Snap the cable retainer into the clip on the engine bellhousing as shown.

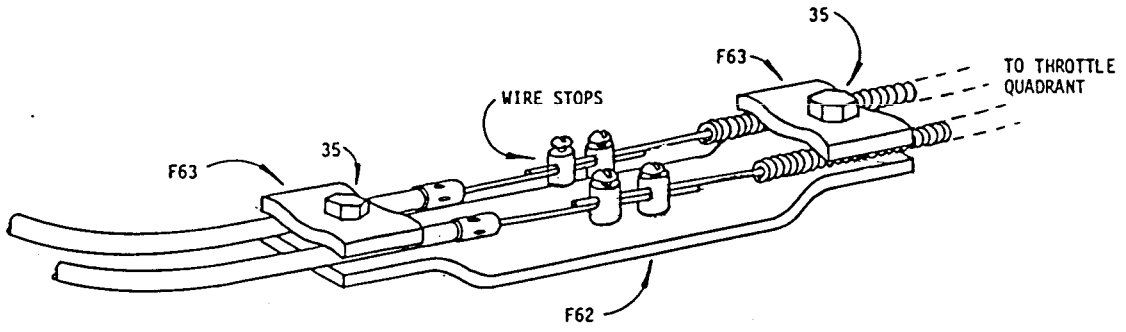


8.2.5 Push the fuel line adaptor over the fitting on the carburetor and secure with two turns of safety wire.

8.2.6 Insert the magneto wire banana plug into the black banana jack on the engine bellhousing.

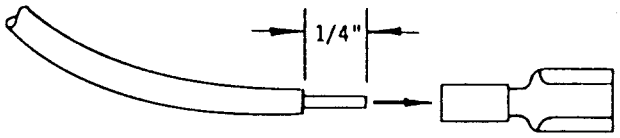
8.2.7 Route the cable assemblies through the F51 clips on the nacelles and dress both throttle cables and magneto wires down the left downtube A303 .

8.2.8 Connect the throttle cables to the throttle quadrant using F62 as shown. Set the throttle levers to the idle position (fully back) and adjust the position of the throttle cables and wire stops so that the throttle butterflies in the carburetors are closed. Tighten the clamps and wire stops and verify that with the levers pushed forward, both throttle butterflies are fully open.



8.2.9 Dress the cables along A303 and fasten in place with tie wraps. Make sure that there are no bends in the cable with a radius less than five inches.

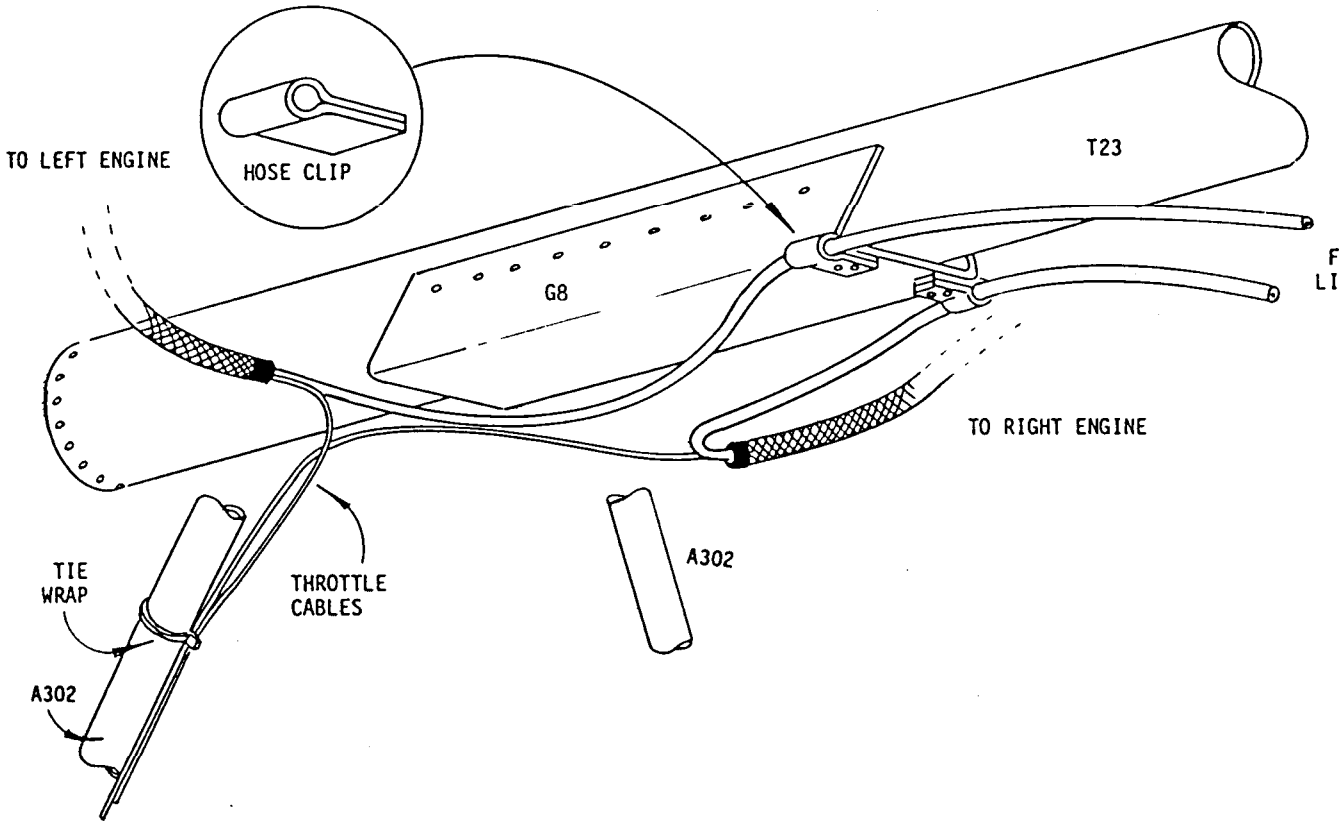
8.2.10 Cut the magneto wire as necessary and attach the terminals to connect to the switches.



STRIP, INSERT AND CRIMP (USING CRIMPING TOOL OR VICE-GRIP PLIERS)

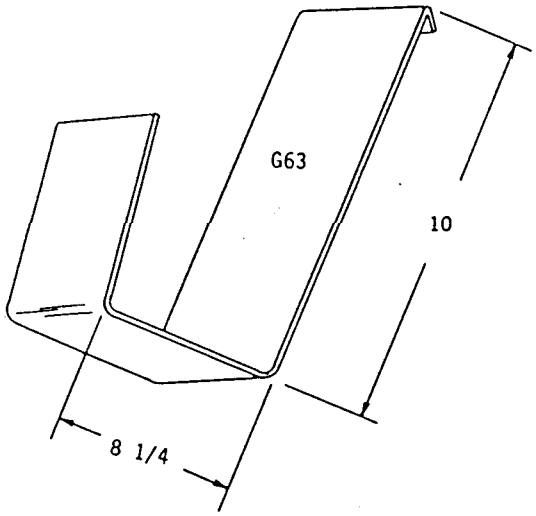
MAKE SURE THE PLASTIC INSULATOR IS PROPERLY POSITIONED AFTER CRIMPING. IF IT APPEARS LOOSE, USE ELECTRICAL TAPE OR PLASTIC SLEEVING TO ENSURE THAT THE TERMINAL CANNOT CONTACT THE F55 SWITCHPLATE.

8.2.11 Use a file or sandpaper to remove the sharp edges from two hose clips, and bend as shown below. Route the fuel lines as shown and rivet the hose clips to the bottom of G8 as indicated.

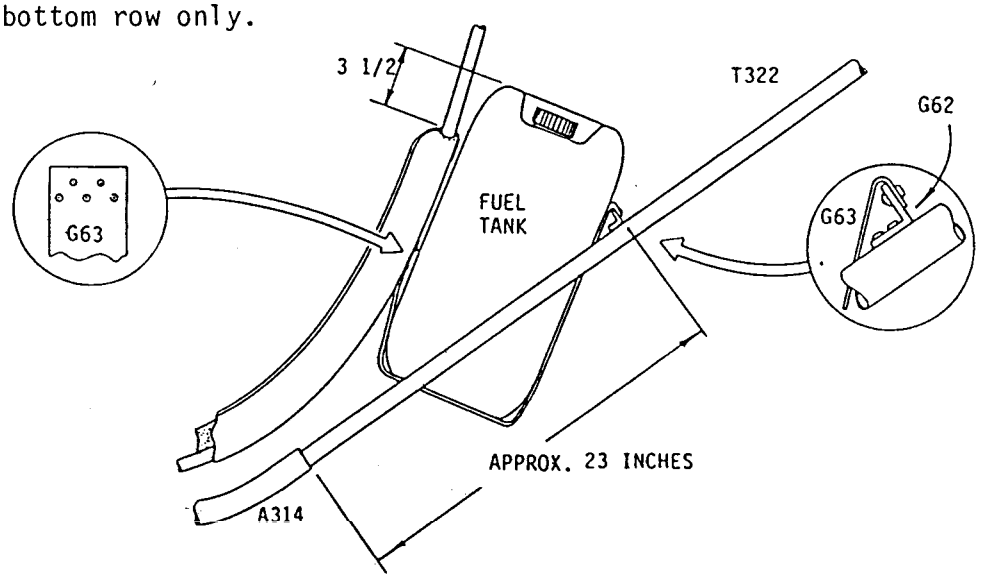


8.3 FUEL TANK INSTALLATION

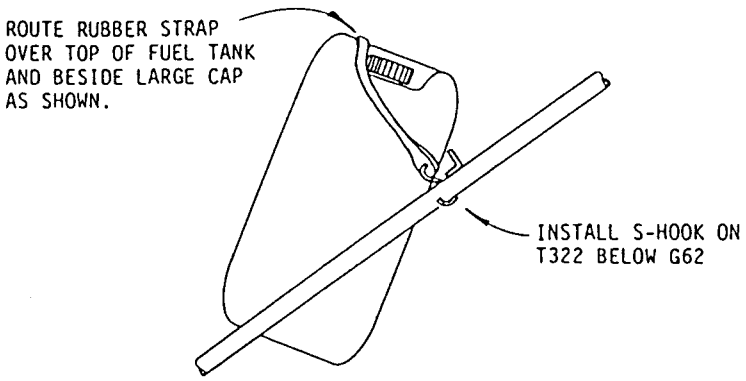
8.3.1 Bend the fuel tank saddle G63 as shown, using a 1/2 inch or 3/4 inch tube as a mandrel to obtain a large bend radius.



8.3.2 Position the fuel tank as shown (allow about 1/4 of an inch between the fuel tank and the seat back) and fit the support angle G62 and the saddle G63 into place. Rivet G62 to the T322's with four stainless steel rivets. Rivet G63 to G26 (the seat back) with five rivets as shown in the inset. Use stainless steel rivets in the bottom row only.



8.3.3 Install the Rubber Strap to hold the Fuel Tank in place. Note that the strap must be routed as shown to hold the tank securely during negative g conditions. Bend the S-Hooks closed (on the strap end) to prevent scratching the Fuel Tank. Open the other end as required to fit over T322.



8.3.4 Remove the large cap from the fuel tank and drill two 15/64 inch holes for the fuel lines. Chamfer the edges of the holes on the top of the cap only with a larger drill.

8.3.5 Feed the fuel lines through the holes in the cap so that the ends of the fuel lines can easily reach the bottom of the fuel tank.

NOTE: The fuel lines may be cut to length if necessary, but they will shrink noticeably when filled with gasoline and left for a prolonged time. Therefore, it is recommended that fuel lines be cut about six inches longer than what would appear to be the correct length.

8.3.6 Slide the ends of the fuel lines onto the nipples on the fuel filters and secure with two turns of lockwire.

8.3.7 Replace the cap and make sure there are no sharp bends in the line which could impede fuel flow.

8.3.8 Drill a 1/8 inch diameter vent hole in the small cap (remove the cap before drilling to avoid drill shavings in the fuel tank).

SECTION 9

WING AND TAIL COVERING

9.1 GENERAL INSTRUCTIONS AND INFORMATION

9.1.1 Materials

Two types of covering materials are used on the Lazair. The wingtips are covered with urethane impregnated (zero porosity) Dacron, and the remainder of the wings and the tail surfaces are covered with .002 inch (2 mil) Tedlar PVF film. The Dacron is applied with Pliobond contact adhesive while the Tedlar is attached with a series of three pressure-sensitive tapes. Both covering materials require heat shrinking to remove wrinkles after application.

9.1.2 Painting

If the wing ribs are to be painted, they should obviously be painted before the wing covering is applied. Any good quality Latex based paint may be used (most oil based paints or lacquers will dissolve the styrofoam ribs and should therefore be avoided). Be sure to keep the paint off the rib capstrips as it will prevent proper adhesion of the Tedlar.

The Dacron for the wingtips is supplied in whatever colour is available at the time, so the tips must be painted if a particular colour is desired. Excellent results can be obtained with urethane paint (available in spray cans) but the following precautions should be observed. Unlike most other types of paint, the overspray produced from spraying urethane does not dry in mid air and form a fine dust which can be easily brushed away. *Urethane overspray sticks like glue.* When spraying the wingtips, the entire wing and everything else within fifteen feet should be completely masked or covered. Since the urethane overspray can also do a fine job of coating your nostrils (and presumably your lungs as well) the use of a breathing mask is highly recommended.

Unlike the Mylar polyester film used on earlier Lazairs, the Tedlar film is inherently paintable. Although long term test data is not available, we have demonstrated good initial adhesion using enamels, lacquers and urethane paints. The demonstrator which you may have seen at Oshkosh '82 was painted with DuPont Centari acrylic enamel. As more information becomes available, it will be distributed via the Lazair Technical Updates. Since a transparent wing is an obvious asset when making inspections as well as when flying, most Lazair owners prefer to leave the inboard wing panels and the bottom surface of the wing unpainted. Use light colours to reduce the heating of the Tedlar and tape by the sun.

9.1.3 Heat Shrinking

A hair dryer will *not* produce enough heat to shrink the covering materials. Some of the larger industrial heat guns (3000 to 4000 watts with adjustable airflow) can be used but they will heat only a small area and are relatively slow. The best heat source is a propane fueled radiant heater. We use a 39,000 BTU heater at the factory, but a 20,000 BTU unit is quite adequate for home use, and may be rented from many tool rental shops. If a propane heater is not available, excellent results may be obtained by using an ordinary dry iron ——it just takes a bit more time.

Shrinking the Tedlar is not difficult, but you should develop your shrinking technique before you attack your airplane. Tape a scrap piece of Tedlar to a wire coathanger and try shrinking it. Hold the radiant heater about 8 to 10 inches from the Tedlar and move it from side to side. At first, the Tedlar will become very loose, but as you continue to heat it, it will tighten and the wrinkles will disappear. The Mylar used on earlier model Lazairs could be overheated quite easily during shrinking, causing it to turn white, then become brittle and eventually melt. The Tedlar will withstand much more heat without damage. However, be careful you don't overheat the Tedlar tape. If overheated, it will shrink to about half its original width and develop undulating edges. After you are satisfied with your heat shrinking on the scrap Tedlar, move the heater closer to it and observe the effect on the tape. When you develop a

feel for the amount of heat required to damage the tape you should be able to prevent it from happening on the airplane.

When you heatshrink the various parts of the airplane, start with the stabilizers, then do the ruddervators and ailerons so that by the time you get to the wings you will be an expert. Position the pieces so that the surface you are shrinking is vertical, and position yourself so you can see light reflecting from the surface of the Tedlar. This will allow you to see any wrinkles more easily.

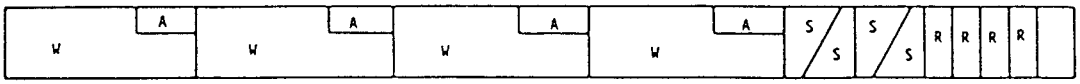
Do not shrink the Tedlar more than necessary to get it tight and wrinkle free. Excessive shrinking may cause the Tedlar to pull away from the tape.

If you are using an iron to shrink the Tedlar, the technique will be somewhat different. The correct temperature should be established by testing since the markings on most irons are not very reliable and the temperature will vary with voltage. To obtain the correct temperature, set the dial at "wool" and let the iron warm up until it is stablized. Touch the bottom of the iron with a small piece of Tedlar. If the Tedlar turns brown, bubbles, smokes, or melts, the iron is too hot. If nothing happens to the Tedlar, the iron is too cold. If the iron temperature is correct, the Tedlar will shrink noticeably, but will remain clear. Adjust the temperature setting gradually until the correct temperature is reached, and make sure it is stabilized before using it on the aircraft. Small adjustments to the temperature may be made if necessary as the shrinking progresses. To avoid scratching the surface of the Tedlar with the iron, *use a sheet of newspaper between the Tedlar and the iron.* Keep the iron moving at all times and go back and forth over the Tedlar until all the wrinkles are removed, and the Tedlar is tight like a drumhead. The technique used for shrinking the Dacron is essentially the same as for the Tedlar except that the required heat is slightly less. Reshrink the Dacron at least once before painting it.

9.1.4 Covering Material Usage

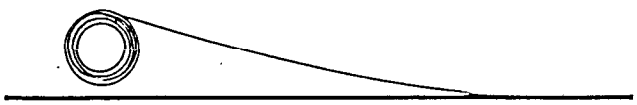
The Dacron is supplied in six pre-cut pieces — two pieces for the bottom and one for the top of each wingtip. The Tedlar is supplied in a 100 foot roll. This is sufficient to cover the entire aircraft with a little bit left over *if it is cut properly,* but there is not

enough Tedlar to permit any gross errors in cutting, so be sure you cut it right the first time. When cutting the Tedlar allow an extra two inches on all sides for handling. The diagram below shows how the pieces may be cut from the roll.



W-WING A-AILERON S-STABILIZER R-RUDDERVATOR

When the Tedlar is unrolled it will become electrostatically charged and will attract any dust particles which come within a few inches of it so it is essential that the covering be done in a relatively clean area —— definitely not in a woodworking shop. To avoid fingerprints on the *inside* of the covering, the Tedlar should be unrolled as shown.



LIKE THIS

NOT LIKE THIS

9.1.5 Tapes

The three types of tape used for the application of the Tedlar covering are as follows:

- single face Tedlar tape, 1-1/2 inches wide, used to cover all seams and edges
- double face foam tape, 3/4 inch wide, used on the top and bottom of the wing ribs, and stabilizer ribs

- double face clear tape, 1/2 inch wide, used under all edges

Sufficient tape is supplied in the kit to apply the covering as described in the instructions, but it must be used carefully to avoid waste.

9.1.6 Surface Preparation

Before covering, all parts of the airframe where tape or adhesive will be applied should be clean and free of grease and oil. Use lacquer thinners or naptha to clean the aluminum and wipe it dry with a clean cloth or paper towel. *Do not get any solvent on the ribs as it will dissolve the styrofoam.*

MAKE SURE ALL SHARP CORNERS AND EDGES ARE FILED OR SANDED SMOOTH WHERE THEY WILL CONTACT THE COVERING MATERIAL.

9.2 DETAILED COVERING INSTRUCTIONS

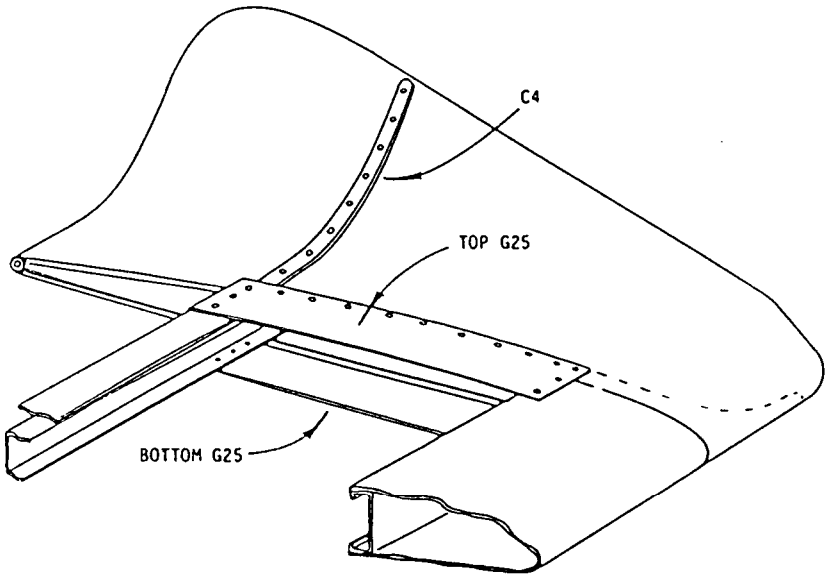
9.2.1 Wing Tips

The Dacron has a shiny side and a dull side. Apply the Dacron with the *shiny side out.* Do not use pliobond adhesive in temperatures below 60° F (16° C).

Start with the bottom aft section first. Check that the pieces fit properly and lay them on your workbench right side up. Apply the pliobond adhesive generously to the R9 tip rib. Put the Dacron into position and press it into the adhesive. After a few seconds, remove the Dacron and allow the adhesive to dry for about three minutes or until it is tacky. Then put the Dacron into position again and press it down tightly. Repeat the process to attach the Dacron to the tip spar and the tip bow T24. Pull the Dacron tight enough to remove all the major wrinkles but it is not necessary to stretch the fabric. Install the other bottom piece the same way, overlapping on the Dacron on the tip spar and covering the tip of the D-cell. When the bottom is covered, trim the edges so that they wrap about 3/4 of the way around T24. Apply a little more adhesive if necessary to secure the edges.

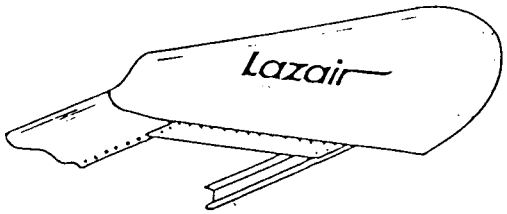
Cover the top of the wingtip using the same technique. Trim the outside edge carefully (since it will be visible). Apply a small amount of adhesive to the outside of the Dacron on T24 and smooth it with your finger.

File the outer tip spar capstrip C4 so that the edges are smooth and rivet it in place on top of C5. Make sure the rivets go between the rivets holding C5 to the tip spar. File the edges and corners of tip gussets G25 and rivet in place as shown. Rivet the G25's on three sides using 1 inch rivet spacing on AS1 and the D-cell and 1-1/2 inch spacing on the tip rib R9.



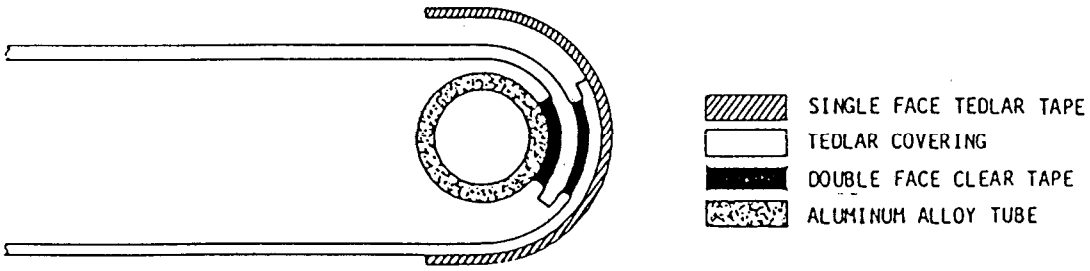
Allow the adhesive to dry overnight before heat shrinking the Dacron. If you use an iron to shrink the Dacron, be sure to test it on a piece of scrap as described in section 9.1.3 to avoid melting the Dacron.

Allow the Dacron to age for a few days and then re-shrink it before painting. Allow the paint at least two days to dry before applying the Lazair wing tip decals. To apply the decals remove the backing paper then press the carrier film with the Lazair logo on it onto the wingtip and remove the carrier film. Note that the backing paper is heavier than the carrier film. If, when you begin to pull the two apart you see the back (white side) of the logo, the film is separating properly. If the front of the logo (black side) is exposed, the film is separating incorrectly. Press it back together and try again.



9.2.2 STABILIZERS

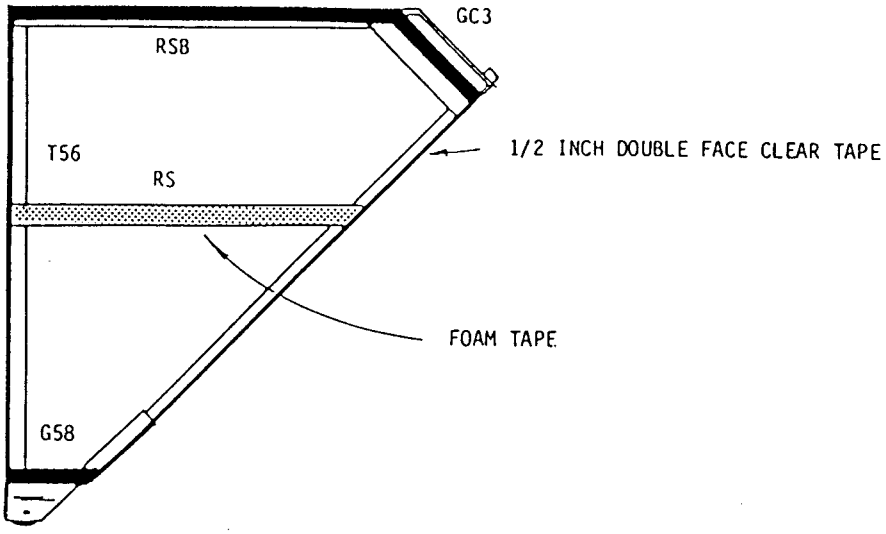
The stabilizers are the easiest surfaces to cover in Tedlar and should, therefore, be done first. Tape and covering should be applied so that when the covering is completed the materials will be overlapped as shown. The illustration is shown for T56 but is typical of the application of Tedlar to airframe tubing. (Note that the thickness of the materials and the spacing between materials have been exaggerated for clarity.)



First, apply one strip of 1/2 inch double face clear tape in the following locations:

leading edge of T55
trailing edge of T56
face of RSB
top edge of G57/58
2" from leading edge of GC3

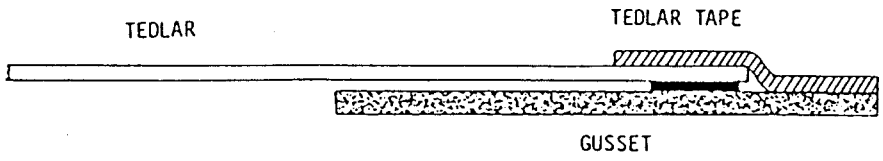
Apply double face foam tape to the face of RS.



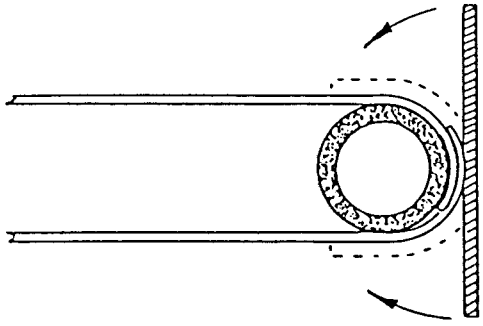
Cut the Tedlar to fit (with about 2" extra for gripping). Remove the backing paper from the foam tape of RS *only* and position the Tedlar. Once the Tedlar touches the tape it doesn't want to let go, so make sure you get it in the right place on the first try. *Tap* the Tedlar on top of the tape before sliding your finger along it to avoid wrinkles. Fold back the Tedlar and remove the backing paper from all the tape below RS. Carefully lower the Tedlar into position and again tap it on top of the tape. Note that the Tedlar should be put on as wrinkle-free as possible but it is not necessary to stretch it. Similarly, remove the backing paper from the tape above RS and attach the Tedlar. Trim the Tedlar with a razor knife on all sides along the edge of the tape.

Turn the stabilizer over and cover the other side. Note that when you do the second side, the double face tape on T55 and T56 is applied over the Tedlar from the first side rather than directly on the tubing. This reduces the amount of tape which must be removed from the tubing should you ever recover the aircraft. Trim the Tedlar using scissors or be very careful with the knife to avoid cutting the Tedlar from the previous side.

Apply the 1-1/2 inch wide single face Tedlar tape on GC2 and GC3 as shown. Cut the tape about an inch longer than the gusset on both ends so it may be wrapped around T55 and T56.



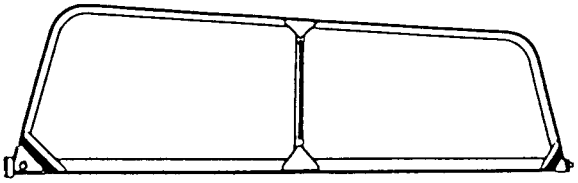
Apply Tedlar tape to the Tedlar on T55, T56, and RSB. Put the tape onto the tube tangentially as shown below, then fold the edges down very gradually, working from the centre toward both ends to avoid wrinkles in the tape. Some wrinkles will inevitably occur in areas around the gussets or RS, but these can usually be smoothed with a hot iron after or during the heat shrinking. Check to make sure all edges are completely taped down with the Tedlar tape before shrinking. Make sure that the Tedlar tape extends at least 3/4 of an inch past the edge of the Tedlar.



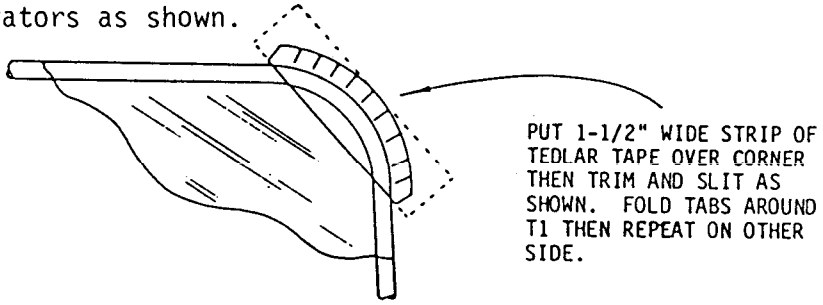
Although an experienced Lazair builder might prefer to cover all the surfaces before starting to do the heat shrinking, it is probably better (if this is your first time) to shrink the stabilizer before covering any other components. This will give you a chance to see how good your covering workmanship is and will probably convince you that a good covering job is not as difficult as you might have imagined. Just follow the instructions in section 9.1.3 and chase the wrinkles around with the radiant heater or iron until they disappear. By the time you finish the second side of the stabilizer, you should have the technique mastered quite well.

9.2.3 Ruddervators

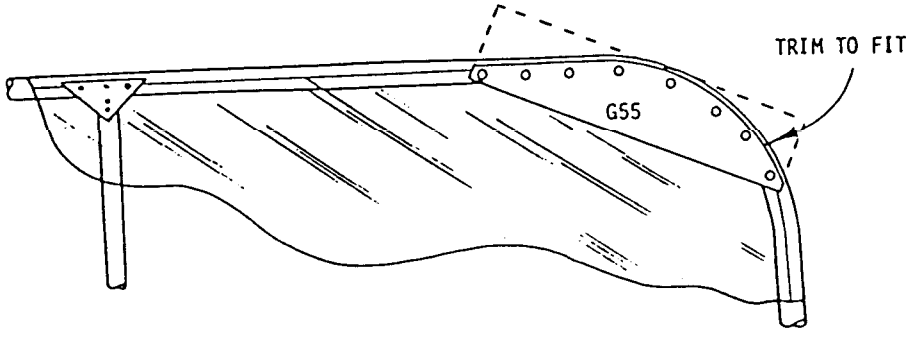
Now that you're an experienced aircraft covering technician, covering the ruddervators should be no problem. Although it is possible to cover a ruddervator using one piece of Tedlar wrapped around the leading edge to cover both sides, it is much easier to cover one side at a time as was done for the stabilizer. The tape should be applied to all edges as was done for the stabilizers. Use ½ inch clear tape rather than the foam tape for the ruddervator rib. Leave the corners of the GC and GCS gussets free of Tedlar as indicated by the taping diagram below to allow a surface to receive the Tedlar tape.



After covering, apply the Tedlar tape to all the edges as was done for the stabilizer. Finish the rounded corners of the ruddervators as shown.



Trim the Ruddervator wear Gussets G55 to fit the outboard corners of the Ruddervators and rivet in place on the *bottom* side of the Ruddervators as shown. This will prevent damage to the Tedlar in the event that the Ruddervators inadvertently scrape along the ground.

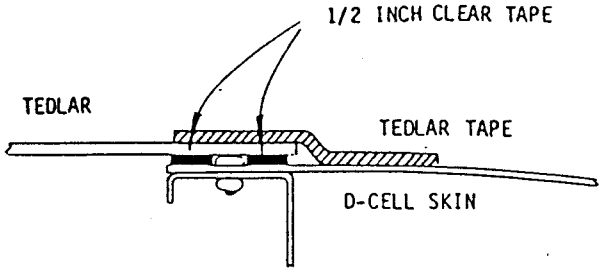


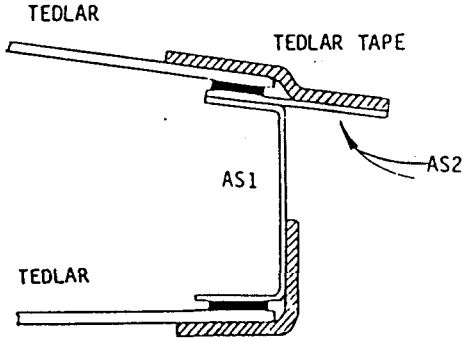
9.2.4 Wings

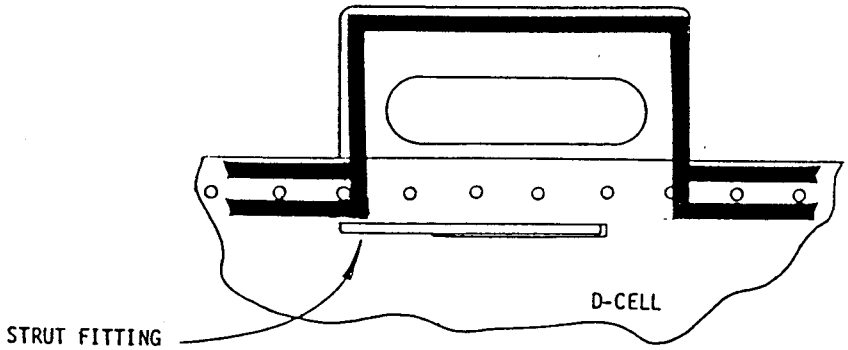
Cover the bottom of the wing first. Use clear tape on the trailing edge (the same as for the stabilizers and ruddervators) and along the bottom of the root rib (R8) and on G25. Use the foam tape on the ribs (on the section between the gussets only __ Do not put foam tape on the gussets).

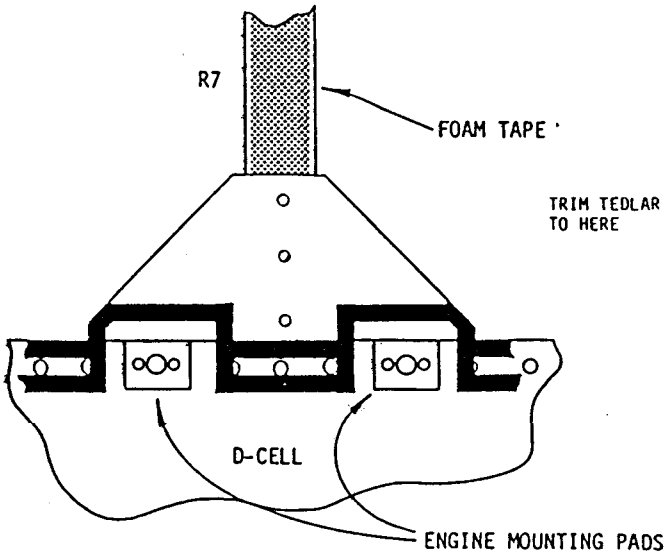
Use a double band of clear tape on the trailing edge of the D-cell (one on each side of the rivets as shown in the illustrations). Apply clear Tape to AS1 and around engine mount pads and strut fitting area as shown. Where possible, position the tape such that the Tedlar can be trimmed on the edge of the tape and allow a space for the overlaying Tedlar tape to cover the edge of the Tedlar *and also adhere to the aluminum alloy skin or fittings.*

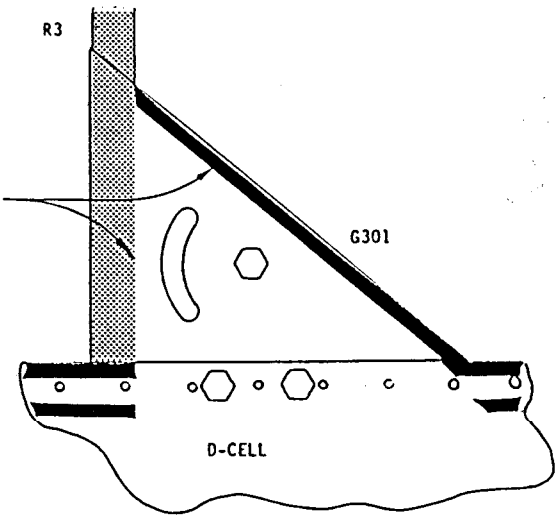
When all the double face tape is in place, unroll the Tedlar and position it so that it extends about one inch past the tape on the D-cell. Make sure that it is parallel to the D-cell and it covers the trailing edge at the root. Using masking tape, temporarily tape the leading edge of the Tedlar to the D-cell outboard of R3. Carefully remove the backing paper from the foam tape on R3 and tap the Tedlar in place. Then, working from R3 toward the wing root, remove the backing paper from the tape on the ribs and attach the Tedlar *one panel at a time.*


1/2 INCH CLEAR TAPE
TEDLAR
TEDLAR TAPE
D-CELL SKIN


TEDLAR
TEDLAR TAPE
AS2
AS1
TEDLAR


D-CELL
STRUT FITTING


R7
FOAM TAPE
D-CELL
ENGINE MOUNTING PADS


R3
TRIM TEDLAR
TO HERE
G301
D-CELL

Although it is possible to do this alone, it is much easier with two or even three people. When the inboard half of the wing is complete, remove the masking tape and attach the Tedlar to the outboard ribs, working outward from R3. Then remove the backing paper and attach the Tedlar to the leading edge and trailing edge.

Trim the Tedlar on all sides (save the pieces you cut off for the ailerons) and apply the Tedlar tape to all edges except the trailing edge. Make sure all the edges are securely covered and taped to the structure. On the root rib, fold the Tedlar tape over the edge so it will adhere to R8, notching the tape as necessary.

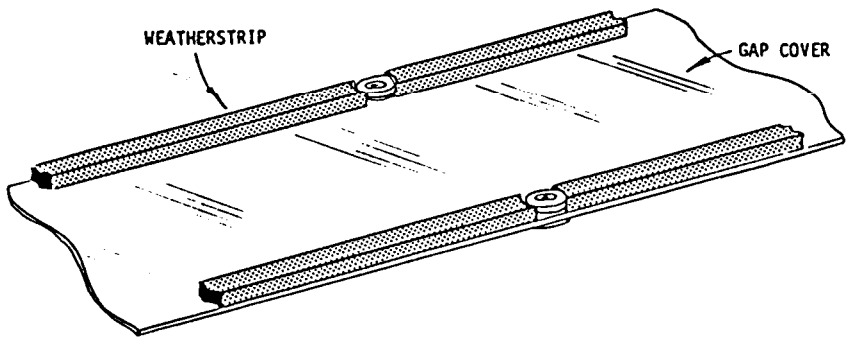
When the bottom of the wing is complete, turn it over and cover the top using the same technique. Finish the edges with Tedlar tape (including the wraparound on the trailing edge) and heatshrink the Tedlar.

9.2.5 AILERONS

The ailerons should be covered using the same techniques as for the other surfaces. Use clear tape on the leading and trailing edges and foam tape on the ribs. Make sure all edges are securely taped down with Tedlar tape and fold the tape around the ends of the inboard and outboard ribs.

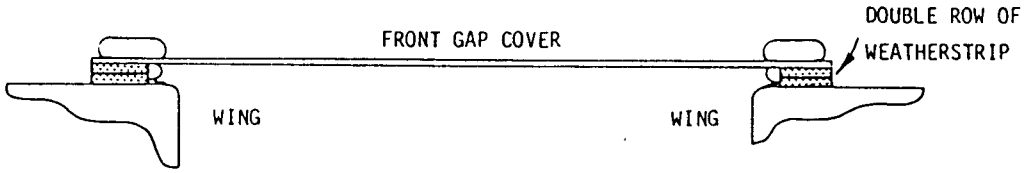
9.2.6 GAP COVERS

9.2.6.1 Apply weatherstrip to the inside of the front gap cover along both edges as shown.



9.2.6.2 With the wings on the fuselage, install the two male snaps on the top of the wing to secure the trailing edge of the front gap cover with aluminum rivets (using the holes drilled in step 7.4.6). Make sure the snaps fit easily through the clearance holes in the mid gap cover.

9.2.6.3 Snap the front gap cover into position and mark the location of the edges of the gap cover on the wings. Remove the gap cover and apply weatherstrip to the top of the wing to mate with the weatherstrip on the gap cover.



CROSS SECTION OF INSTALLED FRONT GAP COVER

9.2.6.4 Pull the front gap cover *tightly* into position, and temporarily tape it in place. Drill the holes for the two snaps in the middle of the front gap cover. Remove the front gap cover and install the two male snaps on the wing.

9.2.6.5 Snap the gap cover on once again. Pull it *tightly* around the D-cell. Drill holes and install the remaining two male snaps.

9.2.6.6 Install weatherstrip to the inside of both edges of the rear gap cover. Do not install weatherstrip to the rear portion of the wing.

9.2.6.7 Fit the rear gap cover into position and pull it up *tightly* against the trailing edge of the wing. The rear gap cover should fit *under* the mid gap cover approximately 1½ inches. Drill holes and install the top two male snaps on the wings. Snap the gap cover in position, pull it tight, drill holes and install the two bottom snaps.

9.2.6.8 Install weatherstrip to the edges of the mid gap cover where it contacts the wing.

9.3 MAINTENANCE OF COVERING MATERIALS

9.3.1 Painted Dacron

The wingtips, when covered in Dacron and painted with urethane, should need little or no maintenance (with the exception of an occasional wash) for many years. When necessary, the urethane may be degreased, sanded lightly with fine sandpaper and re-painted.

9.3.2 Tedlar Life

In July 1982, the covering material for the Lazair was changed from Mylar to Tedlar. The major reason for the change was the superior life expectancy of Tedlar when exposed to ultraviolet radiation from the sun. Depending upon usage and storage location, the Mylar had a useable life of one to three years. Based on tests conducted on Tedlar for other applications, the Tedlar covering is expected to last five to ten years.

Although the longevity of the Tedlar is much superior to Mylar under any conditions, the life can be extended by minimizing the exposure to ultraviolet. In Technical Update Number 3 (September 1981) there are some guidelines for extending the life of Mylar. For maximum life, these suggestions should also be followed for Tedlar (with the exception of the necessity for recovering). The life of the Tedlar may also be extended by painting it to provide UV protection.

> NOTE: SINCE THE COVERING CAN ONLY BE AS GOOD AS THE TAPE WHICH HOLDS IT ON, TO OBTAIN MAXIMUM COVERING LIFE IT IS IMPERATIVE THAT THE TEDLAR TAPE BE COVERED TO PROTECT THE ADHESIVE FROM ULTRAVIOLET RADIATION.

The Tedlar tape may be covered by a metal (aluminum) or metalized Mylar tape, but it is considerably cheaper to simply brush on some aluminum paint over the Tedlar tape. Use masking tape on the Tedlar to obtain a clean straight edge (unless you plan to paint the Tedlar).

9.3.3 Patching Tedlar

One of the most attractive features of Tedlar is the ease with which it can be repaired. Although damaging the Tedlar in flight is very unlikely (except possibly by a bird strike, and even then it is very unlikely that any serious damage would result), damage on the ground due to mishandling, sharp objects in hangars or trailers, falling tree branches, etc., is not uncommon. A simple puncture in the Tedlar will usually not propagate and may be easily patched with a small piece of Tedlar tape. Cut the tape in a circular shape (or at least trim the corners) to prevent the patch from working loose. A rip or tear in the Tedlar may also be repaired with Tedlar tape provided the Tedlar is tight enough to stay in position while the tape is being applied. Reshrink the Tedlar after patching if necessary. If the damage is too extensive to be repaired with tape alone, a panel may be replaced without recovering a complete wing or tail. Just cut out the damaged section with a razor knife (leaving all the tape intact), apply more double face tape, a new piece of Tedlar, trim to size and tape the seams with Tedlar tape. After heat shrinking, the new panel will be indistinguishable from the rest.

9.3.4 Recovering

Recovering a Lazair is even easier than covering it because of all the experience you gained the first time around. But .... (*and this is a very big but*) before you can *recover*, you have to *uncover*. While uncovering is not particularly difficult, it does take time and is rather uninteresting. After going through this a few times, we have learned a few tricks which you may find helpful:

To do the job properly, all the Tedlar and tape should be removed before the new covering is applied. The Tedlar tape holds the Tedlar onto the airframe very well, but fortunately it can be peeled off without too much difficulty when you want to remove it. The clear double face tape is a bit more difficult to remove, but it will come off with a bit of effort. The double face foam tape is another story. It usually holds on until you get fighting mad, then just separates so you are left with a pile of messy foam all over your capstrips. Most of the foam can be removed fairly readily with a wire brush in an electric drill. The remaining adhesive must be scraped away or removed with solvents. We have tried virtually every solvent we could find, and most proved to be unsuccessful. Acrylic solvent/cement (the type used for cementing Plexiglass) removes the tape residue quite readily, but should not be used on the ribs because one drip spilled on a foam rib can make a hole an inch in diameter. Other solvents such as Lacquer Thinner or M.E.K. work reasonably well and are much safer, but they must also be used very carefully when working around the ribs. Once you get all the tape off, the rest is easy. Just go back to section 9.2 (or rely on your own experience) and put on the new covering.