Attached is a list of parts which make up the Lazair kit.

For inventory purposes please refer to this list.

Revised 18 October 1983

LAZAIR™ AIRCRAFT KIT

PARTS LIST

1 FL ______________

Banana Plug - 2

Bracket 1 - 2

BE - 26

BEP - 2

B3 - 24

B4 - 4

BE4 - 3

B7 - 1

1 FR ______________

B13 - 10

Fuel Filter - 2

F1 - 2

F2 - 2

F3 - 2

F4 - 1

F5 - 2

F13 - 2

1 BL ______________

F18 - 2

F22 - 1

F23 - 1

F24 - 1

F34 - 2

F35 - 2

F36 - 2

F37L - 1

1 BR ______________

F37R - 1

F38 - 2

F39 - 4

F41 - 2

F42 - 2

F51 - 2

F53 - 1

F54 - 1

○ CDN. ○ U.S. ○ FRN

NAME:

ADDRESS:

PHONE #:

SERIAL NUMBER:

COLOUR: ○ RED ○ BLUE ○ YELLOW

2 BR ____________

F55 - 1

F58 - 1

F60L - 2

F60R - 2

F62 - 1

F63 - 2

F64 - 2

F225 - 1

2 BL ____________

F236 - 2

F300 - 4

F301 - 4

F302 - 2

F304 - 2

F310 - 4

F311 - 2

F321 L & R - 1 each

2 FR ____________

F322 - 2

F323 - 2

F324 - 2

F325 - 2

F326 - 2

F327 - 1

F328 L & R - 1 each

F329 - 2

2 FL ____________

F330 - 1

F331 - 1

F332 - 4

F335 - 2

F338 - 2

F339 - 6

Stick Grip - 1

G309 - 1

3 FL ____________

GCS - 4

GC - 64

GBR - 24

A318 - 2 (Incl.P304 & P305)

GC13 - 4

G6 - 2

G12 - 2

G15 - 4

3 FR ____________

G20 - 2

G27 - 1

G53 - 4

G55 - 2

G226 - 4

G61 - 1

G304L - 1

G304R - 1

3 BL ______________

G305L - 1

G305R - 1

G307 - 1

G310 - 2

G311 - 2

G312 - 2

T42 - 1

T47 - 2

3 BR ______________

T313 - 2

Hose Clip - 2

HL8 - 2

Snaps - 29

CJ - 1

Switch - 2

Tab - 2

Tie Wrap - 8

4 BR ______________

NB3 - 4

CP23 - 19

CN4 - 1

CN3 - 16

431 - 1

425 - 2

422DS - 1

421 - 2

4 BL ______________

417 - 2

414 - 2

DH46 - 2

46 - 4

323 - 10

321DS - 2

321 - 2

320 - 9

4 FR ______________

317DS - 1

317 - 6

316DS - 5

316 - 8

315 - 19

314 - 12

313 - 22

312 - 9

4 FL ______________

311 - 7

37 - 4

DH36 - 4

36 - 12

DH35 - 4

35DS - 8

35 - 48

34 - 50

5 FL ____________

Wire - 1

Wirestop - 8

Cable H - 2

Cable G - 4

Clip 1 - 2

Tube Gap - 2

P1 - 3

P2 - 2

5 FR ____________

P3 - 24

P4 - 4

P6 - 1

P8 - 2

P12 - 1

P16 - 2

P17 - 2

P300 - 2

5 BL ____________

P301 - 1

P302 - 2

P303 - 1

S250 - 16

S344 - 6

S500 - 4

S600 - 4

S675 - 4

5 BR ____________

S800 - 2

S1000 - 1

S1.205 - 2

S1.5 - 2

S1.9 - 4

A305 - 2

SCS250 - 2

N3 - 237

____

T9 - 1

Throttle Cable Left - 1

Throttle Cable Right - 1

Throttles - 2

G14 - 2

Front Assembly - 1

Strap - 1

Glue - 2

Tips - 1

HSS20 - 1

Rivets Stainless - 300

Velocity Stack Kit - 1

Wheel Bearing - 4

Seat Belt - 1

400 X 8 Tube - 2

TSR - 1

TSL - 1

____

RA - 8

Weatherstrip - 1

A311 - 2

A317 - 2

G308 - 2

Seat Cushion - 1

Seat Cover - 1

Owner's Manual - 1

____

R1 - 2

R2 - 2

R3 - 2

R4 - 2

R5 - 2

R6 - 2

R7 - 2

400 X 8 Tires - 2

F/P Propellers - 4

Large Bundle - 1 check list

Small Bundle - 1 check list

G26 - 1

RSTL - 1

RSBL - 1

RSTR - 1

RSBR - 1

G91 - 1

G92 - 1

A314 - 1

A315 - 1

T58 - 2

Decals - 2

Tape Tedlar 2" - 1 roll

Tape Double Face 1/2" - 4 rolls

Tape Double Face Foam - 1 roll

T57 - 2

T24R - 1

T24L - 1

T330 - 1

R8L - 1

R8R - 1

Tedlar - 1 roll

Fuel Tank - 1
Fuel Tank Caps - 2
G63 - 1

T5A - 1 check list

T5B - 1 check list

T23 - 1 check list

Nosewheel - 1

T25 - 2

T325 - 2

T226 - 2

A301 - 1

A302 - 1

A303 - 2

G301 - 2

T235 - 2

D.J. Exhaust - 2

Muffler - 2

Engine - 2

D-Cell - 2

A309L/309R - Wheelpants

Spinner Kit - 1

M312 - Wheel Hubs - inboard - 2

M313 - Wheel Hubs - outboard - 2

Rivets - 2000

A304L - 1

A304R - 1

A308L - 1

A308R - 1

Brake Cable Outer - 2

Brake Cable Inner - 2

Brake Return Springs - 2

Brake Cable Adjuster - 2

B9 - 4

G76 - 2

P19 - 1

P21 - 2

T52 - 2

T53 - 2

N4 - 18

N5C - 2 (+4 on engine)

N5CNL - 2

Safety Wire - 1

T327 - 1

T329L - 1

T329R - 1

T335 - 4

W5H - 4 (+4 on engine)

W3H - 132

W3T - 58

W3S - 4

W4T - 11

W4H - 13

Tape Paddle - 1

F253 - 2

F254 - 2

F344 - 1

G225 - 4

G242 - 1

G313 - 2

Airspeed Bracket - 1)

Airspeed - 1)

Engine Tool Kit - 1

Engine Manual - 1

LARGE BUNDLE

Revised 18 October 1983

PART NAME	QUANTITY
RSL	1
RSR	1
R9L	1
R9R	1
RS	2
C1A	2
C1B	2
C2	4
C3	2
C4	2
C5	2
C6	2
AS1	4
AS2	4
G25	4
F61	1

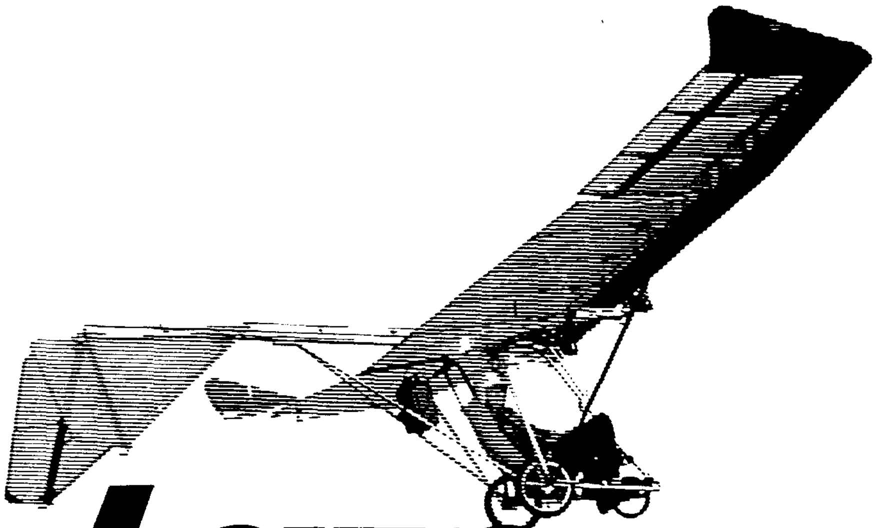
SMALL BUNDLE

Revised 18 October 1983

PART NAME	QUANTITY
G8	1
G22L	1
G22R	1
G23L	1
G23R	1
G62	1
G28	2
G29	4
G30	2

Report No. 81012

Revised October 18, 1983



Lazair™ Microlight Aircraft

series III

ASSEMBLY MANUAL

ULTRA FLIGHT ULTRAFLIGHT MANUFACTURING LIMITED

SPECIAL NOTICE REGARDING TECHNICAL UPDATES

In the green section of this Owner's Manual, we have provided a complete set of the Technical Updates which have been issued up to the present time. These Updates contain technical and safety related information which is essential for the proper maintenance and operation of your aircraft.

Please take the time to review this information carefully and follow the suggestions provided.

As a manufacturer, we want to ensure that every owner receives the Technical Updates, but we can do so only if we know who the owners are. *Please* fill in the attached form and mail it to us so we may put your name on our mailing list. At the present time, these Updates are provided free of charge. Should it become necessary in future to charge a nominal subscription fee, you will be notified in advance.

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Kit No. A925

Date Purchased: 22/3/85

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

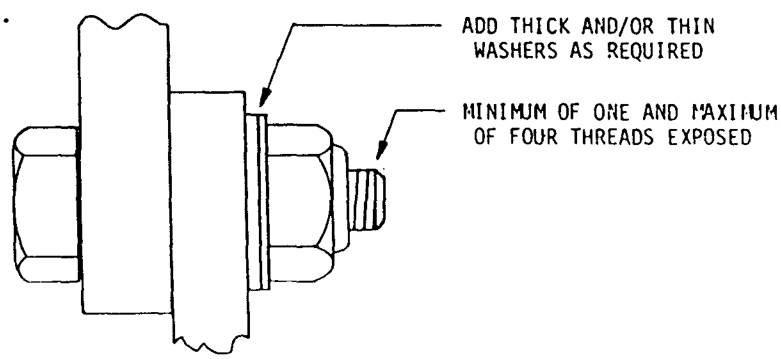
1.5.3 Wherever possible, rivet holes should be at least 1/4 inch away from the edge of the material to be riveted.

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.

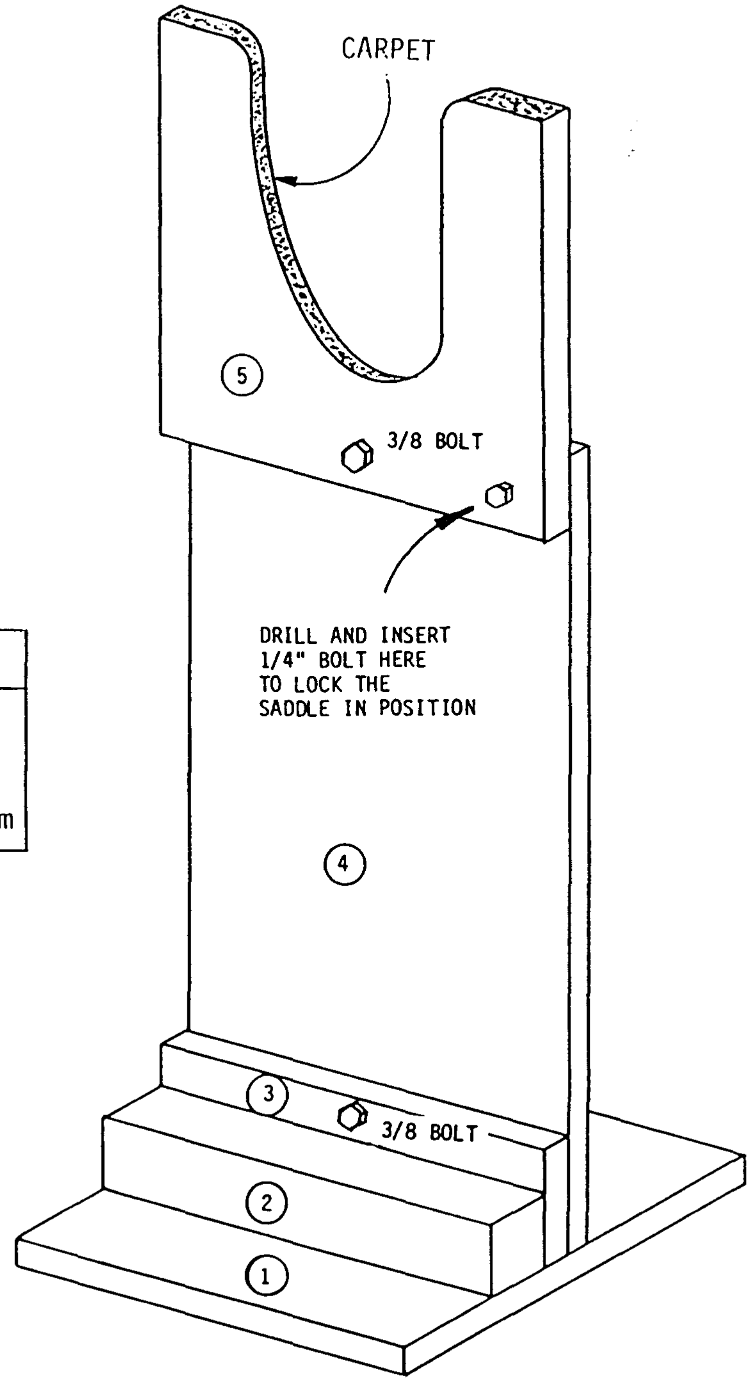
2.2.6 Line the contour of item 5 with a one inch wide strip of carpet material. If staples or nails are used to hold the carpet in place be sure thay are driven in far enough to avoid scratching the D-cell.

MATERIAL SIZES

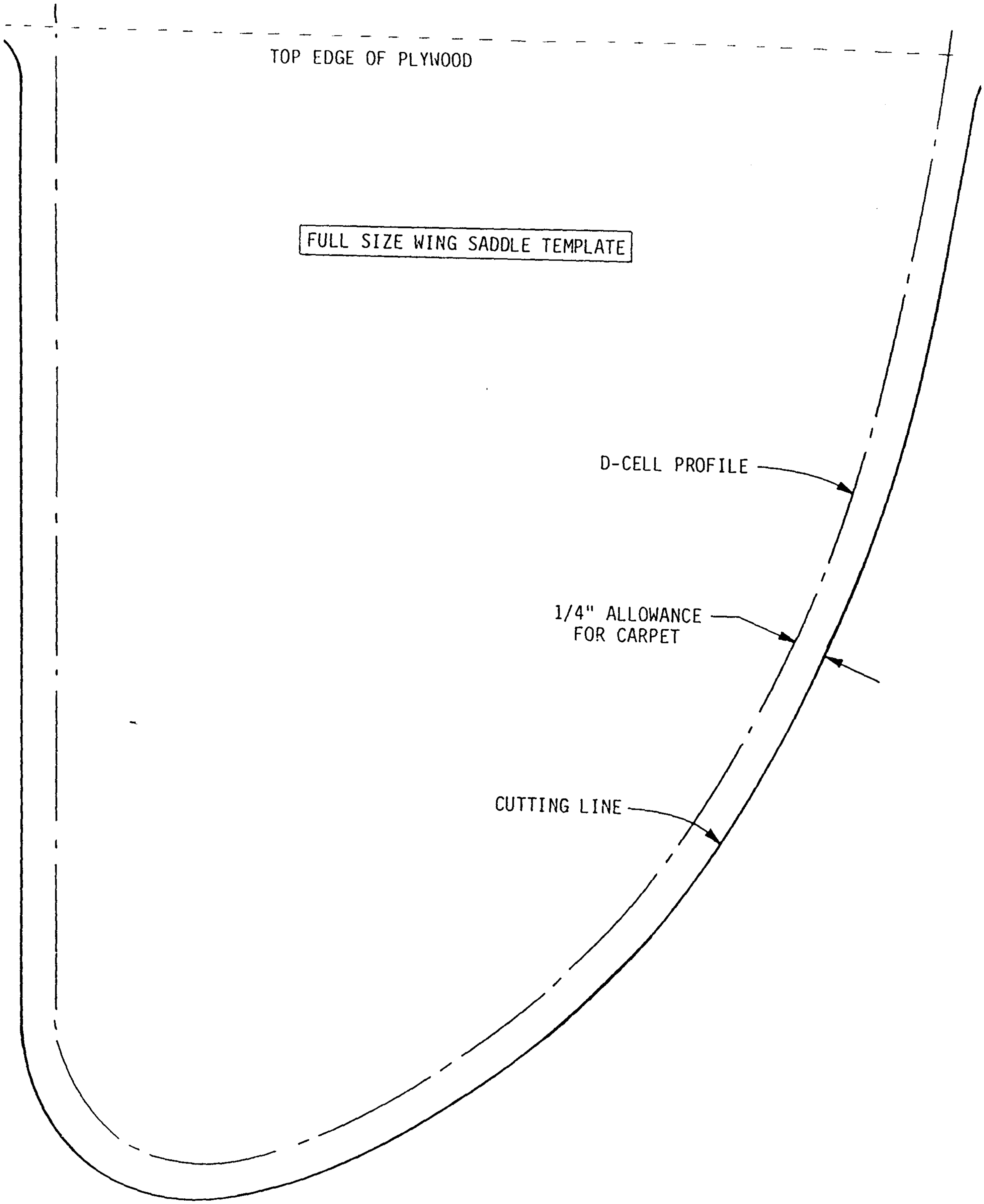
ITEM	SIZE (INCHES)
1	12 x 14
3	12 x 4 1/2
4	12 x 36
5	12 x 14

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

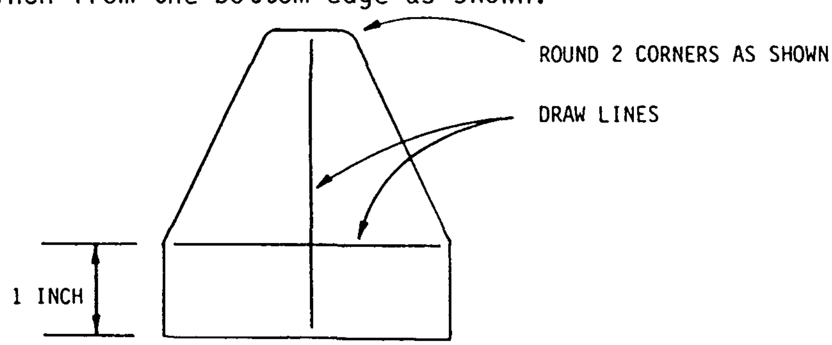
NOTES:

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.*

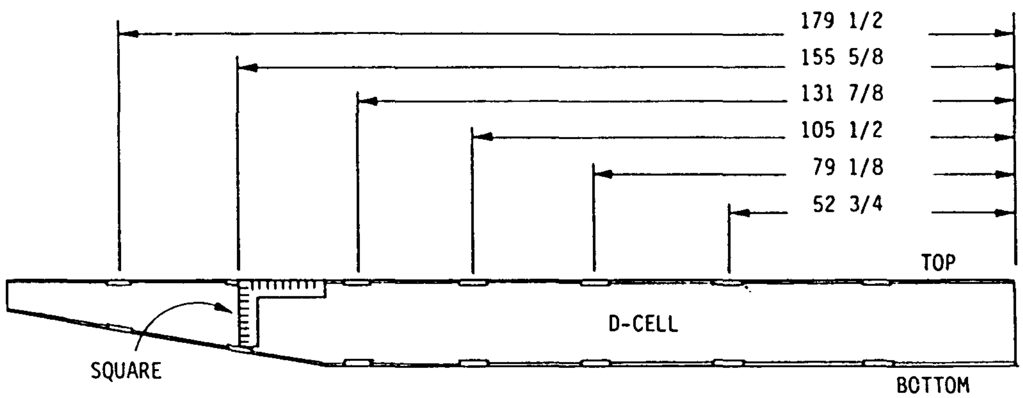
3.1 RIB GUSSET ATTACHMENT

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 $\pm$ 1/16 of an inch. A tolerance of $\pm$ 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.

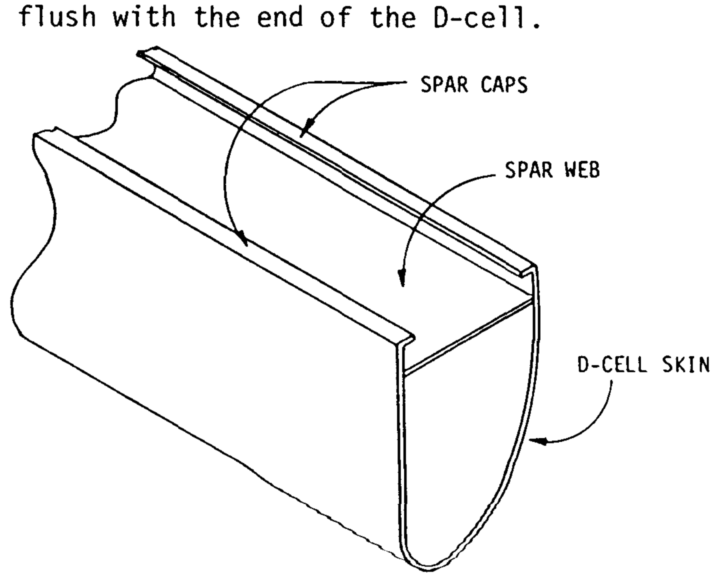
3.1.4 Insert the GBR's under the D-cell skin to a depth of one inch at the locations specified. At some locations it may be necessary to drill out a rivet to insert a GBR.

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

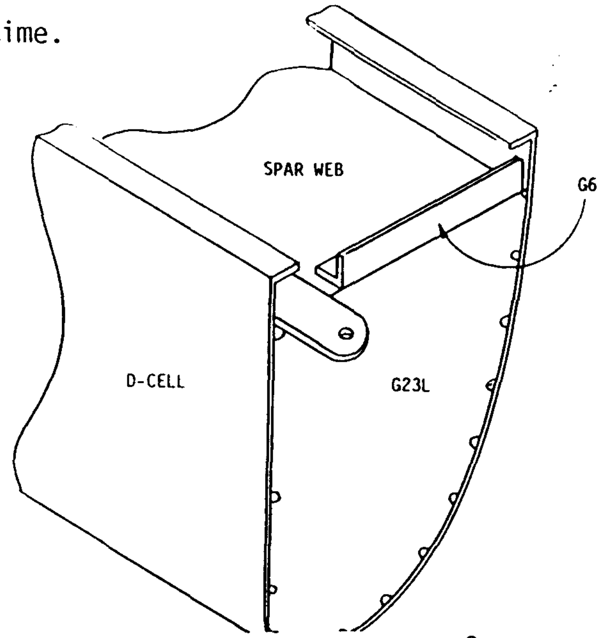
3.2.1 Make sure the tabs on the D-cell root rib G23L are bent at 90^{0}.

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.

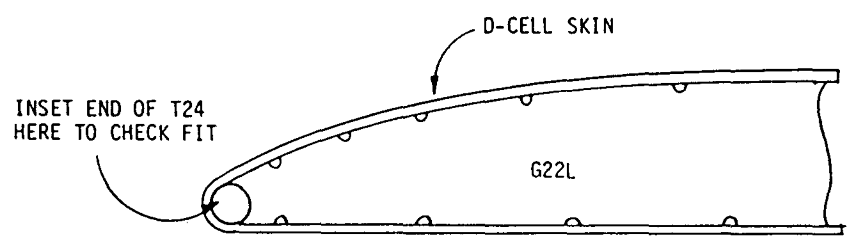


3.2.3 Drill and rivet G23L to the D-cell skin. Put one rivet in each short tab and three rivets in each long tab. Do *not* rivet to the spar web at this time.

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.



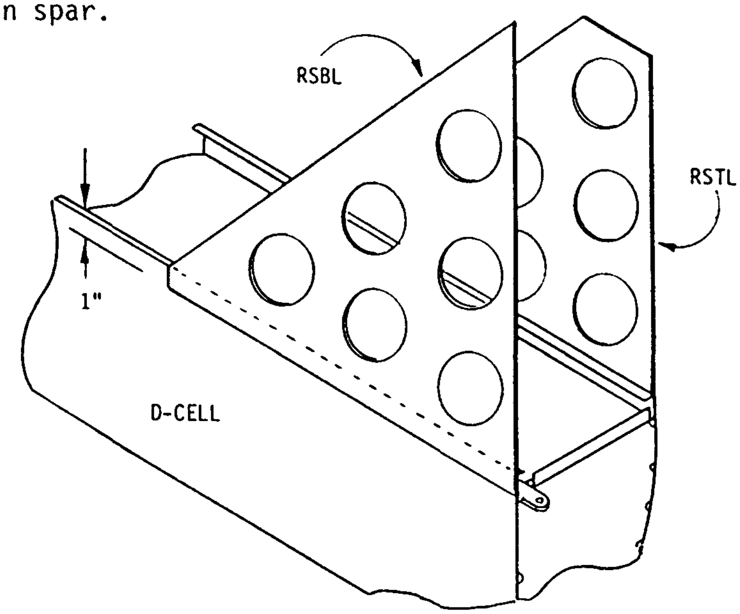
3.2.5 Make sure the tabs on the D-cell tip rib G22L are bent at 90° and fit G22L into the D-cell (tabs first). Cut or file the opening at the leading edge of G22L as necessary to provide a 1/2 inch diameter hole for T24 to be inserted later.



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.

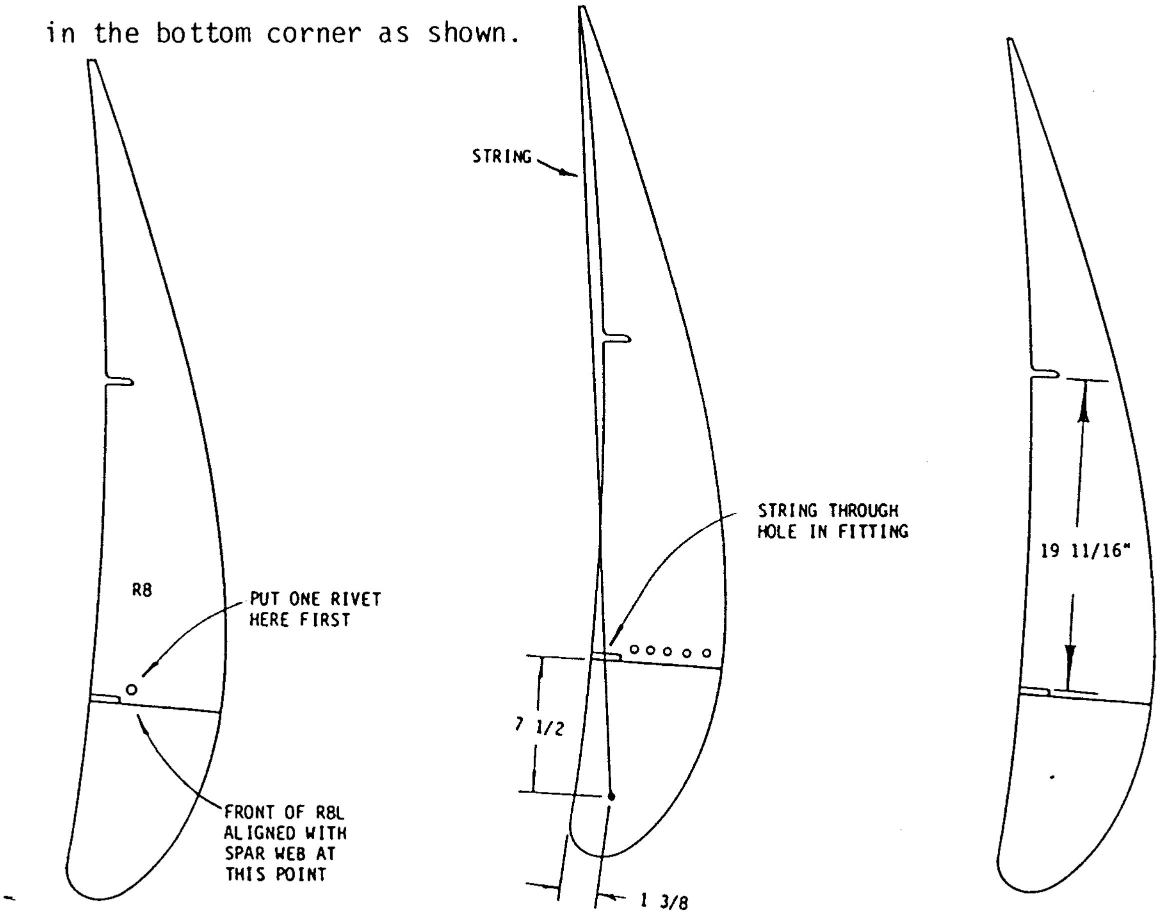
3.3.3 Similarly clamp, drill and rivet the rear spar bottom RSBL to the D-cell.

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.



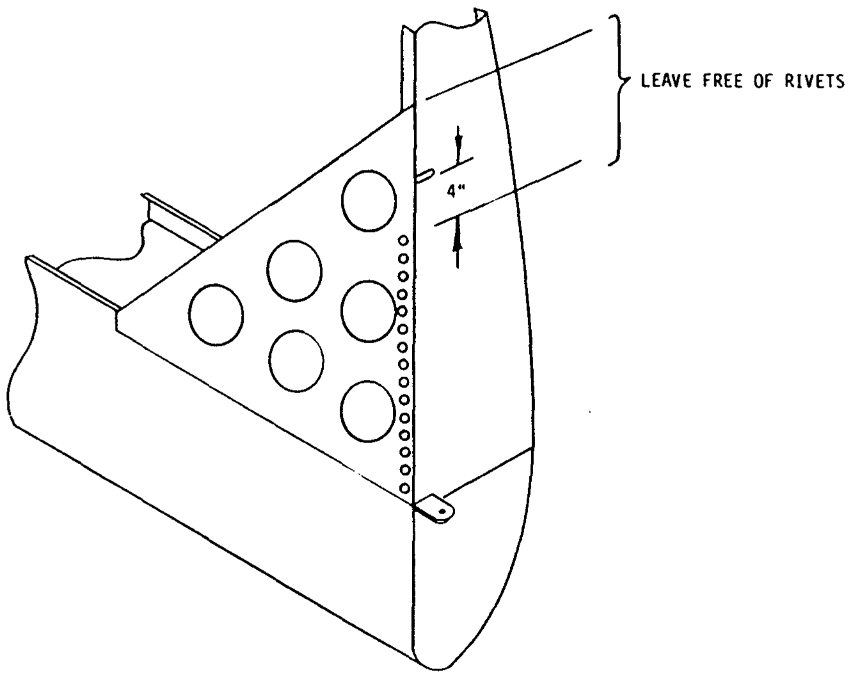
3.3.7 Put a mark on G23L 7-1/2 inches ahead of the spar web and 1-3/8 inches above the bottom of the D-cell. Tape a string to this mark, pass it through the hole in the wing attach fitting and tape it to the bottom of R8L at the trailing edge. Adjust the position of R8L so that the string is straight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

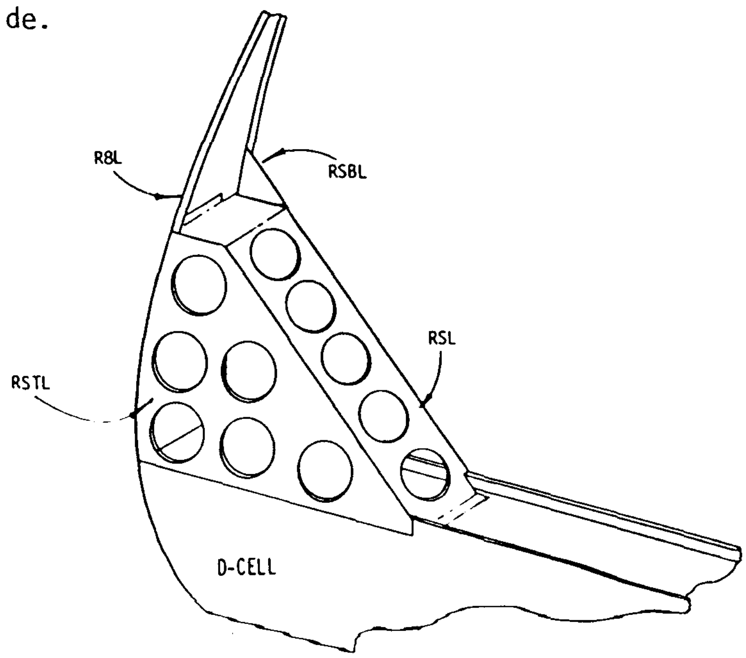
3.3.9 File the slot in R8L to obtain a spacing of 19-11/16 inches between the front wing attach fitting and the slot. Note that this measurement is made between the *rear* surface of the front wing attach fitting and the *leading* edge of the slot.

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.

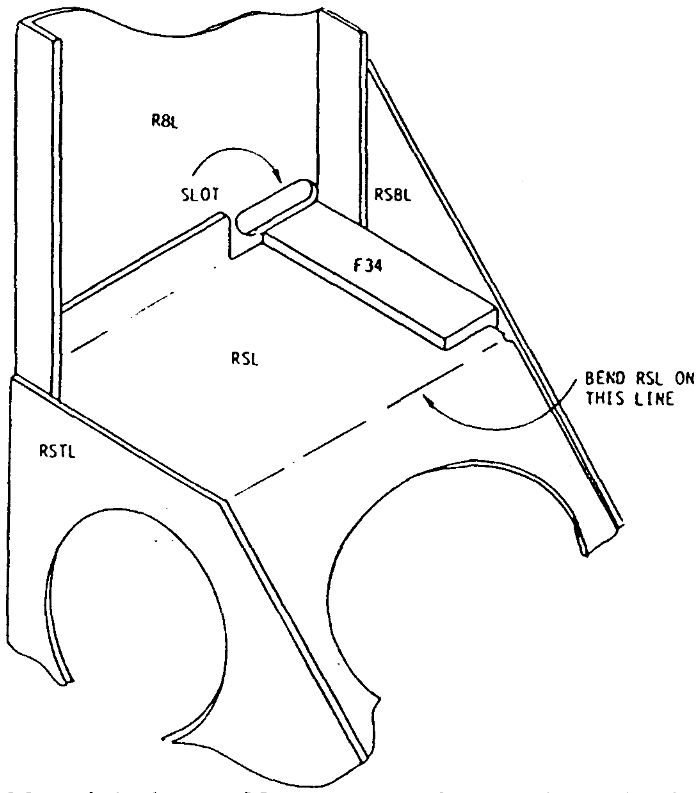
3.3.11 Rivet RSBL to R8L with one-inch rivet spacing. Leave the rear corner free of rivets as shown to allow for the insertion of G12 later.



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.*

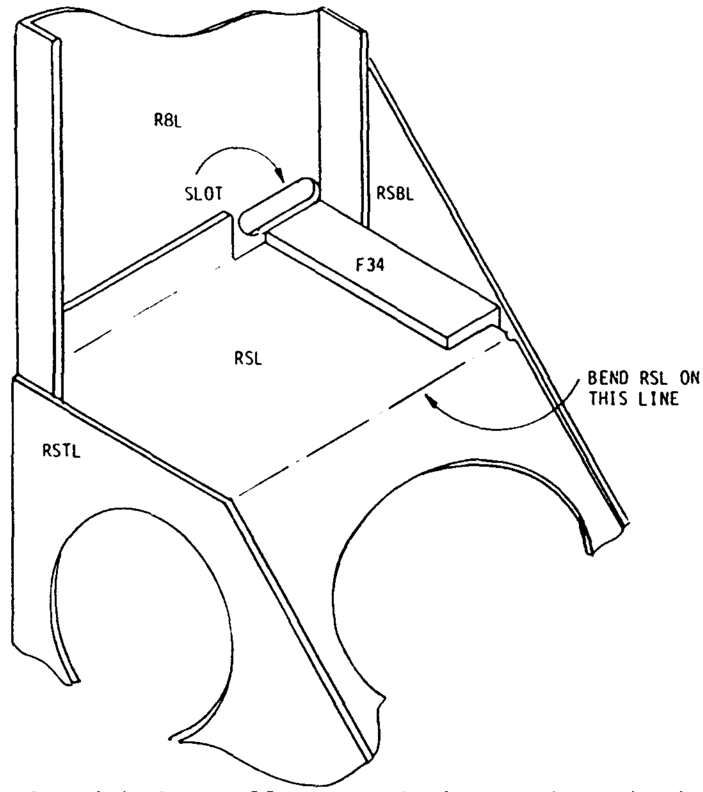


3.3.14 Rivet RSL to R8L with 4 equally spaced rivets through the rear tab of RSL.

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.

3.3.13 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.

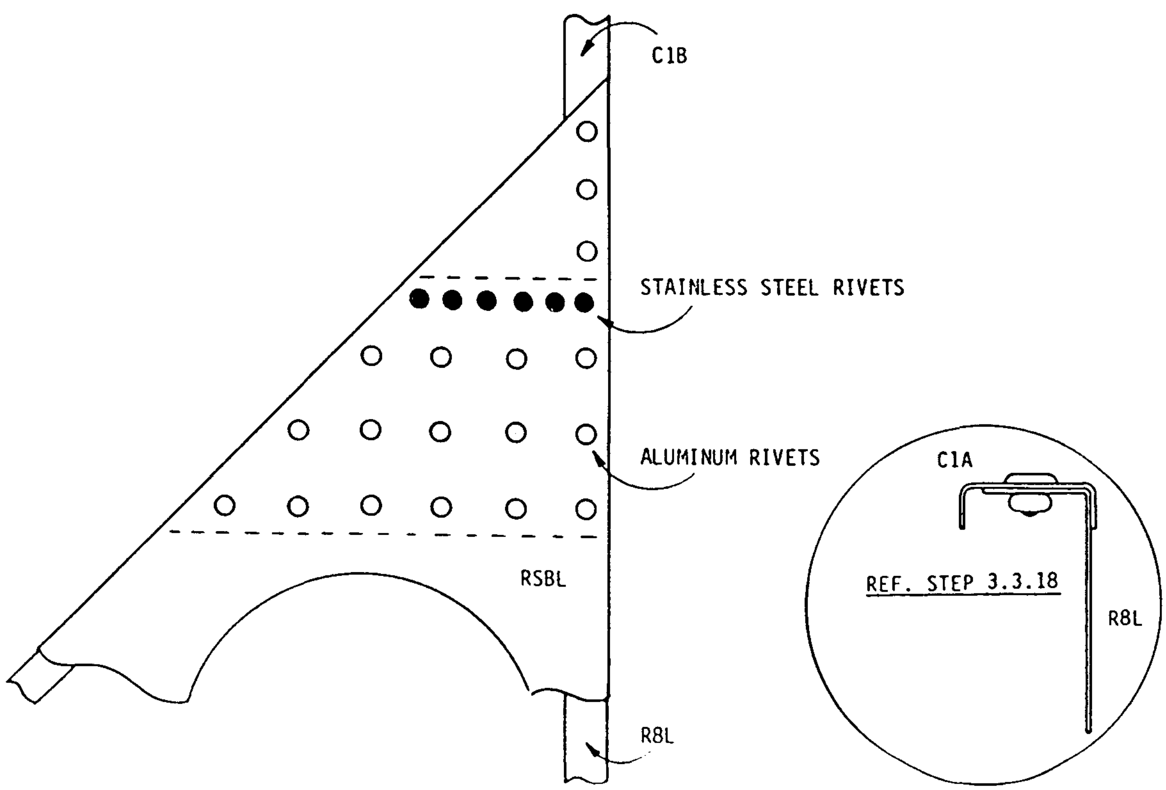
3.3.17 Rivet RSL to the main spar web with 6 equally spaced rivets.

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.

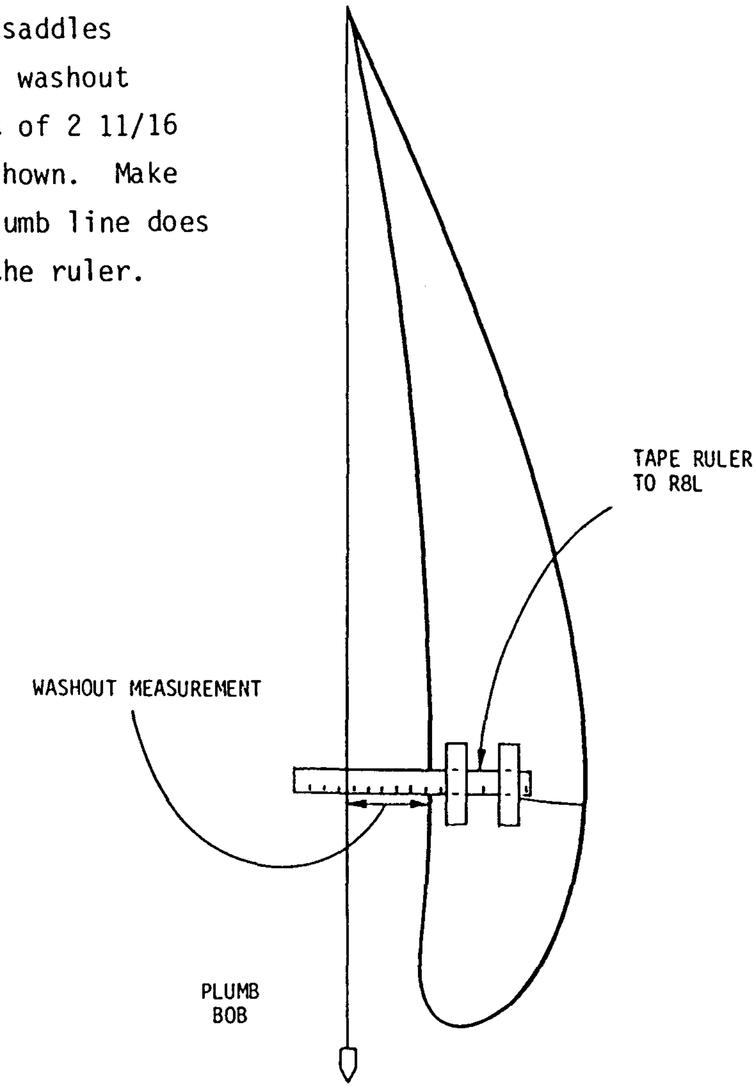
3.4 RIB ATTACHMENT

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.

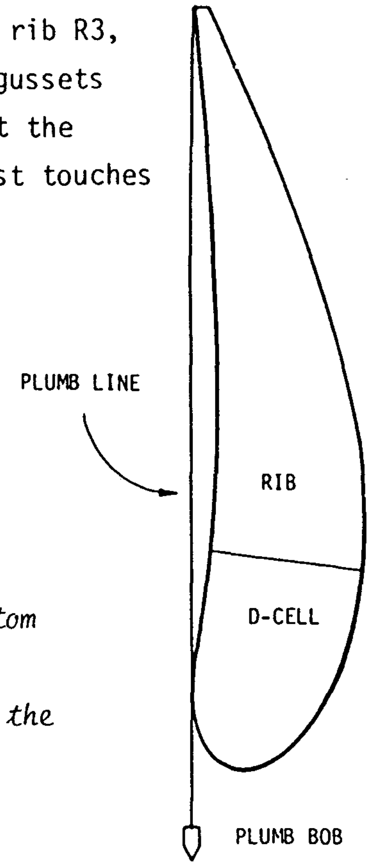
The amount of washout in the Lazair is controlled by measuring the distance between a plumb line (dropped from the trailing edge) and the bottom of the D-cell at the main spar. This distance will be referred to as the washout measurement.

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.

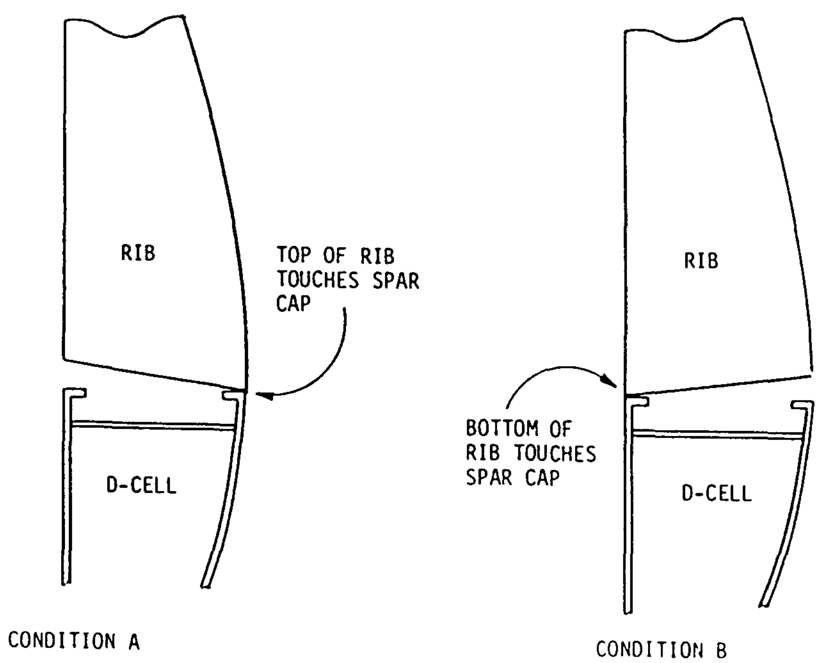


NOTE: *During the next three steps, make sure the wing does not move in the saddles, thereby changing the washout measurement. If the D-cell is not a tight fit in the saddles, it may be necessary to use some small wooden wedges or shims between the saddles and the D-cell. If there is any doubt,* recheck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

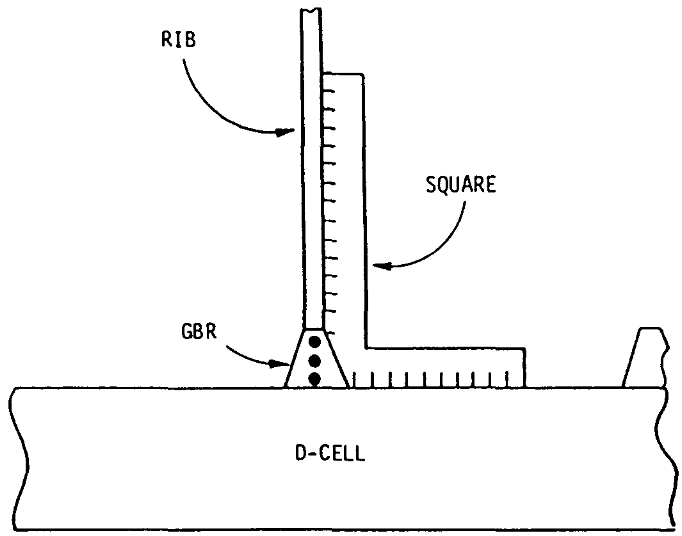
3.4.2 Tape the plumb line to the trailing edge of rib R3, and insert the rib between the appropriate gussets (131 7/8 inches from the wing root). Adjust the position of the rib until the plumb line just touches the bottom of the D-cell as shown.



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.*



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.

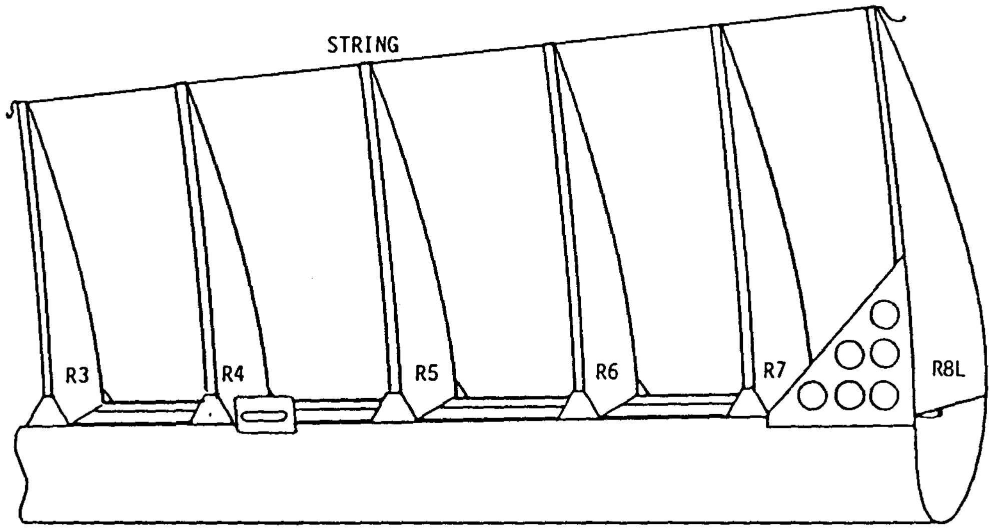
3.4.5 Trim the trailing edge of R3 so that it is 33 1/2 inches from the spar web. Use tin snips to cut the aluminum and a knife to cut the foam.

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.

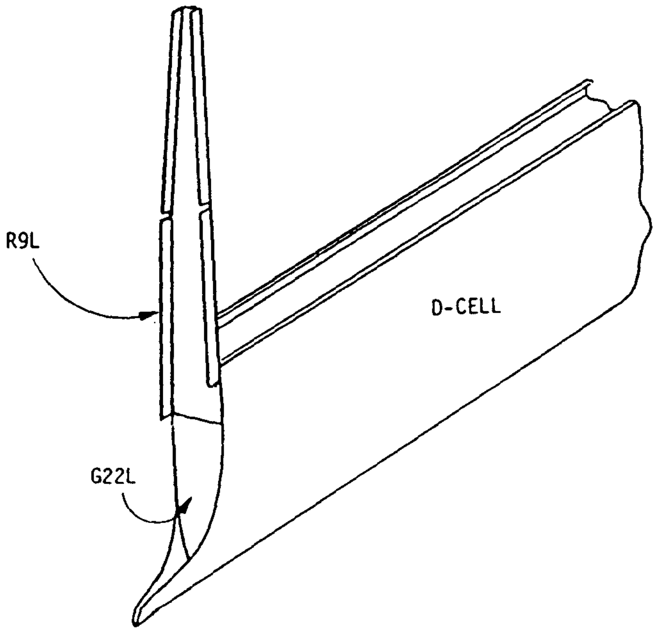
3.4.8 Insert rib R4 (105 1/2 inches from the root) so that the bottom of R4 just touches the string. Rivet R4 in place using the same riveting sequence as for R3.

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

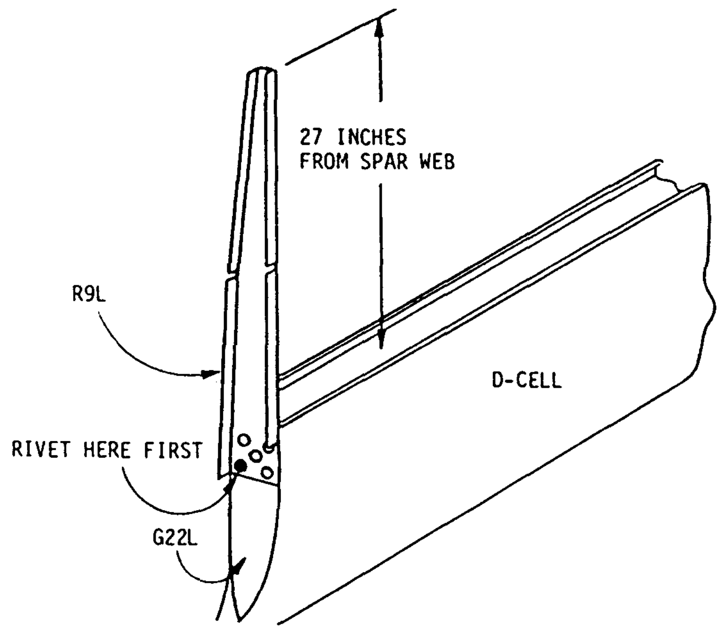


3.4.10 Trim the trailing edge of ribs R4 to R7 so that they just reach the string.

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



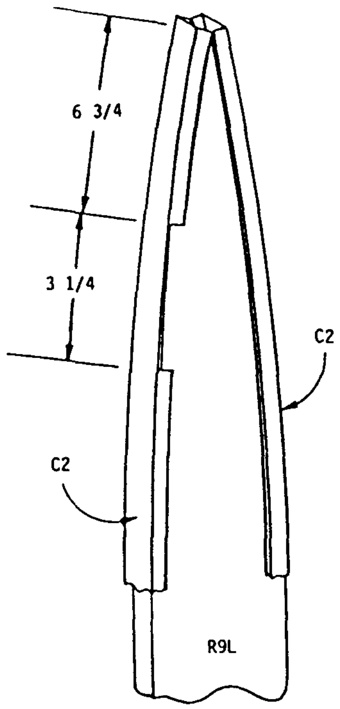
3.4.12 Adjust the position of R9L until the trailing edge of R9L is 27 inches from the spar web and the bottom edge of R9L is in line with the bottom edge of the D-cell. Rivet R9L to G22L with *one rivet only* in the bottom corner as shown.

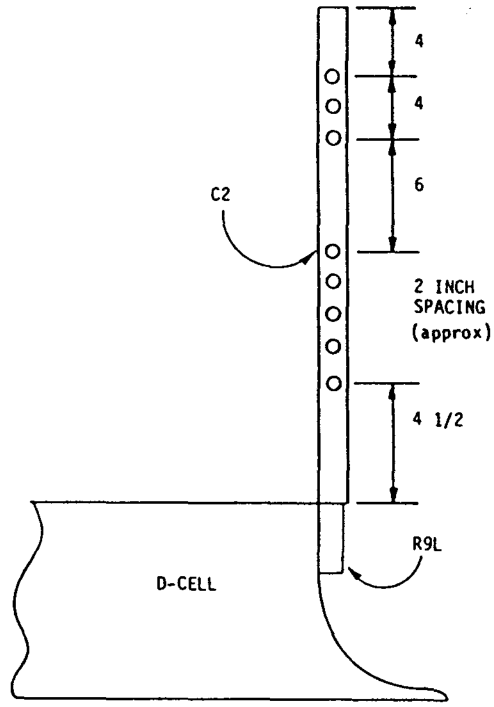


3.4.13 Adjust the wing saddles for a washout measurement of 5 5/8 inches (refer to figure for step 3.4.1).

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.

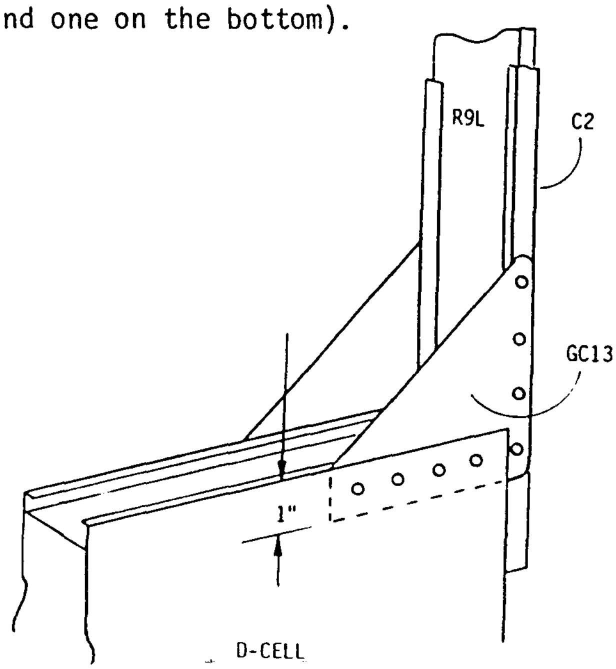
3.4.15 Remove a 3 1/4 inch section of the lip from a capstrip C2 as shown. Note that this section is removed from the *bottom* capstrip only on the *aileron side* of R9.





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).



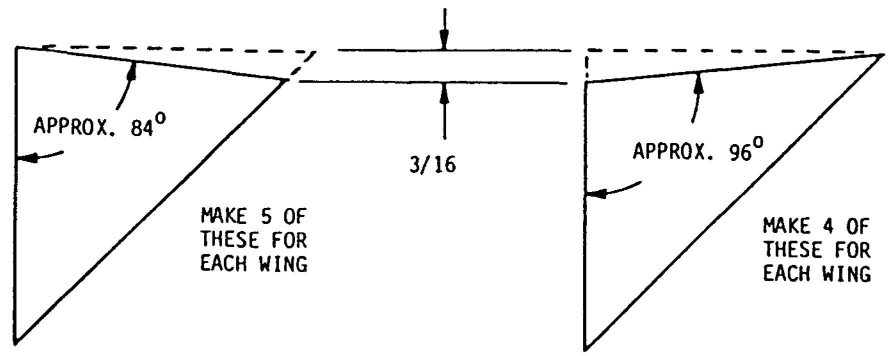
3.4.18 Rivet the GC13's to the D-cell with 4 rivets. Use a square to keep R9L perpendicular to the D-cell and rivet the GC13's to R9L with 4 rivets.

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

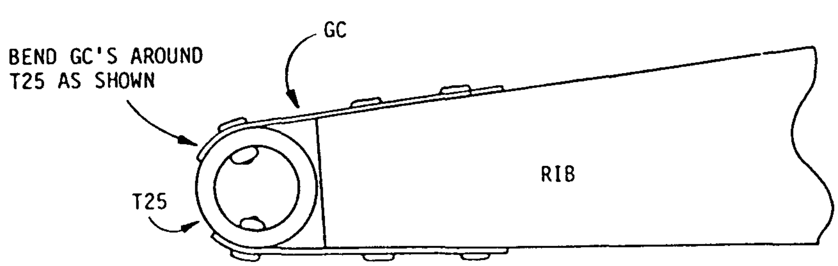
3.5.1 Trim GC gussets as shown. Round the corners of all GC gussets.



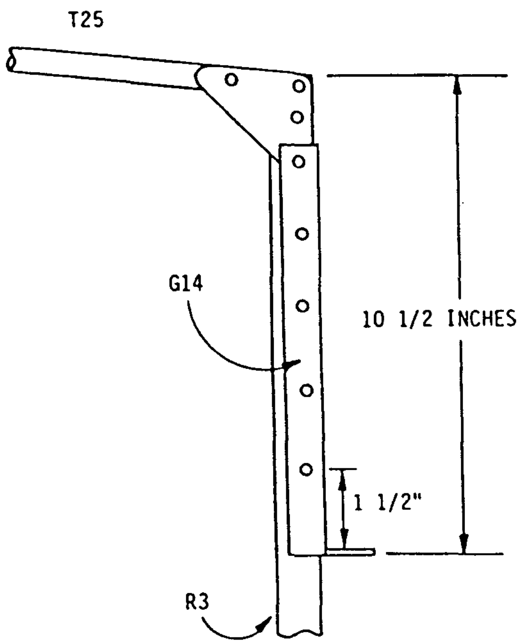
3.5.2 Put the trailing edge T25 in place and hold it temporarily with tape. Check that the distance from the spar web to the rear of the trailing edge (T25) is 48 1/2 inches at the root and 34 inches at R3. Sight along T25 to make sure that all the ribs have been properly trimmed and T25 is straight.

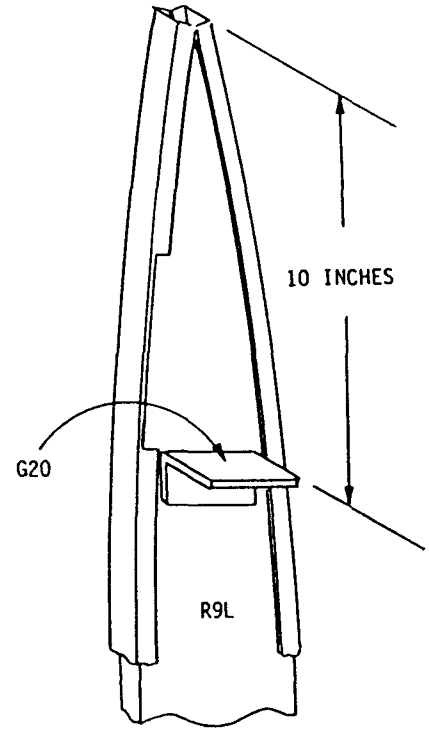
Rivet T25 in place using a GC top and bottom at each rib. For each GC use two rivets into T25 and two rivets into the rib capstrip. Use the 84° modified GC's at the root rib (R8L) and the 96° GC's at R3. Leave out the forwardmost rivet on R3 to allow G14 to be fitted later.

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



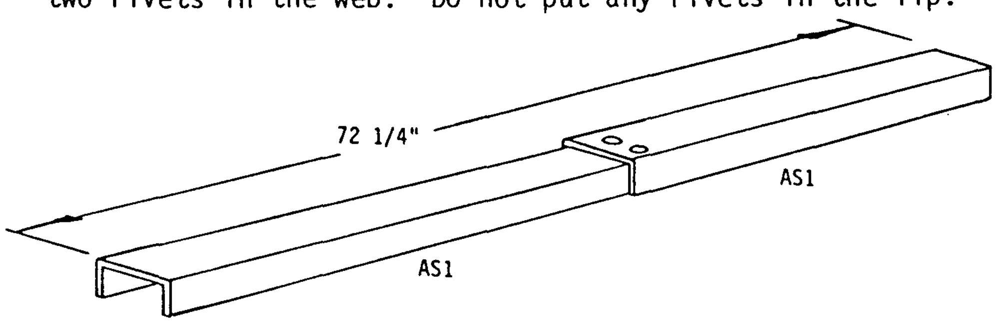
3.5.3 Round the corners on G14 and fit it over R3 as shown. Rivet G14 to R3 with 5 rivets top and bottom. Do not rivet within 1 1/2 inches of the tab on G14.





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

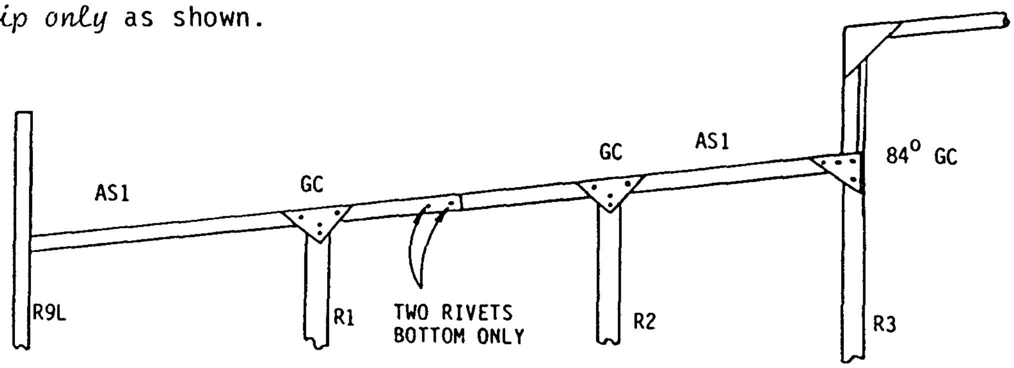
3.5.5 Splice two AS1's together to obtain a total length of 72 1/4 inches. Make sure the two pieces form a straight line. Use two rivets in the web. Do not put any rivets in the lip.



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

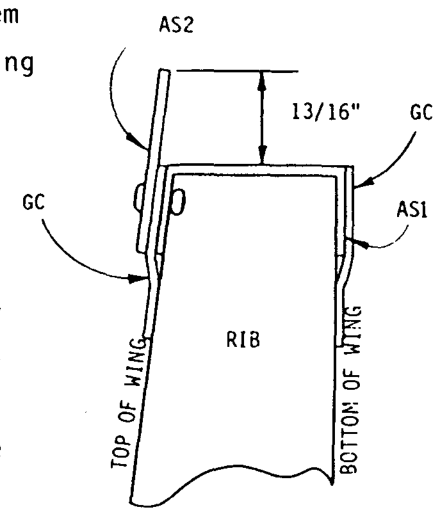
3.5.7 Fit the spliced AS1 assembly over G14, G20, R1, and R2. Make sure that the AS1 assembly is straight, is centred on R3 and R9L, and covers the tabs on G14 and G20 completely. R9L may be moved slightly if necessary to obtain the correct spacing between R9L and R3. Rivet the AS1 assembly in place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

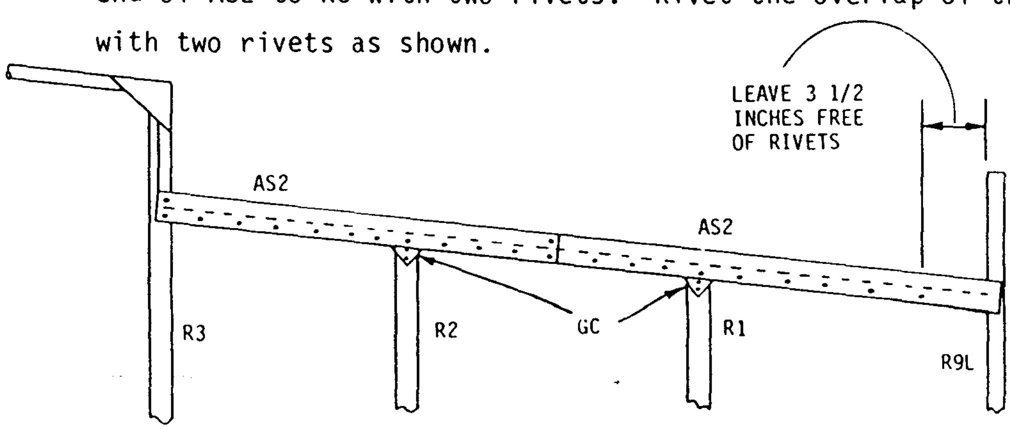
3.5.8 Rivet the AS1 assembly to R3 with a modified (84°) GC gusset *on the bottom of the wing only*. Do not rivet on the top of R3. Make sure AS1 is straight and install two rivets *in the bottom lip only* as shown.



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.

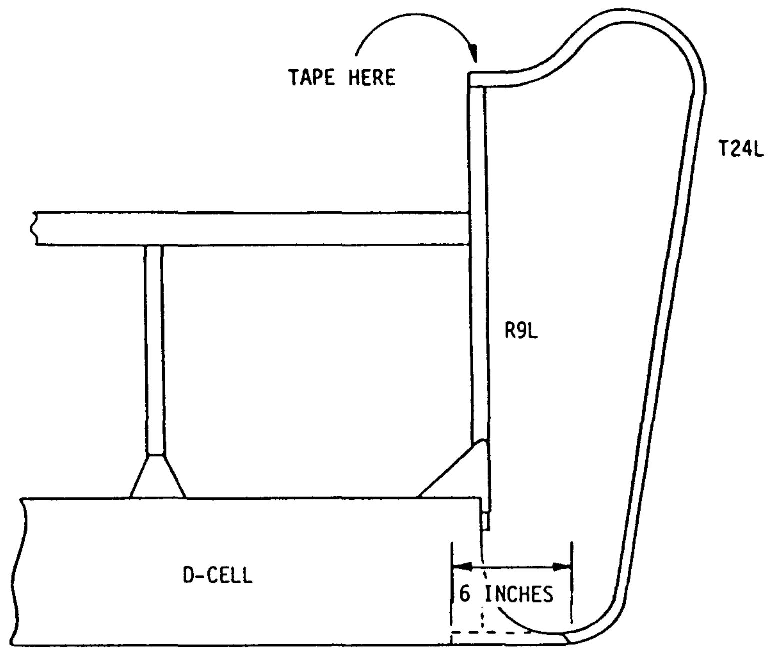
3.5.10 Round the corners on two AS2's and clamp them to the lip of the AS1's on the top of the wing only. The AS2's should extend 13/16 inches behind the web of the AS1's. Sight the trailing edge of the AS2's and make sure it is a straight line. Rivet the AS2's to the AS1's with a 3-inch rivet spacing. 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.





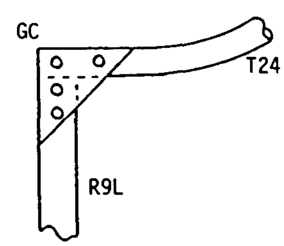
3.6 WING TIP ASSEMBLY

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.



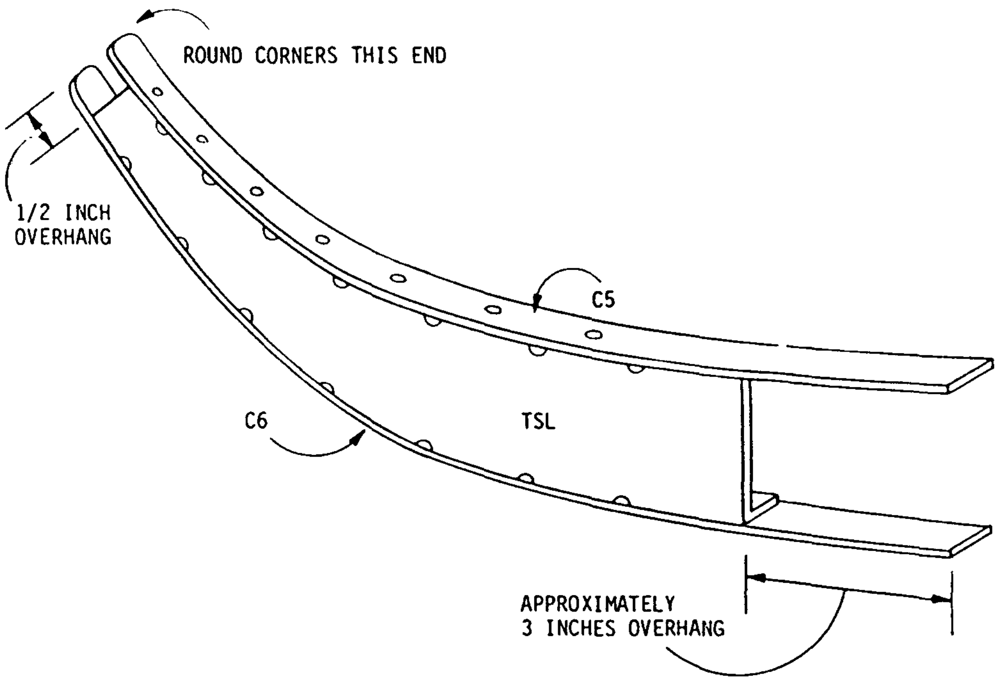
3.6.2 Rivet the leading edge of the tip bow in place with 4 equally spaced rivets through the leading edge of the D-cell skin.

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



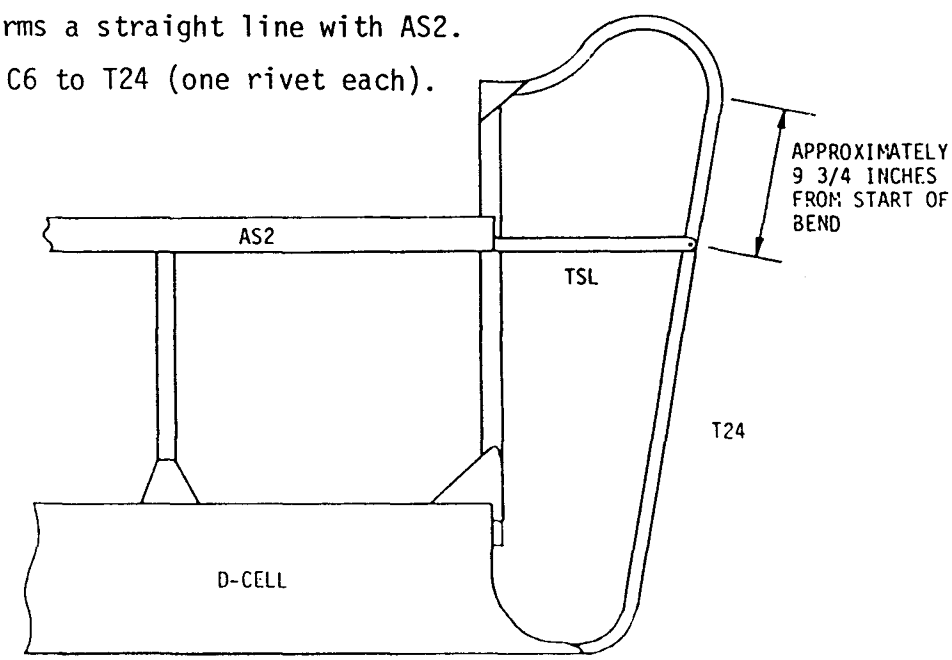
3.6.4 Round the corners on one end of capstrip C5 and rivet it to the inside curve of tip spar TSL as shown. The rounded end of C5 should extend 1/2 inch beyond the narrow end of TSL.

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

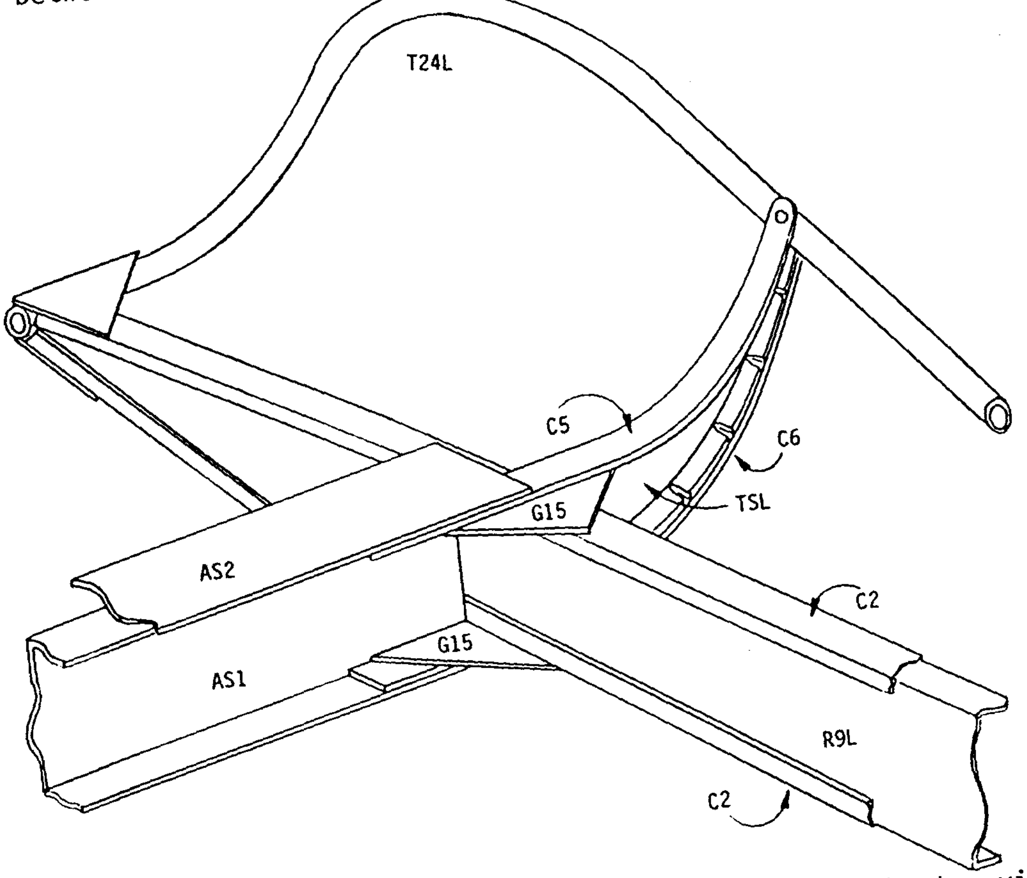


3.6.6 Round one end of capstrip C6 and rivet to the outside curve of TSL as shown. Rivet as in step 3.6.5 above.

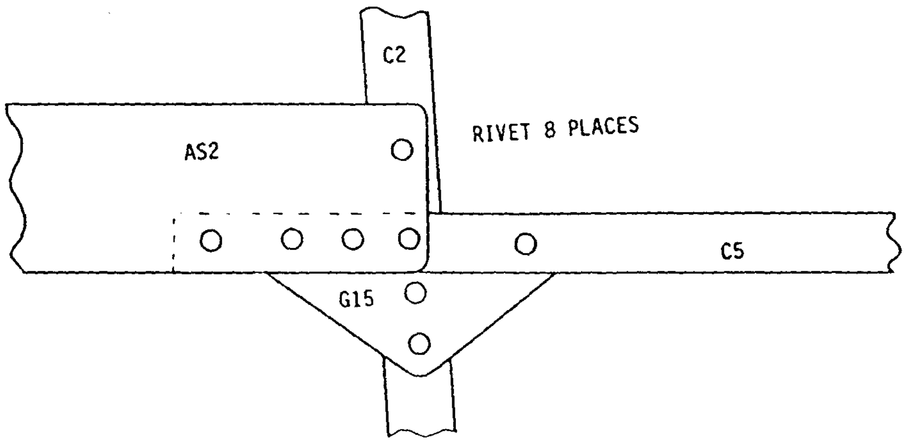
3.6.7 Fit TSL into position as shown. The leading edge of C5 should be in line with the leading edge of AS2 and the 3 inch extensions of C5 and C6 should be inside the flanges of AS1. Sight along the leading edge of AS2 and adjust the position of the TSL assembly so that it forms a straight line with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



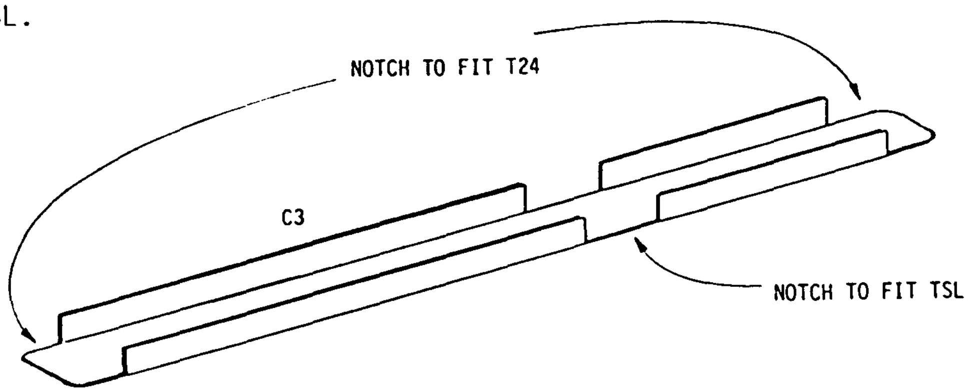
3.6.8 Insert two G15's (one top, one bottom) as shown. The G15's should fit between C5 (or C6) and the tip rib capstrip C2.



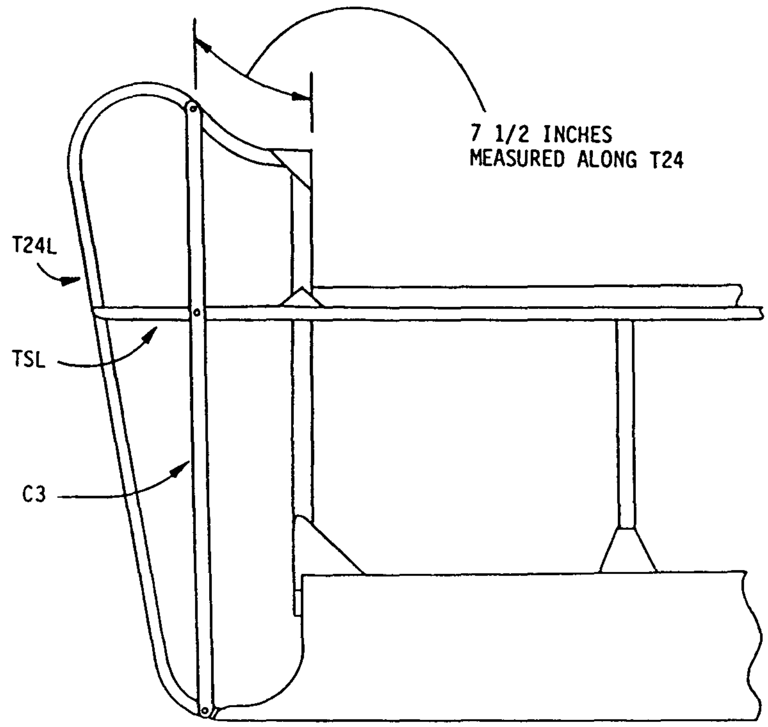
3.6.9 Rivet the tip spar assembly as shown. Note that only the top view is shown. The bottom should be riveted in the same way except that there is no AS2 on the bottom.



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.

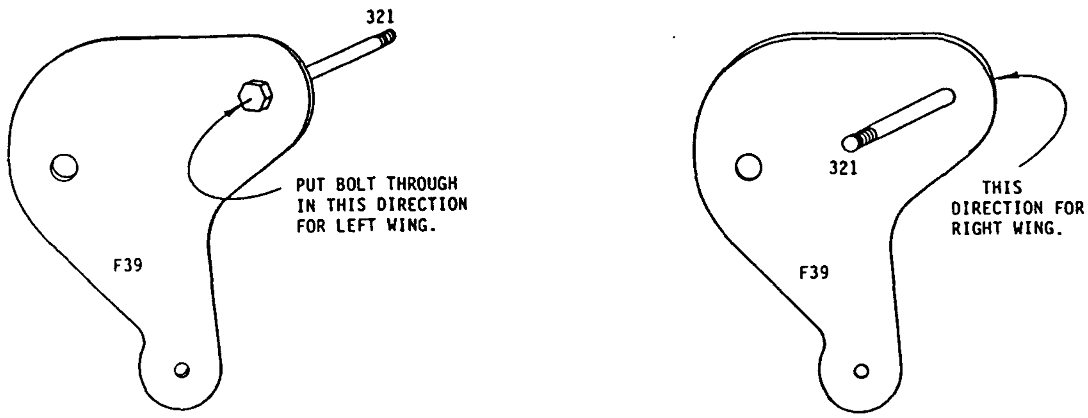
On earlier models (with the overhead control stick) the aileron linkage was connected from the stick, up the fron tube, over the pilot's head to a control horn, then via a pushrod through the wing to a bellcrank. On the Series III Lazair with the lower mounted stick, the ailerons are controlled through 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.

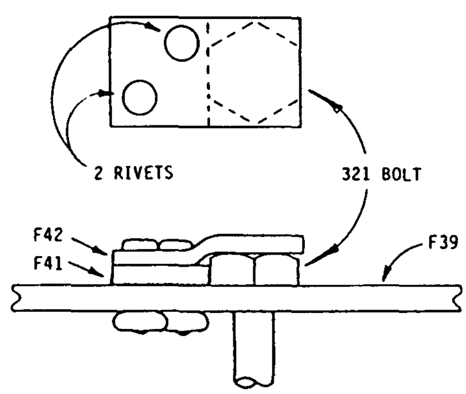
To disassemble the aircraft for transportation or storage, the lift strut and aileron pushrod are disconnected at the inboard end *only* and the strut and pushrod may then be folded against the bottom of the wing.

3.7 AILERON BELLCRANK INSTALLATION

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

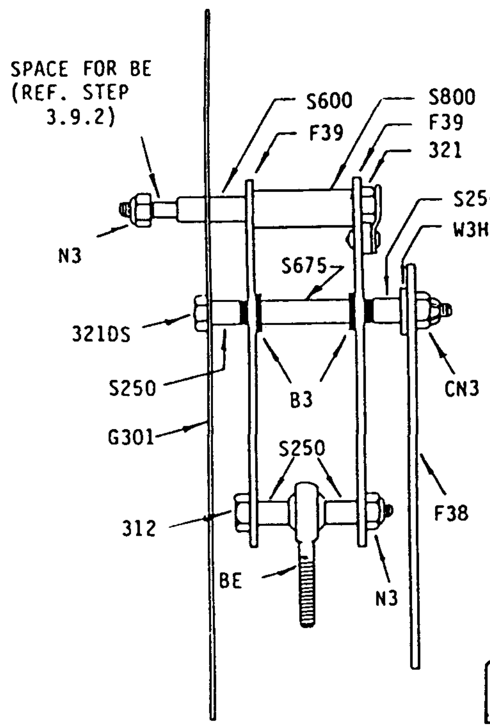


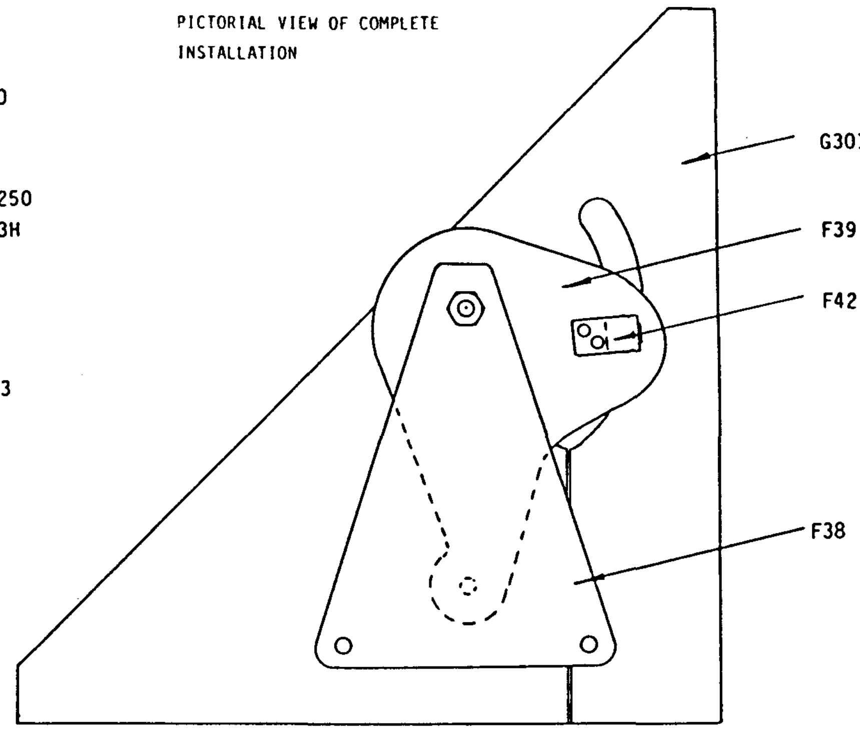
3.7.2 Rivet F41 and F42 to F39 to hold the 321 bolt in place and prevent it from turning. Use two rivets as shown. It may be necessary to bend F42 slightly to allow it to sit flat on F41.



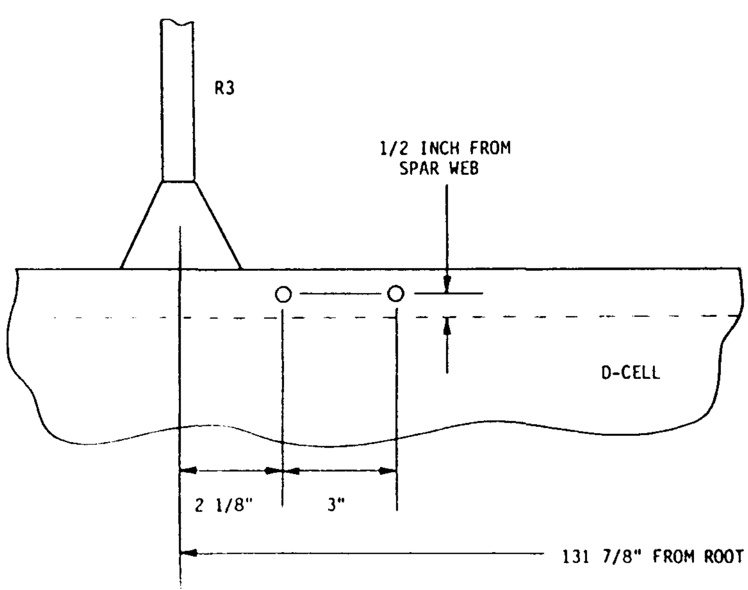
3.7.3 Complete the left aileron bellcrank assembly as shown below. Note that the B3 bushings are installed with the large diameter shoulder on the inside of the F39 bellcranks. Tighten the N3 nut on the 312 bolt securely. Do not tighten the CN3 nut on the 321DS bolt. Do not tighten the N3 nut on the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

Note that the captivated 321 bolt and the S600 spacer fit through the semicircular slot in G301.

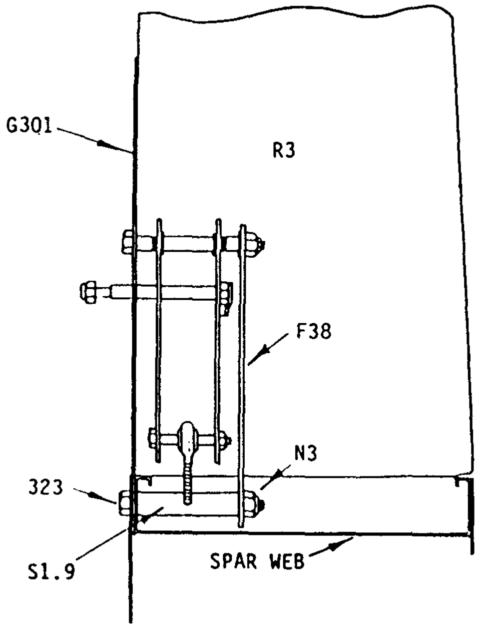


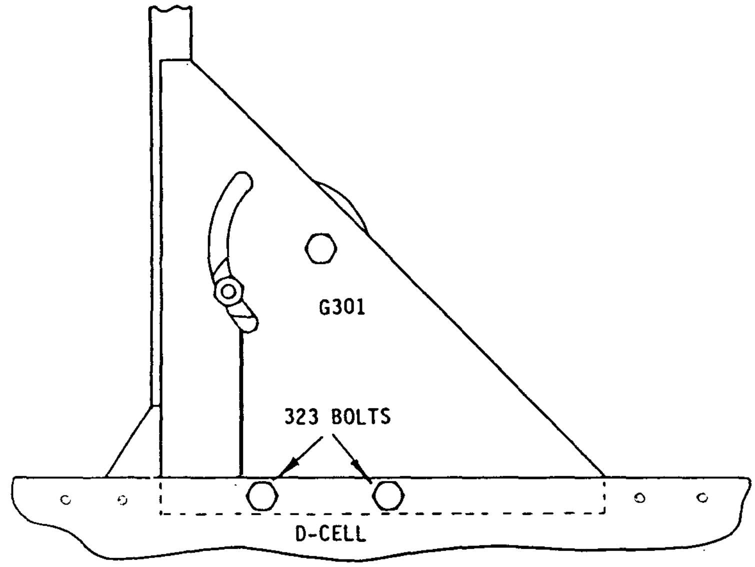


3.7.4 Drill two 3/16 inch holes through the spar cap on the *bottom* of the wing as shown. It may be necessary to drill out one or two rivets to locate these holes properly.

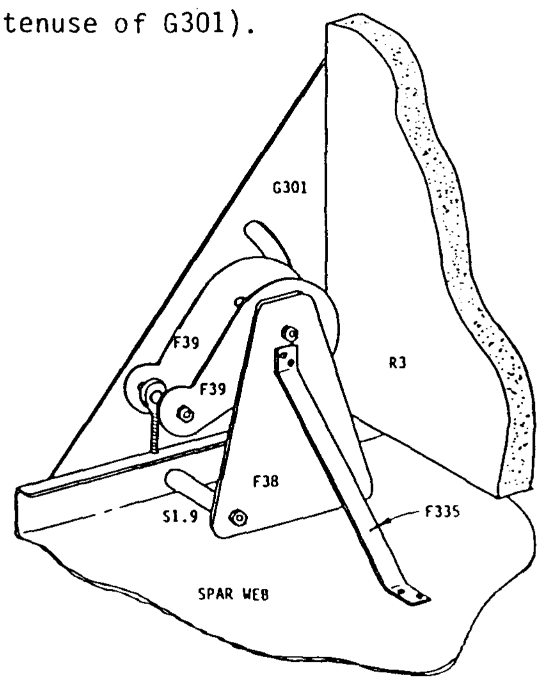


3.7.5 Position G301 and F38 as shown. Drill out any rivets in the spar cap which are under G301. Do not remove the rivets holding GBR to R3. Slip G301 under the D-cell skin until the holes are properly aligned. Bolt the bellcrank assembly to the spar cap using 323 bolts and S1.9 spacers as shown. Use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

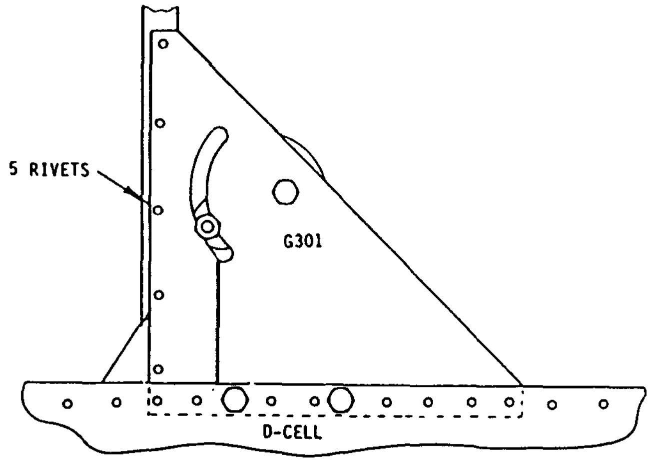




3.7.6 - Drill two 1/8 inch holes in each end of bellcrank bracket F335 and rivet it to F38 as shown. Adjust the position of the bellcrank assembly so that G301 is in plane with the bottom surface of the wing and rivet F335 to the spar web (the position can be checked by holding a straightedge between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

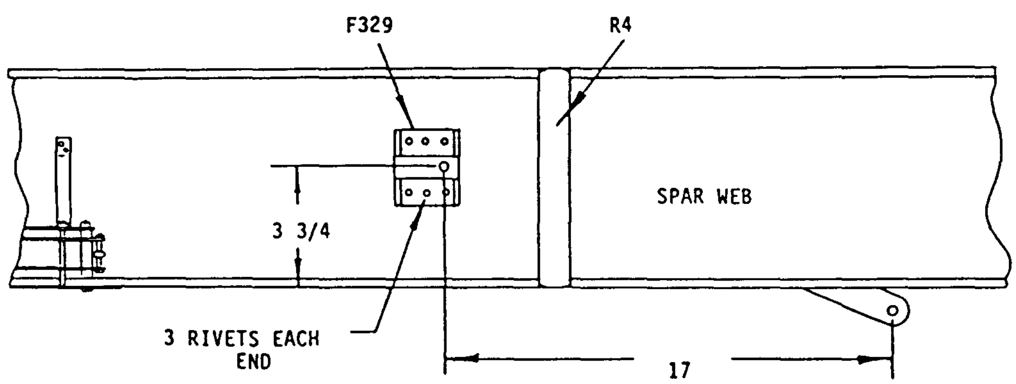


3.7.7 Rivet G301 to the bottom capstrip of R3 with 5 equally spaced rivets. Rivet G301 to the spar cap with a 1 inch rivet spacing.

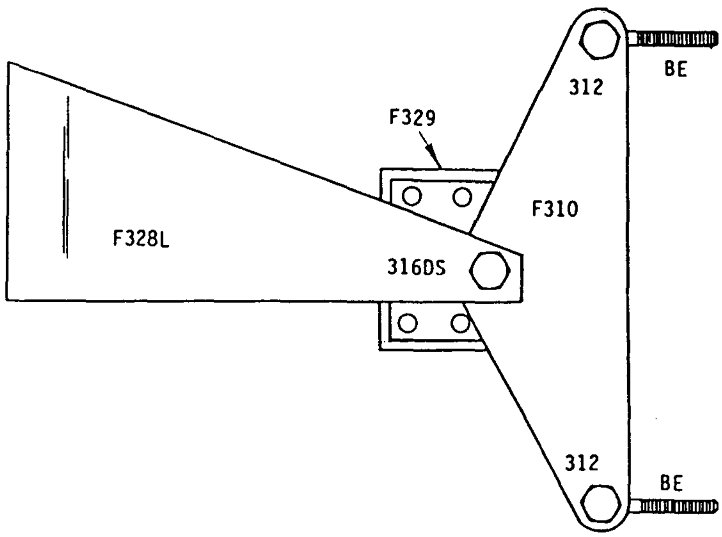


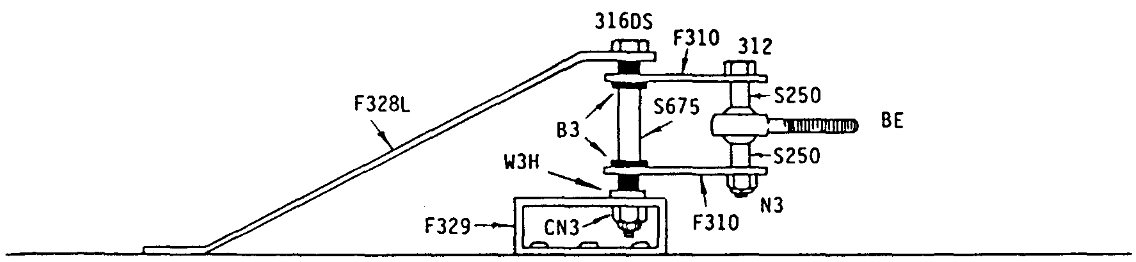
3.7.8 Tighten the castle nut on the 321DS bolt until the bellcrank assembly will just rotate under the force of gravity. Lock the nut with a CP23 cotter pin. Bend the tails on the cotter pin around the nut in opposite directions.

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.

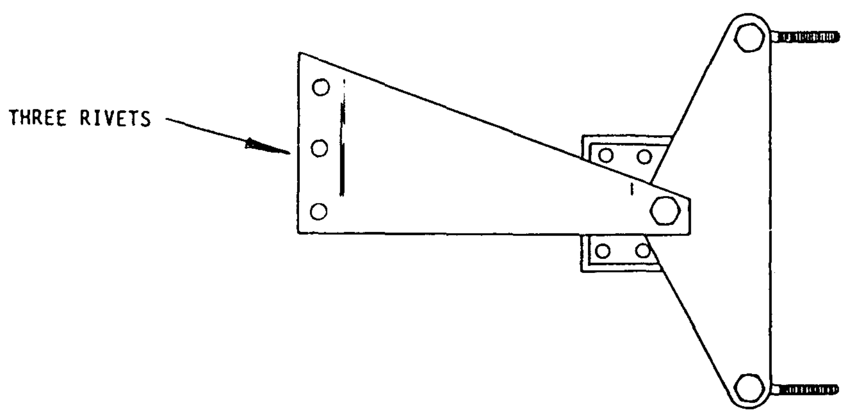


3.7.10 Complete the intermediate bellcrank assembly as shown and bolt it onto the F329 mount. Tighten the CN3 nut on the 316DS bolt to allow the bellcrank to rotate with about the same friction as the F39 assembly (step 3.7.8) and lock the nut with a cotter pin.



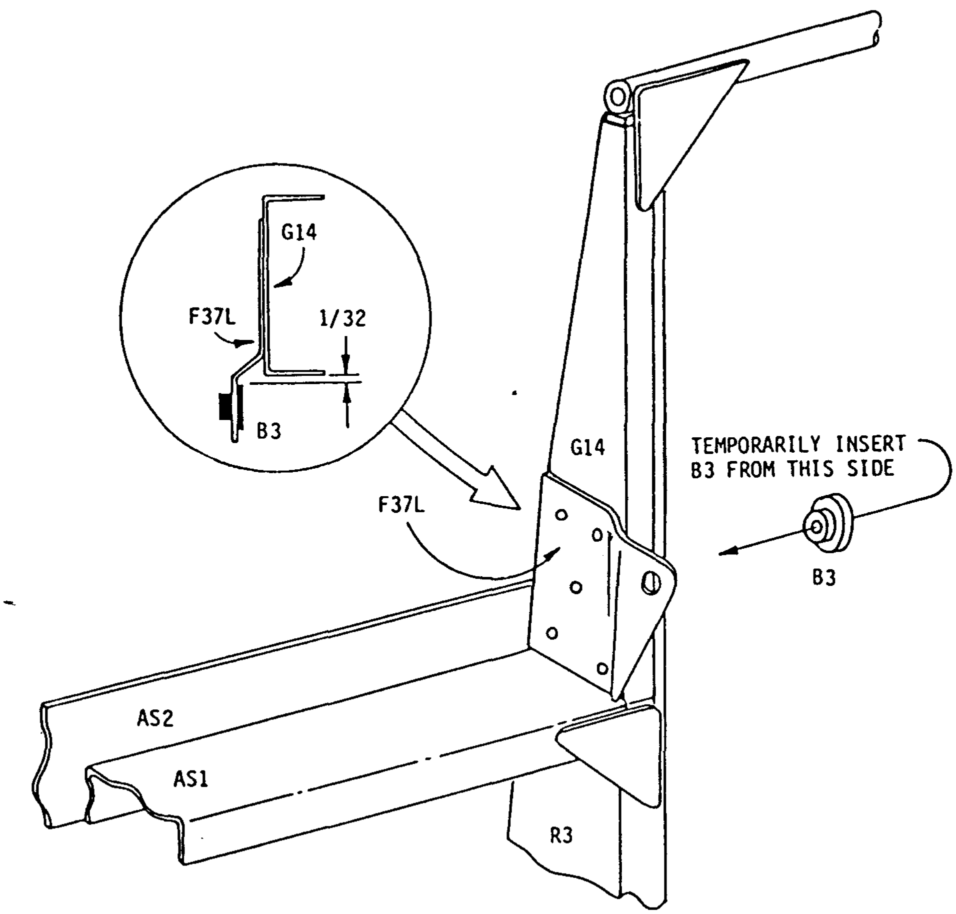


3.7.11 Rivet the bellcrank support F328L to the spar web with 3 rivets as shown. Make sure that the end of F328L is perpendicular to the spar caps and make sure the 316DS pivot bolt is perpendicular to the spar web.



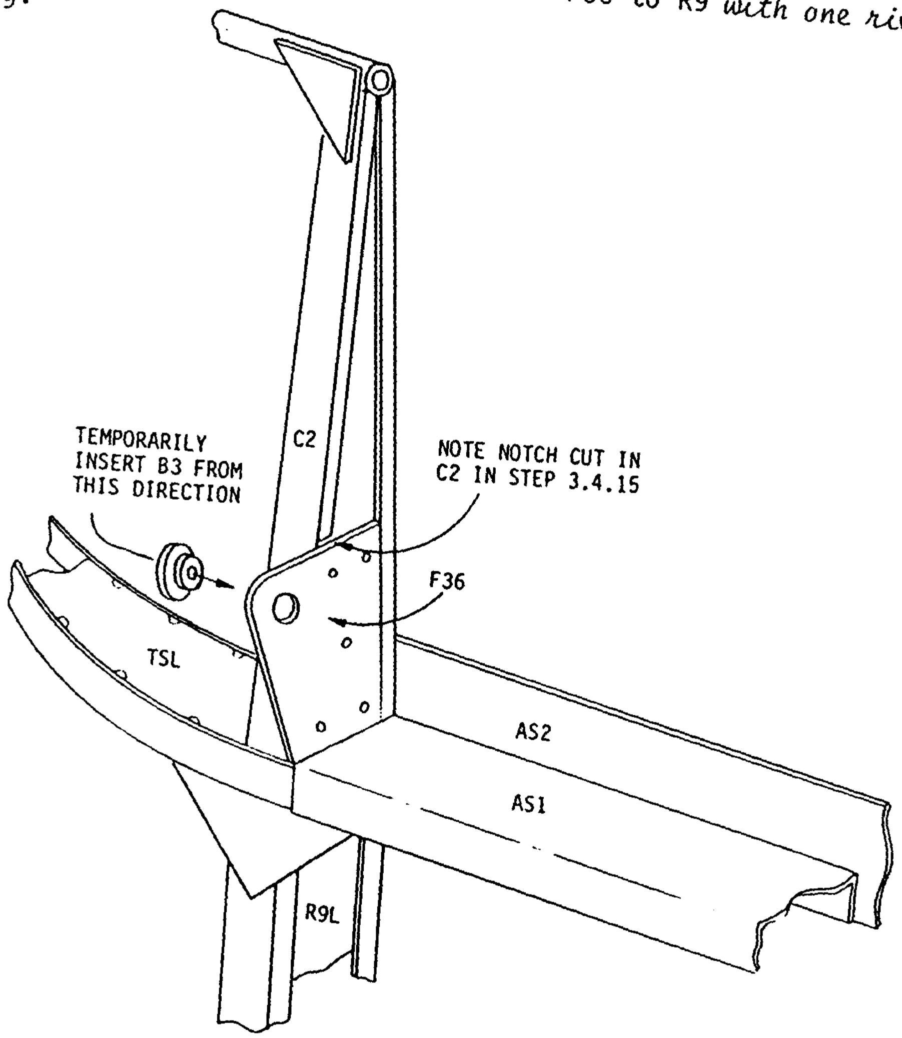
3.8 AILERON ASSEMBLY AND INSTALLATION

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.

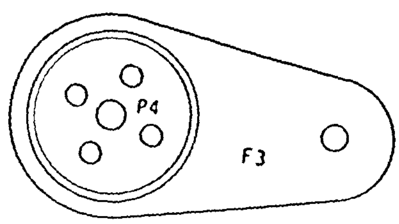


3.8.2 Position the outboard aileron hinge F36 as shown. Make sure the leading edge is tight against AS1. Temporarily install a B3 as in step 3.8.1 and position F36 for a 1/32 inch clearance between

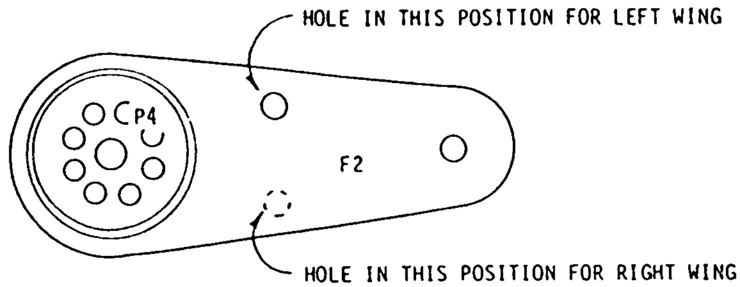
B3 and the C2 capstrip on R9L. Rivet F36 to R9 *with one rivet only.*



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.

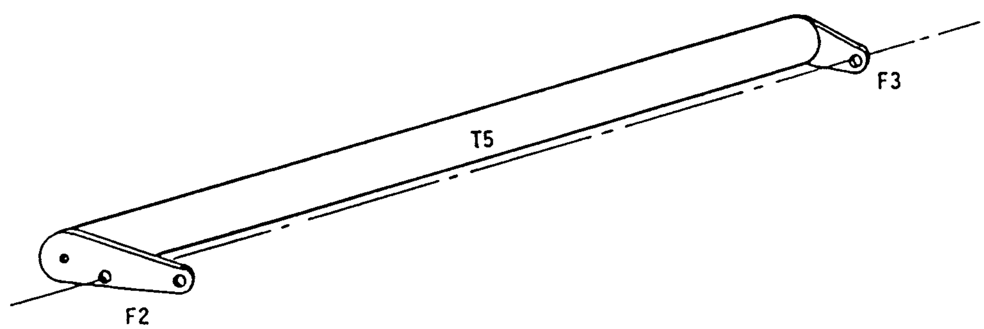


3.8.4 Similarly rivet a P4 to an F2 with *eight* rivets. Note the orientation of the hole in F2.



3.8.5 DELETED

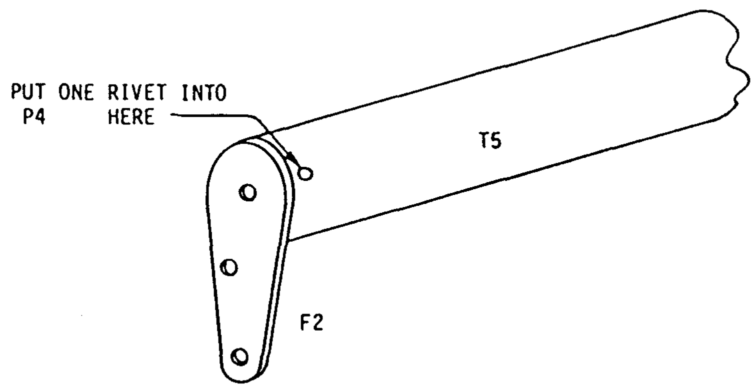
3.8.6 Insert the P4's attached to F2 and F3 into the ends of aileron torque tube T5, but do not rivet at this time. Orient F2 and F3 so that the two hinge holes are in line as shown.



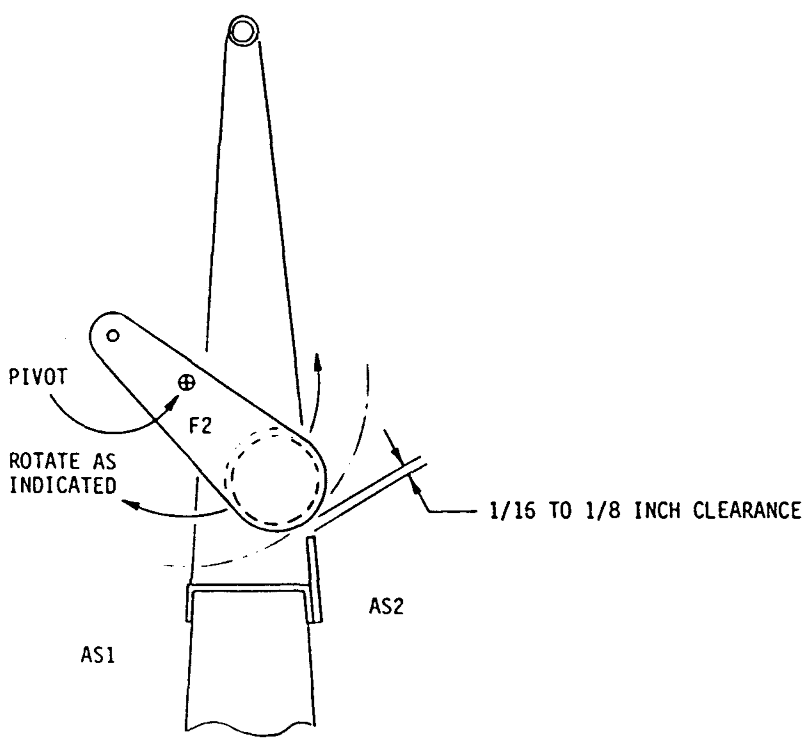
3.8.7 Insert B3 bearings into F36 and F37 *from the aileron side*. Position the aileron torque tube assembly (T5, F2 and F3) between F36 and F37 and temporarily insert two 35 bolts as hinge pins. Note that the F2 end of T5 goes inboard (next to F37). Note also that the hole in F2 nearest T5 is the one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

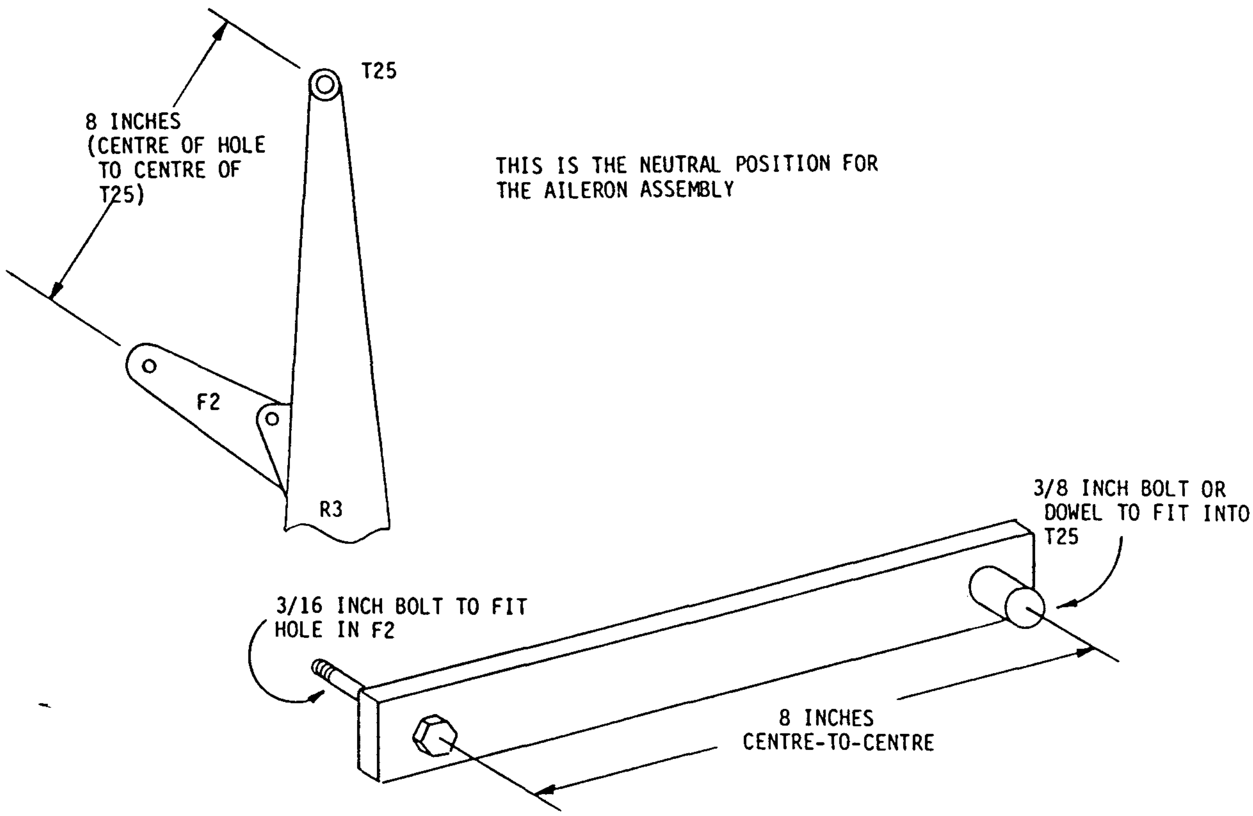
F2 in place *with one rivet only as shown.* Do not rivet F3 at this time.



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.

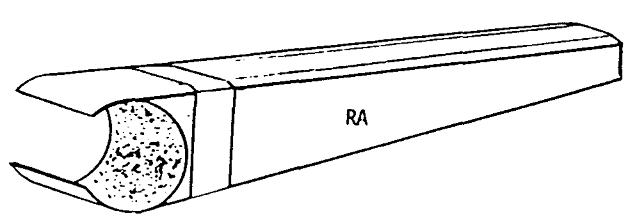


3.8.10 Re-install the T5 assembly and put in the hinge pins. Clamp the position of F2 as shown. A piece of wood and two C-clamps may be used, but it is recommended that a tool be made of wood, plastic or metal as shown in the diagram. Wrap tape around the 3/8 inch dowel pin to make it a tight fit in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

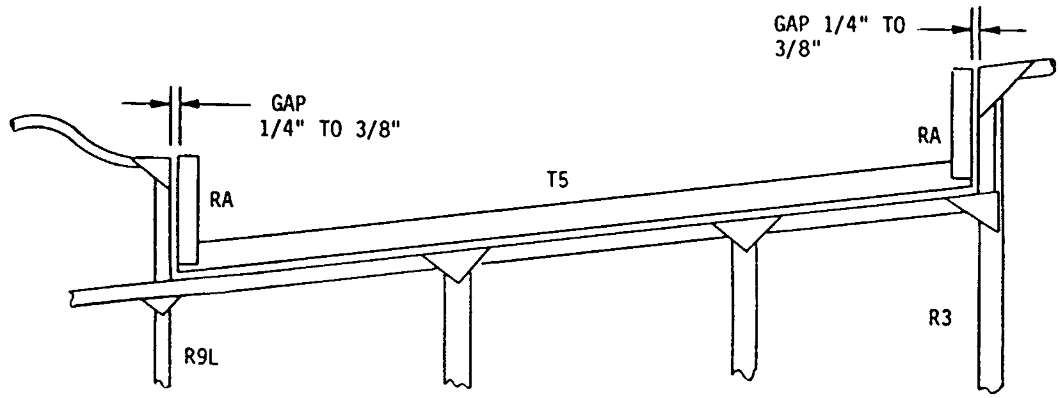


3.8.11 Sight T5 from behind the trailing edge and make sure that it is parallel to AS1/AS2. Rotate the F3 on the end of T5 if necessary. When T5 and AS1/AS2 are parallel, fix F3 in position with one rivet through T5 and the P4 tab (as was done for F2 in step 3.8.8).

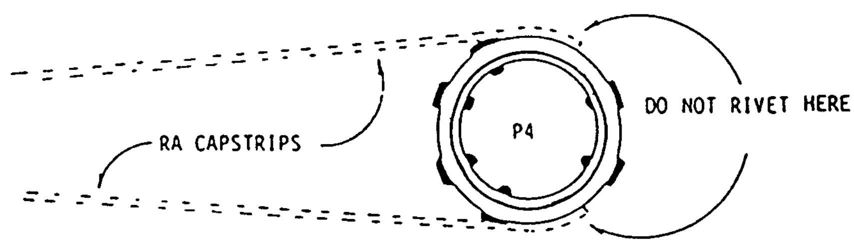
3.8.12 Flatten the capstrips on the aileron ribs RA and bend them to fit around T5. Round the corners of the capstrips with a file.



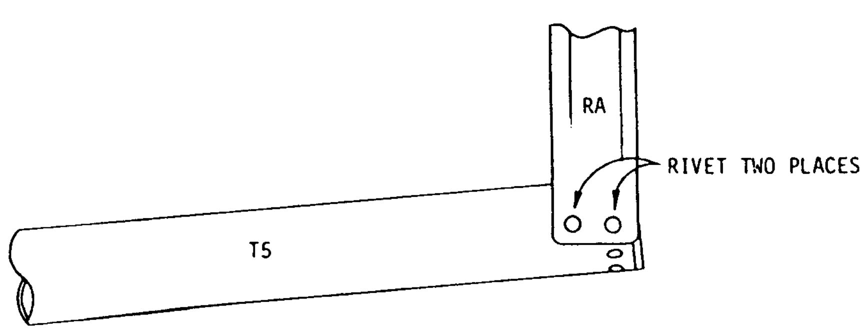
3.8.13 With the T5 assembly clamped in the neutral position, fit the two end ribs on the aileron as shown. Trace around the RA on T5 to mark the location of the capstrips.



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.



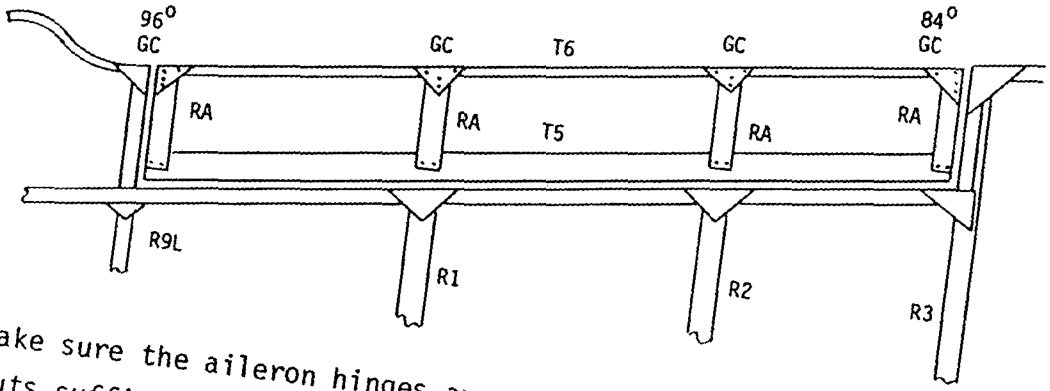
3.8.15 Re-install the T5 assembly. Clamp it in the neutral position and put the end aileron ribs into position again as in the figure for step 3.8.13. Make sure that the RA's are parallel to R9L and R3 with the gap as shown in the figure. Rivet the RA's to T5 with two rivets through each capstrip. Some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



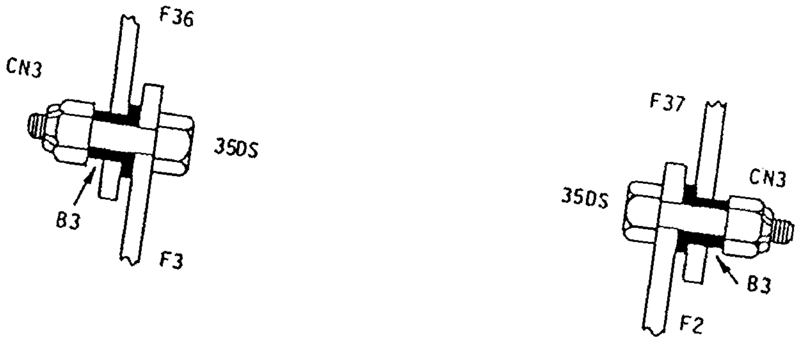
3.8.16 Run a string or a straightedge between the end RA's and fit the two intermediate RA's in place (similar to the installation of ribs R4 to R7 in section 3.4). Sight along ribs R1 and R2 to make sure the aileron ribs are directly in line with them. Rivet the RA's in place with 2 rivets in each capstrip.

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.



3.9 AILERON PUSHROD INSTALLATION

3.9.1 Pushrod Assembly, General Instructions

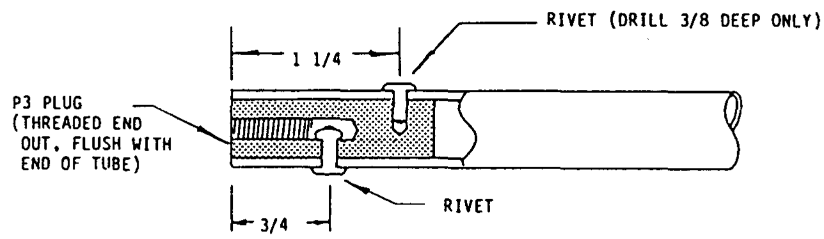
Several pushrods are used in the Aileron control linkage and for best operation, each should be custom fitted. Although the pushrod length is adjustable after assembly, final adjustment of the control system is much easier if the pushrods are assembled as outlined below.

(a) Set the bellcranks or horns to the exact position as indicated in the assembly manual. This will normally be the *neutral* position.

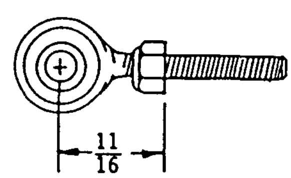
(b) Measure the effective length of the required pushrod (the exact distance between the centres of the bolt holes).

(c) Cut the pushrod tube 1 3/8 inches less than the effective length.

(d) Install P3 plugs in the ends of the pushrod tube as shown.



(e) Put N3 nuts on two BE rodends as shown. Note that the nut is put on "backwards". It will be necessary to screw the nut on and off a few times in the normal orientation to form threads in the nylon before attempting to put the nut on as shown.

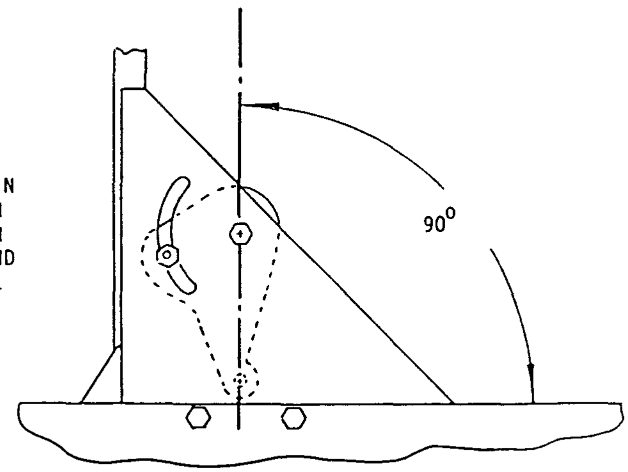


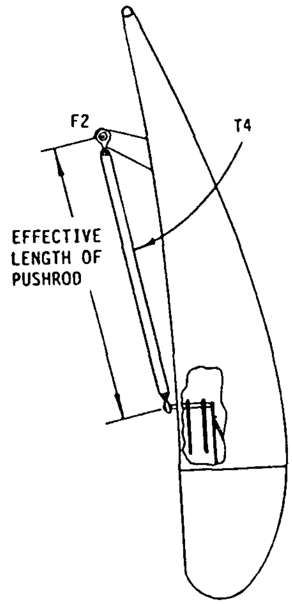
(f) Screw the rodends into the P3's and lock in place by tightening the N3 nut against the P3 plug.

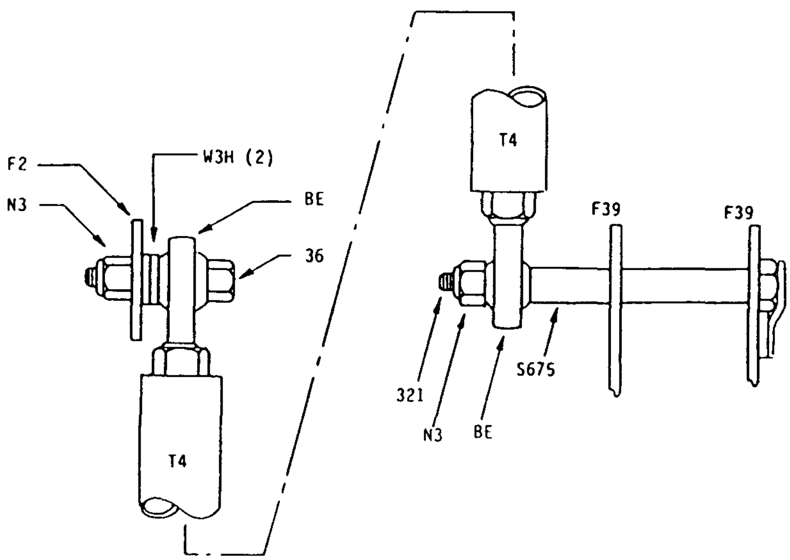
(g) Fit the pushrod into position and check that the bellcranks are positioned as required. If necessary, small adjustments to the pushrod length may be made by screwing the rodends in or out. Note that one full revolution of the rodend will change the pushrod length by 1/32 of an inch. Make sure that the locknuts are securely tightened after adjustment. Ensure that at least 3/8 inch of thread is engaged in the plug.

3.9.2 Install the T4 pushrod assembly between the aileron bellcrank assembly and the aileron horn F2 as follows: First position the aileron in its neutral position. Then set the bellcrank assembly in its neutral position as shown. Measure the *effective length* of the pushrod between the centre of the hole in F2 and the captivated 321 bolt on the bellcrank. Cut T4 1 3/8 inches shorter than this effective length and install the P3 plugs and BE rodends as in step 3.9.1. Install the pushrod as shown and adjust the length if necessary to put the bellcrank into its neutral position.

WITH F39 BELLCRANK IN NEUTRAL POSITION, AN IMAGINARY LINE DRAWN THROUGH THE PIVOT AND THE RODEND HOLE WILL BE PERPENDICULAR TO THE D-CELL.

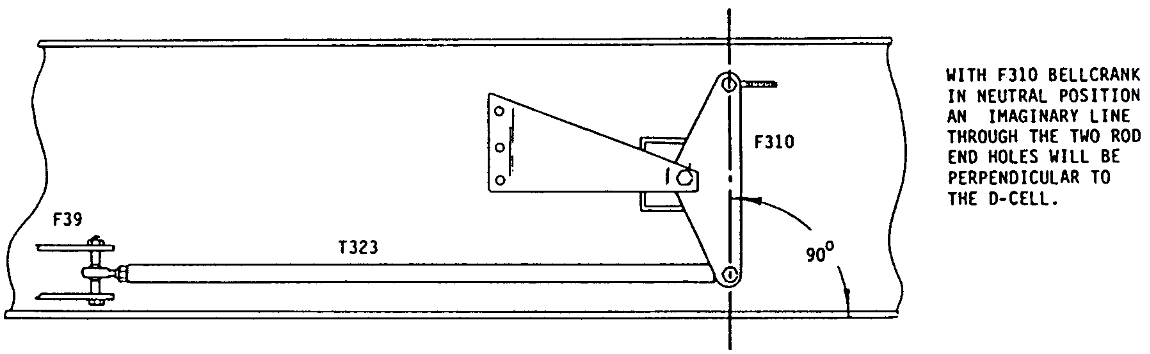




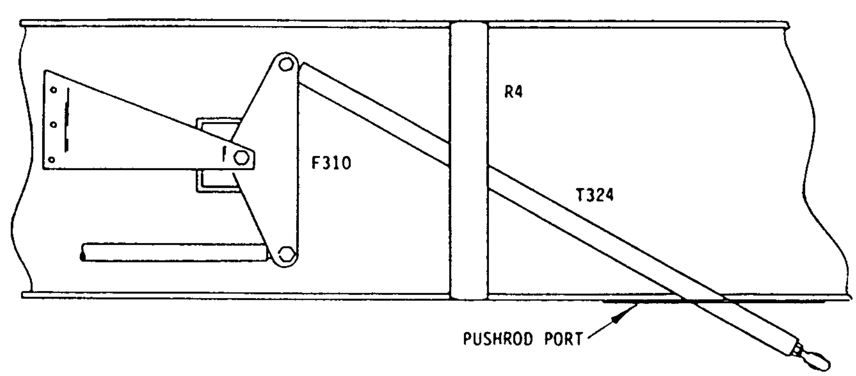


3.9.3 Check that the aileron and bellcrank assembly move freely with little friction and little or no play.

3.9.4 Set the F39 bellcrank assembly and the F310 intermediate bellcrank assemblies to their neutral position as shown. Fit, assemble, install, and adjust the T323 pushrod assembly as described in section 3.9.1 and tighten all nuts securely. Note that the two rodends for this pushrod were installed on the bellcranks previously.



3.9.5 Assemble a T324 pushrod per the instructions in 3.9.1. Do not cut the T324 tube, but position the P3 plugs so that they are flush with the ends of the tube. Note that one of the BE rodends for this pushrod was previously installed on the intermediate bellcrank. Install the T324 pushrod through the pushrod port on the bottom of the wing and through the hole in R4.



3.9.6 Check that the aileron linkage moves freely and without play.

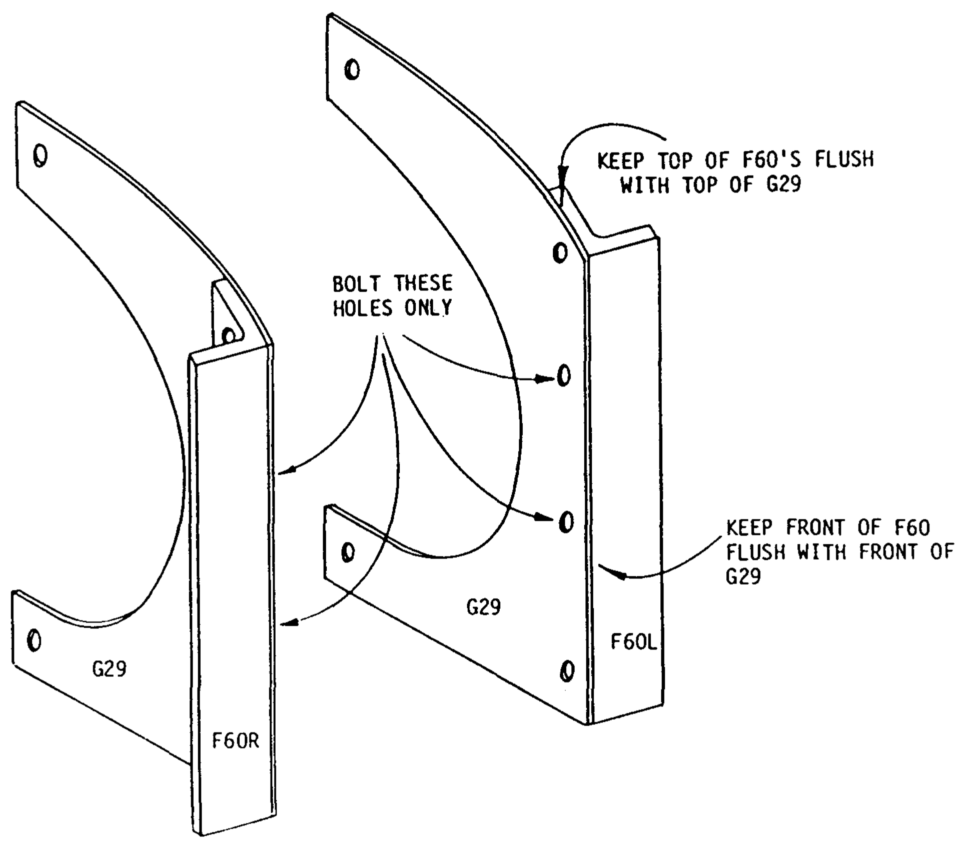
SECTION 4

NACELLE ASSEMBLY

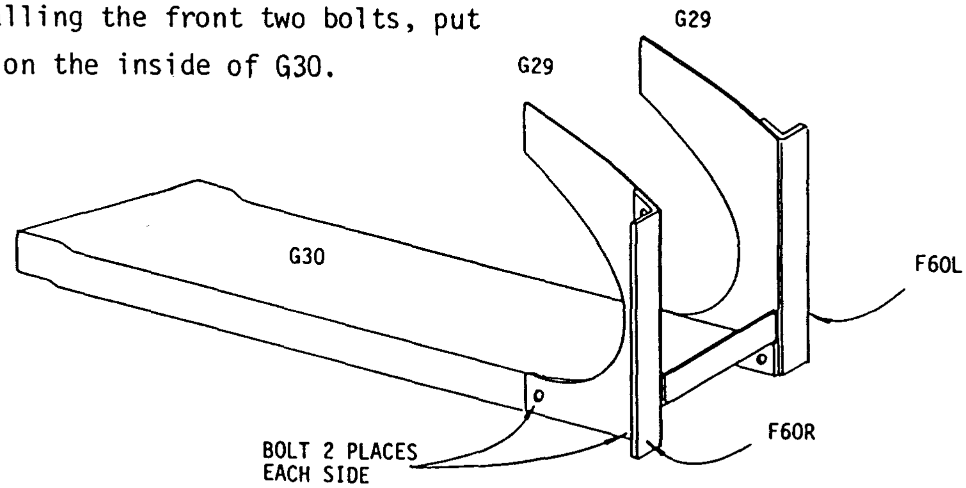
4.1 BASIC ASSEMBLY

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).*

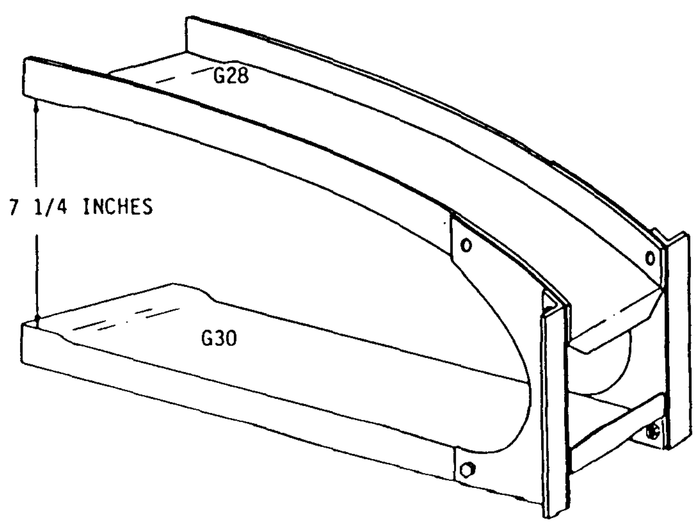
4.1.1 Clamp left and right nacelle front angles (F60L and F60R) to side gussets G29 as shown. Using the G29's as a template, drill the four mounting holes in each of the F60's. Bolt the F60's to the G29's with two 34 bolts in the middle two holes only. Make one left assembly and one right assembly for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



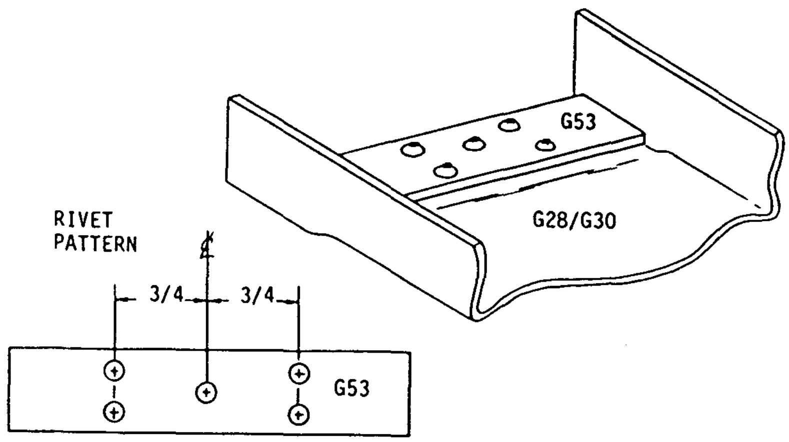
4.1.2 Clamp the nacelle gusset assemblies to the nacelle bottom (G30) as shown below. Make sure the bottom edges of the G29's are flush with the bottom edges of the G30. Make sure the front surface of the bent-up tab on G30 is flush with the front surface of the G29's and F60's. Using the G29's as templates, 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.



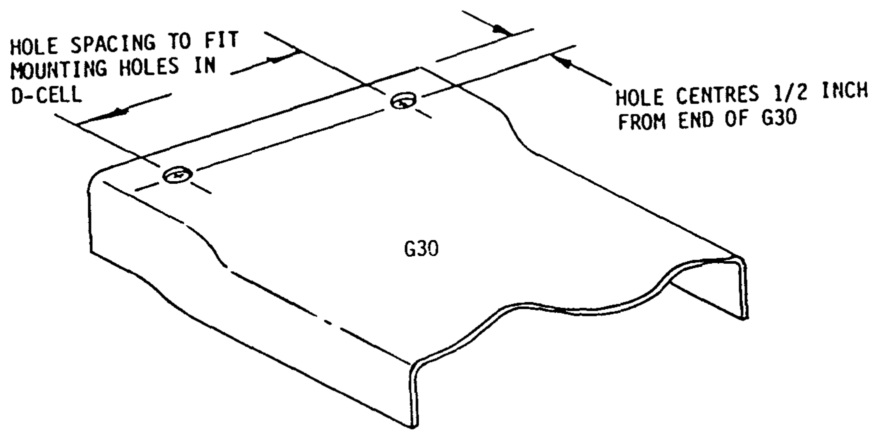
4.1.4 Fit the Nacelle Doublers G53 into G28 and G30 and rivet in place as shown. Make the edge of G53 flush with the trailing edge of G28/G30.



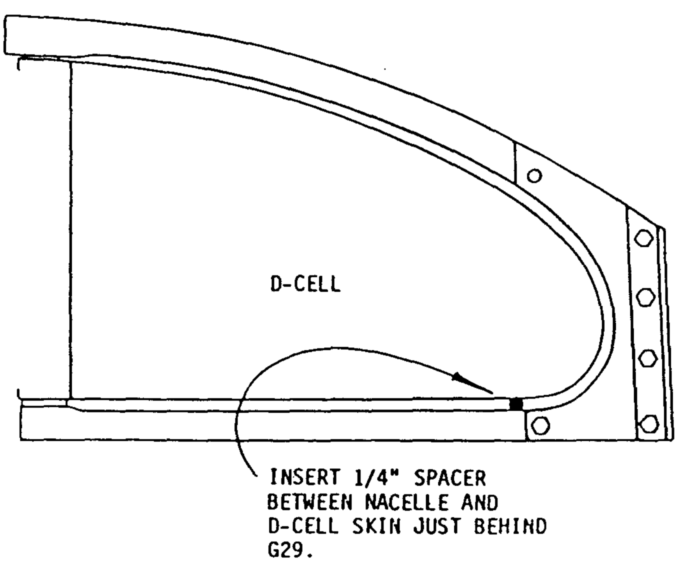
4.2 NACELLE - TO - WING FITTING

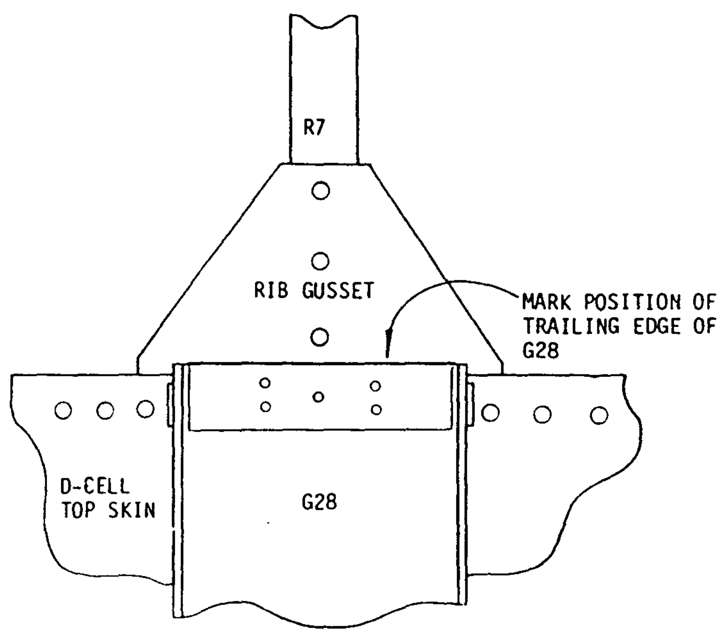
NOTE: *The hole spacing on the nacelle-to-wing mounting holes is nominally 3 inches. However, manufacturing tolerances can cause this measurement to vary as much as ± 1/32". Therefore, to ensure that the nacelle mounting bolts can be inserted and removed easily without resorting to oversize holes, it 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.



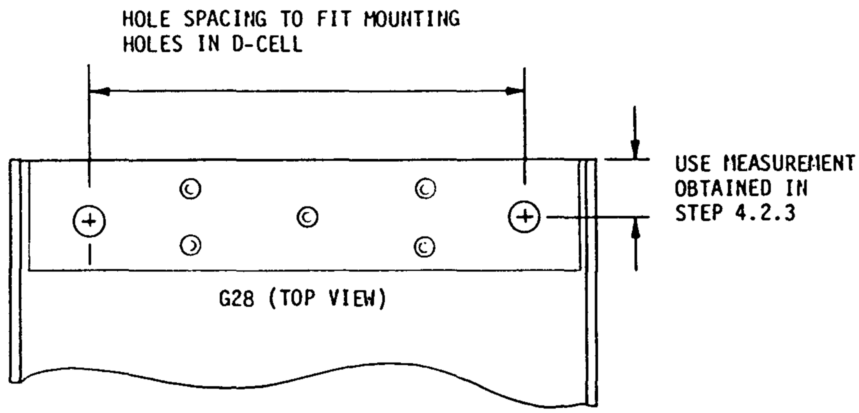
4.2.2 Bolt the nacelle onto the D-cell with two 35 bolts. Temporarily insert a 1/4 inch spacer (tube, dowel or a strip cut from 1/4 inch plywood) between the nacelle and the bottom of the D-cell at the location shown. Push the nacelle firmly against the spacer and mark the location of the trailing edge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



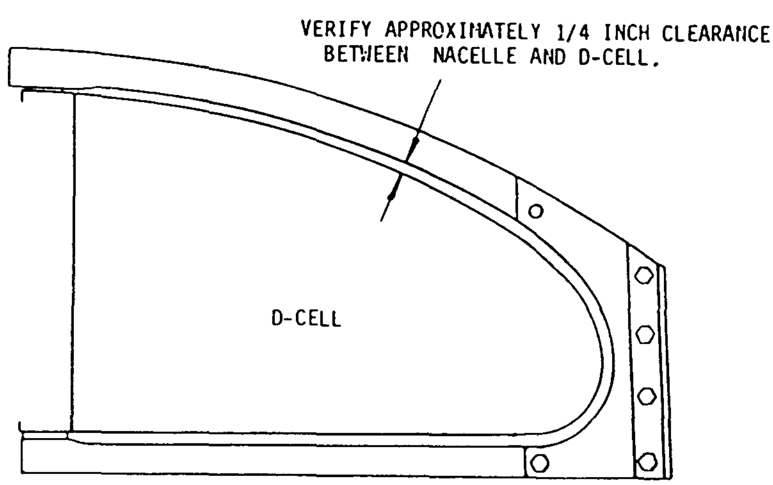


4.2.3 Measure the distance from the line drawn in step 4.2.2 to the centres of the nacelle mounting holes in the top of the D-cell. Note that this measurement might not be the same for both mounting holes. Transfer these measurements to G28.

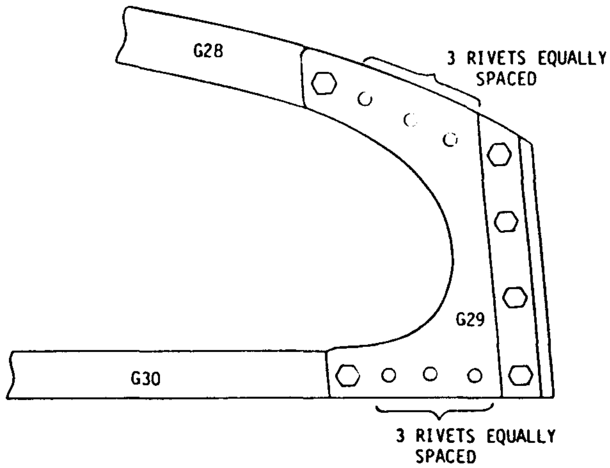
4.2.4 Measure the distance between mounting hole centres on the D-cell. Locate and drill corresponding mounting holes (3/16" diameter) in the G28.



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.

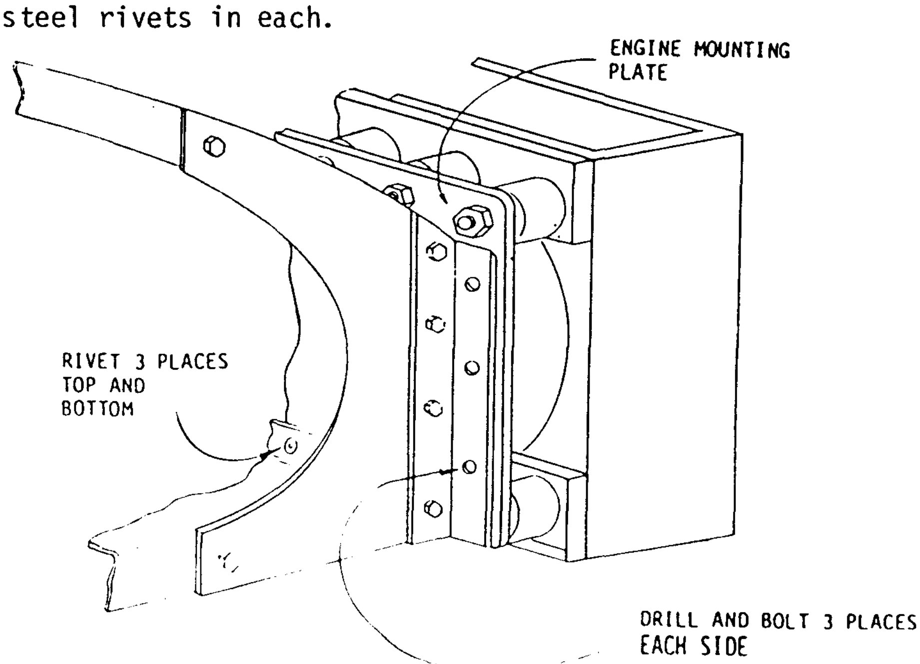


4.2.6 Remove the nacelle from the D-cell. Drill holes and install six rivets on each side of the nacelle as shown.

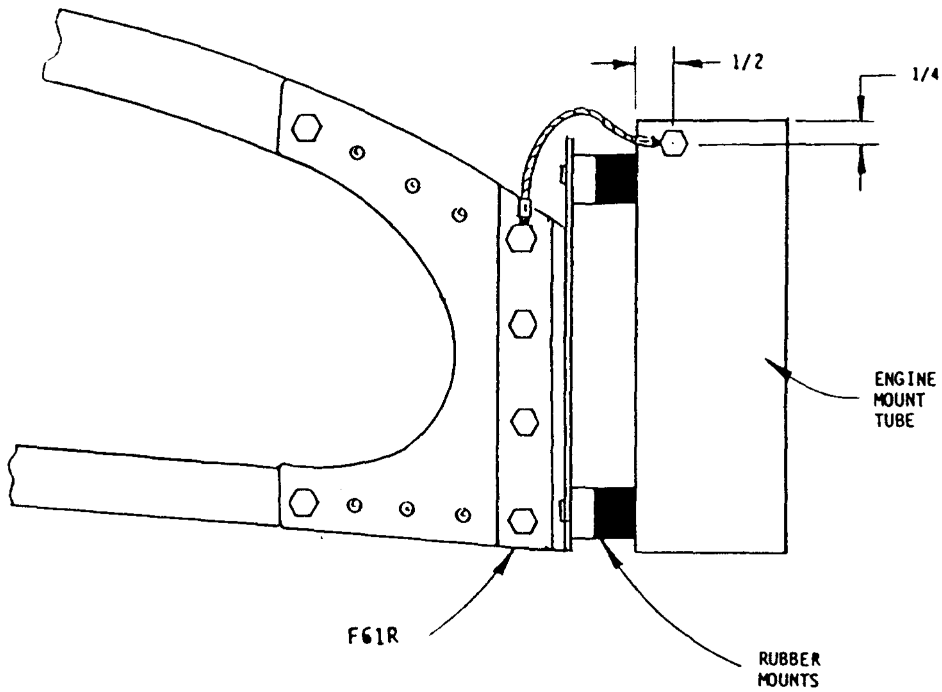


4.3 ENGINE MOUNTING

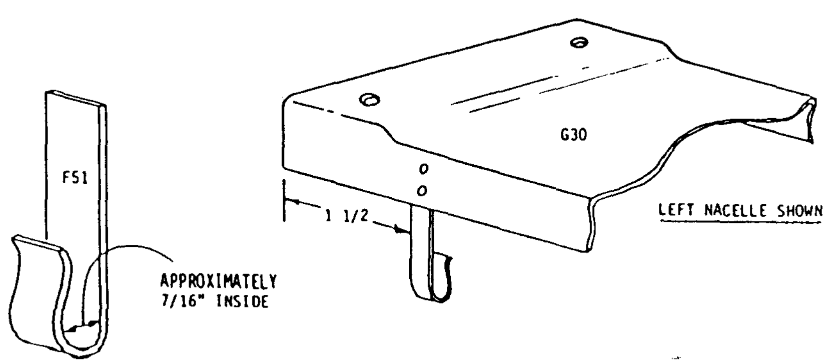
4.3.1 Clamp the nacelle to the engine mounting plate as shown. Centre the nacelle laterally on the mounting plate and make the bottom of the F60's flush with the bottom of the mounting plate as indicated in the figure. Using the F60's as a template, mark and drill the engine mounting plate. Bolt the 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.



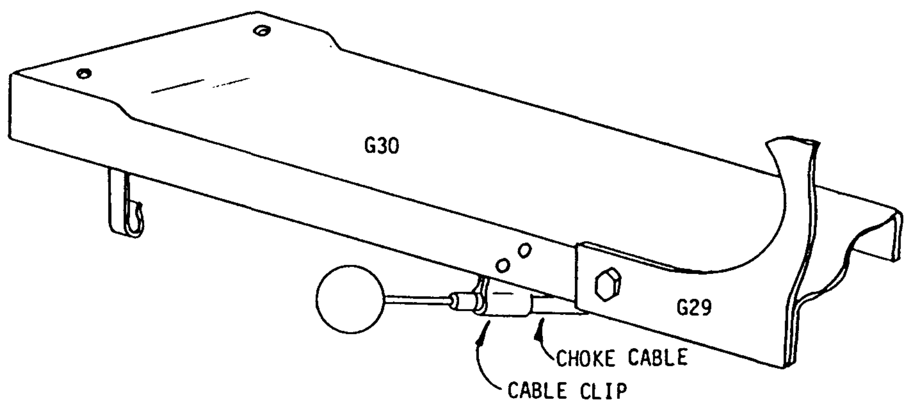
4.3.2 Drill two 3/16 inch holes in each engine mount tube as shown and bolt the ground cables (cable G) in place. *Note that there are two cables per engine.* Use four 34 bolts with W3T washers under the heads. Make sure the cables have enough slack to allow the engine to move on its rubber mounts, and 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.

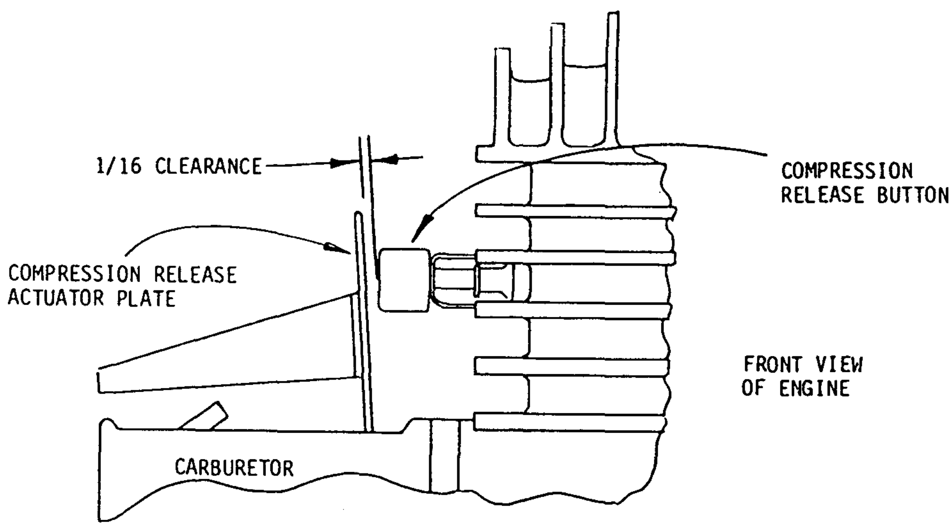


4.3.4 Route the choke cable under the nacelle and rivet the choke cable clip to the G30 flange ahead of the F51, just behind the G29 as shown. Twist the clip slightly to aim the choke cable toward the cockpit without causing a sharp bend in the cable.



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.



PROPELLER SPINNERS INSTALLATION INSTRUCTIONS

PARTS LIST - PROPELLER SPINNER KIT

Part No.	Quantity	Description
H8	2	Spinner
H8F	4	Filler
F343	2	Mounting Flange
SMS 650	22	Sheet Metal Screw
82023	1	Instructions

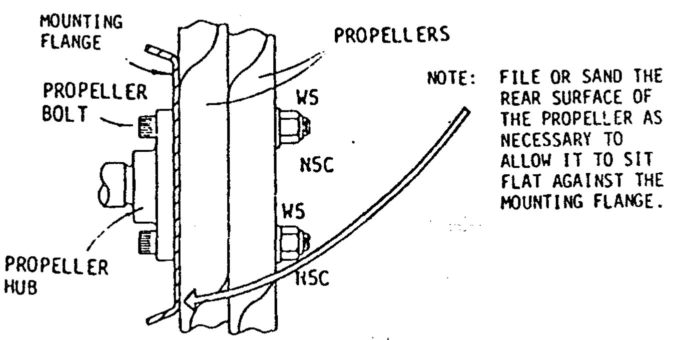
1.0 GENERAL

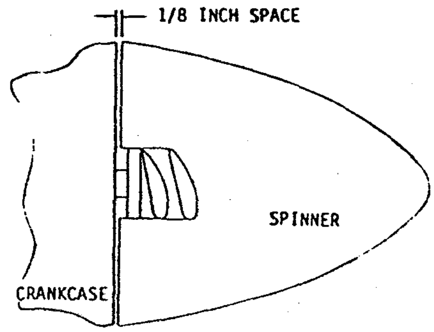
The propeller spinner has been designed to reduce drag, increase thrust and improve the appearance of the Lazair powerplant. Although the spinners can be supplied in three primary colours, they may be painted if you wish to do so. Before painting, they should be sanded lightly with No. 400 sandpaper to remove the mold release oil and improve the adhesion of the paint.

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.

2.0 INSTALLATION

2.1 Remove the propellers, install the spinner mounting flange and reinstall the propellers as shown below. Tighten the nuts on the propeller bolts to approximately 16 foot-pounds.

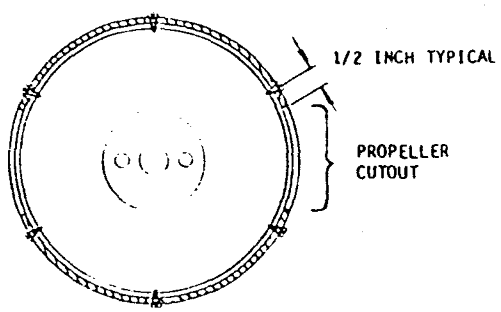


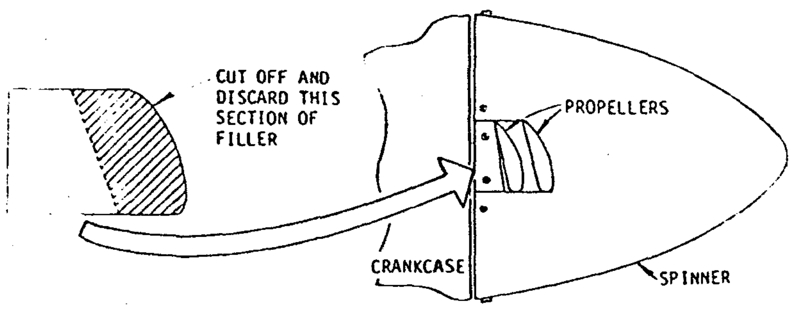


2.2 Position the spinner over the propellers and mounting flange. Cut a slot in a sheet of 1/8 inch thick metal, plastic, cardboard or other material and insert it between the spinner and the engine crankcase to act as a spacer.

Hold the spinner tightly against the spacer to ensure that the space is the same all the way around the spinner

2.3 Drill holes and secure the spinner to the flange using six sheet metal screws located as shown below. Drill holes through both the spinner and the flange with a No. 41 (or 3/32") drill first, then enlarge the holes *in the spinner only* using a No. 28 (or 9/64") drill.





2.4 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.

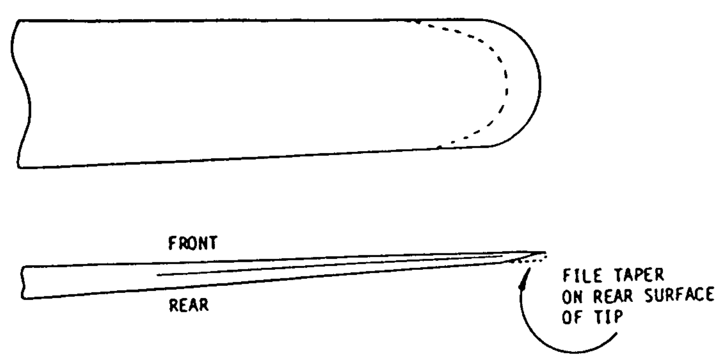
PARTS LIST - PROPELLER SPINNER KIT

Part No.	Quantity	Description
M8	2 ✓	Spinner
M8F	4 ✓	Filler
F343	2 ✓	Mounting Flange
SMS 650	22 ✓	Sheet Metal Screw
82023	1 ✓	Instructions

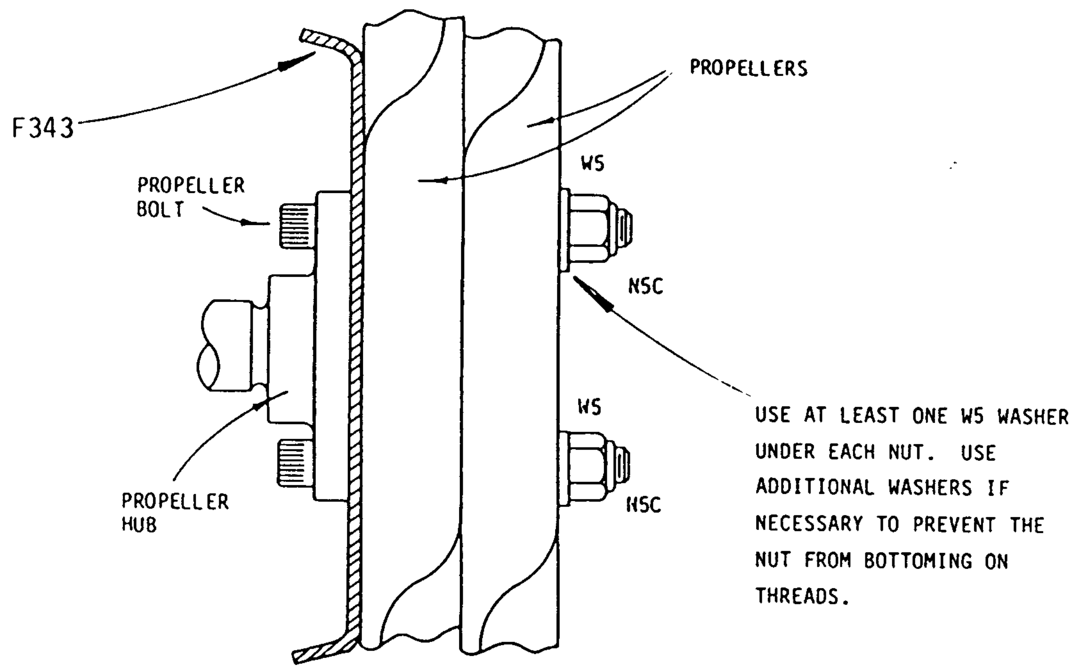
4.4 PROPELLER MOUNTING

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.



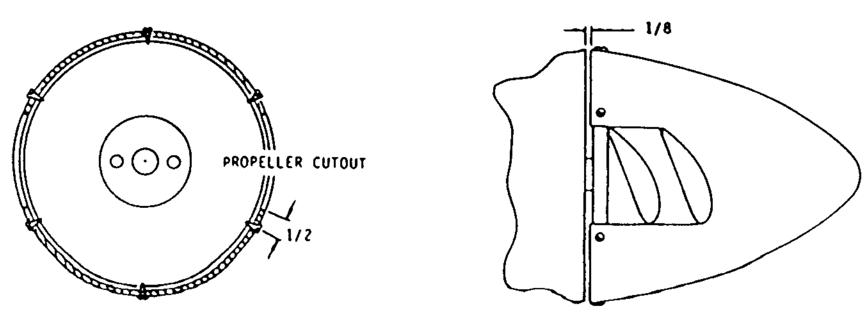
4.4.2 Bolt two propellers onto each propeller hub as shown. Tighten the two propeller nuts with a torque of approximately 16 foot pounds. Note that the F343 spinner mounting flange is part of the spinner kit.



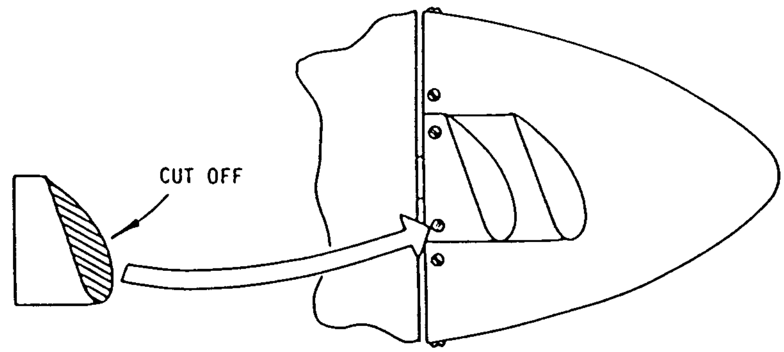
4.4.3 If the spinners are to be painted, they should first be fitted as described below, then lightly sanded with No. 400 sandpaper before painting.

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.

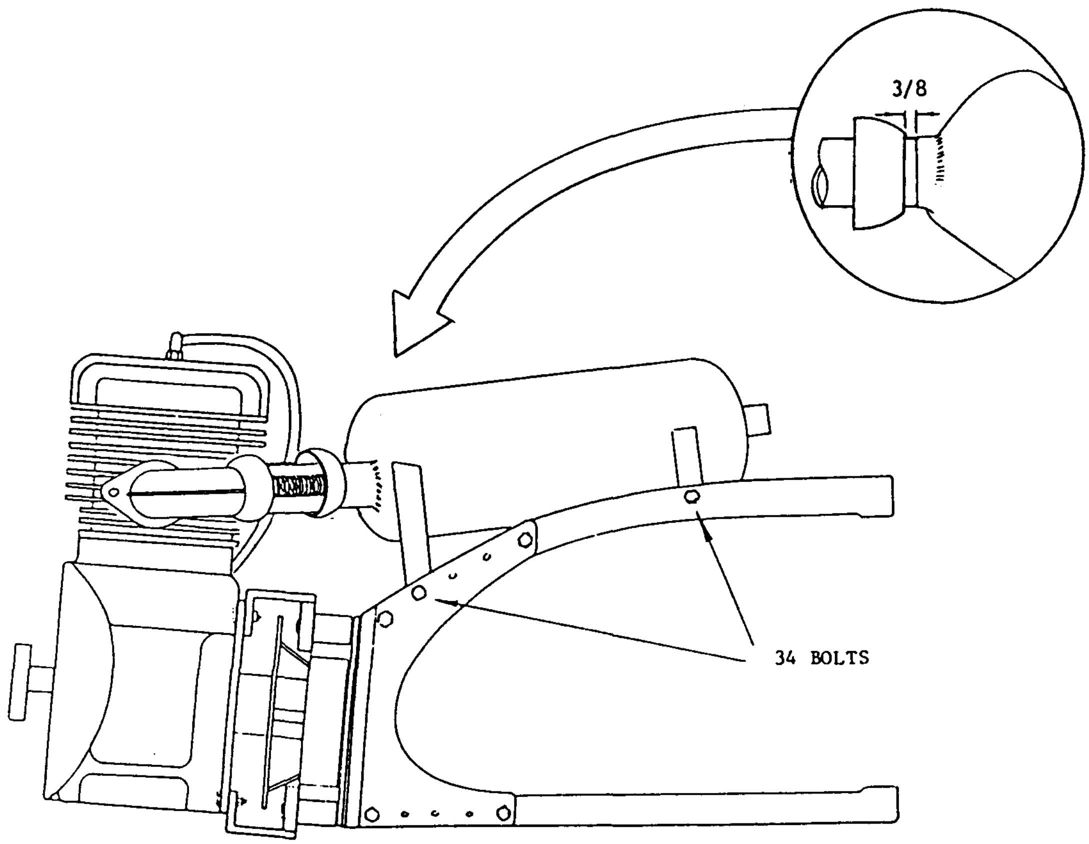


4.4.7 After the spinners have been installed and you are satisfied that they fit properly, the mounting screws should be removed one at a time and reinstalled with Loctite or similar thread locking compound.

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.



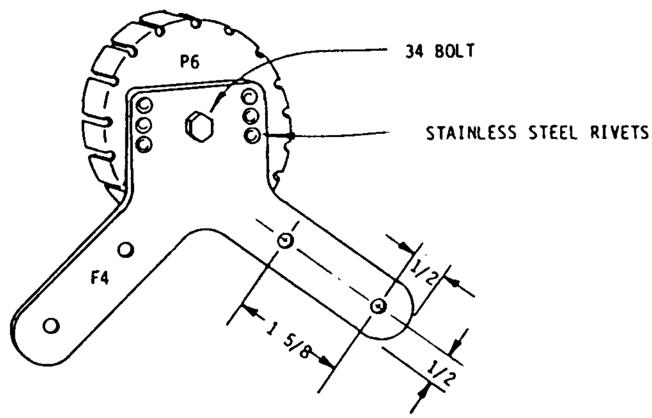
4.5.3 Drill and bolt the muffler mounting legs to the nacelle using four 34 bolts and N3 nuts. Use W3H washers under the nuts for the rear legs only.

FUSELAGE ASSEMBLY

SECTION 5

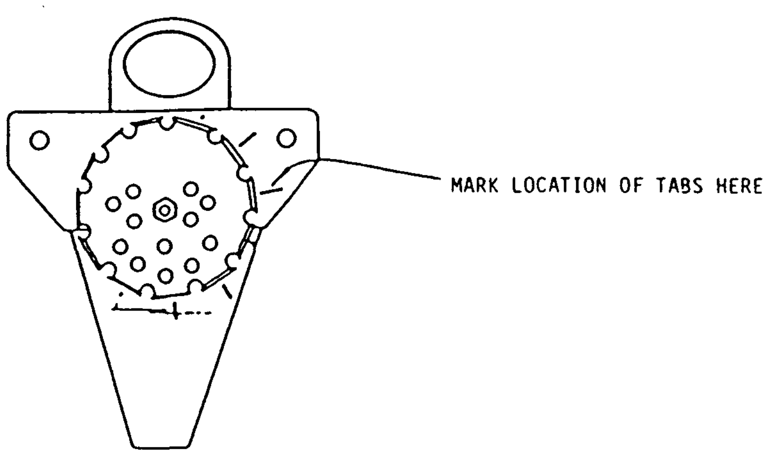
5.1 BOOM ASSEMBLY

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.

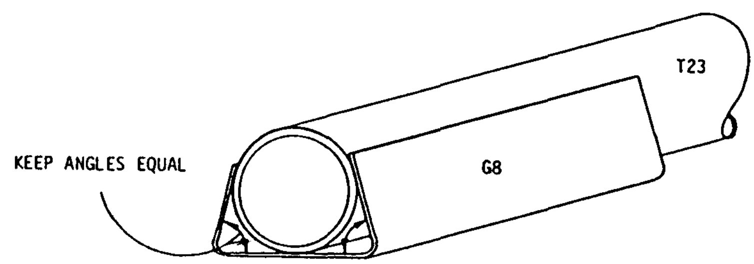


5.1.2 Set the P6 assembly aside for now.

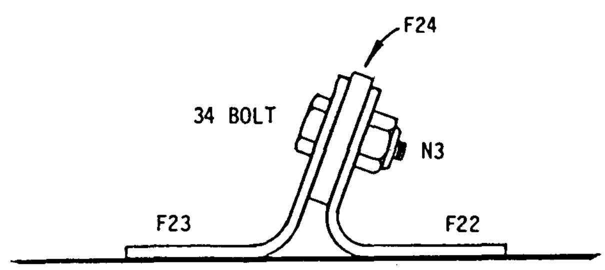
5.1.3 Mark the location of the tabs on the outside of the front assembly and insert the front assembly into the end of the boom. Rivet the front assembly into the boom with one stainless steel rivet into each tab.

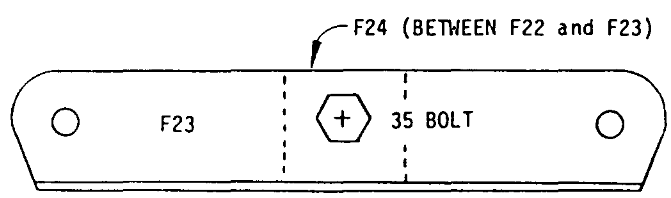


5.1.4 Bend the sides of fuselage doubler G8 so that it will fit tightly over the boom. Make sure the two angles are equal (bend G8 while it is removed from T23 to allow for springback).

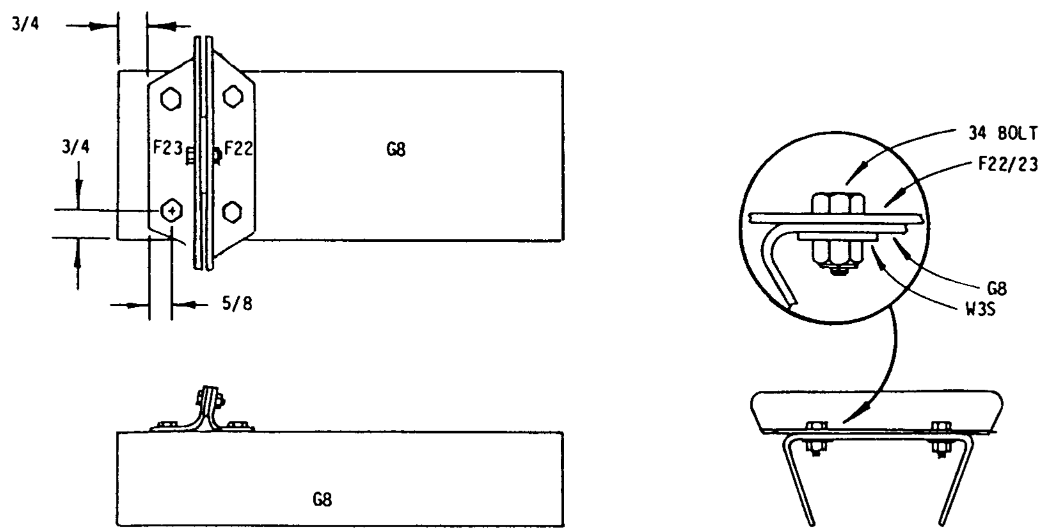


5.1.5 With Rear Spar Brackets F22 and F23 positioned *on a flat surface*, clamp them together using F24 as a spacer as shown. Make sure that F24 is centred laterally. Drill F24 and F22 using the centre hole in F23 as a guide, and bolt together as shown.

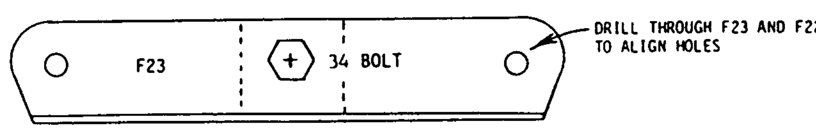




5.1.6 Drill 3/16 inch holes and bolt the F22 and F23 to G8 as shown. Use 34 bolts with W3S washers under the nuts (inside the G8). Make sure that the F22 and F23 are centered laterally on G8 and perpendicular to it.

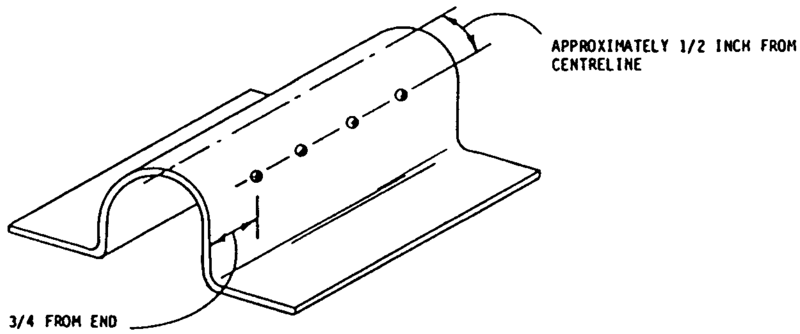


5.1.7 Using a 3/16 inch drill, drill the outboard holes through F23 and F22 to ensure proper alignment.

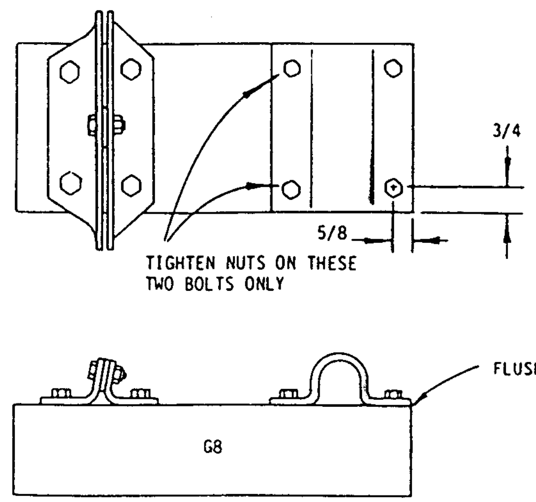


5.1.8 *Carefully* ream the holes in F22 and F23 to 1/4 inch diameter. Make sure the holes are perpendicular to F22. Remove all burrs and sharp edges from the holes.

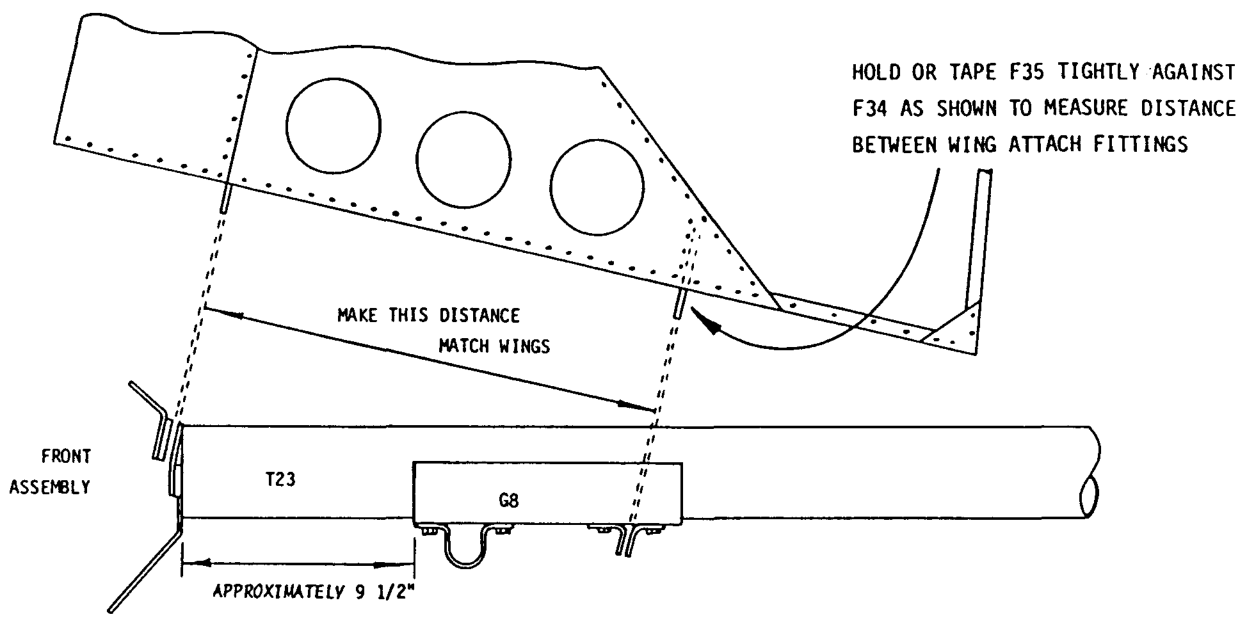
5.1.9 Drill 8 holes 1/8 inch in diameter in downtube clamp F53 as shown (4 holes on each side). Use 3/4 inch spacing.

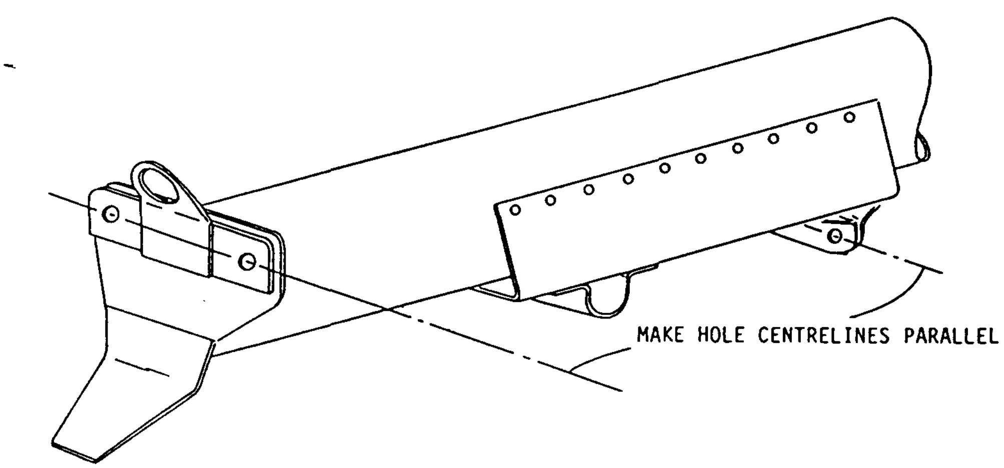


5.1.10 Install F53 on G8 as shown. Use four 34 bolts with W3H washers under the nuts. Leave the nuts on the bolts nearest the end of G8 finger tight only.



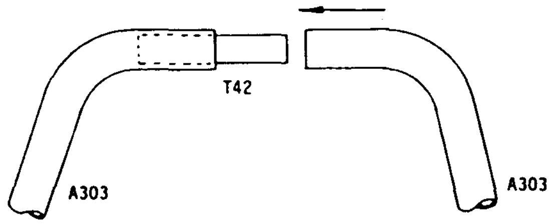
5.1.11 Position G8 on the boom as shown on next page. *Make sure the distance between wing fittings matches the wings.* This measurement is critical if wings are to fit on and off easily. Make sure the holes in F22 and F23 are parallel to the holes in the front fitting. Rivet G8 to the boom with one 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"

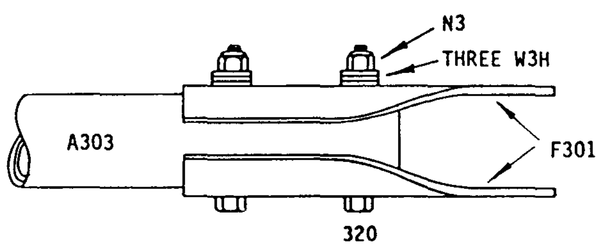

MAKE HOLE CENTRELINES PARALLEL

5.2 A-FRAME ASSEMBLY

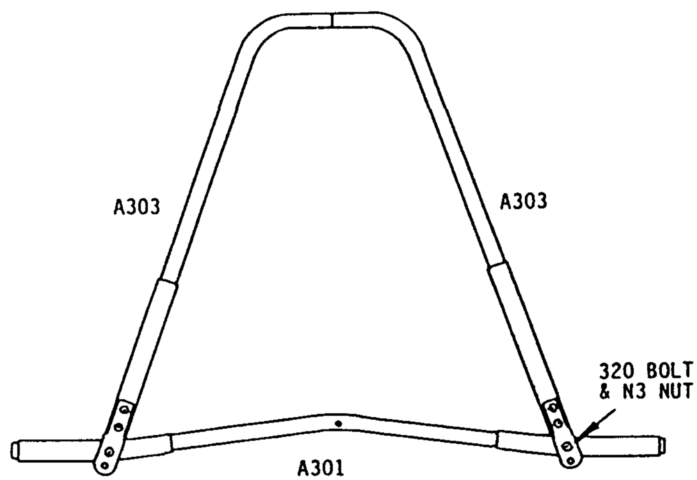
5.2.1 Join the two A303 Downtubes with a T42 splice as shown. Do not rivet at this time.



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 320 bolts. This will allow for the later installation of the F338 brake cable bracket.

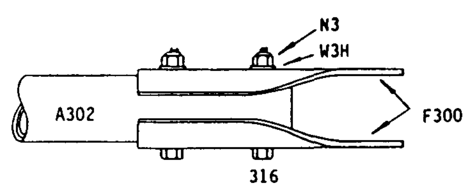


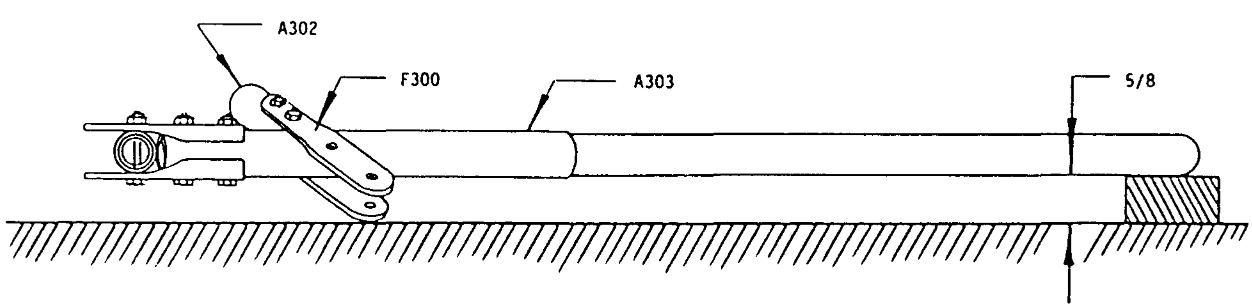
5.2.3 Bolt the A301 axle assembly in place as shown. Make sure that all the bolts in the A-Frame are with the heads on the same side. The side of the A-Frame with the bolt heads is the *forward* side. The 320 bolts will appear to be too long but the additional length is required to accommodate the T329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



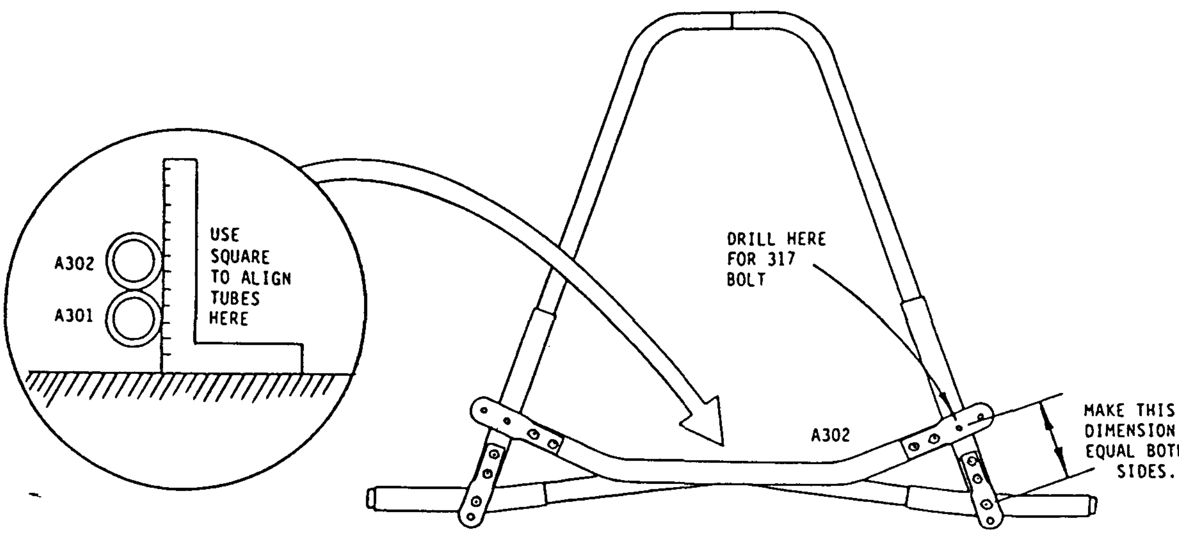
5.2.4 Position the assembled A-Frame on a flat working surface. Push the top part of the A-Frame down firmly onto the working surface to ensure that the A-Frame forms a flat plane, and tighten the nuts on the 317 bolts.

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.

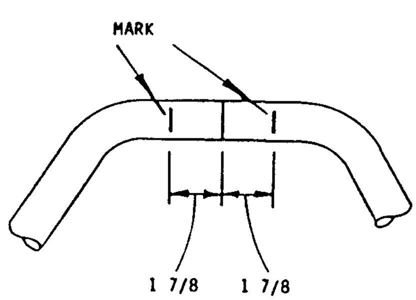


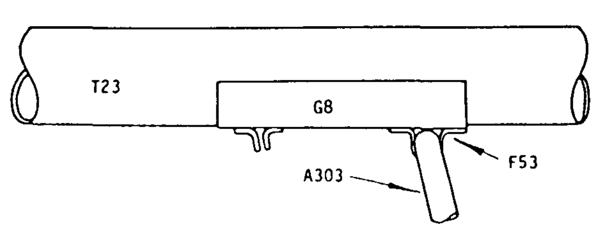


5.2.6 Position the A302 assembly as shown. Use a square to ensure that A302 is exactly above A301. Make sure that the ends of A302 are equidistant from the bottom of the A-Frame as indicated, and drill the two holes in the rear side of the downtubes for the 317 bolts. Put short bolts in these holes to 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).



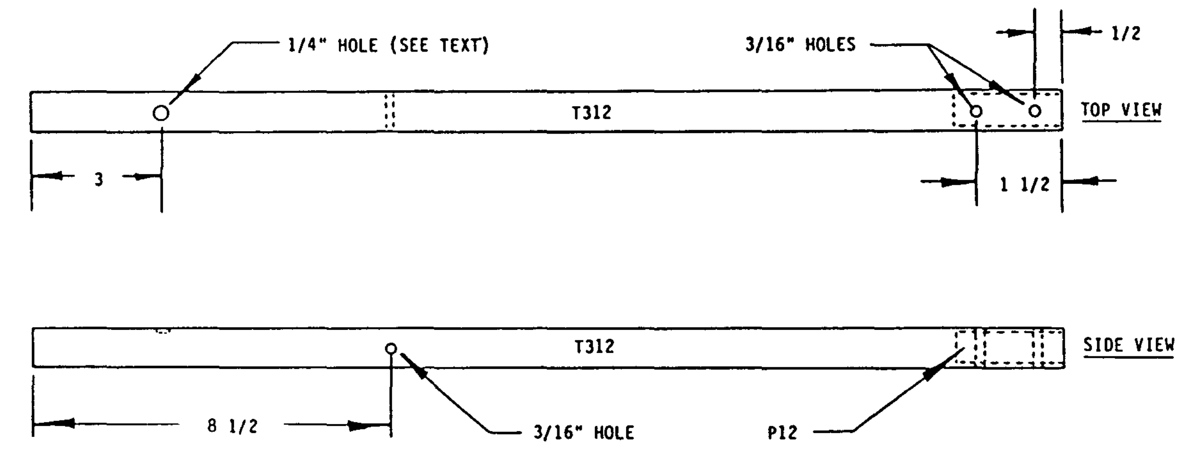
5.2.7 Mark both downtubes as shown. Remove one downtube, then reassemble the A-Frame with the junction of the downtubes inside the F53 downtube clamp. Tighten all the bolts on the A-Frame securely (with the exception of the 320 bolts as indicated in step 5.2.3) and tighten the forward bolts in F53.



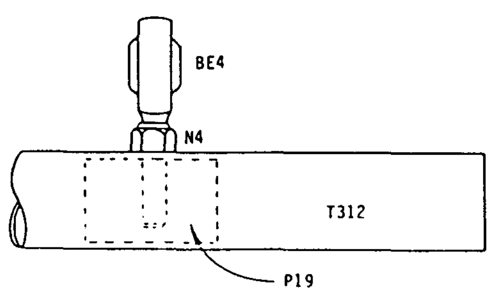


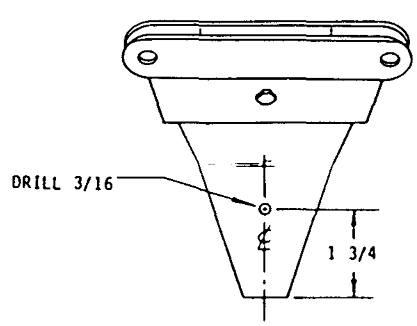
5.3 COCKPIT ASSEMBLY

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.*



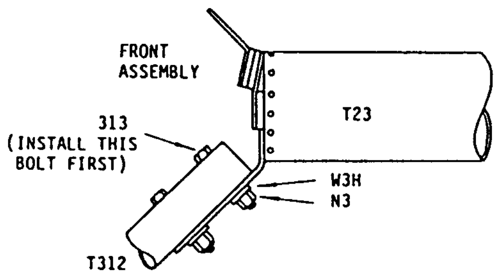
5.3.2 Put an N4 nut on a BE4 rodend as shown and screw the nut on as far as it will go. Insert a P19 plug into the open end of T312, align the threaded hole in the plug with the 1/4 inch hole in the tube, and screw the rodend into the plug. Do not tighten the nut at this time.

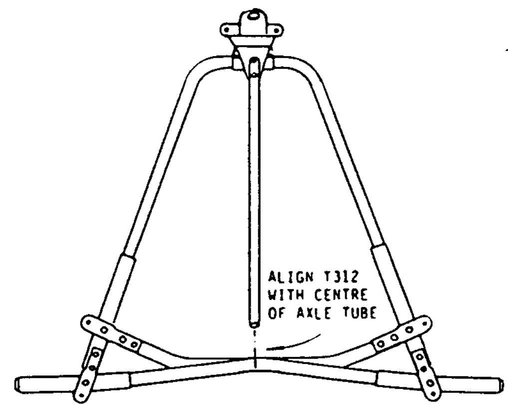




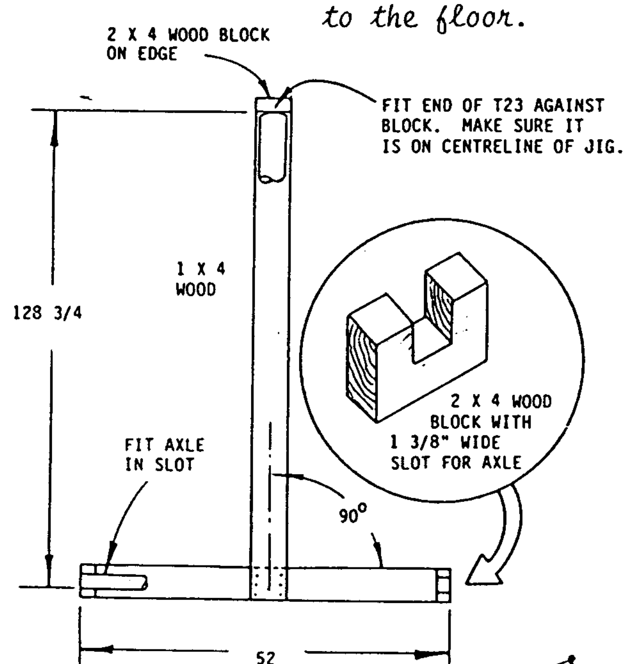
5.3.3 Drill a 3/16 inch hole in the front assembly as shown. Make sure the hole is on the centre line of the fitting.

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.

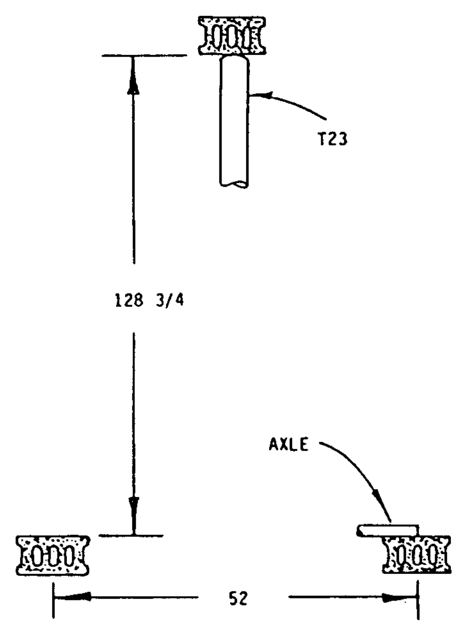




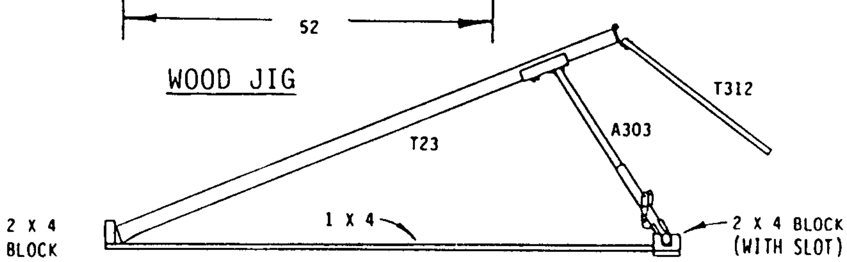
NOTE: *To facilitate the next stages of assembly, it is recommended that some form of jig be constructed. The wooden jig shown on the left is more rigid but the concrete block jig on the right can work equally well if you are careful. Or, if you have a wooden floor in your shop you could nail wooden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



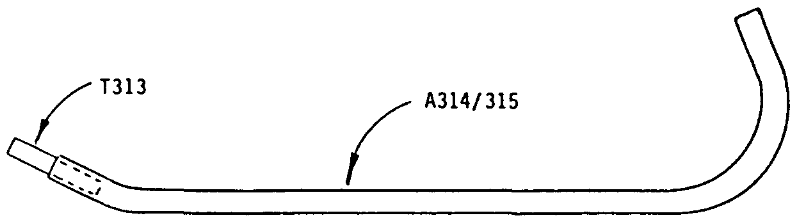
WOOD JIG



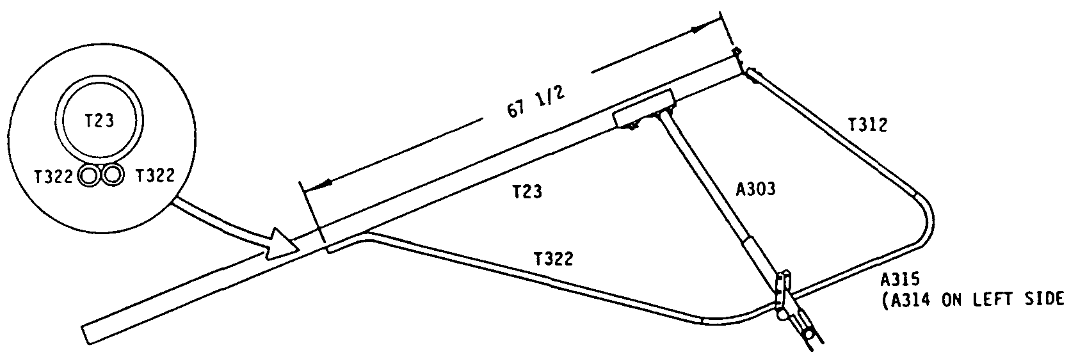
CONCRETE BLOCK JIG



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.



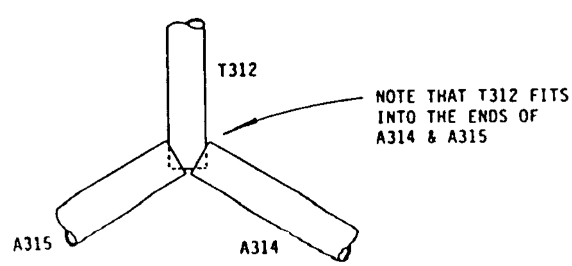
5.3.6 Slide a T322 rear fuselage brace over the T313's and position the tubes as shown. Tape the tails of the T322's temporarily but *tightly* to the bottom of T23 in the position indicated. Tape the junctions of A314/315 and T322 to hold the ends of the tubes tightly together.



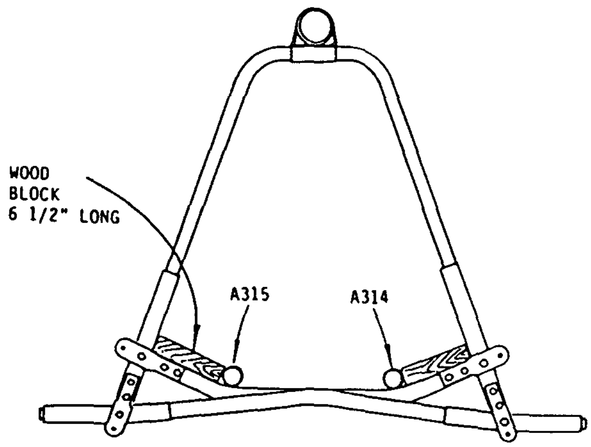
NOTE: *To avoid having to disassemble the fuselage later, now is a good time to install the seatbelt. Slide the loops in the ends of the seatbelt halves over the front of A314 and A315 and slide them back almost to the junction of T322. Normally the half of the belt with the buckle and size adjustment 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.

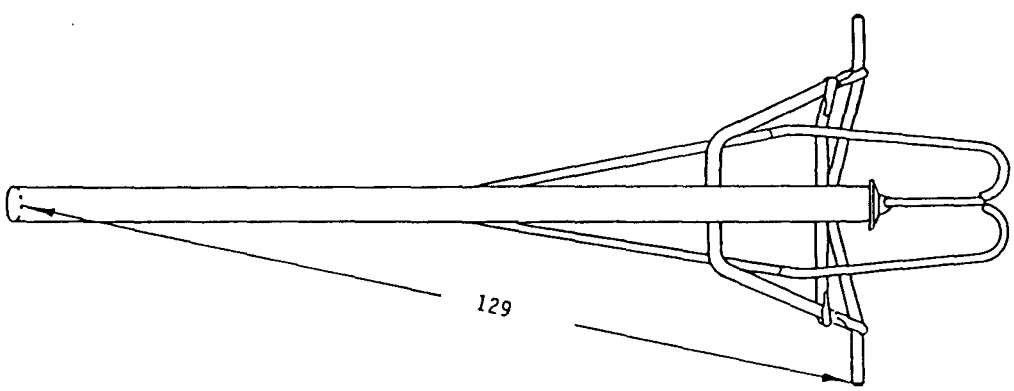
NOSE CLUSTER
FRONT VIEW



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.

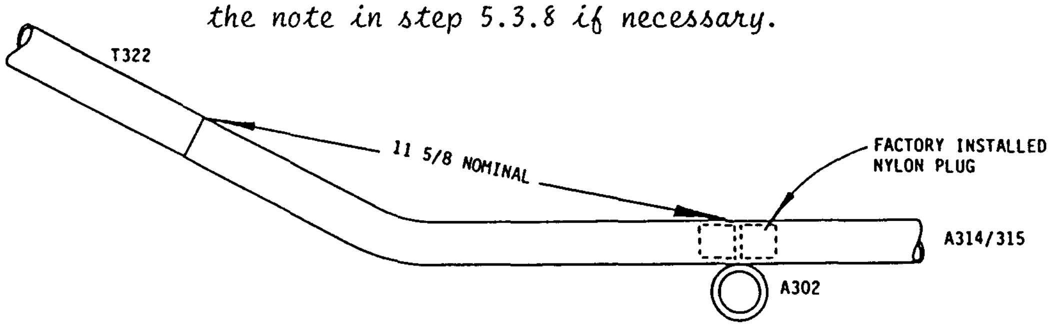


NOTE: *If you are not using a jig as recommended, set the angle between the A-Frame and the boom so that a direct measurement from the bottom rear of T23 to the end of A301 (the axle tube) is 129 inches (measured to the rear side of A301). If you are using a jig, you may wish to use this measurement 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.*



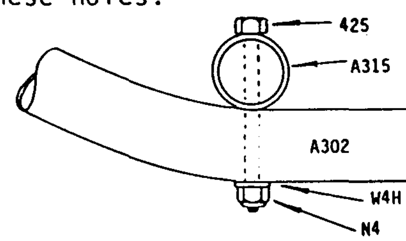
5.3.9 Make sure all the fuselage tubes are aligned properly, then drill and bolt the A314 and A315 to A302 as shown.

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.*

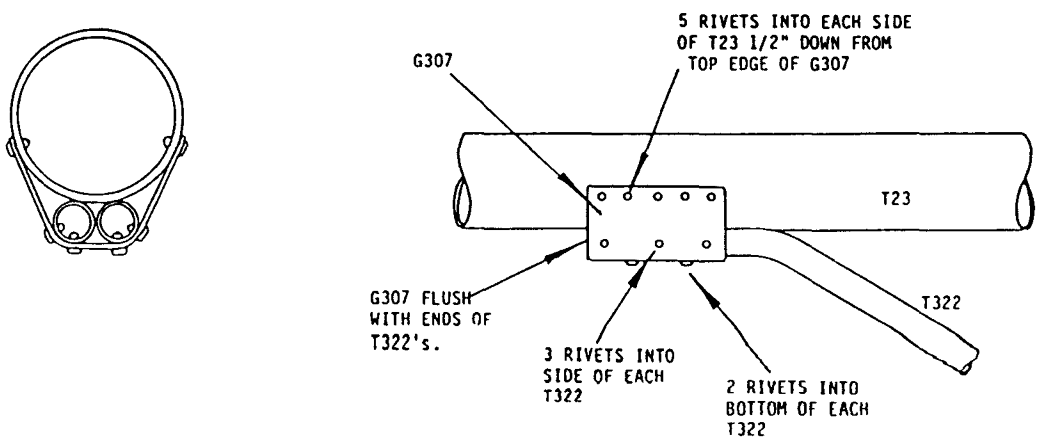


Make sure the bolt hole is vertical and passes through the centre-line of both tubes. Having a friend sight the drill can help considerably when drilling these holes.

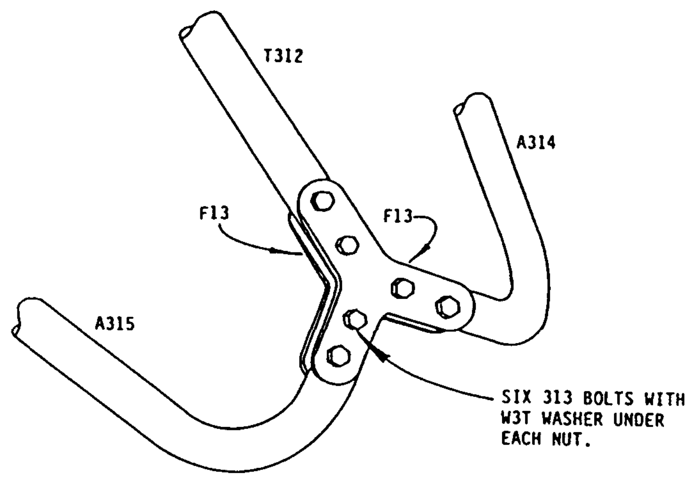
FRONT VIEW



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.

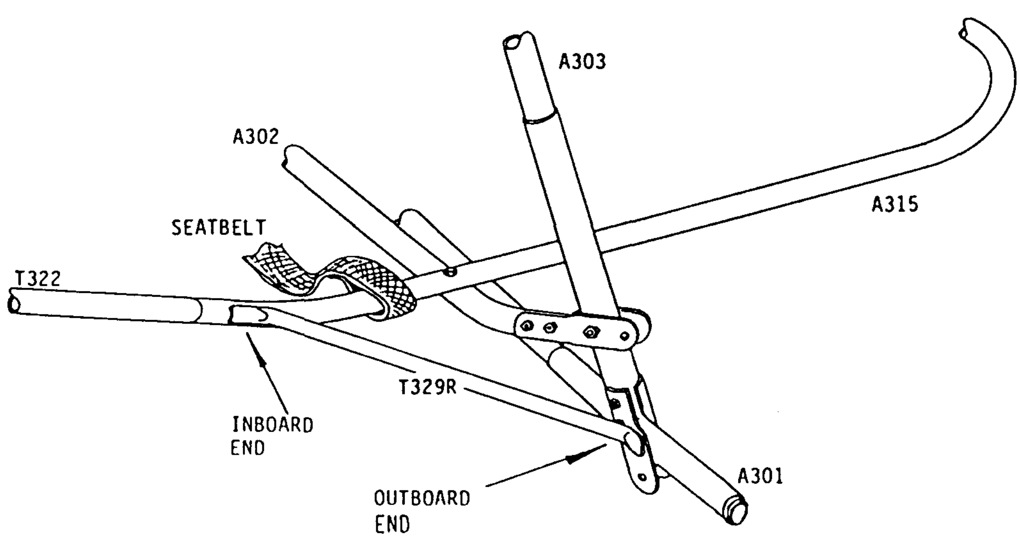


5.3.11 Drill and bolt the nose cluster together using F13's as shown. Do not overtighten the nuts on these bolts as the tubes do not have plugs in them.

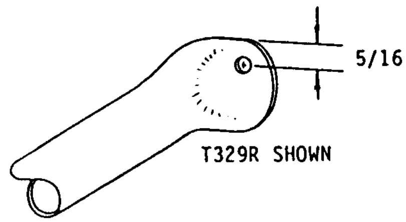


5.3.12 To improve the appearance of your Lazair, you may, if you wish, form the F13's to conform to the tubing since the F13's are made of a relatively ductile alloy. To do so, carefully hammer the edges of the F13's over the tubes using a wooden mallet or a hammer and a wooden block. The internal corners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

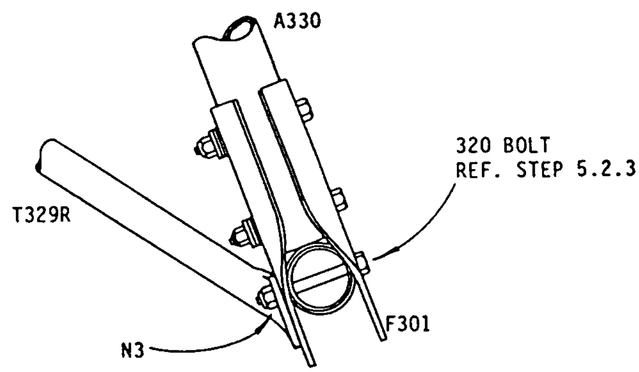
5.3.13 Hold the T329L/R trailing arms in position as shown below to check the fit and help identify the inboard and outboard ends.



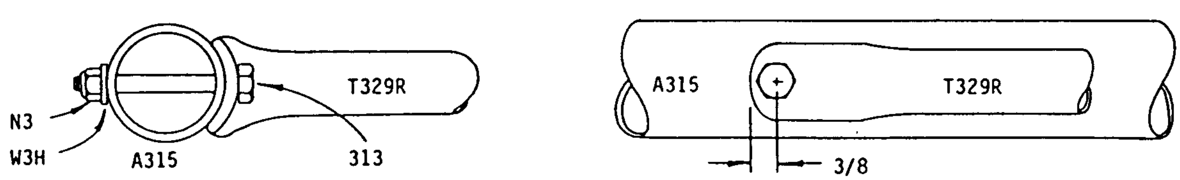
5.3.14 Drill a 3/16" hole in the top corner of the outboard end of T329L/R as shown.



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

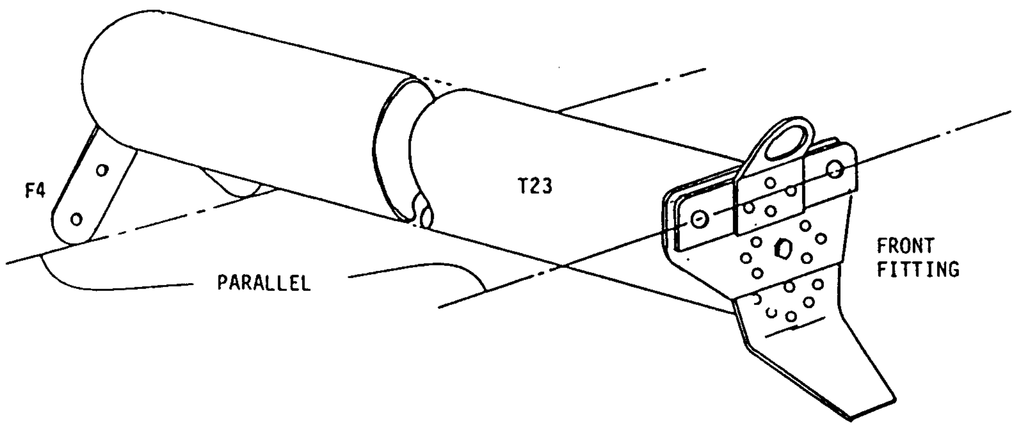


5.3.16 Tape the inboard end of the trailing arms to A314/A315, then drill and bolt as shown.



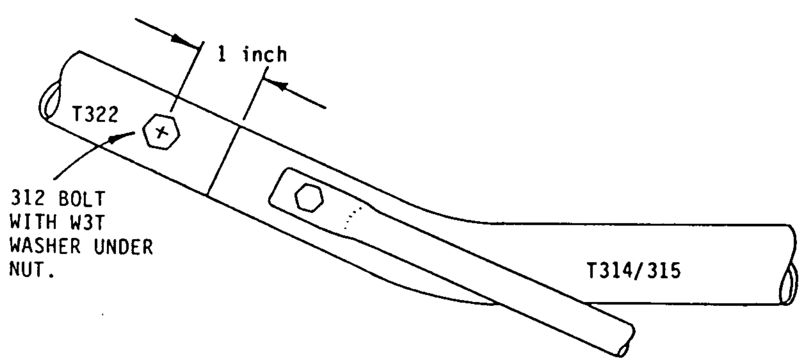
5.3.17 Make sure that the A303 downtubes are pushed together tightly at the top and the A-Frame is centred in F53 (Ref. Step 5.2.7). Drill the downtubes and rivet to F53 with 8 stainless steel rivets using the holes drilled in F53 in Step 5.1.9.

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.



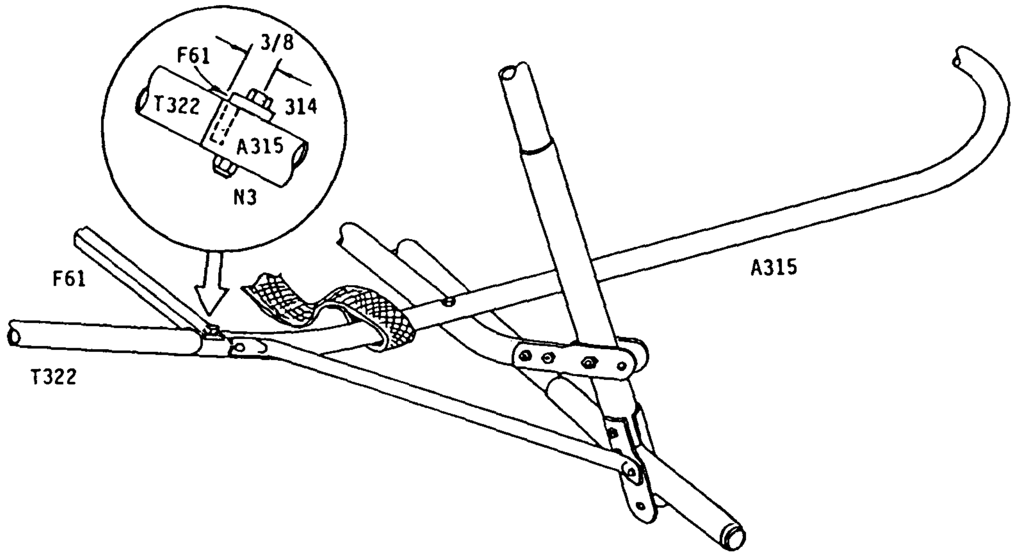
5.3.19 Rivet P6 to T23 with one stainless steel rivet into each tab on P6.

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.

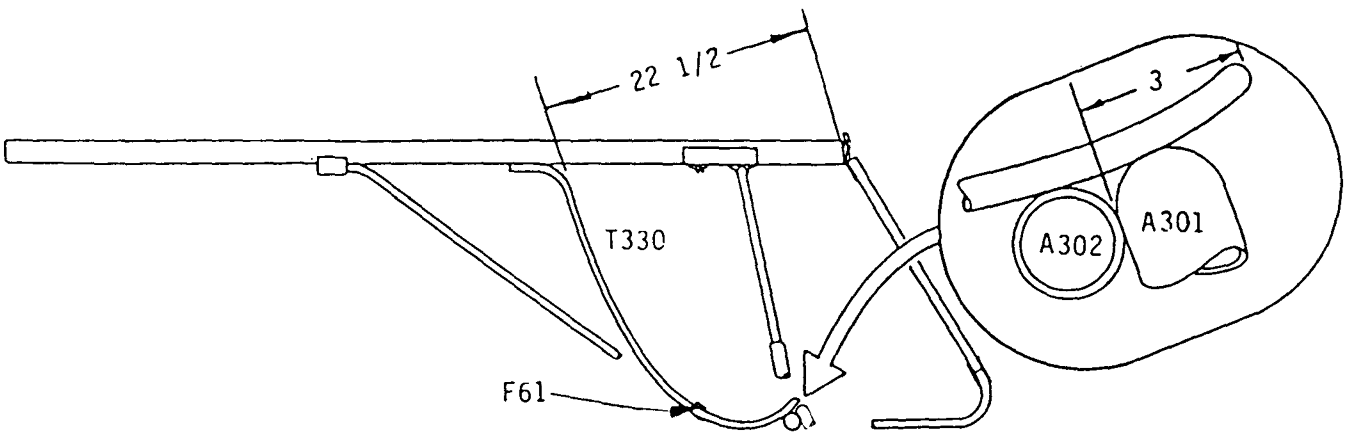


5.4 SEAT INSTALLATION

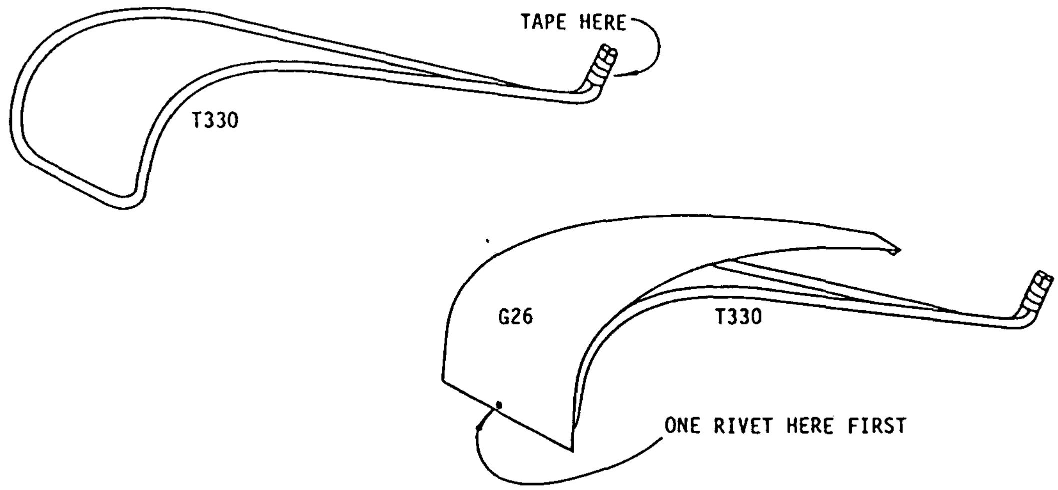
5.4.1 Drill 3/16 inch holes and bolt the seat support angle F61 to the side tubes A314 and A315 as shown.



5.4.2 Set seat tube T330 into position as shown. T330 may be bent slightly, if necessary, to make it touch F61 and A302. When bending T330, bend it very gradually and check the fit frequently. Be sure both sides are bent equally.

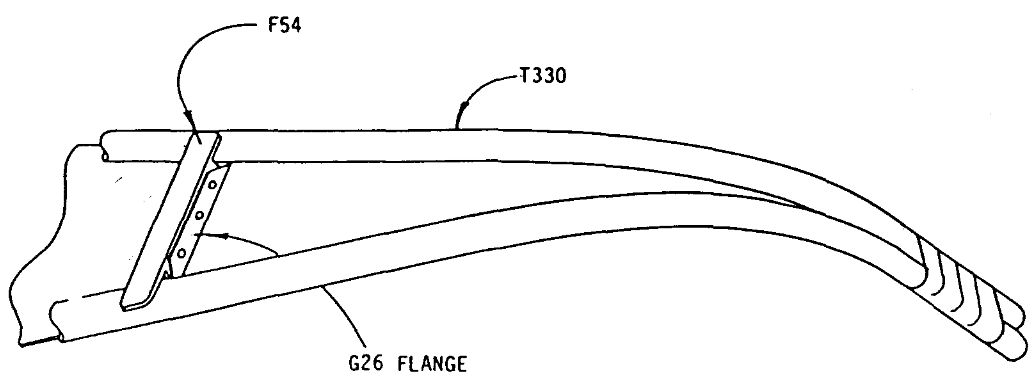


5.4.3 Remove T330 from the fuselage and position it on your work table as shown at left below. Tape the tails together as indicated to keep them aligned properly.

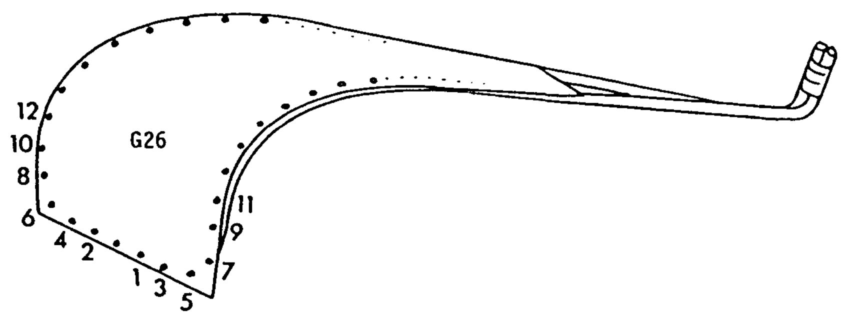


5.4.4 Put the seat skin (G26) in position as shown at right above. Note that the flange on the top edge of G26 should face forward (or downward with the seat positioned as shown). Make sure that G26 is even with the front edge of T330 and is centered properly, then put in one rivet as indicated.

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.*



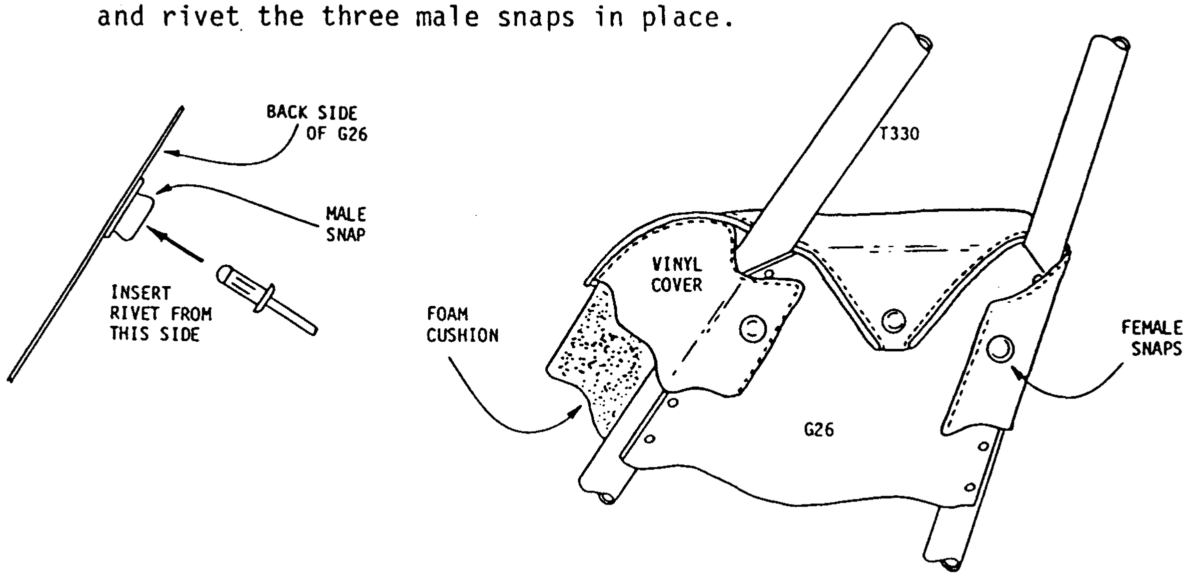
5.4.6 Rivet the seat skin to T330 with a rivet spacing of 2 inches. Install the rivets in the sequence shown below. You may find it helpful to tape the skin in position before riveting. After about 16 rivets have been put in, the tape on the tails of T330 may be loosened to let the tails spread about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

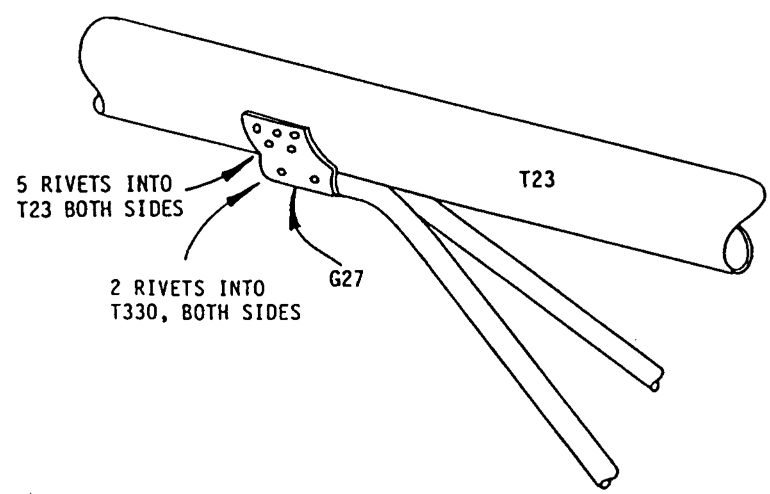


5.4.10 Refit the cushion and cover and snap the top in place. Pull the rest of the cover tight and locate and rivet the balance of the male snaps.

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.

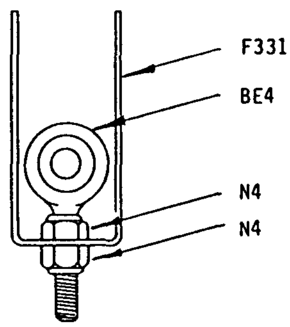


5.4.14 Centre the seat between A314 and A315 and rivet the seat skin G26 to A302 with 5 equally spaced stainless steel rivets.

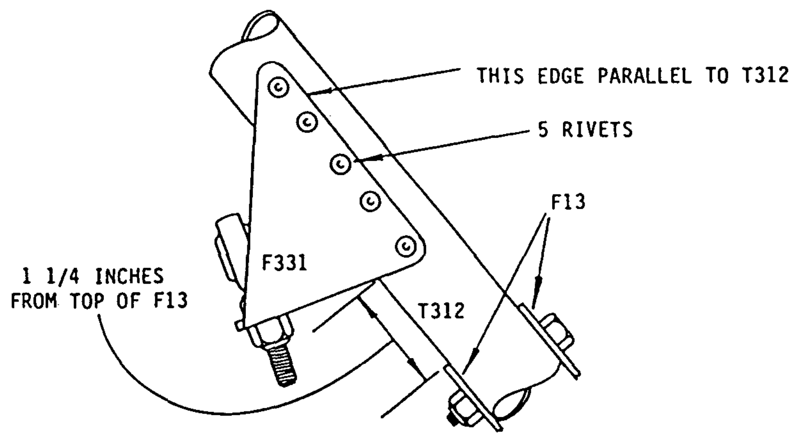
5.4.15 Rivet G26 to F337 with 5 equally spaced stainless steel rivets.

5.5 CONTROL LINKAGE INSTALLATION

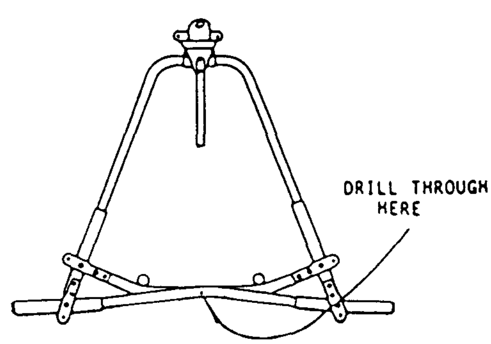
5.5.1 Put an N4 nut on a BE4 rodend (backwards as done previously) and fit the rodend into an F331 bracket as shown.



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.

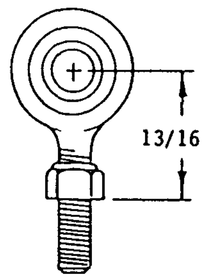


5.5.3 Run a 3/16 inch drill through the centre hole in the A301 axle tube, and extend the hole straight through A302, then ream the hole using a 1/4 inch drill.

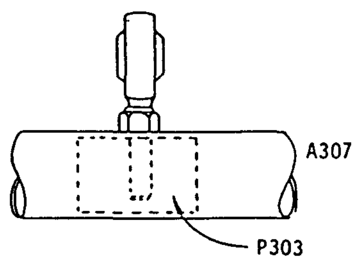


NOTE THAT THIS HOLE MUST BE DRILLED CAREFULLY TO ENSURE SYMMETRICAL STICK TRAVEL (REF. STEP 5.5.14).

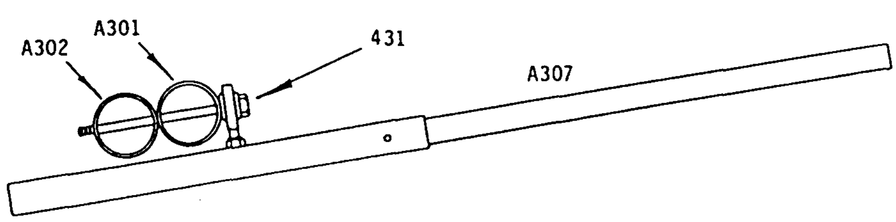
5.5.4 Put another N4 on another BE4 as shown. When measuring to the centre of the hole in the rodend, make sure the ball is properly oriented in the socket.



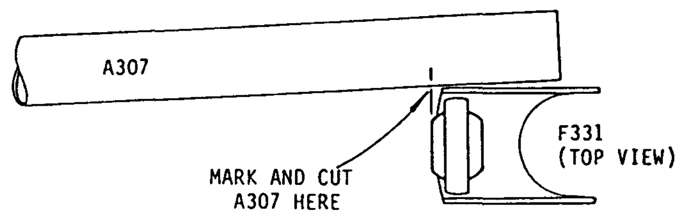
5.5.5 Put a P303 plug into torque tube A307 so the tapped hole in the plug is aligned with the 1/4 inch hole in the tube, and install the BE4 as shown.



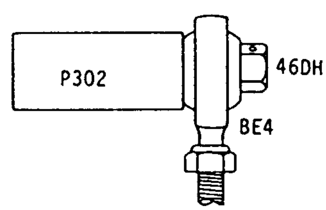
5.5.6 Temporarily install the A307 torquetube assembly as shown. Do not put a nut on the 431 bolt at this time.



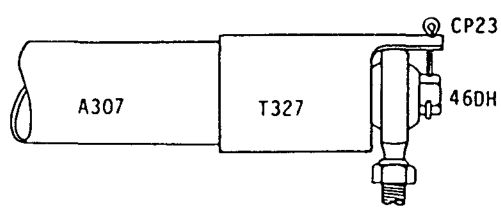
5.5.7 Position the forward end of A307 beside the BE4 rodend in the F331 bracket. Mark the A307 opposite the face of the rodend. Remove A307 and cut it off at the mark.



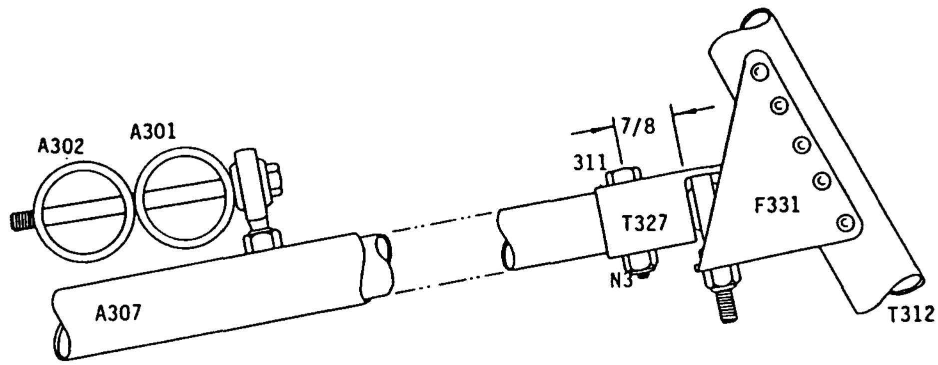
5.5.8 Remove the BE4 rodend from F331 and bolt it to a P302 plug as shown. Tighten the 46DH bolt securely.



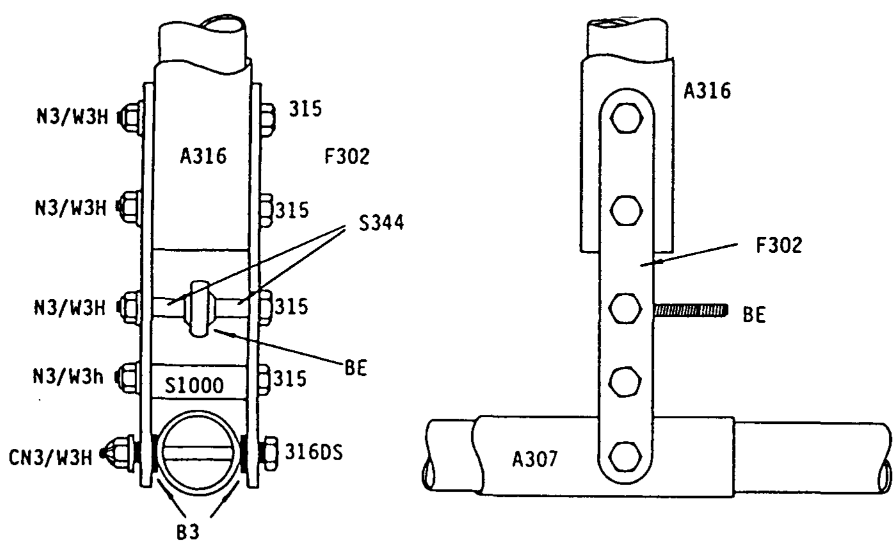
5.5.9 Put a T327 locking tube over the end of A307, and insert the P302 plug into the end of A307. With the end of the plug flush with the end of the tube, run a 1/16 inch drill through the hole in the head of the 46DH bolt to drill a corresponding hole in the tab of the T327, and pin with a CP23 cotter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



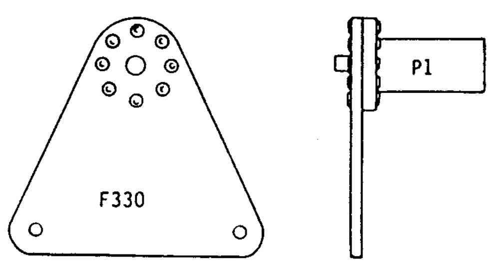
5.5.10 Reinstall the torque tube assembly in the aircraft as shown below and check that it moves freely from side to side. Drill and bolt A307, T327 and P302 as shown.



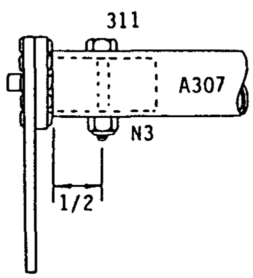
5.5.11 Assemble the control stick on A307 as shown. Tighten the CN3 castle nut until the stick moves with just a bit of friction and install the CP23 cotter pin.

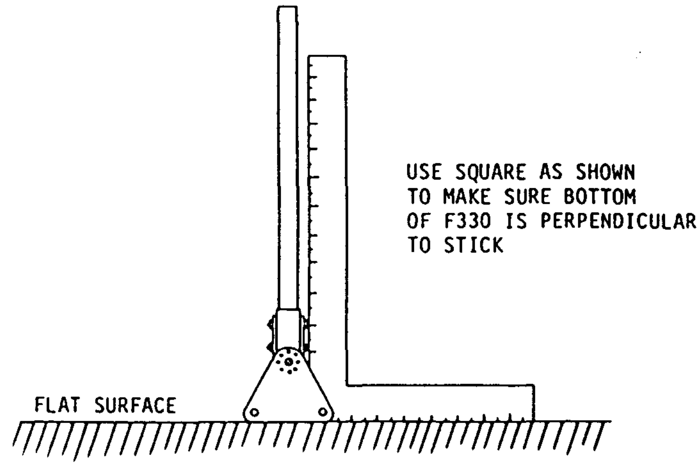


5.5.12 Rivet the aileron control horn F330 to a P1 plug with 8 stainless steel rivets.



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.

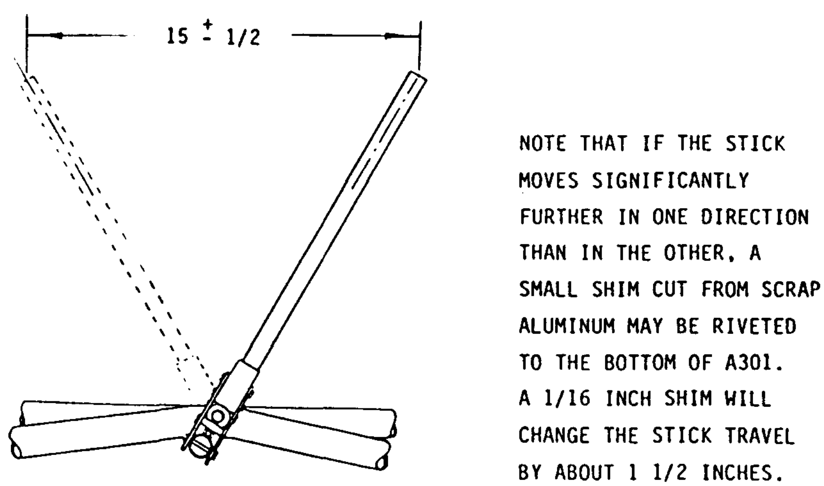




5.5.14 Check and adjust the stick limit stops as follows:

(a) Stick Lateral Movement

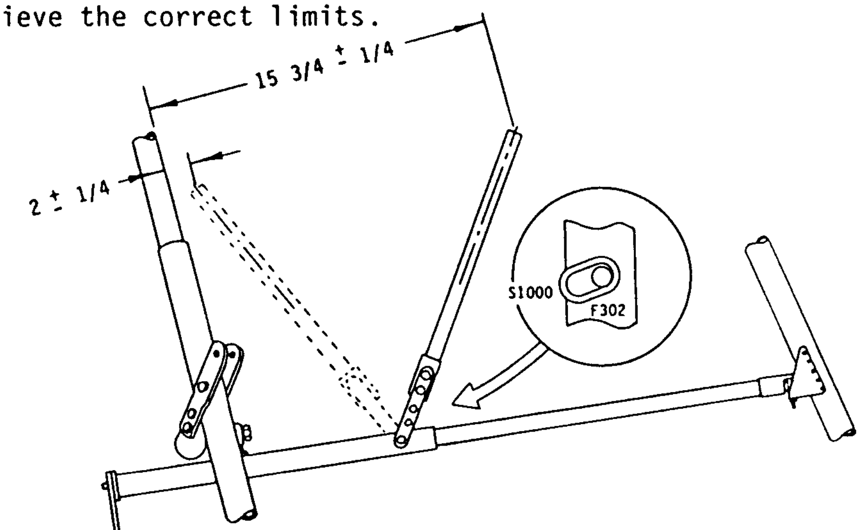
Move the control stick from side to side and check the total movement as indicated. Total stick travel may be adjusted (if necessary) by screwing the BE4 rodend in or out as required. One complete revolution of the rodend will change the total stick travel by approximately one inch. Be sure to tighten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



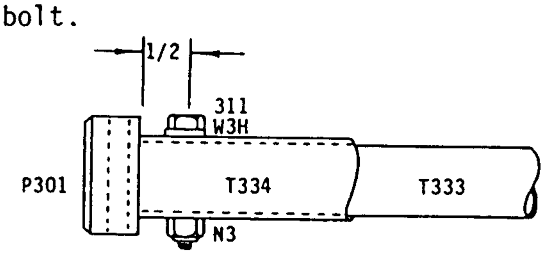
(b) Fore/Aft Movement

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.

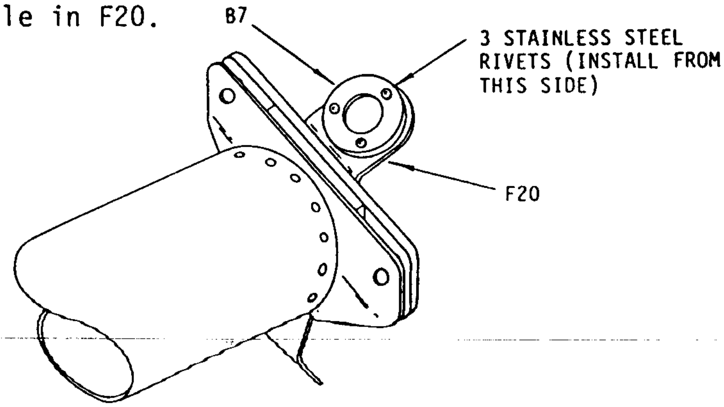
Note that the stick position is measured from the front *plane* of the A-Frame (this is not a direct measurement from the A303 downtube).



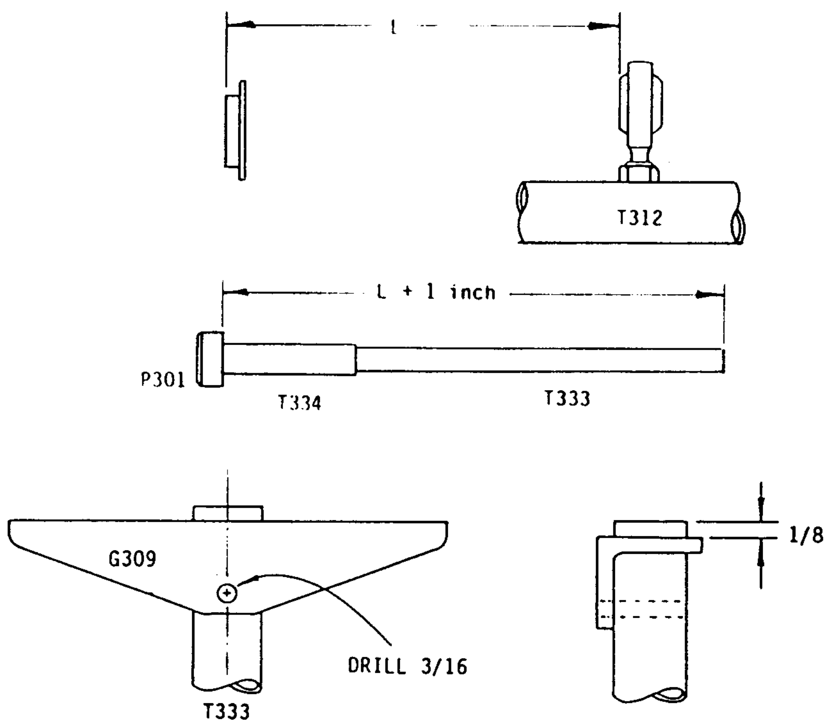
5.5.15 Drill and bolt a P301 mixer plug, T333 torque tube and T334 doubler as shown. Note that the bolt should be parallel to the 1/4 inch hole in the plug. Note also that the washer is installed under the *head* of the bolt.



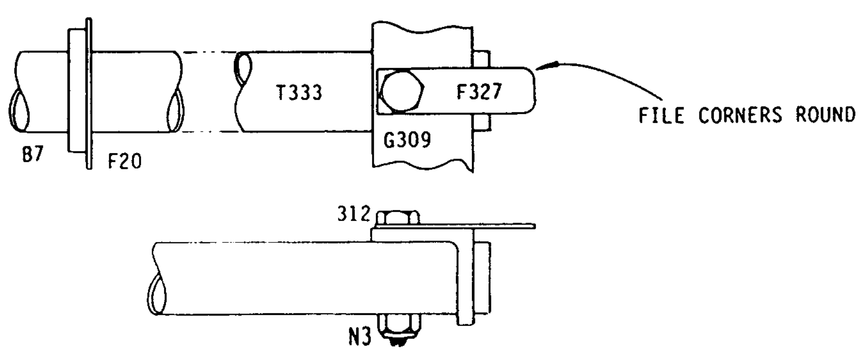
5.5.16 File or sand the inside of a B7 nylon bushing if necessary so it will fit easily over T334. Install B7 on F20 (F20 is part of the front fitting) as shown. Make sure the hole in B7 is concentric with the hole in F20.



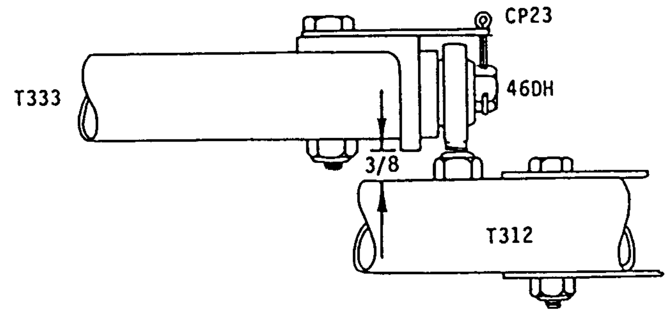
5.5.17 Measure the distance between the top surface of the B7 and the face of the BE4 rodend in T312 (installed in step 5.3.2). Saw the end off T333 so it is 1 inch longer than the measured distance. Install a P302 plug and the G309 ruddervator control horn on the other end of T333 and drill as shown. 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.



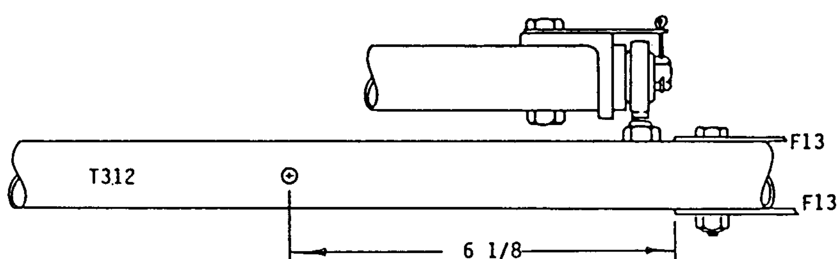
5.5.18 Remove G309 (after marking T333 so that G309 may be reinstalled the same way), and fit T333 through B7. Reinstall G309 and bolt as shown, with an F327 lockplate under the head of the bolt.



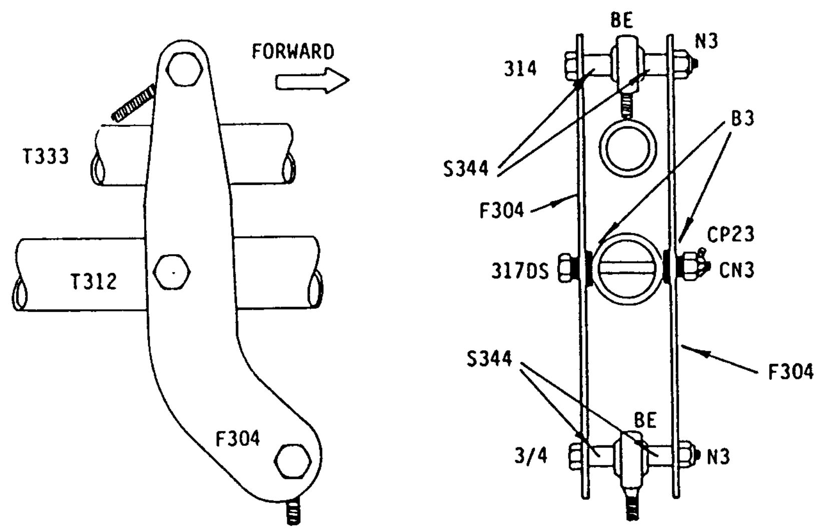
5.5.19 Bolt the end of the T333 assembly to the rodend in T312 (installed in Step 5.3.2) as shown. The clearance between the bottom edge of G309 and T312 should be as close as possible to 3/8 of an inch as indicated. If necessary, screw the rodend in or out to achieve this clearance. An F324 may be used 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.



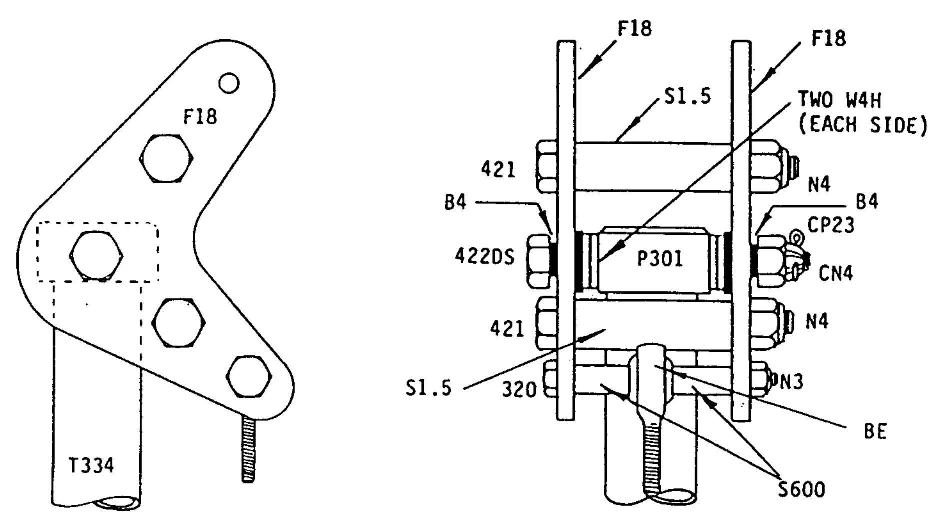
5.5.20 Drill a 3/16 inch hole through T312 as shown. Make sure the hole is horizontal (parallel to A302) and goes through the centreline of T312.



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.

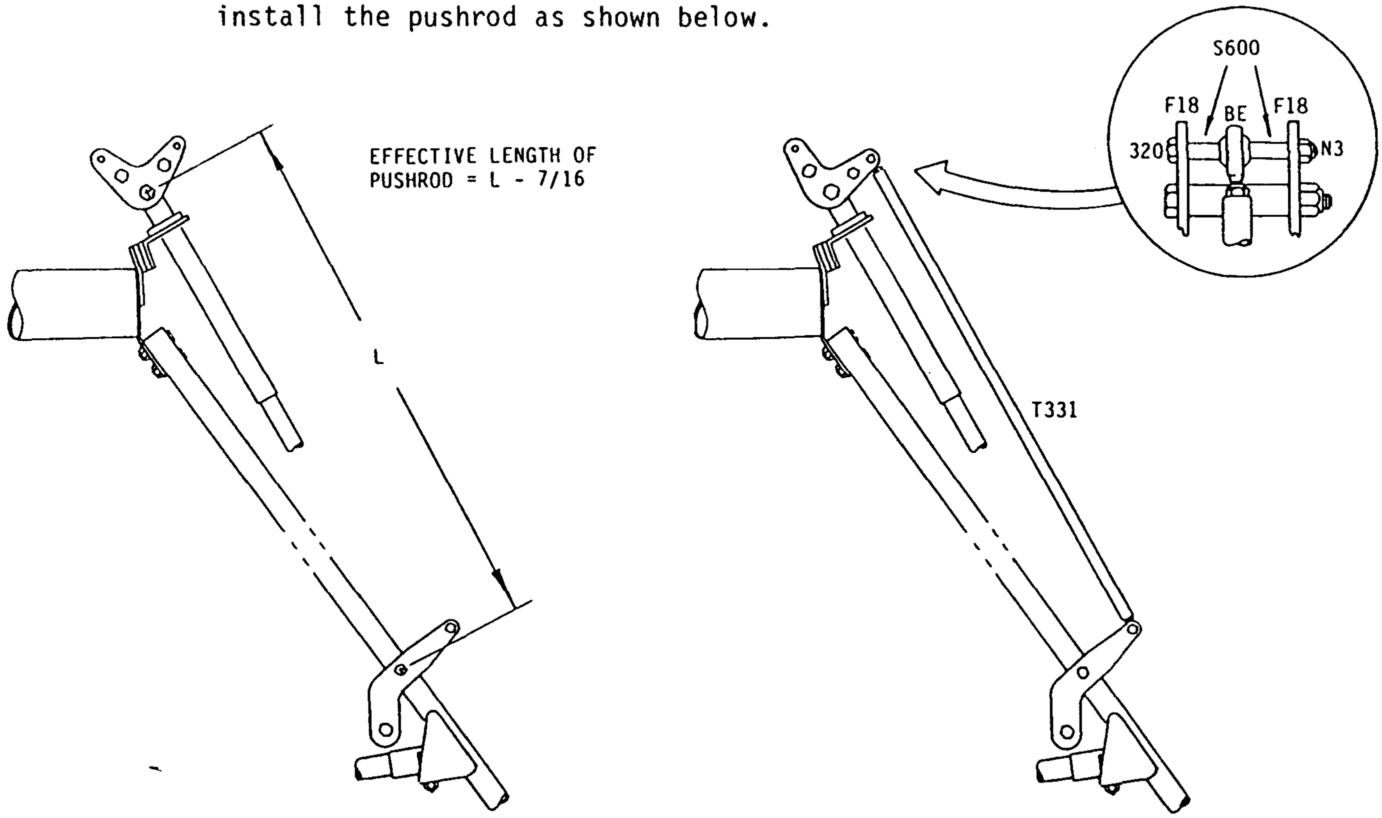


5.5.22 File or sand the edges on the F18 mixer plates (some may be marked F19 as these parts are identical) and assemble the mixer on the mixer plug P301 as shown. Adjust the CN4 nut as was done for the other bellcranks, and lock with a cotter pin. Note that the two legs on the F18 are similar but not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

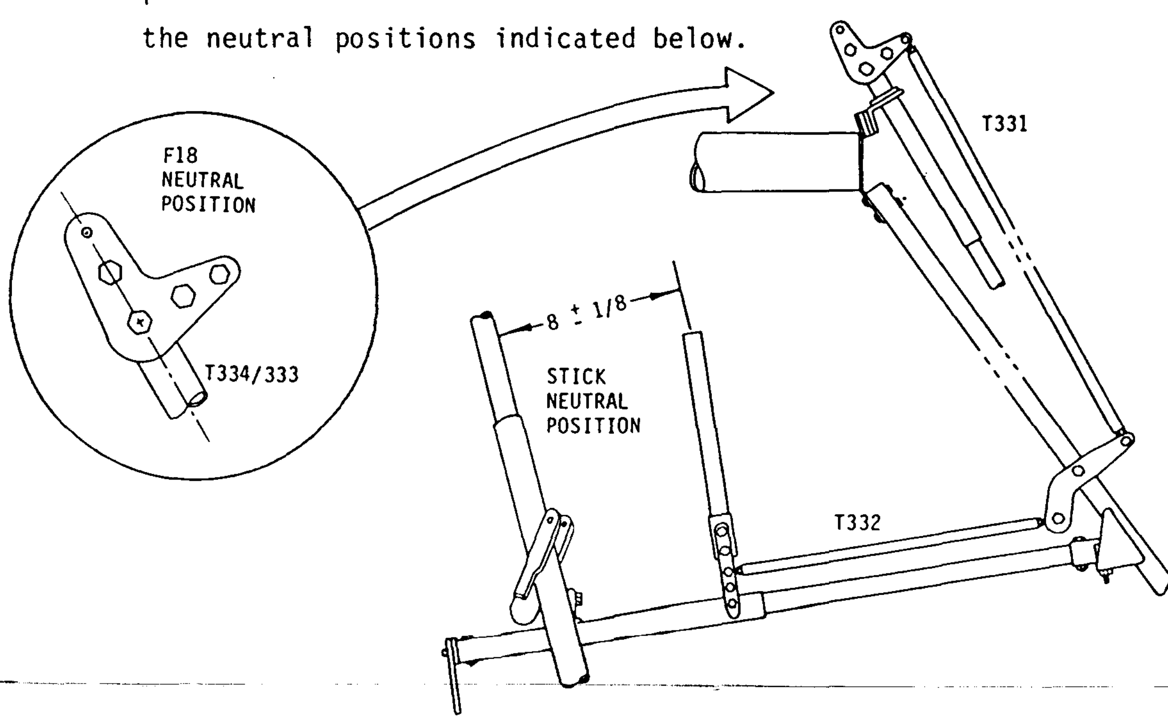


5.5.23 *Assemble the T331 pushrod to interconnect the F18 mixer bellcrank to the F304 elevator control bellcrank as follows:*

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.

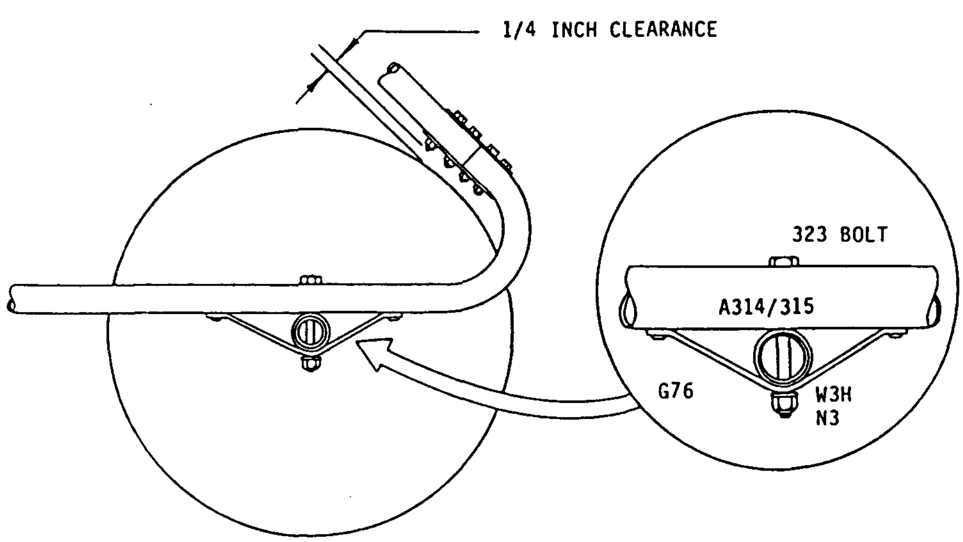


5.5.25 Remove any burrs and sharp edges from the top of the control stick, and slide the stick grip in place. Wetting the inside of the stick grip with water will allow it to slide on more easily.

5.6 NOSEWHEEL AND RUDDER PEDAL INSTALLATION

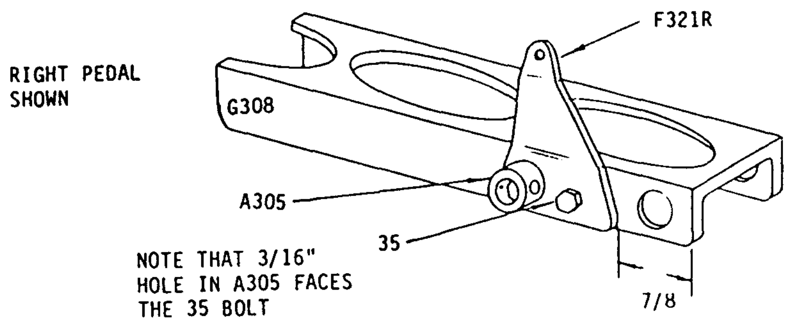
NOTE: *The following instructions have been written with the assumption that you will be installing the nosewheel, at least temporarily as suggested in 1.2.1. If you do not intend to fly the aircraft with the nosewheel installed, it should be used as a gauge for locating the axle (Step 5.6.1), then removed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

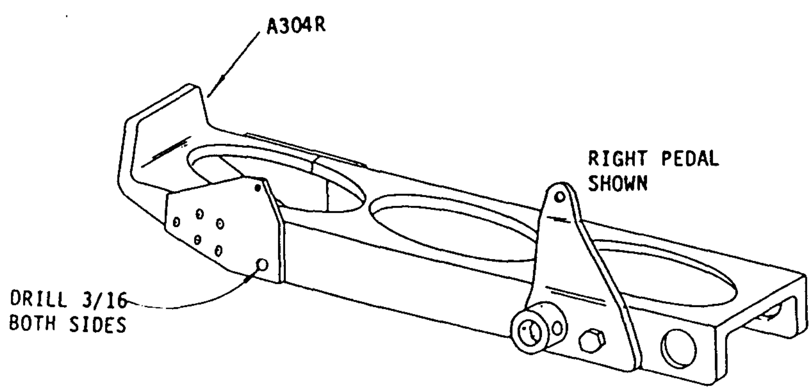


5.6.2 Centre the nosewheel on its axle and rivet the T47 collars in place with two rivets each, allowing about 1/32 of an inch sideplay in the nosewheel.

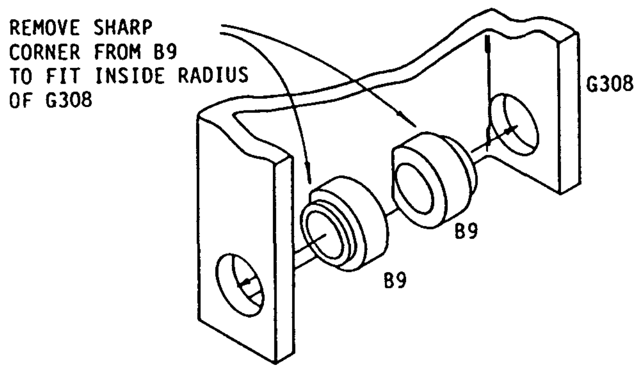
5.6.3 Assemble the two rudder pedals as shown. *Be sure to make one left and one right.* Note that the F321L/R horn is mounted on the inboard side of the pedal. Note also that the upper bolt is part of the A305 assembly.



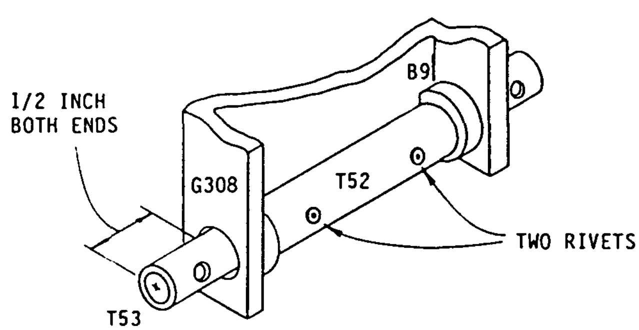
5.6.4 Before installing the rudder pedals, drill the 3/16 inch holes for attaching the brake pedals (A304L/R) as shown, but do not install the brake pedals at this time.



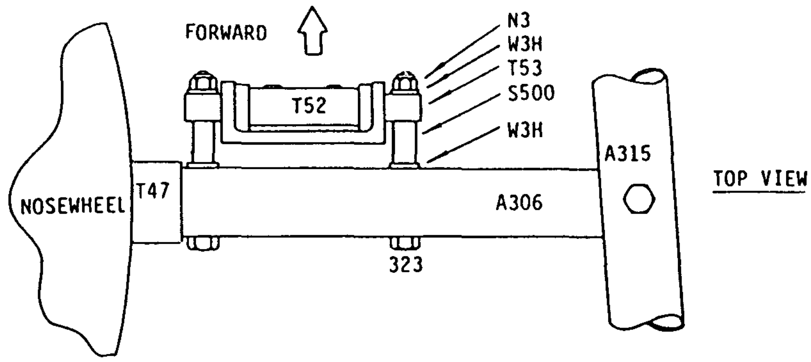
5.6.5 Fit the B9 Rudder Pedal Bushings into the holes in the rudder pedals (from the inside) as shown. Check that the B9's fit flush against the sides of G308 and file the B9's as indicated in the figure if necessary.



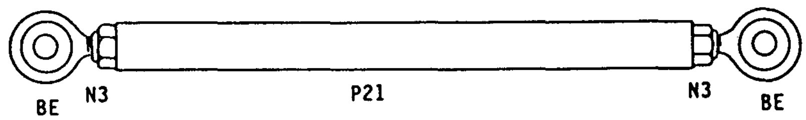
5.6.6 Install the T53 Rudder Pedal Axles and T52 sleeves and rivet as shown. Before riveting make sure that the pedals rotate freely on the axles and trim the T52's to length if required. Locate the rivets so that they are approximately in line with the predrilled holes in T53.



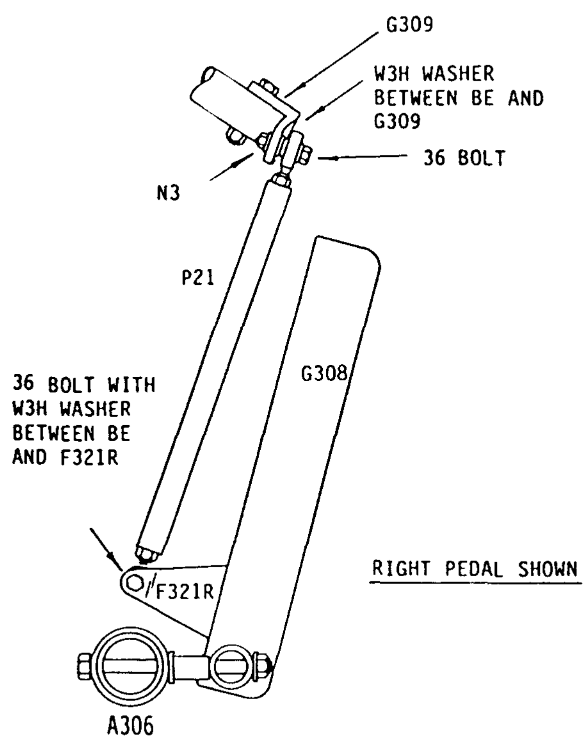
5.6.7 Mount the rudder pedals on the nosewheel axle as shown. Note that for clarity the F321R horn and A305 are not shown in the figure, but should be on the *inboard* side of the pedal.



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.



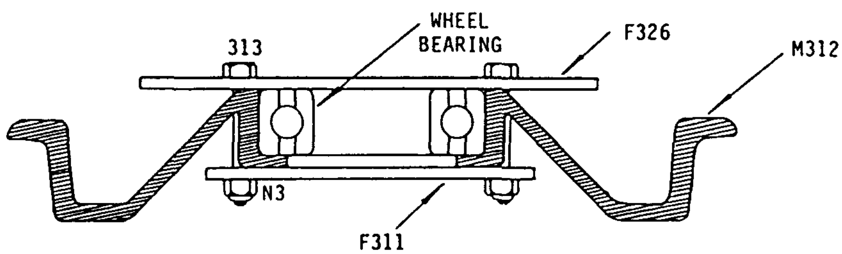
5.6.10 Note that there are two possible rudder pedal control stops provided by (a) the interference between G309 and T312 and (b) interference between the rudder pedals and A314/315. When properly adjusted the initial control stop should be provided by G309/T312 with the pedal on A314/315 used as a secondary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

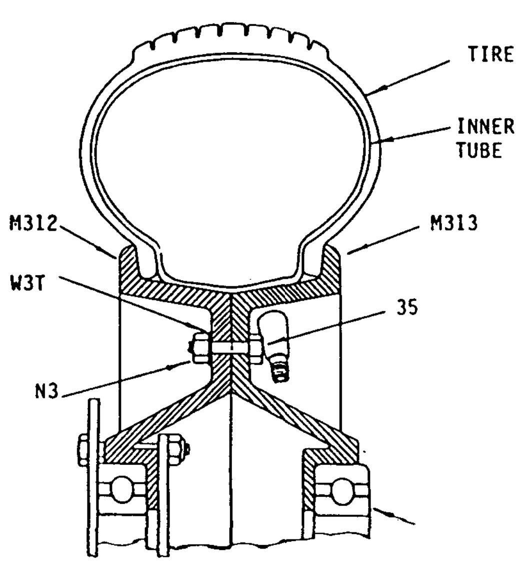
5.7 WHEEL AND BRAKE ASSEMBLY

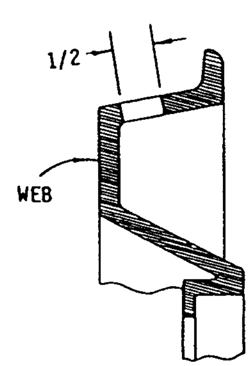
5.7.1 Assemble a wheel bearing, brake disc (F326) and backup disc (F311) on each inboard hub half (M312) as shown. Tighten nuts alternately and *evenly* to avoid distorting the brake disc.



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.*

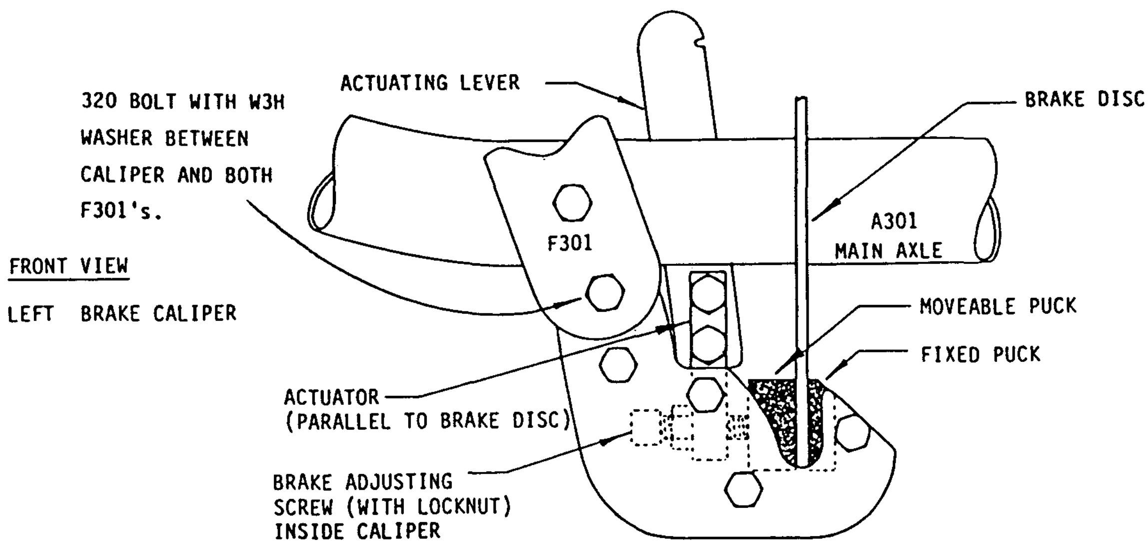
TIRE PRESSURE SHOULD NOT, UNDER ANY CIRCUMSTANCES, EXCEED 18 PSI.

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.

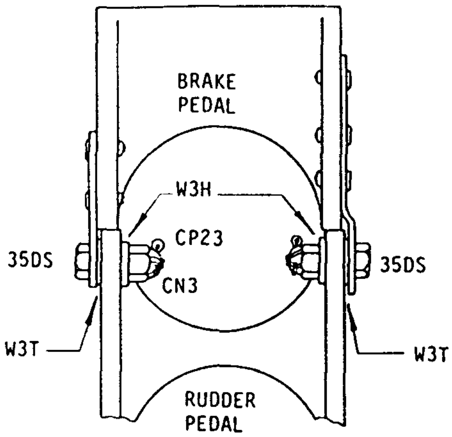
NOTE: *The brake adjusting screw has been set at the factory and should not require readjustment except to compensate for wear. When the brake pucks become sufficiently worn to require adjustment, the adjusting screw should be set so* *that when the brakes are applied, the actuator is parallel to the 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.*

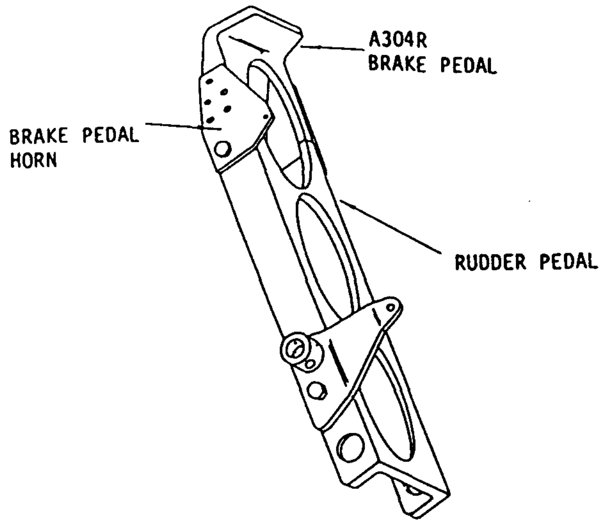


5.7.6 Fit the top of the caliper between the F301 fittings as shown above, and install the 320 bolt. Install a W3H washer under the nut but do not tighten the nut.

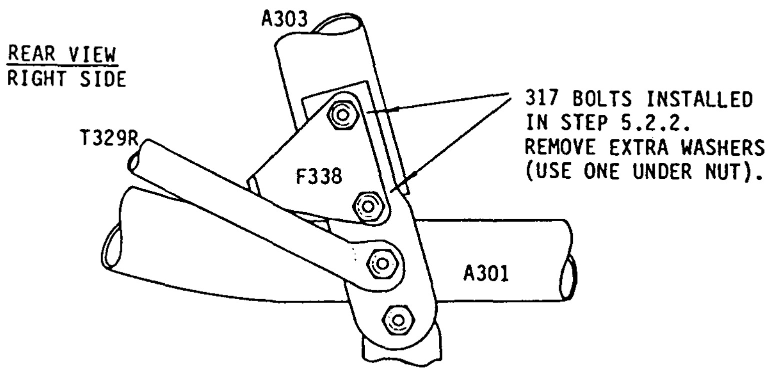
5.7.7 Squeeze the brake actuator to pinch the brake disc tightly between the two pucks, then tighten the nut on the 320 bolt to clamp the caliper in place. The wheel and caliper will now be approximately in the correct position. The final adjustment will be made later.

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.

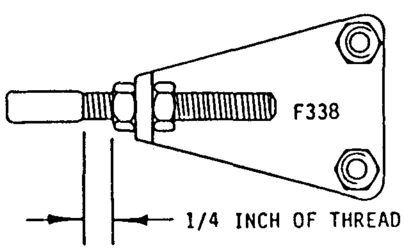




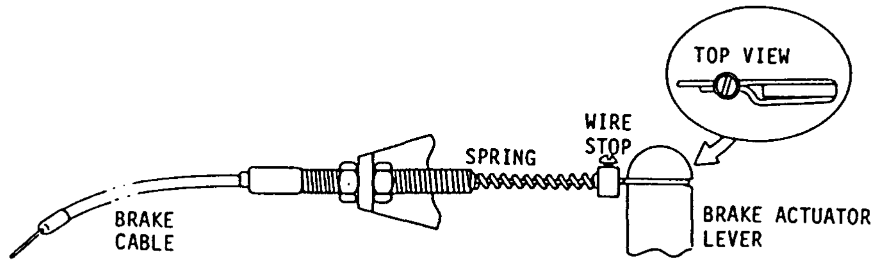
5.7.9 Install the F338 brake cable anchor on the rear side of the downtubes as shown. Notice that the bent tab on F338 with the 5/16 inch hole in it faces toward the rear.



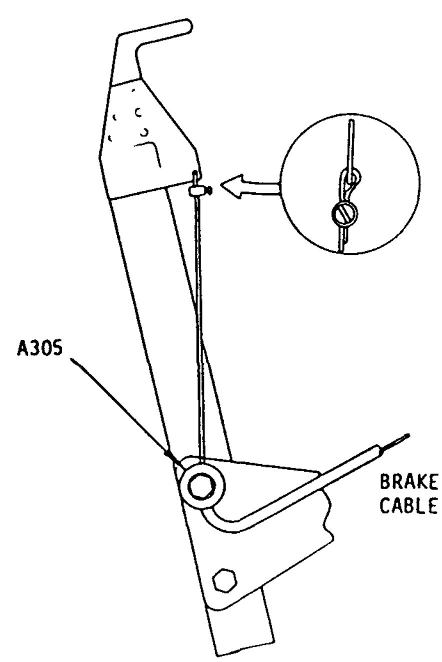
5.7.10 Install the brake cable adjuster in the F338's as shown and tighten the nuts.



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.



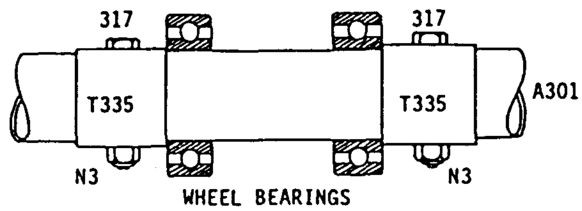
5.7.12 Feed the free end of the brake cable through the A305 cable retainer on the rudder pedal, then fit a wire stop over the inner cable, and feed the cable through the small hole in the brake pedal horn. To obtain the correct cable length, squeeze the lever on the caliper to apply the brakes. With 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.



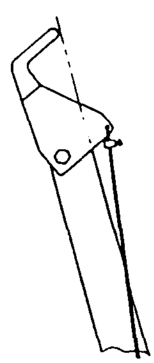
5.7.13 Loosen the nuts on the 315 bolts which clamp the calipers in place, then press the brake pedal firmly, and tighten the nut securely.

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



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.

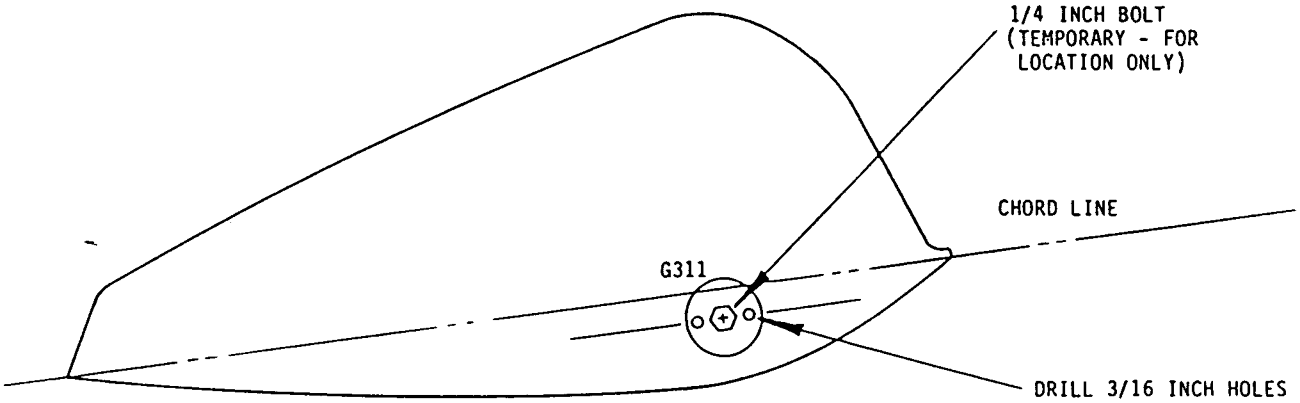
5.7.16 Make sure all nuts are tightened and cut off any excess cable at the brake pedal.

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.

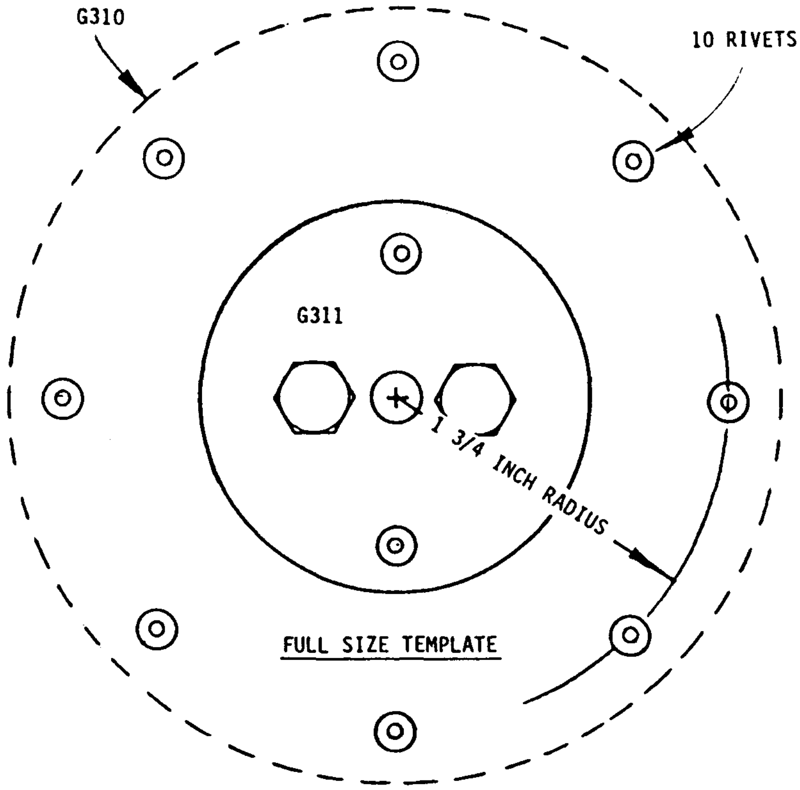
5.8 WHEELPANT ASSEMBLY AND INSTALLATION

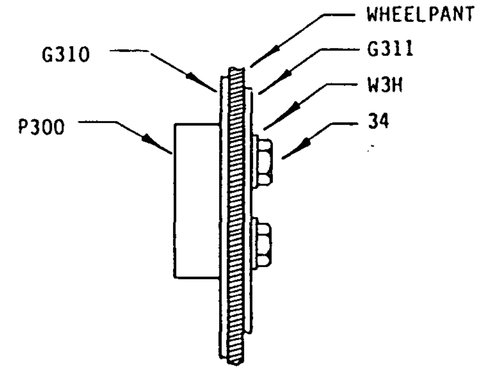
NOTE: *Before the wheelpants are permanently installed on the aircraft, they should be degreased, lightly sanded with No. 400 wet or dry sandpaper, and painted as required to match your Lazair. However, because of the possibility of scratching the paint during installation, it is recommended that the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



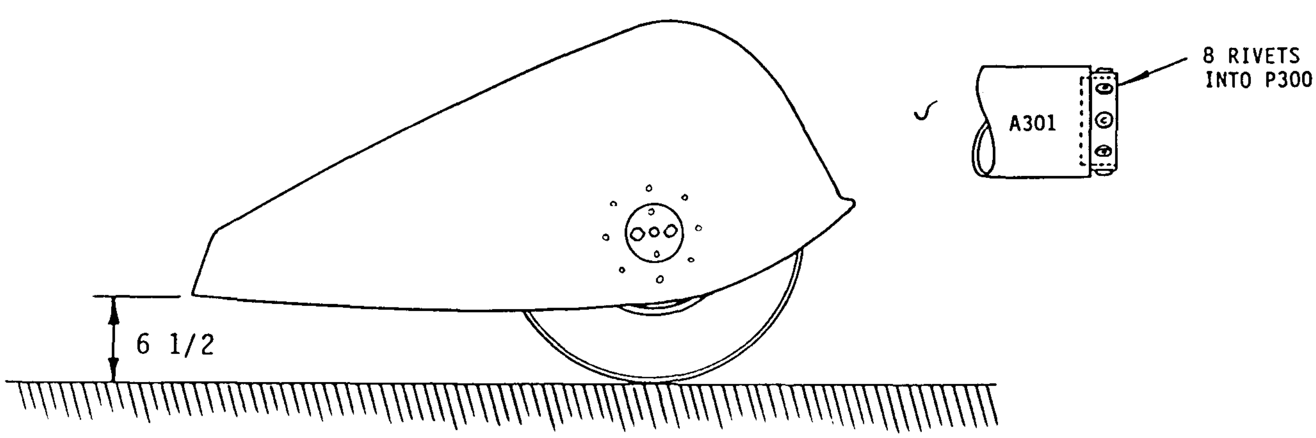
5.8.2 Check the fit of the P300 wheelpant mount plugs in the ends of the A301 main axle. To facilitate assembly, the plugs should fit tightly enough to stay in place. If necessary squeeze the *end* of the axle tube *slightly* to obtain a tight fit with the plug. Bolt the plug, a small tuit (G311) and 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.



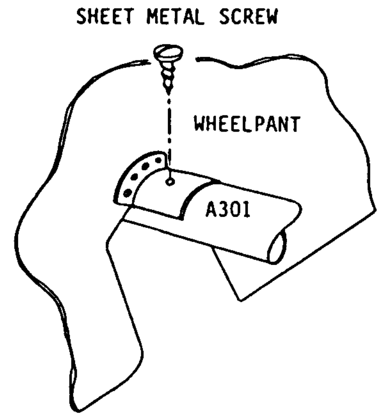


NOTE THAT THE P300 PLUG AND G310 TUIT ARE INSTALLED INSIDE THE WHEELPANT.

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.



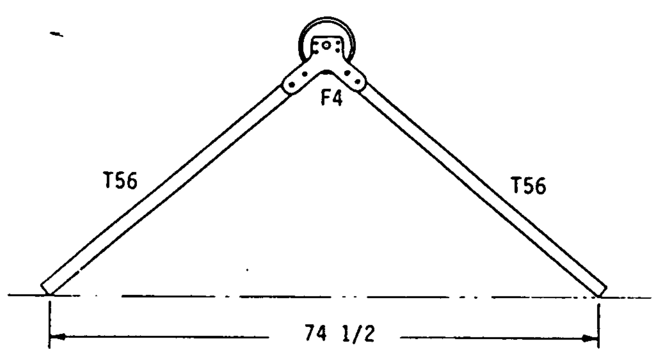
5.8.5 To prevent scratches or damage to the wheelpants, it is recommended that they be removed and stored in a safe place until the tail assembly has been completed.

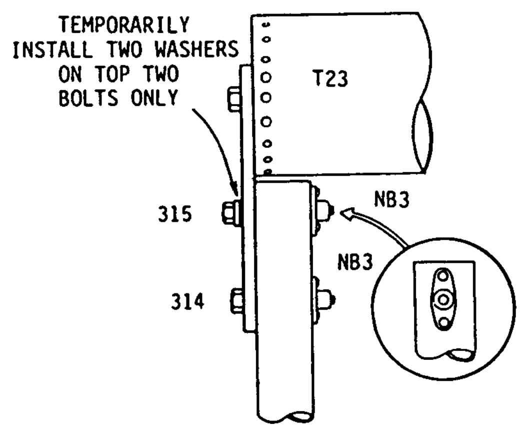
SECTION 6

TAIL ASSEMBLY

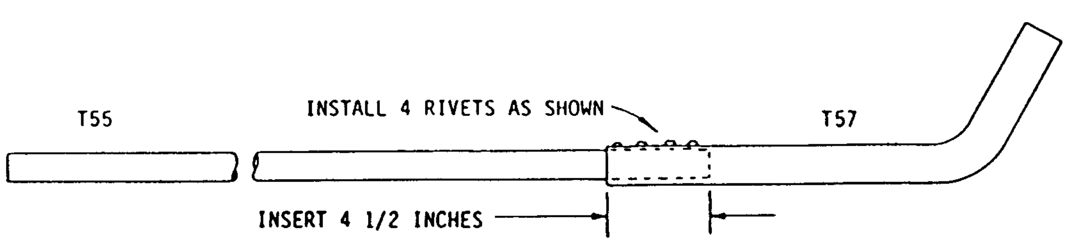
6.1 STABILIZER ASSEMBLY

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.

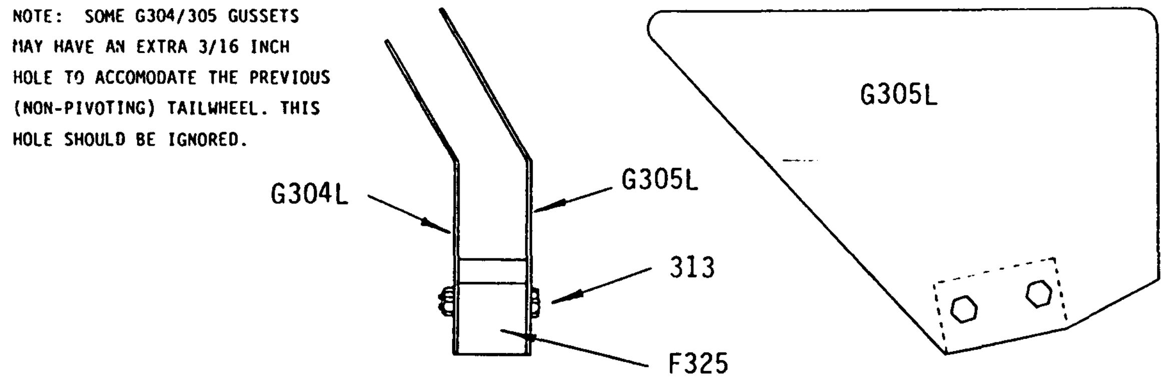




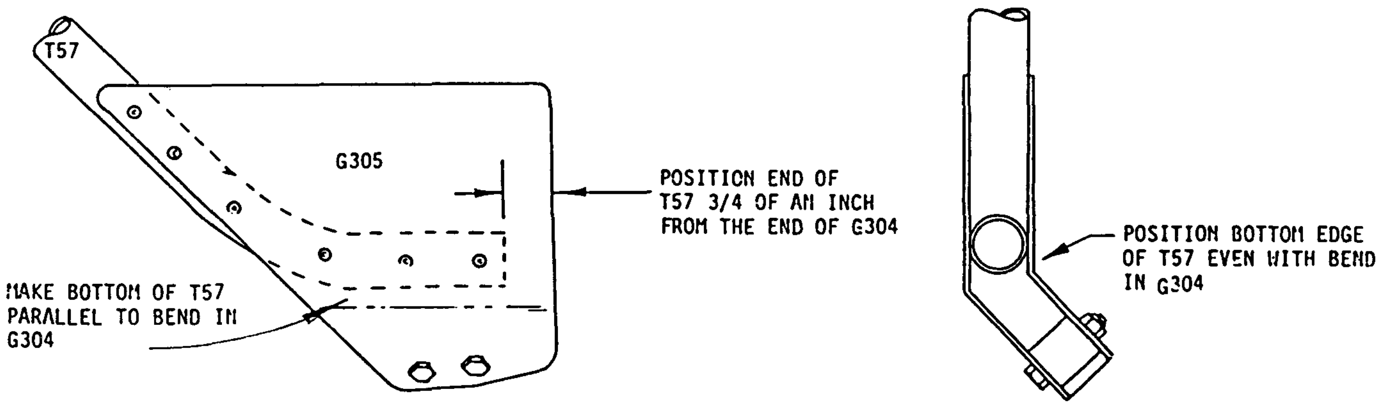
6.1.2 Rivet a T57 Stabilizer Outboard Tube to one end of each T55 Stabilizer Front Tube as shown.



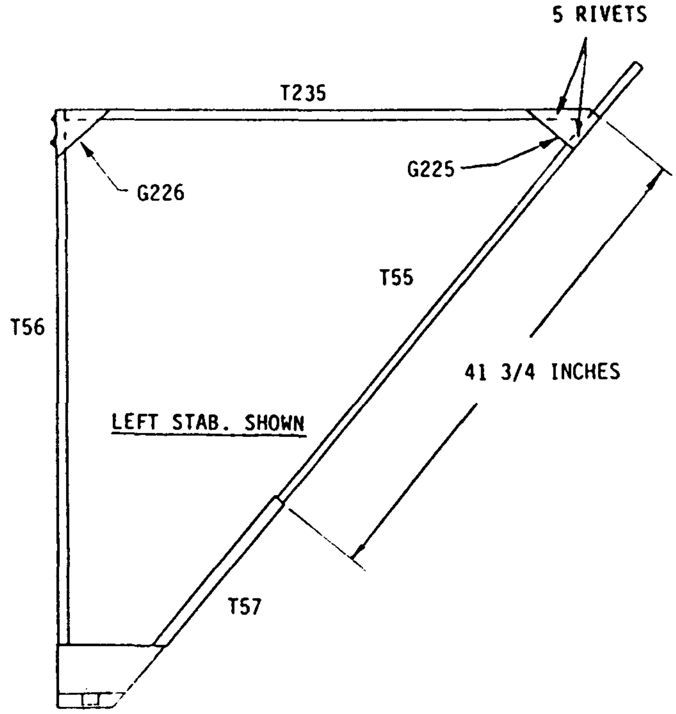
6.1.3 Make up two tailwheel gusset assemblies by temporarily bolting the gussets to the F325 tailwheel mount block. Note that the figure shows the left assembly. Use G304R and G305R for the right assembly.



6.1.4 Fit the gusset assembly over T57 as shown and rivet in place with 6 rivets in each G304 and G305 gusset.



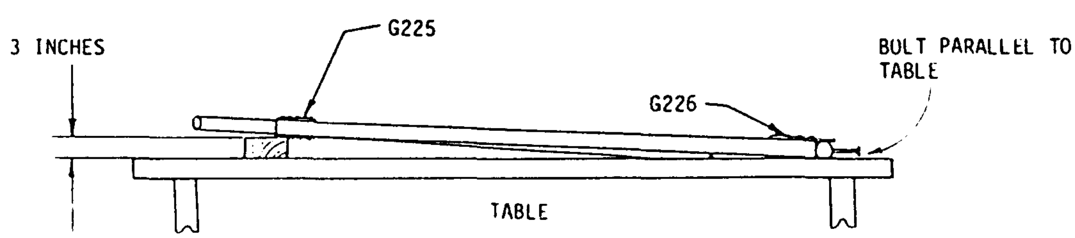
6.1.5 Round the corners on the G225 and G226 gussets and assemble the components of the stabilizer on a flat table as shown. Note that for this step the stabilizer is upside down, and the bend in the tailwheel assembly should be *upward*. Do not rivet the gussets at this time.



6.1.6 Rivet the G225 gusset in place with 5 rivets into T235 and 5 rivets into T55. Rivet G226 in place with 4 rivets into T235. *Do not rivet into T56 at this time.*

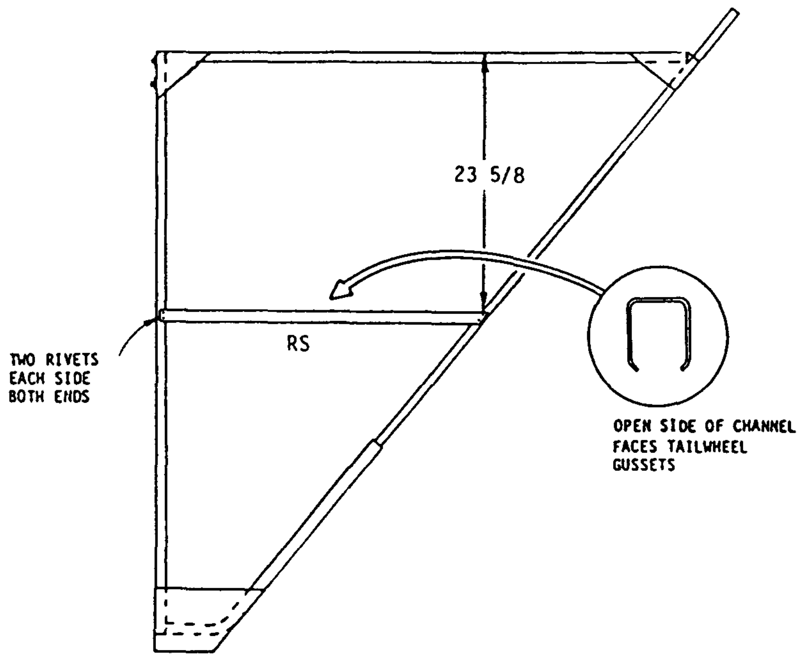
6.1.7 Turn the stabilizer over and rivet the other two G225 and G226 gussets to T55 and T235, making sure the stabilizer forms a flat plane (let the tailwheel gusset assembly hang over the edge of the table).

6.1.8 Elevate the junction of T235 and T55 with a block as shown. *T56 should be flat on the table.* Temporarily screw a long 3/16 bolt (323) into one of the holes in T56. Rotate T56 so that the bolt is parallel to the table top. Rivet the G226's to T56 with 5 rivets in each.



6.1.9 Rivet T56 to the G305 and G304 gussets with 6 rivets in each.

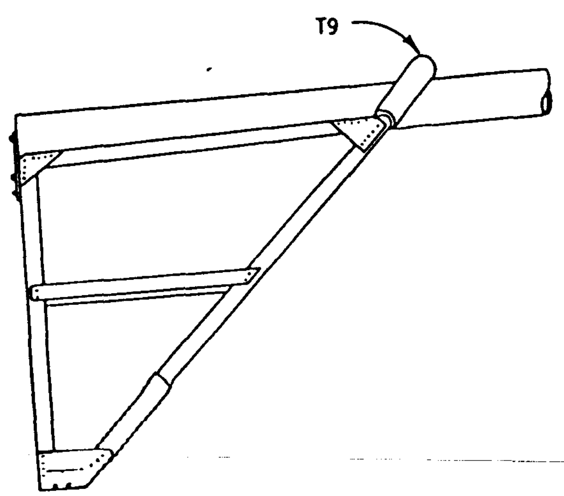
6.1.10 Bend the sides of stabilizer rib RS by hand if necessary so that the sides are parallel. Cut and file the ends of stabilizer rib RS to fit T56 and T55. Rivet in place as shown. Make RS parallel to T235.



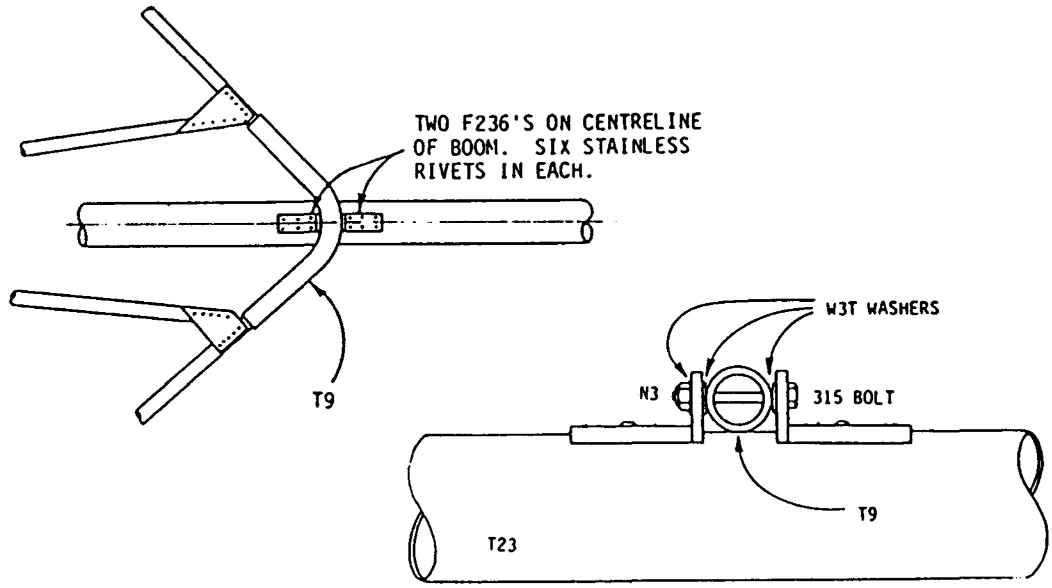
6.1.11 Repeat steps 6.1.6 through 6.1.12 for the right stabilizer.

6.1.12 Support the boom so that the tail surfaces will be clear of the floor when attached. Using the same hardware as in step 6.1.1, attach the stabilizers to the F4. Support the leading edge of the stabilizers to avoid twisting the F4.

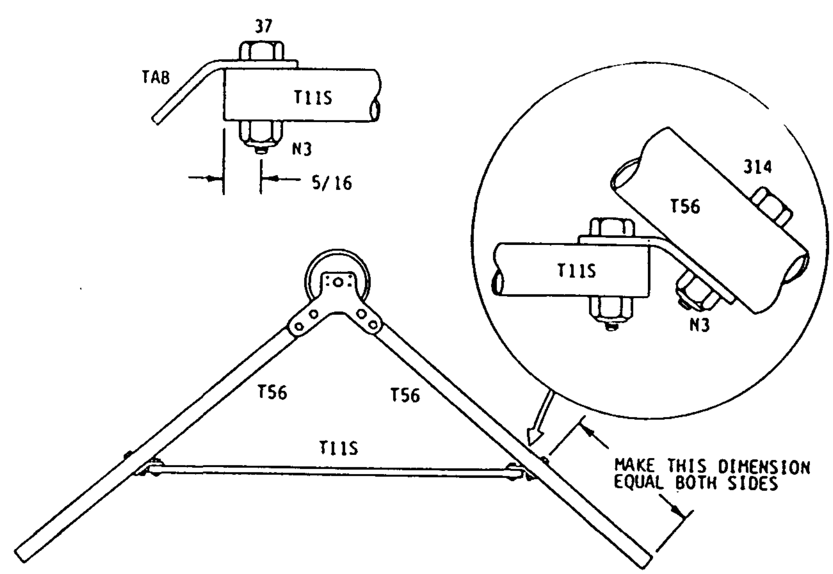
6.1.13 Fit a T9 over the top of the boom and slide it over the ends of the T55's as far as possible as shown below.



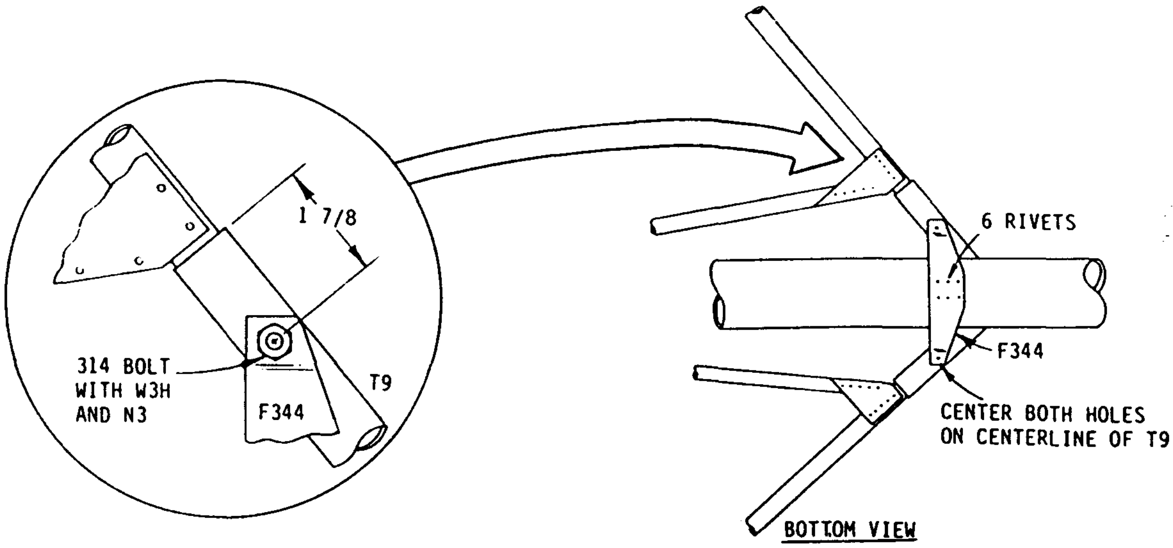
6.1.14 Rivet two F236's to the boom as shown. Drill and bolt T9 to the F236's making sure T9 is centered.



6.1.15 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.

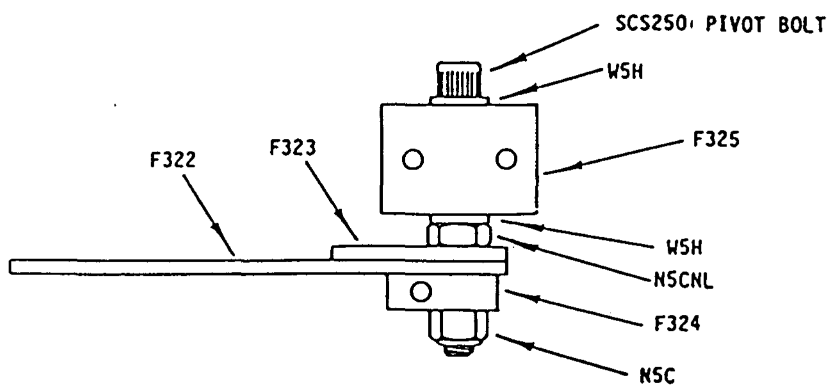


6.1.16 Set the tail on the ground. Block up one side of the tail if necessary so that the spreader is parallel to the main axle. Bend F344 so that it will straddle the bottom of the boom and touch T9 on each side as shown. Make sure the holes in F344 are on the centreline of T9. Rivet F344 to the boom with one stainless rivet.

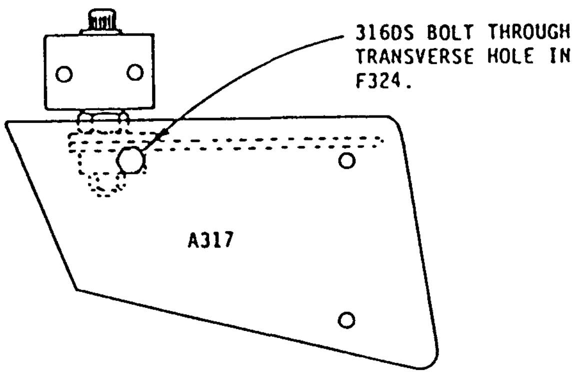


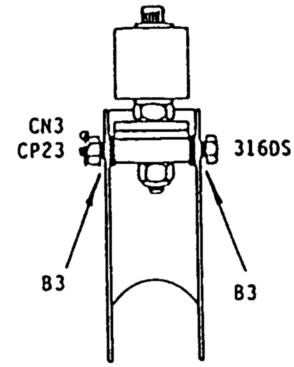
6.1.17 Check the alignment of F344 and bolt it to T9 as shown above. Install the remaining 5 stainless steel rivets in F344.

6.1.18 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 rotation for F325.

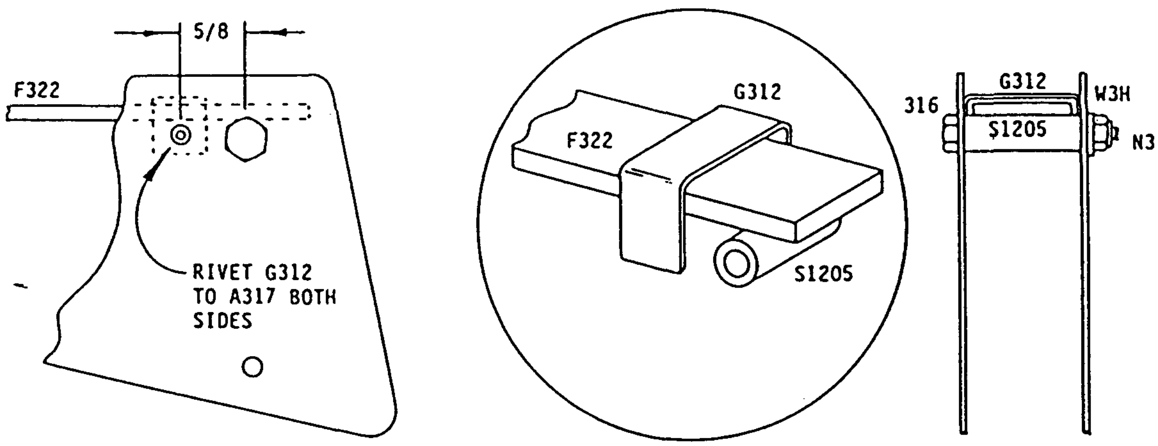


6.1.19 Fit each spring and pivot assembly into a tailwheel pant (A317) as shown. Adjust the CN3 so that A317 will move freely, and pin the nut with a CP23 cotter pin. Make a left and right assembly by inserting the two 316DS bolts in opposite directions. (The left assembly is shown in the figure).

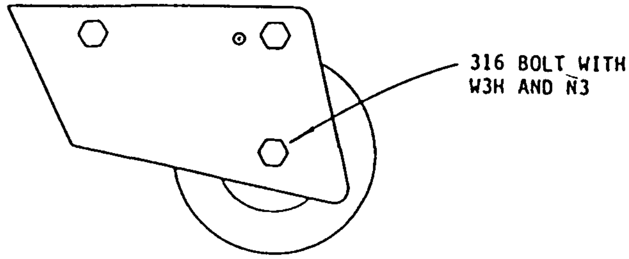




6.1.20 Install the S1205 spacer with a 316 bolt (below the F322 leaf spring). Install the G312 stop and rivet in place as shown to retain the spring. Note that the spring should not be *clamped* by G312 (about 1/16 of an inch play is acceptable).



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

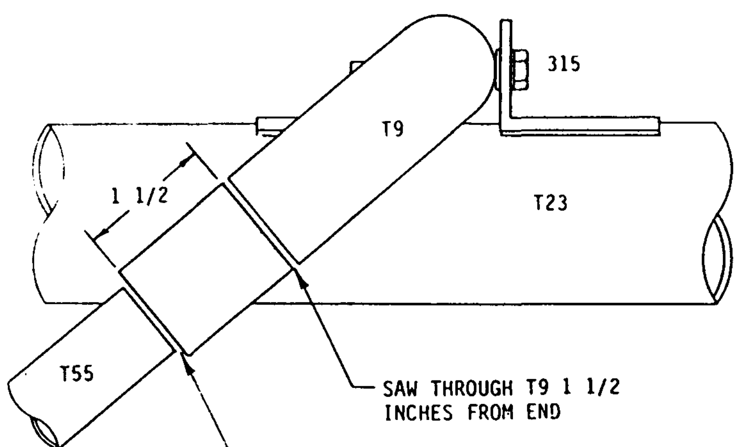


6.1.22 Reinstall the F325 mount blocks on the aircraft. Check that the tailwheel assembly rotates freely on its pivot bolt. Press down on the top of the tail and check that the tailwheel springs deflect.

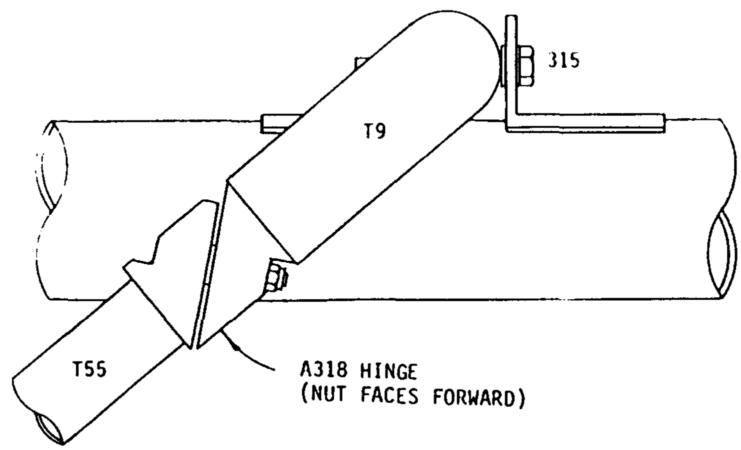
Note: *If you do not want to fold the tail, the stabilizers may be left as is, and you should proceed to section 6.2. If you want to be able to fold the tail, install the forward stabilizer hinges as described below.*

6.1.23 Check that the two halves of the A318 hinges are aligned and tighten the nut securely.

6.1.24 Saw through T55 and T9 as shown, and insert the hinges. Note that it will be necessary to remove a few rivets in T55, and the two 314 bolts installed in 6.1.17.



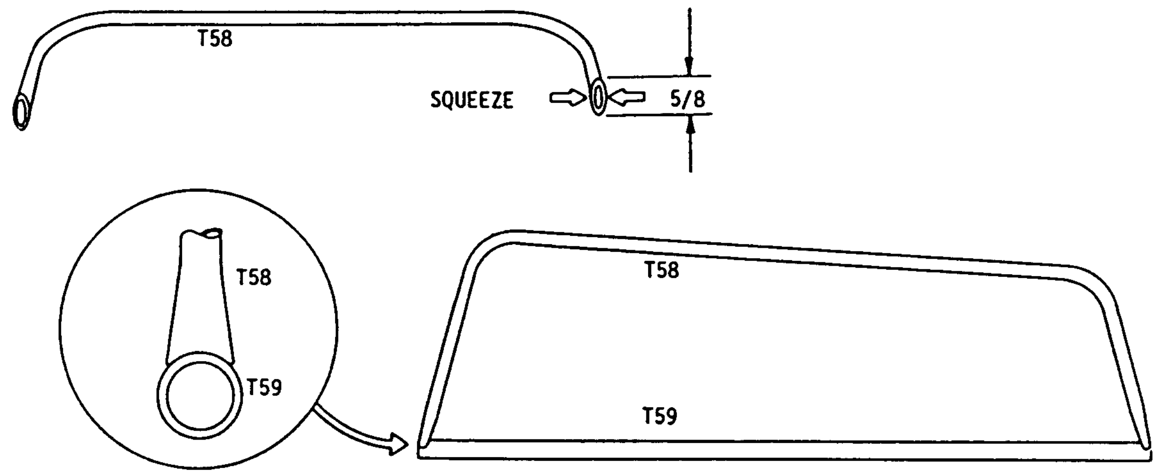
6.1.25 Rotate each hinge so the axis of the hinge pin is aligned with the 314 bolt shown in the figure for step 6.1.1. *Make sure the hinges are properly aligned before bolting them in place.* Drill through the inboard hinge plug using the holes drilled in step 6.1.17 as a guide, and reinsert the 314 bolts. Drill a 3/16 inch hole through each T55 and the inboard hinge plugs. Use one of the rivet holes if possible, but make sure the hole is at least 3/8 of an inch from the end of the hinge plug. Secure with 311 bolts and N3 nuts. Drill out the remaining rivet holes (about 3/8 of an inch deep) and install new rivets.



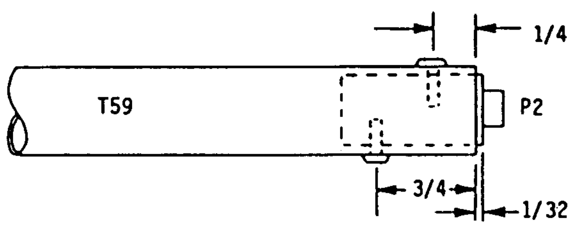
6.1.26 To fold the tail, remove or fold the spreader (T11S), then remove the 315 bolts in F4 (shown in the figure for step 6.1.1). Loosen the 314 bolts so they can act as the rear hinge pins, and loosen the nuts on the forward hinge pins *at least two full turns*.

6.2 RUDDERVATOR ASSEMBLY

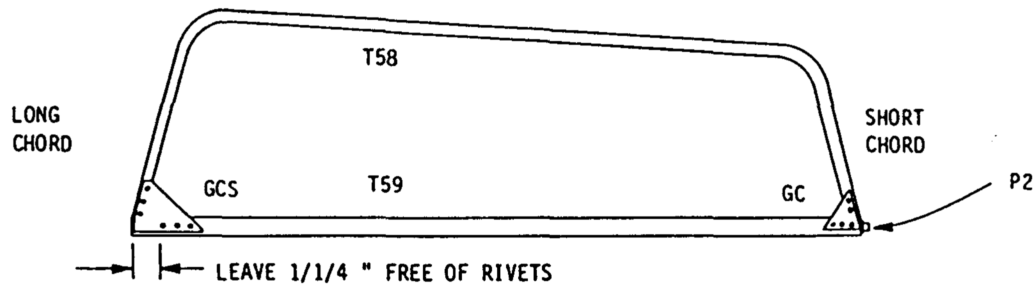
6.2.1 Squeeze the ends of the bent ruddervator tube T58 as shown, then file the ends to fit the torque tube T59.



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

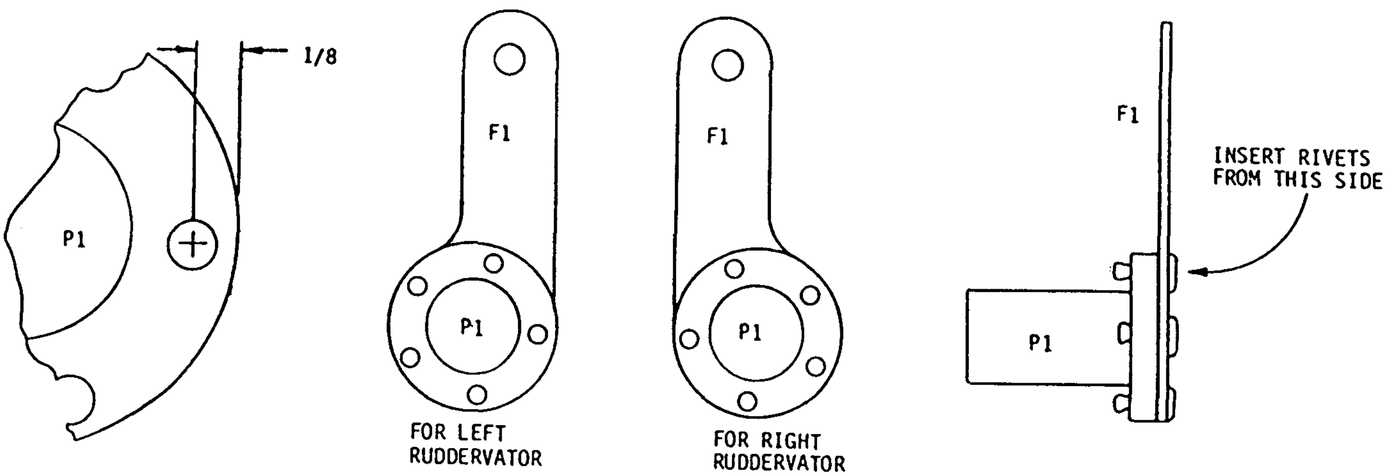


6.2.3 Fit T58 to T59 as in step 6.2.1. Trim GC gussets as required to fit as shown, and round the corners of the GC and GCS gussets. Rivet the gussets in place as shown (both top and bottom). Use five rivets in each GC and six in each GCS. Build the ruddervator on a flat surface and make sure that T59 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.

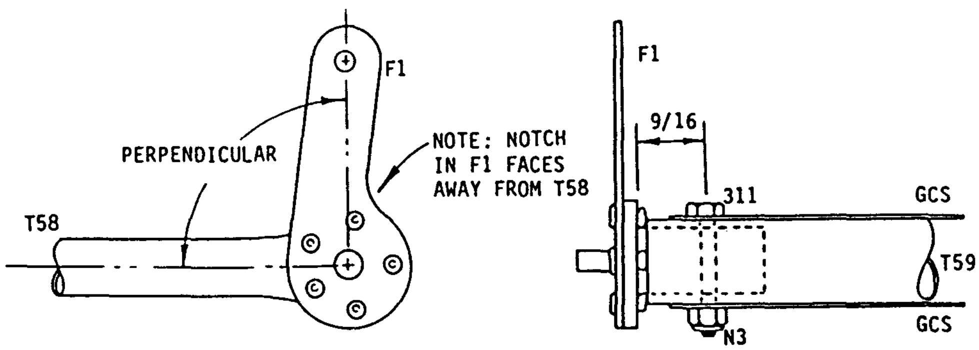


6.2.4 Sand or file the edges of Ruddervator Horn F1 to remove tooling marks, and drill out the hole in the large end to 1/4 inch diameter. Fit F1 over the stud on the end of the Ruddervator Plug P1 and Rivet in place with 5 Stainless Steel Rivets as shown.

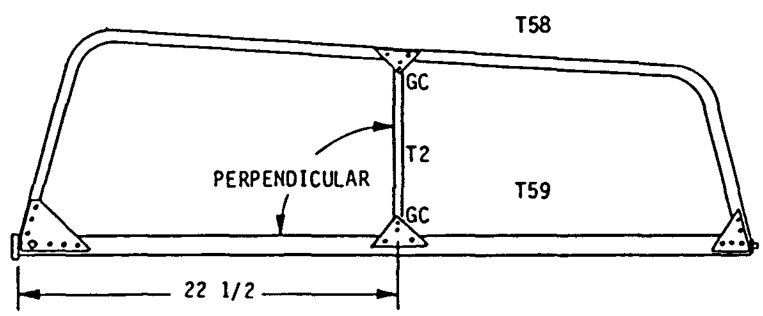
NOTE: *It is possible to install the rivets very close to the edge of P1 and leave enough space for the end of T59 to fit inside the rivet pattern. However, it is easier to install the rivets as shown below and allow the end of T59 to butt against the end of the rivets as shown in the figure for Step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



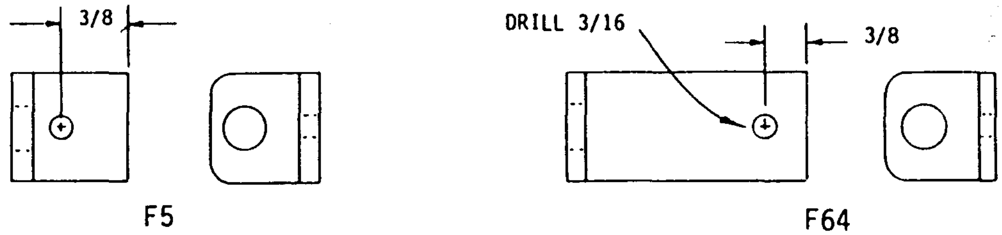
6.2.5 Insert P1 into the open end of T59 and bolt in place as shown. Note that the head of the bolt is on the top surface of the Ruddervator (the side from which F1 projects).



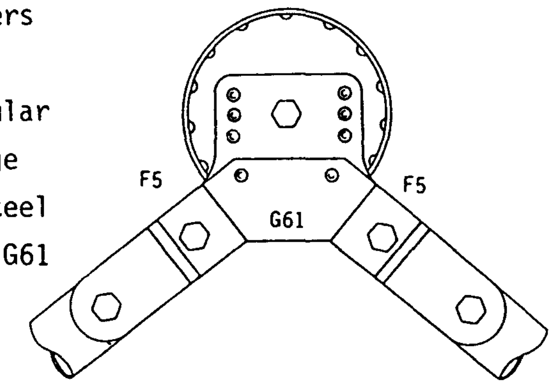
6.2.6 Rivet ruddervator rib T2 into position as shown, using four GC gussets. Trim T2 to length if necessary to keep T58 and T59 straight. Use four rivets in each GC.



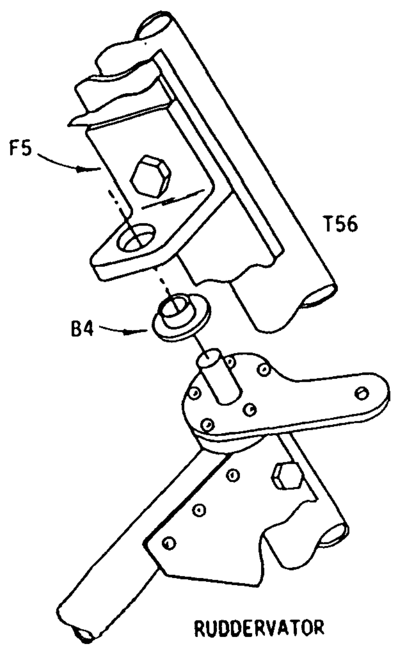
6.2.7 Round the corners on Ruddervator Hinges F5 and F64 as shown and remove all burrs and sharp edges from the predrilled 3/8 inch holes. Drill 3/16 inch mounting holes as indicated.

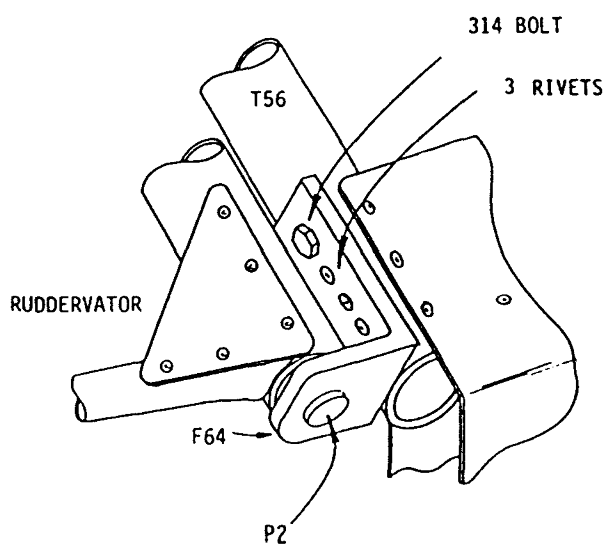


6.2.8 Bolt the F5's in place using the two top bolts on F4 (remove the two washers installed in step 6.1.1). Make sure the surface of the F5's is perpendicular to the axis of T56 and rivet the hinge lock G61 in place with 2 stainless steel rivets as shown. Make sure that the G61 is tight against the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



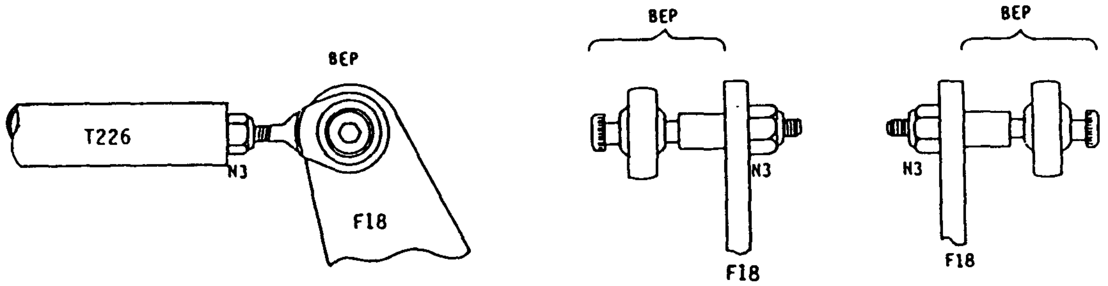
6.2.9 Fit the top of the ruddervator into F5 with a B4 Bearing as shown at left below. Make sure the B4 is properly seated, then fit the F64 over the end of P2 and locate it as shown at right below. Make sure the ruddervator fits properly (T59 is parallel to T56 and there is no end play), then mark the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



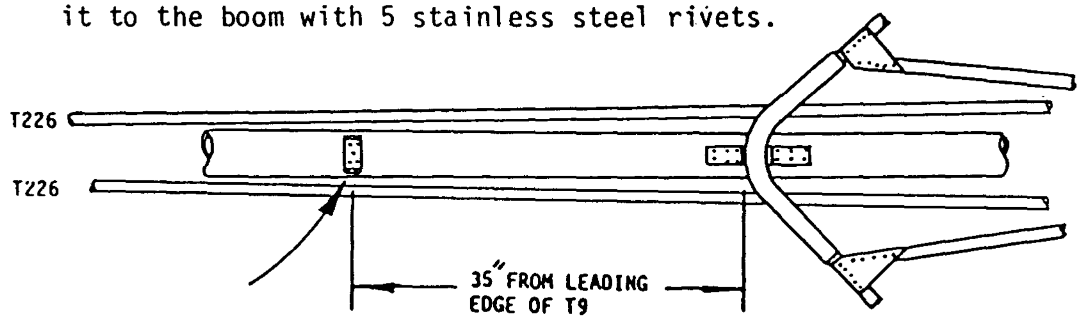


6.3 RUDDERVATOR PUSHROD INSTALLATION

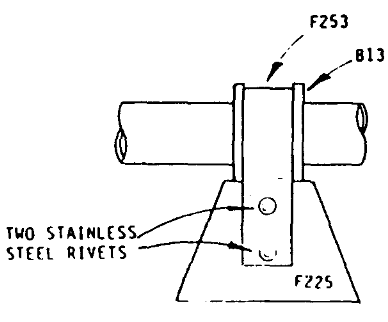
6.3.1 Rivet a P3 plug into *one end only* of both T226 long ruddervator pushrods. Put an N3 nut on each of the BEP pinned rodends and install the pushrods on the F18 mixer assembly as shown. Slide the pushrods into place *under* T9.

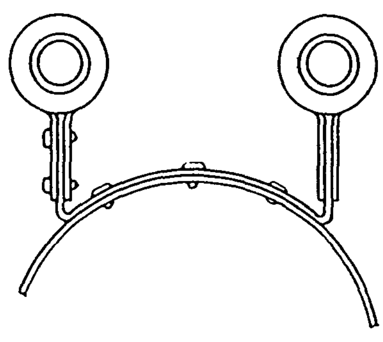


6.3.2 Position the forward pushrod guide bracket F225 as shown and rivet it to the boom with 5 stainless steel rivets.

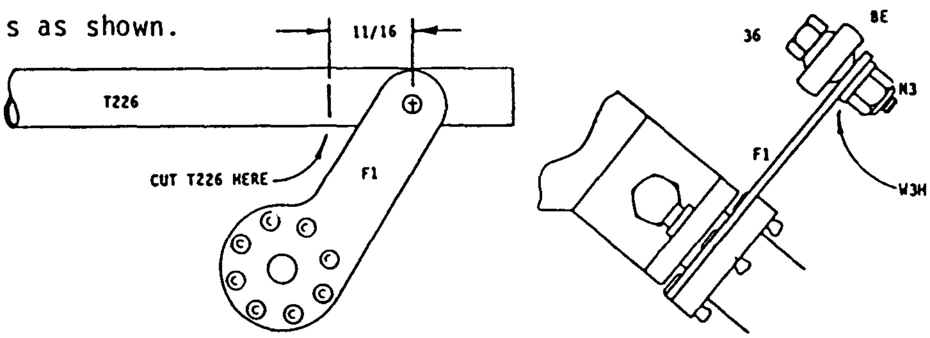


6.3.3 Slide a B13 bushing over each T226 and secure to the F225 bracket using F253 clamps. Before riveting, clamp the F253 in place and check that the axis of the B13's is in line with the T226's.

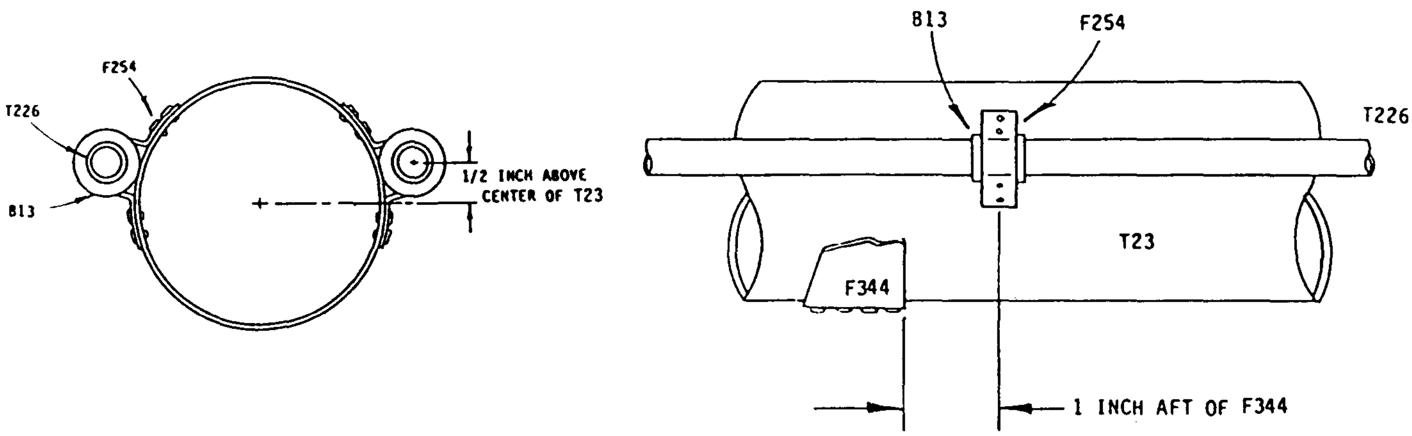




6.3.4 Set the stick in the full forward position (as shown in the figure for Step 5.5.14). Set both ruddervators in the full down position (so they almost touch -- a separation of 1/2 an inch is acceptable). Make sure both ruddervators are deflected equally, and make sure the rear edge of the F18 mixer assembly is parallel to the T23 boom. Hold each T226 beside its respective F1 ruddervator horn and mark the T226 at the centre of the hole in F1. Cut each T226 11/16 of an inch shorter than the mark. Fit another B13 bushing over each T226, then install and rivet a P3 plug flush with the end of each T226. Install BE rodends with locknuts and bolt them to the F1's as shown.



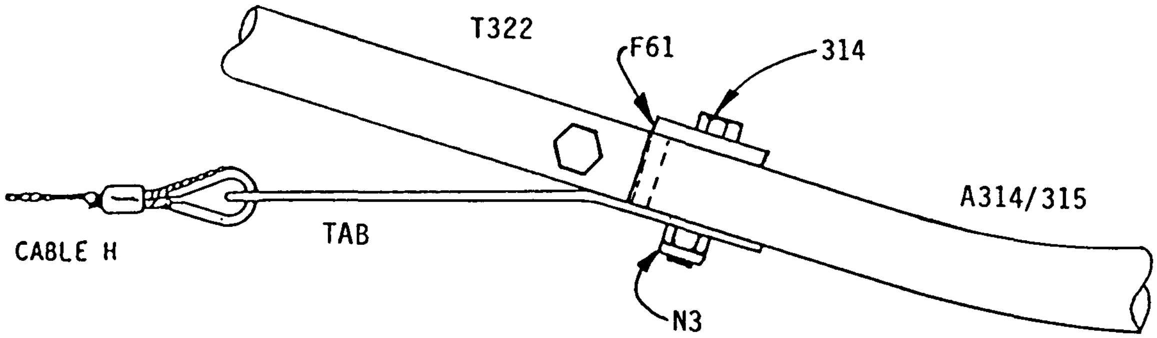
6.3.5 Install the two rear pushrod guides as shown, and rivet in place with 4 stainless steel rivets in each F254 clamp.



6.3.6 Check that the elevator control system works properly with little friction and little or no play. Twist or bend the pushrod guide brackets if necessary so that the B13 bushings are aligned with the T226 pushrods.

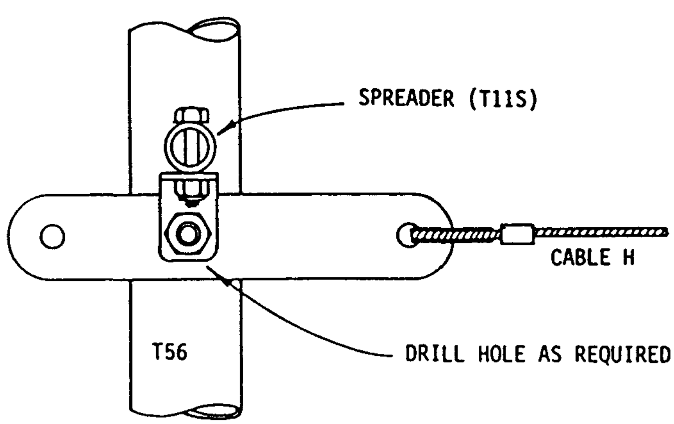
6.4 DRAG CABLE INSTALLATION

6.4.1 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.



6.4.2 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).

6.4.3 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.

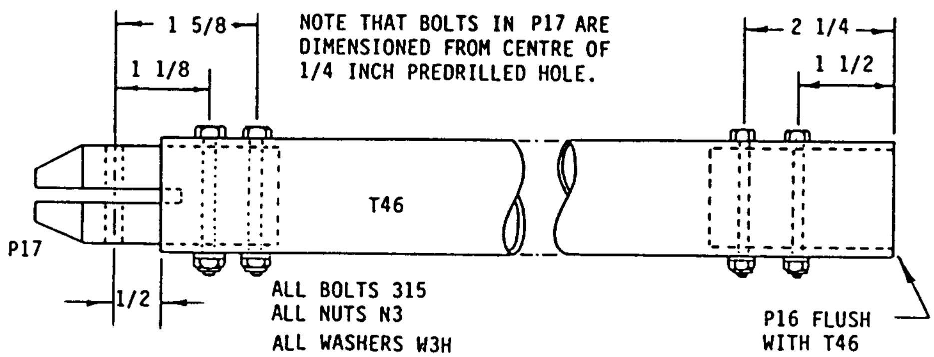


SECTION 7

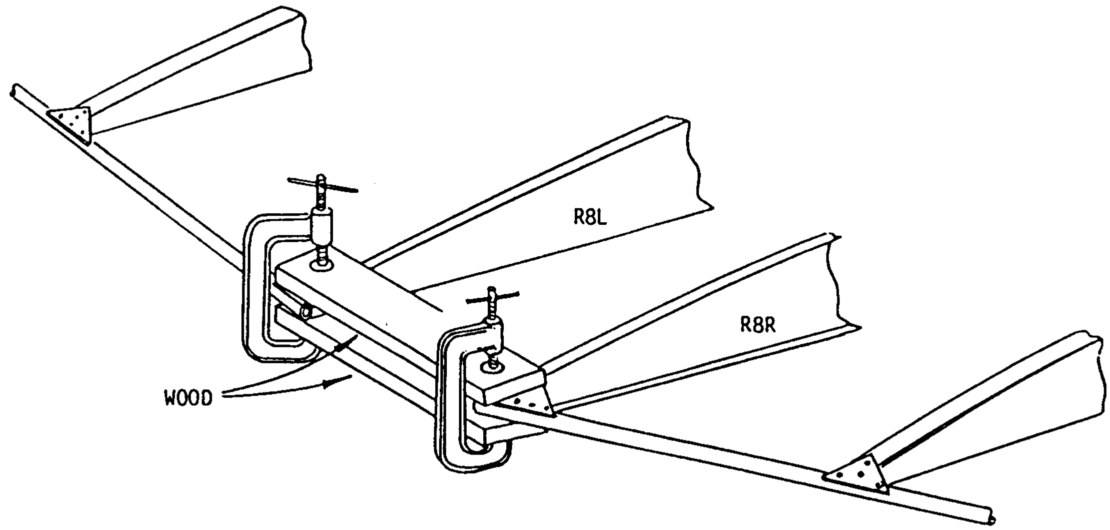
WING TO FUSELAGE MATING

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.

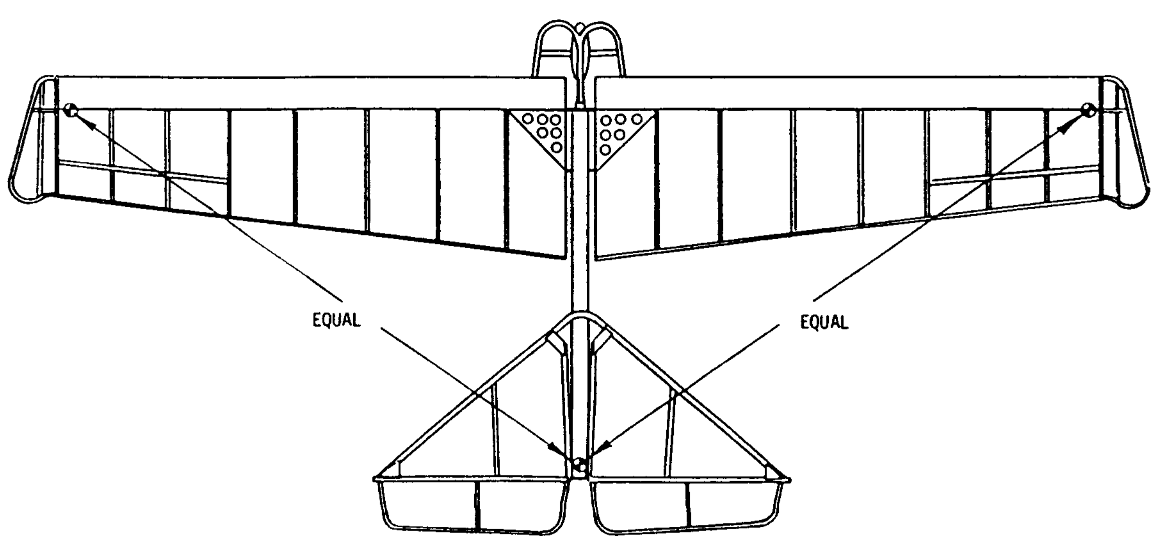


7.1.2 With the aid of at least one assistant, fit the wings onto the fuselage. Secure the wing roots with a 46 bolt through each forward wing attach fitting. Support the wing tips so that both wings are approximately level. Sight along the leading edge and adjust the fore/aft position of one wingtip 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.

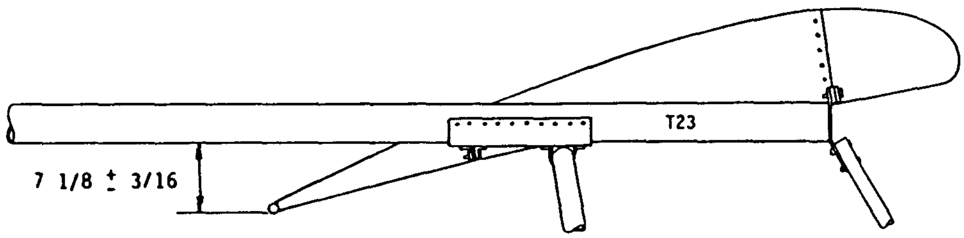


7.1.3 Install the F35 rear spar fittings between F22 and F23 and pin with a 46 bolt. Make sure the outboard end of the F35 goes through the slot in the root rib and fits against the F34.

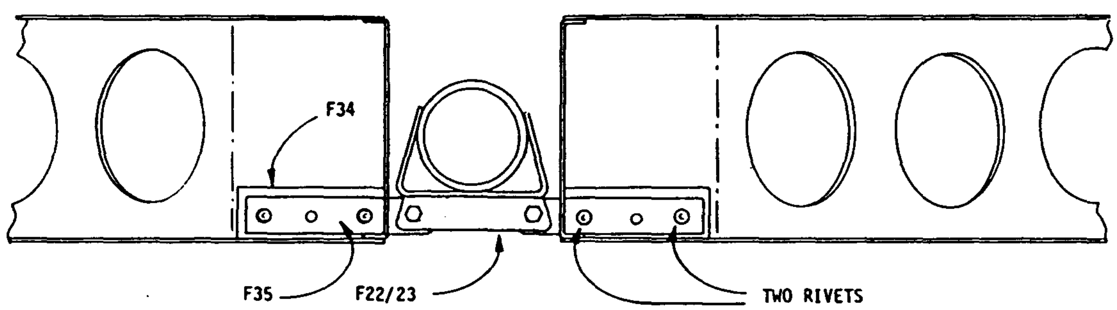
7.1.4 Put a mark on the top of each D-cell (equidistant from the centreline as shown). Put another mark on the top of the boom near the tail. Measure the distance from each mark on the wing to the mark on the tail. Adjust the position of the wing so that this distance is the same for the left and right 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).



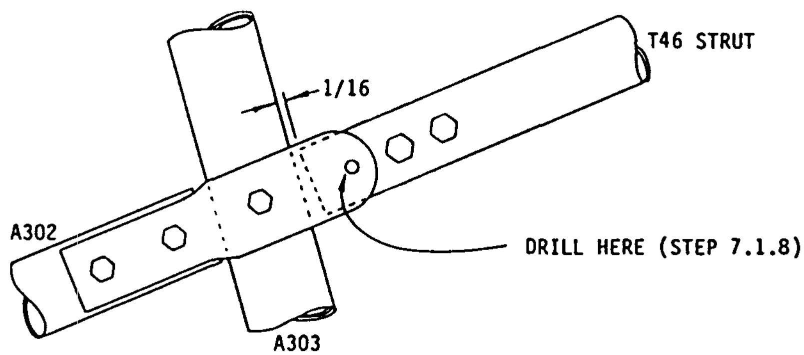
7.1.6 Make sure the F35's are still on the marks as in step 7.1.4 and temporarily rivet the F35's to the F34's with two rivets each as shown.



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).

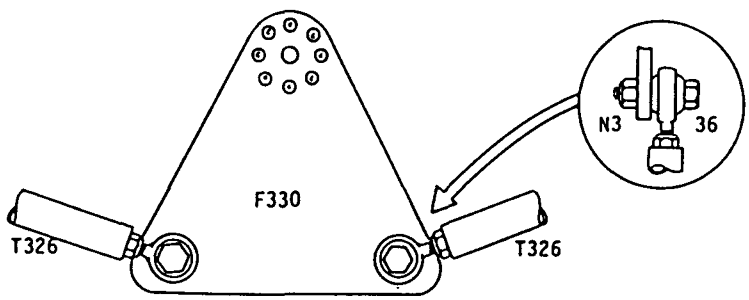


7.1.9 Using a 3/16 inch drill, drill through the strut (T46 and P16) using the hole in the F301's as a guide. Drill approximately half way through from each side to ensure that the hole is aligned with the F301 at both ends. Feed the 3/16 inch drill all the way through both F301's and the strut, then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

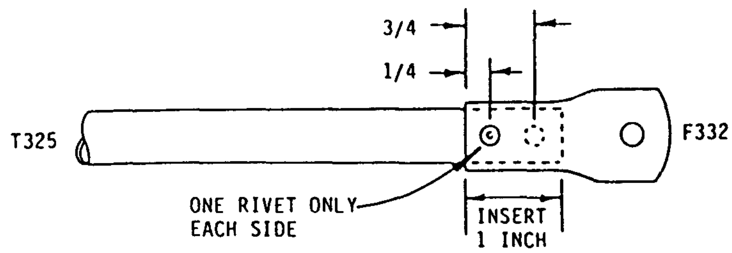
7.2.2 Install the two T326 pushrods on the F330 horn as shown.



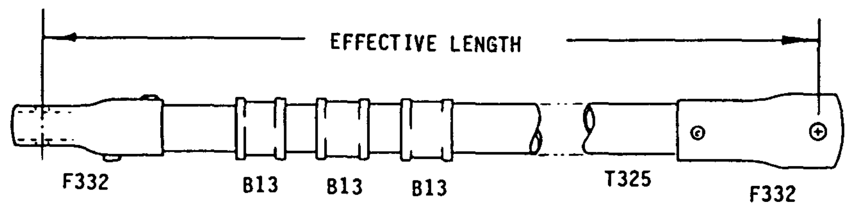
NOTE THAT THE PUSHRODS ARE INSTALLED ON THE <u>REAR</u> SURFACE OF F330

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.

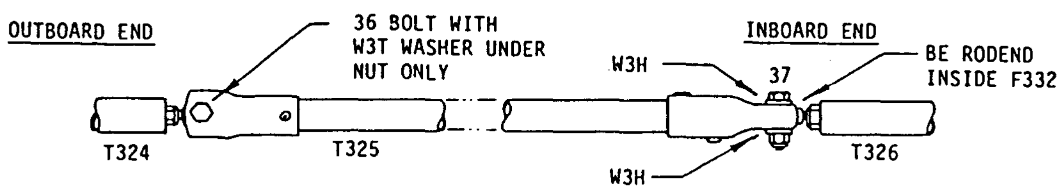
7.2.4 Fit an F332 pushrod fork over *one* end of T325 and rivet as shown.



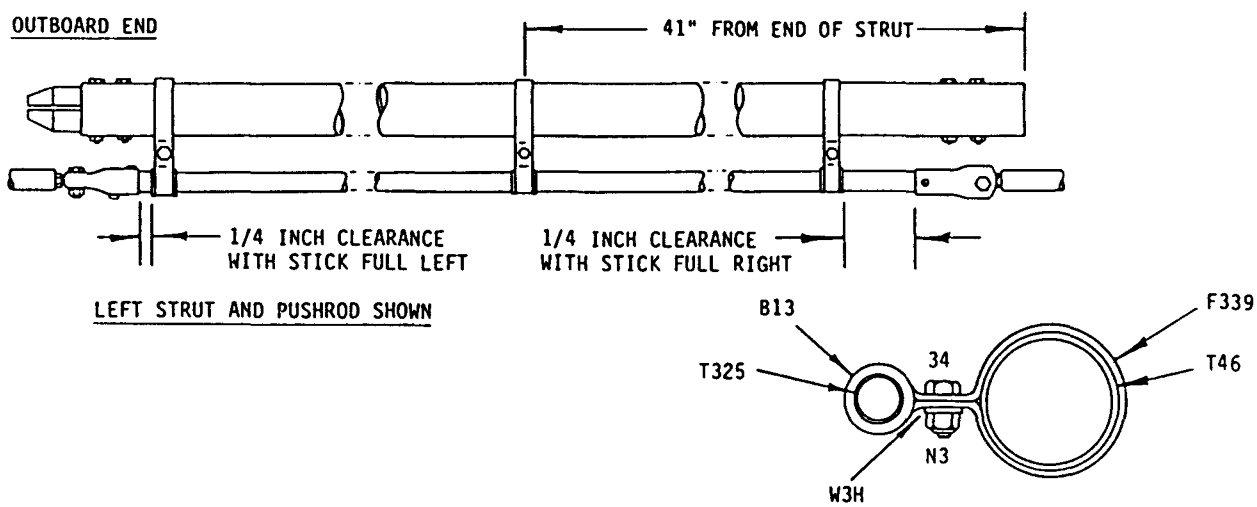
7.2.5 Slide three B13 bushings onto each T325, then install and rivet the other F332 fork. Make sure the hole-to-hole spacing is equal to the "effective length" measured in Step 7.2.3 and be sure the two F332's are perpendicular to each other as shown.



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.



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

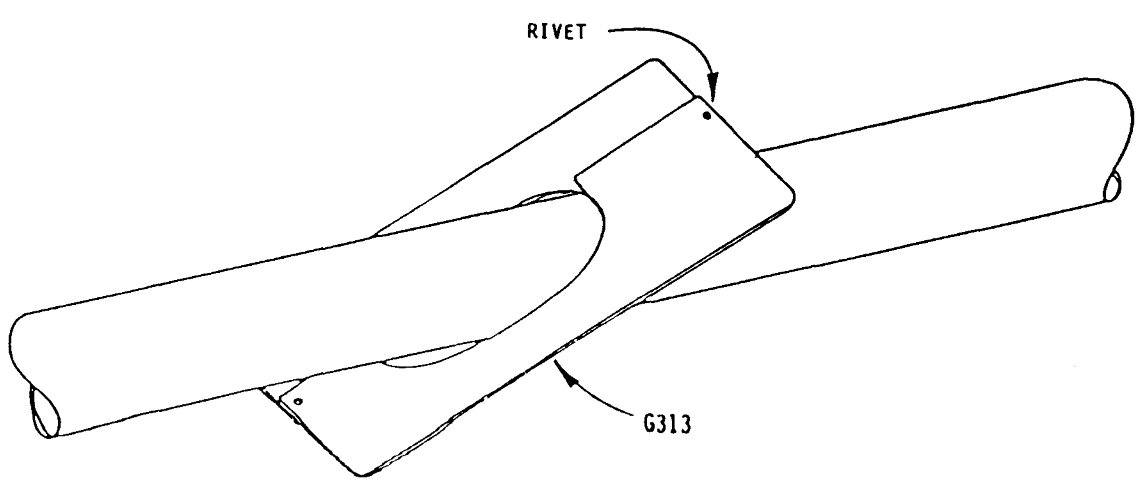
7.3.1 Push down on the nose of the aircraft to lift the tail off the ground. Stand several feet behind the aircraft and sight the spreader (T11S) and the main axle for parallelism. Remove the cable from the *higher* end of the spreader. While holding the outboard corner of the stabilizer, pull the cable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

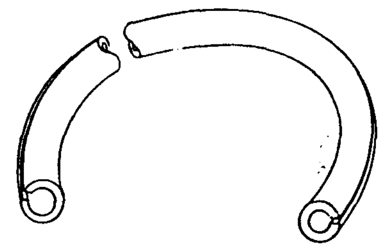
Note that if you cannot get sufficient tension in the cables, the front cable tab may be shortened.

7.4 GAP COVER INSTALLATION

7.4.1 Cut out the two pieces of .020 aluminum alloy which form G313 (the midgap 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).

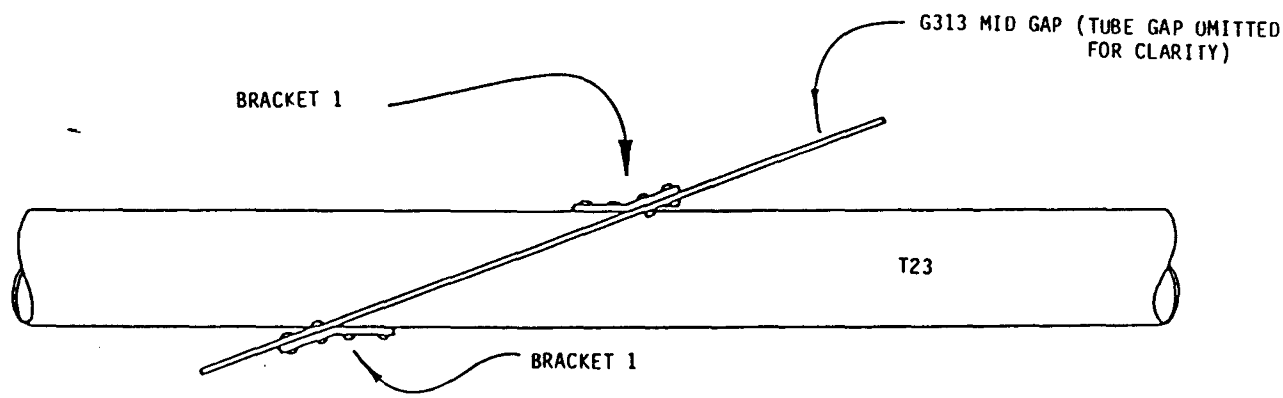


7.4.2 Using a razor knife or other sharp instrument, slit the Tube Gap as shown. If the tube gap has a natural curve, put the slit on the outside of the curve.



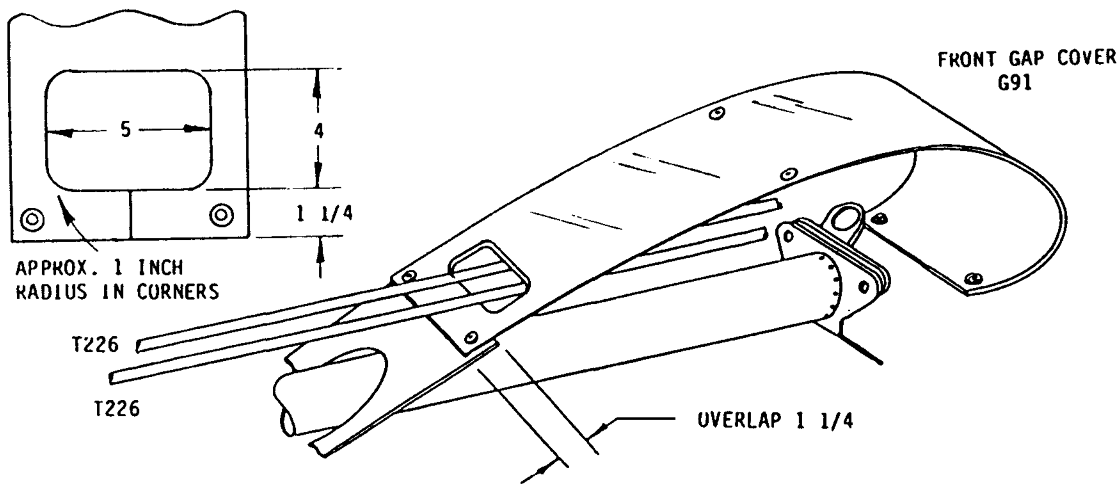
7.4.3 Fit the tube gap onto the inside edge of the mid gap cover and press into place. Position the tube gap so that the ends are under the boom.

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.*

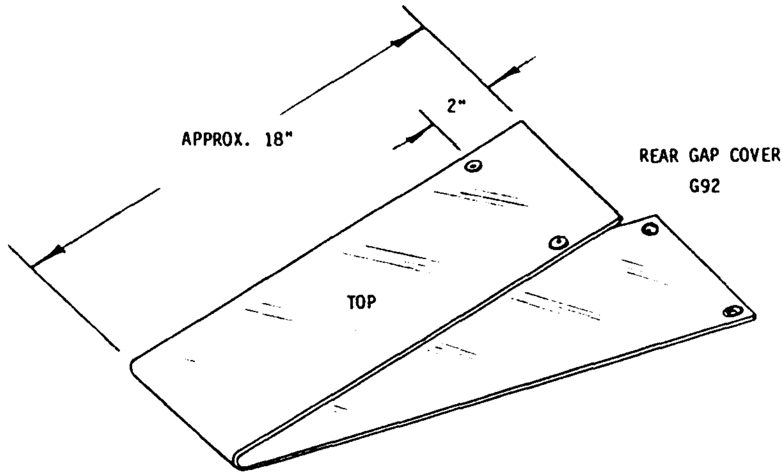
7.4.5 Cut the opening in the front gap cover G91 for the two T226 pushrods as shown. Fit the front gap cover in place and bend it to wrap around the leading edge of the wing. Position the front gap cover so that it overlaps the mid gap cover by 1¼ inches and is centered (with an equal overlap on each wing). Check that there is sufficient clearance around the pushrods and enlarge the hole if necessary. Slit the tube gap and fit it in place.



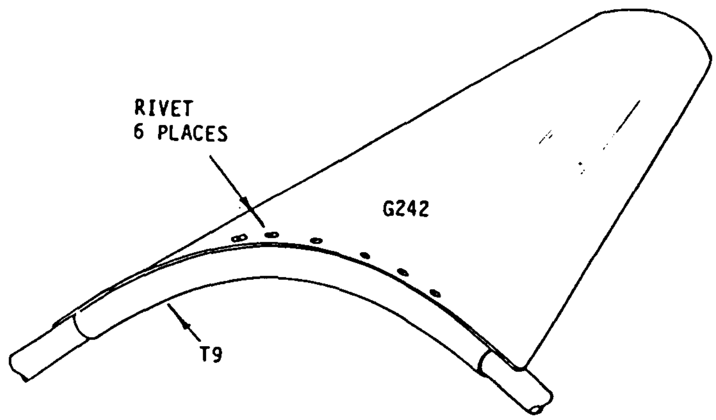
7.4.6 Tape the front gap cover in place temporarily with masking tape and drill 1/8 inch holes for installing the two aft male snaps only. Note that holes have been provided in the female snaps (part of G91) to facilitate proper alignment. Push a 3/32" drill through the hole in the snap and drill through 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).

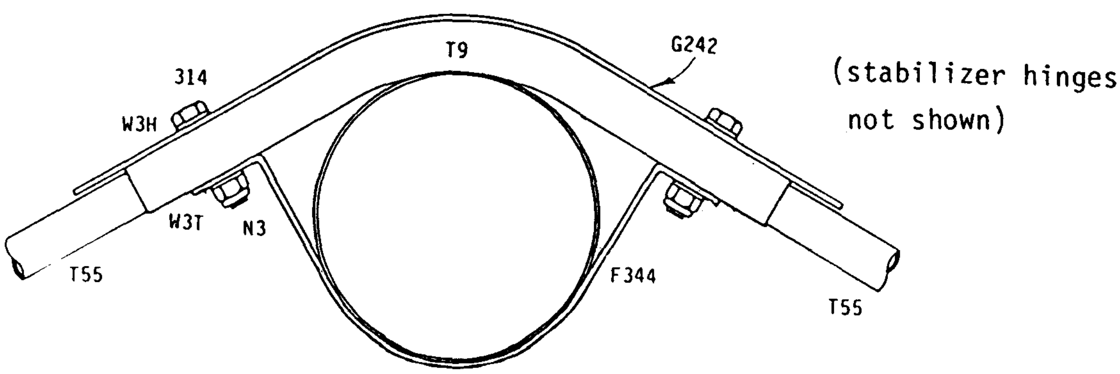
7.4.8 Bend the rear gap cover G92 to fit over the trailing edge (using a piece of ½ inch tubing as a mandrel). Locate the bend so that the top (leading) edge of the rear gap cover will fit under the trailing edge of the mid gap cover approximately 1½ inches. *Do not drill any holes for the snaps at this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



7.4.9 Cut out the tail gap cover G242 with tin snips and file the edges smooth. Bend it to form a smooth curve so that when installed it will conform to T9 and touch the stabilizers along T235. Apply weather strip along the edges where it contacts the stabilizer and rivet it in place as shown below. Note that if you have a non-folding tail, the rivets along the leading edge should not be within 1 5/8 inches of the end of T9 (to avoid riveting into the T55's).



7.4.10 Drill the bolt holes through the gap cover (in line with those drilled in Step 6.1.17) and re-install the 314 bolts.



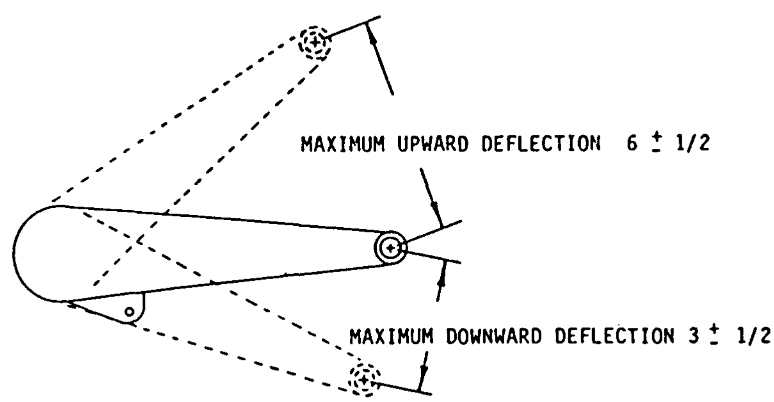
7.5 FINAL CHECKS AND ADJUSTMENTS

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

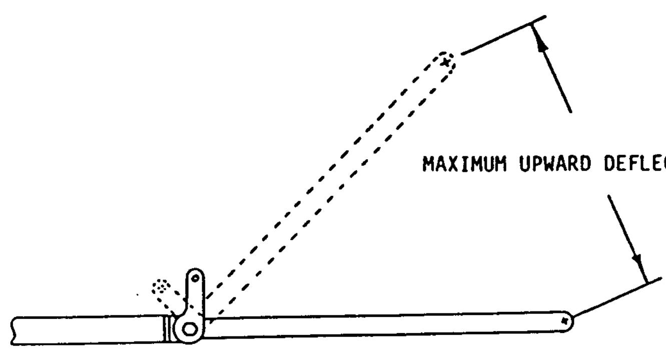
With the stick in the neutral position adjust the position of the rudder pedals so they are parallel to each other. Move the stick slightly if necessary so that one ruddervator is in its neutral position (aligned with its stabilizer). The other ruddervator should be at or very near its neutral position. If necessary, adjust the length of one T26 pushrod <u>or</u> 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.

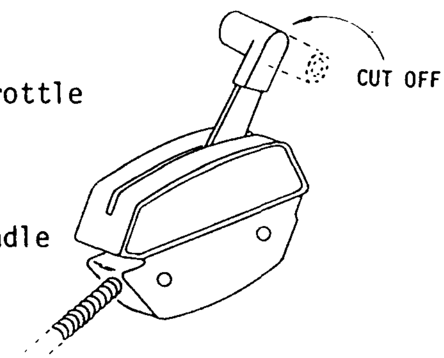
LOCATION	BOLT TYPE	QTY	WASHER
Inboard wing attachment, Front	46	2	W4T
Inboard wing attachment, Rear	46	2	W4H
Inboard strut attachment	417	2	W4H
Outboard strut attachment	414	2	W4T
Aileron pushrods (inboard end)	37	2	W3H
Naçelles to wing, Top	DH35	4	N/R*
Nacelles to wing, Bottom	DH36	4	N/R *

* G53 used as washer

SECTION 8

POWER SYSTEM INSTALLATION

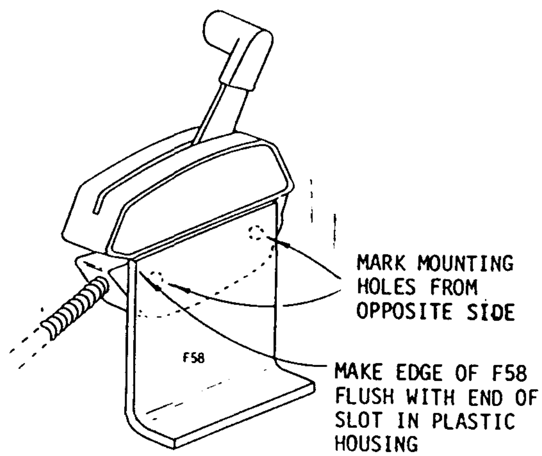
8.1 THROTTLE QUADRANT INSTALLATION



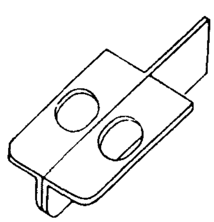
8.1.1 Saw off part of the "T" handle on one throttle lever as shown and sand smooth.

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.*

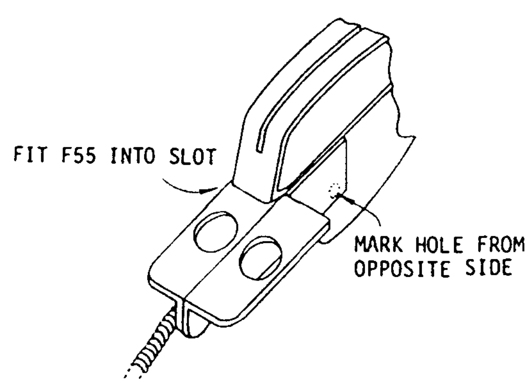
8.1.3 Position the mounting bracket F58 on the throttle lever assembly as shown. Mark the location of the two mounting holes using the plastic housing as a template and drill 3/16 inch holes in F58.



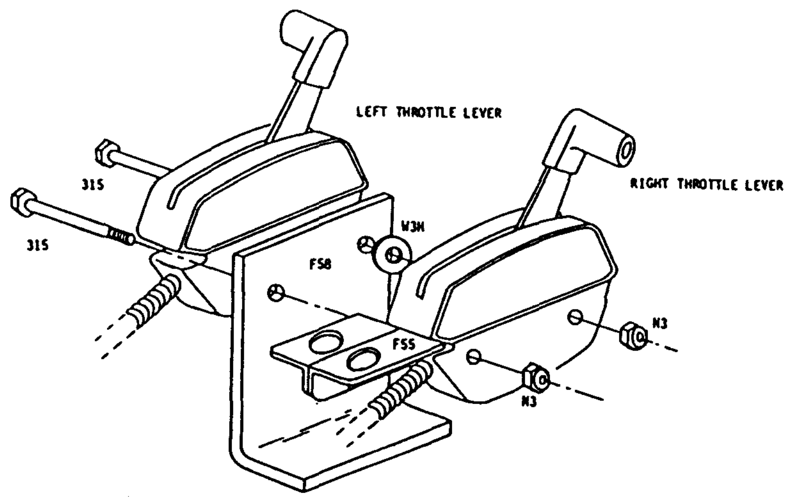
8.1.4 Round the corners of magneto switch plate F55 as shown.



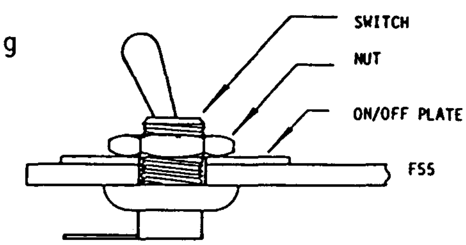
8.1.5 Fit F55 into the slot in one of the plastic throttle housings as shown. Mark and drill the 3/16" mounting hole in the F55.



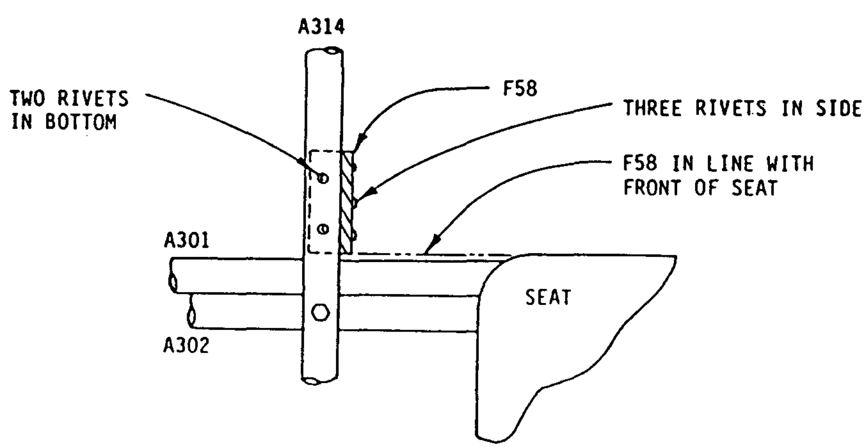
8.1.6 Bolt the throttle quadrant assembly together as shown. Do not forget the W3H washer between the two plastic housings.



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.

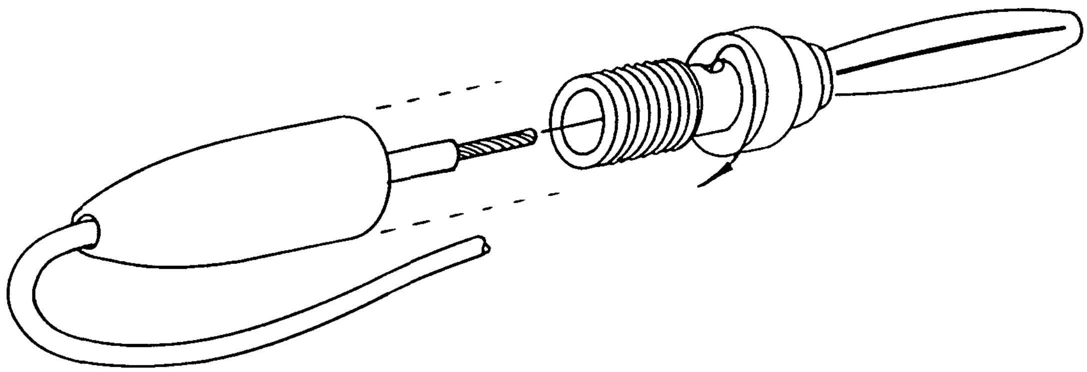


8.1.8 Rivet the throttle quadrant assembly to A314 so that the rear edge of F58 is in line with the front of the seat. This position is an average one for most people. You can, however, position F58 up to an inch either side along A314, as long as it is comfortable for you. Use three stainless steel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

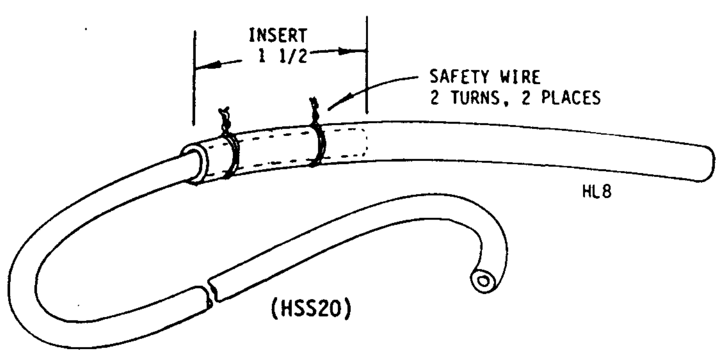


8.2 CABLE, WIRE AND FUEL LINE INSTALLATION

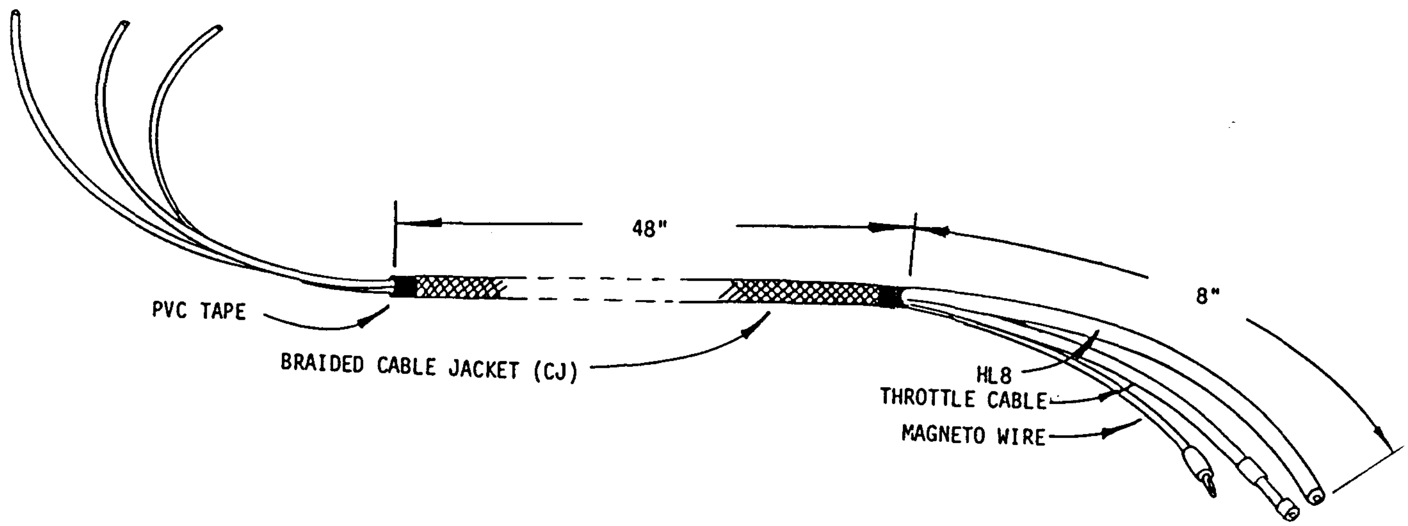
8.2.1 Cut two magneto wires 9 inches longer than the throttle cable outer jackets (note that the left and right throttle cables are not the same length). Strip 1/2 inch of insulation from one end of each wire and attach banana plugs as shown. Although the banana plugs are designed to be solderless, it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



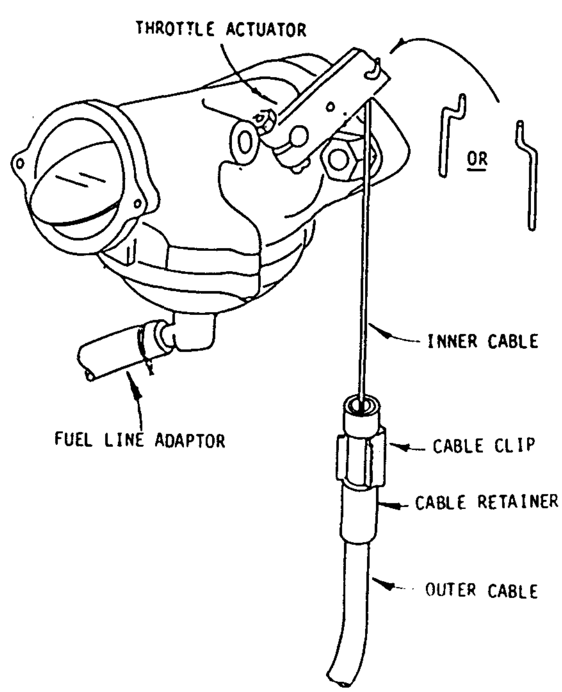
8.2.2 Cut the fuel line (HSS20) into two equal lengths and attach a fuel line adaptor (HL8) to each as shown. Twist the safety wire tight and bend it flat against HL8.



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.

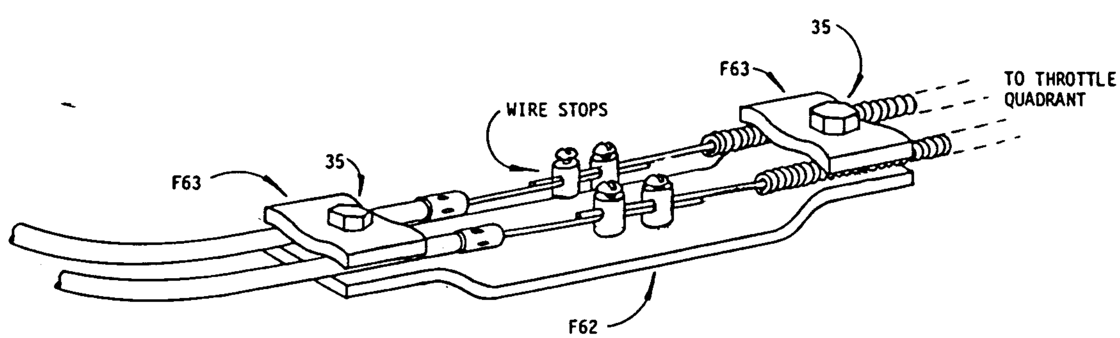


8.2.5 Push the fuel line adaptor over the fitting on the carburetor and secure with two turns of safety wire.

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

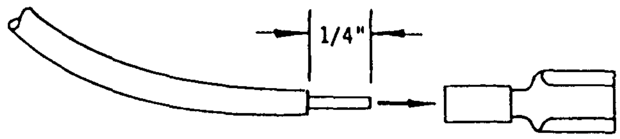
8.2.7 Route the cable assemblies through the F51 clips on the nacelles and dress both throttle cables and magneto wires down the left downtube A303 .

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.

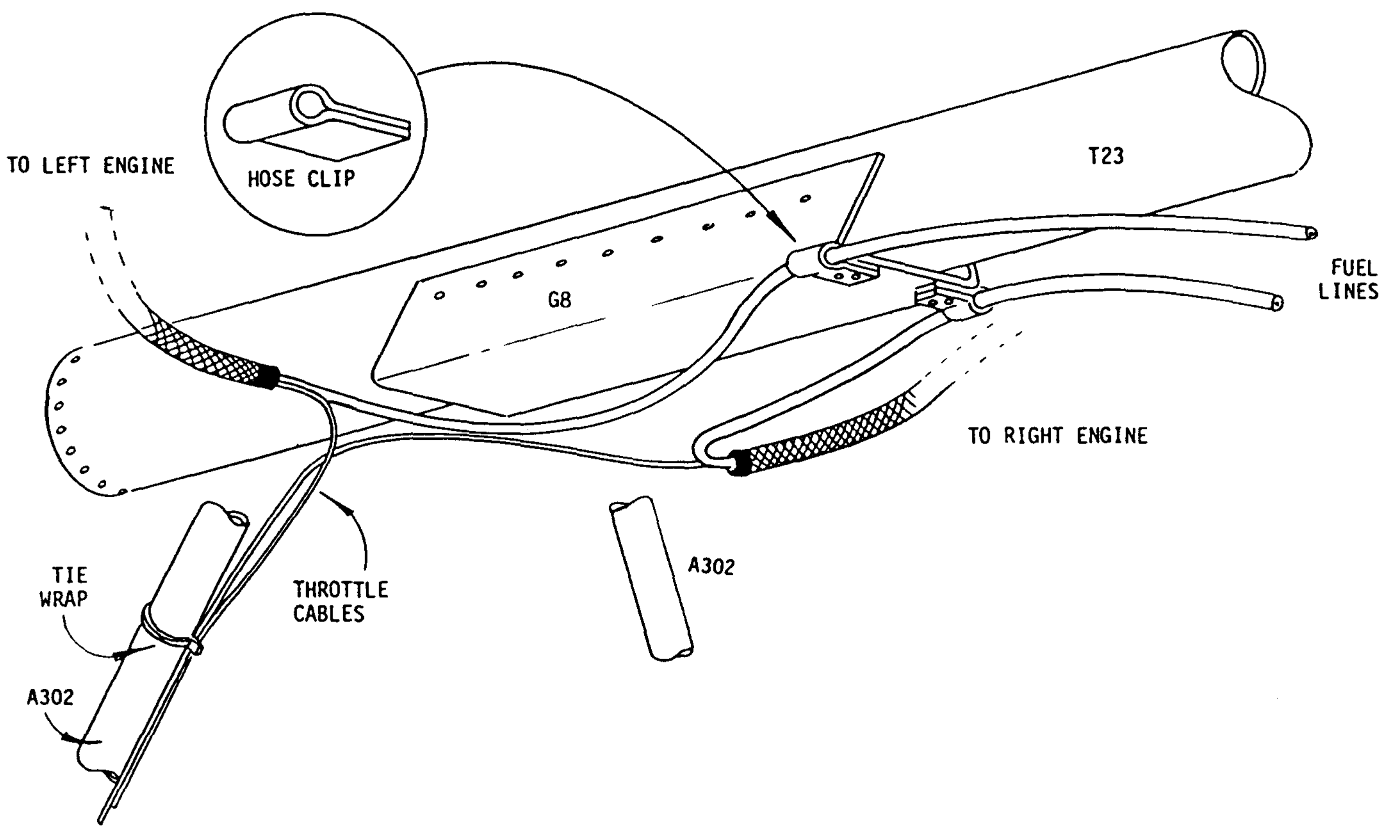
8.2.10 Cut the magneto wire as necessary and attach the terminals to connect to the switches.



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

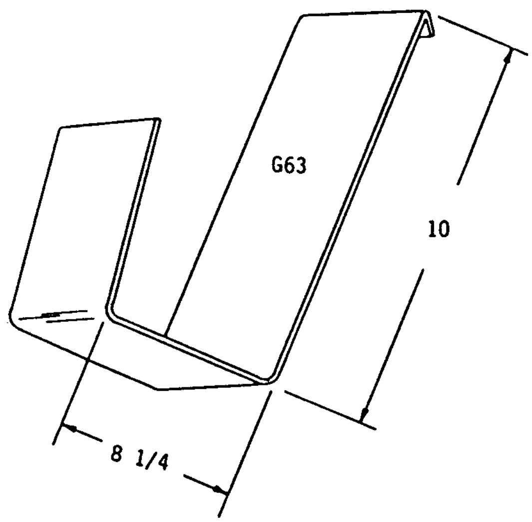
MAKE SURE THE PLASTIC INSULATOR IS PROPERLY POSITIONED AFTER CRIMPING. IF IT APPEARS LOOSE, USE ELECTRICAL TAPE OR PLASTIC SLEEVING TO ENSURE THAT THE TERMINAL CANNOT CONTACT THE F55 SWITCHPLATE.

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.

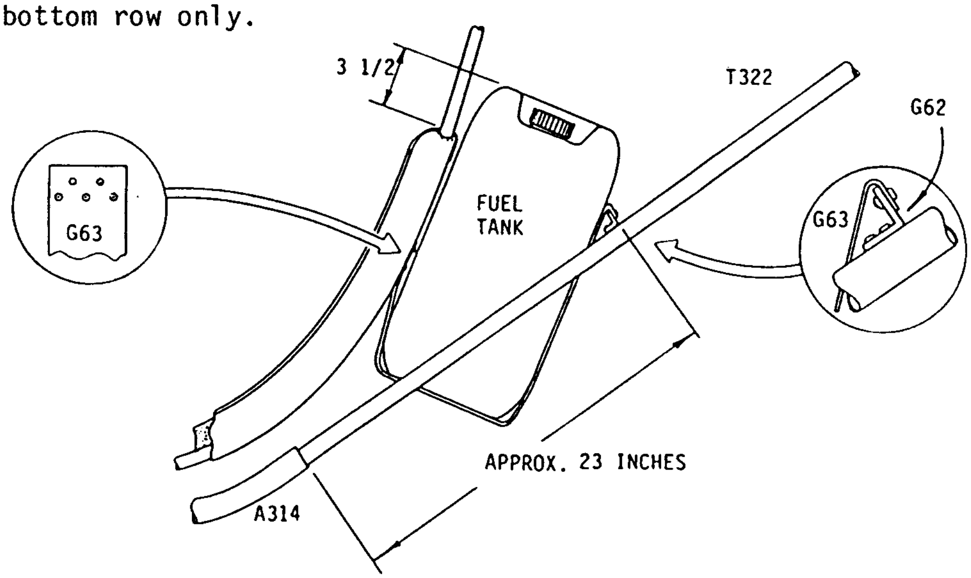


8.3 FUEL TANK INSTALLATION

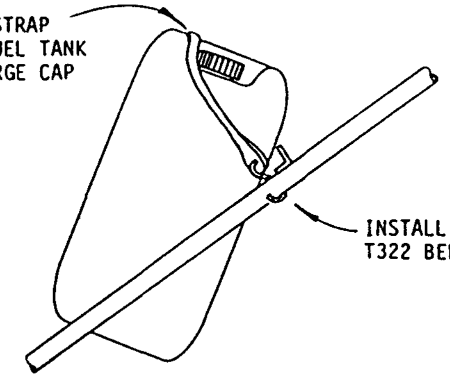
8.3.1 Bend the fuel tank saddle G63 as shown, using a 1/2 inch or 3/4 inch tube as a mandrel to obtain a large bend radius.



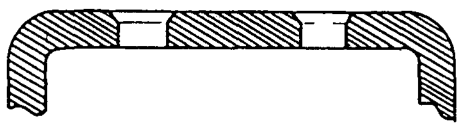
8.3.2 Position the fuel tank as shown (allow about 1/4 of an inch between the fuel tank and the seat back) and fit the support angle G62 and the saddle G63 into place. Rivet G62 to the T322's with four stainless steel rivets. Rivet G63 to G26 (the seat back) with five rivets as shown in the inset. Use 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. Unlike Mylar and most other heat shrinkable covering materials, Tedlar will continue to shrink after the heat source is removed. Therefore, to avoid overheating the Tedlar, apply the heat for a few seconds, then remove it and check for signs of shrinkage. If there is no indication, heat it a bit longer , then remove the heat and check again for shrinkage. As the heating period is increased, you will find the correct exposure so most of the shrinkage will occur *after* the heat source is removed. If the heat is maintained on the Tedlar for a significant period of time after it begins to shrink, it is possible to overheat the material and reduce the adhesion of the tape.

Unlike the Mylar used on earlier Lazairs, Tedlar will not give you any visible indication if it is overheated. Where Mylar will turn white, then become brittle and melt, the Tedlar will just continue to shrink. Be careful also to avoid overheating the tape. Excessive heat on the tape will cause it to shrink noticeably (sometimes as much as half its original width) and develop undulating edges. With a bit of practice you should be able to develop the technique for applying just the right amount of heat to get the wrinkles out without overshrinking the Tedlar.

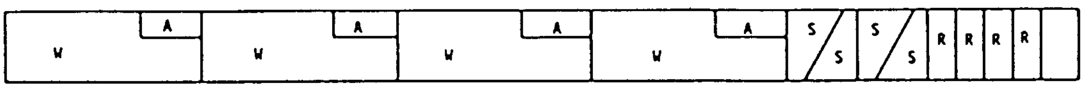
When you heatshrink the various parts of the airplane, start with the stabilizers, then do the ruddervators and ailerons so that by the time you get to the wings you will be an expert. Position the pieces so that the surface you are shrinking is vertical, and position yourself so you can see light reflecting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

As with most acrylic adhesives, the initial tack with this tape is only moderate, but the adhesion improves as it ages. For this reason, it is essential that the tape be firmly pressed down to make sure there is 100 percent initial contact. Then as the adhesive cures, a proper bond will develop.

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.

ADHÉSIF

PLIOBOND*

ADHESIVE

REPAIRS

SPORTS EQUIPMENT	LUGGAGE	TOOLS	LOOSE TILES
LEAKY WINDSHIELDS	GASKETS	JEWELRY	BROKEN TOYS
HOLES IN CANVAS	FURNITURE	MODELS	CAMERA CASES
MORTISE JOINTS			APPLIANCES

POUR RÉPARER

ÉQUIPEMENT DE SPORT	VALISES	OUTILS	CARREAUX DÉCOLLÉS
PARE-BRISE	JOINTS ÉTANCHES	BIJOUX	JOUETS BRISÉS
TOILE PERCÉE	MEUBLES	MODÈLES	ÉTUIS À CAMÉRA
JOINTS À MORTAISE			APPAREILS MÉNAGERS

MODE D'EMPLOI

1. Les surfaces doivent être propres et sèches. Le bois, le cuir, le caoutchouc et les surfaces semblables doivent être polis. Nettoyez les surfaces non poreuses avec du naphte.

2. Appliquez une couche lisse de Pliobond sur les deux surfaces à joindre. Si la surface absorbe cette couche, appliquez des couches supplémentaires quand la première est sèche.

3. Attendez que le ciment soit presque sec avant tout liaisonnement.

4. Tenez sous pression pendant 10 à 15 minutes. On recommande d'exercer une pression jusqu'au séchage, de préférence toute la nuit.

PREMIERS SOINS

En Cas D'Irritation Des Yeux. Bien Rincer Avec De Grande Quantité D'Eau — En Cas D'Inhalation De Grande Concentration De Vapeurs, De Nausée, Ou D'Étourdissement, Donnez De L'Air Frais À La Personne Incommodée — Obtenir Des Soins Médicaux.

ATTENTION — PRODUIT INFLAMMABLE

NE PAS FUMER, NE PAS UTILISER PRÈS DE LA CHALEUR, DU FEU, DE LA FLAMME NUE OU OBJET SUSCEPTIBLE DE PRODUIRE DES ÉTINCELLES OU PRÈS DE COMMUTATEURS ÉMETTANT DES ÉTINCELLES.

DIRECTIONS

1. Surfaces to be cemented must be clean and dry. Wood, leather, rubber and similar surfaces should be buffed. Clean non-porous surfaces including glass, china and steel with naphtha, subsequently polish with clean cloth.

2. Apply smooth coat of Pliobond on both surfaces to be joined together. If Pliobond is absorbed into material, apply additional coats when first coat is dry, in about 10 minutes.

3. Dry cement surfaces until sticky to touch.

4. Press cemented surfaces together firmly — hold under pressure 10-15 minutes. Clamps, vise or similar pressure is recommended until Pliobond is dry — preferably overnight.

FIRST AID TREATMENT

If Eyes Irritated. Flush Thouroughly With Water — If Exposed To High Concentrations of Vapour Or If Nausea Or Dizziness Develops, Remove To Fresh Air — Obtain Medical Attention.

CAUTION FLAMMABLE MIXTURE

DO NOT SMOKE. DO NOT USE NEAR HEAT, FIRE, OPEN FLAME OR SPARK-PRODUCING SWITCHES AND DEVICES.

9.2 DETAILED COVERING INSTRUCTIONS

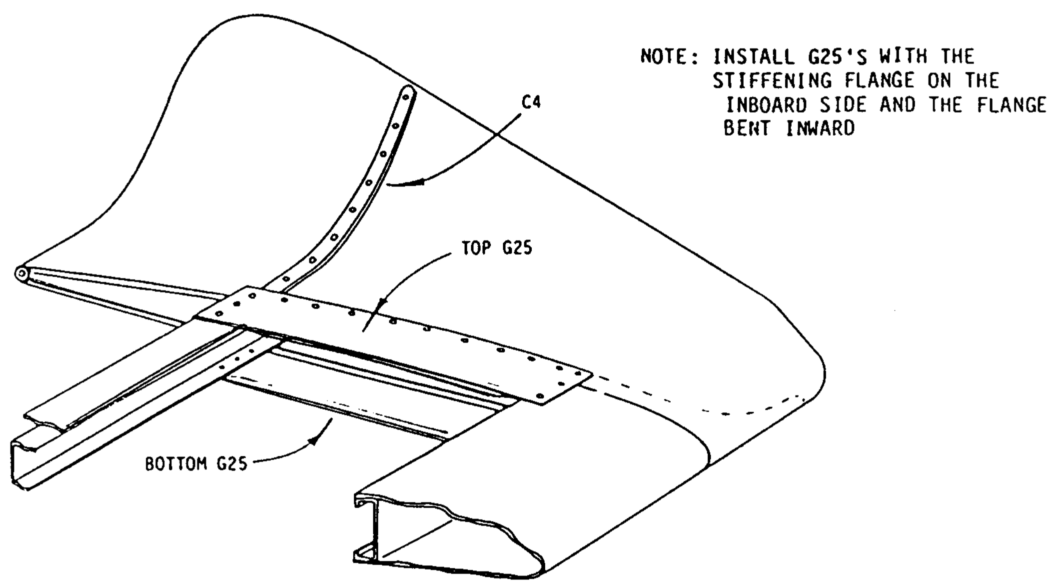
9.2.1 Wing Tips

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.

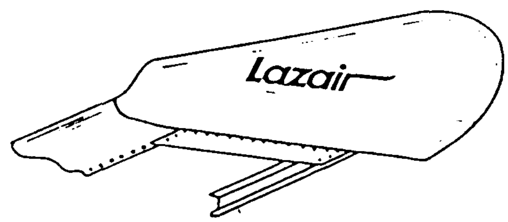
Cover the top of the wingtip using the same technique. Trim the outside edge carefully (since it will be visible). Apply a small amount of adhesive to the outside of the Dacron on T24 and smooth it with your finger.

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.



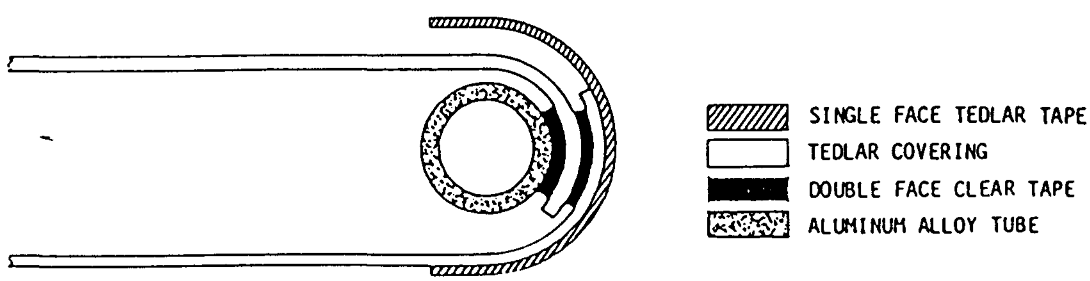
Allow the adhesive to dry overnight before heat shrinking the Dacron. If you use an iron to shrink the Dacron, be sure to test it on a piece of scrap as described in section 9.1.3 to avoid melting the Dacron.

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

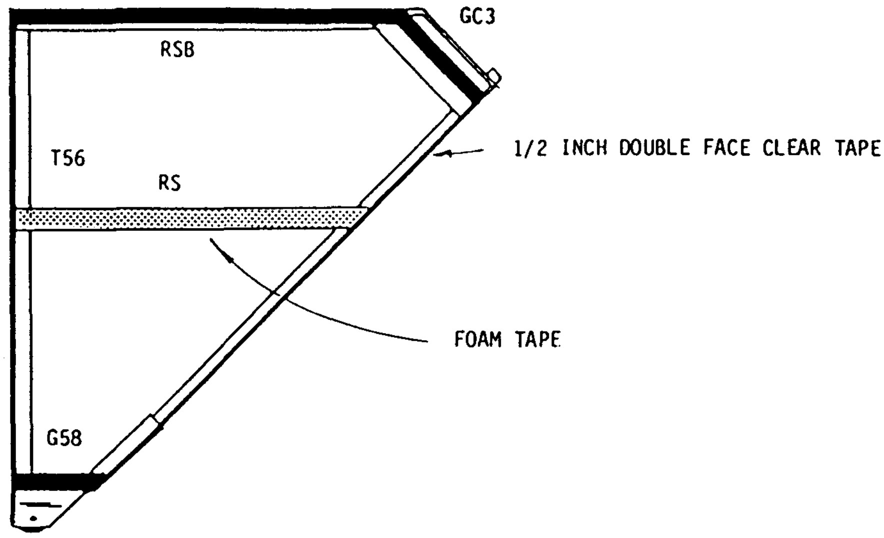
The stabilizers are the easiest surfaces to cover in Tedlar and should, therefore, be done first. Tape and covering should be applied so that when the covering is completed the materials will be overlapped as shown. The illustration is shown for T56 but is typical of the application of Tedlar to airframe 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

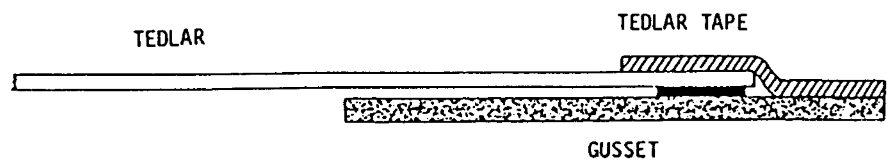
Apply double face foam tape to the face of RS.



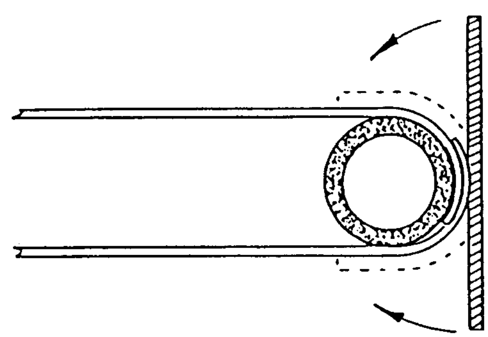
Cut the Tedlar to fit (with about 2" extra for gripping). Remove the backing paper from the foam tape of RS *only* and position the Tedlar. Once the Tedlar touches the tape it doesn't want to let go, so make sure you get it in the right place on the first try. *Tap* the Tedlar on top of the tape before 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.



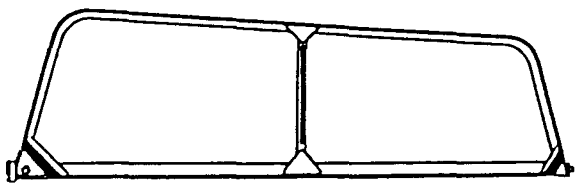
Apply Tedlar tape to the Tedlar on T55, T56, and RSB. Put the tape onto the tube tangentially as shown below, then fold the edges down very gradually, working from the centre toward both ends to avoid wrinkles in the tape. Some wrinkles will inevitably occur in areas around the gussets or RS, but these 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.



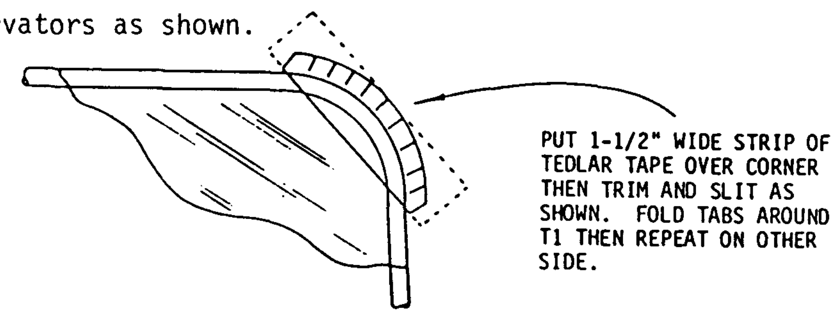
Although an experienced Lazair builder might prefer to cover all the surfaces before starting to do the heat shrinking, it is probably better (if this is your first time) to shrink the stabilizer before covering any other components. This will give you a chance to see how good your covering workmanship 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

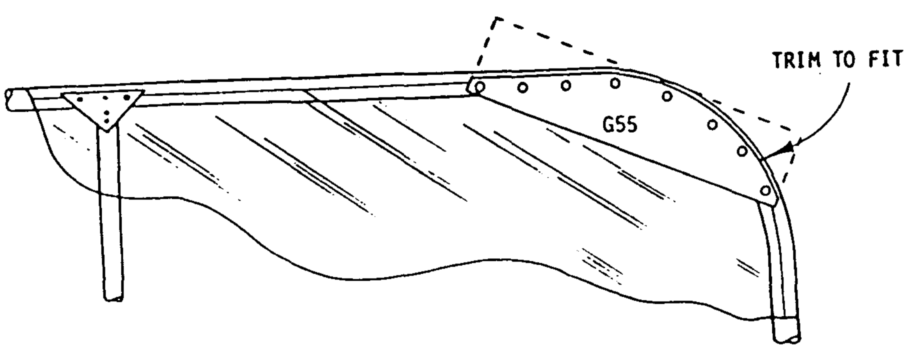
Now that you're an experienced aircraft covering technician, covering the ruddervators should be no problem. Although it is possible to cover a ruddervator using one piece of Tedlar wrapped around the leading edge to cover both sides, it is much easier to cover one side at a time as was done for the 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.



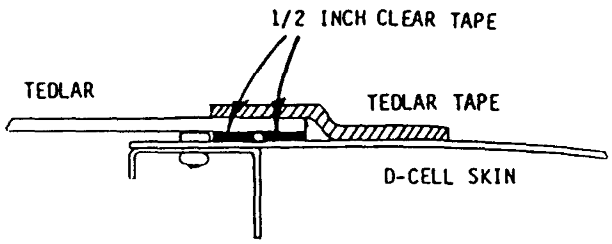
9.2.4 <u>Wings</u>

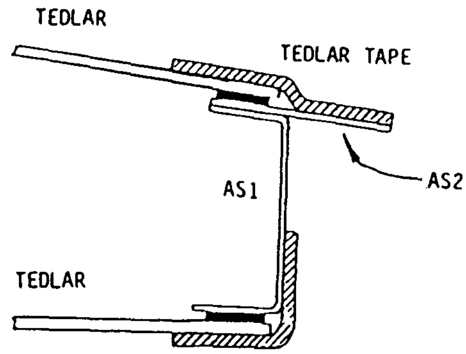
Cover the bottom of the wing first. Use clear tape on the trailing edge (the same as for the stabilizers and ruddervators). Use the foam tape on the ribs (on the section between the gussets only - do not put foam tape on the gussets). Use foam tape on the root rib and on the G25's. Put weatherstrip on the hypotenuse of the spar box (top and bottom).

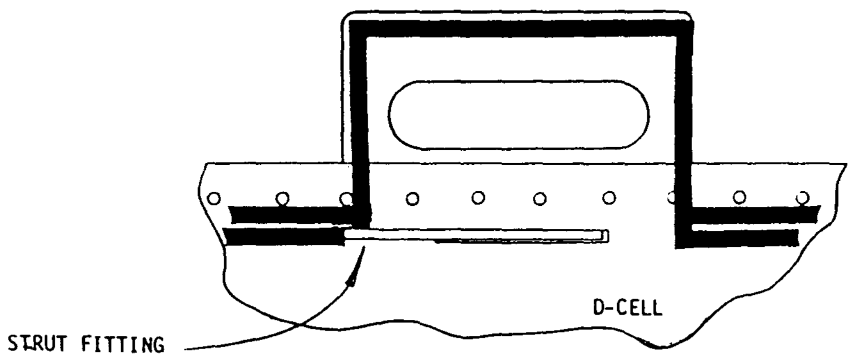
Use a double band of clear tape on the trailing edge of the D-cell (just ahead of the rivets as shown in the illustrations). Apply clear tape to AS1 and around engine mount pads and strut fitting area as shown. Where possible, position the tape such that the Tedlar can be trimmed on the edge of the tape 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.*

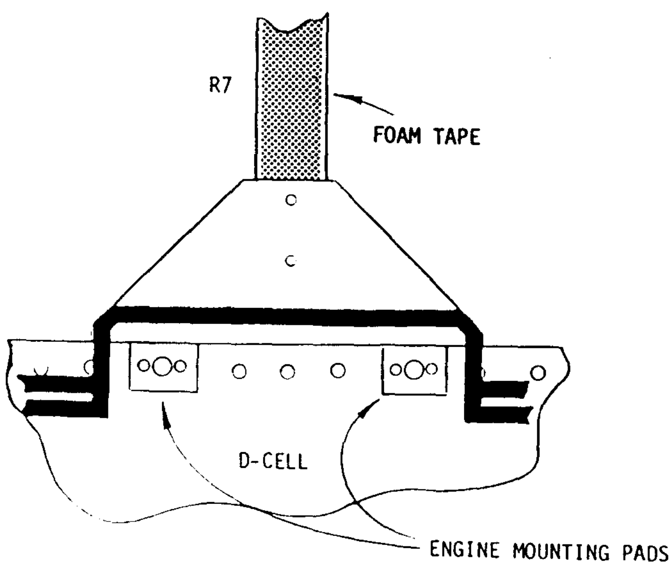
When all the double face tape is in place, unroll the Tedlar and position it so that it extends about one inch ahead of the tape on the D-cell at the tip, and just reaches the trailing edge at the root. When you cover the top of the wing, you will notice that the Tedlar is not quite wide enough to cover both bands of tape on the D-cell and reach the trailing edge *at the root.* Move it back slightly to ensure that it can be securely taped to the trailing edge and let it cover just one band of double face tape on the D-cell (for a short section near the root). Use extra Tedlar tape if necessary to increase the width of the covering at the trailing edge.

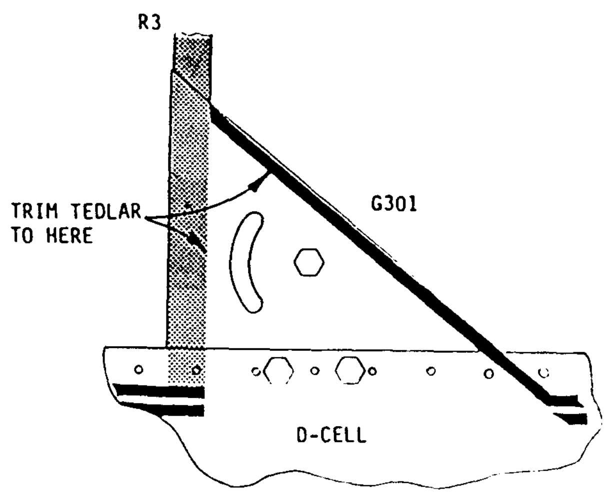
Using masking tape, temporarily tape the leading edge of the Tedlar to the D-cell outboard of R3. Carefully remove the backing paper from the foam tape on R3 and tap the Tedlar in place. Then, working from R3 toward the wing root, remove the backing paper from the tape on the ribs and attach the Tedlar *one panel at a time.* When the inboard panels are complete, remove the backing paper and attach the outboard panels one at a time, working outward from R3. Make sure the Tedlar and double face tape are well pressed down before trimming the Tedlar.


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


TEDLAR
TEDLAR TAPE
AS1
AS2
TEDLAR


STRUT FITTING
D-CELL


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.

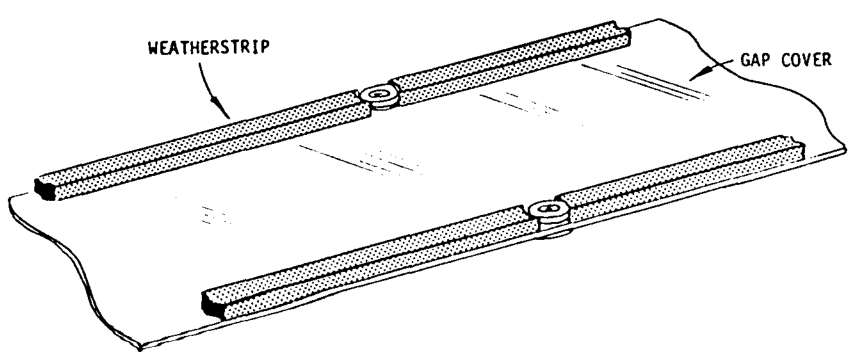
When the bottom of the wing is complete, turn it over and cover the top using the same technique. Finish the edges with Tedlar tape (including the wraparound on the trailing edge) and heatshrink the Tedlar.

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.

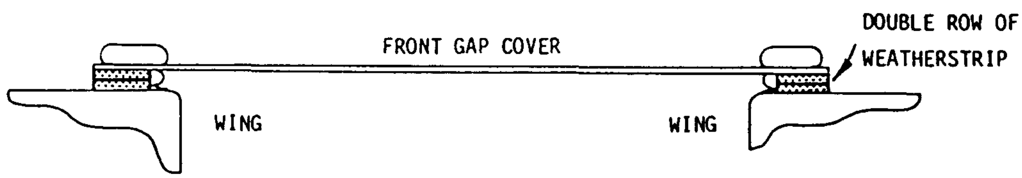
9.2.6 GAP COVERS

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.

REPORT No. 81013

Lazair™

series III

PARTS CATALOGUE

This catalogue is intended as an aid to construction. It is not intended as a packing list. Do not take an inventory of parts received from this catalogue.

TO USE...

1. Look up part number.

2. Beside the part numbers, there are numbers and letters. The letters signify which drawings show the part. The numbers indicate the total number of that part per aircraft.

   EXAMPLE: S675 - 2G , 2M

   There are four S675 per aircraft. Two are shown on drawing M, and two are accounted for on drawing G. Regarding drawing G, you will note that only one is indicated on this drawing as only one wing is shown.

3. Suffixes H, T or S on the end of a bolt or a nut part number signify that:

   H - heavy washer
   T - thin washer
   S - special washer

   These washers go under bolt head if they follow a bolt part number and under the nut if they follow a nut part number.

4. Idents shown in parentheses (x) are for reference only.

Revised October 18, 1983

PART #	QTY. & DWG.
A301	1-J
A302	1-J
A303	2-J
A304L	1-L
A304R	1-L
A305	2-L
A306	1-K
A307	1-M
A308L	1-L
A308R	1-L
A309L	1-T
A309R	1-T
A311	2-N
A314	1-K
A315	1-K
A316	1-M
A317	2-N
A318	2-N
AS1	4-D
AS2	4-D
Banana Plug	2-S
Bracket 1	2-Q
BE	4-F, 8-G, 8-M, 2-N, 4-L
BEP	2-N
BE4	3-M
B3	4-F, 8-G, 4-M, 4-N

PART #	QTY. & DWG.
B4	2-M, 2-N
B7	1-M
B9	4-L
B13	6-J,4-N
Brake cable, outer	2-L
Brake cable, inner	2-L
Brake cable adjuster	2-L
Brake return spring	2-L
Cable H	2-K
Cable G	4-R
Clip 1	2-S
C1A	2-B
C1B	2-B
C2	4-D
C3	2-E
C4	2-E
C5	2-E
C6	2-E
CN3	4-F, 4-G, 4-L, 2-M, 2-N
CP23	4-F, 4-G, 4-L, 5-M, 2-N
CN4	1-M
DH35	4-R
DH36	4-R
DH46	2-M

PART #	QTY. & DWG.
D-Cell	2-A
Exhaust Pipe (DJ)	2-R
Engine Assembly	2-R
Fuel tank	1-K
Fuel Filter	2-K
Front Assembly	1-I
F1	2-O
F2	2-F
F3	2-F
F4	1-N
F5	2-N
F13	2-K
F18	2-M
F22	1-I
F23	1-I
F24	1-I
F34	2-B
F35	2-B
F36	2-D
F37L	1-D
F37R	1-D
F38	2-G
F39	4-G
F41	2-G
F42	2-G

PART #	QTY. & DWG.
F51	2-R
F53	1-I
F54	1-J
F55	1-S
F58	1-S
F60L	2-R
F60R	2-R
F61	1-K
F62	1-S
F63	2-S
F64	2-N
F225	1-N
F236	2-N
F253	2-N
F254	2-N
F300	4-J
F301	4-J
F302	2-M
F304	2-M
F310	4-G
F311	2-T
F321L	1-L
F321R	1-L
F322	2-N
F323	2-N
F324	2-N
F325	2-N

PART #	QTY. & DWG.	PART #	QTY. & DWG.
F326	2-T	G23R	1-B
F327	1-M	G25	4-E
F328L	1-G	G26	1-J
F328R	1-G	G27	1-J
F329	2-G	G28	2-R
F330	1-M	G29	4-R
F331	1-M	G30	2-R
F332	4-J	G53	4-R
F335	2-G	G55	2-O
F338	2-J	G61	1-N
F339	6-J	G62	1-K
F344	1-N	G63	1-K
GCS	4-O	G76	2-K
GC	24-C, 8-D, 4-E, 16-F, 12-O	G91	1-Q
GBR	16-C, 8-D	G92	1-Q
GC13	4-D	G225	4-N
G6	2-B	G226	4-N
G8	1-I	G242	1-Q
G12	2-B	G301	2-G
G14	2-D	G304L	1-N
G15	4-D	G304R	1-N
G20	2-D	G305L	1-N
G22L	1-D	G305R	1-N
G22R	1-D	G306L	2-N
G23L	1-B	G306R	2-N

PART #	QTY. & DWG.
G307	1-K
G308	2-L
G309	1-M
G310	2-T
G311	2-T
G312	2-N
G313	2-Q
Hose Clip	2-I
HSS 20	1-K
Inner tube	2-T
Muffler	2-R
M312	2-T
M313	2-T
Nosewheel	1-T
NB3	4-N
N3	6-B, 6-F, 20-G, 9-I, 36-J, 14-K, 16-L, 21-M, 28-N, 2-O, 4-S, 48-R, 24-T
N4	4-B, 7-J, 6-M
N5C	2-N, 4-P
N5CNL	2-N
P1	2-O, 1-M
P2	2-O
P3	4-F, 8-G, 8-M, 4-N
P4	4-F
P6	1-N

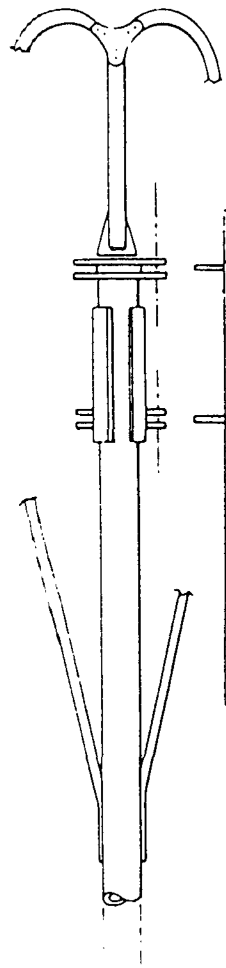
PART #	QTY. & DWG.
P8	2-N
P12	1-K
P16	2-J
P17	2-J
P19	1-M
P21	2-L
P300	2-J
P301	1-M
P302	2-M
P303	1-M
RSTL	1-B
RSTR	1-B
RSBL	1-B
RSBR	1-B
RSL	1-B
RSR	1-B
RS	2-N
RA	8-F
R1	2-D
R2	2-D
R3	2-C
R4	2-C
R5	2-C
R6	2-C
R7	2-C
R8L	1-B

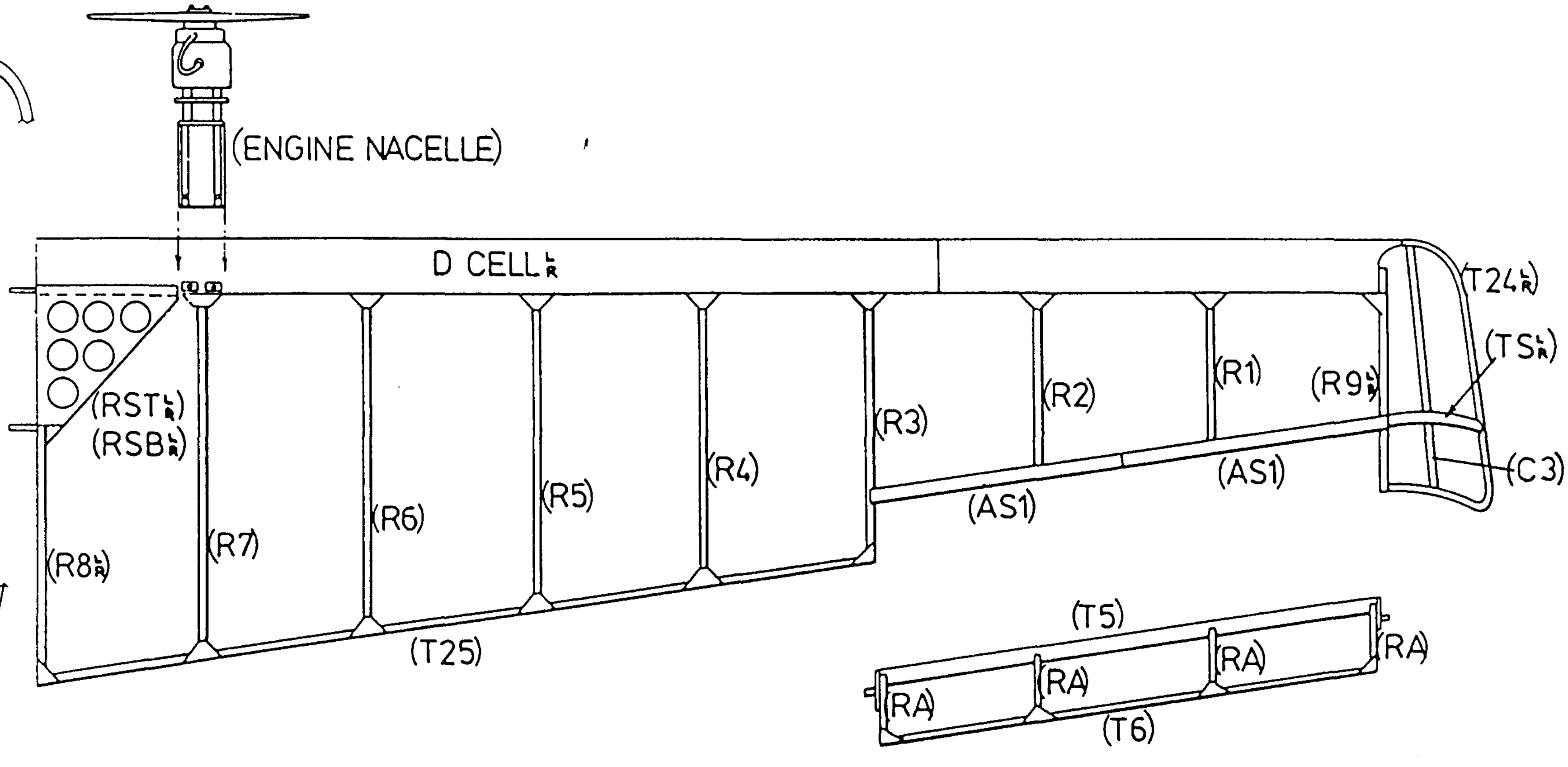
PART #	QTY. & DWG.
R8R	1-B
R9L	1-D
R9R	1-D
Seat Belt	1-J
SCS250	2-N
Sheet metal screws	2-T
Snaps (male)	19-J, 10-Q
Spinner Kit	
Stick Grip	1-M
Straps	1-K
Switch	2-S
S250	16-G
S344	6-M
S500	4-L
S600	2-M, 2-G
S675	4-G
S800	2-G
S1000	1-M
S1205	2-N
S1.5	2-M
S1.9	4-G
TAB	2-N
Throttle Cable -Left	1-S

PART #	QTY. & DWG.
Throttle Cable -Right	1-S
Throttle Lever	2-S
Tie wrap	5-S, 3-L
Tire	2-T
Tube Gap	2-Q
TSL	1-E
TSR	1-E
T2	2-O
T4	2-F
T5	2-F
T6	2-F
T9	1-N
T11S	1-N
T23	1-N
T24L	1-E
T24R	1-E
T25	2-C
T42	1-J
T46	2-J
T47	2-K
T52	2-L
T53	2-L
T55	2-N
T56	2-N
T57	2-N

PART #	QTY. & DWG.	PART #	QTY. & DWG.
T58	2-O	W3T	8-I, 10-K, 2-J, 4-L, 12-N, 16-T
T59	2-O	W3S	4-I
T226	2-N	W4T	4-J
T235	2-N	W4H	2-B, 2-J, 5-M
T312	1-K	W5H	4-N, 4-R
T313	2-K	34	8-I, 10-J, 1-N, 28-R
T322	2-K	35	6-B, 2-L, 1-I, 2-S, 20-R, 16-T
T323	2-G	35DS	4-F, 4-L
T324	2-G	36	2-F, 2-N, 2-J, 2-M, 4-L
T325	2-J	37	2-N, 2-J
T326	2-M	311	2-O, 3-M, 2-N
T327	1-M	312	1-M, 6-G, 2-K
T329L	1-J	313	4-N, 2-J, 8-K, 8-T
T329R	1-J	314	2-K, 8-N, 2-M
T330	1-J	315	8-J, 3-N, 4-M, 2-S
T331	1-M	316	4-J, 4-N
T332	1-M	316DS	2-G, 1-M, 2-N
T333	1-M	317	6-J
T334	1-M	317DS	1-M
T335	4-J	320	1-M, 6-J, 2-L
Weather Strip	1-Q	321	2-G
Wheel Bearing	4-T	321DS	2-G
Wire	1-S	323	2-K, 4-G, 4-L
Wire Stop	4-L, 4-S	46	4-B
W3H	4-F, 2-G, 4-I, 32-J, 4-K, 8-M, 18-L, 14-N, 1-S, 28-R		

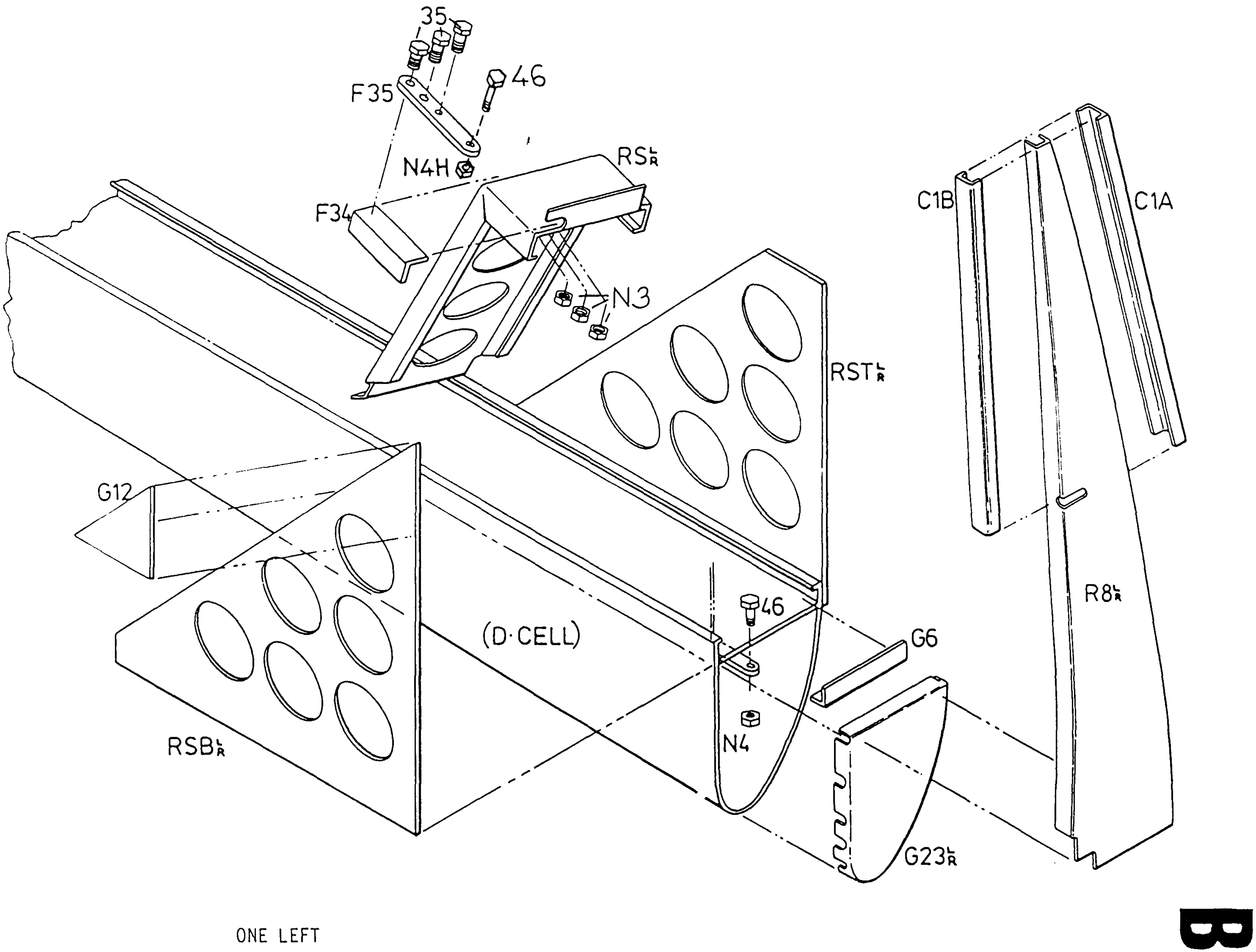
PART #	QTY. & DWG.	PART #	QTY. & DWG.
414	2-J		
417	2-J		
421	2-M		
422DS	1-M		
425	2-J		
431	1-J		





NOTE: L/R NOTATION REPRESENTS LEFT AND RIGHT
OF THE PART.

A



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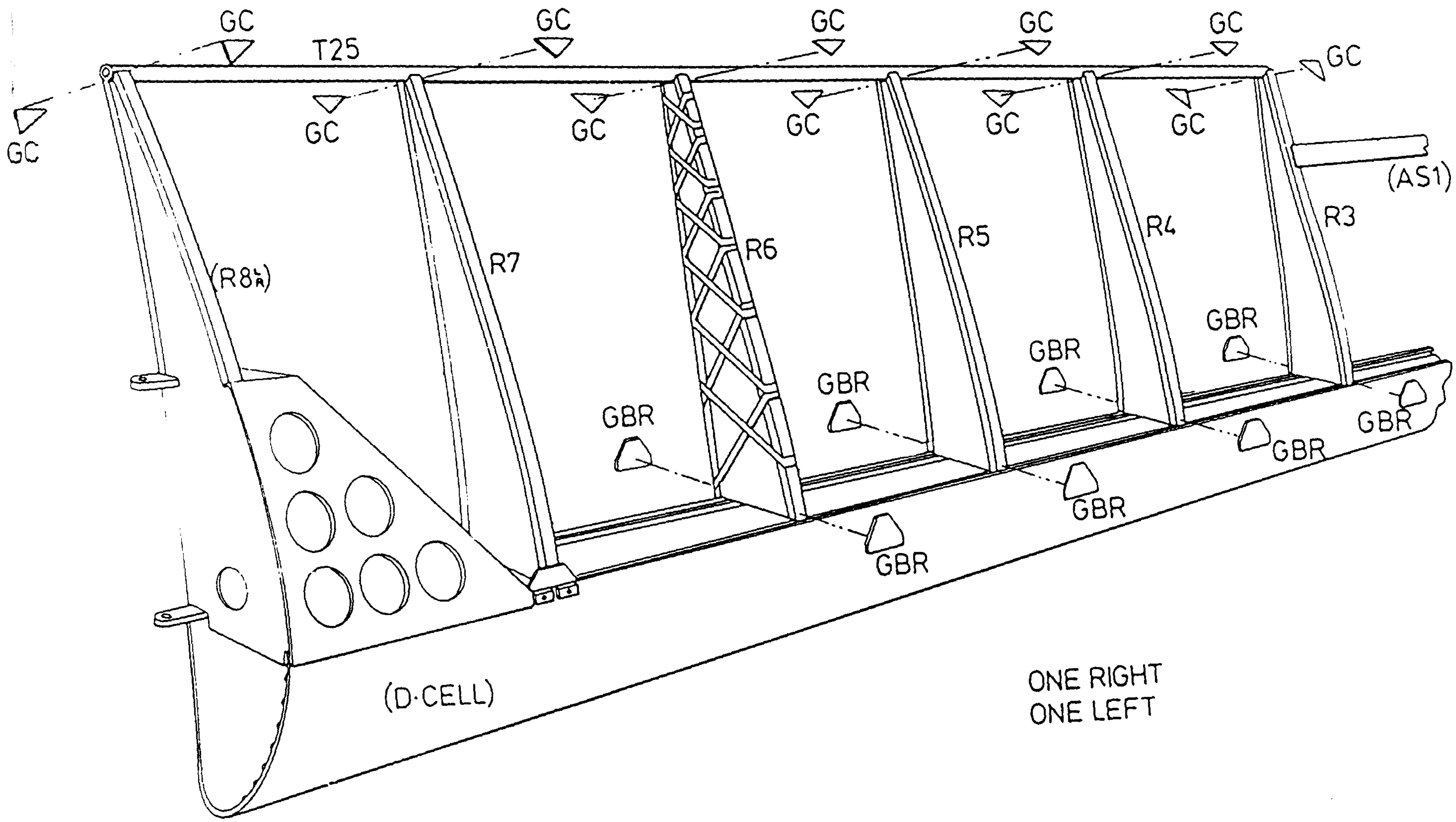
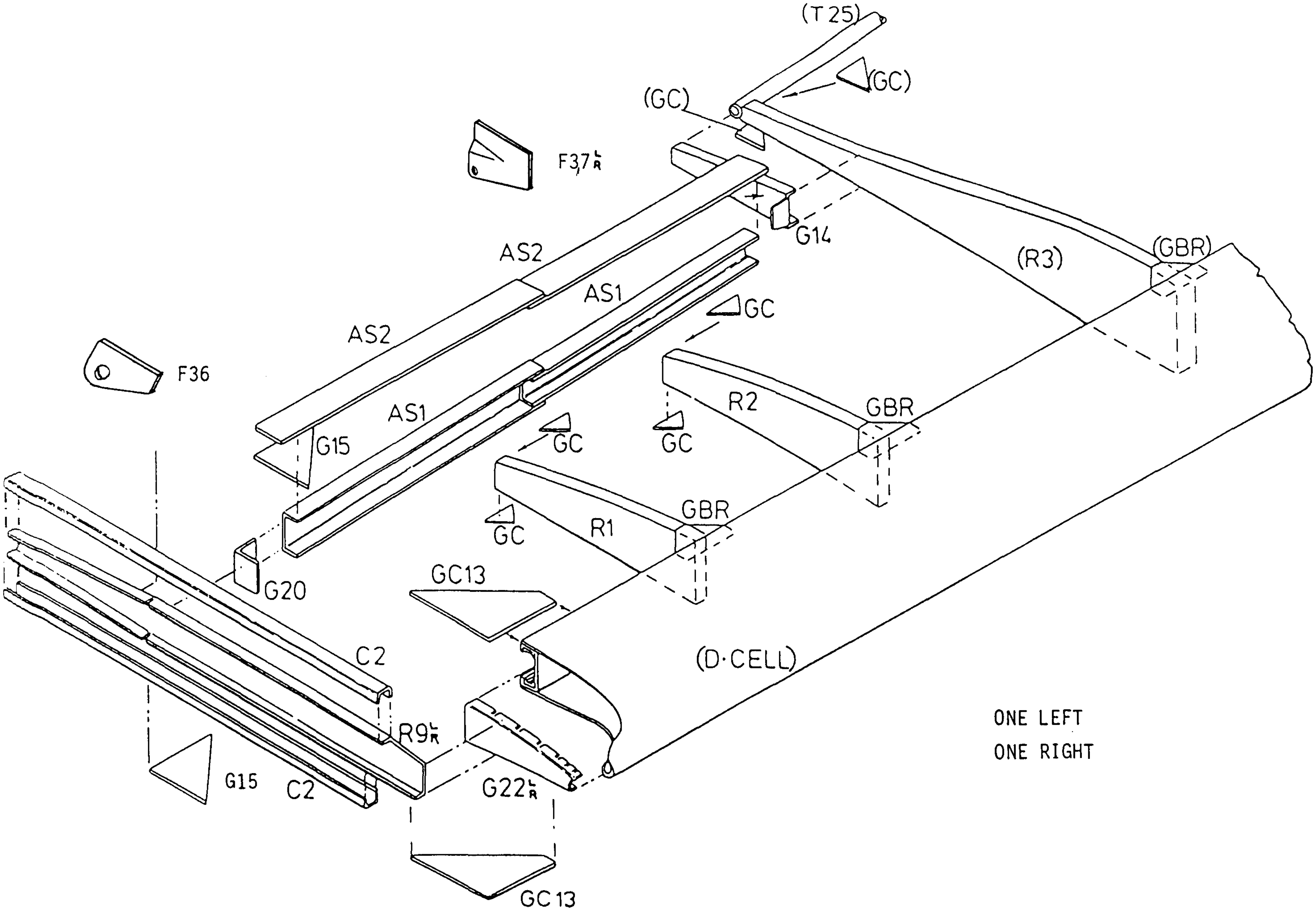
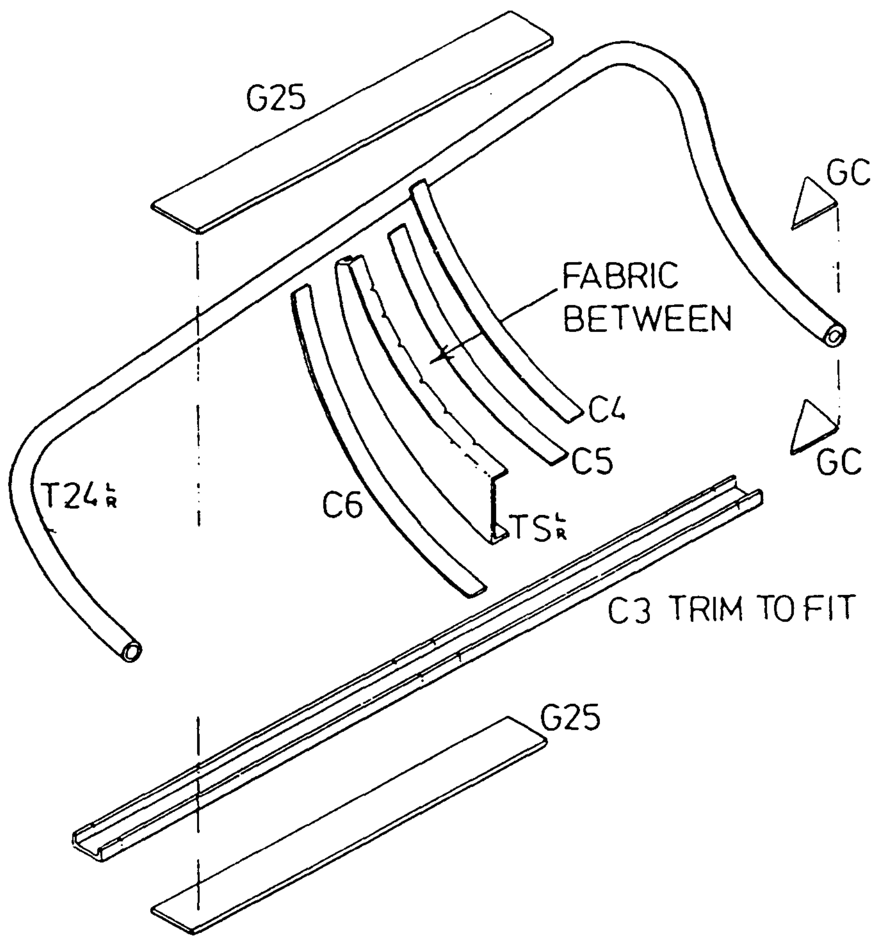

GC
T25
GC
GC
GC
GC
GC
GC
GC
GC
GC
GC
GC
(AS1)
R3
R4
R5
R6
R7
(R8 L/R)
GBR
GBR
GBR
GBR
GBR
GBR
GBR
GBR
GBR
(D-CELL)
ONE RIGHT
ONE LEFT

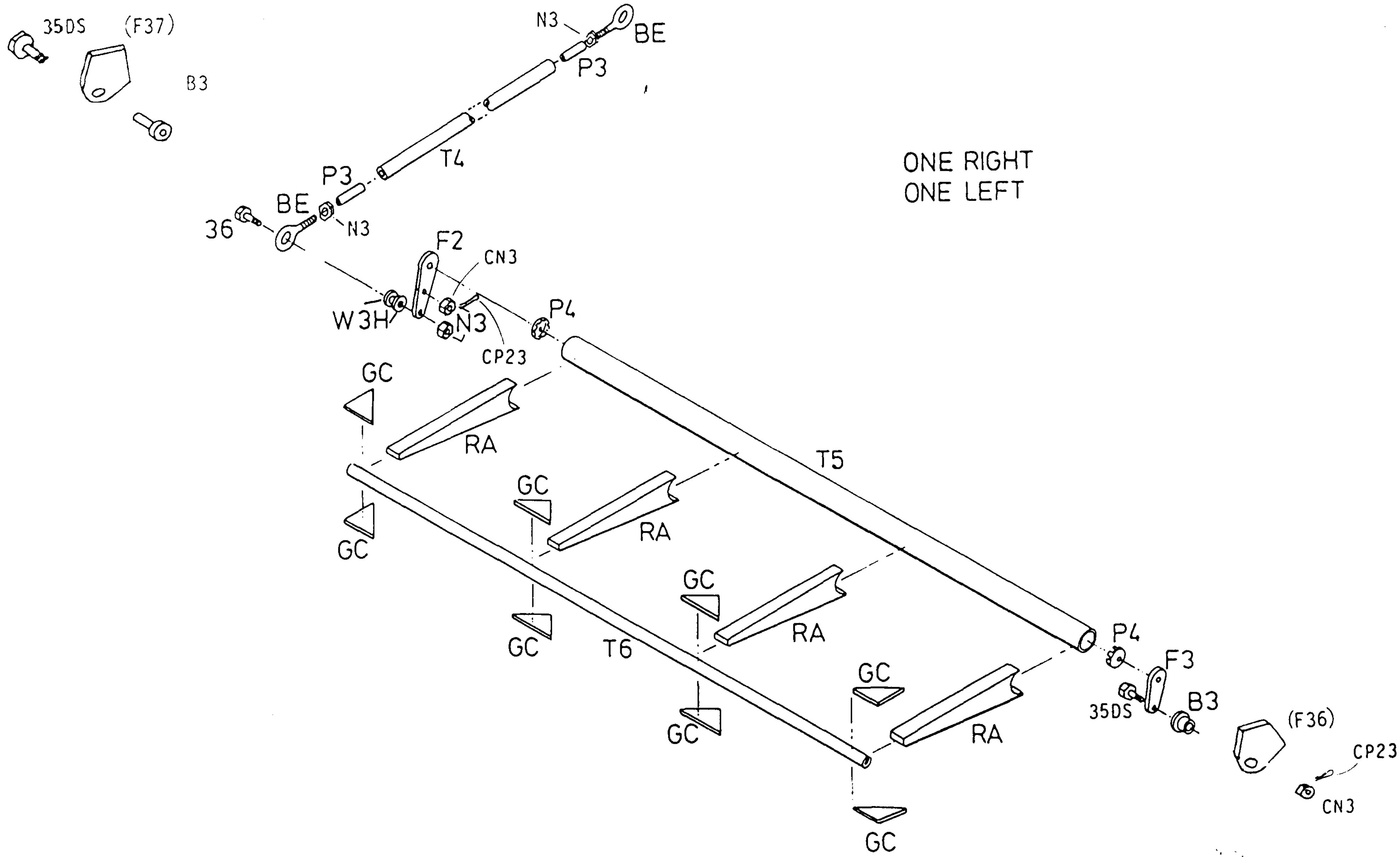


ONE LEFT
ONE RIGHT

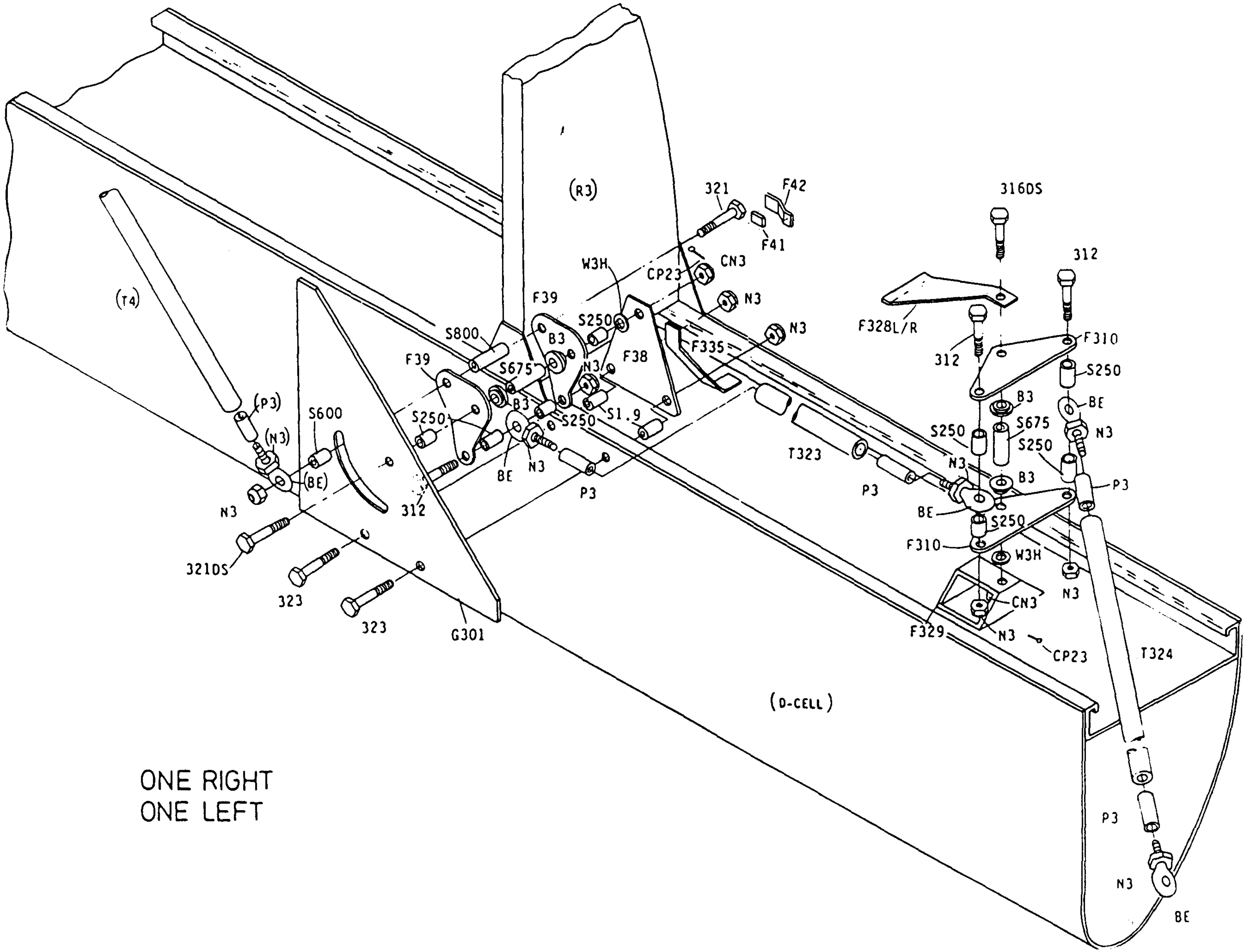
D

E

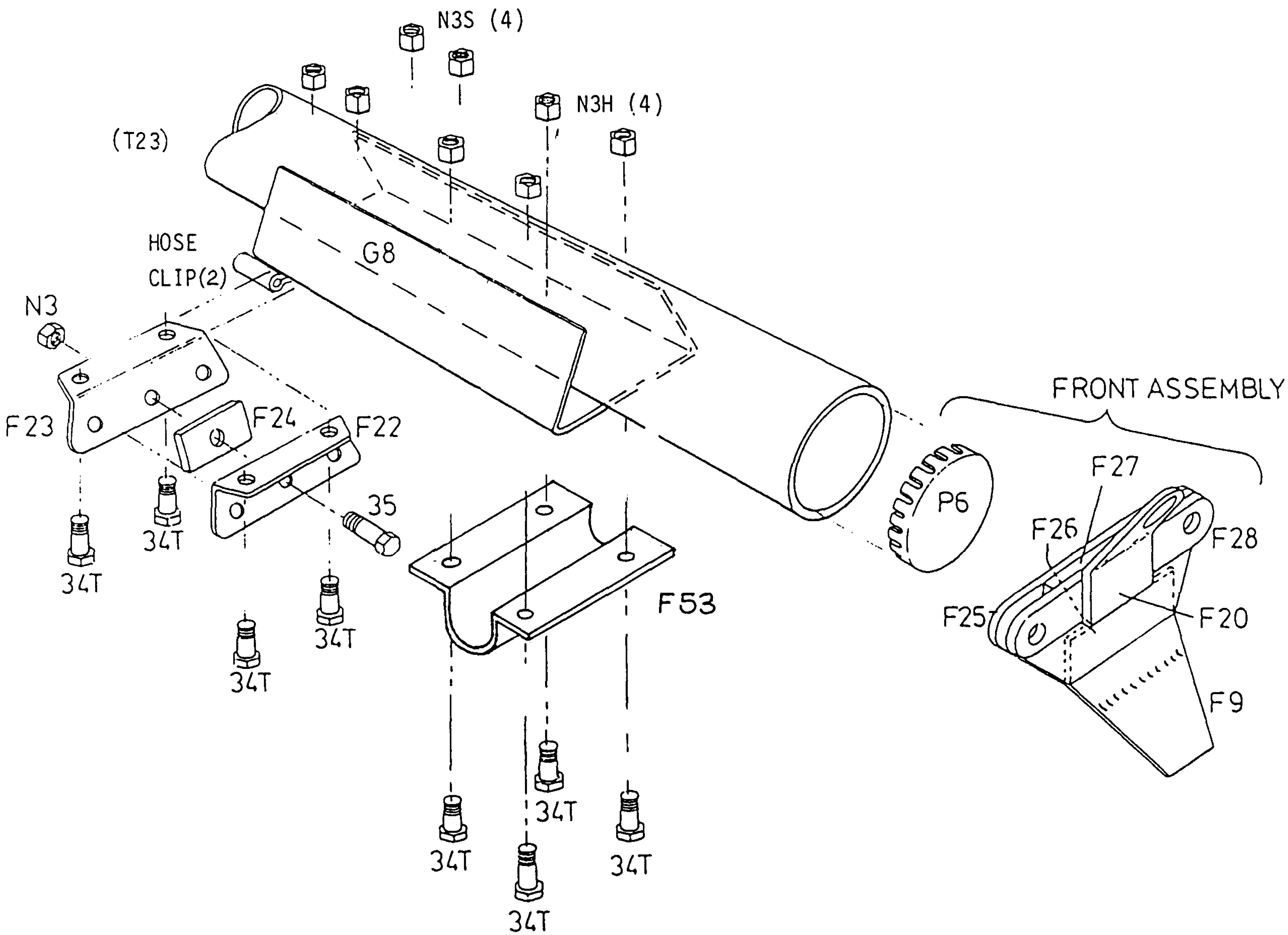

G25
GC
FABRIC
BETWEEN
ONE RIGHT
ONE LEFT
C4
C5
GC
T24 L R
C6
TS L R
C3 TRIM TO FIT
G25

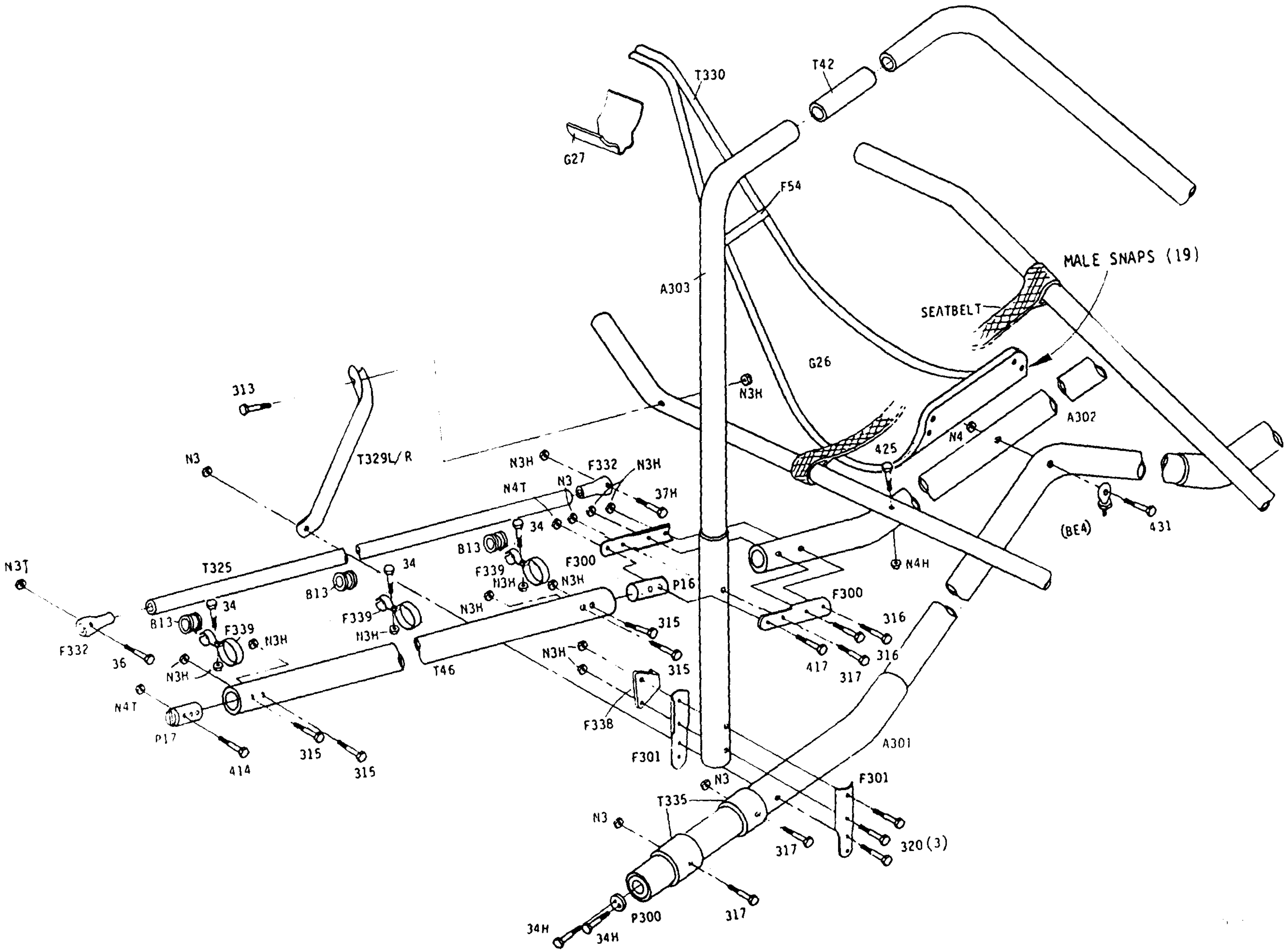


ONE RIGHT
ONE LEFT

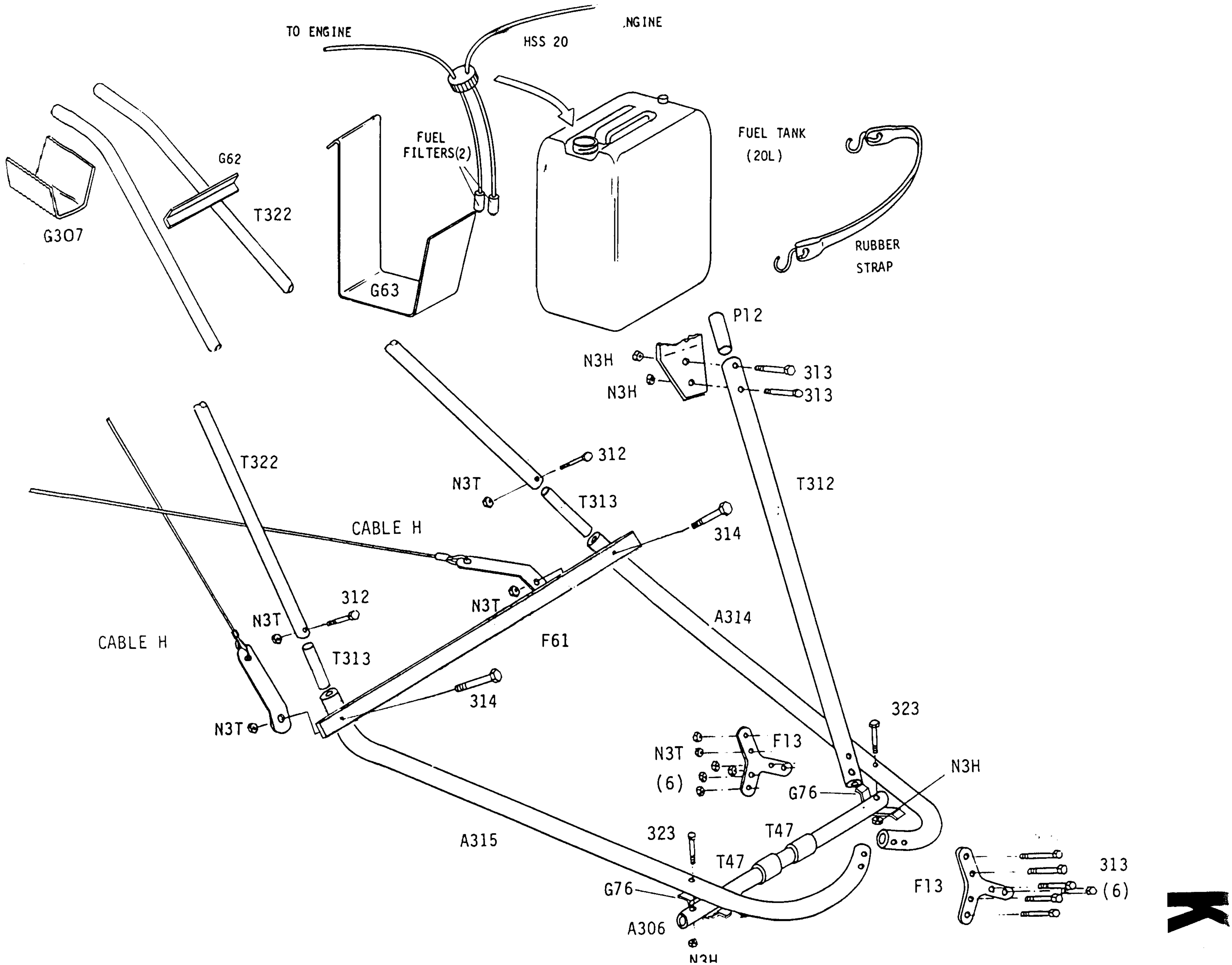


ONE RIGHT
ONE LEFT

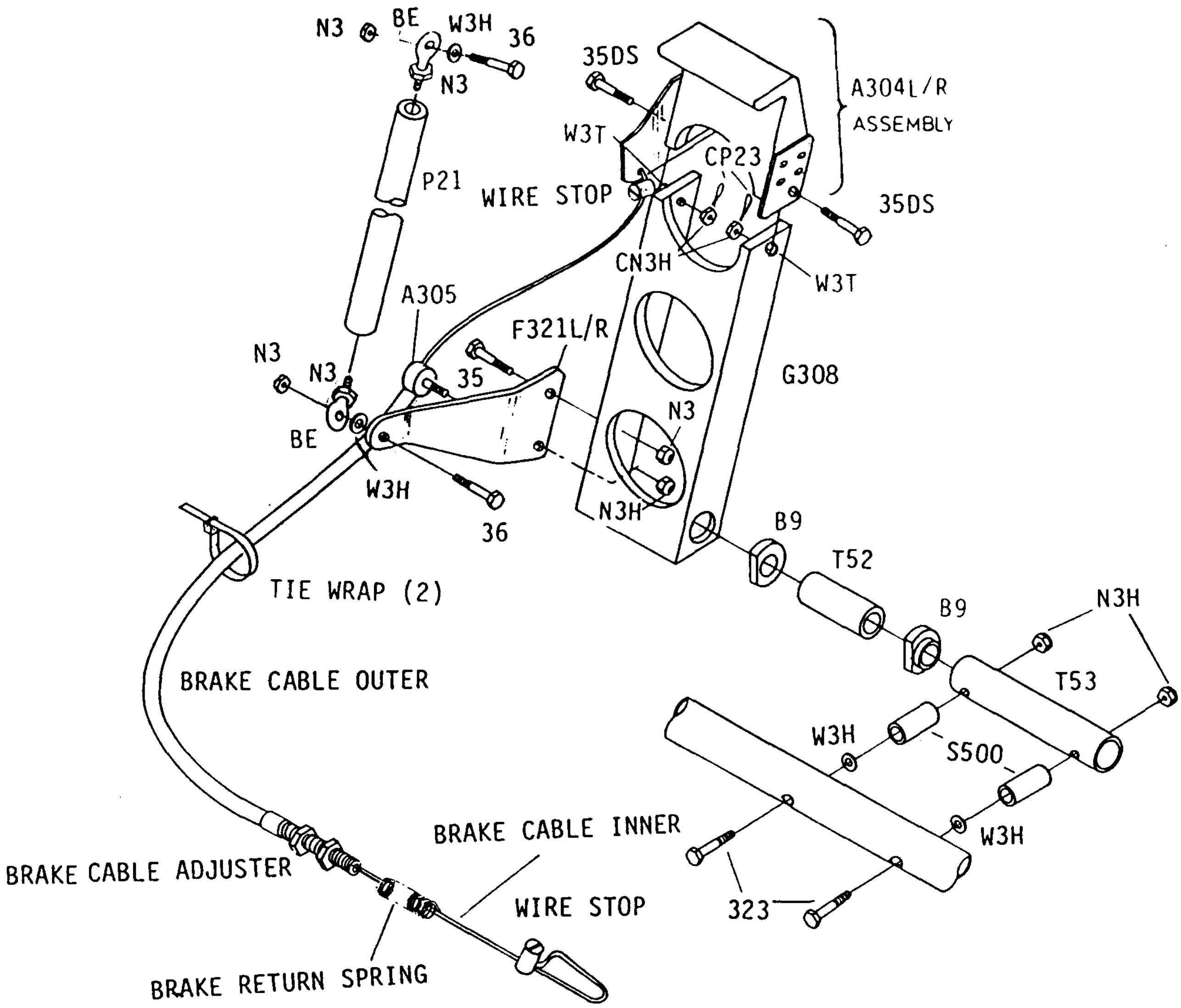

N3S (4)
N3H (4)
(T23)
HOSE
CLIP(2)
G8
N3
F23
F24
F22
35
34T
34T
34T
34T
34T
34T
34T
34T
34T
F53
FRONT ASSEMBLY
P6
F27
F26
F28
F25
F20
F9

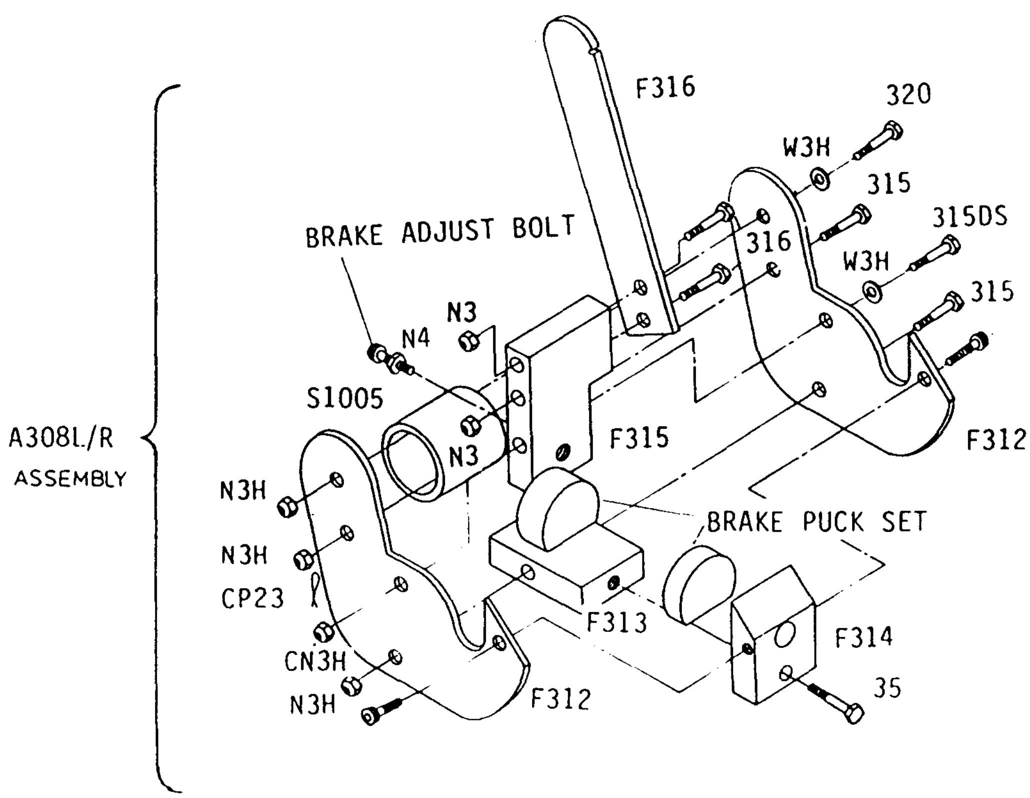


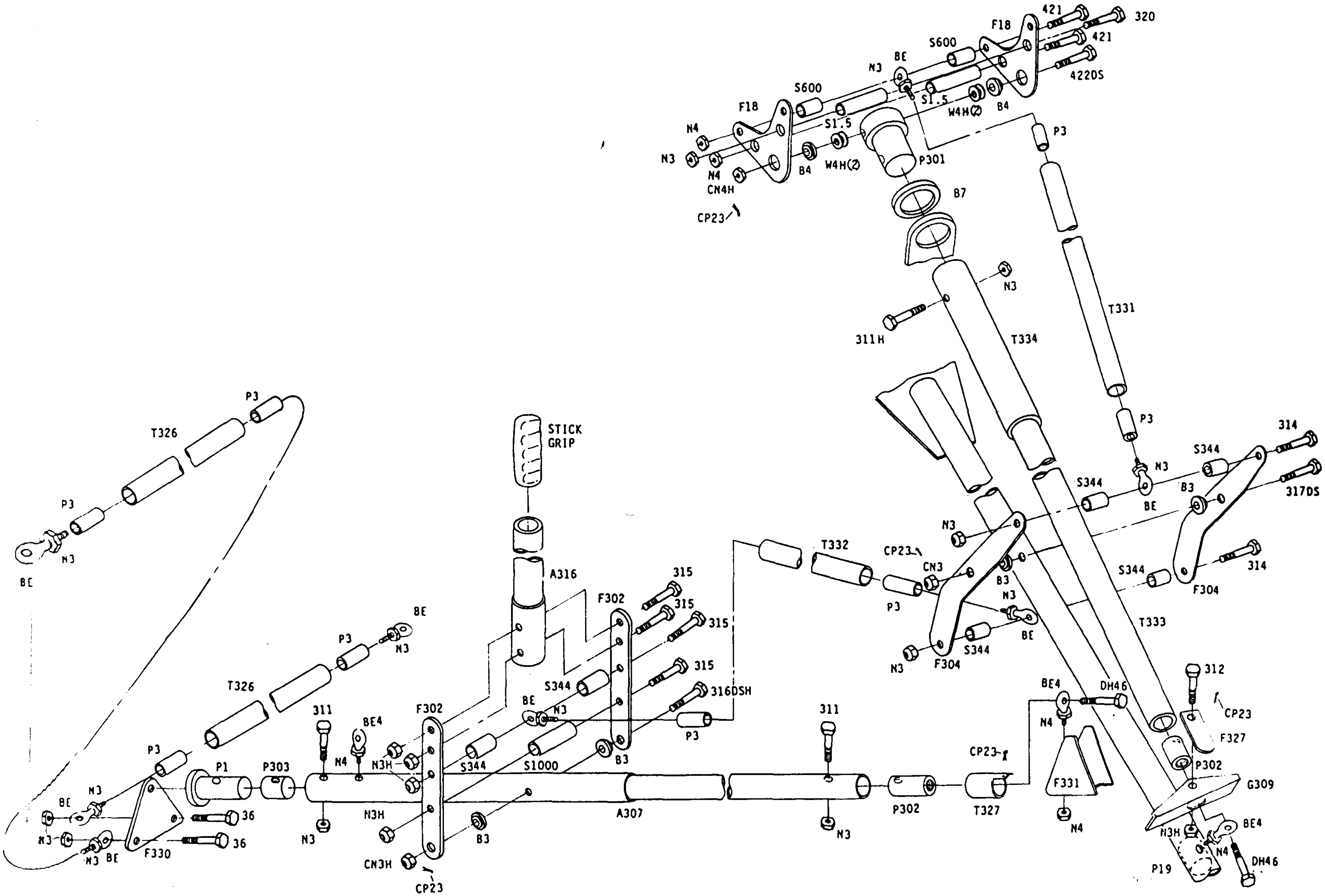
T330
T42
G27
F54
MALE SNAPS (19)
A303
SEATBELT
G26
N3H
A302
313
N4
425
T329L/R
N3
N3H
F332
N3H
37H
N4T
N3
34
(BE4)
431
B13
F300
N4H
N3T
T325
34
F339
N3H
N3H
P16
B13
34
F339
N3H
F300
B13
F339
N3H
N3H
316
N3H
315
F332
36
N3H
T46
N3H
417
316
315
317
N4T
F338
P17
315
414
315
F301
A301
N3
F301
T335
N3
317
320 (3)
P300
317
34H
34H


TO ENGINE
.NGINE
HSS 20
FUEL
FILTERS(2)
FUEL TANK
(20L)
RUBBER
STRAP
G62
G307
T322
G63
P12
N3H
N3H
313
313
T322
312
N3T
T313
T312
CABLE H
314
312
N3T
N3T
A314
CABLE H
F61
T313
314
N3T
323
F13
N3T
(6)
N3H
G76
323
T47
A315
T47
313
G76
F13
(6)
A306
N3H

L

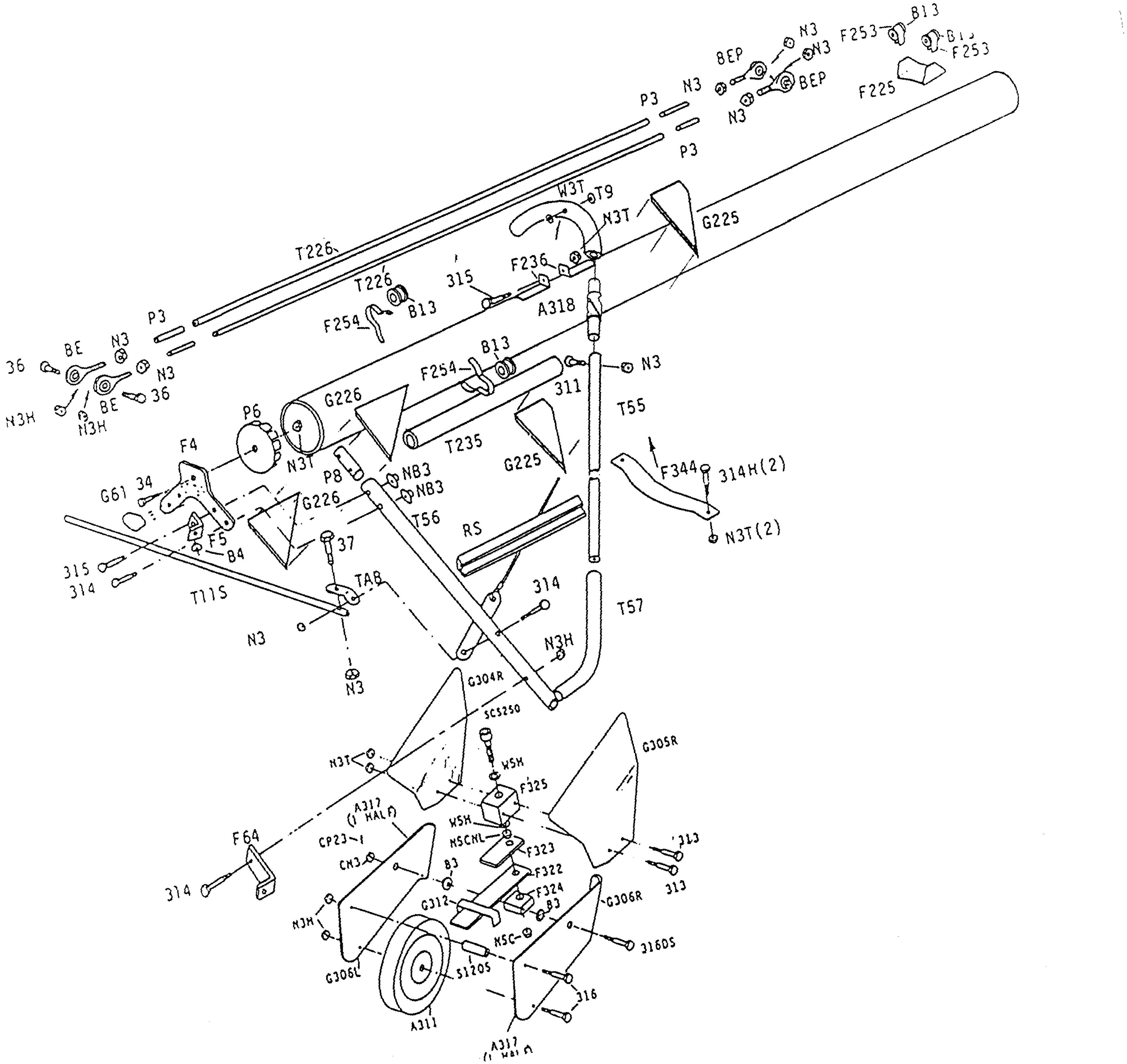

N3
BE
W3H
36
N3
35DS
A304L/R
ASSEMBLY
W3T
P21
CP23
WIRE STOP
35DS
CN3H
W3T
A305
F321L/R
N3
N3
35
G308
BE
N3
W3H
N3H
36
B9
T52
TIE WRAP (2)
B9
N3H
BRAKE CABLE OUTER
T53
W3H
S500
W3H
BRAKE CABLE INNER
BRAKE CABLE ADJUSTER
WIRE STOP
323
BRAKE RETURN SPRING


F316
320
W3H
315
315DS
BRAKE ADJUST BOLT
316
W3H
315
N3
N4
S1005
F315
F312
A308L/R
ASSEMBLY
N3
N3H
BRAKE PUCK SET
N3H
CP23
F313
F314
CN3H
N3H
F312
35

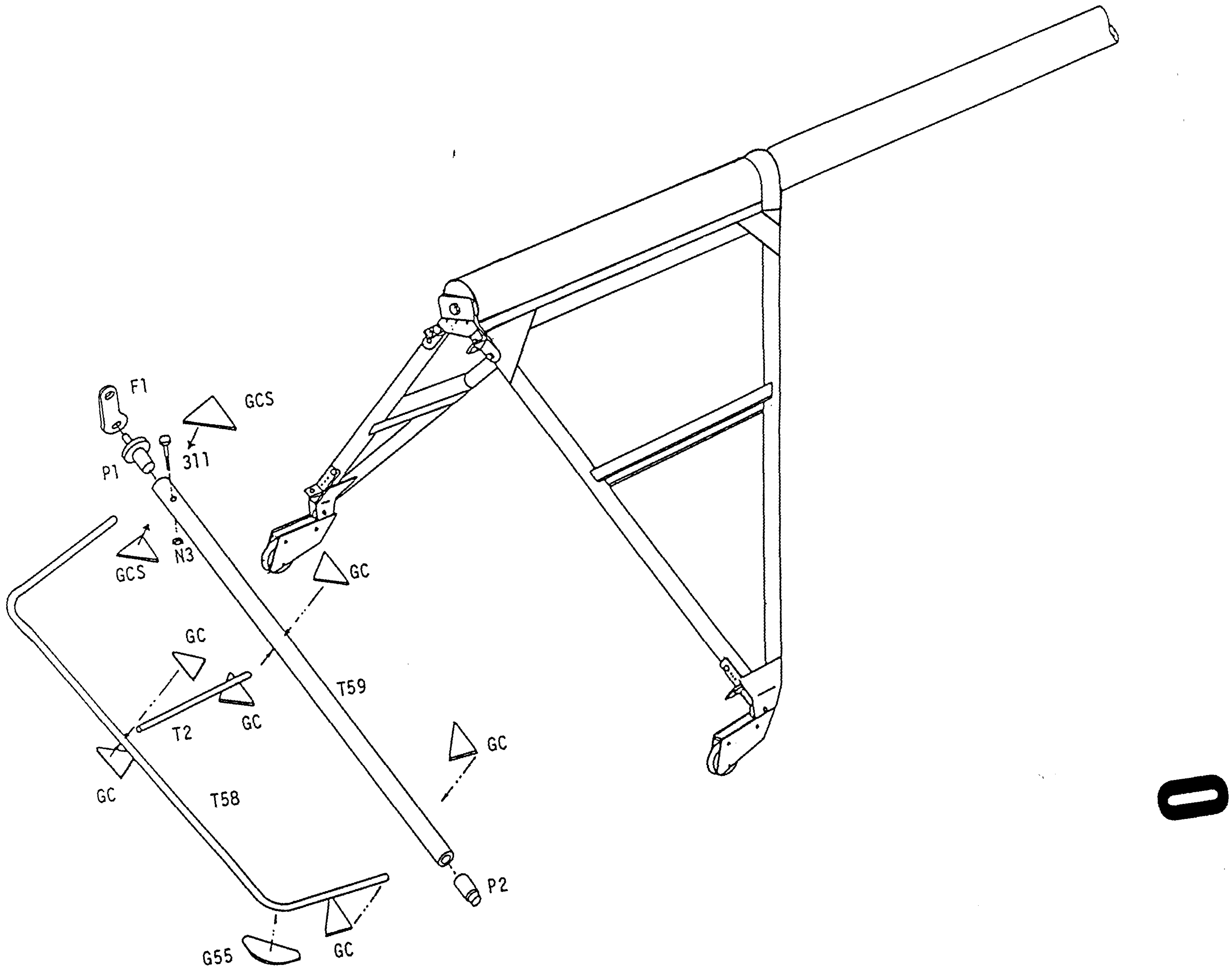

421
320
F18
421
S600
BE
N3
422DS
S600
S1.5
W4H(2)
B4
F18
P3
N4
S1.5
N3
N4
B4
W4H(2)
P301
CN4H
B7
CP23
N3
T331
311H
T334
P3
STICK GRIP
T326
P3
314
S344
N3
S344
B3
317DS
P3
BE
N3
A316
N3
T332
CP23
CN3
BE
315
F302
315
315
P3
B3
314
S344
F304
BE
P3
N3
N3
T333
N3
BE
S344
F304
N3
T326
315
S344
316DSH
312
311
BE4
F302
BE
N3
BE4
DH46
CP23
N4
P3
311
N4
N3H
P3
S344
S1000
B3
P3
P1
P303
CP23
F327
N3
P302
BE
G309
36
F331
N3
N3H
A307
N3
P302
T327
N4
N3
F330
36
B3
N3
N3H
BE4
N3
BE
CN3H
N4
DH46
CP23
P19

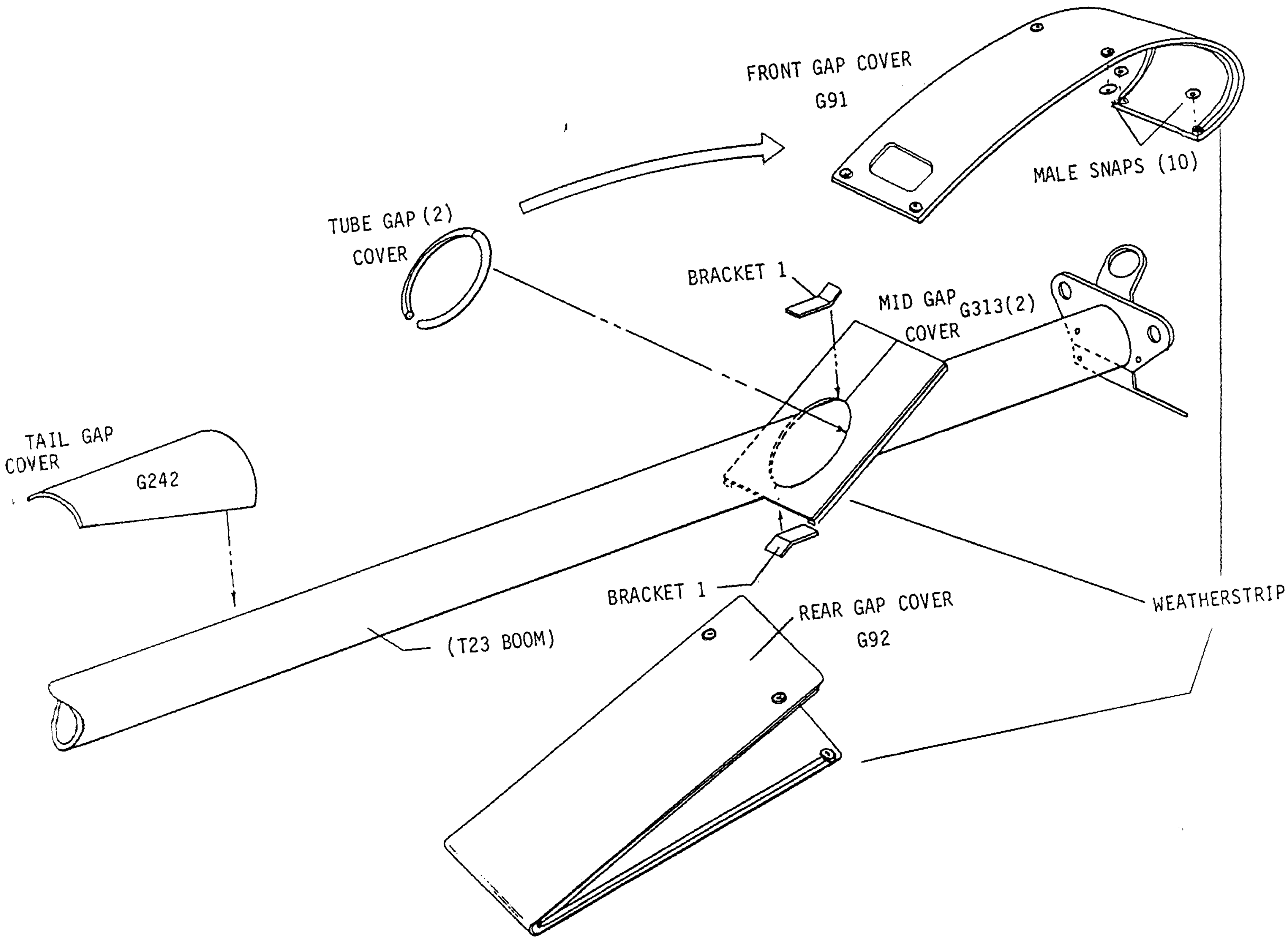
M

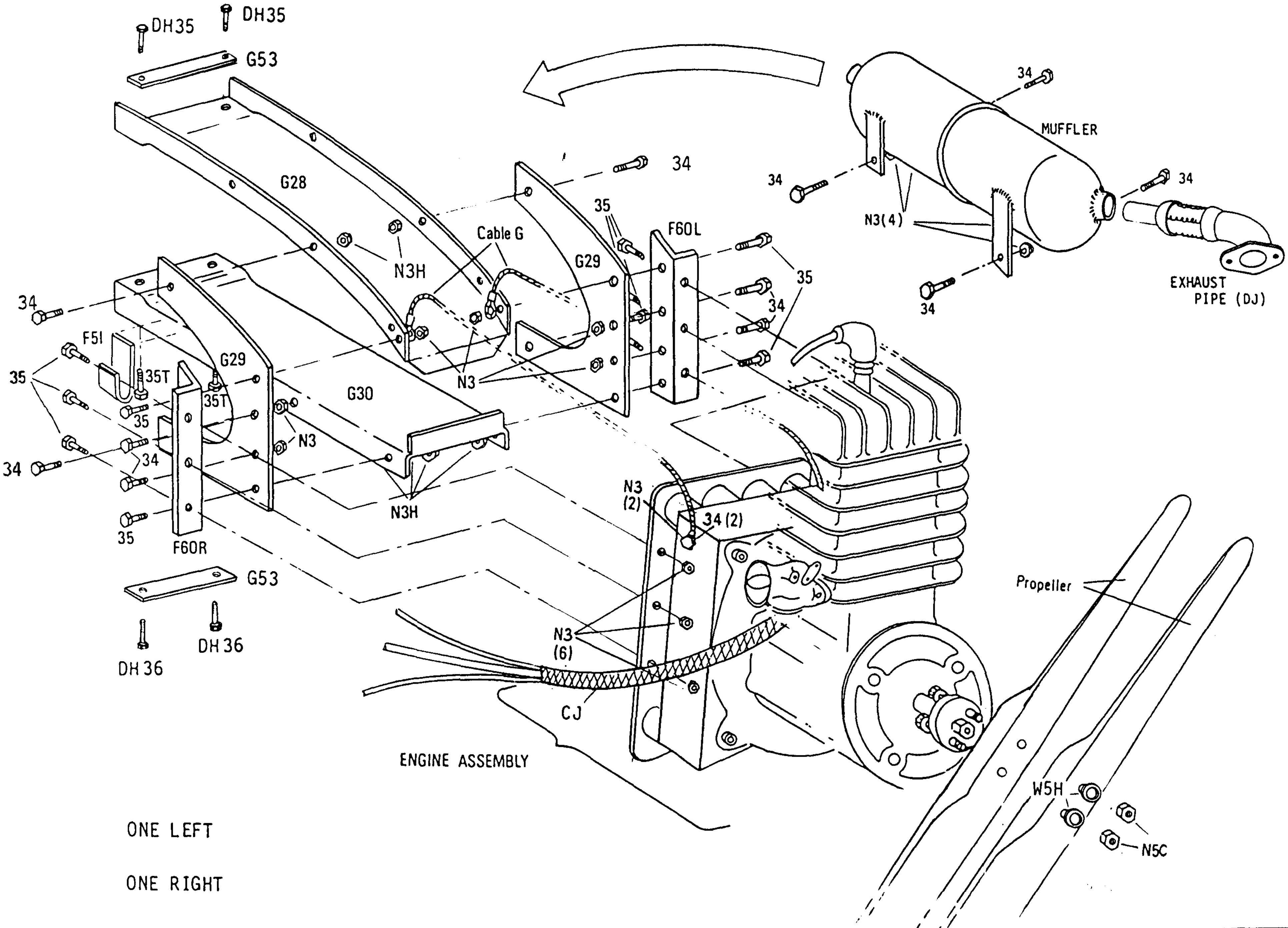
N



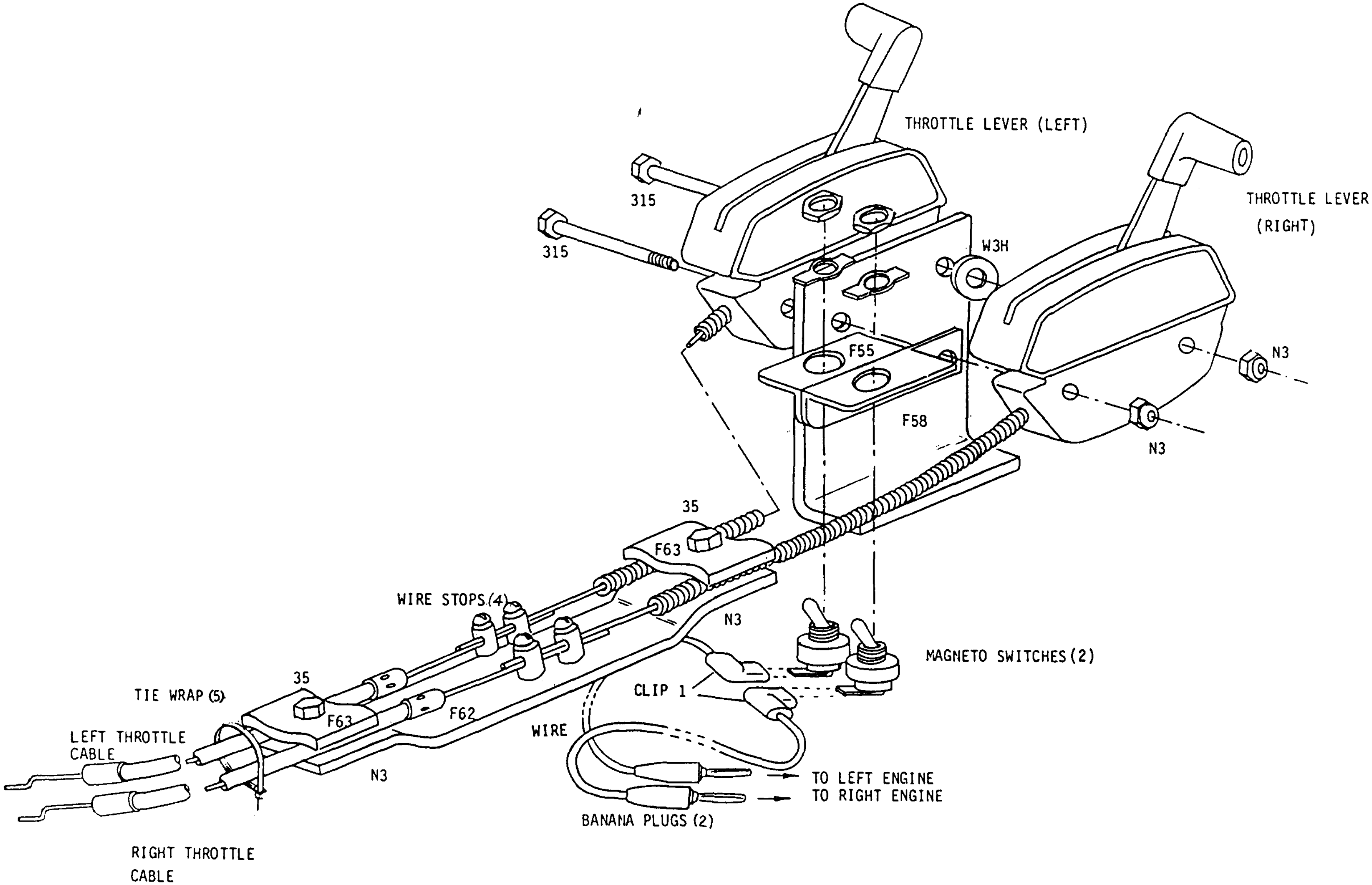
F253
B13
B13
F253
F225
BEP
N3
N3
BEP
N3
N3
P3
P3
W3T
T9
N3T
G225
T226
T226
315
F236
A318
P3
F254
B13
36
BE
N3
N3
BE
36
N3H
N3H
B13
F254
311
N3
G226
P6
N3T
T235
T55
G225
F4
P8
NB3
NB3
F344
314H(2)
G61
34
G226
T56
N3T(2)
RS
F5
B4
37
315
314
TAB
T11S
314
T57
N3
N3H
N3
G304R
SCS250
G305R
N3T
WSH
F325
A317
(1 HALF)
WSH
F64
CP23-1
MSCNL
F323
313
CN3
B3
F322
313
314
F324
B3
G312
G306R
N3H
MSC
3160S
G306L
S120S
316
A311
A317

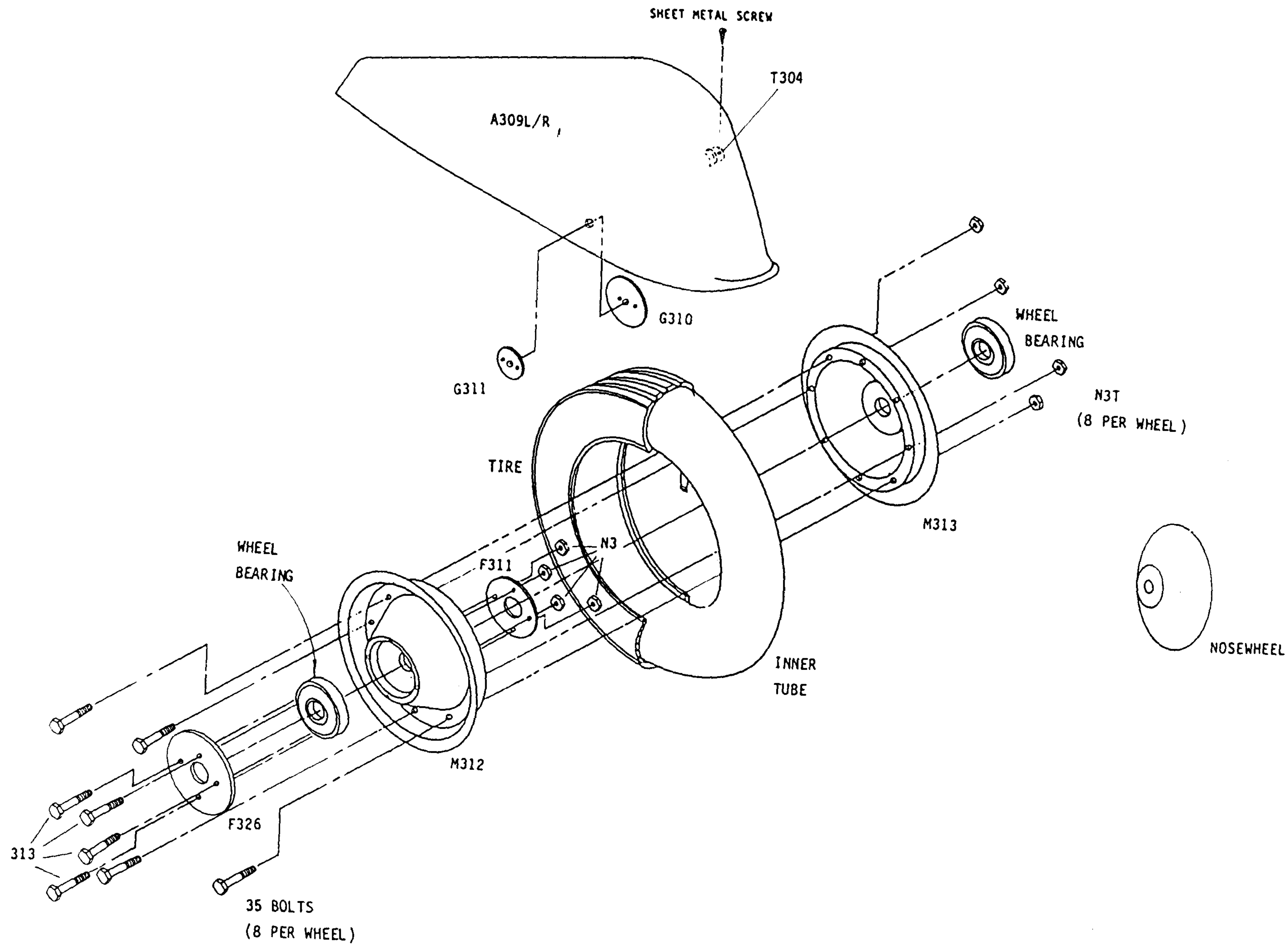

F1
GCS
311
P1
N3
GCS
GC
GC
T59
GC
T2
GC
GC
T58
P2
G55
GC


FRONT GAP COVER
G91
MALE SNAPS (10)
TUBE GAP (2)
COVER
BRACKET 1
MID GAP
COVER
G313(2)
TAIL GAP
COVER
G242
BRACKET 1
(T23 BOOM)
REAR GAP COVER
G92
WEATHERSTRIP



DH35
DH35
G53
G28
34
MUFFLER
34
34
34
N3(4)
Cable G
N3H
35
F60L
G29
35
34
EXHAUST
PIPE (DJ)
34
34
F51
35T
G29
35
35T
35
G30
N3
N3
34
34
N3H
35
F60R
G53
DH 36
DH 36
N3
(2)
34 (2)
Propeller
N3
(6)
CJ
ENGINE ASSEMBLY
W5H
N5C
ONE LEFT
ONE RIGHT

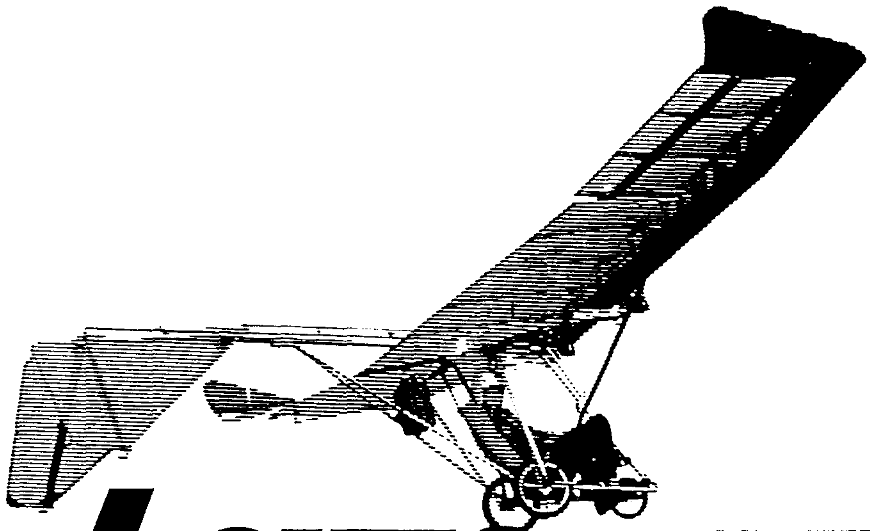

THROTTLE LEVER (LEFT)
THROTTLE LEVER
(RIGHT)
315
315
W3H
N3
F55
F58
N3
35
F63
WIRE STOPS (4)
N3
MAGNETO SWITCHES (2)
35
CLIP 1
TIE WRAP (5)
F63
F62
WIRE
LEFT THROTTLE
CABLE
N3
TO LEFT ENGINE
TO RIGHT ENGINE
BANANA PLUGS (2)
RIGHT THROTTLE
CABLE



SHEET METAL SCREW
T304
A309L/R
G310
G311
WHEEL
BEARING
N3T
(8 PER WHEEL)
TIRE
M313
WHEEL
BEARING
F311
N3
NOSEWHEEL
INNER
TUBE
M312
F326
313
35 BOLTS
(8 PER WHEEL)

Report No. 81011

Revised March 1, 1984



Lazair™

Microlight Aircraft

series III

OPERATING MANUAL

ULTRA FLIGHT ULTRAFLIGHT MANUFACTURING LIMITED

1. INTRODUCTION TO THE LAZAIR

1.1 HISTORY

The Lazair was designed in the fall of 1978 by Dale Kramer of Port Colborne, Ontario, Canada. The Lazair was produced as the best of three designs Dale conceived between the summer of 1977 and November of 1978, and has consistently won awards for excellence in design and workmanship. A product of the flat lands of Ontario, it has taken a 180 pound pilot beyond 7,000 feet. It is soarable and restartable in the air.

1.2 DESIGN CONCEPT

Basically, the Lazair is a rigid wing, three-axis, aerodynamically controlled, lightweight aircraft weighing approximately two hundred and ten pounds. Being that it has full three-axis control, no weight shift is involved in controlling the craft. The Lazair features an inverted V-tail, upswept wing tips, conventional stick and rudder controlling all three axes, and two independently controlled engines situated on the leading edge of the wing approximately two and one half feet from the fuselage centreline.

The design rationale for using these features is as follows:
The inverted V is indisputably the most aerodynamically efficient tail design. The reason this tail is not used more often is structural; the problems being that the tips of the tail are close to the ground and subject to ground obstructions and with the tail tips so close to the ground, there is a rotation problem for slow takeoffs and landings. We have overcome these problems by cable bracing each tail tip to the forward fuselage and by setting the wing to boom incidence at 10 degrees so that in effect, we have a tail dragger aircraft that can be rotated to takeoff and to land. Upswept wingtips are used to increase stability and aileron effectiveness and reduce drag at the wingtips (due to the fact that wingtip vortices transition more smoothly).

As originally conceived, the Lazair did not have rudder pedals and both yaw and roll functions were coordinated through a single stick. In 1981, optional rudder pedals were made available for pilots who wanted the flexibility to separate the two control functions for better crosswind control and ground handling. Because of the overwhelming acceptance of the rudder pedals, they have been made standard equipment on the Series III Lazair.

The Lazair features two of the highest quality two-cycle engines available. Single engine aircraft require the mounting of the power system either in front of, or behind the pilot. When the engine is situated in front of the pilot, the pilot is directly in the accelerated airflow caused by the propeller, making flying less comfortable. When the engine is situated behind the pilot, the propeller is usually mounted behind the engine. This creates overheating problems with the engine and puts the propeller in a more vulnerable position. With either case, in the event of a mishap, it is more hazardous to have the engine directly in line with the pilot rather than offset to the sides, as in a twin engine craft, such as the Lazair. As an added bonus, mounting the engines on the wing creates induced lift which reduces stall speed and increases climb rate.

The first three hundred Lazairs were equipped with a pair of 100 cc engines which were originally designed for an industrial chainsaw. These engines have proven to be reliable, and perform very well under all normal flying conditions. However, to facilitate takeoffs on floats, a new larger engine was introduced in November 1981, and is now standard on all new Lazairs. This engine, a 185 cc, 9.5 HP, two-stroke manufactured in Austria by Rotax, is a universal industrial engine designed for a multitude of applications, one of the most common being a portable water pump used for fighting forest fires (where lives can often depend on the performance of the engine). Before selecting this engine for the Lazair, we questioned the people who manufacture and distribute the water pumps as well as the people who use and maintain them. In every case it was obvious that this particular engine has earned an excellent reputation for performance and reliability. Although this engine cannot be considered a modern design and its power-to-weight ratio is not as high as some of the "screamers" designed for motorcycles, go-carts or snowmobiles, it has a long stroke (relative to most two-stroke engines) and develops its peak horsepower at the relatively low speed of 5,700 RPM, making it ideal as a power plant for a microlight aircraft.

1.3 REQUIRED PILOT ABILITY

The Lazair is an *aircraft*. It does everything a full size aircraft does, but at slower speeds. Consequently, it is very important that the pilot of a Lazair should have at least a student pilot permit and have gone solo in a conventional aircraft. A basic ground school concentrating on aerodynamics and meteorology is also a must. The importance of having flying experience cannot be overstated — the more the better. One could not be expected to jump in a small aircraft with no dual training and have any hope of flying it successfully.

2. THE AIRCRAFT

2.1 CONTROLS

The Series III Lazair has a conventional stick and rudder control. All control functions are standard (right stick produces roll to the right, right rudder pedal produces yaw to the right, back stick produces pitch upward). In addition, since the Lazair is a twin engine aircraft, yaw may also be controlled by using differential engine power. While this is not normally used in flight, it can be quite useful on the ground and a great asset on floats.

Ground handling has been improved by the widening of the landing gear from the previous track of 26 1/2 inches to 46 1/2 inches and the inclusion of independently operated disc brakes.

The throttles and ignition switch are situated so that they are easily accessible at all times. Prior to running the engines and taxiing, one should sit in the cockpit and practice moving the throttles together as well as individually. Knowing the location of the ignition switch and being able to get to it quickly is very important, especially on first taxiing attempts.

2.2 INSTRUMENTS

I Included in your kit is a hang glider airspeed indicator which is usually consistent, but not totally reliable, especially in moist air conditions. Consequently, flight attitude should be used for airspeed control with the airspeed indicator acting as a reference. In steep turns, the g forces tend to pull the float in the airspeed indicator down, making it indicate a very low speed for such a high angle of bank. This is another good reason for airspeed control by the flight attitude method. An altimeter, while not usually required, might occasionally facilitate flying within the prescribed air regulations.

Seat belts, which are necessary in any car or aircraft, are now included as standard equipment in the Lazair kit. The seat belt should be installed securely on the fuselage as described in the Assembly Instructions.

2.3 ASSEMBLY FOR FLIGHT

Before trailering your Lazair to the airfield, count the nuts and bolts used for rigging to make sure you have them all. It is also prudent to take along a few extra nuts and bolts to replace the ones which may be accidently dropped in the grass while rigging the aircraft. The Lazair can be rigged with nothing more than 3/8 inch and 7/16 inch wrenches and a pair of pliers, but the task can be simplified significantly with the addition of a battery powered electric drill with 3/8" and 7/16" nut drivers to fit it.

With the strut (and aileron pushrod) secured to the bottom of the wing, fit the wings onto the fuselage. At the tip, the wing should be held with one hand on the leading edge of the D-cell and the other on the aluminum rib beside the aileron. *Do not* hold onto the curved wing tip, as it is quite fragile. The wing root should be placed in position with the front root fitting bolt put in from the back to the front. The nut then faces forward for easy tightening. The rear spar bolt is then slipped in. This wing tip can then be lowered to rest on a handy block or some other type of object high enough to ensure that the trailing edge is *not* resting on the ground. This block should be positioned such that the wing is resting on the main spar at the tip.

Attach the root fittings of the second wing and, while still holding the wingtip, lower the strut into its fitting. *Do not leave go of this wingtip until the strut of the other wing has been attached.* The wingtips may then be released and nuts put on all the bolts and tightened. Connect the ailerons and tighten the nuts securely.

Prior to putting on the gap covers, all bolts should be rechecked, the stick should be moved in all directions to ensure that the mixer and ailerons are working smoothly, and the gap covers should be installed.

NOTE: *Never fly without the gap covers in place.*

The engines are bolted on, the fuel lines, magneto wires and throttle linkages are attached and the throttles are then checked to make sure that they give full power and return to idle. This will avoid any surprises when the engines are started. Safety wire *ALL* fuel line connections. Before starting the engines, perform a complete preflight check of all nuts, bolts, bearings, pushrods, cables, covering, etc.

2.4 FUEL MIXTURE

As with virtually all two-stroke engines, the engines on the Lazair require the lubricating oil to be mixed with the gasoline. Many types of two-stroke oil are available and each has it advantages and disadvantages. With the smaller engines previously used on a Lazair, we recommended the use of Granberg, a eutectic oil designed to operate with a fuel/oil ratio of 100 to 1. This oil was recómmended by the engine manufacturer and our own testing showed that unlike most other types of lubricating oils, it did not cause spark plugs to foul. It does, however cause the cylinder head to operate at a higher temperature than when using some of the less exotic oils which are used in higher concentrations. The Rotax engine has shown in testing and in service that it is not as prone to spark plug fouling as most other two-stroke engines, and therefore a conventional mineral based two-stroke oil is quite adequate. All the testing and flying at the factory to date has been done using Sunoco, Texaco or BP two-cycle oil mixed in a ratio of 25 to 1. The performance of these oils has been excellent, and we would expect that a mineral oil from any of the reputable manufacturers would work equally well.

Although problems with the Rotax engine have been rare, there have been a few reports of power loss believed to be caused by overheating due to the use of synthetic oils or too low a concentration of mineral oil. For this reason, *the use of synthetic oils is not recommended and the use of mineral based oils mixed in concentrations less than one part oil to twenty-five parts gasoline is not recommended.* Regardless of the type of oil used, it is imperative that it be thoroughly mixed with the gasoline before the engines are started. It should also be noted that insufficient lubrication can result from an incorrectly adjusted carburetor (as described in Section 3.3.3). Experience has shown that leaded gasoline runs much cleaner than unleaded, and therefore *leaded gasoline should always be used.* Spark plugs should be checked every ten hours and cleaned or replaced as necessary.

3. ENGINES

3.1 SPECIFICATIONS

Bore:	62 mm (2.44 in.)
Stroke:	61 mm (2.40 in.)
Displacement:	184 cc (11.2 $in.^3$)
Compression Ratio:	8.5:1
Power Output:	5.2 HP @ 3,000 RPM
	7.6 HP @ 4,000 RPM
	9.2 HP @ 5,000 RPM
Ignition Type:	Bosch Flywheel Magneto with Breaker points
Carburetor Type:	Tillotson Model 229A Diaphragm Type with Integral Fuel Pump

3.2 SERVICE DATA

Spark Plug Type:	NGK A-7 (recommended) or Bosch M240T1 or Champion K-7
Spark Plug Gap:	.016 to .020 Inches
Ignition Point Gap:	.014 to .018 Inches
Ignition Timing:	.14 to .16 Inches BTDC
Magneto Air Gap:	.010 to .013 Inches
Crankshaft End Play:	.001 to .009 Inches
Spark Plug Torque:	30 ft. lb.
Cylinder Head Nuts Torque:	17 ft. lb.
Flywheel Hub Nut Torque:	35 ft. lb.
Propeller Hub Nut Torque:	35 ft. lb.

3.3 OPERATION

CAUTION: *Always be extremely careful around the propellers as you would with any aircraft. The Lazair propellers may be small but they are quite capable of inflicting serious injury.*

3.3.1 Priming

The Tillotson carburetors on the Lazair engines incorporate a check valve which will hold the fuel in the fuel lines for several hours or even days. However, if the engines have not been operated for some time, the fuel will gradually drain back into the tank and it will be necessary to prime the fuel system. This is a simple procedure, made possible by the use of fuel lines with a relatively small inside diameter, and the elimination of the primer bulb which was a source of problems on some of the early Lazairs. To fill the fuel lines, make sure both magneto switches are off, then open both throttles. Close both chokes by *pushing* the choke knobs in. Note that closing the choke automatically activates the compression release to make it easier to pull the starter cord. Pull the starter cord until fuel is visible in the clear fuel line where it enters the carburetor (this usually requires eight to ten pulls). Then pull the starter two more times to ensure that the carburetor fuel passages are filled.

3.3.2 Starting Procedure

Every two-stroke engine seems to have its own unique character, and in time you will discover the exact starting procedure which works best for *your* engines. However, the sequence outlined below works well and should be followed until you discover a better way.

1. Close the choke (and open the compression release).
2. Set the throttle approximately 1/4 open.
3. Set magneto switch on.
4. Pull starter cord until engine starts (use a quick but steady pull).
5. Allow the engine to run for a few seconds then slowly open the choke.
6. Allow the engine to warm up for at least two minutes before using full throttle.
7. Move the throttles from idle to full power several times and check for smooth response.

If an engine hesitates or sputters when the throttle is advanced, it indicates that either the carburetor is not properly adjusted or the engine is not sufficiently warmed up.

NOTE: *As soon as the engine fires, the compression release will be closed (pushed out) automatically. If you want to restart an engine with the choke open, it will be necessary to push the choke knob in (to open the compression release), then pull the knob out again to open the choke.*

As with most two-stroke engines you will probably notice a tendency to four-stroke at some operating speeds. Four-stroking can be recognized by a very severe vibration (made very obvious by the soft rubber engine mounts used on the Lazair) and a loud irritating exhaust noise. While four-stroking is a normal occurance and is not considered a serious problem, it should obviously be avoided as much as possible to prevent damage to the airframe from excessive engine vibration. Proper carburetor adjustment will reduce the tendency to four-stroke, and most engines will four-stroke less after they are broken-in than when they are new.

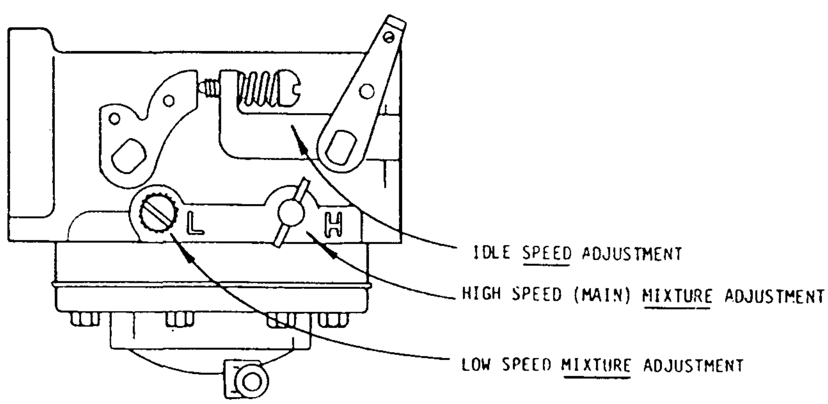
NOTE: *The engines provided in your Lazair kit have been run briefly at the factory but they are not fully broken in. It is recommended that before the first flight, the aircraft be taxied for a minimum of two hours.*

If an engine tends to four-stroke in service, advance the throttle slightly until it runs smoothly. *Do not run an engine continuously in the four-stroke mode.*

3.3.3 CARBURETOR ADJUSTMENTS

The carburetors on your Lazair engines have been adjusted at the factory to allow the engines to be started, but they will require subsequent "fine tuning" at least twice (before and during the break-in period).

> CAUTION: *When making carburetor adjustments with the engine running, be very careful to avoid the propeller. Keep the aircraft securely tied down and have a friend sit in the cockpit to operate the throttles and magneto switches. Crouch down behind the engine, under the wing and keep one hand on the strut to avoid losing your balance. Do not stand between the propeller and the leading edge of the wing.*



There are three adjusting screws on the carburetor:

1. High speed (main) fuel mixture adjustment (labeled "H").
2. Low speed fuel mixture adjustment (labeled "L").
3. Idle speed adjustment (throttle stop).

1. If the carburetor is known to be out of adjustment, close both the main and idle adjustment screws by turning them clockwise until the needle just touches the seat. Do not force the needle into the seat.
2. Open the main adjustment screw 1 1/4 turns.
3. Open the idle adjustment screw 3/4 of a turn.
4. Set the idle speed adjustment so that the throttle butterfly is open slightly.
5. Start the engine and allow it to warm up for several minutes.
6. When the engine is thoroughly warmed up, close the throttle and adjust the *idle speed* adjustment screw to achieve the desired idle speed (approx. 1000 RPM).
7. Open the throttle gradually to full power. Adjust the main mixture adjustment screw (H) to achieve maximum RPM. *Then turn the main adjustment screw 1/4 turn counterclockwise.* This will result in the proper fuel mixture to assure proper lubrication of the engine.

   NOTE: *Do not run the engine with the main mixture adjustment too lean or serious engine damage may occur.*

8. Run the throttles up and down a few times to ensure that the engine responds smoothly. Adjust the *low speed mixture* so that the engine accelerates immediately and smoothly when the throttle is opened suddenly. If it hesitates or stops when you open the throttle, the mixture is too lean. If it puffs blue smoke when you open the throttle it is too rich.

   Note that the low speed mixture adjustment controls the fuel mixture from about 20% to 80% power. In order to have acceptable acceleration from idle, the low speed mixture will probably have to be set slightly richer than the setting required for good midrange operation. (This is due to the fact that this carburetor, like virtually all carburetors on two-stroke engines, does not have an accelerator pump).

4.1 Taxiing

Your first attempt to taxi the Lazair should be made in zero or nearly zero wind. The ideal way to taxi is with the tail slightly off the ground, although with the large castering tailwheels on the Series III Lazair, low speed taxiing can be done with the tail on the ground. If you have installed the nosewheel on your Lazair, you should learn to taxi *with the nosewheel off the ground.* If the nosewheel touches the ground, you are doing something wrong.

As the pilot of a Lazair, you have three methods of ground steering to choose from - rudders, brakes, and engines. As much as possible, all steering should be done using the rudder pedals only. Brakes may be used for very low speed taxiing where the rudders are ineffective and can occasionally be used to get out of trouble, but they should not be used during takeoff because this will extend the takeoff roll. Using differential power can be helpful during a very long crosswind taxi, but it is normally used only when the ground speed is very low (or zero). By depressing one brake pedal and using full power on the opposite engine, it is possible to rotate the Lazair around one wheel — just like the big twins.

The use of brakes for stopping should be kept to a minimum. While learning, you should try to do all your taxiing without using the brakes at all. Then after you are familiar with all the other controls, practise using the brakes. Keep in mind that the Lazair is an aircraft, not an automobile, and use the minimum amount of braking necessary to control your deceleration. Like virtually any taildragger, if you use too much braking force and don't hold the stick back, you can stand the Lazair on its nose. It is particularly important to remember that if you hold the aircraft with the brakes and do a full power engine runup, *you have to hold the stick back* to keep the tail down. Pilots with previous taildragger experience shouldn't find this a problem, but if all your previous flying has been in a brakeless Lazair, then you may have to remind yourself of this a few times.

4.2 The First Flight

The first flight should take place in zero wind, preferably from a long wide grass strip. With a reasonable amount of flying experience and sufficient taxi time to become familiar with the controls, transitioning to the Lazair should be a relatively easy task.

The standard pre-flight should be done. A long run up at full power should be done to make sure the engines are producing maximum RPM and the ignition switches should be checked.

Apply full power and start your takeoff roll keeping the nosewheel just skimming the grass. The aircraft will start to feel light. *Gently* apply back pressure if necessary and the aircraft will lift off. If you feel the tail dragging, then ease forward until you have more airspeed. If rotation occurs at a higher airspeed you may find the initial climb angle quite alarming. The tendency to overrotate seems to be a normal occurence for most people on their first flight. Easing off back pressure or even using slight forward pressure on the stick should allow you to maintain airspeed and continue with a normal climb out. If the runway is long enough, you can reduce power and fly straight and level for awhile. If everything feels in trim and you feel comfortable, apply full power and go for a flight. On your first climb out, you will probably climb out at a higher airspeed than is normally used for best rate of climb. It is not until the Lazair gets down around the 20 mph mark on the airspeed indicator that it climbs best. Once you have reached a comfortable altitude you may begin gentle turns.

As with many aircraft, if you initiate the turn with the ailerons, there will probably be some temporary adverse yaw caused by aileron drag. This has been reduced considerably by the increased differential in the aileron controls, and can be almost totally eliminated if you remember to initiate the turn with the rudder pedals, then as soon as the aircraft begins to yaw, feed enough aileron to coordinate the turn.

Stalls are straight ahead and fully controllable. Trying to spin the Lazair results in a spiral dive. Stalls in turns usually result in the Lazair rolling to the opposite direction. This roll can be stopped as the wings go through level flight. If, for some reason, one engine fails, the Lazair will still fly quite well, but it does require more skill. Depending on the weight and skill of the pilot, the aircraft may gradually descend, maintain altitude, or even climb very slowly. However, in this situation, you should never rely on being able to climb, and should immediately begin looking for a safe landing site. Turns should be made toward the operating engine. Throttling back the operating engine will increase the sink rate, but will facilitate controlling the aircraft. Should the inside engine fail in a turn, reduce power on the other engine to level out.

Stalls on one engine have been straight forward to date. Many times the Lazair has been descended controllably in a mush below stall speed, but this manuever should be performed only by a very experienced pilot using extreme caution.

4.3 Landing

Landing the Lazair is begun with a long approach descending at a constant airspeed with the engines just above the "shake" speed. Once you are sure you have made your field, reduce power to idle and begin to flare at 2 to 3 feet. The Lazair will float for a couple hundred feet and you should settle in at a stalled attitude. In the proper landing attitude, the tailwheels touch just before the main gear. There are three things that deserve note:

1. Once you get below 50 or 100 feet, *do not* turn the engines off unless you have *plenty* of airspeed. With power on at a low airspeed there is quite a lot of induced lift, and when you turn the engines off you could lose some height or go directly into a mush.
2. Do not flare too high and land five feet above the runway. This leads to bruised posteriors and egos.
3. Once on the ground again, you are taxiing the Lazair, so plan ahead which way you are going to be blown and what taxiing techniques to use.

Finally, a word about weather conditions: The Lazair is capable of being flown in very severe weather as long as the pilot is totally familiar with the aircraft and with wind gradient, wind shear, low level turbulence, downwind turns, rotor, thermals, wind shadow and many more wind and weather conditions too numerous to explain here. Knowledge of these micrometeorological phenomenon is best obtained from various texts as well as a *very gradual transition from calm air up to your personal limitations*.

NOTE: *Included with your Lazair owners manual is a small book entitled "Learning to Fly the Lazair". Although this was written several years ago (before the introduction of rudder pedals and the lower pivoted control stick), it contains many helpful hints which could benefit any new Lazair pilot.*

Lazair™

TECHNICAL UPDATE

Distributed as a free service to all Lazair owners

Number 1 May '81

1.1 RUDDERVATOR HINGE BOLT

The 47 bolt that fits into the P1 at the root end of the ruddervator should be held in by bottoming the bolt thread in the threaded hole and should *not* tighten on the B4. This is to ensure that the bolt has no tendency to unscrew. If your bolt is tightening on the B4, then either replace the bolt with a longer bolt or safety wire the head of the bolt.

1.2 NYLON BEARINGS

Wherever there is a B3, B4 or B6 other than the B4 mentioned in number 1 above, the situation should be such that when the moveable surface is moved,the bolt holding the bearing (B3, B4 or B6) should remain stationary. If this is not the case, remove the bearing and file the hole bigger in the moveable surface so that the bolt can then be further tightened without the bearing seizing to the moveable surface.

1.3 FUEL LINE CONNECTIONS

As mentioned in the flying manual, all gas line connections should be safety wired before flying to prevent air bubbles in the gas line (this includes where the gas line attaches to the engine).

1.4 MAINTAIN AIRSPEED

There have been an increasing number of incidents where pilots have tried to climb out at too low an airspeed which results in a mush condition where the aircraft will no longer climb and possibly descend. The mush is controllable, yet sometimes the nose will drop as in a stall. The danger is that people don't recognize this condition, especially when trying to go over obstacles. With this emphasis we hope to prevent some bent tubes and wings.

1.5 IN-FLIGHT RESTARTS

We would like to remind people that air restarts are tricky and should only be attempted at altitudes over 1000 feet until a significant skill is obtained in doing this manoeuvre.

1.6 PRIMER BULBS

We have received word from a few customers that primer bulbs have been failing due to a reaction with the gasoline. Inspect your primer bulbs frequently and if you see any signs of deterioration, replace the bulb with one obtained locally.

1.7 PREFLIGHT INSPECTIONS

Lastly, we would like to remind you of the obvious need to do a complete and thorough preflight inspection before you fly.

Lazair™

TECHNICAL UPDATE

Distributed as a free service to all Lazair owners

Number 2 June '81

2.1 WATER ON WINGS

Water on the wings of any airplane, whether caused by dew or rain, can add a considerable amount of weight and therefore will alter the flight characteristics — especially the rate-of-climb. If you're flying the Lazair, the effect of water on the wings is much more noticeable than it would be with a more conventional light airplane. The leading edge of the Lazair wing is very smooth and relatively free of rivets. This, along with the super-smooth mylar covering makes the Lazair wing one of the most aerodynamically clean wings ever used on a sub-sonic airplane, and is one of the reasons a Lazair is able to outperform most microlights which have more than twice the power-to-weight ratio. However, with beads of water on the wing (and especially on the leading edge) much of the smoothness of the wing is destroyed and climb performance will be significantly reduced. A take-off roll three to four times as long is not uncommon if the wings are wet. You may also find that immediately after lift-off, the airplane will assume a mush attitude and refuse to climb until it reaches an airspeed of about twenty-five or thirty miles per hour and the water beads begin to disperse.

2.2 LONG GRASS

Taking off or landing in reasonably long grass (up to a foot high) is generally not a problem except for the obvious increase in the take-off roll. However, the real long stuff (one and a half to two feet) can get caught in the cables (you know - the ones' people keep walking into) and can put enough stress on the tail to bend T11 (the spreader) or even break F4 (the rear stabilizer attach fitting). This is not a common occurance but it has happened a couple of times and you should be aware of it. Any time you land in long grass (whether intentionally or otherwise) check your T11 and F4 before you take off again.

2.3 PRIMER BULBS

We have recently discovered that the major cause of those annoying air bubbles in the fuel line is the primer bulb. If you're having this problem, the best way to get rid of it is to get rid of the primer bulb. This obviously makes it more difficult to get fuel to the engines initially, but it should solve the bubble problem. If you want to retain the primer, be sure it is positioned so that the outlet end of the primer is lower than the inlet end. This will reduce the possibility of trapped air in the primer entering the fuel line to the engine.

2.4 SPARK PLUGS

Relative to the engines used on most other microlights, the engines on the Lazair have demonstrated excellent reliability. However, like any other two-stroke engine, they will refuse to run with fouled spark plugs. If an engine quits due to fuel starvation, it will usually cough and sputter a few times before it stops. If you notice an engine stop very suddenly with no warning, there's a high probability that the problem is due to a fouled plug. A small fibre of electrically conductive carbon, so small you can barely see it, can cause an engine to stop.

Although no one can guarantee you'll never have a fouled plug problem, there are several things you can do to reduce the possibility to a minimum.

(a) Do *not* use unleaded fuel.

(b) Use a good quality two-stroke oil in the gasoline. Although there are, no doubt, many good oils available, the one we recommend is Granberg (eutetic), mixed in a ratio of 100 to 1.

(c) Check and clean (if necessary) you plugs regularly. Once every five hours is recommended, but this can be altered, based on your own experience. Plugs may be cleaned with a wire brush or with a small sandblaster of the type available at most automotive accessory stores and catalogue outlets for about ten dollars. If you use one of these units, be sure you clean all the sand particles out of the plug before you re-install it. Regardless of how you clean your plugs, make certain you clean all the grit out of the threads and apply a bit of oil before you screw it into the head. Aluminum heads can be damaged very easily by an improperly inserted spark plug. An easy way to avoid wasting valuable flying time cleaning plugs is to keep one or two spare sets of plugs and rotate them periodically.

(d) Never turn the engine over with the spark plug lead off the spark plug, or with the spark plug incorrectly grounded as this could destroy your ignition module. This is a very costly mistake.

2.5 STRUT PLUG HOLE LOCATION

Make sure that the 1/4" holes in the lower strut plugs are drilled with the centre of the hole at least 1/2" from the end. If they are not contact Ultraflight or your local dealer.

Lazair™

TECHNICAL UPDATE

Distributed as a free service to all Lazair owners

Number 3 September '81

3.1 ROUTING OF MAGNETO WIRE

When you mount your engines and connect the magneto grounding wire (the one which runs back to the kill switch) make sure the wire is routed well away from the cylinder head. If it rests against the head, the insulation could melt, causing the wire to be grounded, and stop the engine.

3.2 ERROR IN AIRSPEED INDICATOR READING

If you read your copy of "Learning to Fly the Lazair" you're probably aware that the Hall Brothers airspeed indicator, when mounted on the fuselage of the Lazair, provides a good relative indication of airspeed, but does not give an accurate reading in miles per hour. At take-off speed, the reading is probably accurate within two or three miles per hour but at higher speeds, your actual airspeed will be much higher than indicated. With a reading of 40 mph, your actual airspeed will be probably about 55 mph, and this is the recommended maximum flying speed.

3.3 LEAKY FUEL FILTERS

As reported in a previous letter, most of the problems of air bubbles in the fuel lines have been traced to the primer bulb. However, we have had a couple reports of leaks in the fuel filter. To eliminate this potential problem, we recommend that the in-line filter be replaced with the submersible type.

3.4 AILERON PLUGS

One of our high time demonstrator aircraft has recently developed loose rivets in the aileron plug P4. This particular aileron had only four rivets in it rather than eight as specified in the assembly instructions, so we do not anticipate a problem on customer-built aircraft, but we do suggest that you check your aileron plugs occasionally during the walk-around.

3.5 DON'T DO IT IN THE ROCKS

Although the tail of the Lazair has been designed to withstand the loads imposed by normal and very heavy landings, it is <u>not</u> indestructible. We have had a report of one aircraft which was taking off from a rock-strewn field and struck the tail on a large rock at high speed just prior to take-off. The impact was sufficient to bend the rear stabilizer tube T10 and dislodge the outboard ruddervator hinge pin. Although the pilot was able to maintain control and land without incident, this situation should obviously be avoided if possible. If you have to take off from a rocky field, remember to keep the tail off the ground.

3.6 CHECK YOUR TAIL

In the last letter we mentioned the possibility of breaking the rear tail attach fitting (F4) by landing in very tall grass. Since it might be possible to break or crack an F4 without being aware of it, we suggest that you include a check of the F4 in your walk-around. The most probable location for a crack, if one should ever occur, is through the rivet hole, so this area should be checked carefully.

3.7 TIRE PRESSURE

If you're lucky enough to have the new tundra wheels, remember that they are designed for Low Pressure tires. The best tire pressure will depend on the type of field and the weight of the pilot, but should not under any circumstances, exceed 18 PSI.

3.8 BLUE MAGNETOS

A few of the engines shipped in the past couple of months have had magneto ignition units with a light blue housing. For some reason, these engines will not always run properly with the two magnetos connected to a common grounding switch. (We suspect that the older units contained a decoupling diode which has not been installed in the new blue ones, but this has not yet been confirmed by the manufacturer). In any case, the problem can be eliminated by using a separate switch for each engine (or by using a double pole switch). To save time, if you have the blue magneto units, we suggest that you obtain another switch locally, but if you can't locate one, let us know and we'll send you one.

3.9 AEROBATICS

We have heard recently that a few customers have been flying loops and other aerobatic maneuvers in their Lazairs. While there is no doubt that the Lazair is capable of executing some of these maneuvers (as demonstrated by the Ultraflight factory test pilots), this type of flying is definitely not recommended for the average Lazair pilot. The Lazair is stressed for 4 g's positive and 2 g's negative. This is quite adequate for any normal flying conditions but it is not even close to the stress requirements for fully aerobatic airplanes.

A properly executed inside loop will probably pull less than 3 g's. However, a poorly executed loop (one entered at too high an airspeed or with an abrupt movement on the control column or one with a prolonged period of vertically downward flight) could pull well in excess of the 4 g design limit for the aircraft. We don't want to hear about someone pulling the wings off in flight! Accidents of this type are very easy to avoid — just don't do it.

3.10 IN-FLIGHT RESTARTS

One of the attractive features of the Lazair is its ability to soar with the engines off, and then fly home with its engines restarted. However, restarting these engines in flight is a technique to be practised and learned only after the basic skills of flying the Lazair have been mastered. As was suggested in the first of these update letters, your first attempt to restart in flight should be made at an altitude of at least 1000 feet. It should also be made in an area where you can glide to a safe landing should your restart be unsuccessful.

Although a restart looks easy when you're on the ground watching someone else do it, you may find it's a bit different when you're up in the air trying it yourself. First of all, it's necessary to lean forward to grasp the pull cord — this can be a difficult reach for a short-armed pilot. Leaning forward will change the trim and put the aircraft into a nose down attitude. This can be compensated for by a slight back pressure on the stick, but applying back pressure as you lean forward may not be as easy at first as you might expect.

In addition to this, you will probably experience more difficulty starting the right engine because this requires operating the control column with your left hand. This is not necessarily easy — especially if you've never done it before.

Above all, remember one thing — Fly the Airplane. Regardless of what the engines are doing, your number one priority is to maintain some semblance of straight and level flight. When you're starting an engine, don't look at it — watch where you're going. And one other word of advice — don't forget to turn on the magneto switch. This may sound ridiculous, but even a very experienced pilot will forget occasionally. If you don't believe this, ask John Moody who couldn't get his engine started while demonstrating the restart capability of his Easy Riser to the crowds at Oshkosh this year.

3.11 MYLAR LIFE

The life expectancy of the mylar used to cover the Lazair is proving to be very difficult to predict. One of our demonstrators which has been hangared when not flying, has survived three years with no visible signs of deterioration, while two owners who have had their airplanes tied down in direct sunlight have reported mysterious rips in the mylar in the first year. One of these is believed to be the result of vandalism, but the other appears to be a degradation of the mylar caused by exposure to ultraviolet radiation from the sun. Another Lazair, which was left outside during most of last summer was tested for mylar deterioration by having a 180 pound man walk on the wing and it withstood this with no damage.

Obviously factors other than the duration of the exposure to sunlight will determine the life of the mylar — the intensity of the ultraviolet radiation (a function of latitude and atmospheric conditions) the angle of incidence, and perhaps even the manner in which the heat shrinking was done, could affect the longevity of the mylar.

Based on experience gathered to date, we can offer the following suggestions:

(a) Keep your airplane in a hangar or trailer when not in use.
(b) If a hangar is not available and disassembling your airplane to put it into a trailer after every flight is impractical, make some wing covers from vinyl or fabric.
(c) If your airplane is protected as suggested in (a) or (b) above, replace the mylar every two years.
(d) If your airplane is not protected from ultraviolet radiation, recover at least the top surface of the wing every year and the rest of the mylar every two years.
(e) Test the strength of the mylar occasionally by slapping it soundly with the flat of your hand.

Recovering your Lazair is relatively inexpensive and can easily be done in a weekend, so doing it every two years or even once a year should not be a serious burden.

3.12 CYLINDER HEAD BOLTS

We have received two reports of cylinder head bolts working loose. Considering the number of engines now in use and the total flight hours accumulated, two loose bolts would not indicate a serious problem but it does suggest that the bolts should be checked occasionally and should be re-torqued after the first five hours running time. The recommended torque is 8 foot pounds.

3.13 HOLEY MUFFLERS BATMAN!

Pilots flying Lazairs from high altitude airports can get a bit more thrust to compensate for the reduced air density by drilling four 3/8" diameter holes in the top of each muffler. This will increase the maximum propeller speed by approximately 150 RPM, but since it also produces a corresponding increase in noise, it is not recommended unless you're sure you need the extra thrust.

3.14 RE-USE OF ELASTIC STOPNUTS

Since elastic (or Nylock) nuts gradually lose their grip if they are repeatedly installed and removed, it is recommended that the nuts on the Lazair (N3 and N4) be replaced by new ones after they have been removed three times.

3.15 CUSTOMER DESIGNED MODIFICATIONS

We have seen and been told about many modifications being made to Lazairs. Some of these are good and some are not so good. The modifications which are of greatest concern are those which involve drilling holes in tubing. The bend strength of a tube is drastically reduced by drilling a hole through it — not just as a direct function of the reduction in cross section, but much more because of stress concentration.

There is also a considerable difference in bend strength depending on the location of the hole (whether it is on the neutral or quadrature axis). Unless you are very sure that you understand the effects of drilling a hole, don't do it.

Tubes where additional holes must <u>not</u> be drilled under any circumstances are the wing struts and the main axle. If you have already drilled holes in the 1 1/4" axle tube, and you're not planning to install the new wheel and and axle kit, let us know and we will send you a new 1 1/4" axle.* **

If you have one of the first fifty Lazairs (with the bicycle seat), there will be a hole through the centre of the axle for the seat support tube. Although there has never been a reported problem in this area, the safety factors for a high g flight or landing load are not as high as we would like after watching the way some Lazairs are flown. If you have a Lazair with the bicycle seat, please let us know and we will send you an inner sleeve** to strengthen the mid-section of the axle.

* Please specify the length.

** This part will be supplied at no charge, but will be F.O.B. Port Colborne, Ontario.

Lazair™

TECHNICAL UPDATE

Distributed as a free service to all Lazair owners

Number 4 December '81

4.1 LET IT SNOW -- BUT NOT ON YOUR LAZAIR

This winter we have received three reports of Lazairs, tied down outside, being damaged by snow loads. In each case, the weight of the snow caused a strut to buckle. In one incident, the buckled strut was the only damage, but in the other two, the wingtips and D-cells were damaged when the wing struck the ground.

We did a few measurements and calculations to determine how much load might be caused by snow on the wings. By weighing a plastic bucket full of snow, we arrived at a density of 13.3 pounds per cubic foot. This was done on a relatively warm day when the snow was quite dense, but there will no doubt be days when the snow density will be even higher. Using this measured value of 13.3, and a wing area of 142 square feet, a six inch snowfall would produce a snow weight of 944 pounds. Based on a gross weight of 340 pounds, this snow load would be the equivalent of -2.8 g's.

Hudson's "Engineer's Manual" gives the density of snow as 5 to 12 pounds per cubic foot, fresh fallen, and 15 to 50 pounds per cubic foot when wet or compacted. Using the upper limit, a layer of snow *just over an inch thick* could exceed the design limit of -2 g's. All of these calculations have assumed an equal load distribution over the length of the wingspan. For a snowload, this is a reasonable assumption, but normal flying loads tend to be more concentrated at the wing root and diminish toward the tip, so a snow load will tend to stress the strut more than a flying load of the same *average* value.

What does all this mean? *Don't leave your Lazair outside if there is a chance it might be snowed upon!!*

4.2 PINNED ROD ENDS

Several months ago we received a letter from a builder claiming that a BEP pinned rod end broke as he was tightening the nut. We pulled a random sample of twenty units from stock, did a torque test on them, and they all passed with no problems. For two months, there were no more reported BEP problems, and the first incident was chalked up to a "ham fisted mechanic". Then suddenly we received several reports of BEP's being broken during installation. These failures occurred shortly after we phased in a new batch of BEP's from the manufacturer, so we pulled another sample and discovered that about 90 percent of them could be broken if the nut were tightened to a torque of about 60 inch-pounds. We returned the whole batch to the manufacturer and they replaced it with another batch. We tested the new batch and obtained about the same yield as the batch we returned. We have now been told that the specified torque for these units is 50 inch-pounds and the breaking torque is about 54 inch-pounds. Based on experience to date, it is obvious that this is not a sufficient margin, so we have discontinued the use of this particular part. We are now manufacturing our own BEP's using a standard BE rod end with a specially machined 10-32 capscrew and a shoulder standoff. These units will withstand a torque in excess of that which would normally be applied during installation, and have been designed so that if the nut is overtightened, the standoff will yield before the capscrew, resulting in an inherently safe failure mode (with the rod end captivated on the capscrew).

We do not advocate arbitrary replacement of the previous style BEP's since those which do not break during installation will not break in service (there is a stress reduction in the BEP caused by cold flow of the F18/19 mixer plate). However, anyone ordering a BEP as a replacement part will receive the new design.

4.3 MYLAR WING COVERING

Since the last update, we have continued our efforts to extend the life expectancy of the covering material. The obvious solution is to use a mylar which has been treated with an ultraviolet inhibitor. We have tried several samples of UV inhibited mylar, but unfortunately, one of the steps in the UV treatment involves a flame heating process. This stress relieves the mylar and virtually eliminates its shrinkability. We have tried samples of many other materials (including Lexan which has recently become available in thin film form) but have not yet found a material which combines all of the required qualities (including strength, transparency, shrinkability and UV resistance). We are presently testing and evaluating many types of films including vinyl, acrylic, oriented polystyrene, Tyvek and Tedlar.

In addition to these, we will be looking at off-the-shelf and custom manufactured laminates which combine the properties of two or more materials.

Based on tests conducted to date, mylar still appears to be the best material for the application, and therefore we will continue to use it until we can prove that something else is better. In the meantime, we suggest that you follow the guidelines provided in Item 11 of Update Number 3, and check future Updates for new developments.

4.4 PUSHROD WEAR

Although no serious problems have been encountered, we have seen a couple of Lazairs with measurable wear on the 1/4 inch ruddervator pushrods (T26) where they pass through the F32 guides. The amount of wear does not seem to be a direct function of the time on the airframe, as the most wear seen to date was on an aircraft with only sixty hours on it, while our company demonstrators with several hundred hours on them show virtually no wear. One possible explanation is that dust or other airborne contaminants are trapped by the grease and act as an abrasive and/or corrosion accelerator. We are now considering the use of graphite as a lubricant rather than grease, but we have not had sufficient test time yet to make any firm recommendations on lubricants. However, we do recommend that the pushrods be checked for wear at least once every twenty flight hours. Since the pushrods are made from thick-wall tubing, they can tolerate a noticeable amount of wear without posing a serious problem. However, any pushrod which looks like it is worn should be checked with a micrometer or vernier caliper by measuring the diameter of the worn section and comparing it to the *measured* diameter in a section where there is no wear. If the difference exceeds .030 inches, the pushrod should be replaced.

4.5 KEEP YOUR TIPS UP

In the last update, we advised against making design changes in the Lazair unless you are qualified to predict the consequences of the changes. Since then, we have received a report of a situation which illustrates the point rather dramatically.

Most Lazair owners are probably used to having people ask why the wingtips are turned up rather than down (since the trend on many light airplanes is toward downturned wingtips). Downturned tips tend to increase lift, but since the Lazair was designed around a very high lift airfoil, the additional lift provided by downturned tips is not necessary. What *is* necessary, is a smooth airflow over the ailerons (to increase their effectiveness), and a force which will *lift* the leading wingtip if the aircraft tends to slip sideways.

One Lazair owner decided to redesign his aircraft by installing the wingtips upside down. Fortunately, he had the foresight to have the aircraft test flown by his local Ultraflight distributor who is a commercial pilot with a wealth of flying experience. During the initial phase of the test flight, while executing gentle maneuvers, everything appeared normal. However, after entering a turn with a very high angle of bank, the aircraft began to slip into the turn and refused to come out of it. Only by using every bit of his skill and knowledge was the pilot able to regain control, and in doing so, he lost nearly *four hundred feet* of altitude. This is exactly the same characteristic which was related to us at Oshkosh this summer by the owner of a Mirage (which, incidentally has downturned wingtips).

There is nothing in this world which is so perfect it cannot be improved — not even the Lazair — but the message should be clear. If you don't know what you're doing, don't change it!!

4.6 MOVING OR SELLING?

These technical updates can be important for the safe operation of your Lazair. If you change your address, please let us know so we may continue to keep you informed. Similarly, if you sell your Lazair, please be sure that either you or the purchaser fills in the change of ownership form so we may send the updates to the new owner.

CHANGE OF ADDRESS

ULTRAFLIGHT SALES LIMITED
P.O. BOX 370
PORT COLBORNE, ONTARIO
CANADA L3K 1B7

NAME ______________________ KIT NO. __________

NEW ADDRESS ______________________

____

____

____

CHANGE OF OWNERSHIP

ULTRAFLIGHT SALES LIMITED
P.O. BOX 370
PORT COLBORNE, ONTARIO
CANADA L3K 1B7

SELLER ______________________ KIT NO. __________

PURCHASER ______________________

ADDRESS ______________________

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DEALER (if known) ______________________

Lazair™

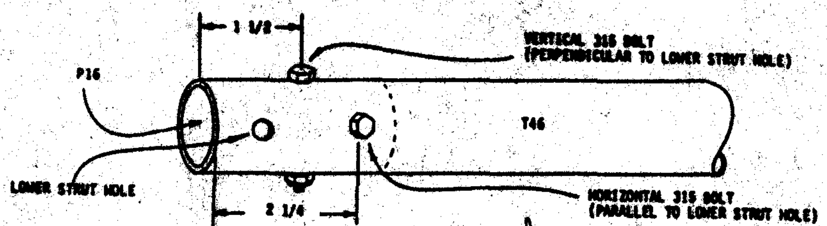
TECHNICAL UPDATE

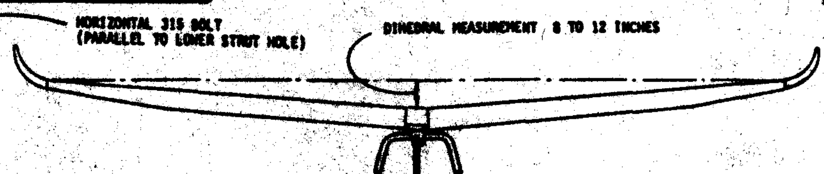
Distributed as a free service to all Lazair owners

Number 5 June '82

5.1 LOWER STRUT PLUG INSTALLATION

Early Lazairs (the ones with the spoked wheels) were designed so that the P16 strut plug extended beyond the end of the T27 strut tube. Later models (with the "Tundra Tires") have a larger diameter axle (which increases the spacing between the F6 gussets to 1 1/4 inches) and therefore the P16 must be installed so that it is flush with the end of the T46 strut tube. If you have one of the first few kits shipped after the changeover, your assembly instructions regarding the position of the P16 may have been somewhat ambiguous. Please check to make sure that your P16's are installed as shown below, and there are two 315 bolts in each strut plug (P17's as well as P16's). As a secondary check, you can measure the Dihedral by stretching a string between the top of the D-cells at the tips. The distance from the string to the top of the D-cell at the root should be between 8 and 12 inches.





If it is necessary to reposition your P16 plugs, it should be possible to do so without having to scrap either the strut or the plug. Wherever possible, use existing holes in the strut. Rotate the P16 and drill new holes in it as necessary. Make sure the center of the lower strut hole is at least 1/2 inch from the end of the strut.

5.2 TINY BUBBLES IN THE LINE

Now that we have eliminated the primer bulb, the in-line filter, and the tee fitting, the problem of bubbles in the fuel line should be gone forever — but now we have found a new source of bubbles — this one even more intriguing than the others.

After one of our factory demonstrators displayed some noticeable bubbles, we checked the fuel line for leaks and determined that there was no place where air could get into the line — this is the main advantage of the submersible fuel filter. Since the bubbles appear to emanate from within the fuel itself, it has been determined that the bubbles are not air, but vaporized fuel. The exact cause of these bubbles is difficult to determine, but it is believed that water in the fuel effectively plugs the filter. Then each time the diaphragm in the fuel pump is pulsed there is a momentary reduction in pressure in the fuel line. This reduction in pressure lasts for only a very small fraction of a second, but it is sufficient to cause a small amount of fuel to vaporize and form a tiny (almost invisible) bubble. These gradually merge to form larger bubbles as they migrate toward the carburetor.

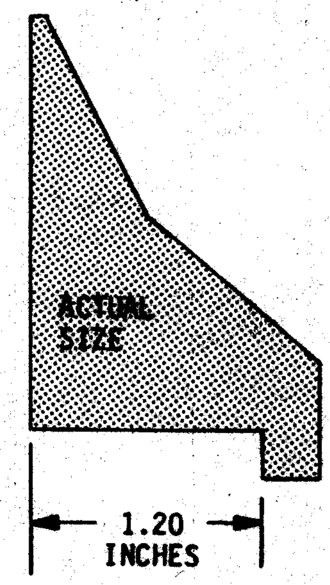
This theory has not been proven, but it has gained credibility from the fact that any time the problem has occured, it has been eliminated (completely) by removing the felt from the fuel filter and rolling and stretching it to get rid of the water.

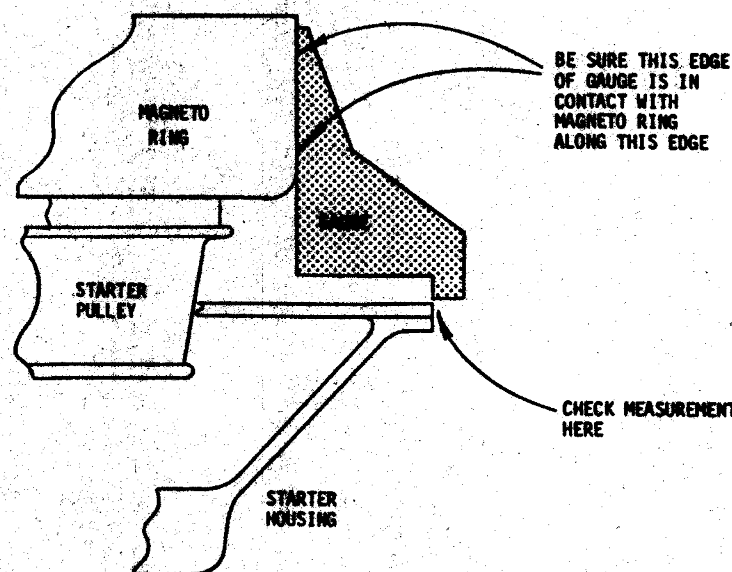
We are now investigating the use of other materials (such as a brass screen) to eliminate the felt filter. In the meantime, check your fuel lines for bubbles frequently while flying. Check your filter periodically (especially if you suspect there may be water in the fuel). Roll the felt between your hands, stretch it, compress it and then put it back on.

5.3 CENTERING OF STARTER ASSEMBLY

To prevent possible damage to the starter pulley on the rotax engine, it is essential that the starter pawl assembly be centered properly. If you remove the starter assembly from the engine or if the engine is removed from the engine mounting assembly, the starter assembly position should be checked after re-assembly as follows:

First, make a measuring gauge from thin sheet metal as shown. Use this gauge to check the radial spacing between the starter housing and the magneto ring. Check the spacing at four places (approximately equally spaced) around the circumference and make sure it does not vary more than plus or minus 1/32 of an inch. If necessary, loosen the 5/16 inch mounting bolts and re-position the engine on the mounts.



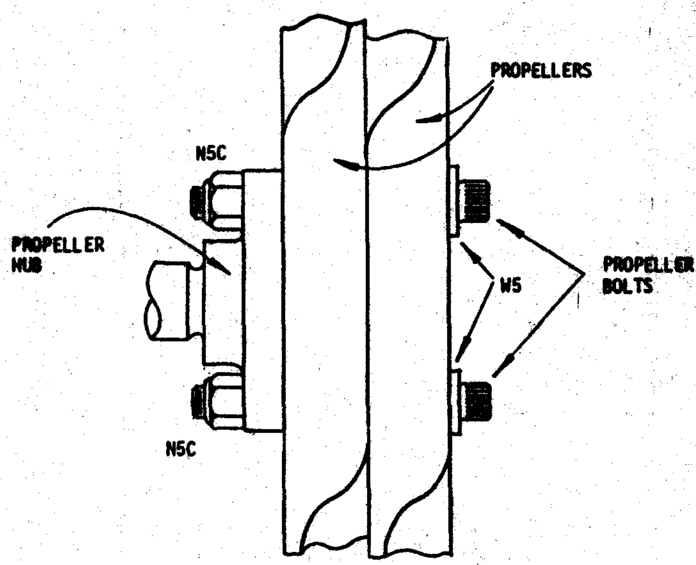


5.4 PROPELLER BOLTS

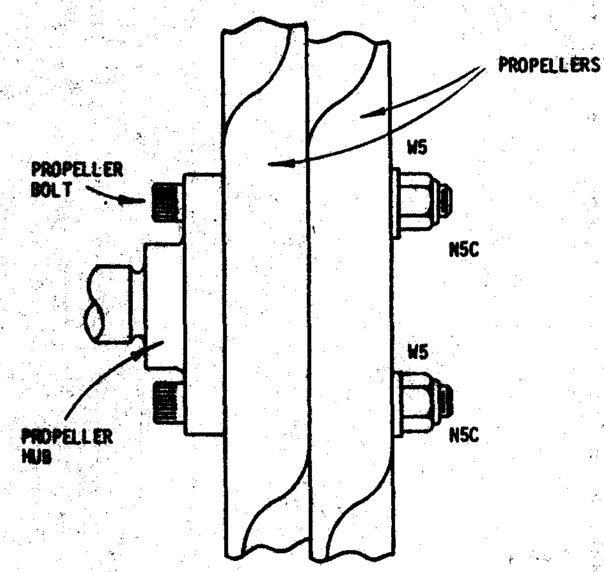
Since the introduction of the rotax engine in November '81 we have had three reports of broken propeller bolts. After examination, it was determined that one of these failures was a result of the engine being run for a considerable length of time with the propeller bolts loose. The other two resulted from the propeller bottoming on the crankshaft nut rather than seating properly on the hub. A special notice regarding this potential problem and a suggested method of checking the depth of the counterbore in the propeller was mailed to all owners of kits shipped prior to January '82 (those who we thought could have experienced this problem) but it appears that some of the notices either did not reach their destination or were ignored by their recipients.

Please check the installation of your propellers and ensure that they are properly seated on the propeller hub. The depth of the counterbore may be increased slightly if necessary to allow the propeller to fit properly against the hub.

To reduce the possibility of a bolt failure (even if a propeller is improperly installed) all kits shipped after May 17, 1982 have the bolts inserted through the hub in the opposite direction to that in the original configuration. To increase the margin of safety, it is recommended that owners of Lazairs shipped prior to May 17, 1982 reverse their propeller bolts as shown below.



ORIGINAL CONFIGURATION

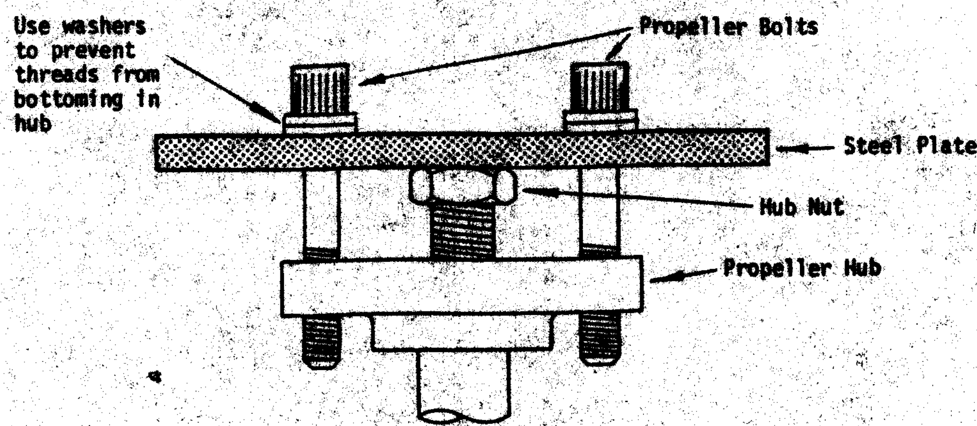


RECOMMENDED BOLT ORIENTATION

This requires drilling out the holes in the propeller hub to 5/16 inches diameter, and allows the part of the bolt which goes through the hub (where the stress is highest) to be the full diameter. As originally configured, the bolts were threaded into the propeller hub.

The threads on the bolt not only reduce the cross sectional area of the bolt by approximately forty percent, but they also introduce a stress concentration, which, under fatigue loads, can be as high as 2.7 to 1. By reversing the bolts, the threaded part of the bolt is moved from the area of maximum stress to the area of minimum stress.

To insert the bolts as recommended, it will be necessary to remove the propeller hub from the crankshaft. If you don't have a gear puller, the following method may be used: First, loosen the crankshaft nut and screw it off until it protrudes about 1/16 of an inch past the end of the crankshaft, then remove the propeller hub using a puller made from 1/4 inch steel and the two propeller bolts as shown. If you don't have a piece of steel handy, you can use one of your nacelle weights and drill a couple of 3/8 inch holes in it. Tighten the two bolts alternately, slowly and evenly until the hub breaks loose from the crankshaft. Tapping the puller where it fits over the end of the crankshaft, while you tighten the bolts, may help to loosen the hub.



When drilling the holes to 5/16" diameter, make sure the drill is perpendicular to the face of the hub. Make sure you put the bolts in the hub before you install the hub on the crankshaft.

To reinstall the propeller hub, make sure the taper on the crankshaft and the hole in the hub are absolutely clean and free of grease. Apply a small amount of Loctite 242 or similar locking compound, fit the hub onto the shaft and tighten the nut to a torque of 35 foot pounds. After the propellers are installed, the N5C propeller nuts should be tightened to a torque of 15 foot pounds.

5.5 UP YOUR CABLES

In update number 2 we discussed the problems of catching long grass in the cables. To alleviate this problem, all new Lazairs have the cables attached to the stabilizer at the end of the spreader (T11 or T11S) rather than at the lower (outboard) corner as was done originally. If you wish to modify your Lazair to move the cables up, it is a relatively easy change provided that you have access to a Nicopress tool and sleeves, since the cables must be shortened. If you can't locate a tool readily, check with your local EAA chapter.

5.6 RUDDERVATOR PUSHRODS

In a previous update (item 4.4, December '81) we reported on a potential wearing of the T26 pushrods where they pass through the F32 pushrod guides. To alleviate this situation, kits shipped in May and June of 1982 included a roll of 5421 or 5423 abrasion resistant tape. We have been flying factory demonstrators with this tape installed for over four months and have not encountered any difficulties. However, if the tape is not properly installed, or if it becomes damaged (by mishandling while assembling or trailering the aircraft) there is a possibility that it could come loose and get wedged in the F32 making it difficult to move the ruddervator pushrods. Although this has not happened, the possibility does exist. Therefore, if you have the tape on your aircraft, it is recommended that the tape be removed from the pushrods and discarded. If you received the tape with your kit, but have not installed it yet, don't.

5.7 D-CELL NOSERIBS

The owner of a highly modified Lazair reported recently that several of the foam noseribs inside his D-cell had moved out of position. This was one of the earlier kits with the .016 inch D-cell skin, (kits A192 and subsequent have a .020 inch D-cell skin) and was fitted with relatively heavy reduction units and very large propellers.

Although this is believed to be an isolated case, it is recommended that all owners check the position of their noseribs occasionally (especially in the area of the engine nacelles). This can be done easily by tapping along the top of the D-cell (about 4 inches ahead of the main spar) and listening for the ribs. There should be a rib every 4 inches. If you should ever get an indication that two or more adjacent ribs are out of position, drill out a few rivets so that the D-cell skin may be lifted sufficiently to look inside (with the aid of a flashlight). Any displaced ribs should be repositioned and bonded in place with panel adhesive. To avoid loosening the D-cell skin, remove only as many rivets as necessary and use tools made from coat hangers to fish the ribs into position.

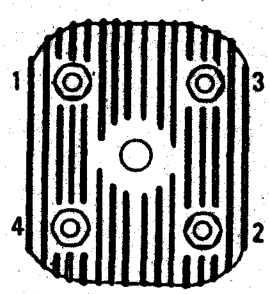
It should be noted that because of this possible problem, the use of Rotax engines on a Lazair with .016 inch leading edge skin is not recommended.

5.8 CARBURETOR STUDS

In spite of the fact that carburetor studs are installed with Loctite and the carburetors are attached with metal-to-metal shakeproof nuts, we have had three reports of carburetor studs or nuts working loose on the Rotax engines. While it is unlikely that this would ever cause a carburetor to fall off, it could become loose enough to cause an engine to stop. To lessen the chance of studs becoming loose, make sure the carburetor nuts are tight. They should be retightened after the first few taxi runs, before the first flight, and at least once every 20 flight hours thereafter. Tightening the carburetor nuts can be made much easier if you modify a 10 mm wrench by making a 45 degree bend in it about 1 1/2 inches from the (open) end.

5.9 CYLINDER HEAD NUTS

As with any engine, the head nuts on the Rotax engine should be re-torqued after the break-in period. It is recommended that this be done after taxiing and before the first flight. To avoid distorting the head, the nuts should be tightened in the sequence shown in the figure below.



When re-torquing the nuts, they should be torqued to 17 foot-pounds. If a head has been removed, or the nuts are very loose, tighten all the nuts to 5 foot pounds each (using the sequence above), then to 10 foot pounds, then to 17 foot pounds.

5.10 ADDITIONAL AIRFRAME CHECKS

NOTE: In May 1982 a completely revised Lazair assembly manual was introduced. For the benefit of those owners having earlier revisions of the manual, some selected paragraphs from the new manual are reprinted below. If you have completed your Lazair, you may wish to check the items listed below, but note that this information is provided as a guide only. If you are satisfied with the way your aircraft flies, it is not necessary to make changes based on these checks, however, you might find the information useful if you plan to make any other changes.

5.10.1 BALANCE (CENTRE-OF-GRAVITY) CHECK

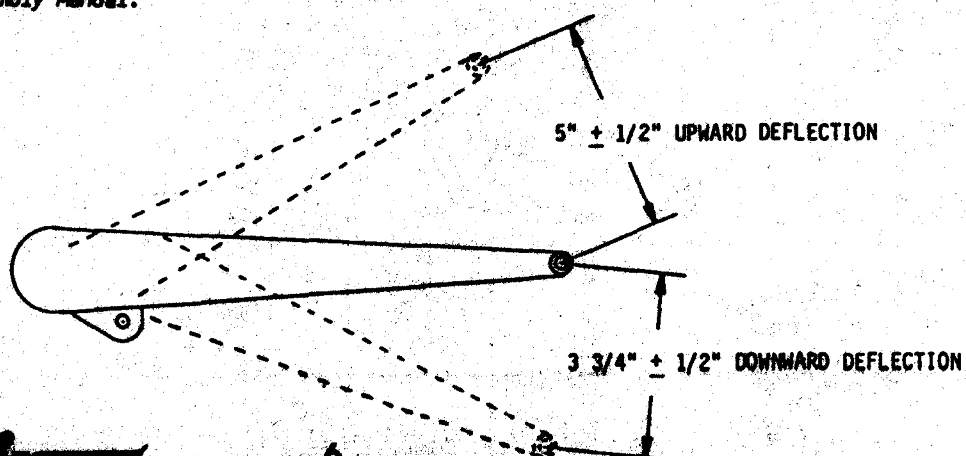
Flight testing has shown that the Lazair is very tolerant of changes to the position of the centre-of-gravity. However, for comfortable hands-off flying at a reasonable airspeed, and for assurance that there is no gross error affecting the centre-of-gravity, the check outlined below is recommended with the centre-of-gravity 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 pilot's feet, or even the type of shoes he is wearing. Minor in-flight adjustments to the position of the centre-of-gravity 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). Hold the aircraft in this position with a bathroom scale under the spreader (T11S). The reading on the scale should be between 1 and 5 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 flying the aircraft and adjusting the centre-of-gravity for hands-off trim at the power setting and airspeed preferred by the pilot.

5.10.2 AILERON DEFLECTION CHECK

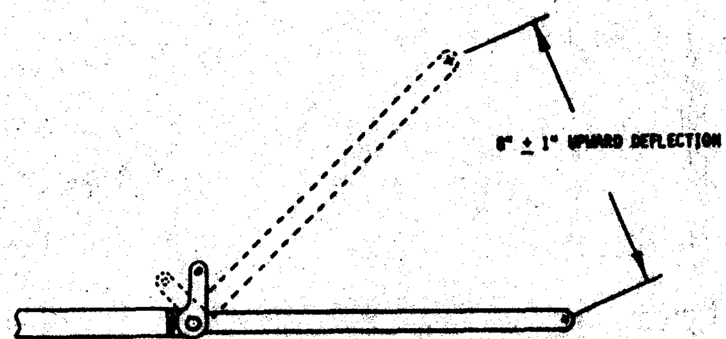
Move the stick as far as possible to the right, making sure it is neutral fore and aft. Check that the aileron deflection is within the limits shown in the figure. Move the stick as far as possible to the left and check the aileron deflection. Aileron travel may be adjusted by removing or inserting washers as described in the Assembly Manual.



5.10.3 RUDDERVATOR DEFLECTION CHECK

Push the stick forward as far as possible. The downward deflection of the ruddervators should be such that they almost touch each other. Adjust the length of pushrod T18 as required to achieve the correct downward deflection.

Pull the stick back as far as possible. The upward deflection of the ruddervator (from the neutral position) should be within the limits shown. Adjust the stop on the control stick as required to obtain the correct upward ruddervator deflection. If the stop is moved, be sure to recheck the downward travel and readjust if necessary.



5.11 AILERON BELLCRANK CLEARANCE

Please check the clearance between the 35 bolt holding the BE rodend to your F39 aileron bellcrank (F39) and the spar cap (reference drawing G in the parts catalog). Although we have seen a problem in this area, a worst-case tolerance buildup plus a slight error in locating the bellcrank mount F38 could possibly combine to cause the bolt to foul on the spar cap. If necessary, the spar cap should be bent slightly to provide sufficient clearance.

5.12 FUEL TANK STRAP ROUTING

When the large (20 litre) fuel tank was introduced, the assembly manual indicated that the rubber strap holding the tank in position should be routed over the top of the tank and beside the large cap. As most owners have already realized, an extra measure of safety can be obtained by routing the strap through the handle on the fuel tank before hooking it onto the T22's.

5.13 FUEL TANK SUPPORT RIVETS

We have had one report of loose rivets on a fuel tank support angle (where it is riveted to the T22's), after a series of hard landings. As a minimum, these rivets should be checked on your walkaround, and it is recommended that they be removed and replaced by stainless steel rivets. On older models, the rivets would be those in F29 and F30. On newer models, (with the 20 litre fuel tank) this would be G62. On newer models, it is also recommended that the bottom three rivets attaching the fuel tank saddle, G63, to the seat back, be replaced by stainless steel as an added precaution.

5.14 NACELLE MOUNTING BOLTS

After three years of production and hundreds of Lazairs flying all over the world, there was never a report of nacelle mounting bolts working loose in flight.......until last week when we were told of two such instances. Fortunately, the remaining bolts held the engines on the wing, but the possibility of an engine falling off is obviously somewhat disconcerting. Since the mounting bolts are threaded into nutplates with an elastic stopnut feature, the bolts should stay in place unless something degrades the gripping action of the stopnut. Although the grip can be reduced slightly with repeated insertion and removal of the bolt, other factors such as the presence of grease or oil are probably more significant.

To make sure your bolts don't work loose, it is recommended that they be lockwired. This may be done by replacing them with drilled-head bolts (type AN3H5A and AN3H6A) or by drilling a small hole through the heads for the lockwire.

Lazair™

TECHNICAL UPDATE

Distributed as a free service to all Lazair owners

Number 6 September '82

PLEASE NOTE: These Technical Updates are provided to all Lazair owners as a free service in the interest of safety. If you know of a Lazair™ owner who is not on our mailing list and is not receiving these updates, please let us know. If you change your address or sell your Lazair™, please use the forms supplied in Update 4 (December '81) to keep us informed.

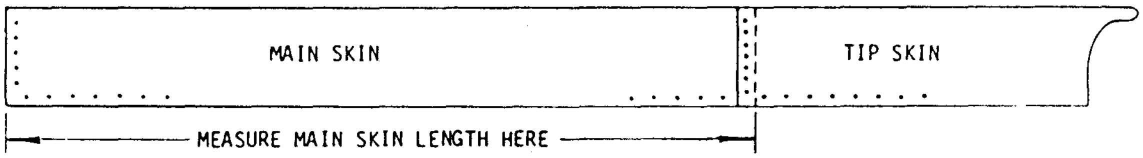
However, distributing this information is not sufficient. The recommendations in these updates must be acted upon before they can be of any benefit. For your own safety as well as the safety of those around you, please take the time to make the recommended changes to your aircraft. In the past six weeks we have had three engines sent to us for service. Not one of them had the propeller bolts installed as recommended in update 5, item 5.4. Please read these updates carefully and make the recommended inspections and/or changes which apply to your Lazair™.

6.1 D-CELL SPLICE

As you are probably aware, the D-Cell skin is comprised of two sections - a main skin and a tip skin. During final inspection of a batch of D-Cells recently, we discovered one which did not have sufficient overlap at the junction of the main skin and the tip skin to allow the proper edge distance for the rivets. Although it is unlikely that any D-Cells were shipped with this defect, please check yours as described below. Since the outboard end of the main skin is covered by the tip skin, if the problem does exist, it will not be obvious and must be checked carefully.

To check the edge distance for the rivets, it is necessary to know the position of the outboard edge of the main skin. To locate this edge, look at the trailing edge of the bottom of the D-Cell. By looking inside, you should be able to see the outboard edge of the main skin. Put a mark on the outside of the tip skin at this point and measure the distance from this mark to the inboard edge of the main skin (so you know the exact length of the main skin). Then transfer this measurement to the leading edge of the D-Cell. You can now draw a line on the tip skin showing the exact location of the edge of the main skin. To achieve the correct edge distance, the rivets should be located so that the centre of the rivet hole is at least 1/4 of an inch from the edge of the skin. If necessary, install additional rivets (with the required edge distance) between the existing rivets.

If the overlap on your D-Cell is insufficient to permit the required edge distance, please contact your dealer or the factory and we will make up a special splicing kit for your D-Cell(s) and ship it to you at no charge.



6.2 KEEP YOUR ASI COOL

Although the Hall brothers airspeed indicators are surviving quite well on the aircraft, we have had two reports of ASI's becoming so hot that they actually bent slightly and were no longer useable after being left in the rear window of a car.

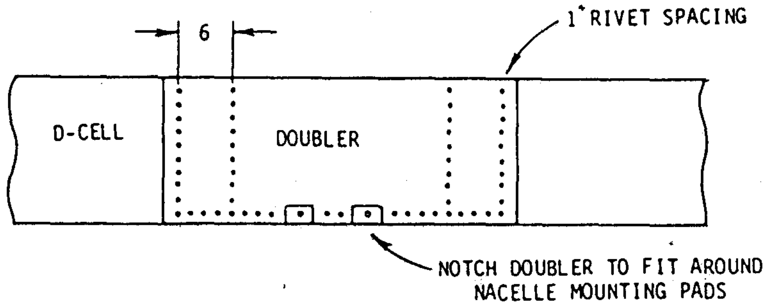
6.6 PROTECT YOUR TAPE

All new Lazairs and many older ones are now being covered in Tedlar. While the operating life of the Tedlar is expected to be many times that of Mylar, the life of the adhesives used on the tapes has not been precisely determined. To obtain the maximum life from the tapes, it is recommended that all tape be protected from ultraviolet exposure. This can be done in several ways. If you intend to paint your Tedlar, then the paint will afford some ultraviolet protection but the degree of that protection will depend on the particular type of pigment used in the paint. Aluminum paint works best and it is therefore recommended that the tapes be painted over with aluminum paint (regardless of whether or not the balance of the Tedlar is painted). As an alternative, the tapes holding the Tedlar in place may be covered by a metalized tape (such as type 850-PAU, available from your local 3M distributor). In addition to providing ultraviolet protection, this tape creates a very neat, clean appearance, especially when used over the foam tape on the ribs.

6.7 ROTAX ENGINES ON .016 INCH D-CELLS

In Update 5, item 5.7 we stated that the use of Rotax engines on Lazair™s with .016 inch leading edge skins was not recommended. This statement was not based on any particular experience, but rather on a lack of experience. At that time, we had one demonstrator flying with this combination, but we did not have sufficient time on it to evaluate the results. Since then, our demonstrator has continued to perform well, however, one dealer who installed Rotax engines on .016 inch D-Cells reported that one of his D-Cells acquired a slight buckle just inboard of the Nacelle when he shut down the engines and one of them backfired. Based on this, we are obviously not recommending the installation of the larger engines on the lighter D-Cells.

However, for those who have already made the conversion and those who probably will (in spite of our recommendations), we suggest that, as a minimum, you rivet on a two foot wide doubler of .020 2024-T3 aluminum alloy over the leading edge of the D-Cells under the Nacelles.



6.8 AXLE GUSSETS FOR RUDDER PEDALS

In the assembly manual for the rudder pedal kit, there is a reminder that when one rudder pedal is pushed down, the other one must come up, and therefore you should not attempt to push on both pedals simultaneously. However, for whatever reason, people do occasionaly push down on both pedals. While reasonable pedal pressure does not cause a problem, excessive force will bend the two 323 bolts which hold the nosewheel axle to the side tubes. To alleviate this problem, we are now including with the rudder pedal kits two small gussets (G76) to help support the axle. If you have an earlier rudder pedal kit and wish to add these gussets, you can make them yourself from two strips of aluminum alloy .040 to .080 inches thick, 1/2 inch wide and 6 inches long. Bend and install the gussets as shown.

aluminum device which mates with the pawls - not the sheave on which the rope is wound). The shape and location of the wear pattern indicates that the pawls are vibrating in synch with the engine, but vibration testing with an amplitude of 10g's over a frequency range of 10 to 100 Hz. failed to detect any resonances. Changing the rate of the pawl springs and adding rubber damping seems to reduce the problem a bit, but not to an acceptable level. Evaluating a potential solution to this type of a problem is very time consuming, because although we have had a few starters show signs of wear in the first 20 hours, most will last 80 to 100 hours before exhibiting any indication of a problem, and it can take this much running time to determine if any improvement has been made.

After several weeks of changing, testing, and evaluating we have reached the conclusion that the only way to get rid of the problems in the Rotax starter is to get rid of the Rotax starter. A survey of manufacturers and small engine mechanics indicated that the most reliable recoil starter in common use is a relatively cheap and simple unit made by Tecumseh. We have several of these starters undergoing testing at present, and so far the results have been excellent. If this starter proves to have the reliability we expect, it will soon become standard on all of our Rotax engines. In addition to improved reliability, this starter also provides a couple of other advantages: it has a larger sheave which makes it much easier to pull when starting the engine, and the overall size is smaller than the Rotax. This allows us to use a simpler smaller engine mount which will accept a close fitting molded engine cowl to reduce drag and improve the appearance. The proposed mounting system will use the same rubber mounts and mounting pattern as we have used since late January 1982 (four mounts on top and two on the bottom) so retrofitting the new starters should be relatively easy.

For those who wish to repair the Rotax starters when necessary, we will be stocking parts. For those who would like to convert to the new starter, we will make a retrofit kit available as soon as the test program is complete and the necessary parts are made. All dealers and distributors will be notified as soon as these retrofit kits are available. As a service to customers, these kits will be sold at our cost, and the usual manufacturer and dealer mark-up will not be applied (when the kits are purchased to replace Rotax starters).

6.13 ENGINE MOUNT ANGLES

We have received two reports of broken G42 engine mount angles (these are the large brackets which are bolted directly to the crankcase). Although this represents less than 0.2% of the mounting brackets in use and therefore does not indicate a trend, a careful inspection of these brackets should be included in your normal pre-flight walkround. Since we will probably be changing to a different type of mount to accomodate the new recoil starter, we expect to have a few surplus mount angles which we could supply at no charge to anyone who returns a broken one.

6.14 WARRANTY CLAIM FORMS

Enclosed with this technical update is a copy of the standard Ultraflight warranty claim form. Even though the warranty period on your kit may have expired, we would apreciate it if you would report any component failures on this form. This will assist us in assessing any potential problem areas so that we may continue to keep all owners informed.

6.15 STABILIZER ATTACHMENT

Approximately a year ago we investigated a potential problem of broken F32 pushrod guides causing the leading edge of the stabilizer to become detached from the boom. At that time, it was determined that it would be necessary to break two F32 fittings to cause a problem, and even if this did happen, the stabilizer would be held in position by the T26 pushrods to permit a safe emergency landing. This conclusion was substantiated by structural testing on the ground, flight testing, and field reports.

Lazair™

TECHNICAL UPDATE

Distributed as a free service to all Lazair owners

Number 7 March '83

7.1 CHECK YOUR NOSEWHEEL AXLE

While doing some modifications to one of our demonstrators recently we noticed a considerable amount of wear on the nosewheel axle. This particular aircraft had made many beach landings last summer and it is probable that much of the wear was caused by sand in the nosewheel bushings. While a worn nosewheel axle might not seem like a serious problem, it could be serious on a Lazair™ equipped with rudder pedals. If the axle is worn sufficiently, to cause an appreciable stress concentration, applying pressure to both rudder pedals simultaneously could cause the axle to fracture and result in the loss of rudder pedal control. This has not happened, and it is unlikely that it ever will, but your nosewheel axle should be checked for wear at least after every 50 hours of flying time, and replaced if necessary. If you land and take off in sandy areas, the checks should be made more frequently.

7.2 PIONEER CYLINDER HEADS

In an early notice to customers (before we began distributing these "green sheets"), owners of Pioneer powered Lazairs were advised that some of the Pioneer engines had developed cracks in the cylinder head. Since there are a few of the early Lazairs still flying with Pioneer engines, this information is provided again. The earlier Pioneer engines seem to be most susceptible to this problem, although many have flown several hundred hours without difficulty. The second generation of Pioneer heads incorporated a vertical web between the cooling fins directly behind the decompressor boss. While this did not eliminate the problem completely, it certainly reduced it. The people at Pioneer suggested that some of the problems may have been caused by a leaky decompressor which can cause a hot spot in the cylinder head and therefore contribute to the cracking. By replacing the decompressor with a suitable length 5/16UNF bolt and gasket, this potential problem can be eliminated. These engines are small enough to make the decompressor unnecessary for starting. However, the most probable cause of this problem is insufficient lubrication which causes the head to overheat. As with all two-stroke engines, the Pioneer must be run with a rich fuel mixture. A mixture which is too lean can result in serious damage. When adjusting the high speed mixture screw on the carburetor, it should be turned in until the engine just begins to slow down, then the screw should be backed out one quarter to one half a turn.

7.3 "CLEAR THE PROP!"

Propellers are dangerous. Propellers can be lethal! Aside from the obvious discomfort if you should inadvertently stick your finger (or your head) into a spinning propeller, you should be aware that any propeller regardless of its material or method of manufacture could possibly break. While the statistical probability of any particular propeller breaking is very low, it is nonetheless, possible. The tensile stress in a spinning propeller can be very high. The acceleration at the tip of a 30 inch diameter prop turning at 6,000 RPM is over 15,000 g's. No, that's not a misprint, it really is fifteen thousand g's. This means that an imbalance of only one tenth of an ounce at the tip of the prop would produce a force of almost a hundred pounds pulling the prop shaft, first one direction, then, 5 milliseconds later, in the

Lazair™

TECHNICAL UPDATE

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Number 8 August '83

8.1 SPINNER MOUNTING FLANGES

We have had several reports of fatigue failures in the spun aluminum flange (F81) used for mounting spinners. Although this may not be a serious problem if it is noticed on a preflight inspection and corrected, we have had a report of a pilot receiving a foot injury when the whole spinner broke loose and flew off. While part of the problem may be due to an absence of loctite on the screws securing the spinner, or an improperly centered spinner, these are not likely the sole causes. Mounting flanges which have a larger bend radius appear to be better but not totally immune to fatigue problems. Newer propellers have a large area on the rear surface machined to fit onto the mounting flange, but some of the older propellers may have some slight interference with the flange from the trailing edge of the blade and this should be filed as necessary to avoid distorting the flange. We are presently running endurance tests with a new design of flange. When the testing is complete, the new flanges will be made available at no charge to all owners who return the original ones. In the meantime, it is strongly recommended that all spinners and mounting flanges be removed. Until new flanges are available, you can fly without spinners --- it doesn't look as good, but the difference in performance isn't noticeable.

8.2 TAPE ADHESION

In the past five months we have had four reports of loosening of Tedlar covering, apparently due to poor tape adhesion. As the reports are all quite different, there is no indication of any one particular problem, and therefore determining the cause (and remedy) is not easy. However, based on the information we have available, we can make the following suggestions.

(a) Avoid overheating the tape (and the Tedlar) when heat shrinking. As stated in the manual, overheating the tape will cause it to shrink excessively and will lift it at the edges. It is also probable that excessive heat will have an adverse effect on the adhesive. Overheating the Tedlar will cause it to shrink excessively and could tend to pull it away from the tape.

(b) When cleaning the aluminum prior to the application of the tape (whether on a new aircraft or when recovering) use only lacquer thinner as suggested in the assembly manual. There is some indication (but no proof) that the use of acetone for cleaning the aluminum may effect the acrylic adhesive on the tape. Do not use metal cleaners (such as Met-All, Nev-R-Dull, Flitz etc.) as many of these are designed to apply a protective coating as well as clean the metal. These coatings (especially the ones which contain silicones) can severely impede tape adhesion.

(c) Make sure there is sufficient overlap of tape on the aluminum (as described in the assembly manual), especially along the D-cell and along the root rib. If in doubt, additional tape should be applied with at least 3/4 of an inch in contact with the aluminum.

(d) If there is any indication of inadequate adhesion around the perimeter of the Tedlar, some of the wide single face tape could be removed and replaced, or additional tape could be applied as in (c) above.

(e) Lack of adhesion of the foam tape on the ribs, while not a common problem, could be a bit more difficult to fix. We have only seen this problem once, and the effected area was so small, it was just left (though watched closely) and the condition has not worsened. If you should ever encounter this situation (and assuming you don't wish to recover the wing), you could rivet an additional aluminum capstrip to the affected ribs on the outside of the covering (similar to C4 on the wingtip). However, if you do this, be sure to put at least one layer of 1 1/2" or 2" tape over the Tedlar before the capstrip is put on and use double face tape under the capstrip. Be sure to file or sand the edges of the capstrip so they do not cut into the covering. In any case, do not (as one customer suggested) attempt to rib stitch the Tedlar. Rib stitching a non rip-stopped material could potentially create many more problems than it could cure. While the additional capstrip suggested above does necessitate drilling rivet holes through the covering, the stress on the covering is distributed by the relatively large area of the capstrip. If rib stitching were used, the stress would be much higher due to the small diameter of the rib cord.

(f) If you paint your Tedlar and/or tape, use a light colour. There is some indication that if it is painted a dark colour and left in direct sunlight for a prolonged period, the covering may tend to creep under the tape due to the extremely high temperature developed.

(g) To check for overshrinkage on your wings, put a straightedge on the trailing edge and measure the deflection of the T25 trailing edge tube between each pair of ribs. A deflection of one sixteenth of an inch is about right. An eighth of an inch is excessive but acceptable. A quarter of an inch deflection indicates that the particular panel has been overshrunk. The covering and tape on that particular panel should be inspected and watched very carefully or replaced.

(h) An inspection of the covering and tape should be included in every preflight.

The following two paragraphs have been added to the assembly manual, and should be observed if you recover your Lazair™:

"As with most acrylic adhesives, the initial tack with this tape is only moderate, but the adhesion improves as it ages. For this reason, it is essential that the tape be firmly pressed down to make sure there is 100 percent initial contact. Then, as the adhesive cures, a proper bond will develop."

"Unlike Mylar and most other heat shrinkable covering materials, Teldar will continue to shrink significantly after the heat source has been removed. Therefore, to avoid overheating the Tedlar, apply the heat for a few seconds, then remove it and check for signs of shrinkage. If there is no indication, heat it a bit longer, then remove the heat and check again for shrinkage. As the heating period is increased, you will find the correct exposure so most of the shrinkage will occur after the heat source has been removed. If the heat is maintained on the Tedlar for a significant period of time after it begins to shrink, it is possible to overheat the material and reduce the adhesion of the tape."

8.3 ENGINE INSPECTIONS

We have received one report of a Rotax engine stoppage because the small wire between the magneto coil and the condenser was routed improperly and contacted the rotating flywheel. Although this is an unlikely

situation, we will be checking all engines before they are shipped to ensure that the wire routing is correct. Engines in the field can be checked quite easily if the engine is removed from the nacelle. The flywheel does not have to be removed since it has cutouts through which the wiring may be inspected.
We also know of two engines which made rather ominous noises when the crankshaft was rotated because the polefaces on the lighting coil were rubbing on the flywheel, so it might be wise to also check that the two screws securing the lighting coil are tight. This can also be done without removing the flywheel.

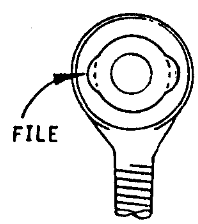
8.4 COMPRESSION RELEASE

We recently received the second report of an engine being damaged because it ingested the valve stem from the compression release. To preclude the possibility of this happening on one of your engines, we suggest you pry off the little green plastic cap and inspect the quality of the riveting which holds the aluminum button onto the valve stem. If there is any sign of weakening or bad riveting, the compression release should be replaced. The plastic cap is not required and may be left off to permit a check of the compression release in every preflight inspection.

8.5 RUDDERVATOR PUSHROD ROTATION

Item 6.16 in an earlier Tech Update described a problem where the BE rodends tend to rotate in the P3 plugs during cross control of rudder and aileron. This problem has been eliminated on the Series III Lazair™ by the use of a totally different control linkage, but if you have one of the earlier models with rudder pedals, you can make two relatively simple changes. First, replace the large diameter S675 spacers supplied with the earlier kits with the small diameter S344 spacers used on the Series III kits (with W3H washers added to make up the required length).

Secondly, the allowable rotation of the ball can be increased by inserting a 3/16 inch diameter chainsaw file through the pinhole in the ball and carefully filing out a small section of the ball retainer as shown. Only a very small amount of metal needs to be removed, so don't file away any more than necessary.



8.6 FUEL FILTERS

That little white plastic cover on the bottom of the carburetor on the Rotax engines contains a small filter screen. This should be removed and inspected (and cleaned if necessary) after the first few hours and every 50 hours thereafter to verify that the fuel filter in the tank is doing its job.

The problem with the felt fuel filters described in Tech Update Item 5.2 appears to have been eliminated by the elimination of the felt fuel filters. The newer kits are supplied with an all metal screen-type filter.

8.7 AXLE WEAR

If you're still flying one of the very early Lazair™s (the ones with the spoked wheels) you should pull the wheels off at least once every 50 hours and check the 4130 steel axle tubes for any indication of rust, wear or any other condition which could lead to failure. We have had two reports of axle breakage resulting in a sudden and extreme increase in dihedral. In one case, the airframe had been highly modified by a previous owner and the steel axle had been replaced by a small diameter aluminum rod with a cross-drilled hole in it prior to the failure. The other one, however, appears to be a failure of the original axle tube caused by wear as a result of a wheel bearing seizure. In lieu of the frequent disassembly and inspection, the axle could be replaced by the later double wall large diameter aluminum one with the tundra wheels, or a 1/8 inch stainless steel cable could be installed to keep the A-frame from spreading in the event of an axle failure.

8.8 ROTAX HEAD GASKETS

There is an indication that the head gaskets on the Rotax engines may compress unevenly if the head nuts are repeatedly retorqued, and this could eventually result in a cracked cylinder head. Retorquing the heads once or twice during the first few hours of operation is not uncommon, but if you find it necessary to retorque the head 3 or 4 times, it is strongly recommended that you replace the head gasket. The recommended tightening sequence and torque value are given in Tech Update Item 5.9.

8.9 SWITCH CONNECTOR INSULATION

The following note regarding the terminals on the magneto switches has been added to Step 8.2.10 in the latest revision of the assembly manual. Please check this on your Lazair™ and make the recommended change if necessary. "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." A short piece of fuel line slipped over each terminal can provide additional protection against accidental grounding of the magneto wire.

8.10 OIL FOR YOUR ROTAX

In the operating manual provided with Rotax powered Lazair™ kits, we recommend the use of mineral based two cycle oil mixed in a ratio of 25 to 1, and do not recommend the use of synthetic lubricants which are usually mixed in much lower concentrations. This advice is based on information supplied by the engine manufacturer, on our own testing and experience, and on feedback from customers. Although some owners have been using synthetics for a considerable length of time with apparently no problems, others have reported mysterious power losses and incipient seizures believed to be a result of inadequate lubrication.

8.11 GROUND ADJUSTABLE PROPELLERS

Although most Lazair™ owners are familiar with the situation regarding the ground adjustable props, the following is provided for the information of those who may have heard only half of the story.

Following over a year and a half of development, we finally began shipping our composite blade ground adjsutable propellers in June of 1983. In mid July we received a call from a customer who described in vivid detail what happened when one of his propeller blades separated in flight. Because of the very real danger presented by this situation (and because there was nothing obviously different about his propeller which could explain why it failed and the others with hundreds of hours on them did not) the decision was made to initiate a 100 percent recall of all the ground adjustable propellers. This decision was not made easily, but it was made quickly and every Lazair™ owner who had been shipped this propeller was personally phoned and asked to return the propeller (or part of it) to the factory. Customers who had received the ground adjustable props in their Series III kis were sent the proven carbon fibre biblade props as replacements, and customers who had purchased the ground adjustable props for retrofit were offered a cash refund. As you might imagine, the cost of this decision was substantial. Including the development costs incurred during the past year and a half, the cost of tooling, the production costs of the propellers which have now been destroyed, the cost of the replacement biblade props, and administrative costs associated with the recall, the bill came to over forty three thousand dollars. While this may seem like a small price to pay if it can avoid a serious accident, it is not an insignificant amount to a company the size of Ultraflight (sometimes we like to think big, but we're not exactly General Motors). It should be noted that the incident mentioned above was the first (and the only) blade separation on one of our production ground adjustable propellers. The recall was issued not because we felt there was a high probability of a second occurrence, but because the possible consequences of a failure are so severe. A failure of a wooden prop or even a small composite prop like our biblades can be frightening and is certainly not without danger, but there is usually enough propeller left after the failure to limit the unbalance to some degree. However, when the ground adjustable blade separated, one whole blade came off, resulting in a horrendous unbalance --- sufficient to tear the engine off its mounts, rip off both ground cables (which are rated at 600 pounds each in tension) and pull out the magneto wire so the engine could not be switched off. Only the throttle cable was left to support the engine and this served only to allow the engine to flail around like a guillotine on a string. Fortunately, the pilot, who has had many years of flying experience, was able to retain his composure, control the aircraft and shut off the engine with the choke, and he was able to land safely. However, if you can visualize yourself in this situation, you might understand why we took the only action which could positively prevent a recurrence. The reaction to the recall has, for the most part, been quite good. Almost every owner agreed to follow our instructions and stop using the propellers. Many even said "Thanks for telling me". However, two individuals have resisted our attempts to dissuade them and are continuing to fly with the ground adjustable props. We care about your safety. We care enough to spend that forty three thousand dollars to help preserve it. If you don't care, there may not be much we can do about it --- but we will continue to try. In the meantime, we are investigating other avenues to try to get a bit more efficiency out of the propulsion system. Many wooden props of various shapes, lengths and pitches have been tested and while some are certainly satisfactory, none has been outstanding, and so far not one has been able to match the thrust-to-noise ratio which was obtained with the ill-fated ground adjustable prop. However, our efforts are continuing and as improvements are made, you will be notified.

Lazair™

TECHNICAL UPDATE

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Number 9 December '83

9.1 MORE ON TAPE

In Technical Update Item 8.2, we described a problem of inadequate tape adhesion and suggested some possible causes and solutions. As the problem has been isolated, not just to a few aircraft, but to a few small areas on those aircraft, it is difficult to find a common denominator. Samples of covering and tape from one aircraft showed excellent adhesion just a few inches away from a small area where the adhesion was unsatisfactory. This suggests a fault in the adhesive (although this appears unlikely in view of the previous statement) or, more probably, inadequate pressure when the tape was applied, or perhaps insufficient or improper cleaning of the material before the tape was applied. Regardless of the cause, our greatest concern is that a small area of poor adhesion might remain undetected by a cursory preflight inspection. Even though the probability of an undetected adhesion problem may be slight, we strongly recommend double taping the Tedlar® on the leading edge of the wing to lessen any chance of an undetected problem. To make this as financially painless as we can (and thereby encourage owners to adopt the recommendation) we are prepared to provide each owner with one 90 foot roll of 2.6 inch wide Tedlar tape, with instructions for proper application, at a special reduced price of $15.00 CDN ($13.00 U.S.), post paid, with a limit of one roll per aircraft. Please note that this is not just a gimmick to sell tape and this price is considerably below the regular retail price. To take advantage of this special price, the order form on page 5 must be filled in completely and returned with full payment. As present stock of tape is limited and there is a significant lead time before the next shipment, owners who wish to continue flying (rather than waiting for spring) are urged to order the tape as soon as possible. Please note that if your kit was shipped with 2.6 inch wide Tedlar tape and your Lazair was covered according to the additional instructions for application, using the tape paddle (applicable to serial numbers A833 and subsequent), the double-taping should not be required. However the tape and covering should be inspected carefully, and the double-tape should be applied if there is any indication of an adhesion problem. Also, each preflight should include visibly checking the tape seams, especially on the leading edges of the wing.

9.2 D-CELL NOSERIBS

Since publishing Technical Update No. 5 in June '82, we have had a second report of loose noseribs inside the D-cell. Because of this, owners of all Lazairs, regardless of vintage, are asked to please check your noseribs as described in Technical Update Item 5.7. If necessary, noseribs should be repositioned and bonded in place. To facilitate this procedure, we can make a repair kit available at a nominal charge. This would include rivets, tape, adhesive, tape gussets (to re-attach the Tedlar) and complete instructions. Although the repair procedure may be somewhat tedious, a pair of wings can be done in less than a day, and the added safety margin and peace of mind would certainly make it worth the trouble.

NOTE: Be sure to determine if this is necessary before double-taping your D-cells (item 9.1).

9.3 PUSHROD LUBRICATION

Most Lazair owners are well aware of those annoying squeaks that eminate from the F32 pushrod guides when someone moves the control column. We have tried many lubricants (Ref. Technical Update Items 4.4 and 5.6) but until recently have not found any to be completely satisfactory. However, while attending the

International Association of Police Chiefs Convention in Detroit (where we had the new Lazair SS on display) we discovered a product called Break-Free® CLP (cleaner, lubricant, & preservative) which is sold primarily for cleaning and lubricating guns. After using this on the pushrods for about two months, it appears to be much better than anything else we have tried. It penetrates and lubricates well, does not seem to attract or trap airborne abrasives, and, based on our testing so far, it appears to last quite well. We are so impressed with it that as soon as we can get a sufficient quantity, we will be including a small bottle with each new Lazair kit, and will also make it available through authorized Ultraflight Dealers and Distributors. The list price* is $2.25 CDN (or $1.60 U.S.) per 20 ml. bottle.

While we're on the subject of pushrods, one owner has reported wear on his pushrods due to rubbing on the gap cover. Although there was clearance on the ground, it appeared that the gap cover tended to lift slightly in flight and contact the pushrods. Check for signs of wear on your aircraft and trim the gap cover if necessary.

9.4 PROPELLER MATERIALS

About a year and a half ago we began working with a glass reinforced thermoplastic polyester material which, although somewhat heavier than the carbon fibre filled nylon which was being used for propellers at that time, promised a higher "flexural modulus". In essence, this means less tendency for tip flutter, and a potential for higher thrust from a particular blade size and shape. Tests on a static test stand, and flight testing, showed that the performance improvement from using this material was small, but measurable. Structural testing, which involved intentionally overspeeding the propellers (the centrifugally developed tensile stress in a propeller at 9,000 RPM is over two and a half times as much as it is at 5,500 RPM), in addition to static pull tests, endurance tests, and notch sensitivity tests, all indicated that the new material was at least as good, and in some respects, better than the carbon fibre/nylon. Several months after we started shipping the glass/polyester propellers we began to receive occasional reports of propellers breaking in service, and a general warning was published in Technical Update Item 7.3. Since then we have been able to examine several broken propellers and have isolated the cause of breakage to three contributing factors --- (a) Propeller bolts overtightened, causing additional compression and shear stresses in the material, (b) propellers being subjected to speeds beyond their design speeds by the use of tuned exhaust systems, and (c) areas of non-homogeneity in the material. Although we can make recommendations to owners, we have no direct control over items (a) and (b). However, we do have some control over Item (c) and that control was exercised by reverting to the previously used carbon fibre/nylon material. Based on statistical data fed back from customers, the endurance of the glass/polyester propellers is significantly better (between two and three times better) than the wooden propellers used initially on the Lazair. However, since we now believe that the carbon/nylon material is significantly superior to the glass/polyester, we want to encourage owners who have glass/polyester props to replace them with carbon/nylon. For those who wish to buy carbon/nylon props and keep the glass/polyester props as spares, the regular price* of $66.08 CDN ($52.86 U.S.) per propeller will apply. However, anyone who returns glass/polyester propellers with an order can receive replacement carbon/nylon props for a reduced price* of $22.00 CDN (or $19.00 U.S.) each. To save shipping costs, you may, if you wish, saw the propeller in two places and return only the center section (containing the 15/16" hole). Determining which material your props are made from is quite easy and can be done by removing a propeller and weighing it. If it weighs more than 10 ounces, it is glass/polyester and should be replaced. If it weighs less than 10 ounces, it is carbon/nylon and need not be replaced. If you don't have a weighscale with sufficient accuracy, you can take the prop to your local supermarket or post office to have it weighed. Note that if the serial number of your kit is below A530 or above A754, (and you have not replaced the original propellers) you can assume that it was not shipped with glass/polyester propellers, and the check should not be necessary. However, before you saw the propeller into pieces, be sure you are not destroying carbon/nylon props as the special price applies only to replacement glass/polyester propellers.

9.5 WATER IN FLOATS

Pilots flying on floats should be aware that any hollow float, regardless of the type of construction, can be cracked or punctured so that it can take on water. If the weight of the water in the float is sufficient to prevent the aircraft from taking off, it might be annoying, but probably not as serious as it can be if the aircraft is able to lift off with water in the floats. Under this condition, the water will tend to run toward the tail of the float during takeoff and climbout, then the first time the stick is pushed forward to attain a nose-down attitude, the water can run to the front of the float and increase the pitching moment significantly. Test flights have been made with over fifty pounds of water in the floats and the aircraft was quite controllable. However, with an inexperienced pilot (or even an experienced pilot who is not aware of the water in the floats) this condition could possibly initiate or at least amplify a pilot induced oscillation.

One method of detecting water in the floats is to mark the nominal waterline on the floats (when you know they are dry, the seat is unoccupied, and the fuel tank is full). Any noticeable change in the waterline will then be an indication of an abnormal condition. A more reliable method would be to put an inspection hole in the top of the float, midway between the two forwardmost crosstubes. This could then be used for a visual inspection (with a flashlight) or could be used for the insertion of a dipstick. Make sure the hole is properly plugged before using the floats so it doesn't become the source of the problem rather than the solution. A toggle-action Thermos® bottle stopper can make an excellent removeable plug.

The use of bulkheads to form watertight compartments inside the hull, to prevent sloshing, is the obvious (but not necessarily easy) ultimate solution. One float manufacturer added bulkheads to a previously acceptable float design and discovered that the stress concentration due to the bulkheads caused his floats to break in a hard landing. We are presently working on a new float design incorporating a special pre-molded bulkhead for proper stress distribution to be used on the Series III Lazair.

9.6 KEEP YOUR BOLTS TIGHT

Owners of Lazairs equipped with the optional rudder pedal kit are reminded that the attachment of the P20 plug to the top of the P22 torque rod is designed as a clamp, not as a pin. To work properly and avoid the possibility of a failure of the P22 torque rod, it is essential that the nut on the 311 bolt be tightened sufficiently to clamp the P20 onto the P22. This should be checked visually and by "feel" during every preflight inspection, and occasionally by using a torque wrench (a torque of 3.0 lb. ft. is recommended). If there is any indication that the threads may be stripped, both the bolt and nut should be replaced.

9.7 CHECK YOUR FRONT FITTING

The owner of a very high time Lazair has reported a fatigue crack in the forward tab on the front fitting (the tab to which the T12 [or T312] is bolted). Although this is not expected to become a common problem, a visual inspection of this fitting should be added to your preflight checklist, and the edges of the fitting should be sanded smooth (ref. paragraph 1.4.1 of the Lazair™ Assembly Manual).

9.8 JURY STRUTS FOR YOUR SERIES II OR III LAZAIR

Those who have seen the Lazair II, the SS, or the Elite, have probably noticed that all of these models have jury struts to increase the allowable gross weight and/or negative limit load factor. Due to numerous enquiries from owners wanting to know if jury struts can be added to their Series II or III Lazairs, we have produced a retrofit kit which includes four jury struts, with clamps, brackets, strut fitting stabilizers, all required hardware, and instructions for a suggested list price* of $59.00 CDN ($48.00 U.S.). With this kit, the customer must widen the slot in the P17 upper strut plug from 1/8 of an inch to 1/4 inch. If you do not wish to do this, the P210 strut plugs as used on the two-place Lazair (which are made with a 1/4 inch slot) are available at $16.22 CDN ($12.98 U.S.) each. The addition of jury struts will increase the negative limit load factor for a Series III Lazair from -1.3 g's to -2.1 g's at 420 pounds gross weight. On a Series II, the limit load factor can be increased from -1.4 g's to -2.2 g's at 395 pounds gross weight. [Note that, by definition, the limit load factor is the demonstrated ultimate load factor divided by a factor of safety of 1.5, and it is the limit load factor which should be used as a criteria when selecting or flying an ultralight. Do not be mislead by some published specifications which may be ultimate values].

9.9 AILERON ADJUSTMENT

When the article in AOPA's "Ultralight Pilot" magazine reported a single engine sink rate of 300 fpm, we thought it was a typographical error and should have read 30 fpm (since this is about the value most Lazair pilots have reported). However, we were told that this was not an error, and 300 fpm was what they measured. Our dealer in that area later test flew the aircraft and confirmed that the single engine performance was considerably inferior to other Lazairs he had flown. In attempting to find the cause, he noticed that with the stick in the neutral position, both ailerons were biased up about 5/8 of an inch. With the pushrods adjusted to their proper neutral position, the aircraft was test flown again, and single engine performance was excellent.

9.10 LAZAIR SERIAL NUMBERS

The serial number of your Lazair(s) is printed on the mailing label for this Technical Update. If no number is shown, this indicates that your serial number is not on file and you are not on the permanent mailing list.

To make sure you continue to receive these mailings, make sure your name, address and Lazair serial number are on file with us. If you have not already done so, write your serial number inside the cover of your Lazair Owners Manual for future reference.

9.11 TRIM TABS

Although the most efficient method of trimming a Lazair is by moving the seat, small adjustments may be made by adding trim tabs to the ruddervators. If, by flying your Lazair, you have decided that a small amount of trim adjustment is required to make it trim out "hands off" (at any safe speed you want), you can add the trim tabs and bend them as required. The tabs should be cut from .025 to .040 thick aluminum alloy and riveted to the trailing edge of both ruddervators then bent slightly, and test flown. Just be sure to bend them in the right direction. If the aircraft feels tail heavy (requires forward pressure on the stick to fly straight and level) the trim tabs should be bent up. Although the size of the trim tab and the angle of bend will depend on the amount of trimming required, a tab 3 inches wide and 12 inches long should more than be adequate for most situations. The tabs should be riveted to the ruddervators as close to the top as possible without causing interference with the ruddervators in the full down position.

* Unless otherwise noted, all prices shown are Manufacturers Suggested List Price, F.O.B. Port Colborne, Ontario, Canada, and are subject to change without notice. When ordering any of the items specified in this bulletin be sure to enclose sufficient funds to cover postage/shipping charges. This will avoid delays in the processing of your order.

Lettair

December '81

News from the land of the Lazair™

FLOATS ..... AND A NEW POWER PLANT FOR THE LAZAIR

After several years of championing the cause for low power microlights, and demonstrating how well the Lazair flies on just eleven horsepower, Ultraflight has done the unthinkable and elected to incorporate a larger engine. This decision was not the result of a submission to the power battle so evident at Oshkosh this year, nor was it based on the popular theory that bigger is better —— it was the eventual outcome of a development program which began over a year and a half ago when we first began flying the Lazair on floats. The first time the Lazair was tested on a pair of crude floats, it flew —— in fact it flew very well. Not only that, it was able to take off using only its two tiny 5 1/2 horsepower engines. Based on this remarkable success, it seemed obvious, at the time, that just a few minor changes should result in a hull design which would serve as a model for the first production run of floats.

Then came the Sun-and-Fun Fly-in at Lakeland, Florida and a chance to try the new floats. The results were less than astounding. Back to the drawing board again .... and again .... and again. Many times we would notice a particular problem, then make a minor change which would overcome that problem —— and create another brand new problem. Every conceivable hull shape was tested —— long hulls, short hulls, skinny hulls, fat hulls, hulls with round bottoms, flat bottoms, concave bottoms, Vee bottoms, inverted Vee bottoms, and more. We had more bottoms than the chorus line at Caesar's Palace. Most of these were based on scientific (or at least pseudo-scientific) theory, but some were tried only to appease the multitude of self appointed experts who magically appear in the middle of any highly visible development program.

In the end, we arrived at a hull design which is certainly far superior to the original design, but still will not guarantee any reasonable minimum take-off run with a heavy pilot, with no wind, on glassy water, *with 5.5 horsepower engines*. Of these four conditions, only the latter (engine size) can be altered by a design change.

Not wanting to obsolete the Lazairs already purchased with the 5.5 horsepower engines, we investigated the possibility of extracting more power from the engines. Because of the inherent unreliability of reduction drive systems (in spite of the claims made by other manufacturers) and the drag caused by the increased frontal area, we decided to stick with the tried and proven direct drive —— keeping in mind that "a speed reducer which does not exist cannot possibly fail". After testing many minor engine modifications, which produced measurable but relatively insignificant increases in output power, we concluded that the only feasible way to obtain the increase in power we wanted would be to use a tuned exhaust system. Once again, enter the experts —— not pseudo experts this time, but real ones. (they must have been at *that* price). This time we got results —— significant results. From an engine which used to produce thirty-five pounds of static thrust, we could now get fifty. Quick .... back to the floats! Heavy pilot, no wind, glassy water —— take-off run less than three hundred feet. This was the performance we'd been looking for! But like everything else in this world, there was a price to be paid —— not just the monitary cost of the tuned pipes, but in performance. Under full throttle, the power is there, but as the throttles are advanced, the power doesn't increase gradually. It picks up normally until the thrust reaches the old limit of about thirty-five pounds, then hesitates for a second or two before instantly jumping to its maximum value. This makes it difficult to maintain a steady cruise power setting and makes taxiing a challenge for a circus acrobat. A more serious problem results from the basic theory that unless you improve the thermal efficiency of an engine, extracting more power from it will increase the heat which it generates. Measurements of cylinder head temperature made on the test stand, as well as during flight tests, indicated a considerable rise with the tuned exhaust under full power —— hot enough under hot day take-off conditions to possibly cause the lubricating oil to break down.

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Both of these problems can be lessened, but not sufficiently to give us the margin of safety and reliability we would like to have for an aircraft engine. So exit tuned pipes, stage left. Once again we were faced with another well known but often avoided truism: If you want horsepower — real reliable horsepower, at low RPM, you have to have cubic centimetres. Fortunately, in parallel with the engine and float development program, we were quietly beating the bushes to locate a larger engine — just in case we might need it.

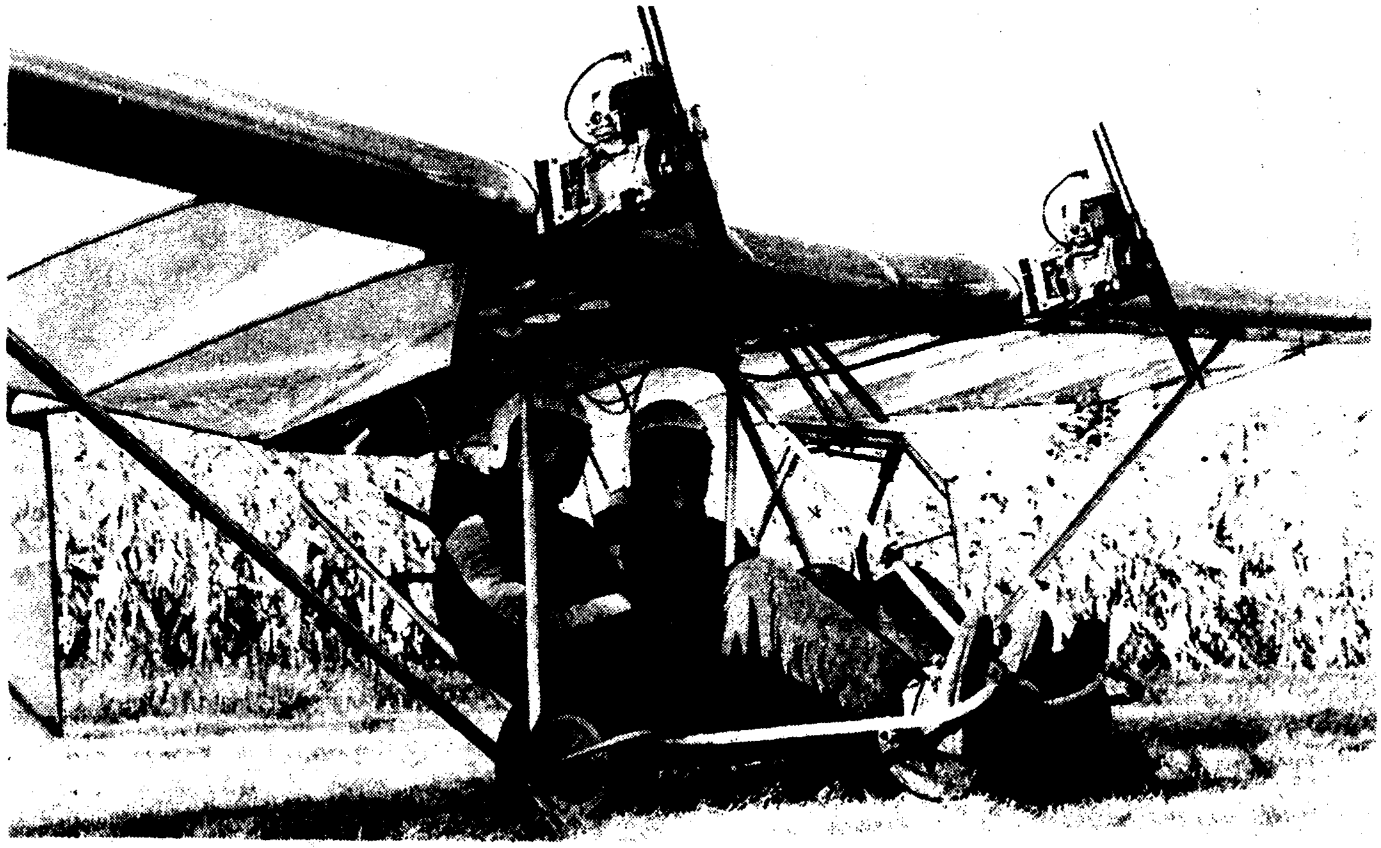
After testing, tearing down, and flying with a myriad of candidates, we selected a 185 cc two stroke engine manufactured in Austria by Rotax. It is a universal industrial engine designed for a multitude of applications, one of the most common being a portable water pump used for fighting forest fires (where lives can often depend on the performance of the engine). Before selecting this engine for the Lazair, we questioned the people who use and maintain them. In every case it was obvious that this particular engine has earned an excellent reputation for performance and reliability. Although this engine cannot be considered a modern design and its power-to-weight ratio is not as high as some of the "screamers" designed for motorcycles, go-carts, or snowmobiles, it has a long stroke (relative to most two-stroke engines) and develops its peak horsepower at the relatively low speed of 5,700 RPM, making it ideal as a power plant for a microlight aircraft. The 185 cc power plant uses the same carbon fibre filled nylon propellers as the 100 cc engines with one rather significant difference — *two* propellers are mounted on each engine. When first tested, the two propellers were mounted at ninety degrees in a four-bladed configuration. With the engine mounted on a test stand so its performance could be monitored, the angle between the two propellers was gradually changed in order to determine the angular displacement which produced the maximum thrust. Surprisingly, the thrust changed by no more than one percent over the whole range of angle from 90^{0} to 0^{0}. Consequently, the production configuration now has one propeller mounted directly on top of the other (somewhat like the wings on a biplane). This unusual looking configuration is not quite as efficient as an optimized two-bladed propeller, but it provides more than adequate thrust with a very small propeller disc (thereby keeping the propeller farther from the pilot) and creates much less aerodynamic drag when gliding than would a conventional four-bladed propeller.

With static thrust increased from thirty-five pounds to about sixty-two pounds, there is a noticeable improvement in take-off roll (now about fifty feet on grass) and rate-of-climb (we're now claiming 400 FPM but we haven't made an accurate measurement yet). Float performance is now very acceptable, with a roll of less than three hundred feet with a heavy pilot on glassy water. With a slight breeze, a slight chop, and an average weight pilot, it will lift off in less than a hundred feet.

We expected that the larger engines would provide more power, but one advantage we didn't anticipate is the improved performance at *low* power settings. Experienced Lazair pilots are aware that a landing in a short field with the Pioneer engines requires shutting down the engines well before touchdown to reduce the tendency of the Lazair to float. This is necessary because at the lowest speed at which the smaller engines will run smoothly, they produce about twelve to fifteen pounds of thrust. The larger engines can be throttled back to produce a thrust of four to five pounds.

As with any product improvement of this type, the bottom line is the pilot reaction. Pilots who have flown the Lazair with the new engines have been unanimous in their reports ... the Lazair flies beautifully with the small engines, but with the larger engines, it's even better. Since floats have just recently become available, only a few pilots have been able to test fly them, but again, the response has been excellent. As expected, virtually everyone who has flown the Lazair on floats has expressed the view that it is even more fun than flying it on wheels. What may surprise some pilots is the fact that flying on floats is also *easier* than flying on wheels.

Although the new engines are now being shipped with complete Lazair kits, they are not yet available for retrofit purposes. The price and availability of the engine retrofit kit and the floats will be announced before the end of January.



THE LAZAIR II TWO-PLACE MICROLIGHT MAKES IT'S MAIDEN FLIGHT

At 1625 hours on November tenth, the Lazair II, Canada's first two-place microlight lifted off the ground and climbed gracefully into the air. Piloting the craft was Dale Kramer, creator of the very successful Lazair and President of Ultraflight.

After a relatively short but rigorous test sequence which included steep turns and stalls, Dale landed the aircraft, announced that it flew perfectly, and invited his wife Linda to climb aboard. Linda, who is manager of Ultraflight Sales Limited and also pilots the single-place Lazair, was beaming after her first flight in the two-place version. When asked how she enjoyed the flight she replied, "It was great!", then added — "Dale turns a lot steeper than I do!"

Far from being a totally new airplane, the Lazair II is essentially the same as its single place baby brother except that the cockpit has been widened to accommodate the extra seat (with dual controls) and a twenty-four inch wide mid-section has been added to the wing. The two 18 foot outboard wing sections for the two-place prototype were taken from one of the company's single-place demonstrators. Even the power plant, which consists of two 185 cc Rotax industrial engines with carbon fiber filled nylon propellers is standard equipment on the single-place aircraft.

Following a test flight by Ultraflight Test Pilot Peter Corley and Chief Engineer Peter Lawrence, Ron Dennis, Air Canada 747 Captain and MOPAC President, accepted an invitation to fly as First Officer in the new Lazair and was obviously impressed by its flight characteristics. Subsequent test flights have been made with combined pilot weights as high as 375 pounds.

Although the F.A.A. in the United States, in its latest NPRM, does not allow a two-place microlight (or ultralight), the Canadian Department of Transport has come out strongly in favour of a two-place for use as a training aircraft. The DoT regulations, as presently proposed, will permit two-place microlights to fly only if one of the two occupants is an accredited Microlight Instructor. Following the successful maiden flight of the Lazair II, Dean Broadfoot, Chief of Flight Standards with the DoT and the senior official responsible for the impending microlight regulations, offered his congratulations and expressed his belief that the availability of a two-place trainer will do much to maintain, and even improve, the excellent safety record that the microlight movement has achieved during its infancy.

Although empty weight and wing loading limits for microlights have not yet been made official, it is anticipated that different requirements will be placed on the two-place trainer. The numbers presently being talked about within the DoT for the two-place trainer are 150 kg (330 pounds) maximum empty weight with a maximum wing loading of 20 kg/m^2 (4.1 pounds per sq. ft.) based on a combined pilot weight of 160 kg (350 pounds).

Although plans to market the Lazair II have not yet been announced, it will be made available to Ultraflight dealers and other approved Microlight Instructors.

LAZAIR SALES HIT RECORD HIGH

November 1981 saw the largest monthly sales volume in the company's three year history. Although total sales of Lazair kits have not quite reached the five hundred mark, the number of kits ordered in November was just short of a hundred (ninty-nine to be exact). Although some of these sales are attributable to more and more pilots discovering the superior flying characteristics of the Lazair, many purchasers ordered their kits in November to beat the December price increase. A lot of people recognized a bargain when they saw it. Obviously, this sudden jump in sales just as we are phasing in a new engine has caused a few problems in production scheduling, but the first shipment of engines from Austria has arrived and will be modified and ready for shipment early in January. The second shipment is now in transit and the order has been placed for another two hundred engines, due to arrive in March. The backlog for complete kits is now approximately twelve weeks, but this should be reduced considerably in the next few months.

LAZAIR PILOT REPORTS

During the annual EAA Fly-in at Oshkosh this summer, Peter Lert, noted aviation writer and editor of Air Progress magazine, and David Martin, a navy F4 pilot and freelance writer, both test flew the Lazair. Obviously, both were very impressed by the Lazair's flight characteristics and they made no attempt to suppress their enthusiam.

David Martin's report appeared in the December 1981 issue of Ultralight Flyer. He sums up his impressions with "The Lazair is a delight to fly, even when conditions are not ideal. It is fun, clever, efficient, quiet and always draws a crowd. In the competitive world of Ultralights, it should be a winner."

Peter Lert's article, complete with coloured photographs, encompasses some eight pages in the November 1981 issue of Air Progress. He uses expressions such as "State of the art in Ultralights" and " Its deceptive simplicity, which tends to overshadow some rather astonishing sophistication" to describe the Lazair. After witnessing Dave Martin's flight, he wrote "...only the fact that Dave is stop-drilled at his ears prevented the grin from causing the top of his head to fall off." Peter underscores his detailed flying impressions with "As you may have gathered, I'm impressed."

If you are a Lazair owner or pilot, or would like to be, you owe it to yourself to find a copy of Air Progress and read Peter's article. If you can't find a friend who will lend you his copy, try your public library.

What is probably the most significant statement made by these distinguished pilots and writers was not published in the magazine ---- after only one brief test flight, they have each placed an order for a Lazair for their own flying enjoyment.

Lettair

News from the land of the Lazair™

June '82

MORE CHANGES TO THE LAZAIR™

........IT JUST KEEPS ON GETTING BETTER

Just like the subject of almost every TV commercial, the latest Lazair™ is new and improved. There are no major changes to the basic design, nothing to make it unrecognizable as a Lazair™, just a few refinements to make it even better than it was before.

TAILWHEELS

Although the Lazair™ was born to fly from a grass strip, and most of them still do operate from grass, a growing number of owners are using paved runways. To avoid the frequent replacement of tailskids, the Lazair™ is now equipped with small tailwheels rather than skids.

BOBBED TAIL

In conjunction with the incorporation of tailwheels, we have also shortened the tail about seven inches. This makes ground handling and take-off a bit easier and improves the appearance without sacrificing performance or control response.

AND IT FOLDS

To facilitate transportation and storage, the tail has now been made foldable. This reduces the required width of a trailer for the Lazair™ from eight feet to less than six feet.

Due to the difficulty in meeting the demand for complete kits, we cannot yet supply parts for retrofit purposes, but for those owners who wish to incorporate the tail changes, a complete modification kit containing all parts required to convert to the short, folding tail with tailwheels will be available in August.

MORE FUEL CAPACITY

In response to requests from pilots who want to extend the range of the Lazair™, a 20 litre (5 US gallons) fuel tank is now standard equipment. At a reasonable power setting, this can extend the endurance to more than four hours. Although the average Lazair™ pilot is unlikely to make many four hour flights, having the larger tank allows many more short flights before a refill is necessary.

This was a relatively easy change for us to incorporate at the factory, but because of the additional fuel load with the larger tank, it is necessary to move the seat ahead and this requires a different shaped seat tube. Therefore, a retrofit kit for converting to the larger fuel tank will not be made available. The fuel tank itself is available as a replacement part, but fitting it to an earlier model airframe is not recommended unless it is done by someone skilled in the arts of airframe maintenance, tube bending and centre-of-gravity adjustments.

DECALS

The new kits also contain a couple of fourteen inch long vinyl Lazair™ decals for the wingtips. These are now available from your ultraflight dealer for use on earlier Lazair™s, bumpers, rear windows or wherever you wish to stick them.

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VELOCITY STACKS

Velocity stacks are now available for the rotax engine, and are included in the new kits. Although not intended to improve performance, the velocity stack retains the fuel which is blown out of the carburetor so that it gets sucked back in instead of being blown over the wing. This not only helps to keep the wings clean but even provides a slight improvement in fuel efficiency.

NEW MUFFLERS

Starting in mid July, all Lazair™ kits will be shipped with the new style mufflers for the Rotax engines. These new mufflers not only muffle the exhaust noise much better than the ones used previously, but they reduce drag and increase thrust because they are mounted on the nacelle behind the engine rather than in the prop blast as before. The muffler is connected to the engine by a specially designed stainless steel flexible exhaust pipe. New mufflers and exhaust pipes will be available for retrofit purposes in early August.

NEW FEATHERS FOR YOUR BIRD....

After over a year of testing and evaluating, we have finally selected a new covering material for the Lazair™. The Mylar® Polyester film which has been used up until now has many properties which make it almost ideal as a covering material--it's lightweight, strong, aerodynamically very clean, has good resistance to gasoline and oil, is transparent, is easy to apply, and has good heat shrinking characteristics. The only undesirable characteristic of the Mylar® is its lack of resistance to ultraviolet radiation and the resultant relatively short life expectancy. Although many Lazair™s which were hangared when not in use have survived three years without recovering, others, which were subjected to continous exposure to sunlight showed noticeable degradation of the covering in the first year.

So the problem was simple. All we had to do was find another material which had all the good properties of the Mylar®, but would last forever.

After beating the bushes for several months and running tests on samples of every potential covering material we could get our hands on, we zeroed in on another product called "Tedlar®", manufactured by DuPont, the same people who make Mylar®.

Tedlar® is a PVF film which possesses a strength-to-weight ratio similar to Mylar®, it has a surface finish which is as smooth as the Mylar®, has excellent resistance to gasoline and oil, and is even easier to apply and heatshrink. The only characteristic which might not be considered as good as Mylar® is its transparency. Although Tedlar® is transparent, it has a slightly frosted appearance. But now for the really good news ..... Tedlar® will last a lot longer than Mylar®. Because of our rather unique application, we cannot expect DuPont to provide us with any guarantee of life expectancy, but they have given us information on the longevity of Tedlar® in other applications such as greenhouses and solar collectors where the environment (in terms of ultraviolet exposure) is much more severe than that which would be seen by most Lazair™s. Unsupported transparent Tedlar® has retained at least 50% of its tensile strength after 10 years in Florida facing south at 45 degrees.

Lazair™ kits shipped from the factory after mid July will contain Tedlar®. For those owners wishing to recover their Lazair™s, a complete recovering kit containing a 100 foot roll of Tedlar® and all tapes (including a special Tedlar® based tape) is available for immediate shipment.

And now for the bad news (you knew this was coming, didn't you).......Tedlar® is not exactly cheap. Mylar®, being the Cadillac of plastic films, wasn't cheap either, but Tedlar® is the Rolls Royce of the film world. The cost of the Tedlar® covering kit is approximately three to four times as much as the Mylar® recovering kit.

AND MORE TO COME..... ***NEW PROPELLERS***

As part of the development program for the two-place Lazair™, we have developed a new propeller which will *become standard equipment on the single place aircraft as soon as it becomes available. As well as providing more thrust (we've measured as much as a 17% increase on the test stand), the new prop will be* ***ground adjustable*** *for pitch. However, we will determine the optimum pitch for normal flying and set the pitch at the factory before the props are shipped. Altering the pitch will not necessarily be recommended, but the capability to do so will be there. Although initial development of the new prop went quite smoothly, we are presently bogged down a bit with the tooling for injection molding the blades, so we still can't predict exactly when the new props will be available. Right now, it looks like availability the end of July to mid August should be possible. Until then, we will continue to ship kits with the unusual but effective biprop.*

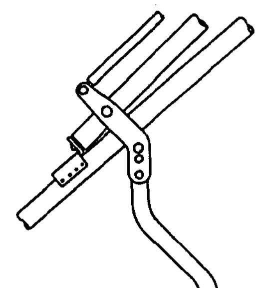
WHEEL PANTS

The first pair of pre-production wheel pants has been pulled from the mold and is being fitted to one of our demonstrators. Wheel pants are not just decorative; in addition to reducing drag, they reduce the mud and water thrown onto the bottom of the wings (and pilot) on those occasions when you have to taxi through a puddle, and they also provide a convenient and comfortable armrest while flying. A limited quantity of wheel pants should be available in mid August.

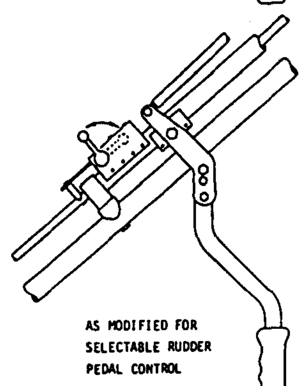
RUDDER PEDALS FOR YOUR LAZAIR™

When the Lazair™ was originally conceived in 1978, it had as one of its unique design features, an aerodynamic control system which used a single stick to control yaw, pitch and roll. With ailerons and rudders interconnected through a mixer, the ability to cross control the aircraft and the resultant spin were effectively eliminated.

However, in the past year, we have received numerous requests from pilots of conventional light and heavy aircraft to provide a means by which rudder pedals could be added to the Lazair™ and the yaw and roll functions separated. In response to these requests, the rudder pedal modification has been developed, tested and put into production as an optional accessory. During the test phase of the program, two interesting phenomena were noticed....1. Even with crossed control capability, neither of the factory test pilots was able to make the Lazair™ spin. We hesitate to claim that it is impossible to spin, because someday someone may find a way to do it, but it has not been possible to initiate a spin by any of the usual techniques.....2. Pilots with several hours in the Lazair™ prefer to fly it with the controls coupled (as in the original Lazair™) in most normal flying conditions. There are, however, some advantages in using rudder pedals in strong crosswinds, especially when landing or taxiing, and there is an improvement in single engine flight capability.



CONVENTIONAL LAZAIR CONTROL STICK INSTALLATION



AS MODIFIED FOR SELECTABLE RUDDER PEDAL CONTROL

With all these factors considered, Ultraflight developed a selectable control system --- one which allows the pilot to decide whether he wants to have his ailerons and rudders coupled for easy flying in gentle winds, or to have separate rudder control with foot pedals for more demanding weather conditions. Switching from one mode to the other is accomplished by a small mechanical toggle switch near the top of the control column and the switch may be operated at any time whether on the ground or in flight.

The complete rudder pedal conversion kit, including all machined aluminum alloy components, injection molded nylon bushings and fittings, aluminum alloy tubing, installation hardware and instructions was made available at a suggested list price of $235.00 CDN ($195.00 U.S.) in mid April and the first production run of 100 kits has already been sold. Additional kits are being manufactured and are expected to be available for delivery before the end of June. Feedback from Lazair™ owners who have installed and flown the rudder pedal kit has been excellent.

LAZAIR™II TWO-PLACE UPDATE

In the December Lettair, we announced the first flight of the engineering prototype Lazair™II. Since then we have been busy testing, evaluating and progressing with the production design.

The production prototype is now being assembled with all parts fabricated from production drawings. Production tooling is being developed simultaneously with the second prototype aircraft, and is progressing quite well. Continued testing with the original prototype has produced relatively few design changes. The only area in which there might be a major change is in the power plant. Although the aircraft flies well with the Rotax engines and the biprops, we would like a bit more thrust to give us a greater margin between cruise and stall. With the present power system, the Lazair™II can be flown quite easily by an experienced pilot, however, it is intended essentially as a trainer, and must be designed to withstand the abuses of a student pilot who may not be sensitive to an impending stall. Of course, we could just lower the maximum allowable gross weight, but this would probably make it too low to be practical (since there are not too many 100 pound instructors available).

Static testing with the new propeller indicates that it should come very close to giving us the thrust we need, but only by flight testing the aircraft will we know for sure. If the testing shows that thrust is still marginal, we will probably select a slightly larger engine for the two-place aircraft.

THE SPRAZAIR™ ..... ULTRAFLIGHT'S AG-PLANE BEING TESTED

Following the signing of an agreement with Micro-Ag Systems of Lake Geneva, Wisconsin, Ultraflight is now officially in the agricultural spray-plane business. Mr. Larry Whiting, president of Micro-Ag Systems, North American distributor of the Micron Spray Head will be supplying the heads to Ultraflight for incorporation into the Sprazair™, the agricultural version of the Lazair™. As part of the reciprocal agreement, Micro-Ag Systems has recently become a dealer for Ultraflight products, with operations in Lake Geneva, and Escalon California. The first Sprazair™ prototype which has been undergoing testing by Ultraflight for the past two months has been purchased by Micro-Ag Systems for further testing and demonstrating. A second prototype is now being assembled at the factory.

The standard Sprazair™ system will use two spray heads to produce a swath of 6 metres (20 feet). With a capacity of 40 litres (10 US gallons) it can cover up to 40 acres (with a coverage of 1 litre per acre). Droplet sizes from 50 to 300 microns are possible by varying the speed of the electrically driven spray heads.

The Sprazair™ is based on the standard Lazair™ with rudder pedals, and includes two side mounted spray tanks, two spray heads, pump, rechargeable battery, and all mechanical, electrical and plumbing fittings and hardware. A limited number of Sprazair™ systems in kit form will be available for test purposes later this summer, and complete systems in kit form or assembled will be available in production quantities by the spring of '83.

Although the Sprazair™ is certainly not the only microlight based spray system, it will be able to take advantage of the superior flying characteristics of the Lazair™ to produce a more precise flight path and much faster turnaround.

CORLEY CALIFORNIA BOUND

Former Chief Test Pilot and longtime Ultraflight employee (he helped build the first prototype and was the first person to fly it), Peter Corley, has succumbed to the call of the wild and has forsaken beautiful downtown Port Colborne for sunny Southern California.

However, he has certainly not forsaken the Lazair™, and will still be demonstrating and selling it and other Ultraflight products while sporting a business card reading "U.S. Ultralight Inc.". U.S. Ultralight Inc. is the new Ultraflight distributorship for southern California.

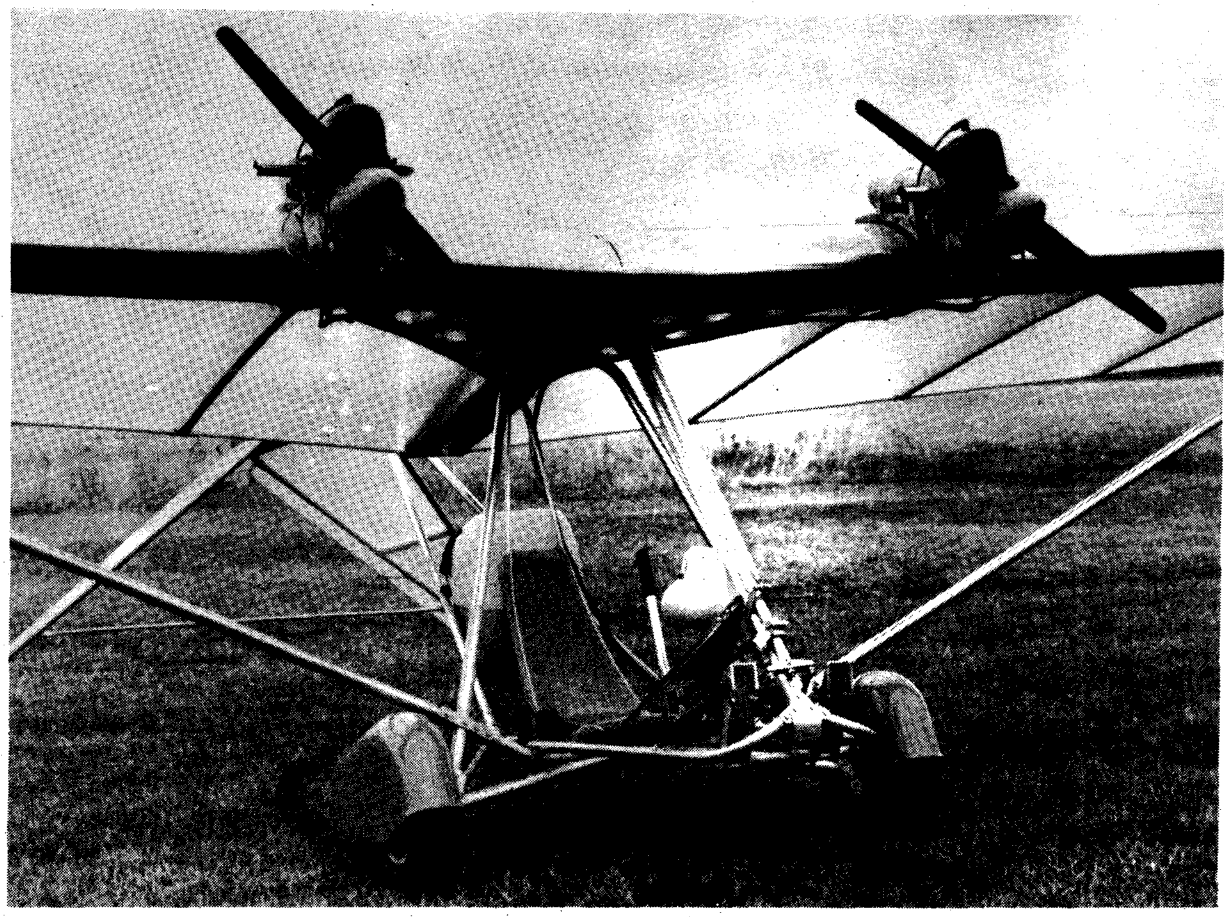
We wish Peter well in his new venture, and those of us who know him, know he'll have no difficulty adjusting to the California lifestyle.

Lettair

News from the land of the Lazair™

March '83

A New Look for the Lazair™



Since its first flight in November 1978, the Lazair™ has remained (in appearance at least) virtually unchanged. In an industry where new designs and designers come and go like sharks in a feeding frenzy, the Lazair™ has proven the excellence of its original unique design features by not only surviving, but prospering. Sure, there have been a few changes—like the larger engines to make float operation possible, the foldable tail, optional rudder pedals, and the Tedlar® covering—but even with these, the Lazair™ still looked essentially like it did when deliveries first began in 1979. However, this has now changed. Like the legendary Volkswagen Beetle and the Rolls Royce Silver Cloud, even the Lazair™ has taken on a new appearance. Now before all you fanatical Lazair™ lovers start yelling "heresy!", relax--it isn't **that** different. The wing planform and airfoil have remained the same, as has the familiar inverted V-tail. Nothing has been changed which would compromise the superb flight characteristics of the Lazair™. It, is however, quite easy to distinguish a new Lazair™ from an older one. Here are some of the twenty-three changes which have been incorporated into the new Lazair™:

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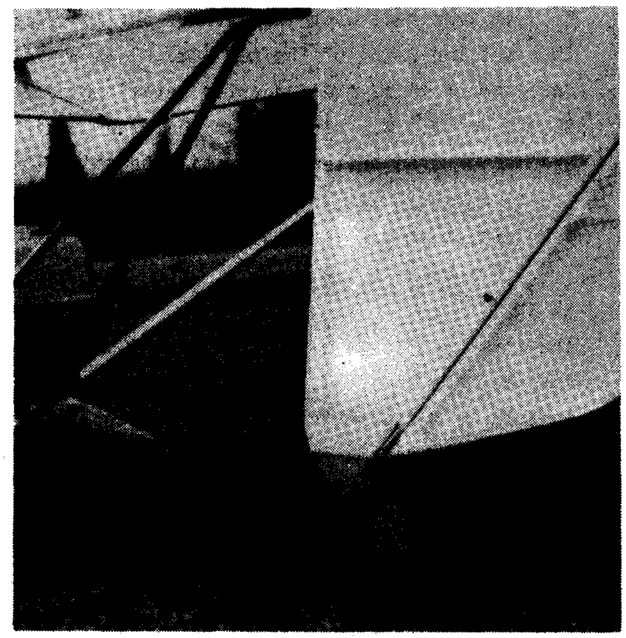
CANADA L3K 1B7

Student pilots or those without experience with a stick controlled aircraft also find the lower stick easier to use because it has a more natural feel. Although all Lazairs™ have three-axis aerodynamic controls, earlier models had the roll and yaw functions integrated through a single control stick. In the spring of 1982 Ultraflight introduced an optional rudder pedal kit to allow independent yaw control for sideslipping, easier ground handling, and better crosswind control. Because of the extremely high degree of pilot acceptance, rudder pedals have been made standard on the new Lazair™.

Although the new Lazair™ will normally be configured for rudder pedal operation, and Ultraflight strongly recommends that all prospective pilots learn to use rudder pedals, it is possible to convert the new Lazair™ to a stick-only mode for pilots with a physical disability which would prevent the use of rudder pedals, or for those who remain convinced that they prefer the integrated stick.

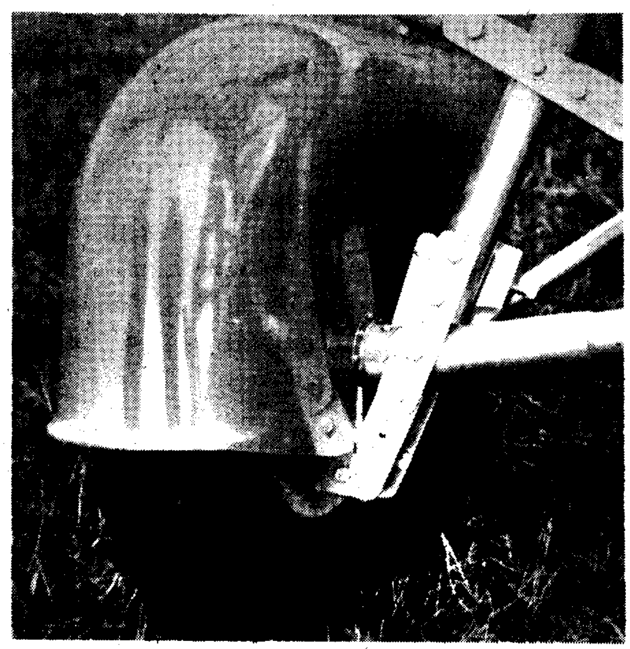
CASTERING TAILWHEELS

The original Lazair™ had tailskids. In mid 1982 these were changed to small wheels in response to pilots who made frequent landings and takeoffs from paved runways. Now Ultraflight has gone one step farther and added fully castering, large (four inch diameter) tailwheels for operation on very rough or totally unimproved runways. Those who have witnessed the testing of the new main gear and tailwheels on Ultraflight's "dunebuggy proving grounds" have been amazed at the way the Lazair™ can be driven at ridiculously high speeds through holes and ditches and over rocks and tree branches without the slightest damage to the aircraft. With the wheels castered, sideloads on the tail during ground handling have been almost totally eliminated and the aircraft can be rotated through 180 degrees in a space not much longer than the length of the fuselage. Like the wide gear and wheelpants, the castering tailwheels have been made standard equipment.



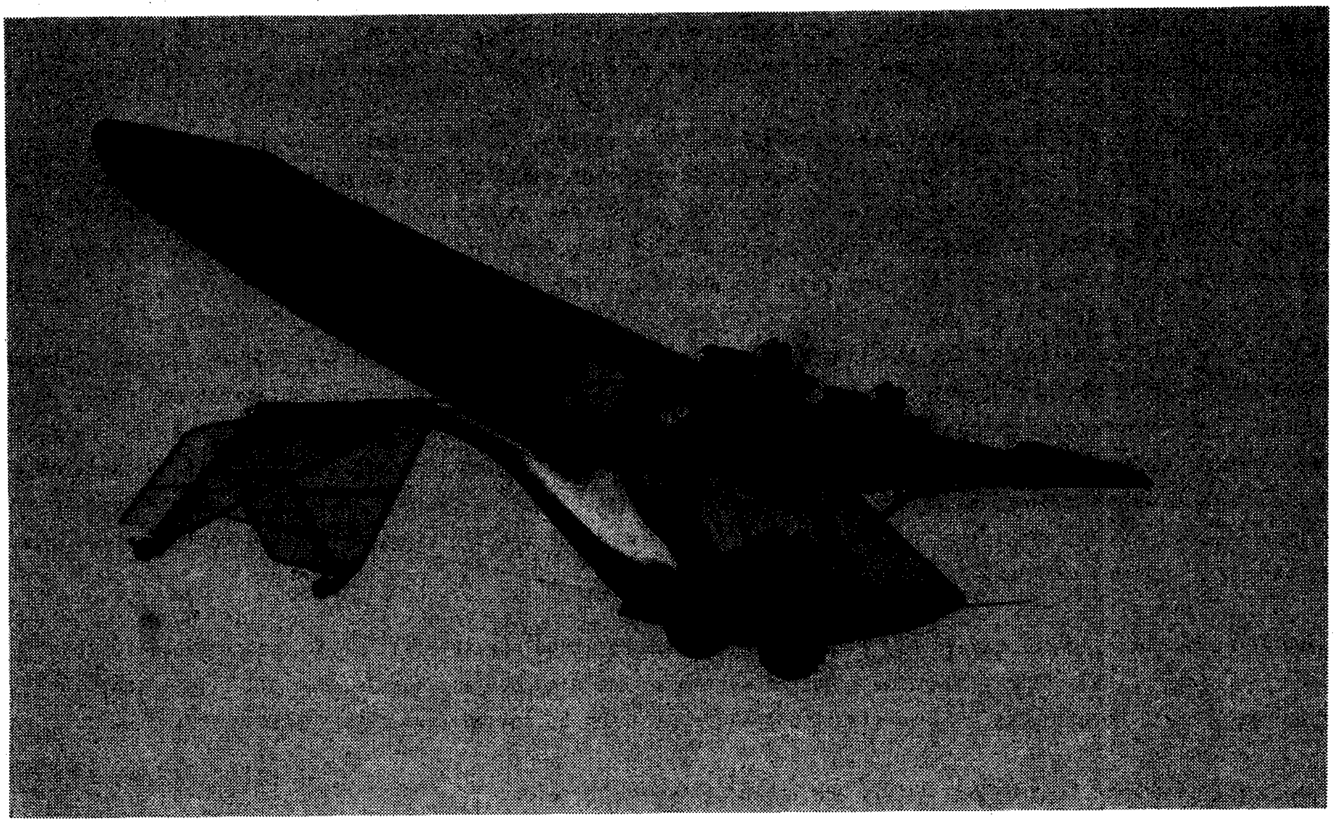
TOE-OPERATED WHEEL BRAKES

When the wheels were designed for the "tundra tires" in 1981, a small flat was incorporated on the side of the hubs so that "someday" disc brakes could be added. That **someday** has finally arrived, and wheelbrakes too have become standard on the Lazair™. To make the brakes useable for steering as well as stopping, they are operated independently by short pivoted extensions on the rudder pedals. By designing a caliper and brake disc especially for the Lazair™ rather than trying to adapt equipment made for snowmobiles or go-carts, it has been possible to fit them inside the wheelpant, well away from fingers, seatbelts and clothing. Although not intended to stop the aircraft on the proverbial dime (too much braking force on any taildragger can stand it on its



Lettair
News from the land of the Lazair™

December '83



Full Cockpit Enclosure for the Lazair

Visitors to the International Ultralight Exposition in Los Angeles (November 11, 12 & 13) were the first to view the new full enclosure for the Lazair. Designed to fit the Series III Lazair and other single-place models in current production, the enclosure will be available as an optional accessory early in 1984.

Comprised of a fiberglass reinforced polyester shell with a polycarbonate windshield, the enclosure weighs under thirty pounds, which allows a stock Series III Lazair with the enclosure to remain within the 254 pound FAA weight limit for ultralights. In addition to low weight, other design goals included low aerodynamic drag, ease of entry, a pleasing appearance and a minimum obstruction to the pilot's visibility. Based on test results, pilot reports and the enthusiastic response from visitors at the Los Angeles show, it appears that all the objectives have been met.

Flight tests using an aluminum mockup have shown no adverse effect on the Lazair's superb flight characteristics, but a definite (though not yet measured) reduction in drag. Entry and exit are made by sliding the entire forward portion of the enclosure (including the windshield) ahead, then tipping it upward slightly into the latched-open position. Although the subject of aesthetic appeal is obviously very subjective, comments from those who saw the display in Los Angeles as well as those who have witnessed test flights have been overwhelmingly positive. The reduction in visibility caused by the enclosure is so slight that officials of the Monterey Park Police Department have decided to use the enclosure on their surveillance Lazair. The enclosure kit will come complete with all molded parts, windshield, mounting hardware and instructions.

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Then in August, Monterey Park heard of the twin-engined Lazair. An invitation was extended to Ultraflight to demonstrate single engine performance and flight characteristics to determine whether the aerial patrol program could once again get off the ground. A demonstration was scheduled for September 26. It was at this demonstration that it became evident to city officials that the desired level of safety could be achieved using the twin engine Lazair. The following day, City of Monterey Park Chief of Police, Jon D. Elder enthusiastically announced that the ultralight program would be reinstated, using the Lazair SS.

Unlike the Series III Lazair, which is fully controllable but will not normally climb on a single engine (or most other ultralights which sink like a stone when they lose an engine) the Lazair SS can easily climb at 100 to 200 fpm with one engine out. The demonstration of this engine-out capability was the single most important factor in Monterey Park's decision to reactivate the program. It is a well known fact that no engine, no matter how good it is, can be totally immune to failure, but when a pilot knows that if an engine should stop, he still has another one to fly back to his base on, he is more able to relax and can devote more of his attention toward his mission objectives.
In a recent meeting with Ultraflight, Lt. Joseph Santoro, the impetus behind the Monterey Park program, stated that the test phase of the program is over. They have proven the worth of the ultralight in police activities and the next step is to put it into full operational use.

LAZAIR- Cover Story in 'Ultralight Pilot'

For over a year now, the editor and staff of AOPA's Ultralight Pilot magazine have been building, test flying, and reporting on most of the popular ultralights. During this time, editor Thomas A. Horne has earned a reputation for wielding his pen like a broadsword in his evaluation of ultralights. With this in mind, we had mixed feelings when we initially learned that they wanted to do a story on the Lazair. Coverage in a magazine of this stature can have a tremendous impact on sales, but the effect can be either positive or negative - depending upon the tone of the article. However, when the twelve page spread on the Lazair (the most ever devoted to any ultralight) appeared in the September/October issue, our state of trepidation soon turned to euphoria. They liked it! Where the writers had many negative comments about most of the other ultralights, they were very positive in their report on the Lazair. From the cover, which calls the Lazair "The Ultimate Ultralight Twin", to the last line which reads ". . . the Lazair represents probably the best investment a prospective ultralight purchaser can make", the article praises the Lazair and confirms the advertised flight characteristics and specifications. The photographs, especially the centerfold which shows the Lazair in soaring flight over the Virginia countryside, are among the best Lazair shots we have seen. Perhaps the best indication of the mood of the article is the fact that we became the first (and only) manufacturer to date to purchase reprints of an Ultralight Pilot article for use in advertising and information packages.

Customer Survey Results

Several weeks ago, we mailed a questionnaire to all Lazair owners. Considering the time required to complete it, and the fact that those who returned the form had to supply postage, the response has been overwhelming. At the time of writing, over 30 percent of all owners have responded and forms are still being received at a rate of several a day. Since a return of 10% for such surveys is generally considered good, we are extremely pleased with the response, and wish to thank all of you who took the time to complete the form and send it in. Your comments will help to shape our products and policies over the next few years. From the replies received to date, we have compiled a few preliminary statistics you may find interesting:

REPORT No. 83017 Revised 4 January 1984

Lazair™

Jury Strut Kit
Installation Manual

ULTRA FLIGHT ULTRAFLIGHT MANUFACTURING LIMITED

1.0 INTRODUCTION

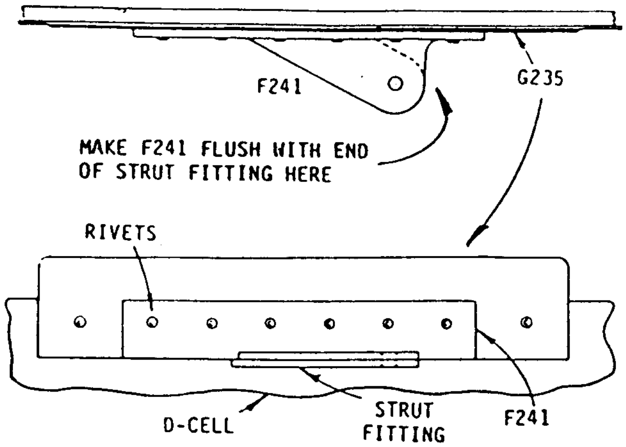
1.1 This jury strut kit has been designed for use on Series I, II or III Lazairs to increase the negative limit load factor. On a Series III, the limit load factor can be increased from -1.3g to -2.1g at a gross weight of 420 pounds. On a Series II, the limit load factor can be increased from -1.4g to -2.2g at 395 pounds gross weight. On a Series I Lazair with .020 inch D-cell skin, the limit load factor can be increased from -1.5g to -2.4g at 370 pounds gross weight. The use of this kit on a Series I Lazair with .016 inch D-cells is not recommended.

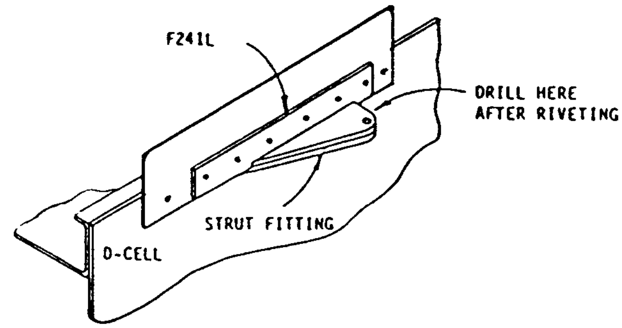
1.2 In addition to the jury struts and attach fittings, the kit also includes two F241 strut stabilizer fittings to distribute the horizontal component of the lift strut force. To fit the P17 upper strut plug over this fitting, the slot in P17 must be widened to 1/4 of an inch as described in paragraph 2.2. Should this plug be damaged during modification or be rendered unserviceable for any reason, order part number P210 as a replacement (P210 is machined with a 1/4 inch slot).

1.3 For disassembly, remove the bolts from the upper end of all jury struts. Loosen the bolts at the lift strut and fold the jury struts flat against the lift strut.

2.0 STRUT AND FITTING MODIFICATION

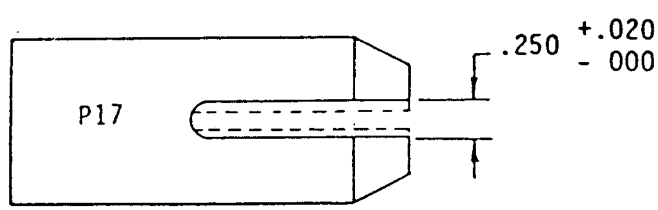
2.1 Remove the wings from the aircraft. Drill out rivets as necessary to remove the 1" x 7" x .040 aluminum strap adjacent to the outboard strut fitting on the wing. Slit the covering only as necessary to remove the strap. Round the corners on a G235 tape gusset and fit it in place of the strap. Fit an F241 strut fitting stabilizer into position and rivet it in place with 6 stainless steel rivets as shown. Tape the wing covering securely to G235 with the 2.6" wide Tedlar tape provided.





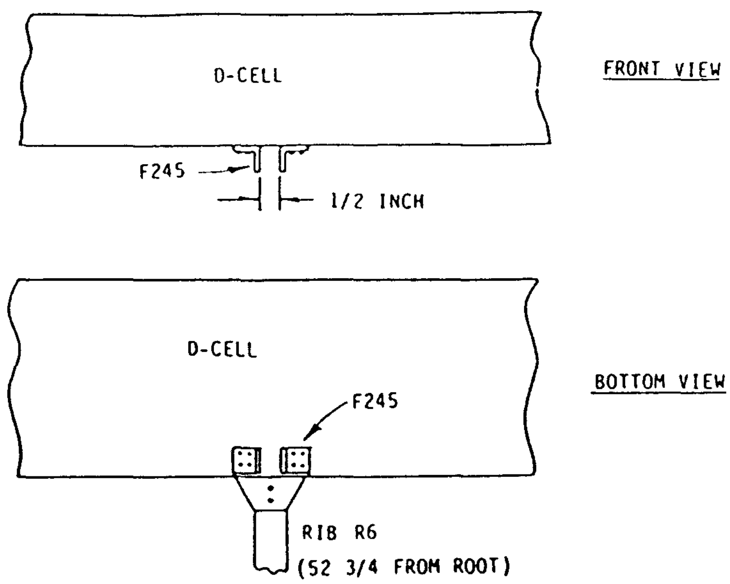
NOTE THAT ON THE SERIES I OR SERIES II LAZAIR, IT WILL BE NECESSARY TO BEND THE OUTBOARD STRUT FITTING SLIGHTLY AS DESCRIBED IN YOUR ASSEMBLY MANUAL (PAGE 5-1 PARA. 7 IN THE SERIES I MANUAL OR PARA. 7.1.7. IN THE SERIES II MANUAL).

2.2 Widen the slot in the P17 plug on each strut as shown. Drill a 1/4 inch hole at the bottom of the slot first, then use a hacksaw or bandsaw to remove the two sides. File the sides of the slot as necessary to remove the saw marks.

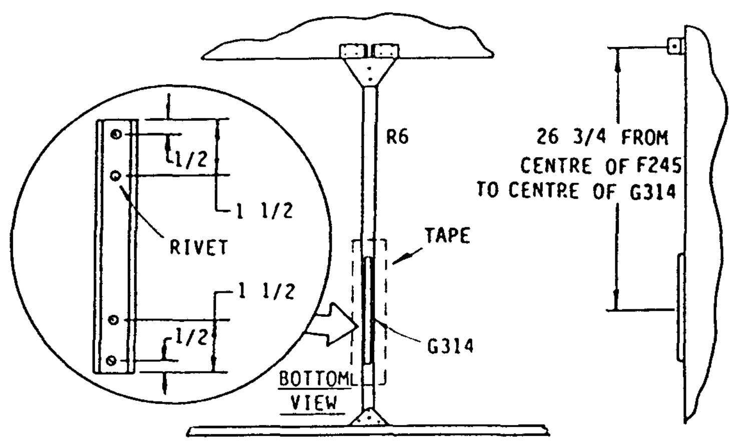


3.0 JURY STRUT FITTINGS INSTALLATION

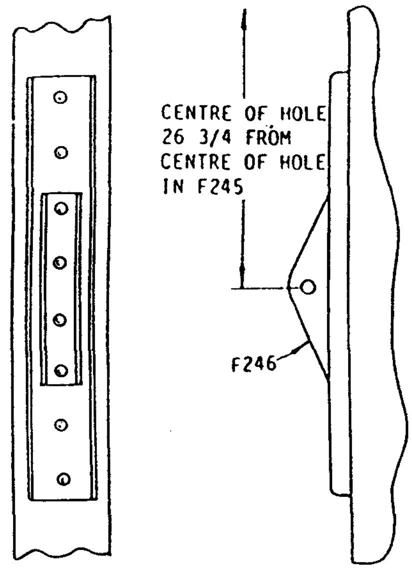
3.1 Rivet the F245 forward jury strut brackets to the under side of the spar cap on each wing as shown, using four stainless steel rivets in each bracket. Drill out and remove any previously installed rivets which would prevent the F245's from fitting tightly against the spar cap.



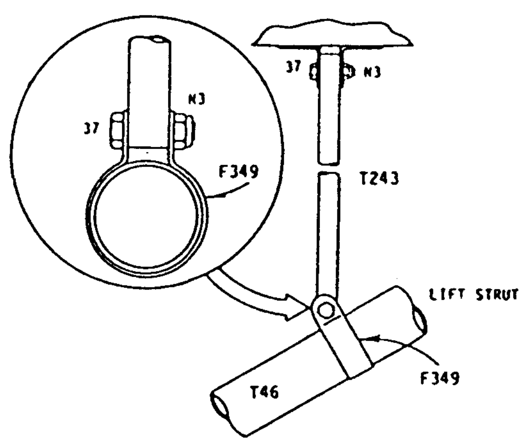
3.2 Apply an 8 inch long piece of Tedlar tape to act as a skin doubler, then rivet a capstrip doubler onto the bottom of each R6 rib with 4 stainless steel rivets as shown.



3.3 Rivet an F246 rear jury strut bracket onto each R6 as shown, with 4 stainless steel rivets.



3.4 Reassemble the wings and struts onto the fuselage. Cut each T243 forward jury strut to fit between the F245's and the lift strut as shown. Drill a 3/16 inch hole in each end of T243 as required and bolt it in place. *Make sure T243 is the proper length to keep the lift strut straight.* Note that T243 should be vertical (perpendicular to the axle) not perpendicular to the wing.



3.5 Similarly cut, fit and bolt the rear jury strut T244 in place between F246 and the lift strut. Note that the F349 clamp which secures T244 to the lift struts fits on the inboard side of the previously installed F349.

3.6 Check again to *make sure the lift strut is straight*, and refit the jury struts if necessary.

PACKING LIST

JURY STRUT RETROFIT KIT JSK

Qty.	Part No.	Description
1	F241L	Stabilizer, Strut Fitting, Left
1	F241R	Stabilizer, Strut Fitting, Right
4	F245	Bracket, forward Jury Strut
2	F246	Bracket, rear Jury Strut
4	F349	Clamp, Jury Strut
2	G314	Doubler, Capstrip
2	G235	Gusset, tape
2	T243	Jury Strut, forward
2	T244	Jury Strut, rear
8	37	Bolt
8	N3	Nut
50	-	Rivet, Stainless Steel
1	-	Tape, Tedlar, 2.6" x 48"
1	83017	Installation Manual

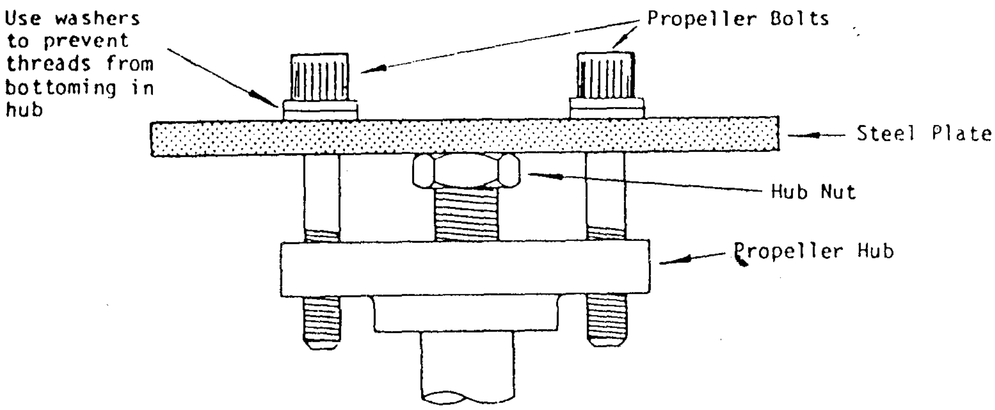
Lazair ULC mounting instructions

The Lazair is propably the easiest Ultralight to install the ULC on.
As you can see in the enclosed pictures, the ULC is carried on top of your body tube.

Mounting of the ULC:
The ULC is held up by two brackets. The longer one goes to the rear, the short one to the front.
Measure 53 1/2" forward from the very end of the body tube.
This is the centre of the rear ULC support bracket.
Measure 69 1/2" forward from the very end of the body tube.
This is the centre of the front bracket.
Install the brackets making sure that your control rods are not rubbing against the inside of the brackets. If need be take a pair of pliers and put a bit of a bend in the bracket to get enough clearance for the control rods.
Set the ULC onto the brackets and tighten all bolts.

Bridle attachement:
Go under the wing and measure 11 1/2" back from the front end of your body tube. At that point, your down tubes are attached to the body tube.
Loop the bridle around the body tube,including the down tubes that are crossing at that point in the loop.
Route the bridle along the side of the body tube through the gap cover back to the canister.
ENSURE THAT THE METAL GAP COVER CAN NOT DAMAGE THE BRIDLE. IF NEED BE, PROTECT THE BRIDLE WITH TAPE.
Be sure that the bridle does not interfere with the free movement of the control rods.
Attach bridle to canister using the quick link.
Secure with Velcro loops.
Attachment of Ripcord:
Measure about 3" back on the body tube,from the down tube that you just wrapped the bridle around.
This is the centre of your ripcord pocket.
Loop the ripcord pocket strap around the body tube and snap the ends together. The pocket should be in the centre of the flat aluminum piece that encloses the body tube at that point. Feed the ripcord through the pocket and push the ripcord handle into the elastic loop that forms the pocket. Bring the ripcord back under the wing attachment bracket and along the side of the body tube. Up to the front portion of the ULC and along the side of the ULC. Connect the ripcord cable to the ripcord pin assembly with the small Quick link. Locktite the quick link
Secure all along the way with Velcro loops. Use the same loops that hold the bridle in place.

Take one of the long Velcro loops that come with the canister and wrap it around the canister and around the



When drilling the holes to 5/16" diameter, make sure the drill is perpendicular to the face of the hub. Make sure you put the bolts in the hub before you install the hub on the crankshaft.

To reinstall the propeller hub, make sure the taper on the crankshaft and the hole in the hub are absolutely clean and free of grease. Apply a small amount of Loctite 242 or similar locking compound, fit the hub onto the shaft and tighten the nut to a torque of 35 foot pounds. After the propellers are installed, the N5C propeller nuts should be tightened to a torque of 15 foot pounds.

5.5 UP YOUR CABLES

update number 2 we discussed the problems of catching long grass in the cables. To alleviate this problem, all new Lazairs have the cables attached to the stabilizer at the end of the spreader (T11 or T11S) rather than at the lower (outboard) corner as was done originally. If you wish to modify your Lazair to move the cables up, it is a relatively easy change provided that you have access to a Nicopress tool and sleeves, since the cables must be shortened. If you can't locate a tool readily, check with your local EAA chapter.

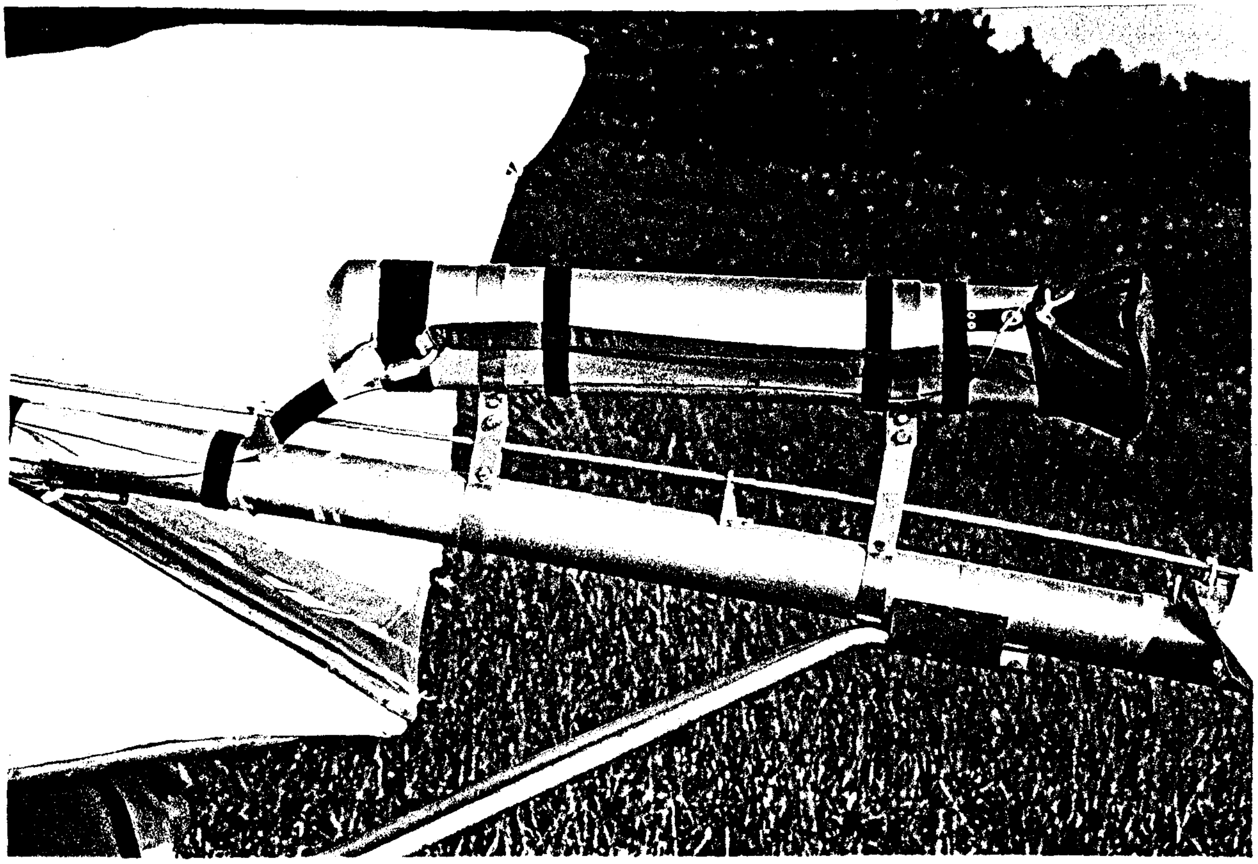
5.6 RUDDERVATOR PUSHRODS

Please be sure that your cables have been moved up as per 5.5 update, before installing your parachute.
NPL

The owner of a highly [illegible]
[illegible]nd moved out of position. This was one of the earlier kits with the .016 inch D-cell skin, (kits A192 and

Lazair™

1)



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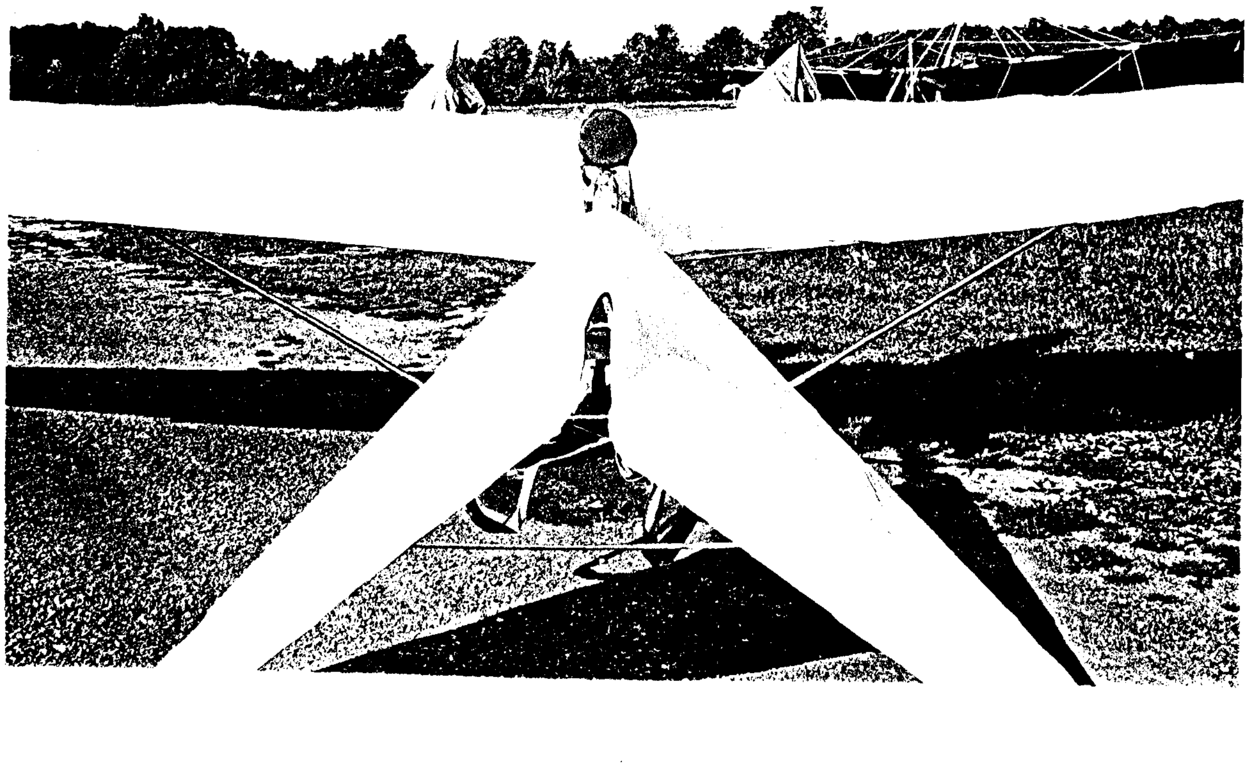

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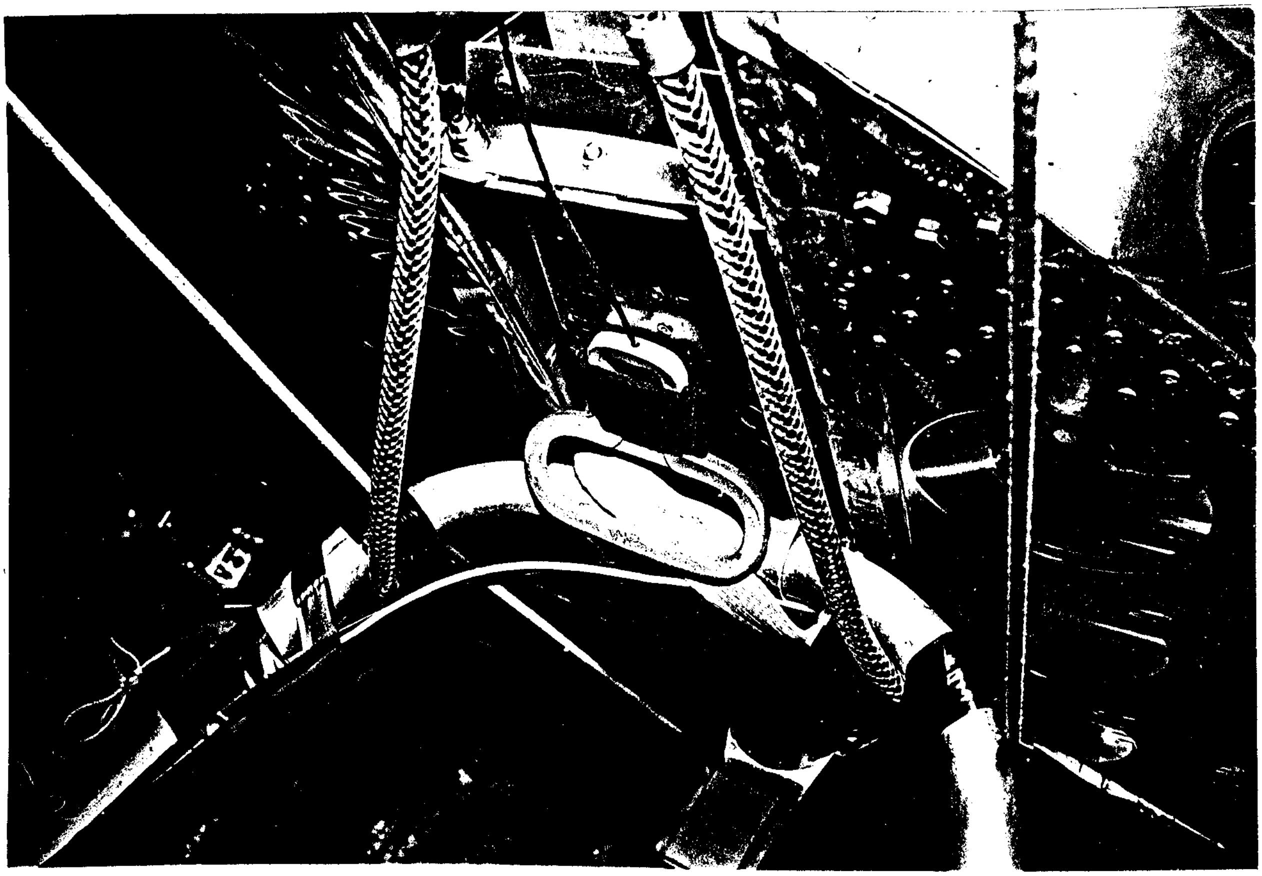

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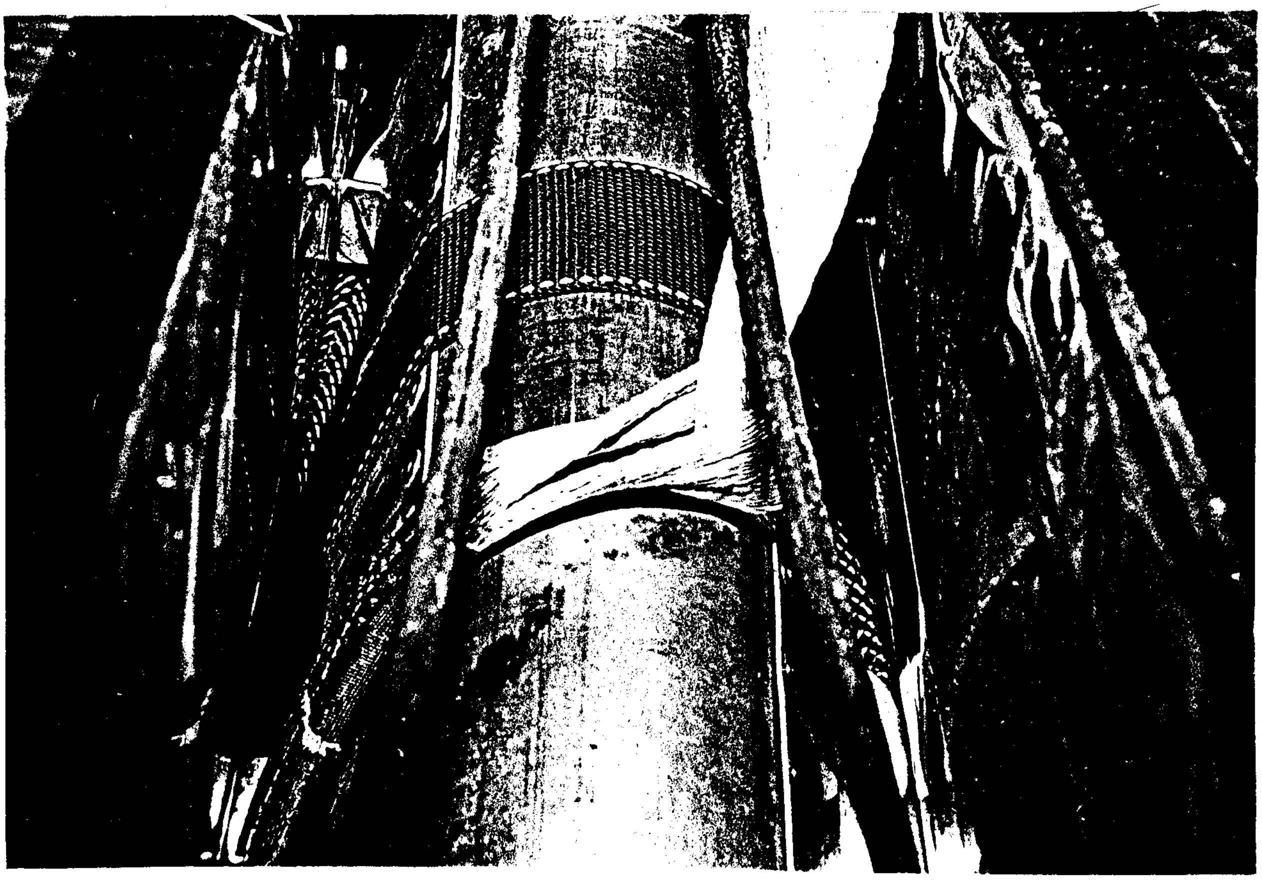


Niagara Parachutes Limited

Box P.O. Box 927 Niagara Falls, Ontario L2E 6V8 Area Code 416 / 358-5211

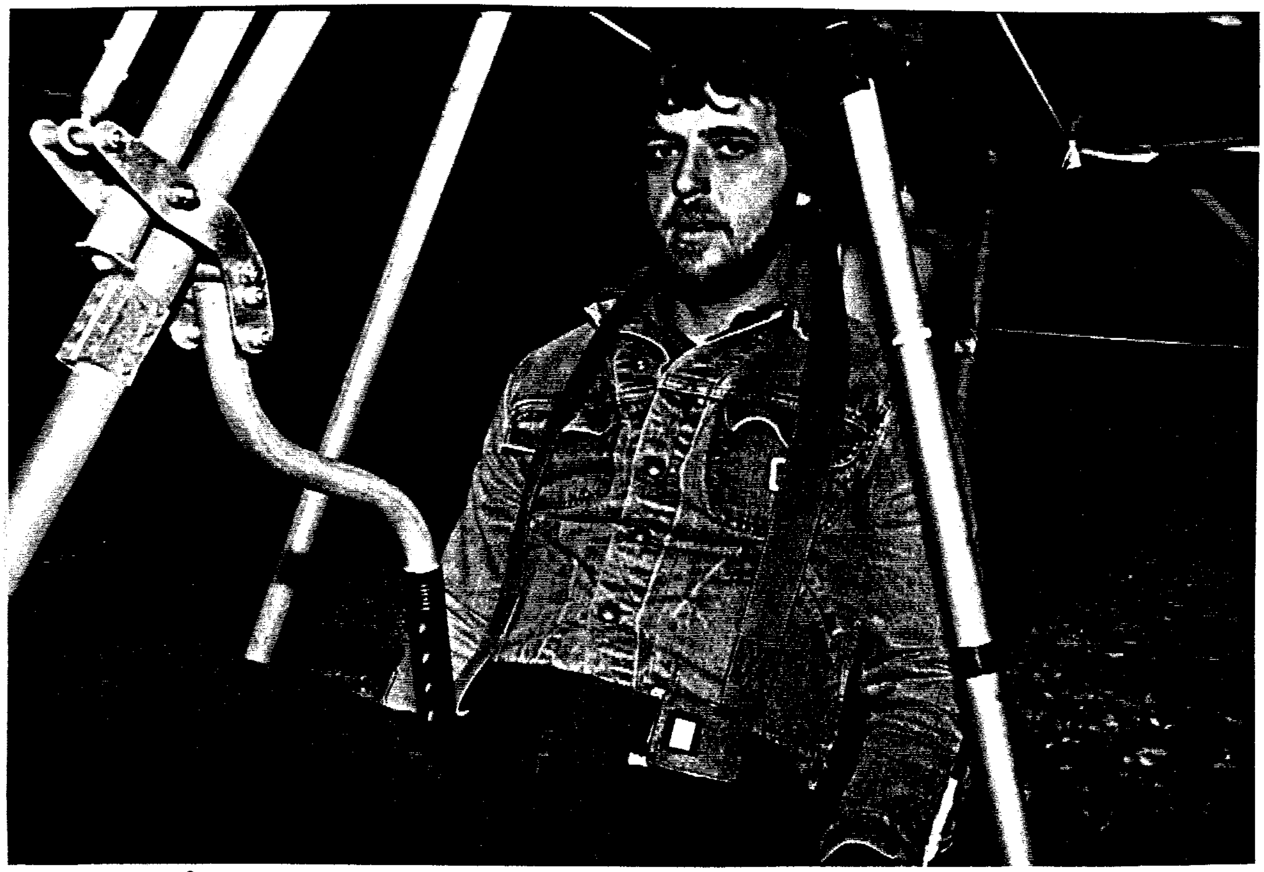
WING COVER, LAZAIR.

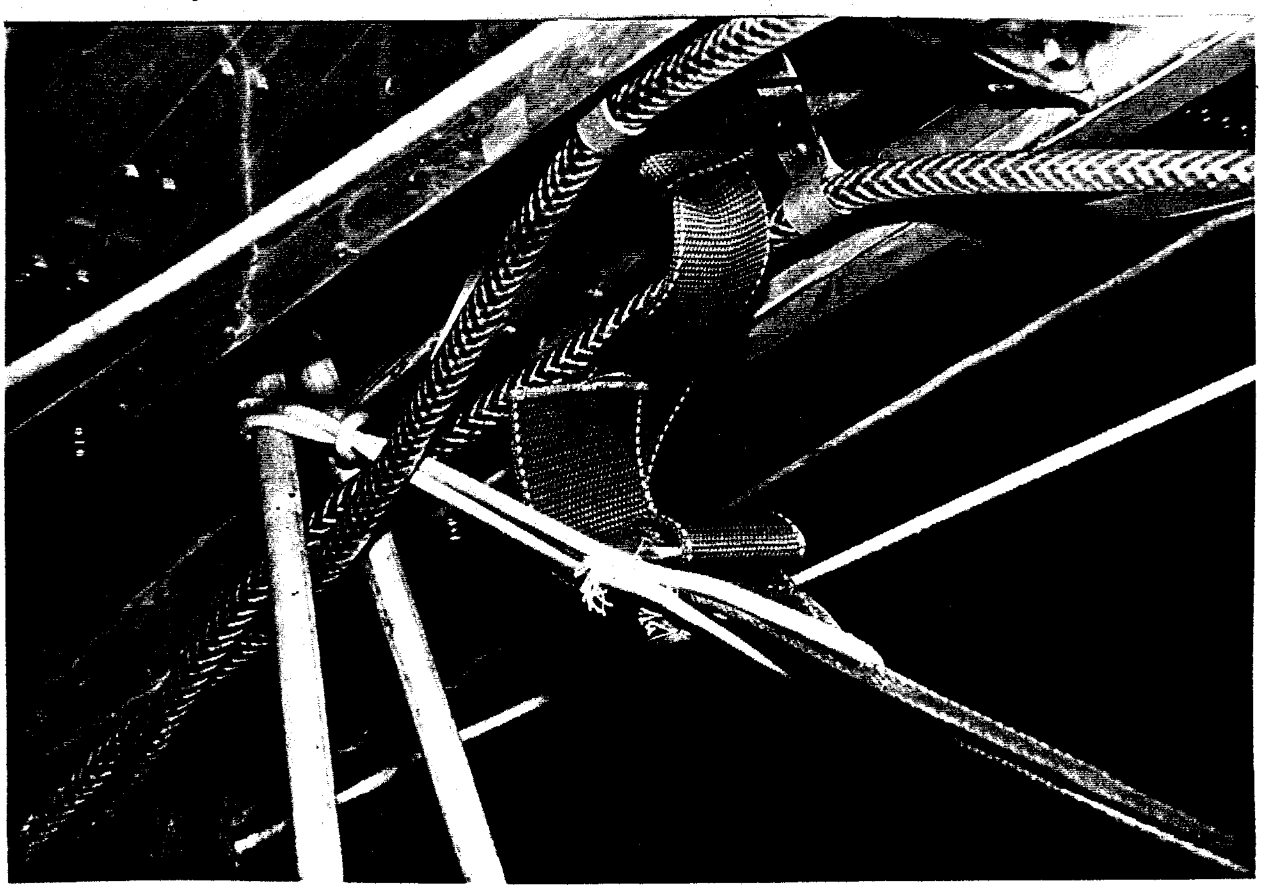
These covers are made to protect your Lazair from UV ray deterioration as well as from dust and dirt.
The fabric is 2.8 oz Polyester with a UV inhibiter. The fabric is also waterproof. This, of course, will keep your wings from soaking up moisture.
These covers will extend the service life of your wing covering by several years.

The complete set consists of:

2 wing covers,1 left,1 right.
1 tail cover.
2 motor cover bags.
PLEASE SPECIFY PROP DIAMETER!!
The price is $235.00 f.o.b. Niagara Falls Ont.
Delivery time is one week from receipt of order.
Terms are payment in full with order.
ONTARIO RESIDENTS ADD 7% RETAIL SALES TAX.

Lazair™





USE OF WARRANTY CLAIM FORMS

The attached Warranty Claim Forms should be used if you wish to return a part for replacement under the standard Ultraflight warranty policy.

In addition to providing us with justification for approving your warranty claim, this information also provides statistical data which can be used to isolate and eliminate design, manufacturing or quality control problems.

To avoid delays in processing, always be sure to quote your Kit No. (Serial No.) in the space provided and provide full details surrounding your claim.

Your co-operation in providing as much detail as possible is appreciated.

IMPORTANT:

If you purchased your Lazair® ultralight aircraft kit through an authorized Ultraflight Sales Ltd. Dealer, warranty claims should be submitted through your Dealer. Do not mail Warranty claim forms and/or parts directly to Ultraflight.

Revised: 12 October 1984

WARRANTY CLAIM FORM

OWNER	
ADDRESS	

DEALER	
ADDRESS	

DISTRIBUTOR	
ADDRESS	

KIT NO.	MODEL	DATE OF PURCHASE
ENGINE HOURS	AIRFRAME HOURS	DATE OF CLAIM

IF A PART FAILED, DESCRIBE NATURE AND CIRCUMSTANCES OF FAILURE:	DATE OF FAILURE

PART NO. & DESCRIPTION	QUANTITY	CHECK ONE		DEFECT IF ANY	FOR FACTORY USE ONLY			
		RETURNED FOR INSPECTION	MISSING FROM KIT		INSP BY	APPR'D	REJECT	DATE / REASON

IF PARTS ARE NOT APPROVED FOR WARRANTY REPLACEMENT, DO YOU WISH TO ORDER A REPLACEMENT PART AT YOUR EXPENSE? YES ☐ NO ☐

SIGNATURE

ripcord at the exact point where the two ripcord cables join into a Y. This will keep the ripcord from moving around and will eliminate any chance of the pins working themselves loose.

When you connect the bridle to the quick link, you may use some Locktite. Be sure to use a type that will allow you to remove it later.
Use the long Velcro straps to keep the quick link from rattling around.

If you have to use this parachute, you will in all propability not have much time.
For ULC deployment on the LAZAIR ONLY , these are our recommendations:
First locate the ripcord by looking at it. Dont go by feeling. With gloves on,a ripcord handle will feel the same as a down tube. Then pull like hell. Actually it'll take only about 5 to 10 lb of pull.
Then kill your engine. The prop wash might actually speed up the deployment of the parachute by a fraction of a second.
Grab some tubing and hang on.Then, if you can, relax. You are less likely to get hurt if your body is relaxed. REMEMBER! Any landing sitting in an airplane that is hanging on a parachute, is a controlled crash. BUT WITHOUT A PARACHUTE, THE CRASH WOULD BE FATAL.

Parts:
- 1 ea ULC parachute 130 o[redacted]
- 2 ULC brackets
- Nuts,bolts,spacers.
- 2 ULC support brackets,1 long,1 short.
- 1 bridle, 72" total length.
- 1 Ripcord,56" handle to fork.
- 1 ea Ripcord pocket strap.
- 3 ea Velcro straps for ULC
- 4 ea Velcro straps for 3" tubing. (9p5h)
- 1 ea ULC cover

The ULC cover is a waterproof cover.(Not shown on pictures,
Hook one end of your ULC cover over the front of the parachute. Pull back and slide over the rear end of the ULC.
To remove, pull the front end off first.

MEMO

To

Date February 19, 1986

From Ultraflight Sales Ltd.

Copies File

Subject

With regard to your recent Warranty Claim the following is provided in response:

RE: Rivet Shortage

While rivets come supplied to us in standard box quantities, we trust our supplier that quantities supplied are as stated on the box. If you have been short-shipped rivets we have also, however, we are forwarding 260 aluminum rivets to you on goodwill.

RE: Isolating Flanges

The isolating flanges we supply with the Lazair Series III Kit are those supplied to us by the engine manufacturer, Rotax for use with the Rotax 185 engine with Tillotson carburetors. While a flat isolating flange is not supplied to us by Rotax for use with the Tillotson carburetors, we accommodate the isolating flange shoulders by enlarging the hole in the carburetor slightly with a drill, just sufficient in length to match the length of the shoulder on the isolating flange.

Once the isolating flange is fitted closely up against the carburetor and installed the engines are test run.

We have had only a very small number of reports of isolating flanges cracking. As your Lazair Series III Kit with Serial Number A925 was shipped from our production facility on 8 March 1985 and has six hours flying time on it, technically this puts it outside the warranty period. Due to the fact that damage to the isolating flanges may occur in transit, due to removal of the flanges at some point or due to another cause while in the customers possession, we have rejected your claim for replacement of the isolating flanges.

MEMO

To [redacted] A925

Date February 19, 1986

From Ultraflight Sales Ltd.

Copies File

Subject

Page 2

With regard to the replacements you state you have obtained which you claim have no shoulders, we can advise that, while the shoulders help to keep the carburetors aligned, provided that the bolts are tight and the carburetor is centered to start with, the shoulders shouldn't matter. We recommend that you do ensure that your carburetors are tight and in position with the current flanges you have installed.

We trust this information is helpful.

Sincerely,

ULTRAFLIGHT SALES LTD.

Linda M. Kramer
General Manager

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