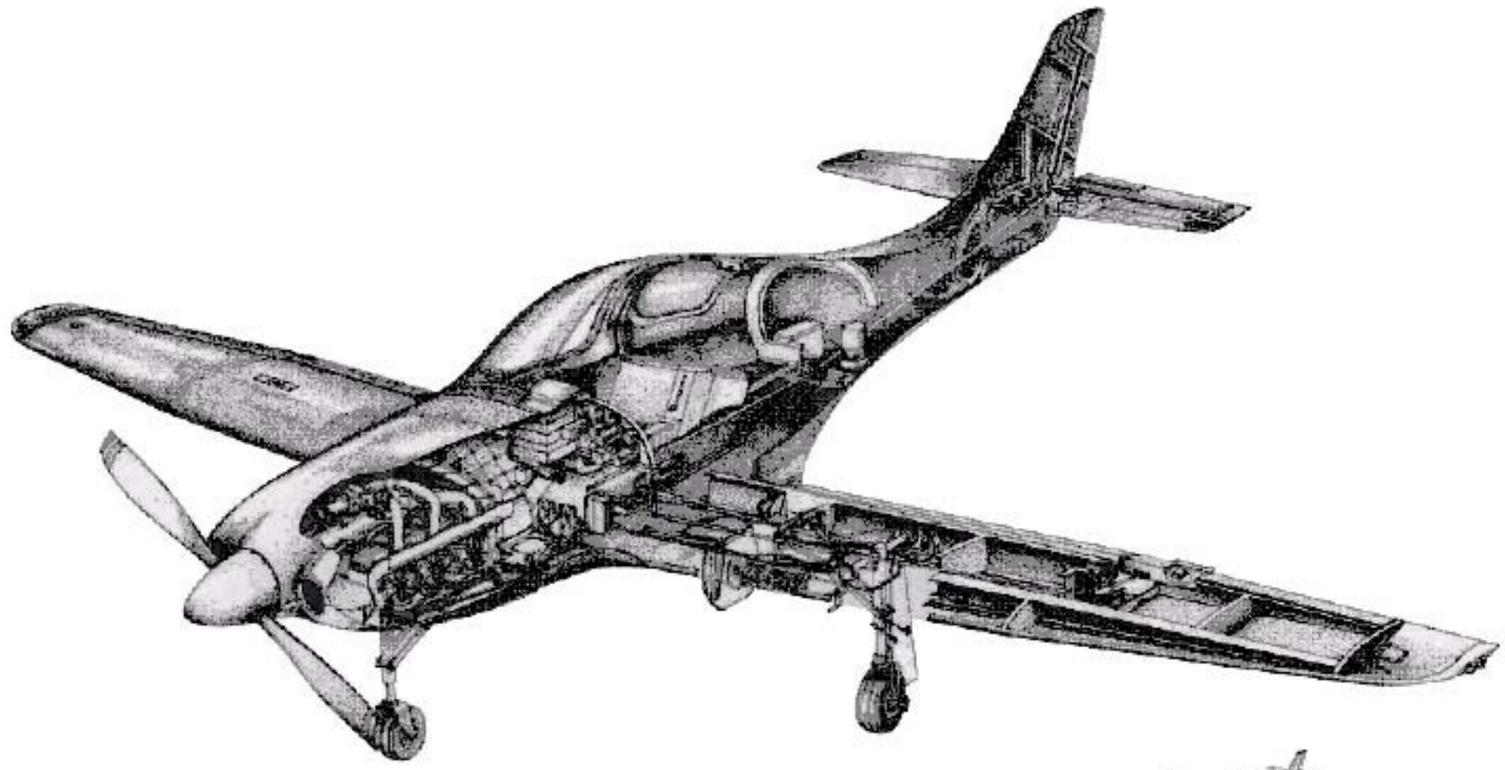
# ASSEMBLY MANUAL

# FOR THE LANCAIR LEGACY



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# Contents






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# REVISION LIST

# CHAPTER 1: INTRODUCTION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 1-1 through 1-5 | 0/02-15-02 | None | Current revision is correct |
| 1-6 | 1/09-18-02 | R&R | Text Correction |
| 1-7 | 0/02-15-02 | None | Current revision is correct |
| 1-8 | 1/09-18-02 | R&R | Text Correction |
| 1-9 | 1/09-18-02 | R&R | Text Correction |
| 1-10 through 1-26 | 0/02-15-02 | None | Current revision is correct |
| 1-27 | 1/09-18-02 | R&R | Text Correction |
| 1-28 through 1-44 | 0/02-15-02 | None | Current revision is correct |
| 1-10 | 2/06-30-04 | R&R | Text correction. |
| 1-3 | 3/12-15-04 | R&R | New table of contents with page numbers. |
| 1-38 | 4/09-30-06 | R&R | New guideline for rivet location in rod ends. |
| 1-11, 1-28, | 6/08/10/07 | R&R | Hysol/Jeffco changes |


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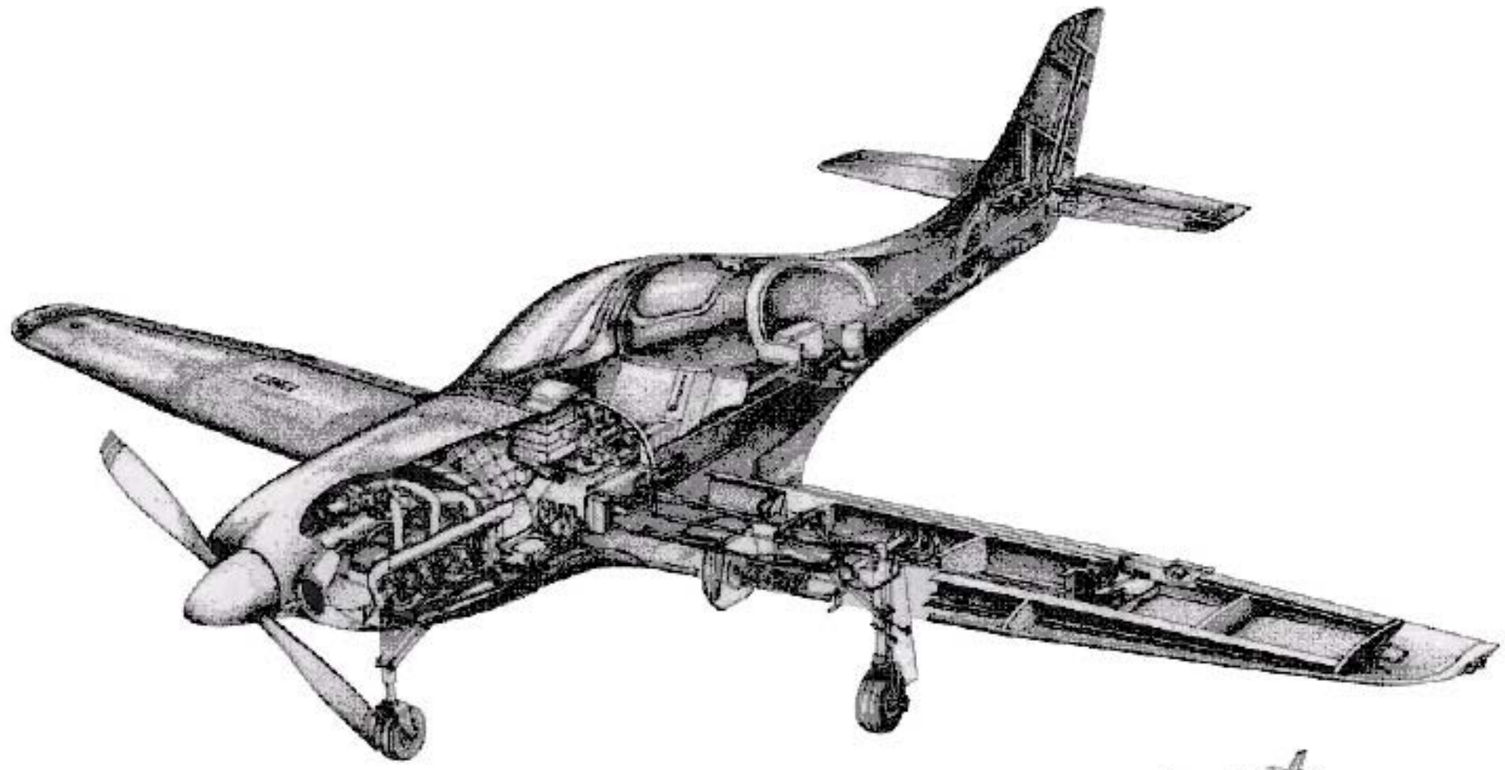

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# Chapter 1: Introduction

## Contents






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# 1. INTRODUCTION

The purpose of this chapter is to familiarize the builder with the use of this manual, the general philosophy behind its layout, the terms we use and their definitions, and the construction materials and methods we will use throughout the manual. You should also read the texts recommended in the preface to familiarize yourself with the fine points of glassworking if you are a newcomer to fiberglass construction techniques. You may want to refer back to this section often as you build your plane. There is a lot of information here, and it would be difficult to absorb it in one reading, so refer to it whenever you aren't familiar with a term, or if you are about to start a step that you're not sure of. It may be explained here in more detail than it would be at each and every spot in the manual that it is used, such as the terms "BID" and "release", which will be found on nearly every page, but only explained in detail in this chapter.

## A. Recommended Background Information

This manual provides detailed step-by-step instructions for assembling the **Lancair Legacy 2000 Kit**. Hands on experience with fiberglass construction techniques and various hand tools is assumed. If you do not have that background knowledge, the study of other, more basic texts will be necessary. Suggested references are given on the following pages.

**EAA**
**Whittman Airfield**
**Oshkosh, WI 54903-3065**
**920- 426-4800**
**www.eaa.org**

## WARNING

**IF DURING CONSTRUCTION YOU HAVE ANY QUESTION OR DOUBT ABOUT A CONSTRUCTION PROCEDURE, DO NOT CONTINUE UNTIL YOU HAVE OBTAINED THE NECESSARY INFORMATION OR SKILL. IF YOU ARE NOT KNOWLEDGEABLE IN FIBERGLASS OR OTHER REQUIRED CONSTRUCTION TECHNIQUES OR TOOLS, OBTAIN THAT KNOWLEDGE BEFORE STARTING CONSTRUCTION.**

**NO CHANGE TO THE AIRCRAFT DESIGN OR SPECIFIED CONSTRUCTION PROCEDURES IS PERMITTED. SUCH CHANGES MAY ADVERSELY EFFECT THE AIRCRAFT'S STRUCTURAL INTEGRITY OR AIRWORTHINESS.**

**FAILURE TO FOLLOW THIS WARNING AND OTHERS FOUND THROUGHOUT THIS MANUAL COULD RESULT IN COMPONENT FAILURE AND LOSS OF AIRCRAFT CONTROL CAUSING SERIOUS INJURY OR DEATH.**

***COMPOSITE MATERIALS PRACTICE KIT*:** This kit contains various materials with which to practice and develop your fiberglass construction technique. It also contains a copy of Burt Rutan's **Moldless Composite Sandwich Homebuilt Aircraft Construction** book described below. This kit is recommended for all newcomers to fiberglass construction and is a good refresher for others.

***MOLDLESS COMPOSITE SANDWICH HOMEBUILT AIRCRAFT CONSTRUCTION*:** by Burt Rutan. Though the hot wire shaping technique covered by this book is not used on the Lancair, this book has a great deal of other excellent, basic fiberglass construction information. Highly recommended.

***BUILDING RUTAN COMPOSITES*:** This is a video tape by Burt Rutan. Although it covers some techniques not used on the Lancair, it shows you how the experts handle fiberglass construction. Highly recommended.

***COMPOSITE CONSTRUCTION FOR HOMEBUILT AIRCRAFT:*** by Jack Lambie. This book is an additional source of useful construction information and goes into the theory of aircraft design as well. Jack's Chapter 9, Safety in Working With Composite Construction, is particularly worth reading. This book would be a useful addition to the above.

***KITPLANE CONSTRUCTION:*** by Ron Wenttaja. This is a resourceful book with information on metal, wood, and composites.

The above publications, practice kit and video tape are available from:

Aircraft Spruce and Specialty Company
225 Airport Circle
Corona, CA 91720
Toll free order line (877) 477-7823
Customer sevice (800) 861-3192
Fax (909) 372-0555
Email: info@aircraft-spruce.com

The following recommended books largely describe aspects of aircraft construction other than working with fiberglass:

***FIREWALL FORWARD:*** by Tony Bingelis is packed with vital info about engine installation. You'll need this when you're getting ready to install the engine.

***THE SPORTPLANE BUILDER:*** by Tony Bingelis has a lot of useful information on aircraft construction in general such as electrical systems, instrumentation and fuel systems. The chapter entitled :You and the FAA" gives important information on the procedures that you will need to follow during construction in order to get your homebuilt's airworthiness certificate.

These two books can be obtained from: **EAA Aviation Foundation**
**Whittman Airfield**
**Oshkosh, WI 59403-3065**
**Phone: 1-920-426-4800**


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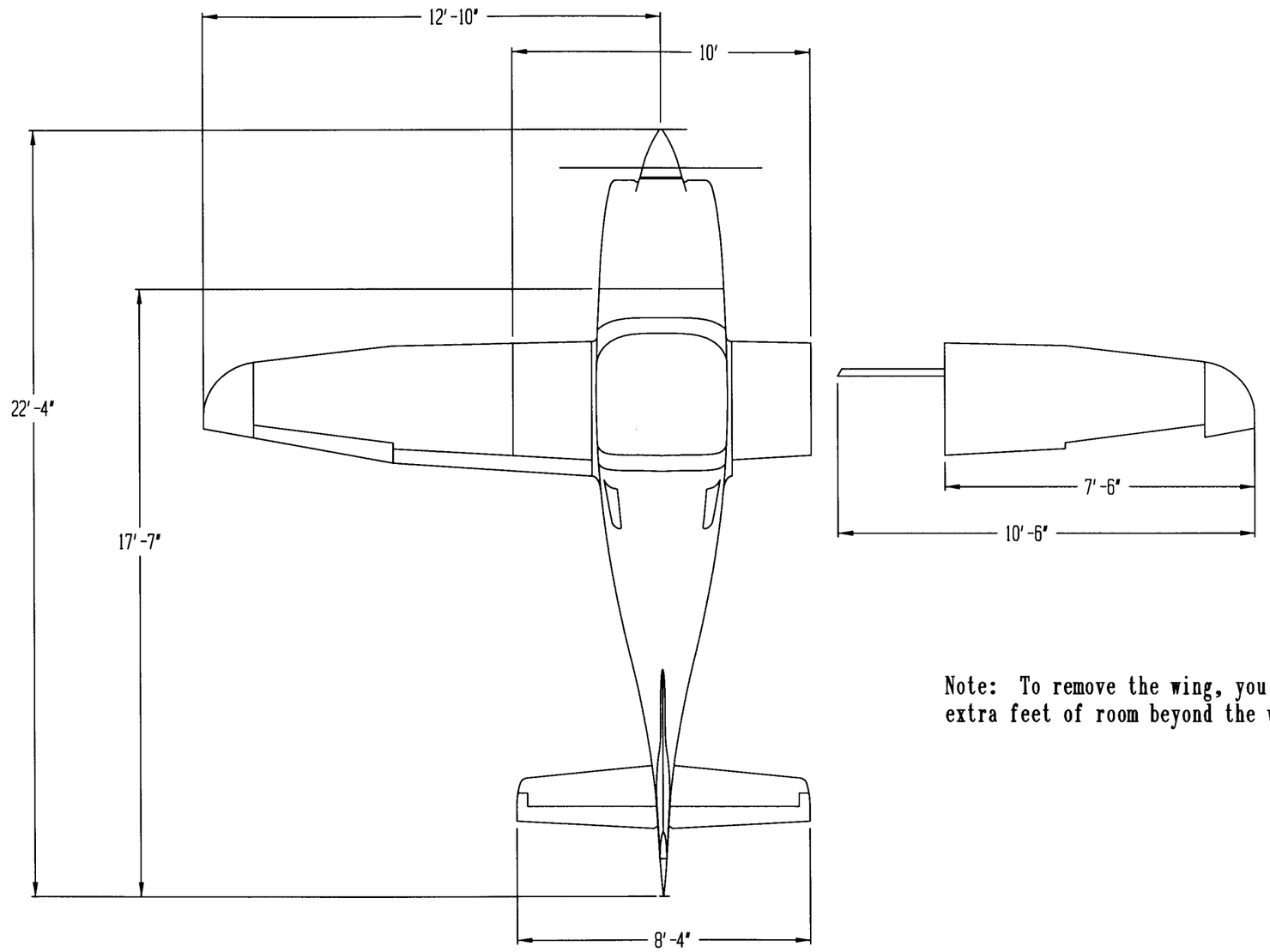
**Shop Floor Area**
**Fig. 1:A:1**




Note: To remove the wing, you need 4 extra feet of room beyond the wing tip.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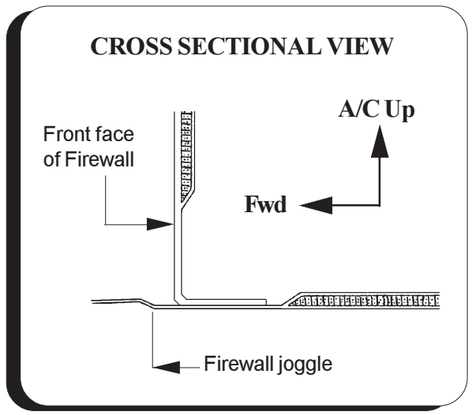
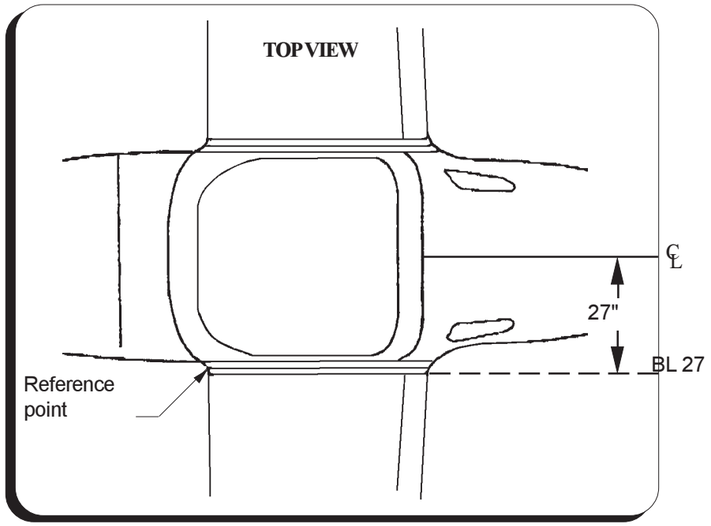
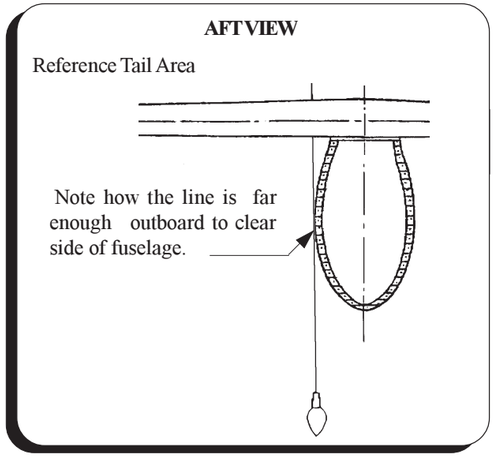
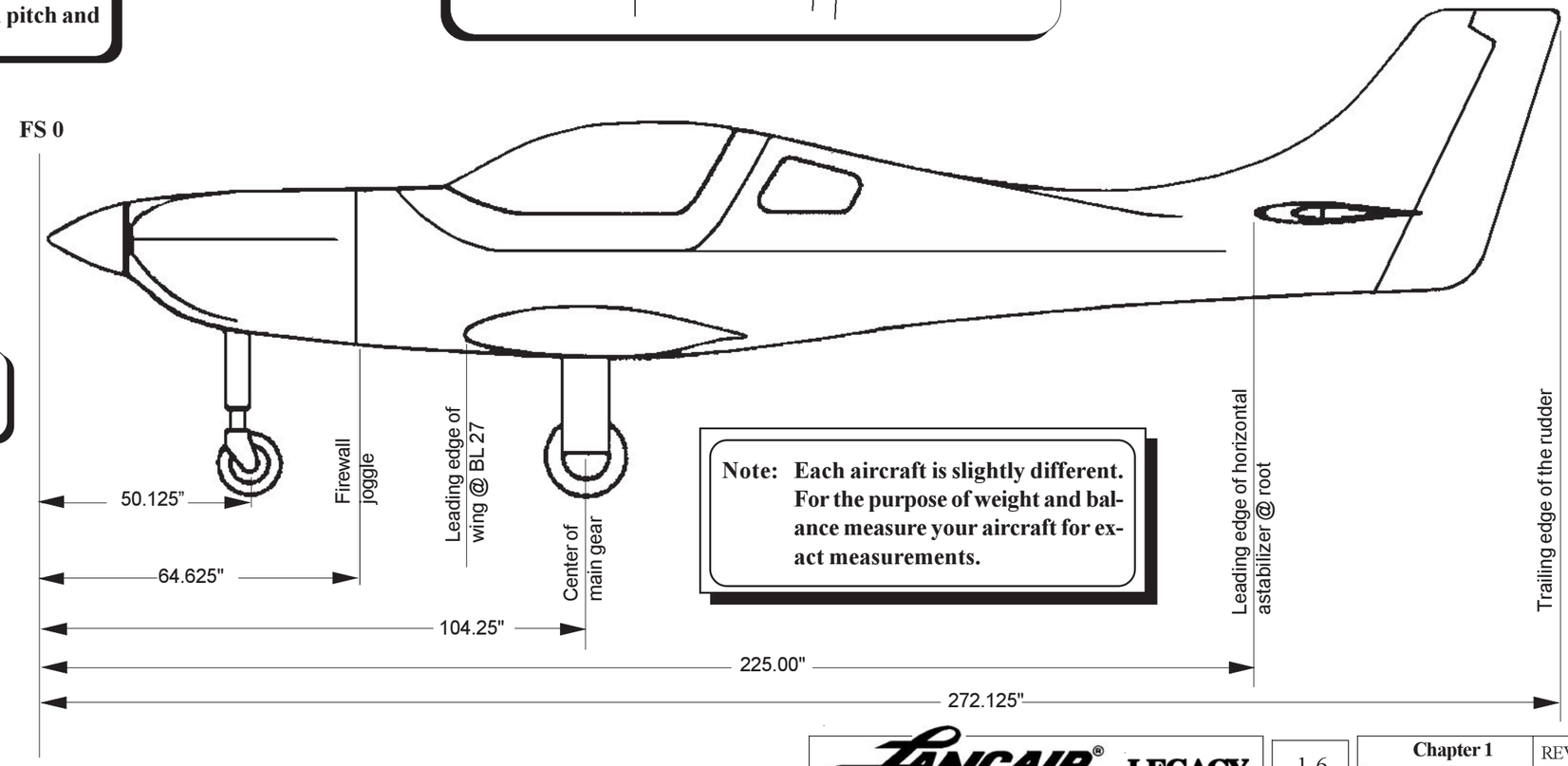
## Aircraft Dimensions
## Fig. 1:A:2




**Note: To level aircraft, open canopy. Use the longerons to level in pitch and roll.**




**Note: Each aircraft is slightly different. For the purpose of weight and balance measure your aircraft for exact measurements.**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## B. Manual Layout and Use

PLEASE- READ THIS MANUAL. In this age of computers that are "user friendly", cars that talk and tell you what their status is, and all of the other bubble-packaged, pre-digested things on the market, many people have gotten out of the habit of reading the manual. That philosophy will not work here. While there really aren't any "complex" steps to building this aircraft, there are many that must not be overlooked. So, please do read this manual.

For ease of understanding and use, this assembly manual is laid out in a logical progression of assembly steps. The first section explains the technique used to prepare and join mating parts. This technique is used throughout the kit assembly process, and is shown in detail.

Following that, actual assembly instructions begin with the horizontal stabilizer. Directions are provided for preparing the necessary fixtures for alignment, installing the spars, ribs, etc.

Assembly instructions for the remaining parts are given in a sequence that either makes for convenient construction or is necessary due to the kit design.

### Chapter Organization

Each chapter is arranged in a similar sequence:

**1. INTRODUCTION:** This describes, in a brief overview, the work that will be performed throughout that chapter.

**2. SPECIAL PARTS, TOOLS & SUPPLIES LISTS**

**A. PARTS:** providing a complete list of all parts or components within the chapter as well as diagrammatic exploded views of the components.
**B. TOOLS**
**C. SUPPLIES:** This list will consist of the tools and supplies required for assembly of components in that particular chapter.

**3. CONSTRUCTION PROCEDURE:** This section is typically divided into specific areas of assembly, and each division is defined by an alphabetical prefix: a, b, etc.

### Revisions

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

Each chapter should be read through entirely and understood before beginning the work it describes. The equipment and supplies called for in each chapter should be on hand and ready for use.

## C. Setting Up Your Shop

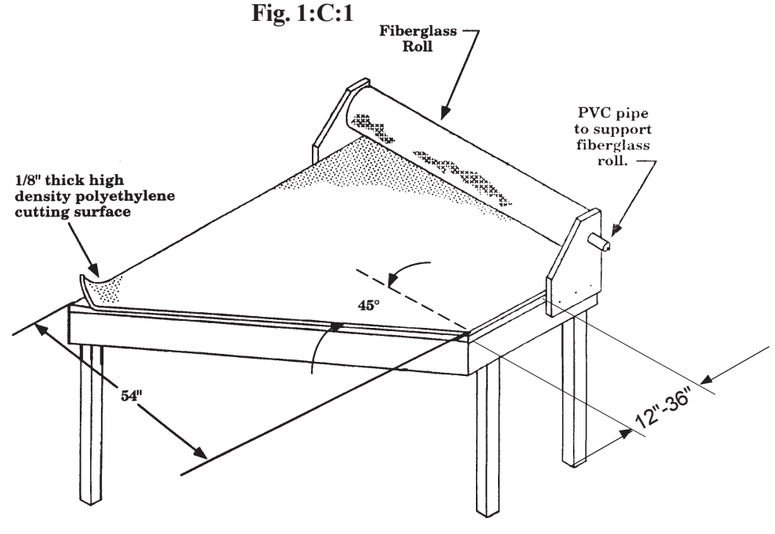
Your work area should be well lit, clean and uncluttered, and have at least one large table to cut on and work with the fiberglass. Since parts will be placed on the floor occasionally, oil, grease and dirt must be removed from the floor to prevent contamination of the parts.

If work is to be done when the outside temperature is less than 70°F, a heat source may be necessary. Working with adhesive or fiberglass resin at lower temperatures, wetting out the fiberglass becomes difficult.

### Cutting Tables

One of the focal points of any composite shop is the fiberglass cutting table. Those of us who previously built composite planes without a cutting table can't believe we were so naive. If you have the room, build a cutting table in your shop!
The cutting table should have the fiberglass roll mounted at one end so you can unwind the cloth onto the table. You should be able to unroll at least four feet of cloth onto the cutting surface. A PVC pipe, or any pipe, can be used as a roller for the cloth roll. Mount the pipe through two plywood supports nailed to the sides of your table.

**Fiberglass Cutting Table**
**Fig. 1:C:1**





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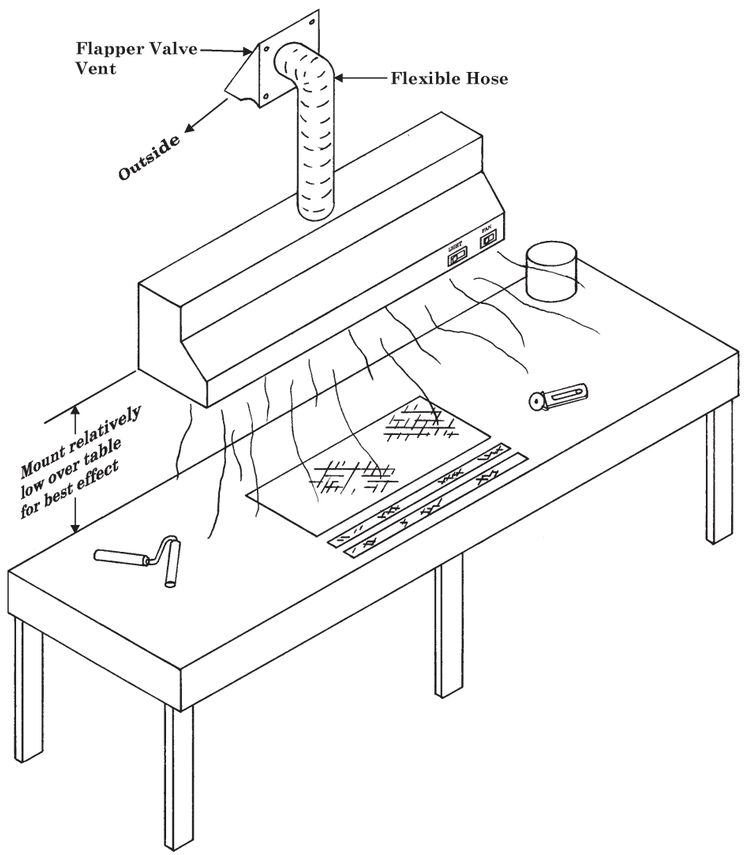
The cutting surface should be a hard plastic, such as 1/8" thick, high density polyethylene (HDPE). Some home supply stores have similar sheets of this material called "Tileboards" for use as shower liners. Check plastic supply stores also. When the plastic surface gets well used and you don't get clean cuts anymore, simply flip the plastic sheet over and use the other side, provided it still fits the table.
When the cutting table is not in use, it's a good idea to at least cover the fiberglass roll with plastic to keep the dirt from settling on it.

This setup for a layup table comes in quite handy when it comes time to start your wet layups. Construct the table about 3' X 8' and mount the exhaust hood low over the table surface. Use the same hard plastic as you installed on the cutting table.

**Layup Table**
**Fig. 1:C:2**




## D. Terms and Definitions

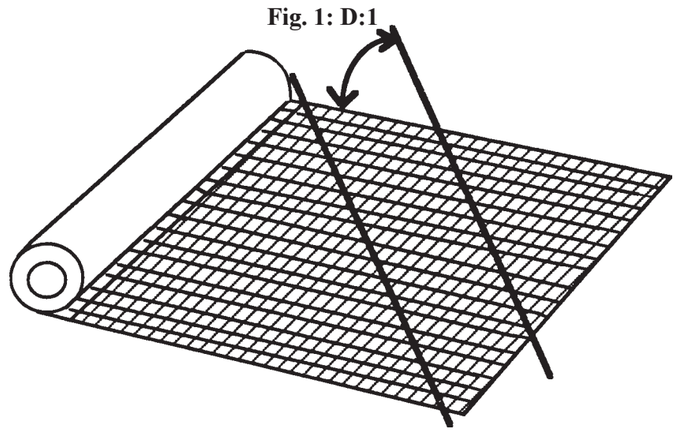
**Aft** Back side or measured back.

**BID tape** A strip of BID cloth cut on the bias, usually 2-4 inches wide.

**Bidirectional glass cloth** Bidirectional glass cloth (BID) means that 50% of its fibers are running in one direction, and 50% of the fibers are running perpendicular (90°) to the other fibers.

**Cutting on the bias** Cutting BID cloth on the bias is to cut in such a way as to leave the fibers on a 45° angle to the edge. See drawing. You can wrap a smaller radius corner when the fibers are running on a 45° angle to the corner.

**Fig. 1: D:1**



**Chord** The length of the airfoil; from the leading edge to the trailing edge of the wing.

**Fig. 1: D:2**


**Cotton Flox** Finely chopped cotton fibers which are in appearance nearly as fine as micro balloons. The big difference is that flox is structurally stronger than micro when combined with epoxy. **USE:** Mixed similarly to micro and used for strengthening glass to glass areas where BID tapes can't be used. This can fill small gaps where pure epoxy might run out and leave a void, also large amounts of pure epoxy is heavier and too brittle. Flox is heavier than micro. **Should be used sparingly - can add a lot of weight if used without discretion.**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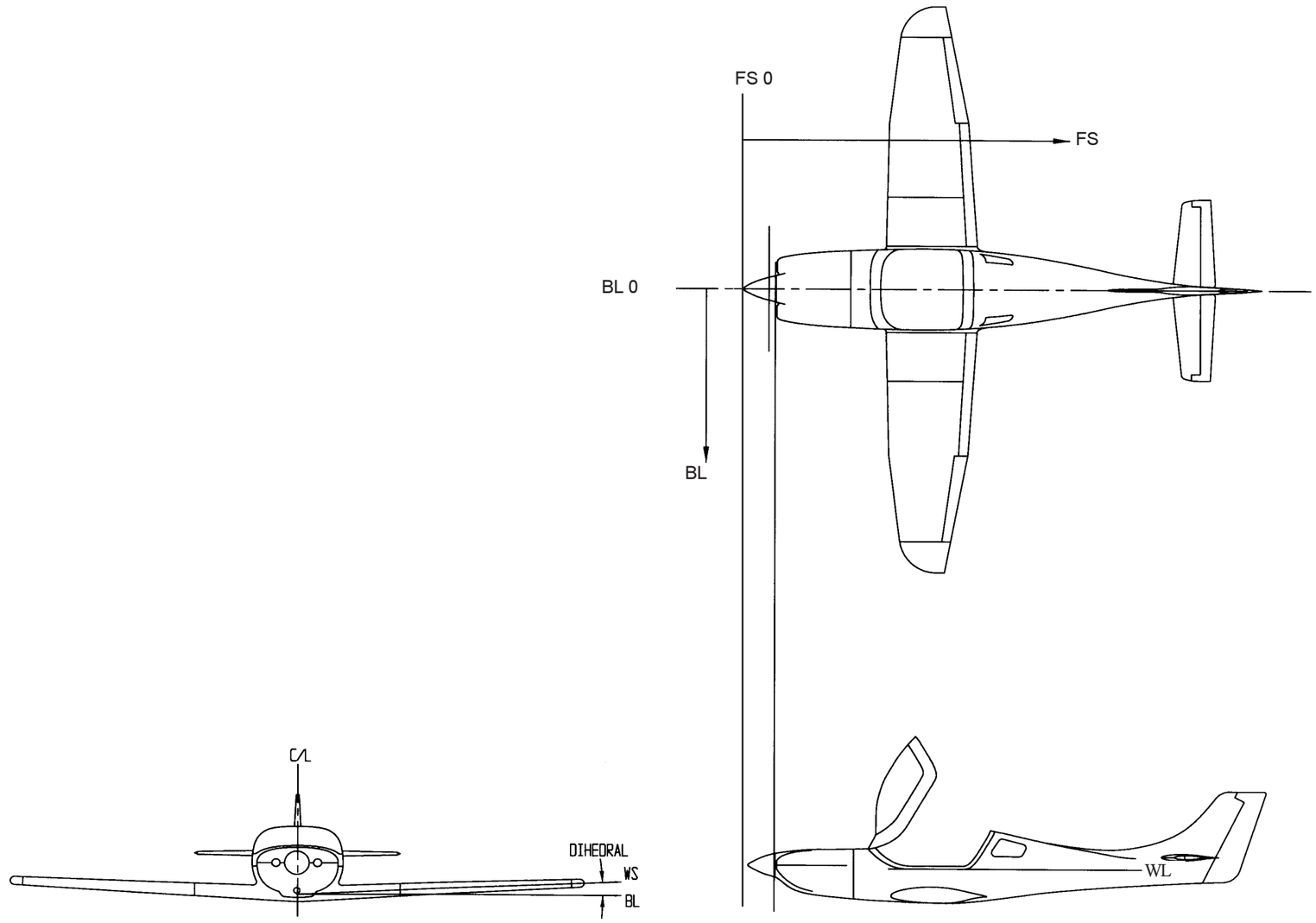
**Legacy Coordinate System**
**Fig. 1:D:3**





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**Ctr** Center.

**BL** Baseline. This line is used to measure distances outward from the centerline of the fuselage. Thus, the baseline is the actual center line. BL measurements are given in inches and positive to the left or right.

**WL** Water line. This is an imaginary line used to measure vertical distances on the plane. On the Legacy 2000 the top of the longeron at the canopy is WL 25.

**WS** Wing Station. The line formed by the chord lines. WS 0 is in the middle of the fuselage

**FS** Fuselage Station. This imaginary line is used to measure distance forward or aft on the fuselage. FS 0 is forward of the spinner.

**Dihedral** Looking at the front of the aircraft, most non-swept wings form a positive angle to the horizontal. This angle is called dihedral. Dihedral improves roll stability on non-swept wing aircraft.

**FSLG** Fuselage.

**Ftg** Fitting.

**Fwd** Forward.

**Inbd** Inboard.

**Longeron** A lengthwise structural member of the fuselage. Some planes have top and bottom longerons.

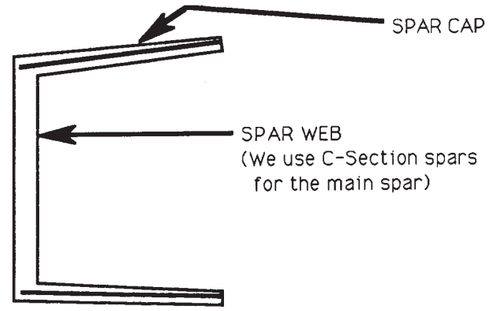
**Micro** Microballoons. These are very small thin-walled air-filled glass bubbles. Being extremely light for their volume, they can be added to resin to produce a very lightweight filler material that is easy to shape and sand. They do not add strength to the mixture however, and should be used where "cosmetics" is the consideration, not strength.

**Outbd** Outboard.

**Peel Ply** A non-structural fabric used in the manufacturing process but must be removed from the part. It is light in color and usually has darker stripes for identification.

**Shearweb** Typically the part of the wing spar that runs vertically.

**Spar cap** The top and bottom members of a spar, held in proper relation by the shear web.




**Typ** Simply means "typical" when seen on a drawing.

## E. Structural Adhesive

**DURING AIRCRAFT ASSEMBLY TWO TYPES OF EPOXY ARE USED: A STRUCTURAL PASTE ADHESIVE AND A LAMINATING RESIN.**

**THE LAMINATING RESIN IS USED TO MAKE FIBERGLASS LAYUPS AND IS ALSO MIXED WITH FLOX OR MICRO.**

**THE STRUCTURAL PASTE ADHESIVE IS USED TO STRUCTURALLY BOND MOLDED PARTS TOGETHER.**

**THESE EPOXIES ARE NOT INTERCHANGEABLE. FOLLOW THE INSTRUCTIONS CONCERNING WHICH SYSTEM TO USE.**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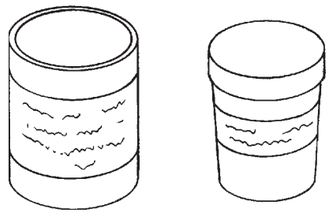
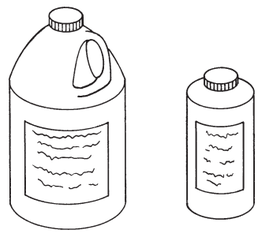
**NOTE:** Although Hysol 9339 Structural Adhesive and a laminating resin from Jeffco are illustrated, other structural adhesives may be used instead of this type if deemed appropriateby the factory. Mixing ratios will also differ. Make sure you use Lancair approved products.

**BE SURE TO CHECK FOR PROPER MIXING RATIOS OF STRUCTURAL ADHESIVES AND LAMINATING RESINS SUPPLIED. FAILURE TO PROPERLY MIX STRUCTURAL ADHESIVES OR LAMINATING RESINS COULD RESULT IN BOND FAILURE.**

HYSOL 9339 ADHESIVE
Mix: 44.5 parts 9339A(blue)
to 100 parts 9339B(White)



JEFFCO 3102/1307LV
Mix: 25 parts 3102
to 100 parts 1307LV



SAMPLE ILLUSTRATIONS, OTHER SYSTEMS MAY BE SUPPLIED AS STANDARD WITH YOUR AIRFRAME KIT. SEE ABOVE WARNING.

NOTE: Most epoxies have a manufacturer's recommended shelf life of typically one year. In some cases this is quite conservative. However, the manufacturers recommendations should be followed.

## F. AN- Bolt and Hardware Guide

This guide to AN hardware can be helpful if you are not familiar with the code number system.

**AN Bolt and Hardware Guide**
**Fig. 1:F:1**

**AN 3 thru AN 20 BOLT - HEX HD, AIRCRAFT**
**AN 21 thru AN 36 BOLT - CLEVIS**
**AN 42 thru AN 49 BOLT - EYE**
**AN 73 thru AN 81 BOLT - DR HD (engine)**
**AN 100 - THIMBLE - CABLE**
**AN 115 SHACKLE - CABLE**
**AN 116 - SHACKLE - SCREW PIN**
**AN 155 BARREL - TURNBUCKLE**
**AN 161 FORK - TURNBUCKLE**
**AN 162 FORK - TURNBUCKLE (for Bearing)**
**AN 165 EYE - TURNBUCKLE (for pin)**
**AN 170 EYE - TURNBUCKLE (for cable)**
**AN 173 thru AN 186 BOLT, CLOSE TOL.**
**AN 210 thru AN 221 PULLEY - CONTROL**
**AN 253 PIN - HINGE**
**AN 254 SCREW - THUMB, NECKED**
**AN 255 SCREW - NECKED**
**AN 256 NUT - SELF LOCK (Rt. Angle Plate)**
**AN 257 HINGE - CONTINUOUS**
**AN 276 JOINT - BALL & SOCKET**
**AN 280 KEY - WOODRUFF**
**AN 295 CUP - OIL**
**AN 310 NUT - CASTLE (Air Frame)**
**AN 315 NUT - PLAIN (Air Frame)**
**AN 316 NUT - CHECK**
**AN 320 NUT - CASTLE, SHEAR**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AN 335 NUT - PL. HEX (NC) Semi-Fin)
AN 340 NUT - HEX, MACH. SCREW (NC)
AN 341 NUT - HEX, BRASS (Elec.)
AN 345 NUT - HEX, MACH. SCREW (NF)
AN 350 NUT - WING
AN 355 NUT - SLOTTED (Engine)
USAF 356 NUT - PAL
AN 360 NUT - PLAIN (Engine)
AN 362 NUT - PLATE, SELF-LOCK. (Hi-Temp.)
AN 363 NUT - HEX, SELF-LOCK. (Hi-Temp.)
AN 364 NUT - HEX, SELF-LOCK. (Thin)
AN 365 NUT - HEX, SELF-LOCK
AN 366 NUT - PLATE, SELF-LOCK
AN 373 NUT - PLATE, SELF-LOCK. (100° CTSK)
AN 380 PIN - COTTER
AN 381 PIN - COTTER, STAINLESS
AN 385 PIN - TAPERED, PLAIN
AN 386 PIN - THREADED TAPER
AN 392 thru AN 406 PIN - CLEVIS
AN 415 PIN - LOCK
AN 416 PIN - RETAINING, SAFETY
AN 426 RIVET - 100° FL. HD., ALUM.
AN 427 RIVET - 100° FL. HD., Steel, Monel, Copper
AN 430 RIVET - RD. HD., ALUM.
AN 435 RIVET - RD. HD., Steel, Monel, Copper
AN 442 RIVET - FL. HD., ALUM.
AN 450 RIVET - TUBULAR
AN 470 RIVET - UNIVERSAL HD., ALUM.

AN hardware guide (continued)

AN 481 CLEVIS - ROD END
AN 486 CLEVIS - ROD END ADJ.
AN 490 ROD END - THREADED
AN 500 SCREW - FILL. HD. (NC)
AN 501 SCREW - FILL. HD. (NF)
AN 502 SCREW - DR. FILL. HD. (Alloy Stl.) (NF)
AN 503 SCREW - DR. FILL. HD. (Alloy Stl.) (NC)
AN 504 SCREW - RD. HD. SELF TAP.
AN 505 SCREW - FLAT HD., 82° (NC)
AN 506 SCREW - FLAT HD., 82° SELF TAP.
AN 507 SCREW - FLAT HD., 100° (NF & NC)
AN 508 SCREW - RD. HD. BRASS (Elec.)
AN 509 SCREW - FL. HD. 100° (Structural) (ALLOY STEEL)
AN 510 SCREW - FLAT HD. 82° (NF)
AN 515 SCREW - RD. HD. (NC)
AN 520 SCREW - RD. HD. (NF)
AN 525 SCREW - WASHER HD. (Alloy Stl.)
AN 526 SCREW - TRUSS HD. (NF & NC)
AN 530 SCREW - RD. HD., SHEET METAL
AN 531 SCREW - FL. HD. 82° SHEET METAL (Type B)
AN 535 SCREW - RD. HD. DRIVE (Type "U")
AN 545 SCREW - WOOD, RD. HD.
AN 550 SCREW - WOOD, FLAT HD.
AN 565 SCREW - HDLESS., SET
AN 663 TERMINAL - CABLE, DBLE. SHK. BALL (FOR SWAGING)
AN 664 TERMINAL - CABLE, SGLE. SHK. BALL (FOR SWAGING)
AN 665 TERMINAL - CABLE, THDED. CLEVIS


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**AN 666 TERMINAL - CABLE, THDED (for swaging)**

**AN 667 TERMINAL - CABLE, FORK END (for swaging)**

**AN 668 TERMINAL - CABLE, EYE END (for swaging)**

**AN 669 - TERMINAL - CABLE, TURNBUCKLE (for swaging)**

**AN 737 CLAMP - HOSE**

**AN 741 CLAMP - TUBE**

**AN 742 CLAMP - PLAIN, SUPPORT**

**AN 900 GASKET - COP. - ASBESTOS, ANGULAR**

**AN 901 GASKET - METAL TUBE**

**AN 931 GROMMET - ELASTIC**

**AN 935 WASHER - LOCK, SPRING**

**AN 936 WASHER - LOCK TOOTH (Ext. & Int)**

**AN 960 WASHER - FLAT, AIRCRAFT**

**AN 961 WASHER - FLAT, BRASS (Elec.)**

**AN 970 WASHER - FLAT, LARGE AREA**

**AN 975 WASHER - TAPER PIN**

**AN 986 RING - LOCK**

AN hardware guide (continued)

| | | |
|---|---|---|
| **AN804** TEE, Flared tube with Bulkhead on run | **AN824** TEE, Flared Tube | **AN842** HOSE ELBOW, Pipe Thread 90° |
| **AN807** ADAPTER Hose to Universal | **AN825** TEE, Flared Tube with Pipe Thread on side (MS20825) | **AN844** HOSE ELBOW, Pipe Thread 45° |
| **AN814** PLUG AND BLEEDER, Screw Thread | **AN826** TEE, Tube with Pipe Thread on Run (MS20826) | **AN911** NIPPLE, Pipe Thread |
| **AN815** UNION, Flared tube | **AN827** CROSS, Flared Tube | **AN912** BUSHING, Pipe Thread Reducer |
| **AN816** NIPPLE, Flared Tube and pipe thread | **AN832** UNION, Flared Tube, Bulkhead and Universal | **AN913** PLUG, Square Head, Pipe Thread (MS20913) |
| **AN818** NUT, Coupling | **AN833** ELBOW, Flared Tube, Bulkhead and Universal, 90° | **AN914** ELBOW Internal and External Pipe Thread, 90° |
| **AN819** (MS20819) SLEEVE, Coupling | **AN834** TEE, Flared, Tube, Bulkhead and Universal | **AN915** ELBOW, Internal and External Pipe Thread, 45° |
| **AN821** ELBOW, Flared Tube, 90° | **AN837** ELBOW, Flared Tube, Bulkhead and Universal, 45° | **AN919** REDUCER, External Thread |
| **AN822** ELBOW, Flared Tube and Pipe Thread, 90° (MS20822) | **AN838** ELBOW Hose to Universal, 90° | **AN924** NUT, Flared Tube, Bulkhead and Universal Fitting |
| **AN823** ELBOW, Flared Tube and Pipe Thread, 45° (MS20823) | **AN840** HOSE NIPPLE, Pipe Threaded | **AN929** CAP, Flared Tube Fitting |



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## Torque Chart
## Fig. 1:F:2

| BOLTS Steel Tension | BOLTS Steel Tension | BOLTS Aluminum |
|---|---|---|
| AN 3 thru AN 20<br>AN 42 thru AN 49<br>AN 73 thru AN 81<br>AN 173 thru AN 186<br>MS 20033 thru MS 20046<br>MS 20073<br>MS 20074<br>AN 509 NK9<br>MS 24694<br>AN 525 NK525<br>MS 27039 | MS 20004 thru MS 20024<br>NAS 144 thru NAS 158<br>NAS 333 thru NAS 340<br>NAS 583 thru NAS 590<br>NAS 624 thru NAS 644<br>NAS 1303 thru NAS 1320<br>NAS 172<br>NAS 174<br>NAS 517 | AN 3DD thru AN 20DD<br>AN 173DD thru AN 186DD<br>AN 509DD<br>AN 525D<br>MS 27039D<br>MS 24694DD |
| | Steel shear bolt<br>NAS 464 | |

| NUTS | | NUTS | | NUTS | |
|---|---|---|---|---|---|
| Steel Tension | Steel Shear | Steel Tension | Steel Shear | Aluminum Tension | Aluminum Shear |
| AN 310<br>AN 315<br>AN 363<br>AN 365<br>NAS 1021<br>MS 17825<br>MS 21045<br>MS 20365<br>MS 20500<br>NAS 679 | AN 320<br>AN 364<br>NAS 1022<br>MS 17826<br>MS 20364 | AN 310<br>AN 315<br>AN 363<br>AN 365<br>MS 17825<br>MS 20365<br>MS 21045<br>NAS 1021<br>NAS 679<br>NAS 1291 | AN 320<br>AN 364<br>NAS 1022<br>MS 17826<br>MS 20364 | AN 365D<br>AN 310D<br>NAS 1021D | AN 320D<br>AN 364D<br>NAS 1022D |

FINE THREAD SERIES

| Nut-bolt size | Torque Limits in.-lbs. | | Torque Limits in.-lbs. | | Torque Limits in.-lbs. | | Torque Limits in.-lbs. | | Torque Limits in.-lbs. | | Torque Limits in.-lbs. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 8 -36 | 12 | 15 | 7 | 9 | | | | | 5 | 10 | 3 | 6 |
| 10 -32 | 20 | 25 | 12 | 15 | 25 | 30 | 15 | 20 | 10 | 15 | 5 | 10 |
| ¼-28 | 50 | 70 | 30 | 40 | 80 | 100 | 50 | 60 | 30 | 45 | 15 | 30 |
| 5/16-24 | 100 | 140 | 60 | 85 | 120 | 145 | 70 | 90 | 40 | 65 | 25 | 40 |
| 3/8 -24 | 160 | 190 | 95 | 110 | 200 | 250 | 120 | 150 | 75 | 110 | 45 | 70 |
| 7/16-20 | 450 | 500 | 270 | 300 | 520 | 630 | 300 | 400 | 180 | 280 | 110 | 170 |
| ½ -20 | 480 | 690 | 290 | 410 | 770 | 950 | 450 | 550 | 280 | 410 | 160 | 260 |
| 9/16-18 | 800 | 1, 000 | 480 | 600 | 1, 100 | 1, 300 | 650 | 800 | 380 | 580 | 230 | 360 |
| 5/8 -18 | 1, 100 | 1, 300 | 660 | 780 | 1, 250 | 1, 550 | 750 | 950 | 550 | 670 | 270 | 420 |
| ¾ -16 | 2, 300 | 2, 500 | 1, 300 | 1, 500 | 2, 650 | 3, 200 | 1, 600 | 1, 900 | 950 | 1, 250 | 560 | 880 |
| ⅞ -14 | 2, 500 | 3, 000 | 1, 500 | 1, 800 | 3, 550 | 4, 350 | 2, 100 | 2, 600 | 1, 250 | 1, 900 | 750 | 1, 200 |
| 1 -14 | 3, 700 | 4, 500 | 2, 200 | 3, 300 | 4, 500 | 5, 500 | 2, 700 | 3, 300 | 1, 600 | 2, 400 | 950 | 1, 500 |
| 1⅛ -12 | 5, 000 | 7, 000 | 3, 000 | 4, 200 | 6, 000 | 7, 300 | 3, 600 | 4, 400 | 2, 100 | 3, 200 | 1, 250 | 2, 000 |
| 1¼ -12 | 9, 000 | 11, 000 | 5, 400 | 6, 600 | 11, 000 | 13, 400 | 6, 600 | 8, 000 | 3, 900 | 5, 600 | 2, 300 | 3, 650 |

**Note: All bolts should be torqued according to the above chart unless otherwise specified.**

# G. Basic Shop Tools

The tools listed are not mandatory for your shop, but we have found them extremely useful in ours. The tools we feel are most important are marked with an asterisk (*). You probably won't be familiar with some of the tools listed, but the purpose and description of these items will be explained.

**Saber saw (jig saw)***

Very handy for cutting out large or complex shapes from pre-preg material. You can use a manual saw, but it won't be fun, or a very pretty sight. Either way, be sure you get sharp blades, and change them often. Dull blades will chew up the edges and make for more sanding/smoothing work later. We use carbide tipped blades exclusively for composite cutting. They work great.

**Electric and / or cordless drill motor***

Most of the material you would have to drill on a glass kit is fairly soft and thin, and should require no more than a small drill motor with at least a 3/8" chuck. If you don't already have one, go buy one with a variable speed (variable, not two speed), and get one with a 1/2" chuck. The extra couple of bucks they cost will be worth it in the long run, and some of the stuff you need to drill, like plastic parts, must be drilled at a very slow speed that is below the range of all single and most two speed drills.

**Drill press**

Here's a tool that most people don't have, but no one that's ever had one will be without again. For precision drilling it is a must. For instance, it can be used in drilling out broken bolts, and with a fly-cutting tip it can cut holes large enough to amaze your neighbors. I wouldn't run right out and buy one just for building the plane, but I would make friends with that guy down the street that has one gathering dust in his garage.

**Drill bits (Numbered AND Fractional)**

It takes a lot of cheap drill bits to make a lousy hole that one good bit could have made quickly and perfectly. If you have a vault to keep them safe in, bite the bullet and buy a good set of numbered drill bits. If cared for, they will last longer and give you better service than your foreign made car. Unfortunately, a good set will seem to cost about as much as that car.

**Rotary sander (rotary or orbital type)***

This, I would go out and buy for building a kit-plane, unless you want arms like Arnold Schwarzenegger. It will definitely make sanding and smoothing the rough edges a lot easier, and a good orbital can be had with a trapper bag to keep a lot of the "stuff" out of the air. And your clothes. And your nose. And everywhere. We don't use one with a bag here, which is why sometimes even in July it looks like it just snowed in the shop.

**Die grinder (angle grinder)**

If you have one, bravo. This is a powerful tool that can custom fit your ribs and bulkheads quickly. Be very careful though, if the high speed grinder surface gets away from you, it can quickly customize everything in the general vicinity. While not a necessity, if you have a used tools store in the area, it would give you an excuse to browse around.


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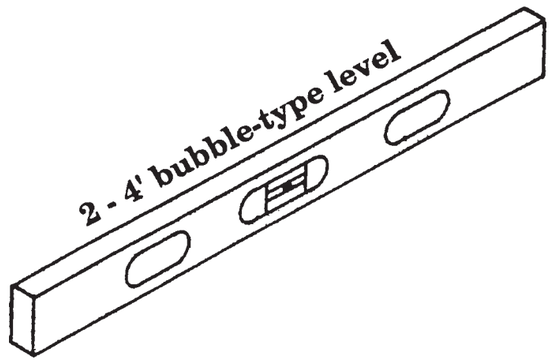
**2 & 4 ft. Carpenter's levels***

If you want a plane to fly straight, you should build it straight. These are indispensable in a good shop. Get the good aluminum ones (you'll be holding them up, down and at various angles in between for hours at a time), make sure they have straight edges, and round the sharp ends a bit so you won't gouge any holes into precious prepared surfaces. All you might find is just a few, little, easily filled dents.

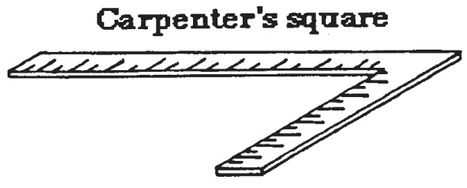
**Carpenter's Level**
**Fig. 1:G:1**




**Carpenter's square**

Buy this when you get the carpenter's levels, and for the same reason. Don't round these ends, just be careful.

**Carpenter's Square (Framing Square)**
**Fig. 1:G:2.**




**Clamps (Vise grip clamps, spring clamps, and "C" clamps)**

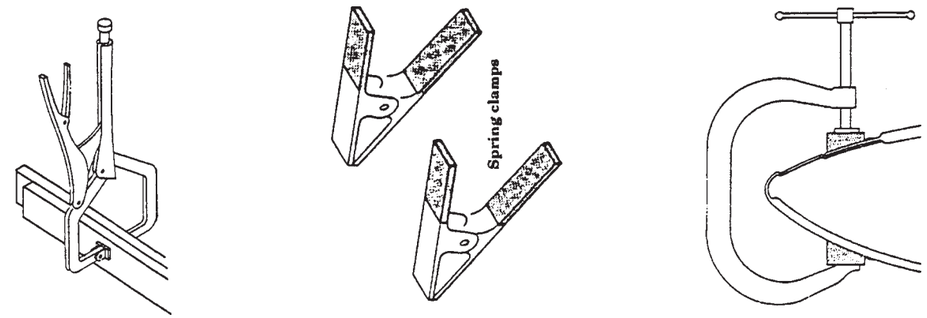
Here's a brief description of the clamps you will need.

A couple of the vise grip clamps for really forcing things together (never-stress again, never use these on any fiberglass, prepreg or carbon composite parts. They grip with enough force to do great damage to the parts, which may not be visible to the naked eye.)

Spring clamps- get a bunch of these when you wander through the used tool store. Three or four large ones like Arnold uses for strengthening his grip, and about a dozen that you can work with one hand while you try to hold the six other parts in exact proper position.

"C" clamps. These should be in the bin next to the spring clamps in the used tool store. If there is an assortment, get three or four of each. Again, use caution when applying these to any glass parts. Tighten slowly, and only until just snug.

**Clamps, Assorted**
**Fig. 1:G:3**




Now that you have clamped the parts together and drilled the holes, the instruction book tells you that you need to insert pop rivets. The best thing to do this with is a pop rivet tool. The second best thing to do this with doesn't work. Get the pop rivet tool. It should come with three extra tips for use with all four common sizes of pop rivets, 3/32", 1/8", 5/32", and 3/16". Three cheap ones will get you through most any project, but a good one will last a lifetime. Get the good one. Besides, it's cheap if you buy it at that used tool store you've been spending so much time in lately.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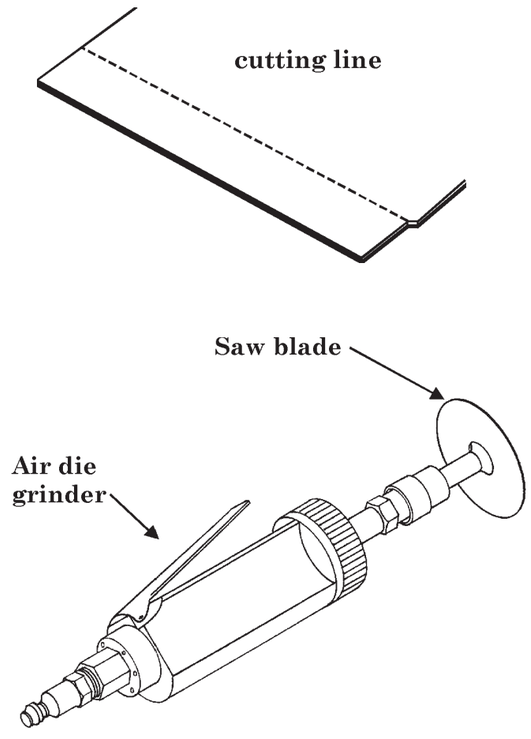
## Specialized Tools

We call them specialized shop tools because it makes it a little easier to swallow the higher price tags on these items. Again, the tools listed are not mandatory for your shop, but we have found them extremely useful in ours. The tools we feel are most important are marked with an asterisk (*).

**Air die grinder tool***

The one we have shown here has a saw blade installed, but they come with a fantastic array of special bits (there's that special word again). We can't imagine building a composite aircraft without a die grinder tool. You'll use this tool more than any other in your growing collection.

**Die Grinder**
**Fig. 1:G:4**

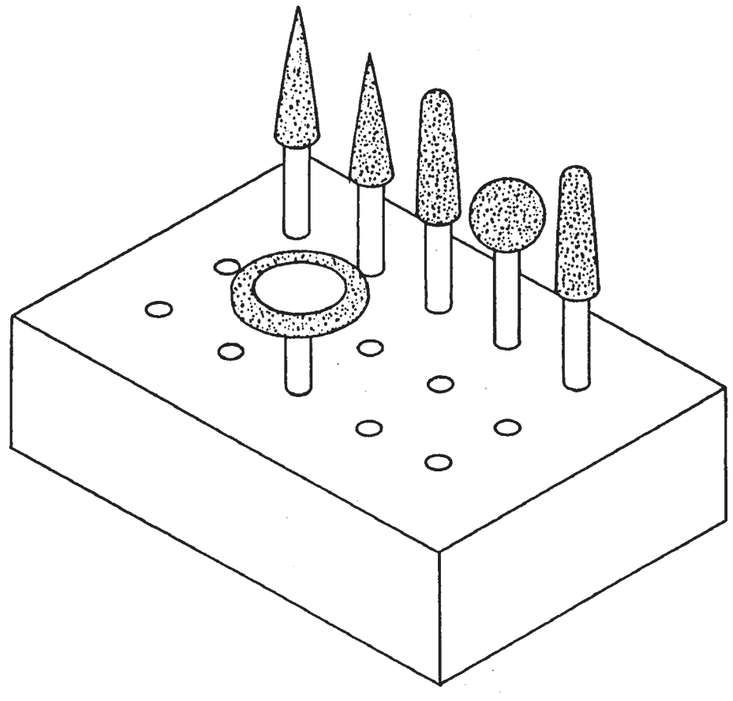



**Note: If you don't have an aircompressor consider getting a Dremmel tool. The Dremmel works similarly to the air die grinder but it is not as powerful.**

**Tungsten carbide bits for Dremel tool***

During construction of the prototype Lancair we were in need of a Dremel bit that could easily cut prepreg. The prepreg is very easy to work with, but it eats power tool blades/bits for breakfast. Dremel's tungsten carbide cutters come in various shapes and sizes and are the best bet. Some Dremel part numbers to look for are 9931 through 9936. We now use these bits almost exclusively because they really cut. As long as you don't use them on aluminum or Kevlar™, which tend to gum them up, the carbide bits last a long time. They're expensive, though. We paid about $12.00 for a single bit, but they're worth it in the long run. For availability check hobby stores, hardware stores, Sears, as well as the Lancair Kit Components, Inc. (KCI) Catalog. They also offer a wide range of cutting, grinding, buffing, polishing, etc. bits for use with the Dremel. If they have them at that used tool store, get one of each. You may never use them all, but they'll sure impress your neighbors. Especially if you make one of these snappy little holders to display them in. You can make it out of a piece of 2x4, drilling holes as you add bits to your collection.

**Tungsten Carbide Bits and Snappy Little Holder**
**Fig. 1:G:5**

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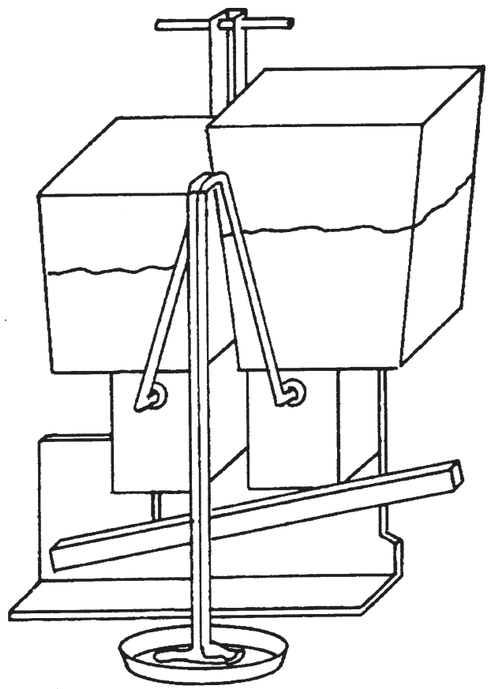
**Epoxy pump (Sticky Stuff dispenser)***

The Sticky Stuff dispenser will pay for itself in saved epoxy. With every pump of the handle, you receive the proper amount of resin and hardener, no weighing, no measuring. With practice you'll know the proper number of pumps needed for the size of lamination you are doing. We offer this item in our KCI catalog, and highly recommend its use. Many builders are using a light bulb heated box over their epoxy pumps to keep the epoxy warm and thin. This is fine, we do the same, but if you're not going to use the pump for a week or so, turn the light bulb off in the box. Otherwise the volatiles in the epoxy can evaporate out and cause faulty curing or no curing at all. If you are a dedicated builder, using the pump every night (I've heard there are such people) you needn't worry about evaporation and can leave the heat on. Use no higher than a 25 watt bulb in your pump box.

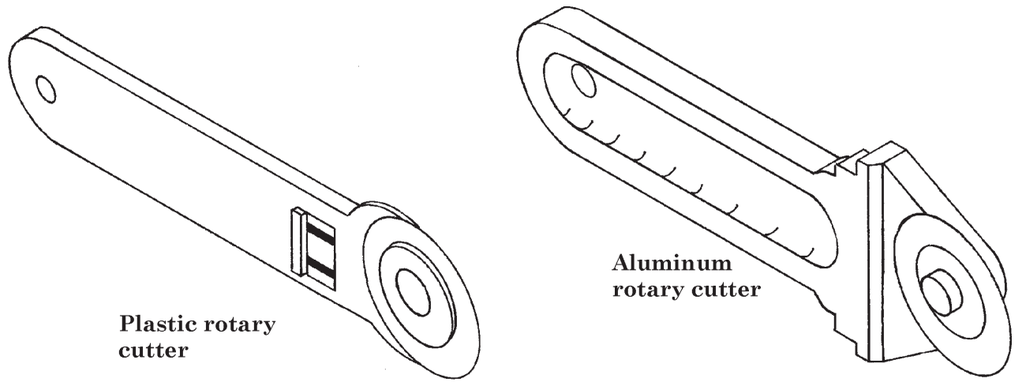
**Epoxy Pump**
**Fig. 1:G:6**



**Roller blade for cutting fiberglass***

Don't even think of using scissors to cut the fiberglass you've just unrolled on your new cutting table. That's like using a 1/2" brush to paint the Golden Gate Bridge. Use a roller blade (looks like a pizza cutter, but it ain't) and you'll cut the time you spend cutting cloth in half (at least!). These roller blades are available through our KCI catalog, or your local fabric store. They sell under the names of roller blades, rotary cutters, and fabric cutters, but all models closely resemble each other. Pick up a couple of extra blades when you buy it and save yourself a trip later. We suggest getting the aluminum rotary cutter (P/N RB-1) for fiberglass work as it tends to last much longer and stands up to acetone.

**Roller Blade (a.k.a. pizza cutter)**
**Fig. 1:G:7**




**2" side paint roller (without furry part) or wallpaper roller***

Another simple but handy tool in our shop is the roller. We use a small, 1-1/2" wide paint roller (without the furry paint sleeve), and a larger, 3" wide roller for pushing the air bubbles out from under laminates. Try sliding a length of PVC tubing onto the paint roller to get a smooth, hard rolling surface. Common paint rollers work okay, but we made a solid aluminum roller that works even better. Wallpaper rollers are also good for this application.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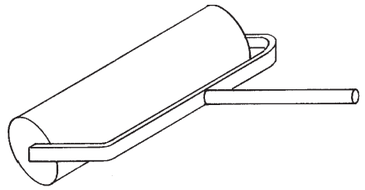
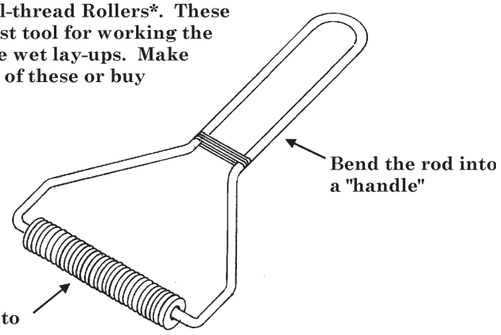
**Smooth, Hard Faced Roller**
**Fig. 1:G:8**



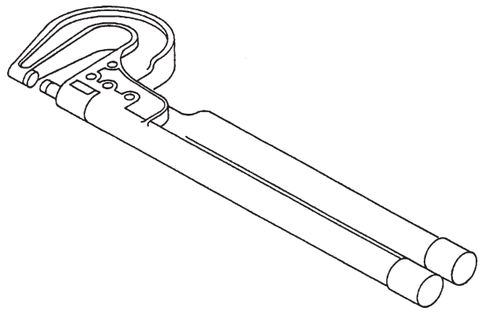
**1 to 1-1/2" wide all-thread Rollers*. These rollers are the best tool for working the bubbles out of the wet lay-ups. Make yourself a couple of these or buy them finished.**




**Rivet squeezer**

This tool will save hours whenever you are installing rivets. Next trip to the used tool store, get one of these, too.

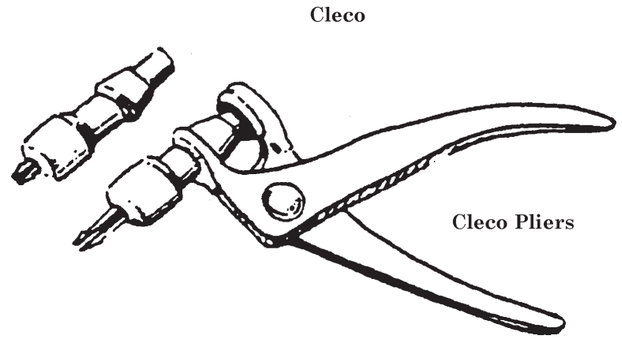
**Rivet Squeezer**
**Fig. 1:G:9**



**Cleco™ Pliers and Clecos***

These are very handy. You should have the Cleco plier (P/N C-200) tool and about 50 of the Cleco bits (P/N C-1/8). We sell them, use them and recommend them to all of our friends.

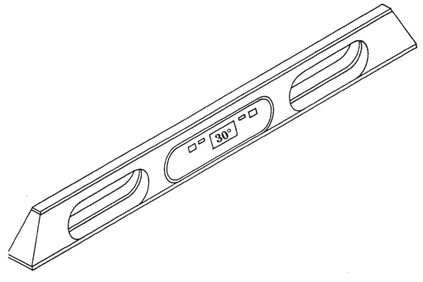
**Clecoes and Cleco pliers**
**Fig. 1:G:10**




**Digital level***

The digital Level has an LCD readout instead of a bubble. The center of some digital Levels pops out to become a small, six inch level that's extremely handy for measuring control surface throws, seat back angles, firewall angles, engine thrust lines, etc., all with an accuracy of 1/10th of a degree.

**The Digital Level**
**Fig. 1:G:11**



You aren't very likely to find one of these at that used tool mart. We've received a few inquiries where to buy digital levels. KCI is now carring a digital level. It's not inexpensive and is progressively more expensive with the longer rails. This is a great tool, but always remember to re-calibrate the level module when you turn it on, otherwise you could be off by a couple of degrees.

KCI
Kit Components, Inc.
2244 Airport Way
Redmond, Or. 97756
**541-923-2244**
**kci@lancair.com**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**Tubing bender**

This will be at the used tool store, where you should be on a first name basis with the owner by now. Tell him you just need one for 1/4" tubing. It should be in the bin right next to the 37° Flaring tool.

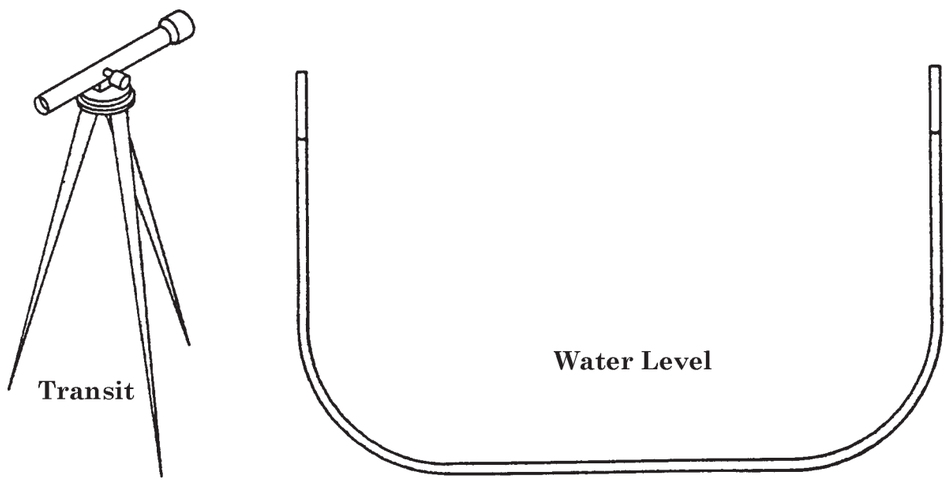
**37° flaring tool**

Keep this with your tube bender. You won't need it often, but when you do nothing else will work. Don't use automotive type flaring tools- they have a different flaring angle.

**Surveyor transit**

If you love gadgets, this one will be fun, but a water level would work just as well for a whole lot less money (just keep a mop around). It may save you an hour or two in setup time, and can usually be rented from surveyor/construction suppliers. Like the water level, it still takes two people to use it effectively, but you can quickly level fuselages, wings, horizontal stabs and jigs, staying dry in the process.

**Transit and Water Level**
**Fig. 1:G:12**




**Water level**

A cheap and simple means of checking wing washout, horizontal stabilizer position, and other big jobs on the airframe. We use 1/4" inch I.D. clear tubing, available at the hardware store. I've heard that dying the water in your water level tube with food coloring can make it easier to read, but when I tried it, the coloring didn't help much, it just messed up the tube.

**Plumb bob**

These should be laying around the tool store somewhere. Since you will be (hopefully) working indoor out of the wind, you will only need a small one for measuring things for vertical.

**1" Makita belt sander**

A real handy item, you might score one of these at the local tool shop (isn't your wife starting to wonder about all the time you've been spending there lately?). Get an assortment of different grit belts for it, they'll all come in handy before this is over.

**Heat gun**

If you have one of these, it can help to warm a couple of parts you want to bond, to straighten a warped part, or a lot of other jobs. It can also destroy parts if care is not taken. Take care when using. The heat gun is a well used tool in our shop, not only for heating parts but for gently heating to cure epoxy, shrinking heat shrink tubing on electrical connections, etc.

## Supplies

**1 mil thick plastic drop cloths**

You will use a lot of these. Fortunately you can probably get them at most hardware stores for about a buck a roll. They're not only great for covering things, but you'll be using them in the preparation of BID tapes and other fiberglass layups. Get several, but be sure they are all the 1 mil thick ones. Thinner, and they won't be easy to handle and thicker, they will be too hard to work . More about that later.

**Paper towels**

If you have a lot of storage room, buy these by the case. If not, keep at least 3 or 4 rolls on hand. You'll be using them for cleaning up drips and dribbles of this and that, as well as using them for some other trick things we'll talk about later in Chapter 5.

**Tongue depressors**

We supply these in the kit, and there should be enough to complete the project with a few left over. You'll be using them mostly for mixing sticks to mix up the epoxy you pump from your nifty Sticky Stuff epoxy dispenser (you do have that on order now, don't you?). You will also be shown how to make a neat little tool out of one later, the kind that you will want to cherish and hang from a special hook on your shop wall.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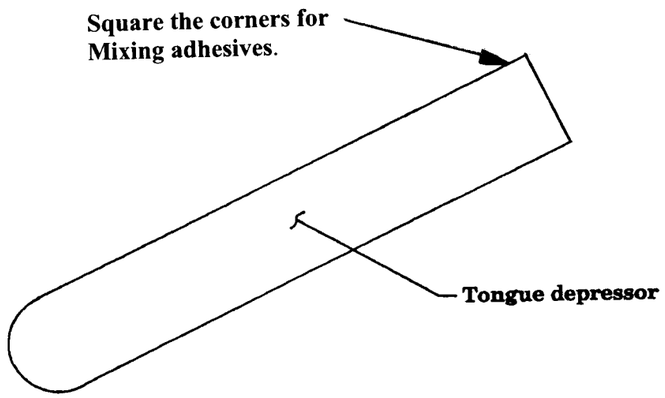
**Tongue Depressor**
**Fig. 1:G:13**




**Brushes (1" wide)**

These too are supplied in the kit. There's a whole bunch of them in there, but don't give them away, you'll need most of them for the project. Simply clean in acetone and re-use.

**Brush, 1" Wide**
**Fig. 1:G:14**

**Note: Cut half of the bristles off**

**Rubber squeegees**

Hit up the auto parts store for a set of the plastic Bondo™ smoothing paddles. There should be 3 or 4 different sizes in the package. They will all come in handy for getting excess epoxy and air out of layups, applying and smoothing out micro, and any number of other things. Clean up is pretty easy and they should last through the project.

**Sandpaper and sanding blocks**

Purchase several sanding blocks and a lot of 40-grit sandpaper. Nearly every time you apply epoxy or BID tapes to a piece, you will have to rough it up with 40 grit first. Get this size for your belt sander and your sanding blocks. Get a couple of sheets of other grits.

3M Production Paper Sheets are the best we've seen for preparing fiberglass and carbon fiber. The are 2 3/4" x 17 1/2" and are meant for longboard sanders. If cut in half, they fit perfectly into most rubber hand sanding blocks. 3M calls this sandpaper "The Green Corps" and the paper is green. Autobody supply and auto paint stores should carry this item.

**Instant glue**

You'll find some of this in the kit, and it will come in handy for many of the steps called out in the manual. You can use it to temporarily tack most any parts together, it is void-filling, and it can become permanent if you use too much. Just a drop or two will suffice for any of the steps in the manual. You can use it to glue a piano hinge in place and measuring where clecoes would get in the way, and test the placement of brackets.

**Instant glue accelerator**

The ultimate stuff for impatient people, this makes instant glue even faster (more instant?). A quick spray of this stuff and the glue is set, right now.

**The eyeball**

Our last tool used to check how straight an edge is, it is the most complicated in design and yet the cheapest and most accurate of all. It's called the human eyeball and should be used whenever possible. If an edge or surface looks straight to the eye, they are straight enough. Even minor discrepancies in wing tip washout can easily be detected by kneeling down ten feet in front of your Lancair, closing one eye, and swiveling your head. Sight one trailing edge tip above the high point of the wing, swivel your head, and sight the other tip, comparing the two.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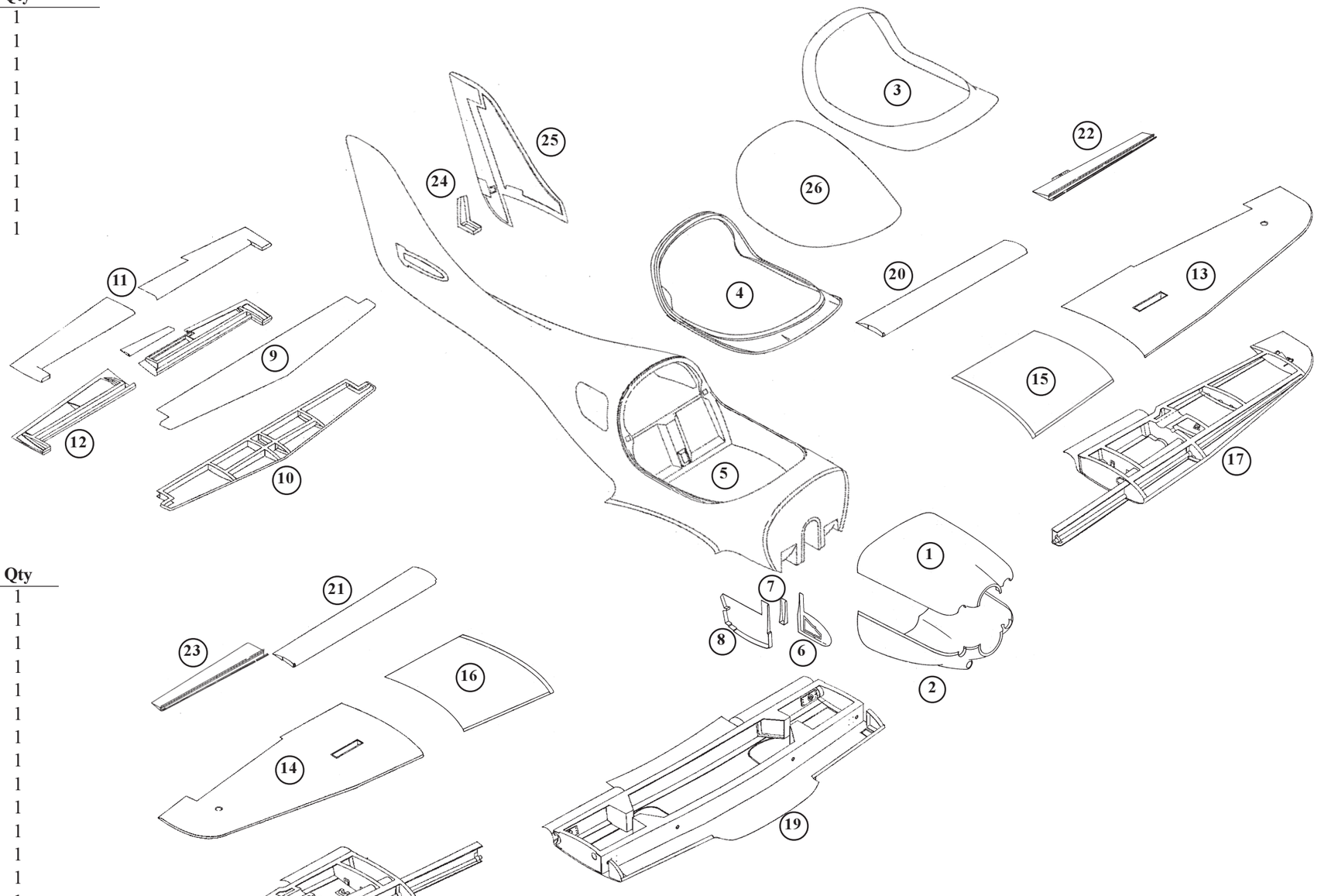
# H. Premolded Parts - Exploded View

*Legend:*

| # | Item | P/N | Qty |
|---|---|---|---|
| 1 | Cowl Top | 4000-01 | 1 |
| 2 | Cowl Bottom | 4000-02 | 1 |
| 3 | Canopy Frame Skin | 4010 | 1 |
| 4 | Canopy Frame Stiffener | 4011 | 1 |
| 5 | Fuselage Assembly | 4020-FB | 1 |
| 6 | Load Pad Left Fwd | 4025-01 | 1 |
| 7 | Load Pad Left Center | 4026-01 | 1 |
| 8 | Rib BL25 Left w/ Load Pad | 4232-01 | 1 |
| 9 | Horiz. Stab. Top Skin | 4100-01 | 1 |
| 10 | Horiz. Stab. Bot Skin Assy. | 4100-02FB | 1 |

*Legend:*

| # | Item | P/N | Qty |
|---|---|---|---|
| 11 | Elevator Skin Top | 4130-01 | 1 |
| 12 | Elevator Bottom Assembly | 4130-02FB | 1 |
| 13 | Wing Outbd Left Skin Top | 4200-01 | 1 |
| 14 | Wing Outbd Right Skin Top | 4200-02 | 1 |
| 15 | Wing Inboard Skin Top | 4200-03 | 1 |
| 16 | Wing Inboard Skin Bottom | 4200-04 | 1 |
| 17 | Wing Left Lower Assembly | 4210-01FB | 1 |
| 18 | Wing Right Lower Assembly | 4210-02FB | 1 |
| 19 | Wing Center Lower Assy | 4210-03FB | 1 |
| 20 | Flap Left Assembly | 4310-02FB | 1 |
| 21 | Flap Right Assembly | 4310-02FB | 1 |
| 22 | Aileron Left Assembly | 4322-01FB | 1 |
| 23 | Aileron Right Assembly | 4322-02FB | 1 |
| 24 | Horiz. Stab. Vert. Bkhd Upper | 4049 | 1 |
| 25 | Vertical Rudder Left Skin | 4044 | 1 |
| 26 | Canopy Windshield | 4600 | 1 |





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## Premolded Parts List - not included in figure

*Legend:*

| # | Item | P/N | Qty |
|---|---|---|---|
| 1 | Canopy Hinge Support Outboard Left | 4015-01 | 1 |
| 2 | Canopy Hinge Support Outboard Right | 4015-02 | 1 |
| 3 | Canopy Hinge Support Inboard Left | 4016-01 | 1 |
| 4 | Canopy Hinge Support Inboard Right | 4016-02 | 1 |
| 5 | Mount Fuel Selector Valve | 4021 | 1 |
| 6 | Firewall Closeout Legacy | 4023 | 1 |
| 7 | Seat Support Left Center | 4024-01 | 1 |
| 8 | Seat Support Right Center | 4024-02 | 1 |
| 9 | Load Pad Right Forward | 4025-02 | 1 |
| 10 | Forward Load Pad Access Panel Left | 4025-03 | 1 |
| 11 | Forward Load Pad Access Panel Right | 4025-04 | 1 |
| 12 | Seat Support Left Outboard | 4027-01 | 1 |
| 13 | Seat Support Right Outboard | 4027-02 | 1 |
| 14 | Instrument Panel | 4028 | 1 |
| 15 | Center Console | 4029 | 1 |
| 16 | Center Console Access Panel Fwd Left | 4029-01 | 1 |
| 17 | Center Console Access Panel Fwd Right | 4029-02 | 1 |
| 18 | Center Console Glove Box | 4029-03 | 1 |
| 19 | Center Console Access Panel Top | 4029-04 | 1 |
| 20 | Center Console Access Panel Aft Left | 4029-05 | 1 |
| 21 | Center Console Access Panel Aft Right | 4029-06 | 1 |
| 22 | Seat Bottom Left | 4033-01 | 1 |
| 23 | Seat Bottom Right | 4033-02 | 1 |
| 24 | Floor Board Left | 4034-01 | 1 |
| 25 | Floor Board Right | 4034-02 | 1 |
| 26 | Push Pull Tube Closeout | 4035 | 1 |
| 27 | Control Tube Cover Top | 4035-01 | 1 |
| 28 | Flap Bay Closeout Left | 4036-01 | 1 |
| 29 | Flap Bay Closeout Right | 4036-02 | 1 |
| 30 | Seat Belt Attach Center Lower | 4040 | 1 |
| 31 | Bulkhead Cover | 4041 | 1 |
| 32 | Bracket Fuel Pump | 4042 | 1 |
| 33 | Rudder Leading Edge Closeout | 4056 | 1 |
| 34 | Battery Shelf | 4038 | 1 |
| 35 | Rudder Trim Tab | 4061 | 1 |
| 36 | Spar Closeout Forward Center | 4214 | 1 |
| 37 | Rib BL25 Right w/ Load Pad | 4232-02 | 1 |
| 38 | Gear Door Inboard Left | 4264-01 | 1 |
| 39 | Gear Door Inboard Right | 4264-02 | 1 |
| 40 | Gear Door Outboard Left | 4265-01 | 1 |
| 41 | Gear Door Outboard Right | 4265-02 | 1 |
| 42 | Fairings Fuel Drain | 4271 | 4 |
| 43 | Control Tube Elevator Forward | ( 1" x 62") | 4465 | 1 |
| 44 | Control Tube Elevator Aft | ( 1 1/4" x 76") | 4466 | 1 |
| 45 | Control Tube Aileron Center | ( 3/4" x 19 1/4") | 4576 | 1 |
| 46 | Control Tube Aileron Inboard | ( 3/4" x 35 1/2") | 4577 | 2 |
| 47 | Control Tube Aileron Outboard | ( 3/4" x 38 1/2") | 4578 | 2 |
| 48 | Control Tube Aileron Bellcrank | ( 3/4" x 11 3/8") | 4579 | 2 |
| 49 | Control Tube Rudder | ( 3/4" x 31") | 4658 | 1 |


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# I. Procedures

## Cleaning, care, and handling of parts

1. Cleaning Parts
You will find instructions calling for the use of cleaning agents throughout this manual. We have found that Methylene Chloride (MC) cleaner is very good in its ability to remove impurities from surfaces. As with all cleaners, be sure to read and follow the safety directions. Acetone is a good cleaner but Methylene Chloride (MC) is superior. *MEK should not be used.*

2. Storage of Premolded Parts
The manner in which your pre-molded parts are stored is very important. Care and thought should be exercised when laying pre-molded parts away for some future use which could be months away. Try to store these parts in a position that won't produce any distorting forces (i.e., store them supported in a position as close to the actual use orientation as possible).

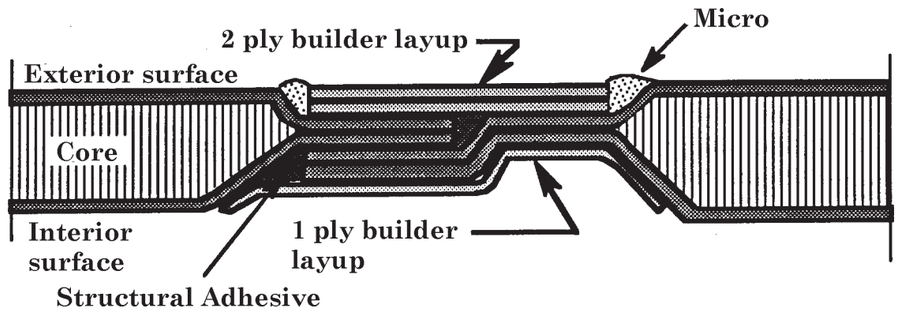
Unlike fiberglass composite parts, the carbon fiber parts are much stiffer and less prone to distortion, however it is still highly recommended that great care be exercised when storing these valuable components. Also, all composite parts should be kept away from direct sunlight for any extended periods of time. An afternoon or a day is perhaps okay. However a week, for example, in direct sunlight would not be acceptable.

3. Honeycomb Prepreg Panels
The prepreg honeycomb panels are available in two types: 3/8" core + 2 BID per side and 1/4" core + 1 BID per side. All BID ply schedules must remain the same when using prepreg panels (i.e., if a part calls for 6 BID on one side and 2 BID on the other side, the 2 BID honeycomb panel will require 4 additional BID on the first side). Also, all attachment BID schedules must remain the same (i.e., if plans call for a 6 BID attachment, then 6 plies (wet layup) must be used.) Typically 1" contact on each surface unless otherwise noted is sufficient.

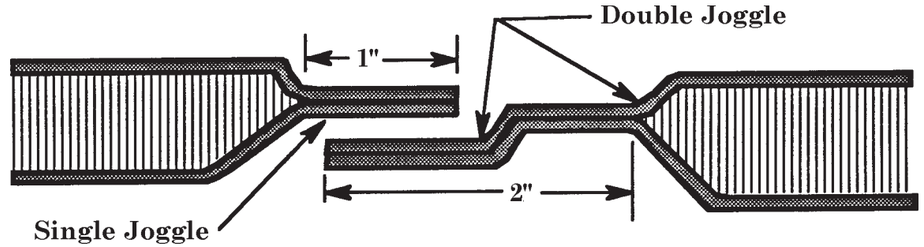
# J. Joint Description

Adjoining parts are attached with bonded, overlapping joints (joggles) reinforced with fiberglass strips, see Figure 1:J:1. Figure 1:J:2 shows the overlaps prior to assembly (the dimensions shown in the figures are approximate). As supplied, the part edges may have excess material. To obtain the dimensions shown the excess material must be trimmed by the builder.

**Reinforced Overlapping Joints**
**Fig. 1:J:1**




**Trimmed Parts**
**Fig. 1:J:2**




*Note: Before trimming, single and double joggle surfaces may look similar. To learn what each looks like, examine the front of the fuselage. The joggle that is forward of the firewall, where the bottom cowl will meet, is an example of a single joggle. The area above and behind the firewall, where the forward deck will mount, is a double joggle.*

CAUTION:
EDGES OF PARTS MAY BE SHARP. HANDLE WITH CARE, USE GLOVES OR FILE/SAND OFF SHARP EDGES.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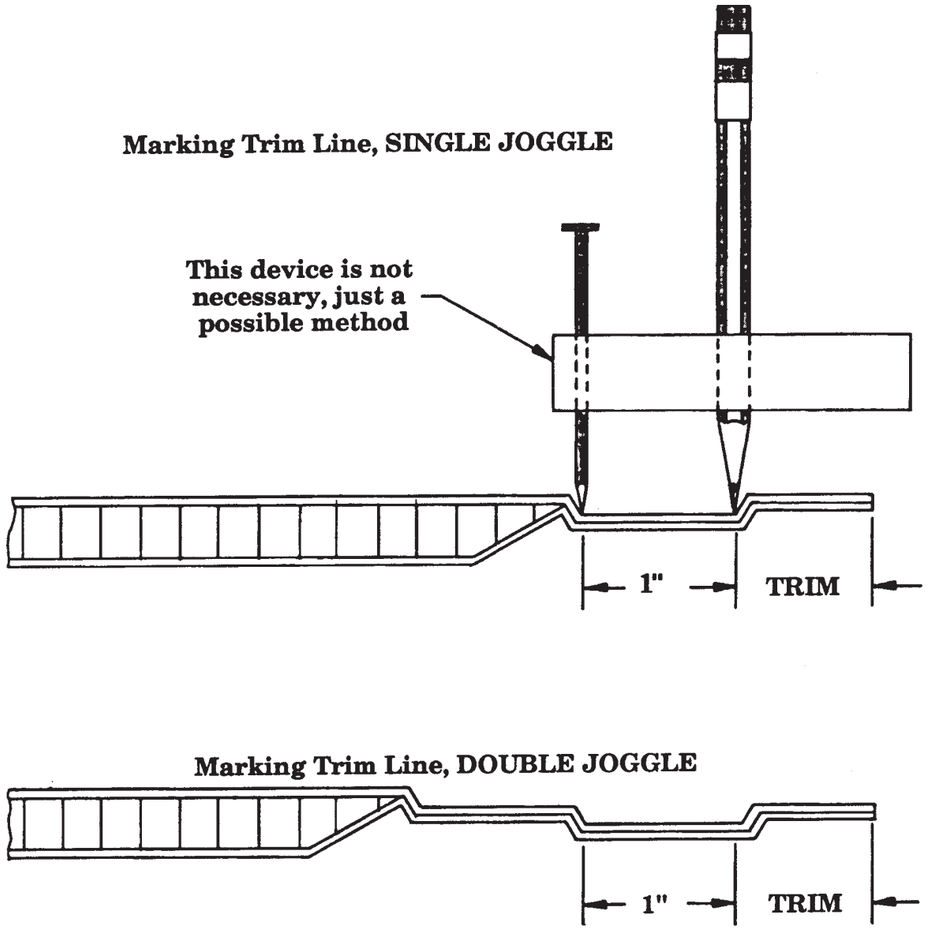
## K. Trimming Procedure

1. Place the fuselage on a convenient working surface. Mark a line on all joggle surfaces as shown in figure 1:K:1. A marking tool can be made from a piece of wood, a nail and a pencil. Make sure the nail tip is well rounded and has no sharp edges which could damage the glass fibers during use. On double joggled surfaces, mark a line as shown in figure 1:K:1.

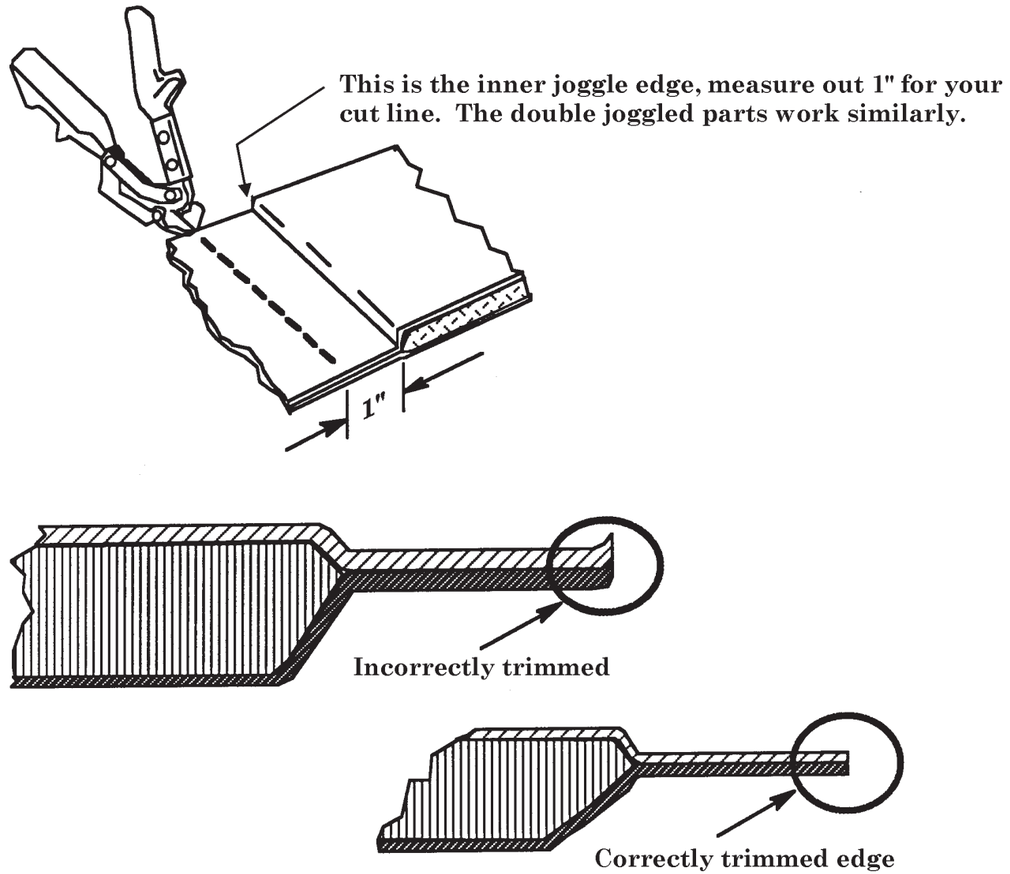
**Trimming Procedure**
**Fig. 1:K:1**




2. Using the shears, cut along the lines. Refer to Figure 1:K:2 for proper appearance of the edge after trimming. If necessary, trim additional material to obtain correct edge shape. Some sanding may be useful to complete the trim and smooth the edge.

3. Repeat this trimming procedure for all joggles.

**Shearing Joggle**
**Fig. 1:K:2**





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## L. Drilling Alignment Holes

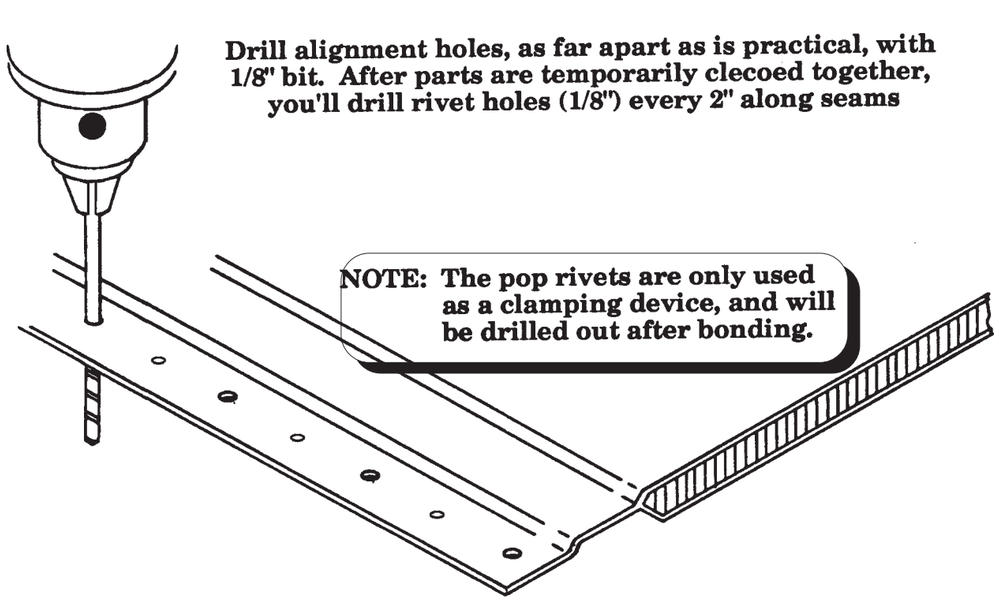
1. Equipment required:
   Electric drill
   1/8" Drill bit

2. Procedure
   To obtain proper overlap alignment during assembly, holes are drilled for screws or clecoes, which are placed in these holes to hold the parts in proper alignment during cure time.

Using a 1/8" drill bit, drill alignment holes in the two parts to be joined (See Fig. 1-27).

Place screws or clecoes in the alignment holes, and drill the rivet holes every 2" in-between alignment holes.

**Drilling Alignment Holes**
**Fig. 1:L:1**




## M. Removing the Protective Coating - Peelply

1. Description of Parts
Molded parts are shipped with a protective coating of "peelply" material on their inner surfaces. This material will interfere with bonding and must be removed. The peelply usually sticks out from the edge of a part in at least one area and looks like white cloth. Where the peelply meets and lays on the part surface it becomes transparent.

**WARNING:**
**ALL PEELPLY MUST BE REMOVED FROM BOND AREAS TO OBTAIN GOOD BONDS. BONDING OR LAYING FIBERGLASS OVER PEELPLY COULD RESULT IN STRUCTURAL FAILURE.**

Most of the peelply has already been removed from your pre-molded parts, but some may remain.

Peelply is removed by hand. It can require considerable force to pull the peelply off in some places. As it is pulled off, it usually tears off in odd shaped pieces. Use a utility knife to pick up a new edge when necessary. Use care not to cut into the glass of the parts.

The white cotton strips running in irregular directions on the surface of the peelply are required by the manufacturing process. These will come off with the peelply but more pulling force will be required.

NOTE: Although removing peelply looks simple, it can cause serious injury if your hand slips and scrapes a sharp edge. This has happened to us here at Lancair and it is not at all fun. **Please be careful.** The peelply can be removed from parts at this time. However, it does provide some protection and may be left on until those parts are needed for assembly. **At that time it MUST be removed.**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It takes practice to drill a close tolerance hole in aluminum and fiberglass. We're not all precision machinists here at the shop, but through trial and error we've come up with some drill combinations that work well for various size screws and rivets.

First a note about tolerances. When a bolt is holding a bracket tight against a bulkhead, rib, firewall etc., you needn't drill a .001" tolerance hole, because the bolt's clamping action will keep the bracket from wearing the bolt hole larger. This applies to rod end bearings and bellcrank bearings that are mounted tight with elastic locknuts. In this case, the slop in the bearings are not dependent on the tolerance of the holes.

Here is a list of drills we commonly use for various bolts and rivets:

-AN 426 rivets are .097" diameter, use #40 drill.

-1/8" rivets are .125" diameter, use 1/8" or #30 (.1285") drills.

-#6 screws are .137", drill a sloppy #29 (.136) hole or a tight #28 (.1405").

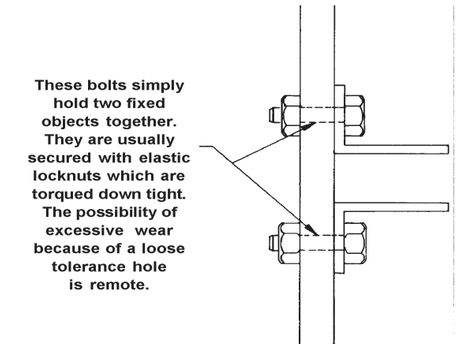
-#8 screws are .161", #20 (.161") and #21 (.159") both work well.

-3/16" (AN3) bolts can use, in addition to the obvious 3/16" drill, a #13 hole with reaming to get a tight fit, (See above section when and where this is necessary). A #12 hole is sometimes too sloppy but can be used for unimportant, quick and dirty holes.

-1/4" (AN4) bolts use 1/4" drill, of course. Also handy are lettered drills, like "E" (.250") or D (.246") with a reamer.

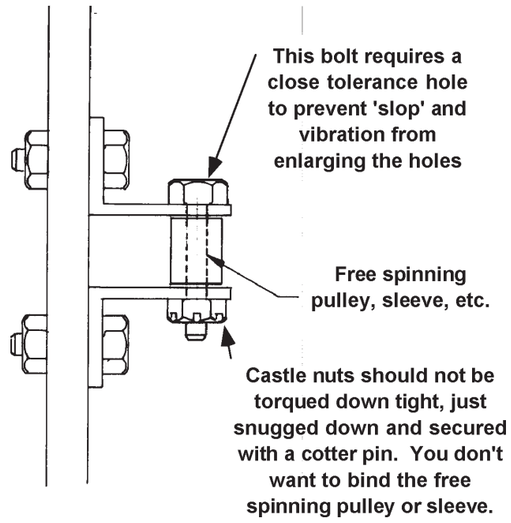
When drilling, creep up on your final drill size. If you want a tight AN4 hole and simply use a 1/4" drill first, the hole will be loose and usually triangular shaped. Try drilling a 3/16" hole first, then 7/32", then 1/4". The extra one minute spent changing drills is well worth it, especially if you're drilling a hole that needs a tight tolerance (See above).

**Bolt Holes Not Requiring Tight Tolerance**
**Fig. 1:N:1**




One the other hand, bolt holes that require close tolerance are those in which the bolt can rotate freely. When a castle nut and cotter pin are called for, it means the nut and bolt will not be tightened against a fixed object but will allow the object to float between the brackets. A loose tolerance bolt hole will allow the bolt to vibrate and slowly enlarge the hole.

**Bolt Holes Requiring Tight Tolerance**
**Fig. 1:N:2**





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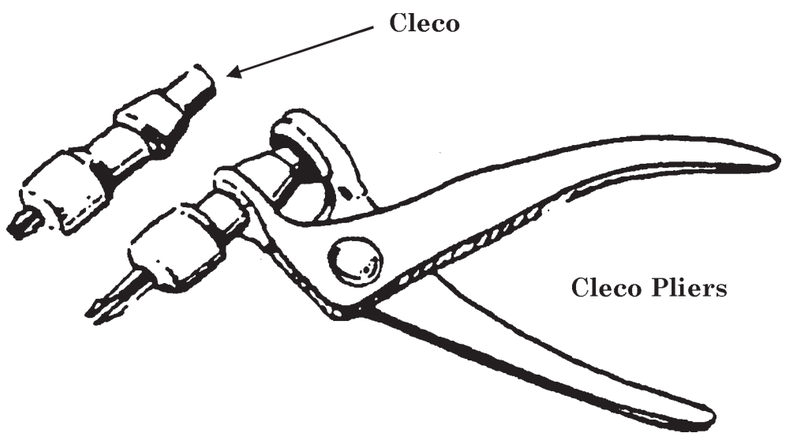
## N. Fastening Parts Together

1. When parts are to be fastened together using epoxy or structural adhesive, they must be held tightly in position until the bonding material has set. Several methods are available, but pop rivets remain the best way to be sure of a proper bond. Typically, the bonding sequence is:
The parts are prepared for bonding:
   a. peelply is removed
   b. Joggled surfaces are trimmed
   c. Alignment holes are drilled
   d. Sheet metal screws or clecoes* (Fig. 1:O:1.) are installed into these holes to hold the parts in alignment while holes are drilled about every 2" from pop rivets.

*Clecoes™ are a sheet metal fastening device used extensively in the aircraft industry (refer to Fig. 1:O:1). A special pair of pliers (cleco tool) is used. The tip of the cleco is inserted into the alignment hole. When the pliers are released, the cleco locks itself into the holes, tightly holding the parts together. Clecoes and cleco pliers are available from aircraft supply stores or catalogs (ours included). Surplus clecoes are inexpensive, and only about 15 are needed for the construction of your airplane.

**NOTE:**
**Either sheet metal screws or clecoes are used as fasteners. If the fastener you will use has grease, oil or other such contaminates, it must be thoroughly cleaned before use to prevent contamination of surfaces which will be bonded later. Methylene Chloride may be used as a cleaning fluid.**

**Cleco and Cleco Pliers**
**Fig. 1:O:1**




Squeeze the pliers and the grippers extend and come together. Insert into the hole, press parts together, and release the cleco. The grippers will spread, holding the parts together.

e. The surfaces to be bonded must now be cleaned since they may have become contaminated during handling and storage. The screws or clecoes are removed and the surfaces to be bonded are cleaned thoroughly with wax and silicone remover, acetone or MC.

**WARNING:**
**FAILURE TO FOLLOW CLEANING STEPS CAN RESULT IN EVENTUAL BOND FAILURE. EVEN SURFACES WHICH APPEAR CLEAN MUST BE CLEANED SINCE NOT ALL CONTAMINANTS ARE OBVIOUS.**
**FOLLOW CAUTIONARY LABEL ON THE WAX AND SILICONE REMOVER CONTAINER. WAX AND SILICONE REMOVER IS FLAMMABLE AND MUST BE KEPT AWAY FROM SPARKS, HEAT AND OPEN FLAMES. HARMFUL OR FATAL IF SWALLOWED. DURING USE AND UNTIL ALL VAPORS ARE GONE: KEEP AREA WILL VENTILATED AND DO NOT SMOKE. EXTINGUISH ALL FLAMES, PILOT LIGHTS AND HEATERS. TURN OFF STOVES, ELECTRICAL TOOLS AND APPLIANCES THAT COULD ACT AS AN IGNITION SOURCE. VAPOR IS HARMFUL. AVOID BREATHING VAPORS AND USE ONLY WITH ADEQUATE VENTILATION. AVOID SKIN AND EYE CONTACT. WEAR RUBBER GLOVES OR SUITABLE PROTECTIVE SKIN BARRIER. WASH HANDS IF THEY COME IN CONTACT WITH THIS LIQUID. IF SPILLED ON CLOTHING, REMOVE AND LAUNDER BEFORE REUSING.**

f. Dampen one cloth or piece of toweling well with the wax and silicone remover and wipe it along the bond surface of either part. Do not rub or scrub the surface as that may work the contaminants into the surface. Follow within seconds with a dry cloth or toweling piece to absorb the solvent and the contaminants it removes from the bonding surface.

g. Continue that process until that seam has been cleaned. Then replace both the wetting and drying cloths with new pieces and repeat the cleaning process for the other half. It at any time the wetting or drying cloth shows any soiling or the drying cloth becomes wet, replace it immediately with a new one.

h. If any obvious contaminants still remain, the above process may be repeated with methylene chloride.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**WARNING**

FOLLOW CAUTIONARY LABELS ON THE METHYLENE CHLORIDE CONTAINER. METHYLENE CHLORIDE IS A VOLATILE SOLVENT. CAUSES IRRITATION OF THE EYES, SKIN AND RESPIRATORY TRACT. PROLONGED BREATHING OF VAPOR CAN CAUSE LOSS OF CONSCIOUSNESS. DO NOT GET IN EYES, ON SKIN, OR CLOTHING. DO NOT TAKE INTERNALLY. AVOID BREATHING OF VAPORS. WHEN HANDLING WEAR CHEMICAL SPLASH GOGGLES, PROTECTIVE CLOTHING AND SOLVENT RESISTANT GLOVES. WASH THOROUGHLY AFTER HANDLING. USE ADEQUATE VENTILATION IN WORK AREA.

i After the seam is cleaned, repeat the cleaning process for the other part.

j. Using clean #80 grit abrasive paper roughen all cleaned surfaces lightly until the surface shows a fine white powder. Remove the powder with a clean cloth or clean brush.

k. The bonding material (epoxy, epoxy/flox, epoxy/micro or structural adhesive) is prepared and applied to one or both surfaces to be bonded.

**WARNING**

THE CONTAINERS USED TO MIX THE ADHESIVE MUST NOT BE WAX COATED. THE WAX COATING COULD CONTAMINATE THE ADHESIVE AND REDUCE THE BOND STRENGTH. LIKEWISE, THE MIXING CONTAINER MUST BE FREE OF DIRT, GREASE, OIL OR OTHER SIMILAR CONTAMINANTS.

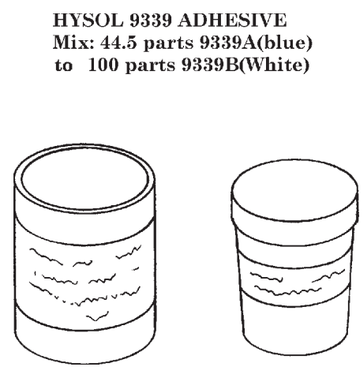
**WARNING**

READ THE CAUTIONARY LABEL ON THE EPOXY CANS. THIS EPOXY IS EXTREMELY IRRITATING TO THE EYES AND CAN CAUSE PERMANENT EYE DAMAGE. MAY ALSO CAUSE SKIN IRRITATION OR SENSITIZATION REACTION IN CERTAIN INDIVIDUALS. PREVENT EYE AND SKIN CONTACT WITH EPOXY MATERIALS. AVOID BREATHING VAPORS. USE ONLY IN WELL VENTILATED AREA. AVOID INHALATION OR EYE CONTACT WITH DUST FROM GRINDING OR SANDING OF CURED EPOXY. REMOVE CONTAMINATED CLOTHING AND LAUNDER BEFORE RE-USE.

If structural adhesive is to be used, prepare it as follows:

HYSOL 9339 Epoxy can be mixed in the proper weight ratio only by using a good scale. A small calculator will help, too. IMPROPER MIXING CAN SPEED OR SLOW CURE TIME AND DECREASE ADHESIVE STRENGTH. ATTENTION TO THE MEASURING PROCESS IS IMPORTANT.

**Hysol Structural Adhesive**
**Fig. 1:O:2**




Note: If you are using another product, make sure it is Lancair approved and that you follow the proper mixing instructions.

The mixing ratio for Hysol 9339 is 100:44.5, part A to part B. The easiest way to do this is put the mixing cup on the scale and record its empty weight. Guessing at how much epoxy you will need for the job, take about 2/3's of that amount from the Part "A" can and put it in the cup, weigh, and subtract the weight of the empty cup from the new weight, giving you the weight of just the epoxy in the cup. Multiply the weight of the epoxy in the cup by 1.455. Add the weight of just the epoxy in the cup to this figure, and now add Part "B" until the cup weight is the same as your calculated figure. Maintaining nearest 1/10 oz. is plenty close enough.

a. Example:
1. Weight of empty cup: .5 oz.
2. Weight with 2/3's (estimated) of the material you'll need, Part "A": 3.7 oz.
3. Weight of Part "A": 3.2 oz
4. Multiply by mix ratio 100:44.5: x 1.4
5. Total weight of Part "A" and Part "B" needed is: 4.6 oz.
6. Add the weight of the cup back in: .5 oz.
7. The total weight, once you've added the proper amount of Part "B": 5.1 oz.
8. Add Part "B" to the cup until it weighs 5.1 oz., mix, and you're ready.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b. Mix the Hysol 9339 epoxy adhesive components as follows:

1. Read all the instructions and information on the epoxy cans. Temperature of the adhesive ingredients and the surrounding room temperature must be 60°F or more.

2. The epoxy has a working life of 2 hours at 77°F. However, at higher temperatures or with a larger batch this working life will be less. Therefore, before mixing adhesive, all necessary equipment should be ready.

3. For the same reason, it is better to mix too much adhesive than too little. If you run out and must mix a second batch, the first batch may have already begun to thicken making it difficult to compress the seam properly and possibly reducing bond strength when cured.
Another reason for mixing more than you need: If you have a little left over, leave it in the corner of the cup with the mixing stick in it. Because cure time varies with temperature, by leaving a little in the cup and leaving the cup near the part you have epoxied, the cup can now be used as your test for curing. Wait at least 24 hours after joining parts. Then, before touching parts, try to move the stick around in the epoxy in the cup. If you can move it at all, your parts have not cured. Wait another 24 hours and repeat. Handling parts before cure is complete can reduce the bond strength and should be avoided.

The epoxy cure time depends on the temperature during cure time. Because of the fire hazards involved with most heaters, it is not recommended to have a heater operating in the room that could cause a fire. However, getting the room nice and warm before applying adhesive, so the parts and air temperature is above 77°F, will help shorten cure times, but remember it will also shorten the pot life/working time of the adhesive.

(a) Estimate the amount of adhesive that you will need for the first seam and measure a sufficient amount of Part "A" and "B" to make that amount.

(b) Using a mixing stick, thoroughly mix the two parts for at least two minutes. Mix longer for larger batches. Occasionally scrape unmixed material from the sides of the cup. Uniform blue-gray color will result.

(c) Apply the structural adhesive as follows (the following assumes the seams have been cleaned and sanded as previously described. If not, do so at this time).

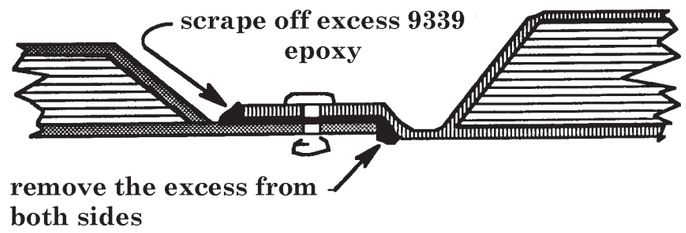
1. Beginning with the seam of the first part you have chosen to start on, with a wood spatula, spread an even layer of adhesive on the overlap surface of the part. Repeat the adhesive application process on the overlap surface of the other part.

2. Overlap the two adhesive coated surfaces and align the holes in the surfaces. Insert a screw or cleco into a hole at each end of the part, or every foot along the part if it is longer than 18". Starting at either end, insert rivets into the predrilled holes and form the heads (backup washers are normally not necessary).

(d) Remove the fasteners and place rivets into those holes.

(e) While the adhesive is still soft, scrape off the excess that squeezes out (Fig. 1-32). Adhesive is much harder to remove when hardened. Use methylene chloride on a clean cloth to remove adhesive that smears on the fiberglass surface. Clean adhesive from the clecoes if any were used.

**Removing Excess Epoxy/Adhesive**
**Fig.1:O:3**




Make sure you're wearing work clothes, since the adhesive may drip on you. Also check for adhesive on hair, arms, etc., and wipe it off before it cures. A long sleeve shirt and long pants are highly recommended.

(f) Wait at least 24 hours, then test your mixing cup residue for cure. If solidly cured, then the part should be ready to start work on once more. Drill out the rivets using a 1/8" drill, and remove any loose pieces.

(g) Fill the rivet holes with a 50/50 mix of micro/flox, clean off any excess, let it harden, and you're done with the seam. To make things a little neater, you can put a piece of tape over the back side of the seam, covering the bottom of the rivet holes, to help contain the filler mix and make a smoother neater finish, that requires less epoxy (and adding less weight, something to think about all through the construction process).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3. Epoxy

(a) Mixing epoxy: As with the structural adhesive, you can use a scale for measuring the proper amount of laminating resin and hardener. There are also some good measuring pumps on the market that will probably pay for themselves (about $265) since you'll waste less epoxy with them, and have less chance of spills or improper mixes. We offer one in our catalog that has performed well here in our own shop for years now.

Typically, you will be using from 1 to 6 ounces at a time.

If you prefer to use a scale instead of a dispenser, you can measure the two parts as you did for the Hysol, except use 1.44 instead of 1.445.

Another way is (Jeffco resin system used here for example purposes only. Use the appropriate ratios for your supplied system of resins.)

(1) Place your empty cup on the scale.
(2) Record the weight of the empty cup.
(3) Estimate amount of epoxy you will need.
(4) Add .25 oz of hardener (yellowish) to cup for each 1-1/4 oz you'll need.
(5) Pour 1 oz of resin (clear) into cup for each .25 oz of hardener and mix thoroughly.

(a) Working time can be as short as ten minutes if it is hot, so be sure everything is in place and ready to go before you begin mixing.
(b) As with the Hysol, the surfaces must be totally free of oil, grease or other contaminants, and slightly roughened. Fasten with pop rivets, let harden, remove fasteners & fill holes.

**NOTE: USE CARE TO MIX YOUR RESINS AND ADHESIVES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS FOR THE PARTICULAR SYSTEM YOU ARE USING. THEY ARE ALL DIFFERENT. AN IMPROPER MIX RATIO COULD RESULT IN IMPROPER BONDING - OR NO BONDING AT ALL.**

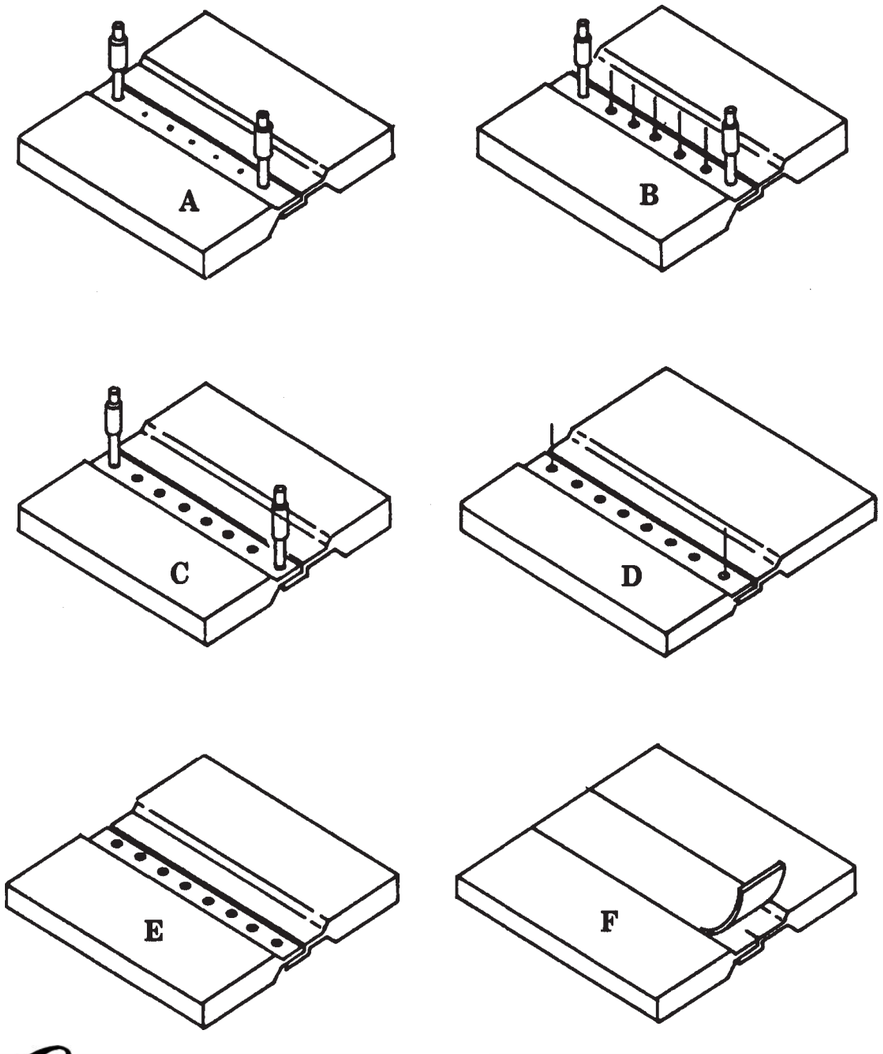
**BE CAREFUL TO PAY ATTENTION TO THE MANUFACTURER'S INSTRUCTIONS!!!**

## O. Fiberglass Strip Installation

**1. Description**

To stiffen joints and provide a double bond, fiberglass strips are laid over the bonded seams as shown in the sequence of drawings in fig. 1:P:1.

**Joining Parts**
**Fig. 1:P:1**





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a. Fig. 1:P:1A shows the two pieces to be joined. After the adhesive has been place along the inside of both pieces to be joined, the two clecoes were installed to hold the parts in alignment.

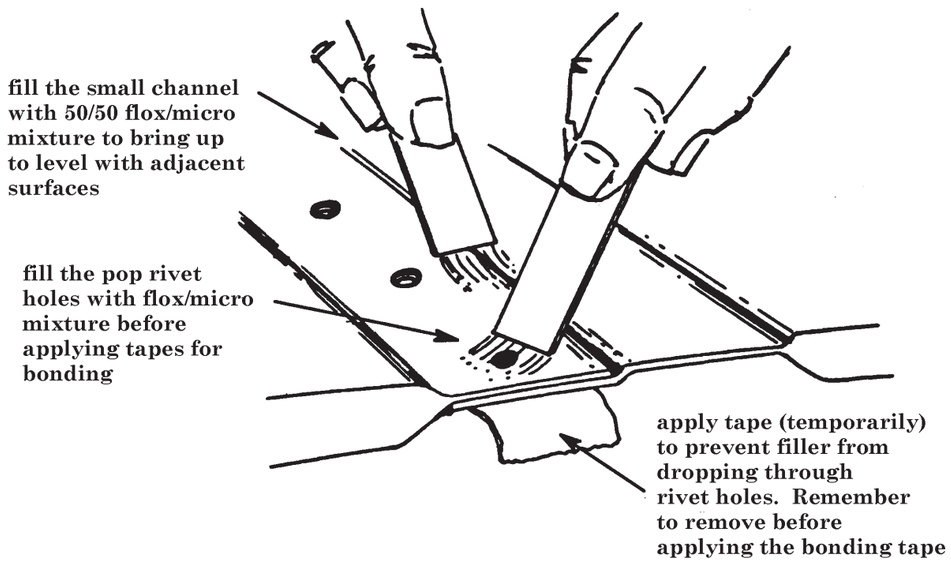
b. Fig. 1:P:1B shows pop rivets set into the other holes drilled 1" apart for the length of the seam.

c. Figure 1:P:1C shows the pop rivets after being compressed.

d. In figure 1:P:1D, the two clecoes have been removed and replaced with pop rivets awaiting compression.

e. Figure 1:P:1E displays the two parts, waiting patiently for the adhesive to cure.

**Preparing Seam For BID Tape**
**Fig. 1:P:2**

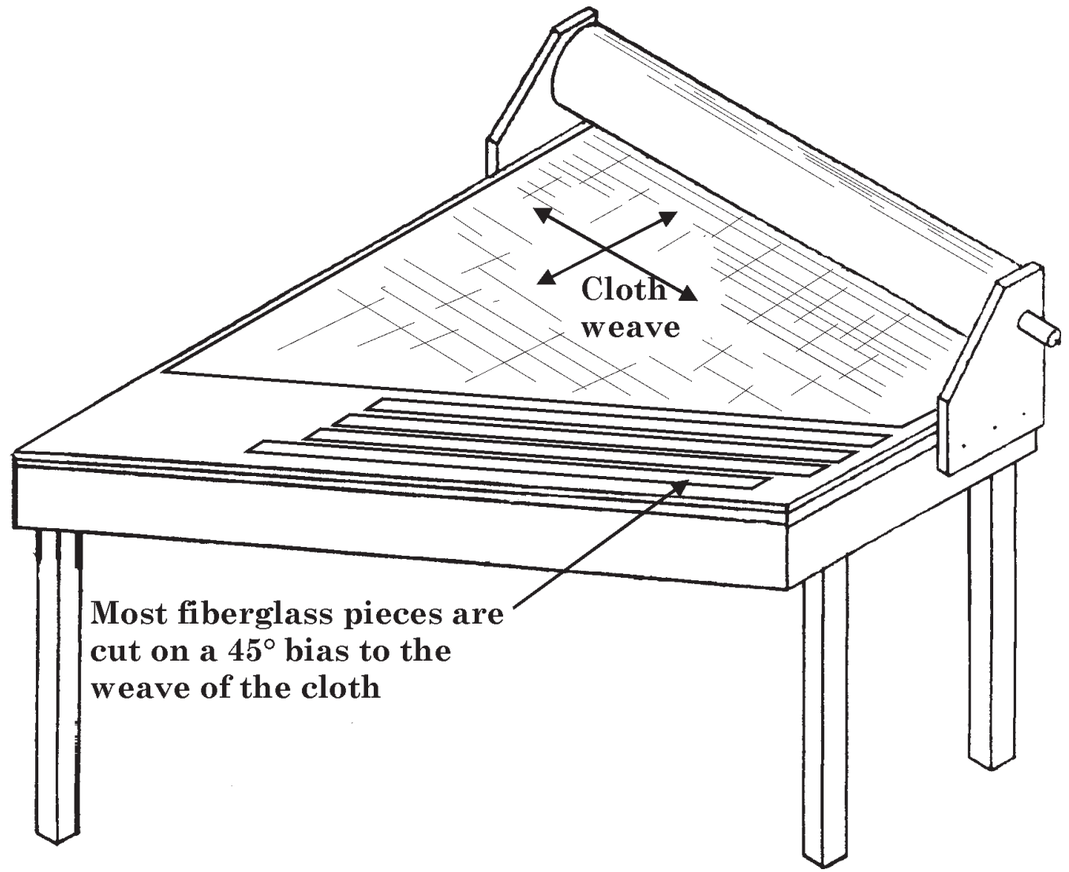



f. After the adhesive has cured, the pop rivets are drilled out, the holes filled with a 50/50 mix of flox and micro (see Fig. 1:P:2) and, without a need to wait for that to cure, a bid strip is being laid into place over the top of the joggles.

## P. Cutting on the Bias

When cutting your cloth with that wonderful roller blade, please pay attention to the weave bias specified for the part you are glassing. There are very few fiberglass parts in the Lancairs that are cut on a 0° bias. Nearly every piece of fiberglass you apply will be cut on a 45° bias. The weave orientation arrows in the construction manuals are there for a reason, please use them.

**Weave Orientation**
**Fig. 1:Q:1**





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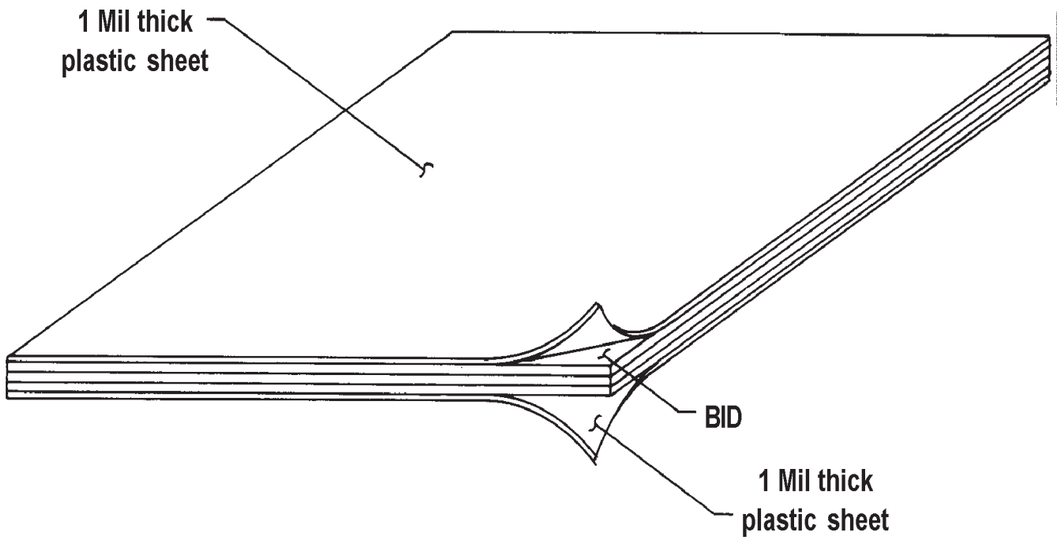
## Q. The Plastic Sandwich

This method of wetting out cloth is simple and invaluable. Many hours can be knocked off your project by using this technique.

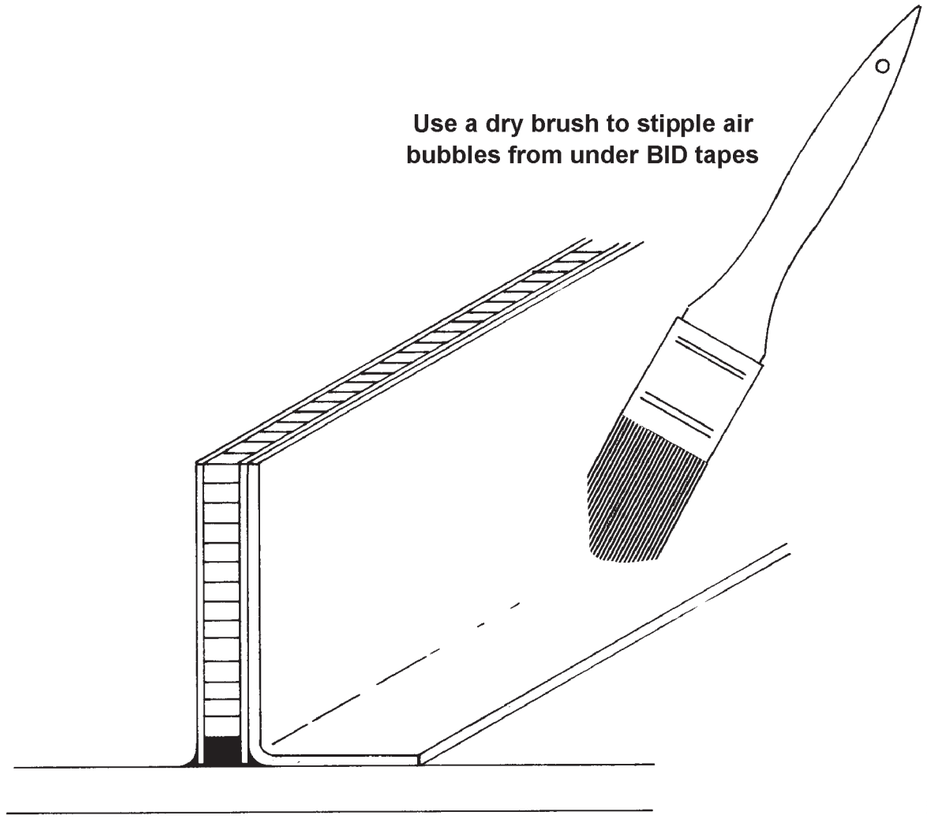
At the hardware store, buy a few rolls of 1 mil thick plastic drop cloths. Regular household garbage bags work well when cut along the edges with a roller blade. Cut two sections of plastic bigger than the piece of fiberglass you are about to apply. Tape one piece of the plastic to your fiberglass cutting table and lay the fiberglass piece (up to 4 BID thick) on the plastic. The cutting table provides an excellent surface for this technique. Wet out the fiberglass cloth with plenty of epoxy. Gravity is your friend, it will allow the epoxy to soak down through the layers of cloth. No need to stipple the BID with a brush, just lay the other piece of plastic over the wetted out cloth and roll the air bubbles and excess epoxy out of the laminate. See the next section for more information on rollers and rolling techniques.

**Plastic Sandwich Method of Wetting Cloth**
**Fig. 1:R:1**




Using a roller blade, cut out the shape of the laminate you need. Remove the shape. See how easy the piece is to handle with the plastic on both sides? Peel the plastic off one side of the sandwich and lay the laminate in position (of course you've already prepared the surface by sanding, cleaning, and painting on a light coat of epoxy). **DON'T APPLY THE LAMINATE WITH THE PLASTIC SIDE DOWN, STRUCTURAL INTEGRITY WILL BE COMPLETELY LOST.**

**Applying Plastic Sandwich Laminate**
**Fig. 1:R:2**




Stipple or roll against the side of the laminate still covered by plastic to squeeze the air bubbles out from underneath. Remove the remaining piece of plastic. You should now have a bubble-free laminate with a good epoxy content. A little extra stippling might be necessary if air bubbles were formed when you removed the plastic. Easy, right?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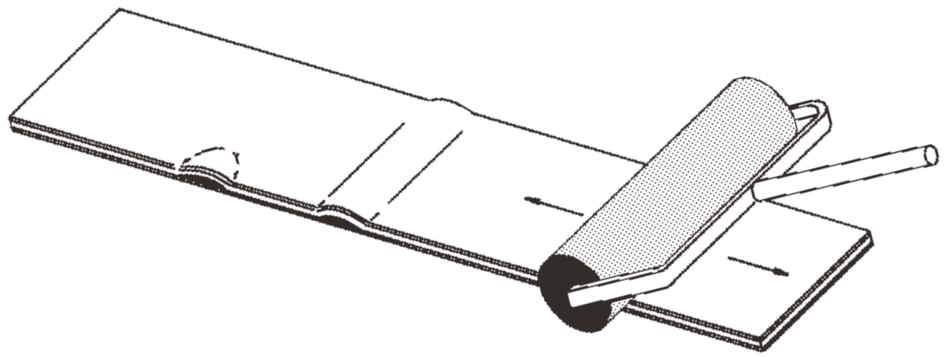
**Using Rollers to Remove Air Bubbles**
**(and Excess Epoxy)**
**Fig. 1:R:3**

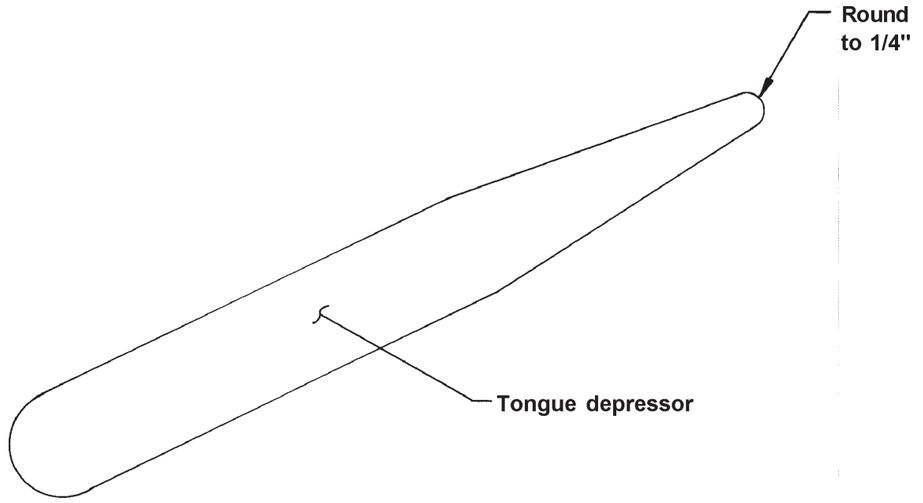


When using the plastic sandwich method of wetting out your fiberglass, simply roll out the bubbles from between the plastic and you have an air free laminate. Peel off one side of the plastic and apply the laminate to whatever you're working on. Before you peel off the second layer of plastic, use the roller to help push the air out from under the laminate.

## R. Tongue Depressors and Micro Radii

Someone asked me recently what was the most important tool in the Lancair shop. Let me think, the milling machine, the high capacity air compressor, the super-trick mini grinder? Naw, the tongue depressor. That's the most important tool. But not just any tongue depressor, the Lancair special modified tongue depressor.

**Modified Tongue Depressor**
**Fig. 1:S:1**




Developed in the late 1980's because of a demand for smaller microballoon radii, the Lancair tongue depressor is a necessary tool for any Lancair builder. You see, the problem with normal tongue depressors is the large radius on each end. If you were to use this radius for all your microballoon filling of joints, your Lancair will be heavier than one with proper joint radii, not by much but every pound counts, right? By sanding down the tongue depressor to a smaller radius, the micro joints on your ribs, bulkheads, etc., will look much more professional. Don't think that more micro will make the joint stronger, in fact it's just the opposite. Microballoons are not structural, so the more fiberglass tape you have bonding the actual part, the stronger the bond will be.
A word of caution. If you get carried away with smaller and smaller micro radii, the fiberglass will want to "bridge" over the microballoons, not bonding as it should. Bridging is fairly easy to detect, the air is visible under the laminate. A little practice will have your micro joints looking great.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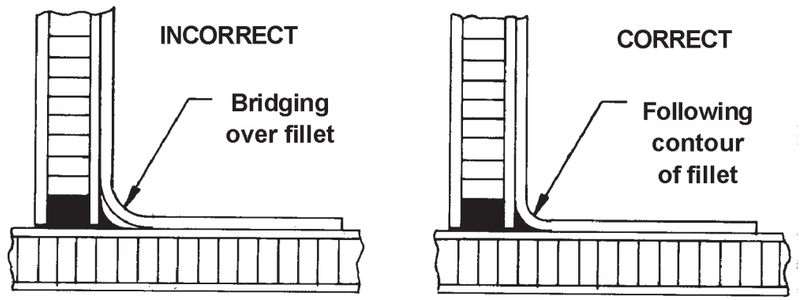
**Bridging Fiberglass Over a Radius**
**Fig. 1:S:2.**

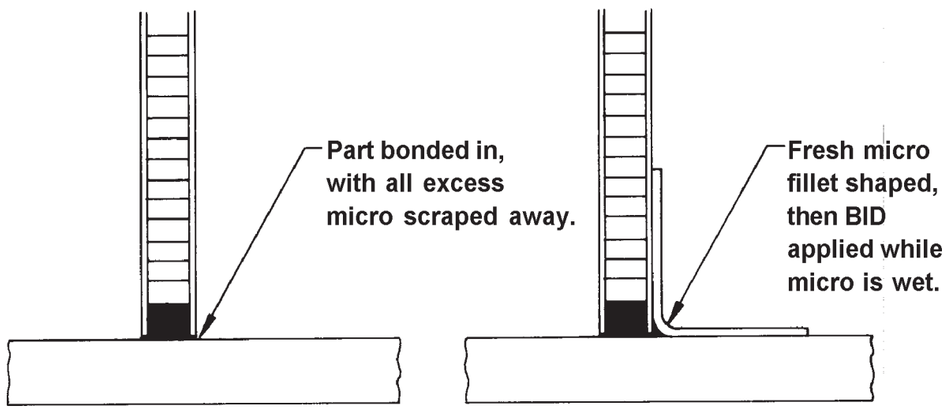



## About those Micro Radii

The subject of how to best apply microballoon radii is a hotly debated topic around the shop (hey, we're bored sometimes, alright?). Eventually we settled on two methods:

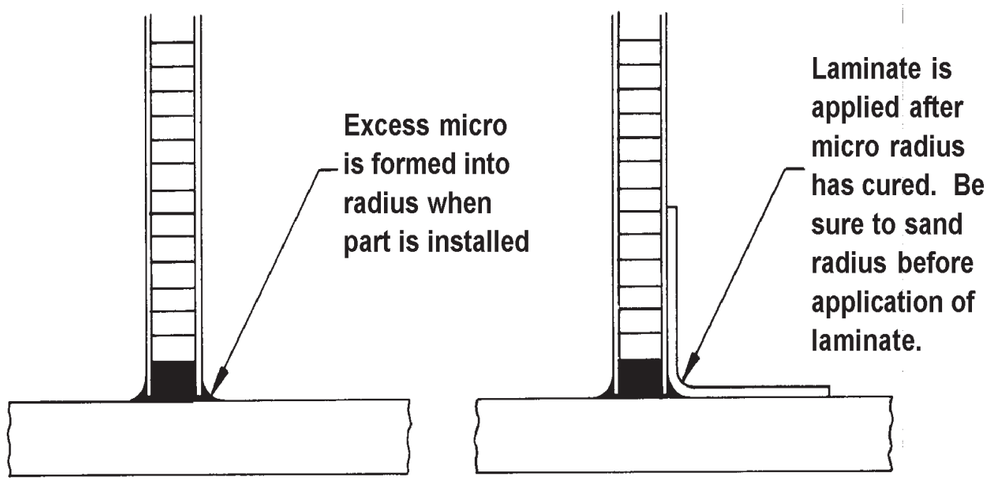
Method #1 - Some believe that the rib/bulkhead should be bonded in and all extra micro scraped away leaving no radius. After the rib/bulkhead is cured in position, another batch of micro can be used to make the radius and the BID tapes applied while this micro is still wet. This method makes application of the micro radius easier because the part is already held firmly in position, but when pure resin is painted onto the area where the BID tapes will be applied, the micro can sag and become runny. When this condition occurs, it is easy to get air bubbles trapped underneath the BID tapes.

**Method #1 of Forming Micro Radii**
**Fig. 1:S:3**




Method #2 - Others, like myself, believe that the micro radius should be formed when the rib/bulkhead is first installed. Care must be taken to hold the rib/bulkhead in its proper position while forming the radius with your modified tongue depressor. After curing, the BID tapes can be applied over a solid micro radius. I feel this method helps eliminate air bubbles forming under the BID tapes because the resin that is used to saturate the tapes will not dissolve the micro. Plus, you can stipple the air bubbles out from under the BID tapes without destroying your beautiful radius. Be sure to sand the areas, including the micro radius, where the BID tapes will be applied.

**Method #2 of Forming Micro Radii**
**Fig. 1:S:4**




All this talk about something as simple as micro radii, you say? Well, you'll be making a lot of these in the process of building your Lancair, and paying attention to details such as this will ensure confidence and pride in your aircraft. As for which method to use for applying micro radii and BID tapes, either will work, but the second method is safer to avoid air bubbles and get a good radius.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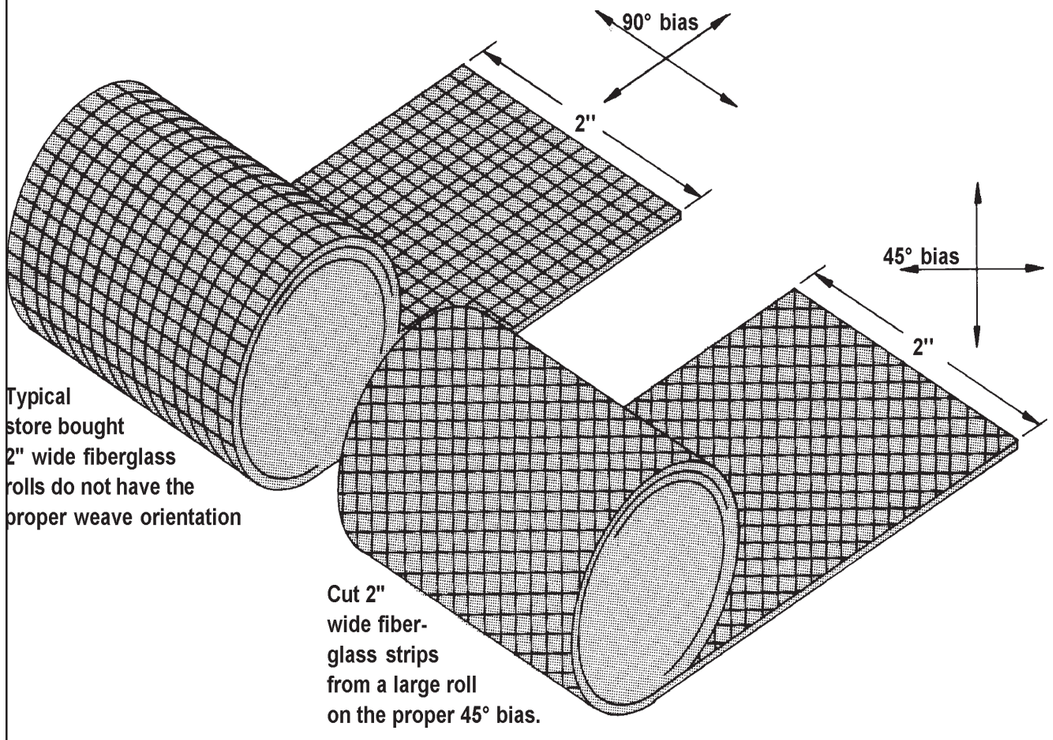
## S. Those Annoying 2"-Wide Bid Tapes

On the subject of glassing in ribs and bulkheads, we've received a few inquiries about using 2" wide, pre-cut fiberglass tape, such as available through Aircraft Spruce, instead of cutting your own out of the 50" wide roll provided in the kit. This is fine, as long as the cloth is cut on a 45° bias. THIS IS IMPORTANT! If you use cloth that is cut 90°, it will only be half as strong. Most commercially available tapes are cut 90° and unsuitable for structural areas such as ribs and bulkheads.

The safe way to glass is to cut your own. At Lancair we cut 20 or 30 tapes at a time, all on a 45° bias. Then we roll the tapes up, carefully so as not to shrink or expand the 2" width, and set them aside in a clean place to use as needed. If you do buy pre-cut tapes, be very sure they have a 45° cloth weave and are of the same strength of the fiberglass.

**Difference in BID Tape Weave**
**Fig. 1:T:5**




## T. Cardboard Templates

In an early newsletter, it was suggested that the builder use cardboard to find the shape of ribs or bulkheads before cutting them out of Clark foam or prepreg. Since many of you are new builders, we thought this is worth repeating.

Simplicity and cost is why we use cardboard templates here at Lancair. The more complex the rib or bulkhead shape, the more a cardboard template will help. Plus, screwing up a piece of cardboard is much cheaper than a similar piece of prepreg.

## U. Building Light

How much resin should I put on my laminates? The worst enemy to a light, high-performance airframe is too much resin. Here at the Lancair factory, we wet out almost all our glass on 1 mil thick plastic, place another plastic sheet over the wetted cloth, and use a roller to squeeze out the excess resin (the plastic sandwich method). Use a fair amount of pressure when rolling to get a good squeezeout of resin. Not only will these BID tapes be much lighter than ones wetted out on the airframe, they will save lots of time and look very profes-sional. And remember, when the call for BID is higher than two or three, you will save even more time (and weight) wetting the cloth out on plastic.

**1. BID schedules**

About those BID schedules, which are the number of fiberglass layers bonding a structure together. A homebuilder's natural instinct is to make his plane stronger. If the manual calls for 2 BID, three or four must be better, right? WRONG! If you increase the number of BID layers in your aircraft you are decreasing its strength. A heavier aircraft is quicker to build up G loads, has less payload, and is slower than the one built to spec. The Lancair was stress analyzed by Martin Hollmann, a leader in composite engineering, and fully tested. We've seen a Lancair with such a high empty weight that it is over gross as soon as the pilot steps into the cockpit, with no fuel! Think about it, and stick to the manual.

**2. Paper towels**

Enough preaching, want to save even more weight? Throw out that peel ply and use paper towels. That's right, paper towels. After pulling the plastic off a newly applied BID tape, place a paper towel directly on the wet glass and tamp it with a dry brush. The towel will soak up excess resin and the tamping will help push out those evil air bubbles. Remove the paper towels before cure.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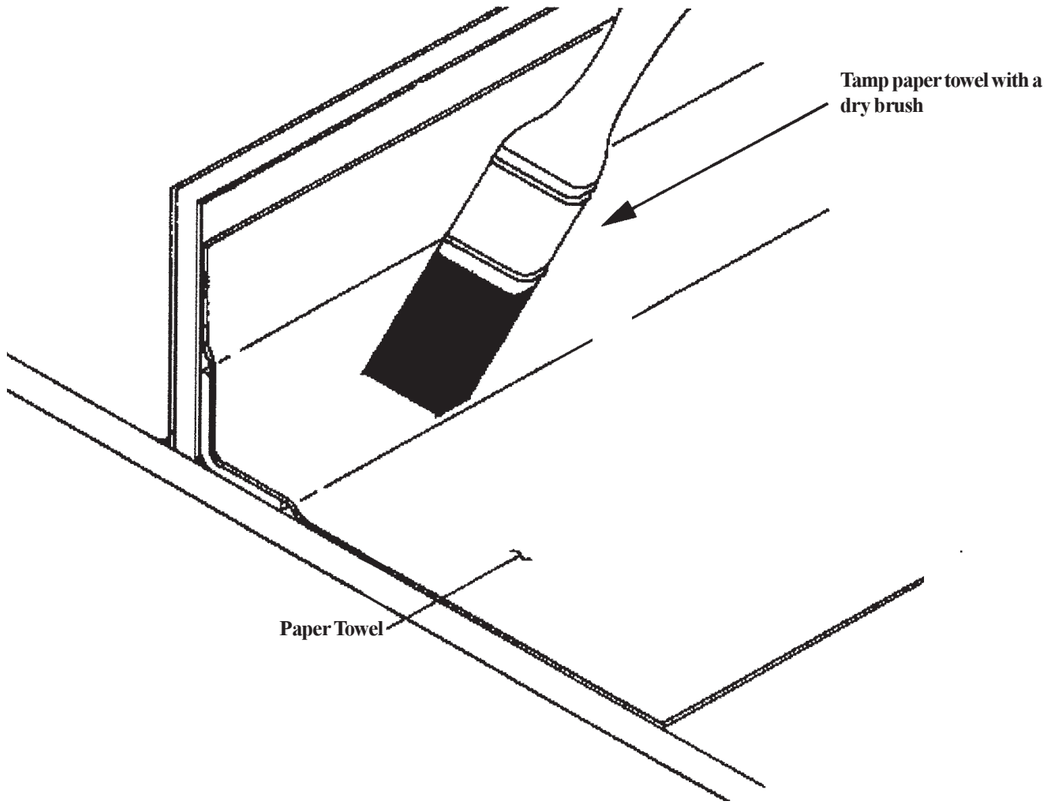
**Soaking Out Excess Resin With Paper Towel**
**Fig. 1:V:1**




When the towel is soaked through, pull it off and look at the results. If the towel has pulled up or distorted the glass, use a dry brush for further tamping. Does the glass still look glossy, with an uneven resin content? Well, put another paper towel on it and tamp it again. So long as you don't make the laminate look white, meaning it's too dry, there will be plenty of resin in the glass. Try it, paper towels are cheap.

# V. Building Straight

Keeping the airframe straight is also important in a good flying aircraft. Your pristine Lancair might weigh in nice, but if it corkscrews through the air in giant barrel rolls when you let go of the stick, you haven't built a straight airplane. Building your plane according to plans and following the advice given in the construction manual, your Lancair should fly straight and true (in Oz.). Back in Kansas and the rest of the world, it seems that one wing is always a tad heavy, or a trailing edge is wavy. Our prototypes never come out exactly straight and true, so we can't expect any of you builders to perform this miracle. Here's some tips that might help.

## Straight Trailing Edges

Now let's pretend that you've jigged your wings perfectly, leveled and attached the horizontal stab, and plumb bobbed the vertical stab and bonded it on. The trailing edges of your Lancair should be straight so the control surfaces can travel freely with a consistent gap. As is usually the case with the plans of all good mice or men, sometimes things aren't quite perfect.

If your wing or tail trailing edge has a slight warp in it, heat the area with a heat gun until it's just too hot to touch. Be very careful not to burn or scorch the fiberglass or carbon fiber. Try heating an extra piece of prepreg material first, just to see how much heat is required to burn it. A piece of straight wood or aluminum angle (the wood is better, because it will cool slower than the aluminum and tend to prevent re-warping the edge) can be clamped to the edge to keep it straight while cooling. Be sure to heat the angle, also. Otherwise the cold aluminum will cool the edge too quickly and the warp will remain. Heat at least an inch forward of the edge and don't discolor or burn the fiberglass (or wood). If the warp still remains, try finding a 1x2 or 2x4 board with the right curvature to warp the edge the opposite way when clamped tight. Heat the edge and let it cool with the board clamped in position. With any luck, the part will spring back nice and straight when the board is removed. See the figures on the next two pages.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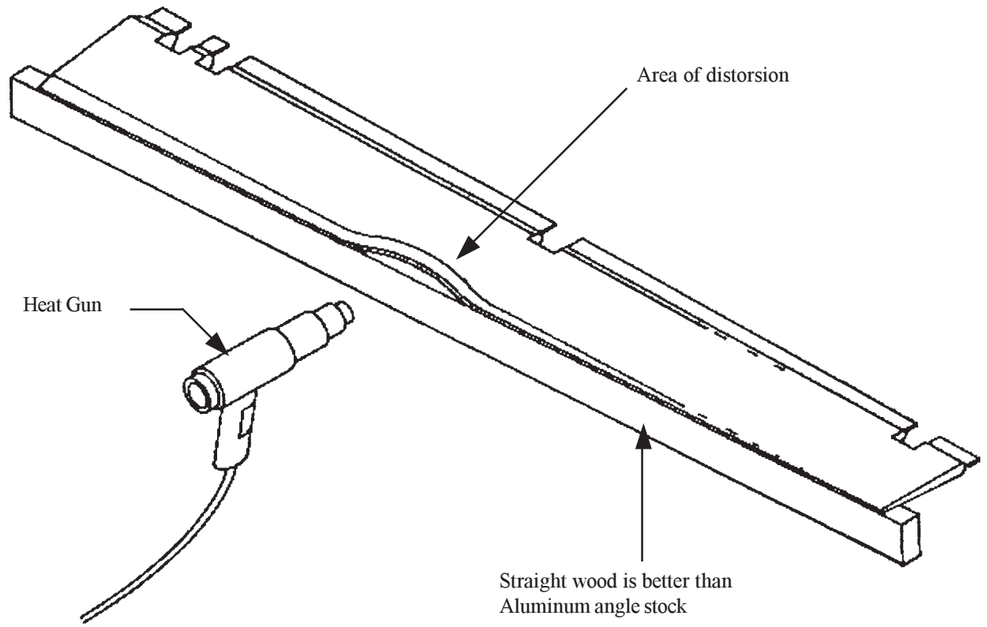
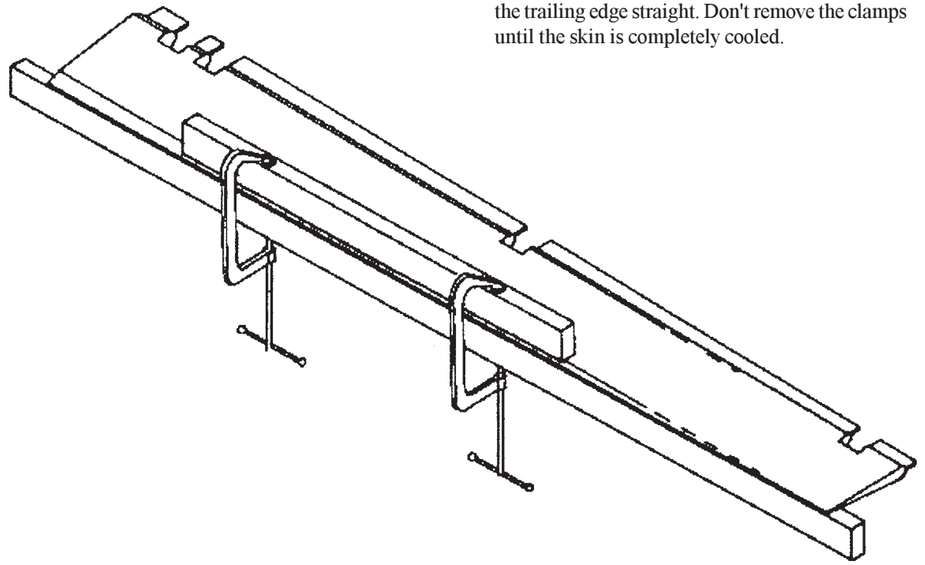
**Straightening Trailing Edges**
**Fig. 1:W:1**




**Straightening Trailing Edges**
**Fig. 1:W:2**

After heating the distorted area, use clamps to hold the trailing edge straight. Don't remove the clamps until the skin is completely cooled.

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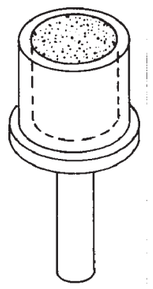
# W. Control Systems

## Pushrod Tips

a. After cutting the pushrod tube to length, don't immediately rivet the rod end in position. It is better to test the pushrod in the system (flap, aileron, elevator) by temporarily securing the rod ends to the pushrod with instant glue. Use only a few drops of glue to secure the rod end or the bond may become more than temporary. Don't cover the rod end with glue then slide it into the pushrod, the bond would be impossible to break free. Once you determine the tube is the proper length, you can break the rod ends free, clean them up, and rivet them in place.

b. Fill the rod ends with a 50/50 micro/flox mixture. This will allow the drill to track straight through the rod end when drilling for the rivets. The solid rod end will also prevent rivets from buckling when they are set in place.

**Filling Rod Ends With Micro/Flox Mixture**
**Fig. 1:X:1**

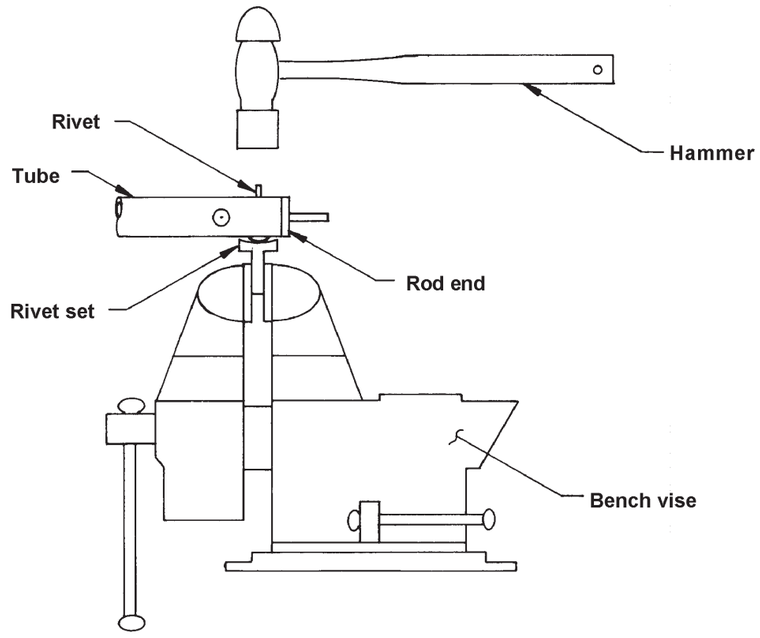


c. When sliding the rod ends into the pushrod tube for the last time (before riveting), coat them with Loctite™ to prevent slippage or vibration wear.

d. A rivet gun is the best method of setting the rivets that secure the rod end. In a pinch, we've used a hammer to lightly tap and expand the rivets. Hit the rivet lightly and accurately to avoid mashing the rivet end to one side. A rivet squeezer is not recommended for pushrod rivets because the rivets may buckle in the center of the pushrod.

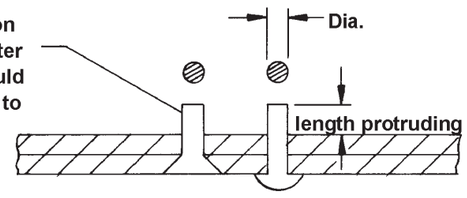
e. Make sure the distance for each rivet to the rod end is enough to prevent the rivets from interfering with each other and the threads of the rod end.

**Setting the Rivets in the Rod End**
**Fig. 1:X:2**




**Rivet Rule**

**RIVET RULE:**
**The correct length of protrusion is equal to 1.5 times the diameter of the rivet, i.e., a 1/8" rivet should extend 3/16" from the material to be riveted.**





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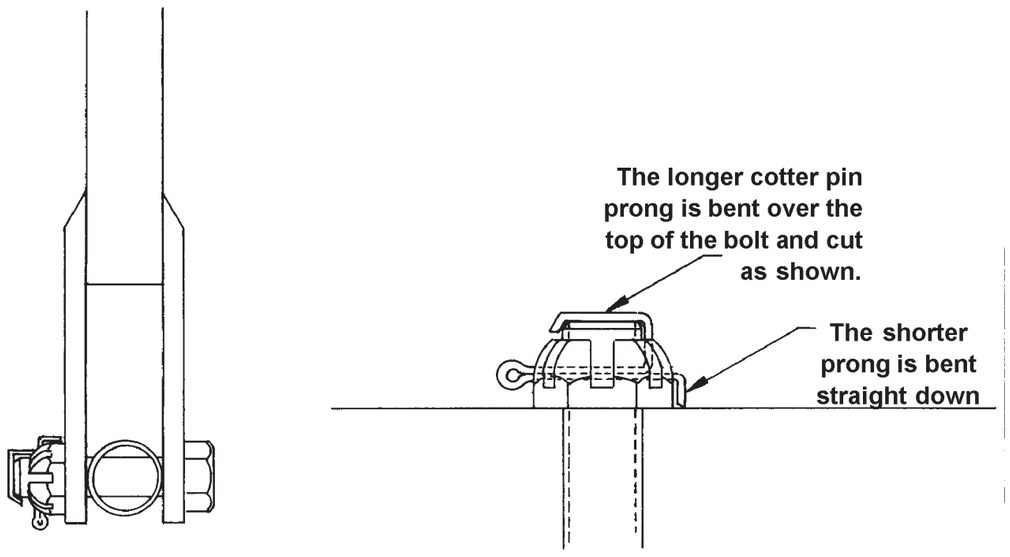
1. **Painting pushrods**
At Lancair we usually spray paint our pushrods with one coat of Zinc Chromate and one coat of color. Hardware store spray cans are fine for the color coat and you can choose from all kinds of nifty colors.

2. **Castle nuts and cotter pins**
One common error in the Lancairs we have inspected is mis-bent cotter pins and castle nuts without cotter pins.

Castle nuts are commonly called for items in the Lancair control systems. A castle nut is only used on drilled bolts and MUST be secured with a cotter pin. Castle nuts are usually snugged down, not tightened like an elastic locknut and the cotter pin will prevent the nut from loosening!

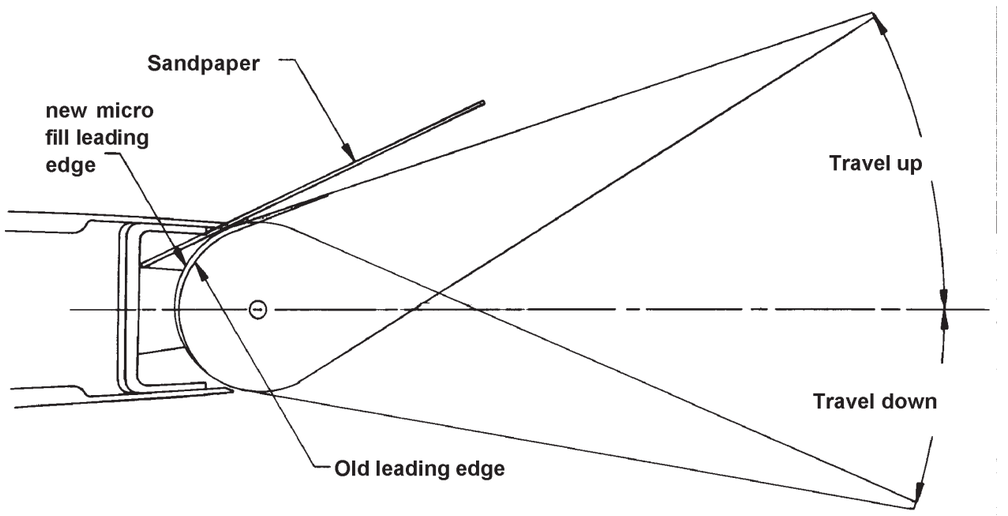
**Properly Pinned Castle Nut**
**Fig. 1:X:3**




The standard method of bending and securing cotter pins is shown above. Many builders simply bend the two cotter prongs around the bolt and call it done. Without cutting the prongs to proper length, the prongs could grab a stray piece of upholstery or wire, possibly jamming the system.

3. **Control surface gaps**
If you'd like to get a closer gap on your control surfaces, try this method. No matter how good the mold, the leading edges of the elevators, ailerons, flaps, and the rudders never seem to fit the trailing edge of the wings and stabs just right. If you have this problem on your elevator, for example, mount the elevator to the horizontal stab and make sure you have at least 1/16" gap between the elevator leading edge and the stab trailing edge. Mark on the elevator where the gap is too great or fairly close and remove the elevator. Now add a micro layer, mixed thick, to the areas marked "too great" and shape a rough radius (a little sculpting skill is helpful).

**Gapping Control Surfaces**
**Fig. 1:X:4**




After the micro cures, sand it so the elevator will just fit back into the stab, and sand the stab trailing edge straight, parallel to the hingeline. Got all that? Now take one strip of sandpaper, 3M or Norton 40 grit longboard sheets work best, and run it back and forth between the elevator and the stab, sanding the micro on the elevator. Another pair of hands is very helpful in this process to hold the elevator stable while you work the sandpaper. Have your helper raise or lower the elevator slightly when you feel the resistance on the sandpaper decrease. Slowly work the elevator through its full range of travel. Now you should see a consistent gap between stab and elevator when the elevator is moved through its travel range.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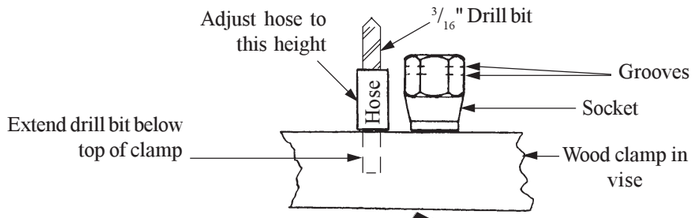
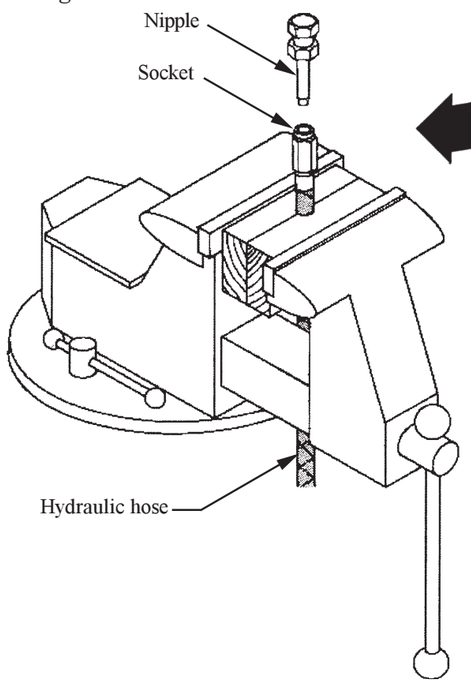
# X. Hydraulic Systems

1. **Eastman hydraulic 3/16" hose and fittings**
   Construct a wood hose clamp, drill a 3/8" hole through a 1" x 2" piece of 3/4" plywood, then cut in two. Use this to clamp the hydraulic hose in a vise . The outside of the socket has two rings of small grooves in the corners of the hex.

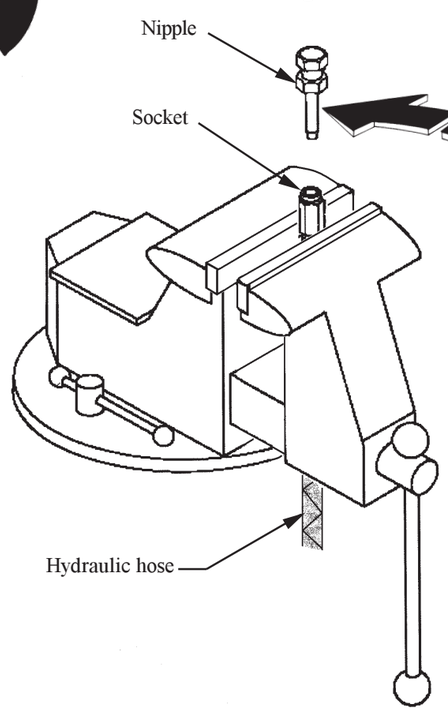
**Clamping Eastman Hose**
**Fig. 1:Y:1**




**Installing Eastman Fittings**
**Fig. 1:Y:2**




**Installing Eastman Fittings**
**Fig. 1:Y:3**



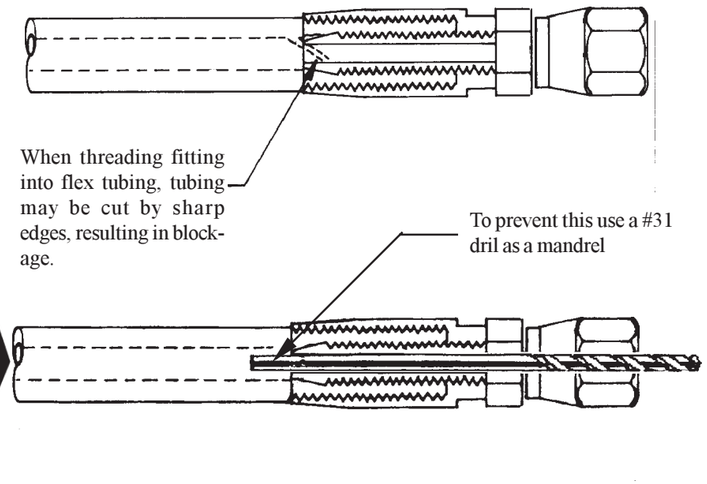

Using the two groves on the socket as a gauge, position the end of the hose between them above the wood clamp, push the shank end of a 3/16" drill bit into hose, so it extends below the wood clamp.

Lubricate the hose and socket with anti-seize or if available "Hoseze-oil" turn the socket counter clockwise on the hose until it touches the wood clamp. Keep turning don't stop and start. If hose twist kinks, or suddenly seems to be easier to turn, cut off hose and start over. (see Fig. 1:Y:2)

Remove hose and socket from wood clamp, and clamp the socket in the vise. Use the shank end of a # 31 drill bit as a mandrel, be sure that it protrudes through the hose end of the nipple. this will prevent the end of nipple from stripping material for inside of hose. (see Fig. 1:Y:3)

Lube the threads on the nipple and turn the nipple into the socket and hose. Bring the hex on the nipple into snug contact with socket but don't tighten further.

**Hose Blockage**
**Fig. 1:Y:4**




Tighten the nipple into the socket and hose, just bring it up snug to the socket don't overtighten! Remove the # 31 drill bit and blow through the line in both directions to be sure there is no flap at the end of the nipple. Clean the line with solvent.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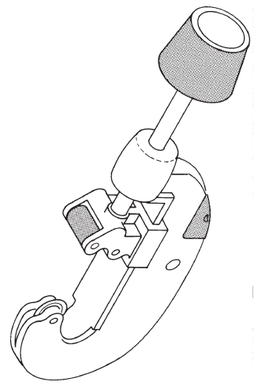
**2. Cutting hydraulic lines**

Most Lancair hydraulic lines are made from 1/4", 5052 aluminum tubing. A tubing cutter is the standard, and best, tool for cutting the aluminum tubing to length.

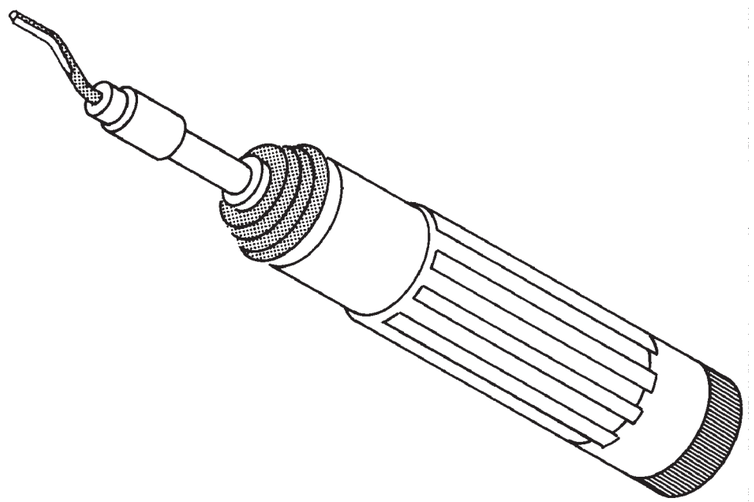
**Tubing Cutter**
**Fig. 1:Y:5**



We use a small cutter because it's much easier to handle. Simply roll the cutter around the tube, tighten the handle slightly, then roll it around the tube again, etc., etc...

After every cut you must debur the inside of the aluminum tube. A small deburring tool makes quick work of this.

**Deburring Tool**
**Fig. 1:Y:6**



**WARNING:** Only debur what is necessary to achieve a smooth edge. Excess use of a deburring tool will remove too much material and potentially weaken the subsequently flared end.

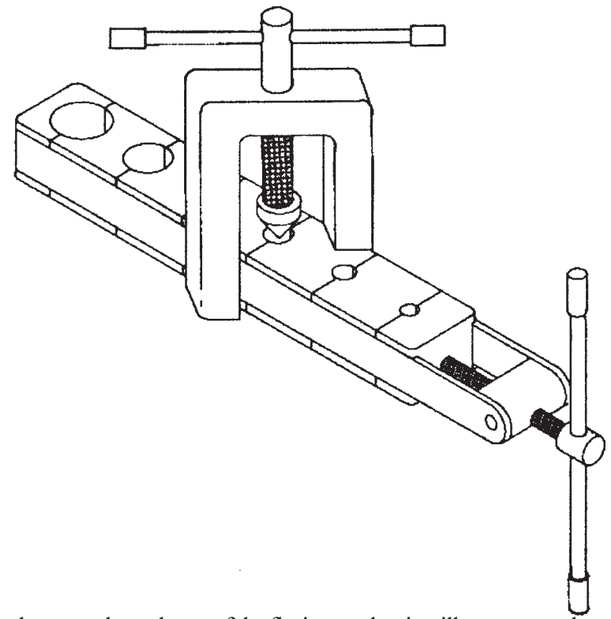
Tony Bingelis has much more information on tubing cutting and deburring in his Sportplane Builder books and Sport Aviation columns. These books are extremely helpful to the home builder. Get them and read them!

## Tube flaring

Here's another area of construction where you need a specialized tool, the flaring tool.

The tube must be deburred, as described in the previous section, in order to get a clean flare. Otherwise you could score the inside of the tube when flaring. The tube may not seal properly in this condition.

**Flaring Tool**
**Fig. 1:Y:7**



We usually grease the cone shaped part of the flaring tool so it will not gouge the tube.
Don't flare the tube too much, the expanding aluminum may crack. The cracks are visible if you look closely.
Experiment and learn how to use your flaring tool. Again, the books by Tony Bingelis contain a lot of valuable info on these sorts of specialized jobs.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## Typical Methods for Securing Hydraulic Lines

**Fig. 1:Y:8**

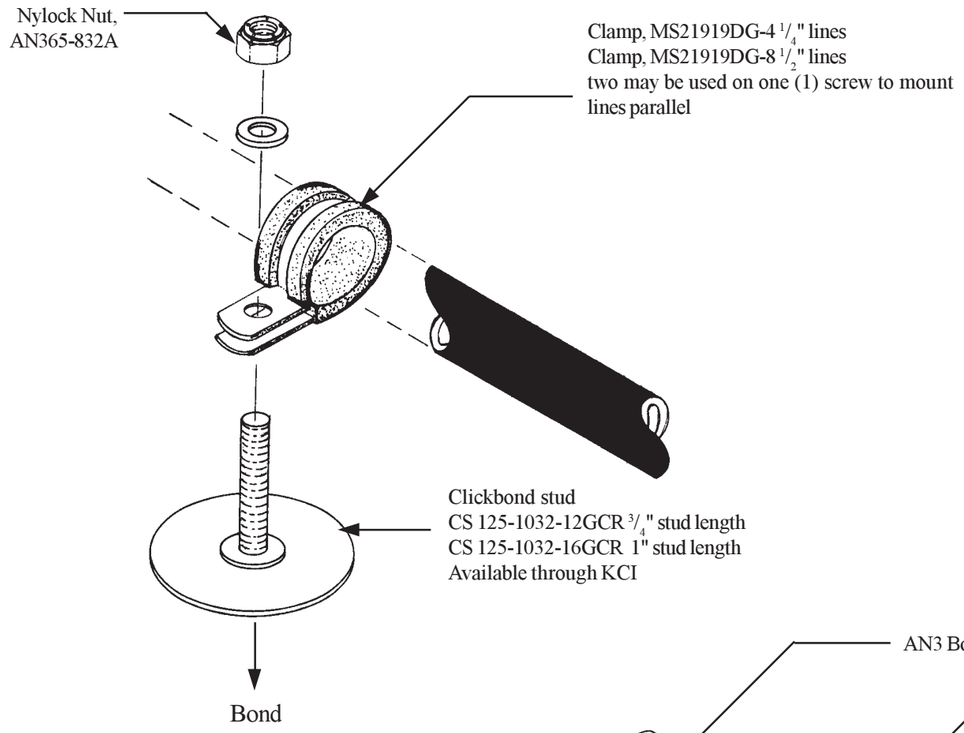



**Fig. 1:Y:9**

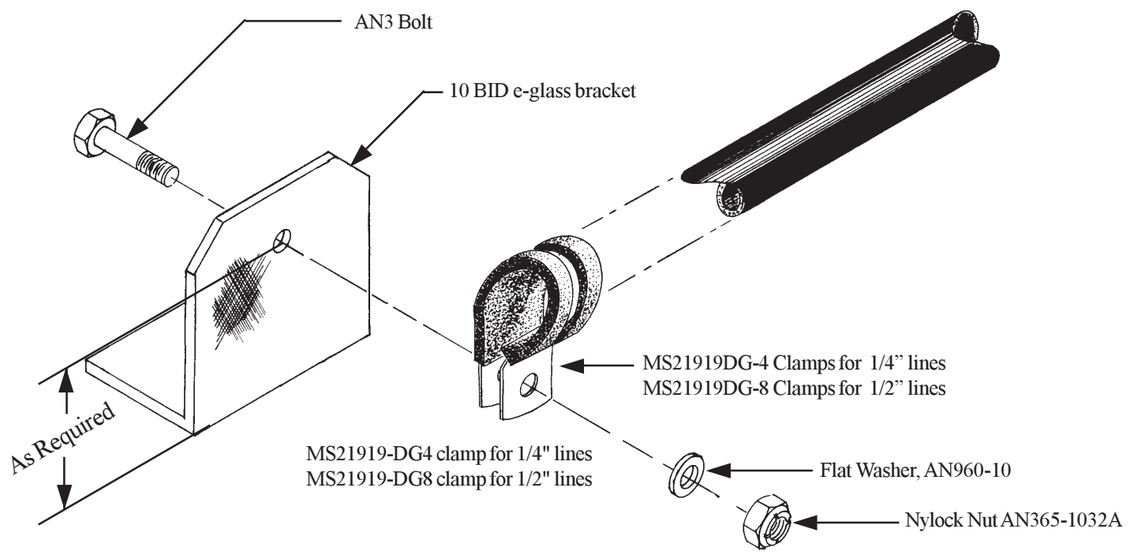
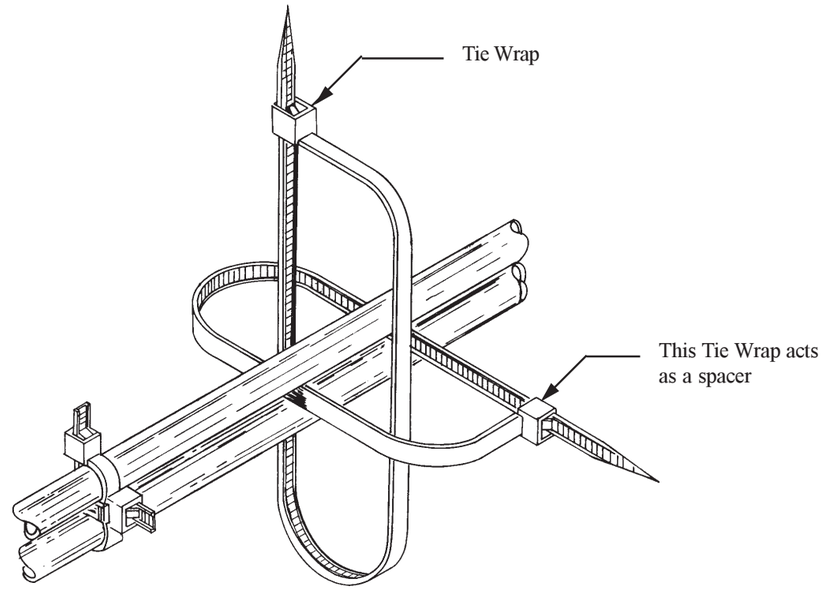



**Fig. 1:Y:11**





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## Y. Painting

In the last year, the Lancair shop has prepared and painted Lancair prototypes. In the process, we've learned a few basic painting tips and rules you may find interesting, or even helpful.

Painting is a disgusting, dirty, tedious, boring, stressful, sometimes toxic process that you will do once and swear never to attempt again. Lock up all your weapons because with one slip of the spray gun, one little mistake, you might feel like ending it all. Bet you can't wait to get started on your paint job now, huh?

Seriously though, if you take your time and don't try to produce a flying Mona Lisa, a good looking paint job is fairly easy to produce. Here's the basic flow chart that we follow for preparation and painting of our Lancairs.

1. Clean all surfaces
2. Sand all surfaces with 80 grit
3. Prime with featherfill
4. Sand with 100 grit
5. Paint with normal primer
6. Sand down to 220 grit
7. Fill pinholes
8. Prime with normal primer
9. Sand down to 360 grit
10. Clean for color coat
11. Paint your favorite color!

Now let's get more detailed, step by step:

Step 1. Before the initial sanding of your surfaces, and before each primer and color coat, you MUST clean the area to remove any contaminants that would affect the paint. We use DuPont Prep-Sol cleaner for this purpose.

Step 2. After you've Prep-Soled your bare fiberglass or carbon fiber surface, scuff up the surface with 80 grit so the primer can bond properly. We use a dual action (DA) sander to make short work of this step.

Step 3. Clean your surfaces with Prep-Sol again in preparation for the first primer coat. We use the polyester based Featherfill primer as a first coat. It may sound strange, but we actually apply the Featherfill with a paint brush. We find brushing on the first coat of primer fills the pinholes much better than spraying does. Don't worry about making this first coat pretty, most all of it will be sanded off anyway.

Step 4. The goal of the Featherfill was to fill the weave of the material and the scattered pinholes. Now you can sand most of the Featherfill away with 100 grit. Use a longboard sanding block or one of the sanding blocks that use 1/2 sheet of sandpaper. If there are low spots in the surface, here is where you'll start to see them.

Step 5. Blow off the surface with an air nozzle and clean with Prep-Sol. This next coat of primer should be the same brand as your color paint. Be sure of compatibility! We've found a few really good primers. The WLS system is a great primer, we used it on the Lancair IV prototype, but the white WLS paint we applied over it isn't sticking worth a darn, especially on the leading edges (We just tell people that the paint tends to burn off during reentry into the earth's atmosphere). We just tried the Superflite primer on the 320 and we're very happy with it's application and sanding properties. Whatever brand you use, spray on a good, thick coat.

Step 6. Sand the primer smooth with 180 grit. We usually wet sand at this point, the sandpaper is much more efficient when wet. This is where many builders start to run into trouble. They begin to paint on coat after coat of primer, only to sand off each coat they apply. They complain about the huge amount of time required to get a good finish on their planes. Well of course it takes a long time if you sand off every bit of primer you put on. They might as well use watercolors, it'd come off real quick when wet sanding. Anyway, you don't have to sand all the way through the primer coat you just applied. Sand until it's smooth and that's all. On the bottom of your plane, you may not want to apply any more primer if this coat has sanded smooth without sanding through. In this case, simply switch to 320 grit and finish it off, ready for the color coat.

Step 7. This is the best time to look for pinholes in your surfaces. Use the air nozzle to blow the dust off the smoothly sanded surface and out of the pinholes. We use Evercoat polyester glazing putty to fill pinholes, chips, and other boo boos. The lacquer glazing putties tend to shrink too much with age, as does Bondo. Use a putty knife, or squeegee, to force the putty into the pinholes. Lightly re-sand the pinhole-covered areas after filling.

Step 8. Now clean all your surfaces and spray on what should be your last coat of primer. Use the same brand of primer as the previous coat. Use your judgement to decide if you need a thinner or thicker primer coat (usually this last coat is applied thinner). This primer coat should look pretty good, very evenly applied and few, if any, sandpaper scratches visible.


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Step 9. Wet sand this last coat of primer with 360 grit. Some builders would cringe at this, saying that the last primer coats should be sanded down to at least 400 grit. We've found that 400 grit sands the surface just a bit too smooth, the paint doesn't have anything to grab onto. The last grit we used on the Lancair 320 repaint job was 320 grit (easy to remember, 320 on a 320) and the gray color coat did not show any scratch marks.

Step 10. This is it! Blow off and clean all your surfaces thoroughly with Prep-Sol. Fill any remaining, pesky pinholes now or forever hold your peace. Use a tack rag, available at all automotive paint stores, to remove the dust and dirt from the surfaces. Congratulations, you're ready to paint.

Step 11. The best advice we can give you about painting the color coat on your aircraft is DON'T, at least not if you don't have the proper facility, tools and training. We convinced ourselves here at Lancair that spraying the color coat on during the early dawn or dusk hours, with the pavement wetted down and no wind, would produce a lovely finish suitable for framing. It just doesn't work that way. Shooting the primer coats on in your back yard with a lousy spray gun is one thing, but getting a dust free, no runs, color coat is another. Seriously consider taking your plane to a paint shop. The Lancairs are perfectly suited for this because you can take the wings off and roll them anywhere. Having a professional shoot the color coat is not as expensive as you think IF you do all the preparation yourself. All the painter will have to do is shoot the color.

If you absolutely must spray the color on yourself, seek advice and assistance from a painter who could probably tell you ten times more than we could about painting.

Again, we're not saying this is the best, or even a standard process for finishing your Lancair, but it works for us. Sure, some of the parts may need an extra coat of primer, some edges may have to be puttied up and reprimed, but these are part of the joys of building your own plane, aren't they?


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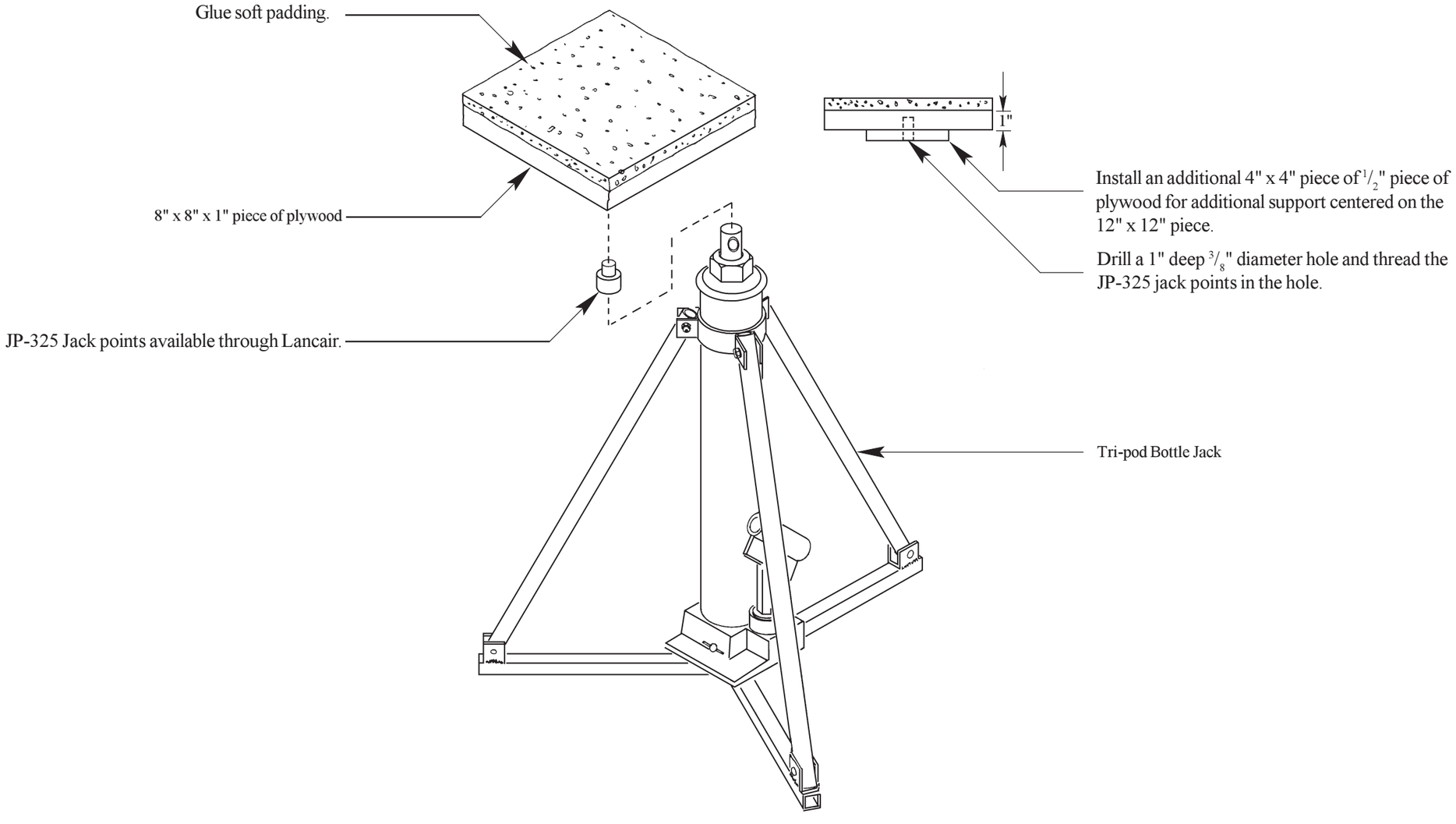
## Z. Building a Jack Stand

**Jack Stand**
**Fig. 1:Y:9**





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# REVISION LIST

# CHAPTER 2: HORIZONTAL STAB. AND ELEVATOR

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 2-1 through 2-7 | 0/02-15-02 | None | Current Revision is Correct |
| 2-8 | 1/09-18-02 | R&R | Corrected Fig. 2:C:2 |
| 2-9 through 2-14 | 0/02-15-02 | None | Current Revision is Correct |
| 2-1 | 2/06-30-04 | R&R | Part number change |
| 2-2 | 2/06-30-04 | R&R | Part number change |
| 2-11 | 2/06-30-04 | R&R | Part number change |
| 2-1 | 3/12-15-04 | R&R | New table of contents with page numbers. |
| 2-13, 2-14 | 6/08-10-07 | R&R | Hysol/Jeffco changes. |



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# Chapter 2: Horizontal Stabilizer and Elevator

Contents



## 1. INTRODUCTION

In this chapter we will be assembling the final components and installing them in the horizontal stabilizer (H. Stab.) and elevators. Then we will complete the chapter by closing the H. Stab and elevators.

The horizontal stabilizer is comprised of two structural skins and an internal structure consisting of spars and ribs. These internal components have been pre-assembled in the bottom stabilizer skin at the factory. The H. Stab is a symmetrical airfoil, which means the shape of the upper surface is the same as the lower surface. The H. Stab is also tapered, meaning that it is thicker in the center than it is at the tips.

The elevator consists of two halves. The internal structure of the elevators has been completed at the factory, including the trim tab.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **H. Stab and Elevator** | | | | |
| 1) | 4100-01 | 1 | Upper H. Stab Skin | |
| 2) | 4100-02 | 1 | Lower H. Stab Skin with premolded Structure | |
| 3) | 4130-01L | 1 | Upper Left Elevator Skin | |
| 4) | 4130-01R | 1 | Upper Right Elevator Skin | |
| 5) | 4130-02L | 1 | Lower Left Elevator Skin with premolded structure | |
| 6) | 4130-02R | 1 | Lower Right Elevator Skin with premolded structure | |
| 7) | 4138-01 | 1 | Upper Trim Tab Skin | |
| 8) | 4138-02 | 1 | Lower Trim Tab Skin | |
| 9) | 4461 | 1 | Trim Tab Cover | |
| 10) | 4450 | 5 | The following are factory installed parts:<br>H. Stab Hinges<br>(Not shown: (20) K1000-3 nutplates and (40) AN426A3-4, (20) AN3-6A bolts, and (20) AN960-10 washers used to secure the hinges to the H. Stab.) | |
| 11) | 4457-01 | 2 | Elevator Counterweights, Left & Right | |
| 12) | 9-020016 | 1 | Elevator Control Horn<br>(Note: refer to the following figure for mounting hardware) | |
| 13 | REH-053-U | 4 | The following are factory installed parts:<br>Elevator Hinges (Elevator)<br>(Not shown: (8) K1000-3 nutplates and (40) AN426A3-4 rivets, (8) AN3-5A bolts, and (20) AN960-10 washers used to secure hinges to elevator. | |
| 14) | S6A | 1 | The following are factory installed parts<br>Trim Tab Servo. Servo may be listed as T2-10A.<br>(Not shown: (6) MS24693-S28 screws, (6) K2000-06 nutplates, and (12) AN426A3-4 rivets to secure it) | |
| 15) | MS20001 | 2 | Trim Tab Hinge<br>(Not shown: Trim tab activator arm, (4) hard rivets to secure it.) | |
| 16) | AN365-1032A | 3 | Locknut | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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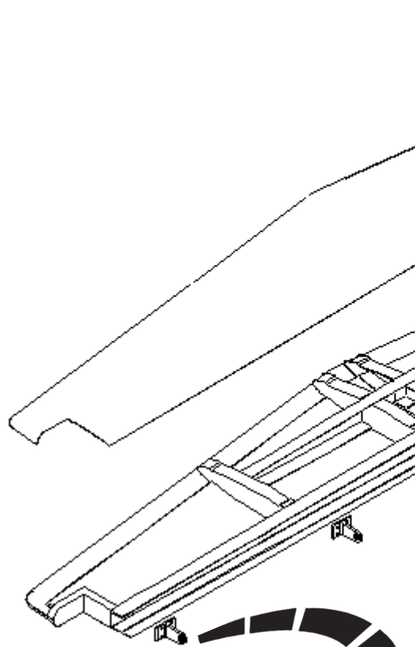
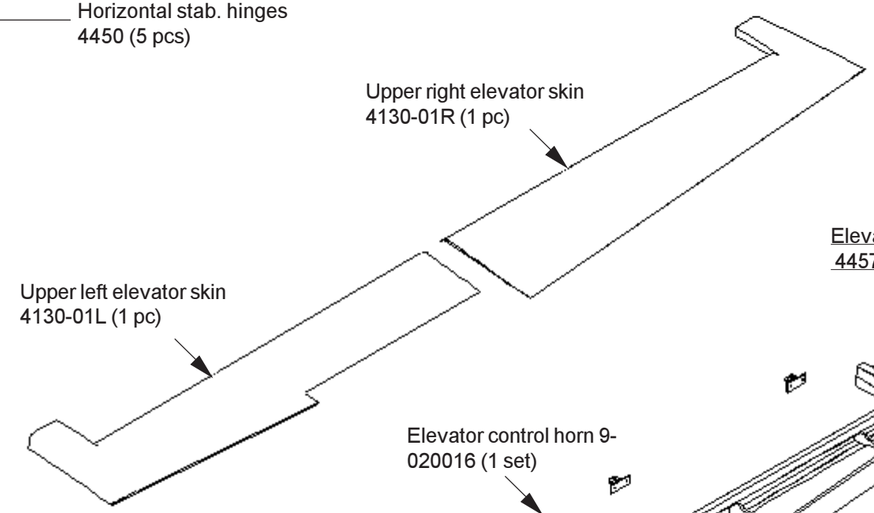
## Horizontal Stab. & Elevator Exploded View
## Fig. 2:A:1



Upper horizontal stab. skin
4100-01 (1 pc)

Lower horizontal stab. skin
4100-02 (1 pc)

Horizontal stab. hinges
4450 (5 pcs)



Upper right elevator skin
4130-01R (1 pc)

Upper left elevator skin
4130-01L (1 pc)

Elevator counterweight
4457-01

Elevator control horn 9-020016 (1 set)

Lower right elevator skin
4130-02R (1 pc)

Elevator hinges REH-053-U (4 pcs)

Trim tab servo, S6A (1 pc)

Elevator trim tab access panel, 4461 (1 pc)

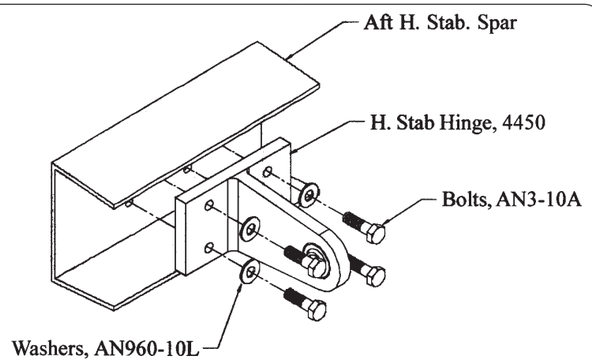
Elevator counterweight
4457-01

Elevator trim tab hinge, MS20001 (1 pc)

Upper elevator trim tab skin, 4138-01 (1 pc)

Lower elevator trim tab skin, 4138-02 (1 pc)

Lower left elevator skin
4130-01L (1 pc)




**Note: Always check bolt lenghts going through composite parts.**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# 3. CONSTRUCTION PROCEDURES

## A. Building the Horizontal Stabilizer Assembly Cradle

The assembly cradle is needed to ensure that a "true" airfoil for the horizontal stabilizer with no twists or warps can be constructed. You can make or purchase these simple airfoil cradles. Using a flat, level tabletop is ideal, and it is essential that the airfoil cradles be properly aligned.

To make the cradles yourself:

1. Use blueprint patterns 4420, 4421, 4422.
2. Check the blueprints for proper scale:

| Location | Chord Length | Tolerances | Blueprint Number |
|---|---|---|---|
| BL 0 | 28.00" | ± 1/8" | 4420 |
| BL 21 | 23.55" | ± 1/8" | 4421 |
| BL 46.75 | 18.00" | ± 1/8" | 4422 |

3. Use spray adhesive and glue 1 copy of 4420, and 2 copies each of 4421 and 4422 to 1/2 particleboard. We like the 3M brand.

4. Using a Sabersaw we cut along the outside of the cradle lines and then sand up to them.

**A 1.** Construct a table for your jig 100" x 36", 30"- 34" tall. We suggest a box-frame structure as shown. The table should be relatively level, but it is not necessary to spend great amounts of time on making it "perfect." The final leveling is done to only the cradles, and not the table. Secure to floor with Bondo.

**A 2.** Draw a straight line 14" from the backside of the table. Draw perpendicular centerlines to this at BL0, BL 21, and BL 46.75 (BL# stands for Baseline, or the center of the aircraft on the longitudinal (roll) axis, ie. BL21 = 21" from centerline.

**A 3.** Install the 2" x 4" cradle supports on one side of the centerlines only. Allow 1/4" each side of the centerlines so the cradles will be centered on the lines. (1/4" is equal to half the thickness of the cradles provided you did use 1/2" wide material. If not, adjust this reference accordingly.

**A 4.** Install and align the cradles using the following procedure:

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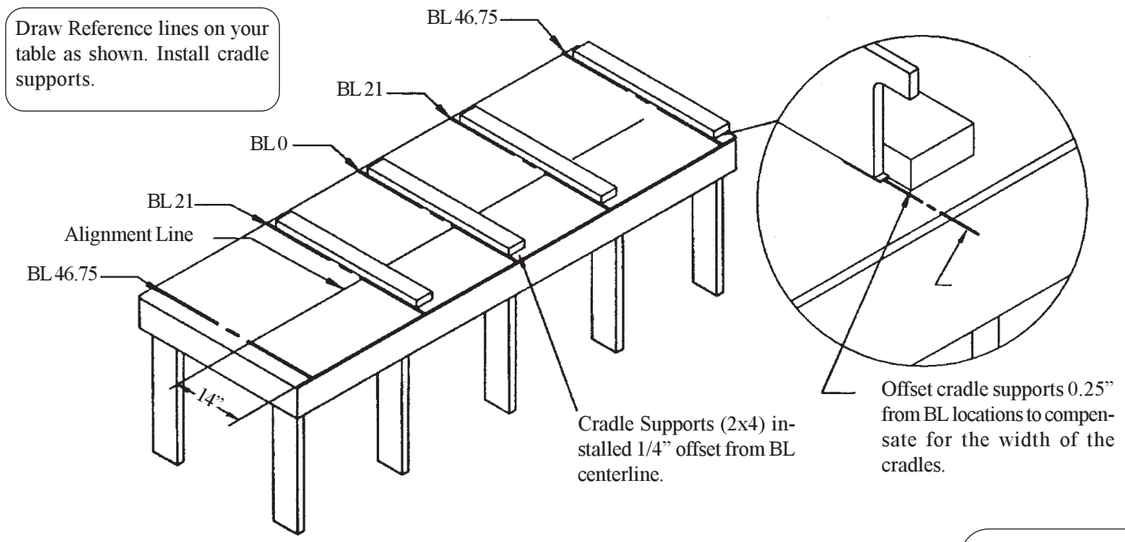
## Horizontal Assembly Jig Construction

**Fig 2:A:2**

### STEP (1)

Alignment Procedure

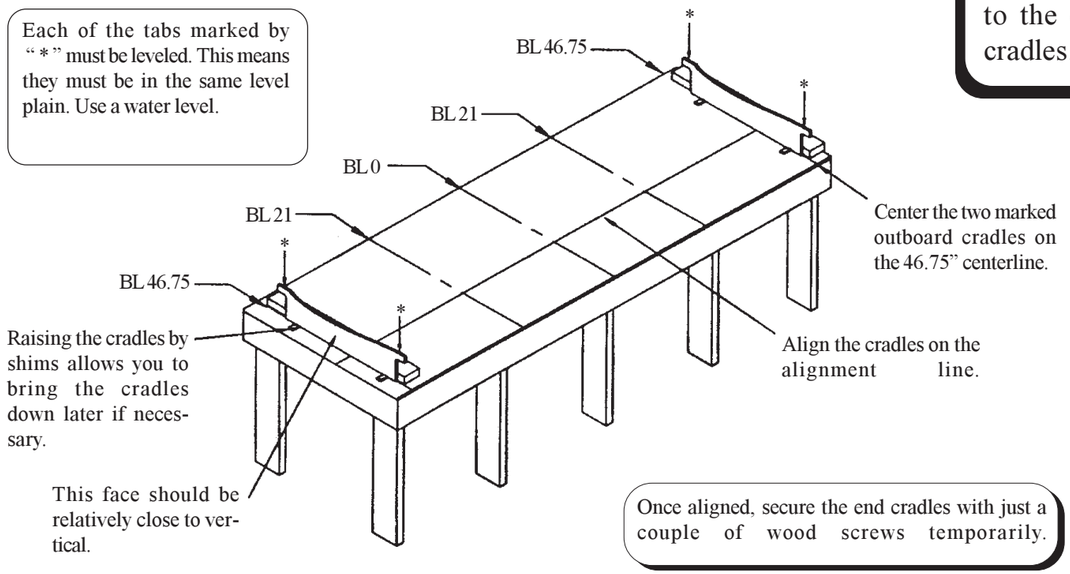
Draw Reference lines on your table as shown. Install cradle supports.




### STEP (2)

Align the two outboard cradles

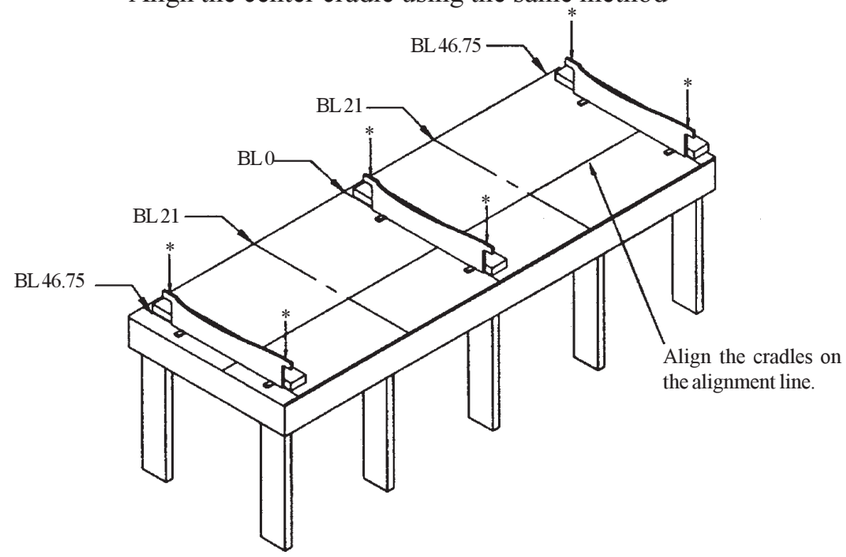
Each of the tabs marked by " * " must be leveled. This means they must be in the same level plain. Use a water level.




Once aligned, secure the end cradles with just a couple of wood screws temporarily.

### STEP (3)

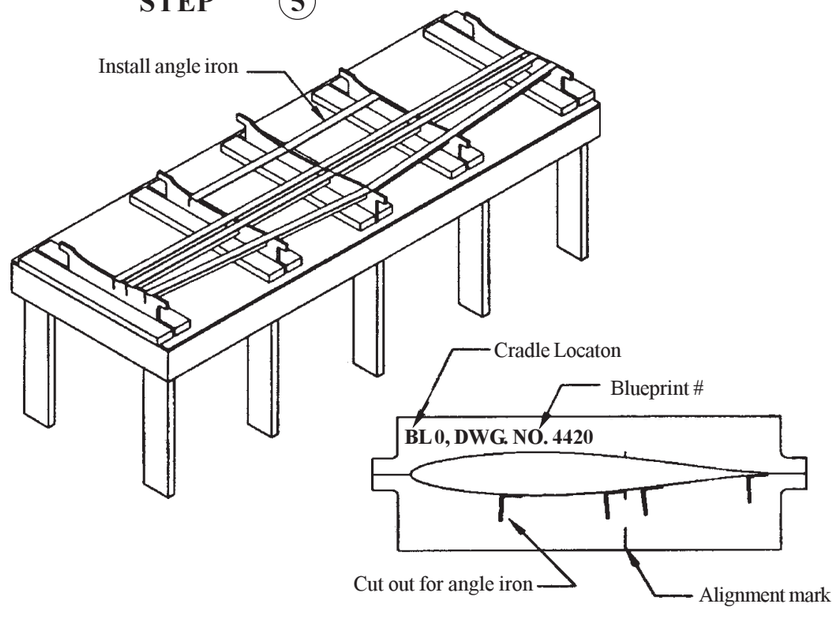
Align the center cradle using the same method




### STEP (4)

Install the two remaining cradles. Align with a stringline to the center and outboard cradles.

### STEP (5)



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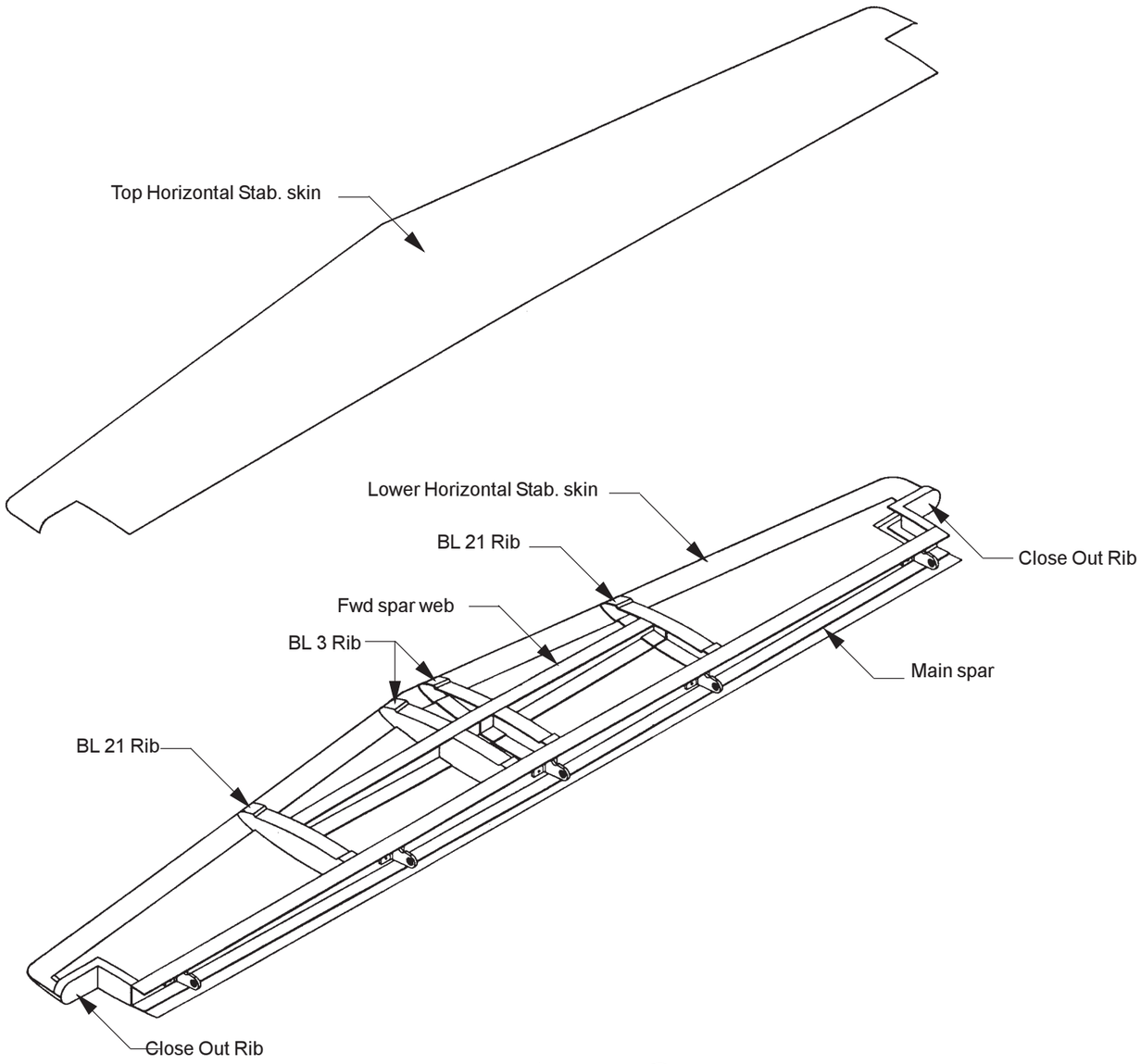
**Horizontal Detail View**
**Fig 2:B:1**





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## B. Horizontal Stabilizer Hinge Brackets

With the horizontal stabilizer table complete, you can now begin building the horizontal stabilizer.

**B 1.** Position the lower horizontal stabilizer assembly in the cradles.

-The stabilizer should be centered.

-The stabilizer should be pushed forward and fit well in the cradles. Look underneath it to make sure the stabilizer conforms to the cradle shape. Use some weight if necessary. Weight down and apply a few dabs of bondo to secure in place.

**WARNING:** STRUCTURAL BONDS *CANNOT* BE MADE OVER PEEL PLY. BE SURE TO REMOVE ALL PEEL PLY FROM BONDING AREAS. FAILURE TO DO SO WILL RESULT IN STRUCTURAL FAILURE OF THE BOND.

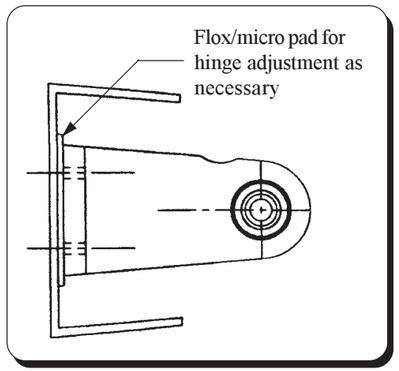
**B 2.** Check the hinge alignment. The alignment was done at the factory but must be double-checked to ensure a proper fit. The horizontal stabilizer must be weighted down in the cradle for this step.

-Install the five 4450 hinges on the rear spar and hold in place with clecoes.

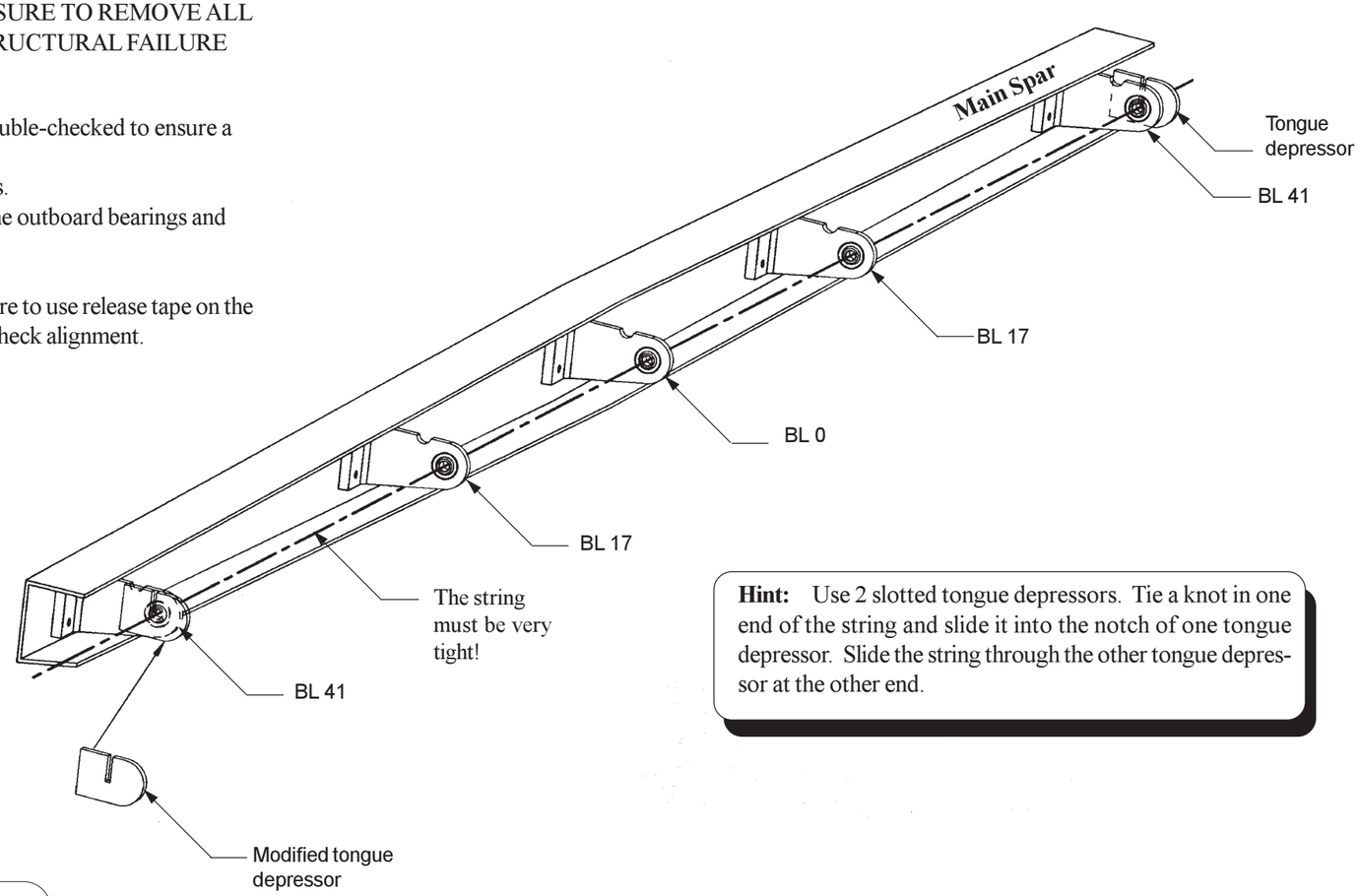
-Pull a string through the bearings, making sure the string is centered on the outboard bearings and that it is tight. Refer to the figure

To adjust fwd/aft alignment:

Apply a layer of 50/50 micro/flox mix between the web and bracket . Be sure to use release tape on the hinge, or you might not be able to remove it when the micro/flox cures, recheck alignment.




**Hinge Alignment**
**Fig. 2:B:2**




**Hint:** Use 2 slotted tongue depressors. Tie a knot in one end of the string and slide it into the notch of one tongue depressor. Slide the string through the other tongue depressor at the other end.

**Note: Adjustments should not be necessary. If you think they are necessary we suggest talking it over first with a Lancair technical representative.**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## C. Elevator Hinge Installation

The 4550 hinges and the 9-020016 elevator control horn must be installed before the elevators can be fitted.

**C 1.** Install the 9-020016 elevator control horn, long end down. Cut a slot in the BL 0 cradle to accommodate the control horn.

**C 2.** Position the elevators.

1. Apply 3 layers of duct tape to the inboard side of the inboard elevator ribs. This is to compensate for a 2 BID installed later on.
2. Install AN4-10A pivot bolts through the 4450 and REH-053-U hinges.

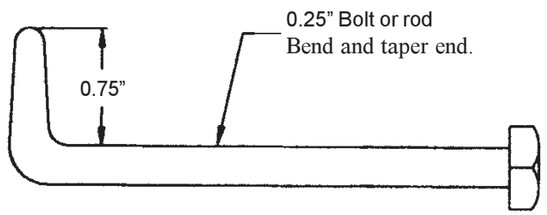
**C 3.** Move the elevator through its full travel range. Make sure the notches for the hinges will clear the hinges by 1/8" at full down travel. (See Fig. 2:C:3)

**C 4.** Expand the notches you made in the lower elevator skin for the hinges 3" - 4" in length, to allow you to get a wrench and needle-nose pliers to the bolts.

> **Hint:** Remove just enough carbon so you can get to the bolts with needle-nose pliers. Installing the elevators can be a frustrating process, especially when you are bent over backwards, holding the elevator and aligning the bolts as a bead of sweat is running down your forehead and into your eyes so you can't see what you are doing. Make a hinge alignment tool as shown in Fig. 2:C:1. Use it to align the hinge, then push it out with the bolt from the other side.

**C 5.** Check the gap between the horizontal stabilizer and the lower elevator skin It should be roughly 0.05 ". You will fine tune this later when you do the body work.

**Hinge Alignment Tool**
**Fig. 2:C:1**





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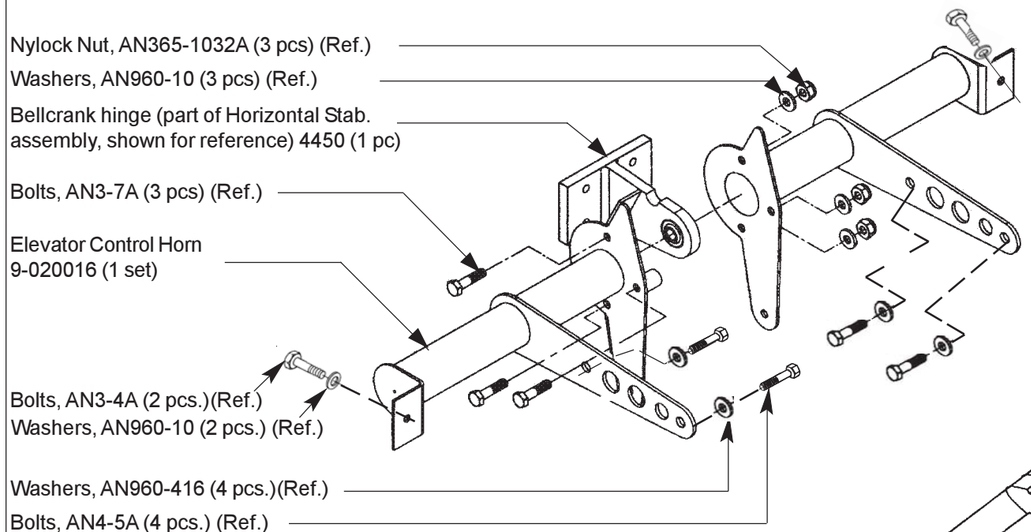
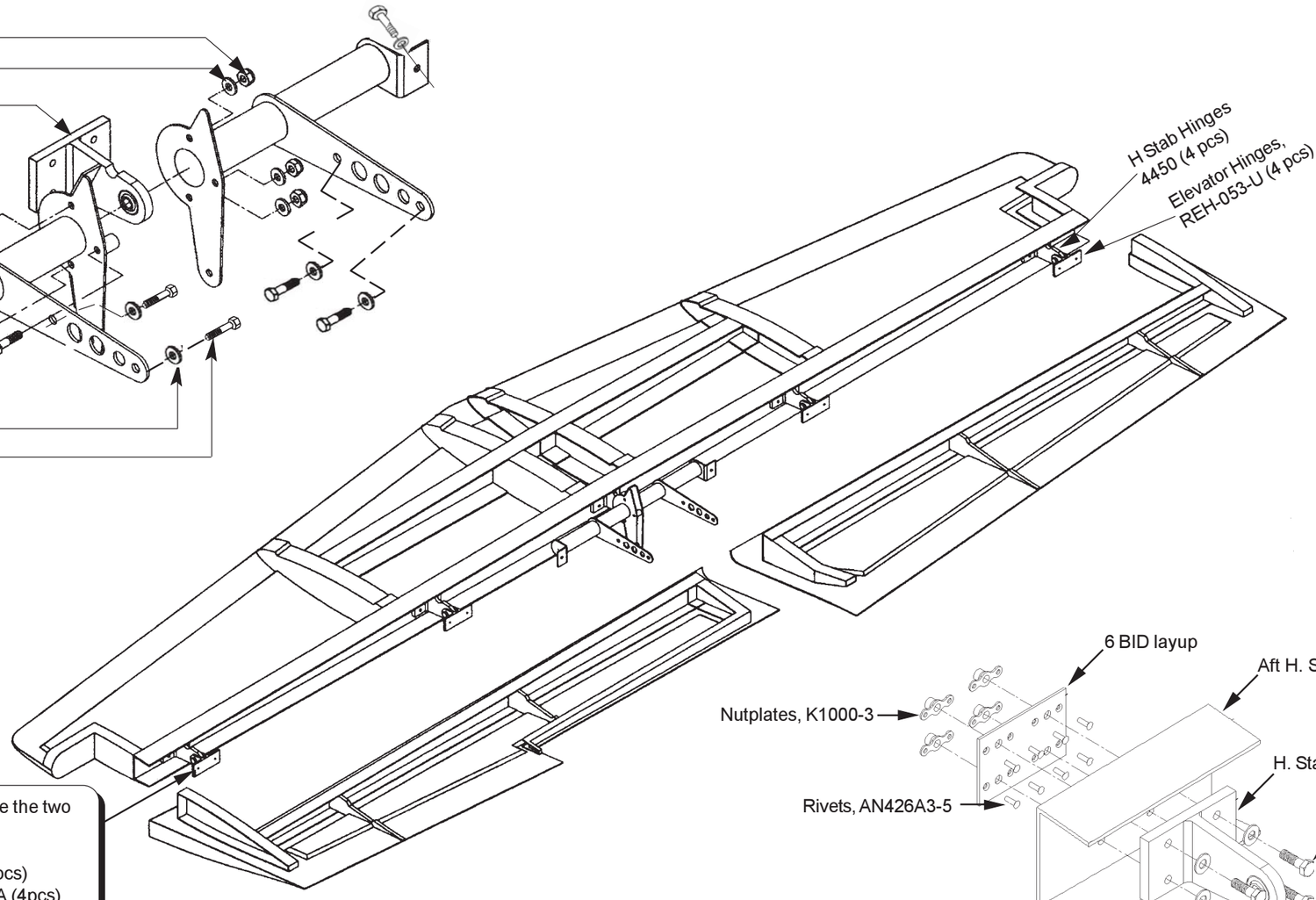
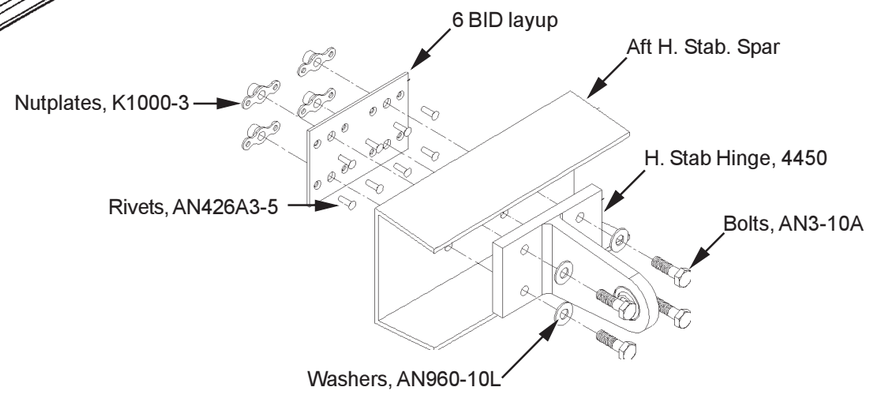
**Horizontal Assembly**
**Fig. 2:C:2**




Hardware used to secure the two hinge halves together:
Bolt, AN 4-10A (4 pcs)
Washer, AN960-416 (4 pcs)
Nylock Nut, AN365-428A (4pcs)

**Note: Always check length of bolts as they may vary.**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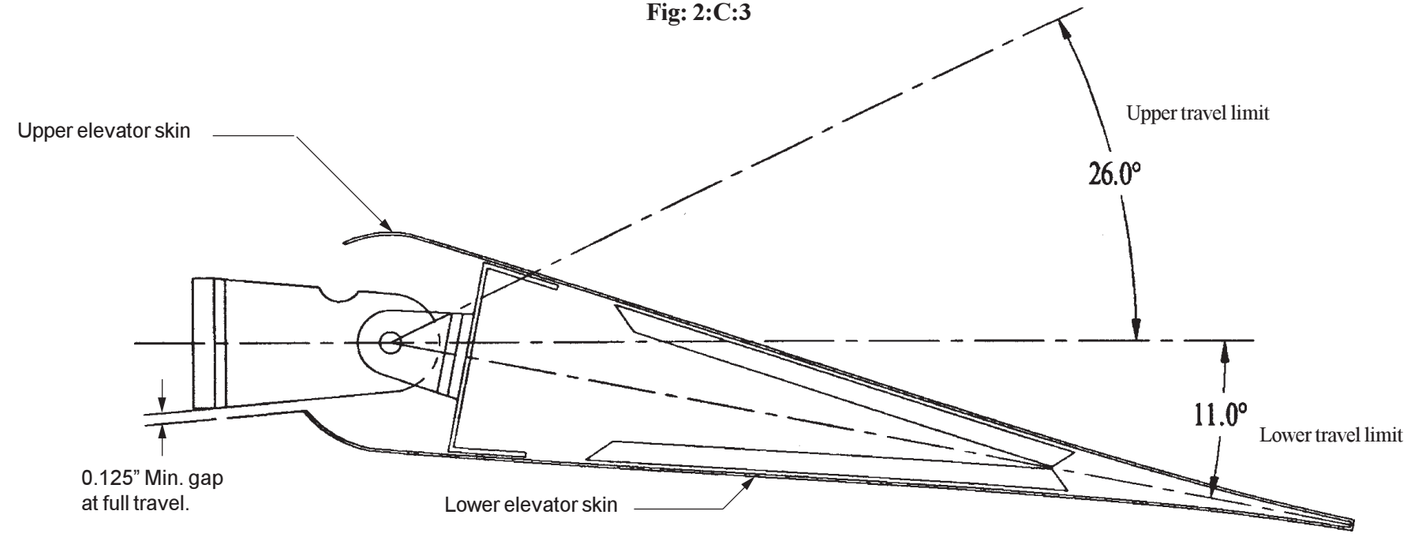
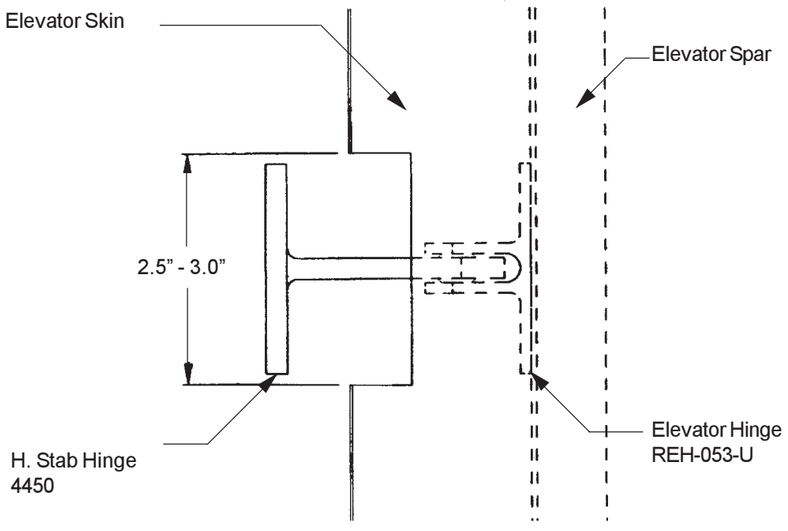
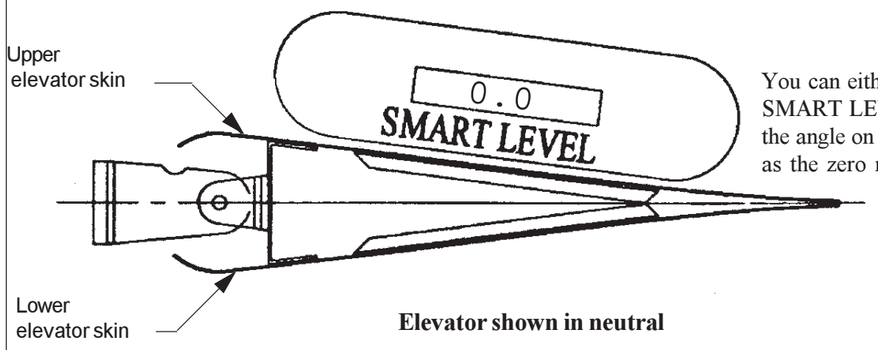
**Elevator Travel and Clearance**
**Fig: 2:C:3**




Carefully open slot as required to allow for any tools needed to install bolts. We recommend the Gear Wrench™ for installation of the locknuts.




You can either set the SMART LEVEL to 0° or use the angle on SMART LEVEL as the zero reference.

**Elevator shown in neutral**

## Recomended method for finding elevator travel

1. Zero the SMART LEVEL in neutral position. The neutral position is defined by the counter weight flange being flushed with the horizontal stabilizer.
2. Set the travel using the SMART LEVEL. The elevator deflection is 26° up and 11° Down.



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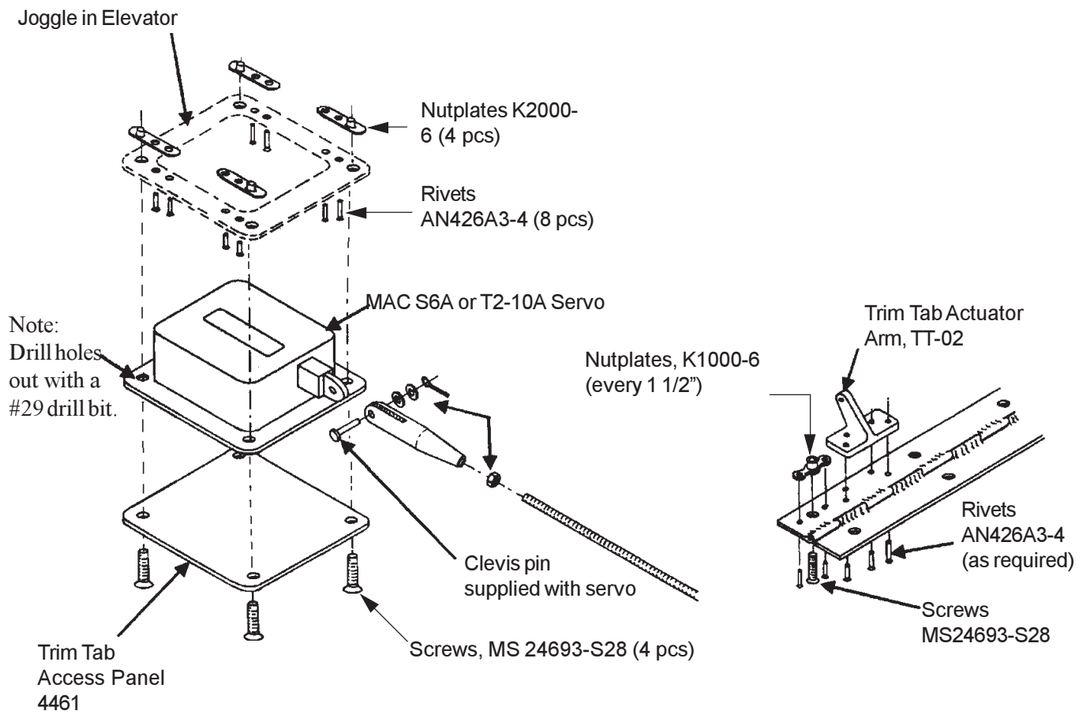
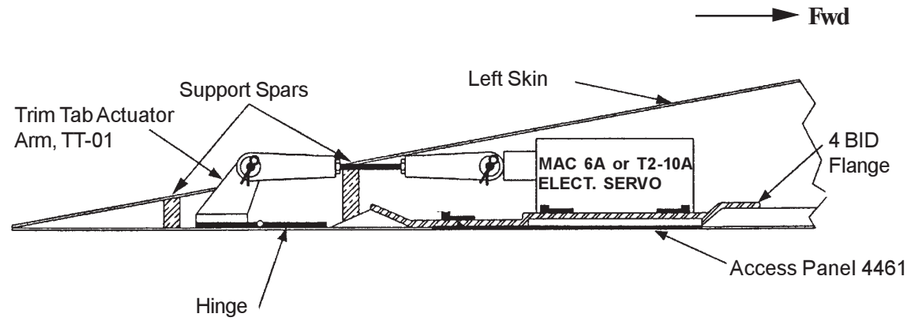
## D. Elevator Trim Tab

The elevator trim tab is preassembled. This selection is primarily for reference of part number and the installation for your reference. The trim tab uses an 6A or T2-10A servo.

**Trim Tab Exploded View**
**Fig 2:D:1**




**Trim Tab Installation**
**Fig 2:D:2**




### Setting the Trim Tab

1. Neutral: The trim tab is aligned to the elevator.
2. Pitch Up: The trim tab moves down. This causes the elevator to go up.
3. Pitch Down: the trim tab moves up. This causes the elevator to go down.

The travel is set such that the trim tab moves an equal distance up and down.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## E. Couterbalancing the Elevators

The elevators on the Legacy 2000 are 100% mass balanced. The elevators will be closed with the premolded lead counterweights in position. Any excess weight will be drilled out. You must be able to rotate the elevators freely on the hinges in order to balance them. You CANNOT properly balance an elevator that is not free floating.

**E 1.** Drop the premolded counterweights (P/N 4457-01) in place. Check the fit of the upper skin to the lead weight. The lead weight should not be holding the skin up.

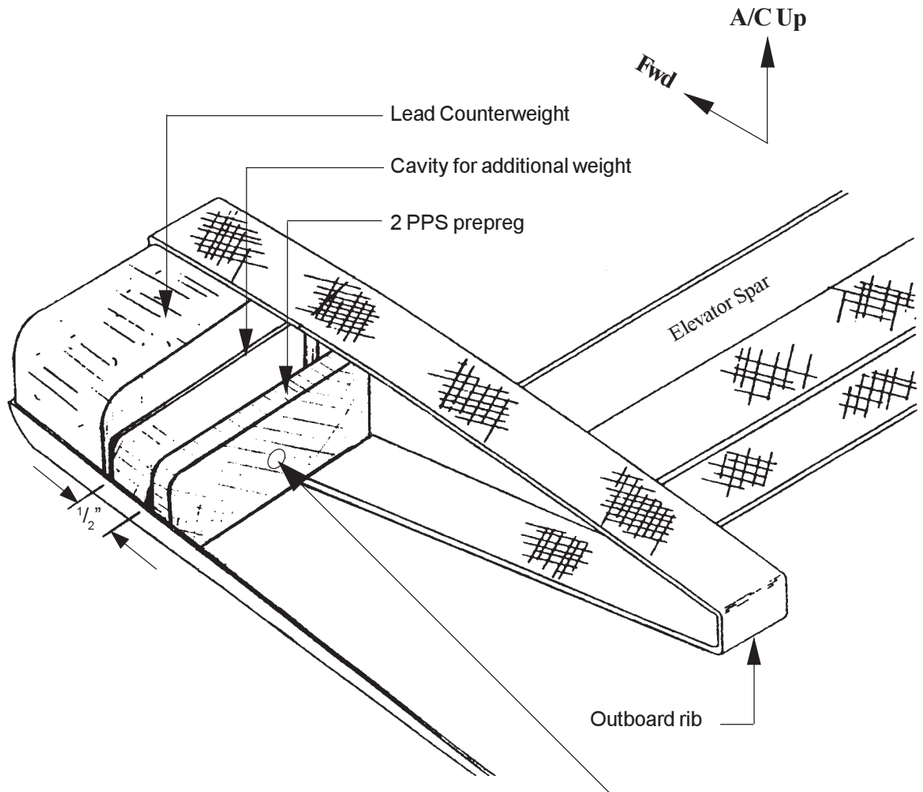
**E 2.** Bond the lead weight in place with epoxy/flox.

**E 3.** Cut and fit a piece of 2 PPS prepreg 1/2" aft of the lead weight. Bond in place.

**E 4.** Install the 2 Bid from the counterweight to the elevator skin and back onto the rib.

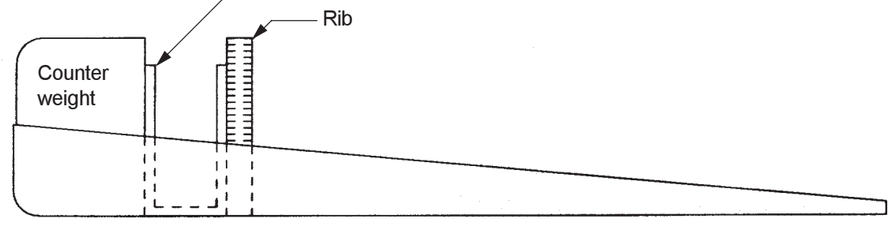
**E 5.** After curing and body work, balance the elevators individually and remove weight as necessary.

**Elevator Counterweight Installation**
**Fig. 2:E:1**




Install a vent hole in the closeout rib. The purpose of the small cavity formed between the lead and rib is to allow you to add weight should it be necessary.

**2 BID Reinforcement**
**Fig. 2:E:2**





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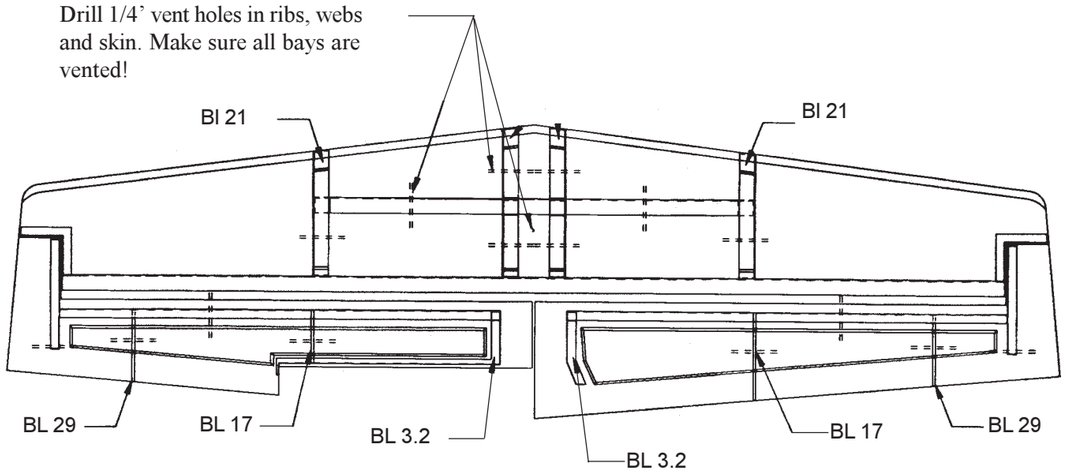
# F. Closing the Horizontal Stabilizer and Elevator

**F 1.** Drill vent holes in ribs, webs, and the skin as shown in the figure.

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

**Horizontal Stab. and Elevator Vent Hole Locations**
**Fig. 2:F:1**




**F 2.** Verify the fit of the upper horizontal stabilizer and elevator skins.
Procedure:

1. Place pieces of clay every 6" on the spars, ribs, etc.
2. Place the skin and clamp down on the cradles. Place weight on the stabilizer and elevators as if you are closing them.
3. Look over the horizontal stabilizer and elevators. There should be no bumps or irregularities, and it should fit well in the cradles. Adjust weight if necessary.
4. Remove the weights and cradles. Confirm that the pieces of clay are .05 or thinner. If they are taller, perform an epoxy/flox release.

**Note: Make sure the horizontal stabilizer and the elevators are positioned correctly in the cradles, and the hinges and control horn are bolted in place.**

Epoxy/Flox release (Only if necessary):

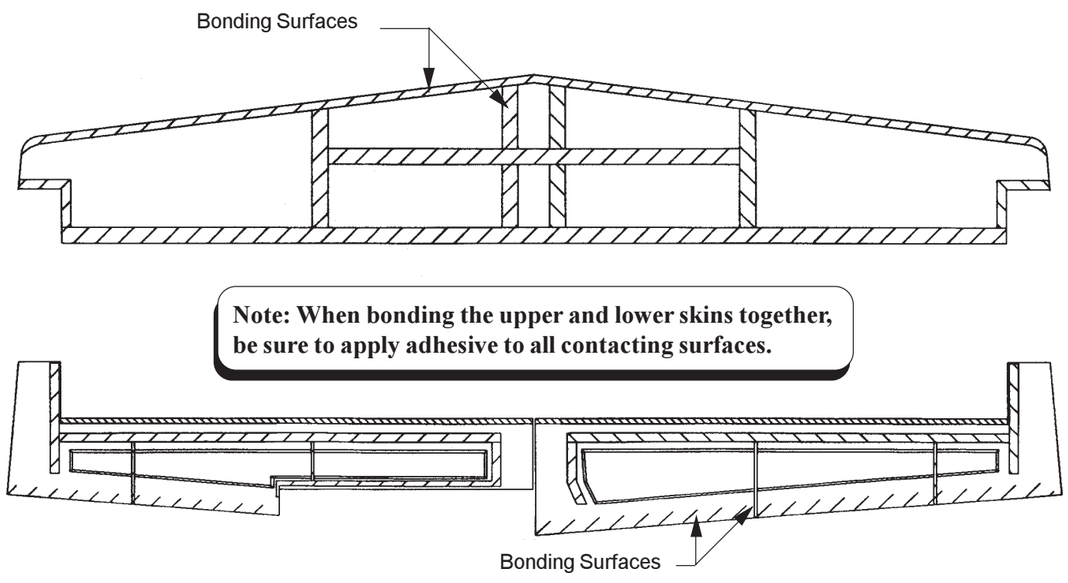
1. The areas to be released must be sanded and cleaned following approved bonding procedures.
2. Use 2 layers of duct tape in the bonding areas to release the upper skin. (This allows room for the resin in the final closing process.)
3. Paint a thin layer of pure epoxy on the spars and ribs.
4. Apply the epoxy/flox mixture to the spars and ribs- don't forget to form it into a triangle shape.
5. Place the upper skin and clamp the cradles down. Add weight as if you are closing. Let cure.
6. Take note of the fit of the upper skin in each area. Look for any gaps, bumps, warps, etc.
7. After cure, remove the weights and cradles. Carefully peel the upper skin away. Remove the tape. Fill any major holes or divots with epoxy/flox.

**F 3.** Practice the closing a couple of times to make sure you have everything you will need- weights, clamps, clecoes, straight edges, etc. Decide what you will use to hold the leading edge joggles together during bonding (screws, clecoes, duct tape?)

**F 4.** De-wax all ribs, spars, and joggles using Acetone. Apply a generous amount with a clean rag or paper. Follow with another clean rag.

**F 5.** Sand all bonding surfaces (upper and lower) with 80-grit sandpaper.Closing the Elevators

**Elevator Bonding Areas**
**Fig. 2:F:2**




**Note: When bonding the upper and lower skins together, be sure to apply adhesive to all contacting surfaces.**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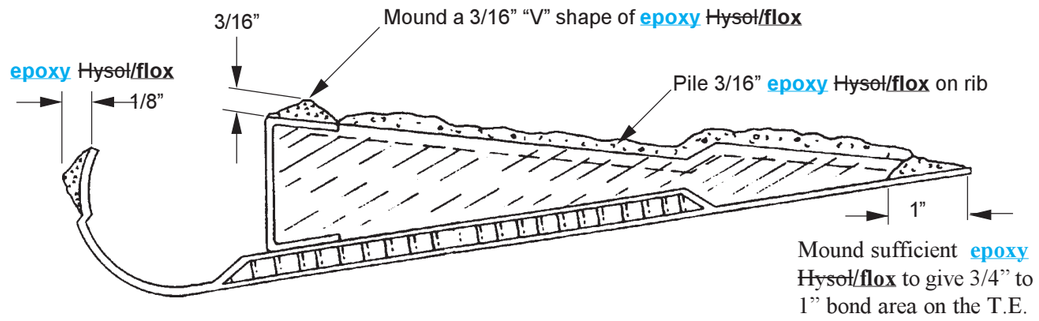
## Closing the Elevators

**F 6.** Brush pure epoxy ~~Hysol~~ on all bonding surfaces.

**F 7.** Mix in 1 tablespoon of flox per 2 ounces of epoxy ~~Hysol~~. Mound epoxy ~~Hysol~~on all bonding surfaces in a "V" shape.

**F 8.** Position the upper skins. Clamp down the cradles and add weight bags. Check visible bonding areas for squeeze out (excess resin).

**Elevator Cross Section @ BL 29**
**Fig. 2:E:3**




NOTE: Once again you must use a straight edge to check for any warped or bowed areas. It's okay to shuffle weights around to allow for this check. This is for all the marbles, so check and double-check. Readjust your weights if necessary.

**F 9.** After the Hysol has cured, sand the outboard joggles on the elevators and clean with acetone. Apply 2 BID by 2" wide strips in the joggles.

**F 10.** Follow the same procedure for the horizontals as for the elevators. Insert the bolts into the hinges to locate the closed elevators and open horizontal into the cradles. Use masking tape to protect the leading edge of the elevators from possible dripping from the trailing edge of the horizontal spar.

**F 11.** Trim the trailing edge of the top horizontal spar skin so that it rest **flush** with the top of the elevators, not on the top of the elevators. The gap between the two parts can be increased later.

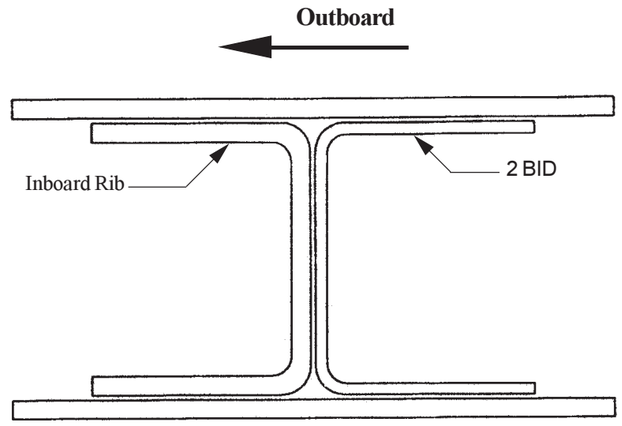
**F 12.** Set up to close with 2 straight edges about 48" long to rest on the top skin above the aft spar. These will extend out and rest on the elevators to keep the skins at the same level.

**F 13.** Position the upper skin. Place straight edge on top of the spar and add weight bags. Use clecoes, screws or duct tape every 3" -5" along the leading edge. Let cure.

**Note: No additional lay-ups required for the horizontal stabilizer, however, an additional 1 BID may be used on the leading edge to cover the cleco holes.**

**F 14.** Remove the elevator control horn assembly. Remove the three (3) layers of duct tape on the control horn arms. Sand the inboard side of the BL 3.2 elevator rib. Vacuum and clean with acetone. Apply 2 BID to the ribs, rolling onto the skins at least 1 1/2".

**Inbd Rib 2 BID Reinforcement**
**Fig. 2:E:4**




**Hint:** Use modeling clay, Silly Putty, etc. to prevent resin from clogging the threads in the bolt holes. Trim around the holes when the resin is in the green cure state, and then remove the clay plugs.

**Note: Make sure the surfaces that the elevator control horn rests against are absolutely flat.**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## G. Elevator Travel Stops

**G 1.** Raise the elevator to its full up travel limit of 26° (use a smart level, the blueprint pattern gauge, etc.). You will have to notch the trailing edge of the H. Stab (don't cut too deep) to attain full elevator travel. Repeat for the lower travel limit of 11°.

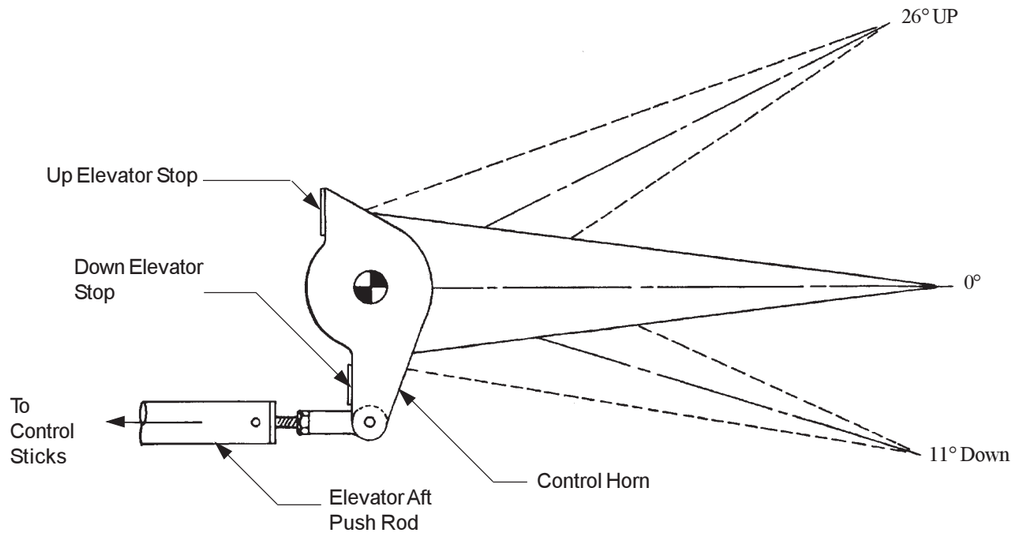
**G 2.** Cut a 1/4" x 3" x 2" piece of phenolic. Sand both sides of the phenolic and the bonding surfaces of the H. Stab with 40 grit sandpaper. Clean with acetone.

**G 3.** Install the phenolic with **Lancair approved** ~~Hysol~~ or epoxy/flox. Form a fillet around the block for a 4 BID lay-up. Let cure.

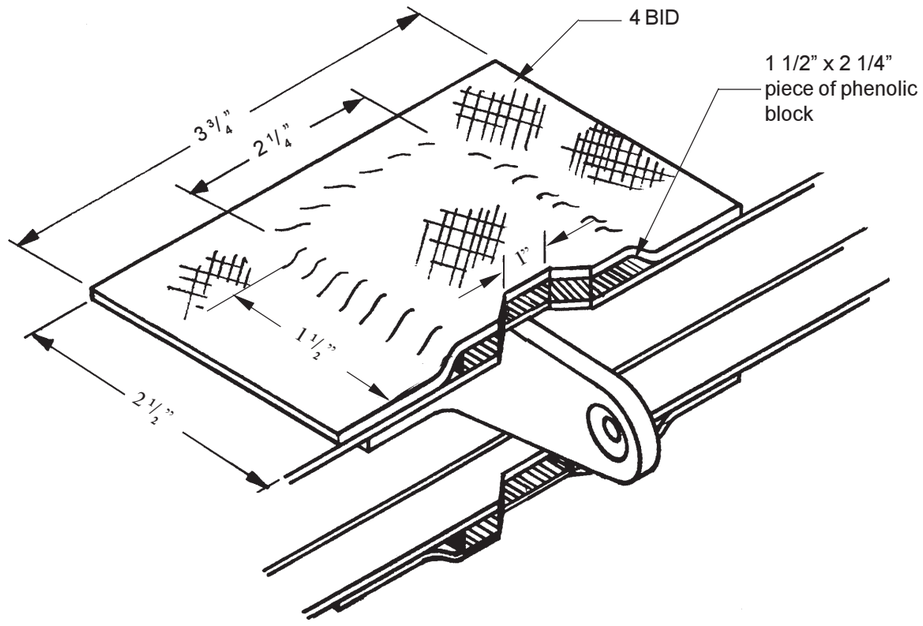
**G 4.** Sand the H. Stab surface and the radius around the phenolic block and clean with acetone. Install the 4 BID lay-up and let cure.

**G 5.** Set the up and down travel by grinding a notch in the phenolic.

**Elevator Travel**
**Fig. 2:G:1**




**Elevator Travel Stops**
**Fig. 2:G:2**





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# REVISION LIST

# CHAPTER 3: WING SYSTEMS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 3-1 | 0/02-15-02 | None | Current Revision is Correct |
| 3-2 | 1/09-18-02 | R&R | Part number Correction |
| 3-3 | 1/09-18-02 | R&R | Text Correction |
| 3-4 through 3-6 | 0/02-15-02 | None | Current Revision is Correct |
| 3-7 | 1/09-18-02 | R&R | Text and part # correction<br>Cleaned up Graphic |
| 3-8 through 3-11 | 0/02-15-02 | None | Current Revision is Correct |
| 3-12 | 1/09-18-02 | R&R | Part # Correction |
| 3-13 | 0/02-15-02 | None | Current Revision is Correct |
| 3-14 | 1/09-18-02 | R&R | Corrected Fig. 3:F:1 |
| 3-15 through 3-25 | 0/02-15-02 | None | Current Revision is Correct |
| 3-26 | 1/09-18-02 | R&R | Text Correction |
| 3-27 | 1/09-18-02 | R&R | Text Correction |
| 3-28 through 3-30 | 0/02-15-02 | None | Current Revision is Correct |
| 3-31 through 3-34 | 0/02-15-02 | None | Current Revision is Correct |
| | | | |
| 3-3 | 2/06-30-04 | R&R | Part number updates. |
| 3-6 | 2/06-30-04 | R&R | New instructions for drilling holes. |
| 3-16 | 2/06-30-04 | R&R | Changed part number. |
| 3-17 | 2/06-30-04 | R&R | Updated graphic, added photo, added instructions. |
| 3-22 | 2/06-30-04 | R&R | Updated instructions. |
| 3-23 | 2/06-30-04 | R&R | Moved fuel pump behind co-pilot seat and adjusted all hydraulic lines accordingly. Added photo. |
| 3-25 | 2/06-30-04 | R&R | Updated hydraulic line support. |
| 3-26 | 2/06-30-04 | R&R | Updated hydraulic lines transition holes. Added photo. |
| 3-27 | 2/06-30-04 | R&R | Corrected location of hole. Added photo. |
| 3-28 | 2/06-30-04 | R&R | Corrected size and location of transition hole. Added photo. |


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| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 3-1 | 3/12-15-04 | R&R | New table of contents with page numbers and part nbr. update. |
| 3-2 through 3-3 | 3/12-15-04 | R&R | Part number updates. |
| 3-5 | 3/12-15-04 | R&R | Part number update. |
| 3-8 | 3/12-15-04 | R&R | Gear door fitting update. |
| 3-12 | 3/12-15-04 | R&R | New inboard gear door hardware. |
| 3-13 | 3/12-15-04 | R&R | New inboard gear and instructions. |
| 3-13b | 3/12-15-04 | Add | New page (to allow for newinstructions on 3-13) with part nbr. update. |
| 3-16 | 3/12-15-04 | R&R | Added new parts. |
| 3-19 | 3/12-15-04 | R&R | Added dimension. |
| 3-23 | 3/12-15-04 | R&R | Added photo showing hydraulic lines crossing main spar. |
| 3-24 | 3/12-15-04 | R&R | Updated hydraulic lines for fuel pump move. |
| 3-25 | 3/12-15-04 | R&R | Added photo and updated dimensions for hydraulic support. |
| 3-27 | 3/12-15-04 | R&R | Updated measurement and carbon layup requirements. |
| 3-29 | 3/12-15-04 | R&R | Updated fuel line openings through bulkhead. |
| 3-35 through 3-37 | 3/12-15-04 | ADD | Add pages. |
| 3-28 | 4/09-30-06 | R&R | Changed hole dia. for seat belt attachment and clarified location. |
| 3-2, 3-15, 3-16 | 6/08-10-07 | R&R | Part changed. |
| 3-3, 3-16, 3-31 | 6/08-10-07 | R&R | Part numbers changed. |
| 3-3, 3-14, 3-16, 3-18, 3-23 | 7/09-10-08 | R&R | Added optional landing lights, part number changes to sequence valve, updated main gear hydraulic cylinder. |
| 3-3, 3-20, 3-21 | 8/09-01-14 | R&R | Added and revised part numbers for Grove wheels and brakes. |


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# Chapter 3: Wing Systems

## Contents



**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**

## 1. INTRODUCTION

In this chapter various systems are installed in the center wing section. A couple of sturdy padded sawhorses should be used to support the center wing section. Note that after installing some items, such as the gear doors, pitot tube, fuel pump, etc, etc you will remove and store for final assembly.

**WARNING: Fuel and Hydraulic lines must be kept clean and free from dust. Cover ends.**

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **PITOT TUBE** | | | | |
| 1) | 4270 | 1 | Pitot Tube Mounting Flange | |
| 2) | AN5812-12-A | 1 | Pitot Tube (12 Volt D.C.) | **Yes |
| 3) | 44-P | 10 ft. | Line | |
| 4) | MS35338-41 | 4 | Lock Washers (included w/ Pitot tube) | |
| 5) | MS24694-S4 | 4 | Machine Screw (Structural) | |
| 6) | MS35207-226 | 4 | Mounting Screws (included w/ Pitot tube) | |
| 7) | 266N-04x04 | 1 | Plastic Fitting | |
| 8) | 6505-4x4 | 1 | Steel Fitting | |
| 9) | CB9151V5 | 3 | Tie Downs, Click Bond | |
| **MARKER BEACON ANTENNA** | | | | |
| 1) | CI 102 | 1 | Marker Beacon Antenna | *Yes |
| 2) | AN3-3A | 4 | Bolts, Undrilled head | |
| 3) | AN960-10 | 4 | Washers, Flat | |
| **COMMUNICATION ANTENNA** | | | | |
| 1) | CI 122C | 1 | Communications Antenna | *Yes |
| 2) | MS24694-S5 | 4 | Machine Screws (Structural) | |
| 3) | K1000-08 | 4 | Anchor Nuts | |
| 4) | MSC-34 | 8 | Pop Rivets (Flush Head) | |
| **SPAR CLOSEOUT** | | | | |
| 1) | 4214 | 1 | Forward Spar Closeout | |



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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **MAIN GEAR DOORS** | | | | |
| | Inboard Gear Doors (for both sides) | | | |
| 1) | 4264-01 | 1 | Inbd Gear Door, Left | |
| 2) | 4264-02 | 1 | Inbd Gear Door, Right | |
| 3) | 4755 | 1 | Assembly for Inboard Main Gear Door Hydraulic (Optional) | |
| | 4714-01 | 1 | Bracket, Inboard Gear Door, Left | |
| | 4714-02 | 1 | Bracket, Inboard Gear Door, Right | |
| | 4726-01B | 1 | Bracket, Outboard Gear Door, Left | |
| | 4726-02B | 1 | Bracket, Outboard Gear Door, Right | |
| | 4787 | 2 | Hydraulic Cylinder Actuator | |
| | 13373 | 2 | Hydraulic Cylinder Spring | |
| | 4766 | 2 | Hydraulic Cylinder Rod | |
| | 4732 | 2 | Bracket, Doubler Inboard Gear | |
| | 4767 | 2 | Spacer | |
| | 4768 | 2 | Spacer | |
| | F34-14 | 2 | Bearing Rod End, Female | |
| | F34-15 | 2 | Bearing Rod End, Female | |
| | 4769 | 2 | Spring Retainer | |
| | AN316-4 | 2 | Check nut | |
| | AN3-20 | 2 | Bolt | |
| | AN3-22 | 2 | Bolt | |
| | MS24665-132 | 4 | Cotter Pin | |
| | AN310-3 | 4 | Nut, Castle | |
| | MS24694-S54 | 8 | Screw, Machine | |
| | AN3-5A | 2 | Bolt | |
| | AN3-7A | 2 | Bolt | |
| | AN3-10A | 2 | Bolt | |
| | AN365-1032A | 12 | Nut, Nylock | |
| | AN960-10 | 22 | Washer, Flat | |
| 4) | 4728 | 2 | Hinge, Piano (Inboard Gear Door) 10” | |
| 5) | AN3-5A | 14 | Bolt, Undrilled | |
| 6) | MS24694-S5 | 26 | Machine Screws (Structural) | |
| 7) | AN365-832A | 26 | Nut, Lock (Metal) | |
| 8) | K1000-3 | 14 | Nut Plates | |
| 9) | MSC-34 | 28 | Pop Rivets, Flush Head | |
| 10) | AN960-08L | 28 | Washer, Flat | |
| 11) | AN960-10 | 14 | Washer, Flat | |
| | Outboard Gear Door (for both sides) | | | |
| 1) | 4265-01 | 1 | Outboard Gear Door, Left | |
| 2) | 4265-02 | 1 | Outboard Gear Door, Right | |
| 3) | 4725 | 4 | Bracket, Outboard Gear Door | |
| 4) | 4727-01 | 2 | Attachment, Outboard Gear Door | |
| 5) | 4727-02 | 4 | Receptacle | |
| 6) | BJ-02 | 8 | Ball Joint Assembly | |
| 7) | AN315-3 | 8 | Nut, Check | |
| 8) | AN364-428 | 4 | Nut, Nylock | |
| 9) | AN365-1032A | 12 | Nut, Nylock | |
| 10) | PH-125-3x3 | 2 | Phenolic Blocks | |
| 11) | GM321 | 4 | Rod, Threaded | |
| 12) | MS24694-S56 | 12 | Screws, Machine (Structural) | |
| 13) | AN960-10 | 12 | Washer, Flat | |
| 14) | AN960-4L | 8 | Washer, Flat | |
| **MAIN GEAR INSTALLATION** | | | | |
| | Main Landing Gear (for both sides) | | | |
| 1) | 4702-01 | 1 | Main Landing Gear (Left) | |
| 2) | 4702-02 | 1 | Main Landing Gear (Right) | |
| 3) | 4707-01 | 8 | .03” Shim | |
| 4) | 4707-02 | 8 | .06” Shim | |
| 5) | 4710 | 2 | Axle, Main Gear | |
| 6) | 4711 | 4 | Spacer, Axle | |
| 7) | AN4-17A | 8 | Bolt, Undrilled Shank | |
| 8) | AN5-14A | 8 | Bolt, Undrilled | |
| 9) | AN5-22A | 2 | Bolt, Undrilled | |
| 10) | MS24665-292 | 2 | Cotter Pin | |
| 11) | MS21025-20 | 2 | Nut, Axle | |
| 12) | AN365-428A | 8 | Nuts, Nylock | |
| 13) | AN365-524A | 10 | Nut, Nylock | |
| 14) | 075-00800 | 2 | Torque Plate | |
| 15) | AN960-516 | 10 | Washer, Flat | |
| 16) | AN960-416 | 8 | Washers, Flat | |
| | Over Center Link Attachment (for both sides) | | | |
| 1) | 4705 | 4 | Over Centerlink Attachment | |
| 2) | 4706 | 2 | Over Centerlink Reinforcement Plate | |
| 3) | 4513 | 4 | Over Center Link Backing Plate | |
| 4) | AN4-15A ~~14A~~ | 8 | Bolts, Undrilled | |
| 5) | AN365-428A | 8 | Nut, Nylock | |
| 6) | AN960-416L | 8 | Washer, Flat | |
| | Over Center Link (for both sides) | | | |
| 1) | 4709-01 | 4 | Shim 0.032” | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**


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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM |
|---|---|---|---|---|
| Over Center Link continued (for both sides) | | | | *(not included with kit)* |
| 2) | 4709-02 | 8 | Shim 0.063” | |
| 3) | 4712-407 | 2 | Hydraulic Cylinder (Main Gear) | |
| 4) | 4718 | 1 | Left Over Center Link | |
| 5) | 4720 | 1 | Right Over Center Link | |
| 6) | 4721 | 4 | Over Center Link Arms | |
| 7) | 4722 | 4 | Bushing | |
| 8) | 4723 | 2 | Spacer | |
| 9) | 4763 | 2 | Main Gear Up Stop | |
| 10) | JM-1 | 2 | Actuator Arm for Micro Switch | |
| 11) | F45-19 | 2 | Bearings, Rod End | |
| 12) | AN3-16A | 4 | Bolt, Undrilled | |
| 13) | AN4-44A | 2 | Bolt, Undrilled | |
| 14) | AN4-12A | 2 | Bolt, Undrilled | |
| 15) | AN4-7A | 2 | Bolt, Undrilled | |
| 16) | AN5-41A | 2 | Bolt, Undrilled | |
| 17) | AN5-20A | 4 | Bolt, Undrilled | |
| 18) | 110-0036 ~~6381K103~~ | 4 | Bushing | |
| 19) | AN5-7 | 2 | Bolt, Drilled | |
| 20) | MS24665-140 | 4 | Cotter Pin | |
| 21) | 198-0004 ~~9416K77~~ | 2 | Clip, Safety | |
| 22) | 198-0003 ~~9416K71~~ | 2 | End Fitting, Metal Ball Socket | |
| 23) | 198-0005 ~~9416K84~~ | 2 | End Fitting, Metal Eyelet | |
| 24) | AN816-4D | 4 | Fittings, Nipple | |
| 25) | 160-0004 ~~9416K24~~ | 2 | Gas Strut | |
| 26) | 1XE1-T | 2 | Main Gear Micro-switch | |
| 27) | AN310-5 | 2 | Nut, Castle | |
| 28) | AN316-5 | 2 | Nut, Check | |
| 29) | AN365-524A | 6 | Nut, Nylock | |
| 30) | AN365-428A | 6 | Nut, Nylock | |
| 31) | AN365-1032A | 4 | Nut, Nylock | |
| 32) | ~~HC-05-A~~ 4786 | 2 | Sequence Valve | |
| 33) | 198-0006 ~~9512K73~~ | 2 | Stud, Ball | |
| 34) | AN960-516 | 16 | Washer, Flat | |
| 35) | AN960-416 | 12 | Washer, Flat | |
| 36) | AN960-10 | 8 | Washer, Flat | |
| 37) | 110-0002B | 4 | Bearing, Thrust, over-center link | |
| 38) | 112-0034 | 4 | Bushing for new actuator w/bearing & old over-center link w/AN5 bolt hole | |
| or | 112-0050 | 4 | Bushing for new actuator w/bearing & new over-center link w/AN3 bolt hole | |
| **MAIN GEAR WHEELS & TIRES** | | | | |
| 1) | AN4-23A | 6 | Bolt, Undrilled | |
| 2) | TU-5.00-5 | 2 | Inner Tube 5” | |
| 3) | 57-1M ~~40-151~~ | 2 | Main Wheel Assembly | |
| 4) | AN365-428A | 6 | Nut, Nylock | |
| 5) | TR-GY 5.00-5 | 2 | Tire, Main Gear | |
| 6) | AN960-416 | 12 | Washers, Flat | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM |
|---|---|---|---|---|
| **CENTER WING SECTION HYDRAULICS** | | | | *(not included with kit)* |
| 1) | AN3-13A | 6 | Bolt, Undrilled | |
| 2) | AN3-10A | 6 | Bolt, Undrilled | |
| 3) | MS219-DG4 | 6 | Clamp | |
| 4) | MS219-DG7 | 6 | Clamp | |
| 5) | AN804-4D | 2 | Fittings, Tee | |
| 6) | AN818-4D | 38 | Fittings, Nut | |
| 7) | AN819-4D | 38 | Fittings, Sleeve | |
| 8) | AN822-4D | 6 | Fittings, Elbow | |
| 9) | AN825-4D | 2 | Fittings, Tee | |
| 10) | AN827-4D | 2 | Fitting, Cross | |
| 11) | AN832-4D | 6 | Fittings, Union | |
| 12) | AN833-4D | 6 | Fittings, Elbow | |
| 13) | AN837-4D | 7 | Fittings, Elbow | |
| 14) | AN924-4D | 15 | Fittings, Nut | |
| 15) | BG03-4NJ | 20 | Hose Fittings | |
| 16) | R703 | 130 in. | Flexible Hydraulic Line | |
| 17) | AN365-1032A | 12 | Nut, Nylock | |
| 18) | PH-250 | 1 | (1/4” x 3.5” x 1.5”) Phenolic Block | |
| 19) | PH-250 | 2 | (1/4” x 3” x 3”) Phenolic Block | |
| 20) | 5052 | 240 in. | 1/4” Tubing, Aluminum | |
| 21) | AN960-10 | 12 | Washer, Flat | |
| **LANDING/TAXI LIGHTS** | | | | |
| 1) | 4228 | 1 | Landing/Taxi Light Mount | **Yes |
| 2) | 4531 | 1 | Landing/Taxi Light Lens | **Yes |
| 3) | 4532 | 1 | Gasket | **Yes |
| 4) | MS35649-262 | 6 | Nut, Check | **Yes |
| 5) | MS24694-S52 | 8 | Screw, Machine | **Yes |
| 6) | 101-0127 ~~91772A157~~ | 6 | Screw, Machine | |
| 7) | MS21069-06 | 6 | Nut Plate | |
| 8) | K1000-08 | 8 | Nut Plate | |
| 9) | 01-0770346-02 | 1 | Landing Light | **Yes |
| 10) | 01-0770346-04 | 1 | Taxi Light | **Yes |
| 11) | 3614 | 6 | Spring | **Yes |
| 12) | AN960-6 | 6 | Washer | **Yes |
| 13) | 800-0001 | 1 (pair) | Main gear landing lights (12 volt) | |
| 14) | 800-0002 | 1 (pair) | Main gear landing lights (24 volt) | |
| **SPEED BRAKES** | | | | |
| 1) | 4530 | 2 | Cover Plates (only used when | **Yes |
| 2) | 4934-12 | 2 | Precise Flight Speed Brakes, 12 Volt | **Yes |
| 3) | 4934-24 | 2 | Precise Flight Speed Brakes, 24 Volt | **Yes |
| 4) | MS24694-S5 | 28 | Screws, Machine (Structural) | |


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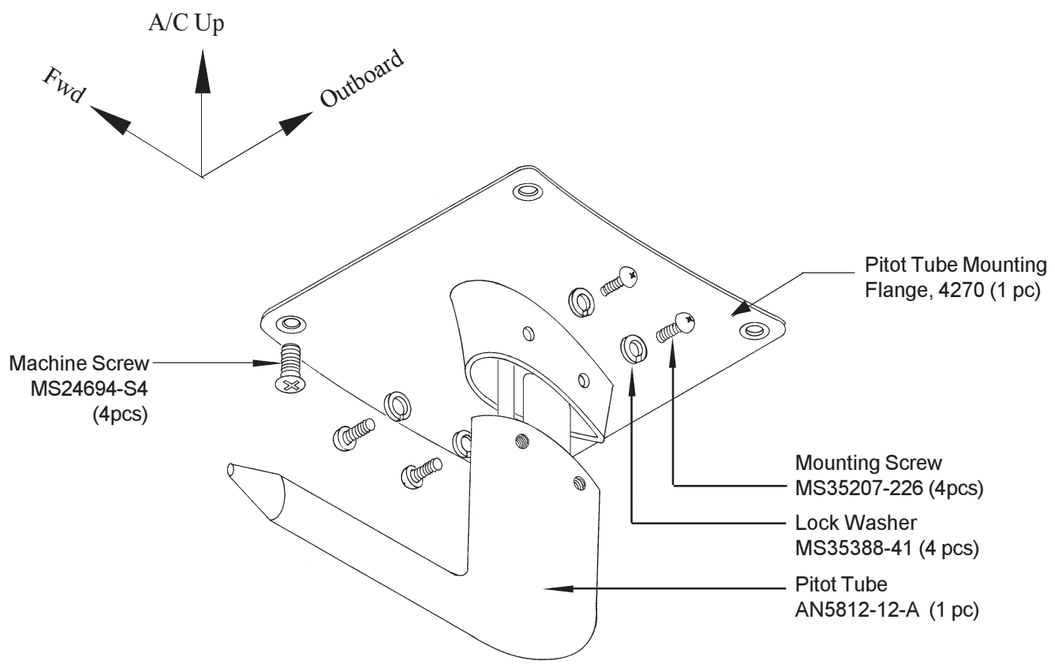
# 3. CONSTRUCTION PROCEDURES

## A. Pitot Tube (Optional)

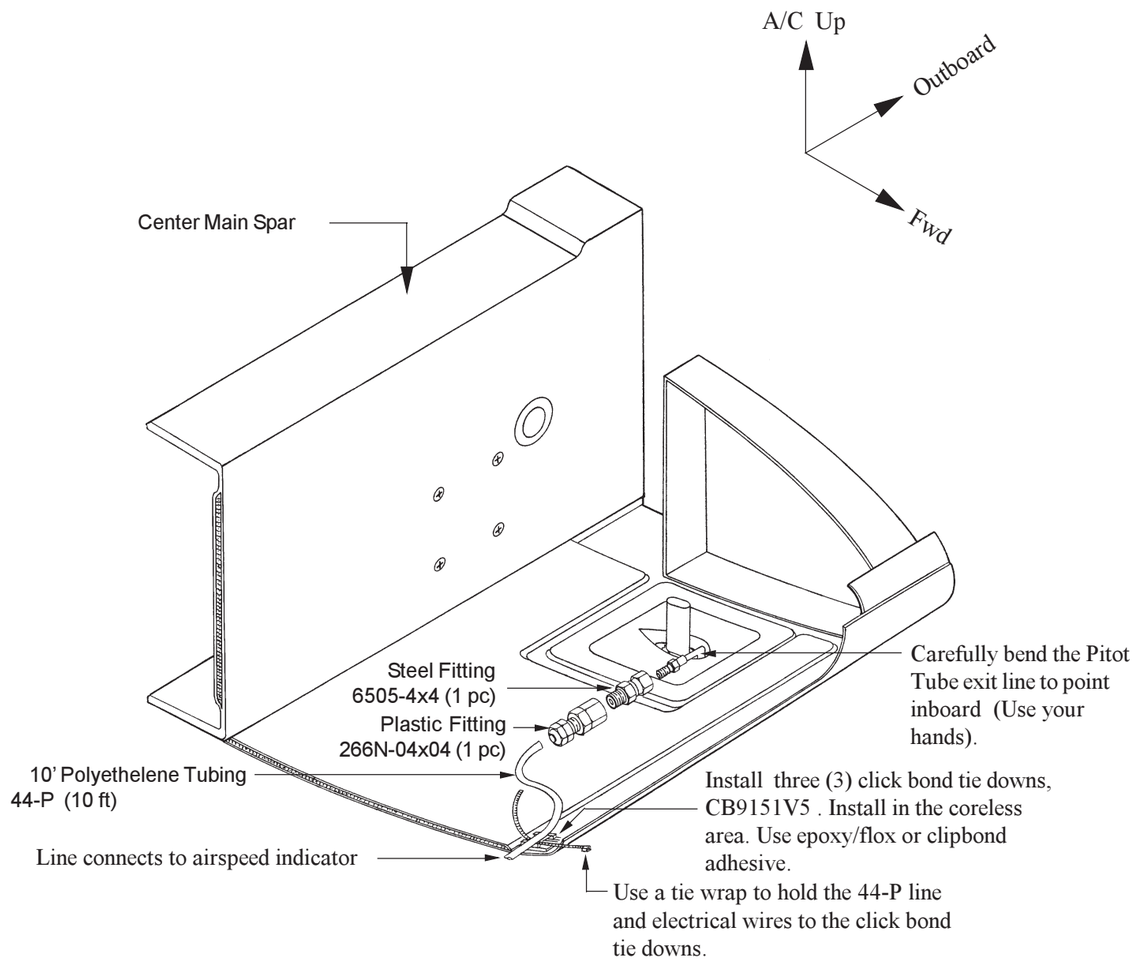
The pitot tube installs in the forward left access panel of the center wing section.

**A 1.** Install in left forward access panel as shown:

**Mounting Pitot Tube**
**Fig. 3:A:1**




**Pitot Tube Line & Wires Routing**
**Fig. 3:A:2**




**Note: Optional Parts available through Kit Components Inc.**



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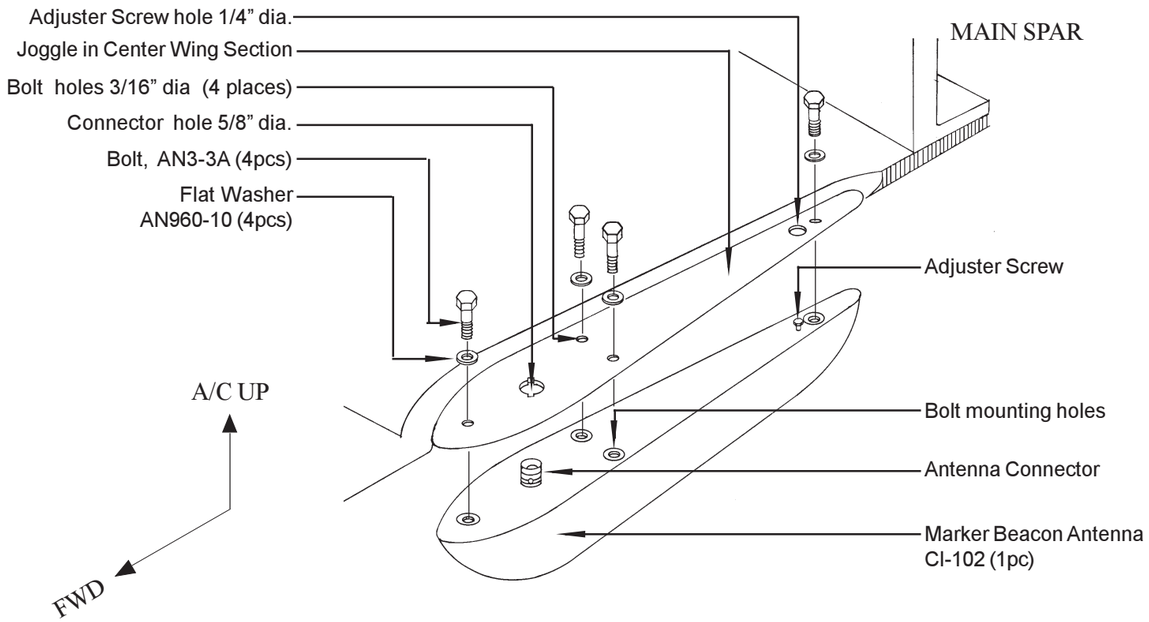
## B. Installing the Marker Beacon Antenna (Optional)

The marker beacon mounts in a joggle in the front center of the center wing section.

**B 1.** Drill holes to size as shown. Mount the marker beacon antenna with hardware as shown.

**Mounting the Marker Beacon**
**Fig. 3:B:1**




## C. Communications Antenna (Optional)

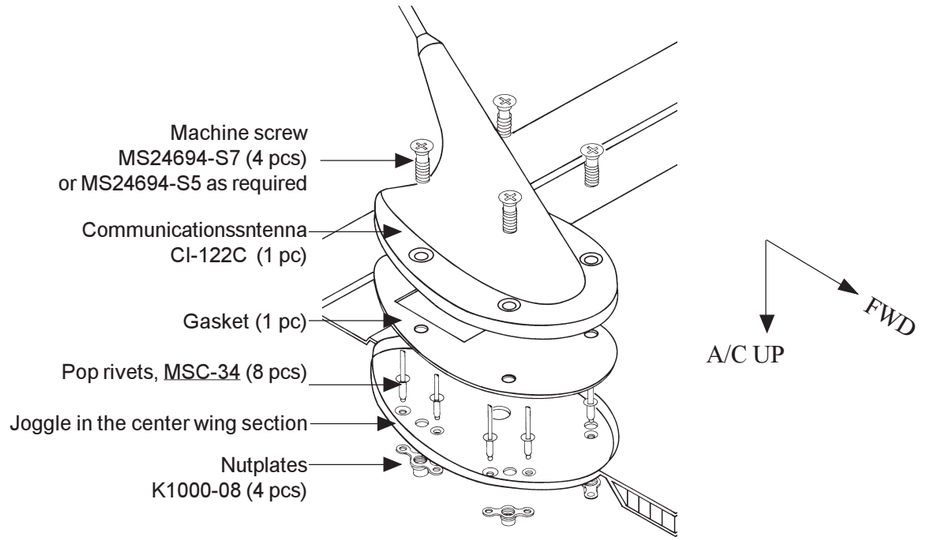
The communications antenna installs in a joggle in the aft center of the center wing section.

**C 1.** Drill the 5/8" hole for the antenna connector.

Using the antenna as a template, drill the four mounting holes using a # 20 drill.

Install the nutplates as shown using a # 40 Drill bit and a 100° countersink for the MSC-34 pop rivets.

**Mounting the Communications Antenna**
**Fig. 3:C:1**




**Note:**

**If you do not wish to install the marker beacon antenna (or the other antennas of the center wing section) apply three (3) BID to the joggled area and body work with micro.**

**Optional Parts (Antenna) available through Lancair Avionics.**



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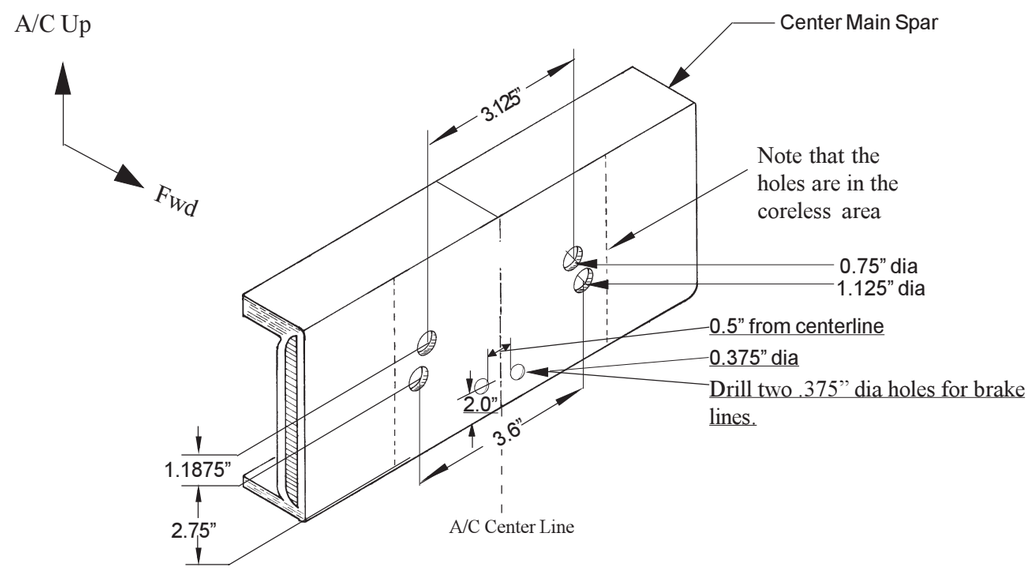
# D. Spar Closeout

**D 1.** Drill the holes for fuel supply (lower two holes) and Fuel return lines (upper) in the Center main spar as shown.

**D 2.** Drill two holes (center two holes) for the brake lines. These two holes should be 0.375" diameter. The placement is approximately 2" from the bottom and 0.5" from the centerline.

**Note: If you are using a Lycoming engine it is not necessary to install fuel return lines.**

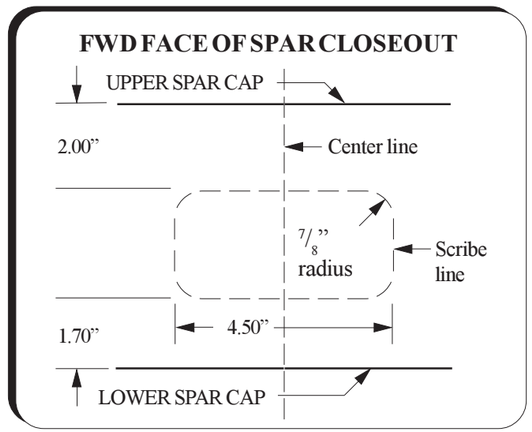
**Fuel Supply/ Return Holes through Center Main Spar**
**Fig. 3:D:1**

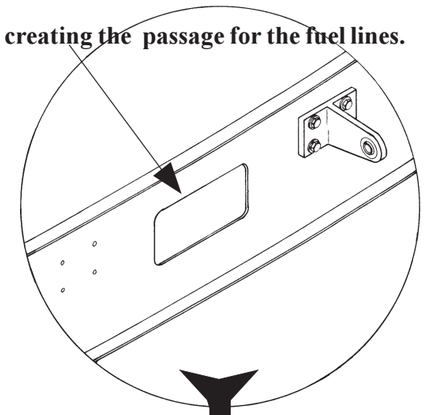



**D 3.** Trim the fuel line transition hole of spar closeout to the scribe line.

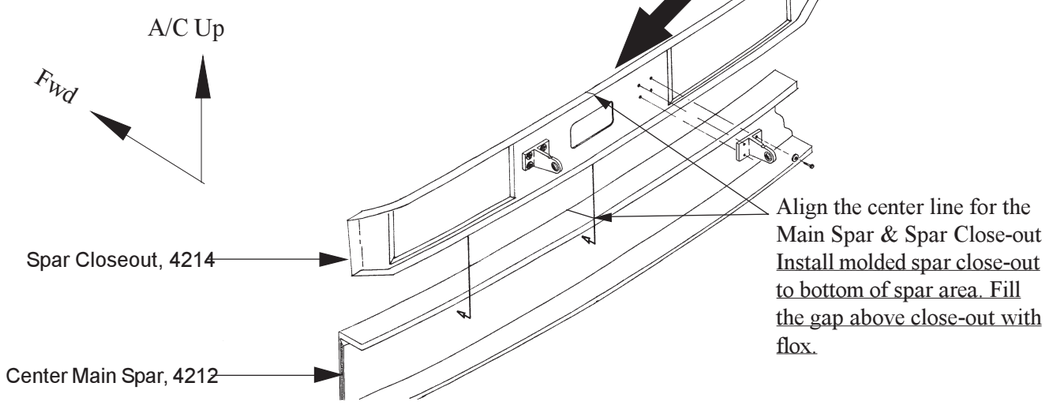
**Fuel Line Transition Hole Spar Closeout**
**Fig. 3:D:2**

**Prior to bonding in the center spar closeout we suggest creating the passage for the fuel lines.**



**Bonding the Spar Closeout to the Center Main Spar**
**Fig. 3:D:3**




**D 4.** Install spar closeout using epoxy & flox using proper bonding procedures. Center the spar closeout ± 1/8".



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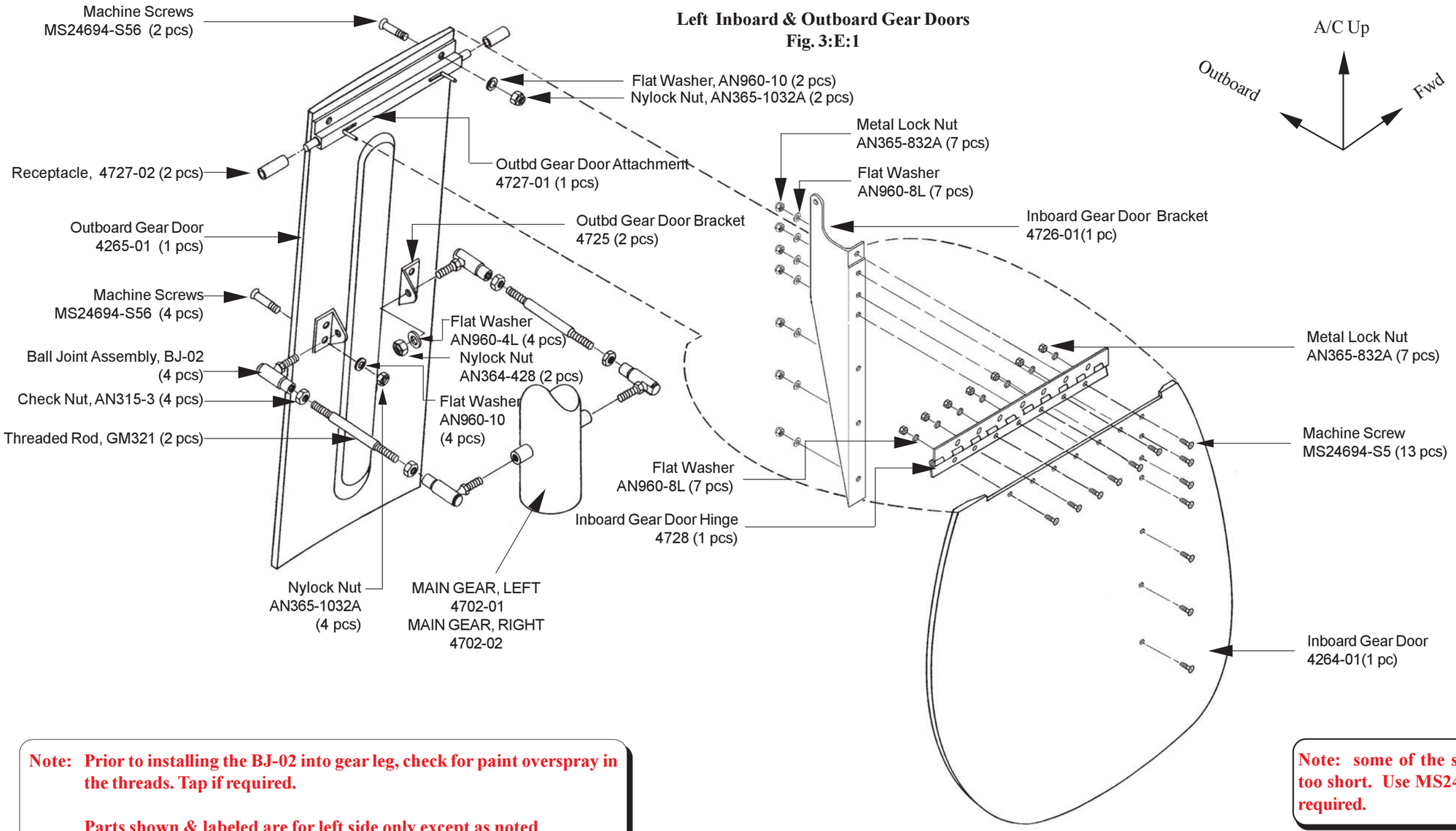
## E. Main Gear Doors

The main gear of the Legacy has two gear doors per side. The outboard gear door is mechanically actuated and the inboard gear door is actuated by a hydraulic cylinder.

**Left Inboard & Outboard Gear Doors**
**Fig. 3:E:1**




**Note: Prior to installing the BJ-02 into gear leg, check for paint overspray in the threads. Tap if required.**

**Parts shown & labeled are for left side only except as noted**

**Note: some of the screws may be too short. Use MS24694-S7 where required.**



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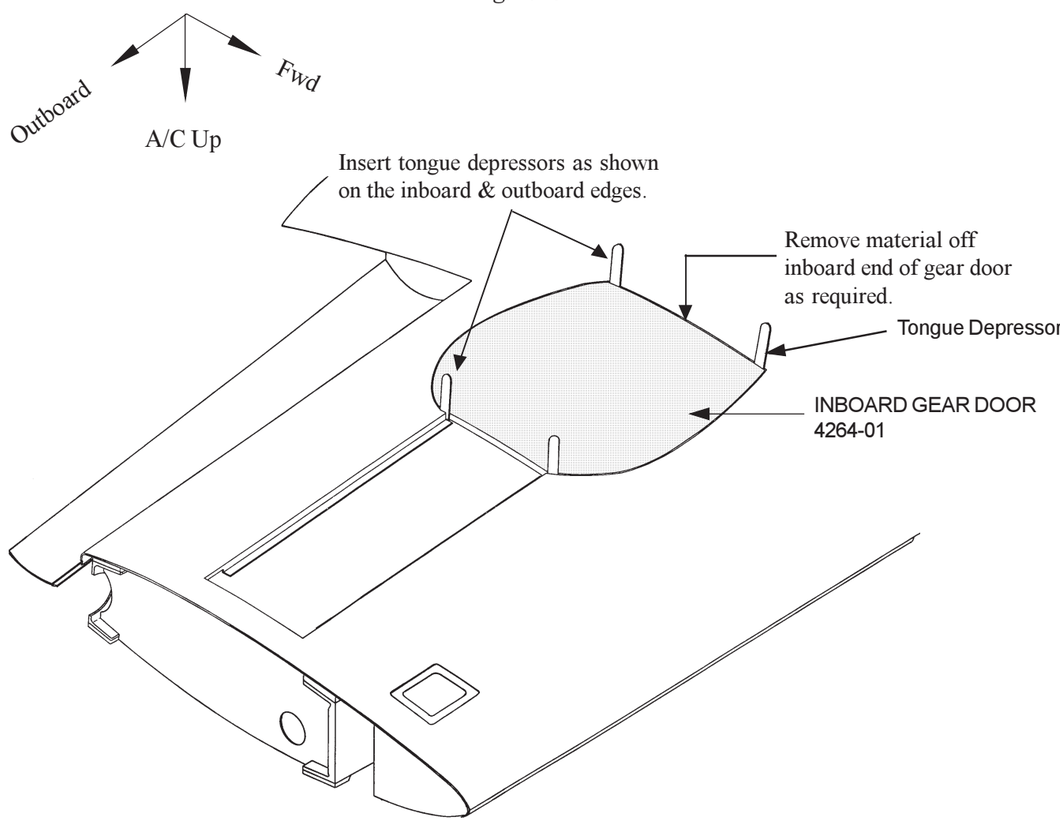
## Fitting the Gear Doors

**E 1.** Lightly sand all edges of the gear doors with a sanding block. Be careful not to sand through the structural plies.

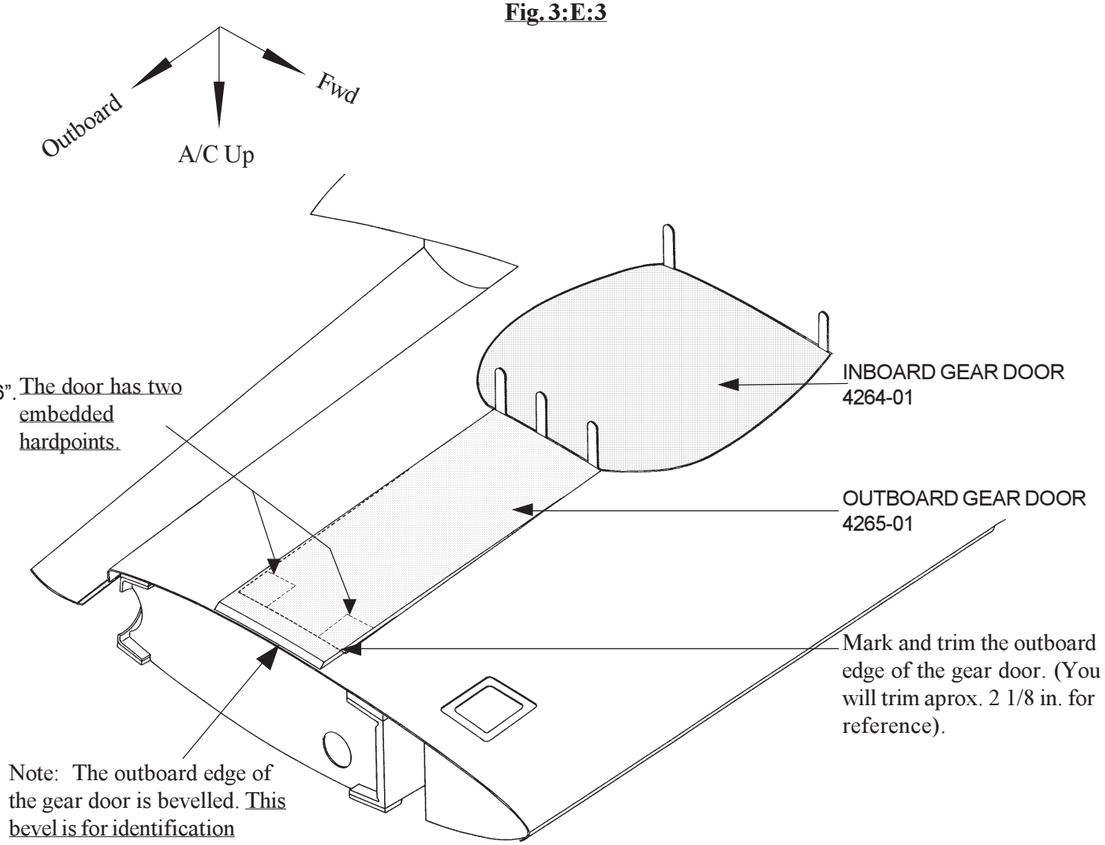
**E 2.** Fit the inboard gear door by removing material off the *inboard edge* of the door to give 0.06 in. clearance all around.

**Fitting Gear Doors**
**Fig. 3:E:2**




**E 3.** Fit the outboard gear door. With the inboard gear door still in place, drop the outboard gear door in place as shown. From the inside, mark the trim line. Note that the bevelled edge of the gear door is outboard.

**Trimming Outboard Gear Door**
**Fig. 3:E:3**





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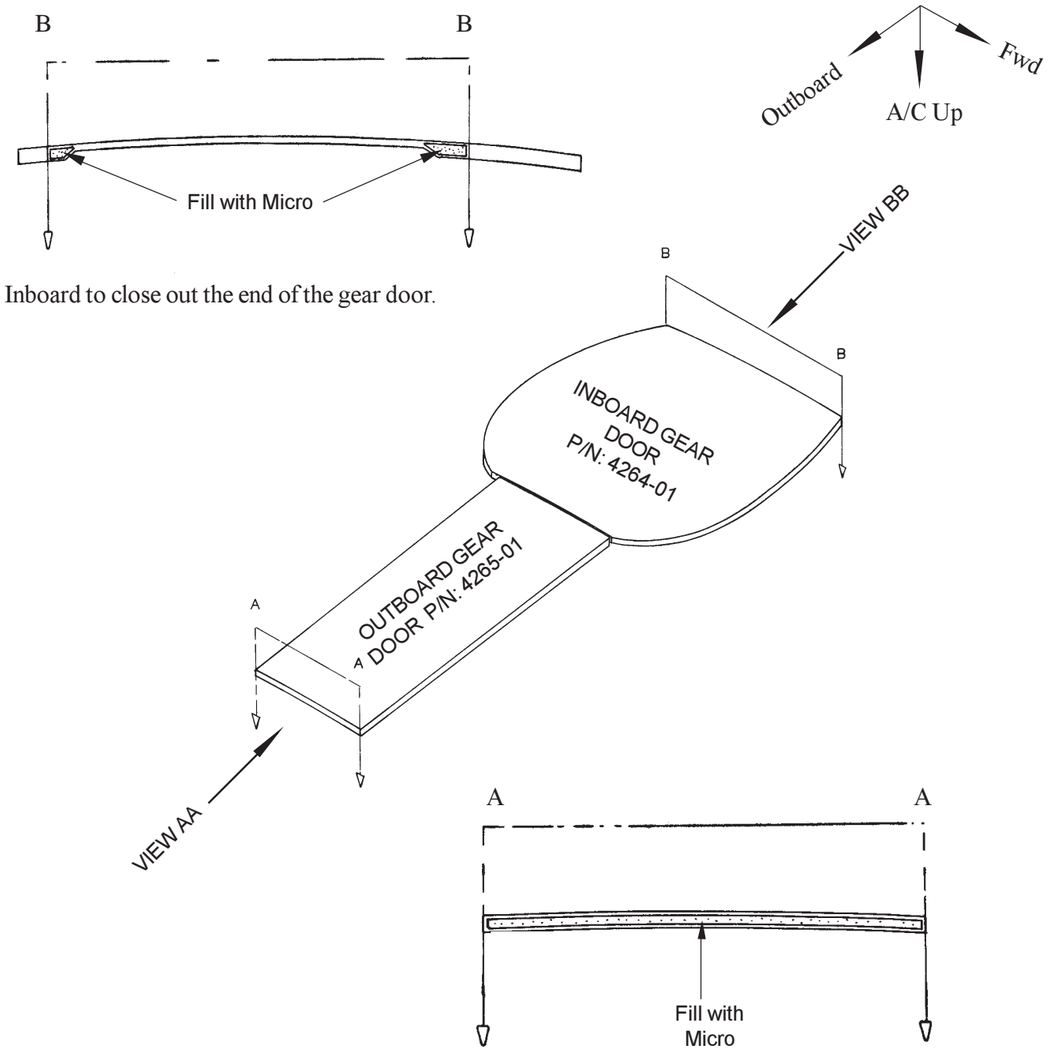
**E 4.** Remove 3/16 of the exposed foam core from the inboard end of inboard gear door and the outboard end of outboard gear door. We suggest using a dremel.
Fill with Epoxy/Micro mix.

**Micro Filling Gear Doors**
**Fig. 3:E:4**




Inboard to close out the end of the gear door.

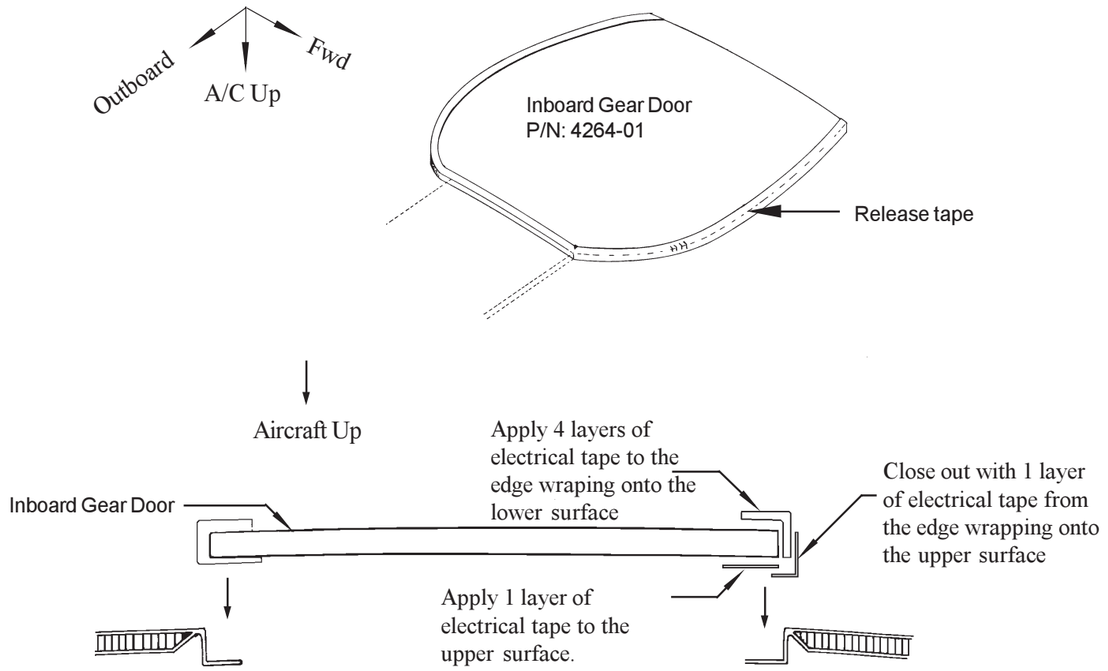
## Gear Doors - Release Tape (Optional)

To get a perfect fit of the gear doors some body work may be required. The end result we are looking for is an even gap around the gear doors and that the gear doors transition nicely to the lower wing skin. This section describes one method for body working the gear doors.

To get an even gear door gap we suggest using electrical tape (referred to as the release tape in this section) as a "spacer". The release applying epoxy/micro with the electrical tape in place will form an even gap between the gear doors and the lower wing skin. Because of the shape of the gear door the doors tend to back lock during the release. Some force is required to remove the gear doors following the release. The correct shape is sanded by hand using the beveled sanding block shown in this section.

Another method is to apply just one layer of a release tape and while the micro is curing, run a knife blade around the perimeter to create the even gap. Also some body work may be required to blend the gear doors to the lower wing skin.

**Inboard Gear Door**
**Release Preparation**
**Fig. 3:E:5**





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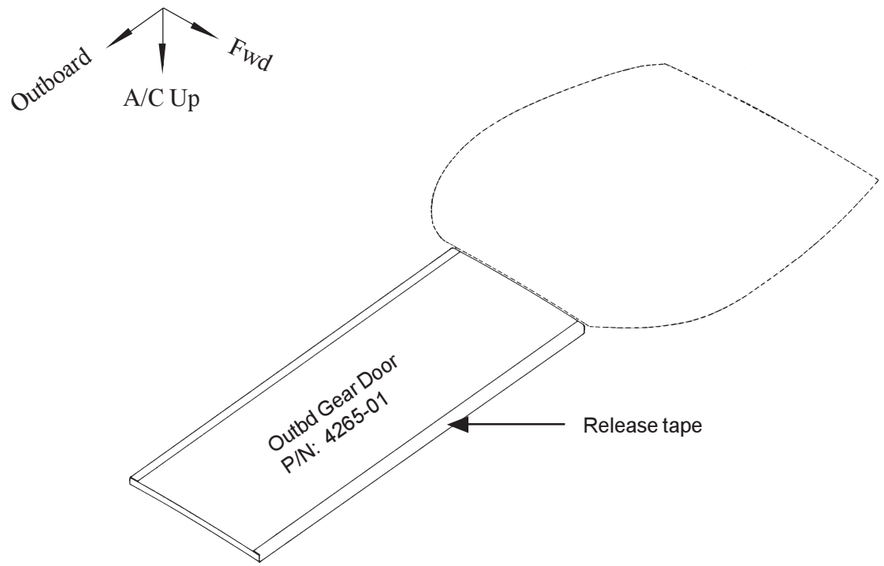
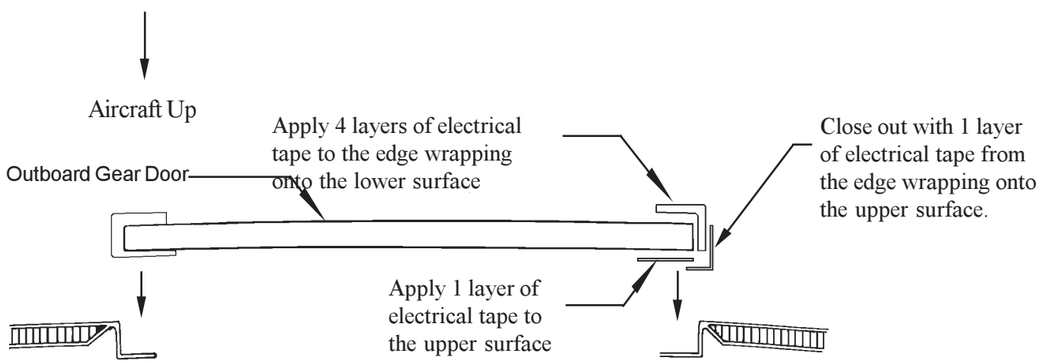
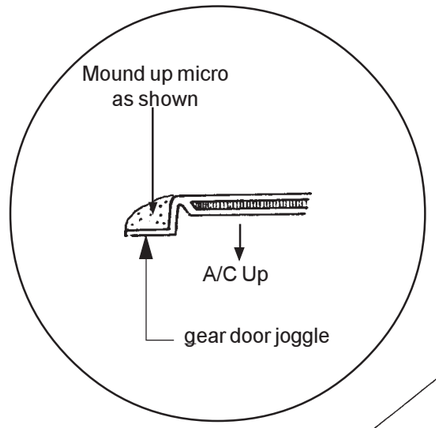
## Outboard Gear Door Release Preparation Fig. 3:E:6

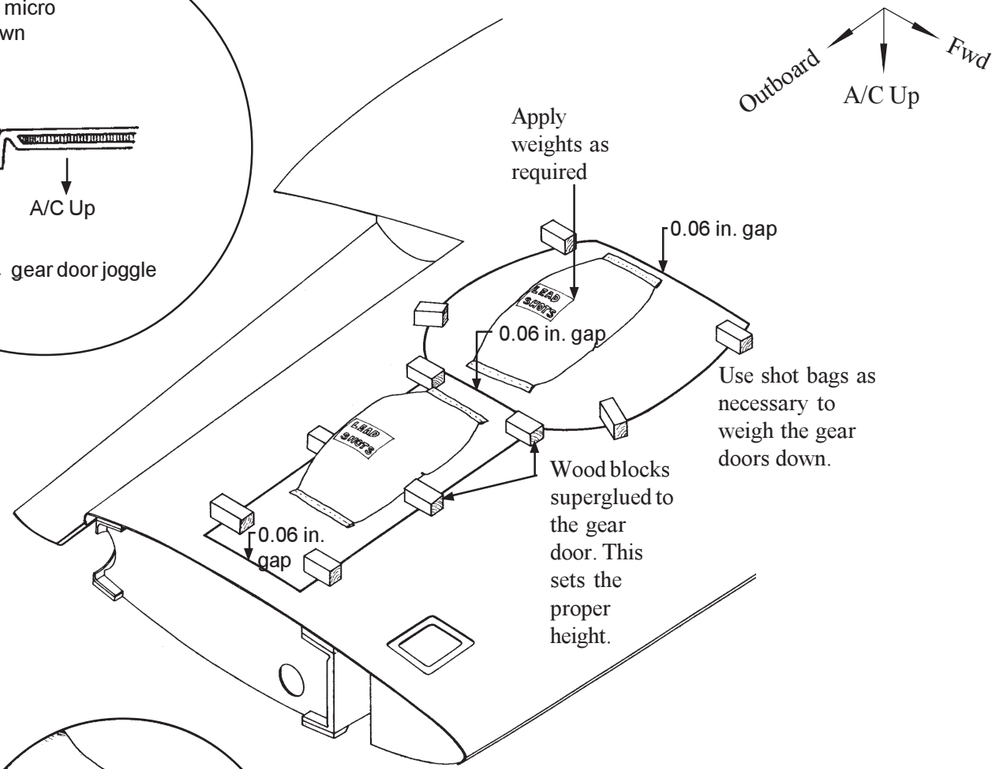
Outboard Gear Door

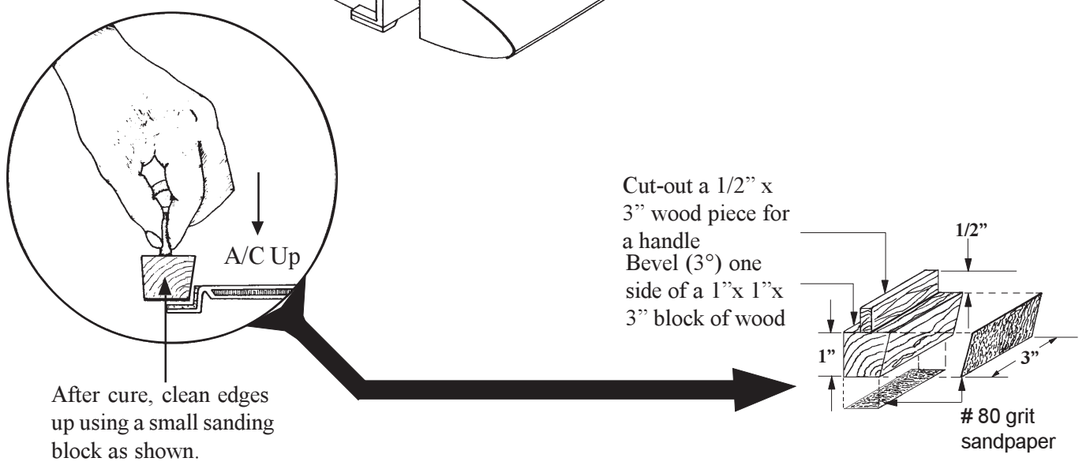



## Gear Door Release Fig. 3:E:7





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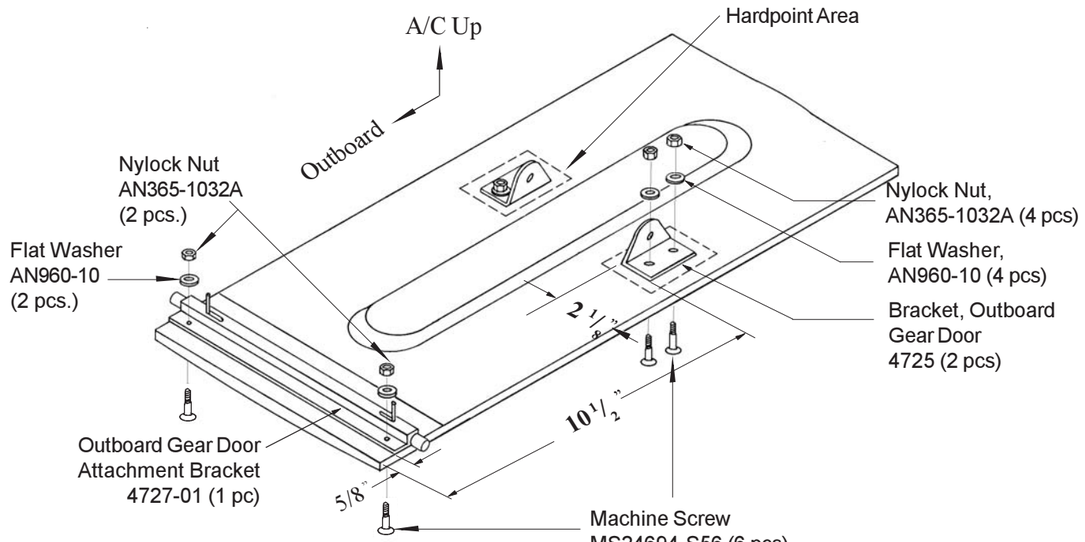
## Gear Doors - Outboard Hardware Mounting

**Outboard Gear Door Hardware Mounting**
**Fig. 3:E:8**




**E 5.** Install the outboard gear attachments as shown. Countersink the outside of the gear door for the screws.

**E 6.** Install the outboard gear door bracket. Countersink the outside of the gear door for the screws.

Note: For outboard gear doors that don't have the hard-points for the outboard gear door attachment bracket screws, it is necessary to install hard-points. Drill the holes as explained above and visually determine if the hard-points are installed. They are identified as follows:

No hard-point - There is foam between the holes.
Hard-point - There is solid e-glass in the holes.

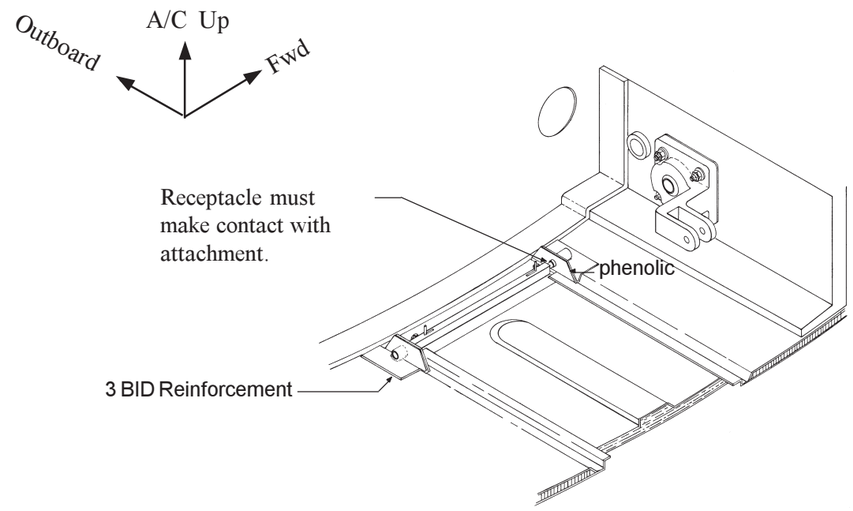
Hard-points are installed as follows:

(1) Mark screw locations on the inside of the gear door.
(2) Draw a 5/8" dia. circle centered on the screw locations.
(3) Remove the **INSIDE LAMINATE ONLY** of the circle you drew.
(4) Remove 1/4" of the core around the hole and fill it with flox.

## Gear Doors - Installing the Outboard Attachment Receptacles

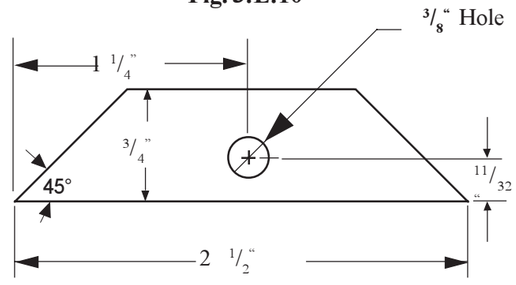
**E 7.** Align the outboard gear door in the joggle. Temporarily secure in place using wood blocks and instant glue.

**Gear Door Alignment**
**Fig. 3:E:9**




**E 8.** From a 1/8 in. piece of phenolic, cut out four (4) pieces as shown below.

**Receptacle Support**
**Fig. 3:E:10**





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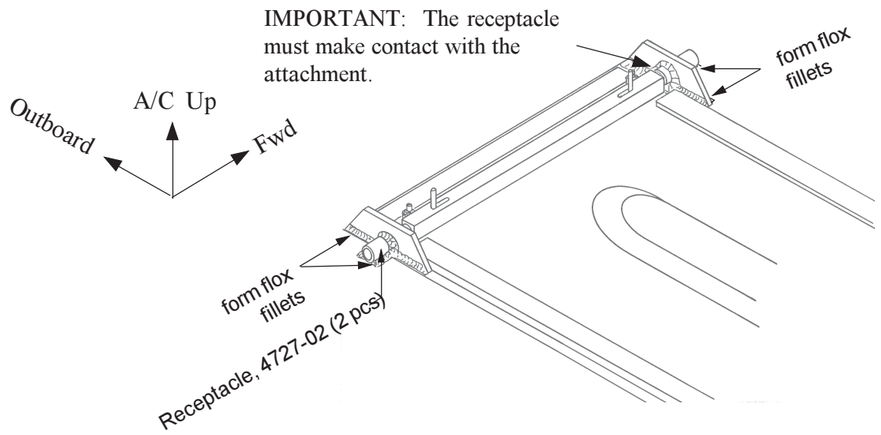
**E 9.** Prepare all bonding surfaces by sanding the inside of the stub wing, receptacle and phenolic.

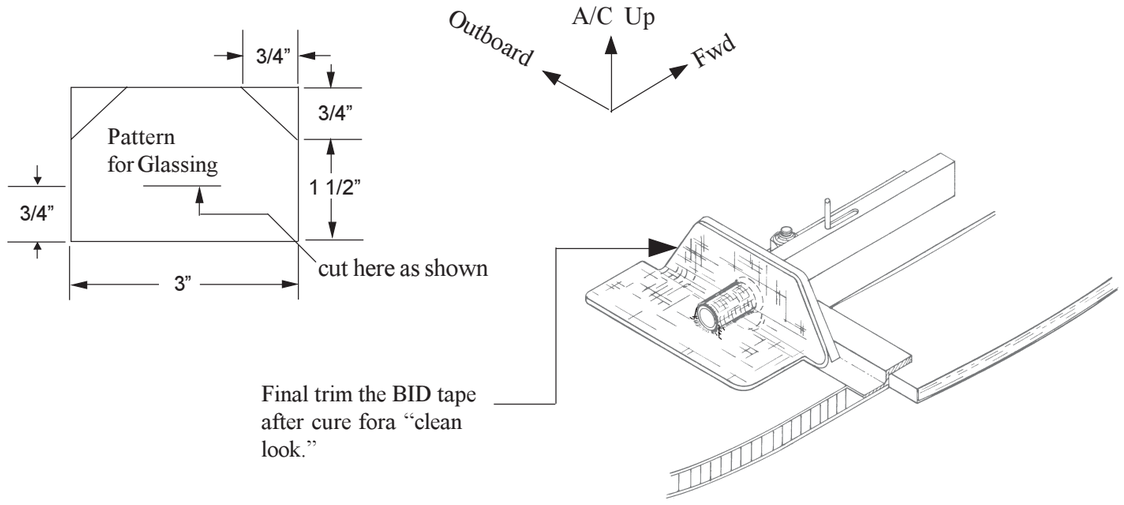
**E 10.** Install the receptacle and the phenolic with epoxy/flox.

**Receptacle Support Bonding**
**Fig. 3:E:11**




**E 11.** Secure with 3 BID using proper bonding procedures.

**Receptacle Support Reinforcement**
**Fig. 3:E:12**

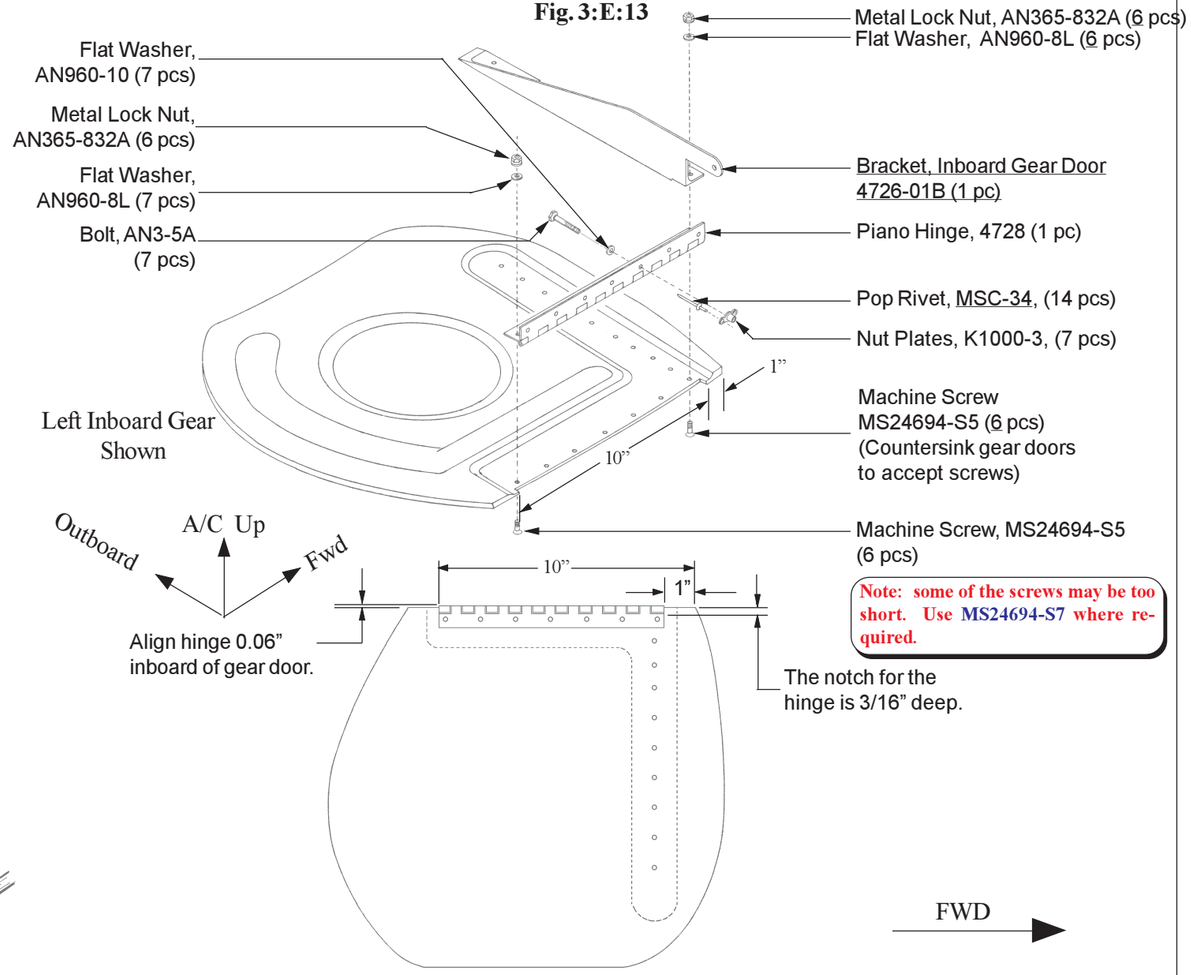



## Installing the Inboard Gear Door

To complete this section the aft loads pad must be installed. Refer to chapter 10 for the aft load pad installation. (The hinges for the inboard gear doors mount to the aft load pads).

Prior to mounting the hinges the inboard gear door must be final trimmed. The inboard edge of the gear door becomes the reference for installing the hinge. Note the 3/16" notch in the inboard edge of the gear door. The notch is to accept the hinge. The .05" sets the gap between the inboard gear door and the joggle. While these dimensions may seem confusing at first we suggest that you study the parts and try to understand the installation process before getting started.

**Inboard Gear Door Hardware Mounting**
**Fig. 3:E:13**




**E 12.** Install hardware in inboard gear door.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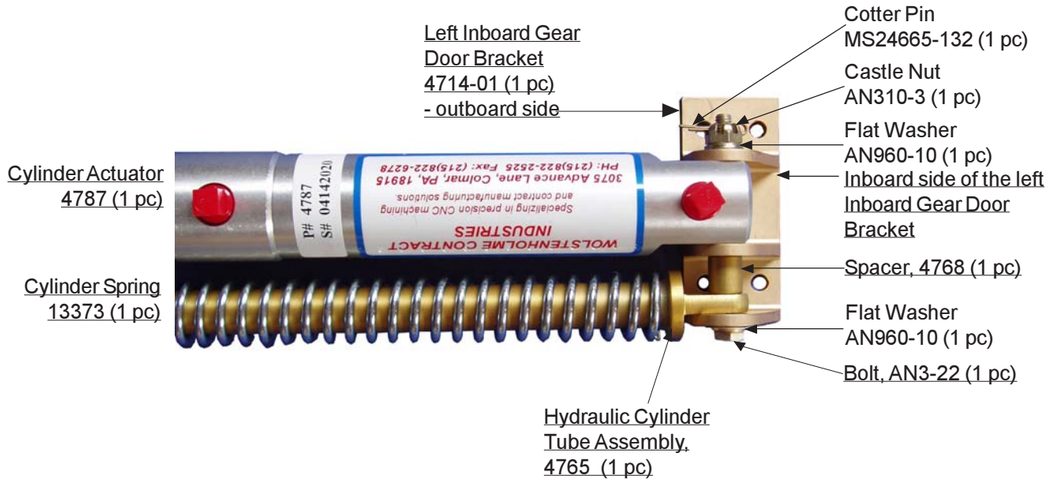
**E 13.** Identify the left indoor gear bracket (4714-01) using the figure below. The outboard edge of the bracket is a 90 deg. side, meaning the face of the bracket and the three bracket arms make a 90 deg. angle on the outboard side. Position the bracket with the two outboard holes over the the two existing holes in the fuselage that are approx. 10" from the cockpit closeout rib. Hold the bracket over the holes and mark the two inboard holes. Drill the inboard holes.

**E 14.** Slide a flat washer, AN960-10, onto bolt AN3-22 then through the inboard gear door bracket, 4714-01, attaching the following in this order: cylinder actuator (4787), spacer (4768), hydraulic cylinder tube assembly (4765), and finish with another flat washer (AN960-10), a castle nut (AN310-3) and secure with cotter pin MS24665-132.

**Inboard Gear Door Hydraulic Cylinder Mounting (part 1)**
**Fig. 3:E:14**




**E 15.** Attach the Left Inboard Gear Door Bracket (4714-02) by aligning its holes with the outboard holes. Countersink the holes in the center wing section for the four screws and install using machine screws, MS24694-S54, with washers, AN960-10L, and nuts AN365-1032A.

**E 16.** Slide the cylinder spring (13373) onto the hydraulic cylinder tube assembly.

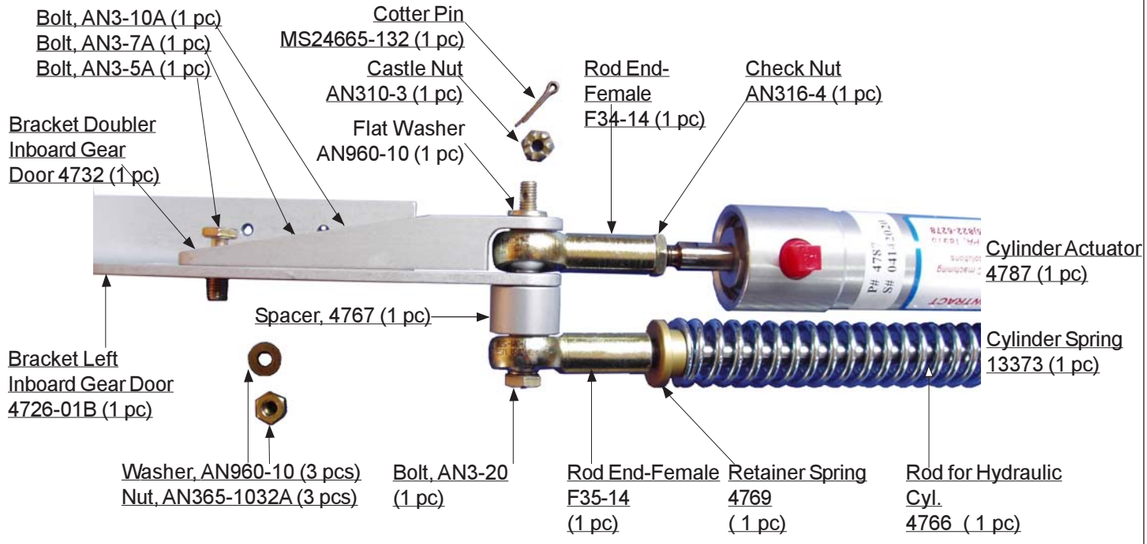
**E 17.** Slide a retainer (4769) onto the tube assembly (4765). Then install and tighten a female rod end (F35-14) onto the assembly.

**E 18.** Iinstall and tighten check nut (AN316-4) followed by a female rod end (F34-14) onto the cylinder actuator.

**E 19.** Now assemble the parts for the other end of the cylinder actuator by sliding an AN3-20 bolt through the bracketdoubler (4732) and the remaining parts in the following order: rod end of the cylinder actuator, through the bracket (4726-01B), spacer (4767) rod end on the retainer spring, a flat washer (AN960-10), a castle nut (AN310-3) and secure with cotter pin MS24665-132.

**E 20.** Finish bolting the two brackets together, 4732 to 4726-01B, using one each of bolts AN3-5A, AN3-7A and AN3-9A and three each of washers AN960-10 and nuts AN365-1032A.

**Inboard Gear Door Hydraulic Cylinder Mounting (part 2)**
**Fig. 3:E:15**




See the previous page for locating and bolting the inboard gear door bracket to the inboard gear door.

**Note: The hydraulic cylinder operation is covered in chapter 16.**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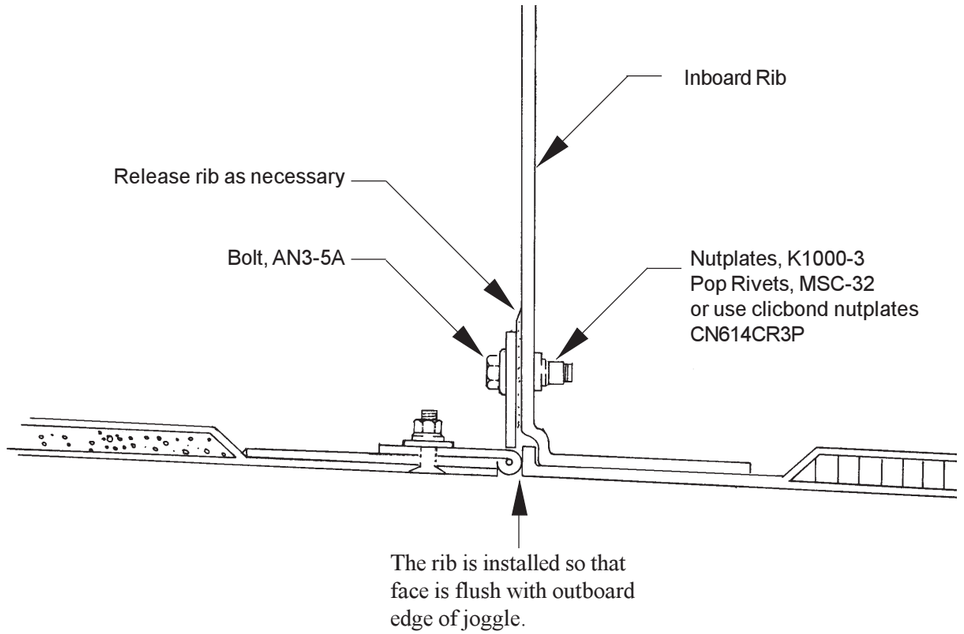
**Inboard Gear Door Hinge Mounting to Inboard Rib**
**Fig. 3:E:16**

**Note: This step must be completed after the rib is aligned. Refer to Chapter 10, Figure 10:B:2.**

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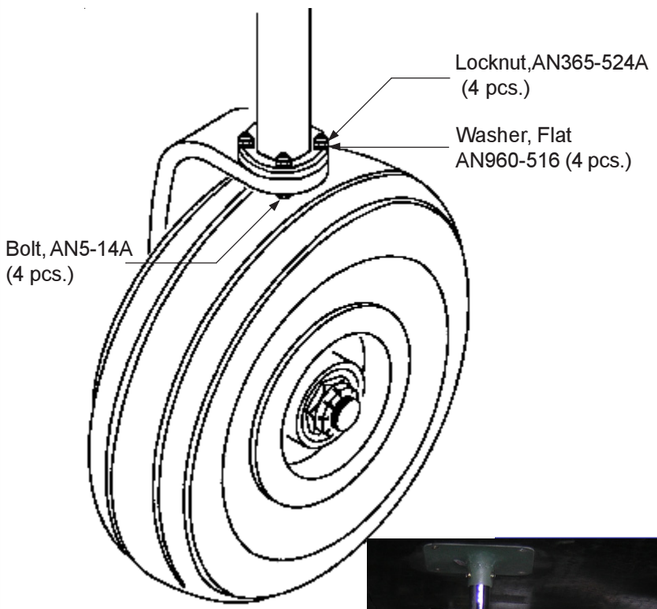
# F. Main Gear Installation

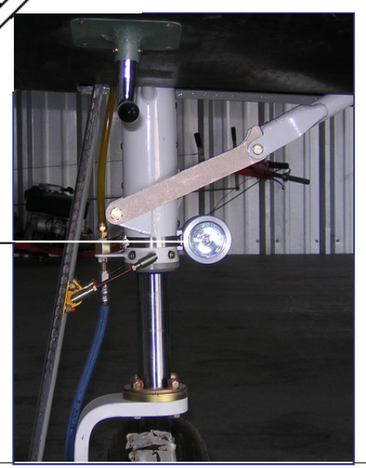
The Legacy landing gear is oleo pneumatic. The landing gear is pre-aligned at the factory however the angle of the gear leg itself must beset as shown later in this section. The first 50 Legacy kits were supplied with a style 1 landing gear and from then on a style 2 landing gear. To identify, style 1 is a one piece type fork as shown and style II has a collar that bolts to the fork as shown on the left. If you have a style 1 type of fork you must comply with service bulletin SB058.

**F 1.** Assemble the main gear legs as shown.

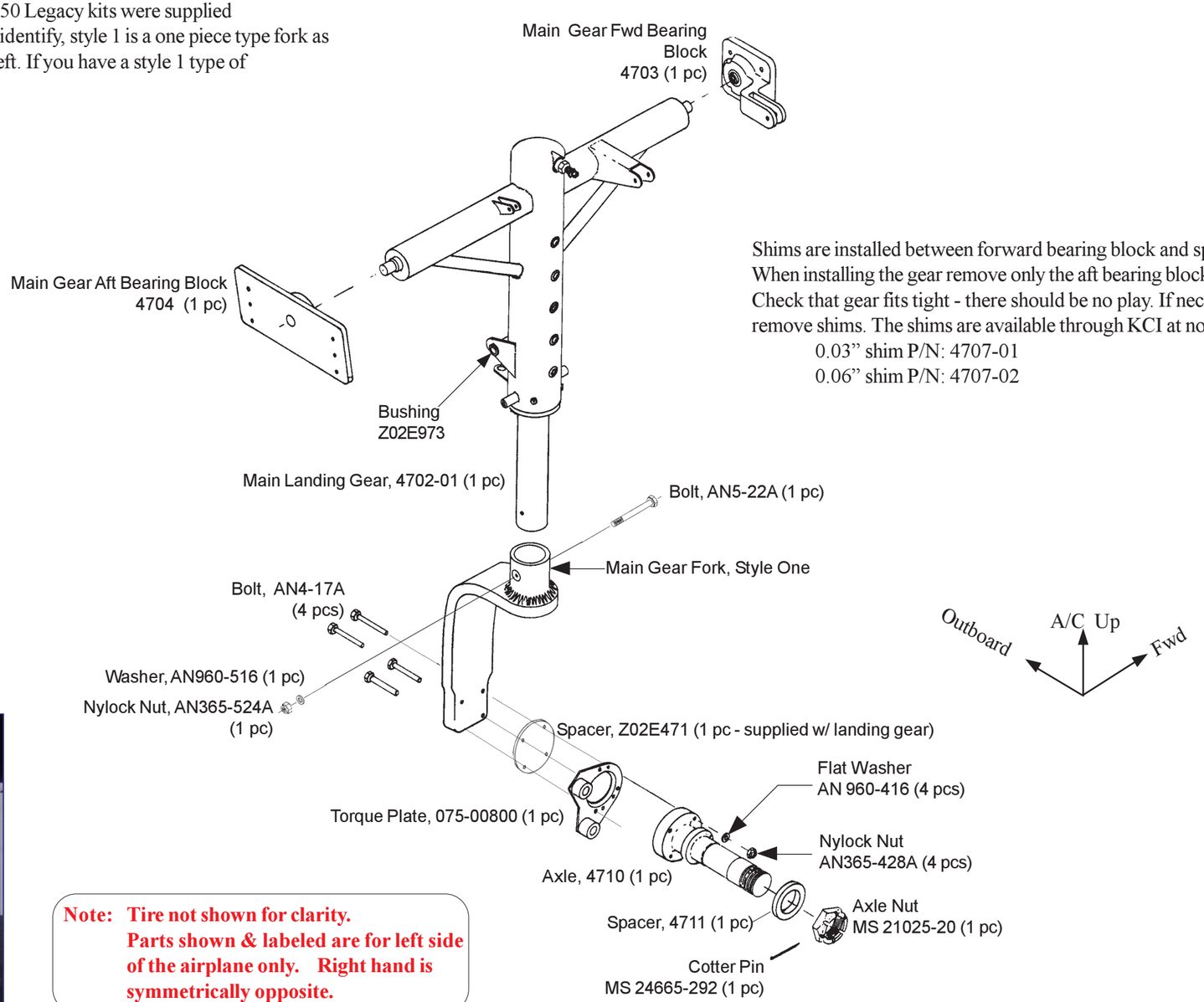
**Main Landing Gear Style II**
**Fig. 3:F:1:b**




Optional Landing Lights
12 volt 800-0001
24 volt 800-0002
(Sold by the pair)



**Main Landing Gear (Exploded View)**
**Fig. 3:F:1**




Shims are installed between forward bearing block and spar at the factory. When installing the gear remove only the aft bearing block.
Check that gear fits tight - there should be no play. If necessary add or remove shims. The shims are available through KCI at no charge.

0.03" shim P/N: 4707-01
0.06" shim P/N: 4707-02

**Note: Tire not shown for clarity. Parts shown & labeled are for left side of the airplane only. Right hand is symmetrically opposite.**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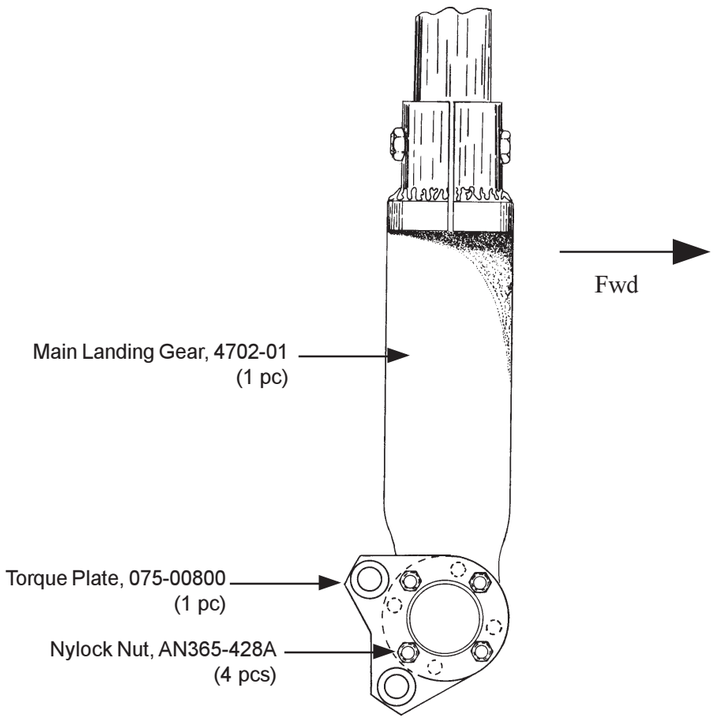
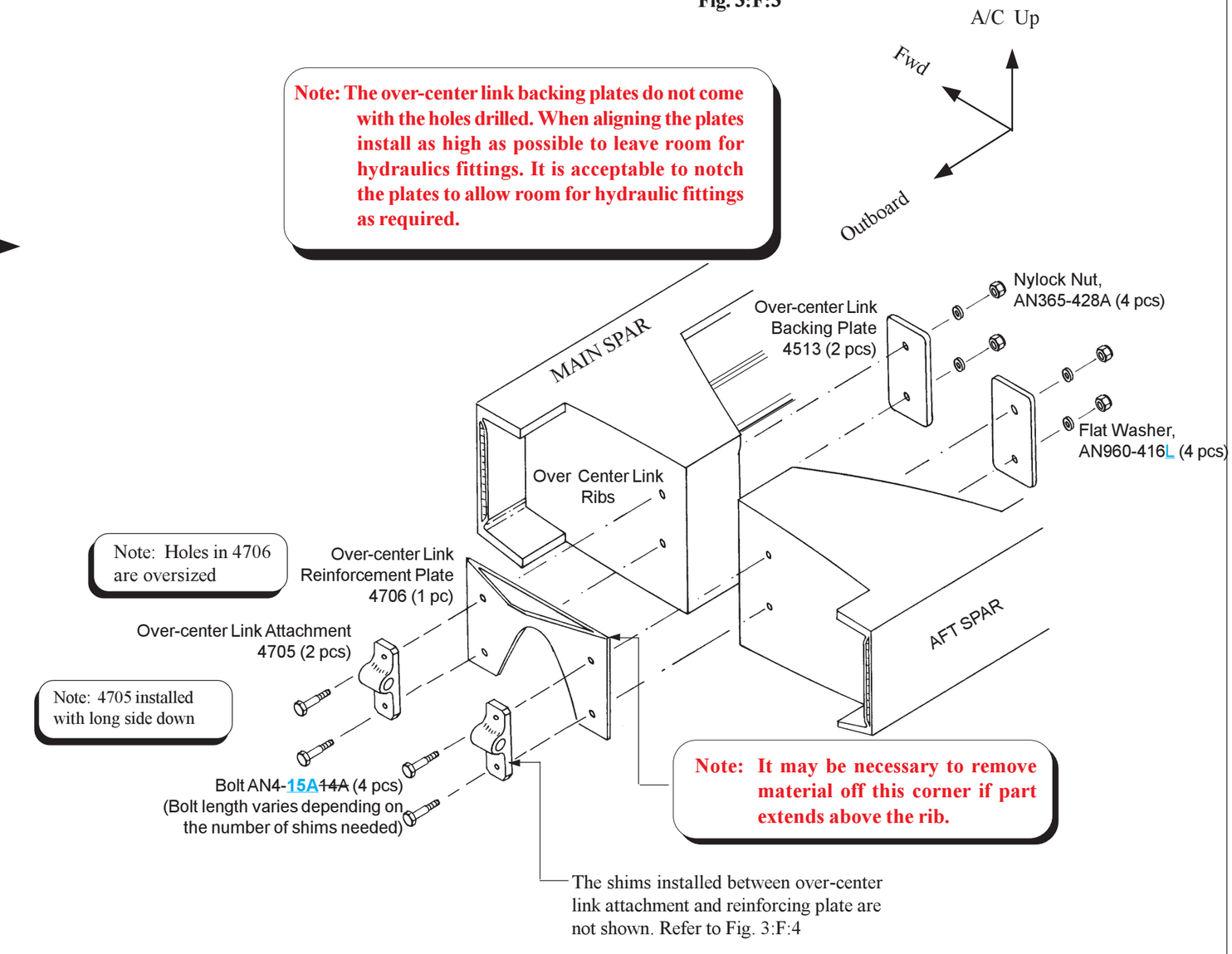
**Torque Plate Positioning**
**Fig. 3:F:2**




**F 2.** Install the hardware at the center link rib as shown.

**Over Center Link Support Assembly**
**Fig. 3:F:3**

**Note: The over-center link backing plates do not come with the holes drilled. When aligning the plates install as high as possible to leave room for hydraulics fittings. It is acceptable to notch the plates to allow room for hydraulic fittings as required.**




**Note:**
**Parts shown & labeled are for one side of the airplane only.**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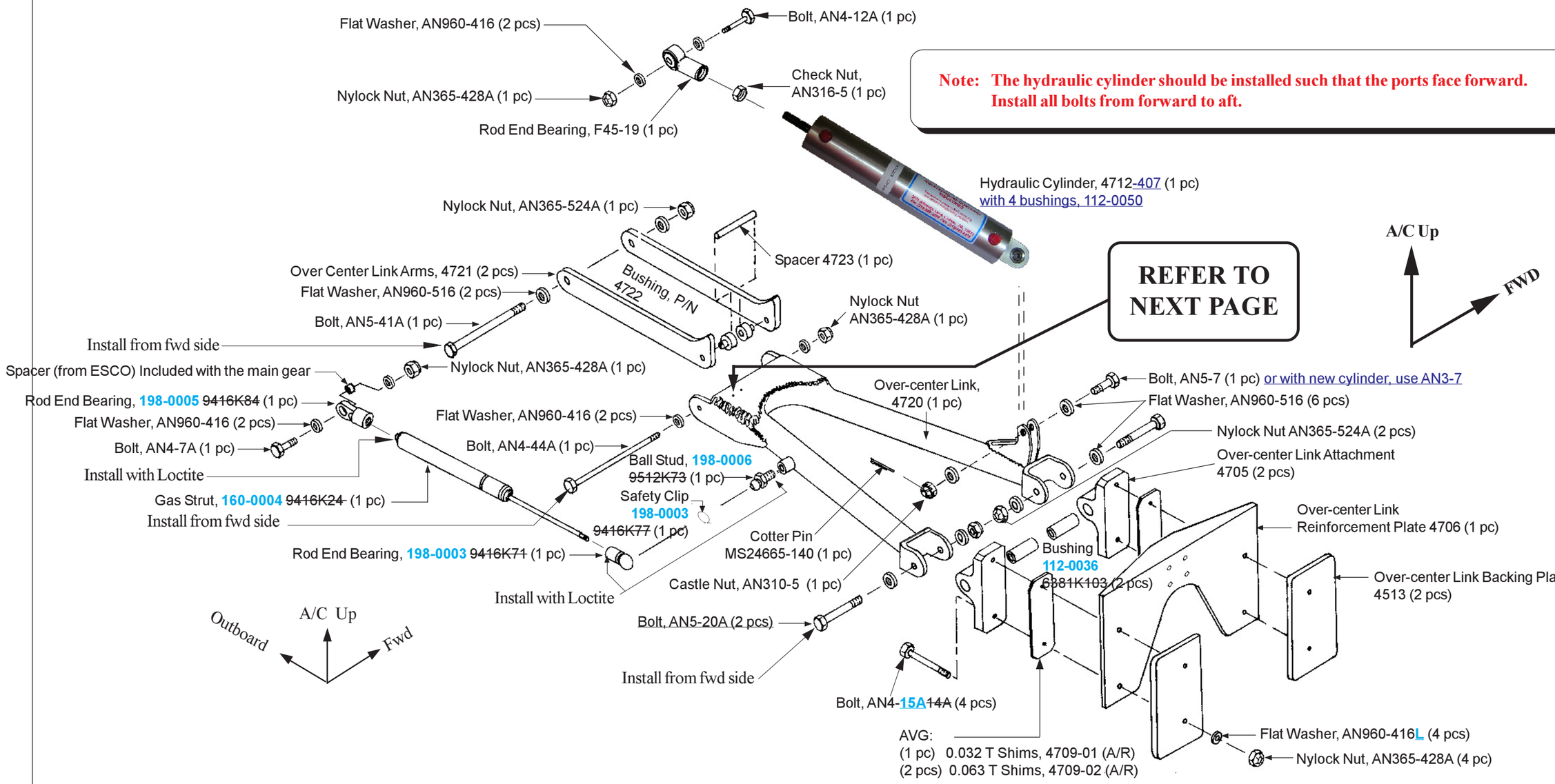
## Over Center Link Assembly
## Fig. 3:F:4




**Note: The hydraulic cylinder should be installed such that the ports face forward. Install all bolts from forward to aft.**

**REFER TO NEXT PAGE**

**Note Install the ball stud, part number 198-0006 ~~9512K73~~ with Loctite 242.**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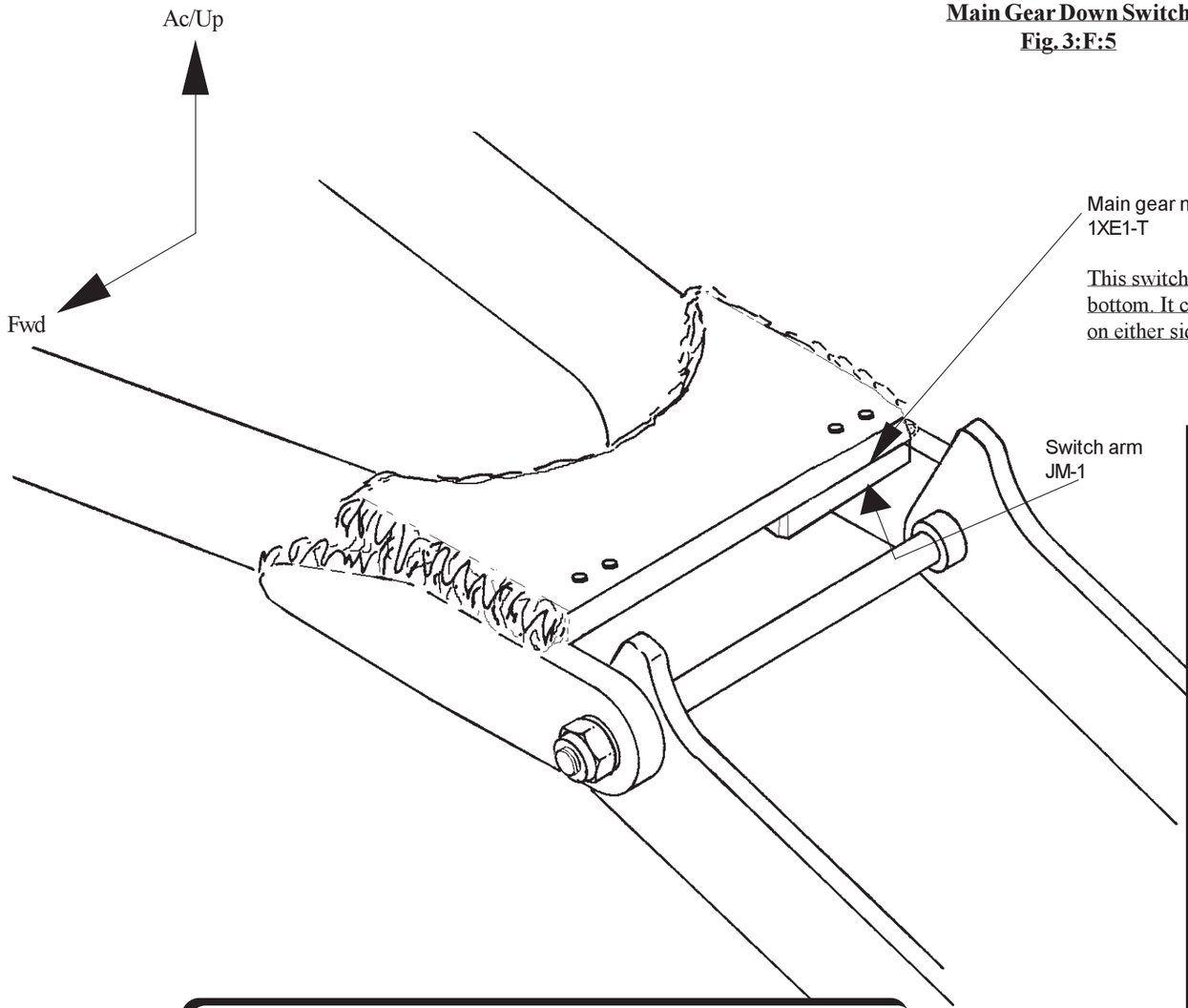
**Main Gear Down Switch**
**Fig. 3:F:5**




Micro switch and switch arm are secured to the 4720 over center linkage with screws provided in the JM-1 packet.


This photograph is taken from beneath the main gear, looking up at the switch.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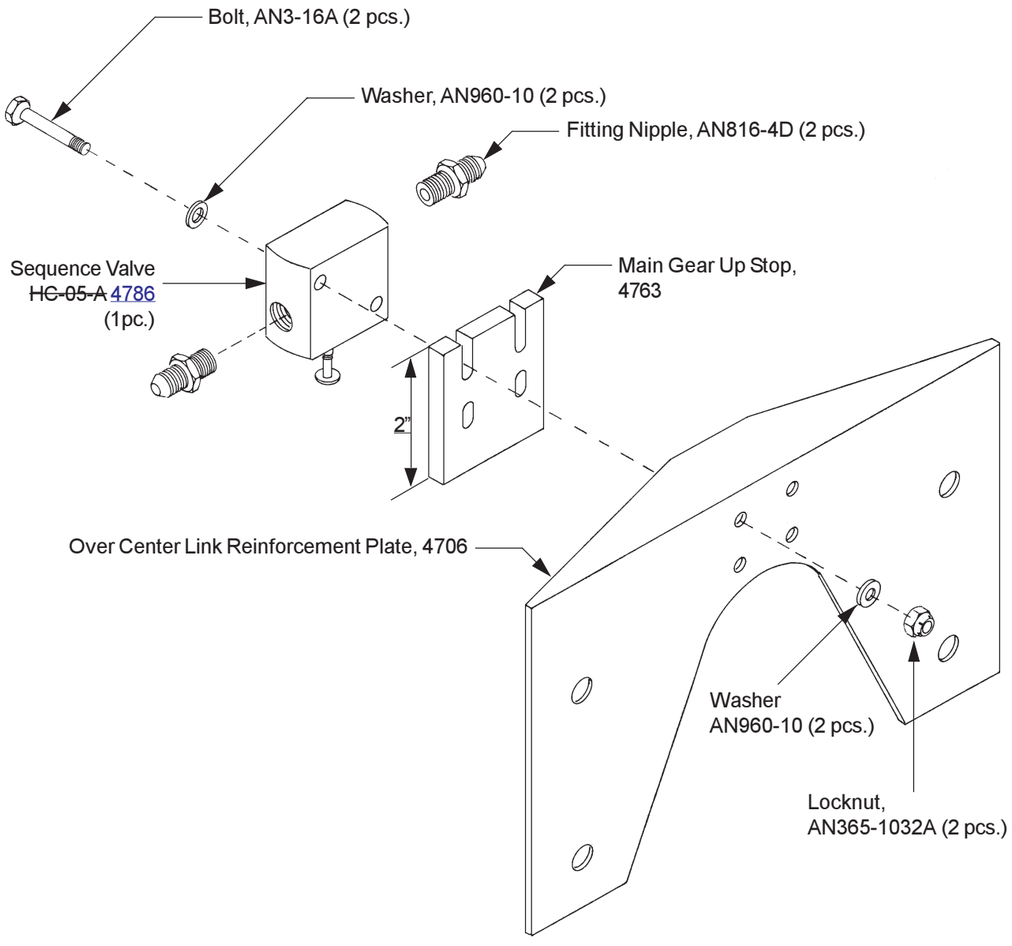
**Sequence Valve/Gear Up Stop**
**Fig. 3:F:7**




**Final adjustment of up stop is explained in chapter 16.**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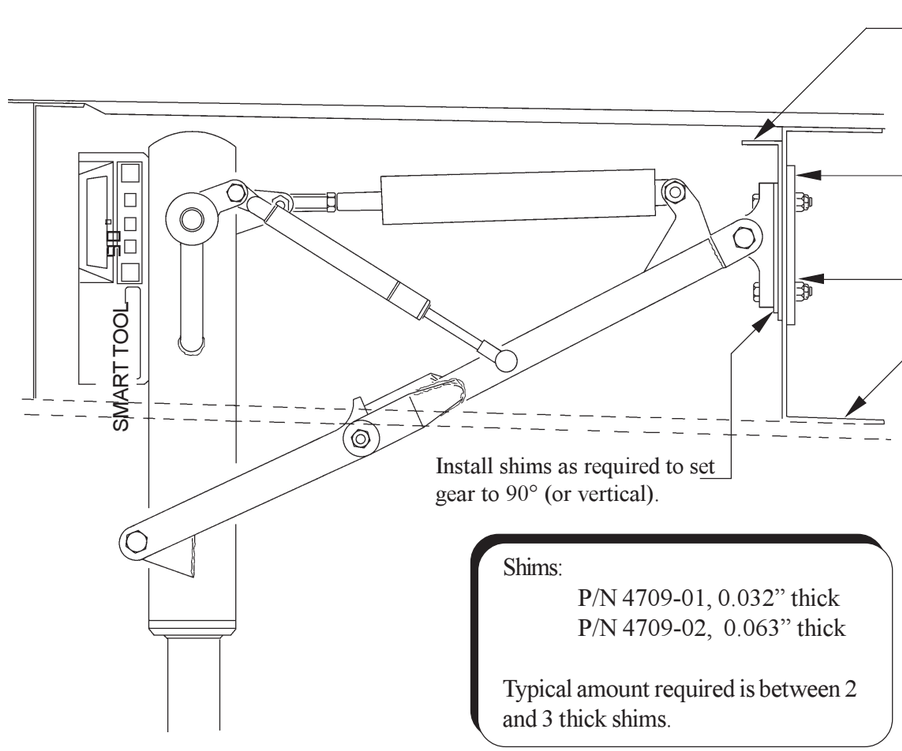
**Over Center Link Reinforcing Plate Shim Installation**
**Looking Forward**
**Fig. 3:F:8**




**Notes:**

**The aircraft must be level for this step. If the center wing section is bonded refer to Figure 10:A:5. If not, level the center wing section tip to tip.**

**The number of shims are not necessarily the same on the front and the back (but should be very close). With the complete mechanism assembled visually inspect the Z02E973 bushing in the gear leg (Fig. 3:F:1) The bushing should be close to centered. Excessive friction (from binding) may be caused by such a misalignment.**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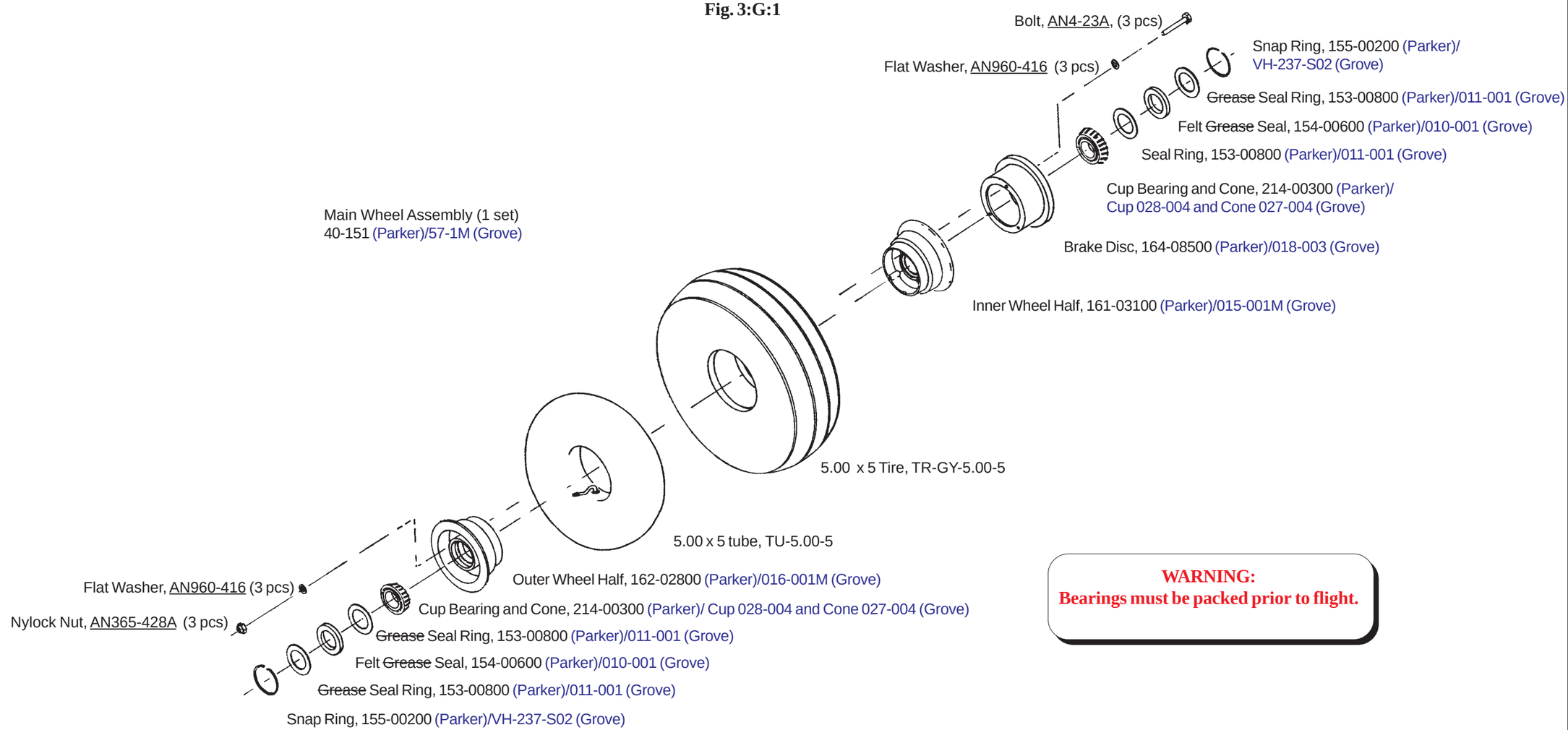
## G. Main Gear Wheels and Tires

The main gear of the Legacy uses 5.00 x 5 wheels & tires. ~~Cleveland wheels and brakes are standard in the kit.~~ Installation of the brakes are in Chapter 18.

**Main Gear Wheels & Tires**
**(Exploded View)**
**Fig. 3:G:1**




**WARNING:**
**Bearings must be packed prior to flight.**

**Note:**
**Parts shown & labeled are for one side of the airplane only.**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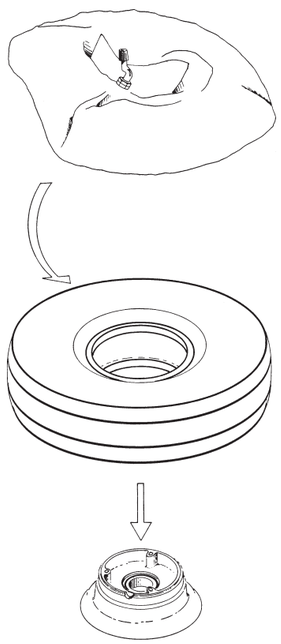
**G 1.** Insert the 5.00 x 5 tube into the tire. Then inflate the tube with a very small amount of air (just enough to unfold it). This will make the assembly easier and prevent kinks.

**Wheel Assembly**
**Fig. 3:G:2**



Tube, TU-5.00 x 5

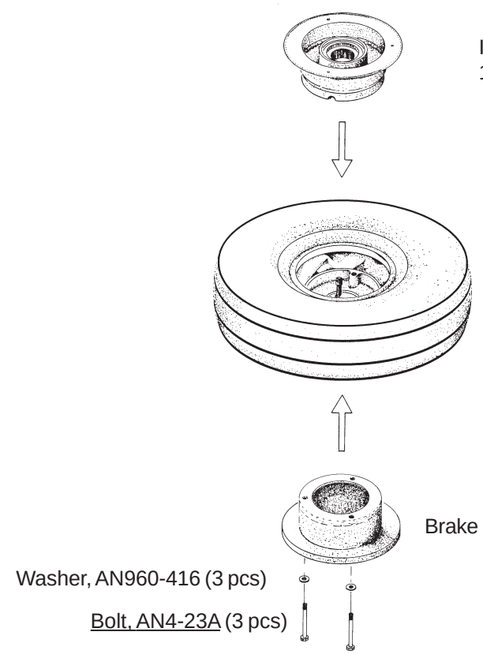
Tire, TR-GY-5.00 x 5

Outboard Rim (the half without the valve stem)
162-02800 (Parker)/016-001M (Grove)

**G 2.** Place the tire and tube into the rim you have set on your bench. Push the tire down onto the rim, always avoid pinching the tube. You'll not be able to push the tire all the way onto the rim, the tire will be fully seated with air pressure.

**G 3.** Place the other half of the rim onto the tire, aligning the valve stem hole & the three (3) bolt holes. Pull the valve stem through the rim as you work the rim down. Here is where most people damage the tube. If you're not careful when pushing the rims together, you can easily pinch the tube or stem between the rims. Instant leak! This problem can be avoided by just being careful & aware of the danger.

**Wheel Assembly**
**Fig. 3:G:3**



Inboard Rim (with hole for stem)
161-03100 (Parker)/015-001M (Grove)

Tire, tube & outer rim half

Brake Disc, 164-08500 (Parker)/018-003 (Grove)

Washer, AN960-416 (3 pcs)

Bolt, AN4-23A (3 pcs)

**G 4.** Before the two halves of a Cleveland rim can be secured together, the brake disc assembly must be placed onto the inboard face of the wheel (the side opposite the valve stem). The two rim halves & the brake disc are secured together with the manufacturer supplied bolts and nuts.

**G 5.** Inflate the Goodyear tires 45 to 50 psi. It is a good idea to do this a few times before full inflation. This will help loosen any folds in the tube.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**G 6.** Grease the two wheel bearings with quality grease, making sure the grease penetrates the entire bearing.

**G 7.** Place the bearings into the races of the wheel. On the Cleveland wheel, after the bearings are placed into the race, a seal consisting of two thin steel washers and a felt washer is secured with a retainer ring. The seals and the rings retain the bearings in the wheel.

**G 8.** Now the wheels are ready to be mounted on the axles. Carefully slide the wheel onto the axle until the inboard bearing has been seated. Secure the wheel with an MS21025-20 axle nut. Tighten the nut until there is no slop in the wheel bearings. The axle nut should be tightened so when you spin the wheel it rotates approximately one turn. Then lock the axle nut into position with a MS24665-292 cotter pin.

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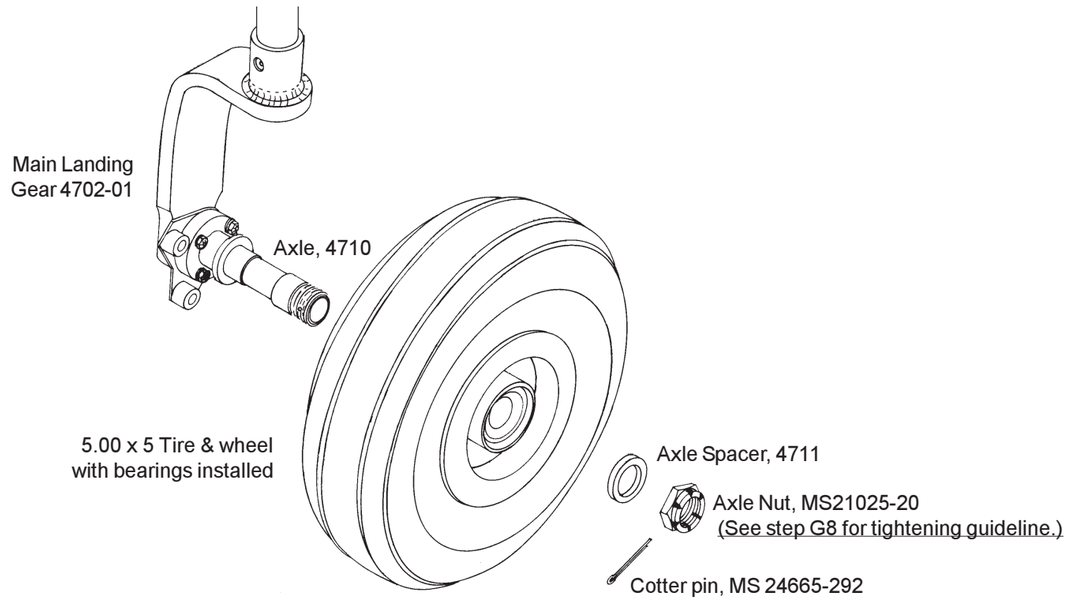
**Securing Wheels to Axles**
**Fig. 3:G:4**




**Note: Parts shown & labeled are for one side of the airplane only.**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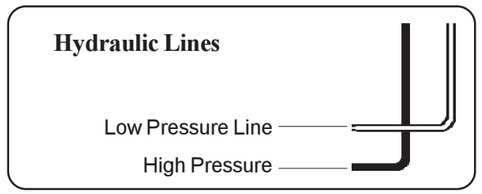
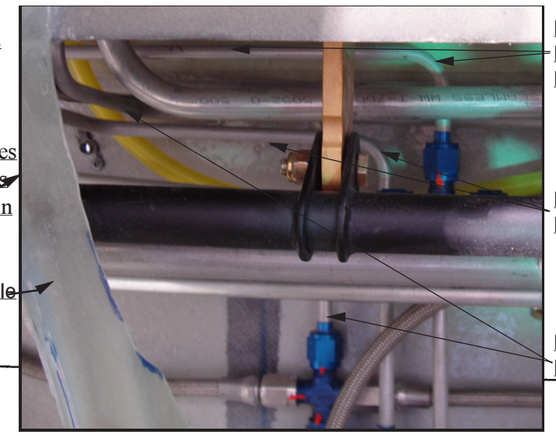
# H. Center Wing Section Hydraulics

To view the schematics of all line layouts, see pages 3-35 through 3-37.

**Center Wing Section Hydraulic line Schematic drawing**

**3:H:1**



Refer to this photo to review the shape of the hydraulic lines as they cross over the main spar.

High Pressure Line

Return Line

Low Pressure

Center console

FIREWALL

REF: FUSELAGE/CENTER WING SECTION JOINT

Nose Gear Cylinder HC-08, (1 pc)

Gear down Line, 4748

Gear up Line, 4749

Elbow fitting (90°), AN822-4D

Bulkhead fitting, AN833-4D (2 pc) with checknut, AN924-4D

Dump Valve, B-42xHF2-BKB

Union Fitting, AN832-4D

Hydraulic Cylinder HC-03-A

Tee Fitting, AN804-4D

AN822-4D

Union Fitting, AN832-4D

Cross Fitting, AN827-4D

Tee Fitting, AN825-4D

MAIN SPAR

HP

LP

LP (DOWN)

HP (UP)

In

Out

Elbow Fitting (45°) AN837-4D

Main Gear Hydraulic Cylinder 4712-407 (1 pc)

Hydraulic Cylinder HC-03-A

HP (UP)

LP (DOWN)

Main Gear Hydraulic Cylinder 4712-407

Sequence Valve, HC-05-A (1 pc) w/ AN816-4D (Nipple) Fitting on both ends.

Elbow Fitting (90°) AN833-4D

Bulkhead Fitting, AN837-4D (3 pcs) with Nut Fitting, AN924-4D (3 pcs)

REF: FUSELAGE/CENTER WING SECTION JOINT

Refer to Figure 3:H:2 for fitting at aft spar.

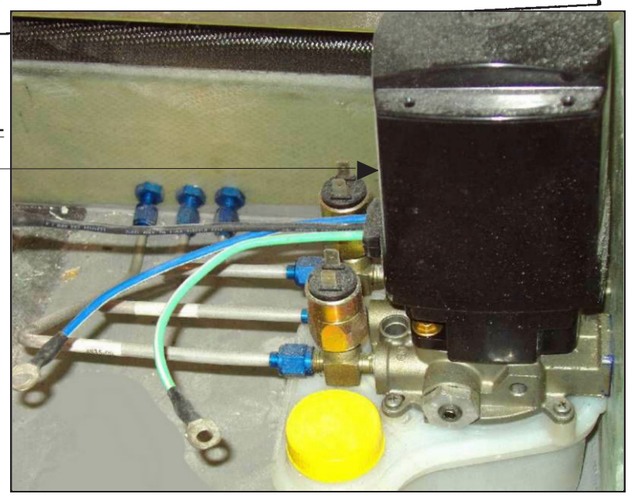
Elbow Fitting (45°), AN837-4D

Elbow Fitting (90°), AN822-4D

Tee Fitting, AN825-4D

Straight Bulkhead Fitting, AN832-4D

Hydraulic Pump, 637715
Has been relocated behind the co-pilot's seat for c.g. reasons.



Return Line

Low Pressure Switch PS 550

Nipple Fitting AN816-4D

High Pressure Switch PS 1000

Tee Fitting 2611- 4 x 2 x 2 (2 pcs)

**Note:**
**Installations aft of the aft spar and forward of the main spar installed in chapter 16. This is a schematic only. Refer to following pages for exact routing.**



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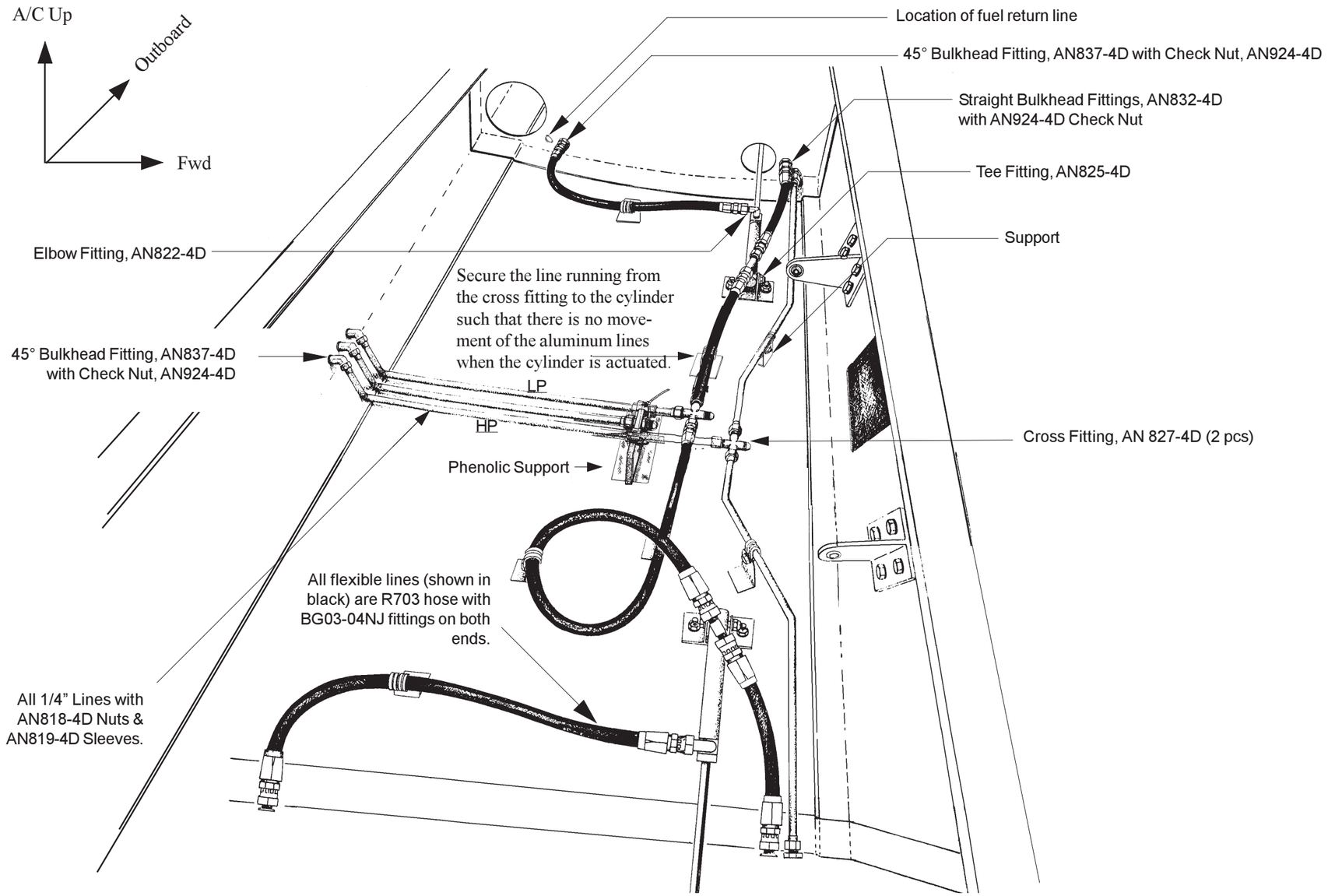
**Center Wing Section Hydraulic Lines Routing**
**Fig. 3:H:2**





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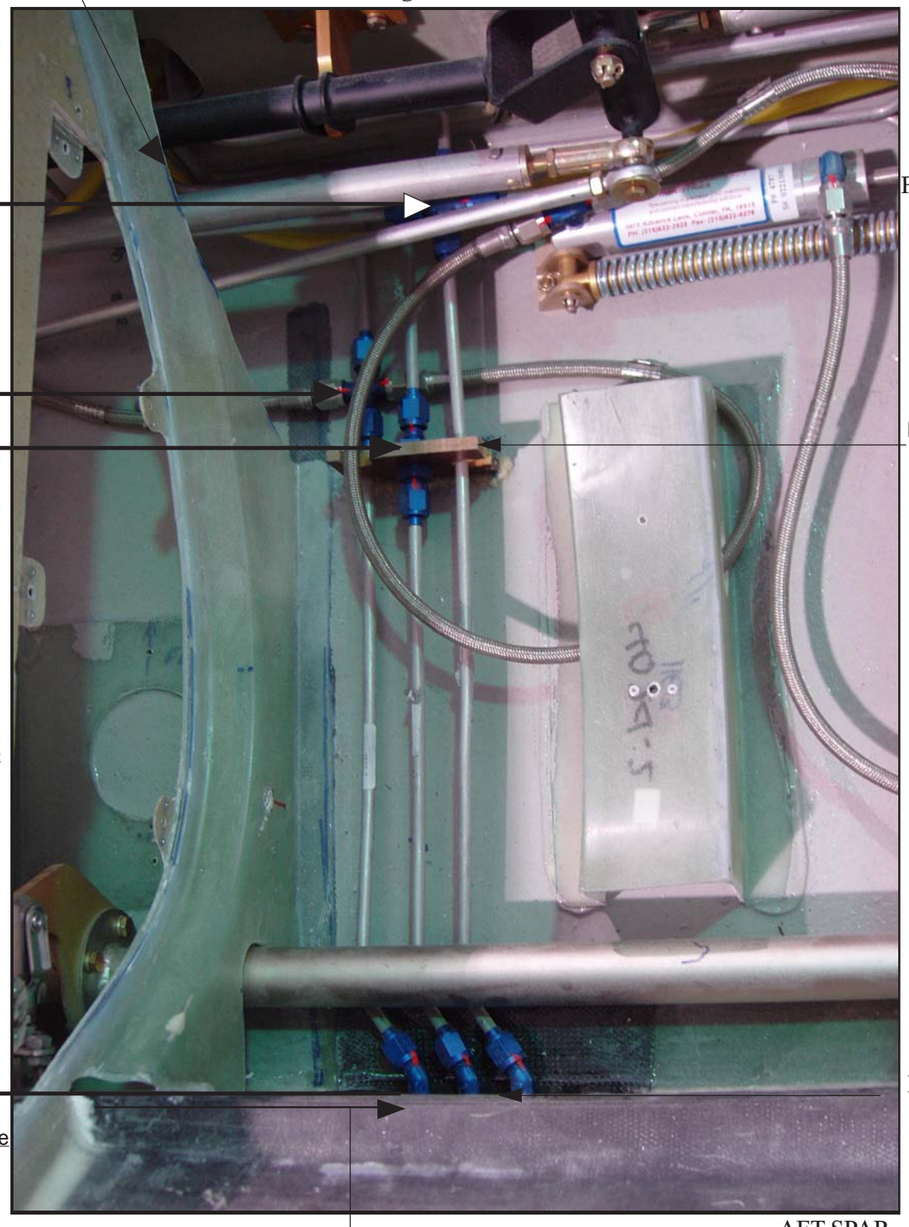
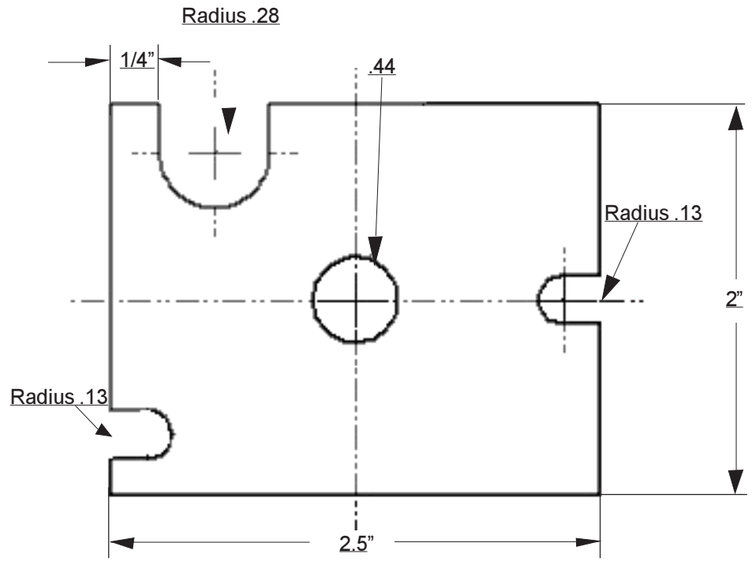
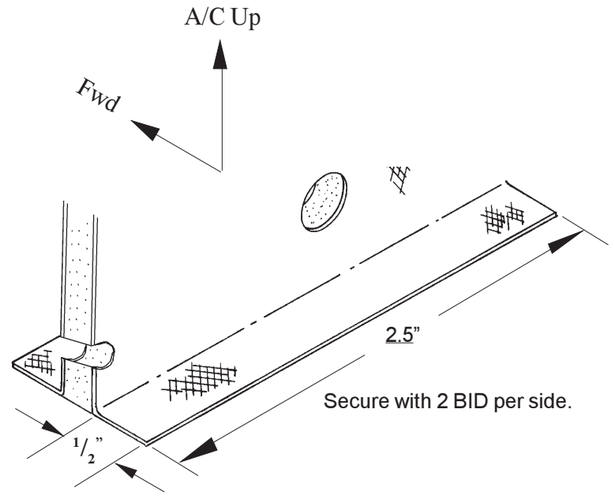
## Positioning of Hydraulic lines
## Top View (Looking Down)
## Fig. 3:H:3




## Suggested Hydraulic Line Support (New layout)
## Fig. 3:H:4



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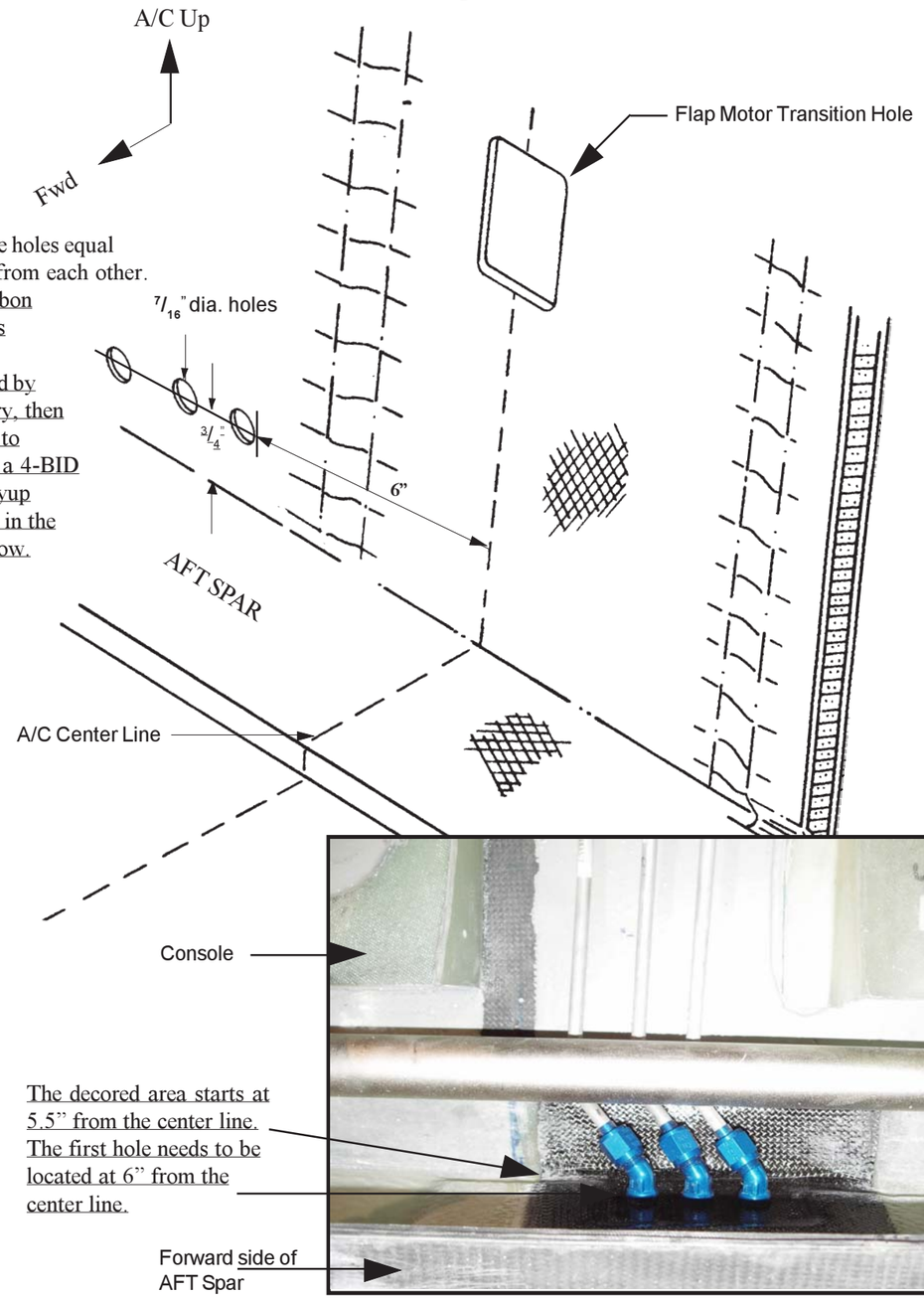
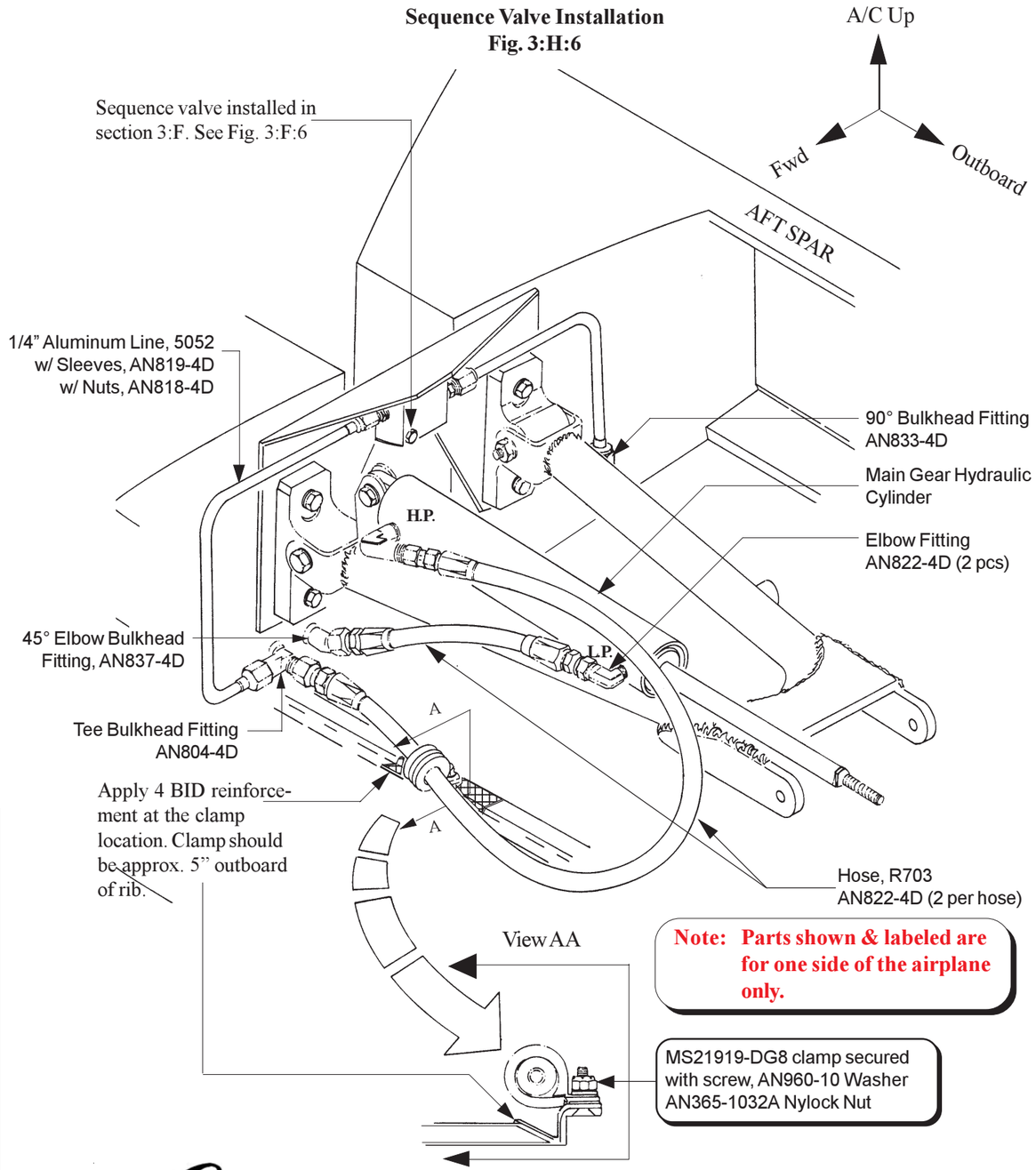
## Aft Spar Hydraulic Line Transition Holes
## Fig. 3:H:5




## Sequence Valve Installation
## Fig. 3:H:6




**Note: Parts shown & labeled are for one side of the airplane only.**



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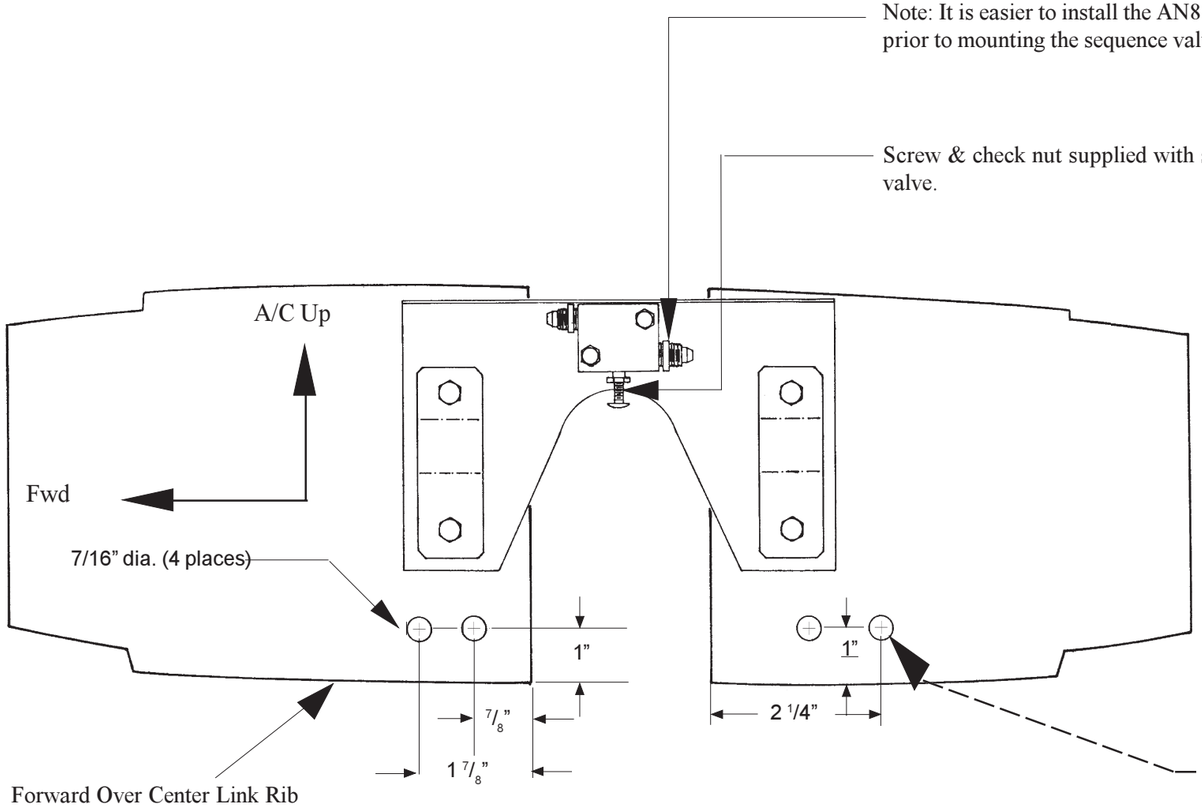
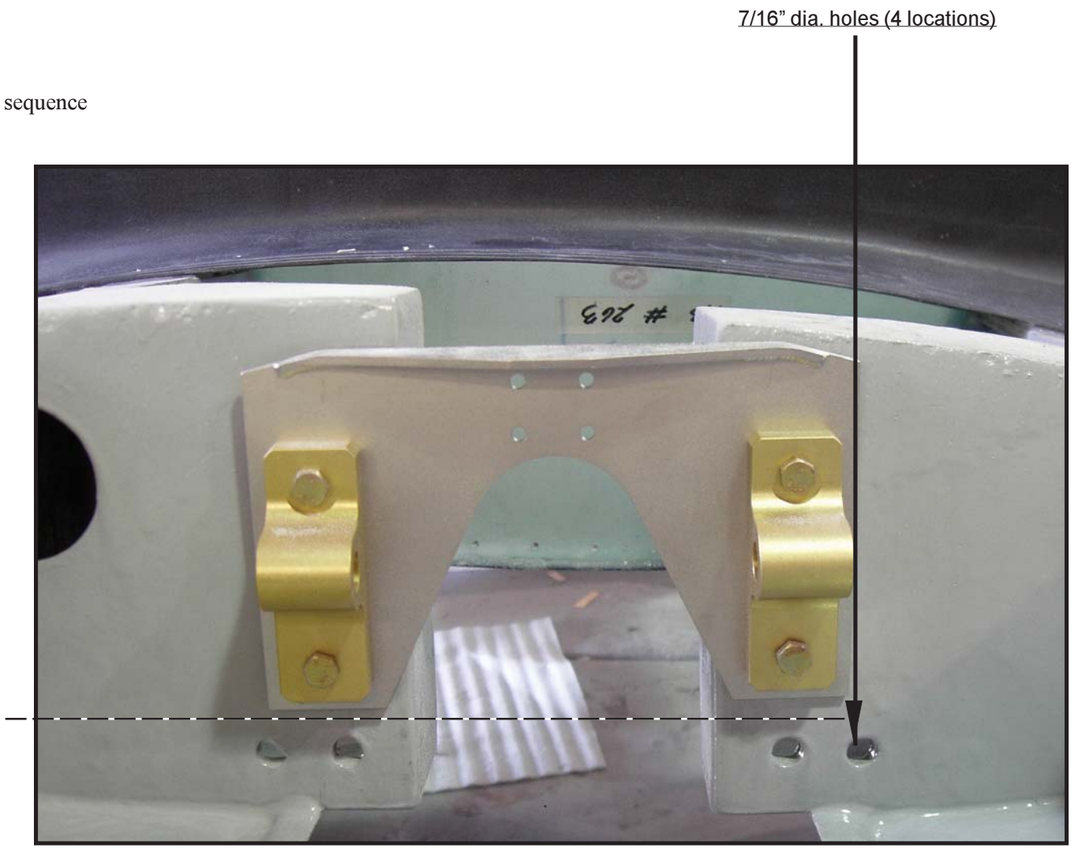
Prior to drilling each hole check the inboard side to ensure that the fitting is installed in a suitable location. It must clear the backing plate (p/n 4513) and mount on the flat surface. It is acceptable to trim a small amount of the backing plate to make room to install the fitting.

**Sequence Valve Installation**
**Continued**
**Fig. 3:H:7**





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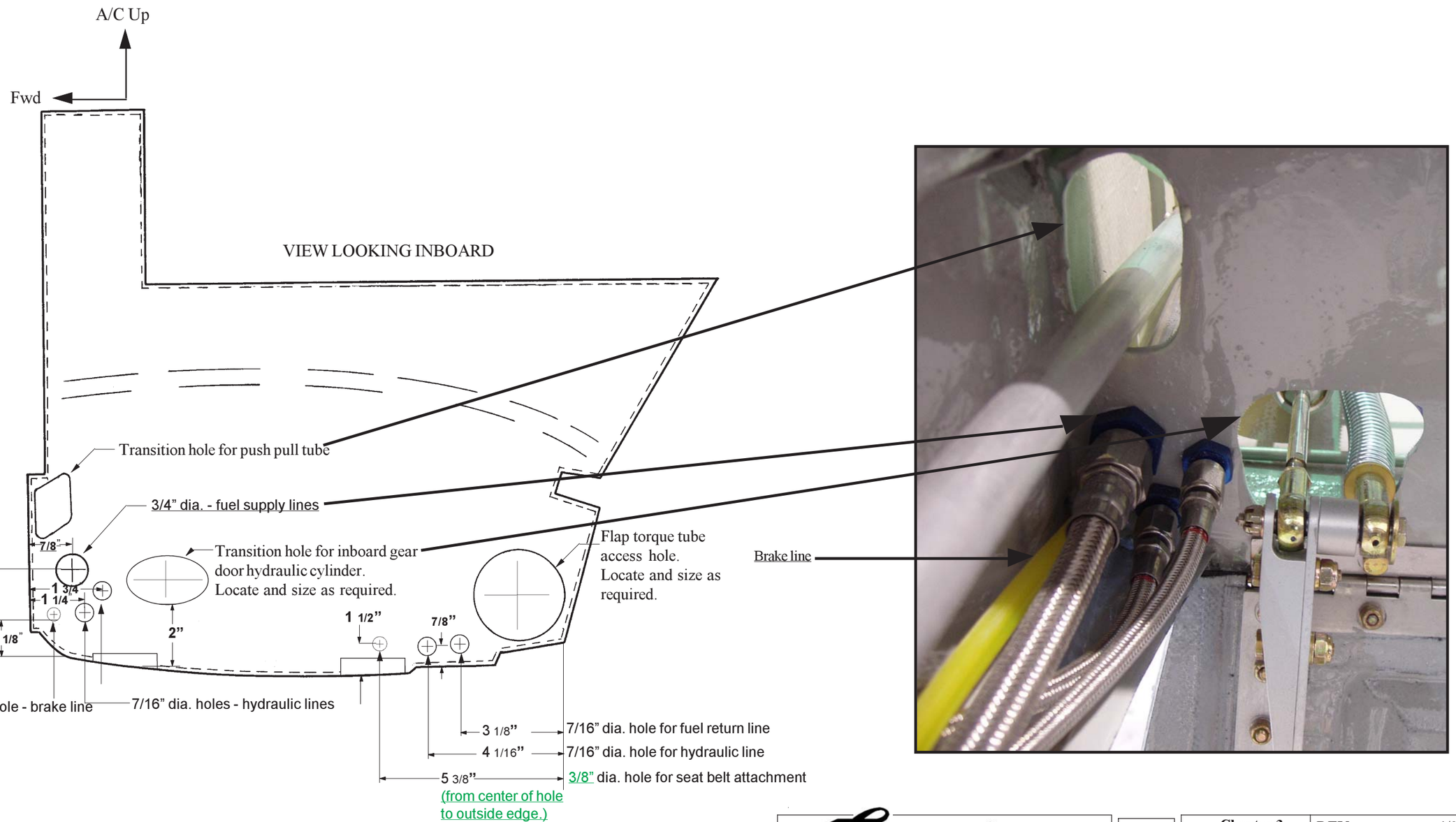
**Transition Holes for Aft Load Pad 19 Rib**
**Fig. 3:H:8**





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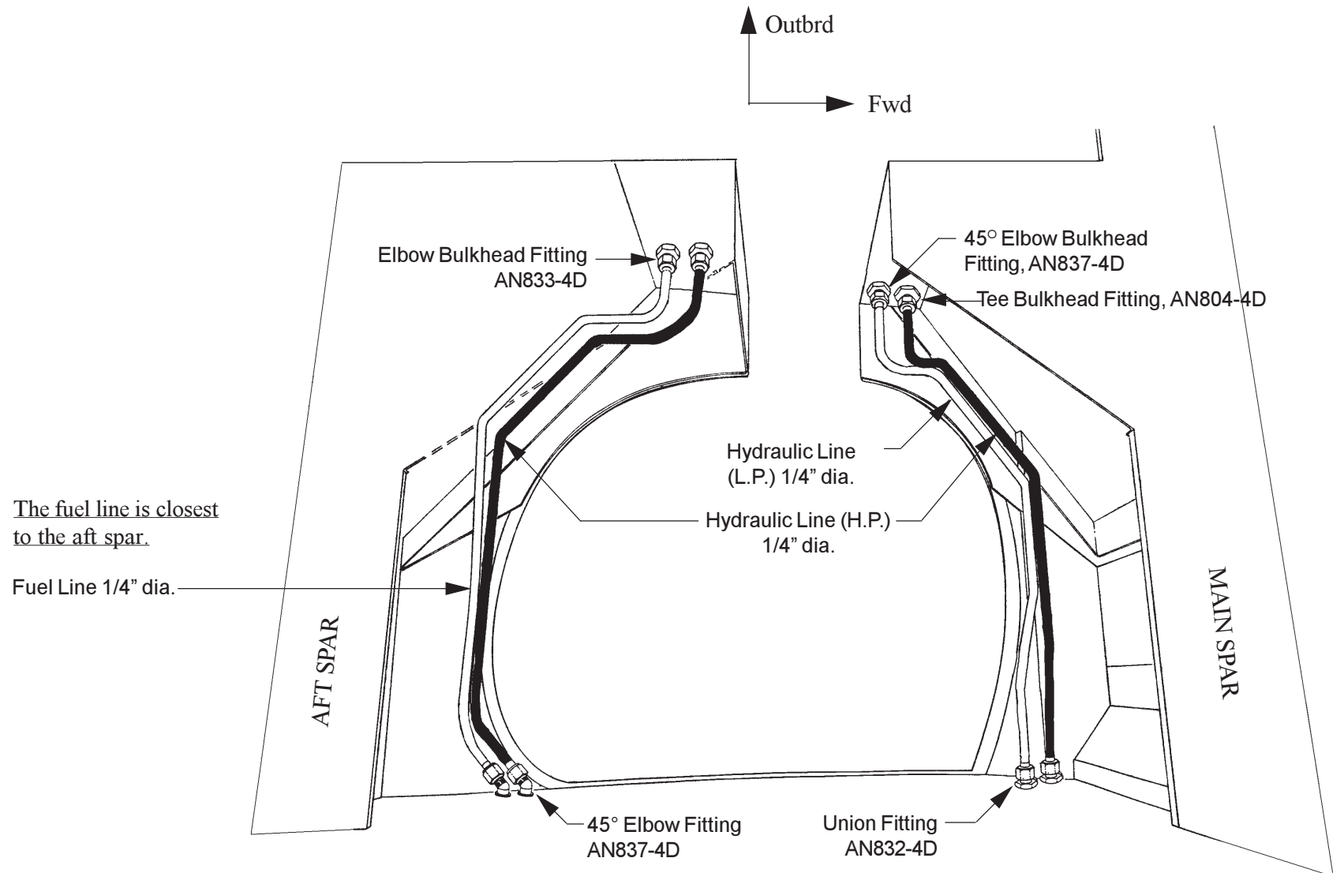
## Hydraulic Line Routing through Gear Well
## Fig. 3:H:9

The fuel and hydraulic lines on the aft side of the gear well must be kept clear of the flap torque tube. We suggest that you temporarily install the flap tube support brackets for reference. Refer to figure 21:A:1.




All lines must be kept clear of opening for the tire clearance. Secure the lines using one of the methods described in Chapter 1.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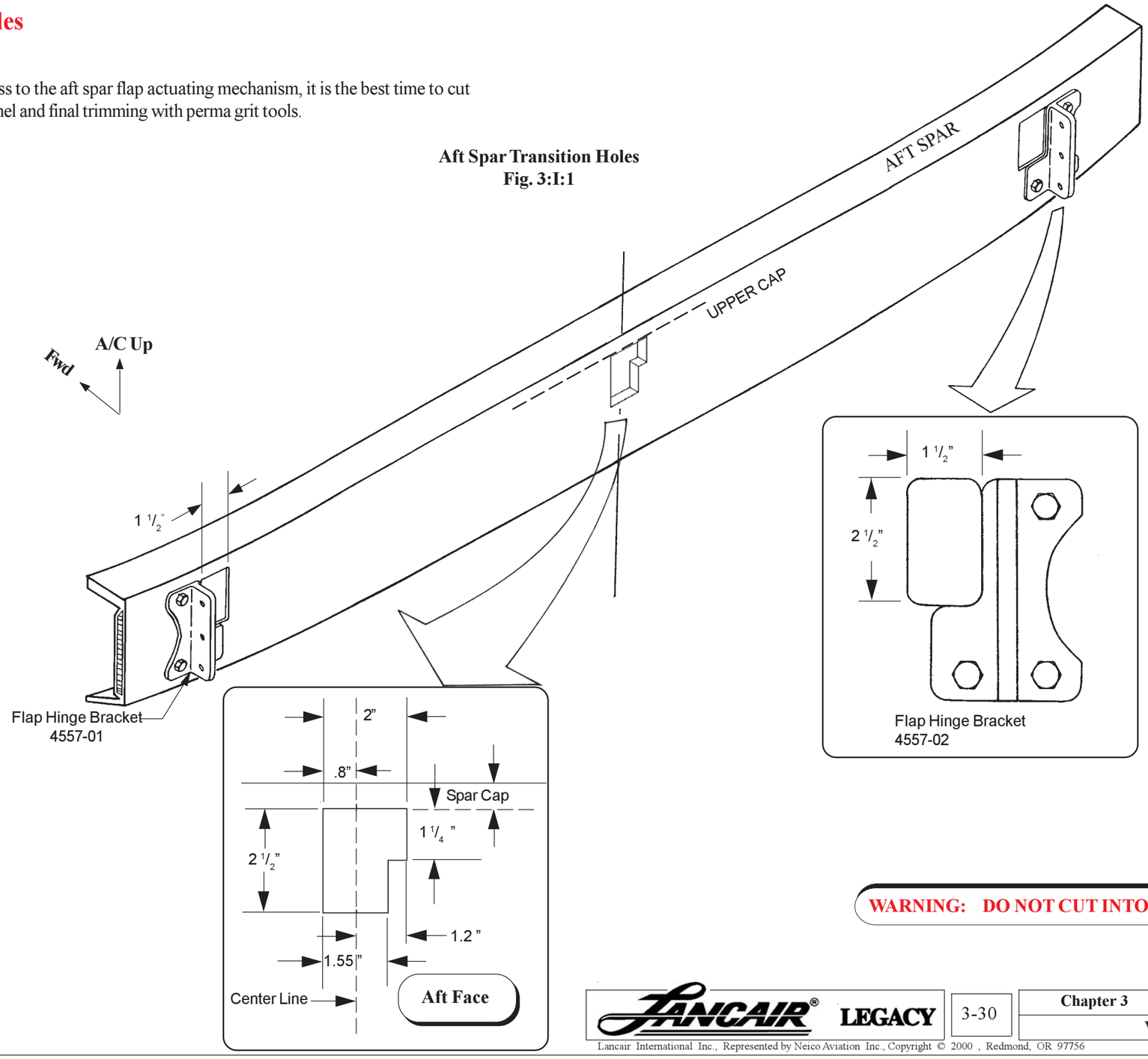
# I. Aft Spar Transition Holes

While you have easy access to the aft spar flap actuating mechanism, it is the best time to cut the holes. We suggest using a dremel and final trimming with perma grit tools.

**Aft Spar Transition Holes**
**Fig. 3:I:1**




**WARNING: DO NOT CUT INTO THE SPAR CAPS.**



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# J. Landing and Taxi Lights (Optional)

**Landing/Taxi Light Exploded View**
**Fig. 3:J:1**

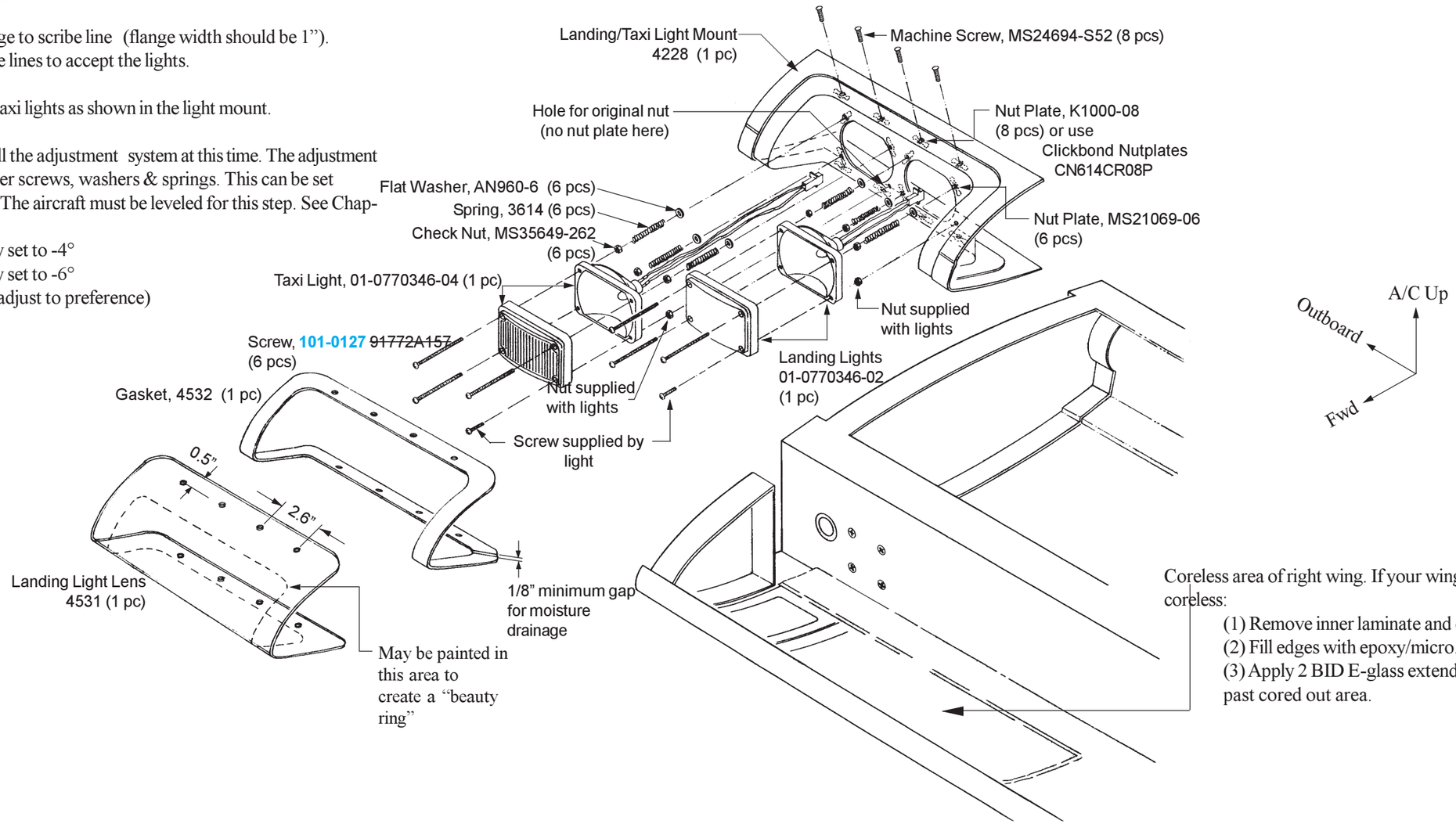
The landing/taxi light kits are available through KCI. They are available for both the left and the right side.

**J 1.** Trim the landing/taxi light mount to the scribe lines. There are two sets of scribe lines:
1) Trim the mount flange to scribe line (flange width should be 1").
2) Trim mount to scribe lines to accept the lights.

**J 2.** Install the landing and taxi lights as shown in the light mount.

Note: it isn't necassary to install the adjustment system at this time. The adjustment mechanism consistsof the longer screws, washers & springs. This can be set anytime after closing the wing. The aircraft must be leveled for this step. See Chapter 7.

Taxi Light: initially set to -4°
Landing Light: initially set to -6°
(Final adjust to preference)




**Note: Optional Parts available through Kit Components Inc.**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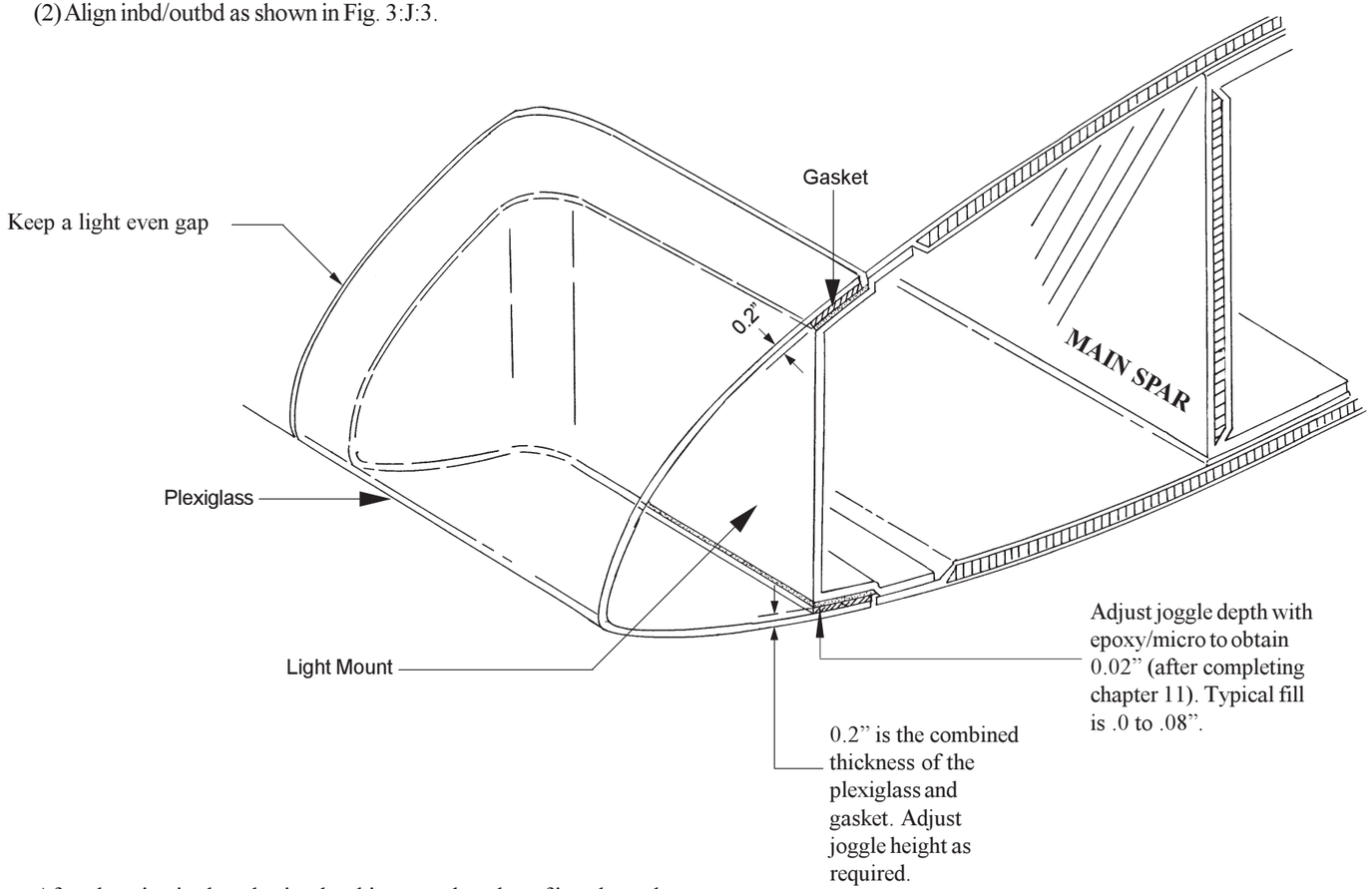
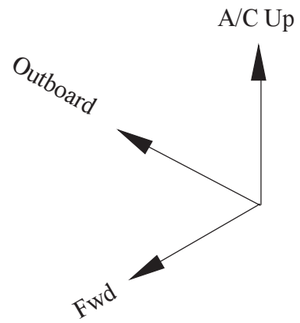
**J 3.** Install light mount. Alignment:
(1) Tight up against the leading edge.
(2) Align inbd/outbd as shown in Fig. 3:J:3.

**Cross section of Light**
**Assembled View**
**Fig. 3:J:2**



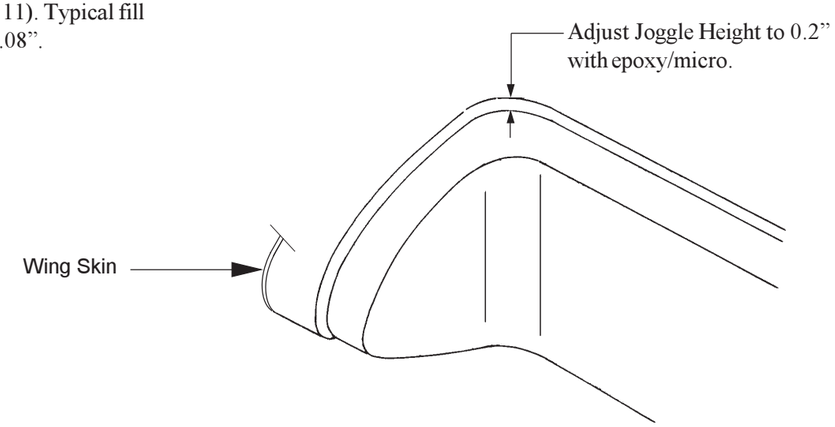




**J 4.** After the wing is closed, trim the skin up to the edge of joggle as shown.

**J 5.** Adjust joggle thickness to 0.2" . At 0.2" the lens will be flush with wing skin.

**J 6.** Trim the plexiglass to fit the opening. We suggest temporarily installing small pieces of gasket material to simulate gasket thickness.

**J 7.** Using a plexiglass drill bit install the lens.





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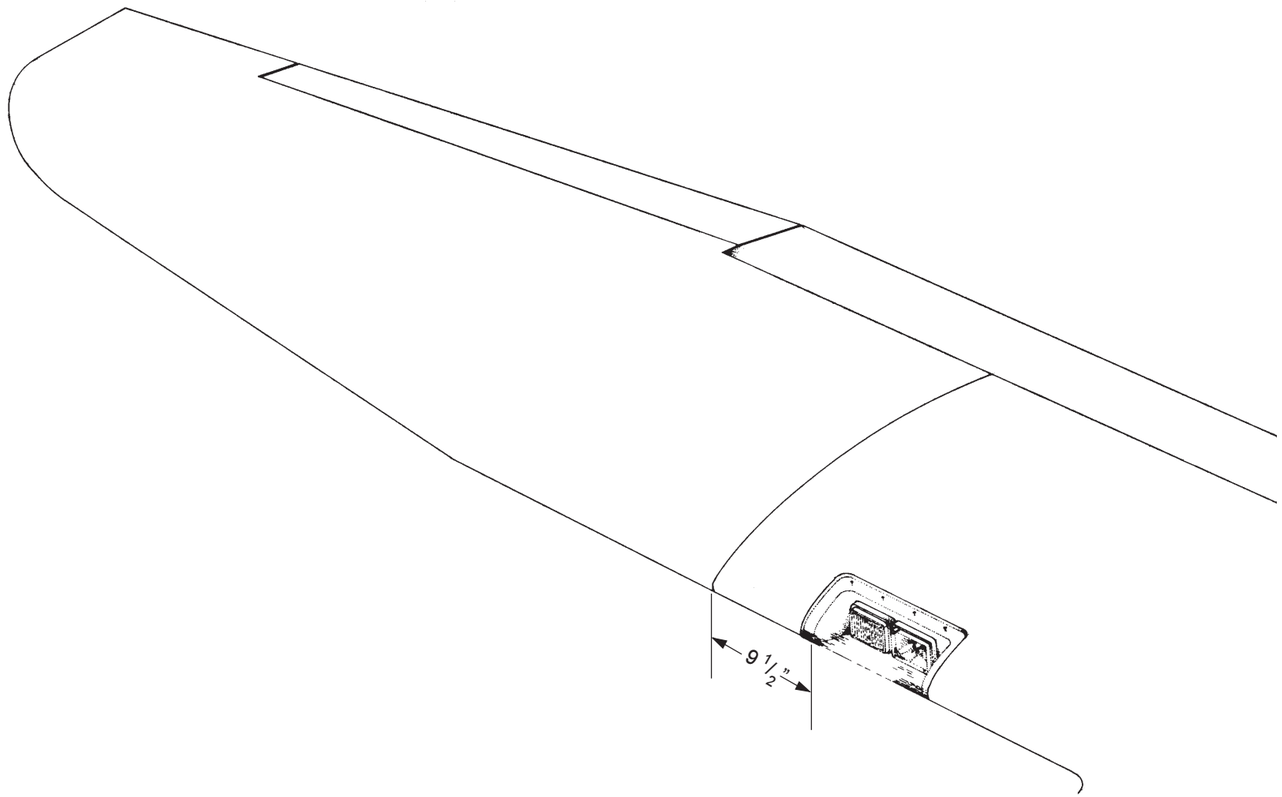
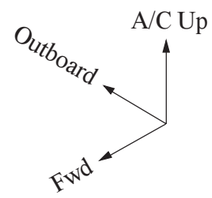
**Landing/Taxi Light Installed**
**Fig. 3:J:3**




**J 8.** Install the lights. Install the gasket, lights and lens with the adjust ment mechanism and set . Note: One of the four screws of the light remains. The adjustment mechanism consists of three (3) screws. The fourth screw is the original screw holding the light together.

**Note: Beauty ring not shown for clarity**
**Optional Parts available through Kit Components Inc.**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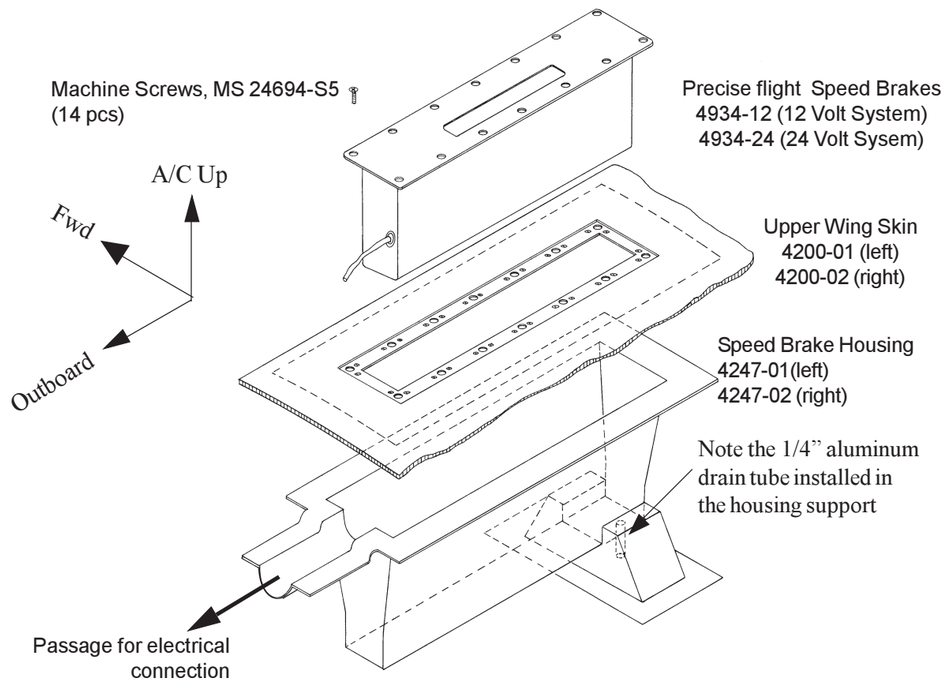
## K. Speed Brakes (Optional)

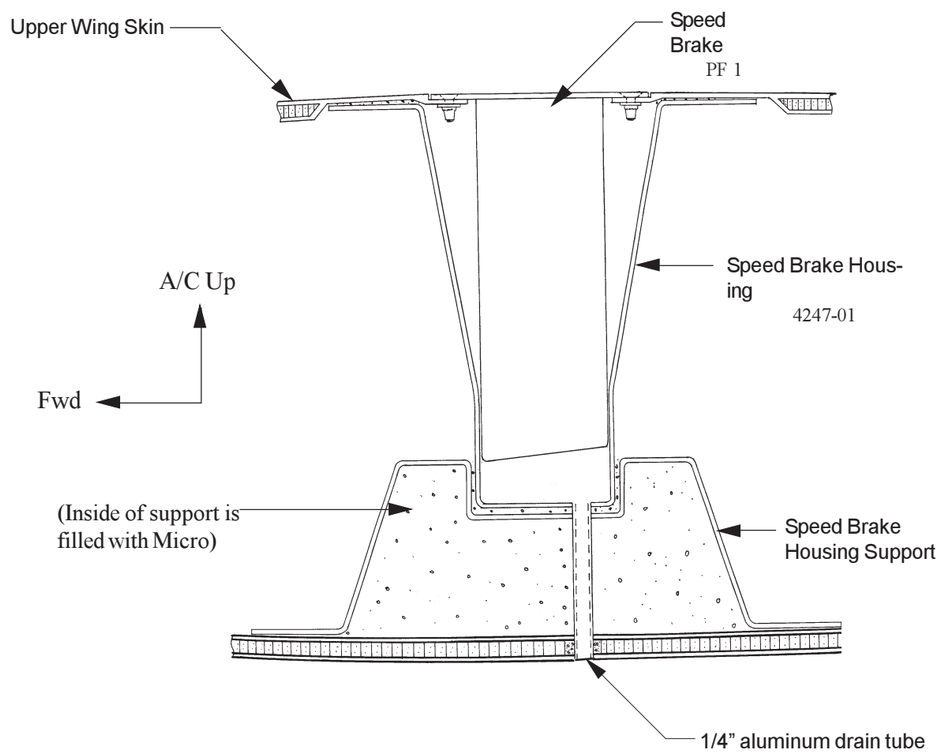
**Speed Brake Installation**
**Fig. 3:K:1**




**Note: If you are not installing speed brakes, install cover plates (P/N: 4530) available through Kit Components Incorporated.**

**Note: Optional Parts available through Kit Components Inc.**

**Speed Brake Drain Tube Installation**
**Fig. 3:K:2**




**K 1.** After closing, install the drain tube. Lightly sand the aluminum tube and install such that both ends are flush.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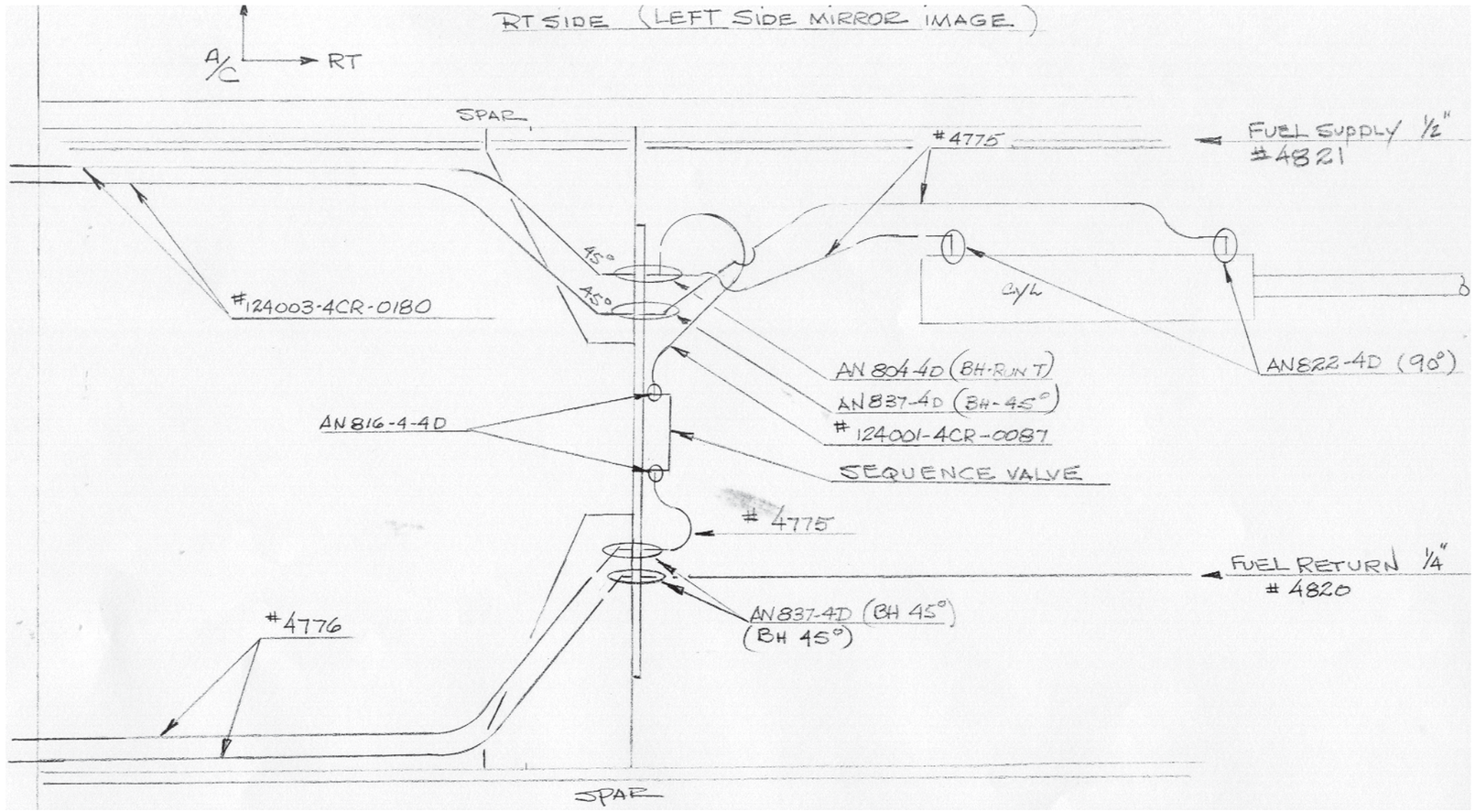
## L. Fuel and Hydraulic Lines Schematics

**Line Schematics for Wings**
**Fig. 3:L:1**





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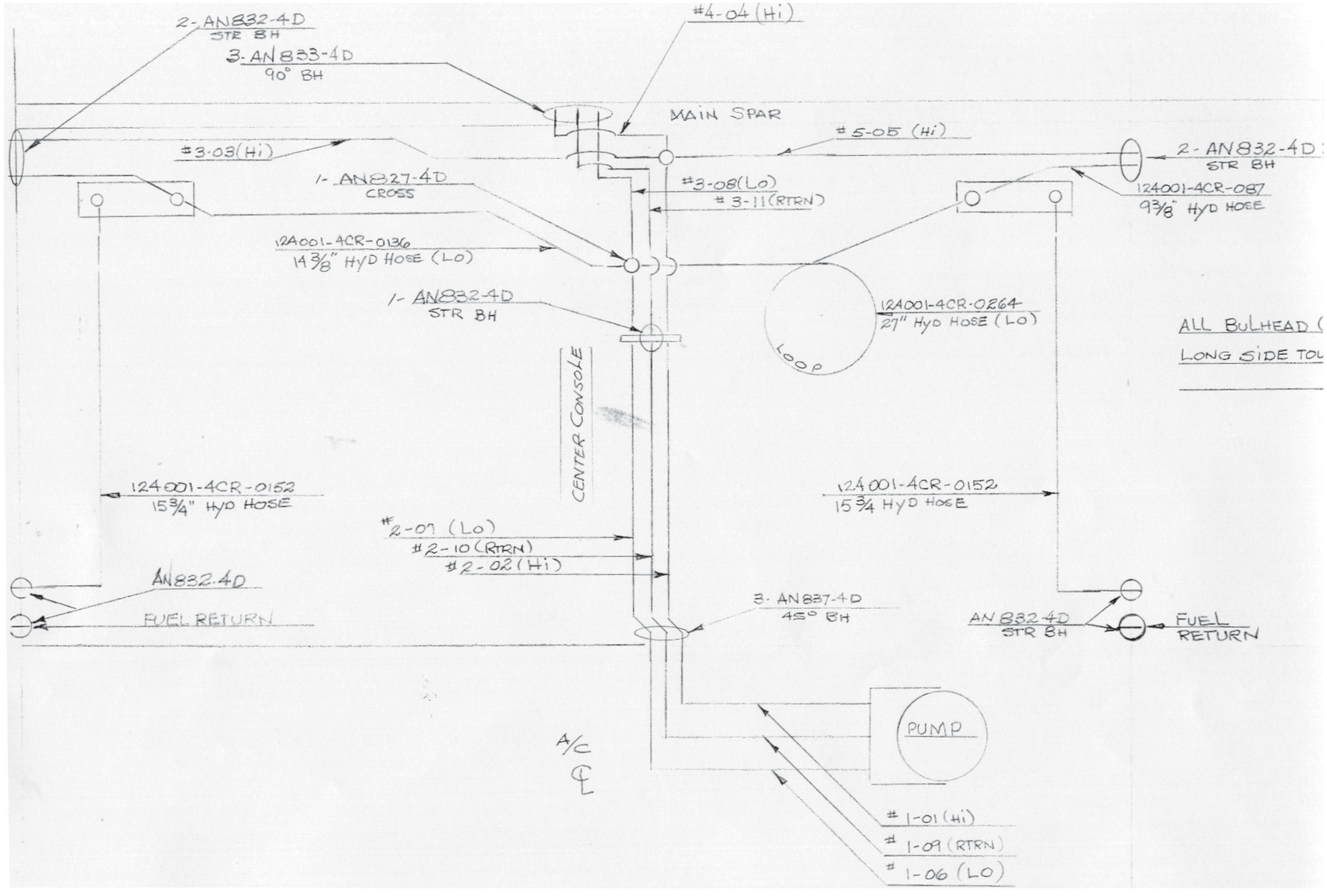
**Line Schematics aft of Main Spar**
**Fig. 3:L:2**





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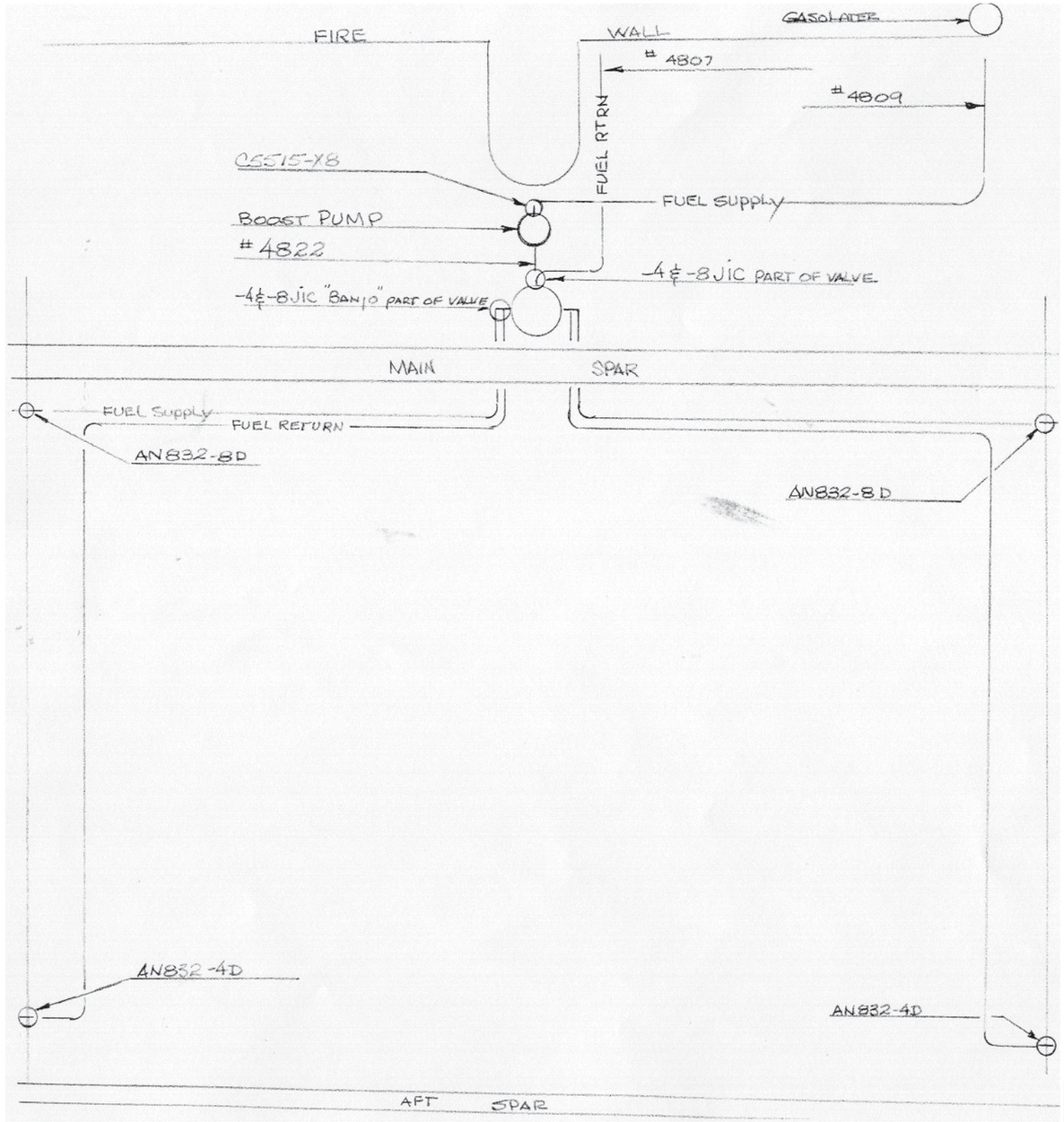
**Fuel Lines with Gascolator and Pump**
**Fig. 3:L:3**





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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM |
|---|---|---|---|---|
| Over Center Link continued (for both sides) | | | | *(not included with kit)* |
| 2) | 4709-02 | 8 | Shim 0.063” | |
| 3) | 4712-407 | 2 | Hydraulic Cylinder (Main Gear) | |
| 4) | 4718 | 1 | Left Over Center Link | |
| 5) | 4720 | 1 | Right Over Center Link | |
| 6) | 4721 | 4 | Over Center Link Arms | |
| 7) | 4722 | 4 | Bushing | |
| 8) | 4723 | 2 | Spacer | |
| 9) | 4763 | 2 | Main Gear Up Stop | |
| 10) | JM-1 | 2 | Actuator Arm for Micro Switch | |
| 11) | F45-19 | 2 | Bearings, Rod End | |
| 12) | AN3-16A | 4 | Bolt, Undrilled | |
| 13) | AN4-44A | 2 | Bolt, Undrilled | |
| 14) | AN4-12A | 2 | Bolt, Undrilled | |
| 15) | AN4-7A | 2 | Bolt, Undrilled | |
| 16) | AN5-41A | 2 | Bolt, Undrilled | |
| 17) | AN5-20A | 4 | Bolt, Undrilled | |
| 18) | 110-0036 ~~6381K103~~ | 4 | Bushing | |
| 19) | AN5-7 | 2 | Bolt, Drilled | |
| 20) | MS24665-140 | 4 | Cotter Pin | |
| 21) | 198-0004 ~~9416K77~~ | 2 | Clip, Safety | |
| 22) | 198-0003 ~~9416K71~~ | 2 | End Fitting, Metal Ball Socket | |
| 23) | 198-0005 ~~9416K84~~ | 2 | End Fitting, Metal Eyelet | |
| 24) | AN816-4D | 4 | Fittings, Nipple | |
| 25) | 160-0004 ~~9416K24~~ | 2 | Gas Strut | |
| 26) | 1XE1-T | 2 | Main Gear Micro-switch | |
| 27) | AN310-5 | 2 | Nut, Castle | |
| 28) | AN316-5 | 2 | Nut, Check | |
| 29) | AN365-524A | 6 | Nut, Nylock | |
| 30) | AN365-428A | 6 | Nut, Nylock | |
| 31) | AN365-1032A | 4 | Nut, Nylock | |
| 32) | ~~HC-05-A~~ 4786 | 2 | Sequence Valve | |
| 33) | 198-0006 ~~9512K73~~ | 2 | Stud, Ball | |
| 34) | AN960-516 | 16 | Washer, Flat | |
| 35) | AN960-416 | 12 | Washer, Flat | |
| 36) | AN960-10 | 8 | Washer, Flat | |
| 37) | 110-0002B | 4 | Bearing, Thrust, over-center link | |
| 38) | 112-0034 | 4 | Bushing for new actuator w/bearing & old over-center link w/AN5 bolt hole | |
| or | 112-0050 | 4 | Bushing for new actuator w/bearing & new over-center link w/AN3 bolt hole | |
| **MAIN GEAR WHEELS & TIRES** | | | | |
| 1) | AN4-22A | 6 | Bolt, Undrilled | |
| 2) | TU-5.00-5 | 2 | Inner Tube 5” | |
| 3) | 40-151 | 2 | Main Wheel Assembly | |
| 5) | AN365-416A | 6 | Nut, Nylock | |
| 6) | TR-GY 5.00-5 | 2 | Tire, Main Gear | |
| 7) | AN960-416L | 12 | Washers, Flat | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM |
|---|---|---|---|---|
| **CENTER WING SECTION HYDRAULICS** | | | | *(not included with kit)* |
| 1) | AN3-13A | 6 | Bolt, Undrilled | |
| 2) | AN3-10A | 6 | Bolt, Undrilled | |
| 3) | MS219-DG4 | 6 | Clamp | |
| 4) | MS219-DG7 | 6 | Clamp | |
| 5) | AN804-4D | 2 | Fittings, Tee | |
| 6) | AN818-4D | 38 | Fittings, Nut | |
| 7) | AN819-4D | 38 | Fittings, Sleeve | |
| 8) | AN822-4D | 6 | Fittings, Elbow | |
| 9) | AN825-4D | 2 | Fittings, Tee | |
| 10) | AN827-4D | 2 | Fitting, Cross | |
| 11) | AN832-4D | 6 | Fittings, Union | |
| 12) | AN833-4D | 6 | Fittings, Elbow | |
| 13) | AN837-4D | 7 | Fittings, Elbow | |
| 14) | AN924-4D | 15 | Fittings, Nut | |
| 15) | BG03-4NJ | 20 | Hose Fittings | |
| 16) | R703 | 130 in. | Flexible Hydraulic Line | |
| 17) | AN365-1032A | 12 | Nut, Nylock | |
| 18) | PH-250 | 1 | (1/4” x 3.5” x 1.5”) Phenolic Block | |
| 19) | PH-250 | 2 | (1/4” x 3” x 3”) Phenolic Block | |
| 20) | 5052 | 240 in. | 1/4” Tubing, Aluminum | |
| 21) | AN960-10 | 12 | Washer, Flat | |
| **LANDING/TAXI LIGHTS** | | | | |
| 1) | 4228 | 1 | Landing/Taxi Light Mount | **Yes |
| 2) | 4531 | 1 | Landing/Taxi Light Lens | **Yes |
| 3) | 4532 | 1 | Gasket | **Yes |
| 4) | MS35649-262 | 6 | Nut, Check | **Yes |
| 5) | MS24694-S52 | 8 | Screw, Machine | **Yes |
| 6) | 101-0127 ~~91772A157~~ | 6 | Screw, Machine | |
| 7) | MS21069-06 | 6 | Nut Plate | |
| 8) | K1000-08 | 8 | Nut Plate | |
| 9) | 01-0770346-02 | 1 | Landing Light | **Yes |
| 10) | 01-0770346-04 | 1 | Taxi Light | **Yes |
| 11) | 3614 | 6 | Spring | **Yes |
| 12) | AN960-6 | 6 | Washer | **Yes |
| 13) | 800-0001 | 1 (pair) | Main gear landing lights (12 volt) | |
| 14) | 800-0002 | 1 (pair) | Main gear landing lights (24 volt) | |
| **SPEED BRAKES** | | | | |
| 1) | 4530 | 2 | Cover Plates (only used when | **Yes |
| 2) | 4934-12 | 2 | Precise Flight Speed Brakes, 12 Volt | **Yes |
| 3) | 4934-24 | 2 | Precise Flight Speed Brakes, 24 Volt | **Yes |
| 4) | MS24694-S5 | 28 | Screws, Machine (Structural) | |


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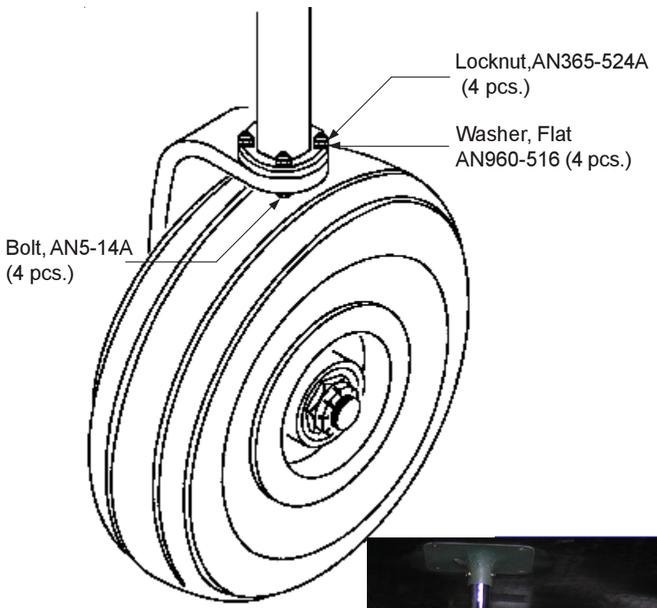
## F. Main Gear Installation

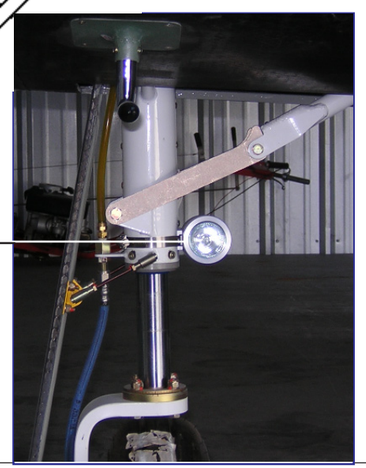
The Legacy landing gear is oleo pneumatic. The landing gear is pre-aligned at the factory however the angle of the gear leg itself must beset as shown later in this section. The first 50 Legacy kits were supplied with a style 1 landing gear and from then on a style 2 landing gear. To identify, style 1 is a one piece type fork as shown and style II has a collar that bolts to the fork as shown on the left. If you have a style 1 type of fork you must comply with service bulletin SB058.

**F 1.** Assemble the main gear legs as shown.

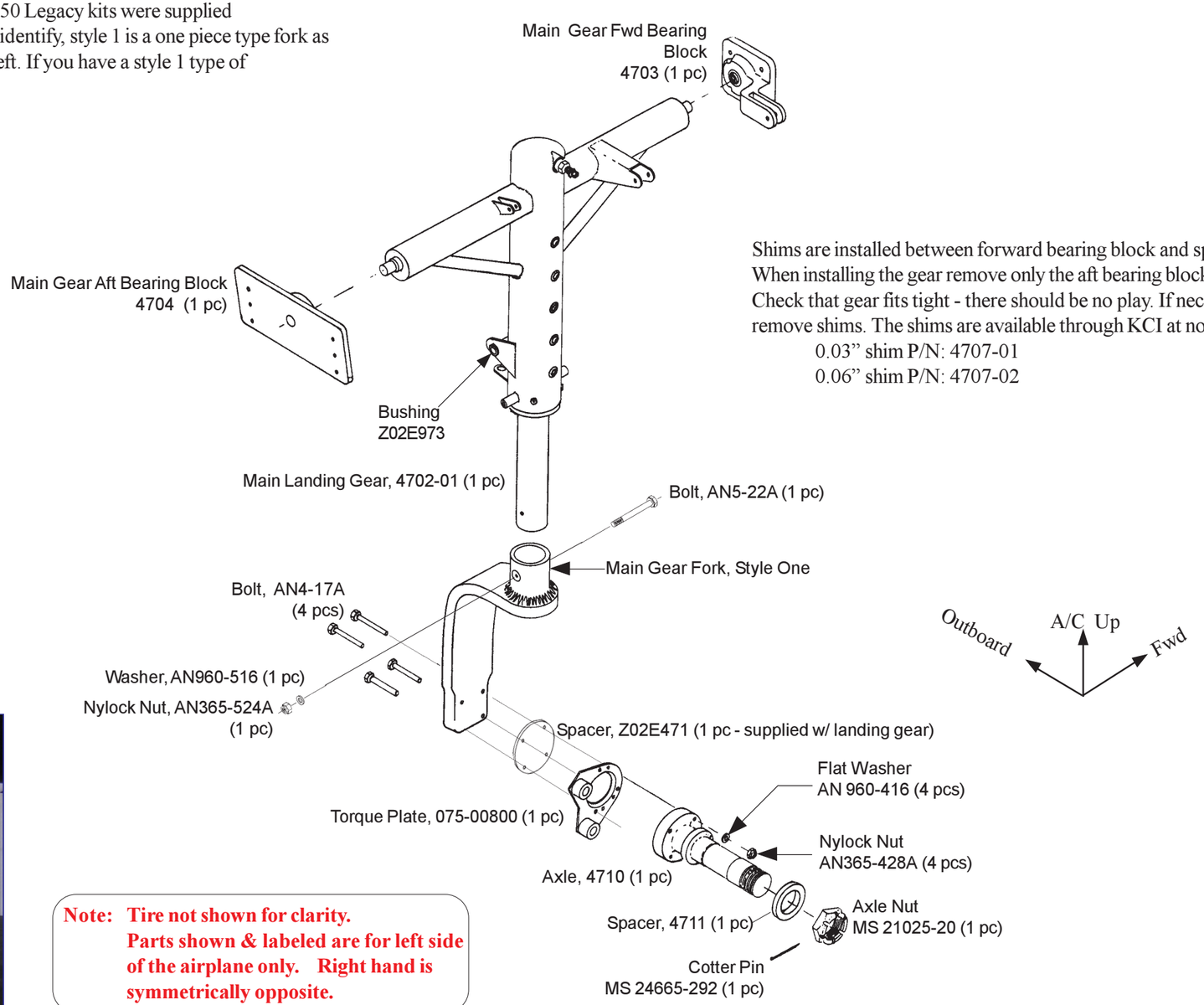
**Main Landing Gear Style II**
**Fig. 3:F:1:b**




Optional Landing Lights
12 volt 800-0001
24 volt 800-0002
(Sold by the pair)



**Main Landing Gear (Exploded View)**
**Fig. 3:F:1**




Shims are installed between forward bearing block and spar at the factory. When installing the gear remove only the aft bearing block.
Check that gear fits tight - there should be no play. If necessary add or remove shims. The shims are available through KCI at no charge.

0.03" shim P/N: 4707-01
0.06" shim P/N: 4707-02

**Note: Tire not shown for clarity. Parts shown & labeled are for left side of the airplane only. Right hand is symmetrically opposite.**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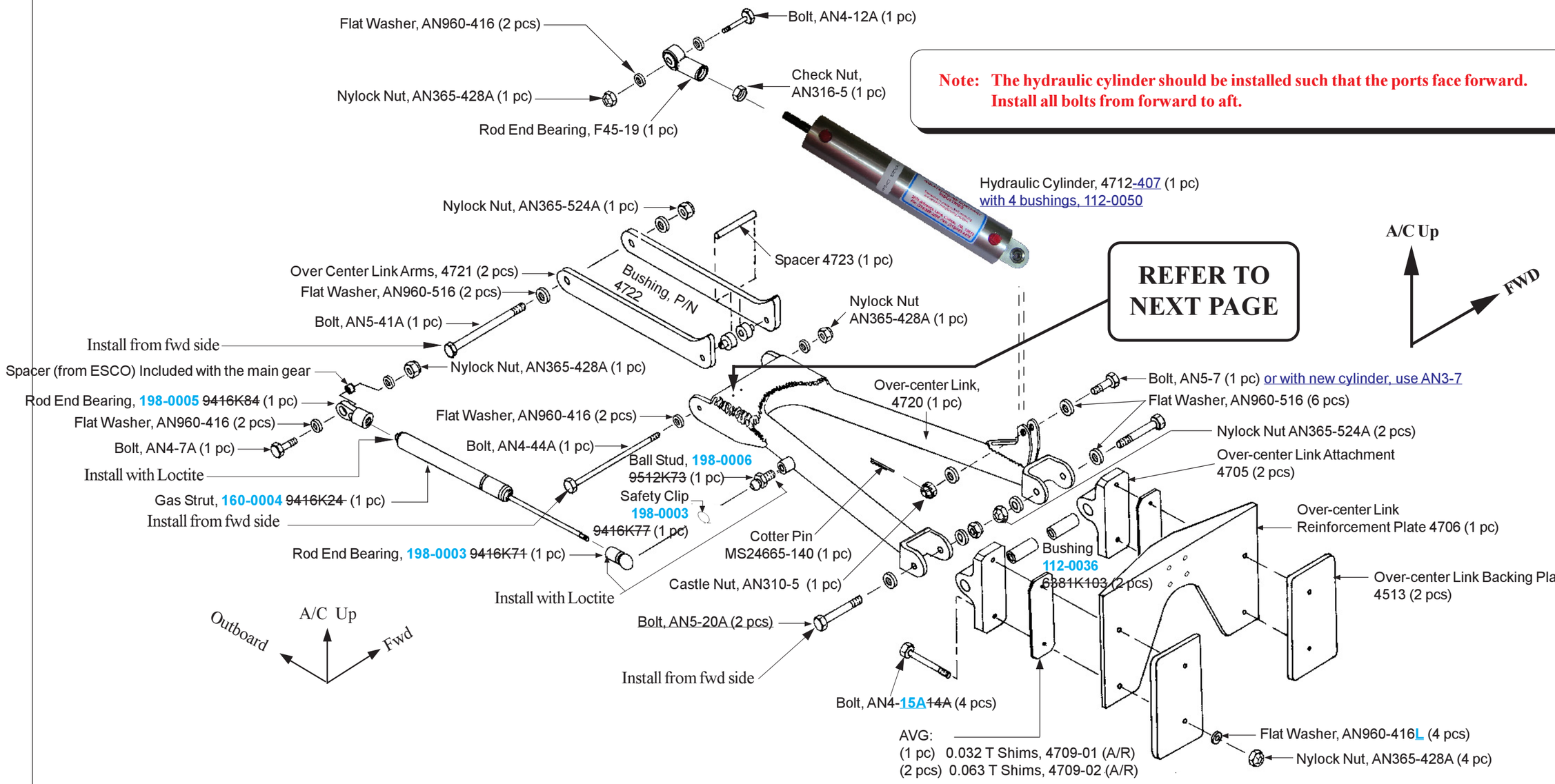
## Over Center Link Assembly
## Fig. 3:F:4




**Note: The hydraulic cylinder should be installed such that the ports face forward. Install all bolts from forward to aft.**

**Note Install the ball stud, part number 198-0006 ~~9512K73~~ with Loctite 242.**



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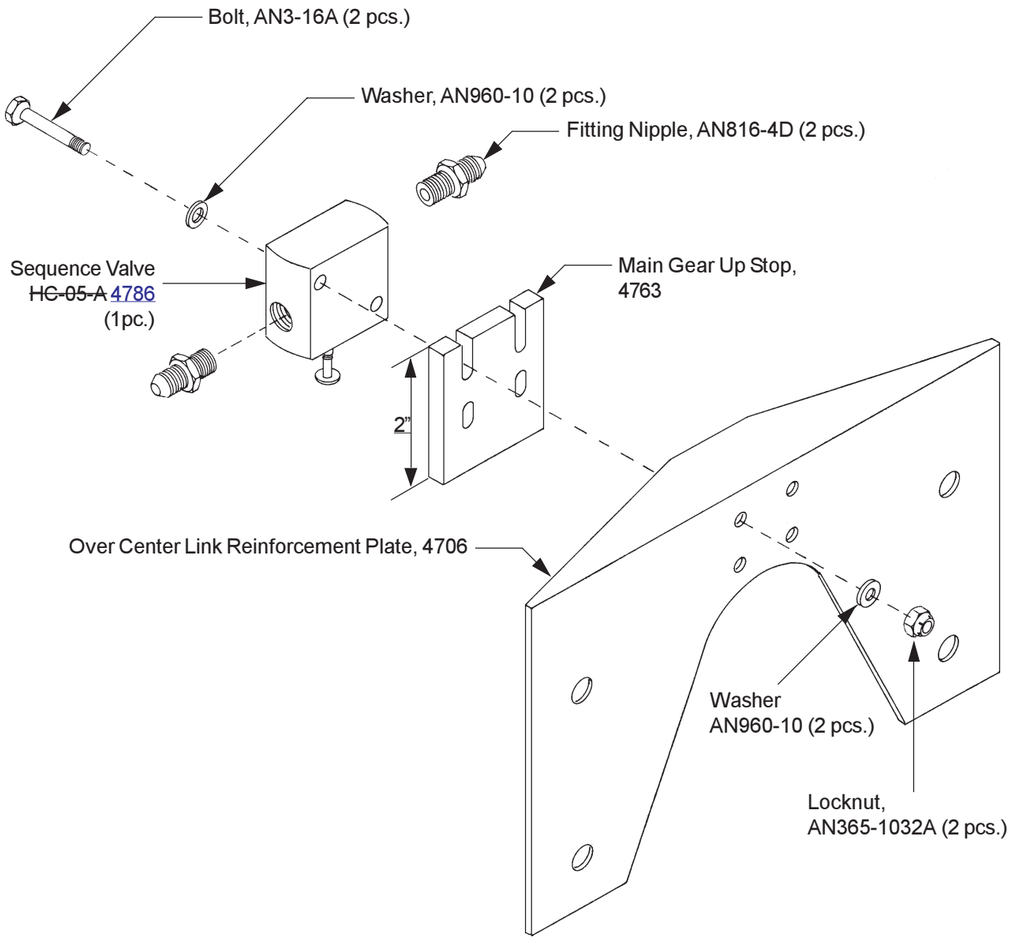
**Sequence Valve/Gear Up Stop**
**Fig. 3:F:7**




**Final adjustment of up stop is explained in chapter 16.**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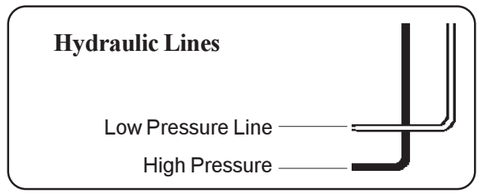
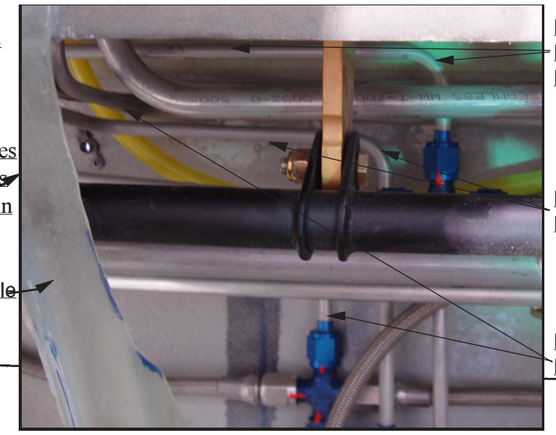
# H. Center Wing Section Hydraulics

To view the schematics of all line layouts, see pages 3-35 through 3-37.

**Center Wing Section Hydraulic line Schematic drawing**

3:H:1



Refer to this photo to review the shape of the hydraulic lines as they cross over the main spar.

High Pressure Line

Return Line

Low Pressure

Center console

FIREWALL

REF: FUSELAGE/CENTER WING SECTION JOINT

Nose Gear Cylinder HC-08, (1 pc)

Gear down Line, 4748

Gear up Line, 4749

Elbow fitting (90°), AN822-4D

Bulkhead fitting, AN833-4D (2 pc) with checknut, AN924-4D

Dump Valve, B-42xHF2-BKB

Union Fitting, AN832-4D

Hydraulic Cylinder HC-03-A

Tee Fitting, AN804-4D

AN822-4D

Union Fitting, AN832-4D

Cross Fitting, AN827-4D

Tee Fitting, AN825-4D

MAIN SPAR

HP

LP

LP (DOWN)

HP (UP)

In

Out

Elbow Fitting (45°) AN837-4D

Main Gear Hydraulic Cylinder 4712-407 (1 pc)

Hydraulic Cylinder HC-03-A

HP (UP)

LP (DOWN)

Main Gear Hydraulic Cylinder 4712-407

Sequence Valve, HC-05-A (1 pc) w/ AN816-4D (Nipple) Fitting on both ends.

Elbow Fitting (90°) AN833-4D

Bulkhead Fitting, AN837-4D (3 pcs) with Nut Fitting, AN924-4D (3 pcs)

REF: FUSELAGE/CENTER WING SECTION JOINT

Refer to Figure 3:H:2 for fitting at aft spar.

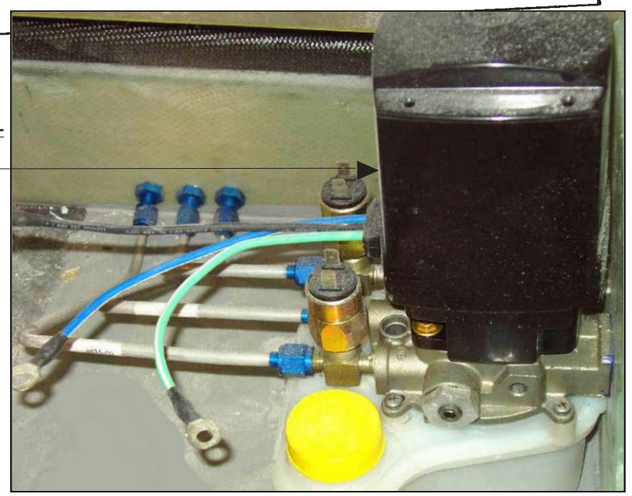
Elbow Fitting (45°), AN837-4D

Elbow Fitting (90°), AN822-4D

Tee Fitting, AN825-4D

Straight Bulkhead Fitting, AN832-4D

Hydraulic Pump, 637715
Has been relocated behind the co-pilot's seat for c.g. reasons.



Return Line

Low Pressure Switch PS 550

Nipple Fitting AN816-4D

High Pressure Switch PS 1000

Tee Fitting 2611- 4 x 2 x 2 (2 pcs)

**Note:**
**Installations aft of the aft spar and forward of the main spar installed in chapter 16. This is a schematic only. Refer to following pages for exact routing.**



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# REVISION LIST

# CHAPTER 4: FUEL SYSTEMS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 4-1 through 4-3 | 0/02-15-02 | None | Current Revision is Correct |
| 4-4 | 1/09-18-02 | R&R | Text Correction |
| 4-5 | TBA | R&R | Text and fig. 4:C:1 Correction |
| 4-6 | 0/02-15-02 | None | Current Revision is Correct |
| 4-7 | 01/09-18-02 | R&R | Text Correction |
| 4-8 | 0/02-15-02 | None | Current Revision is Correct |
| 4-8 | 2/06-30-04 | R&R | Added arrow for air flow direction. |
| 4-9 | 2/06-30-04 | R&R | Added photo. |
| 4-10 | 2/06-30-04 | R&R | Added photo. |
| 4-1 | 3/12-15-04 | R&R | New table of contents with page numbers and part nbr. change. |
| 4-4 | 3/12-15-04 | R&R | Part nbr. change. |
| 4-11 | 3/12-15-04 | R&R | Changed fuel pump fittings. |
| 4-1, 4-4 | 5/05-15-07 | R&R | Part number change only. |
| 4-1, 4-2, 4-4, 4-10, 4-11 | 6/08-11-07 | R&R | Part numbers changed. |
| 4-8, 4-11 | 6/08-11-07 | R&R | Change to instructions. |


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# Chapter 4: Fuel Systems

Contents



## 1. INTRODUCTION

Starting at the filter cap, fuel finds its way through various drain holes through the wing tank. Fuel continues through one of the two check valves also called slosh doors. The slosh doors keep the fuel in the inboard bay during uncoordinated flight. Fuel continues through the fuel pickup and through the center wing section to the fuel selector valve. Next stop is the fuel pump, then the gascolator before it reaches the engine.

If you're using a Continental you must install a fuel return system as some fuel is returned back to the wing tanks.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **GENERAL** | | | | |
| 1) | SPRL-M-L | 2 | Fuel Caps, Metal | **Yes |
| 2) | SPRL-KCI | 2 | Fuel Caps, Plastic | |
| **FUEL SELECTOR** | | | | |
| 1) | 4021 | 1 | Fuel Selector Valve Mounting Flange | |
| 2) | 4808 | 1 | Fuel Selector, Continental | **Yes |
| 3) | EFS 25-2-2B-M | 1 | Fuel Selector, Lycoming | **Yes |
| 4) | K3000-3 | 4 | Nutplates | |
| 5) | MSC-34 | 8 | Rivet, Cherry | |
| 6) | 101-0065 ~~3K146~~ | 4 | Sockethead Screw | |
| 7) | AN525-832R10 | 4 | Washerhead Screw | |
| **FUEL SUPPLY LINES** | | | | |
| 1) | 4805 | 2 | Flexible Hose # 8 x 9.25' | |
| 2) | 4807 | | Pre-made line | **Yes |
| 3) | 4809 | | Pre-made line | **Yes |
| 4) | 165-0000/165-0001/165-0002 ~~85000K83/84/85~~ | 10' | Antichafing Material for Fuel Lines | |
| 5) | AN924-8D | 2 | Check Nut | |
| 6) | MS21919-DG 8 | 4 | Clamps | |
| 7) | CS125-1032-12GCR | 4 | Click Bond Studs 3/16" | |
| 8) | AN818-8D | 8 | Coupling | |
| 9) | FU7-2 | 2 | Fitting, with Screen | |
| 10) | AN833-8D | 2 | Fitting, Elbow (Bulkhead) | |
| 11) | AN832-8D | 2 | Fitting, Union (Bulkhead) | |
| 12) | 5052-.500 x .035 | 12' | 1/2" Aluminum Tubing for Fuel Lines | |
| 13) | AN365-1032A | 4 | Nut, Nylock | |
| 14) | AN819-8D | 8 | Sleeve | |
| 15) | AN960-10L | 4 | Washer, Flat (thin) | |

**Note:**

**Optional Parts available through :**

**(*) Lancair Avionics**

**(**) Kit Components, Inc.**




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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **FUEL VENT LINE CHECK VALVE** | | | | |
| 1) | 545 | 2 | Check Valve | |
| **FUEL RETURN LINES** | | | | |
| 1) | 4806 | 2 | Flexible Hose # 4 x 12’ | |
| 2) | 5052-.250 x .035 | 18’ | 1/4” Aluminum Line | |
| 3) | 85000K83/84/85 | 10’ | Antichafing Material for Fuel Lines | |
| 4) | MS21919-DG 4 | 6 | Clamps | |
| 5) | CS125-1032-12GCR | 6 | Click Bond Studs 3/16” | |
| 6) | AN818-4D | 8 | Coupling | |
| 7) | AN 822-4D | 2 | Fitting, Elbow | |
| 8) | AN833-4D | 2 | Fitting, Elbow (Bulkhead) | |
| 9) | AN832-4D | 2 | Fitting, Union (Bulkhead) | |
| 10) | AN924-4D | 4 | Nut, Check | |
| 11) | AN365-1032A | 6 | Nut, Nylock | |
| 12) | AN819-4D | 8 | Sleeve | |
| 13) | AN960-10L | 6 | Washer, Flat (thin) | |
| **FUEL PROBE (optional)** | | | | |
| 1) | P-300-C-8 | 1 | Fuel Probe (EI) | *Yes |
| 2) | 3010010 | 8’ | Vision Microsystems | *Yes |
| **FUEL boost PUMP kit (optional, PURCHASE ALL AS ONE WITH PUMP KIT)** | | | | |
| 1) | 5456-00-1 | 1 | For 12V Lycoming 540 | **Yes |
| 2) | 5455-00-1 | 1 | For 12V Continental 550 | **Yes |
| 3) | 145-0008 ~~5416K32~~ | 1 | Clamp | **Yes |
| 4) | 229-4-1 | 1 | Fitting, Elbow | **Yes |
| 5) | C5365 x 8 | 2 | Fitting, 45 Degree | **Yes |
| 7) | 3814-6 | 1 | Hose | **Yes |
| 6) | 22-4 | 1 | Splice | **Yes |
| **FUEL DRAIN COVERS** | | | | |
| 1) | F-391-18 | 4 | Fuel Drain Valve | |
| 2) | 4271 | 4 | Fuel Drain Fairing | |

**Note:**

**Optional Parts available through :**

**(*) Lancair Avionics**

**(**) Kit Components, Inc.**



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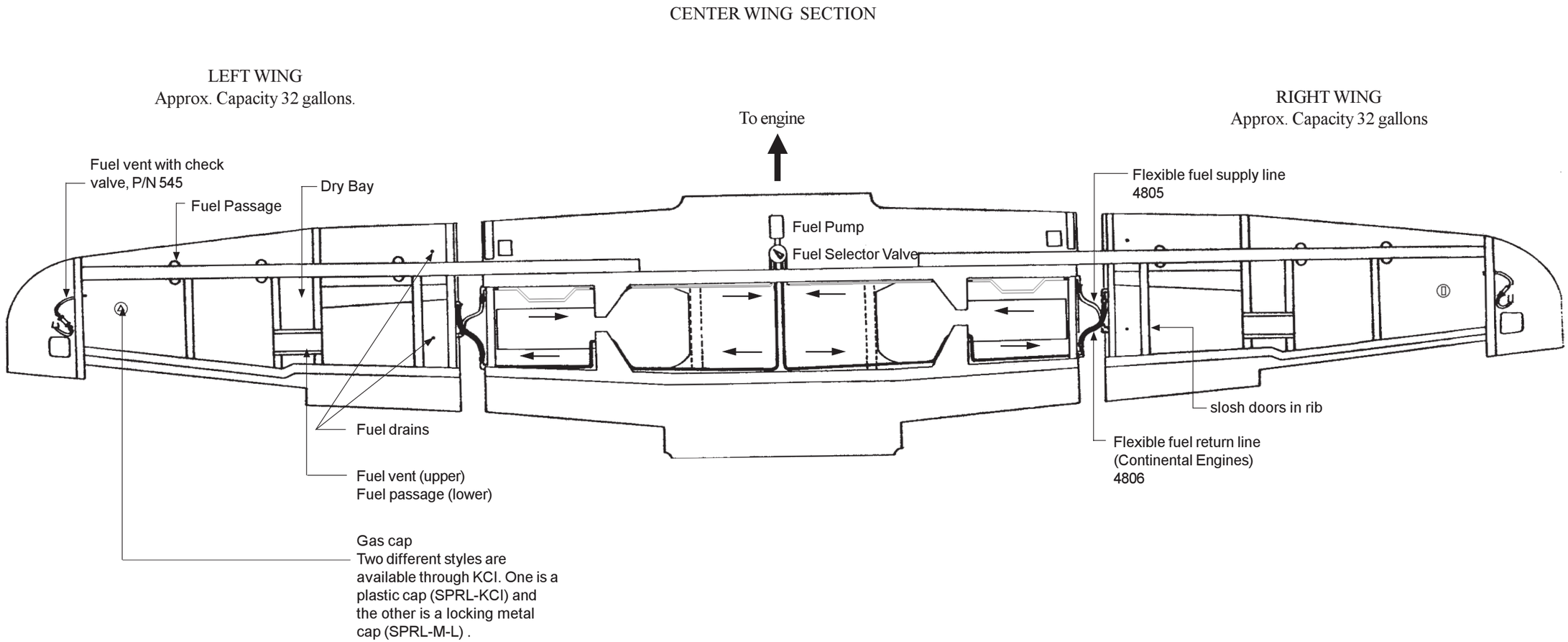
# 3. CONSTRUCTION PROCEDURES

## A. Legacy Fuel System - General Overview

**Legacy Fuel System**
**Fig. 4:A:1**





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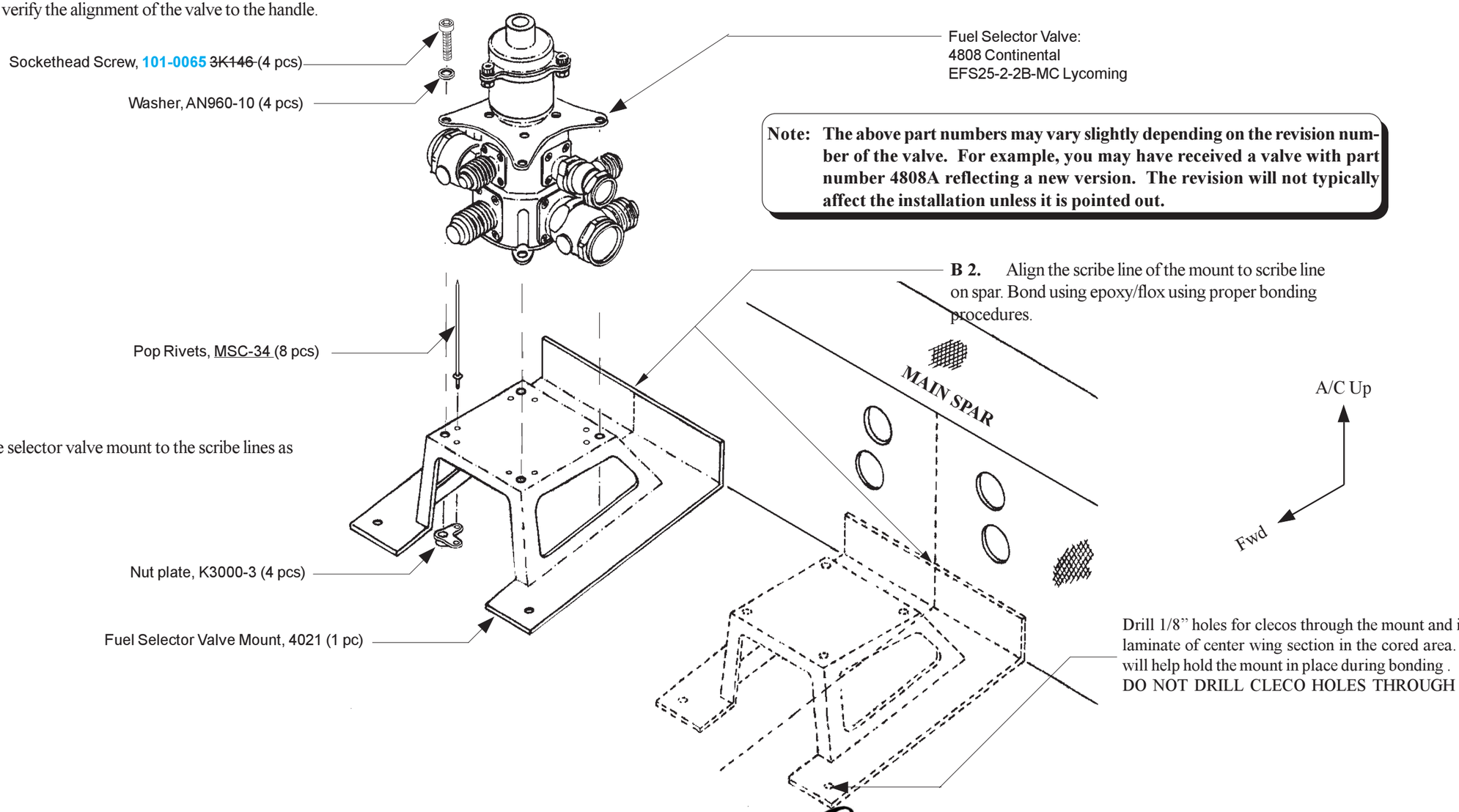
## B. Fuel Selector Valve (Optional)

**Fuel Selector Mount**
**Fig. 4:B:1**

The fuel selector valve mounts just in front of the main spar along the fuselage center line. Note that the mount is slightly angled to make the valve parallel to the handle that mounts in the center console. Provided you build everything precise the fuel selector and the fuel selector valve hande will align. We suggest that you also read section 14:G:1 to get a better idea of how the parts align. Prior to permanently mounting the valve it is a good idea to fit the centger console to verify the alignment of the valve to the handle.




**Note: The above part numbers may vary slightly depending on the revision number of the valve. For example, you may have received a valve with part number 4808A reflecting a new version. The revision will not typically affect the installation unless it is pointed out.**

**B 1.** Trim the selector valve mount to the scribe lines as shown.

**B 2.** Align the scribe line of the mount to scribe line on spar. Bond using epoxy/flox using proper bonding procedures.

Drill 1/8" holes for clecos through the mount and inner laminate of center wing section in the cored area. This will help hold the mount in place during bonding .
DO NOT DRILL CLECO HOLES THROUGH SPAR.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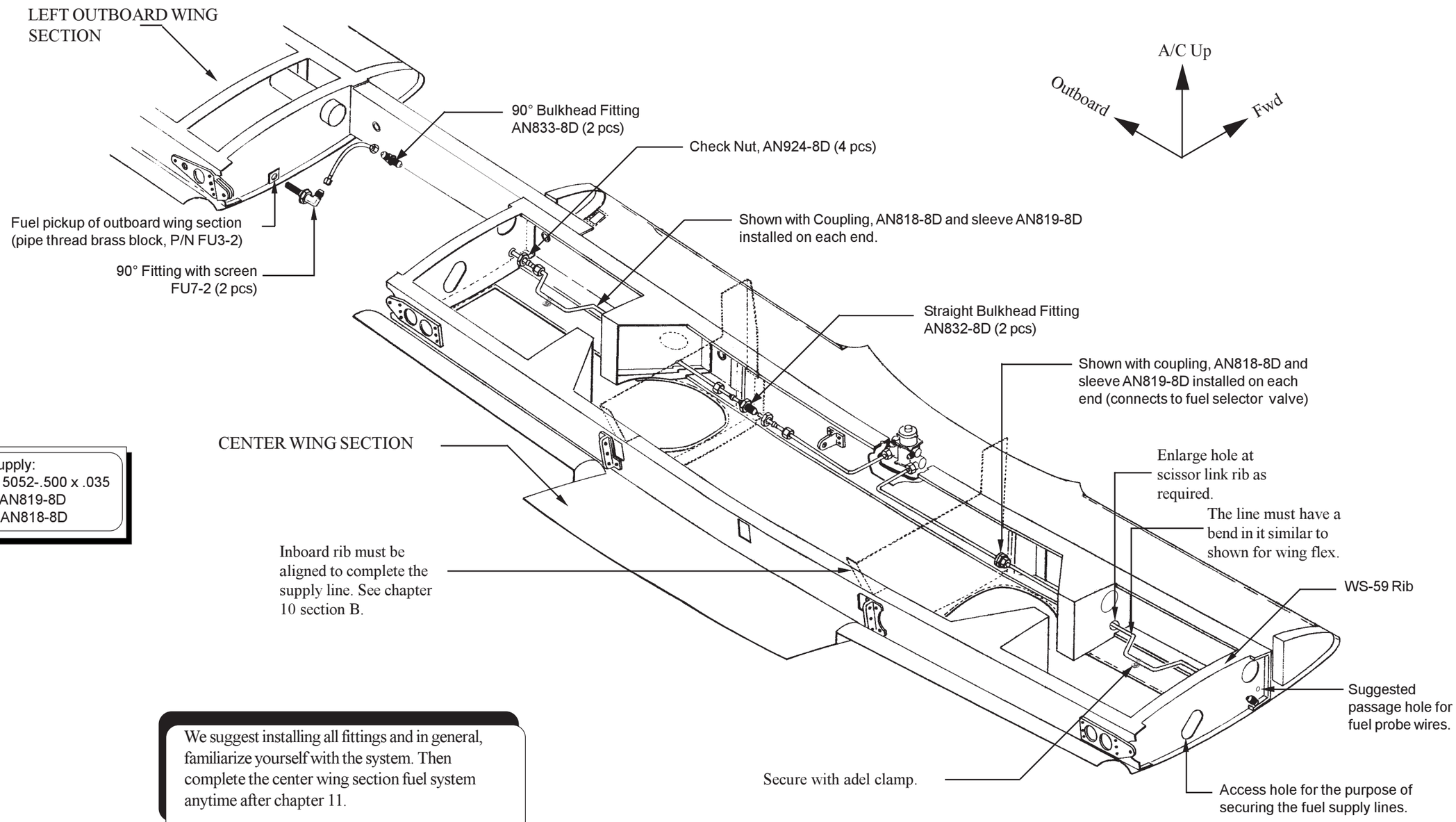
## C. Fuel Supply Lines

**Fuel Supply Lines for Center WingSection**
**(Exploded View)**
**Fig. 4:C:1**




All fuel supply:
lines 5052-.500 x .035
sleeves AN819-8D
nuts AN818-8D

We suggest installing all fittings and in general, familiarize yourself with the system. Then complete the center wing section fuel system anytime after chapter 11.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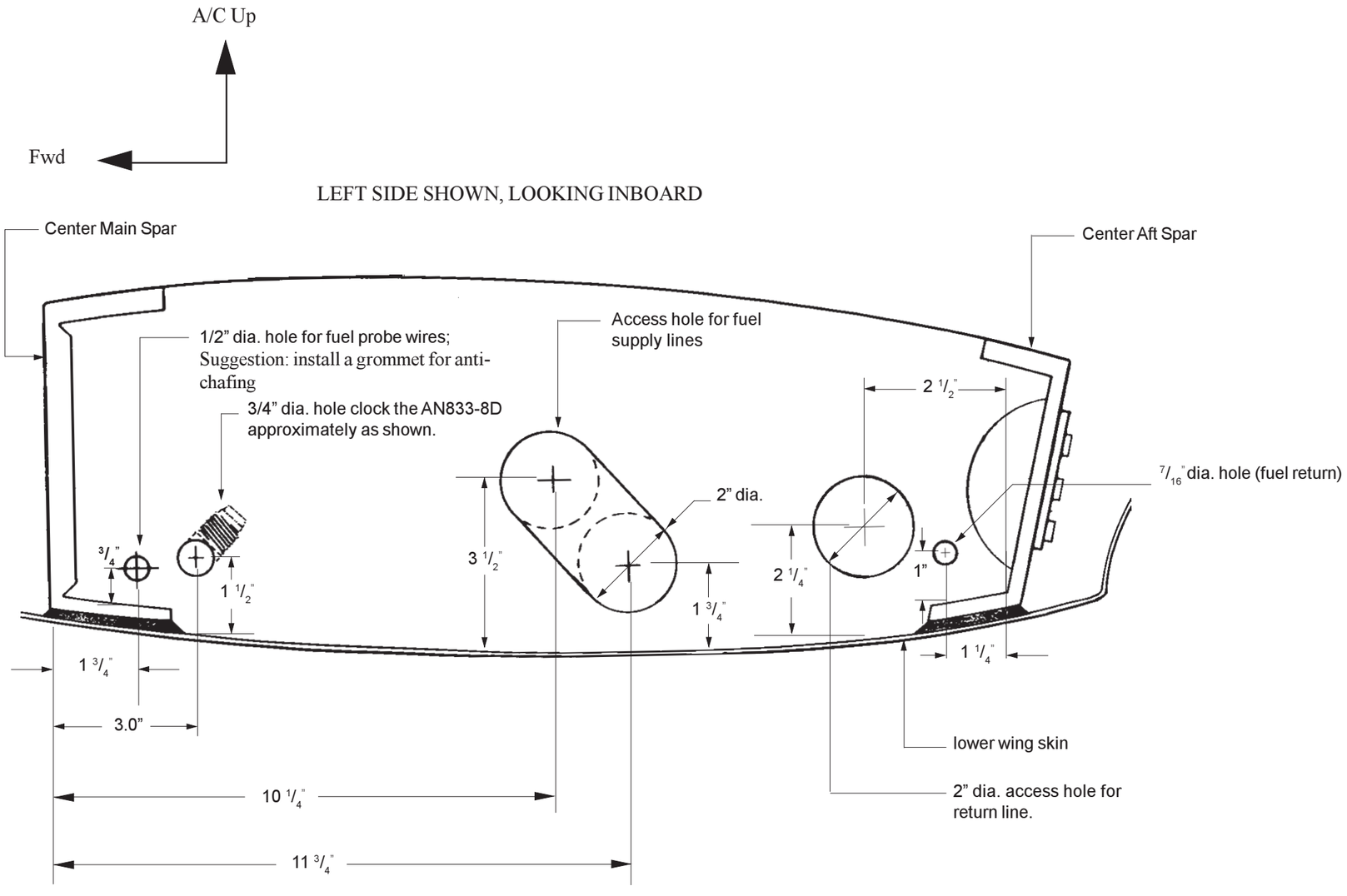
**Fuel System Related Holes of WS 61.5 Rib**
**Fig. 4:C:2**





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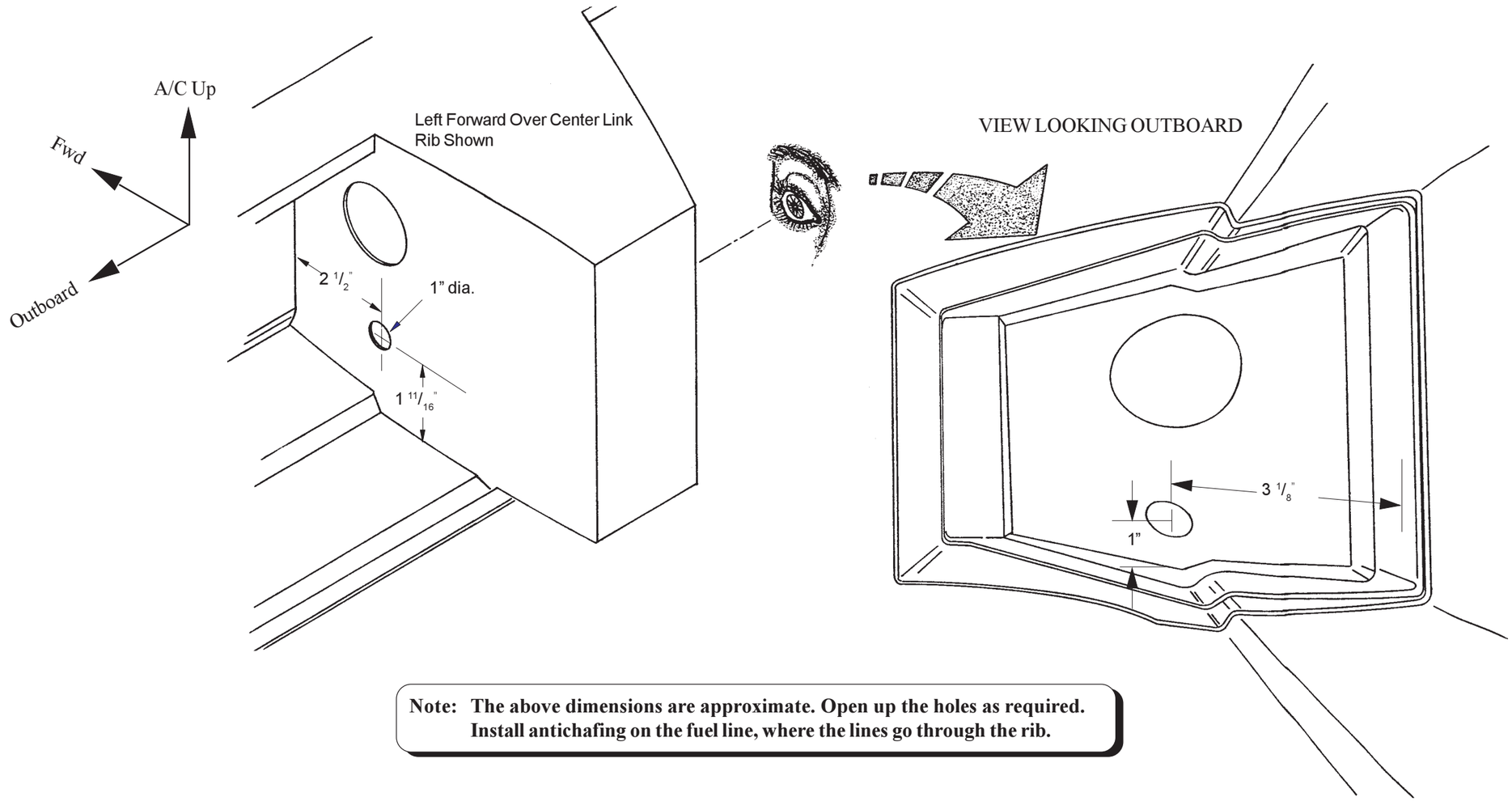
**Fuel Supply Lines through Over Center Link Rib**
**Fig . 4:C:3**




**Note: The above dimensions are approximate. Open up the holes as required. Install antichafing on the fuel line, where the lines go through the rib.**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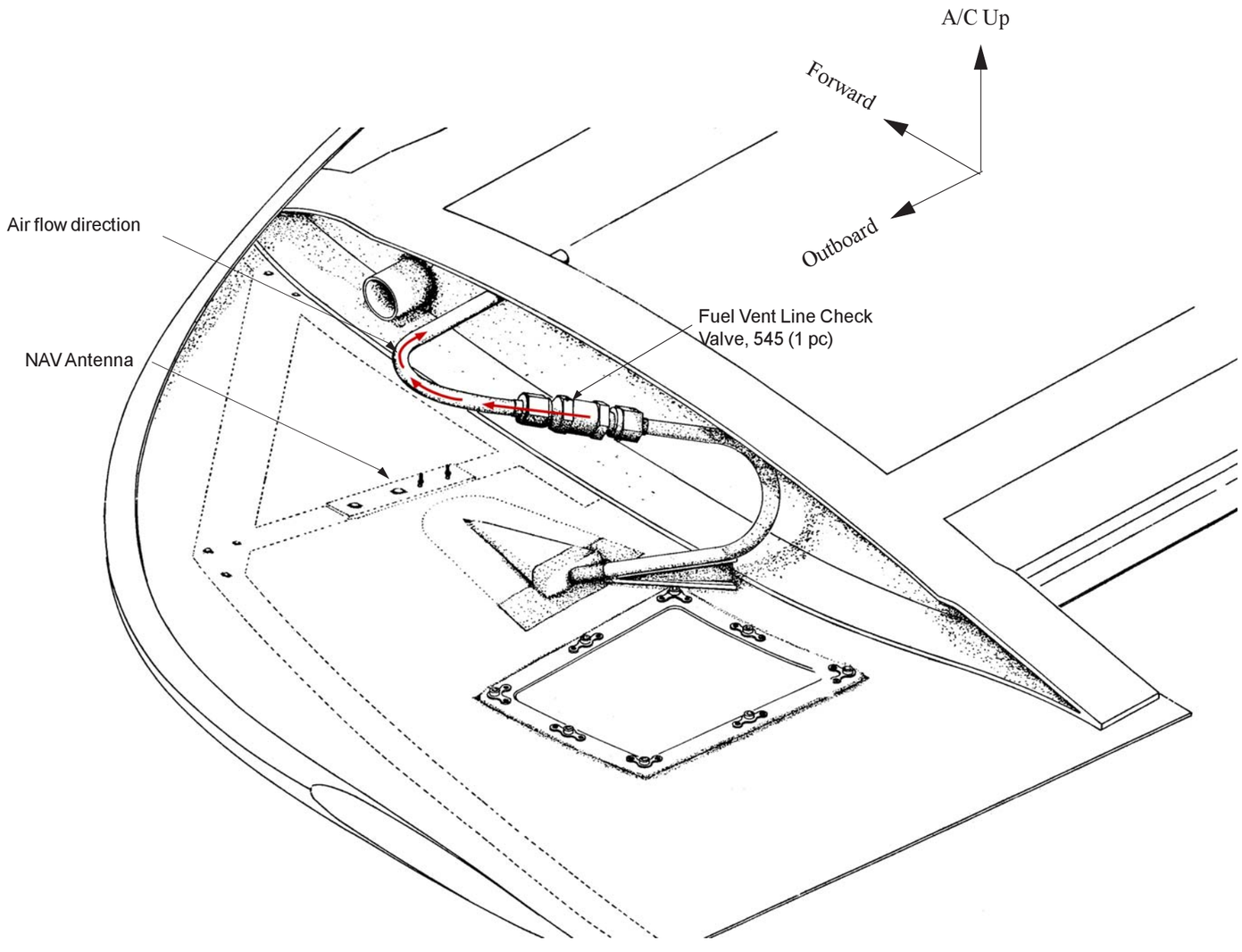
## D. Fuel Vent Line Check Valve

**D 1.** Install the fuel vent line check valve as shown. The red arrow must point towards the tank, which the air flows into.

**Installing Fuel Vent Line Check Valve**
**Fig. 4:D:1**





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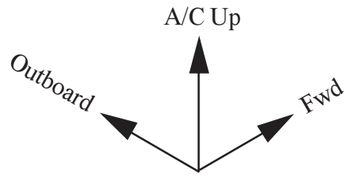
## E. Fuel Return Lines

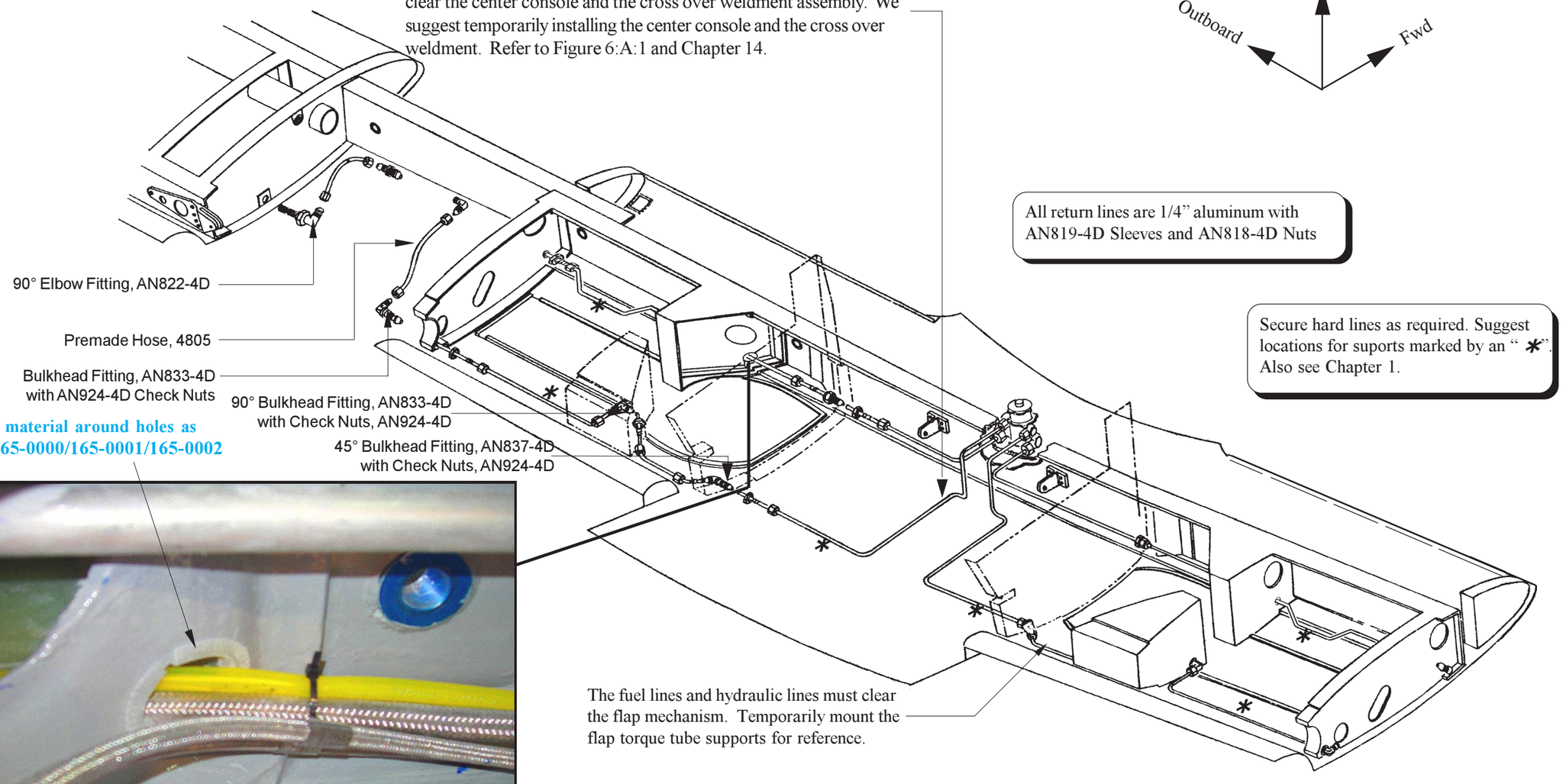
**Return Lines**
**Fig. 4:E:1**

Refer to this figure for the approximate routing of lines. The lines must clear the center console and the cross over weldment assembly. We suggest temporarily installing the center console and the cross over weldment. Refer to Figure 6:A:1 and Chapter 14.

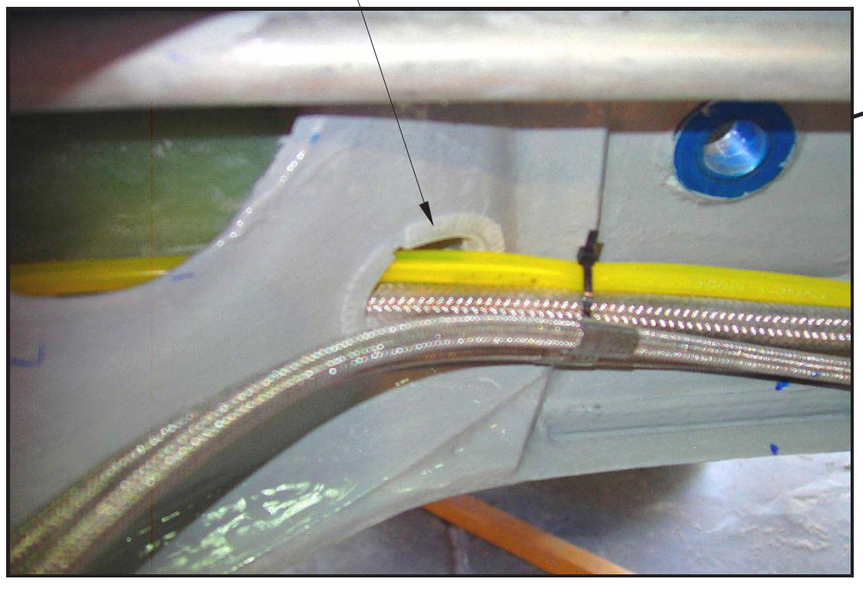



All return lines are 1/4" aluminum with AN819-4D Sleeves and AN818-4D Nuts

Secure hard lines as required. Suggest locations for suports marked by an " ✱". Also see Chapter 1.




**Use anti-chaffing material around holes as required. Part #165-0000/165-0001/165-0002**



**Note: Aft spar not shown for clarity.**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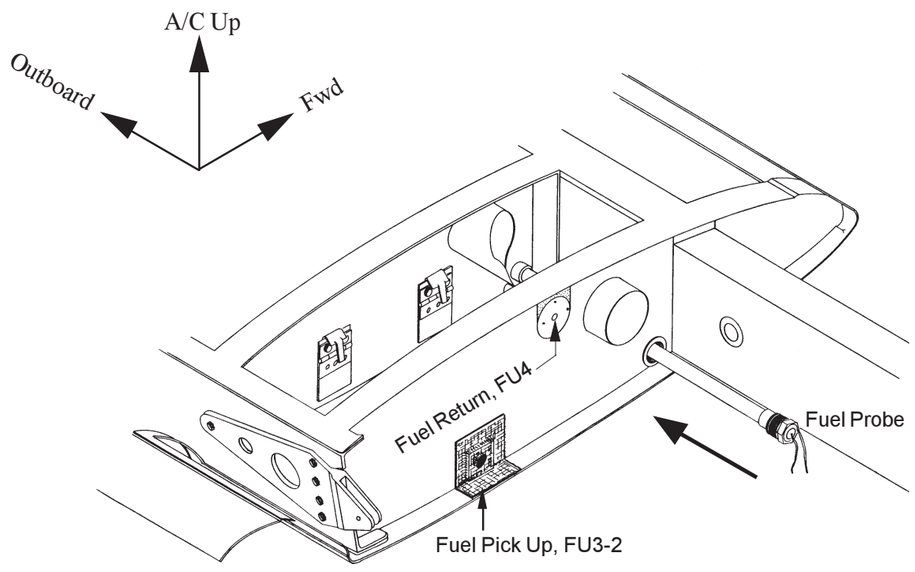
## F. Fuel Probe (Optional)

**F 1.** Lancair offers two options for the fuel probes. One is for Vision Micro Systems (VMS) and the other is from Electronics International (EI). The installation is identical. Both systems are available through Lancair Avionics.

> Warning: Apply antiseize on the threads of the aluminum fuel probe mount. Without antiseize the fuel probe will cold weld to the aluminum fuel probe.

**Fuel Probe Installation**
**Fig. 4:F:1**




Fuel Probes VMS P/N: 3050010
Fuel Probes EI P/N: P-300-C-8

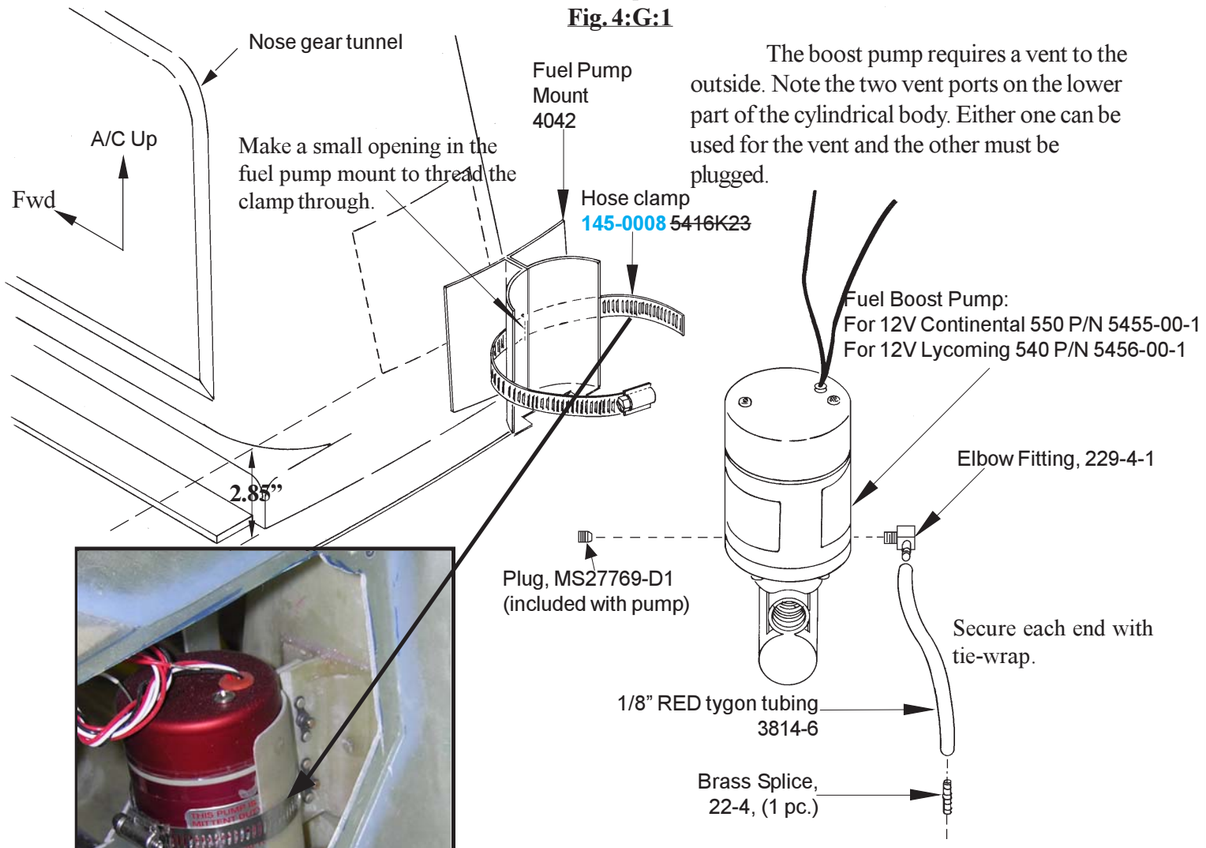
**Note: The correct fuel probe length for the Lancair Legacy fuel tanks is 72".**

## G. Fuel Boost Pump (Optional)

**G 1.** The type of fuel pump used depends on the type of engine installed. The Continental requires a two-stage fuel pump while the Lycoming a single stage. Two- stage means that the pump has a low boost. Refer to the pilot operating handbook for proper use.

**G 2.** The new, longer fuel pump mount needs to be cut from web. Adjust the length of the mount as necessary. The piece holding the fuel pump can be either bonded or screwed to the other section of the mount. Refer to the photograph for current installation method.

**Fuel Boost Pump Installation**
**Fig. 4:G:1**




Drill through the floor using a #10 drill bit.
Pot the piece in place using epoxy/flox.

Bond the fuel pump mount to the nose gear tunnel using epoxy/flox.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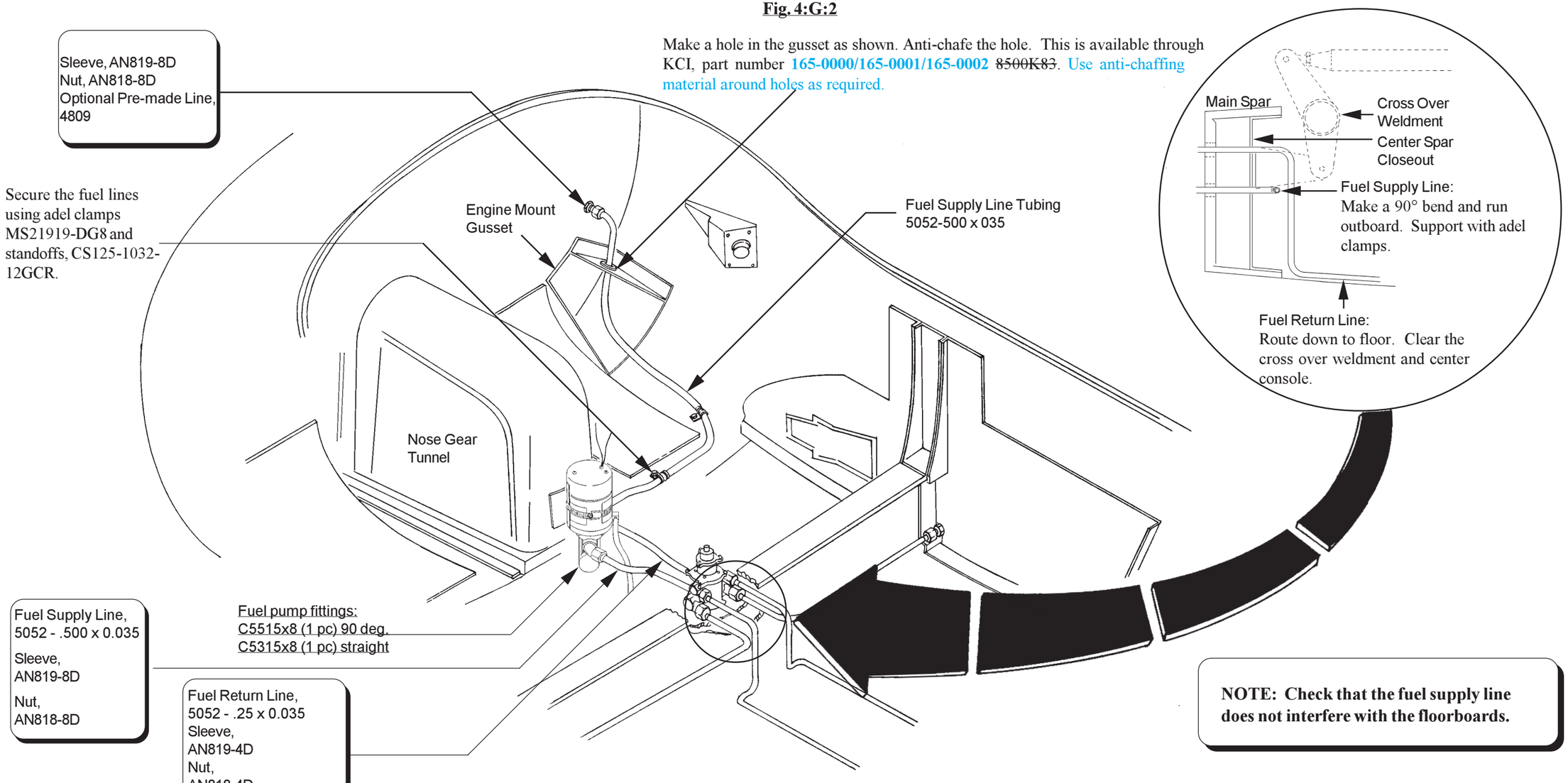
Refer to Blueprint # 4862 for the location of the fuel supply and fuel return fittings in firewall. Fuel return is not needed with the Lycoming installations. This figure completes the fuel lines installation up to the firewall.

**Fuel Line Installation**
**Fig. 4:G:2**




**NOTE: Check that the fuel supply line does not interfere with the floorboards.**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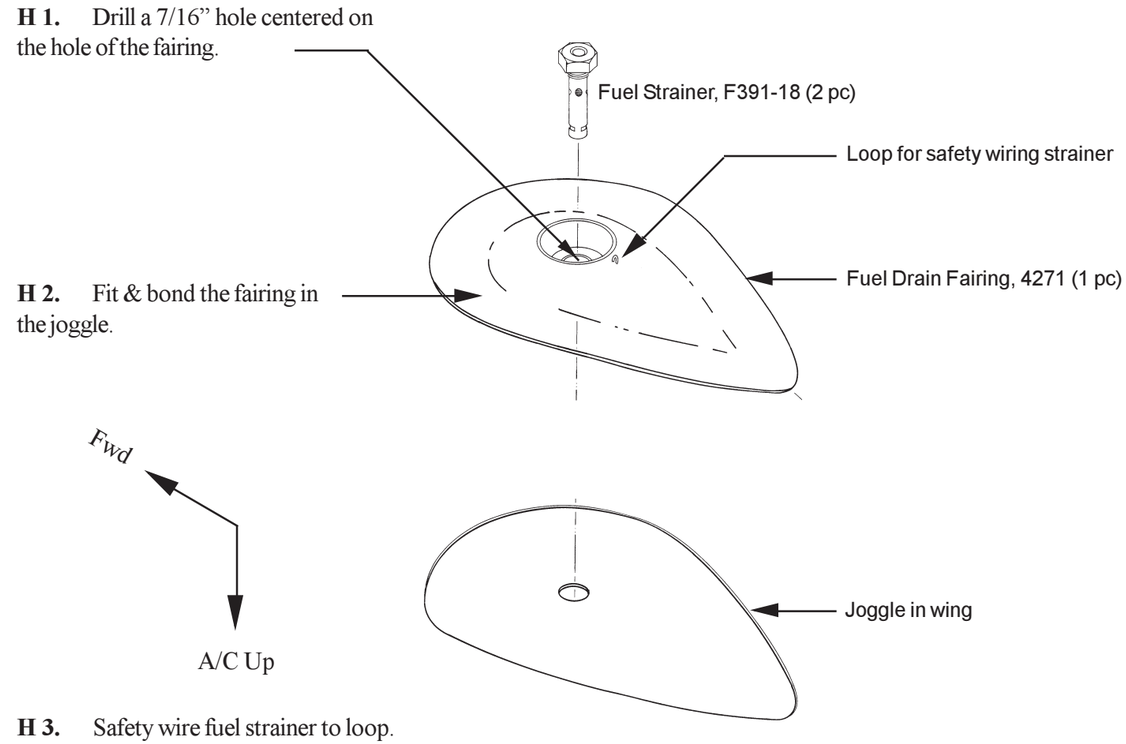
## H. Fuel Drain Covers

**Fuel Drain Fairing**
**Fig. 4:H:1**




**H 3.** Safety wire fuel strainer to loop.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# REVISION LIST

# CHAPTER 5: OUTBOARD WING SEC. INSTALLATION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 5-1through 5-2 | 0/02-15-02 | None | Current Revision is Correct |
| 5-1 | 3/12-15-04 | R&R | New table of contents with page numbers. |
| 5-2 | 4/09-30-06 | R&R | Added torque requirements for wing bolt. Corrected part numbers. |


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# Chapter 5: Outboard Wing Section Installation

Contents



## 1. INTRODUCTION

Throughout the construction process the outboard wing sections are installed and then taken off again. It is not necessary to install all hardware such as washers and nuts everytime you install the wings for fitting purposes only. Obviously all hardware must be installed prior to flight.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| 1) | 4510 | 4 | Bolt | |
| 2) | 4511 | 4 | Locknut | |
| 3) | 4512 | 4 | Special Washer | |
| 4) | AN960-12 | 4 | Washer, Flat | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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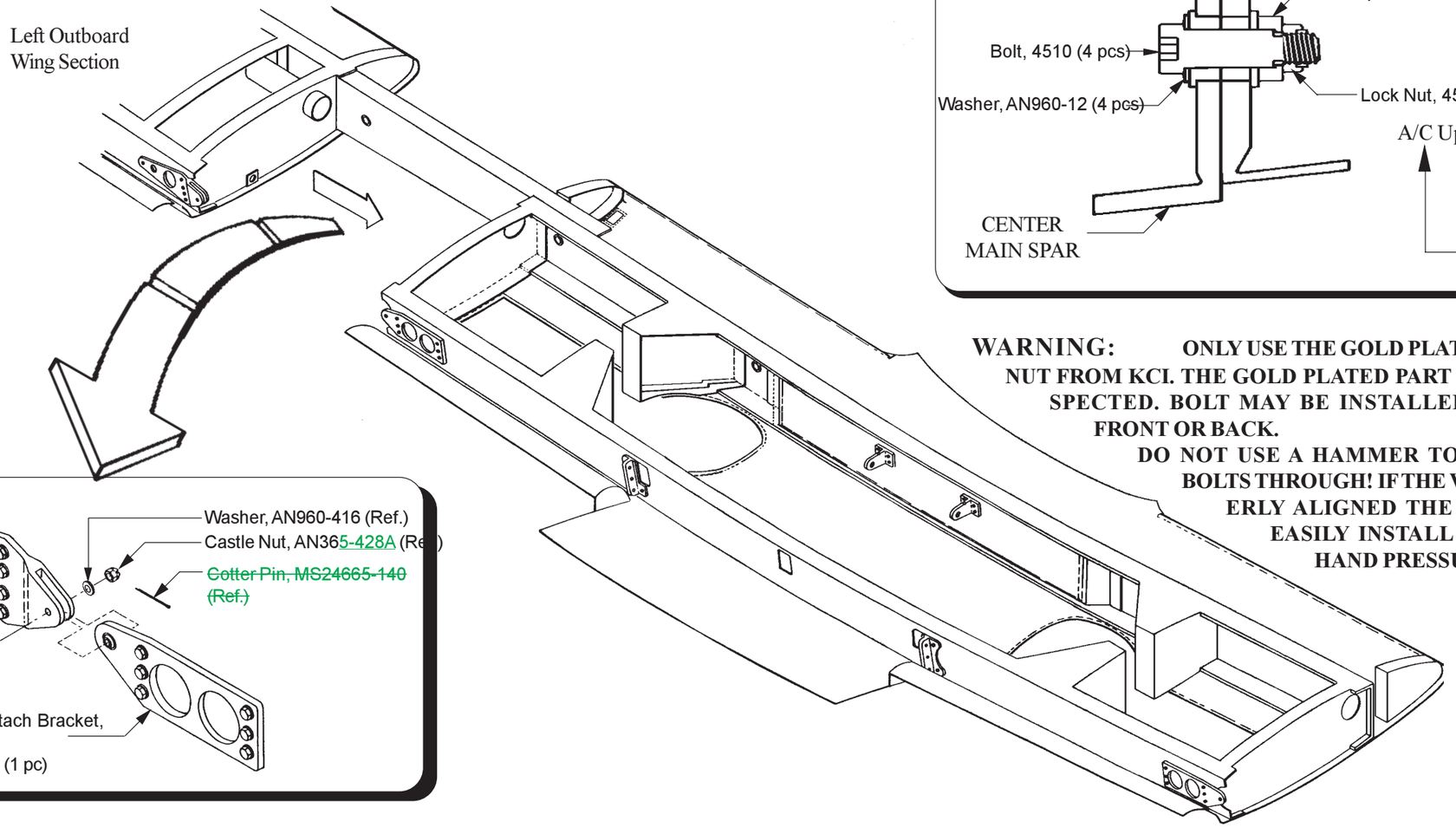
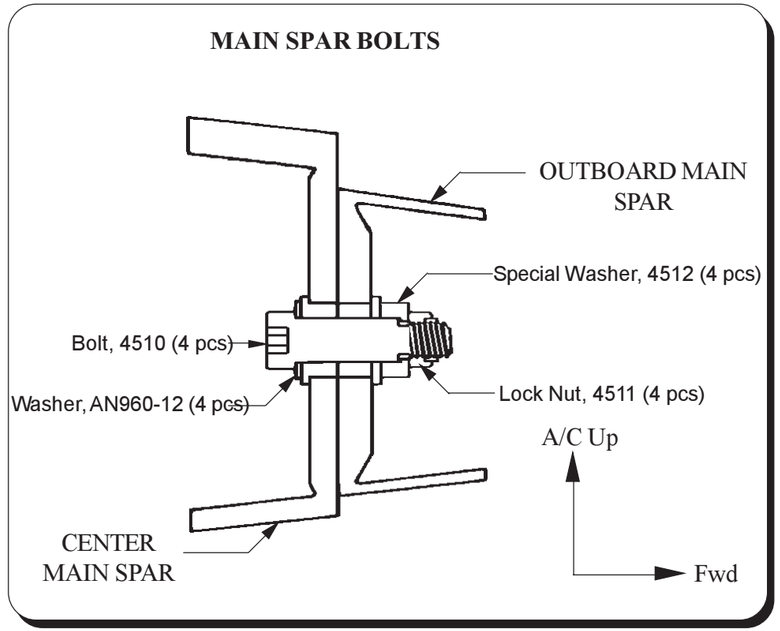
# 3. CONSTRUCTION PROCEDURES

## A. Wing Installation and Removal

Torque the wing bolt to 40ft./lb.

**Wing Installaton**
**Fig. 5:A:1**




**WARNING: ONLY USE THE GOLD PLATED BOLT AND NUT FROM KCI. THE GOLD PLATED PART HAS BEEN INSPECTED. BOLT MAY BE INSTALLED FROM THE FRONT OR BACK.**

**DO NOT USE A HAMMER TO POUND THE BOLTS THROUGH! IF THE WING IS PROPERLY ALIGNED THE BOLTS WILL EASILY INSTALL WITH LIGHT HAND PRESSURE.**



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# REVISION LIST

# CHAPTER 6: AILERON CONTROLS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 6-1 | 0/02-15-02 | None | Current Revision is Correct |
| 6-2 | 1/09-18-02 | R&R | Part # Correction |
| 6-3 through 6-5 | 0/02-15-02 | None | Current Revision is Correct |
| 6-6 | 1/09-18-02 | R&R | Part # Correction |
| 6-7 through 6-9 | 0/02-15-02 | None | Current Revision is Correct |
| 6-1 | 2/06-30-04 | R&R | Part number change. |
| 6-3 | 2/06-30-04 | R&R | Part number change and added instruction. |
| 6-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 6-3 | 4/09-30-06 | R&R | Part number change. |
| 6-1, 6-3 | 6/08-10-07 | R&R | Part number changed. |


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# Chapter 6: Aileron Controls

Contents



## 1. INTRODUCTION

This chapter takes you through the installation and alignment of the aileron system. In section C you will counter balance the ailerons. In the Final section of this chapter we explained the proper installation and operation of the trim system.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **CONTROL STICK** | | | | |
| 1) | 4715 | 2 | Control Stick | |
| 2) | 4716 | 1 | Crossover Weldment | |
| 3) | AN4-10A | 2 | Bolt, Drilled Shank | |
| 4) | AN4-22 | 2 | Bolt, Drilled Shank | |
| 5) | AN3-33A | 2 | Bolt, Undrilled Shank | |
| 6) | AN3-6A | 8 | Bolt, Undrilled Shank | |
| 7) | 100-0004 ~~93548A546~~ | 2 | Bolt, Carriage | |
| 8) | CD315-12 | 4 | Bushing, Control Stick | |
| 9) | AN310-4 | 4 | Nut, Castle | |
| 10) | MS35649-2252 | 4 | Nut, Check | |
| 11) | AN365-1032A | 2 | Nut, Nylock | |
| 12) | AN365-428A | 2 | Nut, Nylock | |
| 13) | AN960-416 | 8 | Washer, Flat | |
| 14) | AN960-10 | 8 | Washer, Flat | |
| 15) | AN970-3 | 4 | Washer, Flat | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **AILERON CONTROL RIGGING** | | | | |
| 1) | 4322-01/4320-01 | 1 | Left Aileron (preassembled) | |
| 2) | 4322-02/4320-02 | 1 | Right Aileron (preassembled) | |
| 3) | 4575 | 2 | Preassembled Aileron Actuator Arm | |
| 4) | 4576 | 1 | Preassembled Center Control Tube | |
| 5) | 4577 | 2 | Preassembled Inboard Control Tube | |
| 6) | 4578 | 2 | Preassembled Outboard Control Tube 3/4” | |
| 7) | 4579 | 2 | Preassembled Control Tube (Bellcrank to Aileron) 3/4” | |
| 8) | 4581 | 2 | Aileron Idler Arm | |
| 9) | AL 208-01 | 2 | Aileron Bellcrank | |
| 10) | AN3-10A | 10 | Bolts, Undrilled | |
| 11) | AN4-14A | 2 | Bolts, Undrilled | |
| 12) | AN5-13A | 2 | Bolts, Undrilled | |
| 13) | CD315-12 | 4 | Spacers | |
| 14) | AN365-428A | 4 | Nuts, Nylock | |
| 15) | AN365-524A | 2 | Nuts, Nylock | |
| 16) | AN365-1032A | 10 | Nuts, Nylock | |
| 17) | AN960-10 | 4 | Washer, Flat | |
| 18) | AN960-10L | 10 | Washers, Flat | |
| 19) | AN960-416 | 8 | Washers, Flat | |
| 20) | AN960-516 | 2 | Washer, Flat | |
| **COUNTER BALANCING AILERONS** | | | | |
| 1) | 4585 | A/R | Pre moulded Lead Counterweights | |
| 2) | AN365-1032A | 30 | Nuts, Nylock | |
| 3) | MS24694-S56 | 30 | Screw, Machine | |
| 4) | AN960-10L | 30 | Washer, Flat | |
| **AILERON TRIM SYSTEM** | | | | |
| 1) | T4-5-T5 | 1 | Trim Servo | |


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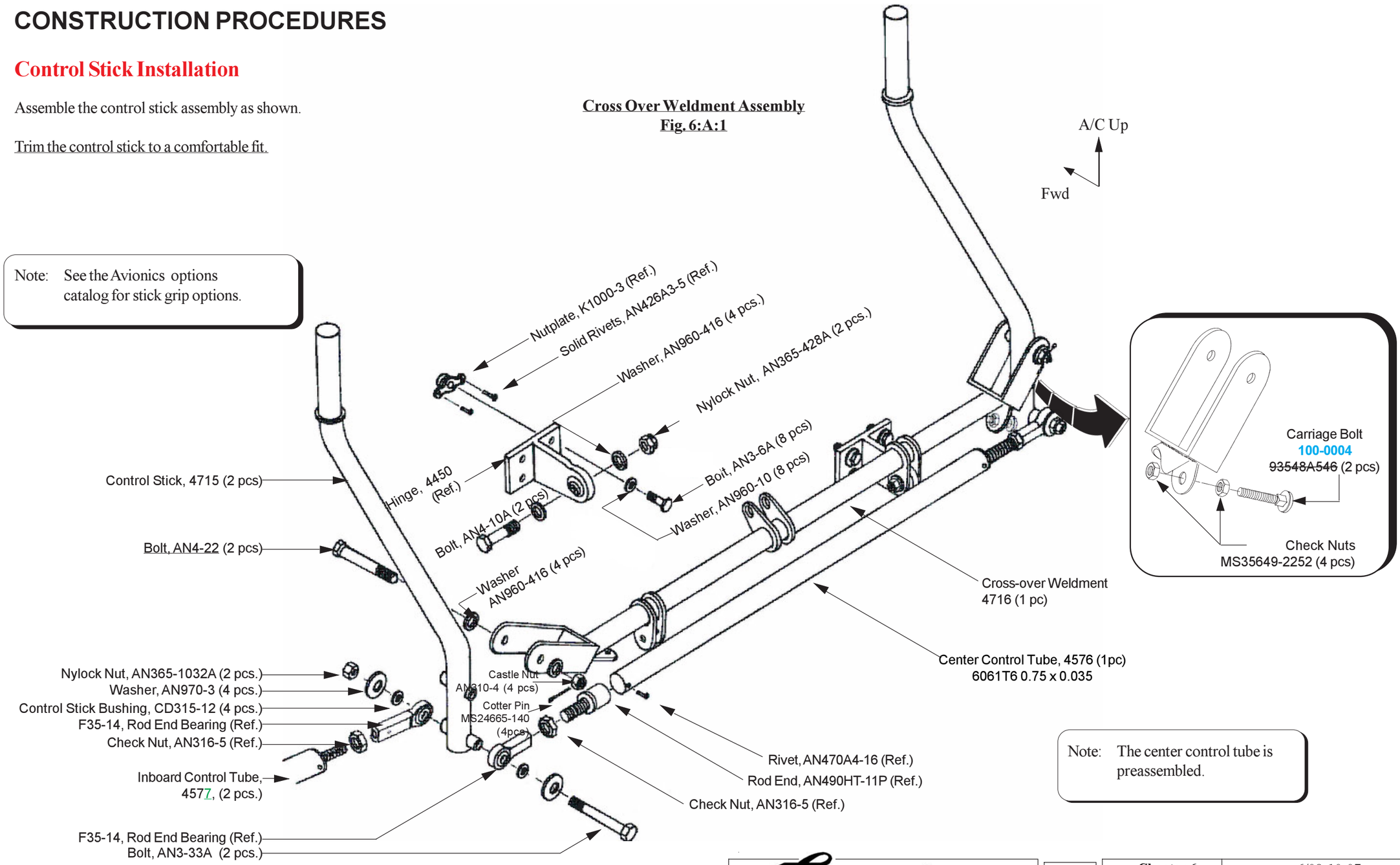
# 3. CONSTRUCTION PROCEDURES

## A. Control Stick Installation

**A 1.** Assemble the control stick assembly as shown.

**A 2.** Trim the control stick to a comfortable fit.

**Cross Over Weldment Assembly**
**Fig. 6:A:1**



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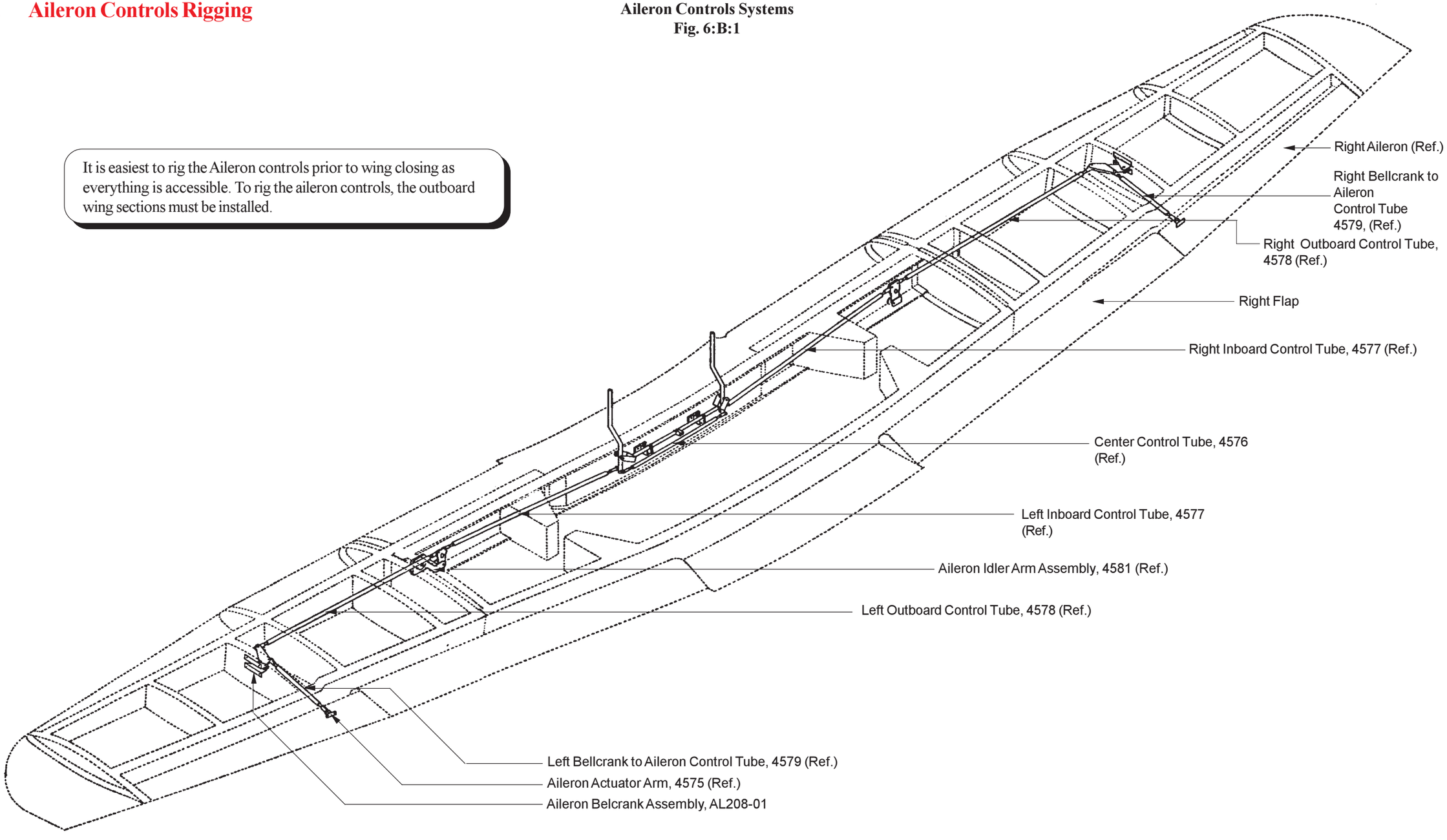
## B. Aileron Controls Rigging

It is easiest to rig the Aileron controls prior to wing closing as everything is accessible. To rig the aileron controls, the outboard wing sections must be installed.

**Aileron Controls Systems**
**Fig. 6:B:1**





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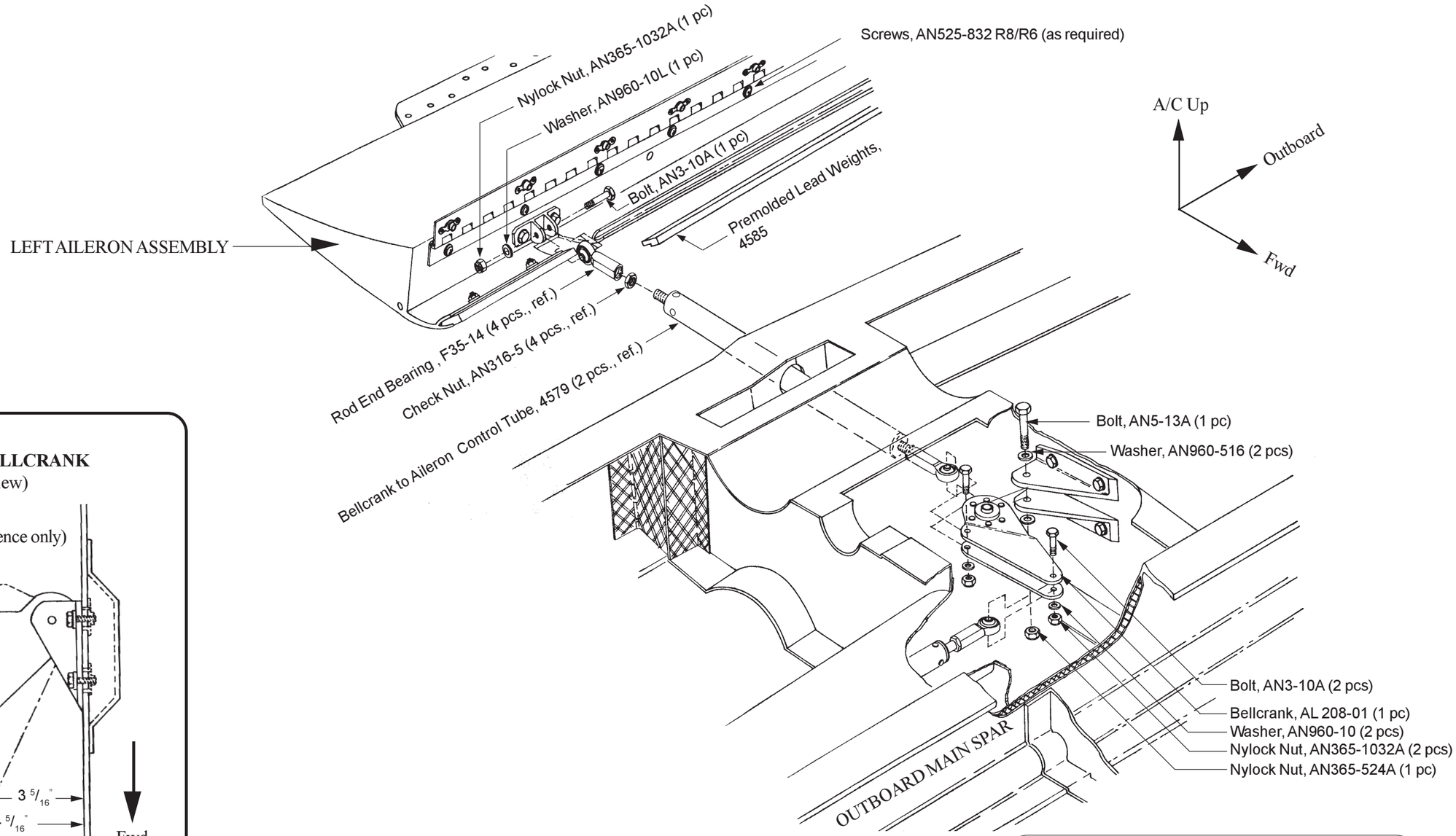
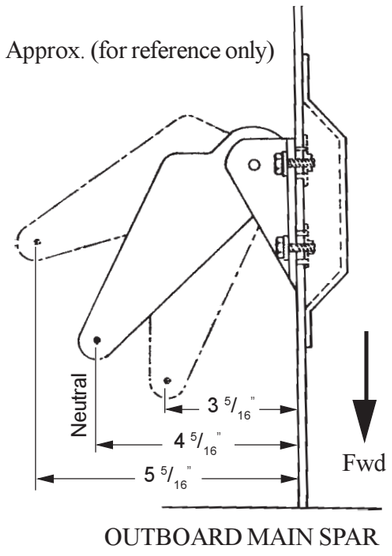
**Aileron Bellcrank Assembly**
**Fig. 6:B:2**




**AILERON BELLCRANK**
(Top View)




**Note: Parts shown & labeled are for left side only.**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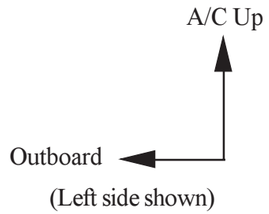
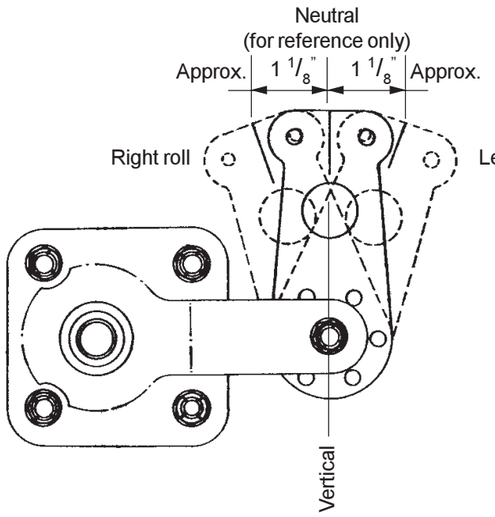
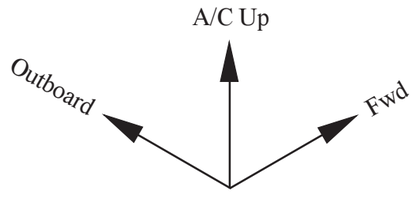
## Aileron Idler Arm
## Fig. 6:B:3

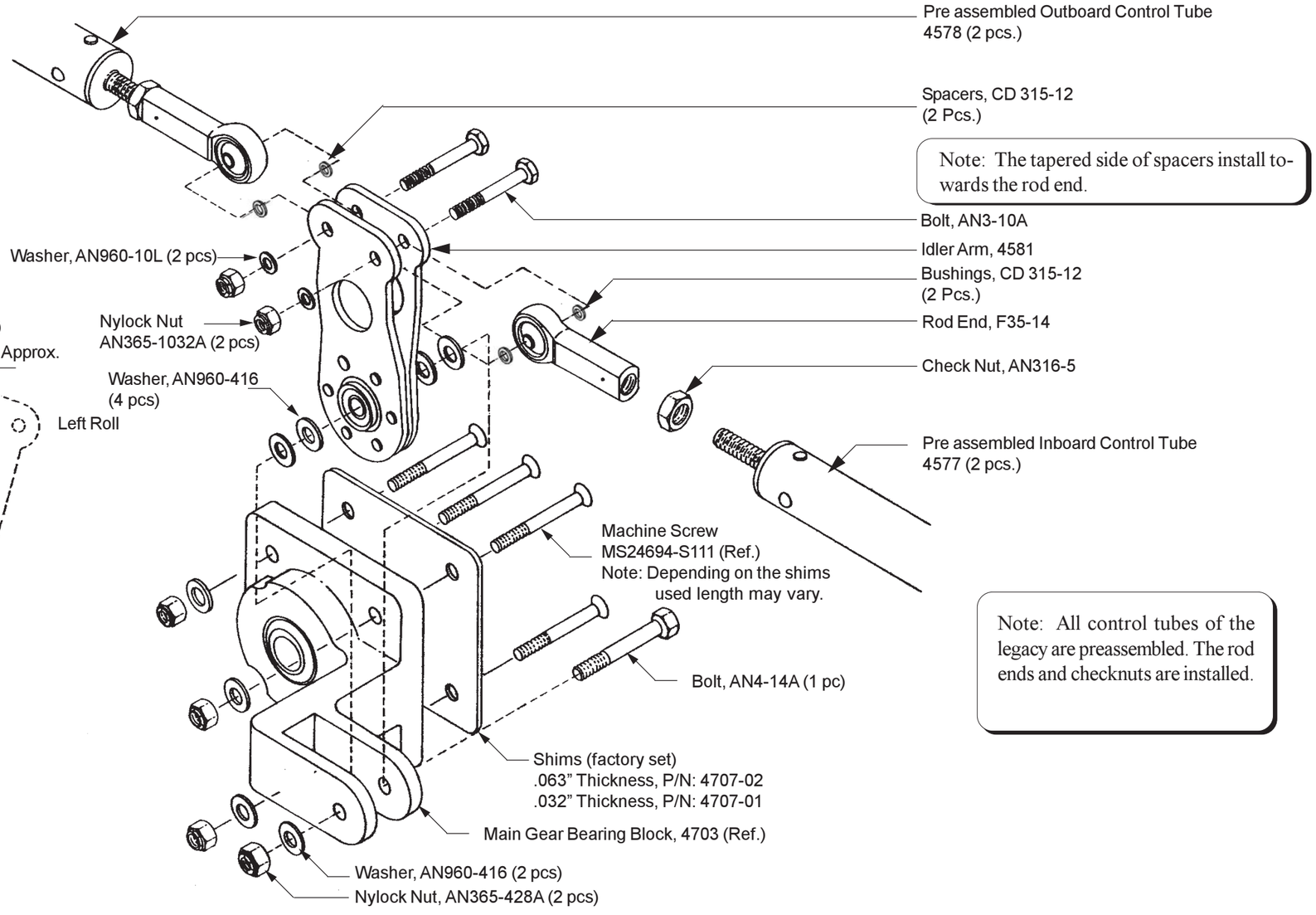
The basis for rigging the aileron control system is to set the stick, idler arm, bellcrank and the aileron to neutral. Then the control tubes are adjusted accordingly.




### Setting Idler Arm Neutral




Note: The tapered side of spacers install towards the rod end.

Note: All control tubes of the legacy are preassembled. The rod ends and checknuts are installed.

**Note: Parts shown & labeled are for left side only.**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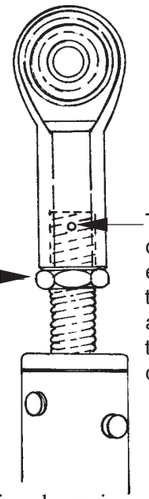
**W A R N I N G**
**(read and understand this)**

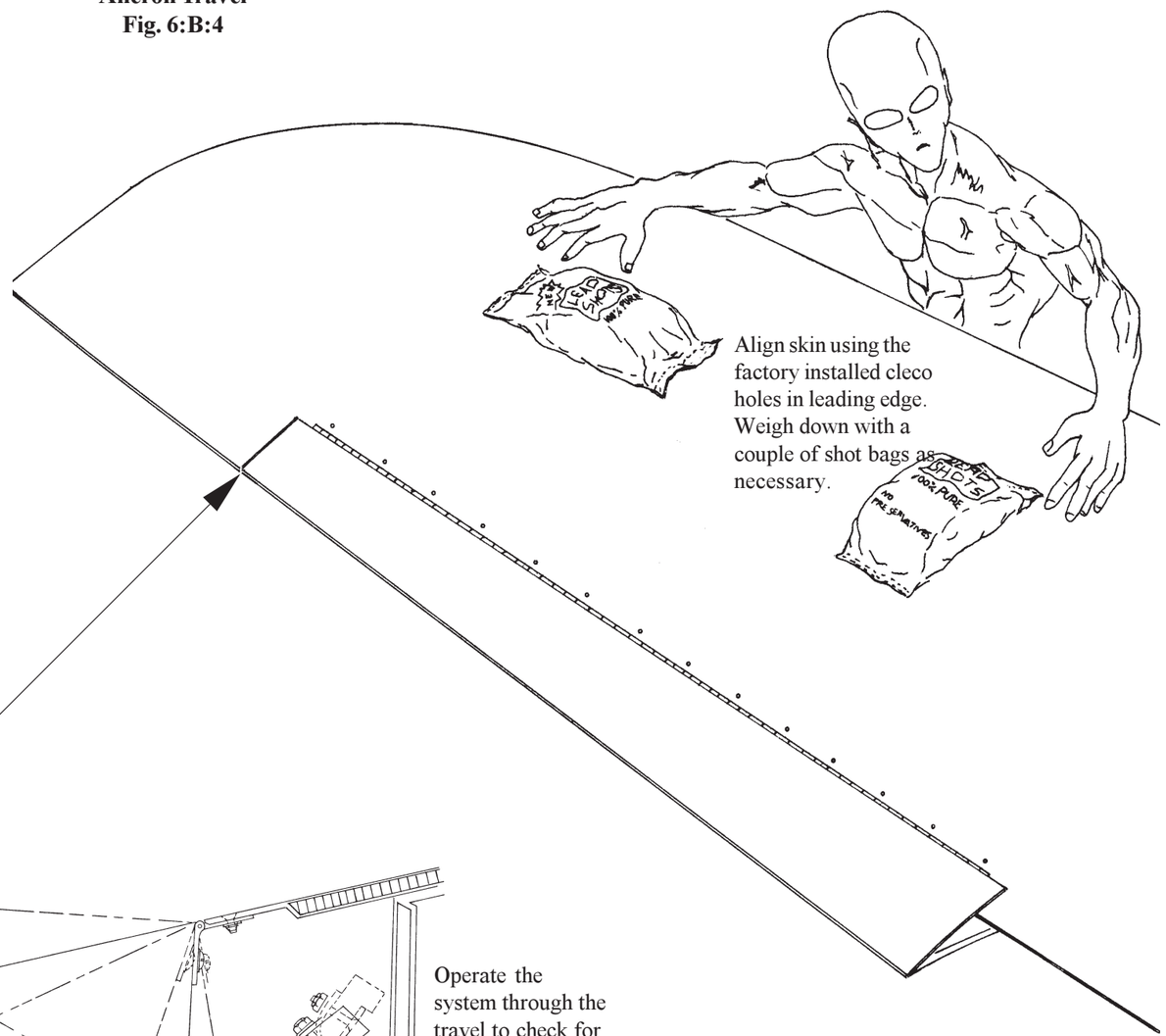


When set, the check nut must be tightened.

The purpose of this hole is to check that the rod is sufficiently engaged. Using a thin wire try to insert through the hole. If you are able to insert the wire into the rod end there are not sufficient threads in rod end.

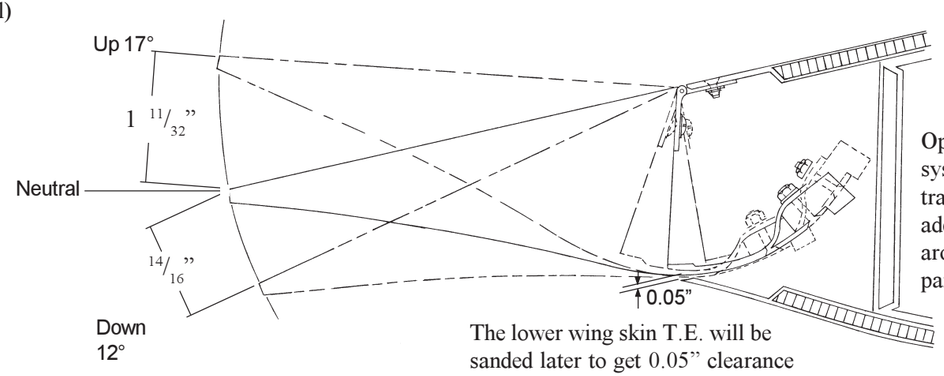
( The situation shown is acceptable)

**Aileron Travel**
**Fig. 6:B:4**




Align skin using the factory installed cleco holes in leading edge. Weigh down with a couple of shot bags as necessary.

The aileron is flush with wing tip in neutral position. (This establishes neutral)




Operate the system through the travel to check for adequate clearance around all moving parts.

The lower wing skin T.E. will be sanded later to get 0.05" clearance between wing skin and aileron.

Note: The dimensions are at the *outboard end* of the aileron.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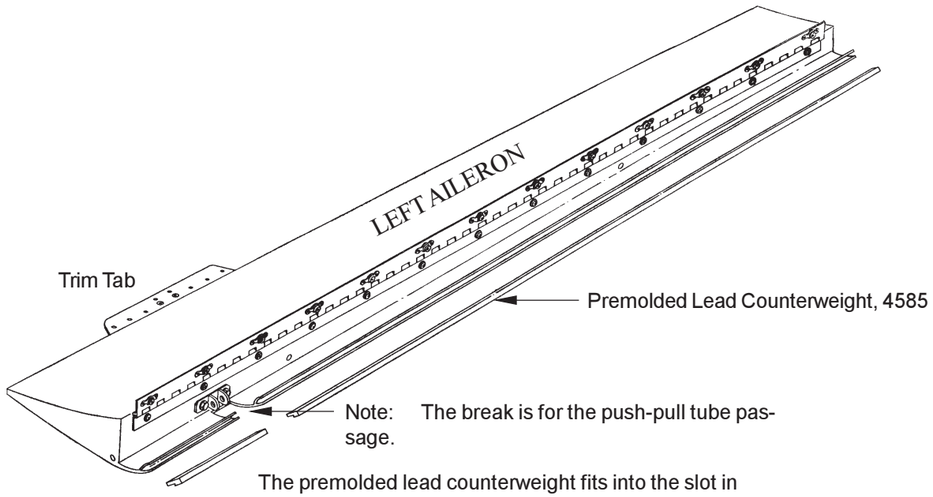
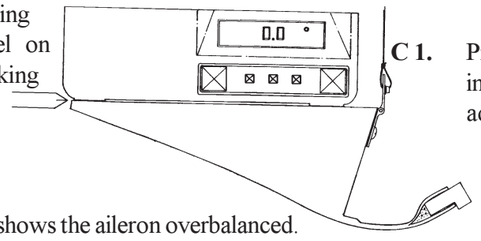
# C. Counterbalancing Ailerons

The Legacy ailerons are 100% mass balanced. Initially install more lead than needed. After paint the excess will be removed for 100% mass balance.

Note: Left side will require slightly more weight than the right side due to the trim system.




Suggestion: Use a pointer as a reference for balancing (You can't leave the level on the aileron when checking the balance.)

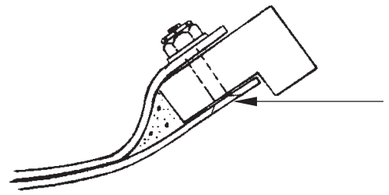



Note: The above figure shows the aileron overbalanced.

**C 1.** Prior to bonding the lead counterweights, insert the weights into the slots and add/remove lead as necessary.

**C 2.** Temporary superglue the lead weights into place. Install aileron on wing and check for proper clearance through the travel range.

**Counter Balancing Ailerons**
**Fig. 6:C:1**

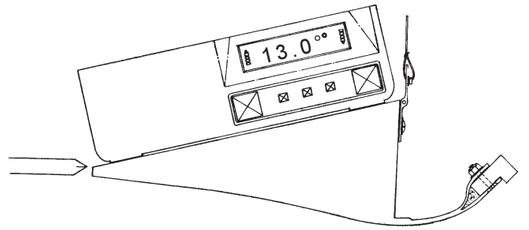


**C 3.** Bond the counterweight in place with epoxy/flox.

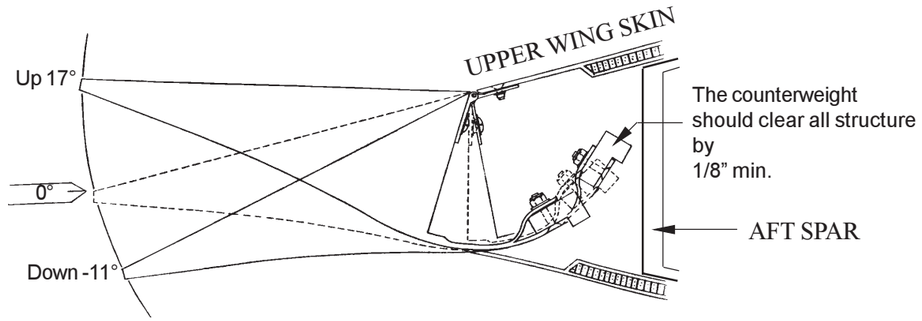
**C 4.** Secure the counter weight every 3" with a countersunk screw (MS24694-S56), washer(AN960-10L) and nylock nut (AN365-1032A).

**C 5.** After paint remove lead as required to achieve 100% balance.

Note: All hardware including the trim system must be installed!




Note: The above figure shows the aileron 100% mass balanced at the wing tip.




**C 6.** Install the aileron and check for proper clearance through the travel range.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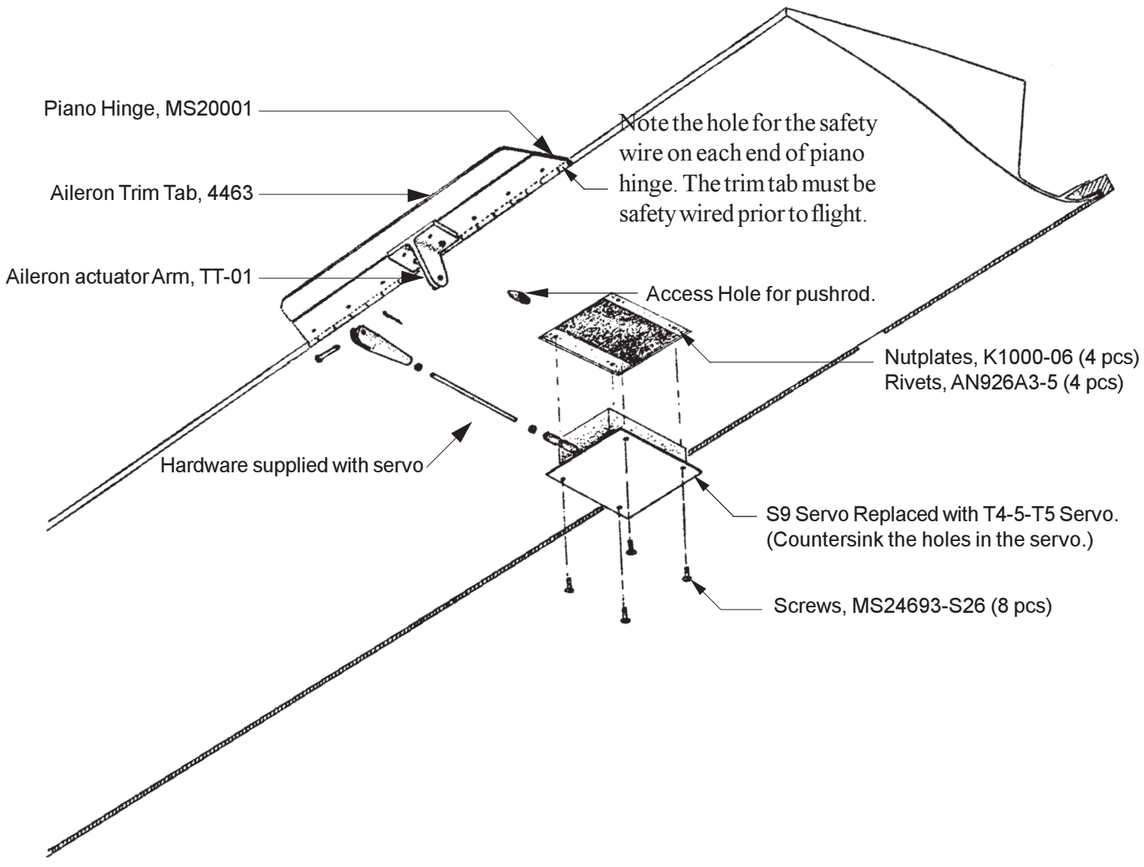
## D. Aileron Trim System

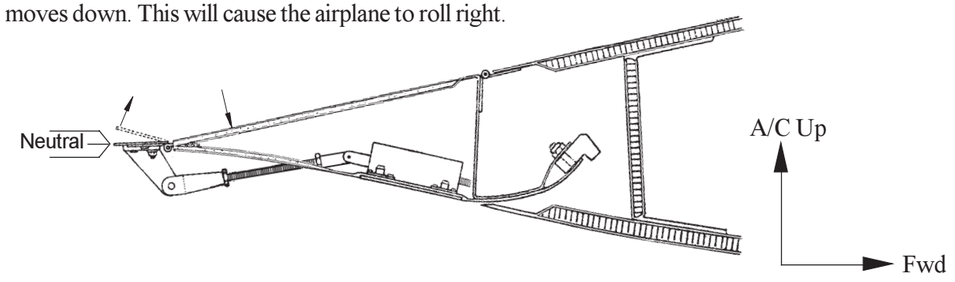
**Aileron Trim System**
**Fig 6:D:1**




### How the Trim System Works

A trim tab deflection results in opposite deflection of control surface.

**Example:** As the trim tab moves up, the (left) aileron moves down. This will cause the airplane to roll right.




### Instructions for Adjusting the Aileron Trim Servo

1. Use a 12V battery to set the servo to center of travel (this is the neutral point).
2. Set the trim tab to neutral position (level).
3. Adjust the clevis accordingly.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# REVISION LIST

# CHAPTER 7: AIRCRAFT ALIGNMENT JIG

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 7-1 through 7-12 | 0/02-15-02 | None | Current revision is correct |
| 7-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |


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# Chapter 7: Aircraft Alignment Jig

Contents



## 1. INTRODUCTION

The Aircraft alignment jig aligns the wings to the fuselage to the horizontal to the vertical. The jig is used in the subsequent chapters during the installation of these parts.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **WING JIG** | | | | |
| 1) | BP-4423 | 2 | Blueprint, WS 46.16 Cradle | |
| 2) | BP-4424 | 2 | Blueprint, WS 137.2 Cradle | |
| **AFT FUSELAGE** | | | | |
| 1) | BP-4415 | 1 | Blueprint, Aft Fuselage Cradle | |
| 2) | BP-4421 | 2 | Blueprint, BL 21 H. Stab. Cradle | |
| 3) | N/A | 2 | Aft Fuselage Cradle Mounting Plates | |
| 4) | AN3-5A | 6 | Bolts, Undrilled | |
| 5) | AN365-1032A | 6 | Nut, Nylock | |
| 6) | AN960-10 | 6 | Washers, Flat | |
| **VERTICAL TAIL SUPPORTS** | | | | |
| 1) | BP-4416-01 | 1 | Blueprint, Top Vertical Cradle | |
| 2) | BP-4416-02 | 1 | Blueprint, Lower Vertical Cradle | |

### Supplies List

| QTY | DESCRIPTION |
|---|---|
| A/R | Wood |
| A/R | Wood Screws |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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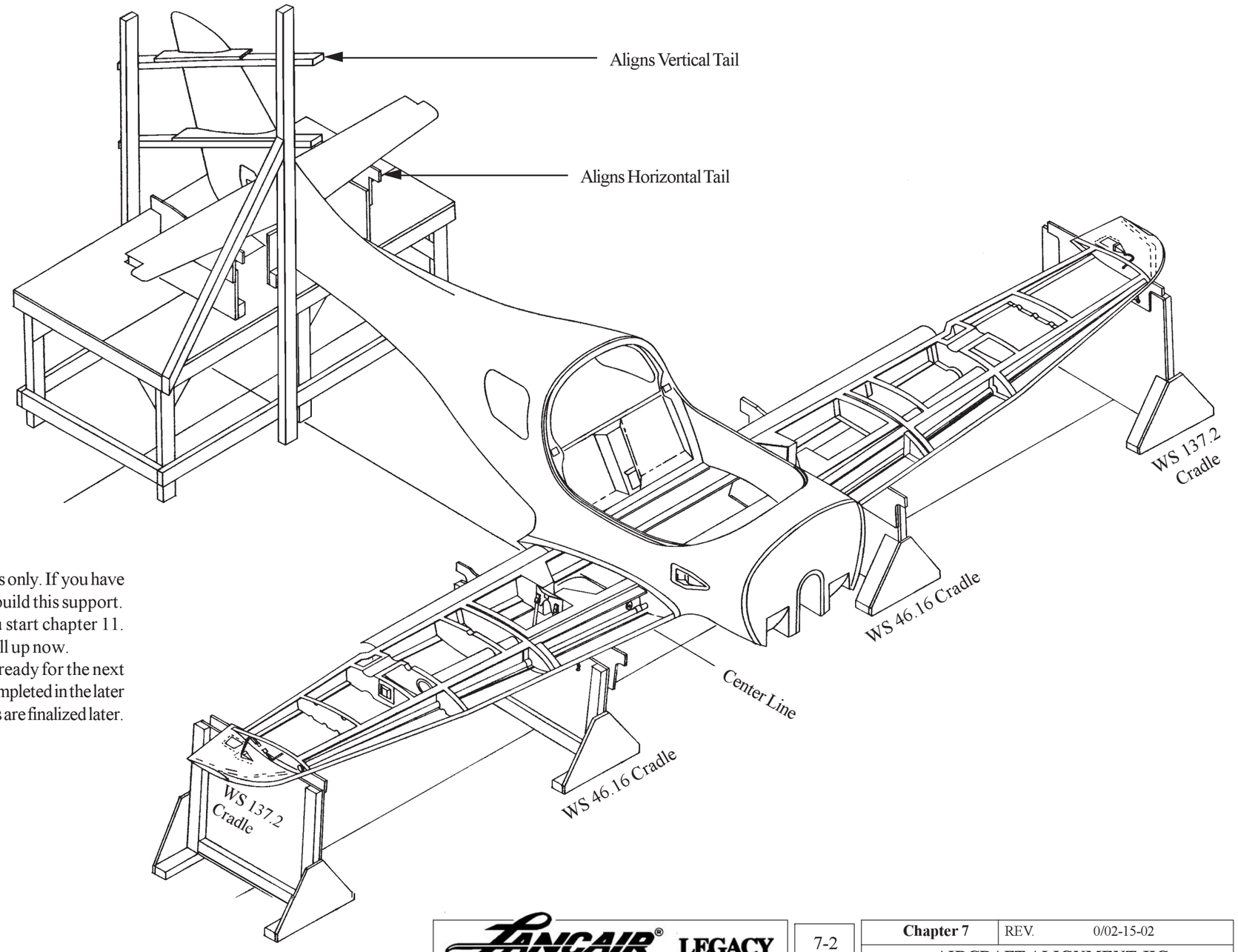
**Aircraft Alignment Jig Introduction**
**Fig. 7:A:1**




**A few important notes before getting started:**

1. The 137.2 cradle supports are used for closing the wings only. If you have been to the builders assist program you don't need to build this support.
2. You don't need to build the aft alignment jig until you start chapter 11. However if you have the room, we suggest you set it all up now.
3. The purpose of this chapter is to get the alignment jig ready for the next chapters. Some of the final alignments to the jig will be completed in the later chapters. The text will specifically state which alignments are finalized later.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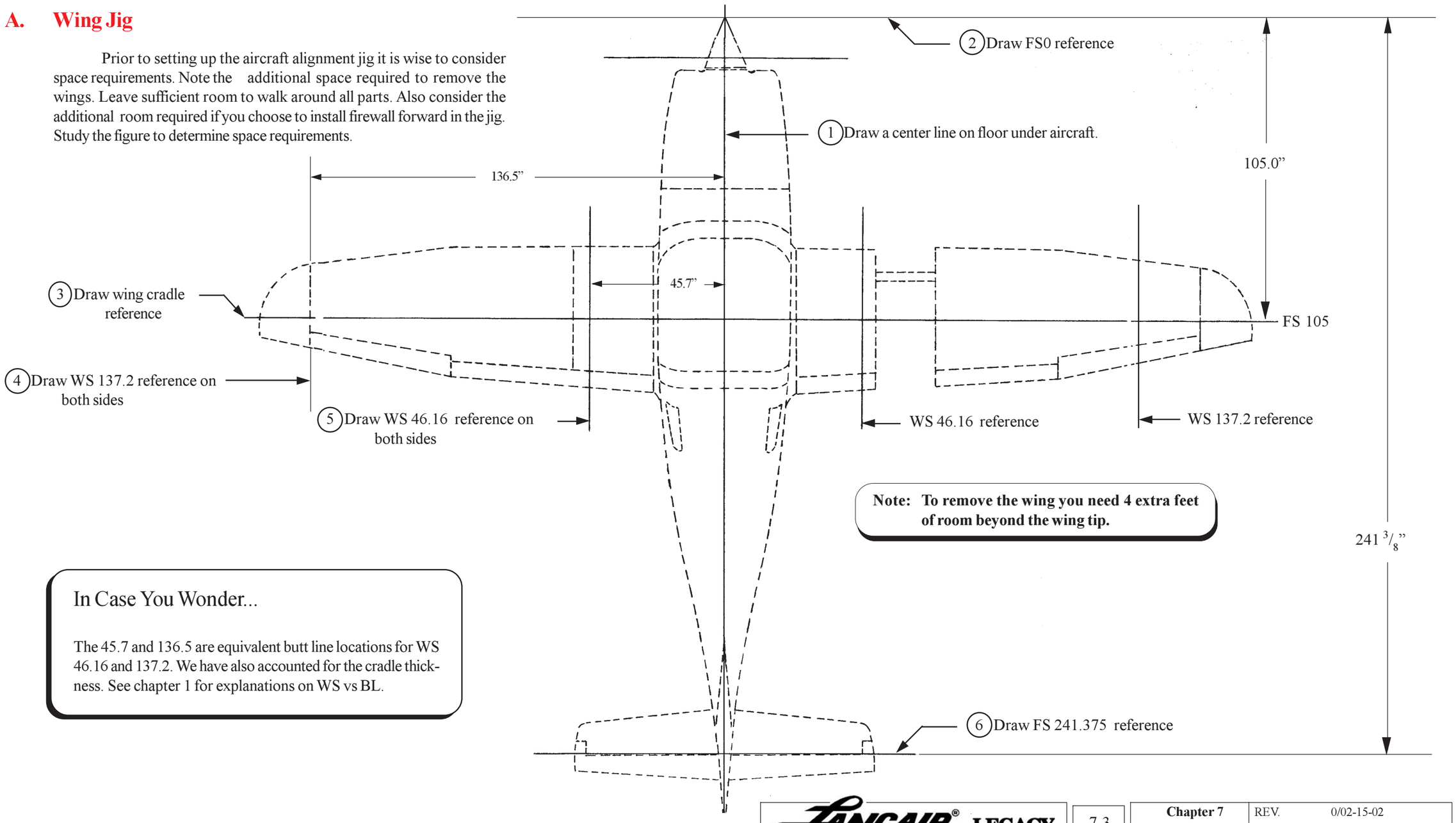
# 3. CONSTRUCTION PROCEDURES

## A. Wing Jig

Prior to setting up the aircraft alignment jig it is wise to consider space requirements. Note the additional space required to remove the wings. Leave sufficient room to walk around all parts. Also consider the additional room required if you choose to install firewall forward in the jig. Study the figure to determine space requirements.

**Shop Lay out**
**Fig. 7:A:2**




**Note: To remove the wing you need 4 extra feet of room beyond the wing tip.**

### In Case You Wonder...

The 45.7 and 136.5 are equivalent butt line locations for WS 46.16 and 137.2. We have also accounted for the cradle thickness. See chapter 1 for explanations on WS vs BL.



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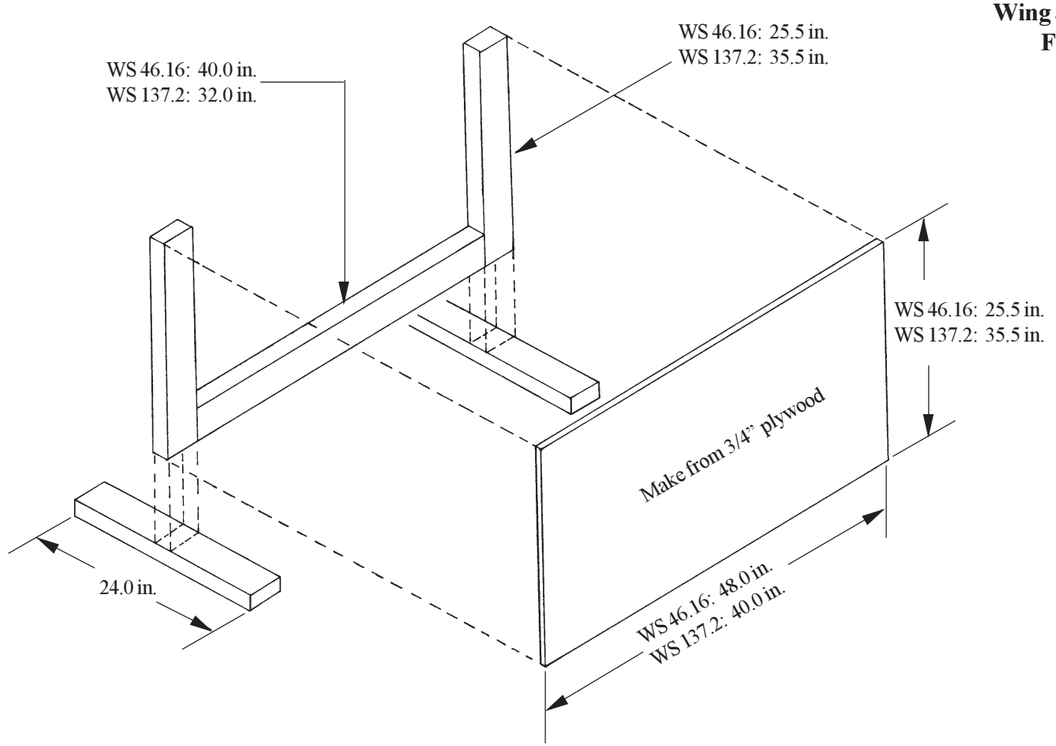
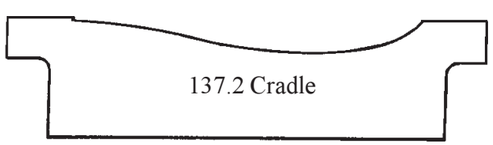
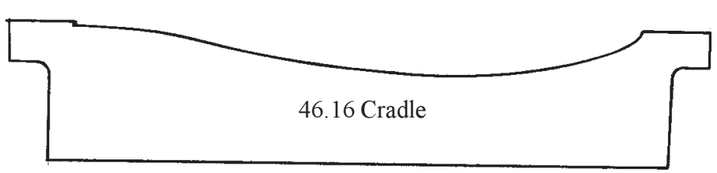
There are a total of four (4) supports for the wing, 2 at the WS 46.16 and 2 at WS 137.2. Note that there are 2 sets of dimensions given: One for the WS 46.16 support and one for the WS 137.2 support.

**Wing Jig Supports**
**Fig 7:A:3**

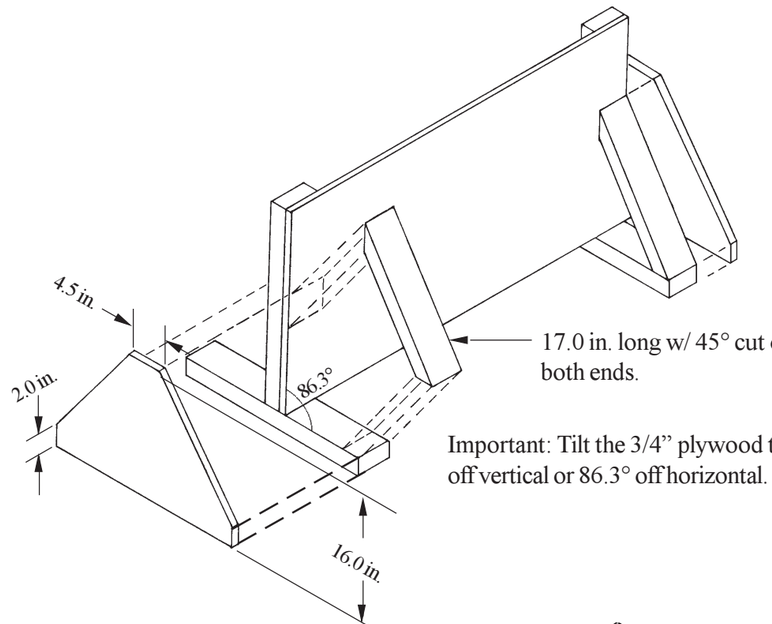



Cut 2 pieces from 3/4" plywood or particle board

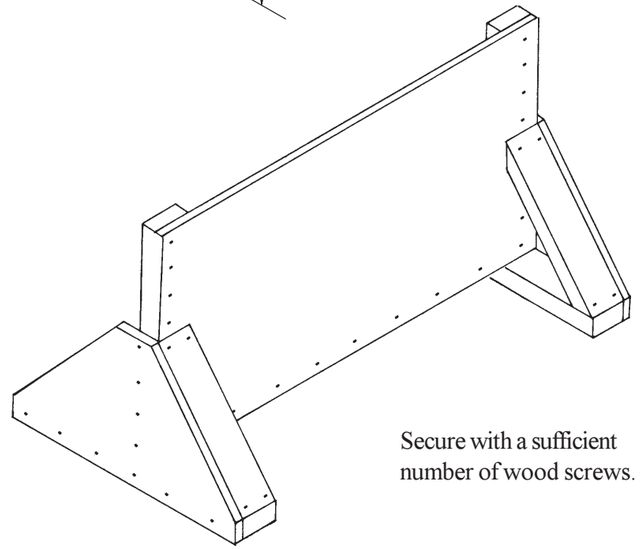



Cut 2 pieces from 3/4" plywood or particle board




17.0 in. long w/ 45° cut on both ends.

Important: Tilt the 3/4" plywood to 3.7° off vertical or 86.3° off horizontal.



Secure with a sufficient number of wood screws.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**Align Left 46.16 Cradle**
**Fig. 7:A:4**

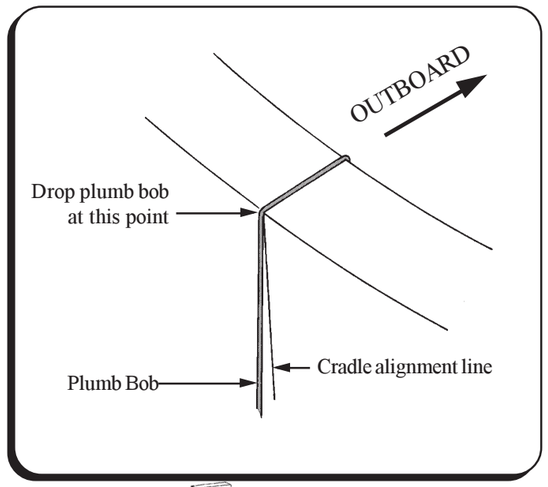
It is easiest to start by setting one of the 46.16 cradles. All the other cradles will be aligned to this one. So let's start with the left 46.16 cradle.

## 46.16 Alignment:

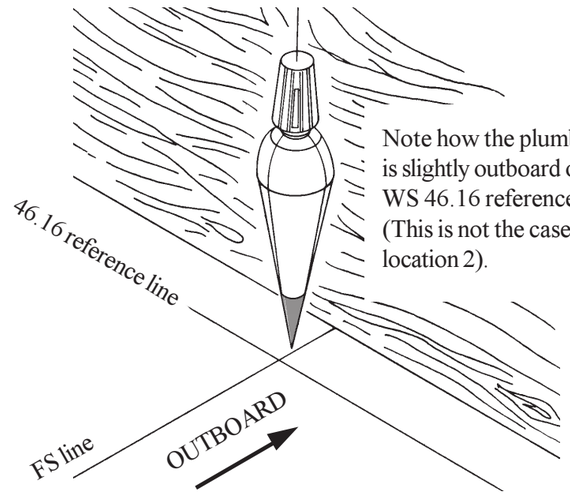
1. Start by setting the cradle to +1.2° ± .1°. This is the wing incidence. (This means leading edge up.)

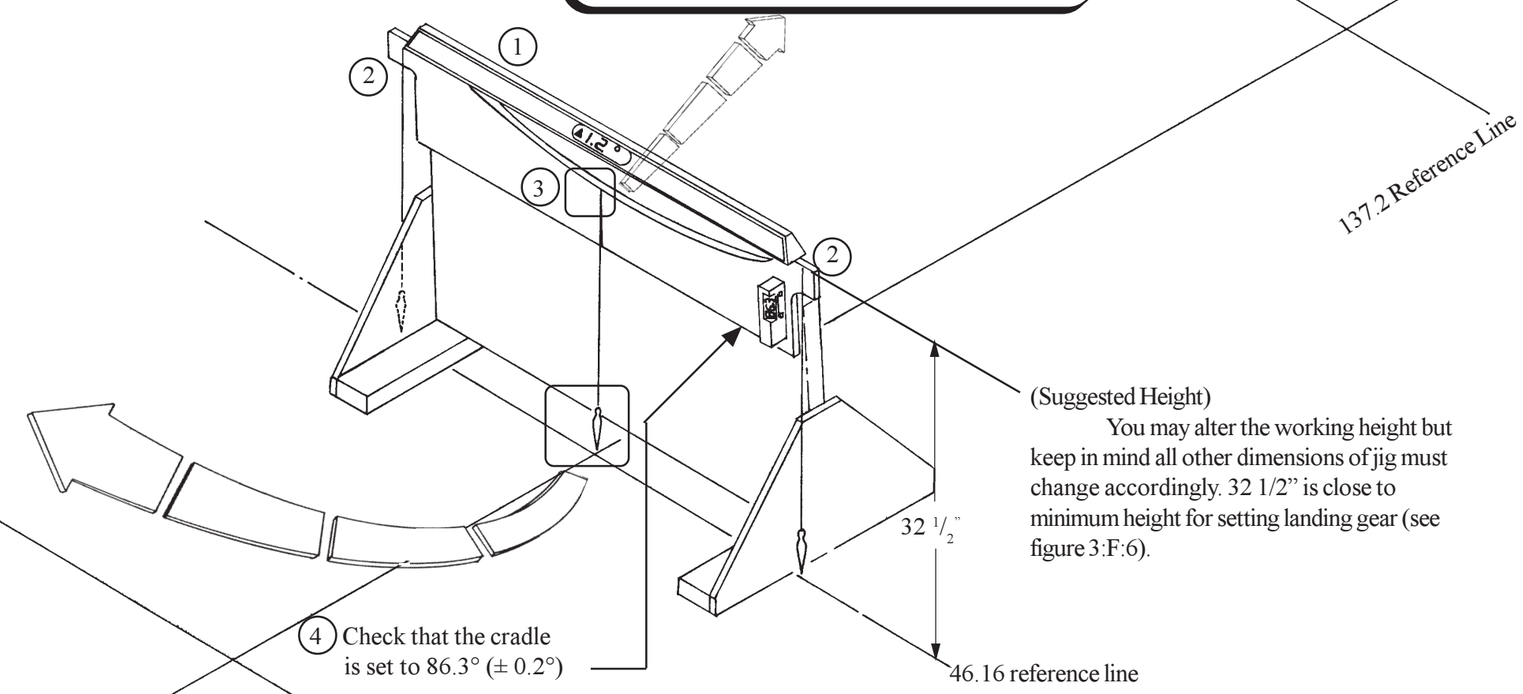
2. Align the cradle to the 46.16 reference line. Plumb bob off the inboard face of the cradle as shown.

3. Align the cradle to the cradle reference line.




**ALIGNING CRADLE TO FS 105**





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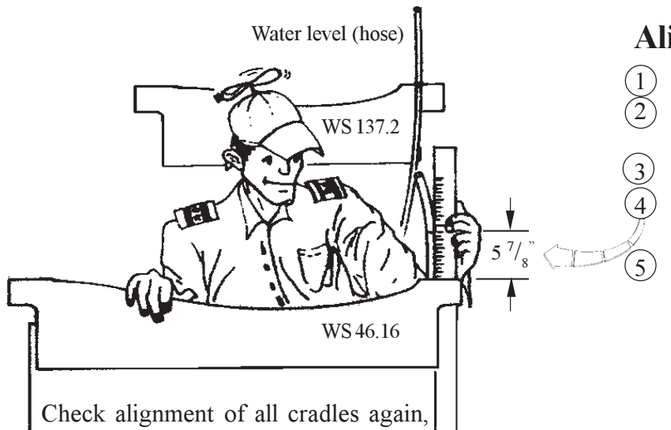
The remainder of the wing cradles are set in similar manner using the 41.16 left cradle as reference.

**Aligning 46.16 Cradles**
**Fig. 7:A:5**




## Alignment Criteria

1. Set all cradles to 1.2° (± 0.1°).
2. Align the cradles to their respective WS reference lines.
3. Align all cradles to the cradle reference line.
4. Set the 137.2 cradles 5 $^{7}/_{8}$" above the 46.16 cradle.
5. Align to the right 46.16 cradle to the left as shown.

Check alignment of all cradles again, Bondo feet in place. Secure cradles using a sufficient amount of screws. At this point you can check how the wing fits the jig. A small amount of weight may be necessary for the wing to conform to the jig.

It is acceptable to make minor adjustments:

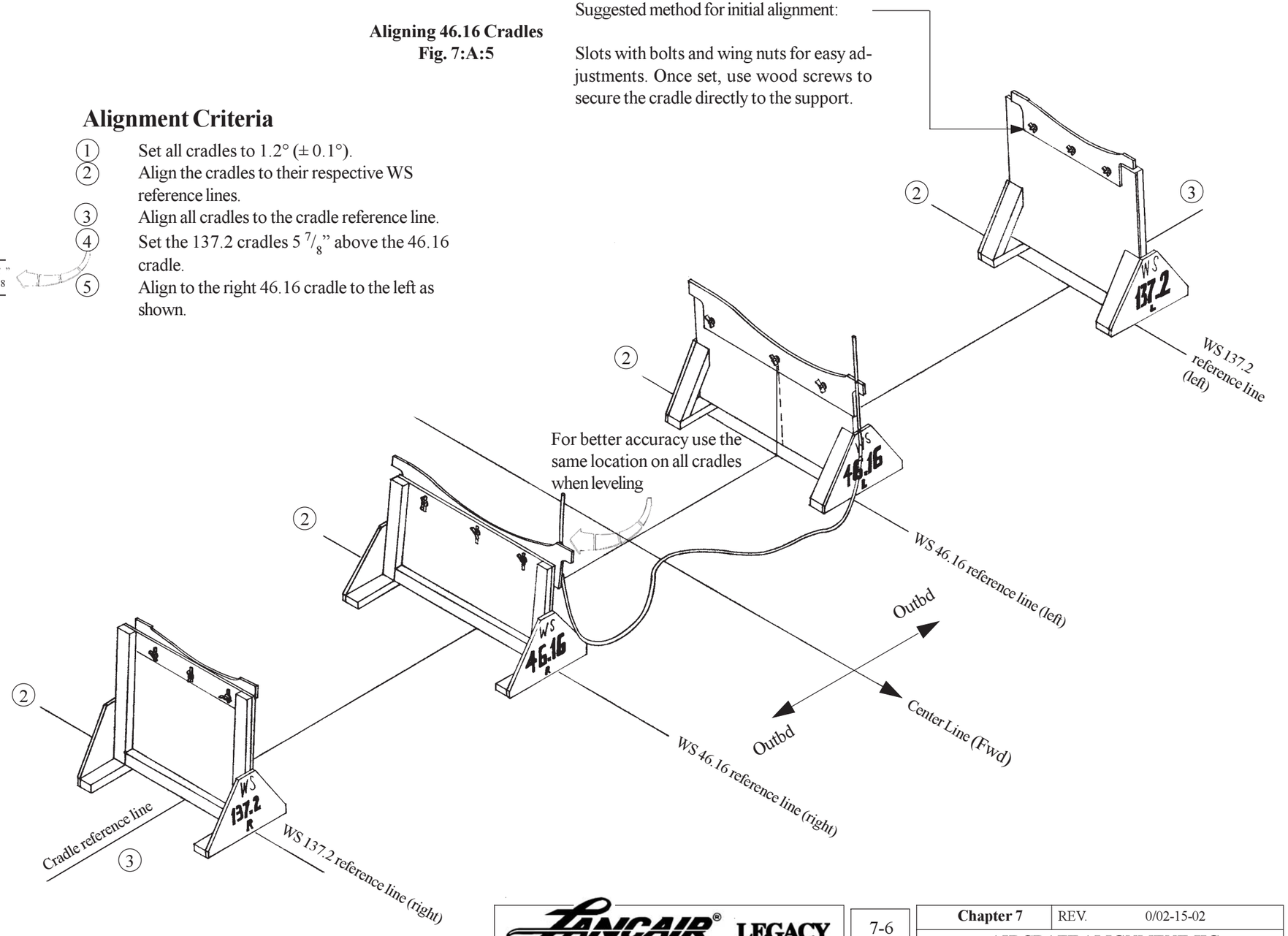
1. <u>You can</u> make minor adjustments to 137.2 in the fore/aft direction if necessary.

2. <u>You can</u> make minor adjustments to 137.2 in the up/down direction if necessary.

3. <u>You can not</u> alter the incidence of 1.2°!

Suggested method for initial alignment:

Slots with bolts and wing nuts for easy adjustments. Once set, use wood screws to secure the cradle directly to the support.





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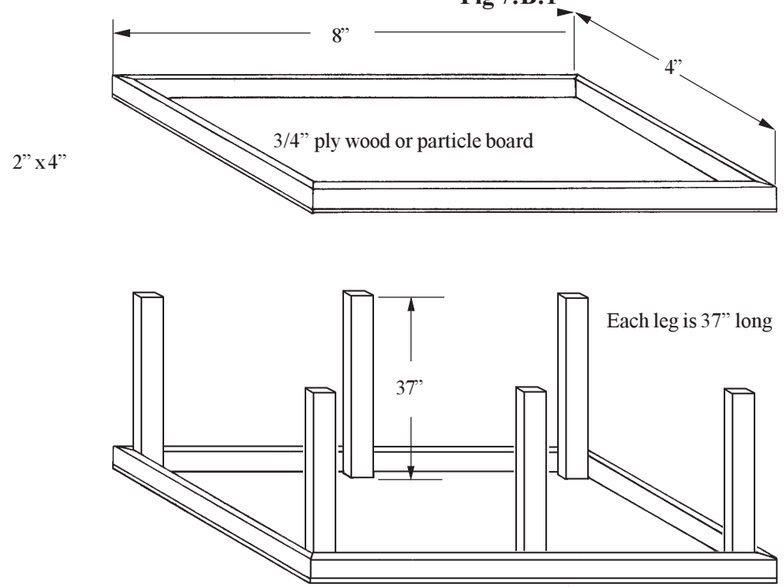
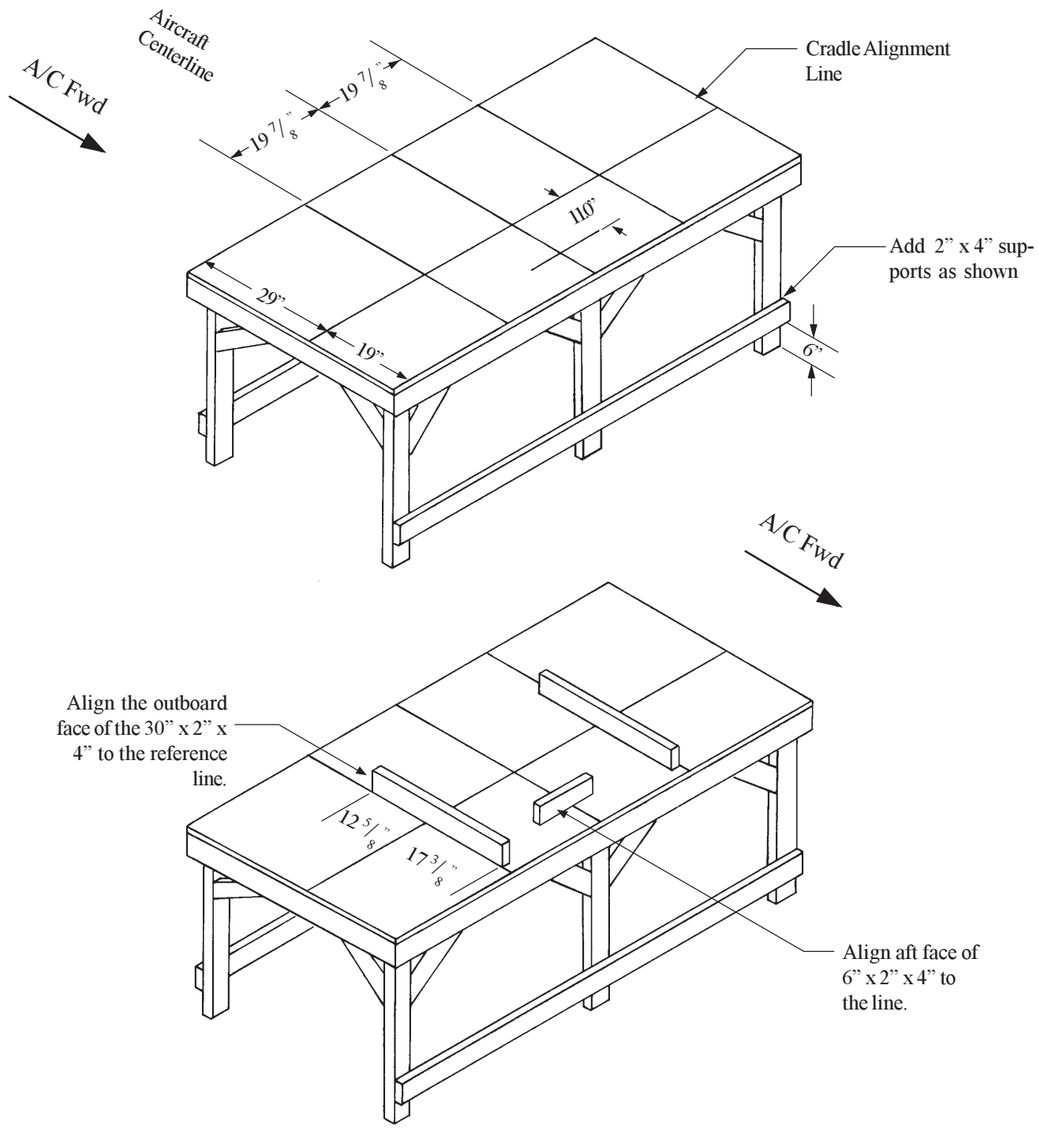
## B. Aft Fuselage Jig

**Aft Fuselage Jig Table**
**Fig 7:B:1**




**Aft Fuselage Jig Table Alignment Marks**
**Fig. 7:B:2**





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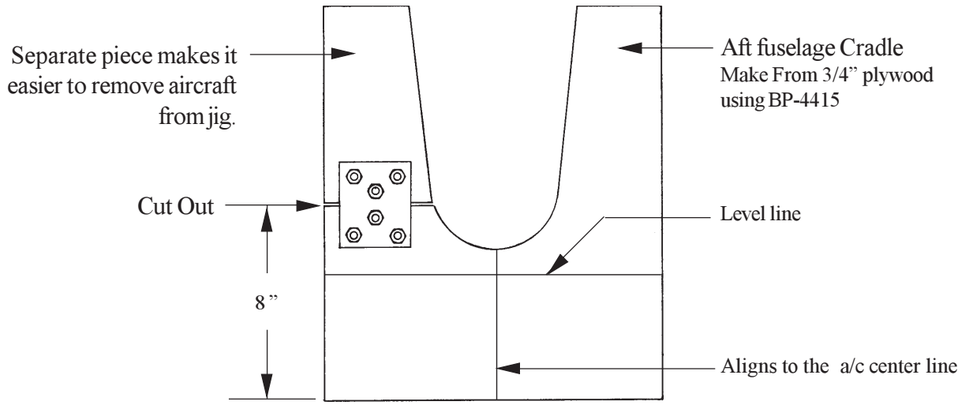
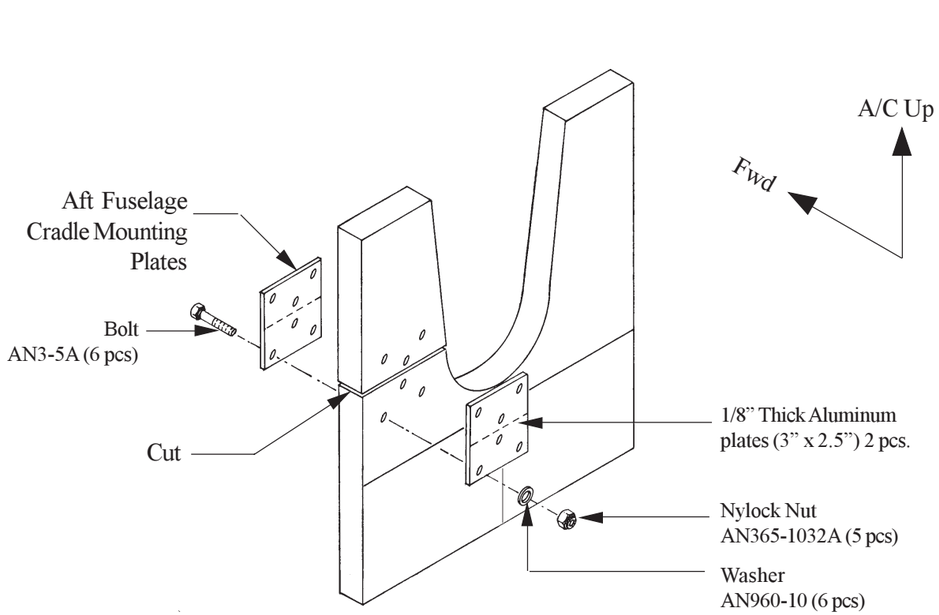
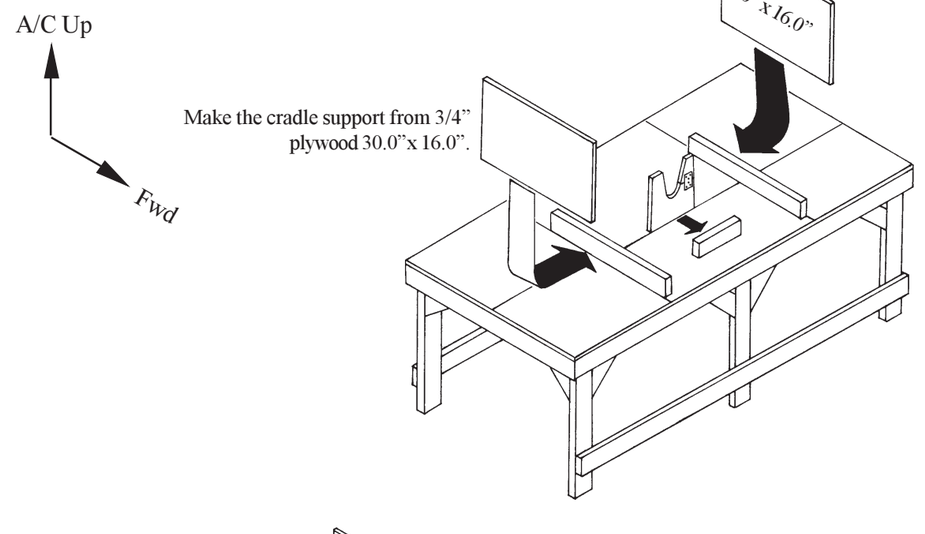
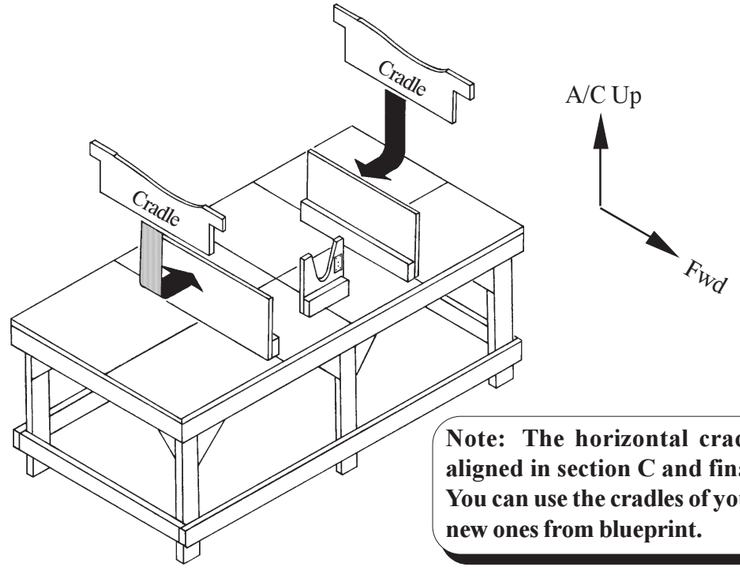
**Aft Fuselage Jig**
**Fig. 7:B:3**

**VIEW FROM AFT**




**Note: The horizontal cradles are approximately aligned in section C and final aligned in chapter 12. You can use the cradles of your horizontal jig or make new ones from blueprint.**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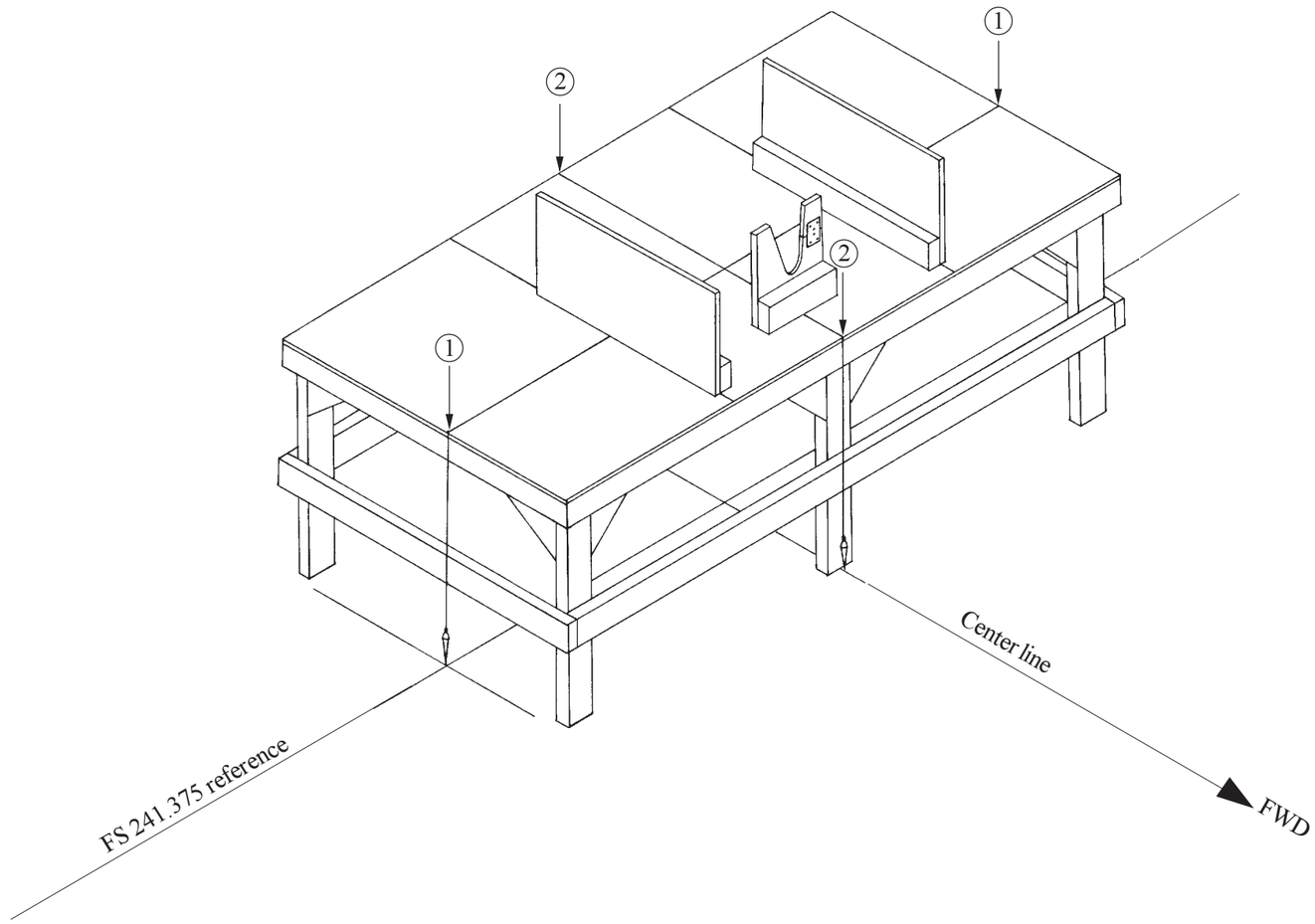
**Aligning Aft Fuselage Jig**
**Fig. 7:B:4**




**To Align the Aft Fuselage Jig Table:**

① Plumb bob table to FS 241.375 reference.

② Plumb bob table to aircraft center line.

③ The table should be approximate level (within 3/16" end to the end and front to aft).

④ Bondo legs in place.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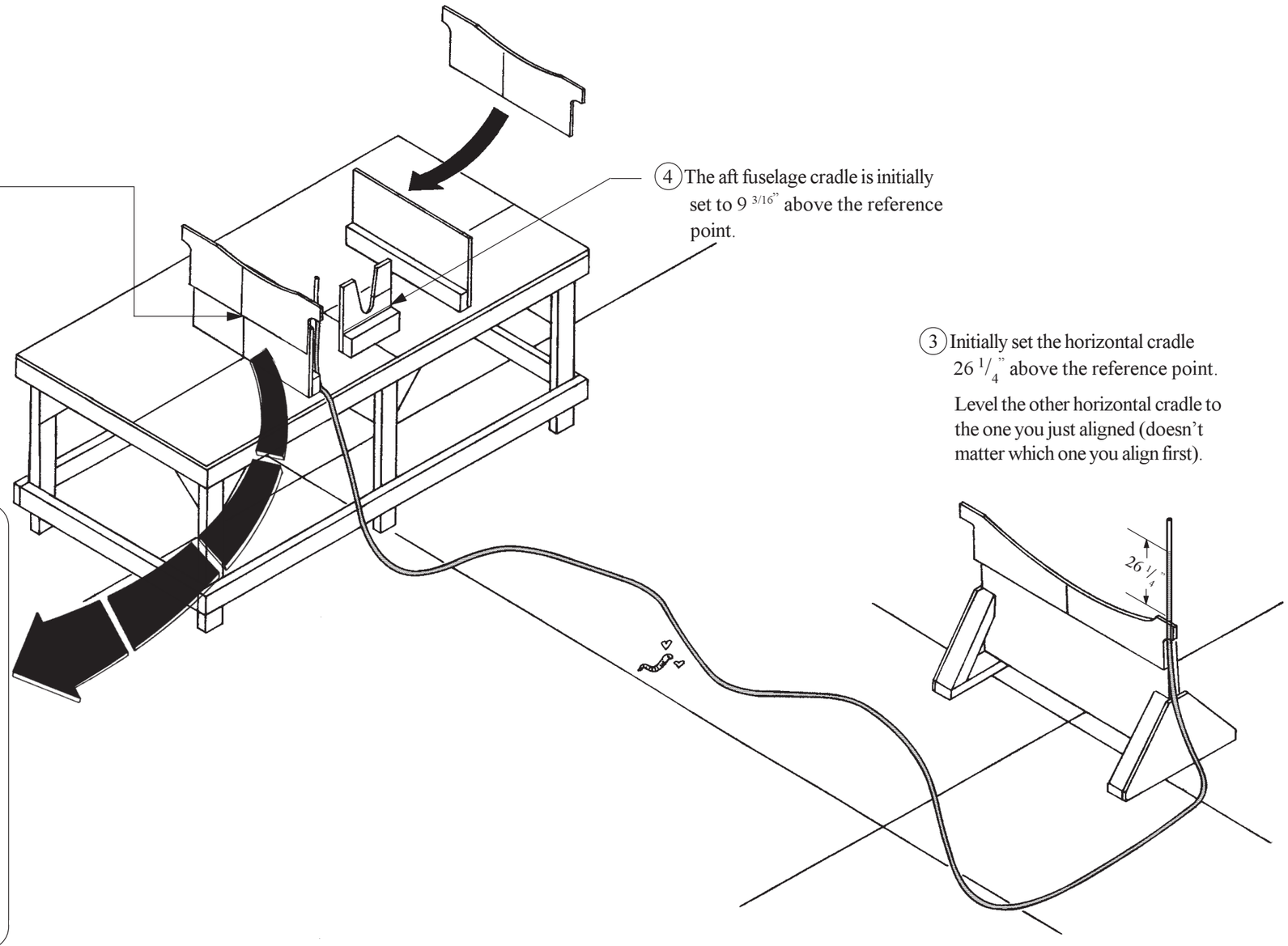
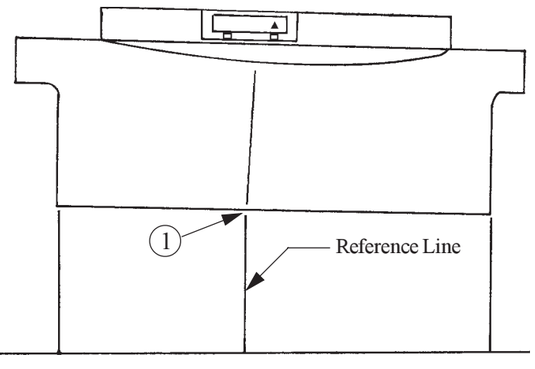
**Horizontal Cradle Alignment**
**Fig. 7:B:5**

Initially align the aft cradles as shown. The final alignment is done with the entire aircraft on the jig. (For the purpose of completing chapter 8 you don't need the aft fuselage jig).




2 The cradle must be set to -0.5°. This is the incidence of the tail. (This means nose down)





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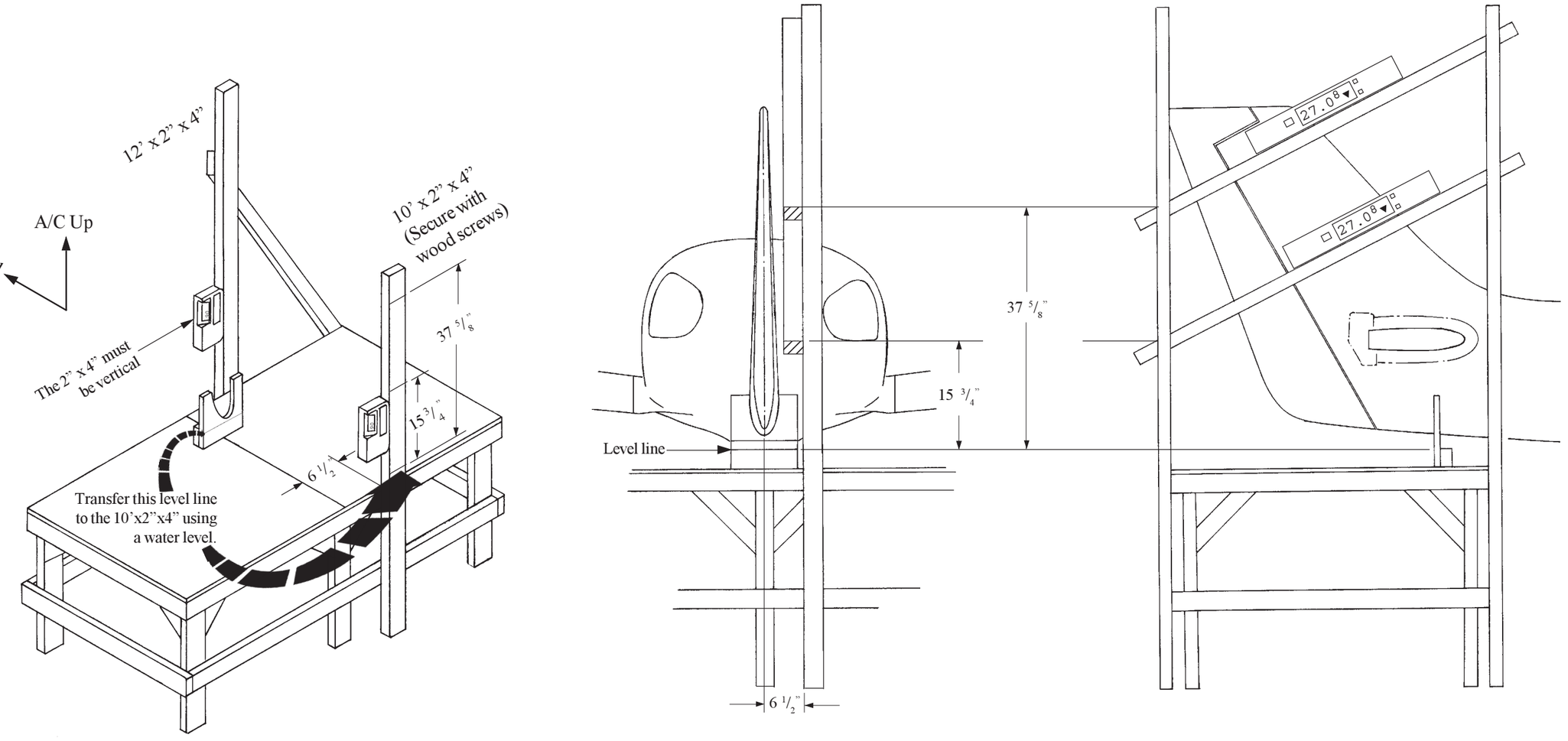
## C. Vertical Tail Supports

The vertical tail support is used for closing the vertical. It is final aligned and used in chapter 13.

**Vertical Tail Support**
**Fig. 7:C:1**



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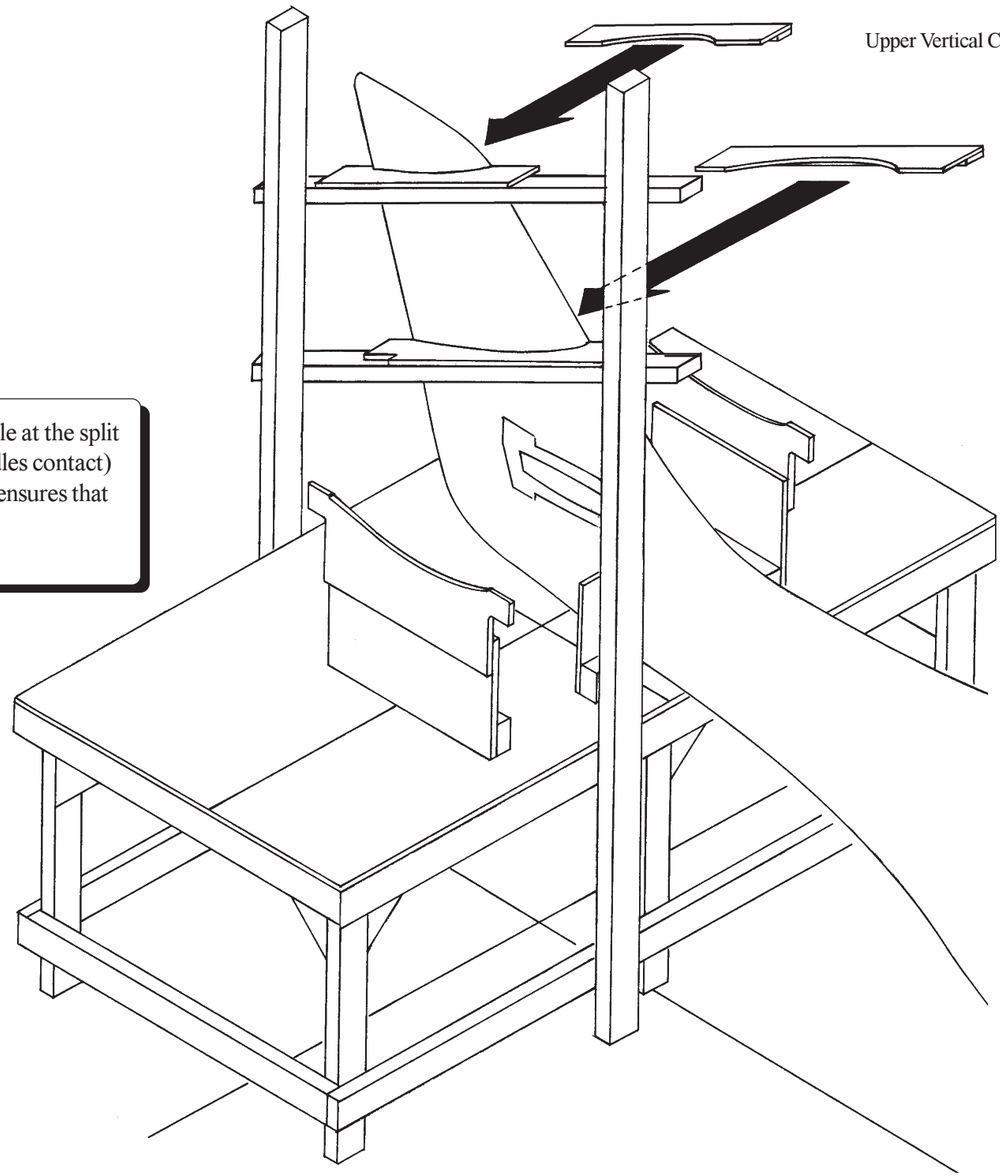
**Tail Supports**
**Fig. 7:C:2**

Align the cradles as necessary to fit the vertical. It is acceptable to move the cradles up/down and aft/fore as necessary to get a good fit.

Plumb bob the front and aft of the cradle at the split line (where the left and right of the cradles contact) onto the centerline of the aircraft. This ensures that there will be no twist in the vertical tail.




Make cradles out of 1/2" plywood or particle board using blueprint BP-4416-01and BP-4416-02.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# REVISION LIST

# CHAPTER 8: OUTBOARD WING SECTION CLOSING

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 8-1 through 8-11 | 0/02-15-02 | None | Current revision is correct |
| 8-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers and changed part nbr. |
| 8-11 | 3/12-15-04 | R&R | Changed part nbr. |


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# Chapter 8: Outboard Wing Section Closing

Contents



## 1. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **STROBE LIGHT** | | | | |
| 1) | A600 PR | 1 | Whelen Strobe/Nav Light Left | **Yes |
| 2) | A600 PG | 1 | Whelen Strobe/Nav Light Right | **Yes |
| 5) | MS21069-06 | 3 | Nutplates | |
| 6) | MSC-34 | 12 | Rivets | |
| 3) | MS24693-S28 | 4 | Screws, Machine (Structural) | |
| 4) | MS24693-S26 | 2 | Screws, Machine (Structural) | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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# 2. CONSTRUCTION PROCEDURES

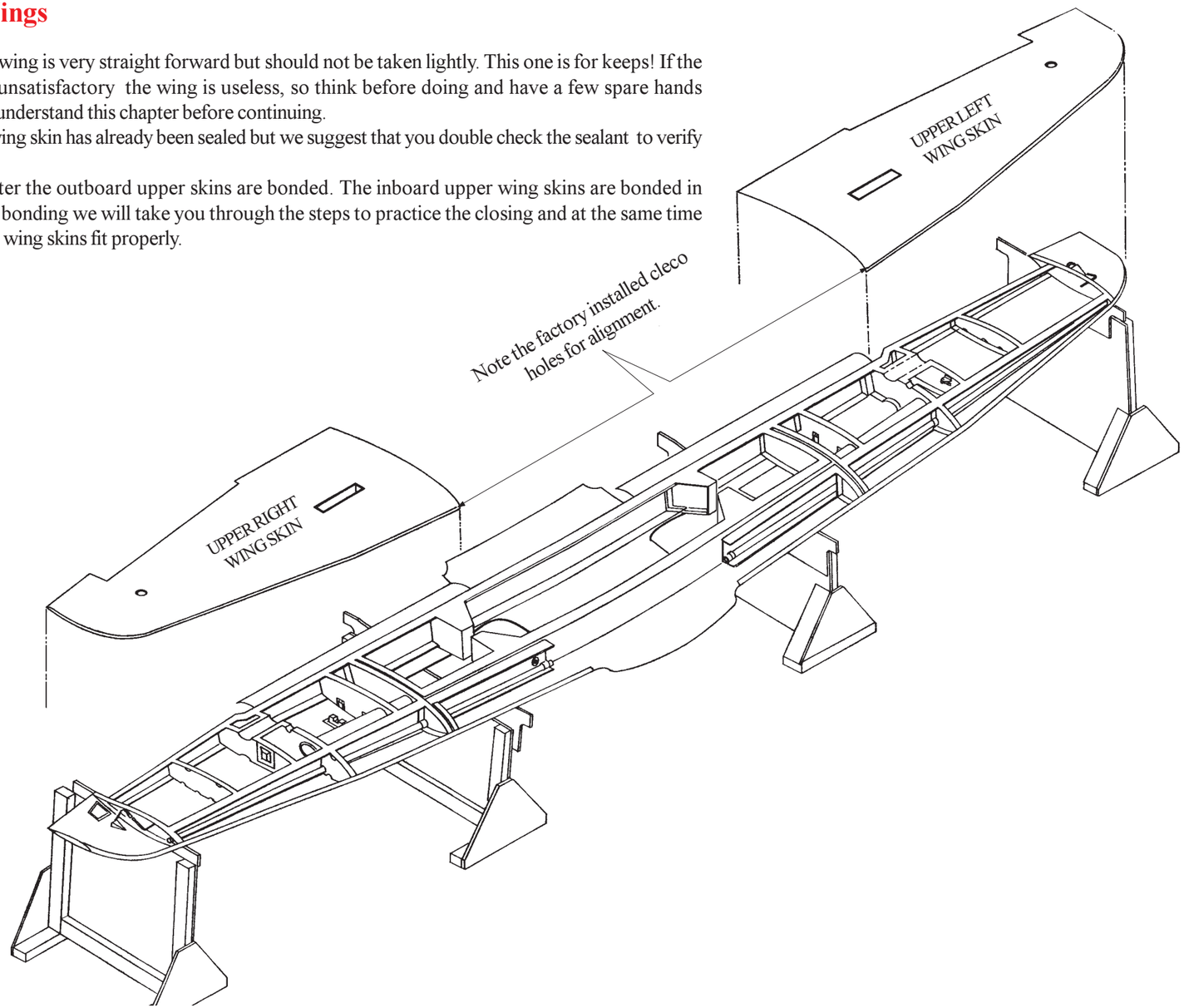
## A. Closing the Wings

Closing the wing is very straight forward but should not be taken lightly. This one is for keeps! If the upper skin bond is unsatisfactory the wing is useless, so think before doing and have a few spare hands available. Read and understand this chapter before continuing.

The upper wing skin has already been sealed but we suggest that you double check the sealant to verify the location.

In this chapter the outboard upper skins are bonded. The inboard upper wing skins are bonded in chapter 11. Prior to bonding we will take you through the steps to practice the closing and at the same time check that the upper wing skins fit properly.

**Closing the Wings**
**Fig. 8:A:1**




Double check everything. Here's a partial list of things to look for:

* If there is a dip or bump in the skin now it will be permanent when you bond the bottom skin into position. Check the structure for straightness. If you think there might be a problem call Lancair to discuss the options.

* Recheck that the fuel sealer is not contaminating any bonding surface. A small overlap (less than 1/8" (3 mm) of fuel sealer to the structure bonding area is okay.

* Be sure the slosh door rib on WS-68.5 is secured with proper bolts. You will not be able to access this door after the wing is closed, so make sure it operates freely.

* Clean dust and debris from the fuel tank. Don't do a Mega-Blunder, like leaving tools inside your newly closed wing! (It's happened!)

* Cover all Hardware you can access. Cover the idler arm and bell crank. DO NOT FORGET TO REMOVE THE TAPE AFTER BONDING!

* You should have accurate marks on the upper wing skin for the ribs, spar, and shear web locations. If you sand them off in the process you must remark them so you will know where to apply the adhesive.

* Check that every fuel bay has a drain and vent hole.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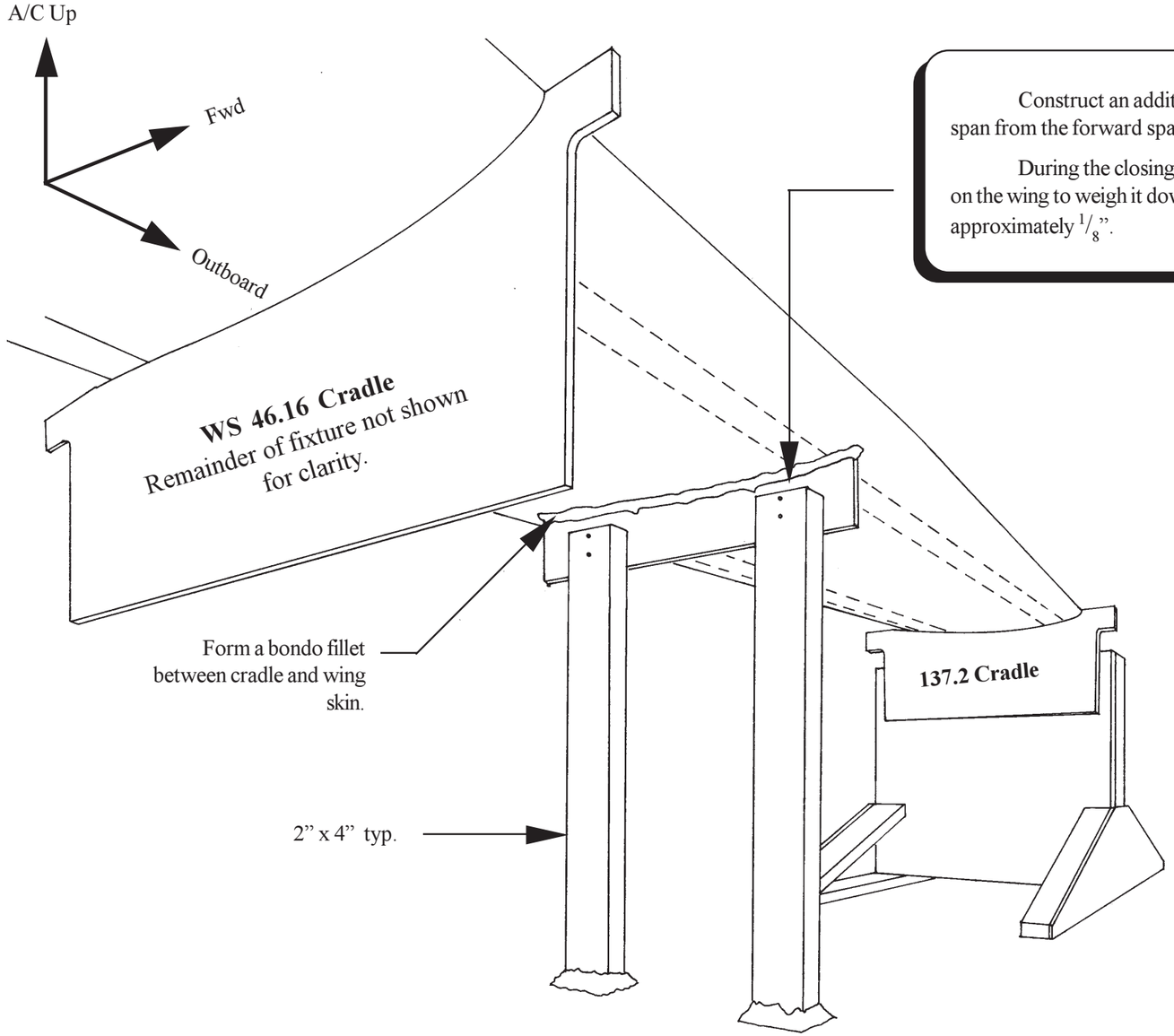
**Additional Support for Wing Closing**
**Fig. 8:A:2**




Construct an additional support at WS 90.5. The support should span from the forward spar to the aft spar.

During the closing process you will use approximately 600 lbs on the wing to weigh it down. Without this support the wing would bow approximately $^{1}/_{8}$".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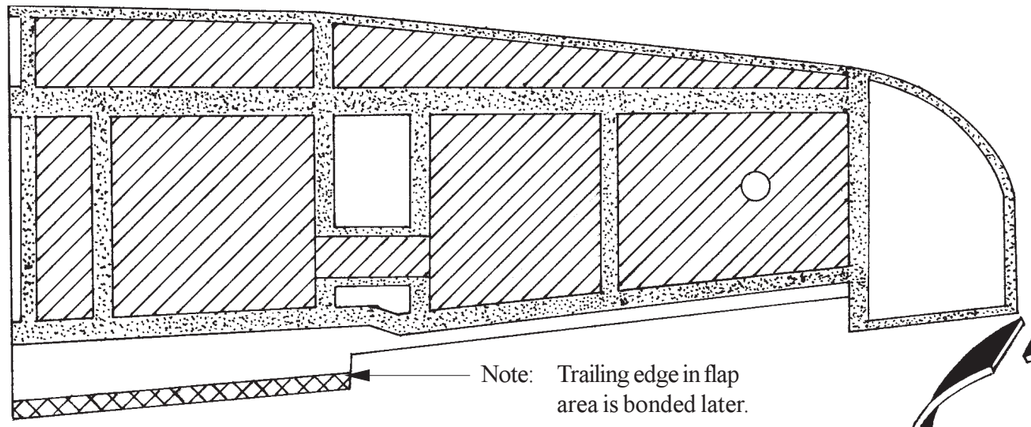
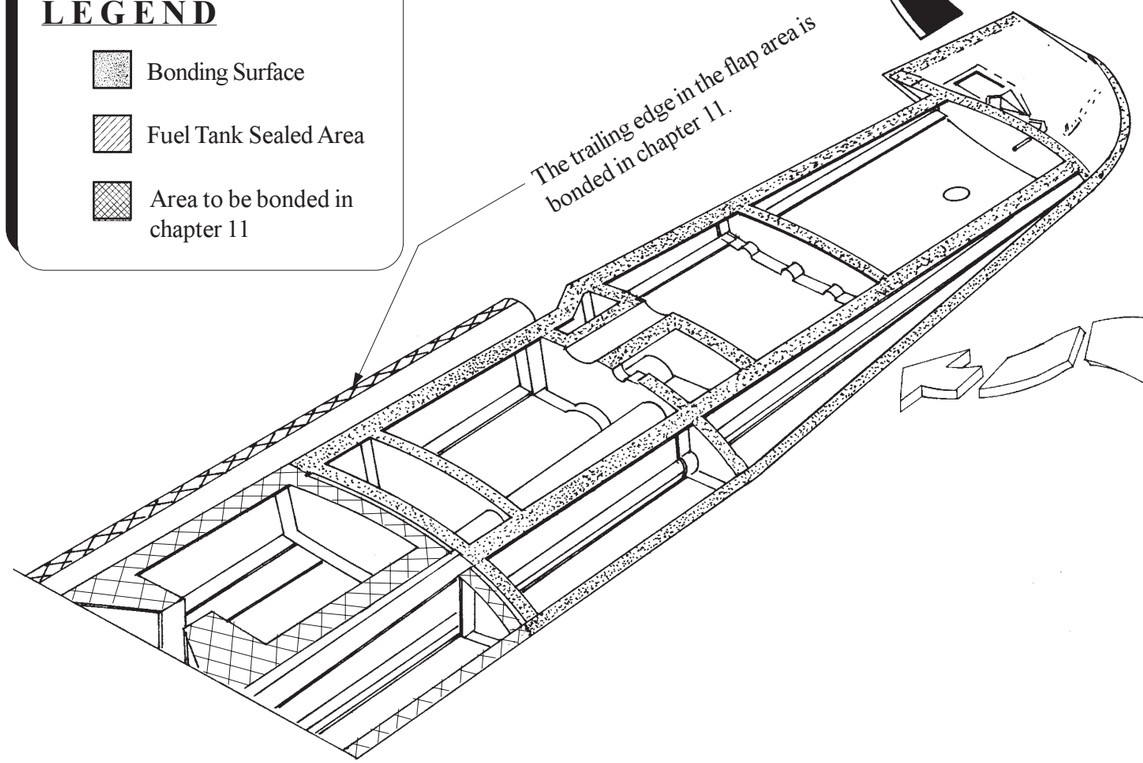
**Bonding Areas**
**Fig. 8:A:3**

## Bonding Areas of Upper Wing Skin

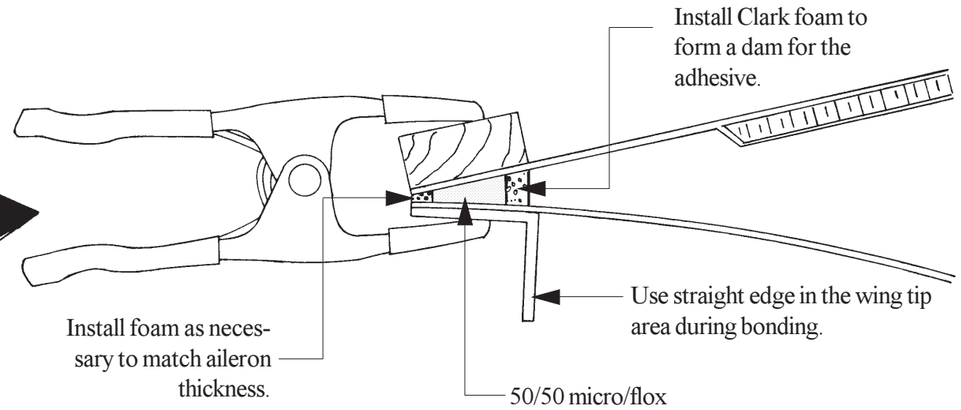



**LEGEND**

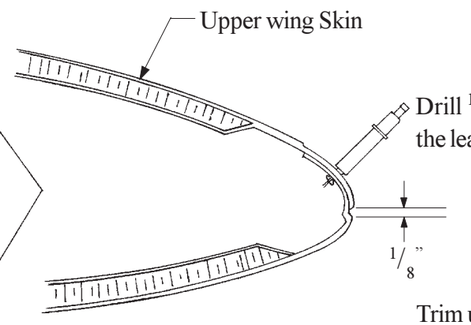
- Bonding Surface
- Fuel Tank Sealed Area
- Area to be bonded in chapter 11




## Trailing Edge Cross Section at Wing Tip




## Typical Leading Edge Cross Section




Trim upper skin back as necessary to avoid the skin riding onto joggle. We suggest 1/8" clearance.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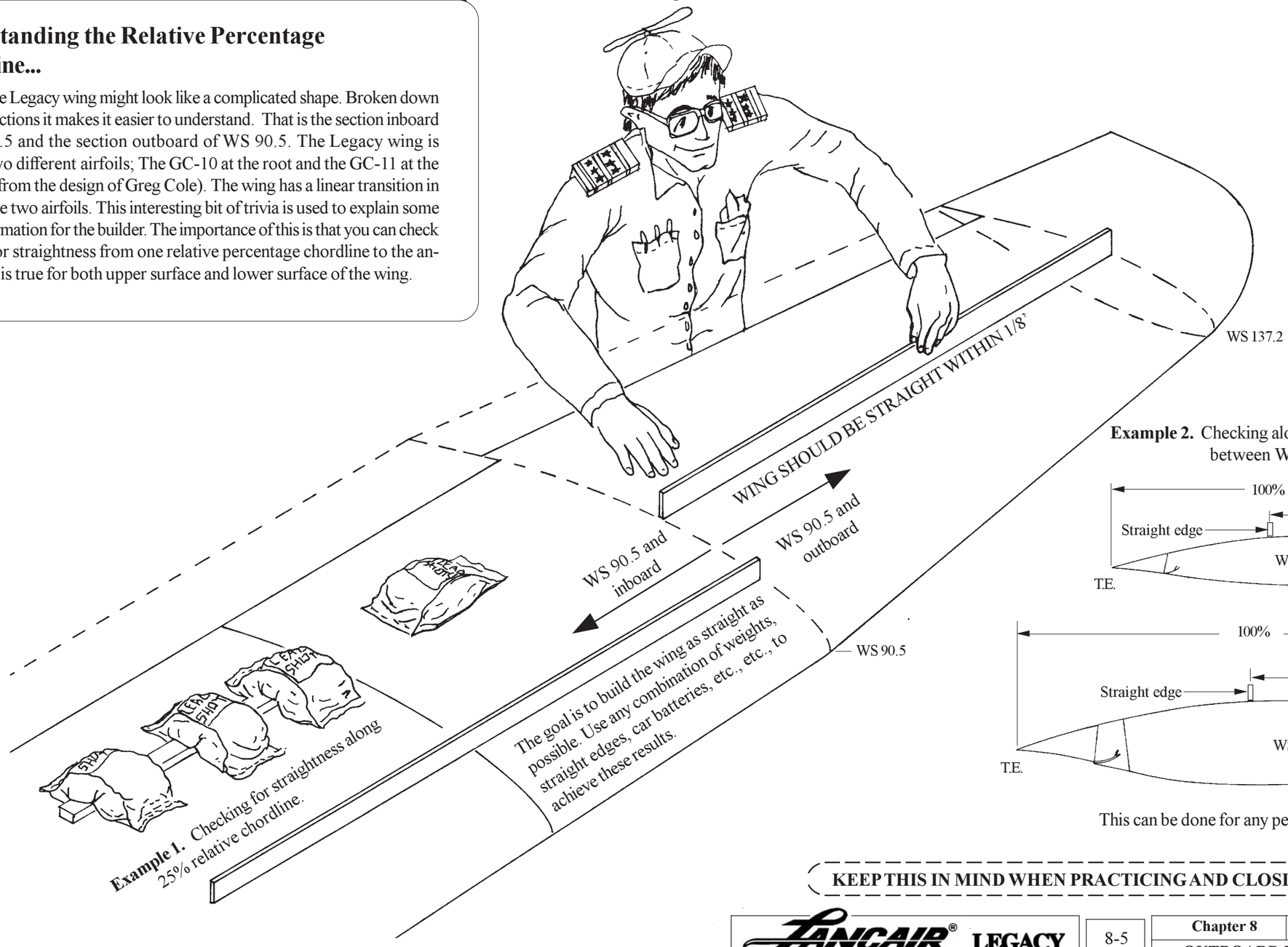
## Understanding the Relative Percentage Chordline...

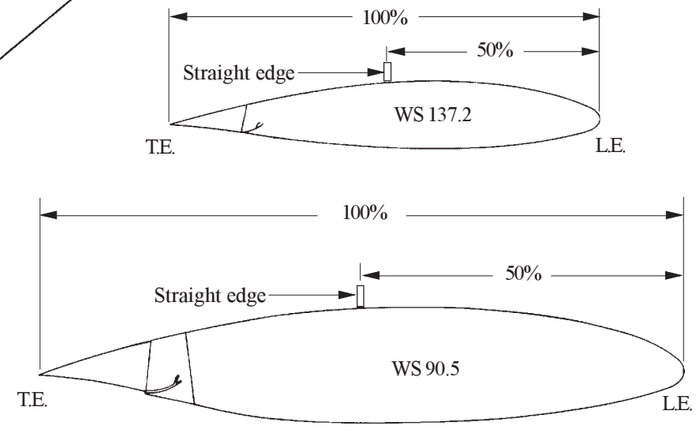
The Legacy wing might look like a complicated shape. Broken down into two sections it makes it easier to understand. That is the section inboard of WS 90.5 and the section outboard of WS 90.5. The Legacy wing is made of two different airfoils; The GC-10 at the root and the GC-11 at the tip ( GC is from the design of Greg Cole). The wing has a linear transition in between the two airfoils. This interesting bit of trivia is used to explain some useful information for the builder. The importance of this is that you can check the wing for straightness from one relative percentage chordline to the another. This is true for both upper surface and lower surface of the wing.

**Checking for Wing Straightness**
**Fig. 8:A:4**




**Example 1.** Checking for straightness along 25% relative chordline.

**Example 2.** Checking along 50% chordline between WS 90.5 and WS 137.2




This can be done for any percent chordline.

**KEEP THIS IN MIND WHEN PRACTICING AND CLOSING THE WING!!**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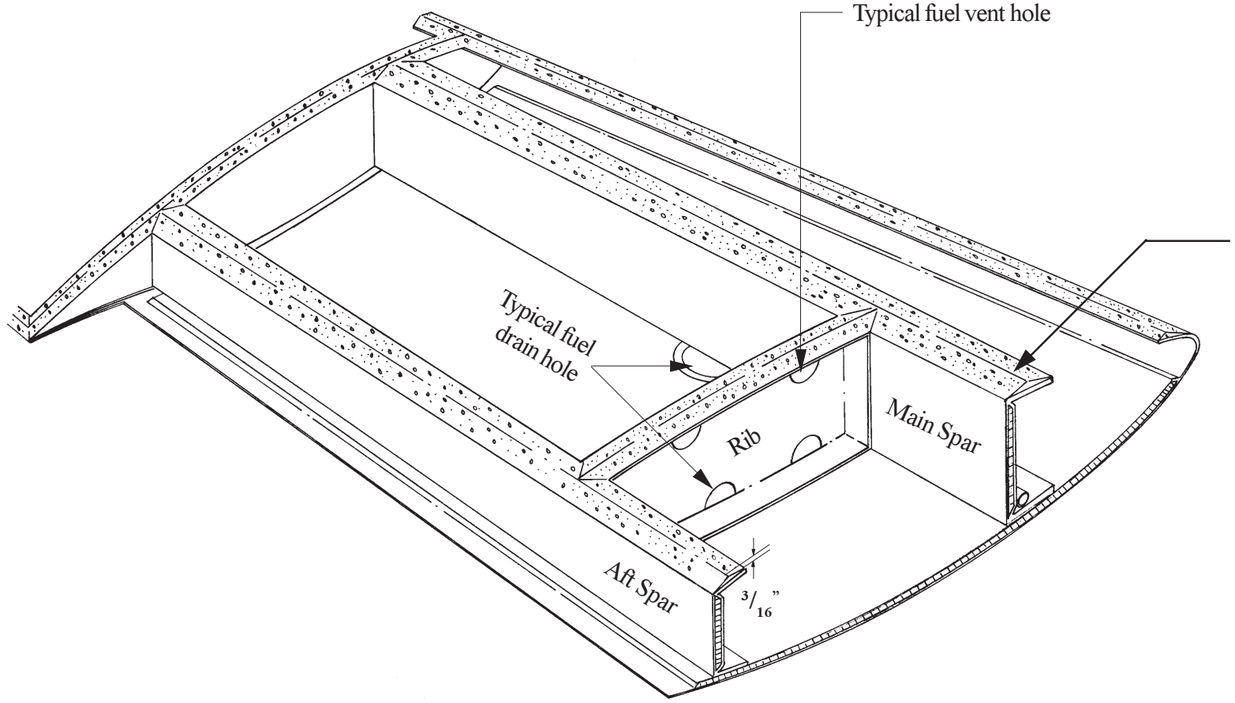
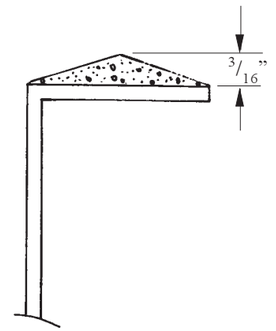
**Applying Adhesive**
**Fig. 8:A:5**

**Be aware of working time!**

This varies between the adhesives, batch size and temperature. If you mix a large batch spread as soon as possible to avoid exotherming.




**Typical Internal Part**




Attempt to form a perfect 3/16" tall inverted "V" shape. We suggest you use a plastic squeegee to form the adhesive. Careful application of adhesive will reduce the chance of leakage.

Follow normal bonding procedures. It is extremely important that you understand these procedures for this step! You can use any Lancair approved structural adhesive for bonding the upper skin.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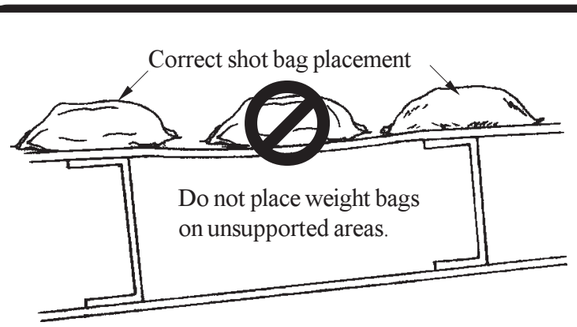
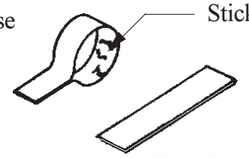
**Typical Arrangement during Closing**
**Fig 8:A:6**



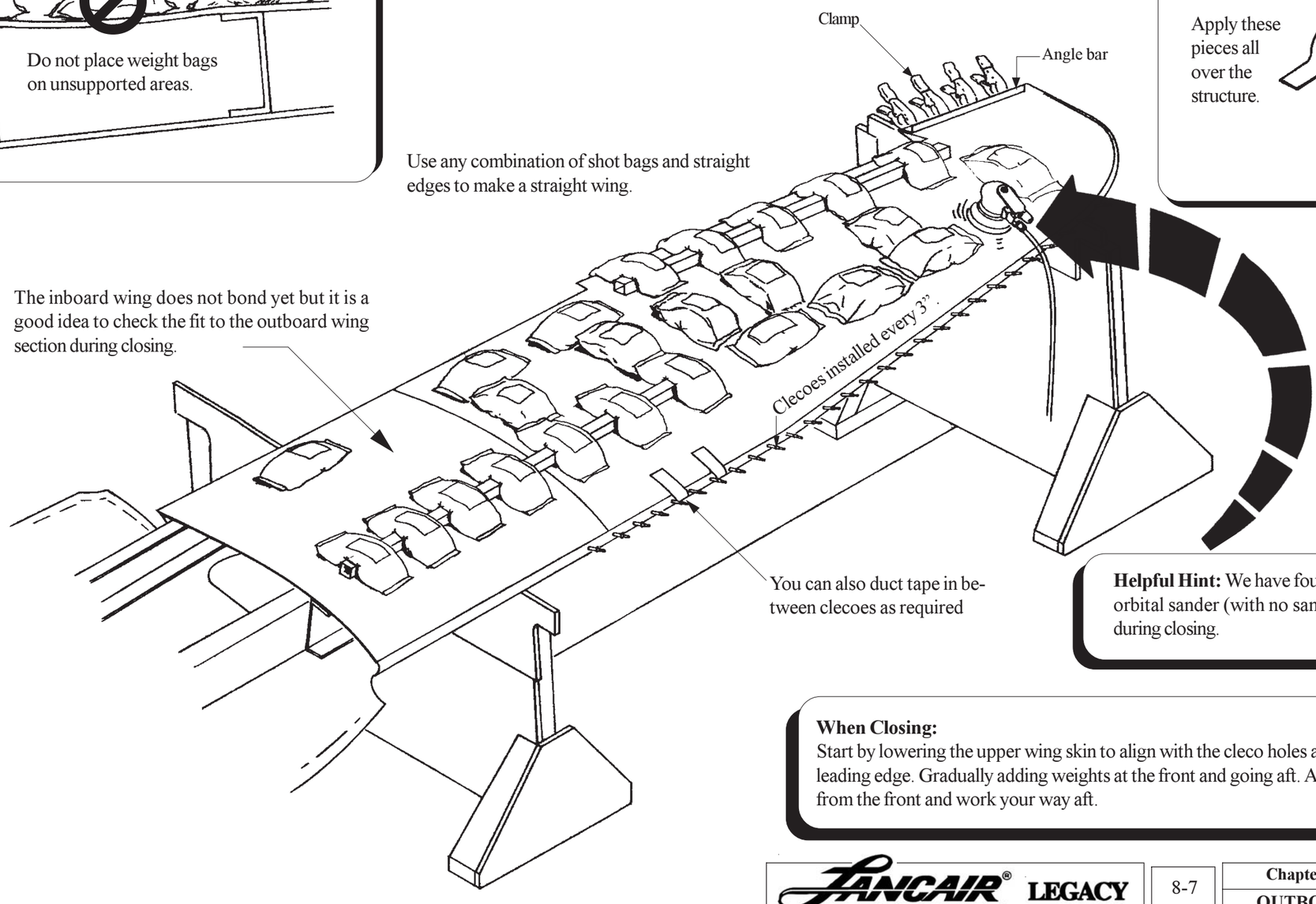

**Suggestion:**
During practice closing use masking tape as shown to check the fit:




If flat after practice you have a good fit.

Use any combination of shot bags and straight edges to make a straight wing.

The inboard wing does not bond yet but it is a good idea to check the fit to the outboard wing section during closing.




**Helpful Hint:** We have found that using a padded dual action orbital sander (with no sand paper) helps settle the adhesive during closing.

**When Closing:**
Start by lowering the upper wing skin to align with the cleco holes at the leading edge. Gradually adding weights at the front and going aft. Always work from the front and work your way aft.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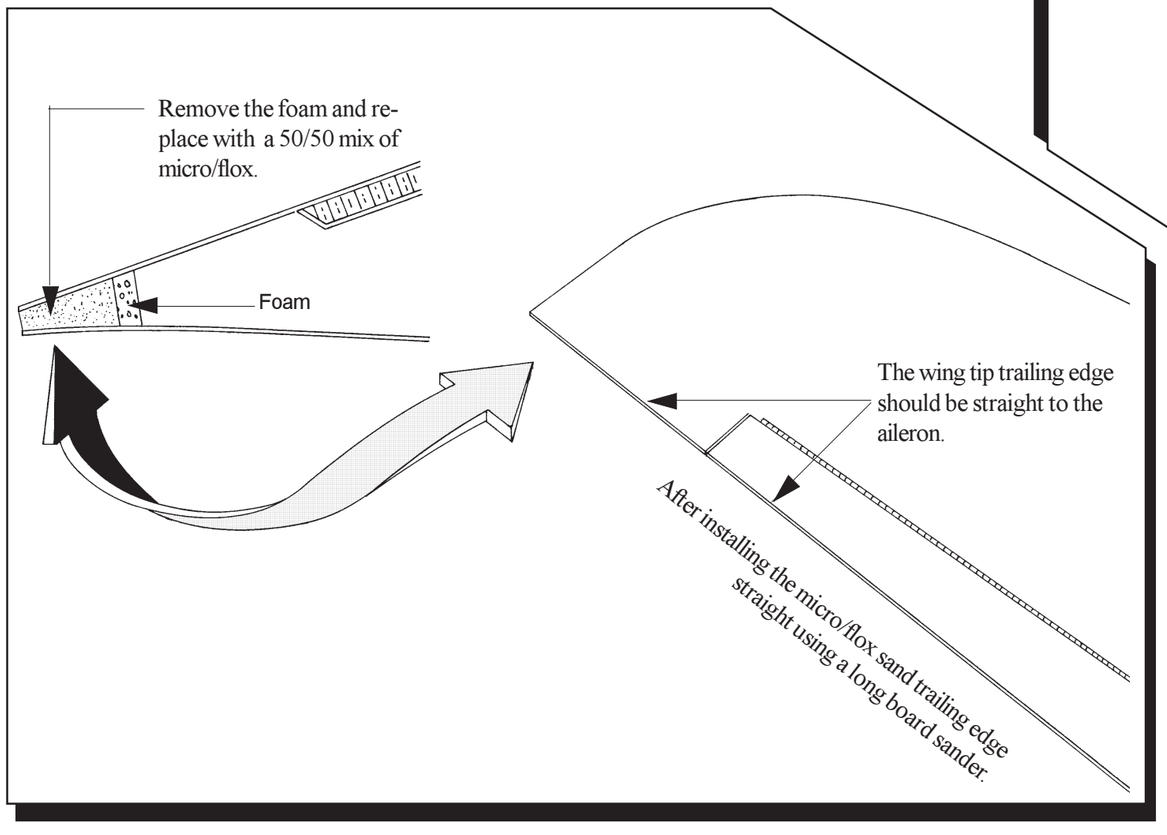
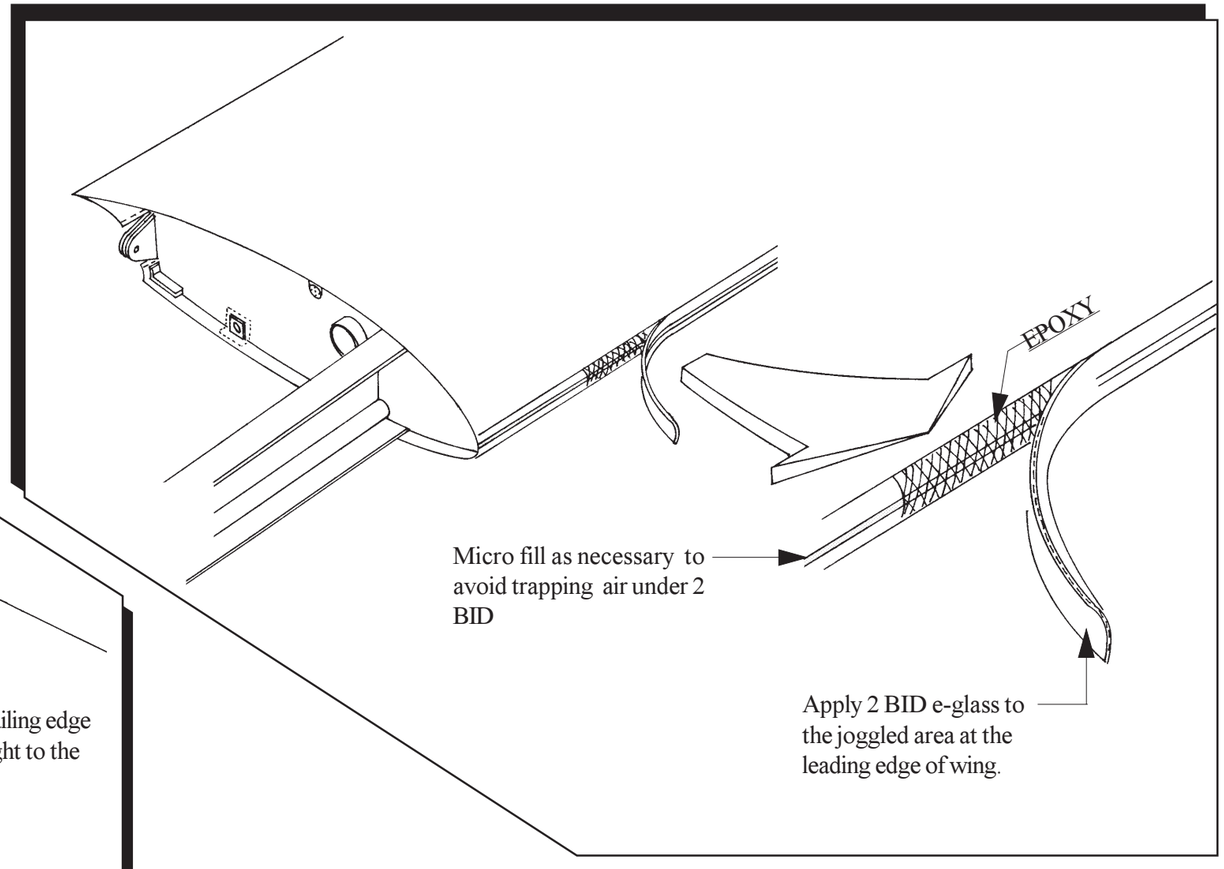
**L.E. BID and T.E. Fill**
**Fig. 8:A:7**





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## B. Pressure Testing the Wings

You should wait a couple of weeks prior to pressure testing the wing to make sure it is fully cured. If you were careful with shaping your capstrips and applied a sufficient amount of adhesive when closing the wings you should have no problems with fuel leaks.

Pressurizing a fuel tank with air should be done very carefully. Only 1 psi is required to test the fuel tank. If you have strong lungs you will be able to apply 1 psi. Any more than 2 psi would hurt the wing structure. To pressurize a wing use a bicycle pump or one of those foot pumps for inflating rafts. Using an air compressor should be avoided as it is easy to over pressurize the wing. You must monitor the pressure with a gauge if you use anything but your lungs.

Another method is to use low pressure (suck the air out of the tank). It can be safer because it is harder to implode a wing than explode a wing.

The tools needed to pressure check a wing are simple: something to pressurize a wing with, like the pumps previously mentioned, and a gauge to read the pressure in the wing. The gauge can be a cheap dial type gauge connected to the brass fuel drain with the appropriate fittings. Another method is to attach a balloon. Leave the balloon for 30 min. If you can't detect a change in the size, you are fine. Be aware that some air will actually leak through the balloon skin.

Tape off all tank openings that are not being used to either pump in air or check pressure. Even the fuel caps must be taped over because they are not airtight. When the tank is pressurized, the gauge will usually fall off a little bit just after stopping the air pressure, but should remain steady after that.

Leaks are detected by a drop in the tank pressure. Most of the time you can locate the leaks by listening carefully. If you suspect a leak in an area brush soap and water around the edges until the bubbles are sighted, just like checking an inner tube.

### Fixing a Leak

Once you locate a leak, it is best to create a vacuum on the tank to suck the epoxy into the crack. Use your shop vacuum to pull the vacuum. **Be careful, a powerful shop vacuum may collapse the wing**. Just bring the vacuum close up to the fuel cap for a slight pressure drop.

You can also use a sloshing compound to fix leaks. Depending on the type of sealer you used, make sure the sloshing compound is compatible, and position the wing so the compound will sink to the edges where you suspect the leak is. The sloshing compound is poured into the wing through one of the openings. The wing is positioned such that the sloshing compound runs towards the suspected area of the leak. This method should be a last resort as it tends to be messy. Attempt to keep the sloshing compound away from the slosh doors. If this becomes necessary, it is a good idea to contact Lancair.

**INTENTIONALLY LEFT BLANK**


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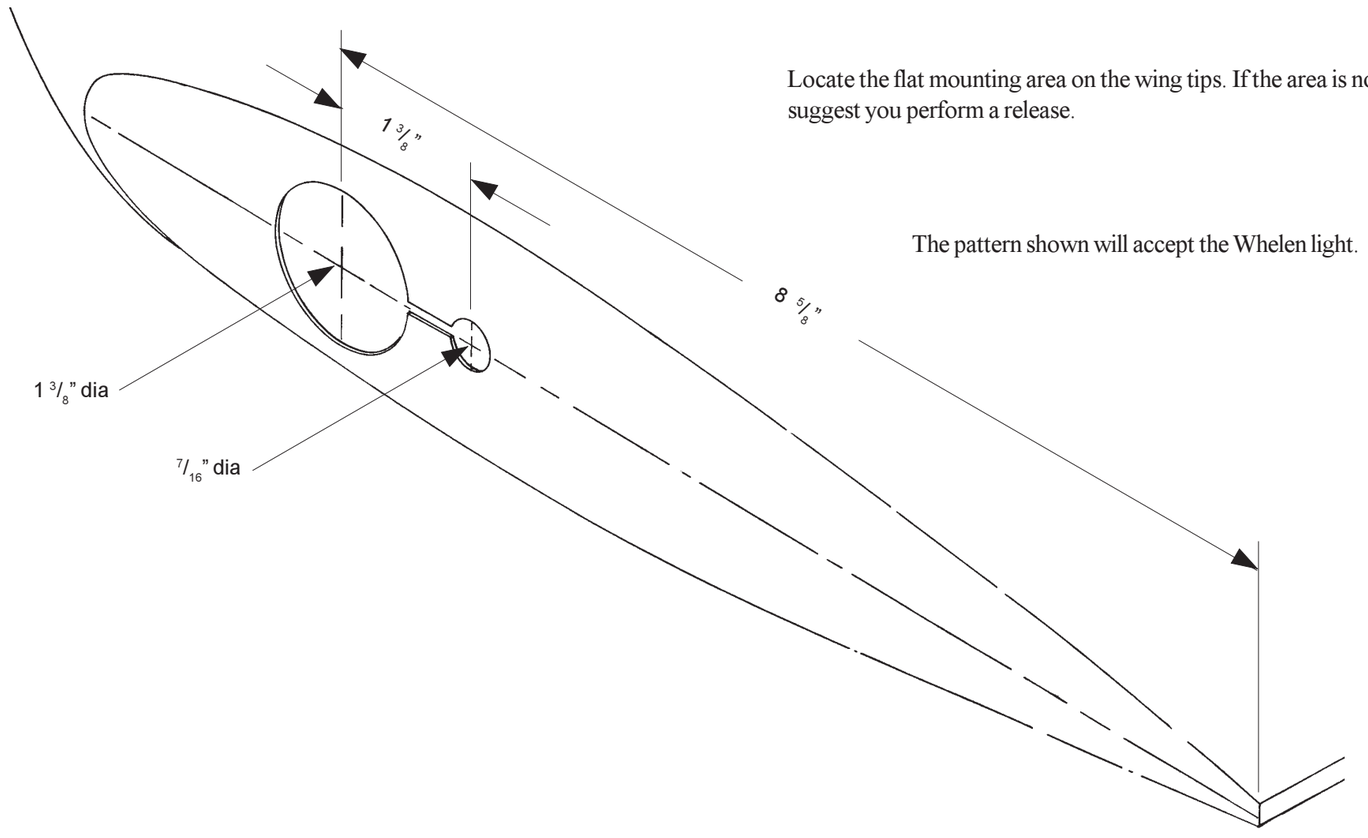
## C. Strobe and Nav Lights

**Strobe/ NAV Lights Installation**
**8:C:1**

The Legacy wing tips are made to accept the Whelen A600 PR/A600 PG light assemblies. The unit incorporates all required lighting for night flight. It has the red (left side) or green (right side) wing tip position light, a strobe light in the middle and a white tail light at the back. The Kit A600 includes all; a left and a right assembly, power supply and installation wire kit.




Locate the flat mounting area on the wing tips. If the area is not flat we suggest you perform a release.

The pattern shown will accept the Whelen light.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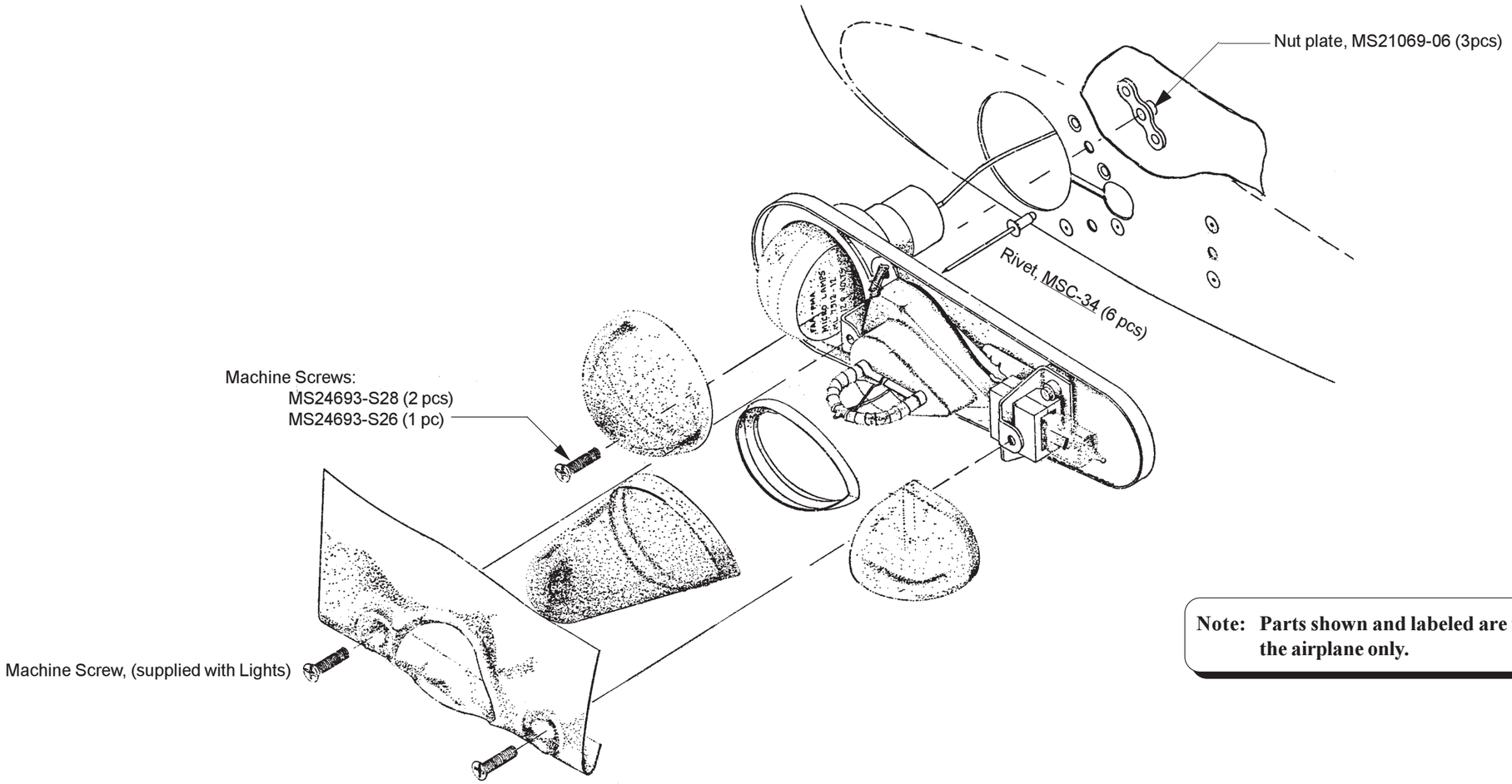
**Strobe/NAV lights Exploded view**
**Fig. 8:C:2**




**Note: Parts shown and labeled are for one side of the airplane only.**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# REVISION LIST

# CHAPTER 9: CANOPY

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.
Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 9-1through 9-3 | 1/09-18-02 | R&R | Part # Correction |
| 9-4 through 9-8 | 0/02-15-02 | None | Current revision is correct |
| 9-9 | 1/09-18-02 | R&R | Corrected Figure 9:B:1 |
| 9-10 through 9-16 | 0/02-15-02 | None | Current revision is correct |
| 9-17 | 1/09-18-02 | R&R | Text correction |
| 9-18 | 1/09-18-02 | R&R | Corrected Fig. 9:C:2 |
| 9-19 through 9-23 | 0/02-15-02 | None | Current revision is correct |
| 9-24 | 1/09-18-02 | R&R | Corrected Fig. 9:D:2 |
| 9-25 through 9-28 | 0/02-15-02 | None | Current revision is correct |
| 9-29 through 9-30 | 1/09-18-02 | R&R | Part # correction |
| 9-31 through 9-35 | 0/02-15-02 | None | Current revision is correct |
| 9-36 | 1/09-18-02 | R&R | Text correction |
| 9-37 through 9-39 | 0/02-15-02 | None | Current revision is correct |
| 9-40 | 1/09-18-02 | R&R | Part # correction.<br>Figure 9:J:2 correction |
| 9-3 | 2/06-30-04 | R&R | Updated part number. |
| 9-23 | 2/06-30-04 | R&R | Deleted instructions D3 and D4 and View AA graphic. |
| 9-24 | 2/06-30-04 | R&R | Updated figure 9:D:2 and corrected detail view. |
| 9-30 | 2/06-30-04 | R&R | Changed parts. |
| 9-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 9-2 | 3/12-15-04 | R&R | Updated parts list. |
| 9-17 | 3/12-15-04 | R&R | Updated rivets from MSC-32 to MSC-34. |
| 9-23 | 3/12-15-04 | R&R | Updated figure 9:D:1. |
| 9-35 | 3/12-15-04 | R&R | Updated figure 9:H:1 and added parts. |
| 9-36 | 3/12-15-04 | R&R | Updated figure 9:H:2 and added instructions. |


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| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 9-2, 9-3, 9-5, 9-9, 9-18, 9-24 | 6/08-10-07 | R&R | Part numbers changed. |


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# Chapter 9: Canopy

Contents



## 1. INTRODUCTION

The Legacy canopy consists of three major pieces, the canopy frame, the windshield and the canopy stiffener.

The forward hinging canopy is standard on the Legacy. The hinges bolt directly to the stiffener. The gas struts attach directly to the hinges. The other end of the gas strut mounts to the firewall.

To obtain a good fit it is essential that you understand the assembly. We suggest reading this section before starting the construction.

A protective film is supplied by the manufacturer. This is a waterbase protectant and should be left on the windows until your aircraft is painted to avoid scratches.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **CANOPY LATCH MECHANISM** | | | | |
| 1) | 4455 | 1 | Bushing | |
| 2) | 4608 | 4 | Hook | |
| 3) | 4609 | 1 | Torque Tube, Left | |
| 4) | 4610 | 1 | Torque tube, Right | |
| 5) | 4618 | 2 | Delrin Striker, Canopy | |
| 6) | 4619 | 2 | Striker Plate, Canopy Latch | |
| 7) | 4620 | 2 | Receptacle, Canopy Latch | |
| 8) | 1100-31 | 1 | Bearing Block | |
| 9) | F34-14 | 4 | Bearing, Rod End | |
| 10) | AN3-3A | 2 | Bolt, Undrilled | |
| 11) | AN3-4A | 8 | Bolt, Undrilled | |
| 12) | AN3-5A | 4 | Bolt, Undrilled | |
| 13) | AN3-7A | 1 | Bolt, Undrilled | |
| 14) | AN3-10A | 4 | Bolt, Undrilled | |
| 15) | AN3-10 | 2 | Bolt, Undrilled | |
| 16) | AN3-11A | 2 | Bolt, Undrilled | |
| 17) | 1100-07 | 1 | Bushing, Delrin | |
| 18) | 1100-11 | 1 | Clamp | |
| 19) | 1100-04 | 1 | Collet | |
| 20) | MS24665-132 | 3 | Cotter Pin | |
| 21) | 1100-01 | 1 | Handle | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**




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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| 22) | CD316-05 | 1 | Handle | |
| 23) | CD316-09 | 1 | Hoop | |
| 24) | 1100-02 | 1 | Knob, Thread | |
| 25) | 1100-03 | 1 | Knob, Countersink | |
| 26) | AN310-3 | 3 | Nut, Castle | |
| 27) | AN316-4 | 4 | Nut, Check | |
| 28) | AN365-428A | 1 | Nut, Nylock | |
| 29) | AN365-1032A | 13 | Nut, Nylock | |
| 30) | K1000-3 | 8 | Nutplates | |
| 31) | K1000-08 | 8 | Nutplates | |
| 32) | MSC-34 | 32 | Rivets | |
| 33) | **164-0001** ~~92383A261~~ | 1 | Roll pin | |
| 34) | AL206-01 | 2 | Rod | |
| 35) | MS24694-S5 | 8 | Screw, Machine | |
| 36) | MS24693-S48 | 8 | Screw, Machine | |
| 37) | MS24694-S104 | 1 | Screw, Machine | |
| 38) | **101-0097** ~~4AM13~~ | 1 | Screw, Socket Head | |
| 39) | **101-0067** ~~4AM92~~ | 1 | Screw, Socket Head | |
| 40) | CD316-02 | 1 | Spindle | |
| 41) | CD316-07 | 1 | Spring | |
| 42) | 5596 | 1 | Spring | |
| 43) | CD316-06 | 1 | Tab, Spring | |
| 44) | AN960-10 | 19 | Washer, Flat | |
| 45) | AN960-10L | 8 | Washer, Flat (thin) | |
| 46) | AN960-416 | 1 | Washer | |
| **CANOPY** | | | | |
| 1) | 4010 | 1 | Canopy Skin | |
| 2) | 4011 | 1 | Canopy Stiffener | |
| 3) | 4015-01 | 1 | Canopy Hinge Support, Outboard, Left | |
| 4) | 4015-02 | 1 | Canopy Hinge Support, Outboard, Right | |
| 5) | 4016-01 | 1 | Canopy Hinge Support, Inboard, Left | |
| 6) | 4016-02 | 1 | Canopy Hinge Support, Inboard, Right | |
| 7) | 4600 | 1 | Windshield | |
| 8) | 4603 | 2 | Shim, Canopy Hinge | |
| 9) | 4605-01 | 1 | Canopy Hinge, Left | |
| 10) | 4605-02 | 1 | Canopy Hinge, Right | |
| 11) | 4606 | 2 | Bracket, “T” Attach | |
| 12) | 4607 | 1 | Support Tube, Canopy Hinge | **Yes |
| 13) | 4611 | 4 | Bushing, Hinge | |
| 14) | 4621 | 2 | Alignment Plate, Canopy | |
| 15) | 4622 | 2 | Striker Plate, Canopy Alignment | |
| 16) | 4623 | 2 | Striker Plate, Delrin | |
| 17) | 4624 | 2 | Screws, Machine (drilled) | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| 18) | 4625 | 1 | Ring Seal, Canopy | |
| 19) | 4626 | 1 | Pattern | |
| 20) | AN3-11A | 2 | Bolt, Undrilled | |
| 21) | AN3-4A | 4 | Bolt, Undrilled | |
| 22) | AN4-7 | 4 | Bolt, Drilled Shank | |
| 23) | AN4-7A | 4 | Bolt, Undrilled | |
| 24) | AN5-5A | 2 | Bolt, Undrilled | |
| 25) | **198-0002** ~~9416K66~~ | 4 | End fork | |
| 26) | MS24665-140 | 4 | Cotter Pin | |
| 27) | K1000-03 | 4 | Nutplates | |
| 28) | K2000-4 | 4 | Nutplates | |
| 29) | AN310-4 | 4 | Nuts, Castle | |
| 30) | AN363-1032 | 4 | Nuts, Lock (all metal) | |
| 31) | AN363-1032A | 6 | Nuts, Lock | |
| 32) | AN365-1032A | 2 | Nuts, Nylock | |
| 33) | AN426A3-8 | 8 | Rivets | |
| 34) | MSC-34 | 8 | Rivets | |
| 35) | MS24693-(AR) | 4 | Screws, Machine | |
| 36) | MS24694-S9 | 2 | Screws | |
| 37) | MS24694-S54 | 2 | Screws | |
| 38) | **160-0003** ~~9416K165~~ | 2 | Strut, Gas | |
| 39) | AN960-10 | 10 | Washer, Flat | |
| 40) | AN960-10L | 4 | Washer, Flat (thin) | |
| 41) | AN960-416 | 8 | Washer, Flat | |
| 42) | AN960-616 | 2 | Washer, Flat | |
| 43) | AN960-616L | 4 | Washer, Flat | |
| 44) | AN970-3 | 2 | Washer, Flat - large area washers | |
| 45) | SWS-951 | 1 | RTV Silicone | |
| 46) | 4028-01 | 1 | Glare shield | |
| 47) | 561-2 | 1 | Defroster inlet flange | |
| **INFLATABLE CANOPY SEAL ( optional)** | | | | |
| 1) | 4940-01 | 1 | Optional Inflatable Canopy Seal | **Yes |
| 2) | 3814-6 | 1 | Air Line | **Yes |
| 3) | MS21919-DG14 | 1 | Clamp | **Yes |
| 4) | 4LD-061-D00 | 1 | Check Valve | **Yes |
| 5) | 326-0-12 | 1 | Electric Door Seal Pump | **Yes |
| 6) | 237-4-2 | 1 | Fitting, “T” | **Yes |
| 7) | 28-4-2 | 1 | Fitting | **Yes |
| 8) | MJTV-3 | 1 | Pneumatic Door Seal Switch | **Yes |
| 9) | 01664080-032 | 1 | Pressure Switch | **Yes |
| 10) | 22-4 | 1 | Union | **Yes |


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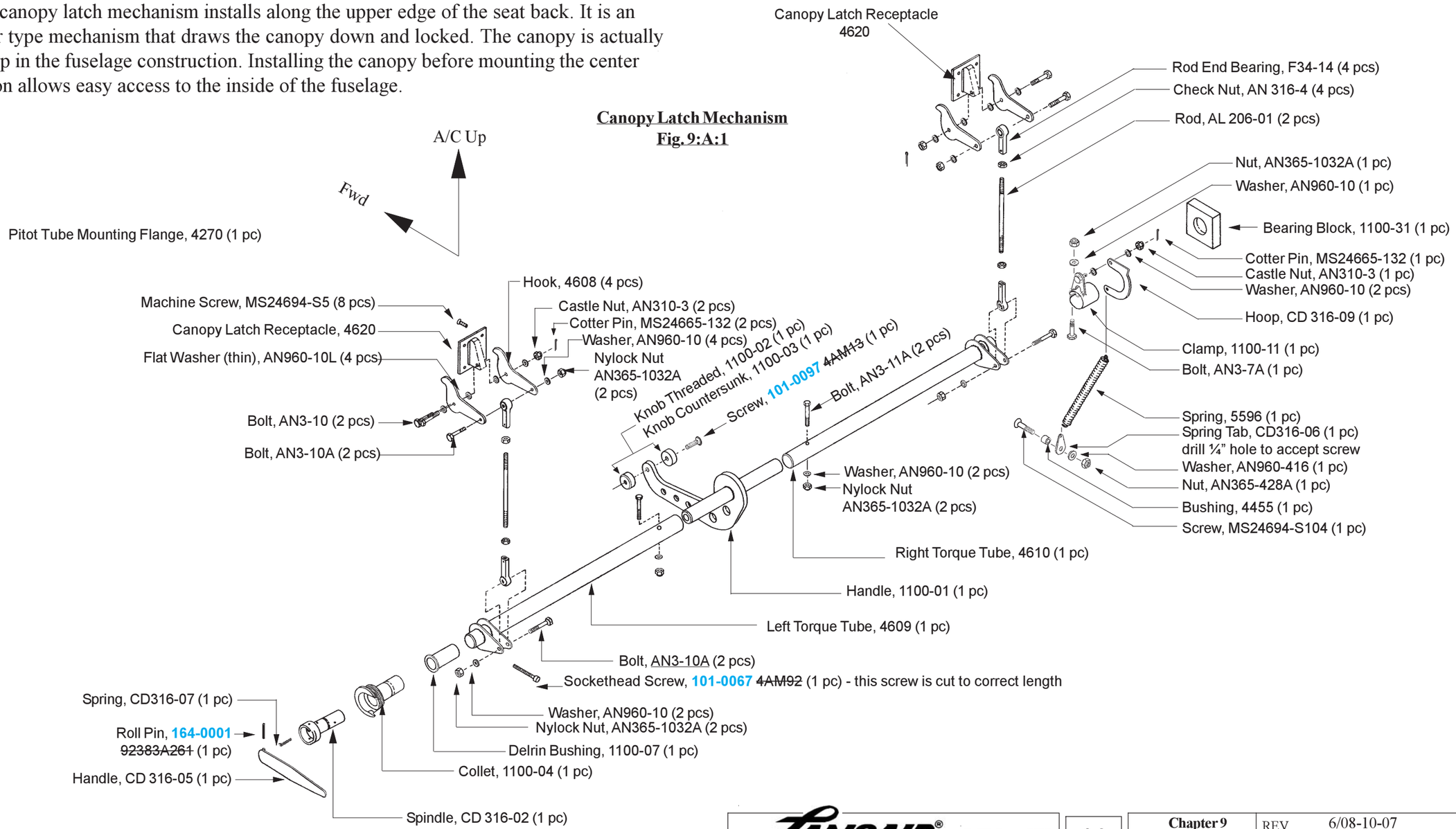
# 3. CONSTRUCTION PROCEDURES

## A. Canopy Latch Mechanism

The canopy latch mechanism installs along the upper edge of the seat back. It is an over-center type mechanism that draws the canopy down and locked. The canopy is actually the first step in the fuselage construction. Installing the canopy before mounting the center wing section allows easy access to the inside of the fuselage.

**Canopy Latch Mechanism**
**Fig. 9:A:1**



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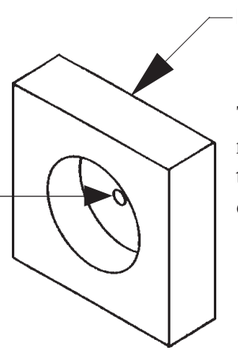
The first step in installing the canopy latch mechanism is to install the bearing block on the right side of the fuselage. On each side of the fuselage there is a 1/8" alignment hole. At this point locate the pilot holes.

**A 1.** Drill a 1/8" hole all the way through the block. The 1/8" hole must be centered in the existing hole.

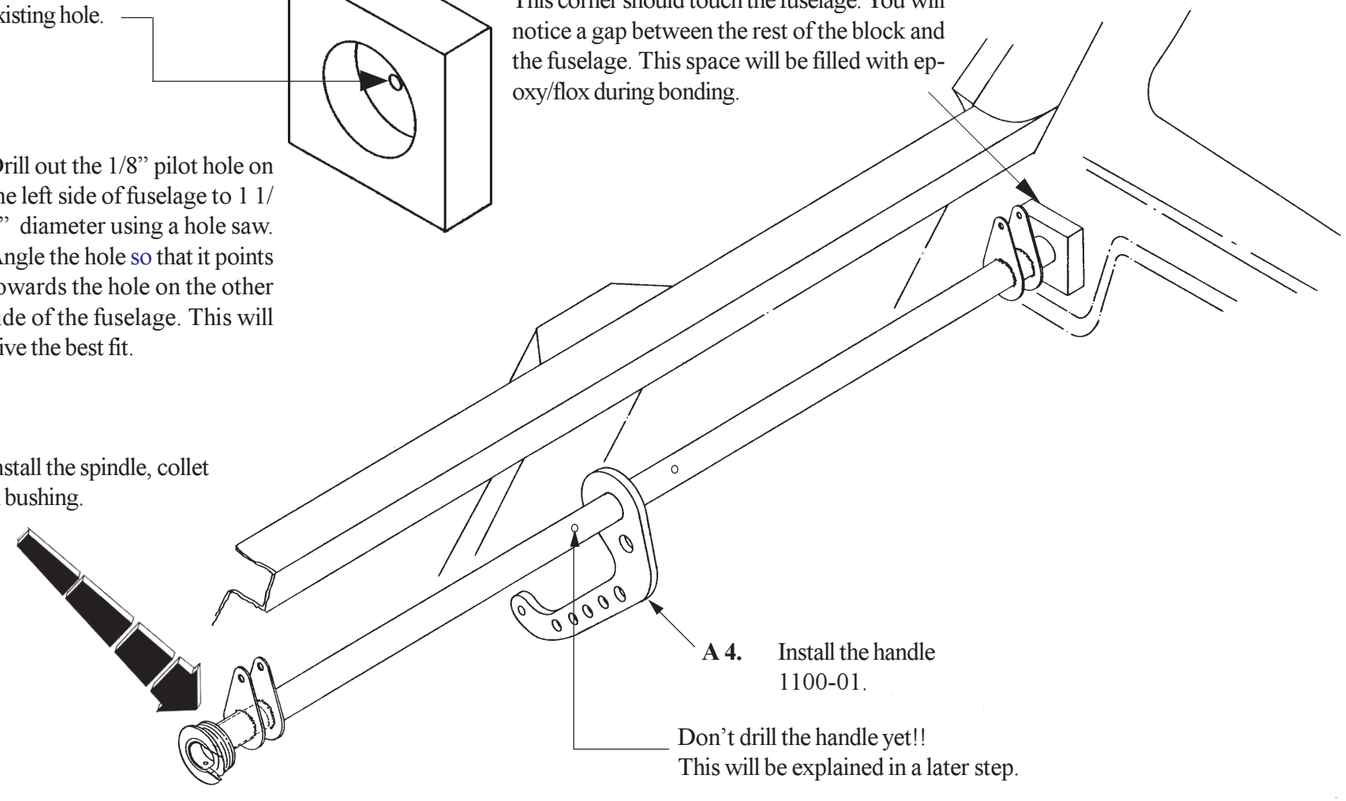



**A 2.** Drill out the 1/8" pilot hole on the left side of fuselage to 1 1/2" diameter using a hole saw. Angle the hole so that it points towards the hole on the other side of the fuselage. This will give the best fit.

**A 3.** Install the spindle, collet and delrin bushing.

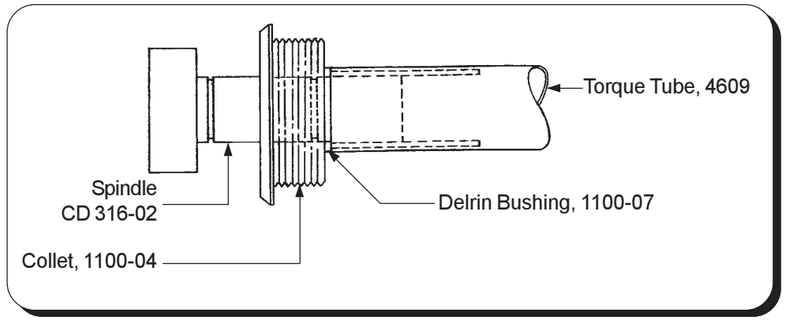
**Installing Bearing Block**
**Fig. 9:A:2**

This corner should touch the fuselage. You will notice a gap between the rest of the block and the fuselage. This space will be filled with epoxy/flox during bonding.



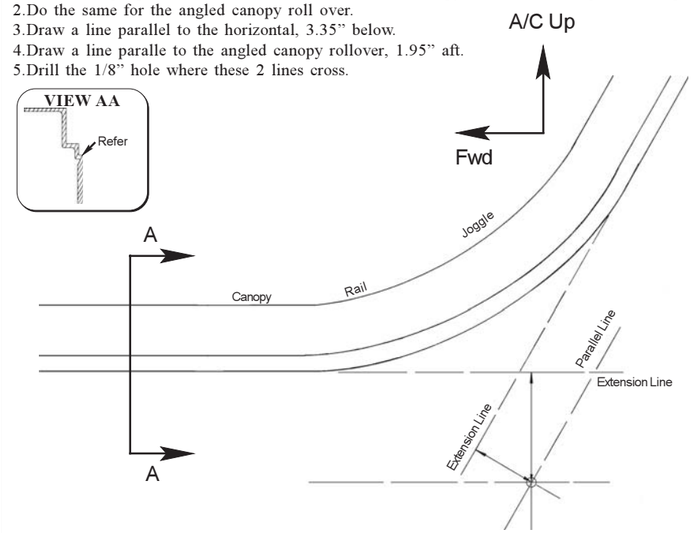
**A 4.** Install the handle 1100-01.

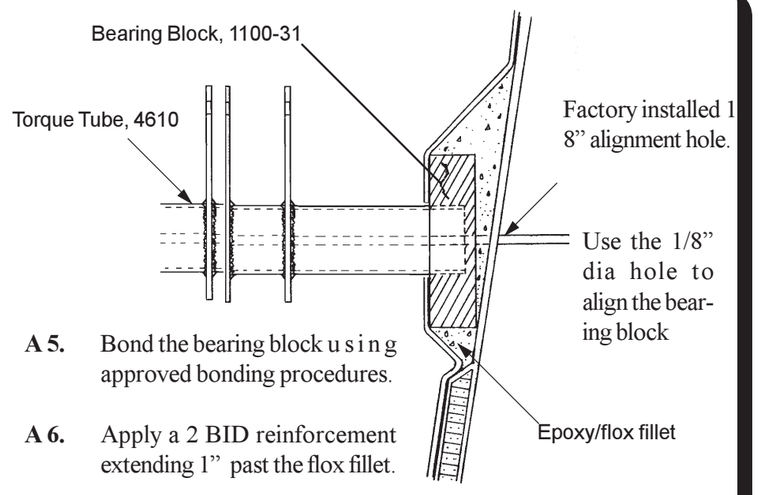
Don't drill the handle yet!! This will be explained in a later step.




## Checking Alignment Hole Location

1.Use masking tape or a ruler to extend the horizontal canopy rail line aft along the fuselage.
2.Do the same for the angled canopy roll over.
3.Draw a line parallel to the horizontal, 3.35" below.
4.Draw a line paralle to the angled canopy rollover, 1.95" aft.
5.Drill the 1/8" hole where these 2 lines cross.




**A 5.** Bond the bearing block using approved bonding procedures.

**A 6.** Apply a 2 BID reinforcement extending 1" past the flox fillet.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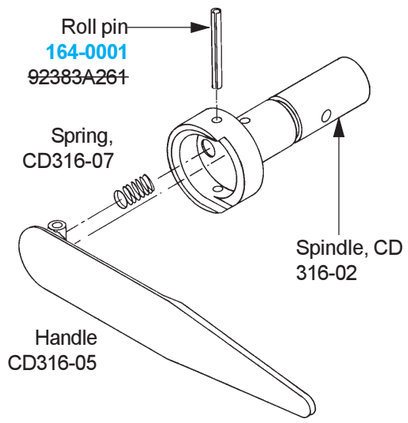
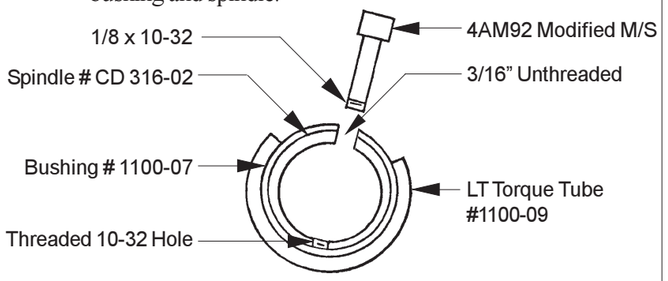
**Installing the Collet**
**Fig. 9:A:3**

**A 7.** Assemble the handle to the spindle.

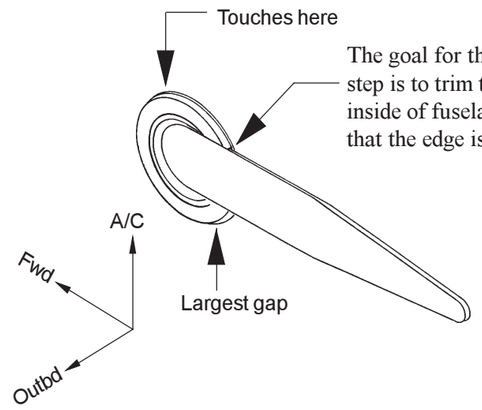



**A 8.** Move handle so that the unthreaded hole in spindle aligns with the bushing hole.
- The 4AM92 socket head machine screw must be modified before it is installed. Screw an AN315-3 nut onto the 4AM92 screw as far as it will go. Cut off the excess threads and dress with file. Remove the AN315-3 nut. There should be slightly less then 1/8" threads remaining.
- Insert the modified 4AM92 bolt through the torque tube, bushing and spindle.

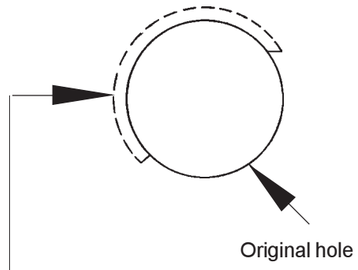



Note the hole drilled in the bushing

**A 9.** Install the assembly back into the collet and onto the torque tube. Note how the assembly is not flush with the side of the fuselage. In the next step you will trim the hole in the fuselage to get a better fit.

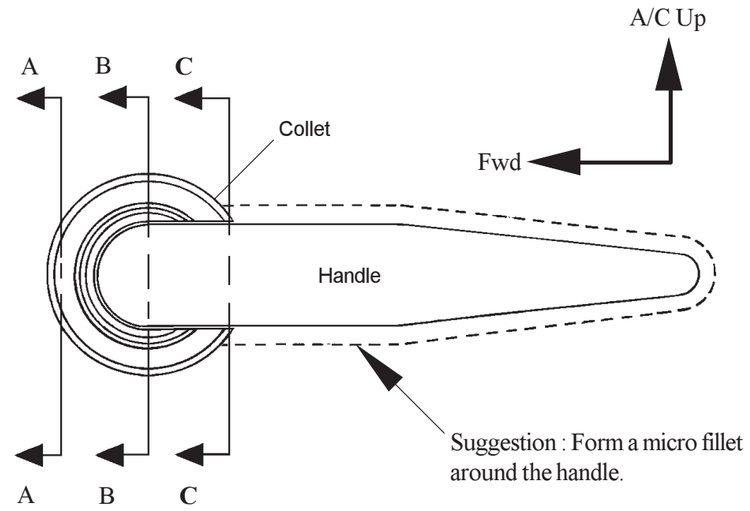



**A 10.** Trim the outer laminate of the hole to get a better fit.

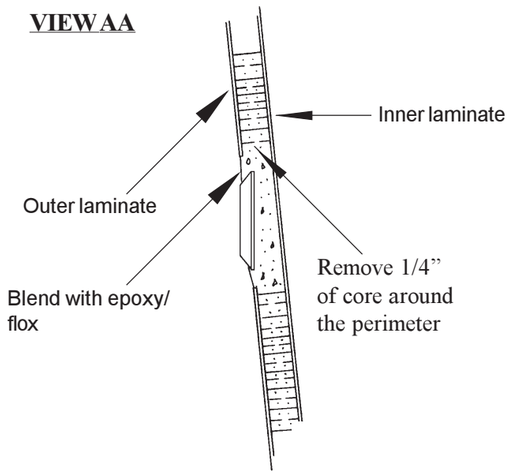


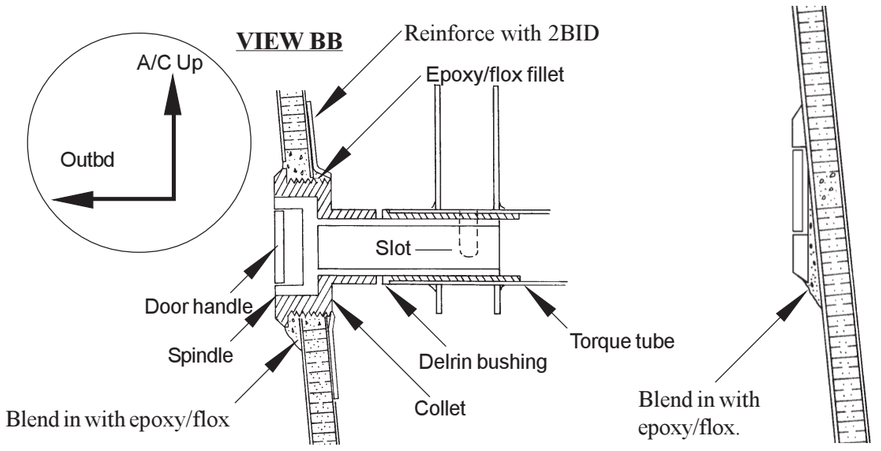

Trim the outer laminate approximately as shown. (Use the collet to determine how much to trim.)
Refer to the figure below.

**VIEWS LOOKING STRAIGHT AT HOLE FROM OUTSIDE**




**A 11.** Install the handle with epoxy/flox using approved bonding procedures. Use epoxy/flox. Reinforce with 2 BID on inside.





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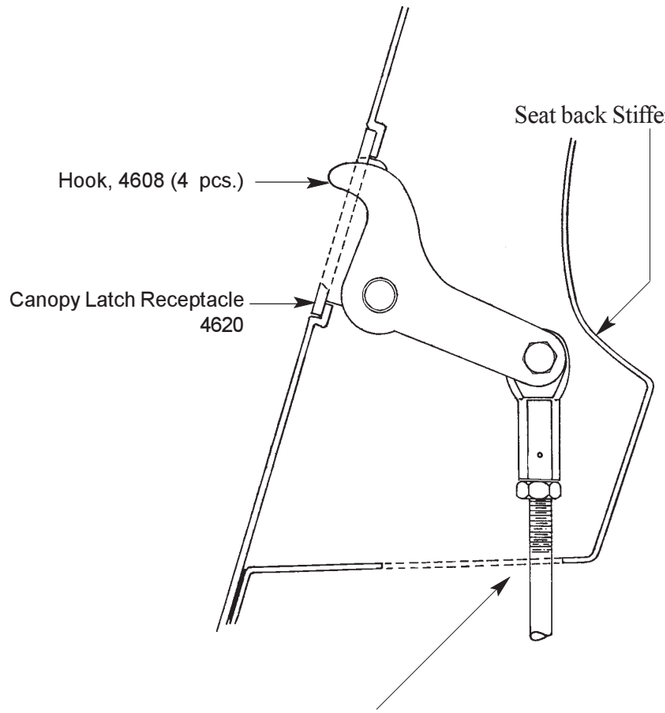
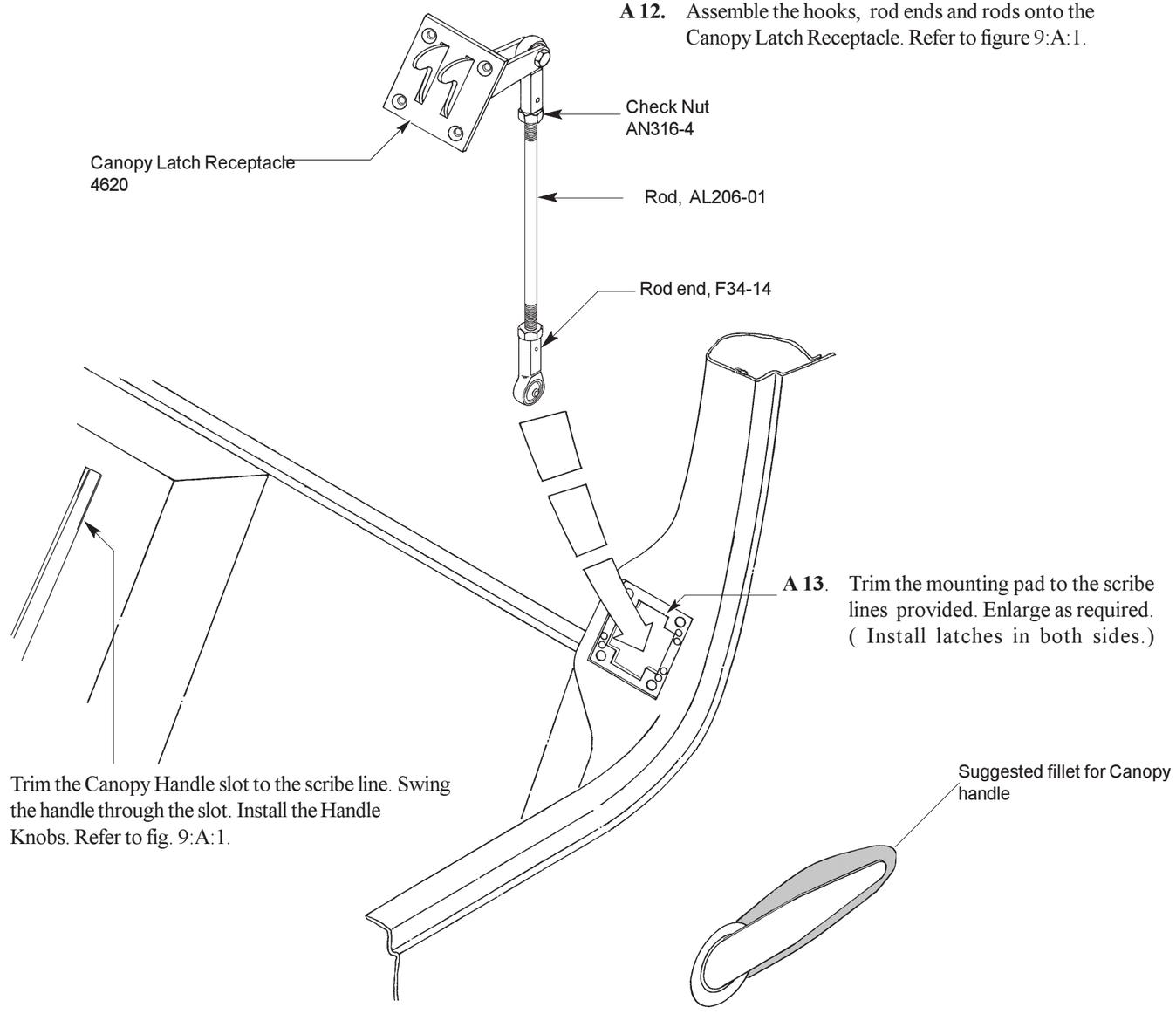



**A 11.** Create a hole in the Seat back Stiffener for the rod. Estimate initial location then size and enlarge as required.

**Canopy Latch Installation**
**Fig. 9:A:4**




**A 12.** Assemble the hooks, rod ends and rods onto the Canopy Latch Receptacle. Refer to figure 9:A:1.

**A 13.** Trim the mounting pad to the scribe lines provided. Enlarge as required. ( Install latches in both sides.)

**A 14.** Trim the Canopy Handle slot to the scribe line. Swing the handle through the slot. Install the Handle Knobs. Refer to fig. 9:A:1.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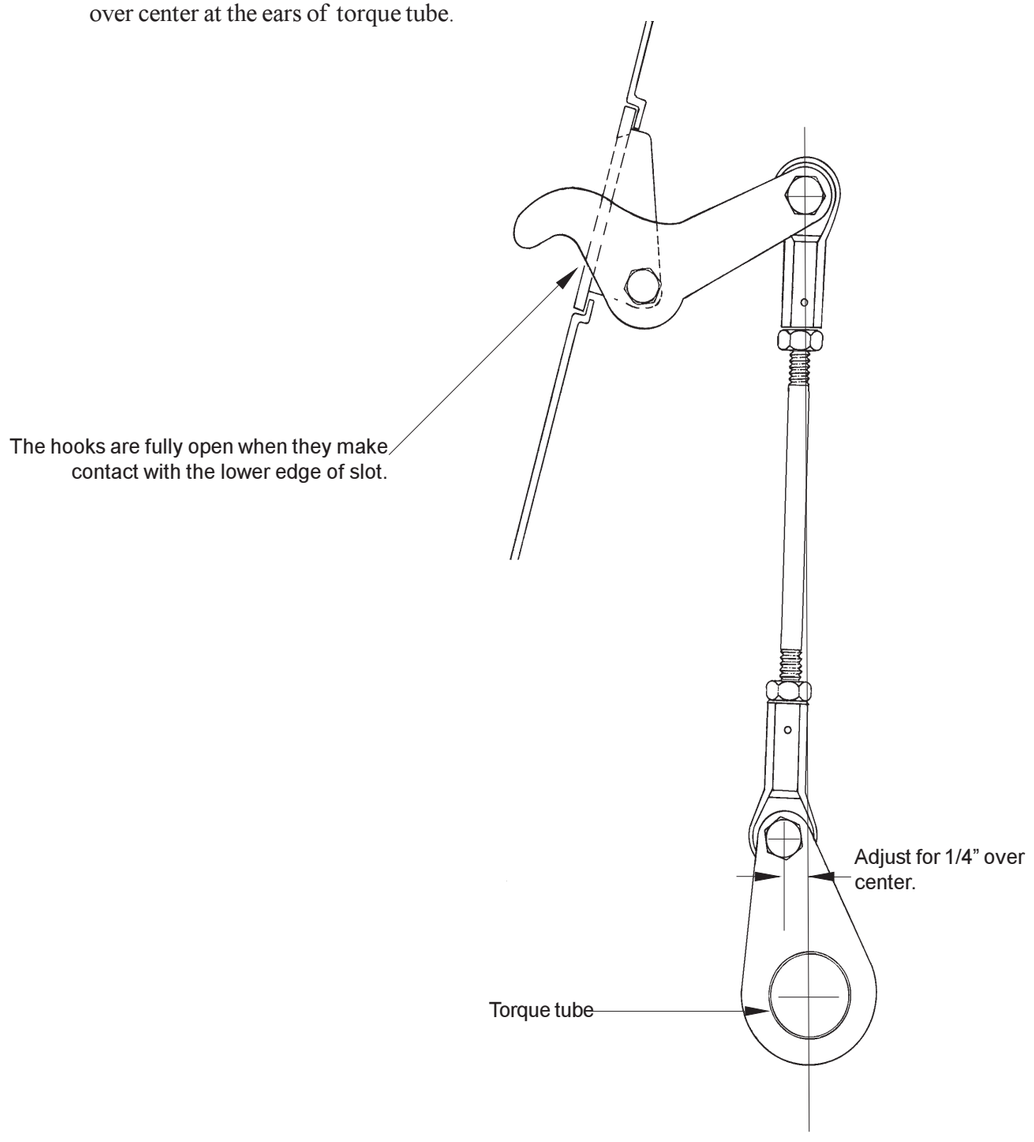
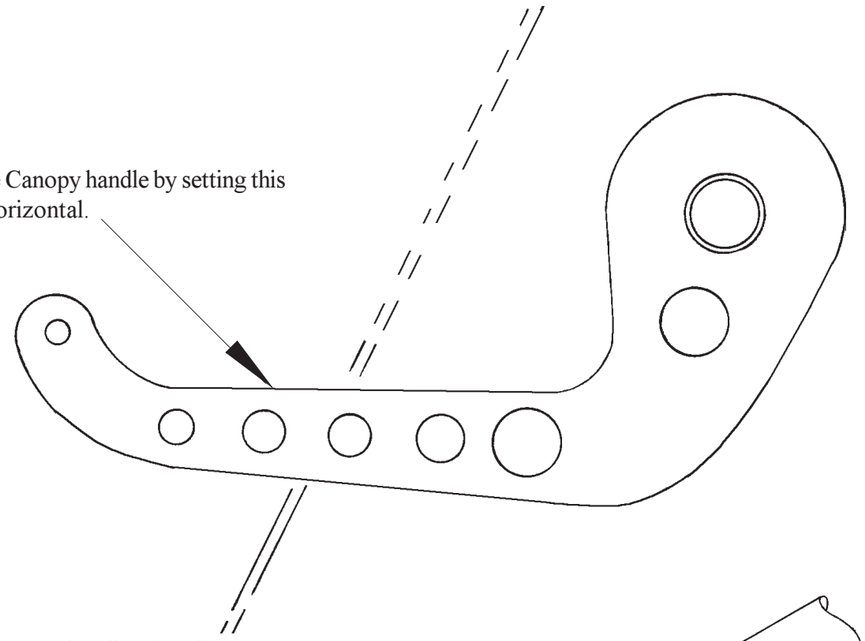
**Aligning and Drilling Canopy Torque Tubes**
**Fig. 9:A:5**

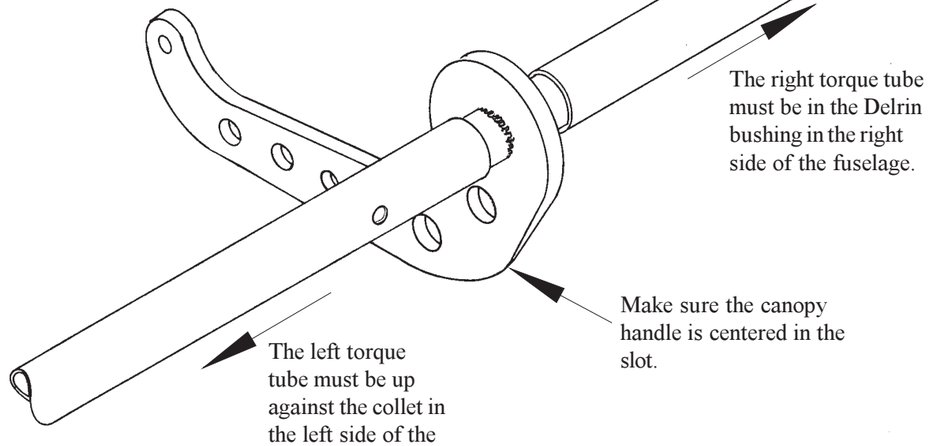
**A 15.** Adjust the rod ends so that the hook is fully open and the mechanism is about 1/4" over center at the ears of torque tube.




**A 16.** Level the Canopy handle by setting this surface horizontal.



**A 17**. Drill the canopy handle using the holes in the torque tube as guide.





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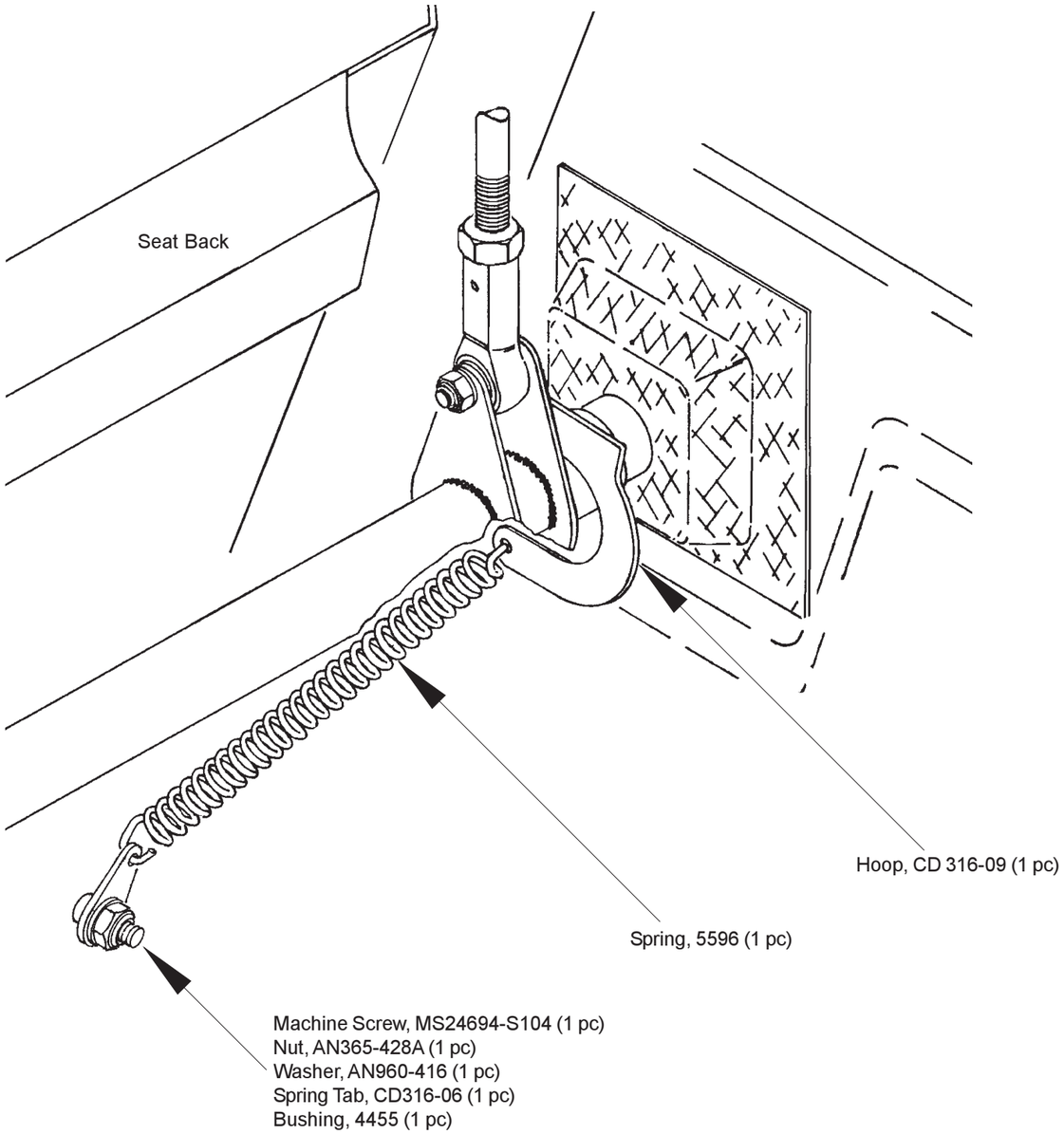
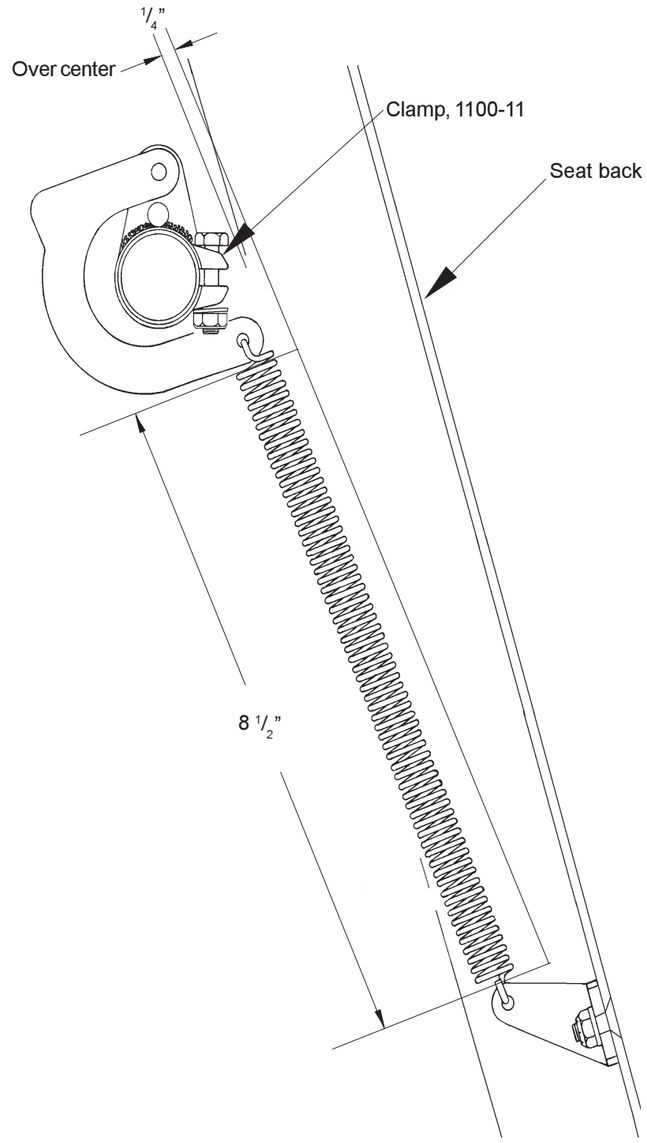
**Canopy Over Center Spring Mechanism**
**Fig. 9:A:6**





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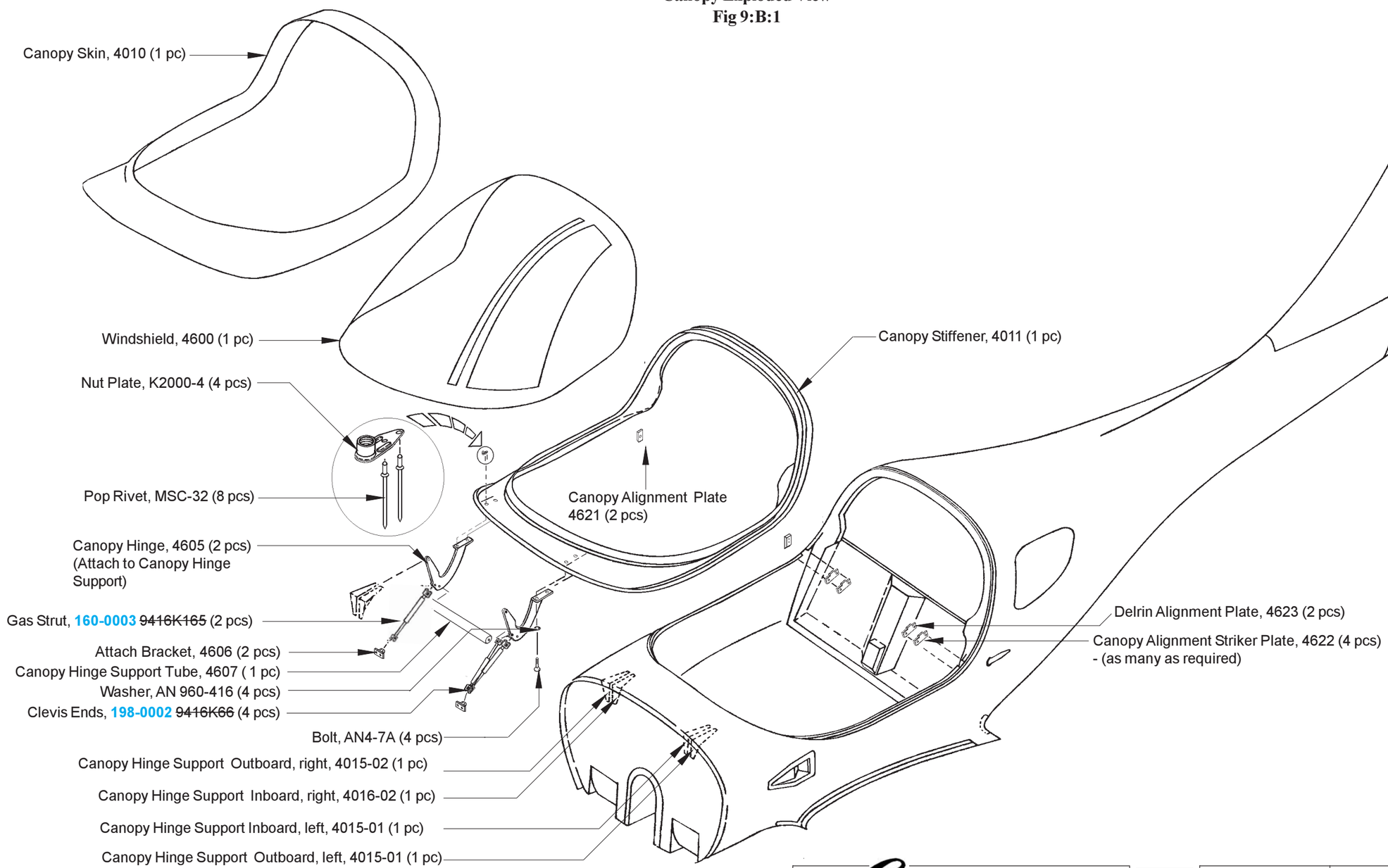
## B. Canopy Stiffener Alignment

**Canopy Exploded View**
**Fig 9:B:1**





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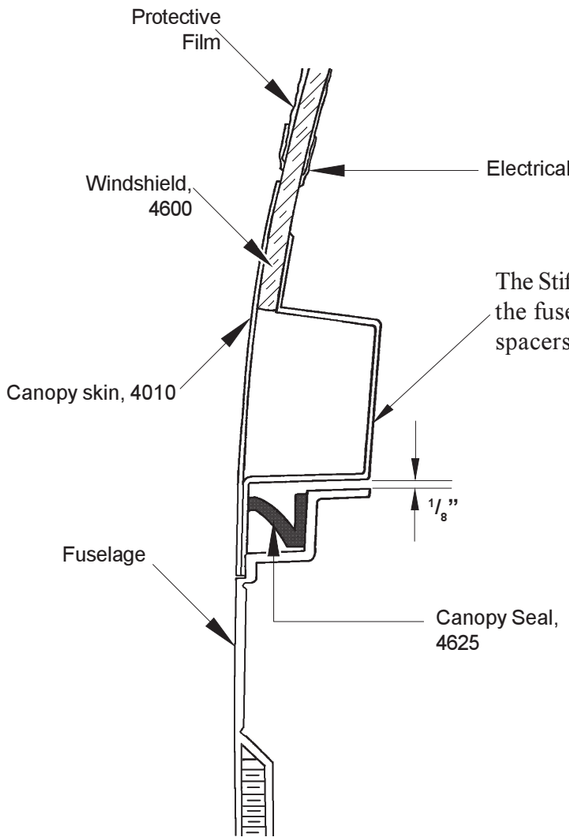
To understand the canopy assembly, study figure 9:B:2

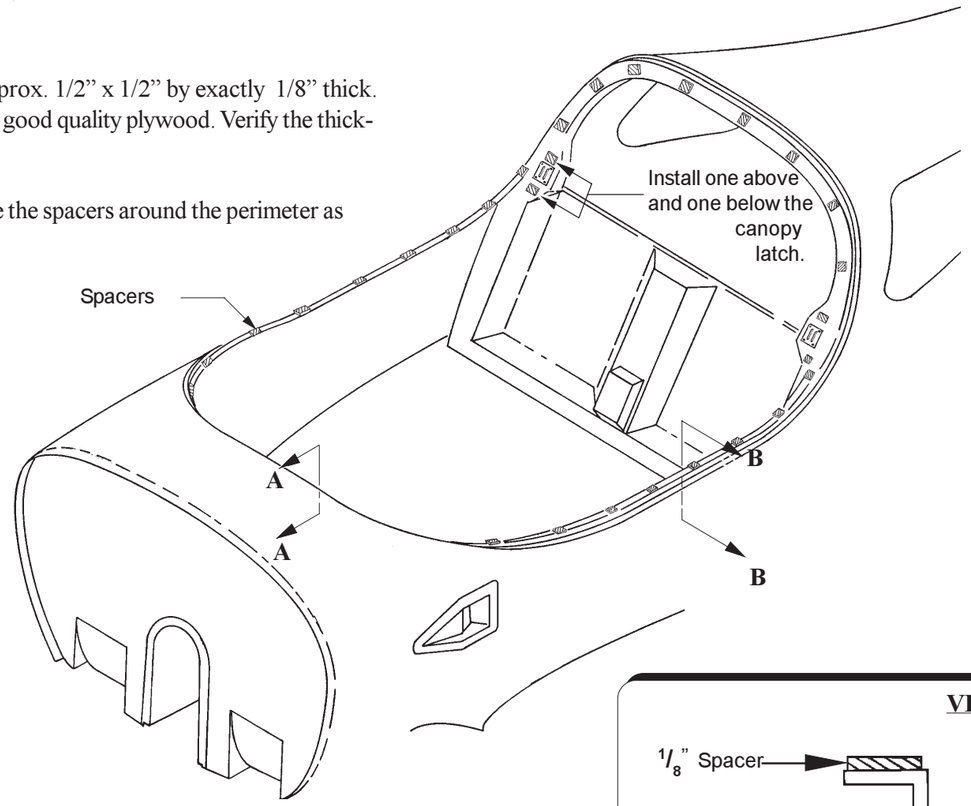
**Typical Canopy Cross Section**
**Fig. 9:B:2**

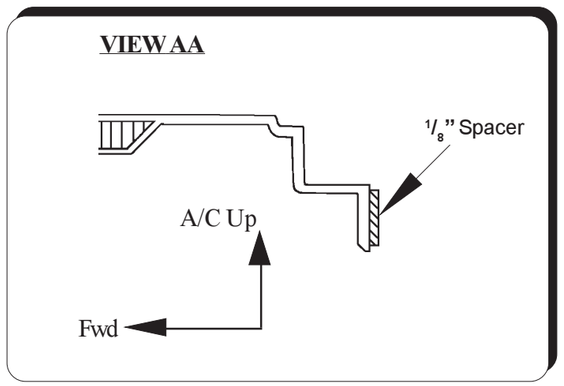


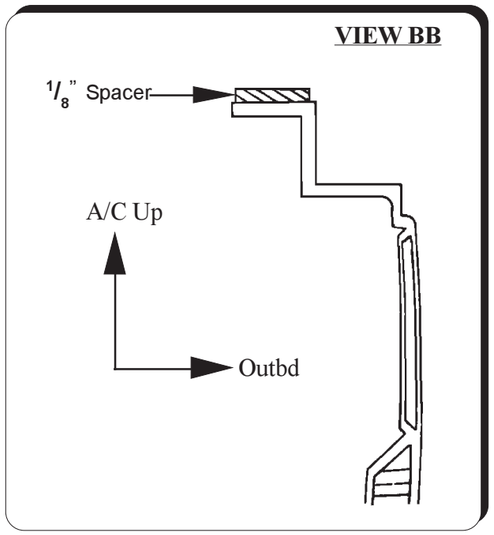

**B 1.** Cut 40 pcs of approx. 1/2" x 1/2" by exactly 1/8" thick. We suggest using good quality plywood. Verify the thickness.

**B 2.** Evenly super glue the spacers around the perimeter as shown.

**1/8" Spacer Installation**
**Fig. 9:B:3**





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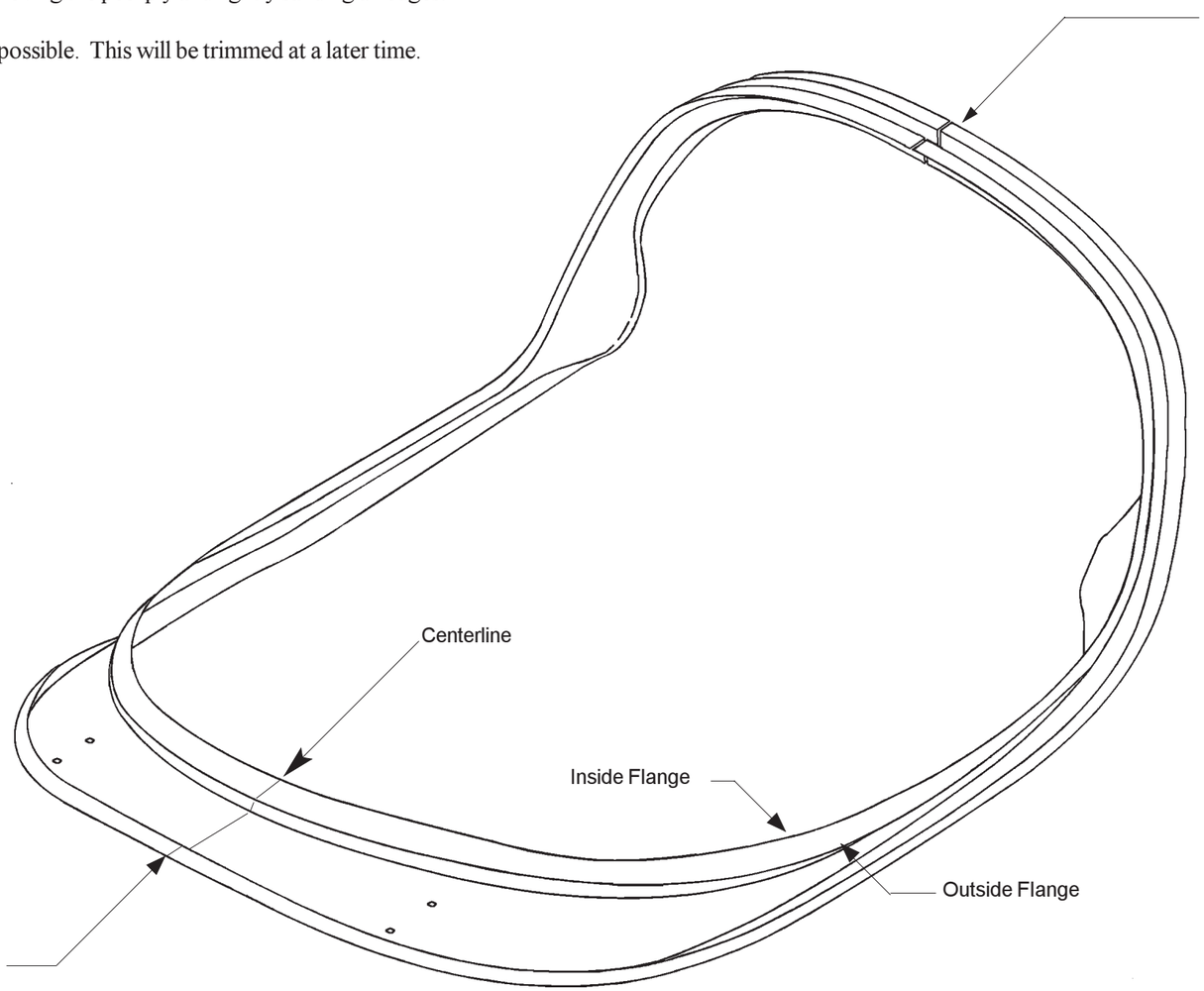
**Canopy Stiffener Preparation**
**Fig. 9:B:4**

**B 3.** Prepare the canopy stiffener by removing the peel ply and lightly sanding all edges.

Note: Leave the outside flange as long as possible. This will be trimmed at a later time.




**B 4.** Make a fine cut along the center of the canopy stiffener. The width of this gap will be opened up as required in the next steps. The cut gives the stiffener the flexibility required to custom fit the fuselage.

**B 5.** Transfer the scribe line of the canopy stiffener from the mold side to the outside. This is for the initial alignment.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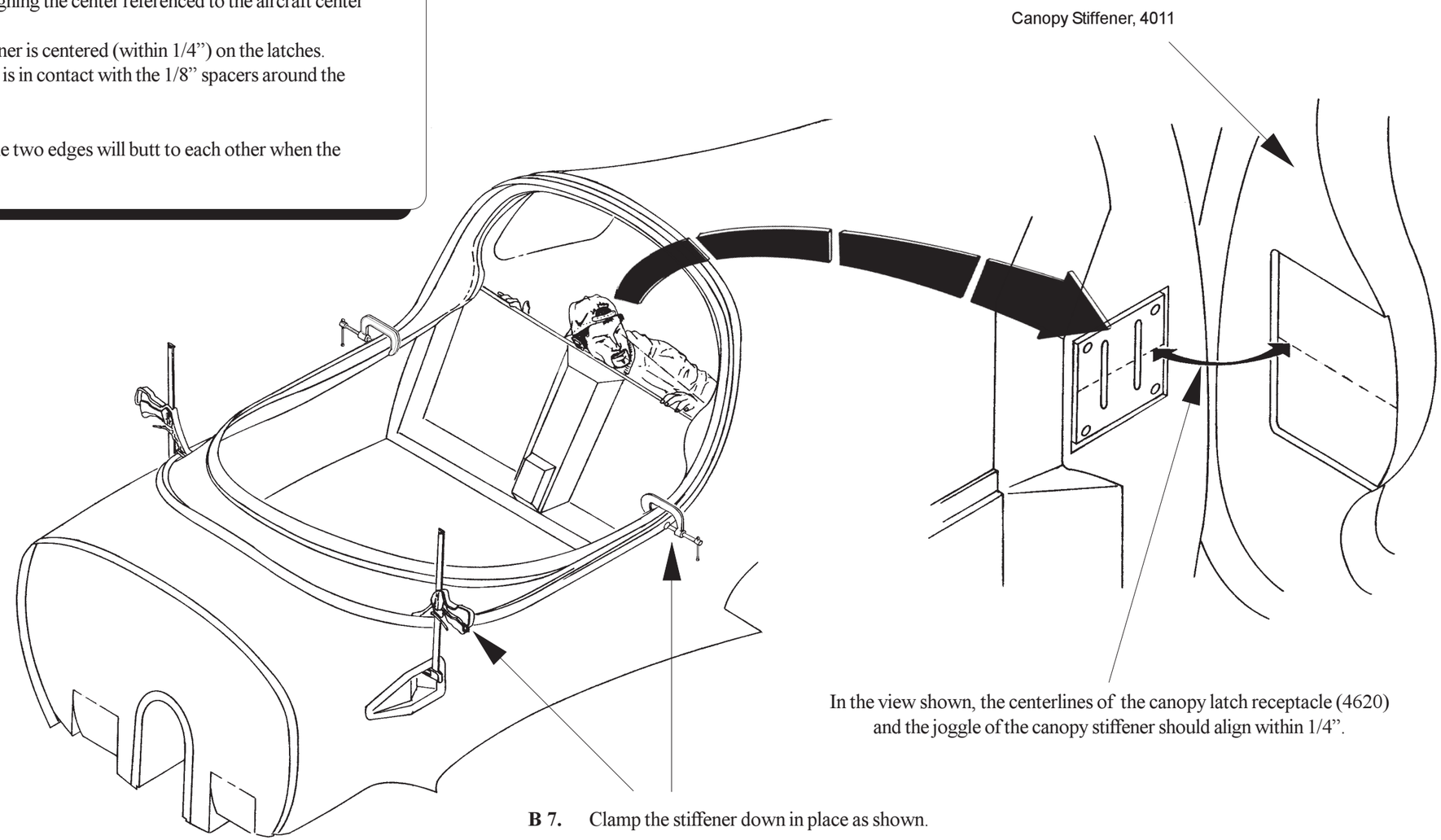
**Canopy Stiffener Alignment**
**Fig. 9:B:5**

**B 6.** Align the canopy stiffener using the suggestions of figure 9:B:5.

Aligning the canopy stiffener:

1) Initially center the stiffener by aligning the center referenced to the aircraft center line.
2) Verify that the joggle of the stiffener is centered (within 1/4") on the latches.
3) Visually inspect that the stiffener is in contact with the 1/8" spacers around the perimeter.

Increase cut width as required. Ideally the two edges will butt to each other when the canopy is aligned.




In the view shown, the centerlines of the canopy latch receptacle (4620) and the joggle of the canopy stiffener should align within 1/4".

**B 7.** Clamp the stiffener down in place as shown.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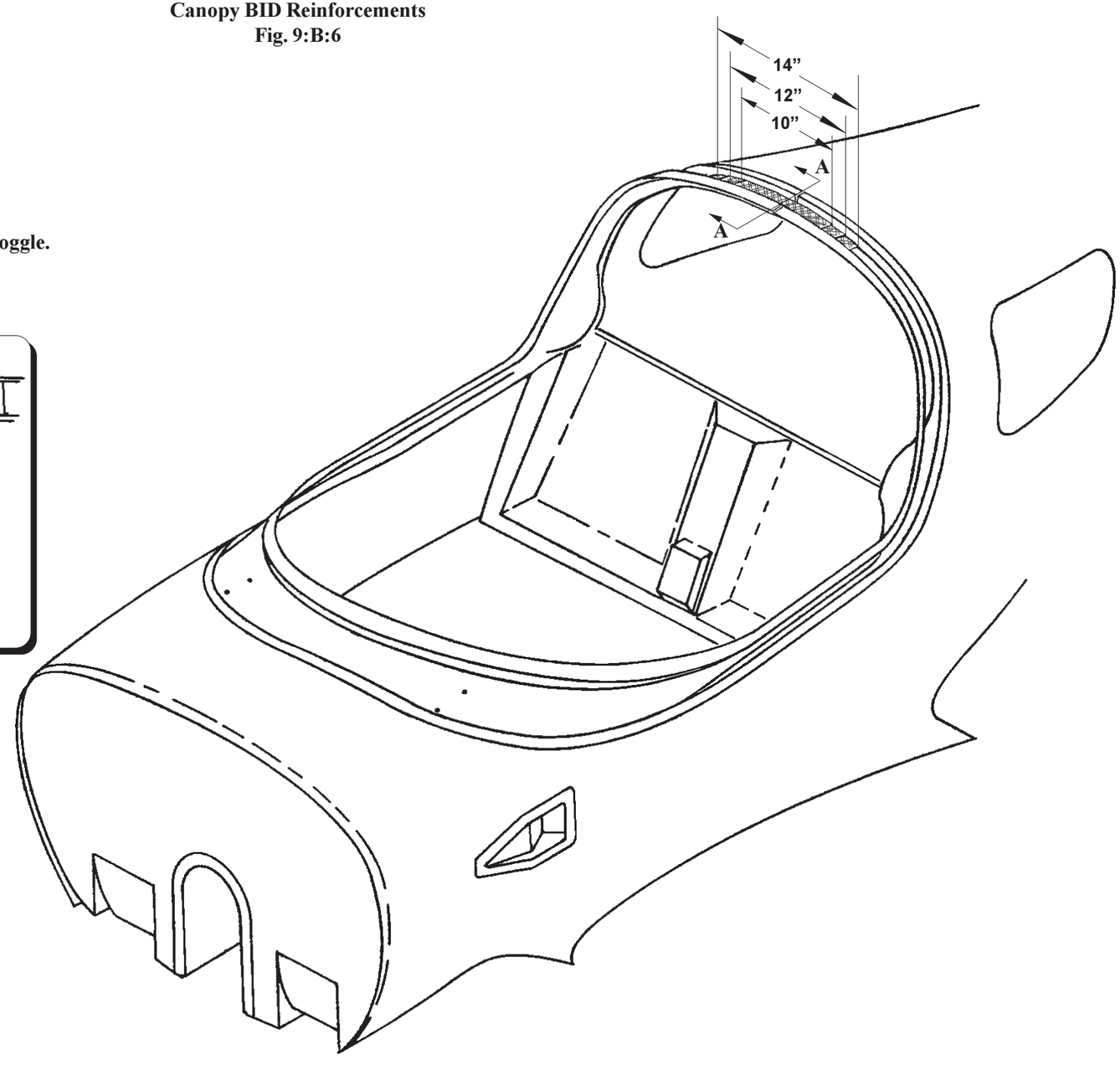
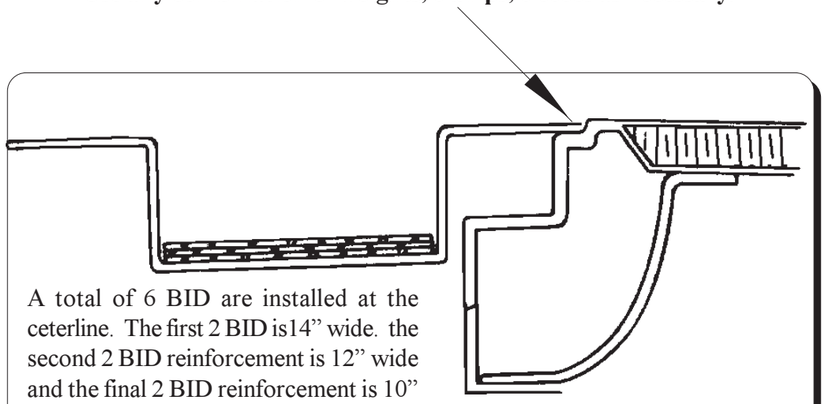
**Canopy BID Reinforcements**
**Fig. 9:B:6**




**TYPICAL CROSS SECTION AA**

**IMPORTANT:**
**Prior to installing the BID ensure that the stiffener is firmly in its joggle.**
**Use any combination of weights, clamps, clecoes as necessary.**



A total of 6 BID are installed at the ceterline. The first 2 BID is14” wide. the second 2 BID reinforcement is 12” wide and the final 2 BID reinforcement is 10” wide.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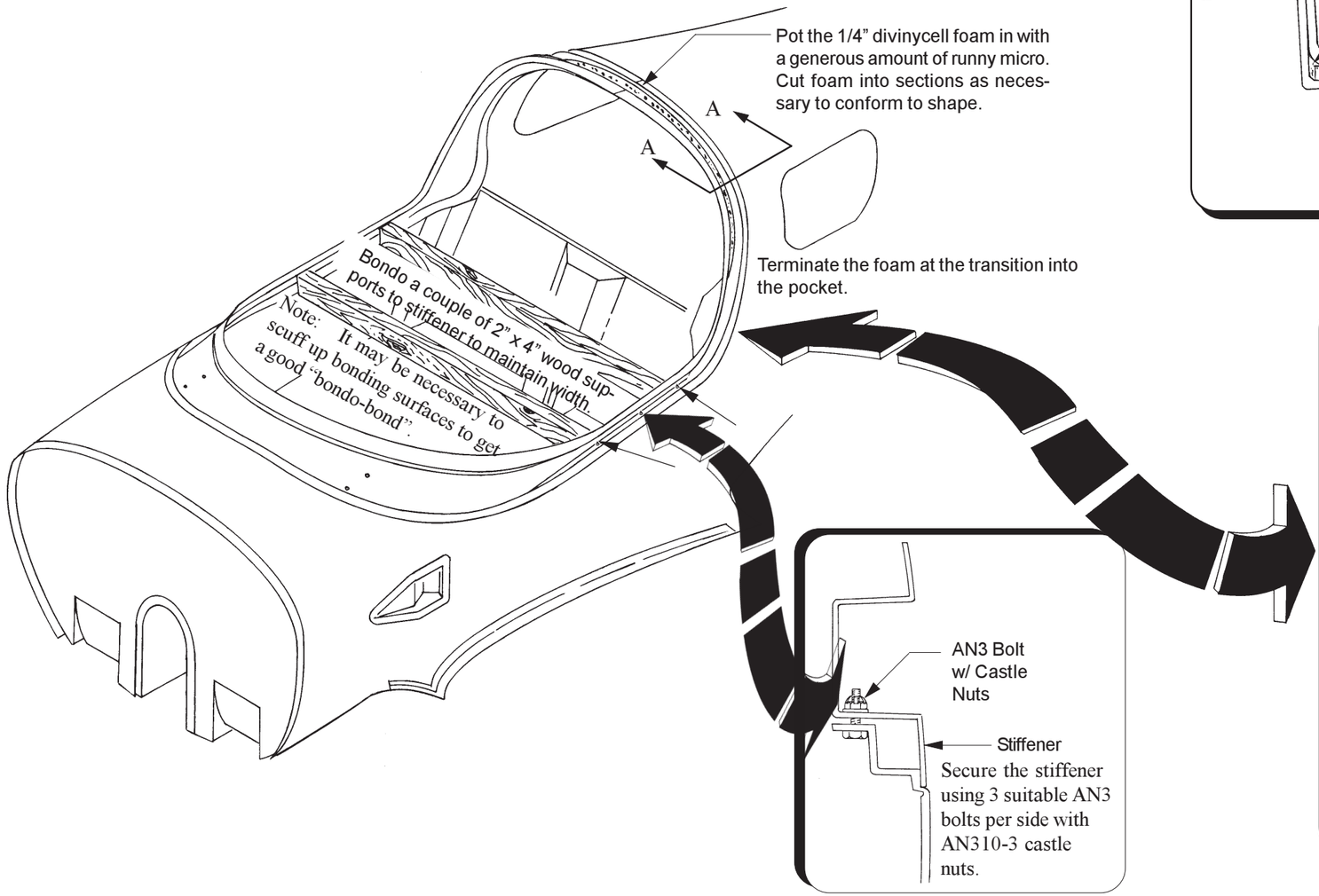
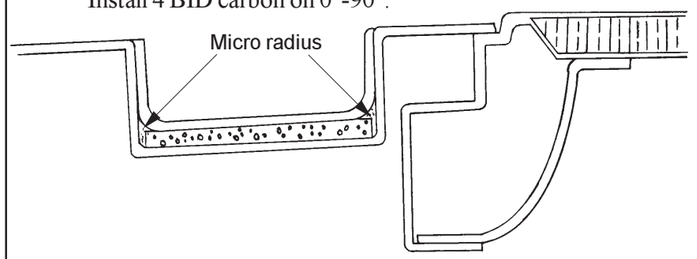
The canopy stiffener will now be custom fit to the fuselage. Once BID is secured loosen screws up and inspect the fit. Without applying any force to the stiffener, it should naturally rest on the 1/8" spacers.

**Canopy BID Reinforcements**
**Fig. 9:B:7**

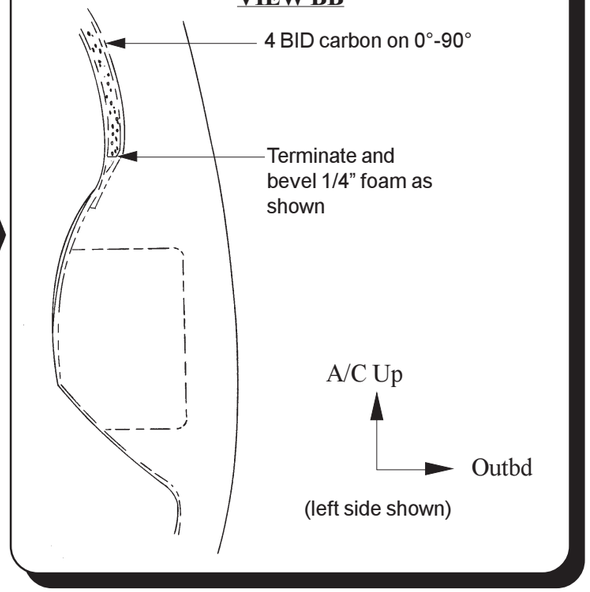



**VIEWAA**

Pot the foam in. Form micro radii as shown.
Install 4 BID carbon on 0°-90°.




**VIEW BB**





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**Trimming Canopy Skin**
**Fig. 9:B:8**

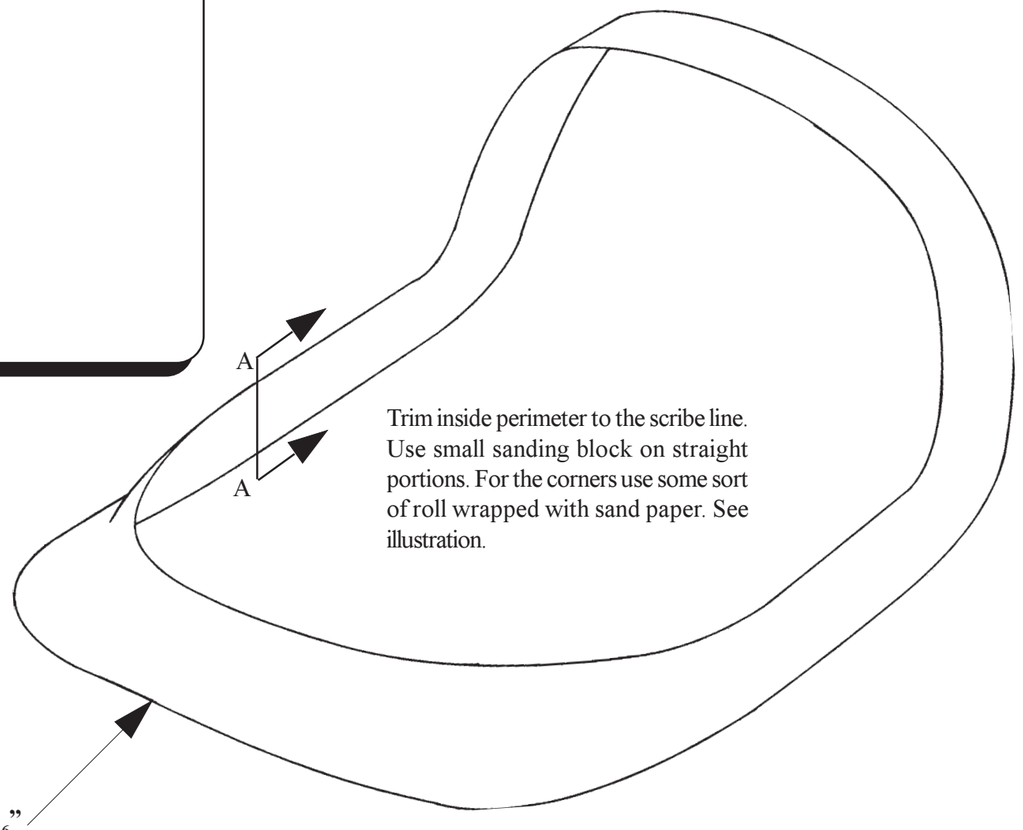
**VIEW AA**

Bevel window cutout on the outer edges for a smoother fit.

Sand as shown ( not to a sharp edge)

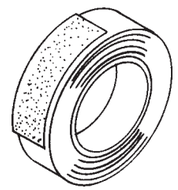
Outboard

Note: Trim to the scribe line and final sand before beveling.




Trim inside perimeter to the scribe line. Use small sanding block on straight portions. For the corners use some sort of roll wrapped with sand paper. See illustration.

Leave the outside perimeter $^{3}/_{16}$" long for now.

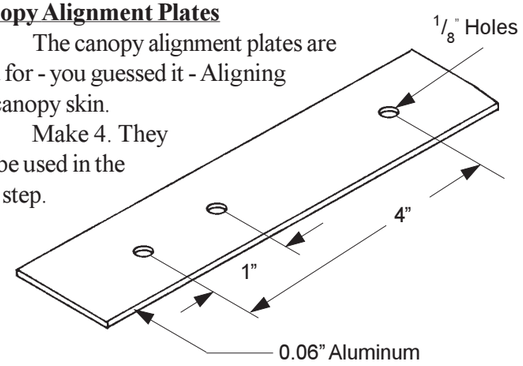


A roll of tape (Approx. 5" dia.) with stickback sand paper is a great tool for sanding the corners.

**Canopy Alignment Plates**

The canopy alignment plates are used for - you guessed it - Aligning the canopy skin.

Make 4. They will be used in the next step.





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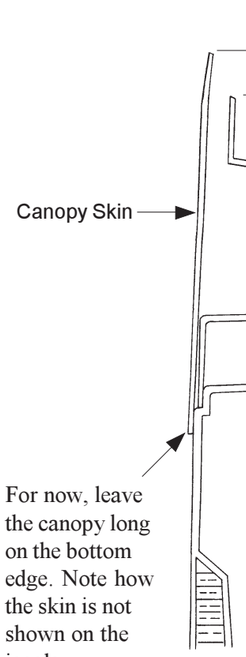
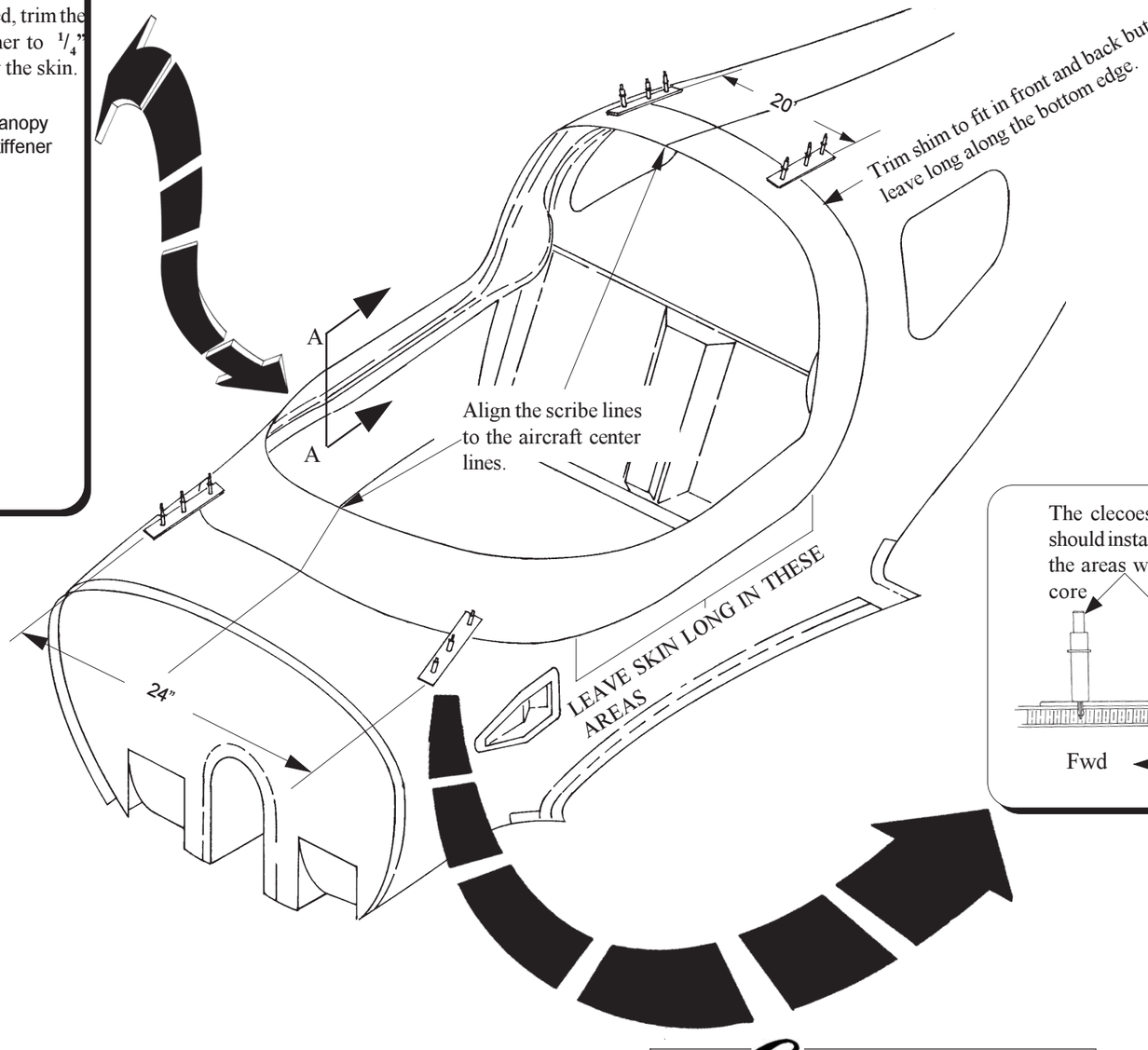
**Canopy Skin Alignment**
**Fig. 9:B:9**

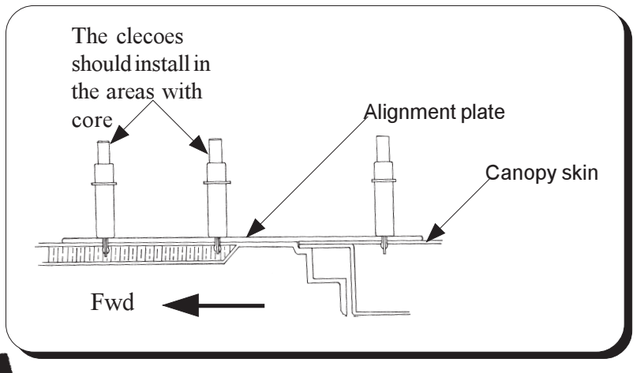
**VIEW A A**




Once the skin is aligned, trim the stiffener to 1/4" below the skin.

For now, leave the canopy long on the bottom edge. Note how the skin is not shown on the joggle.





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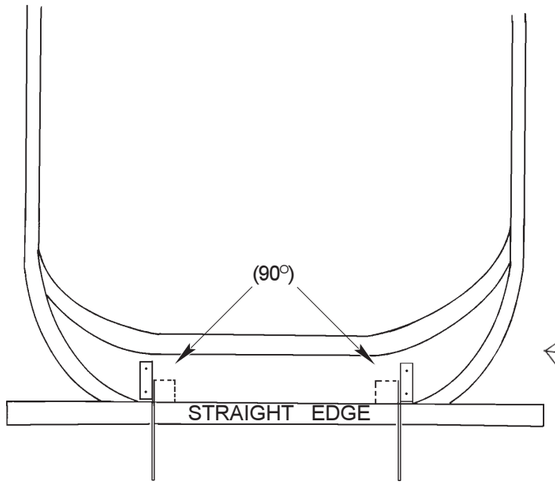
## C. Canopy Hinge

### Alignment

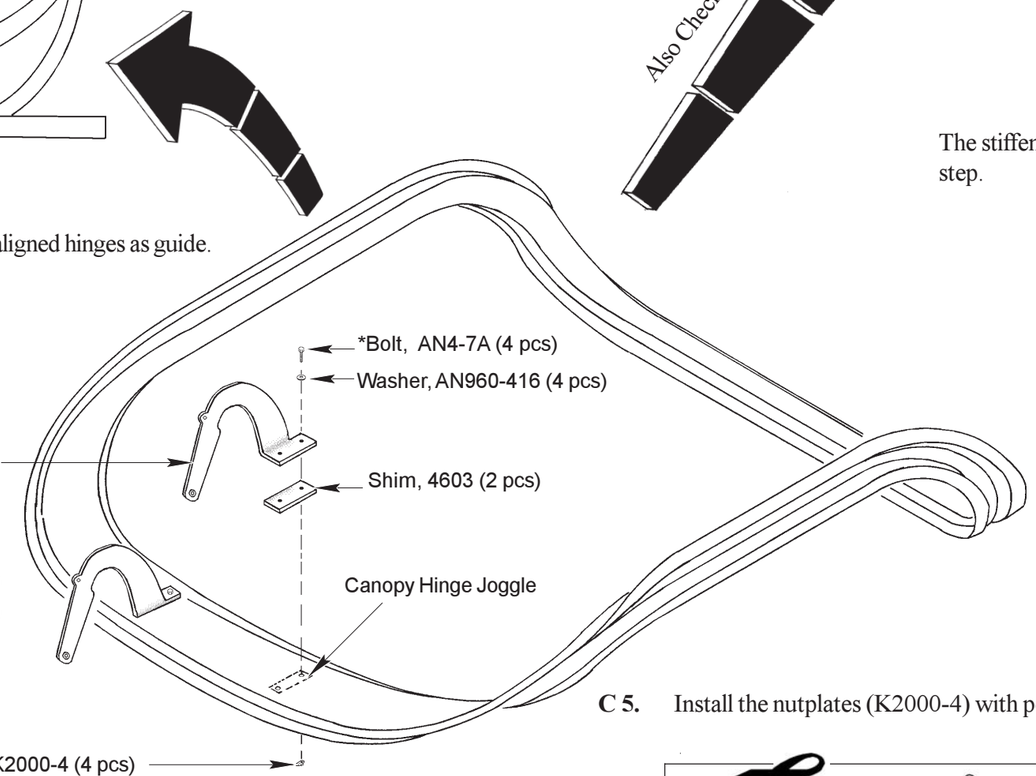
**C 1.** Initially align the hinges by fitting them into the canopy hinge joggles.

**C 2.** Check that the hinges are parallel by using a straight edge and a square.



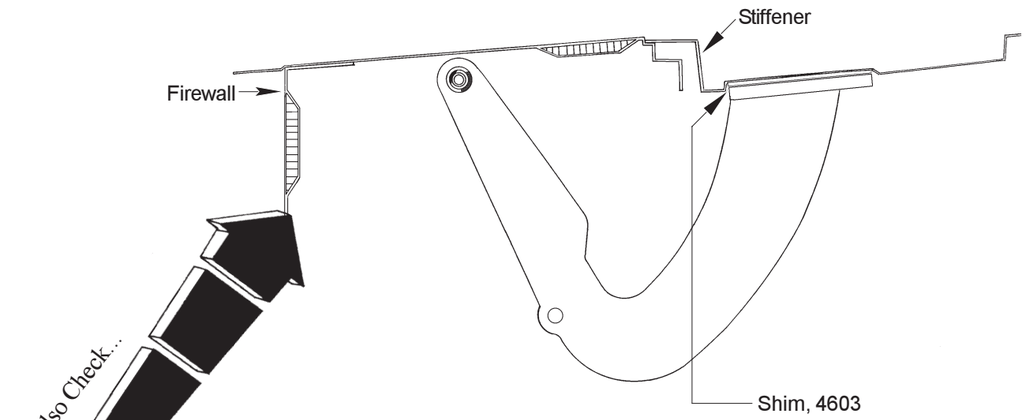

**C 3.** Drill 1/4" holes through the stiffener using the aligned hinges as guide.

**Canopy Hinge Installation**
**Fig. 9:C:1**




***Note: Bolt length may vary**

**C 4.** For the initial installation of the canopy, the canopy hinge shim is used. This allows for adjustment later on. The purpose of the shim is to compensate for the force excerted by the gas struts. You will notice that the force of the gas struts tend to lift the canopy up and out of the joggle. Removing the shims allows you to compensate for the force of the gas struts. For now leave the shims in place.




The stiffener must be aligned and up against the 1/8" pieces of phenolic for this step.

**C 5.** Install the nutplates (K2000-4) with pop rivets (MSC-34).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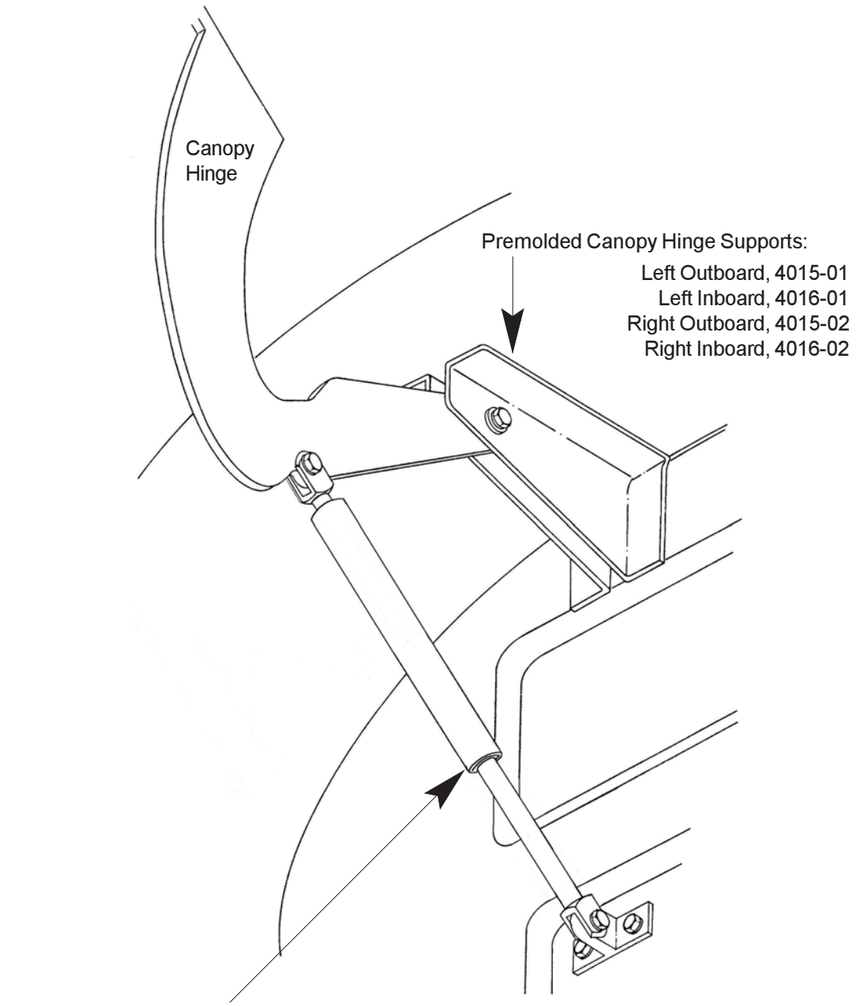
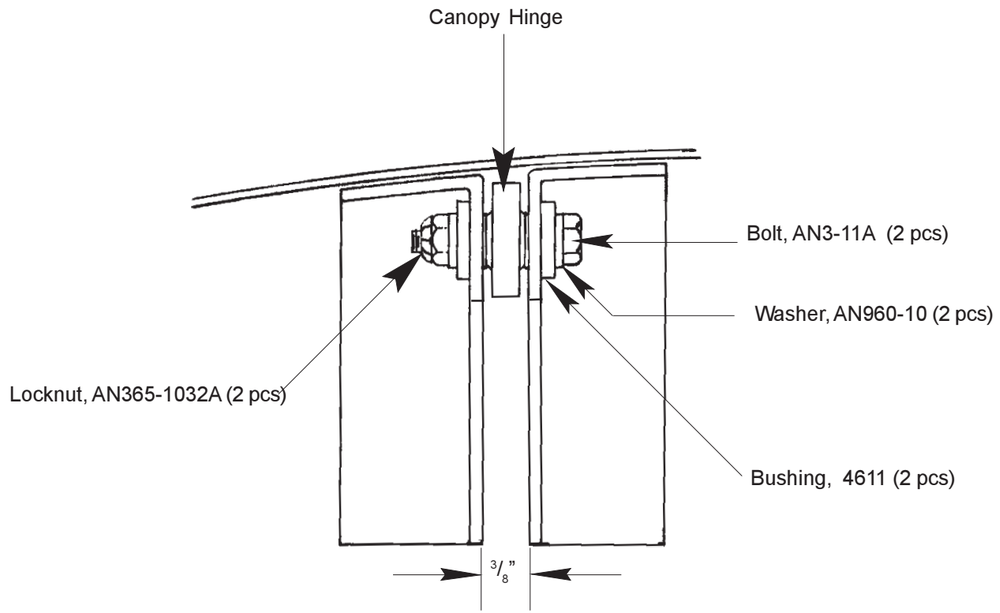
**Canopy Hinge Mounting**
**(Assembled View)**
**Fig. 9:C:2**




To explain the next few steps, we decided to show the finished installation first.

Note how the Canopy hinge mounts between the two premolded Canopy Hinge Supports.





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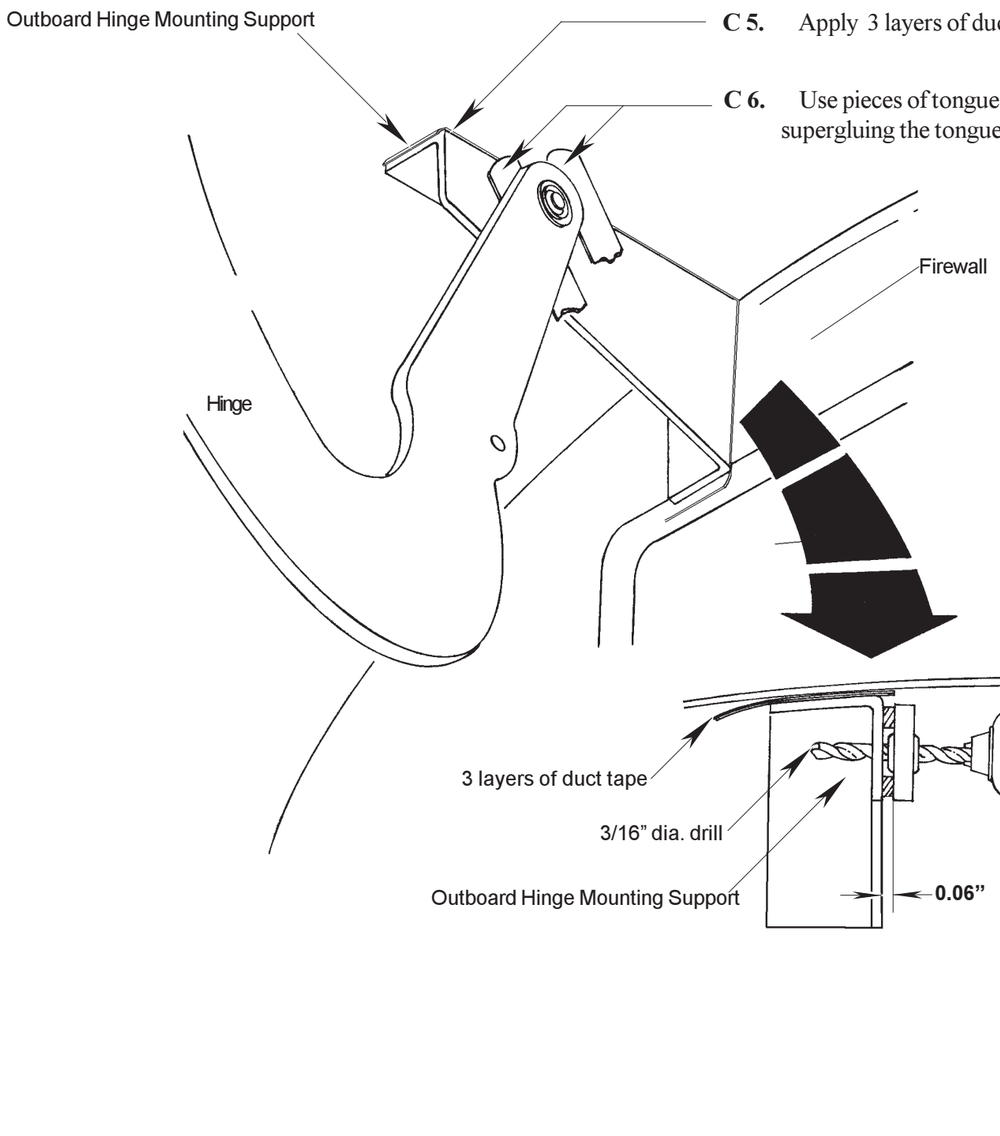
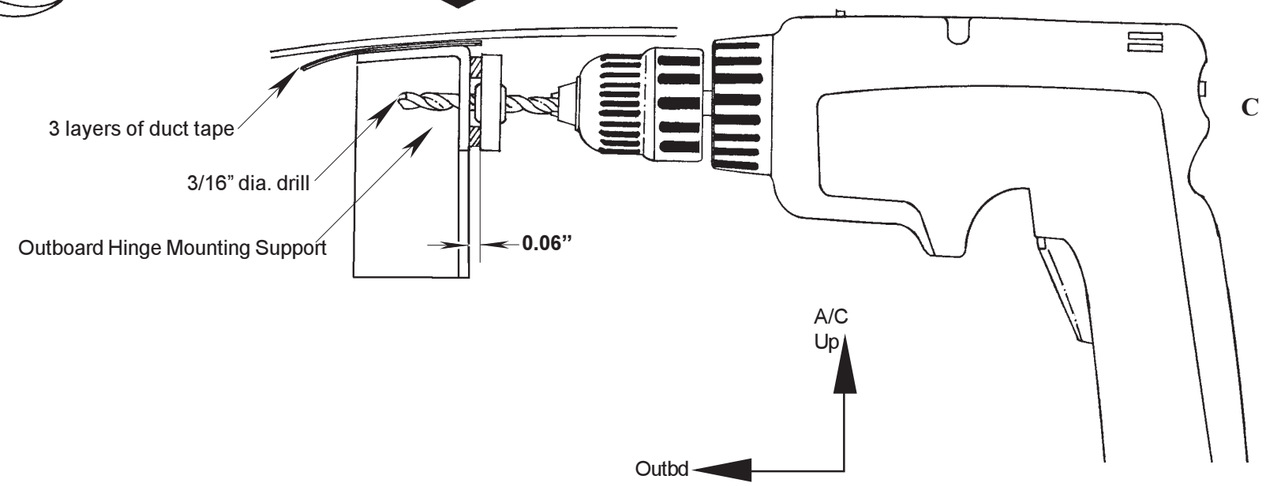
**Canopy Hinge Mounting Support Alignment**
**Fig. 9:C:3**




**C 5.** Apply 3 layers of duct tape for adhesive and tolerance.

**C 6.** Use pieces of tongue depressors for spacing. We suggest supergluing the tongue depressors to the Hinge Mounting Support.

**NOTE: The Canopy must be aligned for this step. Bolt down in place using the 6 AN3 bolts.**




**C 7.** With the Hinge Support aligned and held in place, drill through the Outboard Hinge Supports. Drill size: 3/16"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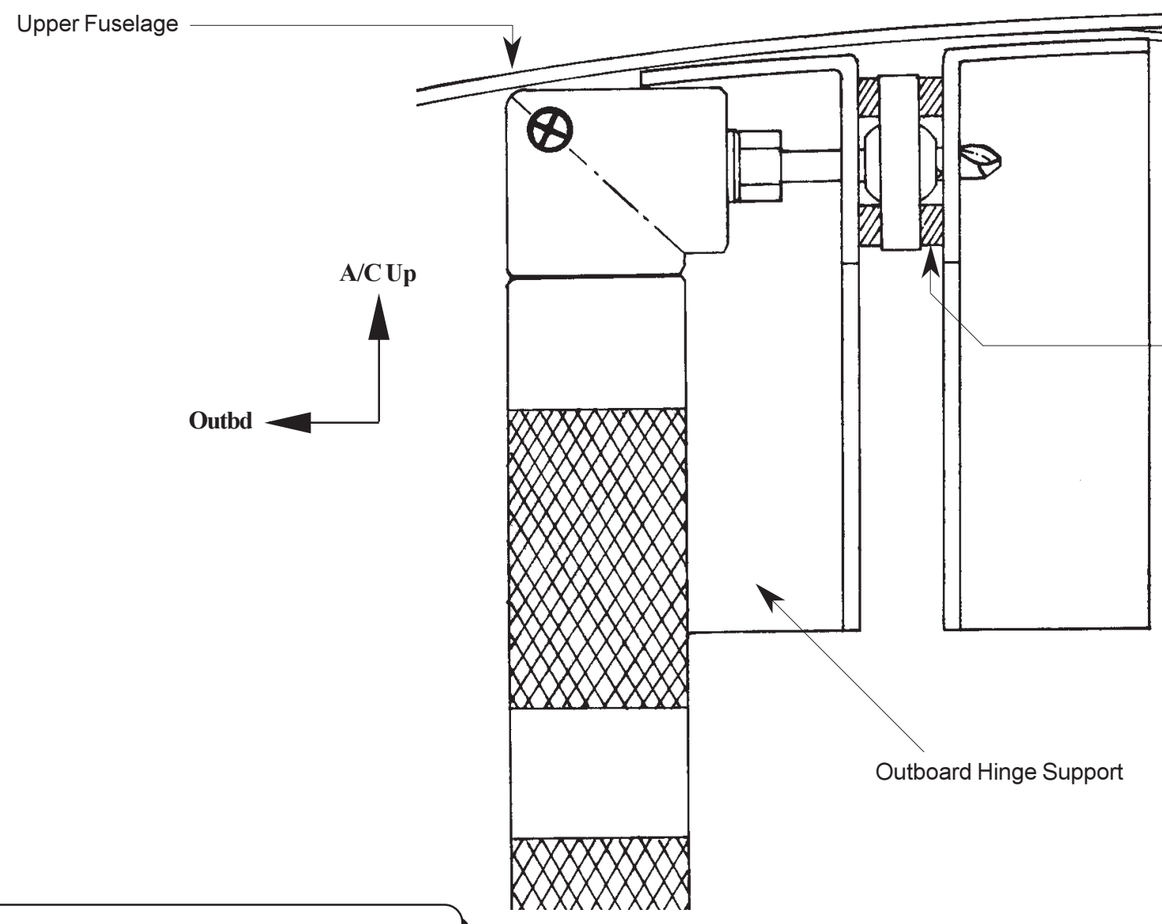
**Canopy Hinge Mounting Support Alignment**
**Fig. 9:C:4**

**( LEFT SIDE SHOWN )**




**C 8**. Apply 3 layers of duct tape to the Inboard Hinge Support. The duct tape should be between the Support and Upper Fuselage, and between the Support and the firewall (just like the Outboard Support).

**C 9.** Install the 0.06" spacers.

**C 10.** With the Inboard Hinge Support aligned and held in place, drill through the Inboard Hinge Support. Use a Tight angle drill.

**NOTE: You may not have enough room to position the drill as shown. Second option is to clamp everything together, remove the canopy and drill. Another method is to accurately mark the Inboard Hinge Support, remove and end drill.**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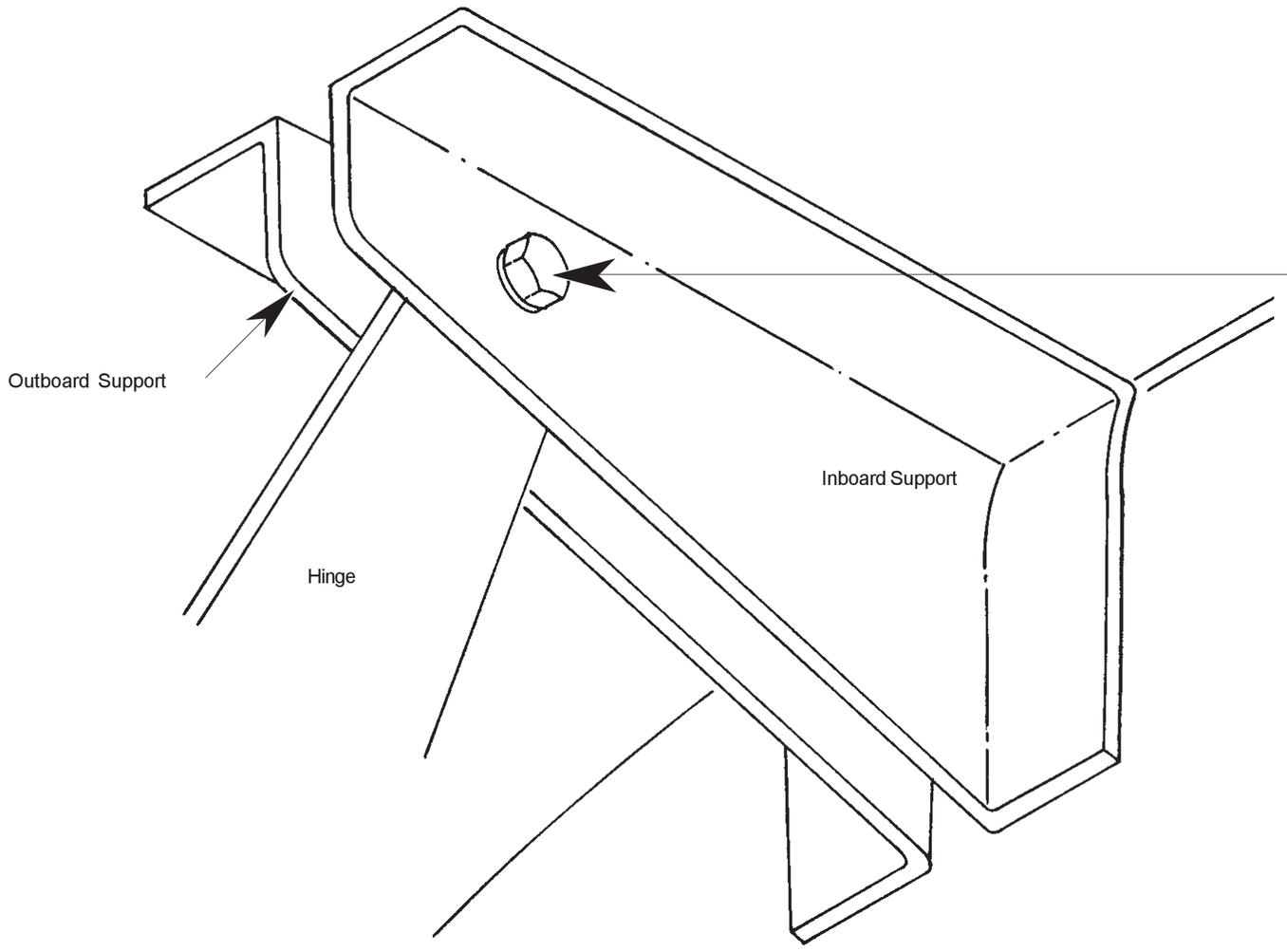
**Bonding Canopy Hinge Supports**
**Fig. 9:C:5**




**C 11.** Bond the Hinge Supports.

**IMPORTANT:**

1) The 0.06" spacers must be in place.

2) The whole assembly must be clamped together - we suggest using a bolt.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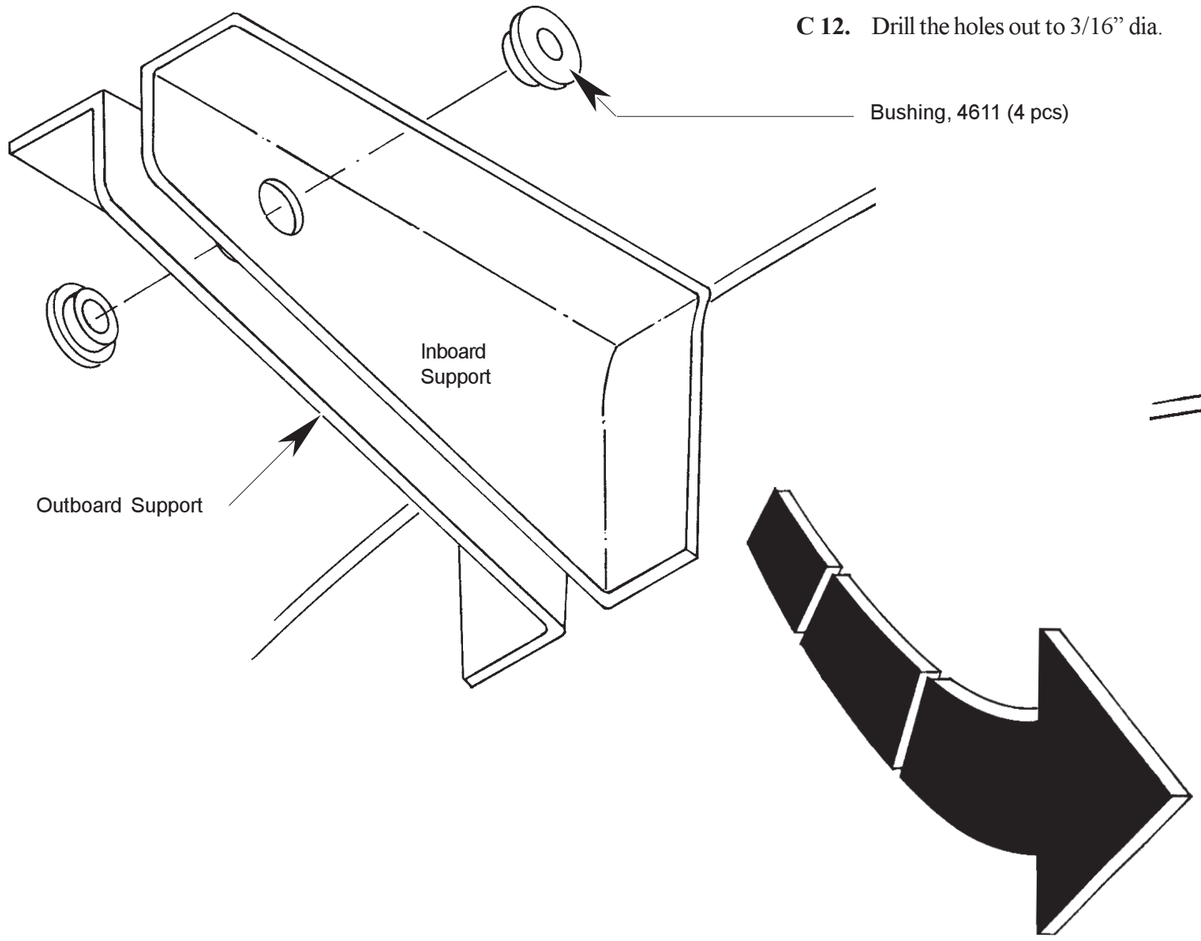
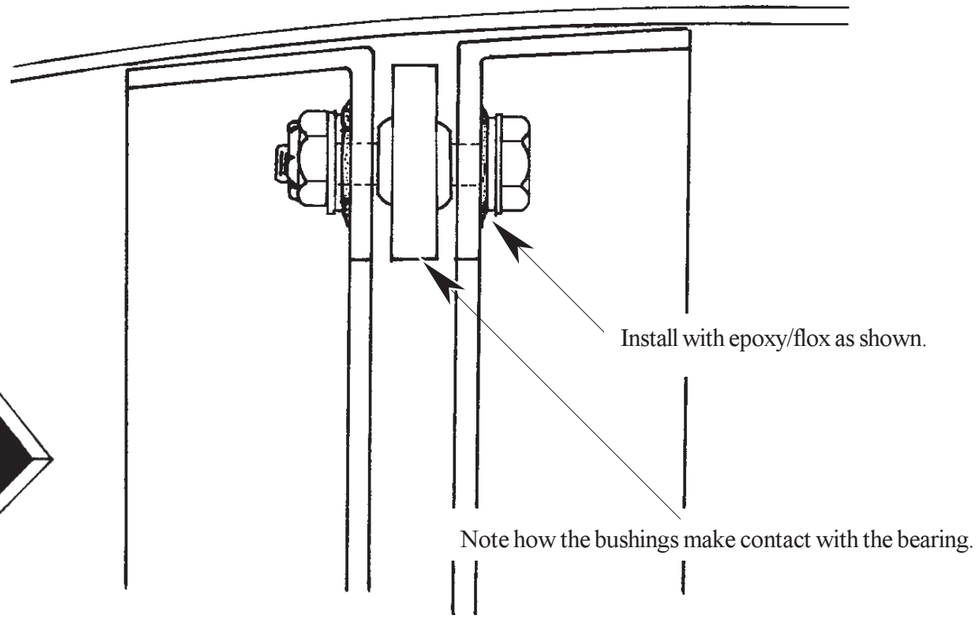
**Canopy Hinge Bushing Installation**
**Fig. 9:C:6**




**C 12.** Drill the holes out to 3/16" dia.

**C 13.** Install the Bushings.





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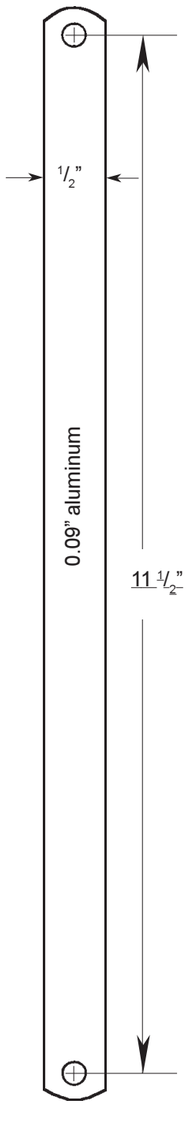
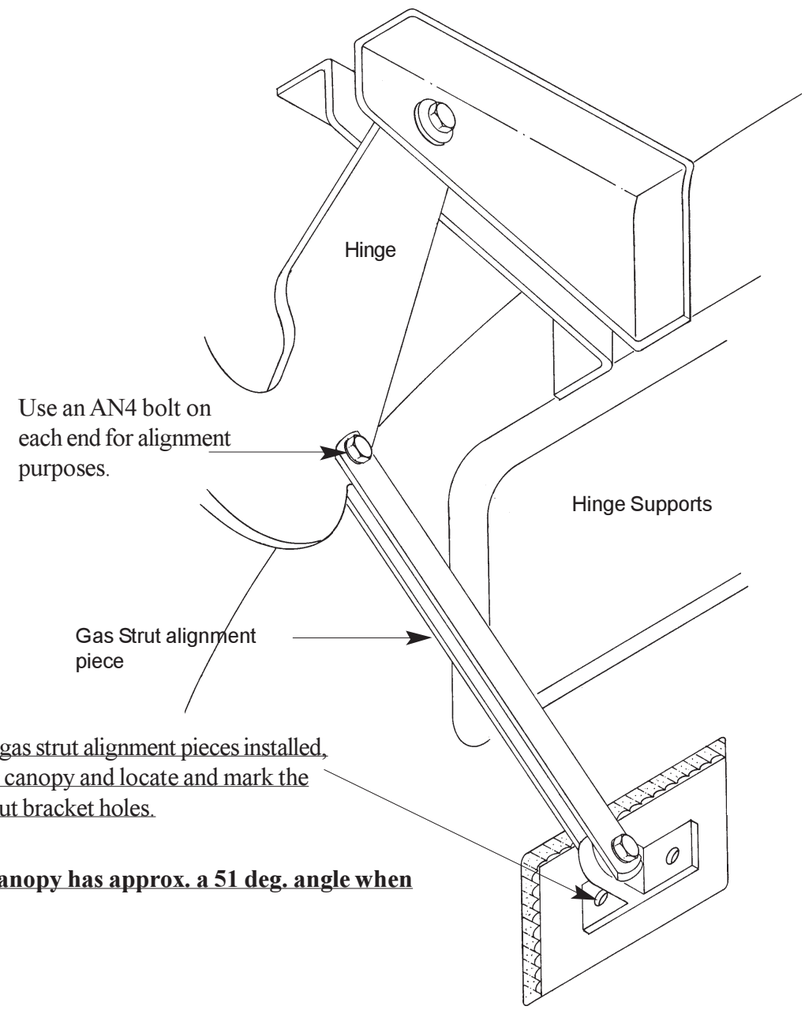
## D. Gas Strut

**D 1.** Make the gas strut alignment pieces as shown. The length is identical to the compressed length of the gas strut plus 1/8" for tolerance.




**Canopy Gas Strut Installation**
**Fig. 9:D:1**




With the gas strut alignment pieces installed, close the canopy and locate and mark the lower strut bracket holes.

**Note: Canopy has approx. a 51 deg. angle when open.**

**INTENTIONALLY LEFT BLANK**
**DUE TO UPDATE REV. 2/06-30-04**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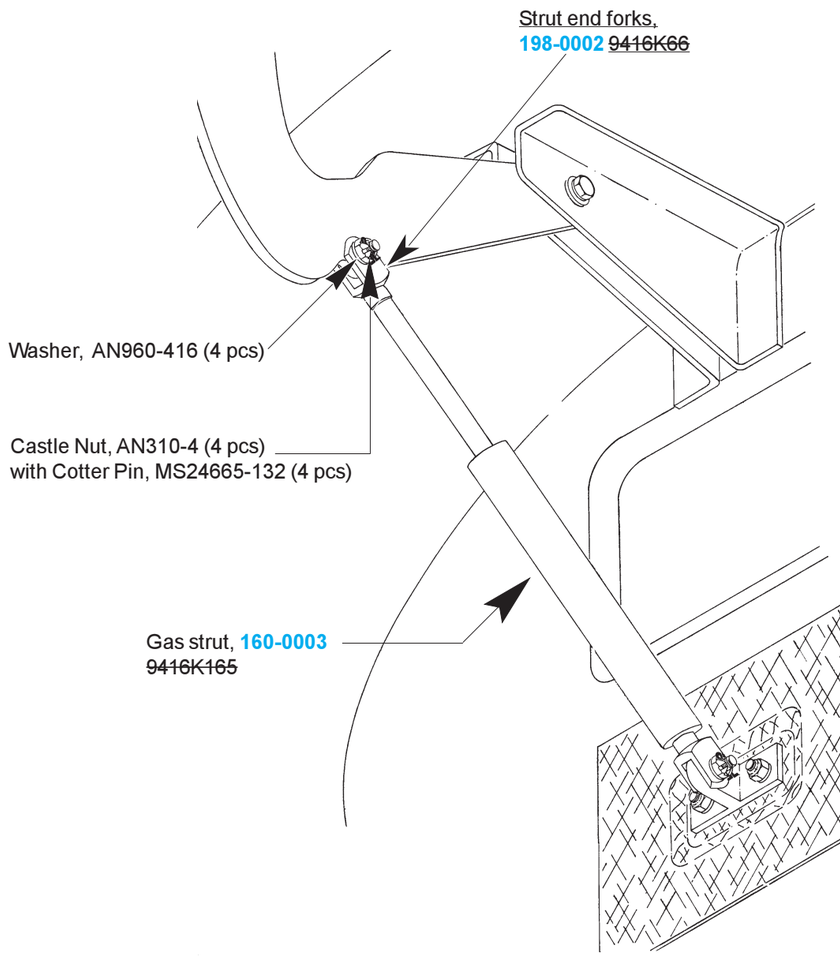
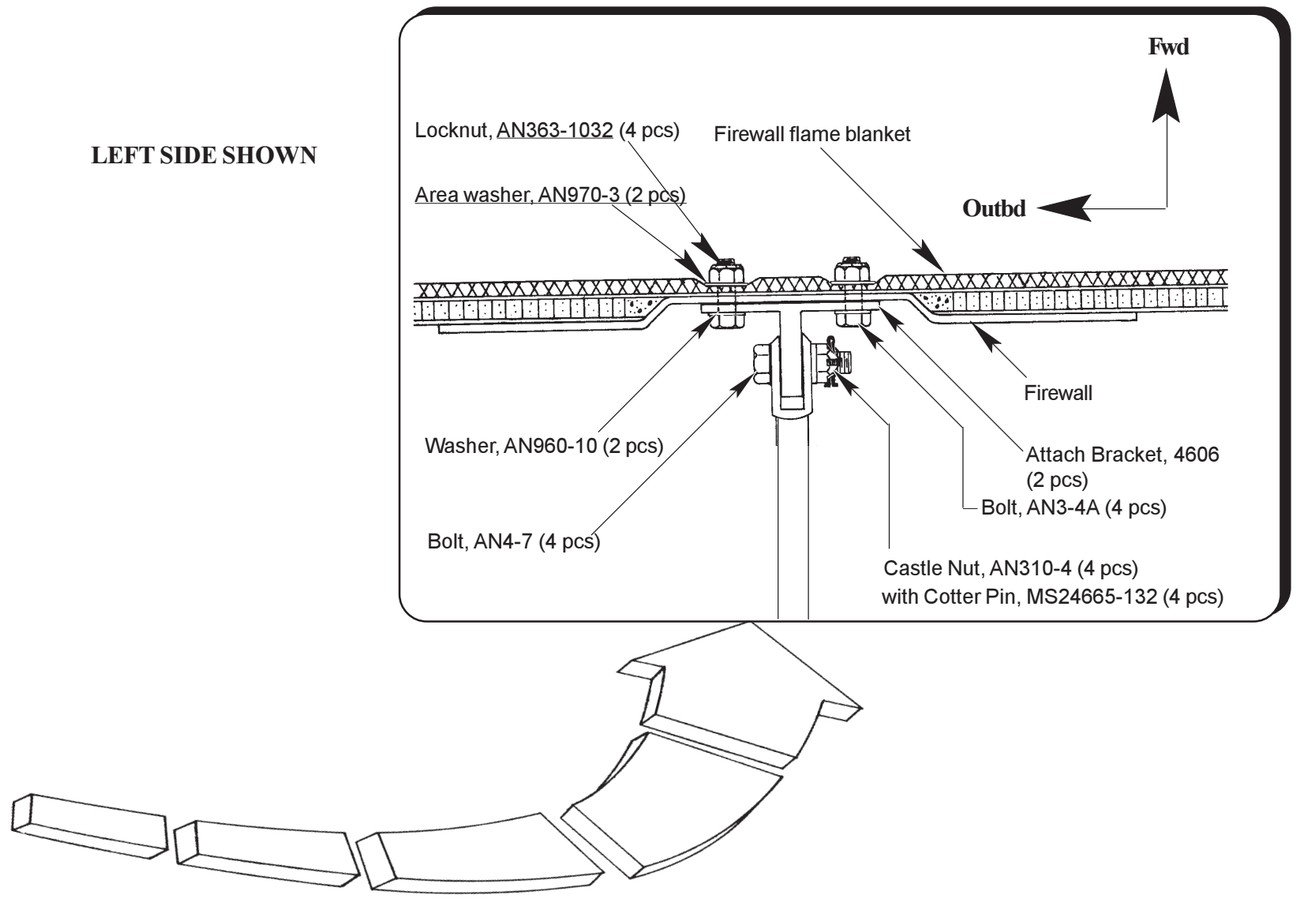
## Canopy Gas Strut Completion
## Fig. 9:D:2




**LEFT SIDE SHOWN**





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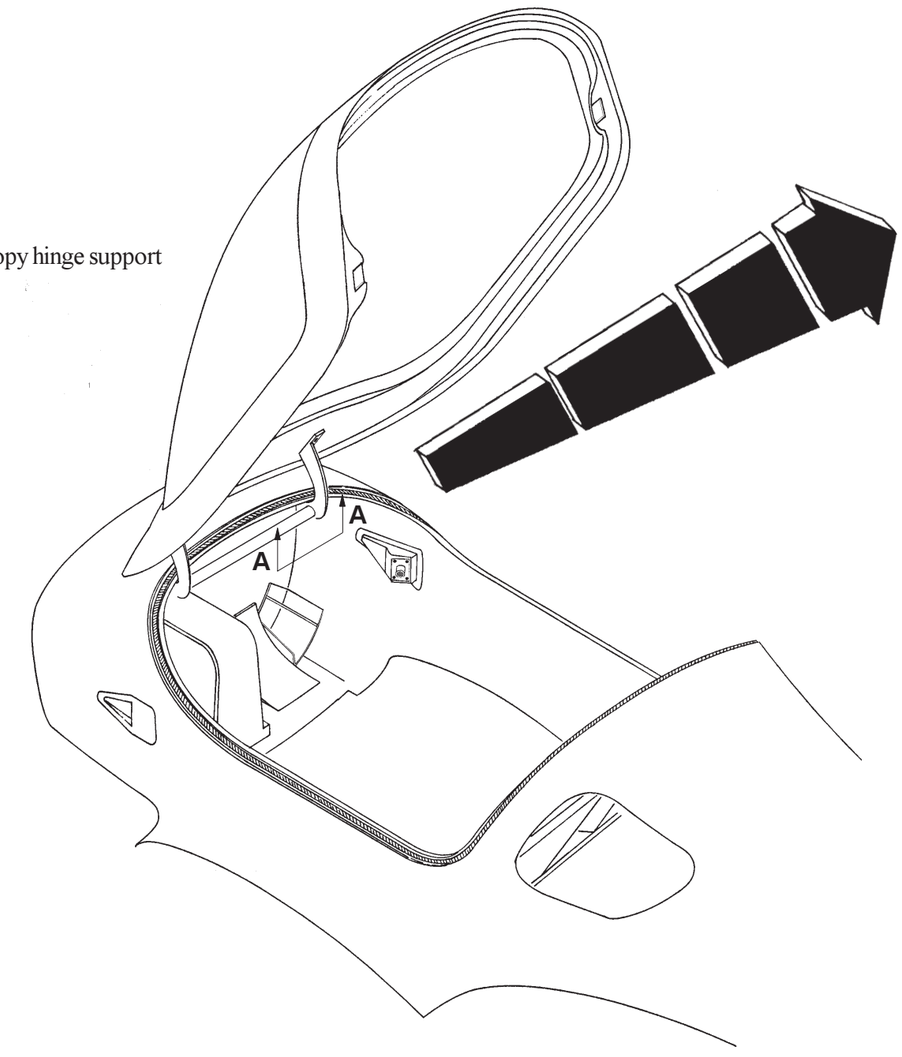
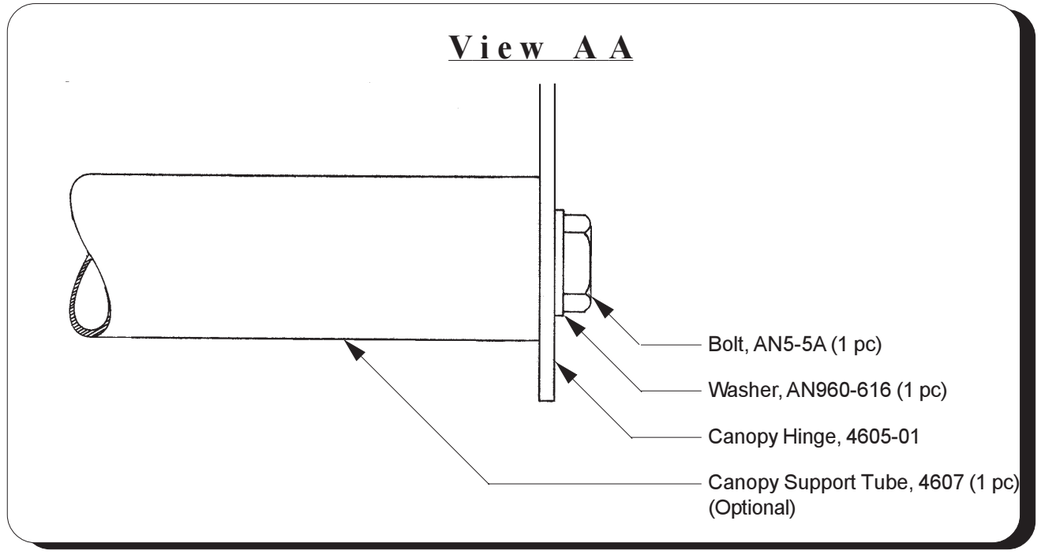
**Canopy Hinge Support**
**Fig. 9:D:3**

Install the canopy hinge support as shown:




**NOTE: The canopy hinge support increases the stiffness of the canopy hinges. However, the tube may cause clearance problems with the radios and other equipment.**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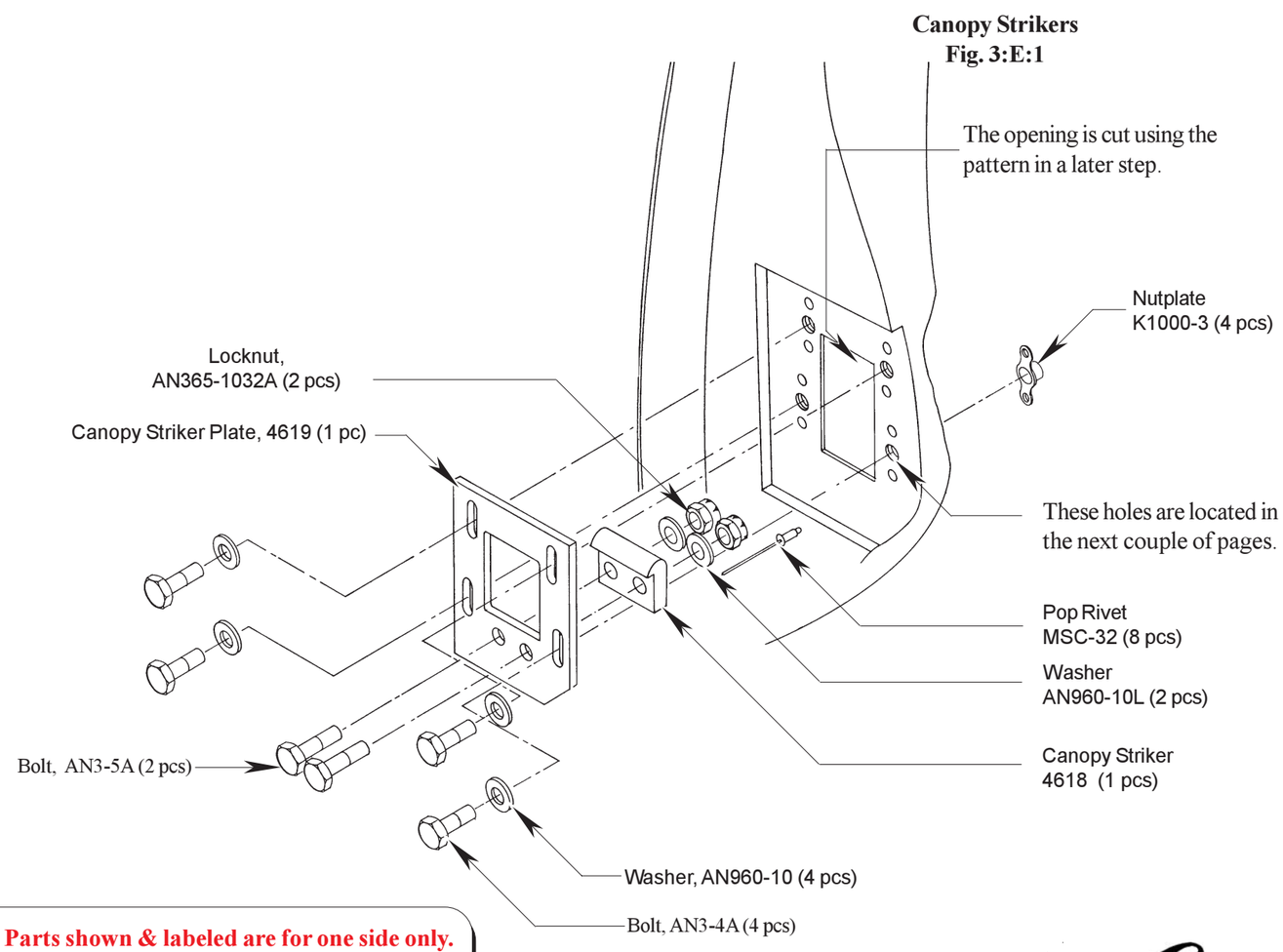
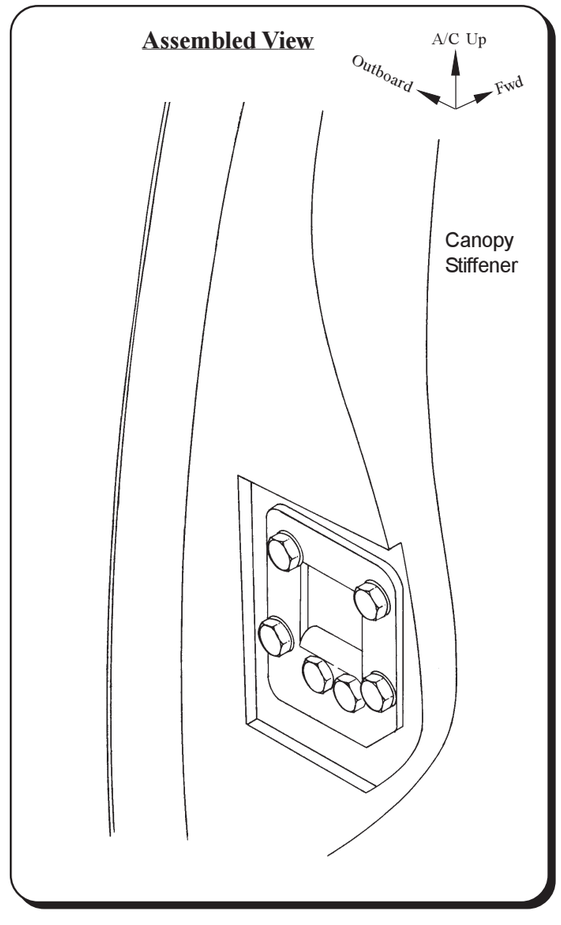
## E. Canopy Stricker Metchanism

In section A you installed the canopy latch mechanism in the fuselage. When closed the canopy hooks move out of their slots and "grab: a catch in the canopy stiffener. The alignment of this catch is obviously critical to properly locking the canopy down. We will refer to this "catch" as the canopy striker mechanism.

We supply two parts used to properly align the canopy striker mechanism. The first is a screw that has a #40 hole drilled through the center. This is used to transfer a reference hole in the canopy stiffener by back drilling through the canopy latch receptacle. The second alignment tool is a drill template. The drill template serves two functions, the first

**Canopy Strikers**
**Fig. 3:E:1**




**Note: Parts shown & labeled are for one side only.**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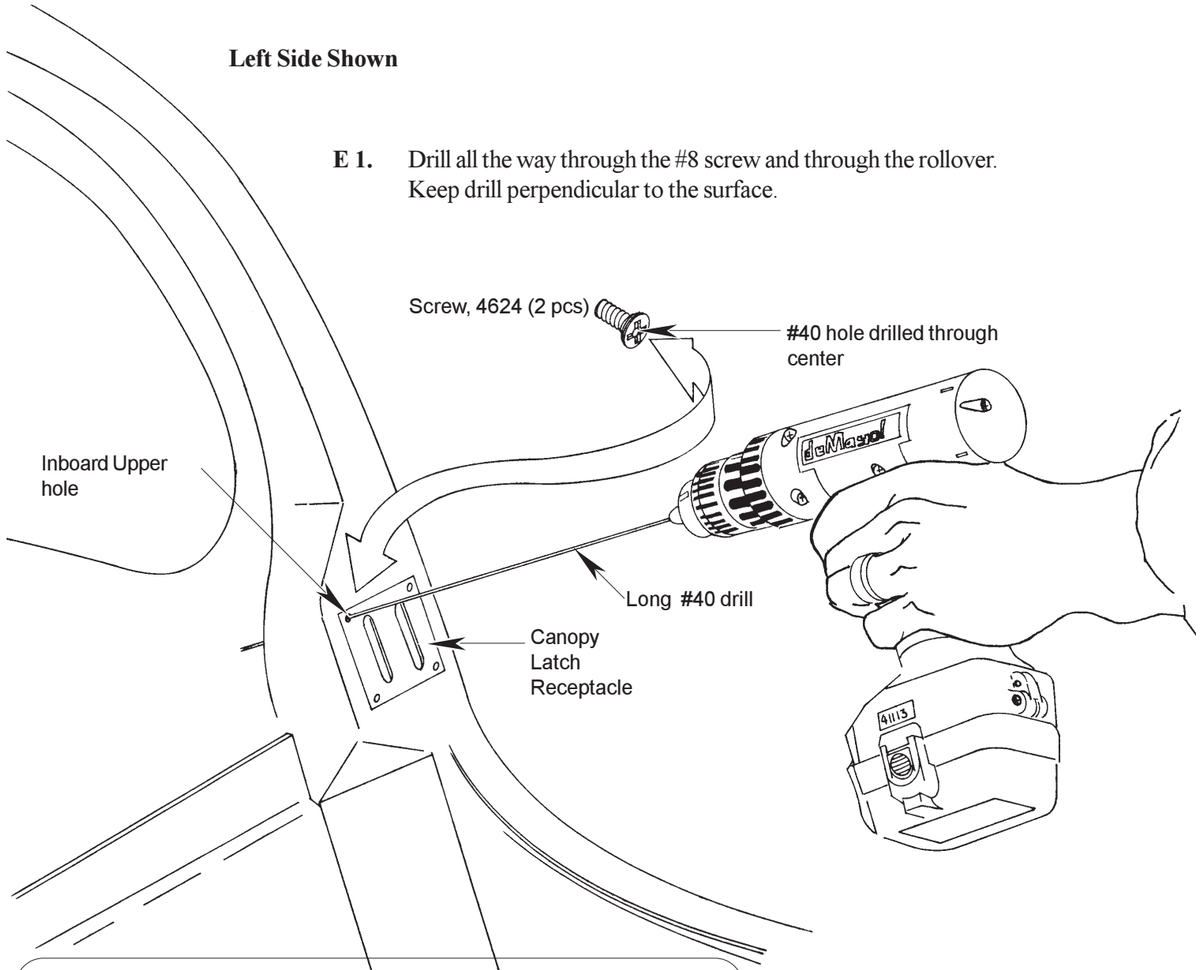
**Canopy Stiffener Reference Hole**
**Fig. 9:E:2**

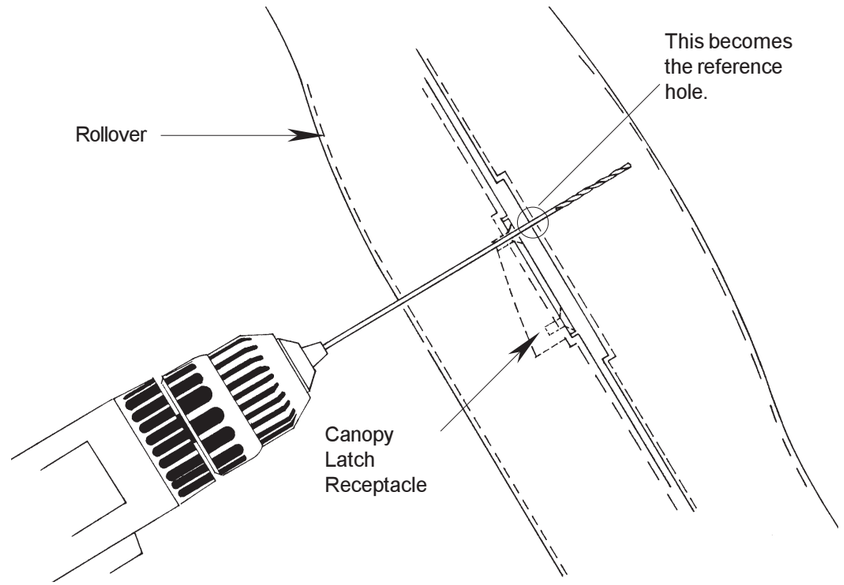
**Left Side Shown**

**E 1.** Drill all the way through the #8 screw and through the rollover. Keep drill perpendicular to the surface.

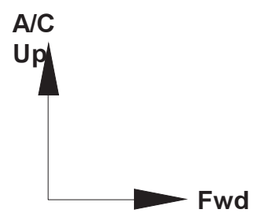



**Note: Parts shown & labeled are for one side of the airplane only.**

**E 2.** Drill through the backside of the rollover and into the Stiffener. Repeat process on the other side.




**E 3.** Drill the hole out to size using a #10 drill bit.




**Note: View is looking outboard at left side.**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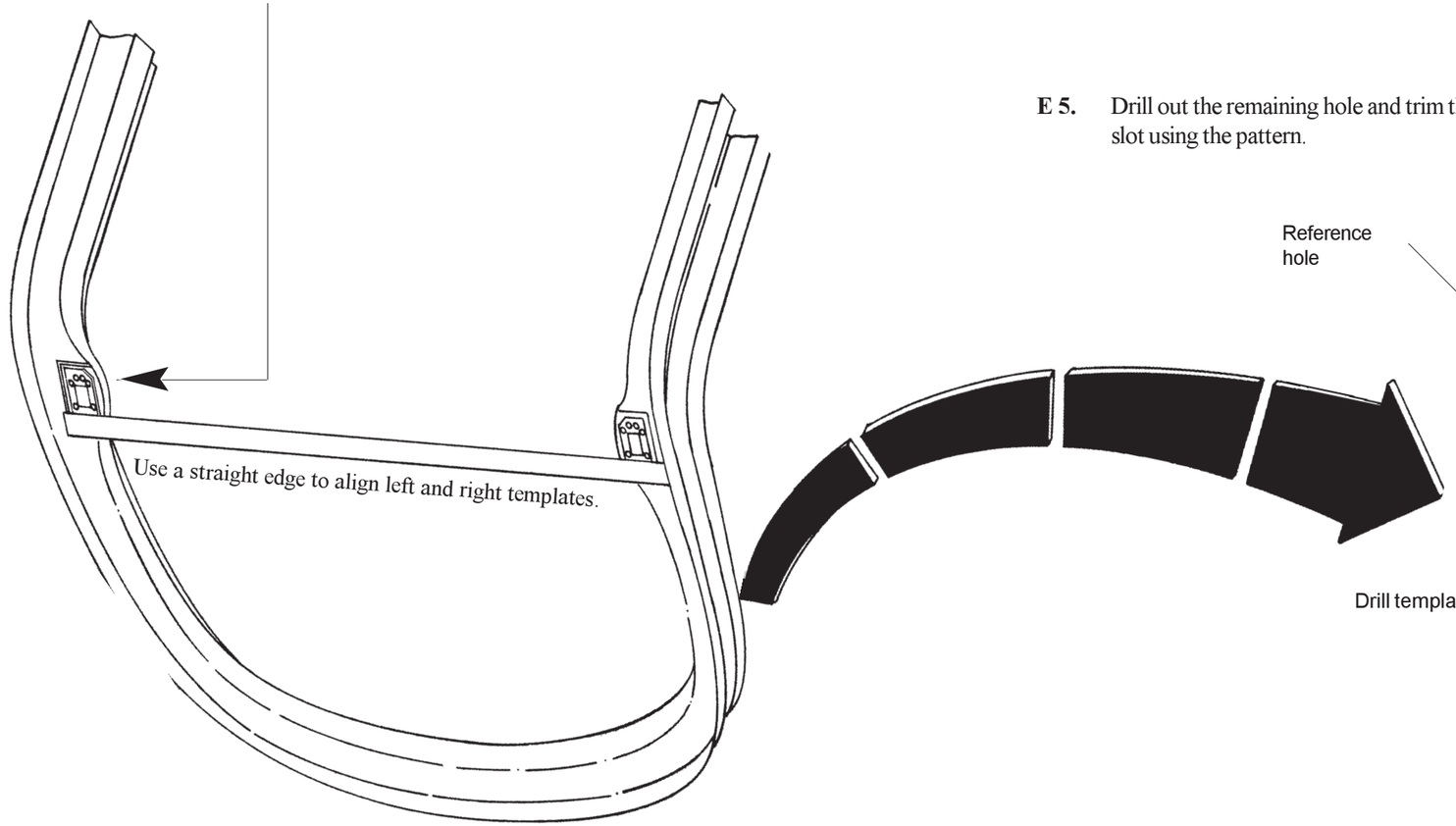
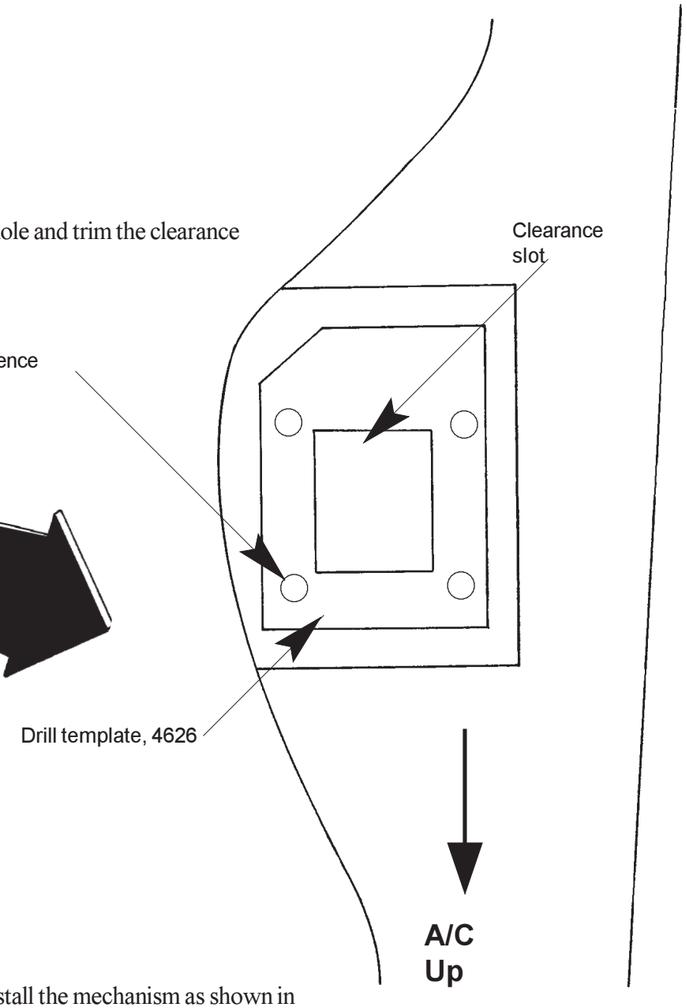
**Canopy Striker Alignment**
**Fig. 9:E:3**

**E 4.** Insert an AN3 bolt through upper inboard hole.




**E 5.** Drill out the remaining hole and trim the clearance slot using the pattern.




**E 6.** Assemble and install the mechanism as shown in fig. 9:E:1.

**NOTE: The final adjustment is done after door seal is installed.**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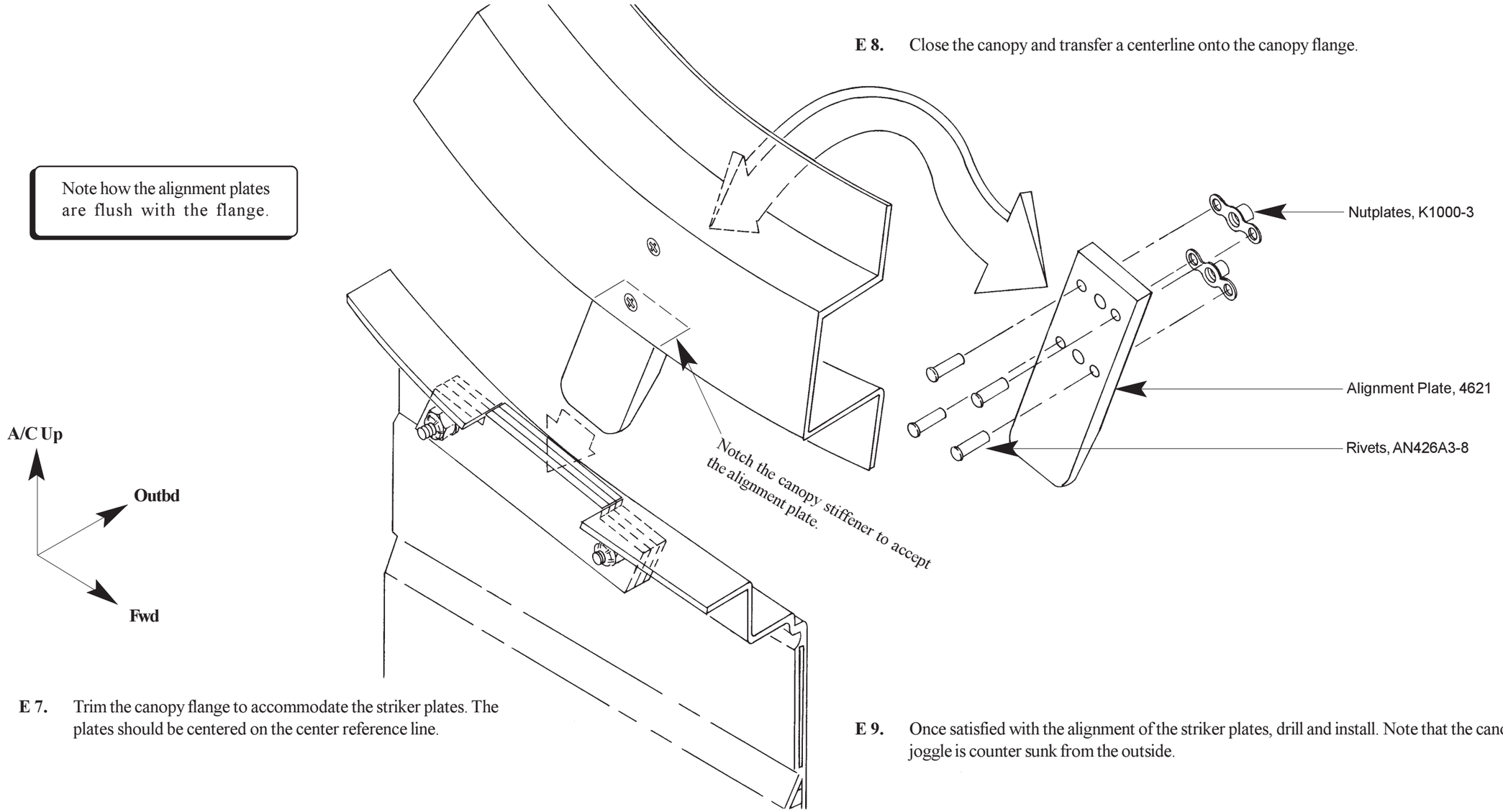
**Canopy Striker Plate Installation**
**Fig. 9:E:4**

Note how the alignment plates are flush with the flange.




**E 7.** Trim the canopy flange to accommodate the striker plates. The plates should be centered on the center reference line.

**E 8.** Close the canopy and transfer a centerline onto the canopy flange.

**E 9.** Once satisfied with the alignment of the striker plates, drill and install. Note that the canopy joggle is counter sunk from the outside.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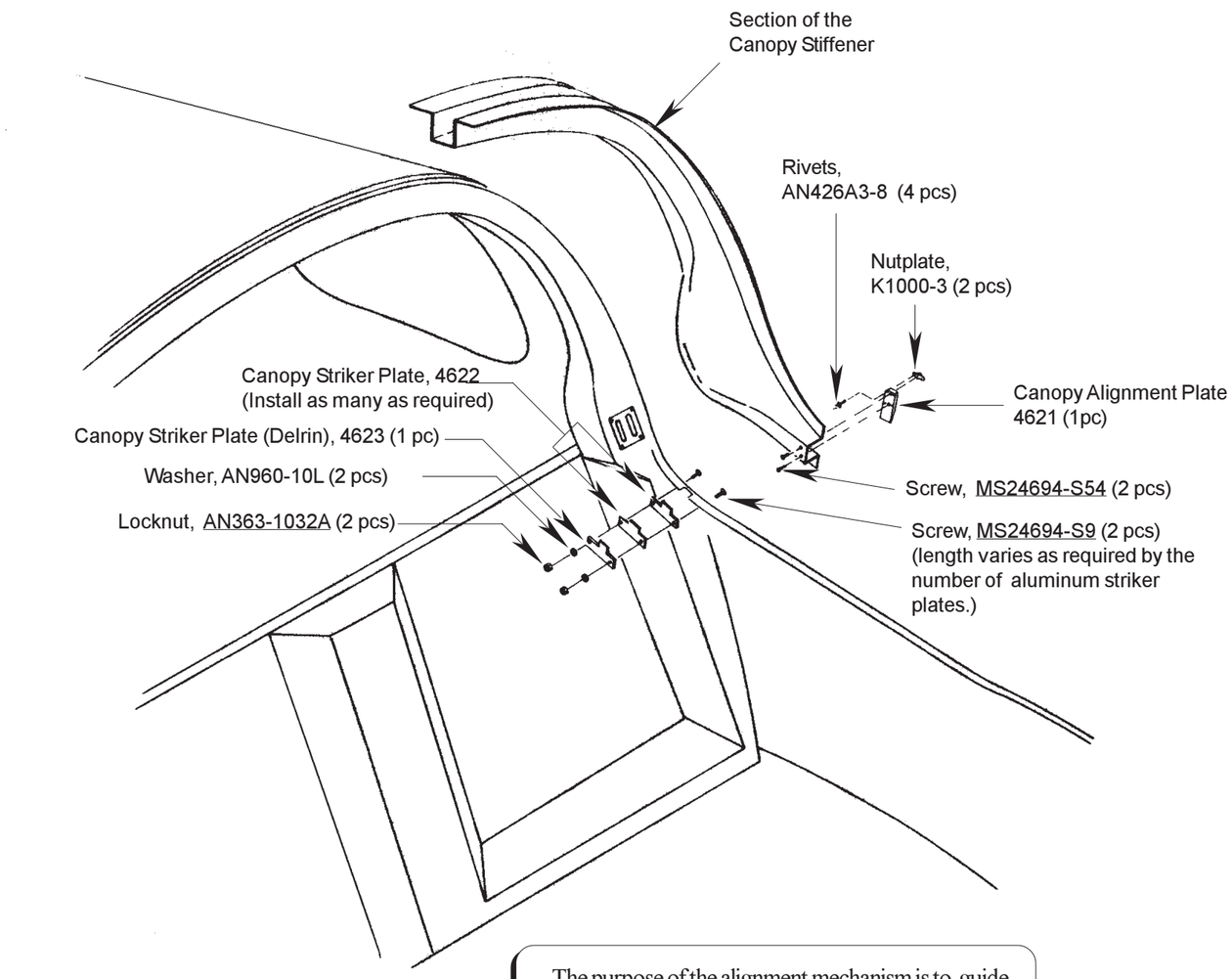
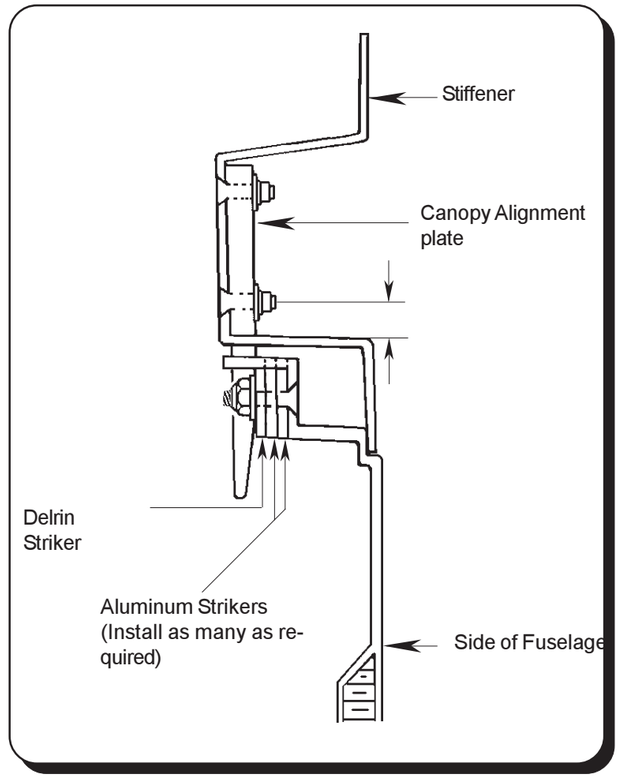
# F. Canopy Alignment Mechanism

**Canopy Alignment Mechanism**
**Fig. 9:F:1**




The purpose of the alignment mechanism is to guide the canopy in place and to keep it there.

**Note: Quantities shown are for one side only.**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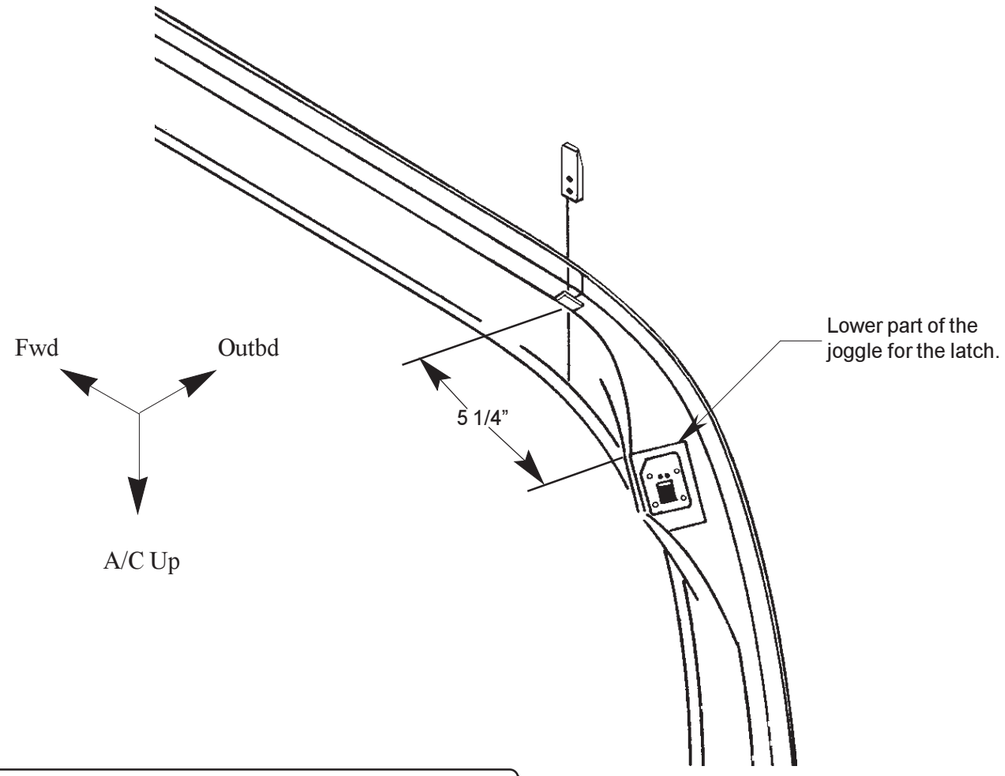
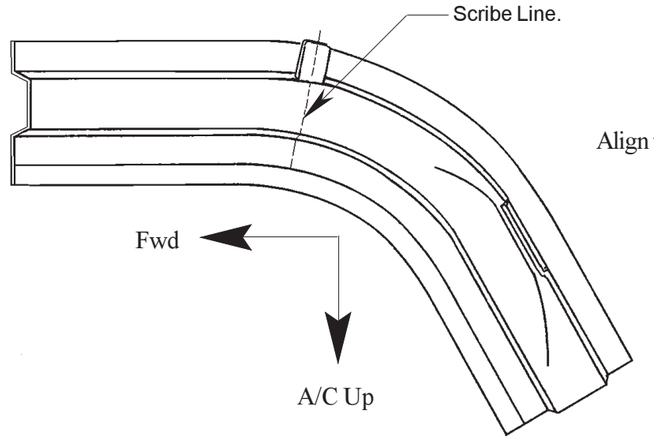
**Canopy Alignment Plate Installation**
**Fig. 9:F:2**



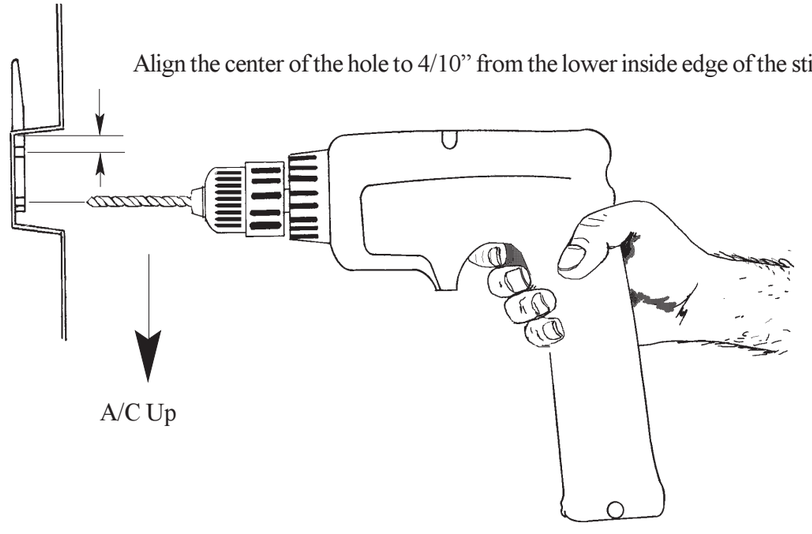




Align the striker plate to the scribe line.

**NOTE: If your scribe line is missing, the center of the scribe line is 5 1/4” from the lower part of the canopy latch joggle.**

**F 1.** Cut a 1” x 15/32” slot centered on the scribe line. The opening is large enough to accommodate the striker with nutplates.

Align the center of the hole to 4/10” from the lower inside edge of the stiffener.




**F 2.** Drill the 2 holes from inside of stiffener and countersink holes for the screws.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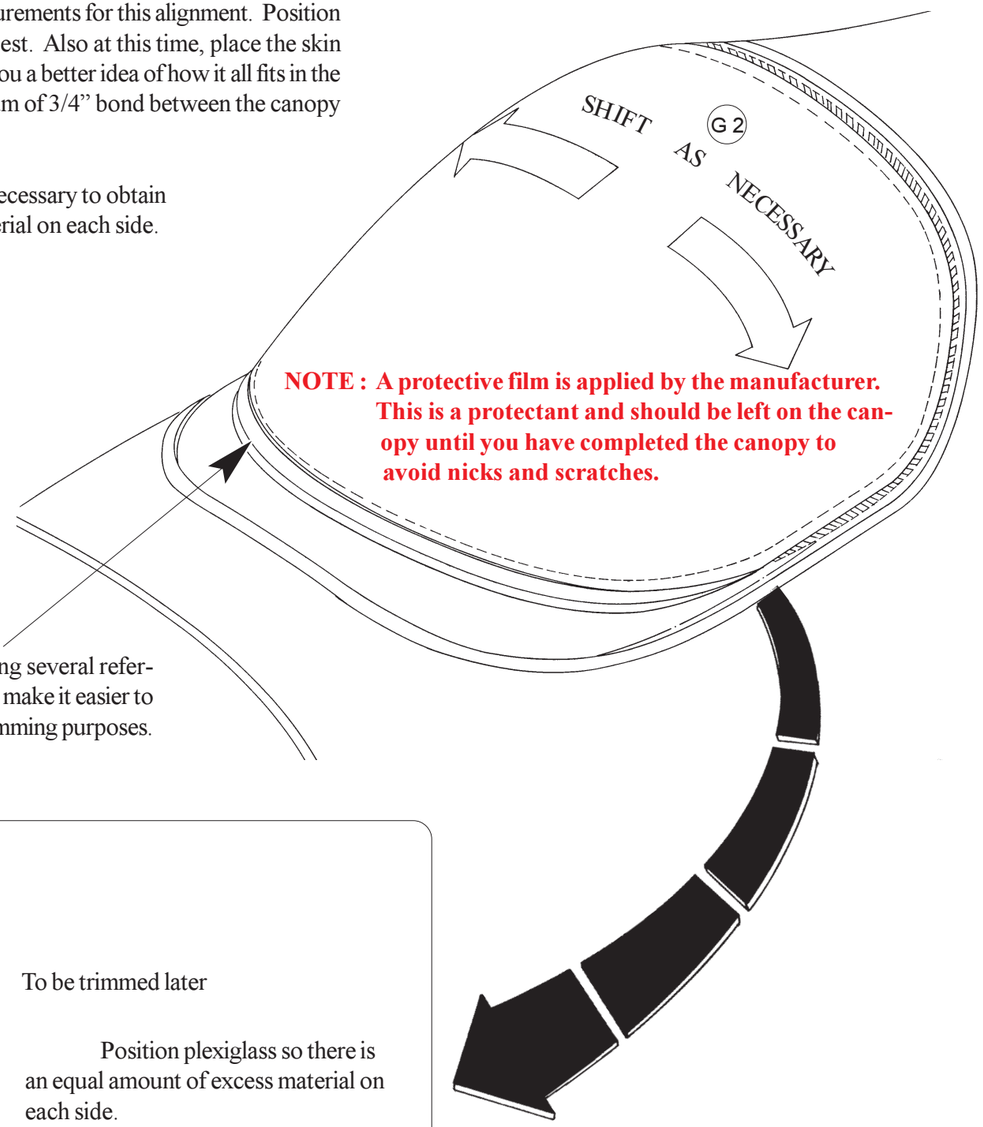
# G. Windshield Installation

## Canopy Alignment

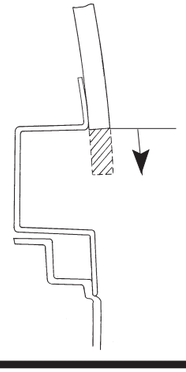
**G 1.** Before trimming any material off the canopy, position the canopy onto the stiffener. There are no measurements for this alignment. Position the canopy to where it fits the best. Also at this time, place the skin onto the canopy. This will give you a better idea of how it all fits in the end. You should have a minimum of 3/4" bond between the canopy and stiffener.

**G 2.** Slide plexiglass left to right as necessary to obtain an equal amount of excess material on each side.

**Canopy Alignment**
**Fig. 9:G:1**




Once aligned, we suggest making several reference lines around the perimeter. This will make it easier to reposition when canopy is moved for trimming purposes.



To be trimmed later

Position plexiglass so there is an equal amount of excess material on each side.

Here are some DOs and DON'Ts for handling plexiglass that have been learned from much ($$) experience.

**DO:** Leave the protective barrier on as much of the windows as possible for as long as possible.

**DO:** Cut the plexiglass with a bandsaw or an angle grinder. The bandsaw should have a fine tooth blade and be set on low speed.

**DO:** Always keep the plexiglass held firmly against the working surface when cutting or trimming. An old section of carpet on your workbench lessens the danger of scratching the plexiglass.

**DON'T:** Cut the plexiglass with a reciprocating blade, like a sabersaw.

**DON'T:** Drill holes through the plexiglass. It's too easy to crack.

**DON'T:** Clean plexiglass with acetone or MC. They may not seem to affect the surface, but these chemicals dry out the plexiglass and cause later discoloration. Cleaning should be done with isopropyl (rubbing) alcohol.

**DON'T:** Clean the plexiglass window with rubbing alcohol in the bonding areas *after sanding*. The plexiglass may absorb the rubbing alcohol if sanded. Never clean the edges. The edges are rough and may absorb the rubbing alcohol.

The correct method of cleaning the plexiglass window is to first clean the (unsanded) bonding surface with rubbing alcohol. Apply with a soft cloth such as a T-shirt. Sand the bonding areas thoroughly so no glossy areas remain. Using high pressure air or clean cloth, remove the sanding dust from the surface. Don't touch the bonding surfaces prior to bonding.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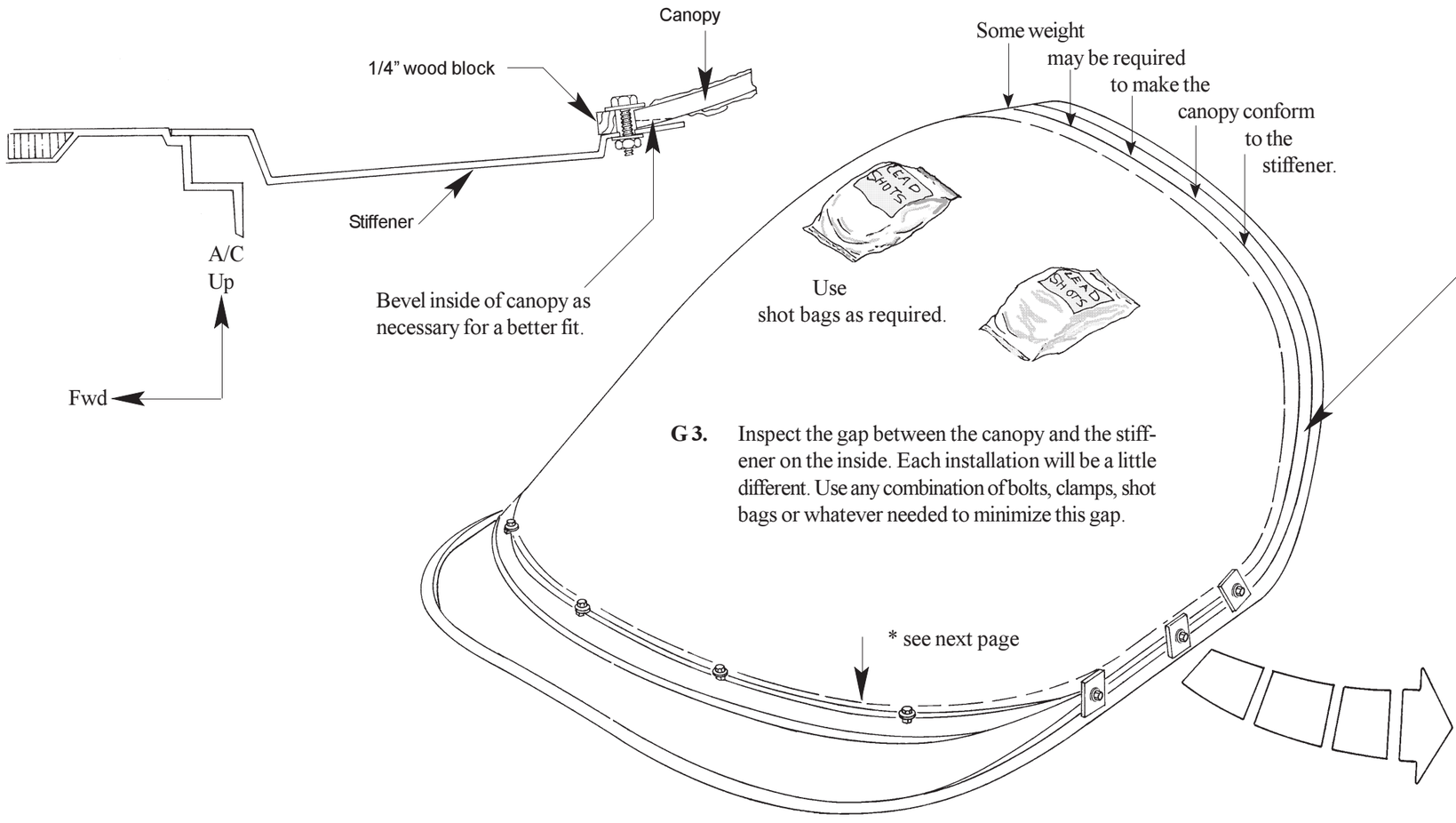
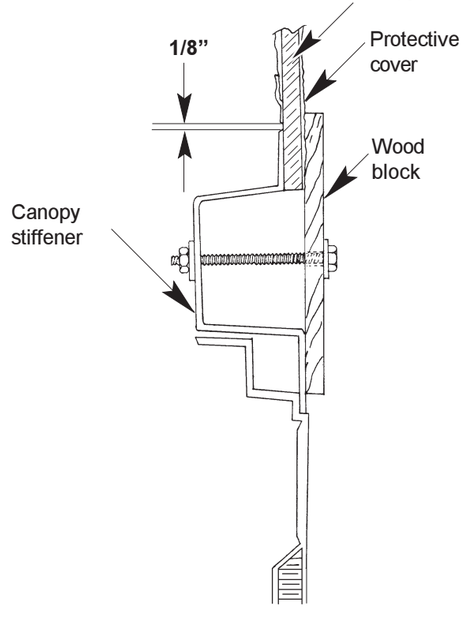
**Securing Canopy**
**Fig. 9:G:2**




**G 3.** Inspect the gap between the canopy and the stiffener on the inside. Each installation will be a little different. Use any combination of bolts, clamps, shot bags or whatever needed to minimize this gap.

**G 4.** Peel back the protective cover 1/4" from the stiffener on the inside. Apply electrical tape to 1/8" from stiffener.




**G 3.** Follow normal bonding procedures for the installation of canopy using Hysol.

**NOTE: Review the DOs and DON'Ts for the plexiglass windows. Mix a little flox in the Hysol. Snug the bolts up just enough to get the canopy to make good contact with the stiffener.**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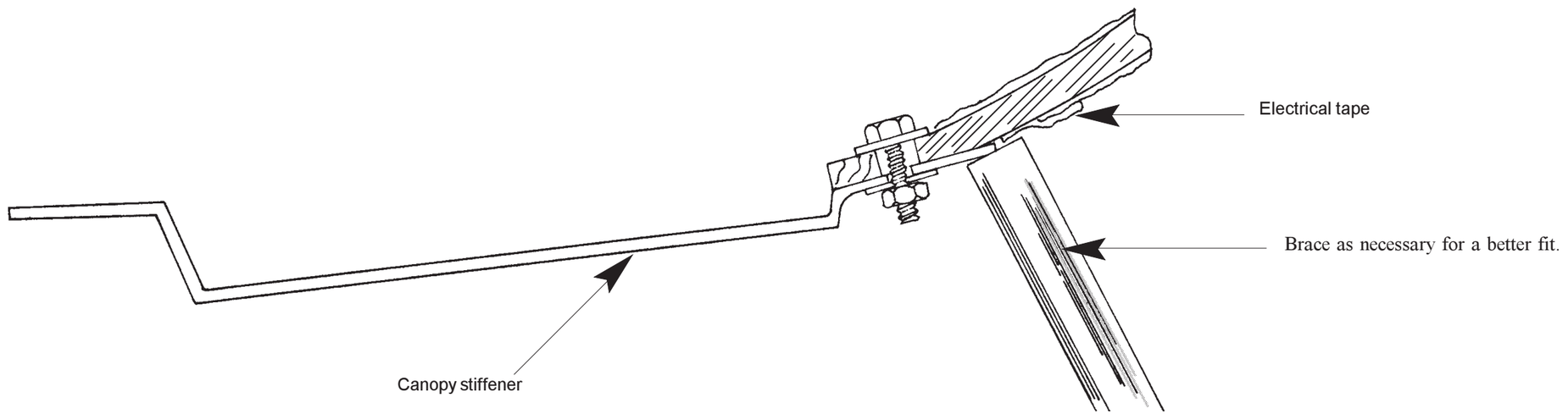
The left front side and back tend to be problem areas for a proper fit . During bonding you may want to brace a stick up against the stiffener to get a better fit.

**Bracing During Bonding**
**Fig. 9:G:3**





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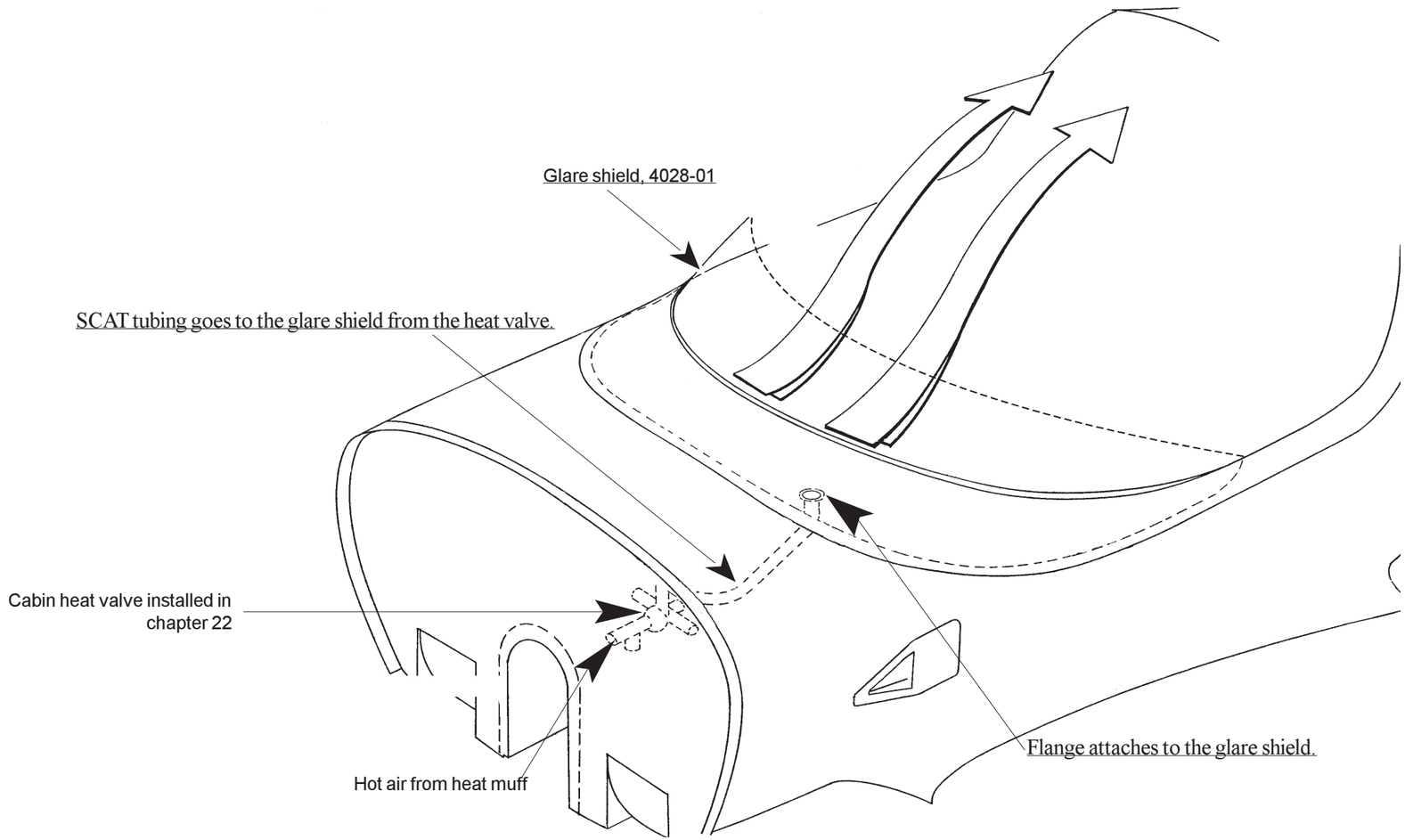
## H. Canopy Defroster

**Canopy Defroster**
**Fig. 9:H:1**





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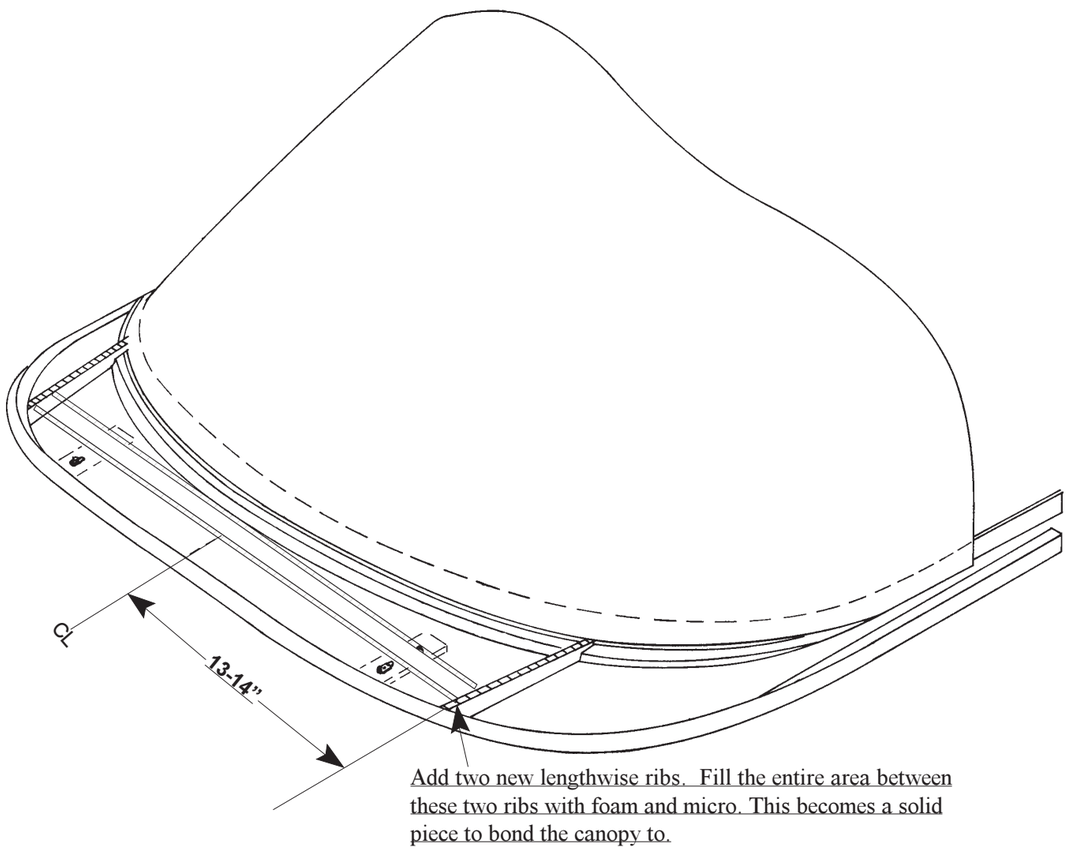
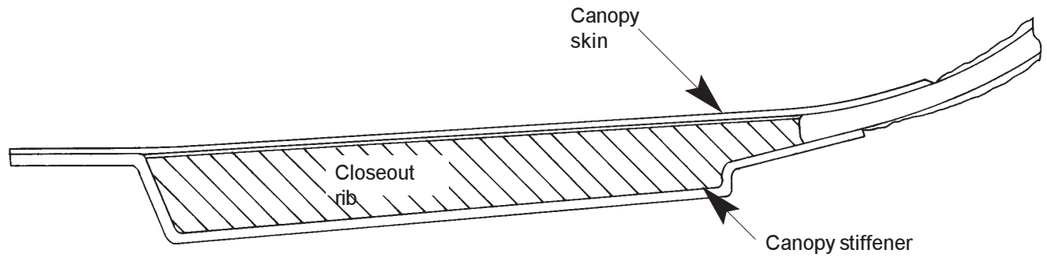
## Defroster Construction
## Fig. 9:H:2

**H 1**. Add two ribs lengthwise between the cross ribs.

**H 2.** Fill the area between the left and right ribs using foam and micro.

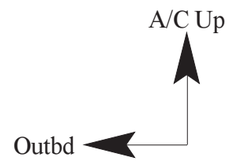


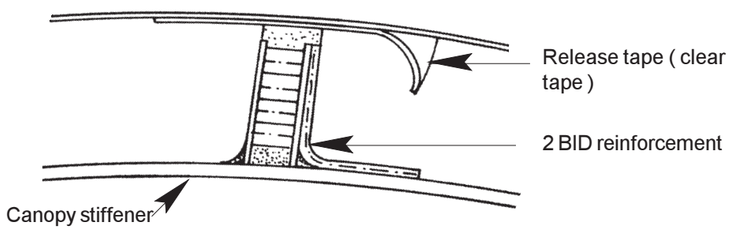

**H 3.** Install the 2 pcs prepreg ribs about 13-14" from centerline. Make pattern and trim to fit.




**H 4.** Release as necessary. The ribs must seal the chamber.

1. Apply release tape to the canopy skin in the area of the close out rib. Apply epoxy/flox to the rib.
2. Lower the skin in place and let cure.




3. After the release is cured remove the skin and clean up the excess epoxy/flox.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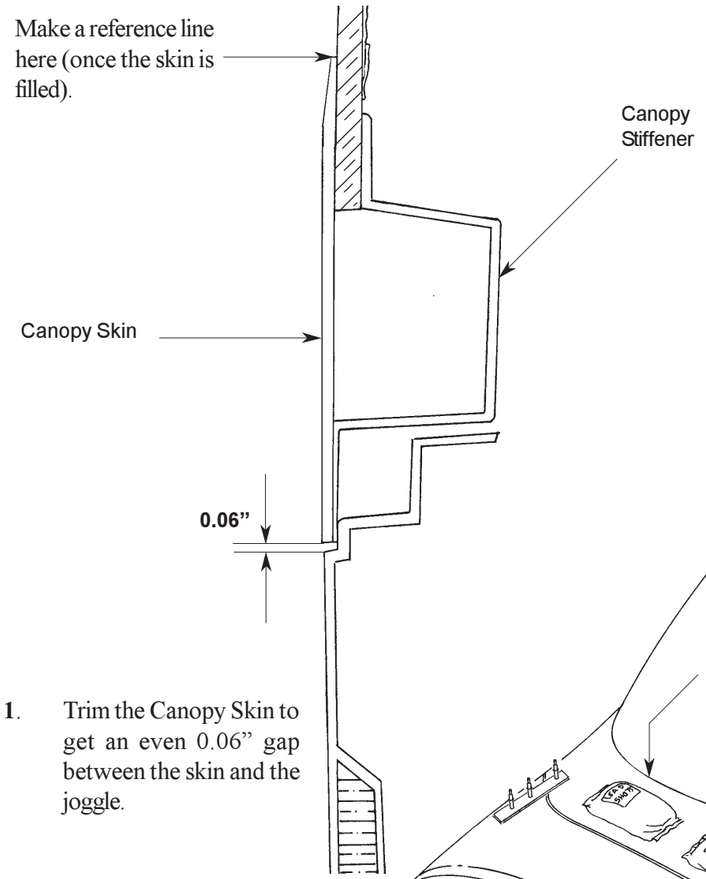
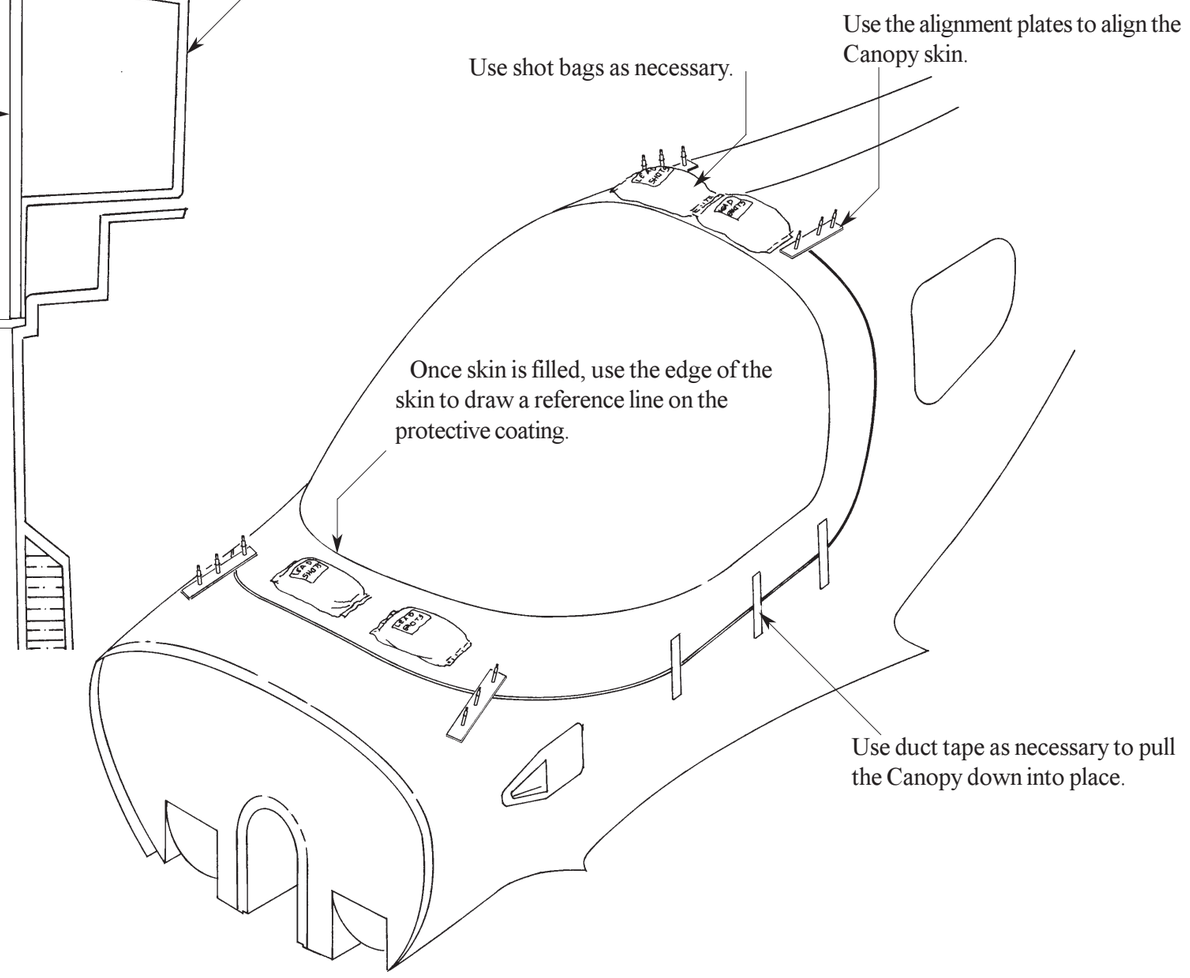
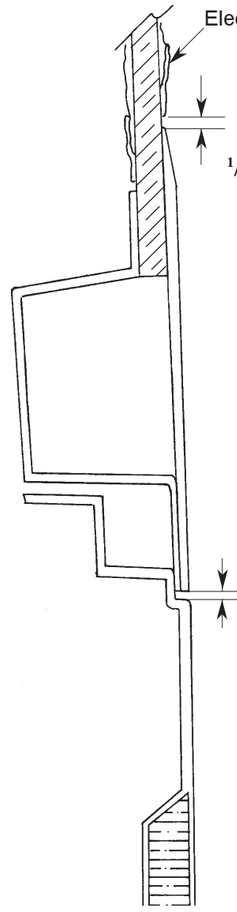
# I. Canopy Skin Bonding




**I 1.** Trim the Canopy Skin to get an even 0.06” gap between the skin and the joggle.

**Canopy Skin**
**9:I:1**




**I 2.** Peel away the protective material on the outside of the canopy approx 1/4” inside of the reference line. Apply 1/2” wide electrical tape to the outside of the canopy. The edge of the tape should be 1/8” short of the canopy skin.



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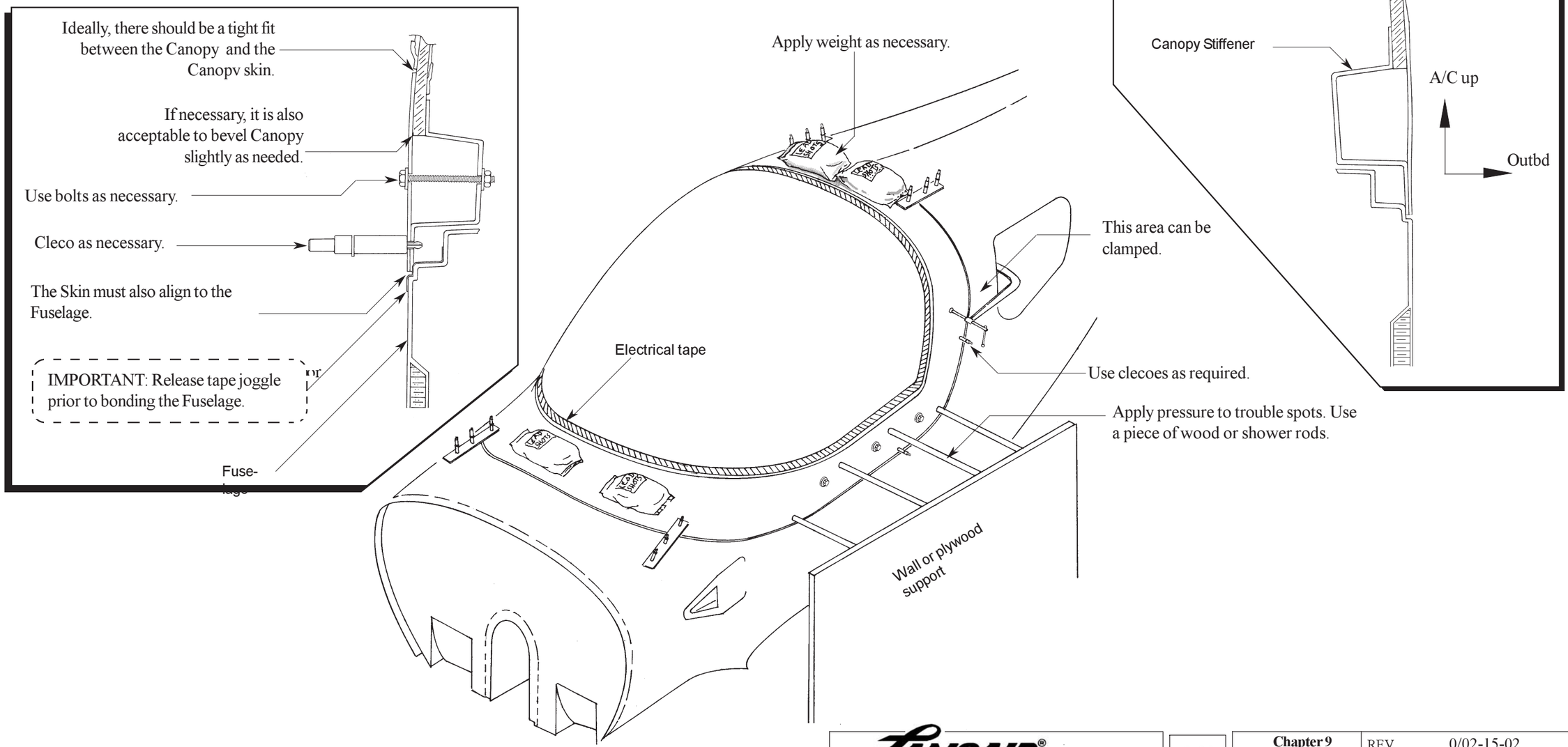
By now you have a good idea of how your particular Canopy skin fits. You may have noticed a couple of areas that perhaps could fit better. The end goal is to have a minimum bond gap between the Canopy and the Canopy Skin. The skin should also be flush with the fuselage. Use any combination of the suggestions and whatever also works. The key is to have a method worked out prior to Canopy skin installation. The bonding itself is at least a two-man job!

**Bonding Canopy Skin**
**Fig. 9:I:2**





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## J. Canopy Seal

After paint a canopy seal should be installed. The purpose of the canopy seal is to reduce the wind noise and keep the rain out. The canopy seal provided is an extruded "V" shape of silicon rubber. The canopy seal installs in a joggle provided in the fuselage.

Also available is an optional inflatable canopy seal. The inflatable canopy seal is inflated with air from a pump regulated by a pressure switch. The option is available through KCI. The inflatable seal mounts much the same way. Before staring the installation we suggest masking off the area surrounding the joggle simply to protect the paint from the adhesive.

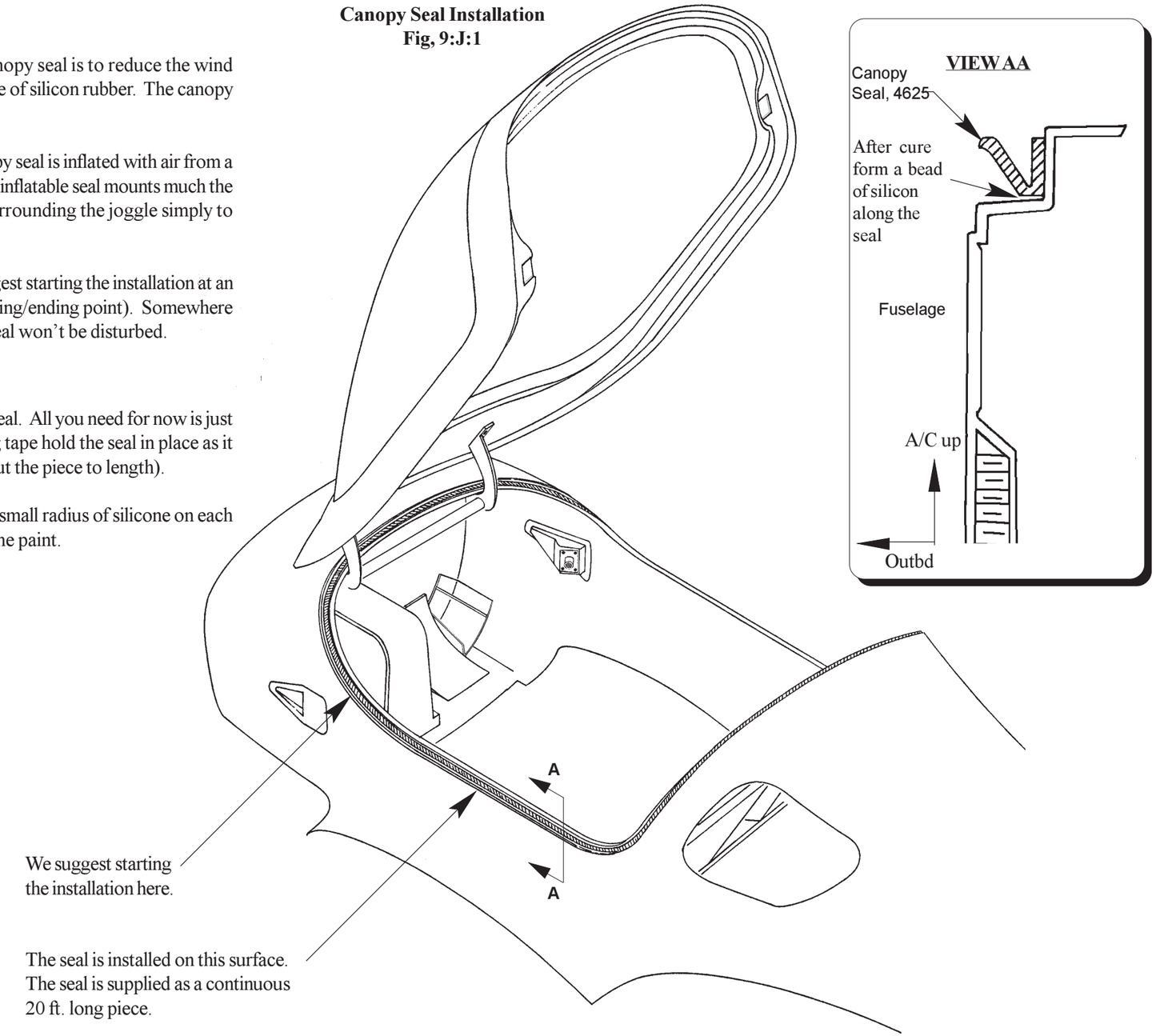
The canopy seal is supplied as a continuous 20 foot long piece. We suggest starting the installation at an area where water is least likely to accumulate. (There will be a seam at the starting/ending point). Somewhere along the longerons would be the best- perhaps towards the front where the seal won't be disturbed.

### Proper Orientation

Start by applying a small bead centered on the foot print of the canopy seal. All you need for now is just a small amount of the adhesive to hold in place. Using small pieces of masking tape hold the seal in place as it is curing. Continue around the perimeter and join the two halves at the end (Cut the piece to length).

Once the silicone has cured remove the smaller pieces of tape. Form a small radius of silicone on each side of the seal. Once applied, remove the masking tape you used to protect the paint.

**Canopy Seal Installation**
**Fig, 9:J:1**





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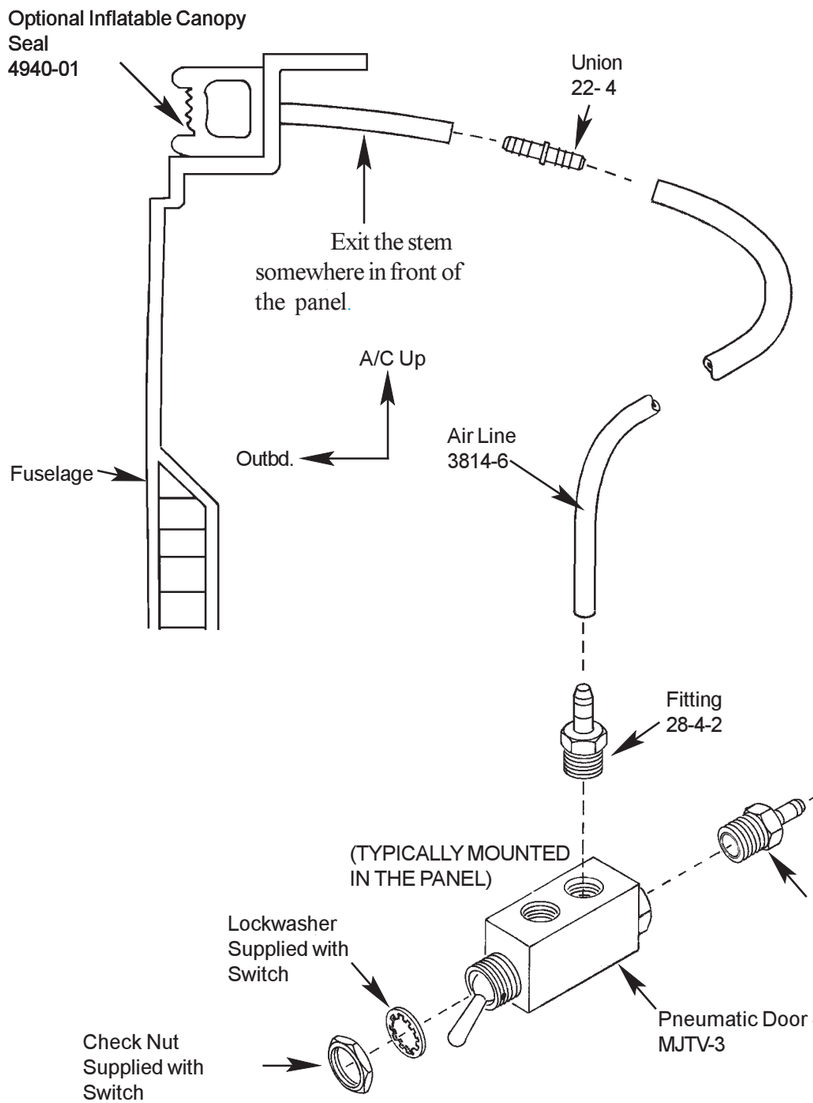
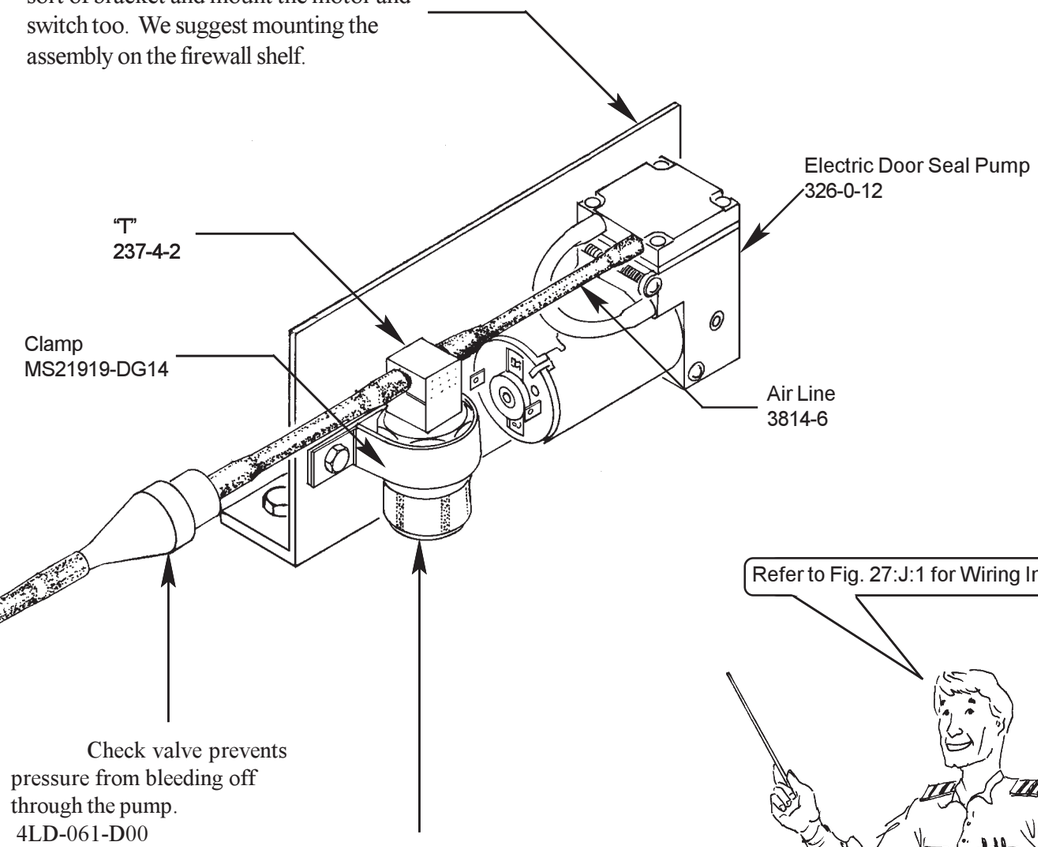
**Optional Inflatable Canopy Seal**
**Fig. 9:J:2**

The pneumatic expandable cockpit seal expands to fill a gap of 3/4". The seal is kept at 20 psi by a remotely mounted air pump. In this system a pressure switch activates the pump when the seal pressure falls below 20 psi.




Typical installation. Make some sort of bracket and mount the motor and switch too. We suggest mounting the assembly on the firewall shelf.




Check valve prevents pressure from bleeding off through the pump.
4LD-061-D00

20 psi Pressure Switch
(When the pressure reaches 20 psi the pump is shut down until the pressure drops).
01664080-032



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# REVISION LIST

# CHAPTER 10:CENTER WING SECTION INSTALLATION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 10-1 through 10-11 | 0/02-15-02 | None | Current revision is correct |
| 10-12 | 1/09-18-02 | R&R | Corrected Figure 10:B:1 |
| 10-13 through 10-18 | 0/02-15-02 | None | Current revision is correct |
| 10-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |


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# Chapter 10: Center Wing Section Installation

Contents



## 1. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| 1) | 4025-01 | 1 | Load Pad, Forward Left | |
| 2) | 4025-02 | 1 | Load Pad, Forward Right | |
| 3) | 4025-03 | 1 | Load Pad Access Panel, Left | |
| 4) | 4025-04 | 1 | Load Pad Access Panel, Right | |
| 5) | 4026-01 | 1 | Load Pad, Center Left | |
| 6) | 4026-02 | 1 | Load Pad, Center Right | |
| 7) | 4200-03 | 1 | Upper Wing Skin, Left Inboard | |
| 8) | 4200-04 | 1 | Upper Wing Skin, Right Inboard | |
| 9) | 4232-01 | 1 | Load Pad, Aft left | |
| 10) | 4232-02 | 1 | Load Pad, Aft Right | |
| 11) | EVAC-U8 | 1 | Emergency Escape Smoke Hood | **Yes |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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# 2. CONSTRUCTION PROCEDURES

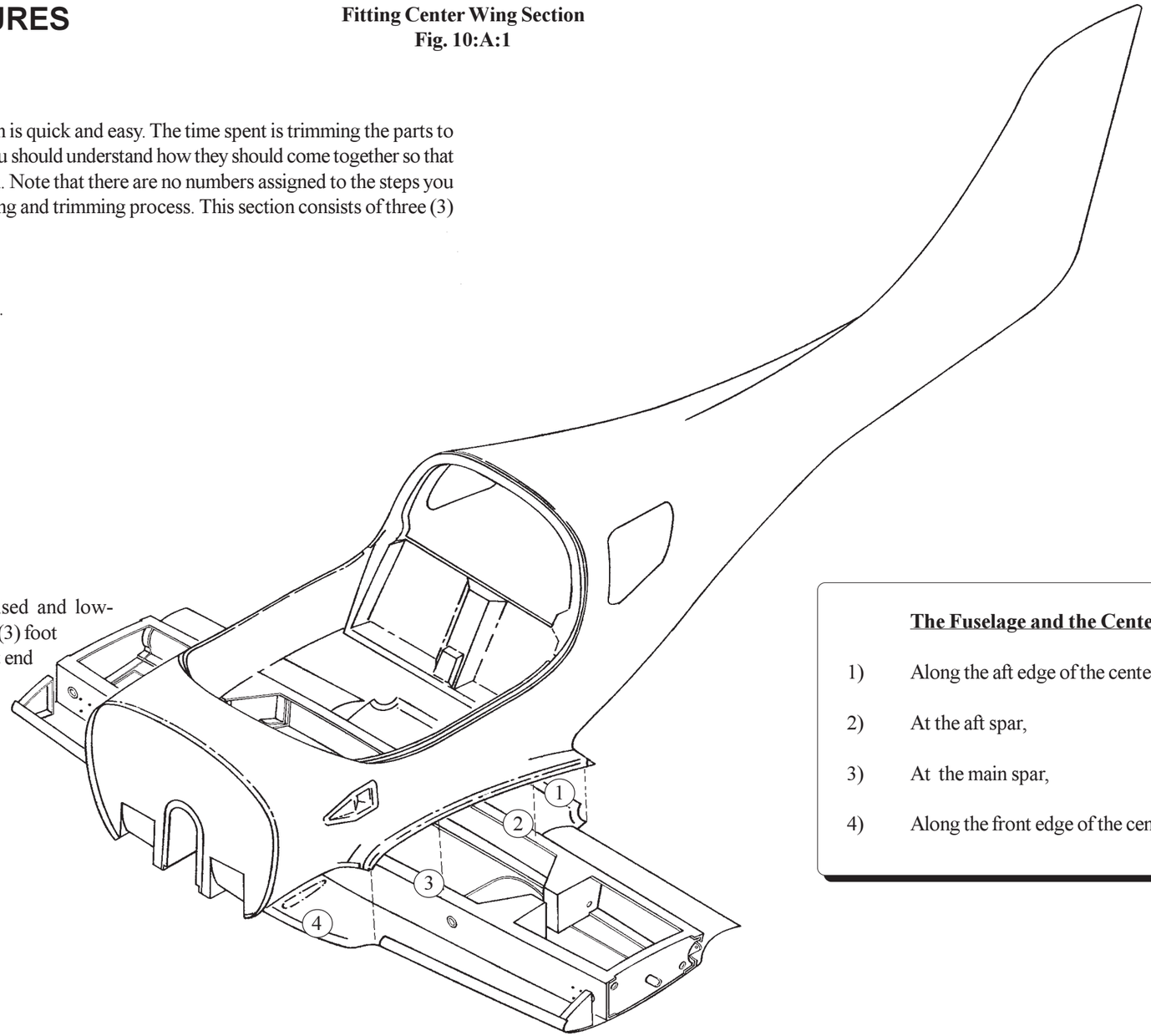
## A. Bonding the Center Wing Section

The actual bonding of the center wing section is quick and easy. The time spent is trimming the parts to fit each other. In fitting the parts it is important that you should understand how they should come together so that you can make the judgement as to how much to trim. Note that there are no numbers assigned to the steps you will perform in this section. It is a back and forth fitting and trimming process. This section consists of three (3) parts:

1) Fit and trim the parts.
2) Final alignment and drilling holes for clecoes.
3) The bonding of center wing section.

The fuselage will have to be repetitively raised and lowered for checking and trimming. We suggest a three (3) foot tall saw horse for the purpose of supporting the front end of the fuselage when raised.

**Fitting Center Wing Section**
**Fig. 10:A:1**




**The Fuselage and the Center Wing Section Bond**

1) Along the aft edge of the center wing section,
2) At the aft spar,
3) At the main spar,
4) Along the front edge of the center wing section.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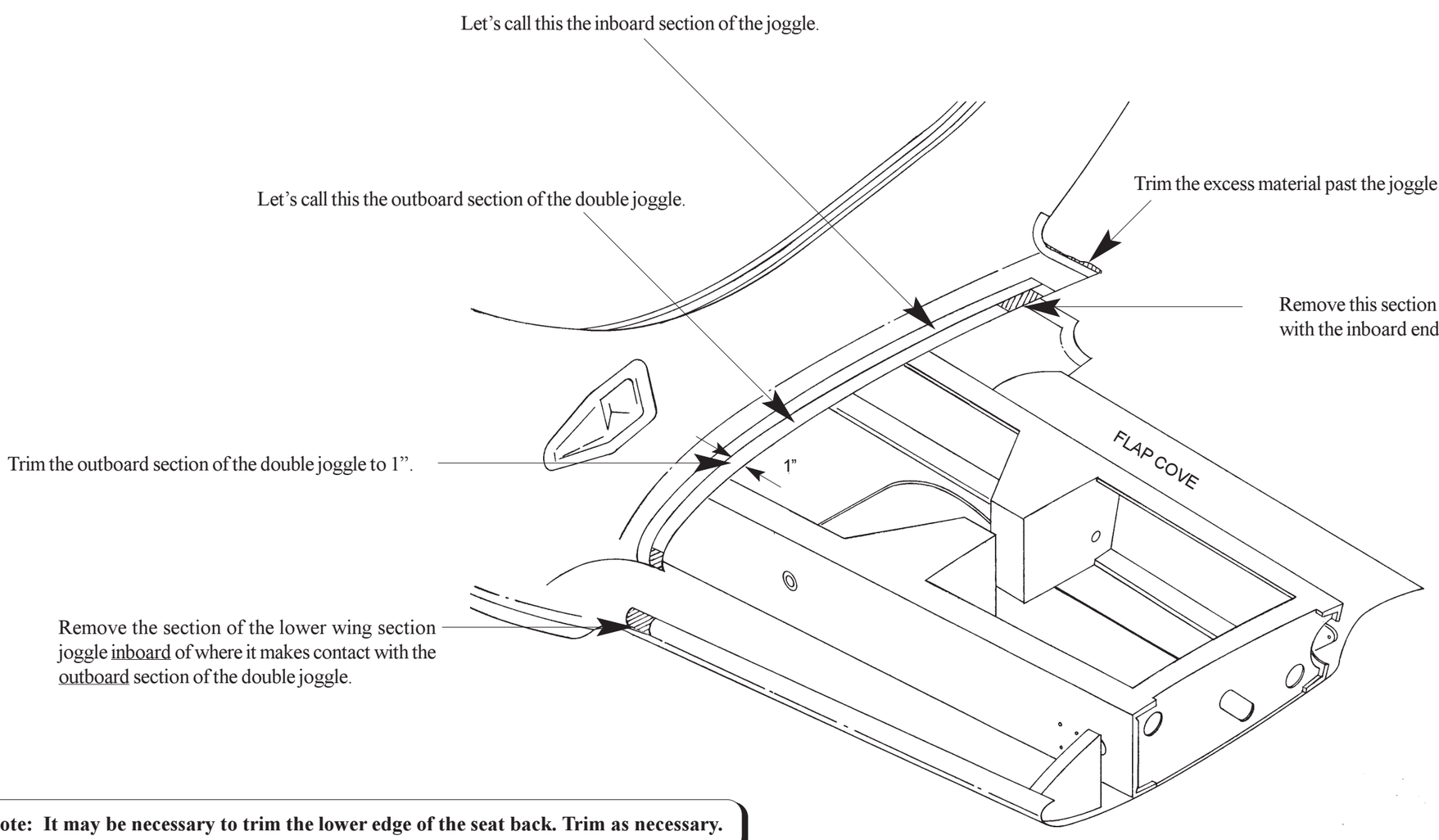
**Trimming Joggles Wing Fillet Area**
**Fig. 10:A:2**




**Note: It may be necessary to trim the lower edge of the seat back. Trim as necessary.**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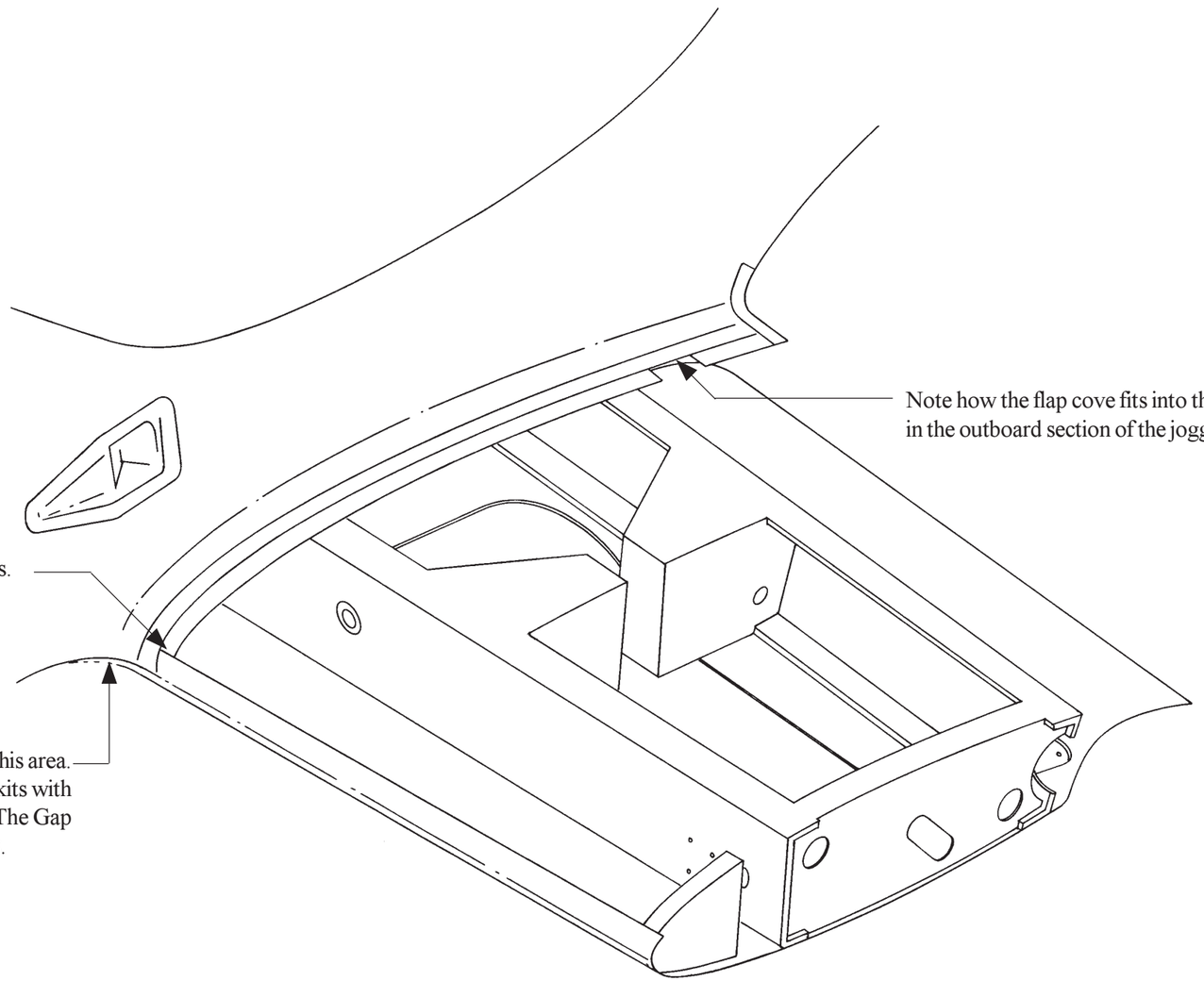
**Fitting Joggles Wing Fairing Area**
**Fig. 10:A:3**





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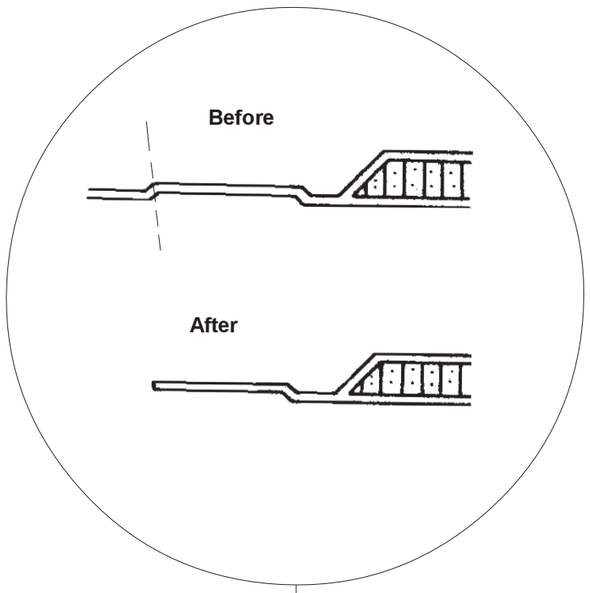
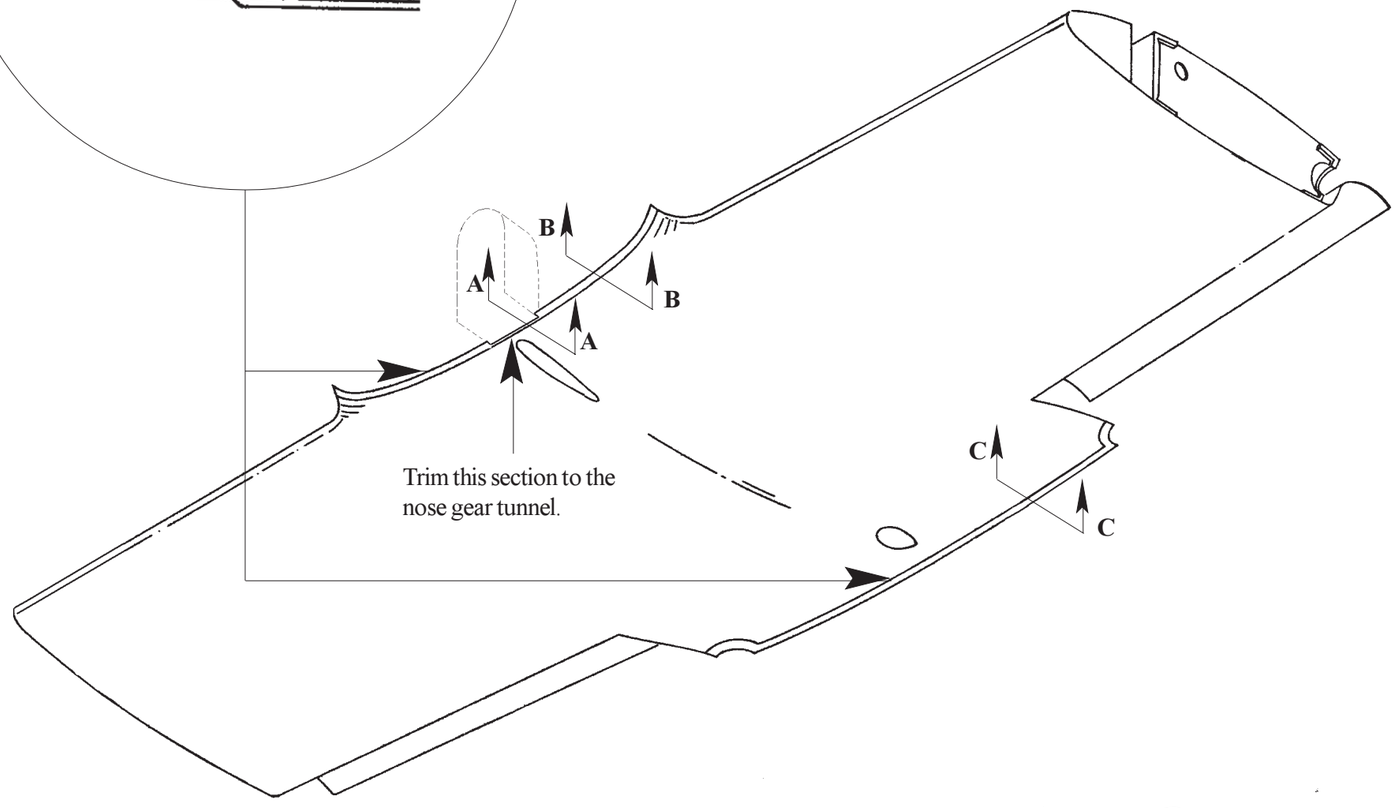
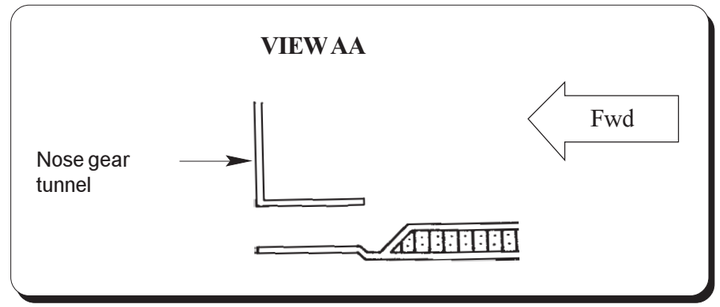
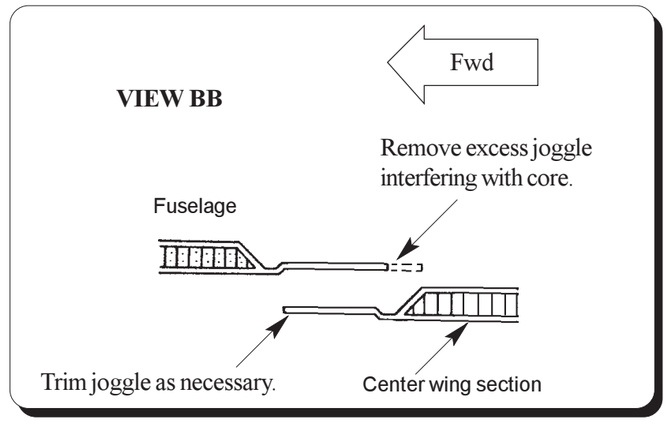
**Trimming Joggles Center Wing Section**
**Fig. 10:A:4**

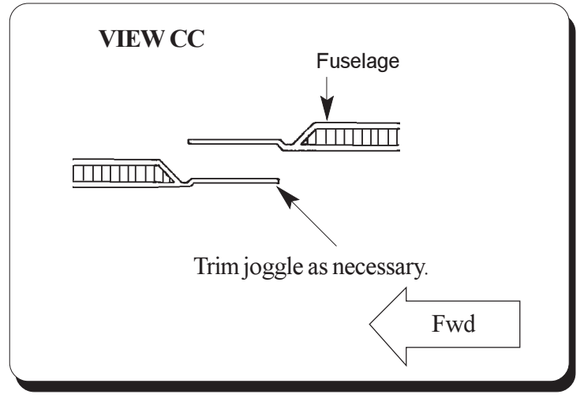
## INITIAL CENTER WING SECTION JOGGLE TRIMMING





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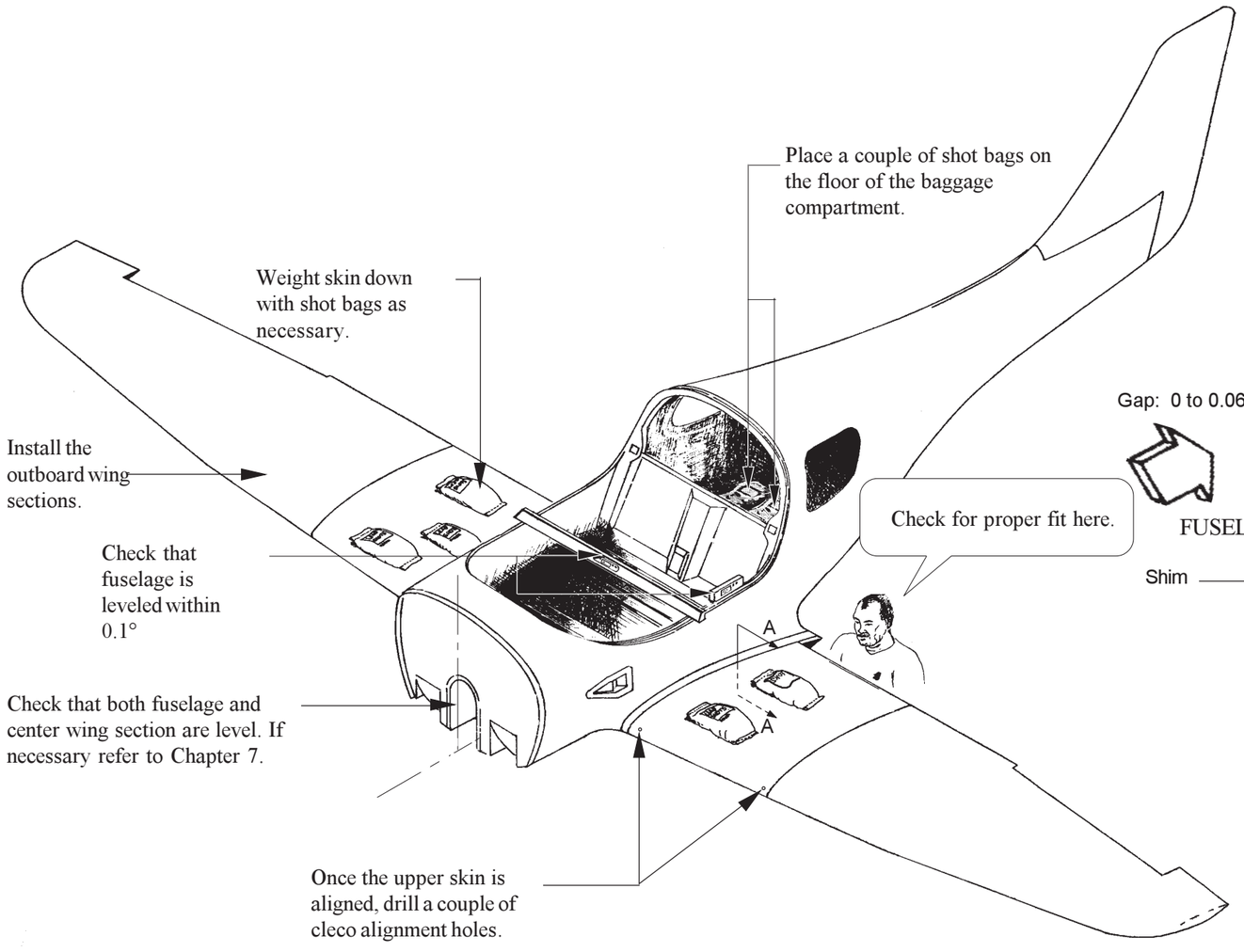
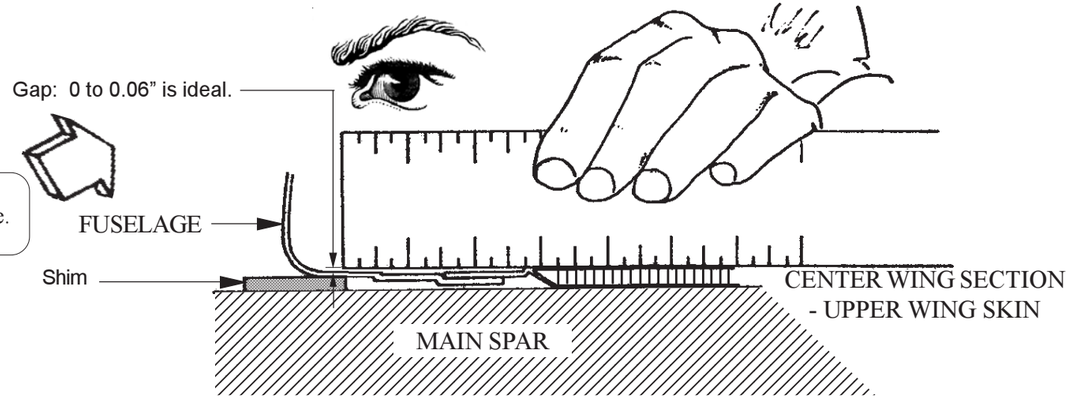
**Wing Skin to Fuselage Fitting**
**Fig. 10:A:5**




**VIEW AA**




**CHECK FIT OF UPPER SKIN TO FUSELAGE**
Using a straight edge check the fit of the upper wing skin to fairing. The wing skin should be *level* or 0.06" above fuselage. Adjust with shims as necessary between wing fairing and spar.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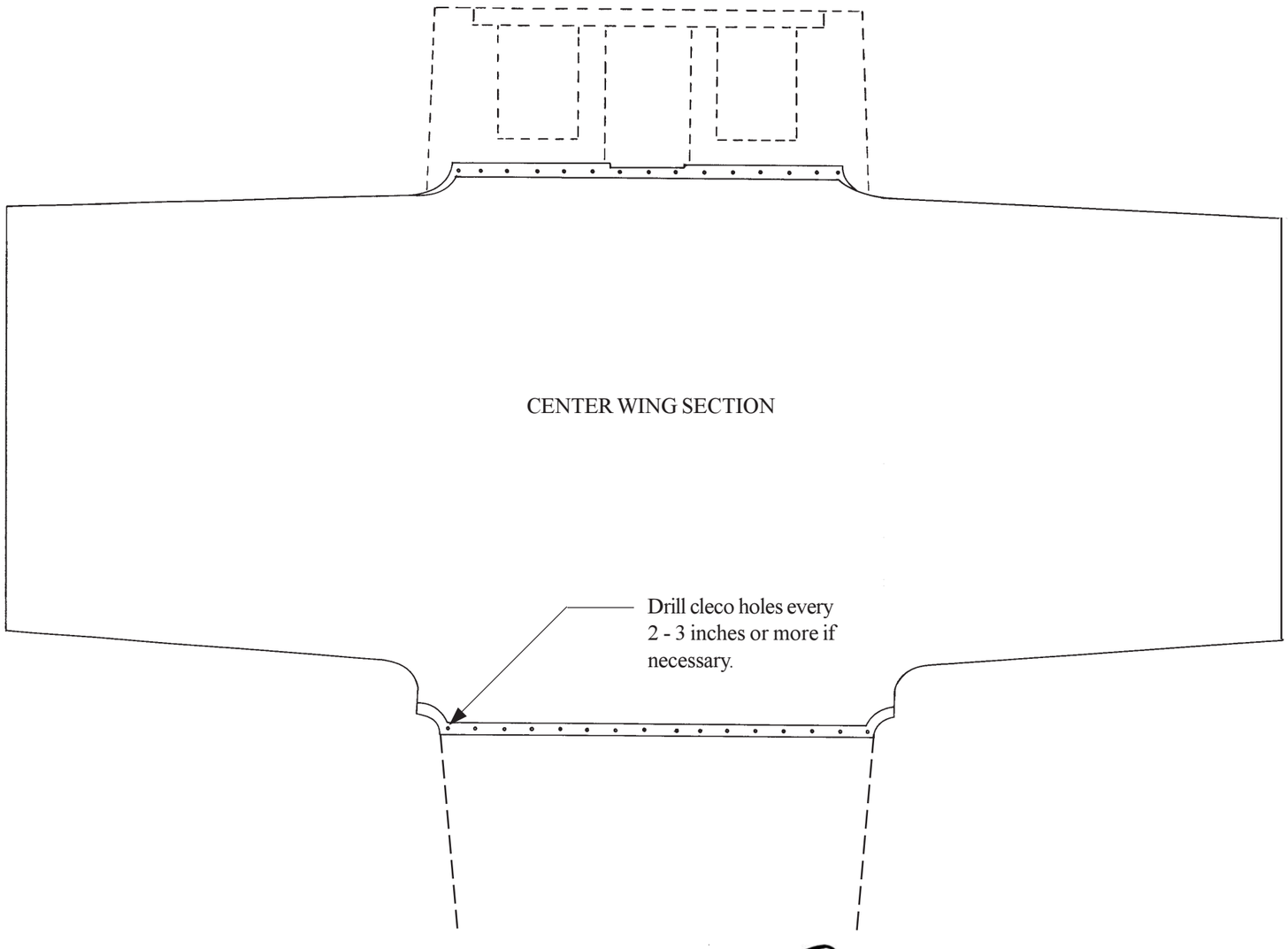
**Cleco Holes**
**(Bottom View)**
**Fig. 10:A:6**





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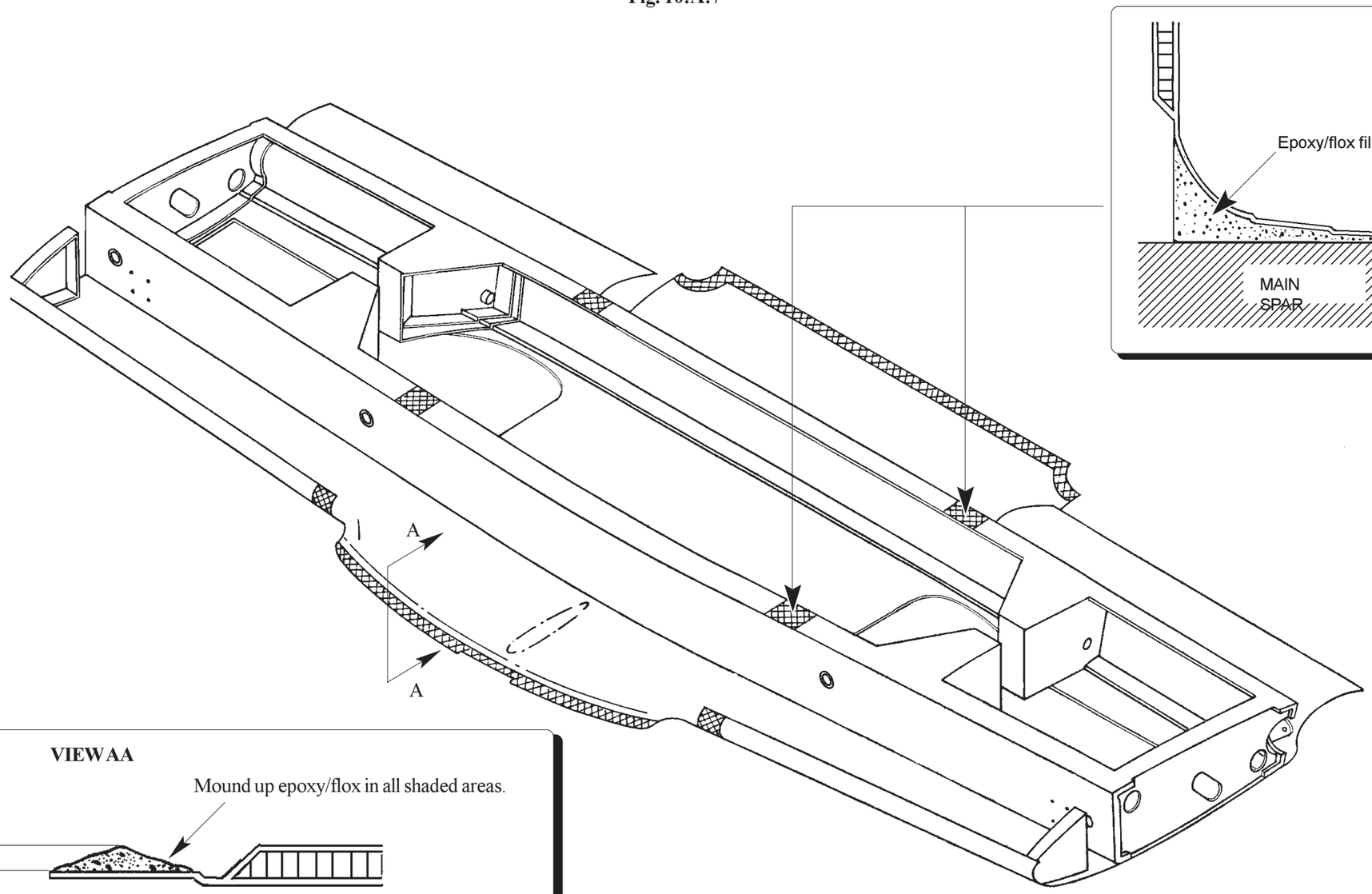
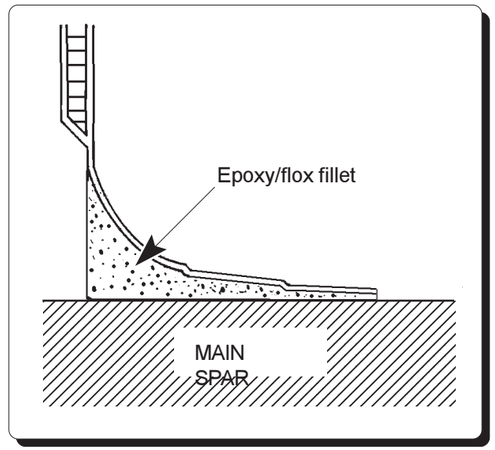
**Bonding Center Wing Section**
**Fig. 10:A:7**




**VIEW AA**

Mound up epoxy/flox in all shaded areas.

Approx. **3/16”**



**NOTE: Refer to chapter 1 for proper bonding procedures if necessary.**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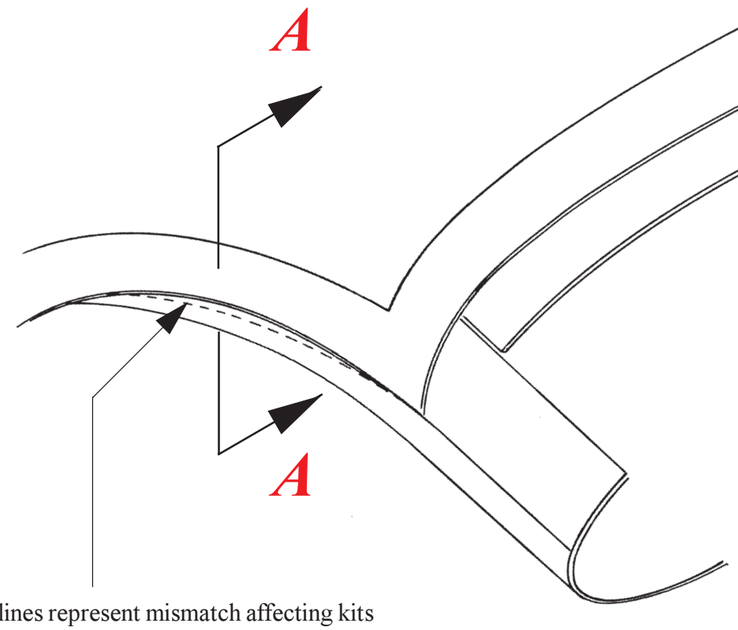
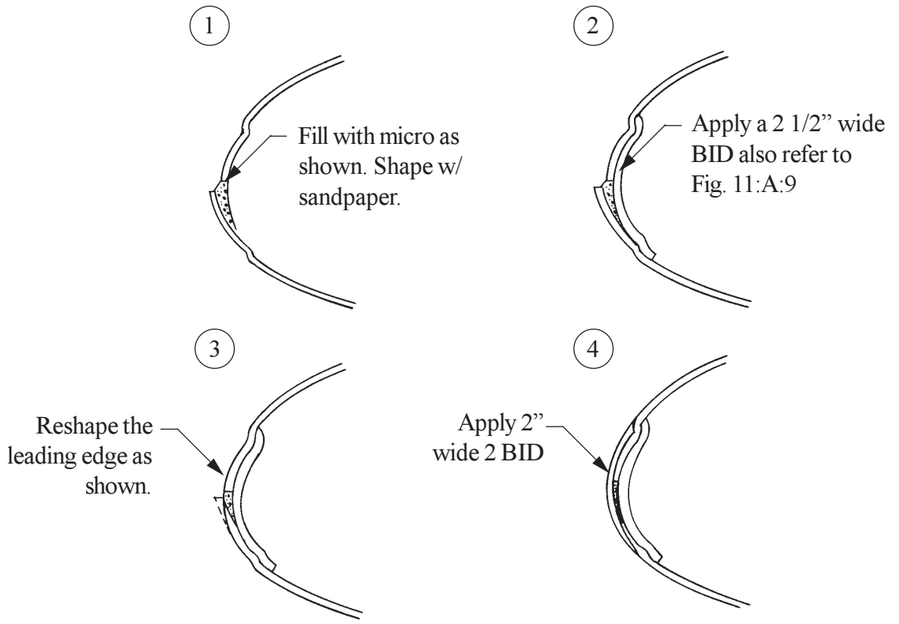
**Leading Edge at Fuselage Junction**
**Fig. 10:A:8**

We mentioned in figure 10:A:3 that kits with serial numbers 1001(F.B.# 100) through 1023(F.B.# 127) have a slight mismatch in the leading edge of the wing at the fuselage junction. The construction procedure is essentially the same. The differences are pointed out below.

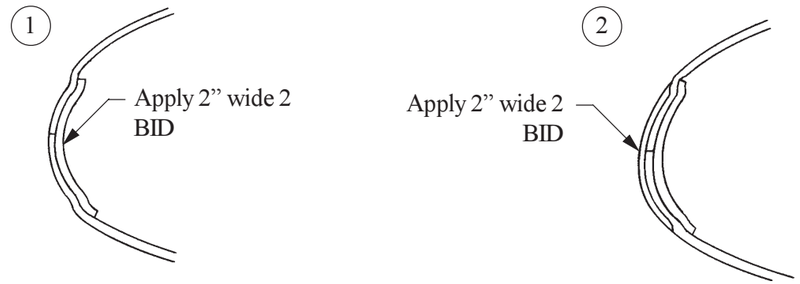



Dashed lines represent mismatch affecting kits with serial # 1001 (F.B. # 100) through 1023 (F.B.# 127).

Kits with F.B. # 100 through F.B. # 127




Kits with F.B. # 128 and on.





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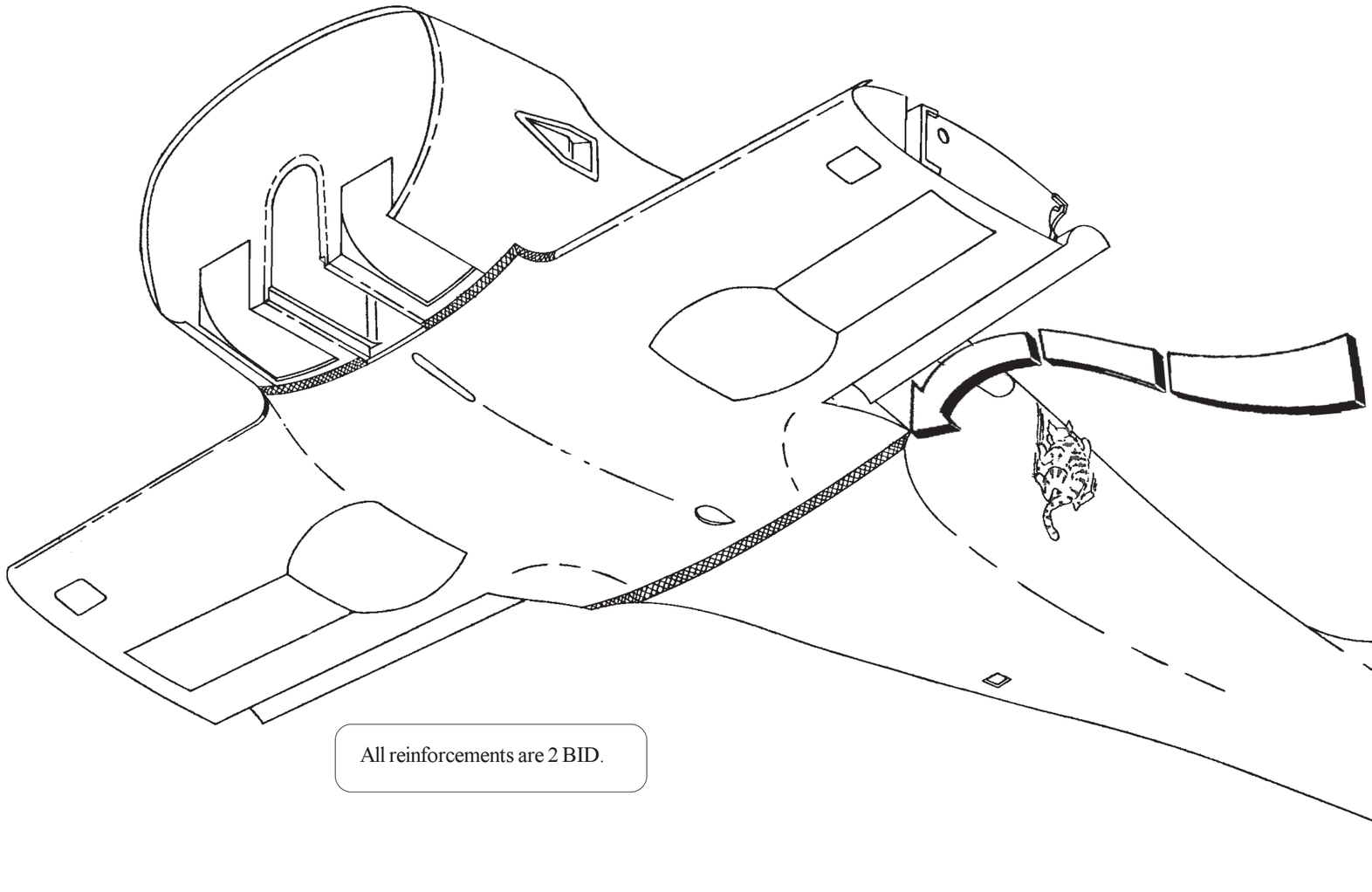
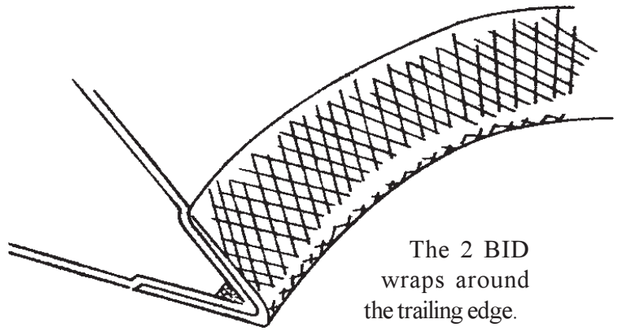
**2 BID Reinforcements**
**Fig. 10:A:9**



All reinforcements are 2 BID.



The 2 BID wraps around the trailing edge.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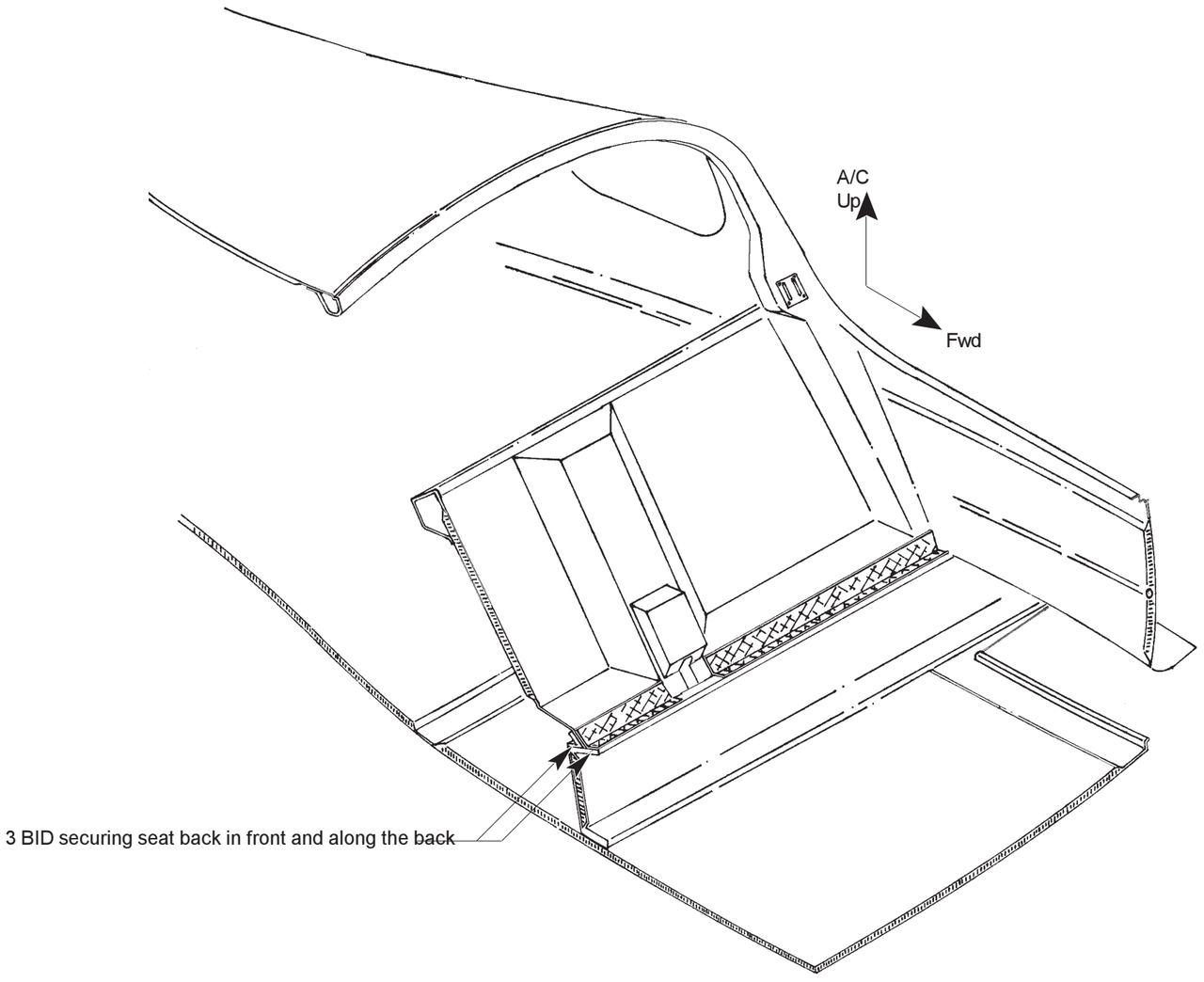
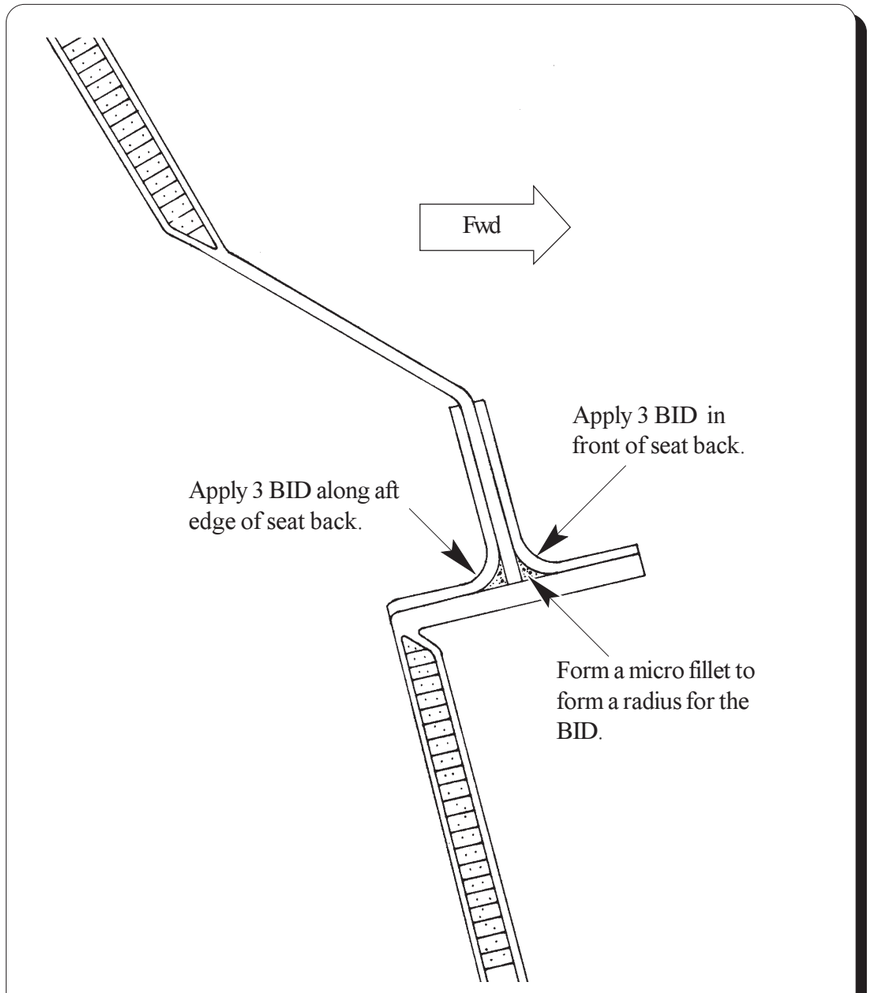
**Seat Back BID Reinforcements**
**Fig. 10:A:10**





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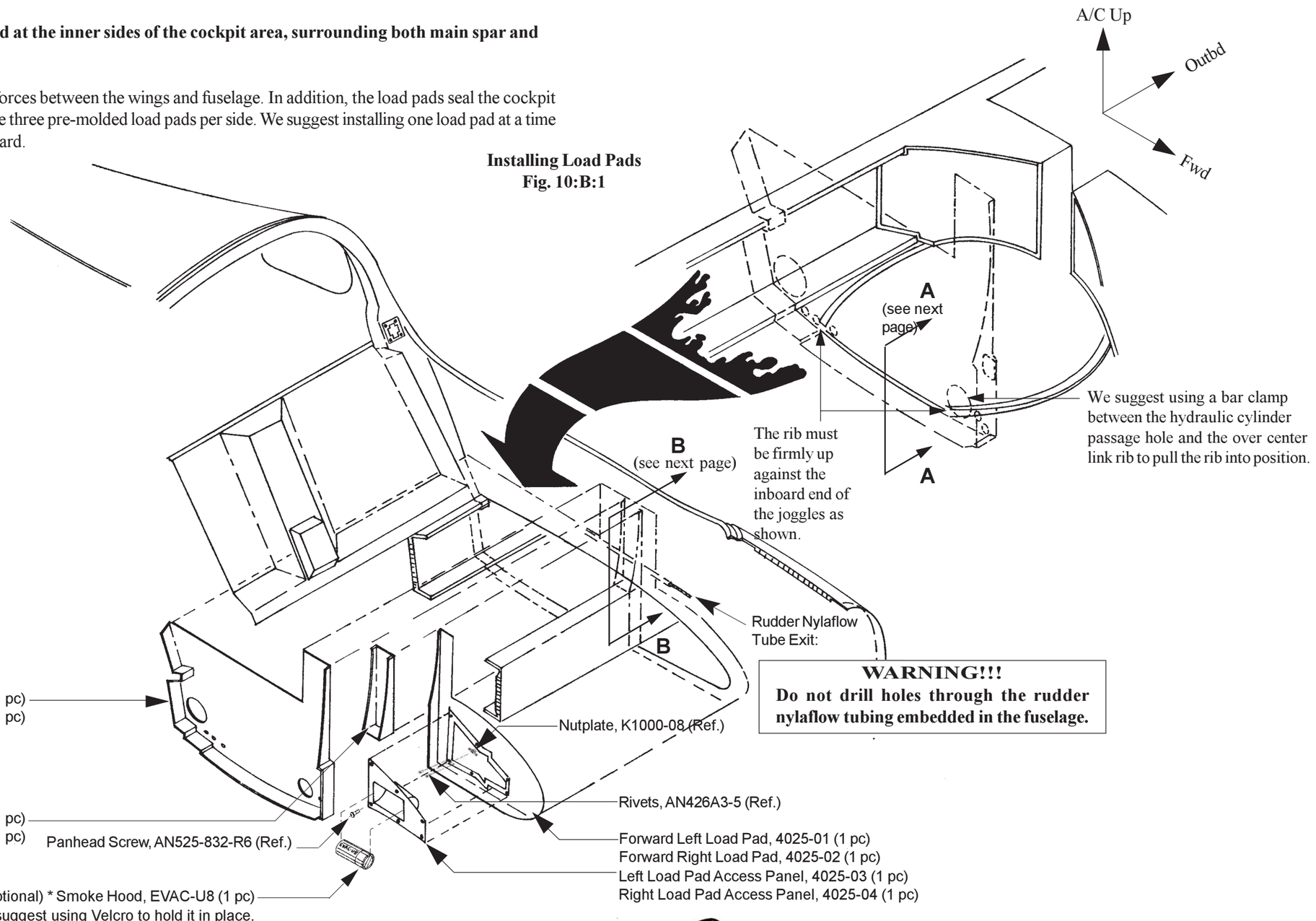
## B. Installing Load Pads

**The Load Pads are located at the inner sides of the cockpit area, surrounding both main spar and aft spar.**

**B 1.** The load pads transfer the forces between the wings and fuselage. In addition, the load pads seal the cockpit from the gear well. There are three pre-molded load pads per side. We suggest installing one load pad at a time and working your way forward.

**Installing Load Pads**
**Fig. 10:B:1**




**Note:**

**(*) Optional Parts available through Kit Components Inc.**



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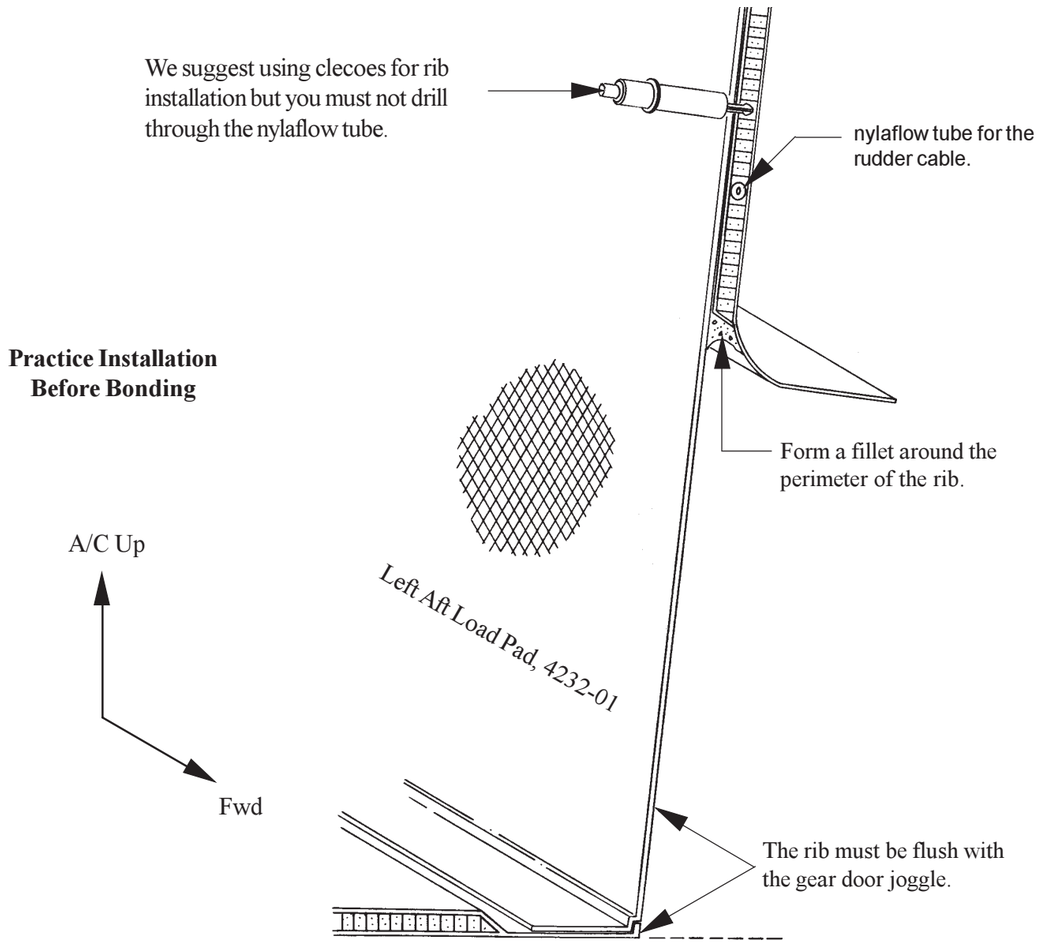
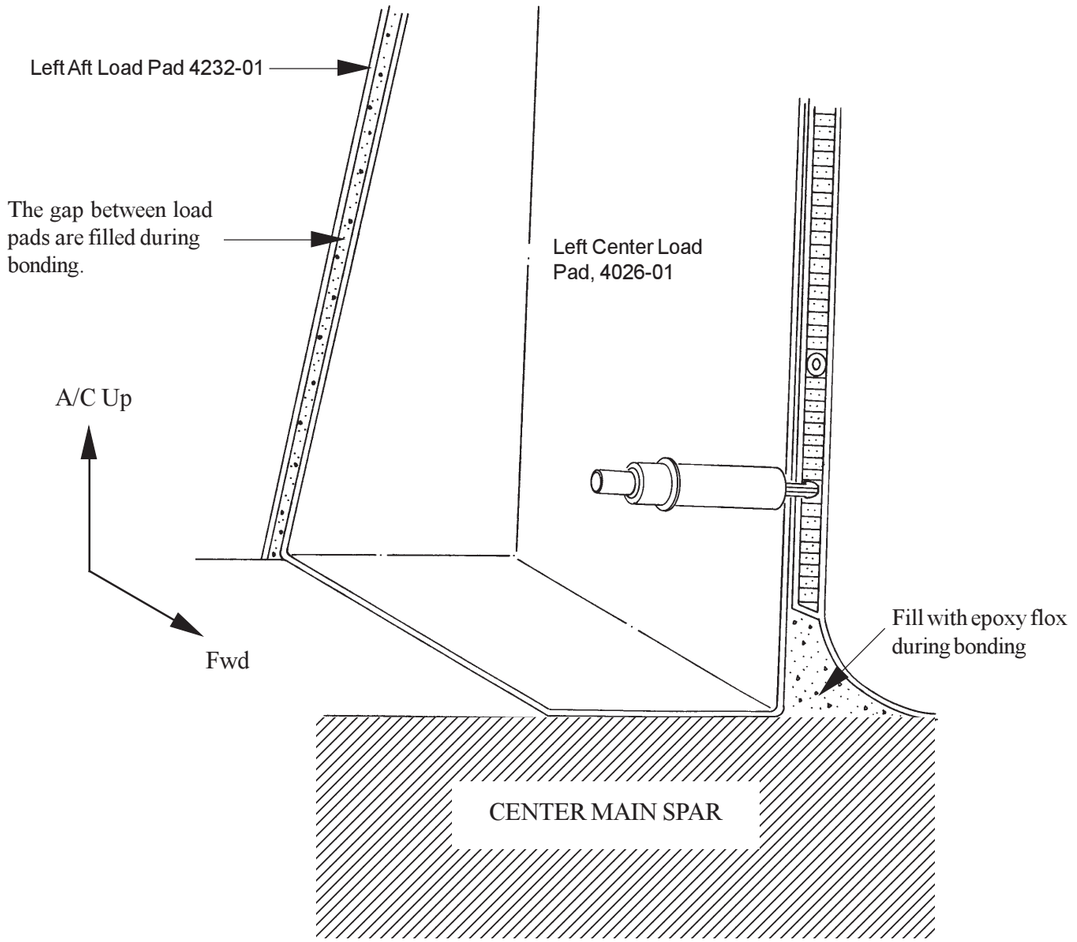
**Installing Load Pads**
**(Cross Section)**
**Fig. 10:B:2**

## VIEW AA




**Practice Installation Before Bonding**

## VIEW BB




**Other Notes on installing the Aft Load Pad**

1) Load Pad Alignment
   - a) Load pad should be flush with the gear door joggle.
   - b) The load pad must be positioned as far forward as possible up against the spar. You will notice an approximate 1/4" gap between rib and aft spar. This is to allow clearance during installation. Fill gap with flox during bonding.
   - c) Align rib prior to bonding with clecoes, clamps and whatever is necessary.
   - d) Bond using a slightly runny epoxy/flox mix following approved bonding procedures.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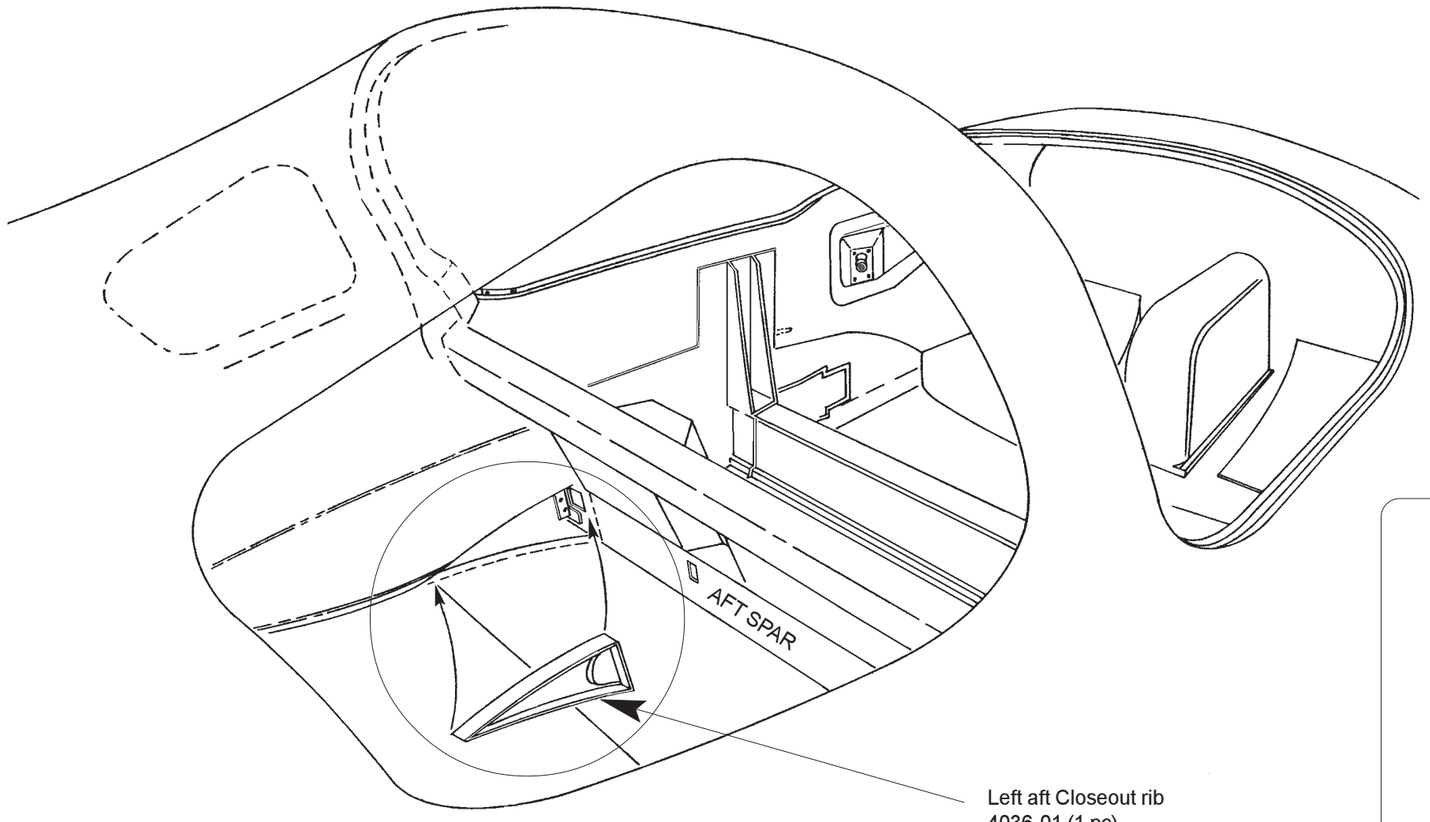
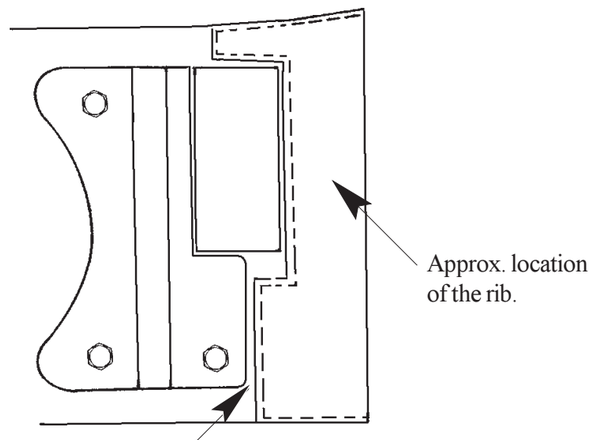
## C. Installing the Aft Closeout Rib

**Installing Aft Closeout Rib**
**Fig. 10:C:1**




The closeout rib installs just aft of the aft spar as shown. The purpose of the rib is to seal the cockpit from the outside. Exact location is not critical. Install from inside the baggage compartment.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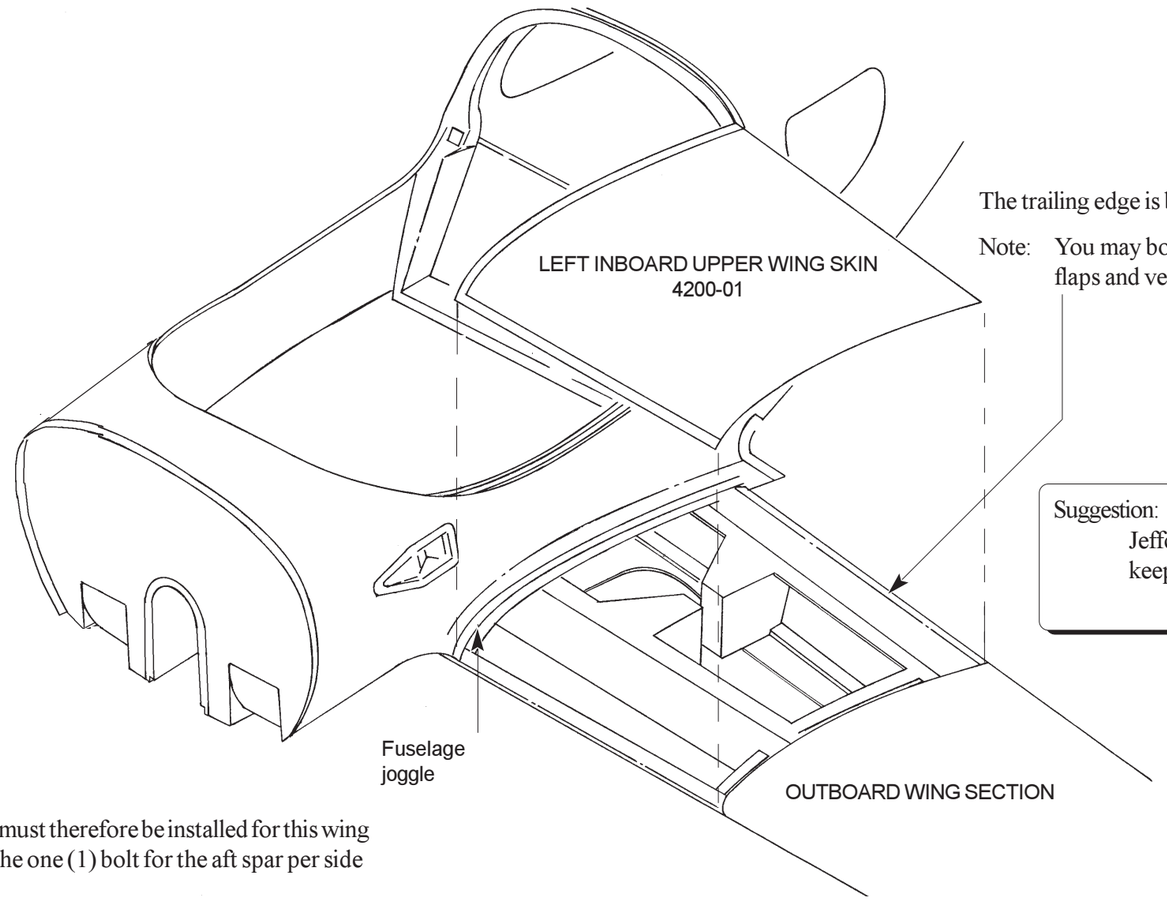
## D. Closing the Center Wing Section

**Closing Center Wing Section**
**( General Overview )**
**Fig. 10:D:1**

In this section you will close the inboard wing sections. Prior to closing out we suggest that you complete all systems of the center wing section (such as landing gear installation, hydraulics and the fuel system.




The trailing edge is bonded in chapter 21.

Note: You may bond the trailing edge if you install the flaps and verify the fit as explained in chapter 21.

Suggestion: Paint the inside of the gear wells with Jeffco fuel tank sealant (9700-1G ). It makes keeping the gear wells clean much easier.

The inboard wing section is aligned to:

1) The fuselage joggle.
2) The outboard wing section. The outboard wing section must therefore be installed for this wing section. Install the two (2) bolts of the main spars and the one (1) bolt for the aft spar per side for proper alignment.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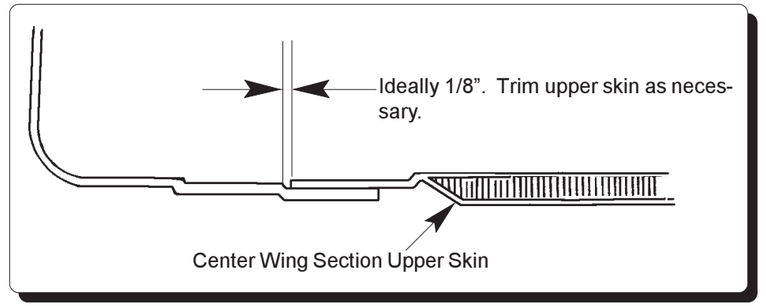
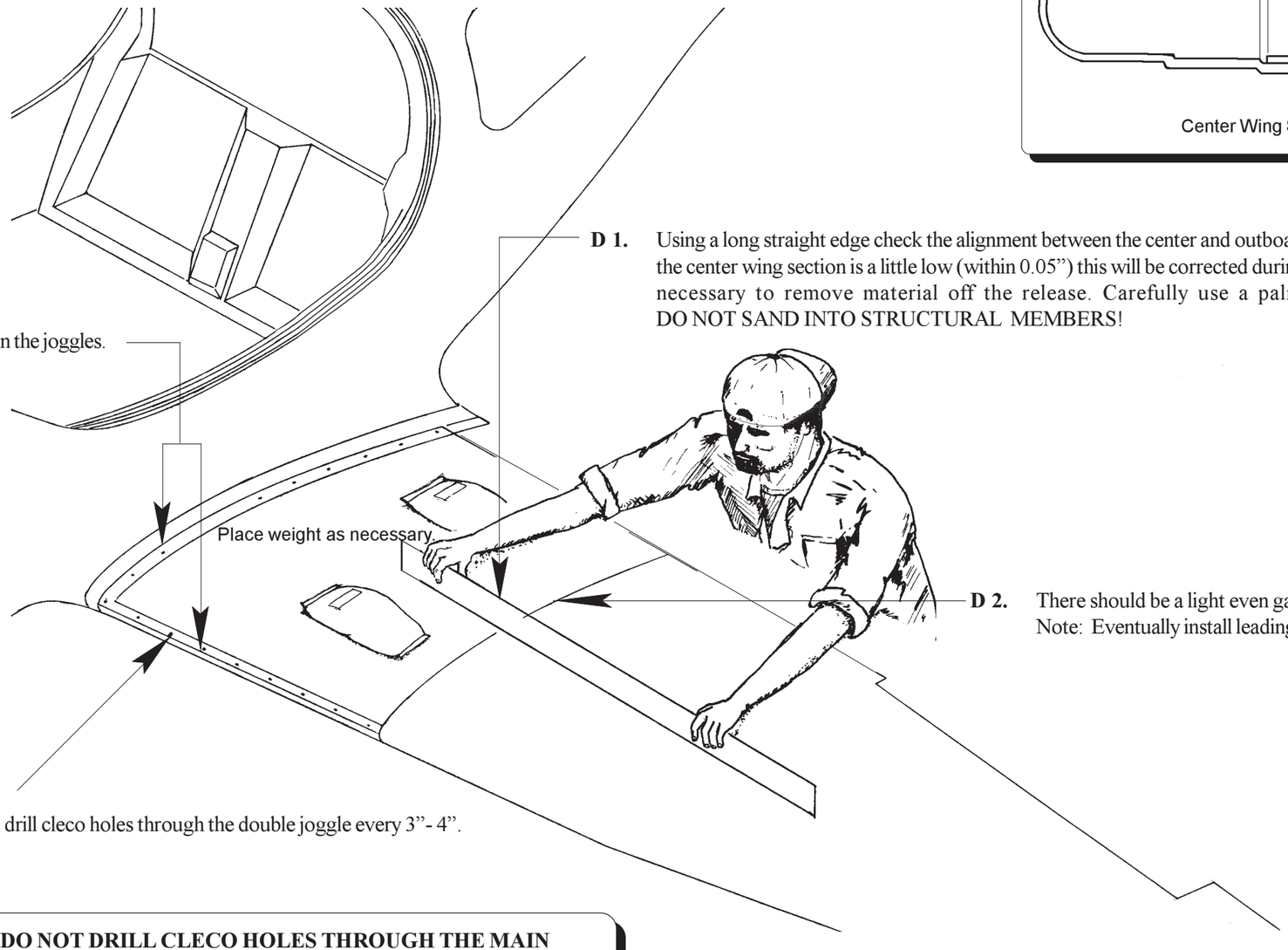
**Aligning Center Upper Wing Section Upper Skins**
**Fig. 10:D:2**




**D 1.** Using a long straight edge check the alignment between the center and outboard wing sections. Note: If the center wing section is a little low (within 0.05") this will be corrected during closing. If high it will be necessary to remove material off the release. Carefully use a palm sander as necessary. DO NOT SAND INTO STRUCTURAL MEMBERS!

**D 2.** There should be a light even gap between skins. Note: Eventually install leading edge tape.

**D 3.** Align the joggles.

**D 4.** Once aligned, drill cleco holes through the double joggle every 3"- 4".

**WARNING: DO NOT DRILL CLECO HOLES THROUGH THE MAIN SPAR OR AFT SPAR!**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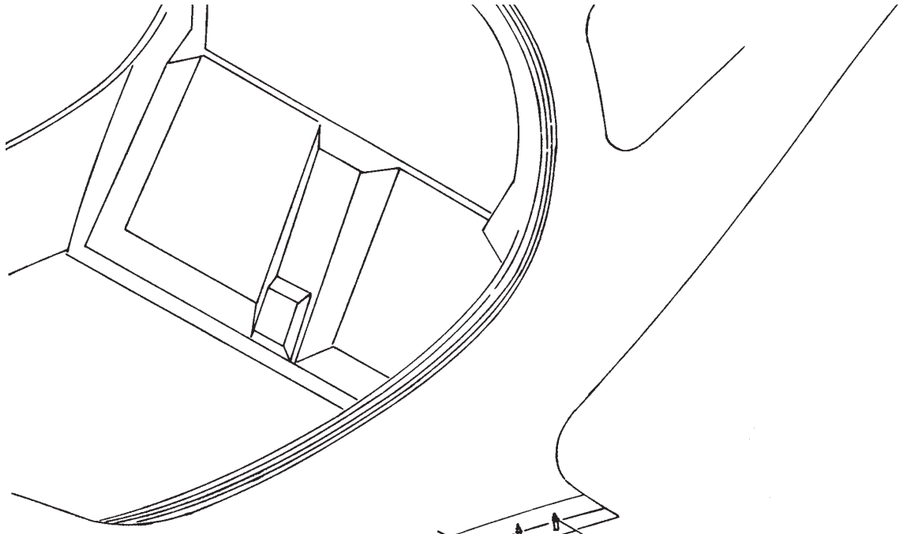
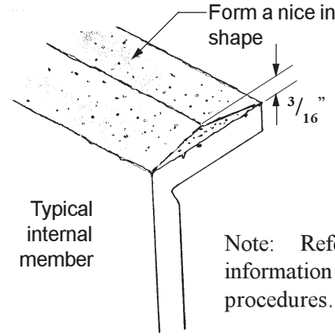
**Closing Center Wing Section**
**Fig. 10:D:3**






Note: Refer to chapter 8 for more information regarding closing procedures.

**WARNING (AGAIN) DO NOT DRILL HOLES INTO SPAR!!**

Use any combination of straight edges and weights to achieve proper results. Inspect using straight edges as shown in Fig. 10:D:2.

Suggestion: Remove adhesive "squeeze out" from the gear wells prior to cure.

Inspect leading edge during bonding. Install more clecoes and/or use duct tape as required.

Shown: "U" channel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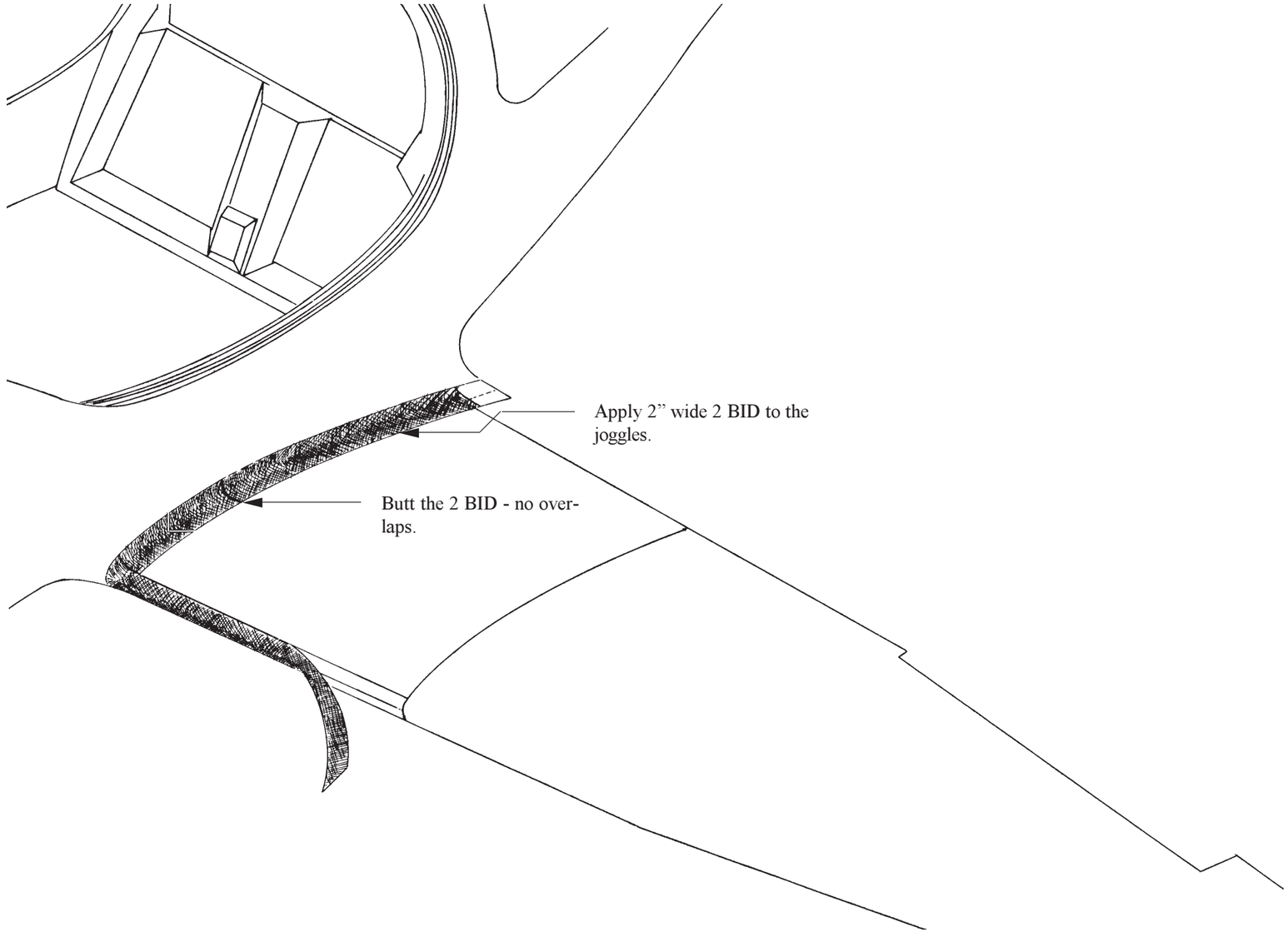
**Joggle BID Reinforcements**
**Fig. 10:D:4**





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# REVISION LIST

# CHAPTER 11: HORIZONTAL TAIL INSTALLATION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 11-1 through 11-5 | 0/02-15-02 | R&R | Current revision is correct |
| 11-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |


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# Chapter 11: Horizontal Tail Installation

Contents



## 1. INTRODUCTION

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| 1) | 4049 | 1 | Vertical bulkhead | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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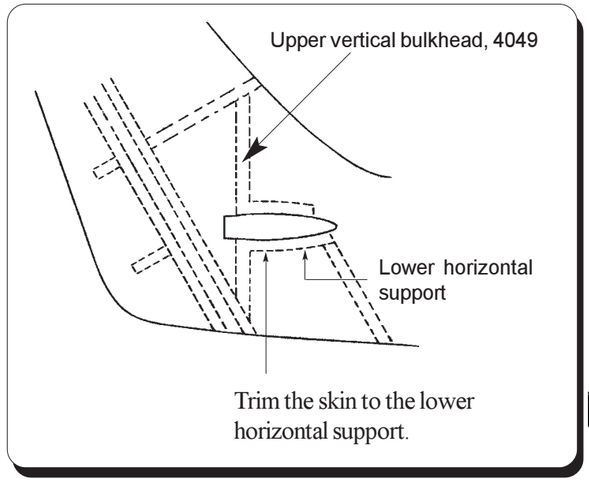
# 3. CONSTRUCTION PROCEDURES

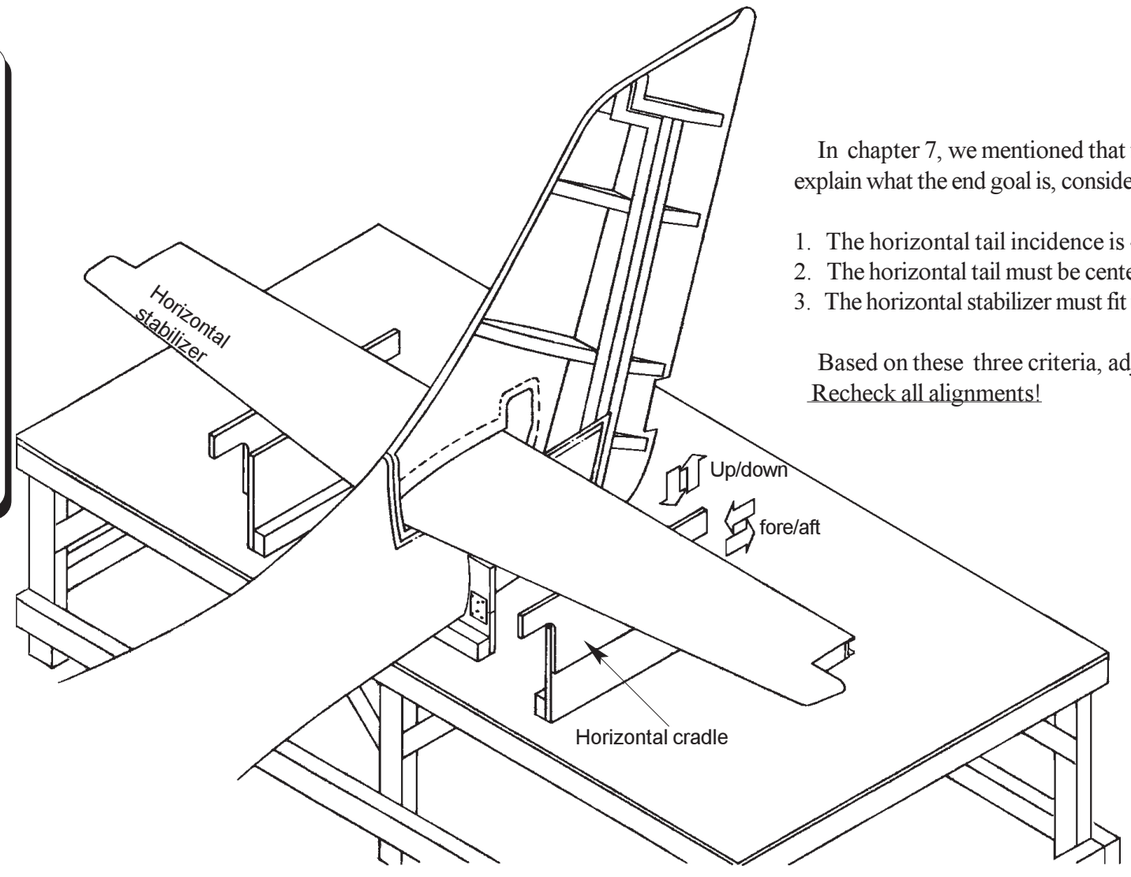
## A. Bonding the Horizontal Stabilizer

### Trimming the Left Vertical Skin

Trim the remainder to fit the horizontal tail. This is a gradual trim and fit process using the horizontal tail. The ideal gap between the vertical and horizontal should be between 0.05" and 1/8".




**Horizontal Tail Alignment**
**Fig. 11:A:1**




In chapter 7, we mentioned that the horizontal cradles are final aligned in this chapter. To explain what the end goal is, consider the following requirements:

1. The horizontal tail incidence is -0.6° to -0.3°. Also refer to chapter 7.
2. The horizontal tail must be centered.
3. The horizontal stabilizer must fit the lower horizontal support. Visually check this.

Based on these three criteria, adjust the horizontal cradles as necessary.
Recheck all alignments!

**WARNING: BE SURE TO ESTABLISH WHICHv SIDE IS UP AND DOWN FOR THE HORIZONTAL STABILIZER! ONE EASY WAY TO IDENTIFY THE BOTTOM IS TO LOCATE THE DRAIN HOLE IN THE BOTTOM SKIN.**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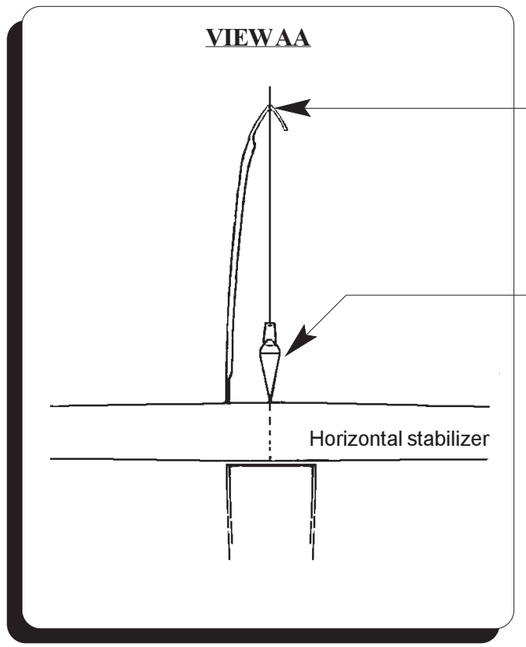
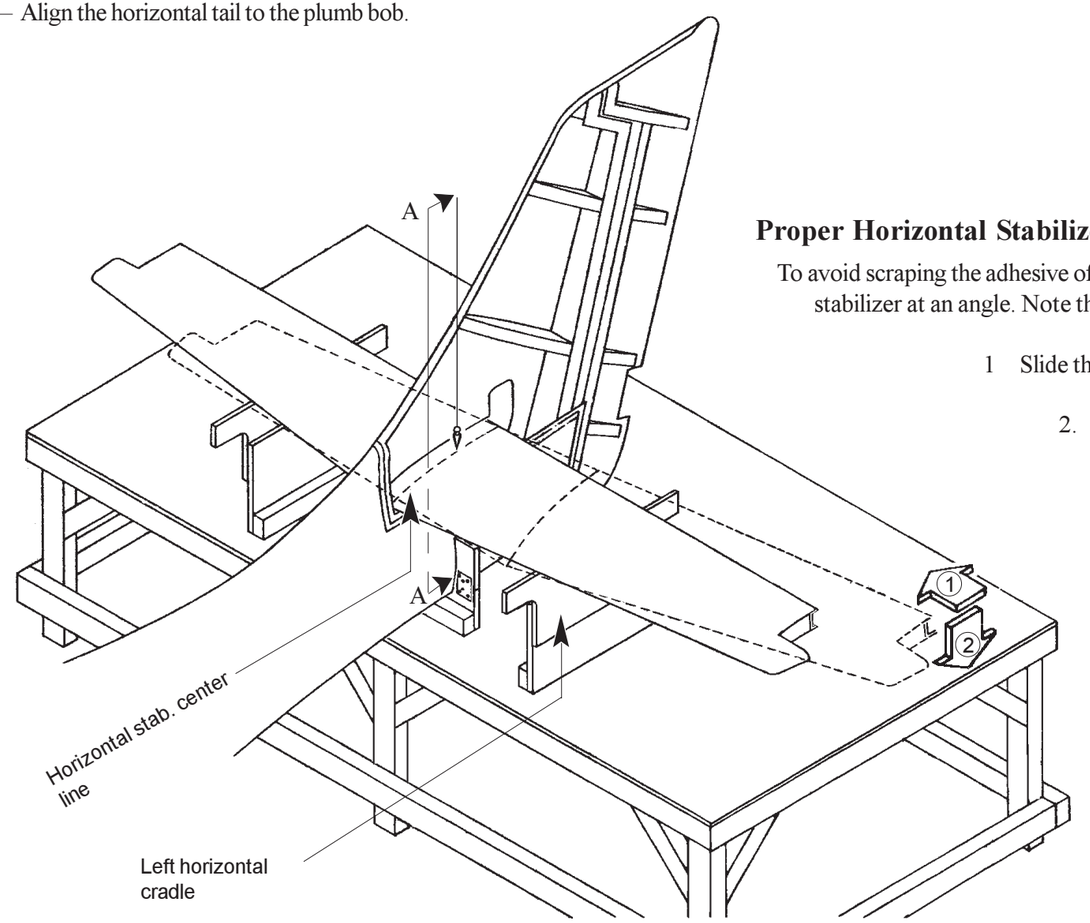
**Centering Horizontal Tail**
**Fig. 11:A:2**




The right horizontal cradle is temporarily removed during horizontal stabilizer installation. We suggest that you use bolts with wing nuts for easy installation during bonding.




Horizontal Stabilizer Center Line

To properly center the horizontal stabilizer, you need an accurate center line. We suggest that you use the center hinge and transfer a center line onto the upper skin.

## Proper Horizontal Stabilizer Installation during Bonding

To avoid scraping the adhesive off during bonding, it is important to install the horizontal stabilizer at an angle. Note that the right cradle is removed during the step.

1 Slide the horizontal at an angle.

2. Lower in place and align.

PRACTICE BEFORE BONDING!!!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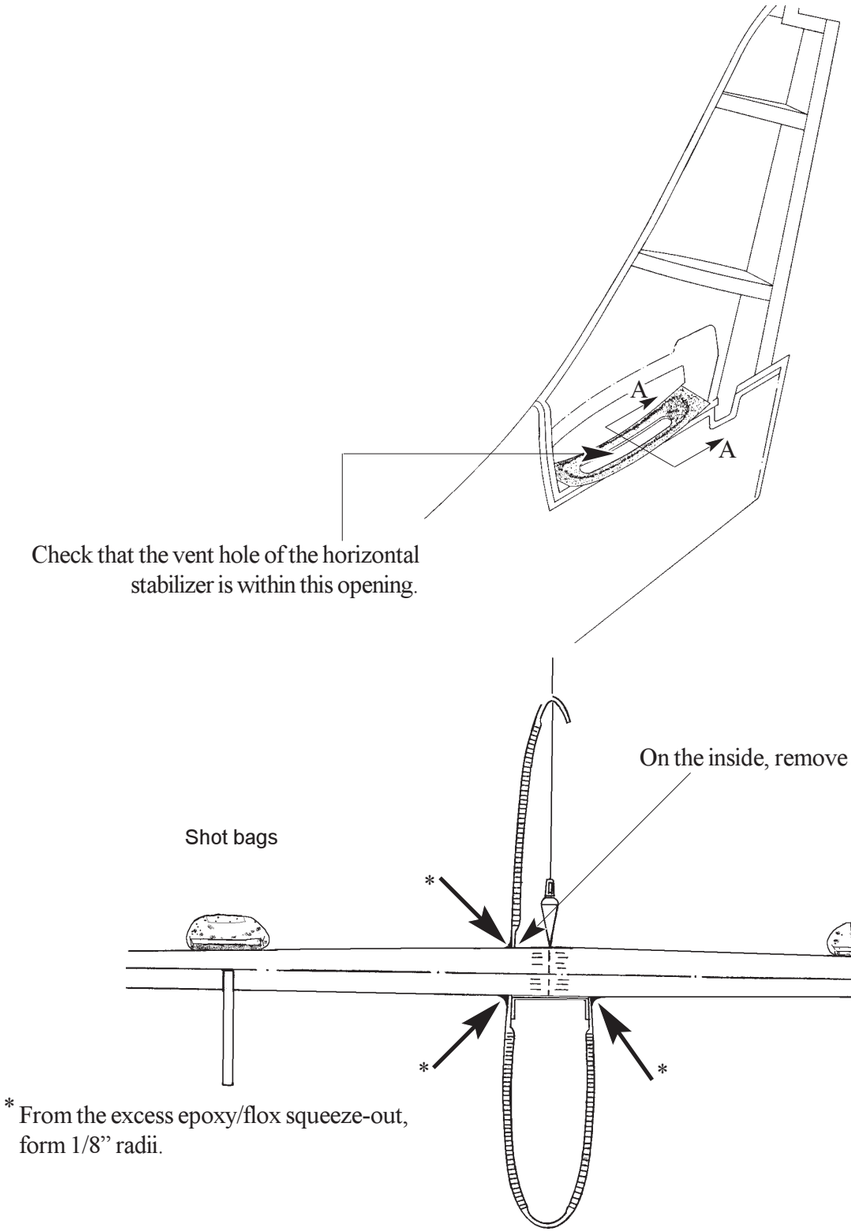
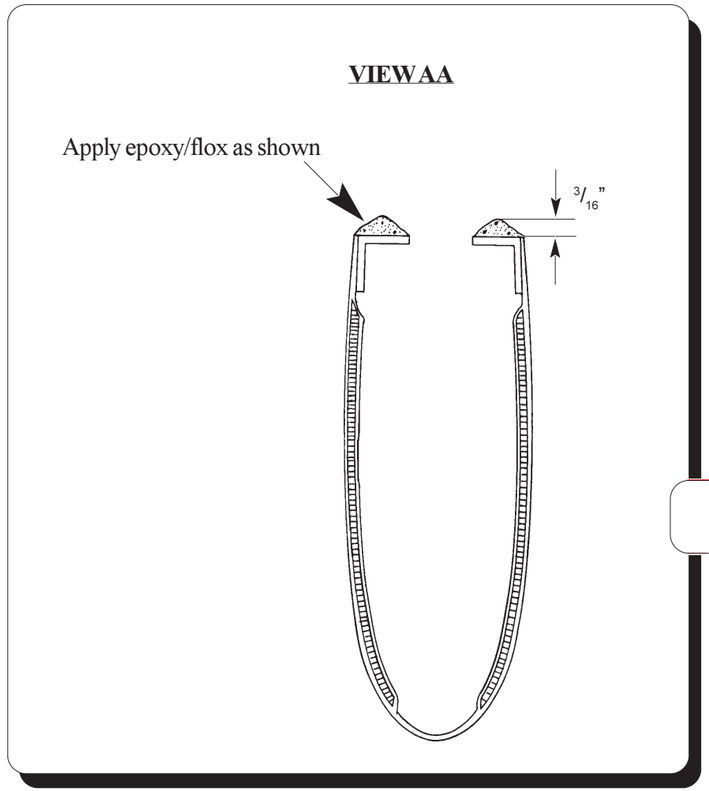
**Bonding Horizontal Stab**
**Fig. 11:A:3**





**NOTE: The BID reinforcements for the horizontal stabilizer are completed in chapter 12:E.**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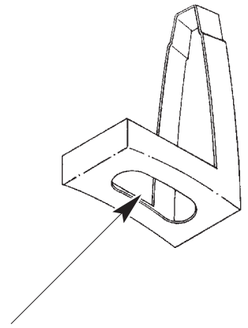
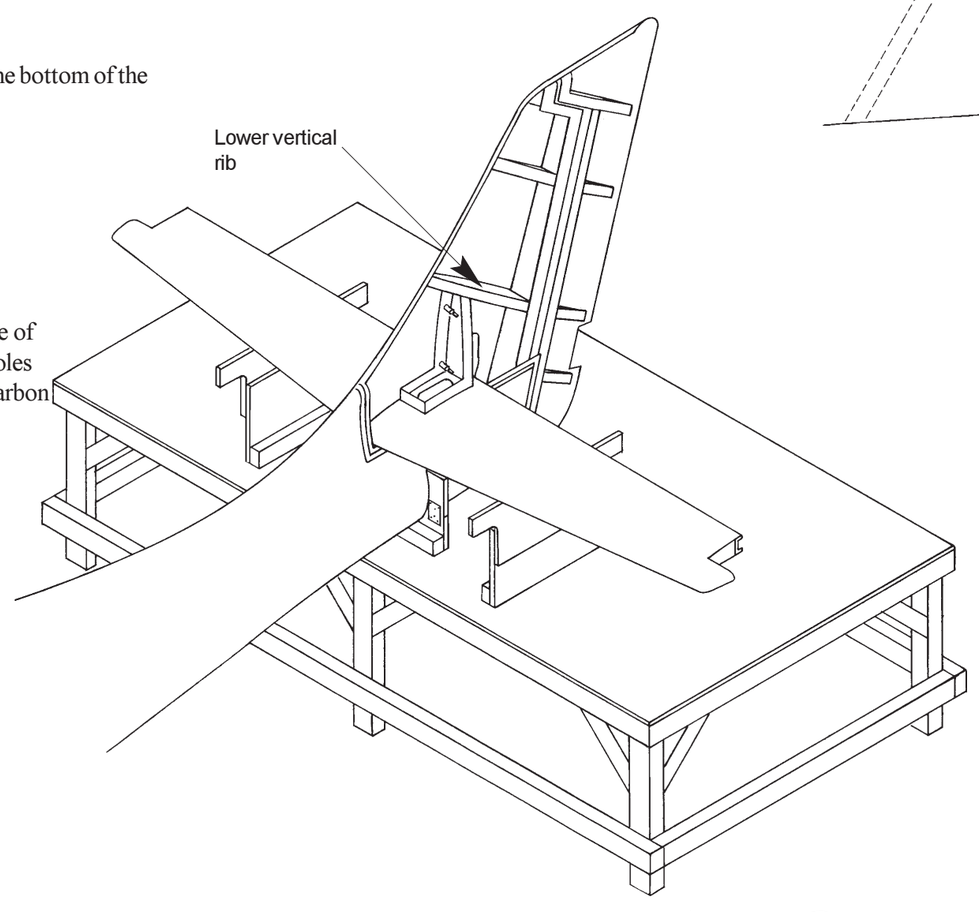
## B. Vertical Web Installation

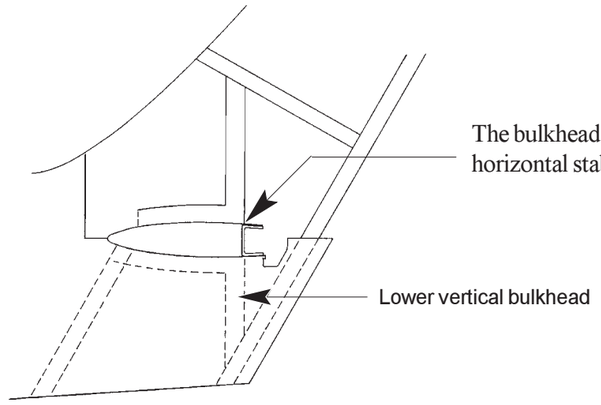


**B 1.** Trim the lightening hole to the scribe line. In the bottom of the vertical bulkhead P/N 4049.

Align as explained and use a couple of clecoes drilled into vertical. Don't drill any holes into the horizontal as there is unidirectional carbon fiber in the horizontal.

**Upper Vertical Bulkhead Installation**
**Fig. 11:B:1**




**Bulkhead Alignment**

1. Align to horizontal stab.
2. It should fit nicely into the lower vertical rib.
3. Install as close as possible to the right vertical skin (keep the bond to a minimal thickness).

**B 2.** Bond using epoxy/flox.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# REVISION LIST

# CHAPTER 12 : VERTICAL CLOSEOUT

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision.
"Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 12-1 through 12-9 | 0/02-15-02 | None | Current Revision is Correct |
| 12-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 12-1 | 3/12-15-04 | R&R | Updated parts list. |
| 12-7 | 3/12-15-04 | R&R | Updated rivets from MSC-32 to MSC-34. |


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# Chapter 12: Vertical Closeout

Contents



## 1. INTRODUCTION

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| 1) | 4044 | 1 | Vertical Stabilizer/Rudder Skin, Left side | |
| 2) | 4460 | 2 | Access Panel, Left/Right Elevator Weldment | |
| 3) | 4656 | 1 | Lead Counterweight, Rudder | |
| 4) | K1000-08 | 14 | Nutplates | |
| 5) | MSC-34 | 28 | Rivets | |
| 6) | MS24694-S3 | 14 | Screw, Machine | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**




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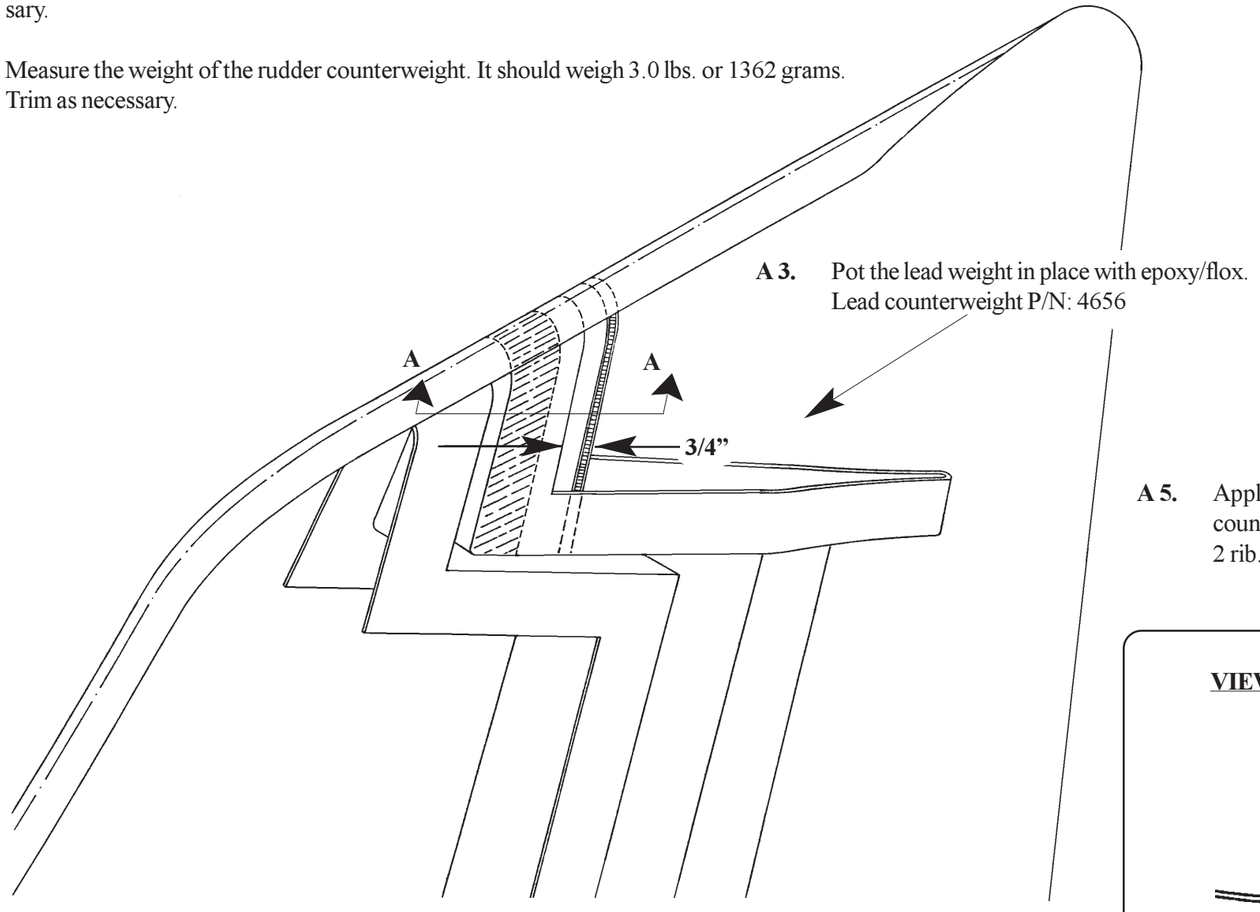
# 3. CONSTRUCTION PROCEDURES

## A. Counterweight Installation

**A 1.** Fit the rudder counterweight as far forward as possible. Some trimming of the counterweight may be necessary.

**A 2.** Measure the weight of the rudder counterweight. It should weigh 3.0 lbs. or 1362 grams. Trim as necessary.

**Rudder Counterweight Installation**
**Fig. 12:A:1**

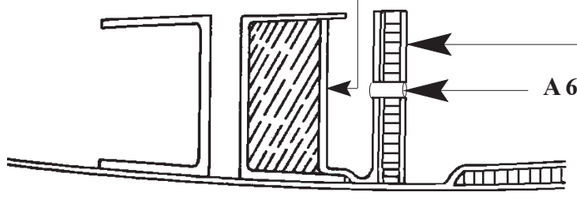



**A 3.** Pot the lead weight in place with epoxy/flox. Lead counterweight P/N: 4656

**A 4.** Install and fit a piece of 2 core 2 3/4” aft of the rib. The purpose of the compartment is to leave room for adding lead if necessary.

**A 5.** Apply a 2 BID reinforcement extending from the lead counterweight onto the rudder skin and onto the 2 core 2 rib.

**VIEW AA**



**A 6.** Drill a 3/16” dia vent hole.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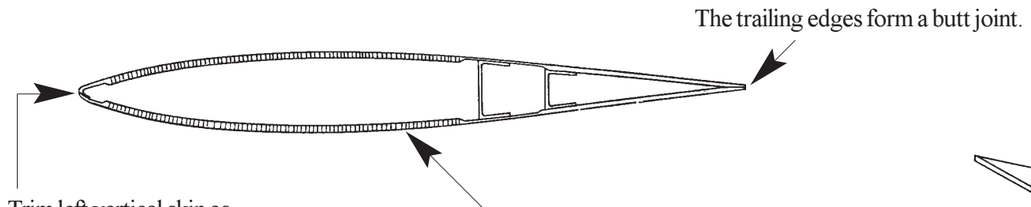
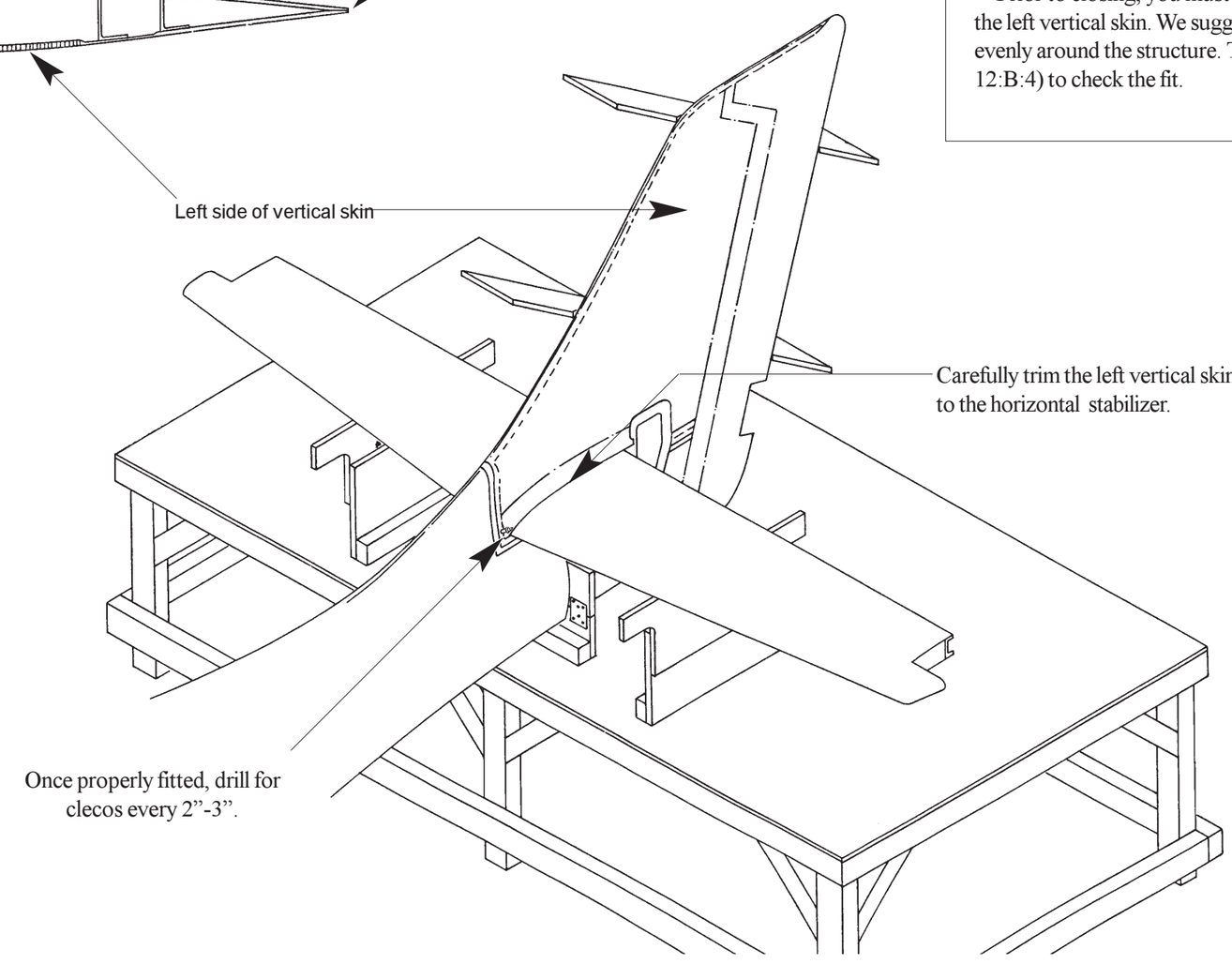
## B. Left Vertical Skin Installation

**Fitting Left Vertical Skin**
**Fig. 12:B:1**

**Typical Vertical Tail Cross Section**




Prior to closing, you must carefully check the fit of the ribs and spars to the left vertical skin. We suggest using small pieces of play dough distributed evenly around the structure. Then practice the closing process (refer to figure 12:B:4) to check the fit.



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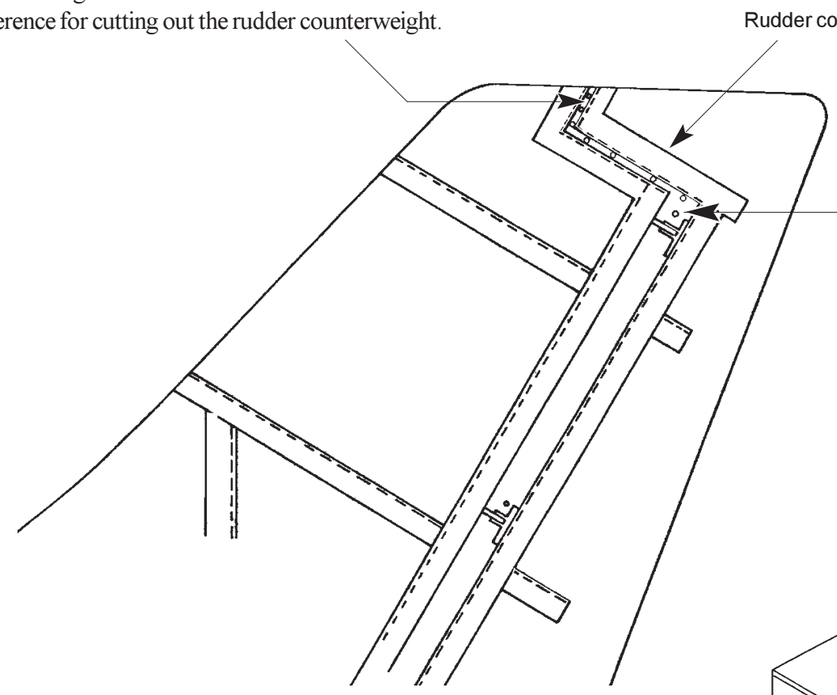
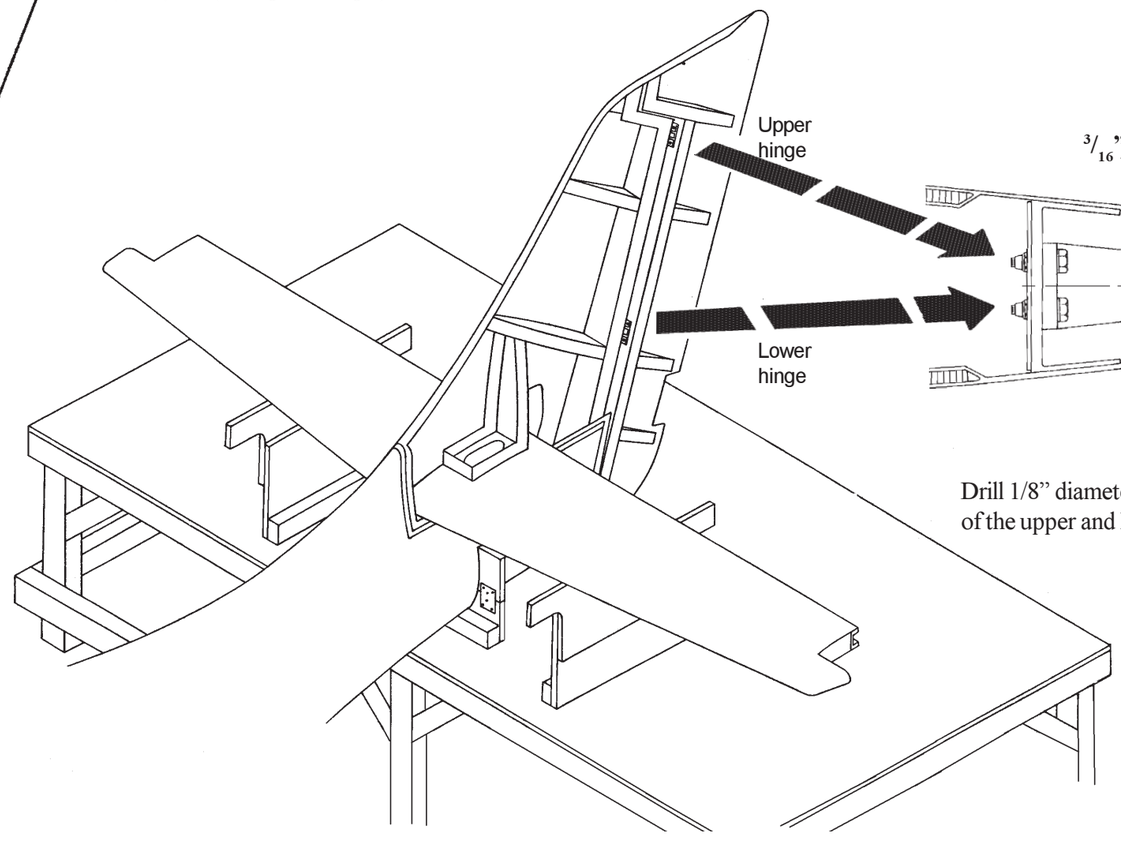
## Rudder Trim Line Reference Holes
## Fig. 12:B:2

Drill a series of 1/8” dia. holes close to the rudder counterweight closeout rib. These holes will be used as reference for cutting out the rudder counterweight.




Drill 1/8” diameter holes 3/16” aft of the pivot point of the upper and lower hinges.

**NOTE:**
**DRILL HOLES IN BOTH LEFT AND RIGHT VERTICAL SKINS.**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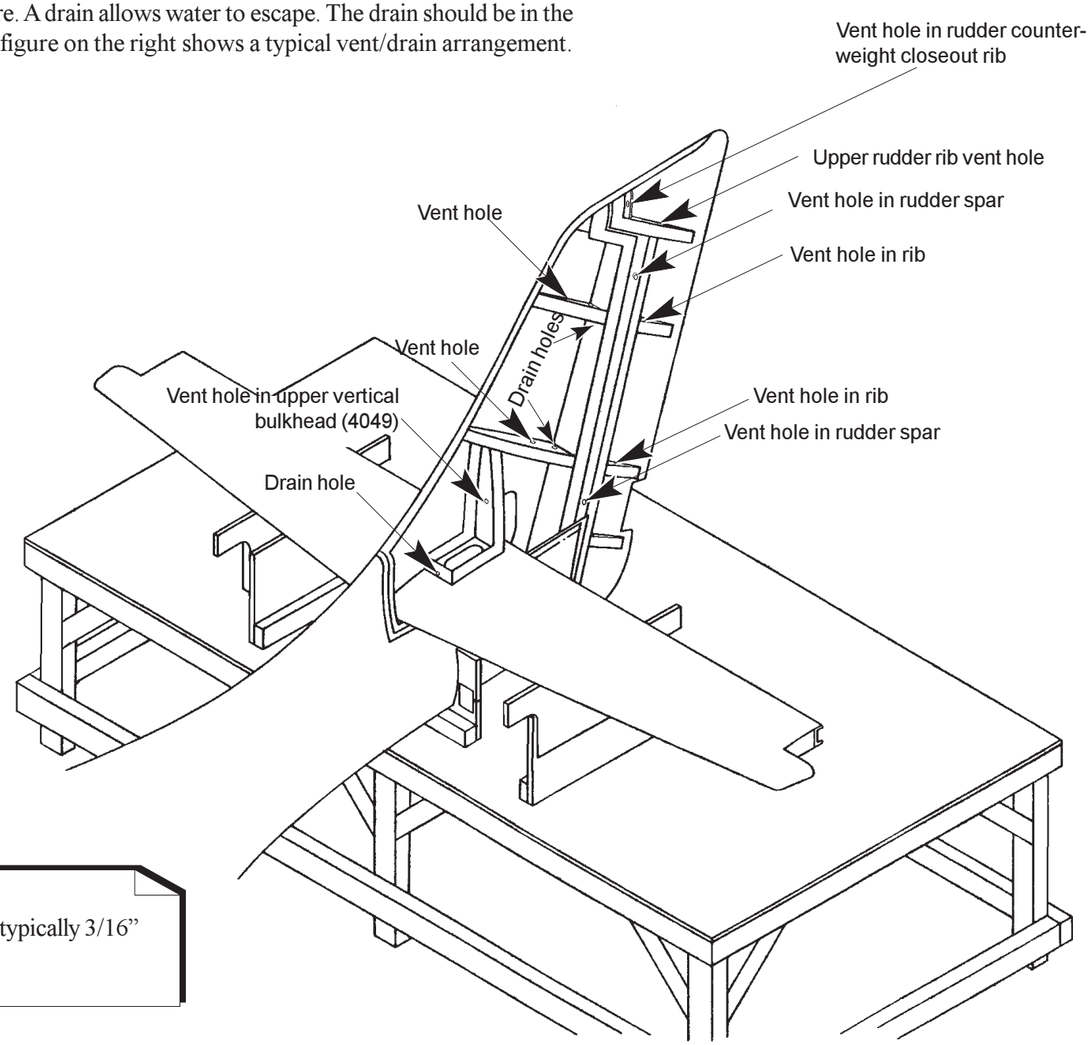
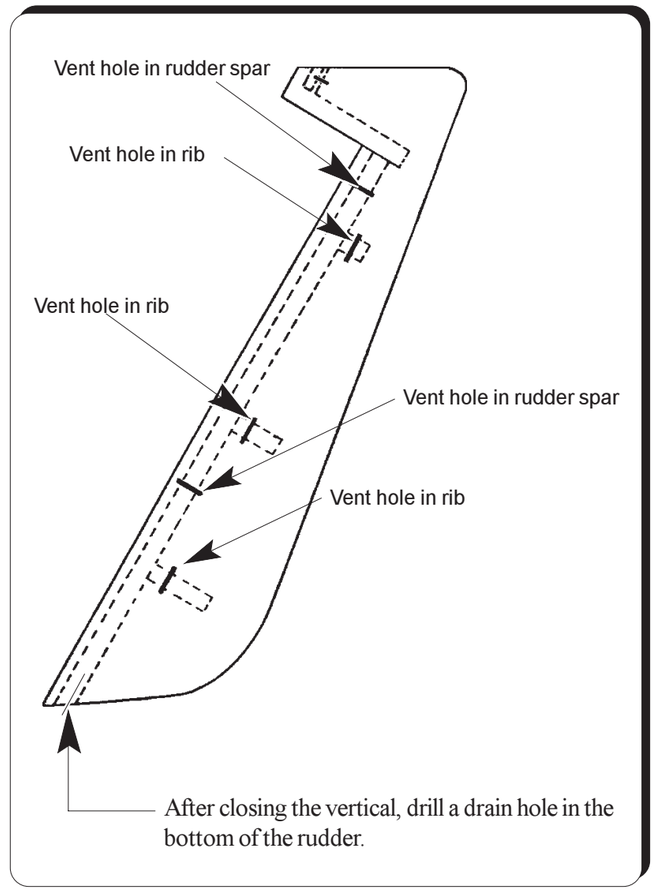
**Vertical Tail Vent Holes**
**Fig. 12:B:3**

All compartments within the structure must have both a way to vent and a drain. A vent allows a passage for air with changing pressure. A drain allows water to escape. The drain should be in the lowest area of the compartment. The figure on the right shows a typical vent/drain arrangement.




Vent and drain holes are typically 3/16" in diameter.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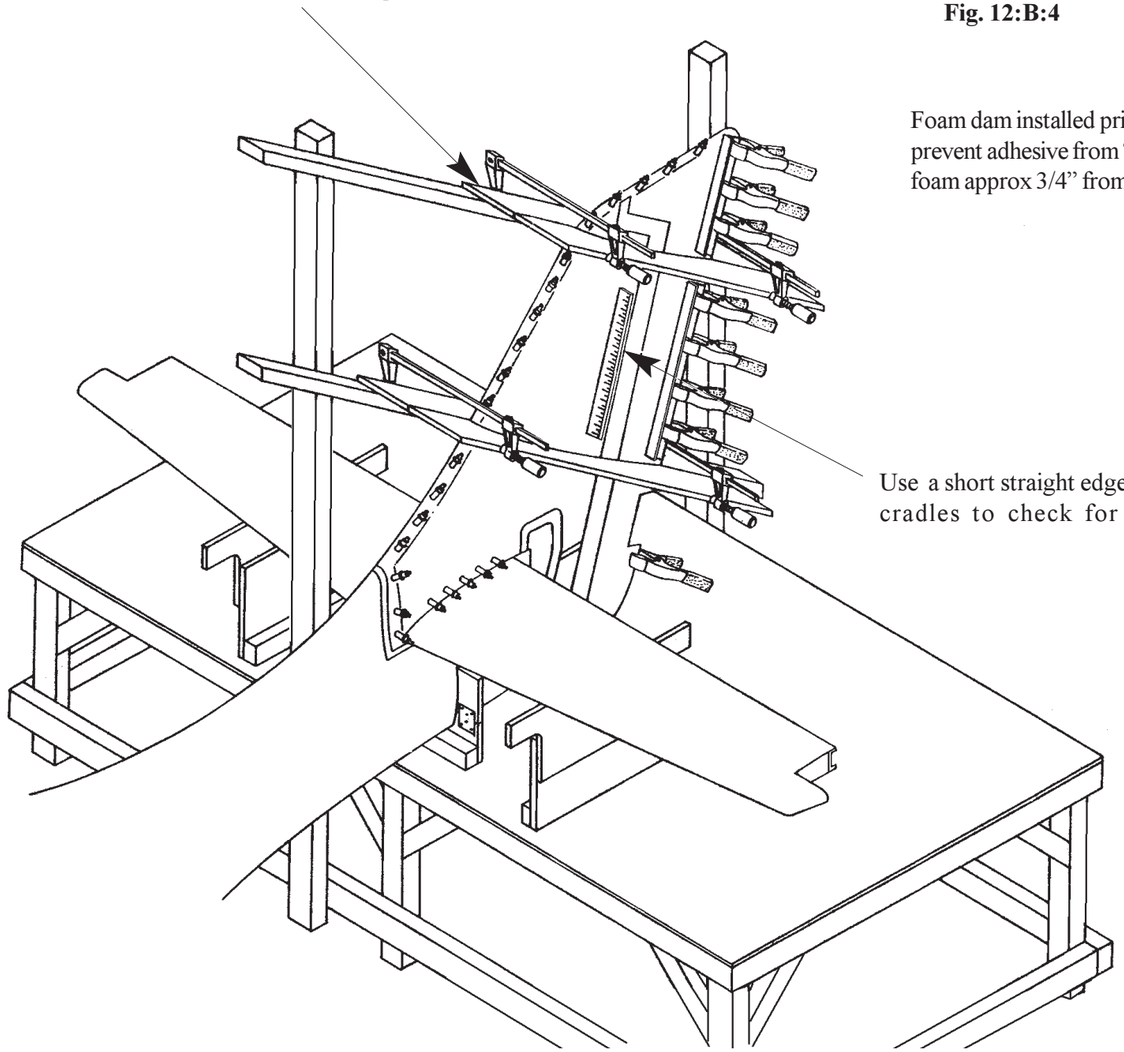
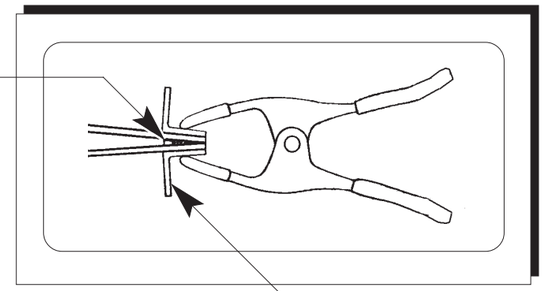
**Closing Vertical Stabilizer**
**Fig. 12:B:4**

Use the left side of the vertical cradles for this step.



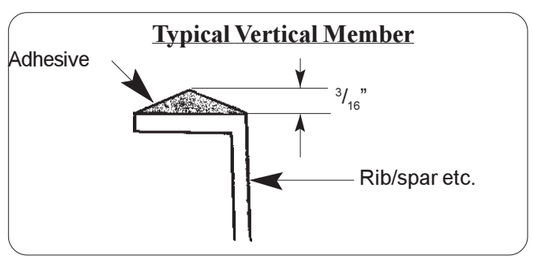
Use a short straight edge in between the cradles to check for straightness.

Foam dam installed prior to closing to prevent adhesive from "running away". Install foam approx 3/4" from trailing edge.



Clamp short pieces of preferably angled aluminum to ensure a straight trailing edge.

**Typical Vertical Member**




Use epoxy/flox or other approved adhesive for the closing process. Follow proper bonding procedures!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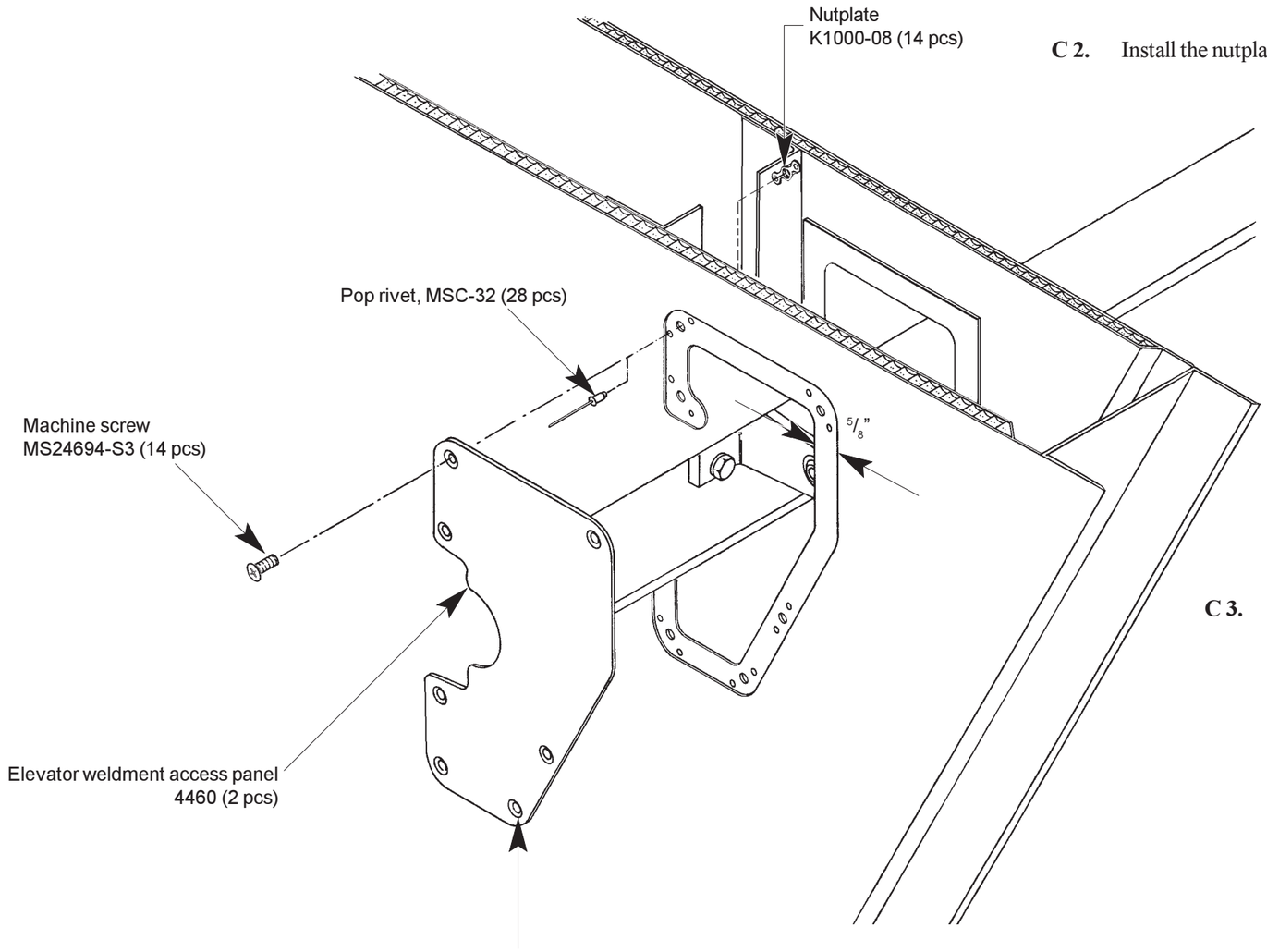
## C. Elevator Weldment Access Panel

**C 1.** Center the elevator weldment access panel in the joggle. Drill the holes for the screws using the inspection panel as a drill guide. Use a #20 drill.

**Elevator Weldment Access Panel**
**Fig. 12:C:1**




**C 2.** Install the nutplates using MSC-34 pop rivets.

**C 3.** Trim the flange to approximately 5/8". Around the nutplates, this dimension will increase as necessary.

**C 4.** Countersink the holes for the elevator access panels using a 100 degree countersink.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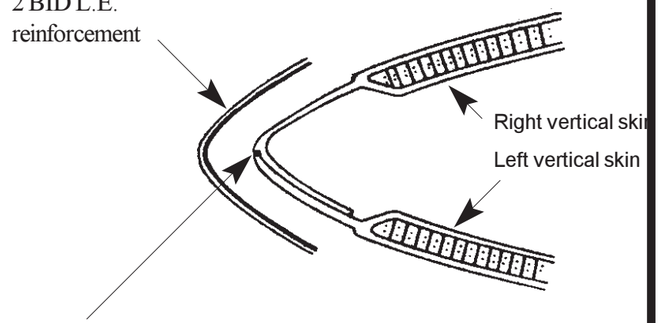
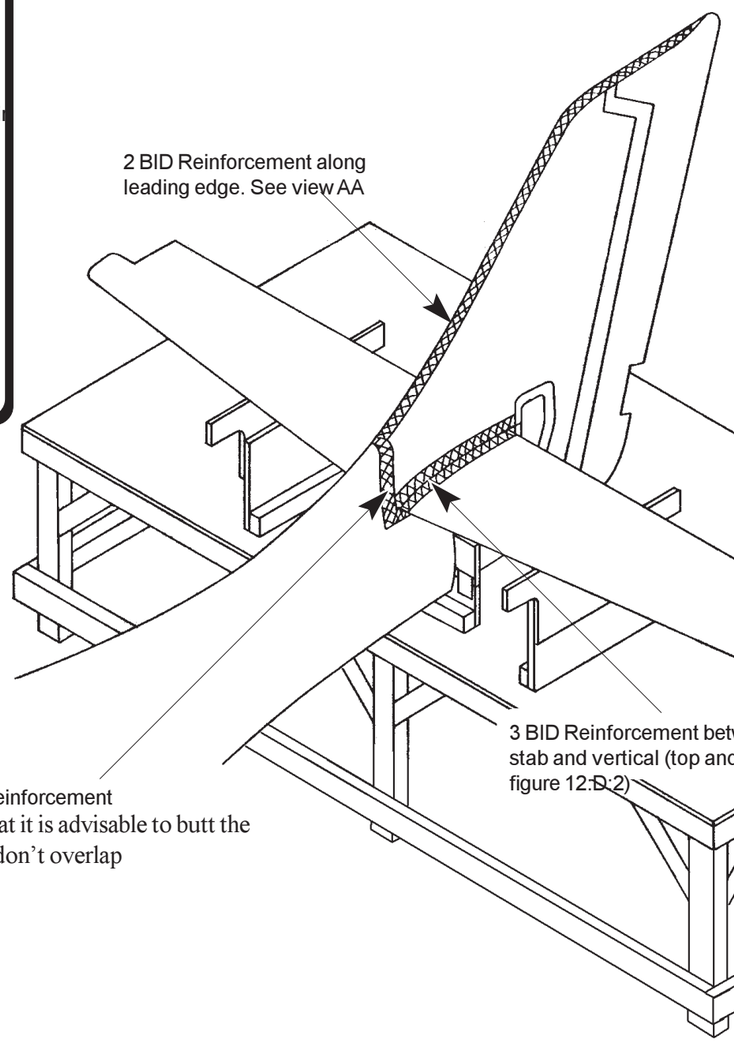
## D. Bonding the Vertical Stabilizer

**Leading edge of Vertical Stabilizer**

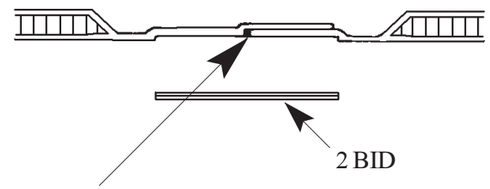
**VIEW AA**




**BID Reinforcemenrts**
**Fig. 12:D:1**




**VIEW BB**



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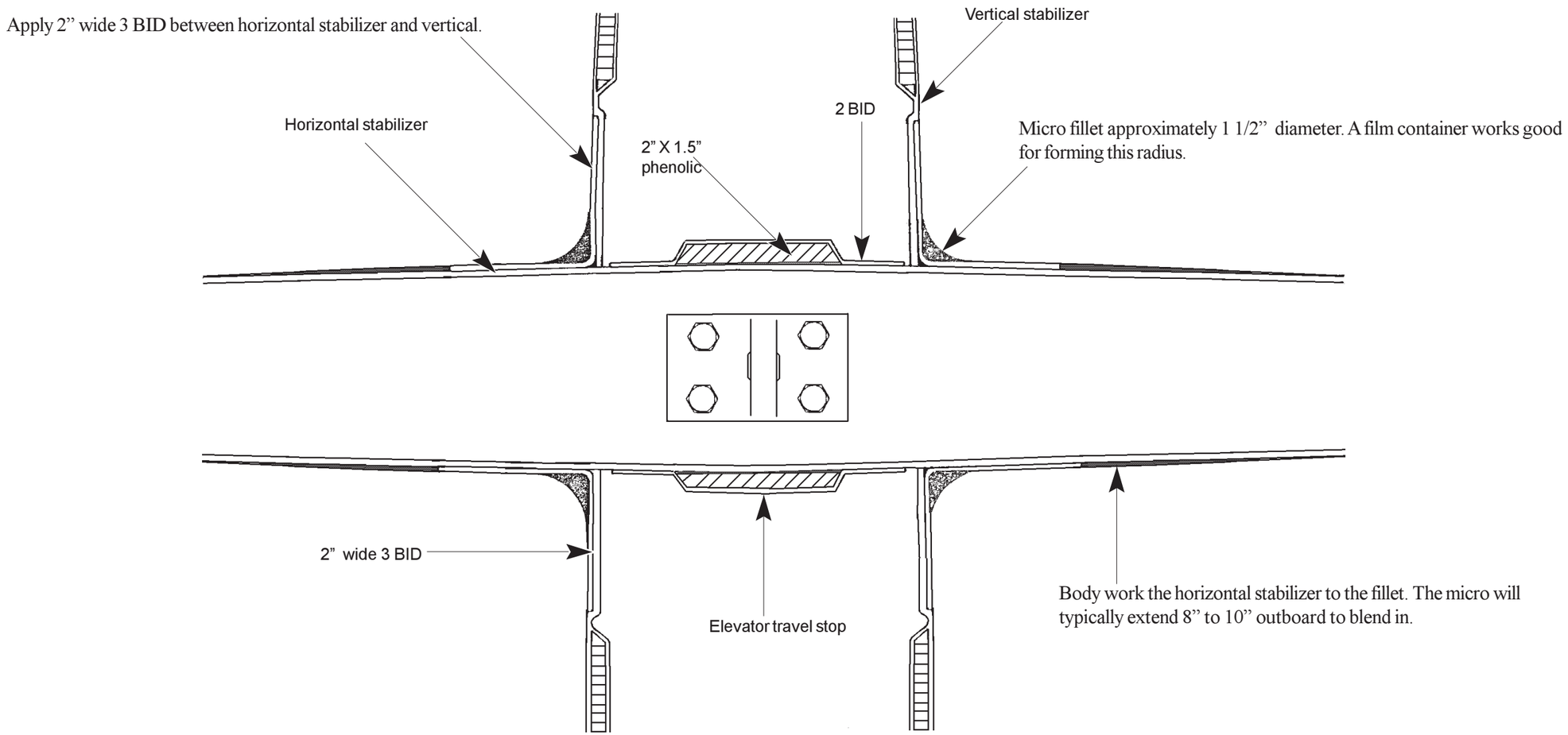
**BID Reinforcements Securing Horizontal Stabilizer**
**Fig. 12:D:2**




**CROSS SECTIONAL VIEW LOOKING FORWARD**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# REVISION LIST

# CHAPTER 13: FIREWALL FORWARD (PART 1)

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 13-1 | 1/09-18-02 | R&R | Part # correction |
| 13-2 | 1/09-18-02 | R&R | Part # correction |
| 13-3 through 13-9 | 0/02-15-02 | None | Current revision is correct |
| 13-10 through 13-11 | 1/09-18-02 | R&R | Text correction |
| 13-12 | 1/09-18-02 | R&R | Part # Corrections |
| 13-13 | 1/09-18-02 | R&R | Text Correction |
| 13-14 | 1/09-18-02 | R&R | Part # Correction |
| 13-15 | 1/09-18-02 | R&R | Correction of fig. 13:E:1 |
| 13-16 | 1/09-18-02 | R&R | Part # Correction |
| 13-17 | 1/09-18-02 | R&R | Part # Correction |
| 13-18 | 1/09-18-02 | R&R | Part # Correction |
| 13-19 | 1/09-18-02 | R&R | Text and Fig 13:F:3 Correction |
| 13-20 | 1/09-18-02 | R&R | Correction of fig. 13:F:4 |
| 13-21 | 1/09-18-02 | R&R | Correction of fig. 13:F:5<br>Text correction |
| 13-22 | 1/09-18-02 | R&R | Text correction |
| 13-23 through 13-26 | 0/02-15-02 | None | Current Revision is Correct |
| 13-1 | 2/06-30-04 | R&R | Deleted items from parts list. |
| 13-10 | 2/06-30-04 | R&R | Added instruction. |
| 13-11 | 2/06-30-04 | R&R | Added instruction. |
| 13-13 | 2/06-30-04 | R&R | Updated instructions. Added photo. |
| 13-15 | 2/06-30-04 | R&R | Updated part numbers. |


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| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 13-17 | 2/06-30-04 | R&R | New figure 13:F:2 - Nose gear plunger. |
| 13-21 | 2/06-30-04 | R&R | Updated gear door information. |
| 13-22 | 2/06-30-04 | R&R | Updated gear door information. |
| 13-23 | 2/06-30-04 | R&R | Updated gear door spring information. |
| 13-24 | 2/06-30-04 | R&R | Updated gear door plunger information. |
| 13-25 | 2/06-30-04 | R&R | Updated gear door bracket information. |
| 13-26 | 2/06-30-04 | R&R | Updated figure 13:G:1. |
| 13-2 | 3/12-15-04 | R&R | Updated parts list. |
| 13-18 | 3/12-15-04 | R&R | Intentionally blank due to new nose gear door plunger. |
| 13-19 | 3/12-15-04 | R&R | New dimension and instructions. |
| 13-22 | 3/12-15-04 | R&R | Added photo. |
| 13-23 | 3/12-15-04 | R&R | Corrected geometry. |
| 13-24 | 3/12-15-04 | R&R | Updated photo. |
| 13-1 thru 13-2 | 4/09-29-06 | R&R | Corrected parts list. |
| 13-6 | 4/09-29-06 | R&R | Updated torque for engine mount to firewall. |
| 13-10 thru 13-11 | 4/09-29-06 | R&R | Added washers between engine mount and firewall. |
| 13-12 | 4/09-29-06 | R&R | Corrected drawing and added update. |
| 13-1, 13-2, 13-12 | 6/08-10-07 | R&R | Part number change only. |
| 13-2, 13-11, 13-12, 13-14, 13-15, 13-17, 13-18, 13-23, 13-24, 13-25, | 6/08-10-07 | R&R | Parts changed and new nose gear assembly. |
| 13-2, 13-14b | 7/09-10-08 | R&R | New page for alternative nose gear installation and update to the parts list. |


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# Contents



## 1. INTRODUCTION

Chapter 13 covers both the Lycoming 540 and Continental 550 engine mount installations. The subtle differences are pointed out. The main purpose of this chapter is to get your airplane on 3 wheels so you can move it around as needed. After this chapter, the aircraft alignment jig is no longer needed. The firewall forward installation is completed in chapter 26.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **FIREWALL CLOSEOUT** | | | | |
| 1) | 4023 | 1 | Nose Gear Tunnel Closeout | |
| 2) | PH-250-3x5 | 1 | Phenolic Block | |
| **FIREWALL FLAME BLANKET** | | | | |
| 1) | FFB-002 | 1 | Firewall Flame Blanket | |
| ~~2)~~ | ~~PH-125-4x6~~ | ~~1~~ | ~~Phenolic Block~~ | |
| 3) | RTV-106 | 1 | Silicon, High Temperature | |
| **LYCOMING 540 - ENGINE MOUNT INSTALLATION** | | | | |
| 1) | 4070 | 1 | Support, Engine Mount | |
| 2) | 4861 | 1 | 540 Engine Mount | |
| 3) | AN7-25A | 3 | Bolts, Undrilled | |
| 4) | AN7-13A | 2 | Bolts, Undrilled | |
| 5) | AN4-10A | 4 | Bolts, Undrilled | |
| 6) | AN4-11A | 4 | Bolts, Undrilled | |
| 7) | AN365-720A | 5 | Nut, Nylock | |
| 8) | AN365-428A | 4 | Nylock Nut | |
| 9) | PH-250-2x2 | 1 | Phenolic Block | |
| 10) | AN970-7 | 5 | Washer, Large Area | |
| 11) | AN970-4 | 4 | Washer, Large Area | |
| 12) | AN960-416 | 4 | Washer, Flat | |
| 13) | AN960-716 | 10 | Washer, Flat | |
| **CONTINENTAL 550 - ENGINE MOUNT INSTALLATION** | | | | |
| 1) | 4860 | 1 | 550 Engine Mount | |
| 2) | AN4-10A | 4 | Bolts, Undrilled | |
| 3) | AN4-11A | 4 | Bolts, Undrilled | |
| 4) | AN7-15A ~~13A~~ | 2 | Bolts, Undrilled | |
| 5) | AN7-25A | 2 | Bolts, Undrilled | |
| 6) | AN365-428A | 4 | Nylock Nut | |
| 7) | AN365-720A | 4 | Nut, Nylock | |
| 8) | AN970-4 | 4 | Washer, Large Area | |
| 9) | AN970-7 | 4 | Washer, Large Area | |
| 10) | AN960-416 | 4 | Washer, Flat | |
| 11) | AN960-716 | 10 | Washer, Flat | |


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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **550/540 - NOSE GEAR INSTALLATION** | | | | |
| 1) | 4701 | 1 | Nose Gear w/ Fork and Bushing (or alternative part 432-0005) | |
| 2) | 4717-01 | 1 | Nose Gear Bearing Block, Left | |
| 3) | 4717-02 | 1 | Nose Gear Bearing Block, Right | |
| 4) | 433-0001 ~~4721~~ | 2 | Over-center Link Arms | |
| 5) | 4722 | 2 | Bushing | |
| 6) | 4736 | 1 | Nose Gear Ball Stud | |
| 7) | F45-19 | 1 | Bearing, Rod End | |
| 8) | AN3-10A | 3 | Bolt,Undrilled | |
| 9) | AN3-12A | 4 | Bolt, Undrilled | |
| 10) | AN4-11A | 4 | Bolt, Undrilled | (**Yes 2 with tow bar plate) |
| 11) | AN4-12A | 9 | Bolt, Undrilled | (**Yes 2 with tow bar plate) |
| ~~12)~~ | ~~AN4-13A~~ | ~~2~~ | ~~Bolts, Undrilled (With Tow Bar Plate Option)~~ | ~~**Yes~~ |
| 13) | AN5-7 | 1 | Bolt, Undrilled | |
| 14) | AN5-41A | 1 | Bolt, Undrilled | |
| 15) | 112-0026 ~~6381K103~~ | 2 | Bushing | |
| ~~16)~~ | ~~RR-01~~ | ~~2~~ | ~~Circlip~~ | |
| 17) | 198-0004 ~~9416K77~~ | 2 | Clip, Safety | |
| 18) | MS24665-140 | 3 | Cotter Pin | |
| 19) | HC-08 | 1 | Hydraulic Cylinder, Nose Gear | |
| 20) | AN363-1032 | 7 | Lock Nut, All Metal | |
| 21) | AN363-428A | 2 | Lock Nut, All Metal | |
| 22) | AN363-524 | 2 | Lock Nut, All Metal | |
| 23) | AN365-428A | 5 | Nut, Nylock | |
| 24) | AN310-5 | 3 | Nut, Castle | |
| 25) | AN316-5 | 1 | Nut, Check | |
| 26) | 198-0003 ~~9416K71~~ | 2 | Socket, Steel Ball | |
| 27) | 160-0002 ~~9416K15~~ | 1 | Strut, Gas | |
| 28) | 198-0006 ~~9512K73~~ | 1 | Stud, Ball | |
| 29) | TB-1-03 | 1 | Tow Bar Plate | **Yes |
| 30) | TB-1 | 1 | Tow Bar | **Yes |
| 31) | AN960-10 | 20 | Washer, Flat | |
| 32) | AN960-10L | 10 | Washer, Flat | |
| 33) | AN960-416 | 4 | Washer, Flat | |
| 34) | AN960-516 | 14 | Washer, Flat | |
| 35) | AN960-516L | 10 | Washer, Flat | |
| 36) | 110-0002 | 4 | Washer, Thrust | |
| 37 | 212-0073 | 2 | Keeper Plate | |
| **NOSE GEAR MICRO SWITCH** | | | | |
| 1) | 1XE1-T | 1 | Micro Switch, Nose Gear | |
| 2) | JM-1 | 1 | Switch Arm | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **NOSE WHEEL & TIRE** | | | | |
| 1) | 4785 | 1 | Anti-tube-pincher-deal™ | |
| 2) | AN4-47A ~~51A~~ | 1 | Bolt, Undrilled | |
| 3) | AN3-3A | 4 | Bolt, Undrilled | |
| 4) | AN365-428A | 5 | Nut, Nylock | |
| 5) | 430-0000 ~~TR-5 x 8 PLY~~ | 1 | Tire | |
| 6) | TU-5.00-11 x 4 | 1 | Tube | |
| 7) | AN960-416 | 10 | Washer, Flat | |
| 8) | AN960-10 | 4 | Washer, Flat | |
| 9) | 59-3M-LA ~~GM035-2~~ | 1 | Wheel, Nose | |
| 10) | Z02E276 | 1 | Axle | |
| 11) | GM038 | 1 | Axle bushing | |
| **NOSE GEAR DOORS (Obsolete parts were removed from this list due to space contraints.)** | | | | |
| 1) | 6061-T6 | 6 ft | 1 1/4" x 1 1/4" x 1/8" Gear Door Rails (approx. 36") | |
| 2) | GM318-01 | 2 | Gear Door, Nose (approx. 35") | |
| 3) | GM320-36 | 2 | Aluminum Gear Door Stiffener (34") | |
| 4) | MS20001 | 2 | Hinge, Piano (34") | |
| 5) | | 1 | Phenolic crush plate, 3" x 1.125" | |
| 6) | 240-0001 | 1 | Nose gear door assembly | |
| 7) | AN3-6A | 1 | Bolt, 10-32 x 25/32 | |
| 8) | AN960-10L | 4 | Washer, lite 3/16 | |
| 9) | HFC-3AU | 1~~2~~ | Female rod ends | |
| 10) | BJ-04 | 2 | Rod ends | |
| 11) | AN3-7A | 7 | Bolt | |
| 12) | AN315-3 | 2 | Checknuts | |
| 13) | 209-0018 | 2 | Bracket | |
| 14) | AN3-10A | 4 | Bolt, Undrilled | |
| 15) | AN5-20 | 2 | Bolt, Drilled | |
| 16) | AN363-1032 | 4 | Nut, Lock (All metal) | |
| 17) | AN365-1032A | 14~~2~~ | Nut, Nylock | |
| 18) | K1000-3 | 22 | Nutplate | |
| 19) | AN426A3-5 | 44 | Rivet | |
| 20) | AN426AD3-5 | 68 | Rivet | |
| 21) | MS24694-S48 | 22 | Screw | |
| 22) | MS24694-S50 | 4 | Screw | |
| 23) | AN526-1032R14 | 4~~2~~ | Screw, Washer Head | |
| 24) | AN960-10 | 23~~14~~ | Washer, Flat | |
| 25) | CN614CR3P | | Nutplate | |
| 26) | MS24694-S51 | | Screw, Machine | |
| 27) | AN960-10L | 3 | Washer, Flat | |


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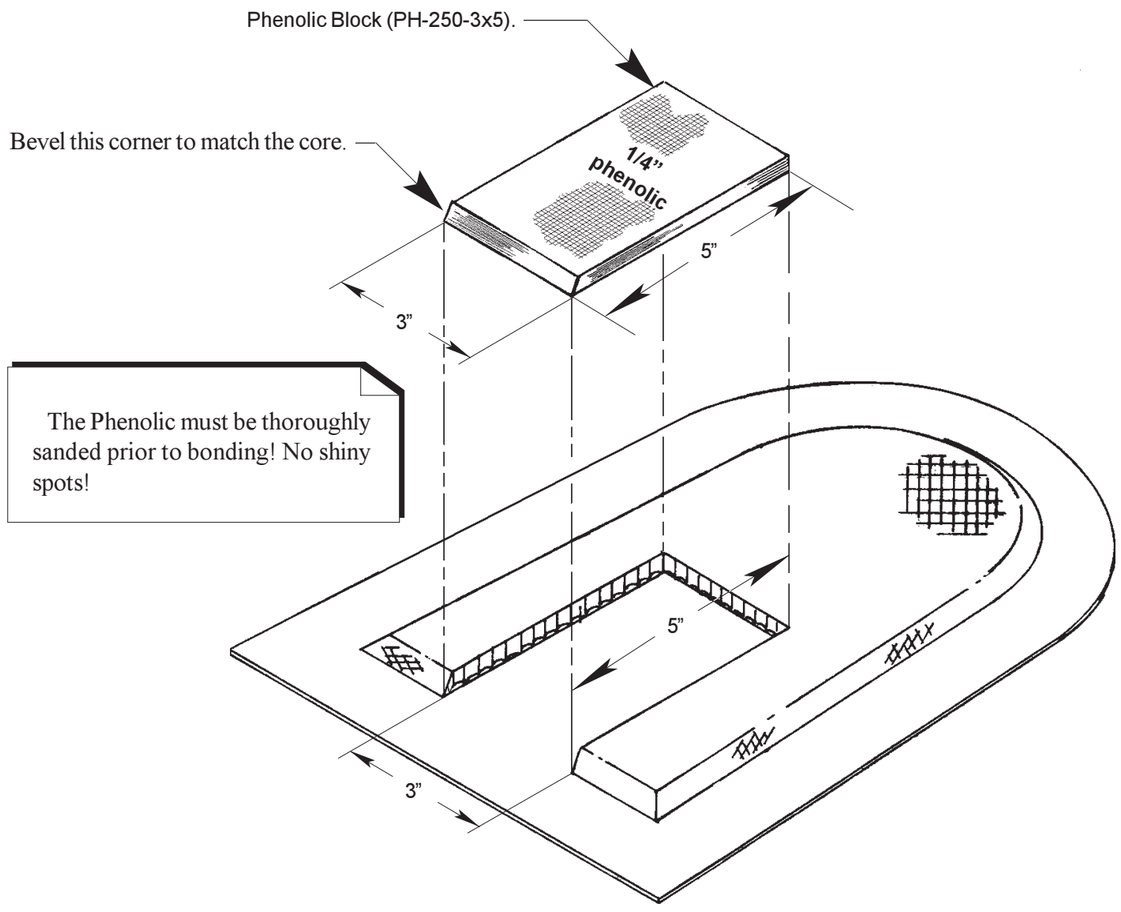
# 3. CONSTRUCTION PROCEDURES

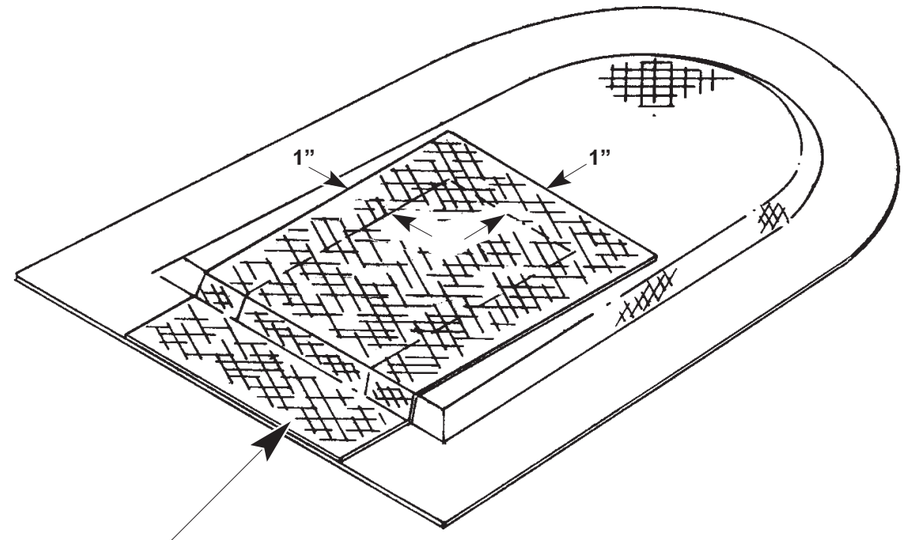
## A. Firewall Closeout

**Firewall Closeout Hardpoint**
**Fig. 13:A:1**




The Phenolic must be thoroughly sanded prior to bonding! No shiny spots!

Remove a 3" x 5" section of the aft laminate and core of the nose gear tunnel closeout. Install the piece of phenolic with epoxy/flox using proper bonding procedures.




Apply 3 BID on ±45° extending 1" past the edge of the phenolic in all directions.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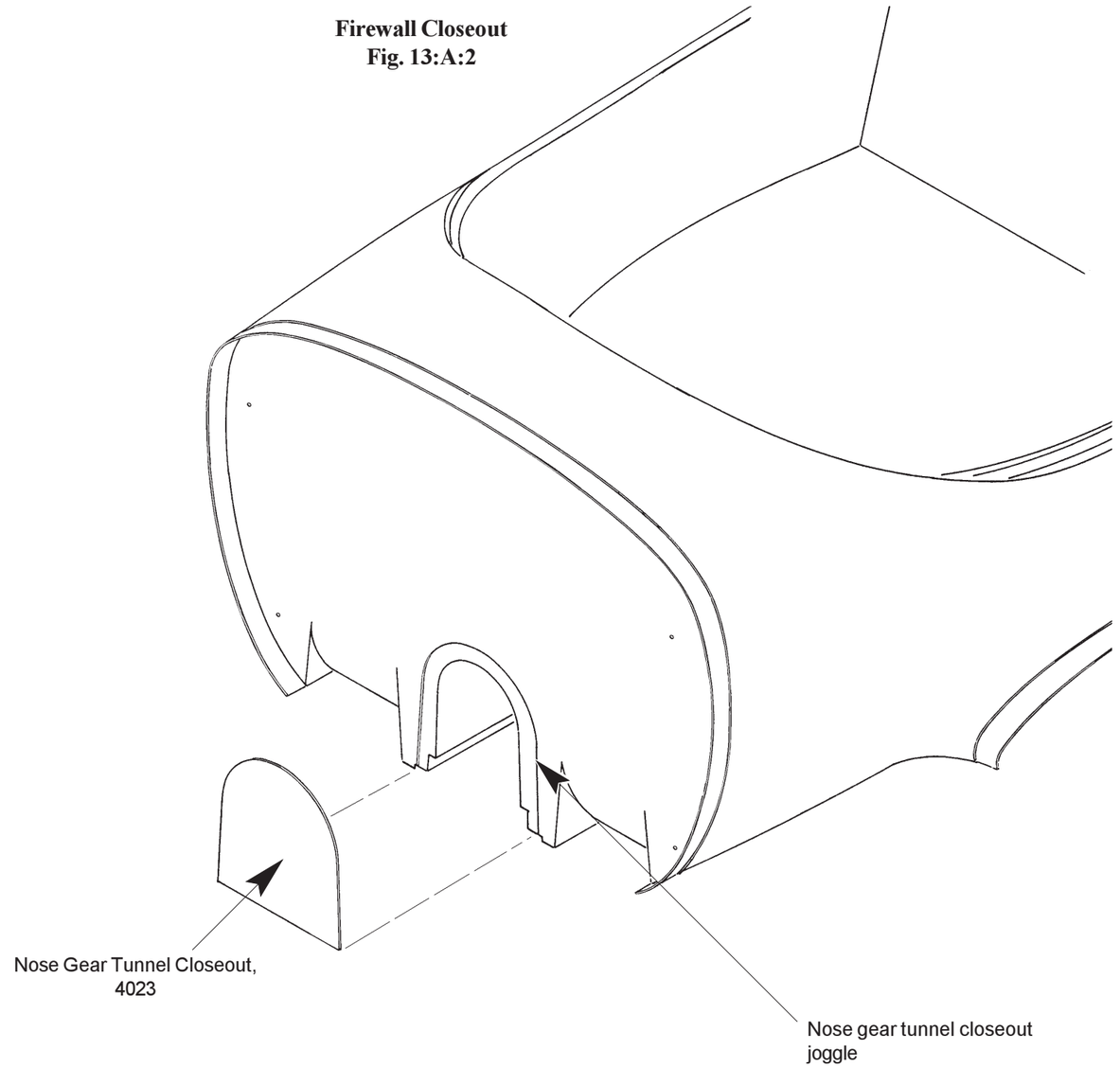
**A 1.** Trim the nose gear tunnel closeout to fit the joggle on the firewall.

**A 2.** Bond the nose gear tunnel closeout using epoxy/flox.

**Firewall Closeout**
**Fig. 13:A:2**





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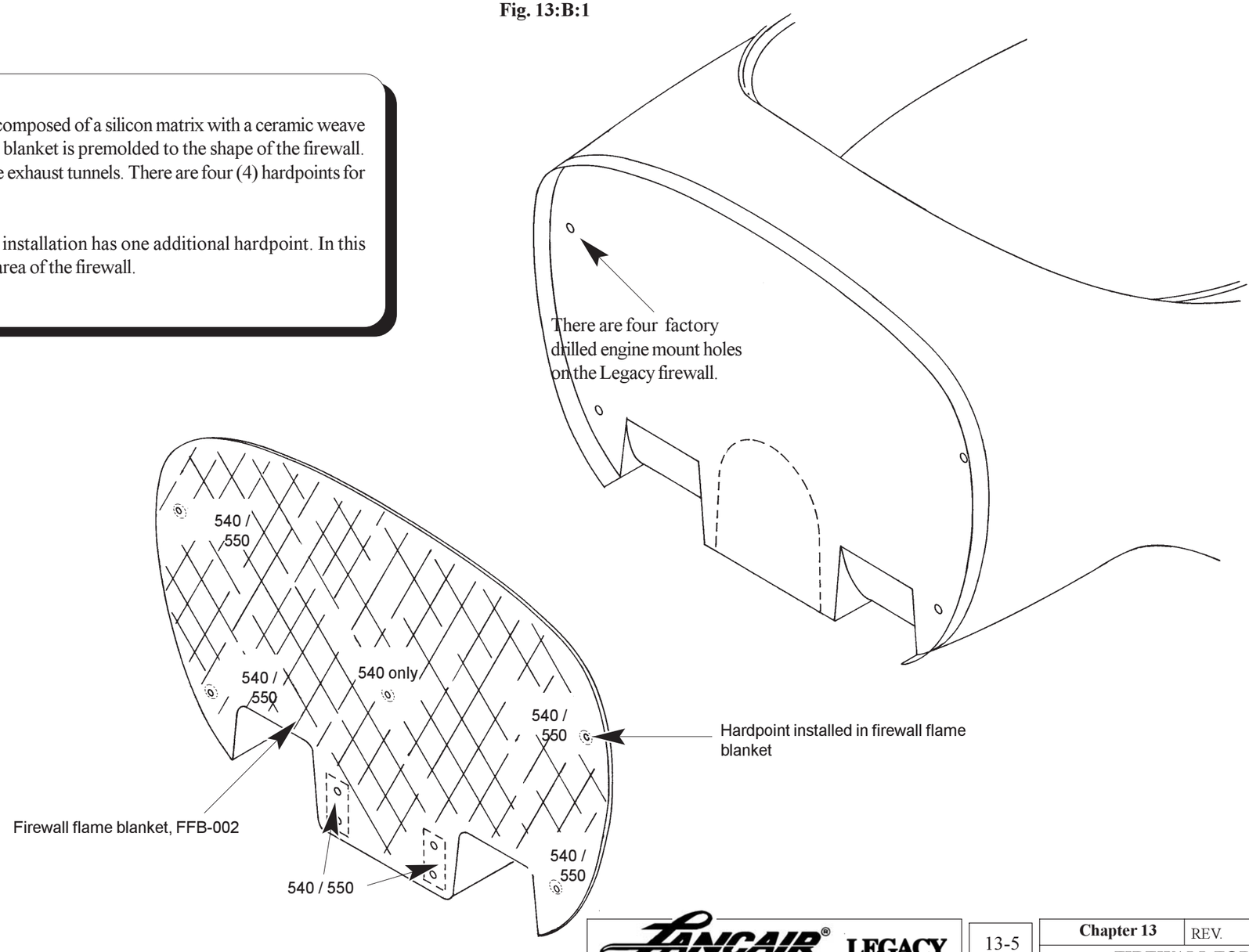
## B. Firewall Flame Blanket

The firewall flame blanket is composed of a silicon matrix with a ceramic weave and an aluminized surface. The blanket is premolded to the shape of the firewall. Note the preformed shape of the exhaust tunnels. There are four (4) hardpoints for the engine mount.

Note that the Lycoming 540 installation has one additional hardpoint. In this chapter, you will reinforce this area of the firewall.

**Firewall Flame Blanket General Overview**
**Fig. 13:B:1**





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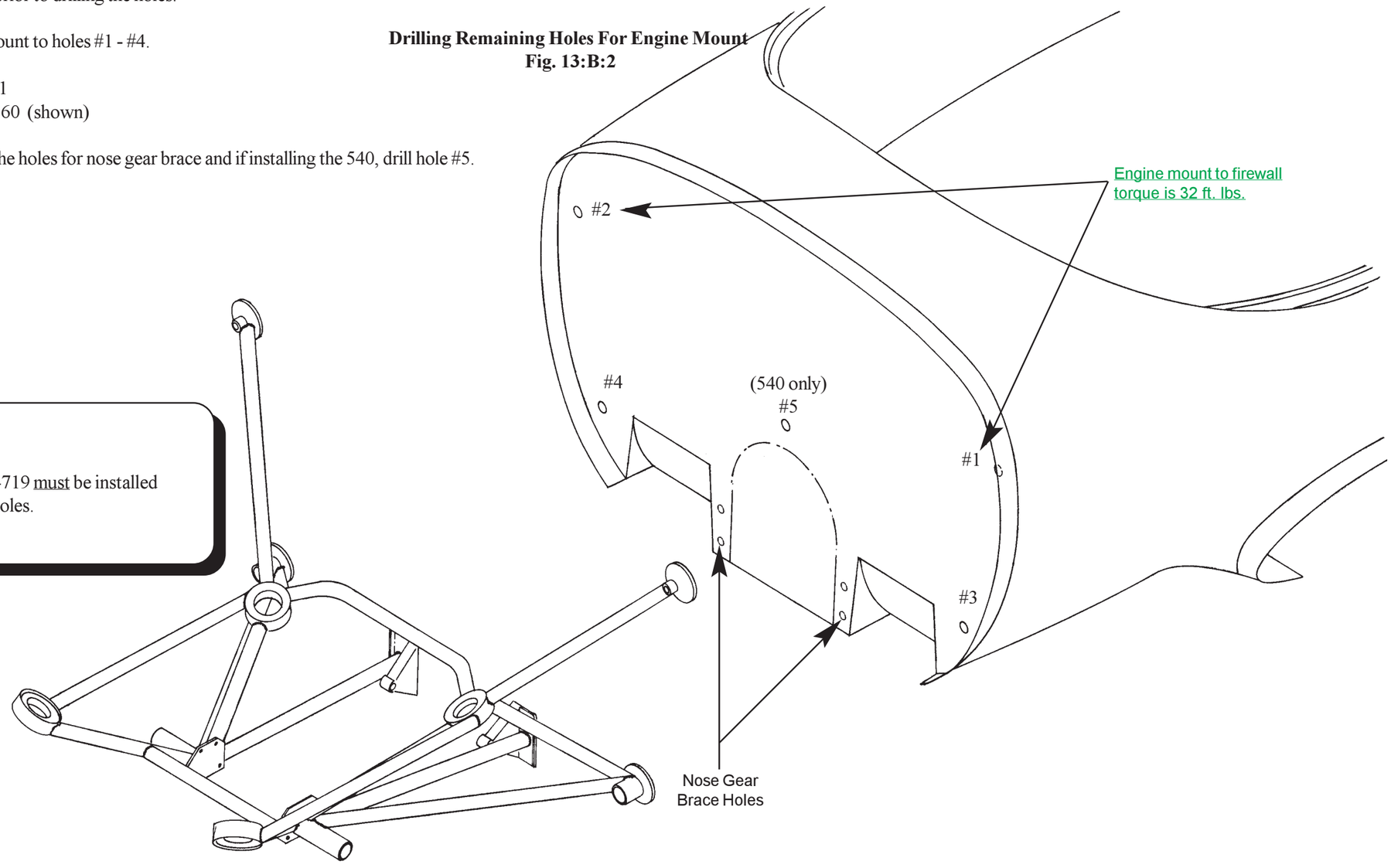
Holes #1-#4 are pre-drilled on the firewall. These holes are common to both the 540 and 550 installations. Note that hole #5 is unique to the 540 installation. In this section you will drill for the nose gear brace holes and if you are installing the 540, you need to drill hole #5.

**B 1.** Install the nose gear over center link weldment (4719) on the engine mount. Refer to Figure 13:D:1. The weldment must be installed prior to drilling the holes.

**B 2.** Temporarily mount the engine mount to holes #1 - #4.
Engine mount:
Lycoming 540, P/N: 4861
Continental 550, P/N: 4860 (shown)

**B 3.** Using a 1/4" diameter drill, drill the holes for nose gear brace and if installing the 540, drill hole #5.

**Drilling Remaining Holes For Engine Mount**
**Fig. 13:B:2**




**WARNING**

The over center link weldment P/N 4719 must be installed prior to drilling the nose gear brace holes.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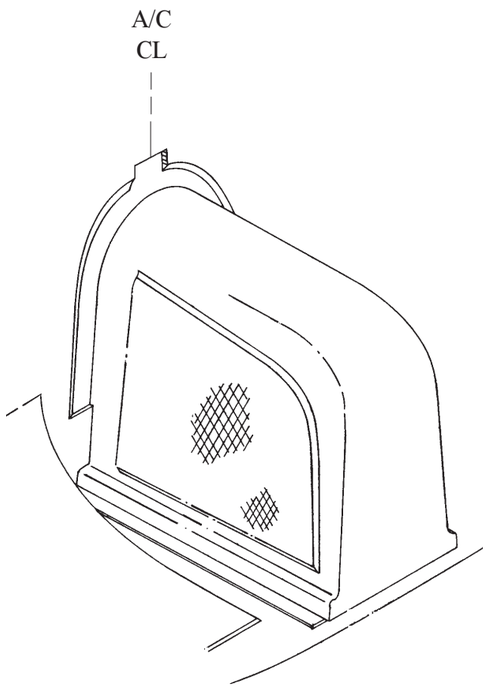
**Firewall Reinforcements for 540 Installations only**
**Fig. 13:B:3**

This page is for Lycoming 540 installation only.

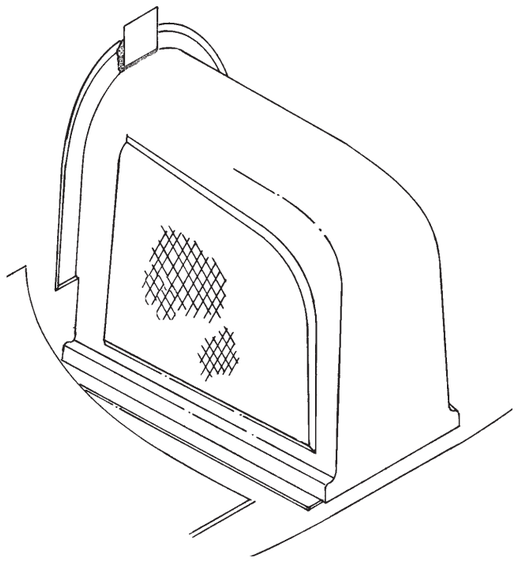
A/C Up

Fwd

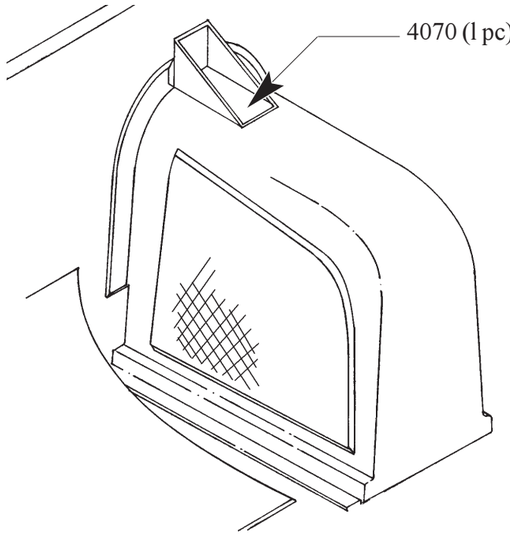
**B 4.** Remove a 2" x 2" section of the aft laminate and core centered on the hole.




**B 5.** Install a 2" x 2" x .250 piece of phenolic with epoxy/flox.



**B 6.** Additional engine mount for 540 installation, P/N 4070. Install with epoxy/flox.




**B 7.** Reinstall the engine mount and drill the center hole again.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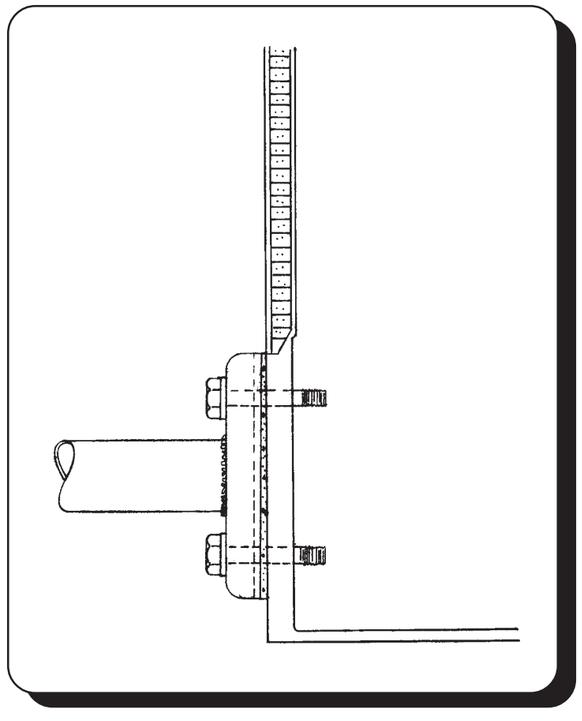
**Engine Mount Spacer Bonding**
**Fig. 13:B:4**

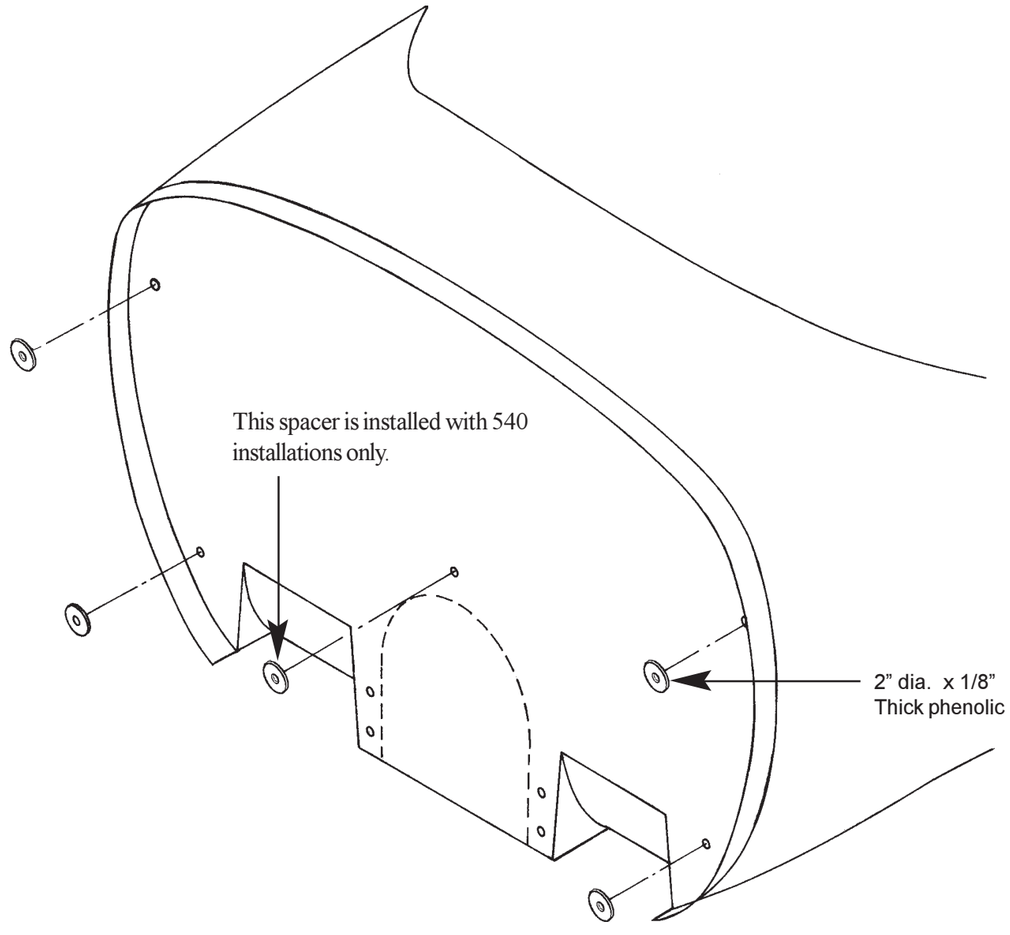
If you look on the aft side of the firewall flame blanket, you will notice seven areas with the insulation removed. To compensate for these recessed areas, we bond spacers to the firewall.

**B 8.** Bond the phenolic spacers in place with epoxy/flox.

**NOSE GEAR BRACE RELEASE**



**B 9.** Install the engine mount and observe the fit of the engine mount at the nose gear brace holes. If the fit is less than perfect, we suggest that you perform a release with epoxy/flox as shown on the left. Bond the spacer in place at the same time as you make the flox pad. Insert bolts through the holes of the engine mount to properly align the spacer.





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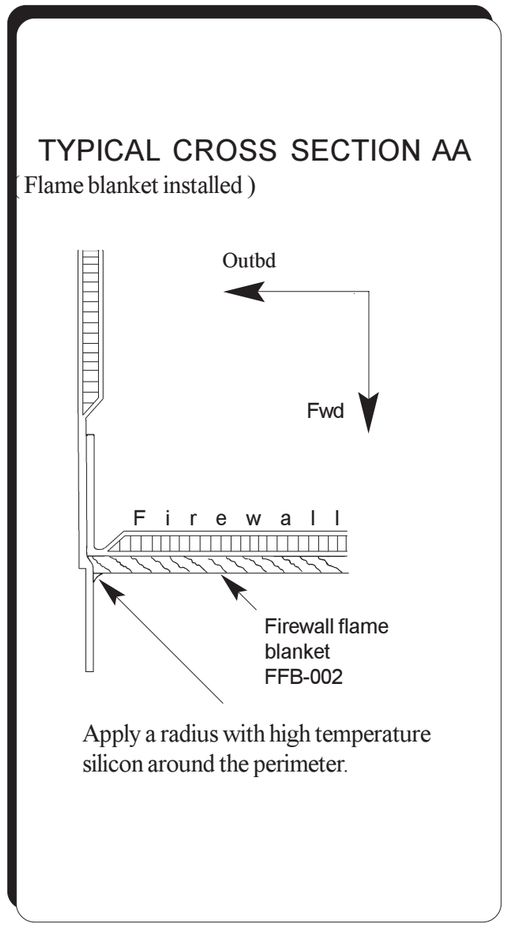
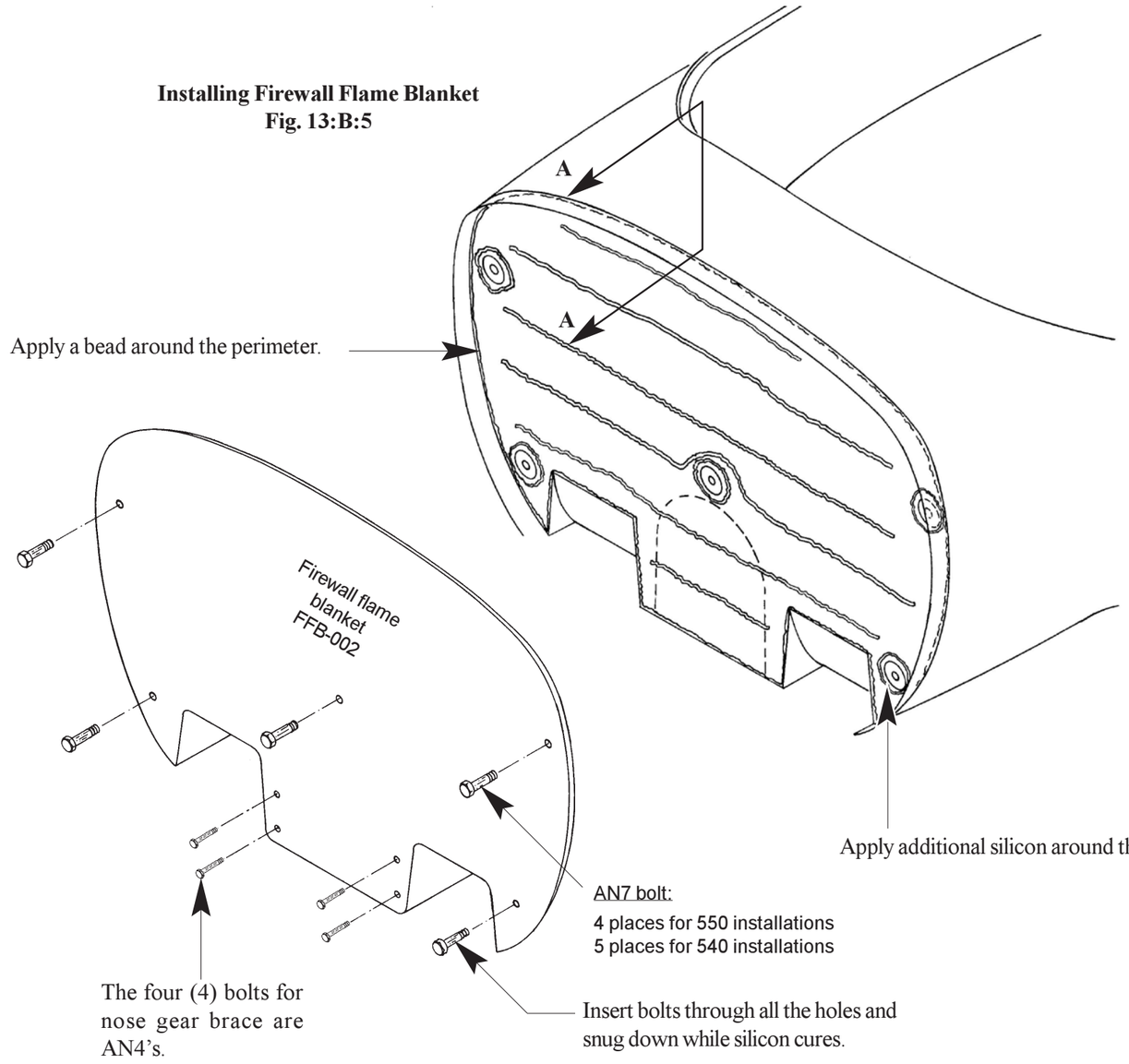
**B 10.** Prior to installing the firewall blanket, we suggest using a punch to create holes in the correct locations.

**B 11.** Apply high temperature silicon (P/N: RTV-106) to the firewall.




**Installing Firewall Flame Blanket**
**Fig. 13:B:5**





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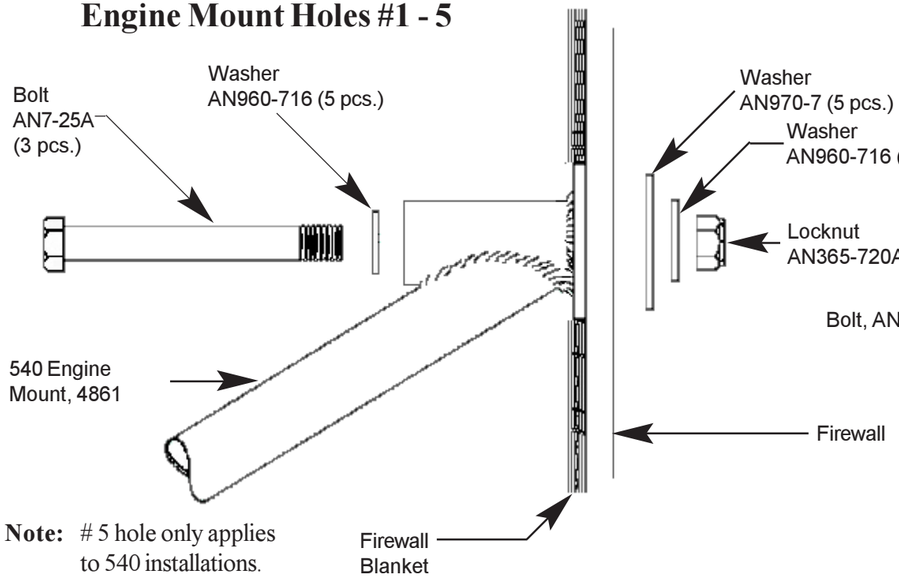
## C. Engine Mount Installation

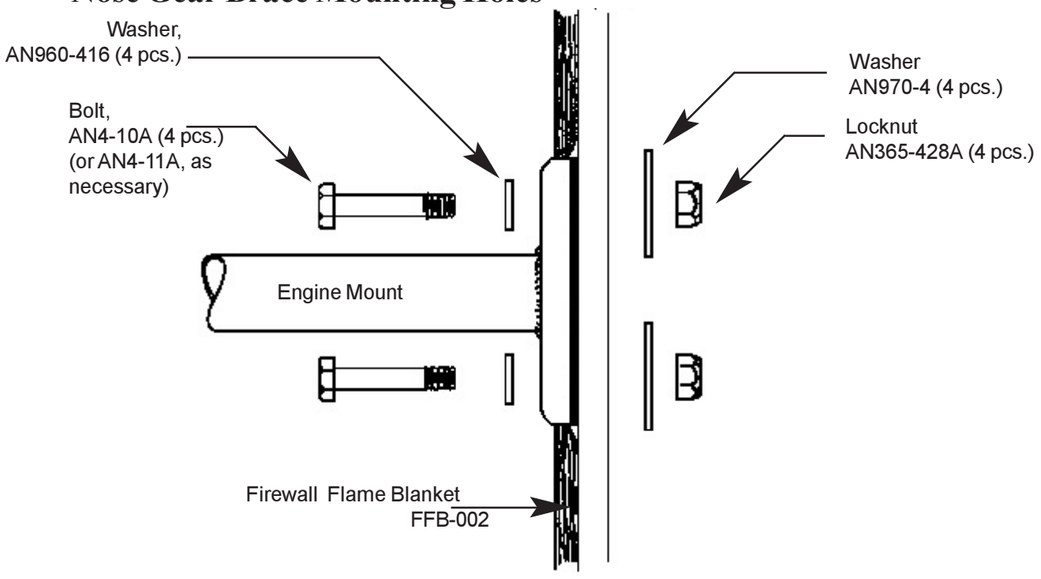
**C 1.** The four nose gear brace mounting holes are drilled by the builder.

### Engine Mount Holes #1 - 5

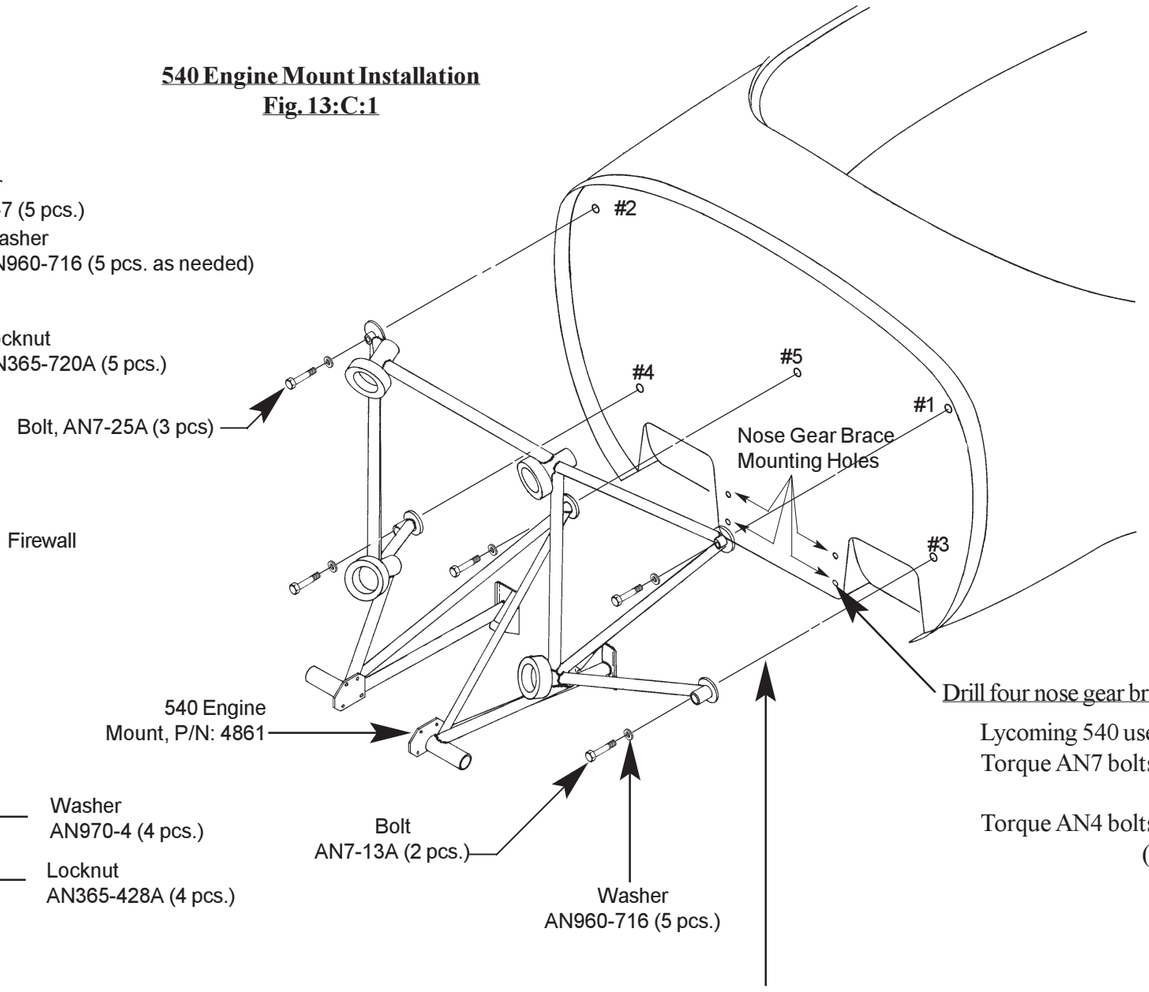



**Note:** # 5 hole only applies to 540 installations.

### Nose Gear Brace Mounting Holes




**540 Engine Mount Installation**
**Fig. 13:C:1**




Drill four nose gear brace mounting holes.

Lycoming 540 uses mount # 4861.
Torque AN7 bolts to 37.5-41.2 ft-lb.
(450-494.4 in-lb.)
Torque AN4 bolts to 4.17-5.83 ft-lb.
(50.04-69.96 in-lb.)

Add one or two AN970-7 washers between the motor mount and the firewall. This will help prevent sag for fitting the cowling.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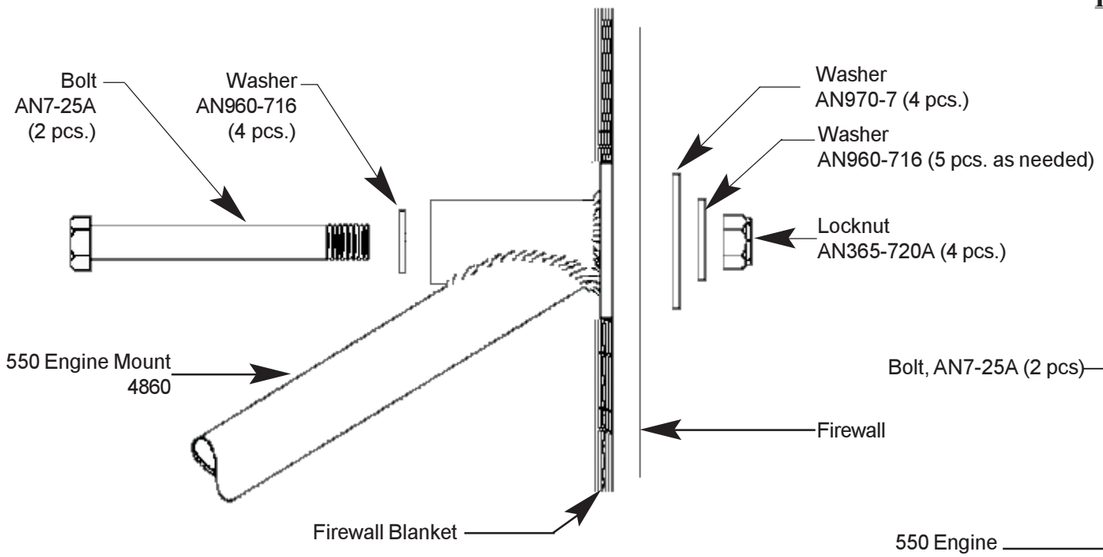
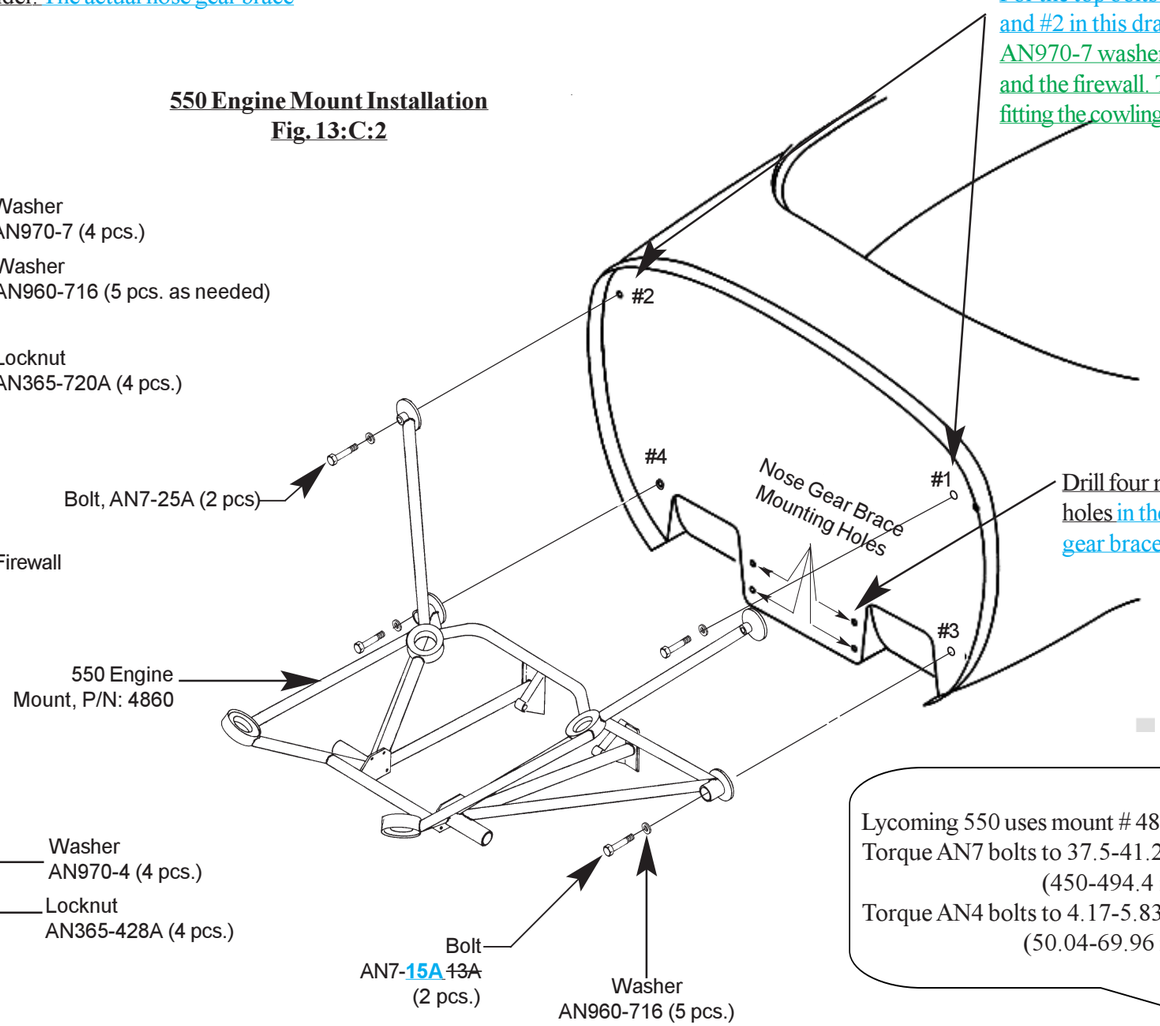
**C 1.** The four nose gear brace mounting holes in the firewall are drilled by the builder. The actual nose gear brace is pre-drilled.

## Engine Mount Holes #1 - 4

~~**Note:** # 5 hole only applies to 540 installations.~~



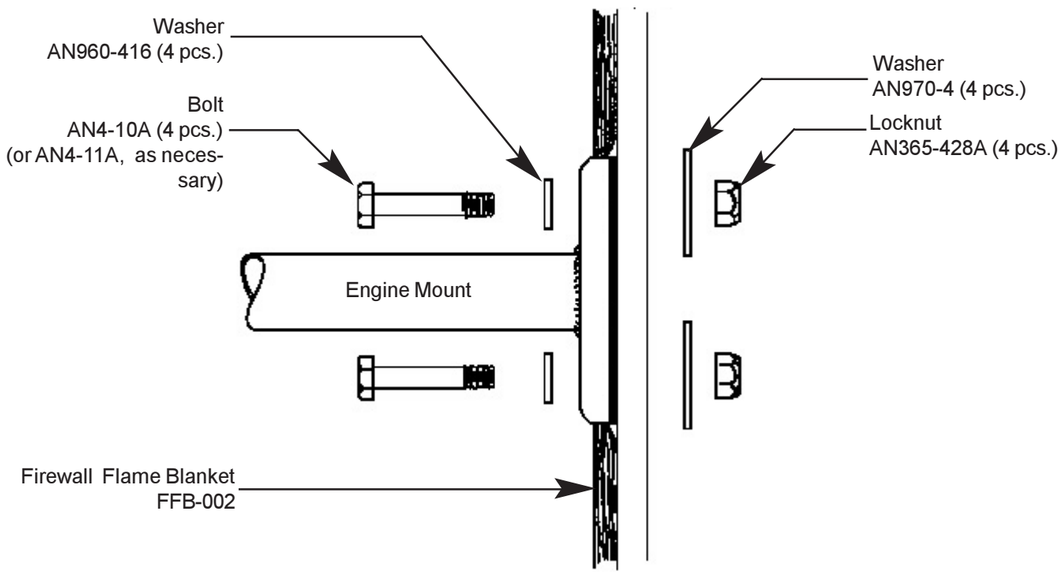

**550 Engine Mount Installation**
**Fig. 13:C:2**




For the top bolts only (bolt hole positions #1 and #2 in this drawing): Add one ~~or two~~ AN970-7 washer between the motor mount and the firewall. This will help prevent sag for fitting the cowling.

Drill four nose gear brace mounting holes in the firewall. The actual nose gear brace is already pre-drilled.

### Nose Gear Brace Mounting Holes




Lycoming 550 uses mount # 4860.
Torque AN7 bolts to 37.5-41.2 ft-lb.
(450-494.4 in-lb.)
Torque AN4 bolts to 4.17-5.83 ft-lb.
(50.04-69.96 in-lb.)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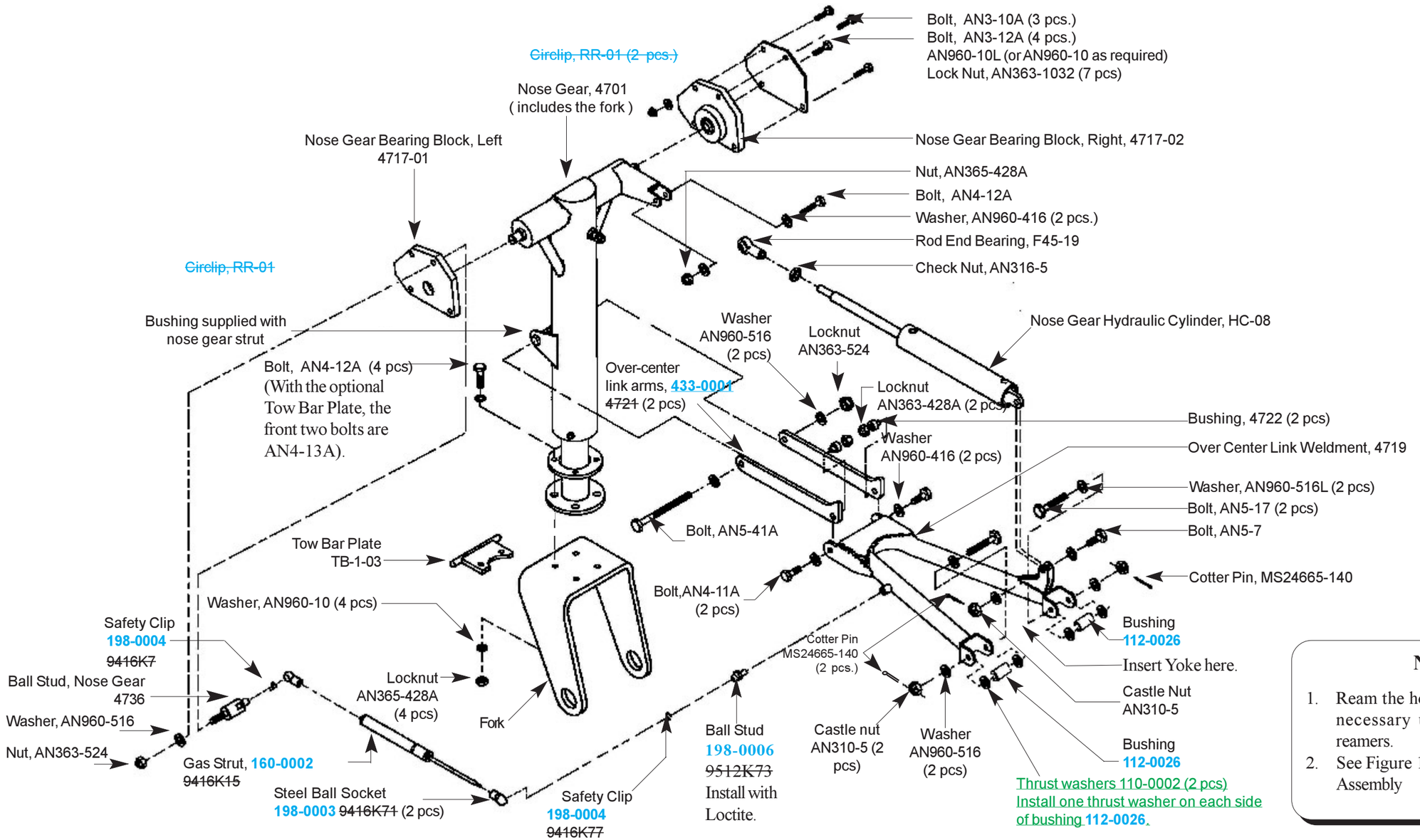
## D. Nose Gear Installation

**D 1.** Assemble!- Install the assembled linkage on the engine mount.

**Nose Gear Assembly Exploded View**
**Fig. 13:D:1**




**NOTE:**

1. Ream the holes of the weldment as necessary using 1/4" and 5/16" reamers.
2. See Figure 13:D:2 for Retract Yoke Assembly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## Left Side View

**Aligning Nose Gear to Mounting Pads**
**Fig. 13:D:2**

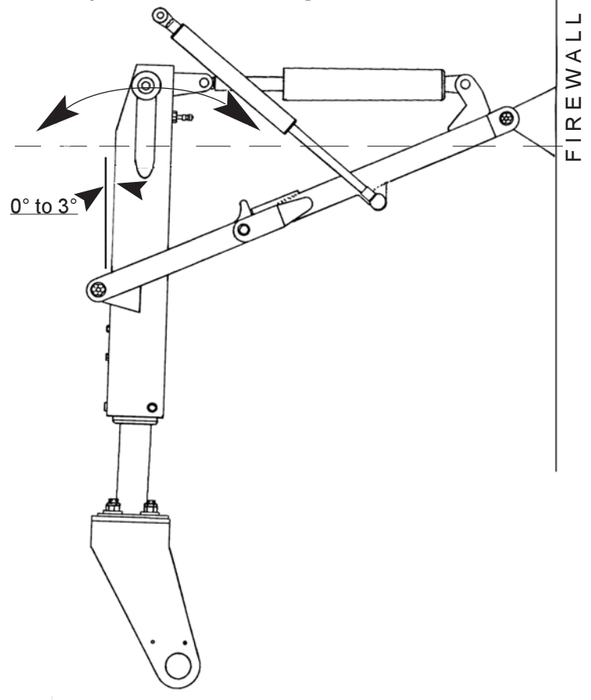
**D 2.** Adjust the rake of the nose gear between 0 to 3 degrees forward. There are a number of things to consider before final drilling of the gear bearing blocks.

1. The bearing block must align to the mating plates of the engine mount such that you get sufficient edge distance around the bolts.

2. Prior to drilling the bearing blocks, swing the gear and check for clearances! Pay particular attention to the clearance between the over center link weldment and the nose strut. Also check clear ance between the hydraulic cylinder and the over center link weldment.

When you are satisfied that the mechanism clears and swings freely, you can drill for the bearing block.

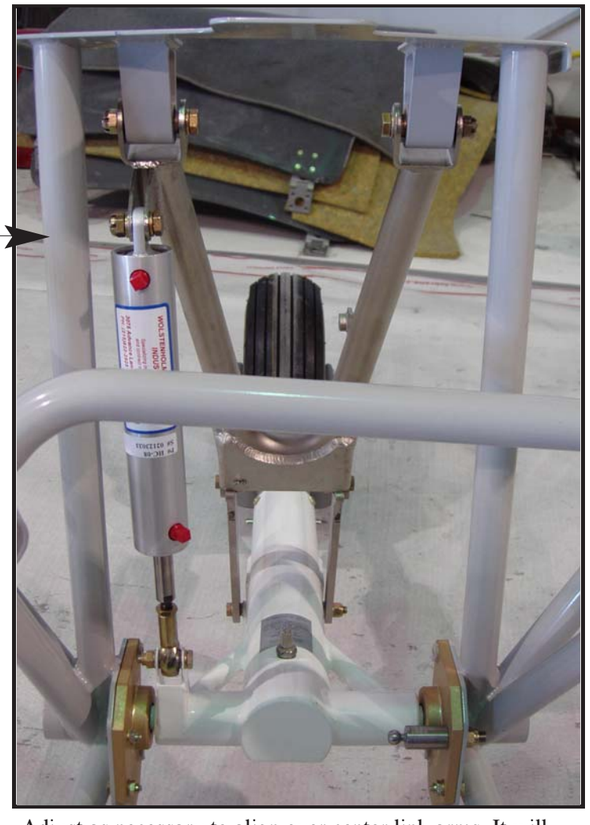
**Note:** Make all adjustments without the gas strut attached.




**D 3.** Align the strut as shown in side view, top view and front view. Clamp as shown. Retract the gear to check for any binding.

**D 4.** Once aligned, drill holes through the bearing blocks.

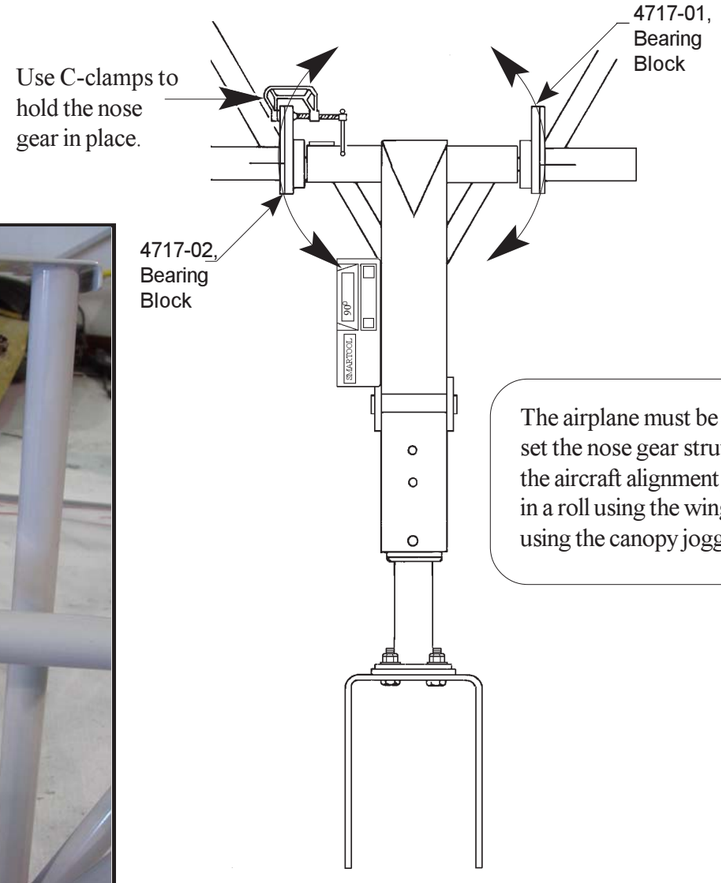
### TOP VIEW




Adjust as necessary to align over center link arms. It will align by itself if assembled.

### FRONT VIEW

Adjust as necessary to set strut vertical.




The airplane must be leveled properly to set the nose gear strut. If you did not build the aircraft alignment jig, level the airplane in a roll using the wing tips and in pitch using the canopy joggle.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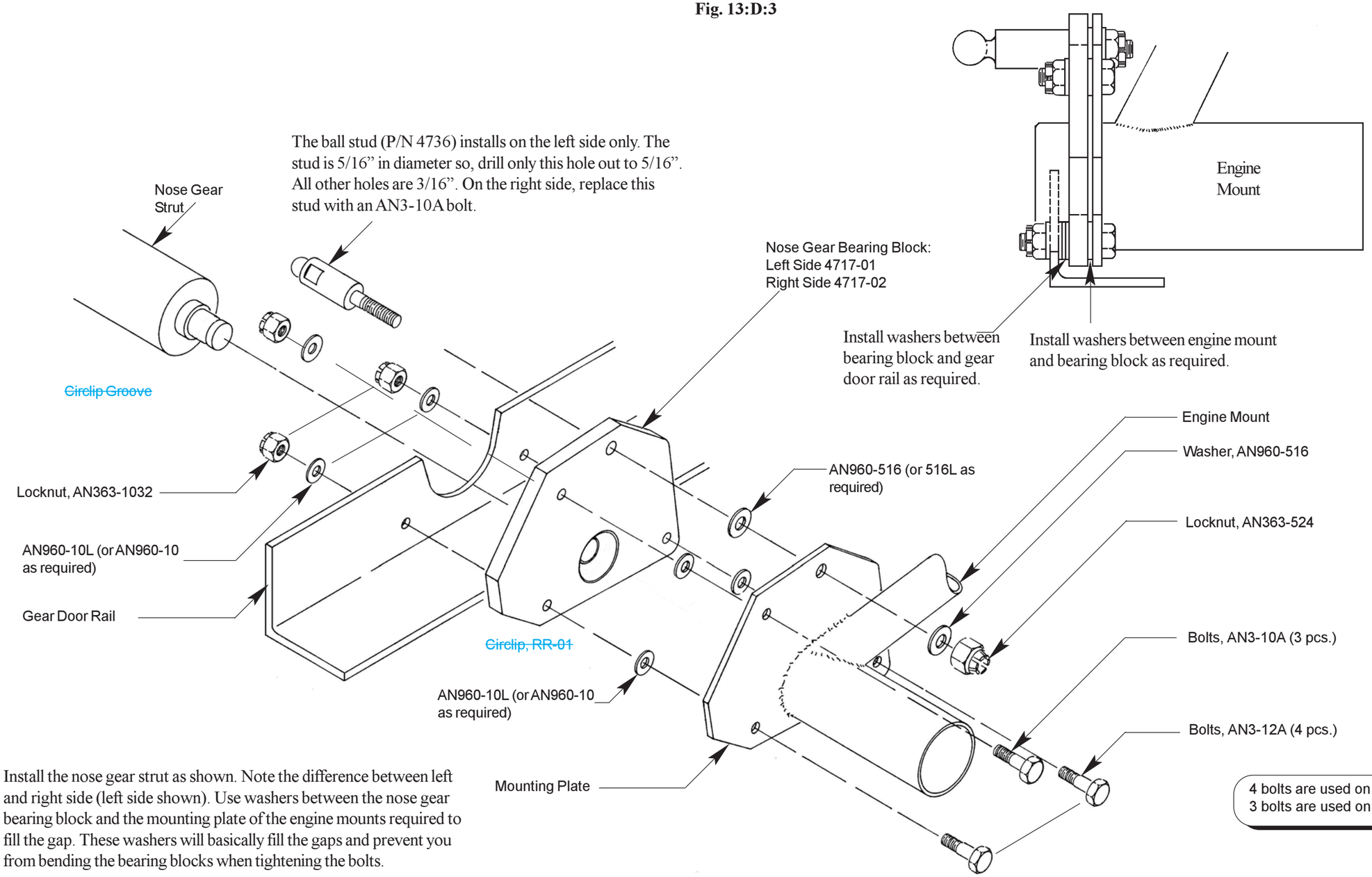
**Nose Gear Strut Installation**
**Fig. 13:D:3**




**D 5.** Install the nose gear strut as shown. Note the difference between left and right side (left side shown). Use washers between the nose gear bearing block and the mounting plate of the engine mounts required to fill the gap. These washers will basically fill the gaps and prevent you from bending the bearing blocks when tightening the bolts.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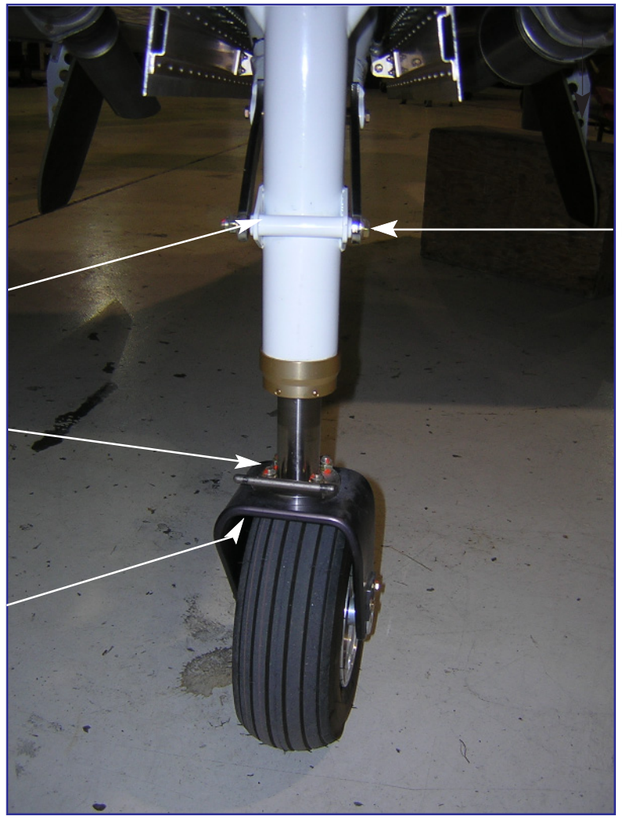
# Alternative Nose Gear Installation

Parts used for this alternative installation are the same as the parts used on the previous page. For greater detail, please refer to the previous page.

Nose Gear, 432-0005 for the retractable gear*
( includes the fork )



Bushing supplied with nose gear strut

Bolt, AN5-41A

Bolt, AN4-12A (4 pcs) (With the optional Tow Bar Plate, the front two bolts are AN4-13A).

Washer, AN960-10 (4 pcs)
Locknut, AN365-428A (4 pcs)

## Alternative Nose Gear Installation
## Fig. 13:D:1b

Nose Gear, 432-0005 for the retractable gear*
( includes the fork )

Over-center link arms
433-0001 ~~4721~~ (2 pcs)

Washer, AN960-516 (2 pcs)
Locknut, AN363-524

Tow Bar Plate TB-1-03

Fork

* Note: The part number for the fixed gear's nose gear is 432-0002.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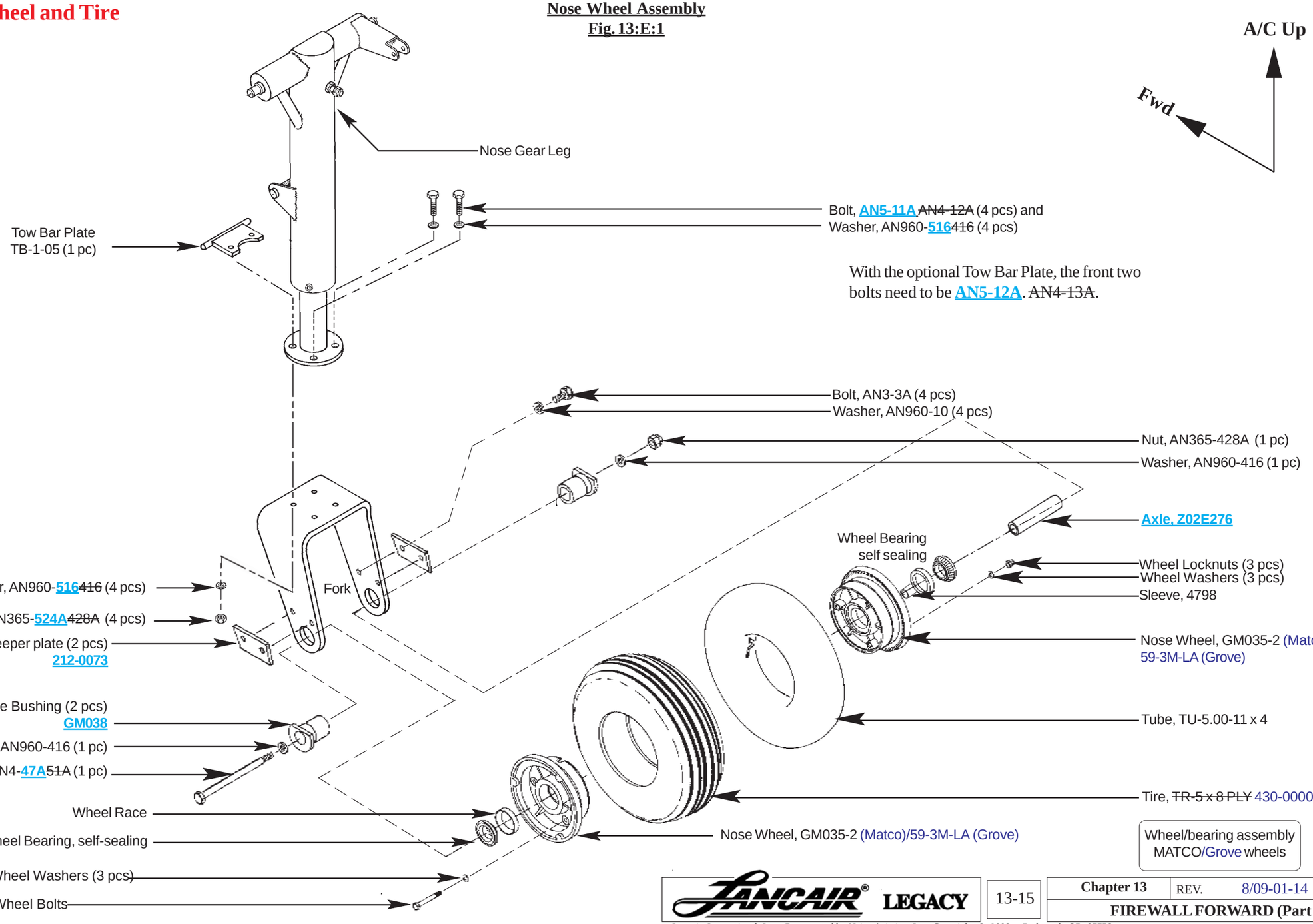
## E. Nose Wheel and Tire

**Nose Wheel Assembly**
**Fig. 13:E:1**



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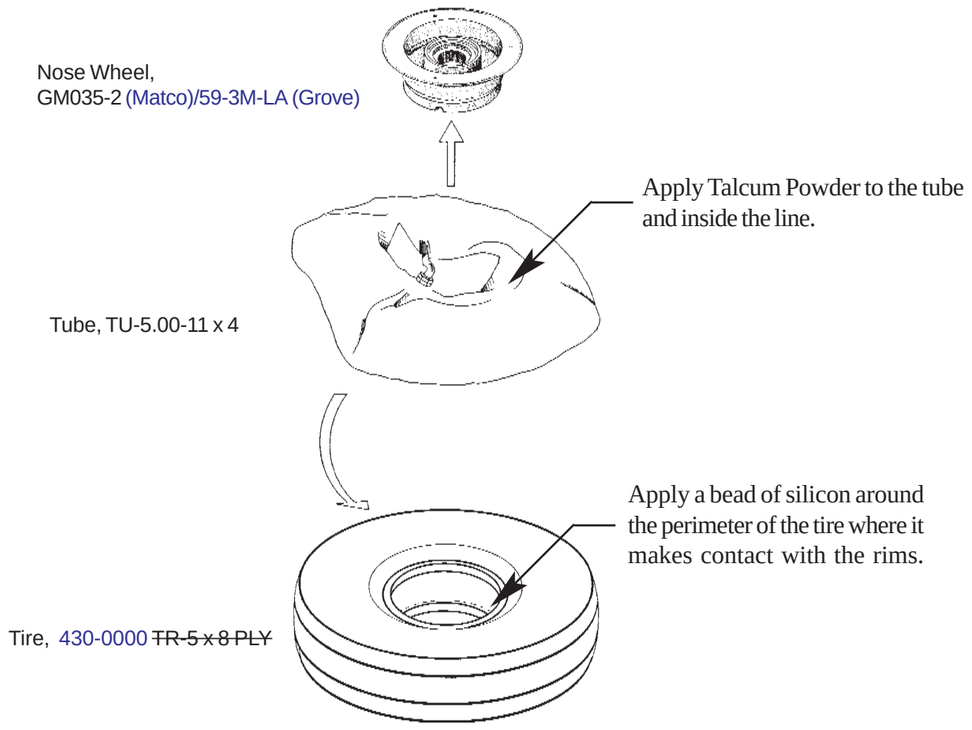
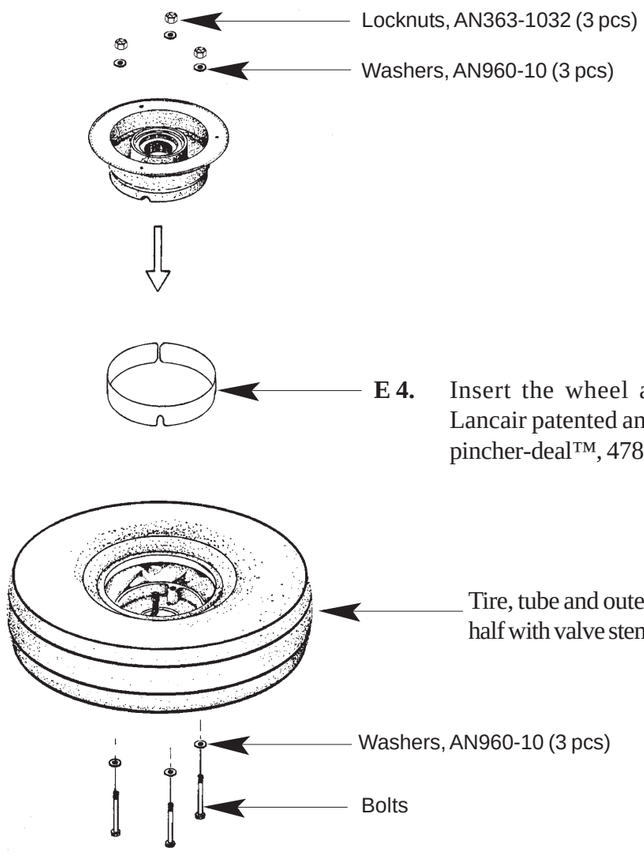
**E 1.** Insert the tube into the tire. Then inflate the tube with a small amount of air.

**E 2.** Insert the tire and tube assembly into the rim half that has the passage for the valve stem. Pull the valve stem through.

**E 3.** Position the assembly on the work bench with the wheel half facing down. Note the world famous Lancair designed anti tire tuber pincher deal. You will see a notch designed to fit around the valve stem. The anti pincher slides between the tube and wheel and helps prevent tube pinching when the two halves are put together.

**Assembling Tire and Wheel**
**Fig. 13:E:2**





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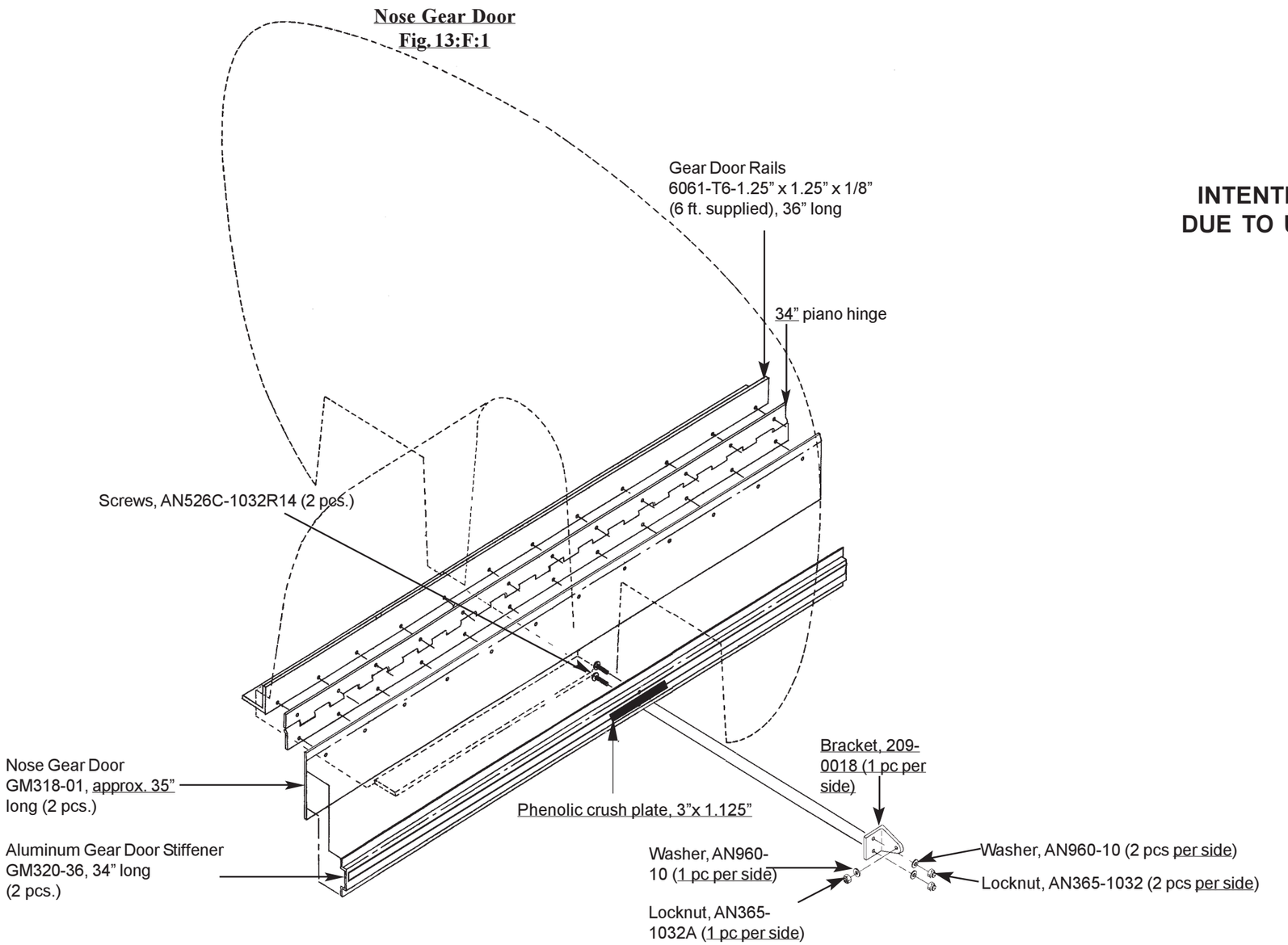
## F. Nose Gear Doors

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**DUE TO UPDATE REV. 5/06-20-07**


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DUE TO UPDATE REV. 3/12-15-04

INTENTIONALLY LEFT BLANK
DUE TO UPDATE REV. 3/12-15-04


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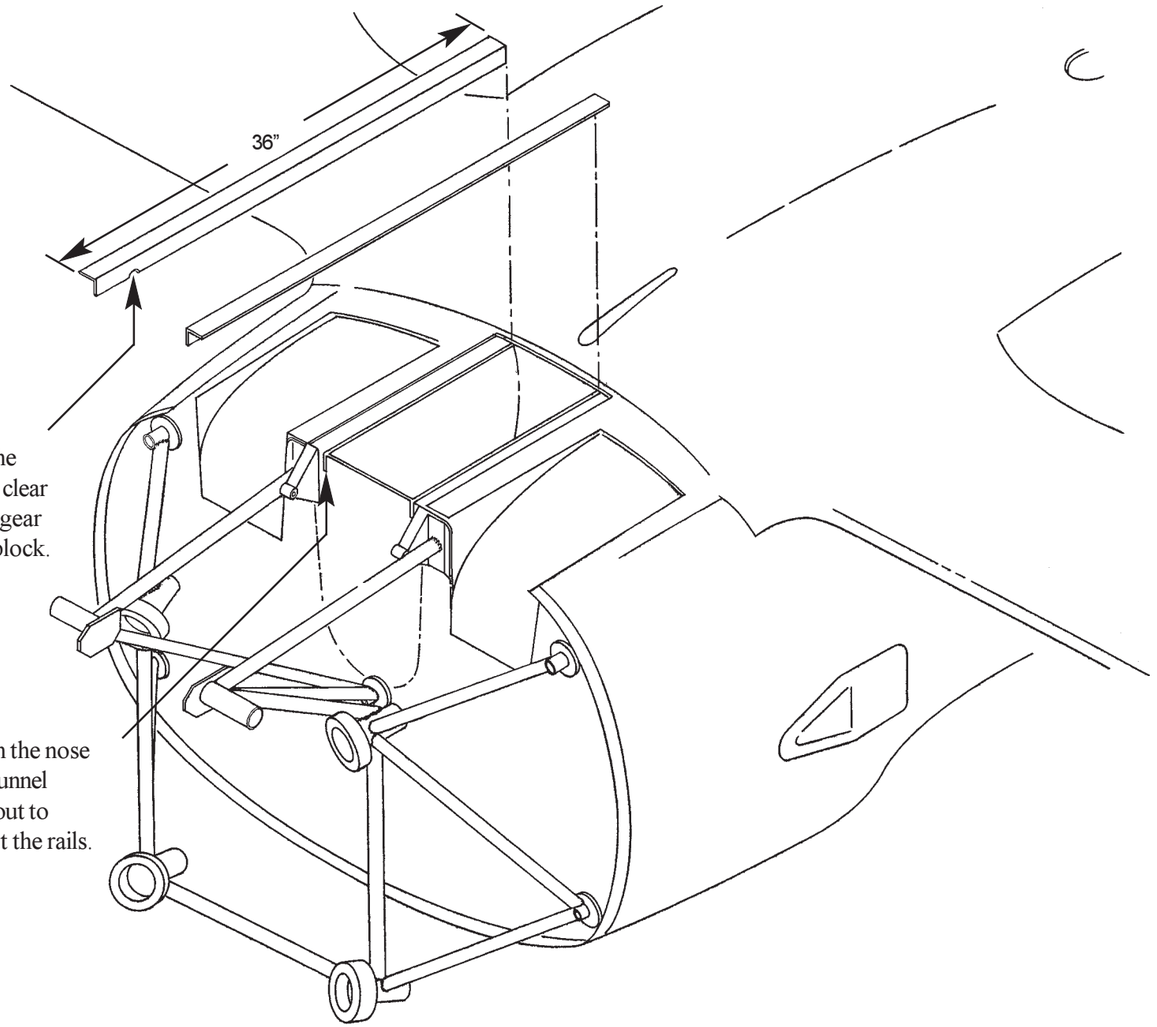
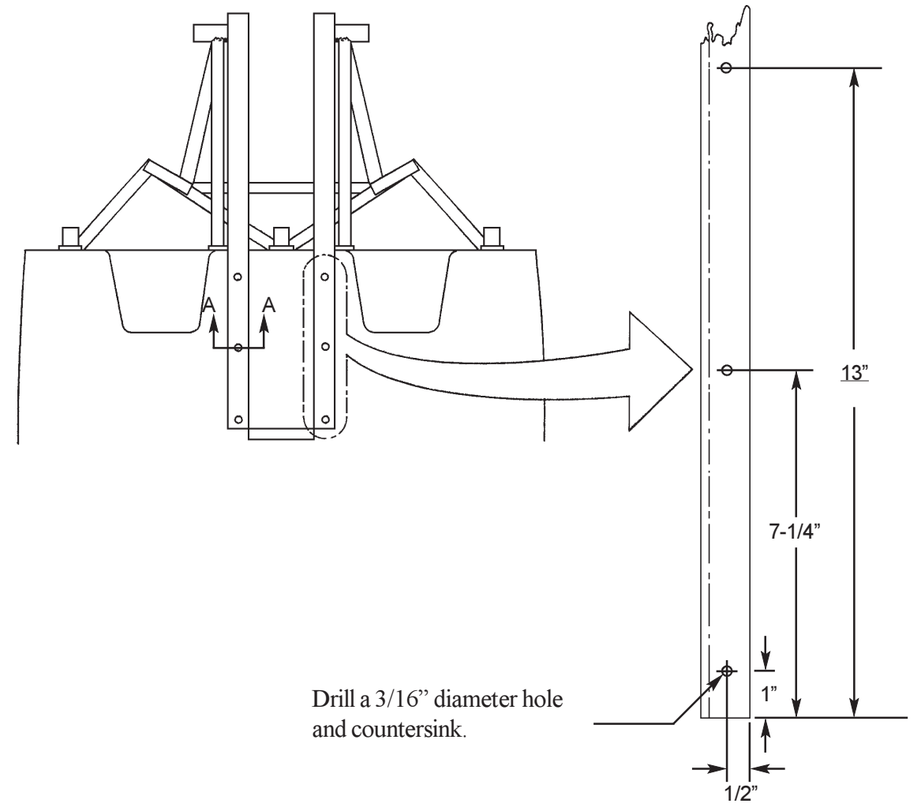
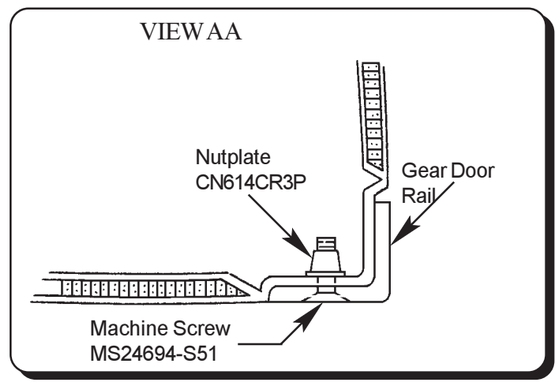
**F 1.** Cut 2 pieces of the 6061-T6, 1.25” x 1.25” x 1/8” angle aluminum to 36”.

**Gear Door Rail Installation**
**Fig. 13:F:7**




You may want to do a micro release between the gear door rail and the nose gear tunnel to get a good fit so the rail cannot move.





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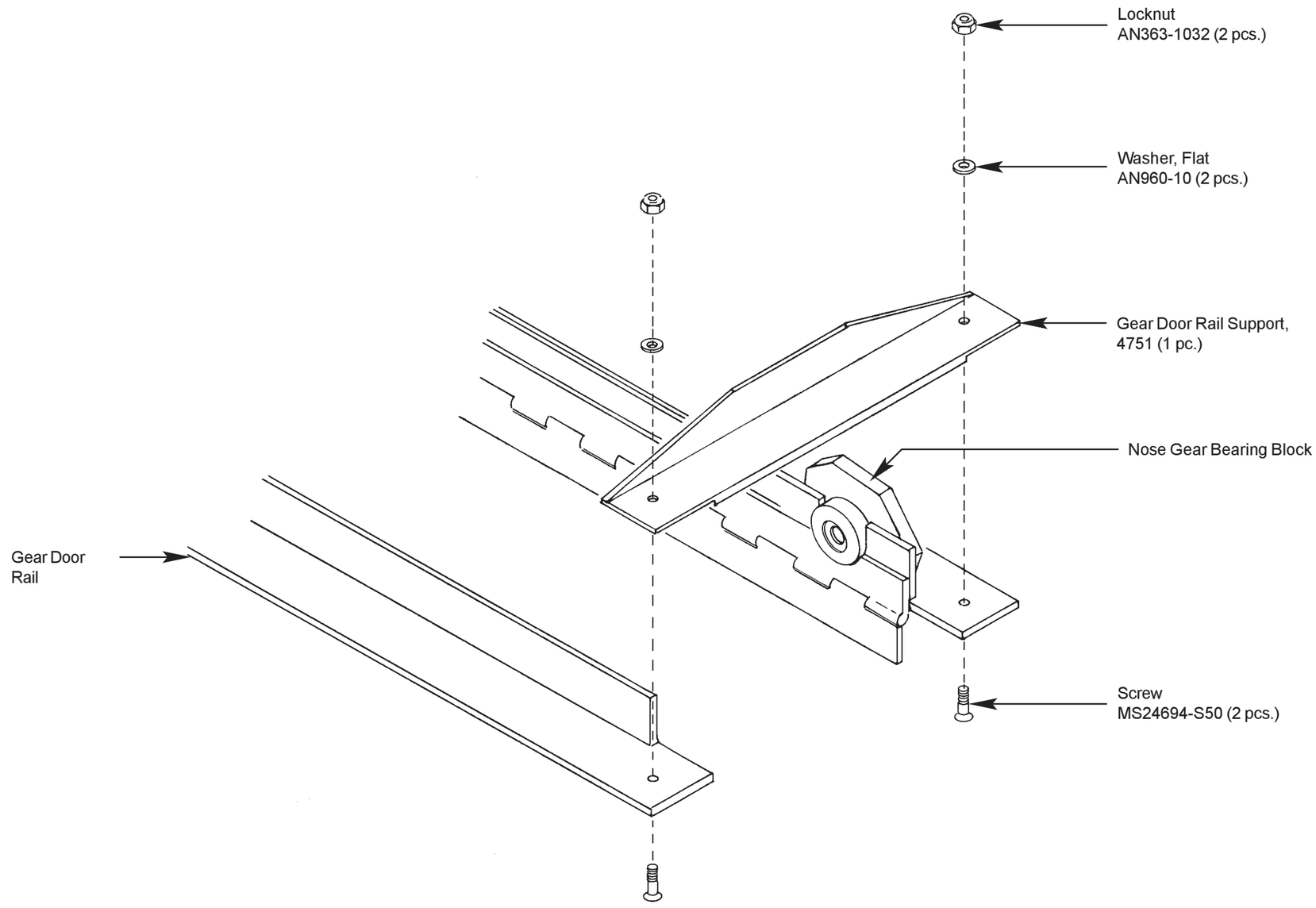
**Gear Door Rail Support**
**Fig. 13:F:8**





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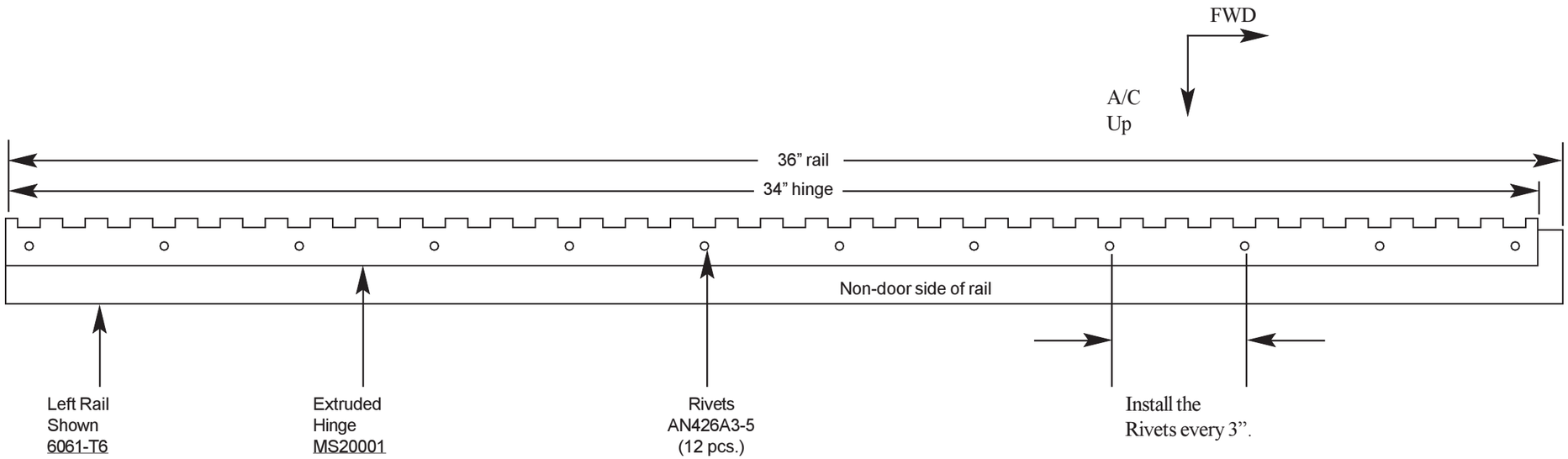
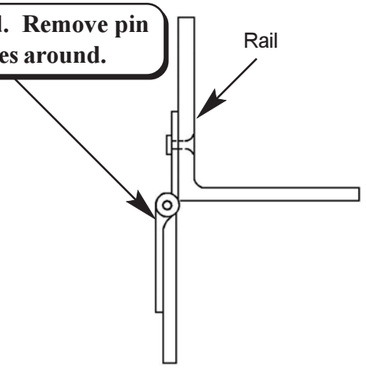
**Securing Hinge to Rail**
**Fig. 13:F:9**

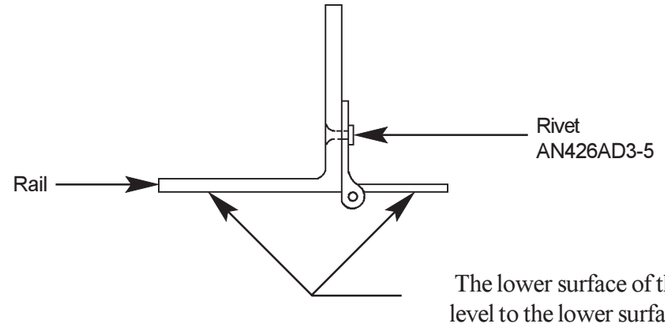
## SIDE VIEW OF LEFT RAIL




The gear door hinges (MS20001) are riveted to the gear door rails (6061-T6) and attached with screws to the gear doors (GM318-01).

**NOTE: Hinge is reversed. Remove pin and flip hinge sides around.**




The lower surface of the hinge is set level to the lower surface of the rail.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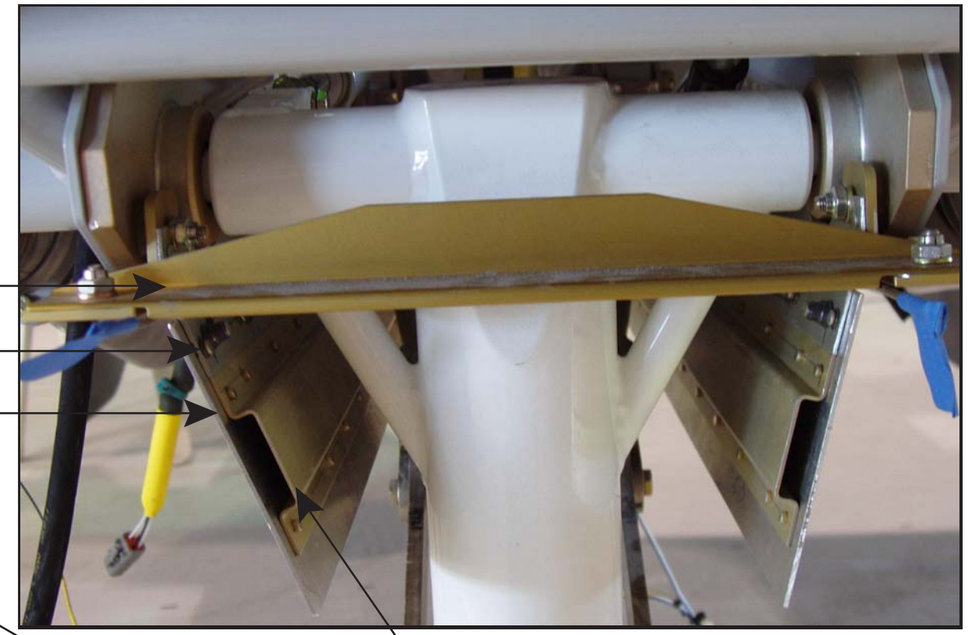
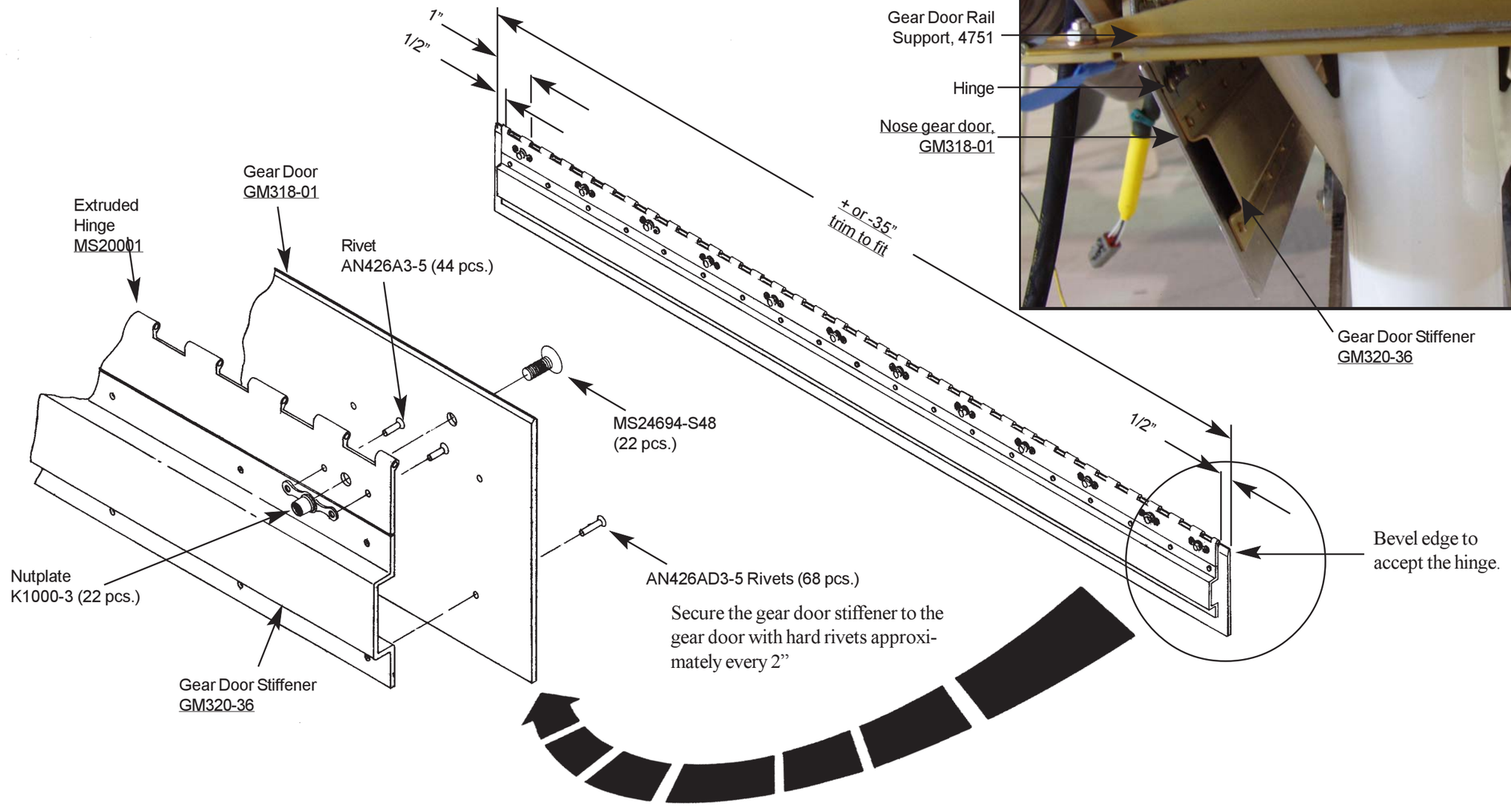
## Securing Hinge and Stiffener to Nose Gear Door
## Fig. 13:F:10





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~~F-1. Remove the spring from the back of the nose gear door plunger assembly by removing the Allen "stop" screw.~~

~~F-2. Reassemble the plunger without the spring.~~

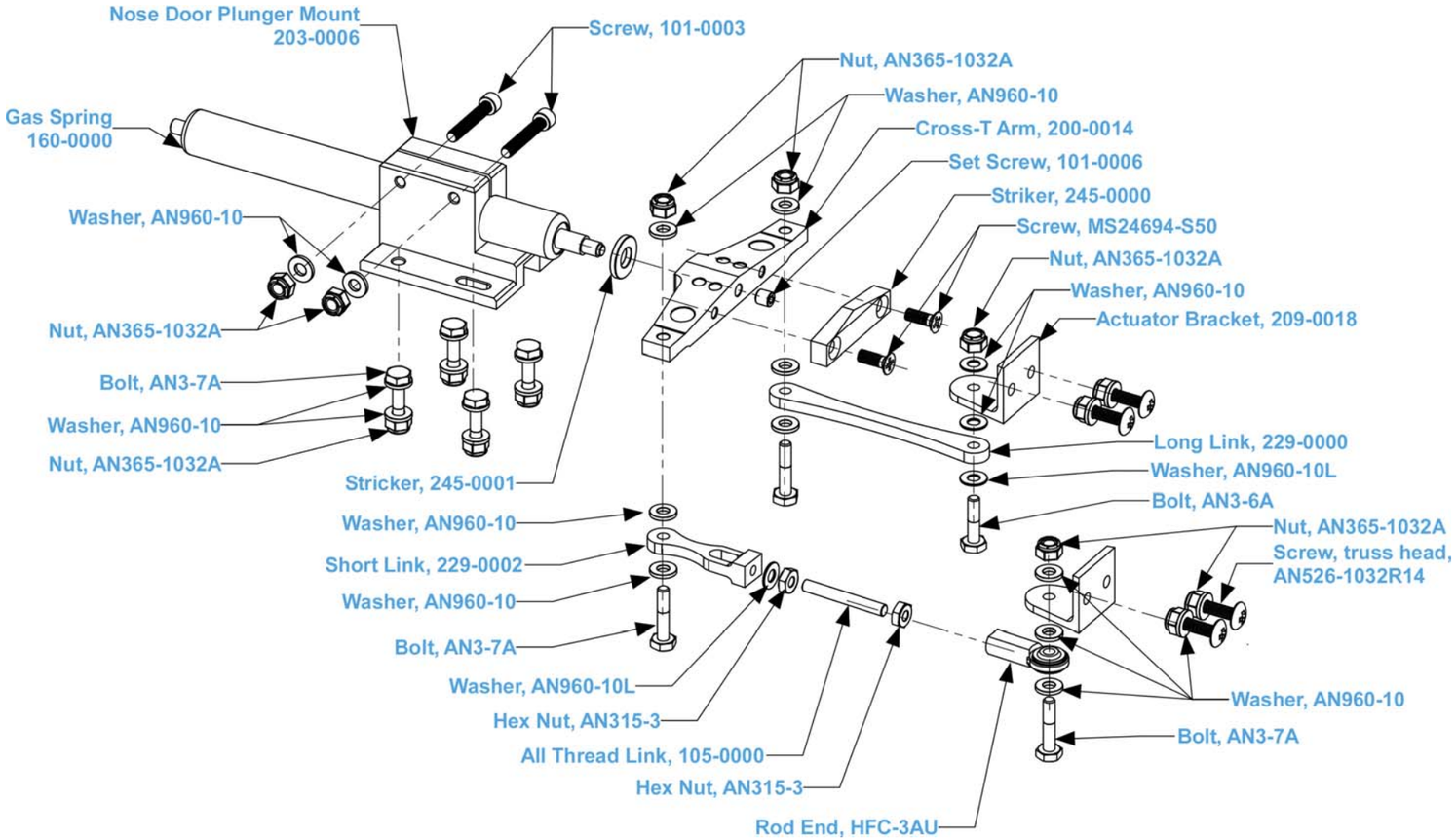
## HOW THE GEOMETRY WORKS:

1. By moving the up stop "down", the gear doors will open wider and you will have more clearance between the pushrod and the over-center link. However, you don't want the doors too wide."

2. By moving the up stop "up" the gear door will open less and you will have less clearance between the pushrod and the over-center link.

To determine the location of the up stop you need to observe the clearance between the over-center link and the gear door pushrod arm. You will notice when retracting and extending the nose gear that the clearance between the over-center link and the gear door pushrods depends on the length of the pushrods.

**Nose Door Plunger Assembly ~~Nose Gear Door Spring~~**
**Fig. 13:F:3**




**Note: Refer to the next page for a drawing and photo of the completed assembly.**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~~F 4. Attach the gear door pushrods to the plunger.~~

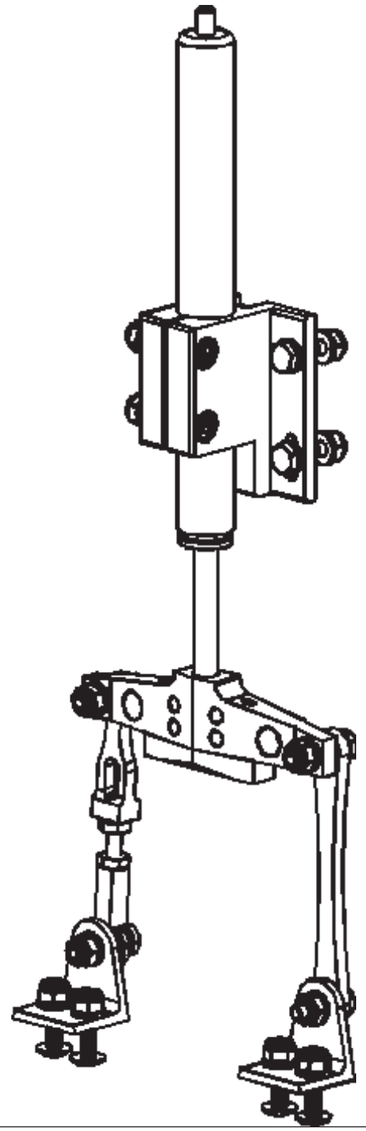
~~F 5. Position the plunger directly over the nose-gear strut on the firewall.~~

~~F 6. Fully compress the plunger.~~

**Completed Nose Door Plunger Assembly**

~~Nose Gear Up Stop~~

**Fig. 13:F:4**

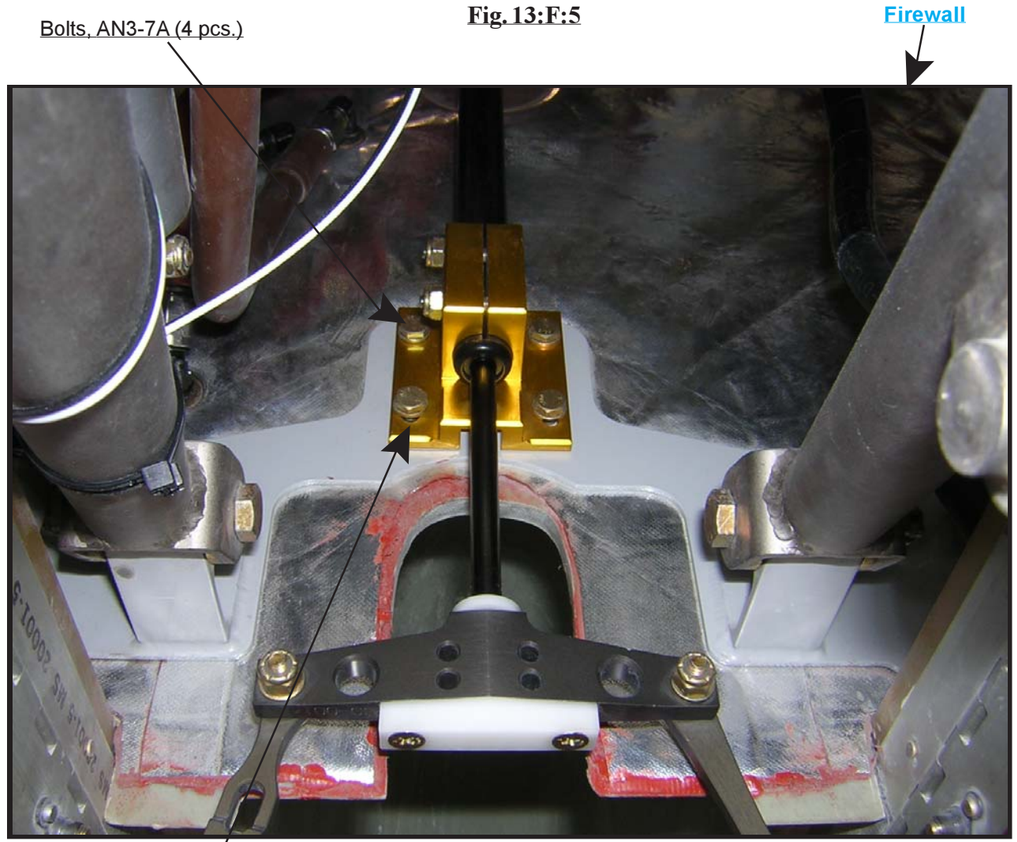


~~F 7. When you are satisfied with the clearance between the nose gear and nose gear doors, use the plunger housing as a guide to drill the two bottom holes through the firewall in approximately the center of the slots.~~

~~F 8. Install the plunger bolts (AN3-7A), washers (AN960-10) and nuts (AN365-1032A).~~

**Plunger Installed on Firewall (new photo)**

**Fig. 13:F:5**




The latest engine mounts come with the holes located on the plate. You may need to slot the holes in order to allow the bolts to slide into place.

F 2. Drill the two holes for the two top bolts to secure the plunger to the firewall. Install the bolts (AN3-7A), washers (AN960-10) and nuts (AN365-1032A).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**F 3.** Center the control horn on the gear door stiffener and mark the location.

**F 4.** Fabricate a 3" x 1.125" x .250" phenolic or aluminum plug. See Figure 13:F:1 for a view of its location.

**F 5.** Sand the plug to fit inside the stiffener rail. This is used to prevent the door from being crushed. Place it in the door, beneath the control horn.

**F 6.** Position the control horn on the door so that the push rods are vertical.

**F 7.** Drill the holes and install the hardware.

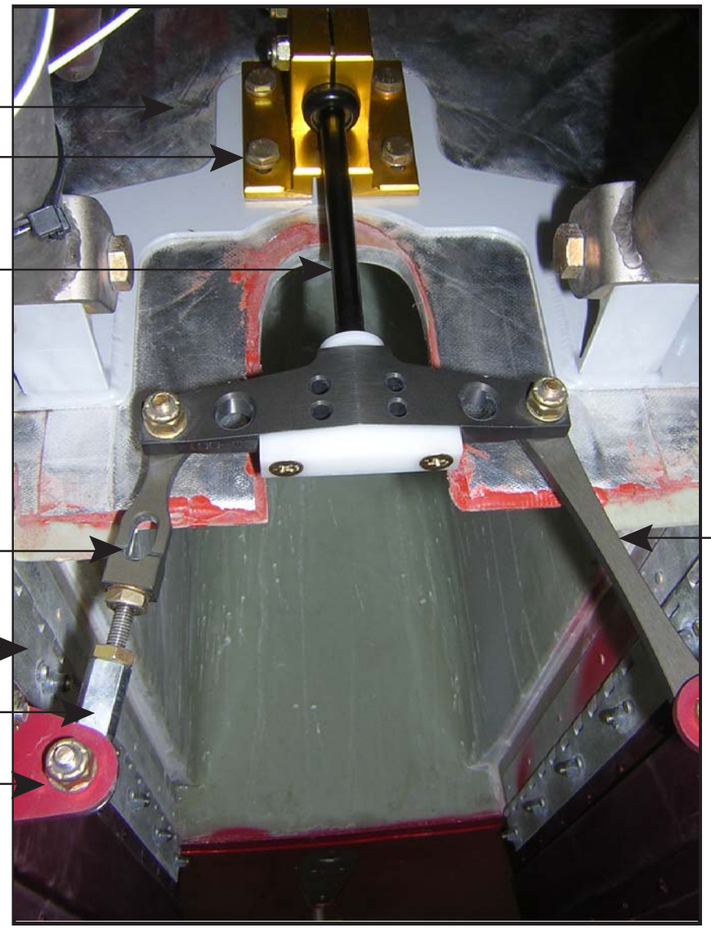
**F 8.** Attach the gear door push rod on one side.

**F 9.** Retract the nose gear and verify tht the nose gear doors completely close. Adjust the rod ends as necessary.

**F 10.** Repeat these steps for the the other door.

~~**F 18.** After the final adjustment, remove the plunger and re-install the spring. Now re-install the plunger assembly.~~

**Nose Gear Door Actuator Assembly Mounted to the Firewall**
**Fig. 13:F:6**



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## G. Nose Gear Micro Switch

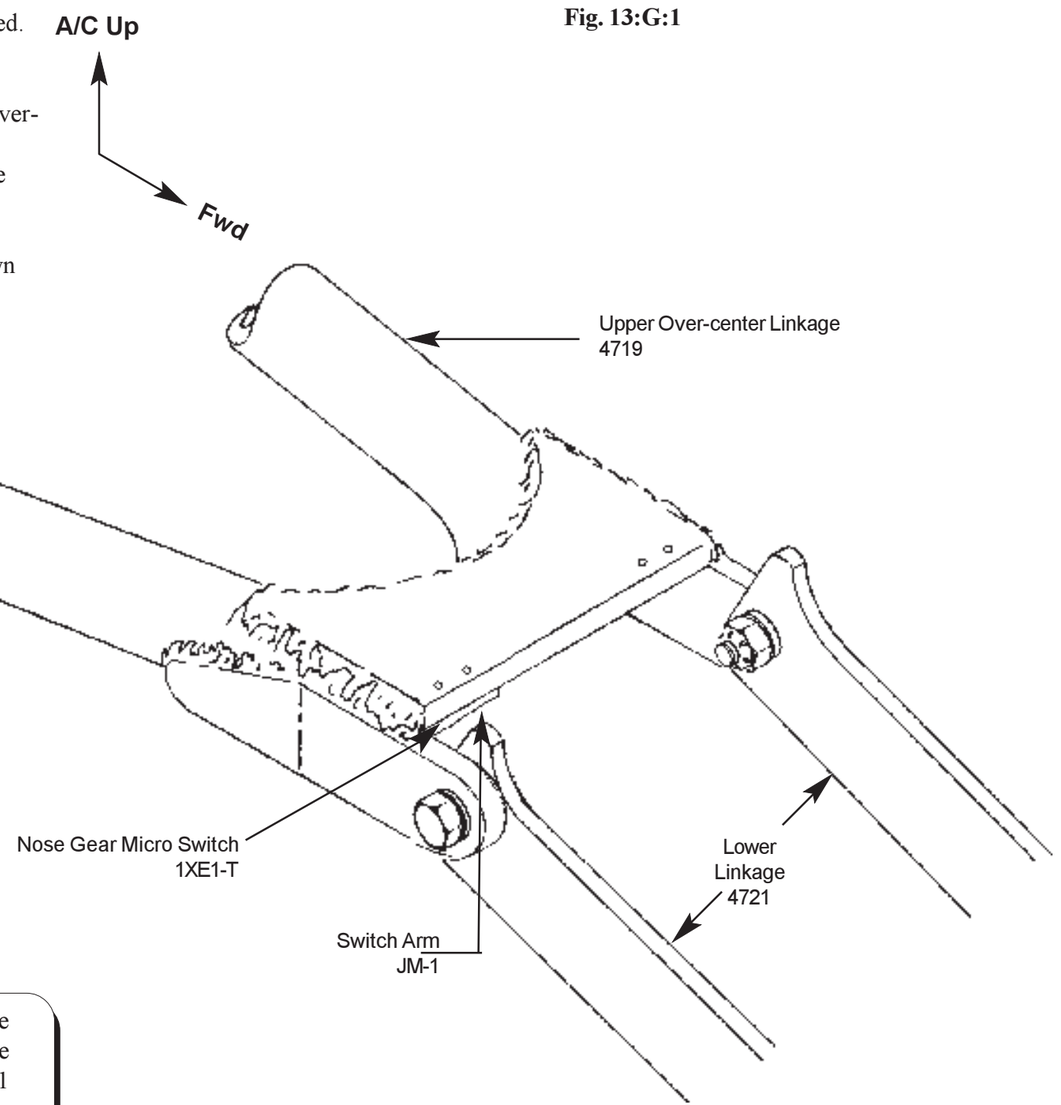
### Nose Gear Down Switch

A micro switch is mounted to the 4719 over-center linkage to indicate if the nose gear is down and locked. The switch is activated by the 4721 lower over-center linkage.

Use the hardware supplied in the JM-1 packet to secure the 1XE1-T micro switch to the 4719 upper over-center linkage. Two switch mounting holes are predrilled in the linkage for this purpose. The nuts and lockwashers should be on the bottom of the 4721 linkage. Use a drop of Loctite on these nuts just to be sure of a good hold.

The right, 4721 over-center linkage should press the switch arm when the nose gear is locked in the down position. You should be able to hear the "click" of the switch as it contacts and releases.

**Nose Gear Micro Switch**
**Fig. 13:G:1**




The micro switch and switch arm are secured to the 4719 over-center linkage with the screws provided in the JM-1 packet.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# REVISION LIST

# CHAPTER 13: FIREWALL FORWARD (PART 1)

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 13-1 | 1/09-18-02 | R&R | Part # correction |
| 13-2 | 1/09-18-02 | R&R | Part # correction |
| 13-3 through 13-9 | 0/02-15-02 | None | Current revision is correct |
| 13-10 through 13-11 | 1/09-18-02 | R&R | Text correction |
| 13-12 | 1/09-18-02 | R&R | Part # Corrections |
| 13-13 | 1/09-18-02 | R&R | Text Correction |
| 13-14 | 1/09-18-02 | R&R | Part # Correction |
| 13-15 | 1/09-18-02 | R&R | Correction of fig. 13:E:1 |
| 13-16 | 1/09-18-02 | R&R | Part # Correction |
| 13-17 | 1/09-18-02 | R&R | Part # Correction |
| 13-18 | 1/09-18-02 | R&R | Part # Correction |
| 13-19 | 1/09-18-02 | R&R | Text and Fig 13:F:3 Correction |
| 13-20 | 1/09-18-02 | R&R | Correction of fig. 13:F:4 |
| 13-21 | 1/09-18-02 | R&R | Correction of fig. 13:F:5<br>Text correction |
| 13-22 | 1/09-18-02 | R&R | Text correction |
| 13-23 through 13-26 | 0/02-15-02 | None | Current Revision is Correct |
| 13-1 | 2/06-30-04 | R&R | Deleted items from parts list. |
| 13-10 | 2/06-30-04 | R&R | Added instruction. |
| 13-11 | 2/06-30-04 | R&R | Added instruction. |
| 13-13 | 2/06-30-04 | R&R | Updated instructions. Added photo. |
| 13-15 | 2/06-30-04 | R&R | Updated part numbers. |


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| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 13-17 | 2/06-30-04 | R&R | New figure 13:F:2 - Nose gear plunger. |
| 13-21 | 2/06-30-04 | R&R | Updated gear door information. |
| 13-22 | 2/06-30-04 | R&R | Updated gear door information. |
| 13-23 | 2/06-30-04 | R&R | Updated gear door spring information. |
| 13-24 | 2/06-30-04 | R&R | Updated gear door plunger information. |
| 13-25 | 2/06-30-04 | R&R | Updated gear door bracket information. |
| 13-26 | 2/06-30-04 | R&R | Updated figure 13:G:1. |
| 13-2 | 3/12-15-04 | R&R | Updated parts list. |
| 13-18 | 3/12-15-04 | R&R | Intentionally blank due to new nose gear door plunger. |
| 13-19 | 3/12-15-04 | R&R | New dimension and instructions. |
| 13-22 | 3/12-15-04 | R&R | Added photo. |
| 13-23 | 3/12-15-04 | R&R | Corrected geometry. |
| 13-24 | 3/12-15-04 | R&R | Updated photo. |
| 13-1 thru 13-2 | 4/09-29-06 | R&R | Corrected parts list. |
| 13-6 | 4/09-29-06 | R&R | Updated torque for engine mount to firewall. |
| 13-10 thru 13-11 | 4/09-29-06 | R&R | Added washers between engine mount and firewall. |
| 13-12 | 4/09-29-06 | R&R | Corrected drawing and added update. |
| 13-1, 13-2, 13-12 | 6/08-10-07 | R&R | Part number change only. |
| 13-2, 13-11, 13-12, 13-14, 13-15, 13-17, 13-18, 13-23, 13-24, 13-25, | 6/08-10-07 | R&R | Parts changed and new nose gear assembly. |
| 13-2, 13-14b | 7/09-10-08 | R&R | New page for alternative nose gear installation and update to the parts list. |


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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **550/540 - NOSE GEAR INSTALLATION** | | | | |
| 1) | 4701 | 1 | Nose Gear w/ Fork and Bushing (or alternative part 432-0005) | |
| 2) | 4717-01 | 1 | Nose Gear Bearing Block, Left | |
| 3) | 4717-02 | 1 | Nose Gear Bearing Block, Right | |
| 4) | 433-0001 ~~4721~~ | 2 | Over-center Link Arms | |
| 5) | 4722 | 2 | Bushing | |
| 6) | 4736 | 1 | Nose Gear Ball Stud | |
| 7) | F45-19 | 1 | Bearing, Rod End | |
| 8) | AN3-10A | 3 | Bolt,Undrilled | |
| 9) | AN3-12A | 4 | Bolt, Undrilled | |
| 10) | AN4-11A | 4 | Bolt, Undrilled | (**Yes 2 with tow bar plate) |
| 11) | AN4-12A | 9 | Bolt, Undrilled | (**Yes 2 with tow bar plate) |
| ~~12)~~ | ~~AN4-13A~~ | ~~2~~ | ~~Bolts, Undrilled (With Tow Bar Plate Option)~~ | ~~**Yes~~ |
| 13) | AN5-7 | 1 | Bolt, Undrilled | |
| 14) | AN5-41A | 1 | Bolt, Undrilled | |
| 15) | 112-0026 ~~6381K103~~ | 2 | Bushing | |
| ~~16)~~ | ~~RR-01~~ | ~~2~~ | ~~Circlip~~ | |
| 17) | 198-0004 ~~9416K77~~ | 2 | Clip, Safety | |
| 18) | MS24665-140 | 3 | Cotter Pin | |
| 19) | HC-08 | 1 | Hydraulic Cylinder, Nose Gear | |
| 20) | AN363-1032 | 7 | Lock Nut, All Metal | |
| 21) | AN363-428A | 2 | Lock Nut, All Metal | |
| 22) | AN363-524 | 2 | Lock Nut, All Metal | |
| 23) | AN365-428A | 5 | Nut, Nylock | |
| 24) | AN310-5 | 3 | Nut, Castle | |
| 25) | AN316-5 | 1 | Nut, Check | |
| 26) | 198-0003 ~~9416K71~~ | 2 | Socket, Steel Ball | |
| 27) | 160-0002 ~~9416K15~~ | 1 | Strut, Gas | |
| 28) | 198-0006 ~~9512K73~~ | 1 | Stud, Ball | |
| 29) | TB-1-03 | 1 | Tow Bar Plate | **Yes |
| 30) | TB-1 | 1 | Tow Bar | **Yes |
| 31) | AN960-10 | 20 | Washer, Flat | |
| 32) | AN960-10L | 10 | Washer, Flat | |
| 33) | AN960-416 | 4 | Washer, Flat | |
| 34) | AN960-516 | 14 | Washer, Flat | |
| 35) | AN960-516L | 10 | Washer, Flat | |
| 36) | 110-0002 | 4 | Washer, Thrust | |
| 37 | 212-0073 | 2 | Keeper Plate | |
| **NOSE GEAR MICRO SWITCH** | | | | |
| 1) | 1XE1-T | 1 | Micro Switch, Nose Gear | |
| 2) | JM-1 | 1 | Switch Arm | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **NOSE WHEEL & TIRE** | | | | |
| 1) | 4785 | 1 | Anti-tube-pincher-deal™ | |
| 2) | AN4-47A ~~51A~~ | 1 | Bolt, Undrilled | |
| 3) | AN3-3A | 4 | Bolt, Undrilled | |
| 4) | AN365-428A | 5 | Nut, Nylock | |
| 5) | TR-5 x 8 PLY | 1 | Tire | |
| 6) | TU-5.00-11 x 4 | 1 | Tube | |
| 7) | AN960-416 | 10 | Washer, Flat | |
| 8) | AN960-10 | 4 | Washer, Flat | |
| 9) | GM035-2 | 1 | Wheel, Nose | |
| 10) | Z02E276 | 1 | Axle | |
| 11) | GM038 | 1 | Axle bushing | |
| **NOSE GEAR DOORS (Obsolete parts were removed from this list due to space contraints.)** | | | | |
| 1) | 6061-T6 | 6 ft | 1 1/4" x 1 1/4" x 1/8" Gear Door Rails (approx. 36") | |
| 2) | GM318-01 | 2 | Gear Door, Nose (approx. 35") | |
| 3) | GM320-36 | 2 | Aluminum Gear Door Stiffener (34") | |
| 4) | MS20001 | 2 | Hinge, Piano (34") | |
| 5) | | 1 | Phenolic crush plate, 3" x 1.125" | |
| 6) | 240-0001 | 1 | Nose gear door assembly | |
| 7) | AN3-6A | 1 | Bolt, 10-32 x 25/32 | |
| 8) | AN960-10L | 4 | Washer, lite 3/16 | |
| 9) | HFC-3AU | 1~~2~~ | Female rod ends | |
| 10) | BJ-04 | 2 | Rod ends | |
| 11) | AN3-7A | 7 | Bolt | |
| 12) | AN315-3 | 2 | Checknuts | |
| 13) | 209-0018 | 2 | Bracket | |
| 14) | AN3-10A | 4 | Bolt, Undrilled | |
| 15) | AN5-20 | 2 | Bolt, Drilled | |
| 16) | AN363-1032 | 4 | Nut, Lock (All metal) | |
| 17) | AN365-1032A | 14~~2~~ | Nut, Nylock | |
| 18) | K1000-3 | 22 | Nutplate | |
| 19) | AN426A3-5 | 44 | Rivet | |
| 20) | AN426AD3-5 | 68 | Rivet | |
| 21) | MS24694-S48 | 22 | Screw | |
| 22) | MS24694-S50 | 4 | Screw | |
| 23) | AN526-1032R14 | 4~~2~~ | Screw, Washer Head | |
| 24) | AN960-10 | 23~~14~~ | Washer, Flat | |
| 25) | CN614CR3P | | Nutplate | |
| 26) | MS24694-S51 | | Screw, Machine | |
| 27) | AN960-10L | 3 | Washer, Flat | |


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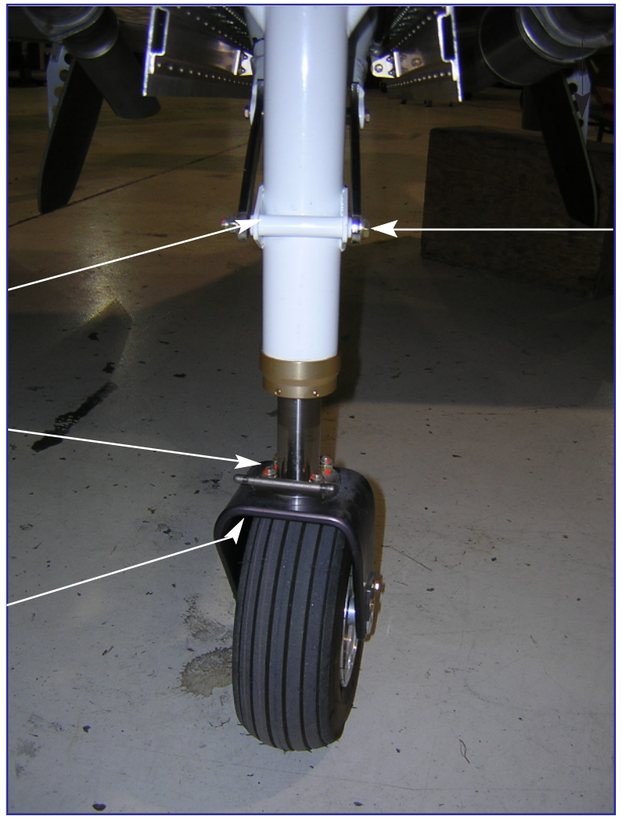
# Alternative Nose Gear Installation

Parts used for this alternative installation are the same as the parts used on the previous page. For greater detail, please refer to the previous page.

Nose Gear, 432-0005 for the retractable gear*
( includes the fork )



Bushing supplied with nose gear strut

Bolt, AN5-41A

Bolt, AN4-12A (4 pcs) (With the optional Tow Bar Plate, the front two bolts are AN4-13A).

Washer, AN960-10 (4 pcs)
Locknut, AN365-428A (4 pcs)

## Alternative Nose Gear Installation
## Fig. 13:D:1b

Nose Gear, 432-0005 for the retractable gear*
( includes the fork )

Over-center link arms
433-0001 ~~4721~~ (2 pcs)

Washer, AN960-516 (2 pcs)
Locknut, AN363-524

Tow Bar Plate TB-1-03

Fork

* Note: The part number for the fixed gear's nose gear is 432-0002.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# REVISION LIST

# CHAPTER 14: CENTER CONSOLE

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 14-1 | 0/02-15-02 | None | Ccurrent revision is correct |
| 14-2 | 1/09-18-02 | R&R | Part # correction |
| 14-3 through 14-7 | 0/02-15-02 | None | Current revision is correct |
| 14-8 | 1/09-18-02 | R&R | Corrected Fig.14:C:1 |
| 14-9 through 14-12 | 0/02-15-02 | None | Current revision is correct |
| 14-13 | 1/09-18-02 | R&R | Corrected Fig.14:G:1 |
| 14-14 | 0/02-15-02 | None | Current revision is correct |
| | | | |
| 14-2 | 2/06-30-04 | R&R | Added instructions and photo. |
| 14-8 | 2/06-30-04 | R&R | Corrected seat belt alignment piece. |
| 14-12 | 2/06-30-04 | R&R | Added instructions and two photos. |
| | | | |
| 14-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 14-1 | 3/12-15-04 | R&R | Updated parts list. |
| 14-6 | 3/12-15-04 | R&R | Added text dexcribing vertical clearance. |
| 14-12 | 3/12-15-04 | R&R | Corrected template by adding measurements. |
| 14-13 | 3/12-15-04 | R&R | Updated rivets. |
| | | | |
| 14-1 thru 14-7 | 4/09-30-06 | R&R | Updated drawings for new center console. |
| 14-10 | 4/09-30-06 | R&R | Removed dump valve cover |
| 14-11 thru 14-14 | 4/09-30-06 | R&R | Updated drawings and photos for new center console. |


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# Chapter 14: Center Console

Contents



## 1. INTRODUCTION

The center console serves several different functions. It is an arm rest, it supports the seats, it supports the instrument panel, and many others. The fuel selector valve installs in the console. It also contains a glove box. The pages with changes reflect drawings or photos of the new console.

Keep in mind when assembling the cockpit section that as much as possible we are trying to seal from the outside. The center console and the seats are intended (as much as possible) to seal the cockpit from the air that enters the gear well. The barrier from the elements is formed by the seat pan and the center console.

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **CENTER CONSOLE** | | | | |
| 1) | 4029 | 1 | Center Console | |
| 2) | 4029-01 | 1 | Access Panel, Left | |
| 3) | 4029-02 | 1 | Access Panel, Right | |
| 4) | 4029-03 | 1 | Glove Box Closeout | |
| 5) | 4040 | 1 | Center Seat Belt Reinforcement | |
| 6) | 4905 | 1 | Glove Box Cover | |
| 7) | MS20001 | 1’ | Hinge, Piano 1’ | |
| 8) | K1000-08 | 3 | Nutplate | |
| 9) | AN426A3-4 | 18 | Rivets | |
| 10) | MS24693-S51 | 3 | Screws, Machine | |
| **FORWARD ACCESS PANEL** | | | | |
| 1) | K1000-08 | 8 | Nutplate | |
| 2) | AN426A3-5 | 16 | Rivets | |
| 3) | AN525-832-R6 | 8 | Screw, Pan Head | |
| **DUMP VALVE MOUNTING** | | | | |
| 1) | 4830 | 1 | Guard, Dump Valve Mounting | **Yes |
| 1) | AN837-4D | 1 | Fitting, Bulkhead | |
| 2) | AN822-4D | 1 | Fitting, Elbow | |
| 3) | AN826-4D | 2 | Fitting, Tee | |
| 4) | AN818-4D | 2 | Nut | |
| 5) | AN924-4D | 1 | Nut, Check | |
| 6) | AN819-4D | 2 | Sleeve | |
| 7) | B-42XHF2-BKB | 1 | Valve, Dump | |
| 8) | AN960-916 | 1 | Washer, Flat | |
| **FUEL SELECTOR VALVE** | | | | |
| 1) | 3K146 | 4 | Bolt, Allen | **Yes |
| 1) | AN3-3A | 4 | Bolt, Undrilled | |
| 2) | K1000-3 | 4 | Nutplate | |
| 3) | MSC-34 | 8 | Rivets, Pop | |
| 4) | EFS 25-2-2B-M | 1 | Valve, Fuel Selector for Lycoming 540 | **Yes |
| 5) | EFS25-20D2-4B2M | 1 | Valve, Fuel Selector for Continental 550 | **Yes |
| 6) | AN960-10 | 4 | Washer, flat | |



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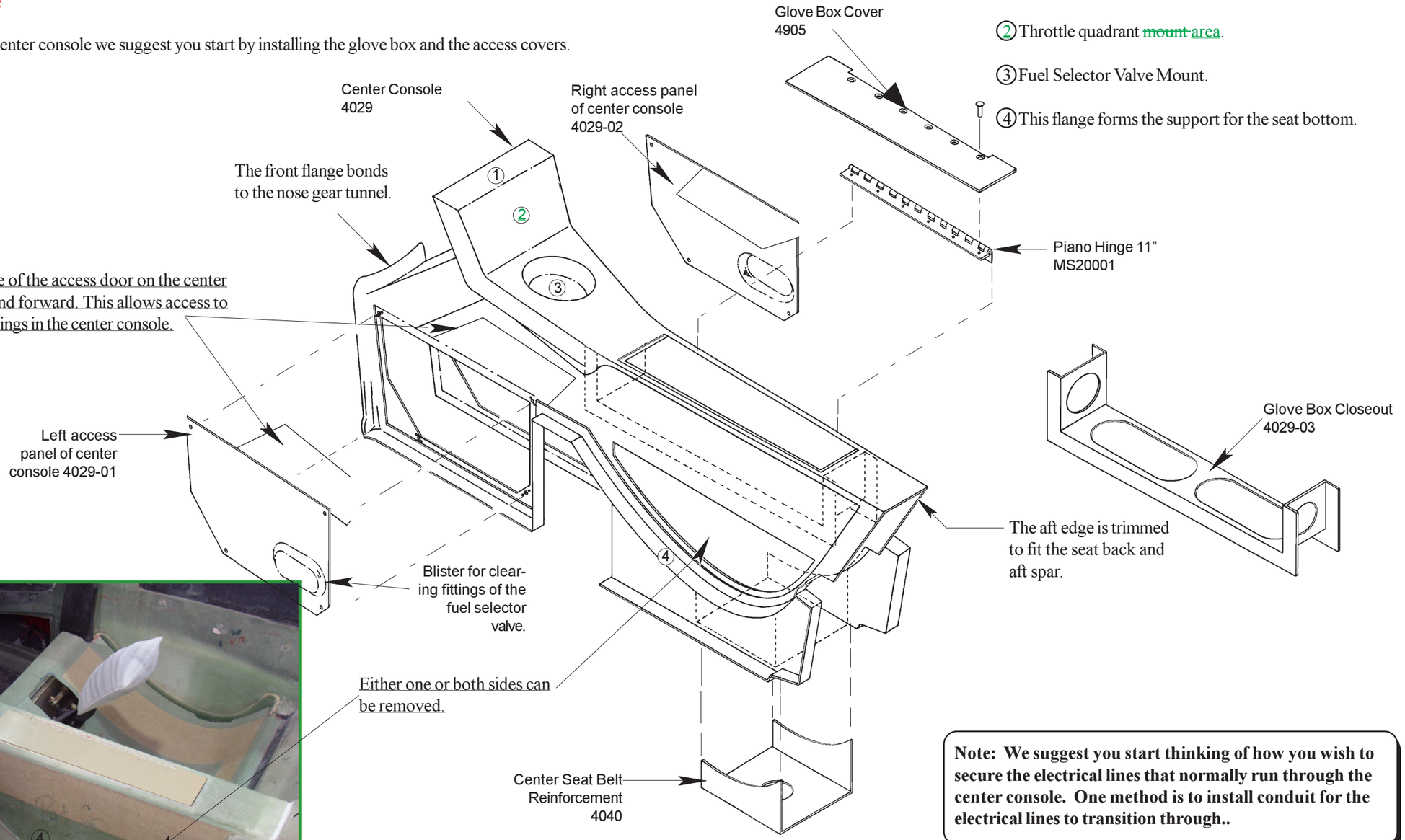
# 3. CONSTRUCTION PROCEDURE

## A. Center Console

Prior to installing the center console we suggest you start by installing the glove box and the access covers.

**Center Console Exploded View**
**Fig 14:A:1**



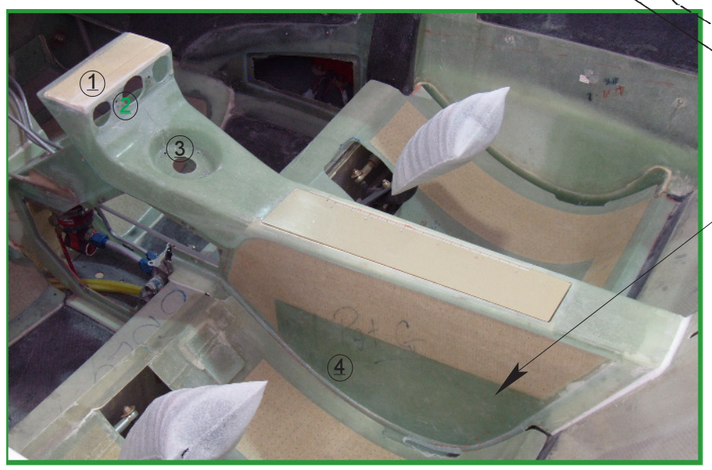

**L E G E N D**

① The upper horizontal surface supports the instrument panel.

② Throttle quadrant ~~mount~~ area.

③ Fuel Selector Valve Mount.

④ This flange forms the support for the seat bottom.




**Note: We suggest you start thinking of how you wish to secure the electrical lines that normally run through the center console. One method is to install conduit for the electrical lines to transition through..**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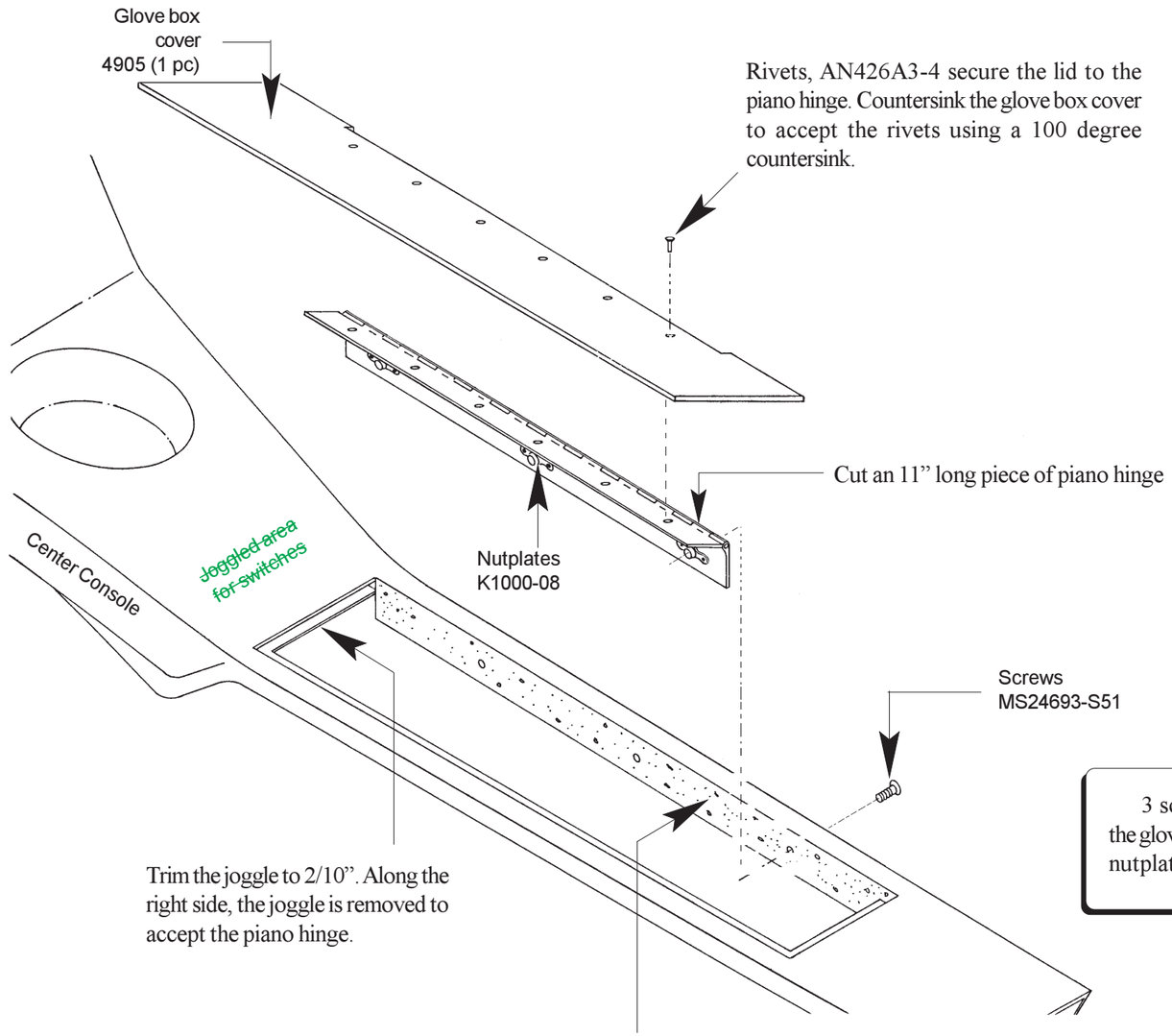
## Glove Box

You don't have to install the glove box, however, if there is room, we find it real handy. All parts except the latch are included in the kit. KCI carries a Hartwell latch that works. In selecting a latch, consider how you plan to finish the glove box. Some options are covering the lid with upholstery or a nice wood laminate. Here is your chance to be creative!

**Glove Box Exploded View**
**Fig. 14:A:2**



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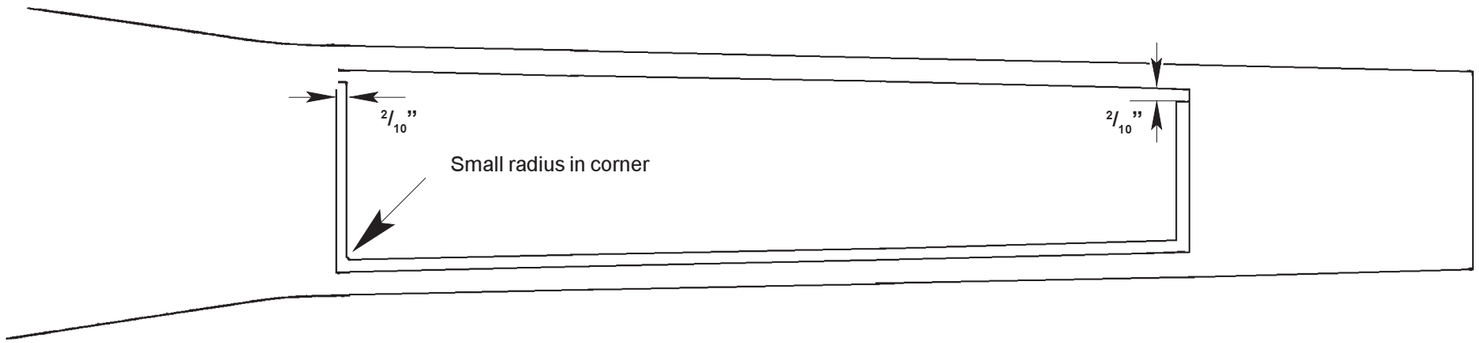
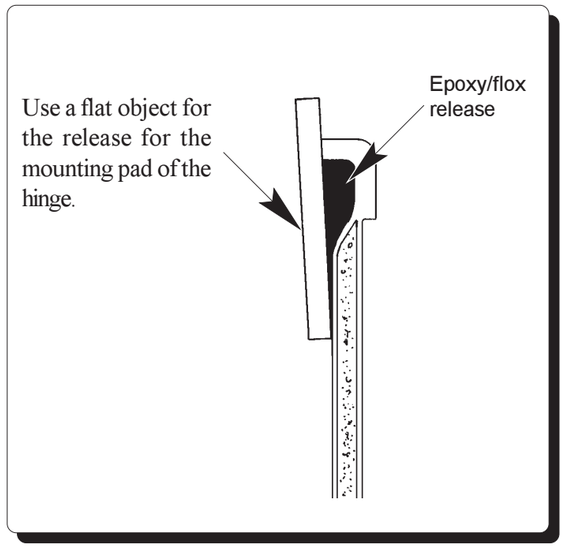
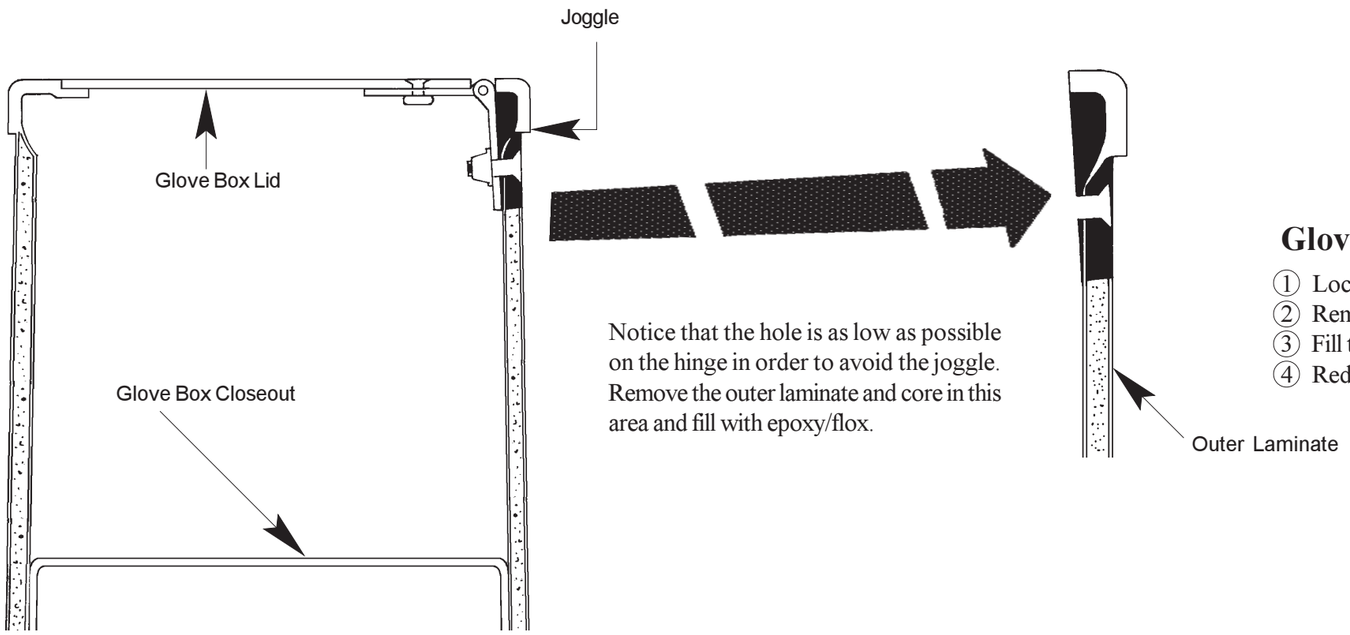
**Glove Box Cross Sections**
**Fig. 14:A:3**




## Glove Box Lid

1. Locate and drill the hole.
2. Remove the outer laminate and core around the hole.
3. Fill the section with epoxy/flox.
4. Redrill the hole and countersink for screw.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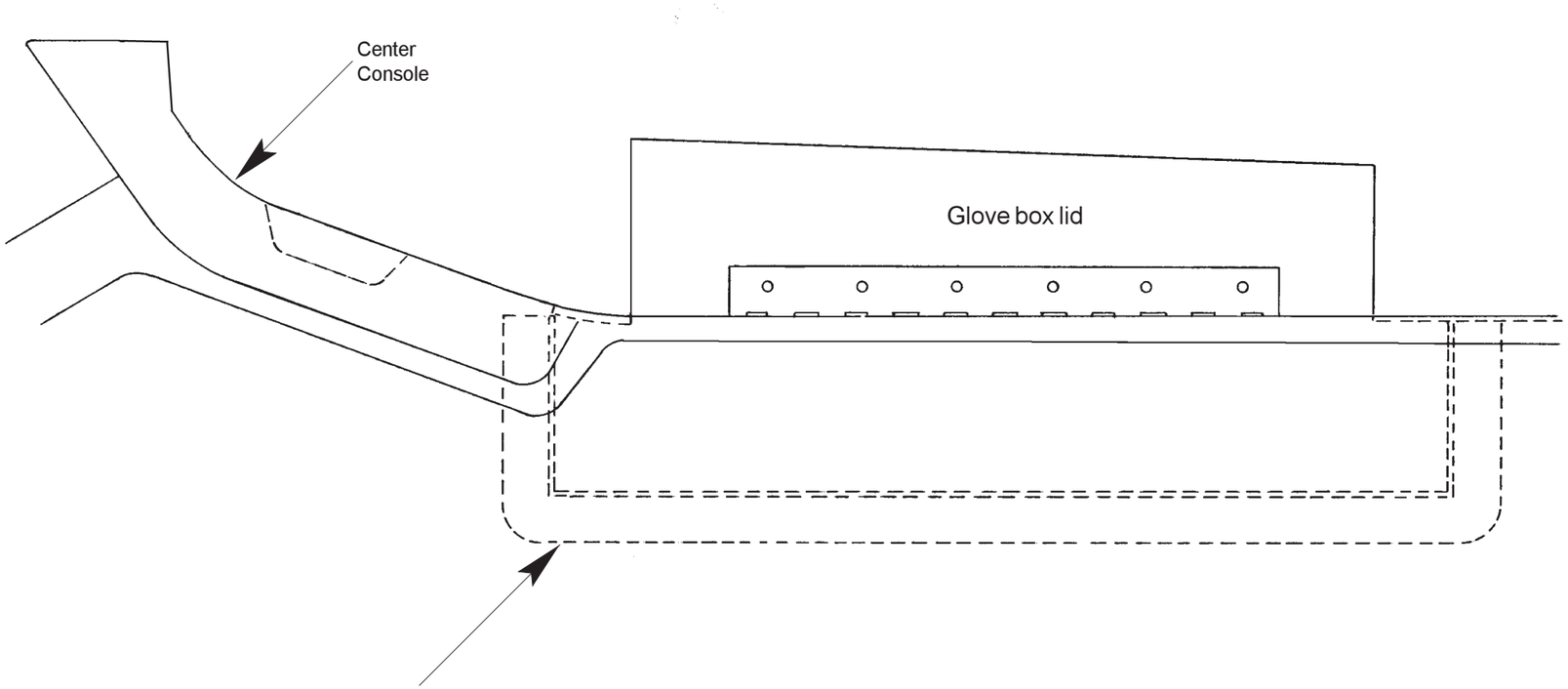
**Glove Box Closeout Installation**
**Fig. 14:A:4**




Center the Glove box closeout on the opening. Bond in place using epoxy/flox.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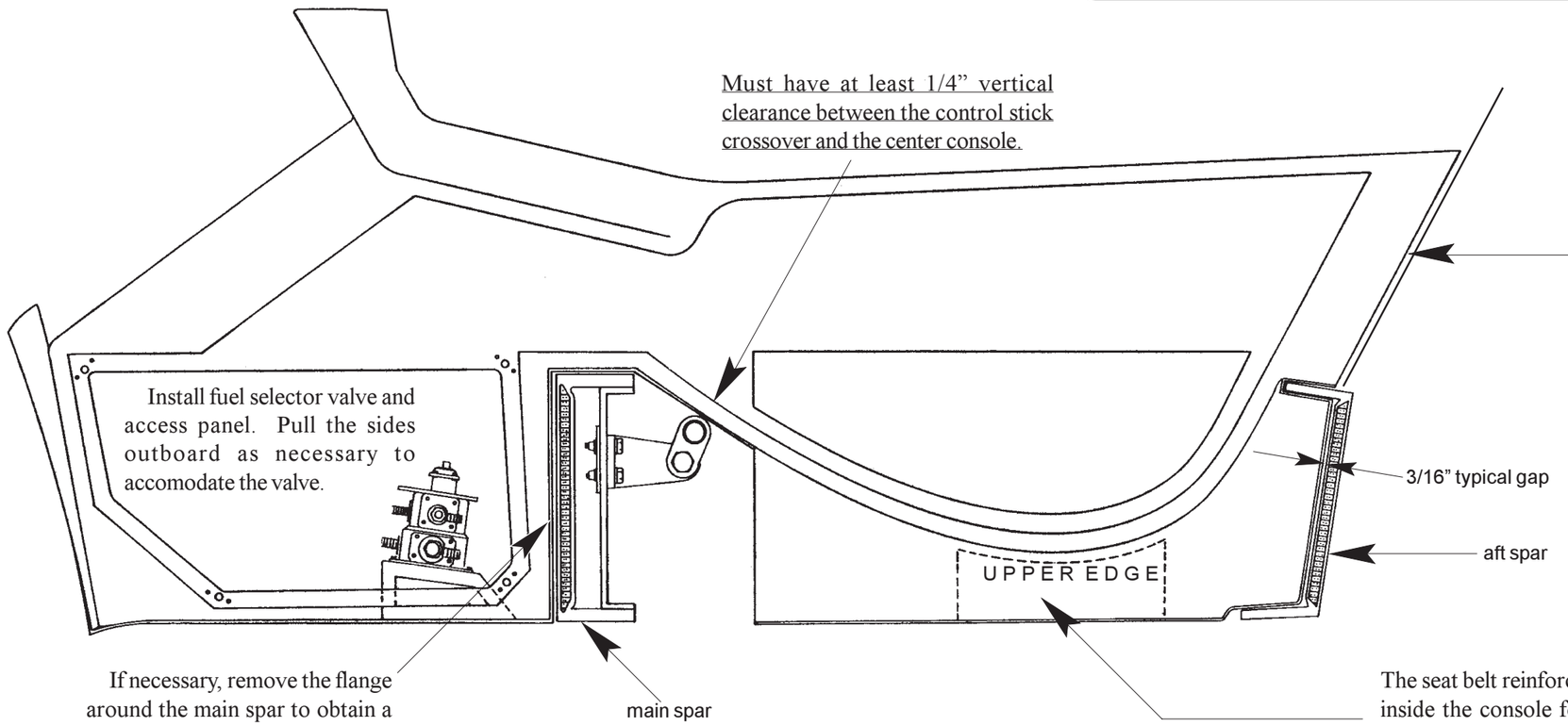
## B. Fitting the Center Console

Fitting the center console is a gradual process of installing-removing-trimming (repeat) to get a nice fit. When installing the center console the aft end is installed into the aft spar and then the front is lowered in place. At first it will probably not even fit down in between the spars until some material is trimmed off the aft end where it fits up against the seat back. Carefully trim the center console as you obviously want a nice fit. The center consoles are built with an allowance for variation from aircraft to aircraft. You may see 3/16" gap between the nose gear tunnel and console and a similar amount between the aft end and the aft spar. The fuel selector valve should be mounted for fitting the center console. Also install the access panels. This will insure that the fuel selector valve will fit inside the console.

**Fitting Center Console (and Seat Belt Attachment)**
**Fig. 14:B:1**

**Note: Remove the hydraulic lines that run through center console for this step.**





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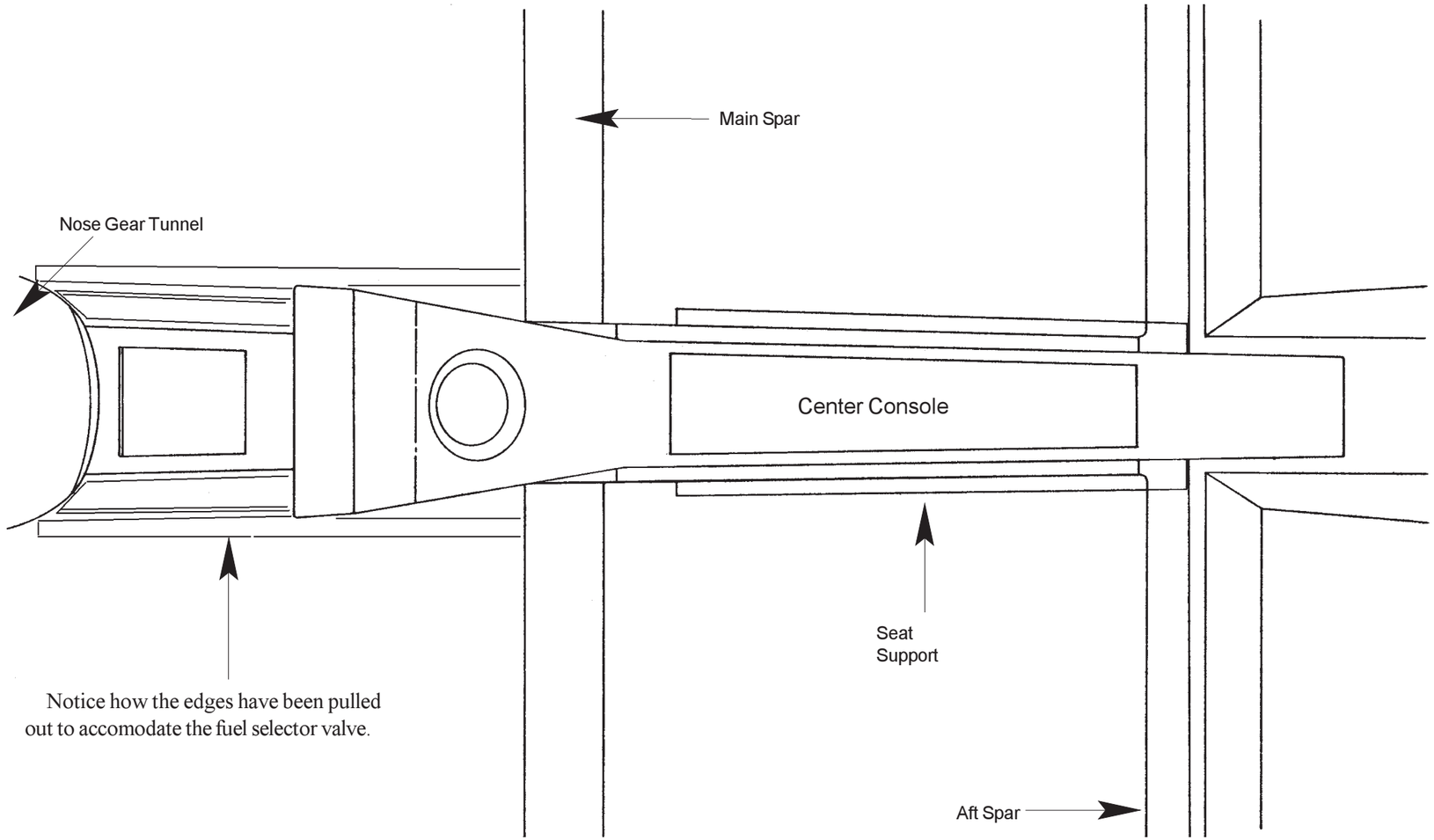
**Fitting Center Console**
**Fig. 14:B:2**





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## C. Seat Belt Reinforcement

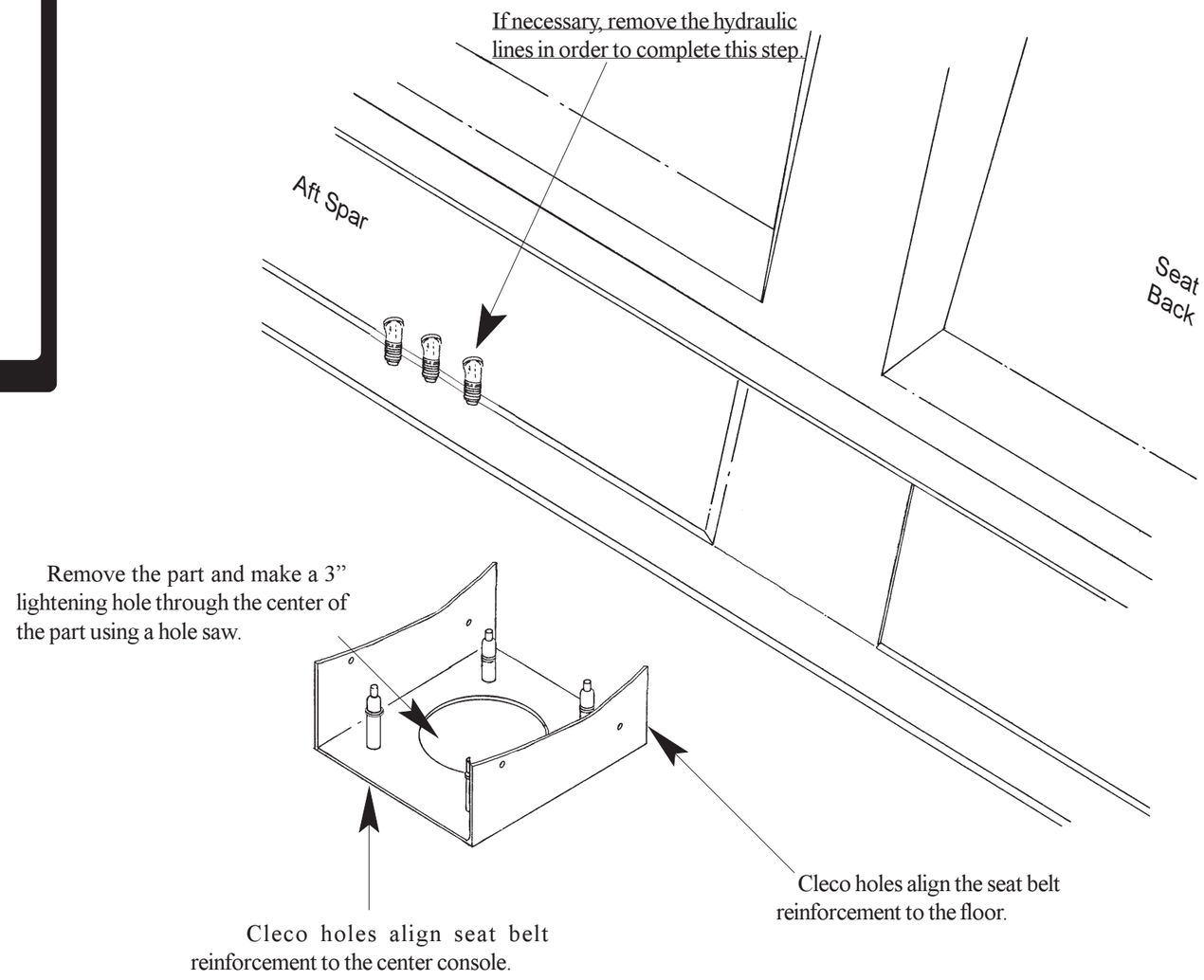
Once the center console and the seat belt reinforcement are aligned:

1. Drill cleco alignment holes through the center console into seat belt reinforcement.

2. Drill cleco holes through the seat belt reinforcement into the floor.

The outboard faces of the seat belt reinforcement will bond to to the center console. Refer to section H.

**Bonding Seat Belt Reinforcement**
**Fig. 14:C:1**





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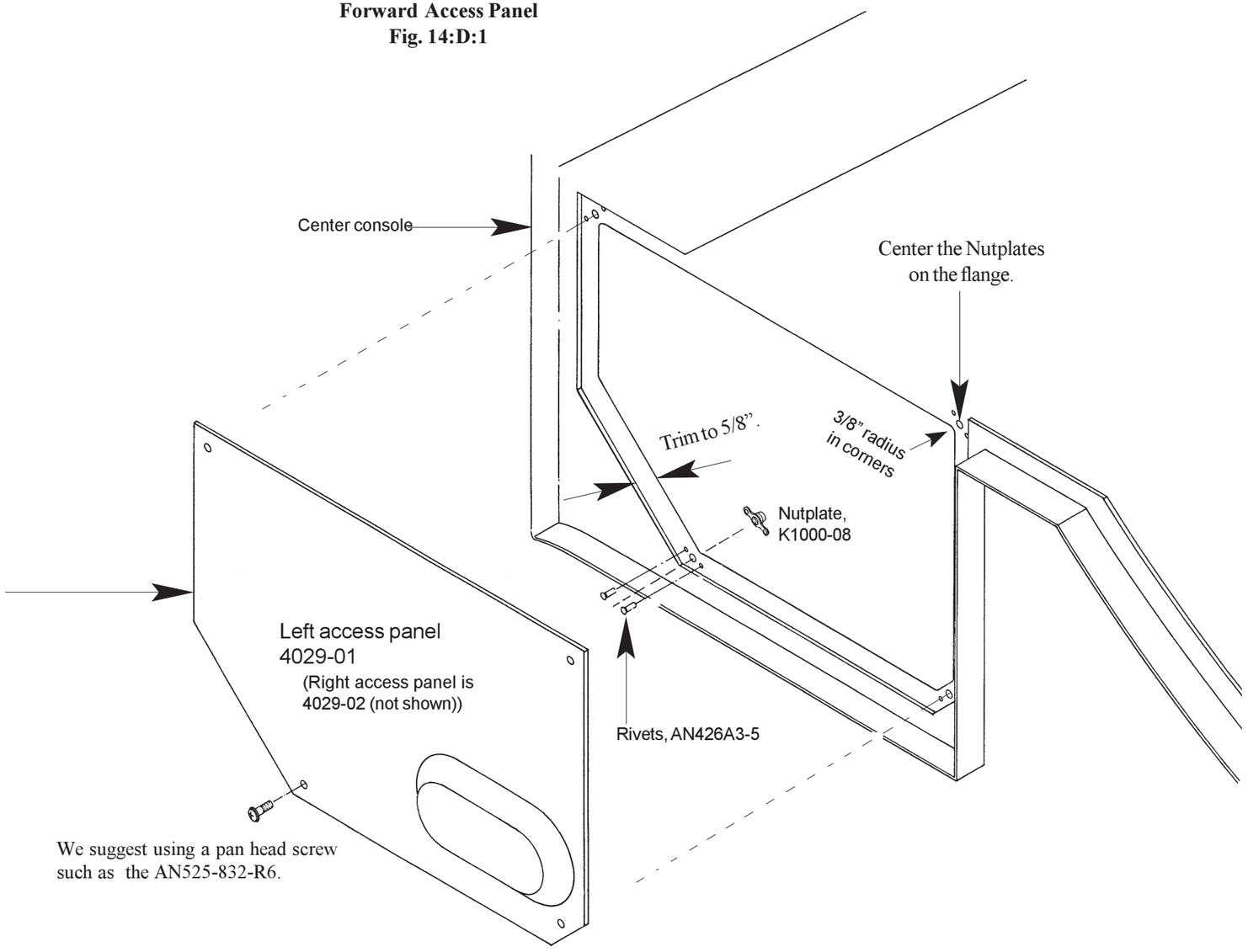
## D. Forward Access Panel

The forward access panel of the center console allows easy access to the fuel boost pump, marker beacon antenna and the fuel selector valve.

**Forward Access Panel**
**Fig. 14:D:1**




Fit the forward access panel so it fits nicely into the joggle. Exactly how much to trim largely depends on personal preference and how you plan to finish the panel. For example if you plan to wrap the panel with leather, you should trim the panel to get 1/8" clearance all around. You may want to simply trim to an exact fit for now and trim as required later during upholstery.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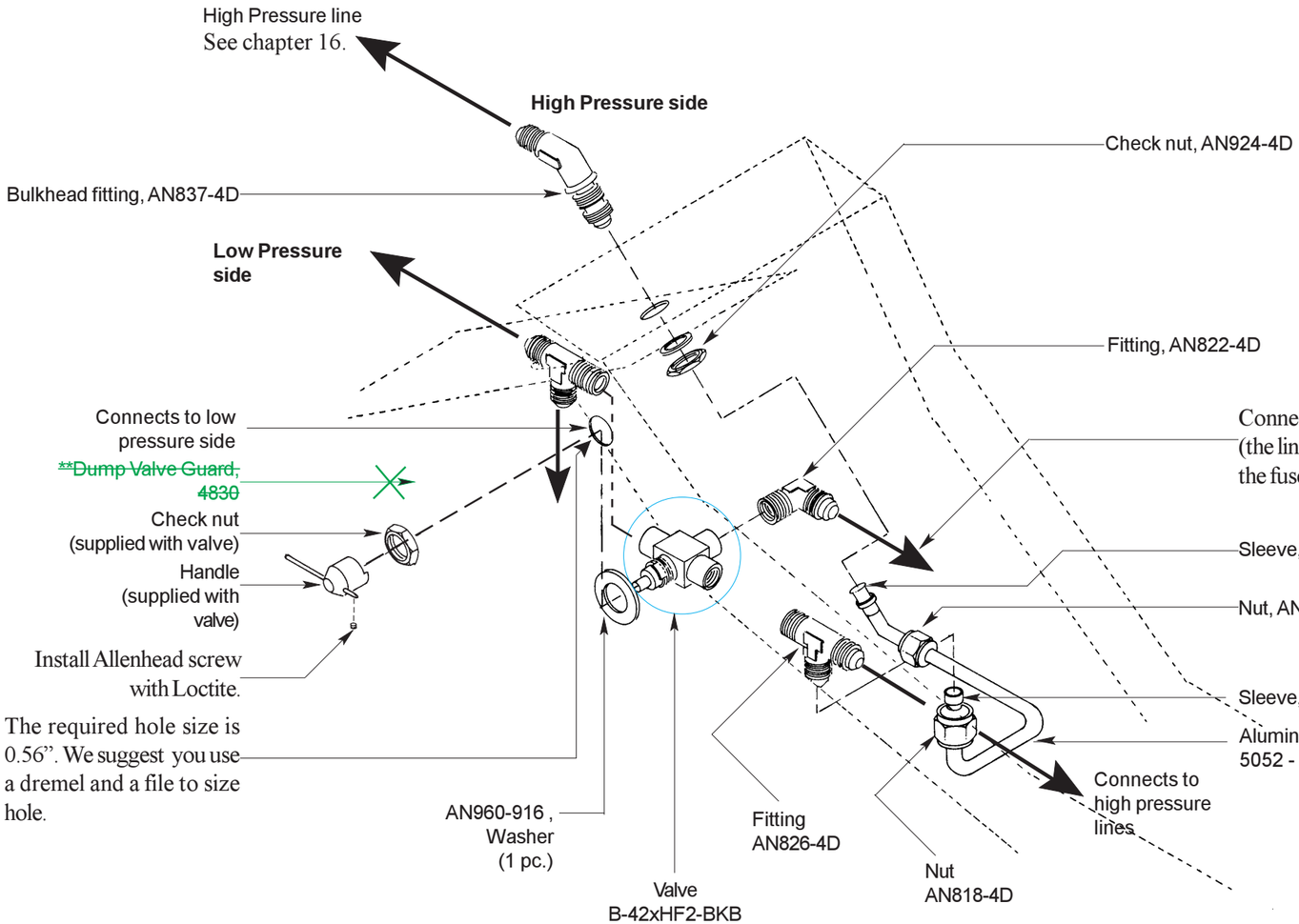
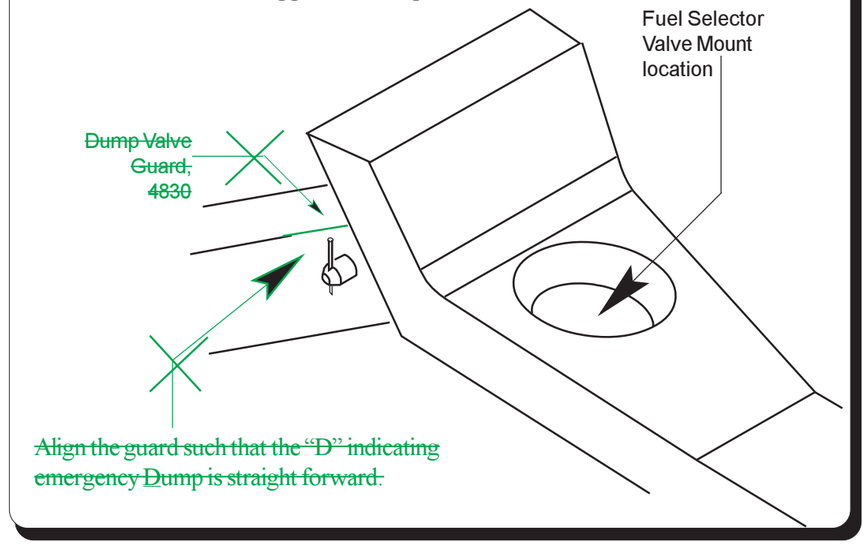
## E. Dump Valve Mounting

**Dump Valve Mounting**
**Fig. 14:E:1**




**Suggested Dump Valve Guard**




The dump valve mounts in the center console by your right knee. The dump valve allows emergency gear extension by opening all ports. Note that the valve has two positions. It is either all open or all closed. In normal operation, all ports are closed.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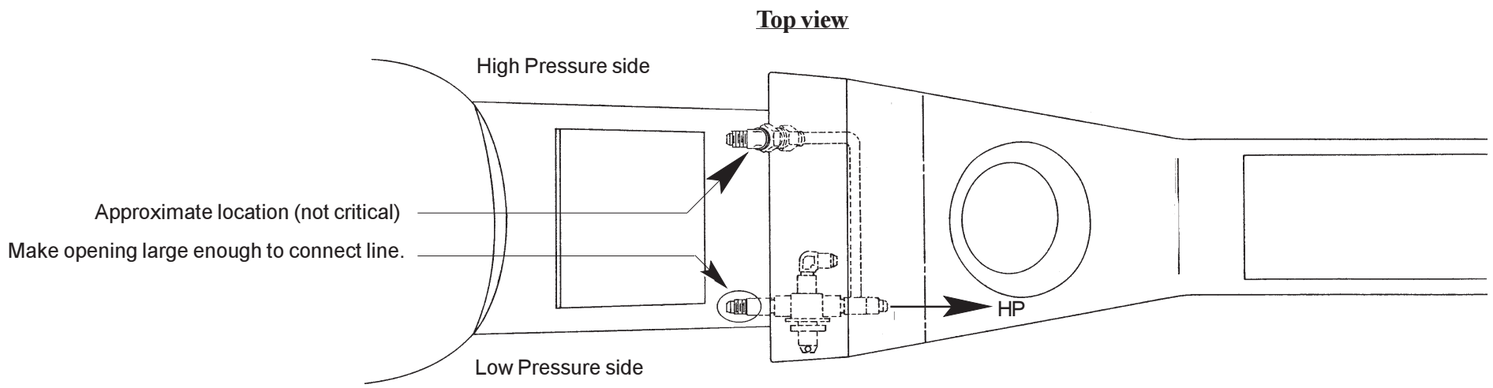
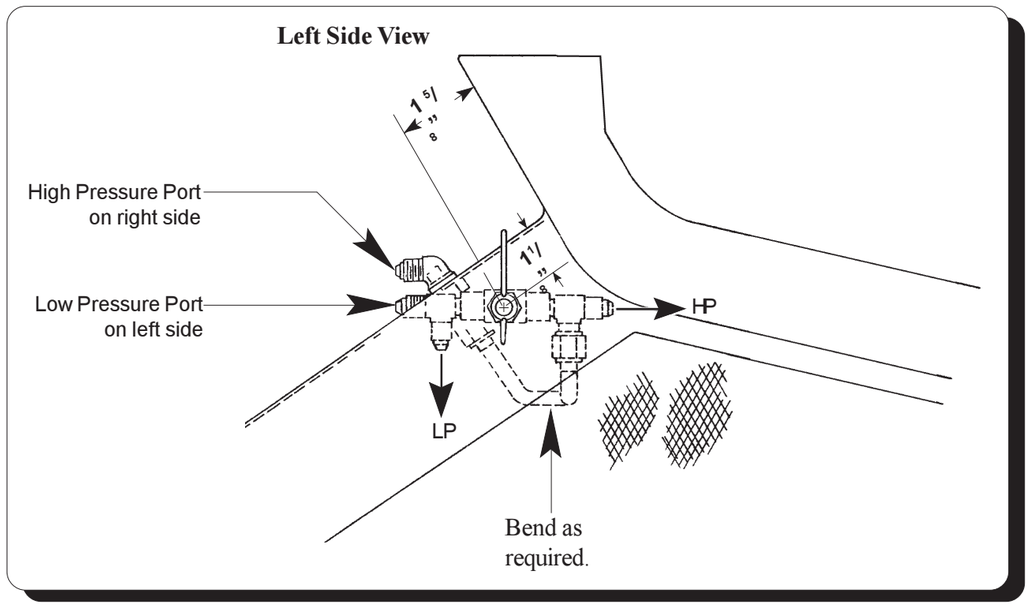
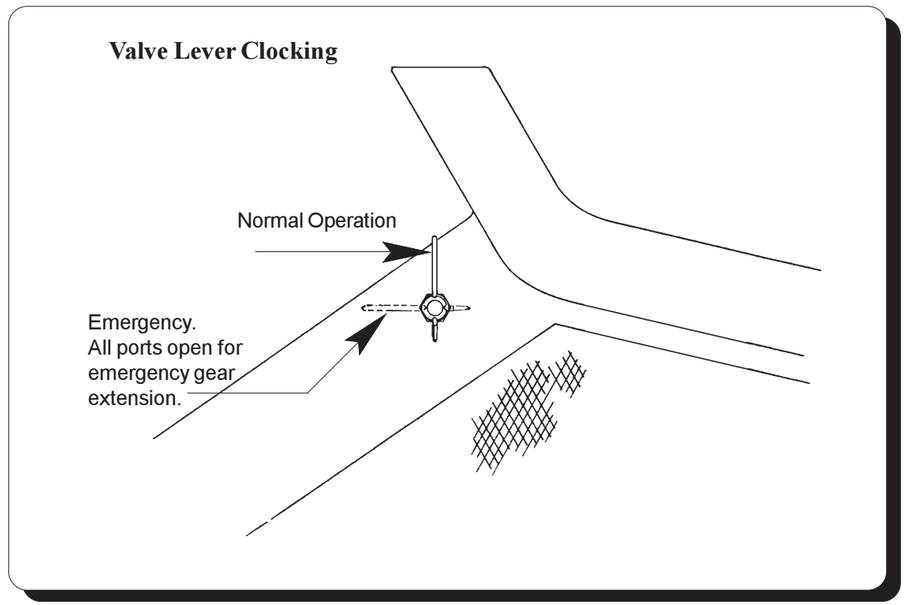
**Dump Valve Location**
**Fig. 14:E:2**





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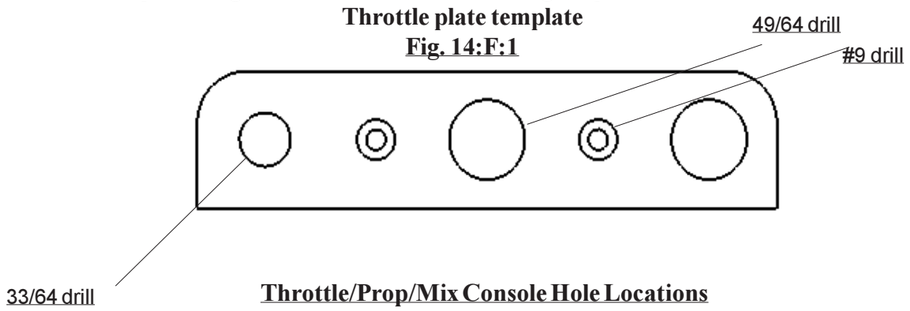
# F. Throttle - Prop - Mix

The throttle, propeller and mixture controls mount in the center console.

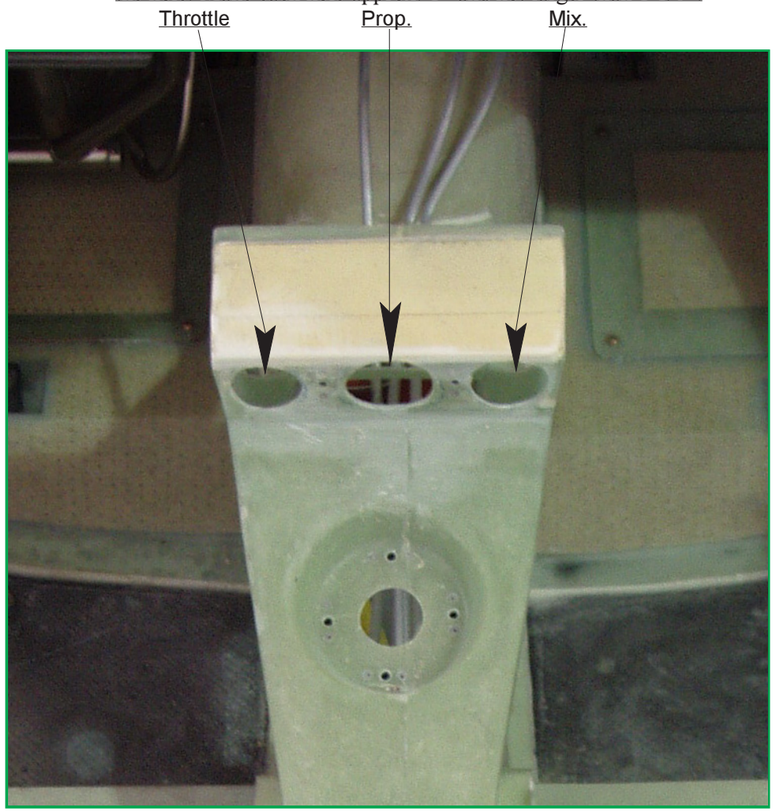
**F 1.** Create a throttle plate using 1/8" aluminum and the following template.

**Throttle plate template**
**Fig. 14:F:1**




**Throttle/Prop/Mix Console Hole Locations**
**Fig. 14:F:1**

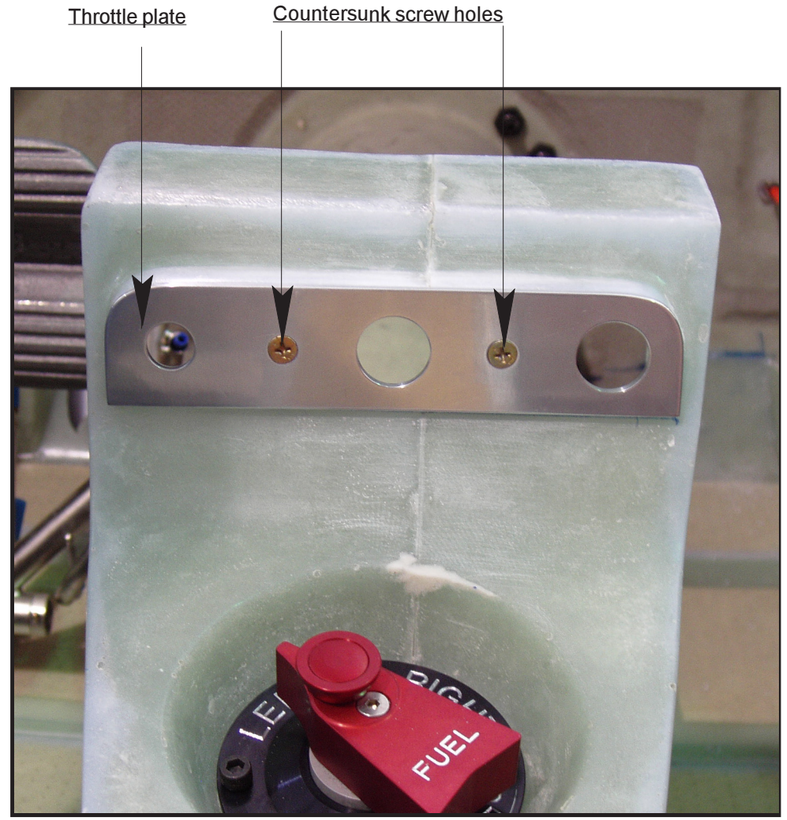
The hole sizes need to be large enough to fit the large nuts on the control rods through the hole. Make each hole approx. 1" and not larger than 1 1/8".




**F 2.** Drill holes in the center console using the throttle plate you created as a location template. See Figure 14:F:1.

**F 3.** Install the throttle plate as shown in Figure 14:F:2. Use screws MS24694-S5 to install the throttle plate to the center console.

**Installed Throttle Plate**
**Fig. 14:F:2**





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## G. Fuel Selector Valve Handle

The fuel selector valve handle mounts in the recessed area in the center console. In this section you will install the handle. It is very important that you properly align the handle to the fuel selector.

There are several slightly different variations of the spindle (the tube extending from the handle) but in principle they all work the same. In some of the earlier versions the spindle was not attached to the handle. Later version are attached and the most recent styles have a "U" joint to account for misalignment between the handle and the valve. It is important that you understand how the system works to properly install the handle. If you haven't already done so play with the fuel selector itself and understand its operation. As you turn the selector blow on the different ports to see how it works. Also read the manufacturer's instructions.

**G 1.** Drill a 5/8" diameter hole centered in the mounting area. Drop the handle into place. Observe how the spindle fits into the selector valve. The spindle should align quite well to the selector valve. If there is a large angular difference between the spindle and the valve use shims (washers) underneath the fuel selector valve to align it better. It may also be necessary to trim the length of the spindle.

NOTE: THE SPINDLE KEY (THE LOWER PORTION OF THE SPINDLE WITH THE GROOVE) MUST INSERT A MINIMUM OF ½" INTO THE FUEL SELECTOR VALVE.

**G 2.** Disconnect the fuel line at the fuel pickup at each of the two wings.

**G 3.** Disconnect the fuel line at the gascolator (or anywhere downstream of the fuel selector valve).

**G 4.** Move the fuel selector to the left position. Note that the fuel selector valve has a positive detent in the LEFT position, in the RIGHT position, and in the OFF position. When the fuel selector valve is operating properly you must be able to positively feel the detent.

**G 5.** With the fuel selector valve in the left position blow through the fuel line that you disconnected at the left wing. Have a helper check that air is exiting at the gascolator and that there is no air exiting at the right wing.

**G 6**. Repeat for the right tank.

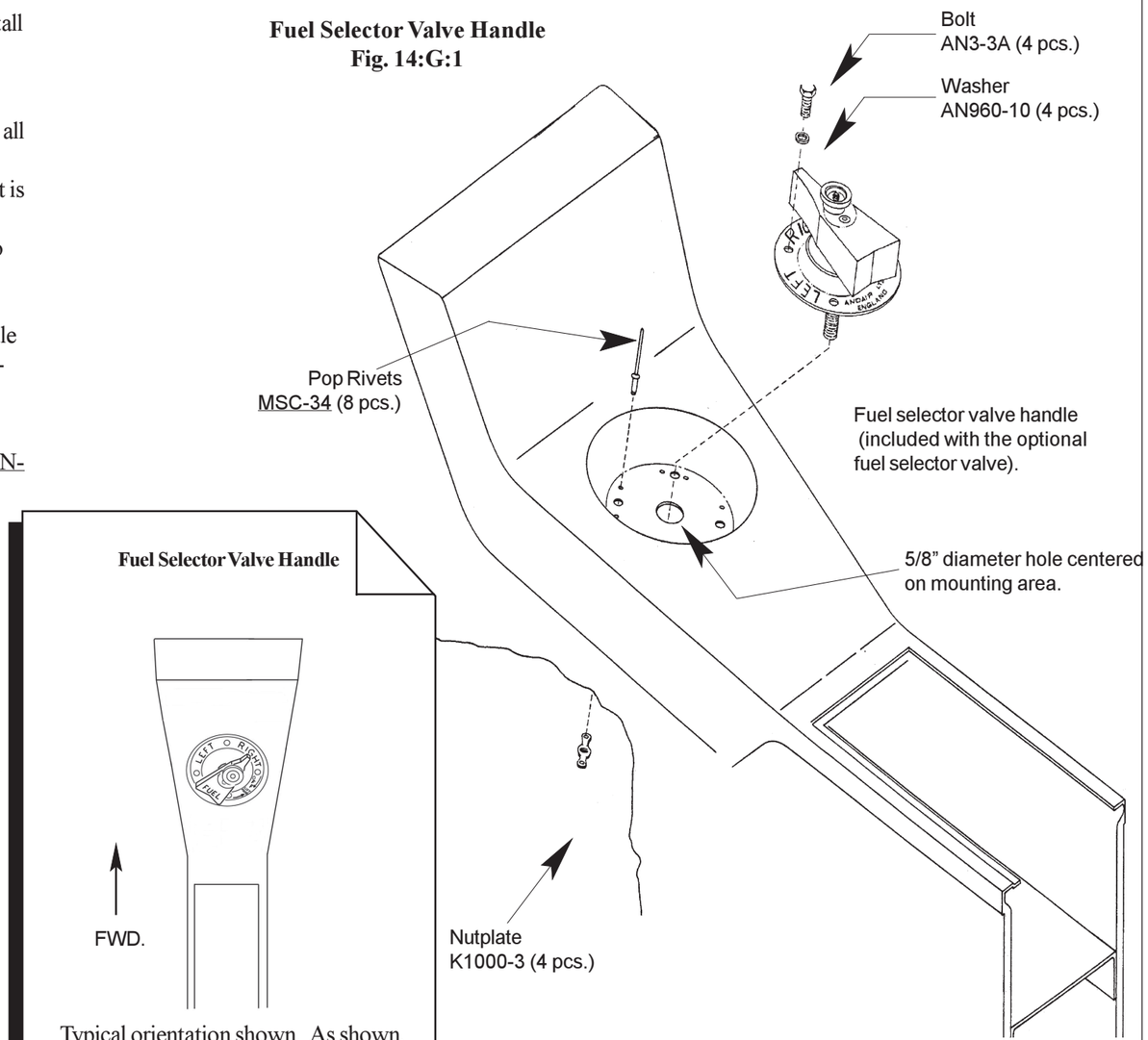
**G 7.** With the fuel selector valve in the OFF position attempt to blow through the fuel lines from both the LEFT and the RIGHT wing. You should not be able to blow any air through the lines.

**G 8.** Mount the fuel selector valve handle accordingly.

Depending on the clocking of fuel selector handle to fuel selector the actual orientation of the fuel selector handle may vary. All recent fuel selector valves for both the Lycoming and the Continental are clocked such that the LEFT tank position is 45 deg. off to the left side. The RIGHT tank will be 45 degrees off to the right side. The OFF position will be at approx. 4 o'clock.

RUN THE ENGINE ON THE GROUND WITH THE FUEL SELECTOR VALVE AT HIGH POWER SETTINGS IN BOTH THE LEFT AND THE RIGHT TANK POSITIONS PRIOR TO FLIGHT.

**Fuel Selector Valve Handle**
**Fig. 14:G:1**




Typical orientation shown. As shown, the fuel selector valve handle is positioned such that left is 45° to the left and right is 45° to the right.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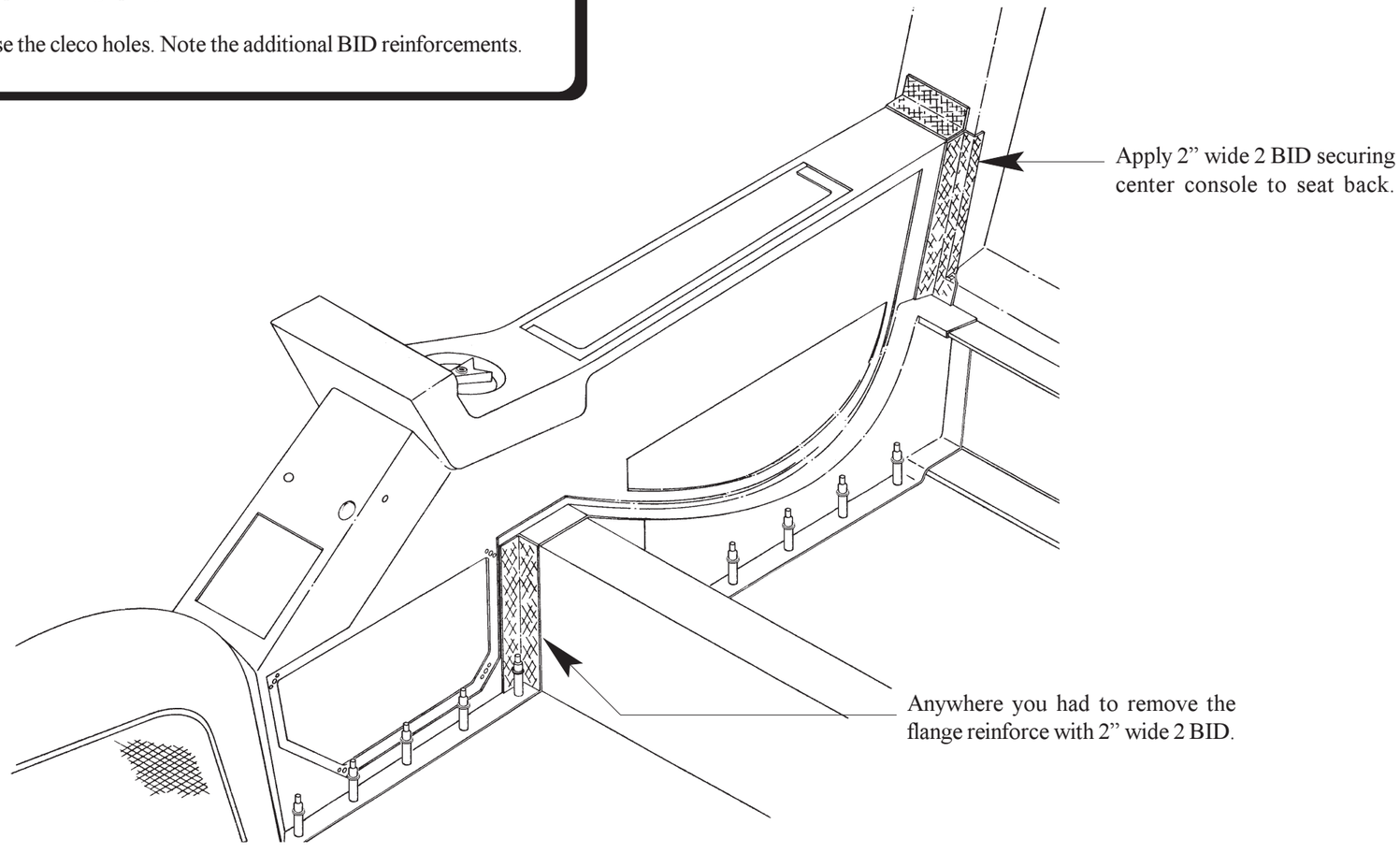
## H. Center Console Bonding

Bond the center console in place using epoxy/flox.

For alignment be sure to use the cleco holes. Note the additional BID reinforcements.

**Center Console Bonding**
**Fig. 14:H:1**





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# REVISION LIST

# CHAPTER 15: SEATS AND SEAT BELTS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 15-1 through 15-6 | 0/02-15-02 | None | Current revision is correct |
| 15-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 15-3 | 3/12-15-04 | R&R | Updated instructions. |


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# Chapter 15: Seats & Seat Belts

Contents



## 1. INTRODUCTION

The standard Legacy seat belt system is a 3-point harness. It consist of a lap belt and a shoulder harness. The lap belt bolts to a reinforced section of the inboard rib. The shoulder harness secures to a hardpoint in the ceiling of the baggage compartment.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **FITTING SEAT PAN** | | | | |
| 1) | 4024-01 | 1 | Seat Support, Left Center | |
| 2) | 4024-02 | 1 | Seat Support, Right Center | |
| 3) | 4027-01 | 1 | Outboard Seat Support, Left | |
| 4) | 4027-02 | 1 | Outboard Seat Support, Right | |
| 5) | 4033-01 | 1 | Seat Pan, Left | |
| 6) | 4033-02 | 1 | Seat Pan, Right | |
| **INSTALLING SEAT BELTS** | | | | |
| 1) | AN6-10A | 4 | Bolt, Undrilled | |
| 2) | 1106-01 | 2 | Lap Belt | |
| 3) | AN365-624A | 6 | Nut, Nylock | |
| 4) | MS24694-S199 | 2 | Screw, Machine | |
| 5) | 1106-02 | 2 | Shoulder Harness | |
| 6) | AN960-616 | 16 | Washer, Flat | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**




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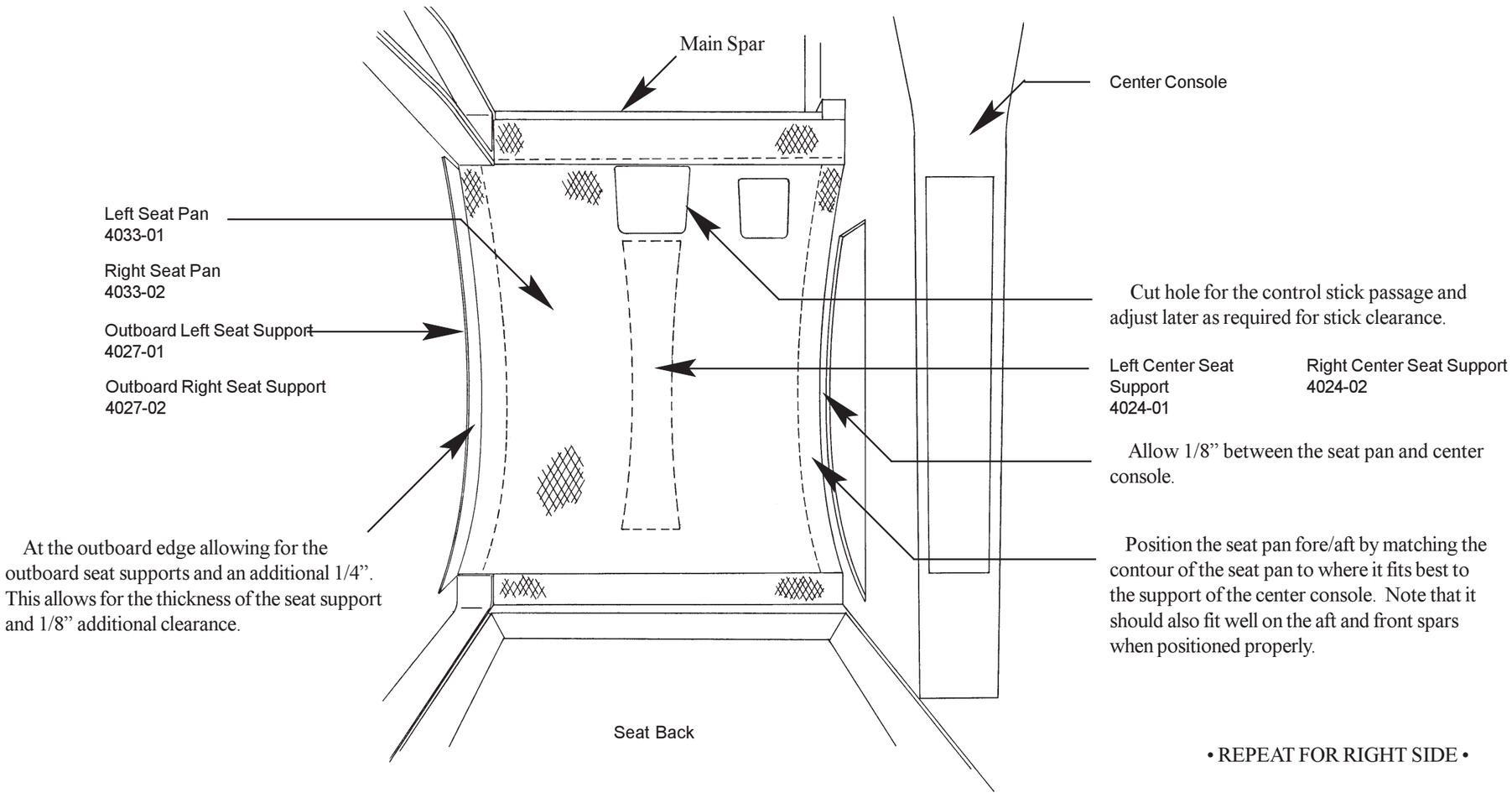
# 3. CONSTRUCTION PROCEDURES

## A. Fitting the Seat Pans

**A 1.** The seat pans have scribe lines to and in the fitting process. Start by triming 1/8" outside the scribe lines and custom fit following the instructions.

**Fitting Seat Pans**
**Fig. 15:A:1**




• REPEAT FOR RIGHT SIDE •



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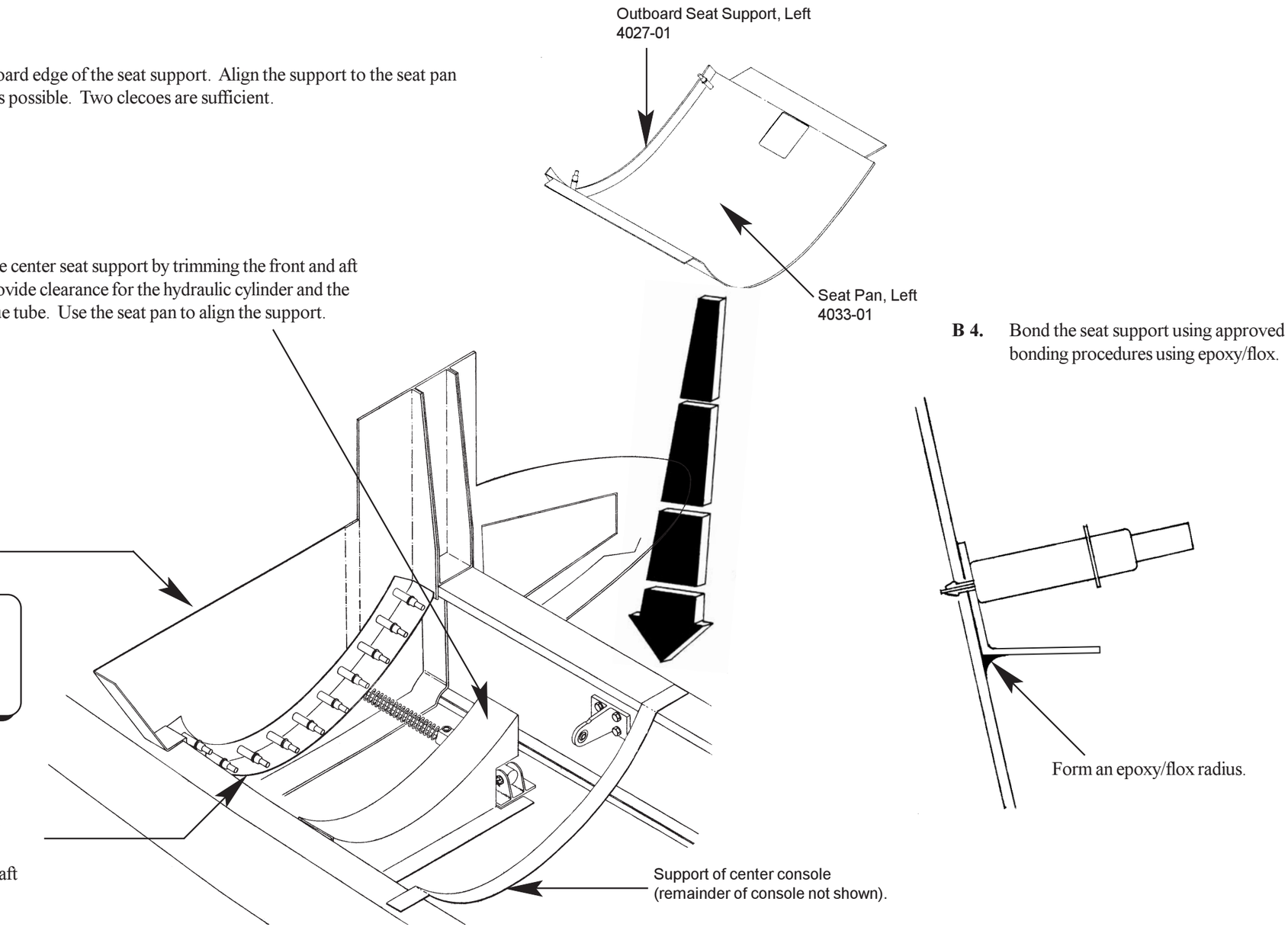
## B. Outboard Seat Supports

**Installing Outboard Seat Supports**
**Fig. 15:B:1**




**B 1**. Cleco the seat support to the outboard edge of the seat support. Align the support to the seat pan by matching the contours as best as possible. Two clecoes are sufficient.

**B 2.** Fit the center seat support by trimming the front and aft to provide clearance for the hydraulic cylinder and the torque tube. Use the seat pan to align the support.

**WARNING:**

**DO NOT DRILL CLECO HOLES THROUGH THE SPARS!**

**B 3.** Fit and trim the outboard support. Start by aligning the seat pan to the three supports. Once aligned, cleco the seat support to the aft closeout rib.

**B 4.** Bond the seat support using approved bonding procedures using epoxy/flox.



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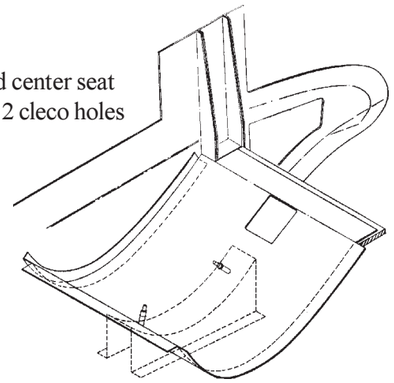
## C. Center Seat Supports

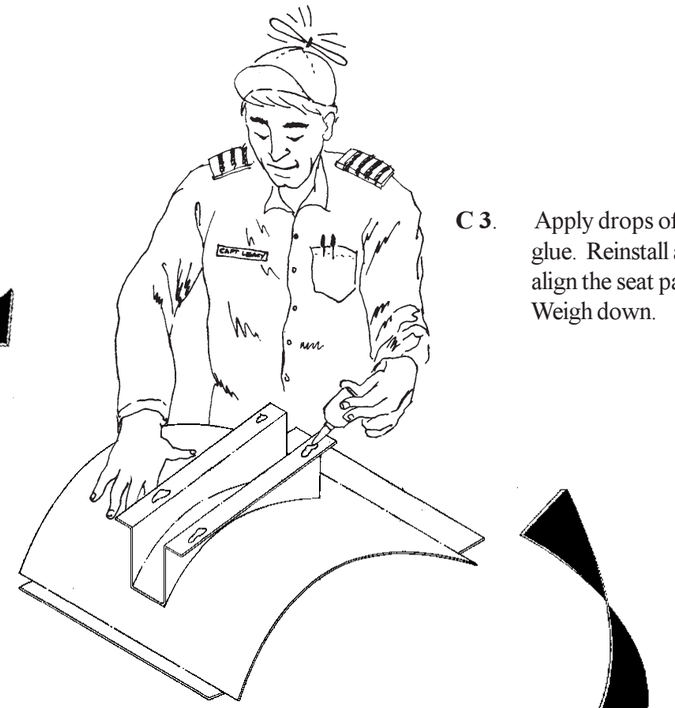
**Center Supports**
**Fig. 15:C:1**

**C 1.** With the seat pan and center seat support aligned, drill 2 cleco holes through the seat pan.

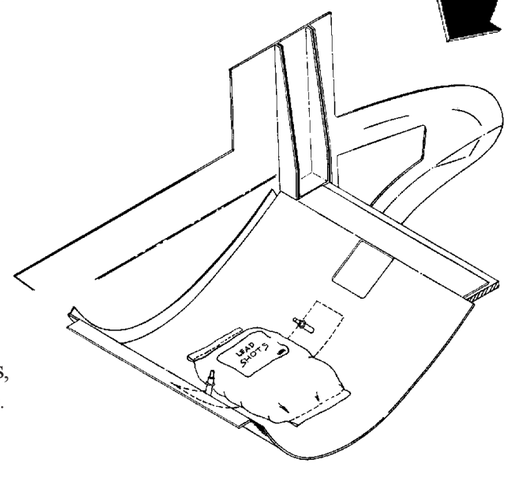


**C 2.** Remove seat pan and

turn upside down (don't remove clecoes yet).



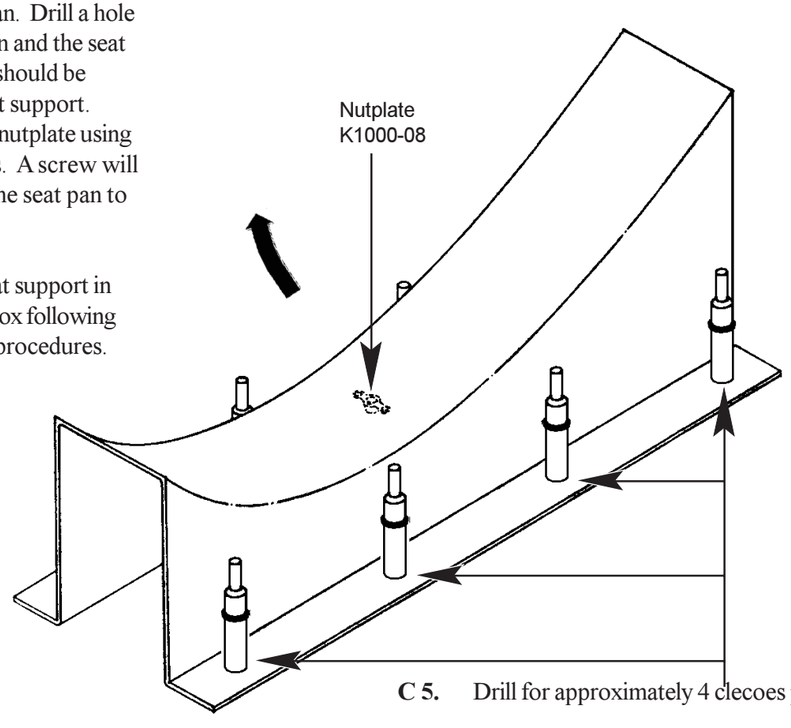

**C 3.** Apply drops of instant glue. Reinstall and align the seat pan. Weigh down.




**C 4.** Remove the two clecoes, weight bag and seat pan.

**C 6.** Reinstall the seat pan. Drill a hole through the seat pan and the seat support. The hole should be centered on the seat support. Install a K1000-08 nutplate using MSC-32 pop rivets. A screw will be used to secure the seat pan to the seat support.

**C 7.** Bond the center seat support in place using epoxy/flox following approved bonding procedures.




**C 5.** Drill for approximately 4 clecoes per side.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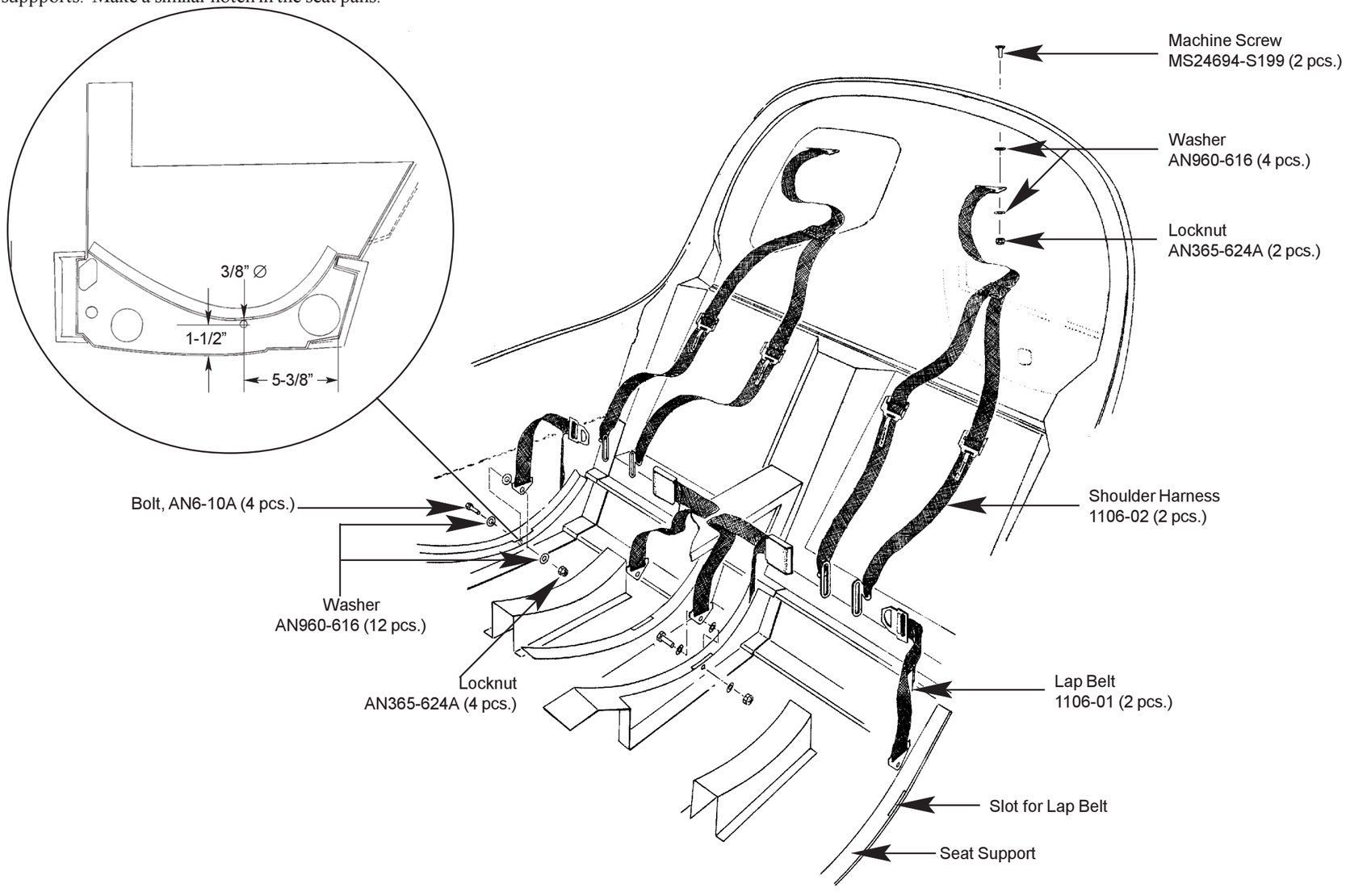
## D. Installing the Seat Belts

Install the seat belts using the hardware shown. Note the slots for the lap belts in the seat suppports. Make a similar notch in the seat pans.

**Installing Seat Belts**
**Fig. 15:D:1**



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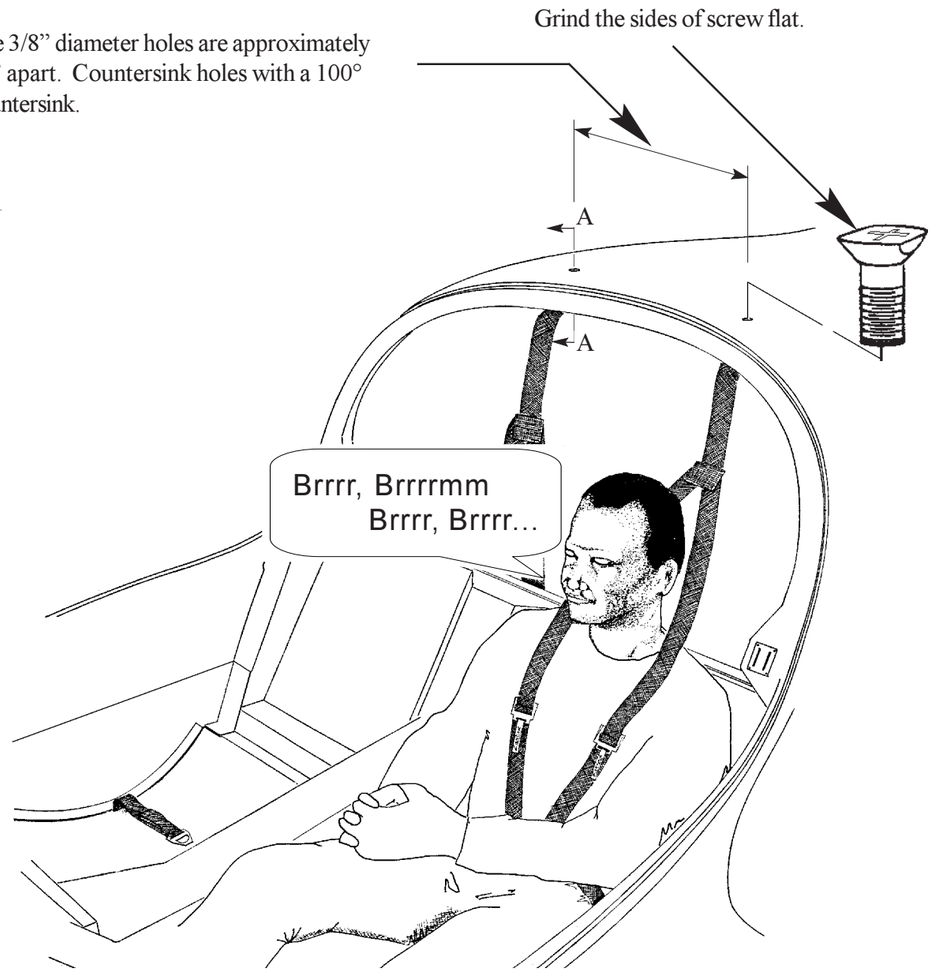
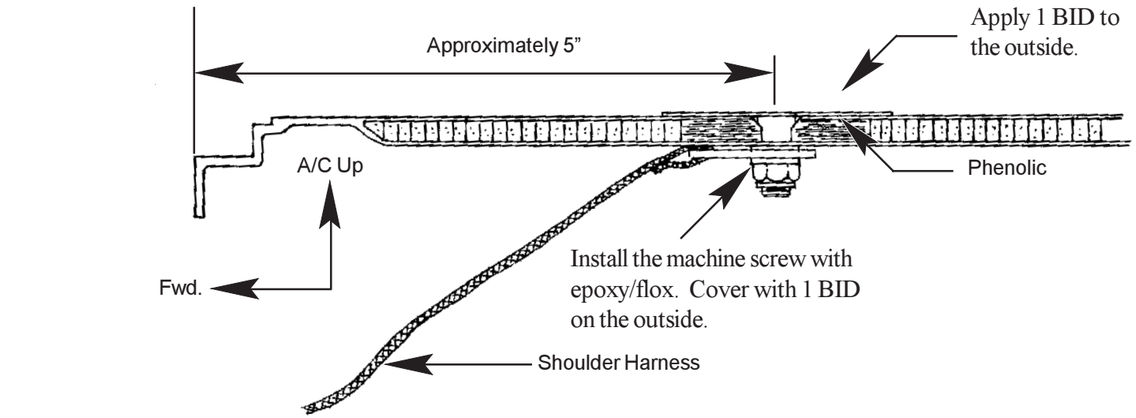
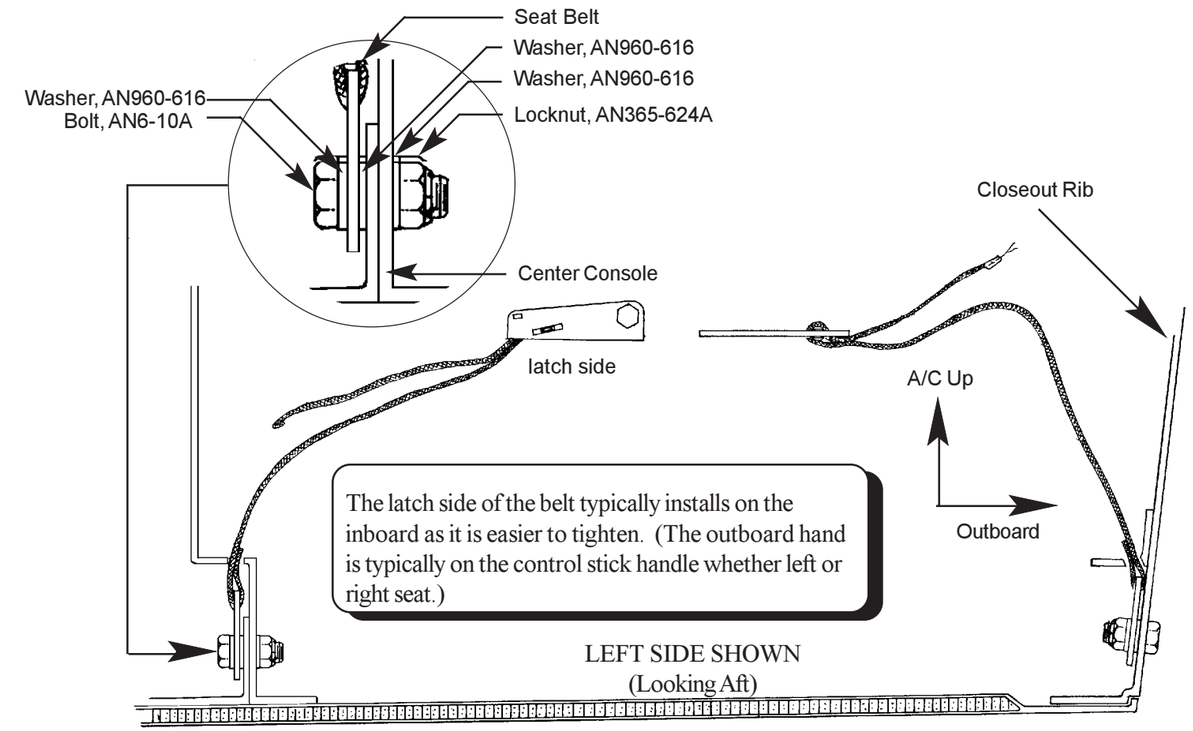
The 3/8” diameter holes are approximately 15” apart. Countersink holes with a 100° countersink.




**Installing Seat Belts**
**Fig. 15:D:2**

You must locate the phenolic and verify that you are drilling through the center of the phenolic.





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# REVISION LIST

# CHAPTER 16: HYDRAULIC SYSTEM COMPLETION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision.
"Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 16-1 through 16-4 | 0/02-15-02 | None | Current revision is correct |
| 16-5 | 1/09-18-02 | R&R | Correction of Fig. 16:A:3 |
| 16-6 through 16-7 | 1/09-18-02 | R&R | Text correction |
| 16-8 | 1/09-18-02 | R&R | Correction of Fig. 16:B:2 |
| 16-9 through 16-16 | 0/02-15-02 | None | Current revision is correct |
| 16-17 | 1/09-18-02 | R&R | Correction of Fig. 16:H:1 |
| 16-18 through 16-22 | 0/02-15-02 | None | Current revision is correct |
| 16-23 through 16-24 | 1/09-18-02 | Add | Fig. 16:N:1 and 16:N:2 Added |
| | | | |
| 16-1 | 2/06-30-04 | R&R | Updated intro. for new hydraulic pump location. |
| 16-3 | 2/06-30-04 | R&R | Updated for new hydraulic pump location. |
| 16-4 through 16-6 | 2/06-30-04 | R&R | Deleted pages. |
| | | | |
| 16-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 16-2 | 3/12-15-04 | R&R | Updated parts list. |
| 16-3 | 3/12-15-04 | R&R | Added bolt information used to install pump. |
| 16-4 through 16-6 | 3/12-15-04 | R&R | Added back blank pages to replace deleted pages. |
| 16-8 | 3/12-15-04 | R&R | Added photo and instructions for hydraulic line routing. |
| 16-9 | 3/12-15-04 | R&R | Replaced figure 16:B:3 with photo. |
| 16-17 | 3/12-15-04 | R&R | Replaced figure 16:H:1 with photo. |
| 16-23 through 16-24 | 3/12-15-04 | R | Deleted pages. |


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| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 16-2 | 4/09-30-06 | R&R | Updated parts list. |
| 16-3 | 4/09-30-06 | R&R | Updated fuel pump mount. |
| 16-9 | 6/08-10-07 | R&R | Corrected hydraulic fittings. |


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# Chapter 16: Hydraulic Systems Completion



## 1. INTRODUCTION

In this chapter you will complete the hydraulics installation. This installation can be divided into three sections.

1. The first section is that portion of the hydraulics located between the main and aft spar. This section was installed in chapter 3.

2. The second section is that portion of the hydraulics aft of the aft spar. It includes the hydraulic pump which installs aft of the co-pilot's seat back. This will be completed in section A of this chapter.

3. The final portion is that forward of the main spar. It includes the dump valve and the nose gear hydraulics. This will be completed in section B of this chapter.

Prior to actually running the hydraulics, the system is adjusted. The gear legs are adjusted to the up stops. Note that the up stops are mechanical stops. Both in the up and down position the hydraulic system will continue to exert a force against the stops. The gear doors are also adjusted. Prior to hydraulic operation the system is checked by moving all parts by hand. These adjustments are in section C, D and E of this chapter.

The next few sections include wiring and adjustments of the pressure switches of the hydraulics.



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## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **HYDRAULIC LINES: AFT OF AFT SPAR** | | | | |
| 1) | 5052 | 210” | Aluminum Tube 1/4” O.D., .035 wall | |
| 2) | MS21919D6-4 | 6 | Clamp | **Yes |
| 3) | CS125-1032-12GCR | 6 | Clickbond Stud | **Yes |
| 4) | 2611-4x2x2 | 2 | Fitting | |
| 5) | AN816-4D | 1 | Fitting, Nipple | |
| 6) | AN832-4D | 3 | Fitting, Union | |
| 7) | 637715 | 1 | Hydraulic Pump with Reservoir | |
| 8) | AN365-1032A | 6 | Nut | **Yes |
| 9) | AN924-4D | 3 | Nut, Check | |
| 10) | AN818-4D | 12 | Nut, Coupling | |
| 11) | PS-550 | 1 | Pressure Switch, Low | |
| 12) | 016942004 1016 | 1 | Pressure Switch, High | |
| 13) | AN819-4D | 12 | Sleeve, Coupling | |
| ~~14)~~ | ~~MS20074-06-05~~ | ~~2~~ | ~~Screws~~ (not included in kit) | **Yes |
| 15) | AN960-10 | 6 | Washer | **Yes |
| 16) | 4356 | 1 | Mount for hydraulic pump | |
| **HYDRAULIC LINES: FORWARD OF MAIN SPAR** | | | | |
| 1) | 4275 | 1 | Bracket, Hydraulic Fitting | |
| 2) | 4745 | 1 | Premade Line | **Yes |
| 3) | 4746 | 1 | Premade Line | **Yes |
| 4) | 4747 | 1 | Premade Line | **Yes |
| 5) | 4748 | 1 | Hydraulic Line (Short) | |
| 6) | 4749 | 1 | Hydraulic Line (Long) | |
| 7) | 4862 | 1 | Blueprint # | |
| 8) | 5052 | 144” | Aluminum Tube 1/4” O.D., .035 wall | |
| 9) | HK822-4 | 1 | Fitting, Elbow 90° (Restricted) | |
| 10) | AN822-4 | 1 | Fitting, Elbow 90° | |
| 11) | AN833-4D | 3 | Fitting, Elbow 90° | |
| 12) | AN833-4 | 2 | Fitting, Elbow 90° (Steel) | |
| 13) | AN924-4D | 3 | Nut, Coupling | |
| 14) | AN924-4 | 2 | Nut, Coupling (Steel) | |

**Note:**

**Optional Parts available through :**

**(*) Lancair Avionics**

**(**) Kit Components, Inc.**


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# 3. CONSTRUCTION PROCEDURES

## A. Hydraulic Lines - Aft of Aft Spar

**A 1.** Hook up the pre-made lines to the hydraulic pump.

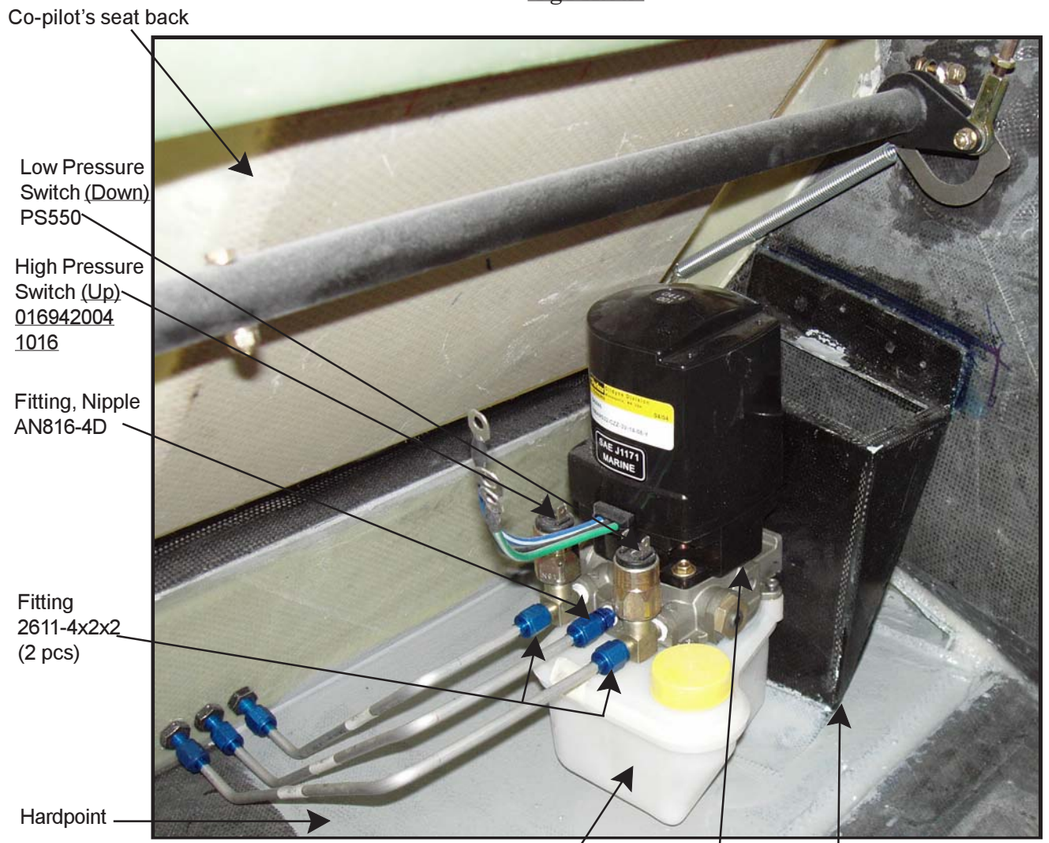
**A 2.** Now you are ready to locate the pump behind the co-pilot's seat. Locate the pump fore and aft.

**A 3.** Install the mount (4356) by bonding it in place.

**A 4.** Attach the pump to the mount. Use two 3/8" 16-course thread bolts 5/8" long to attach the pump to the mount.

Make sure the reservoir clears the floor by 3/8".

**Hydraulic Pump Installation behind Copilot Seat**
**Fig. 16:A:1**





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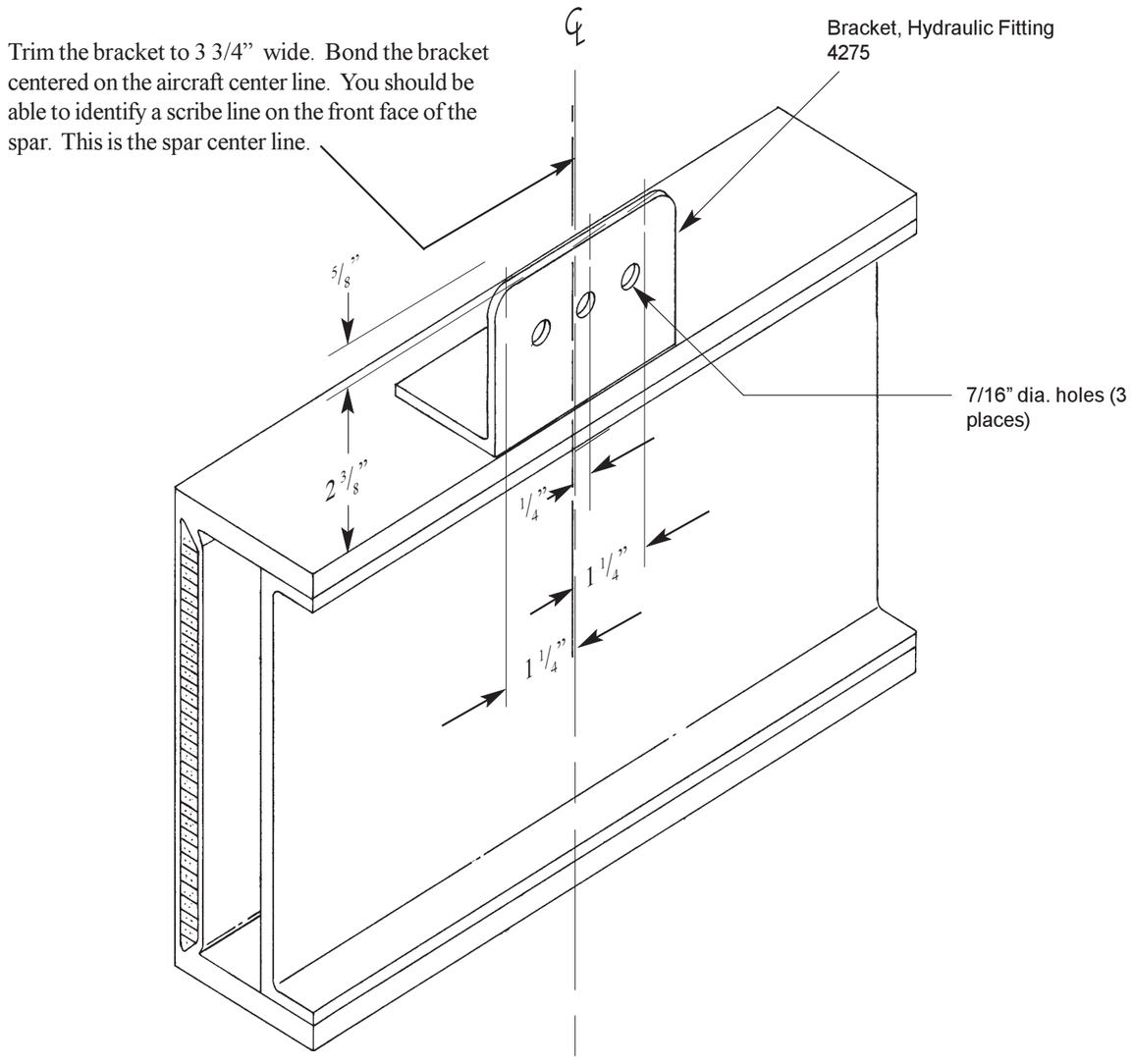
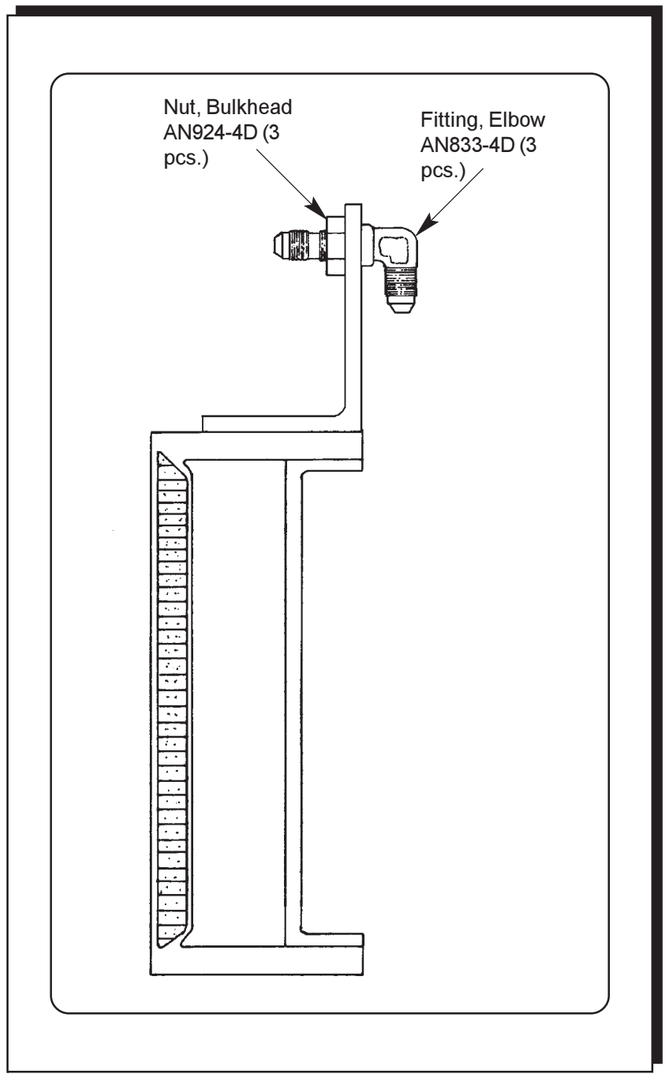
## B. Hydraulic Lines - Forward of Main Spar

**Hydraulics Marking Bracket on Main Spar**
**Fig. 16:B:1**

There is a junction in the hydraulics above the main spar. The hydraulic lines connect through bulkhead fittings installed in a bracket at the main spar.





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**Hydraulics: Lines Going to Hydraulic Valve**
**Fig. 16:B:2**

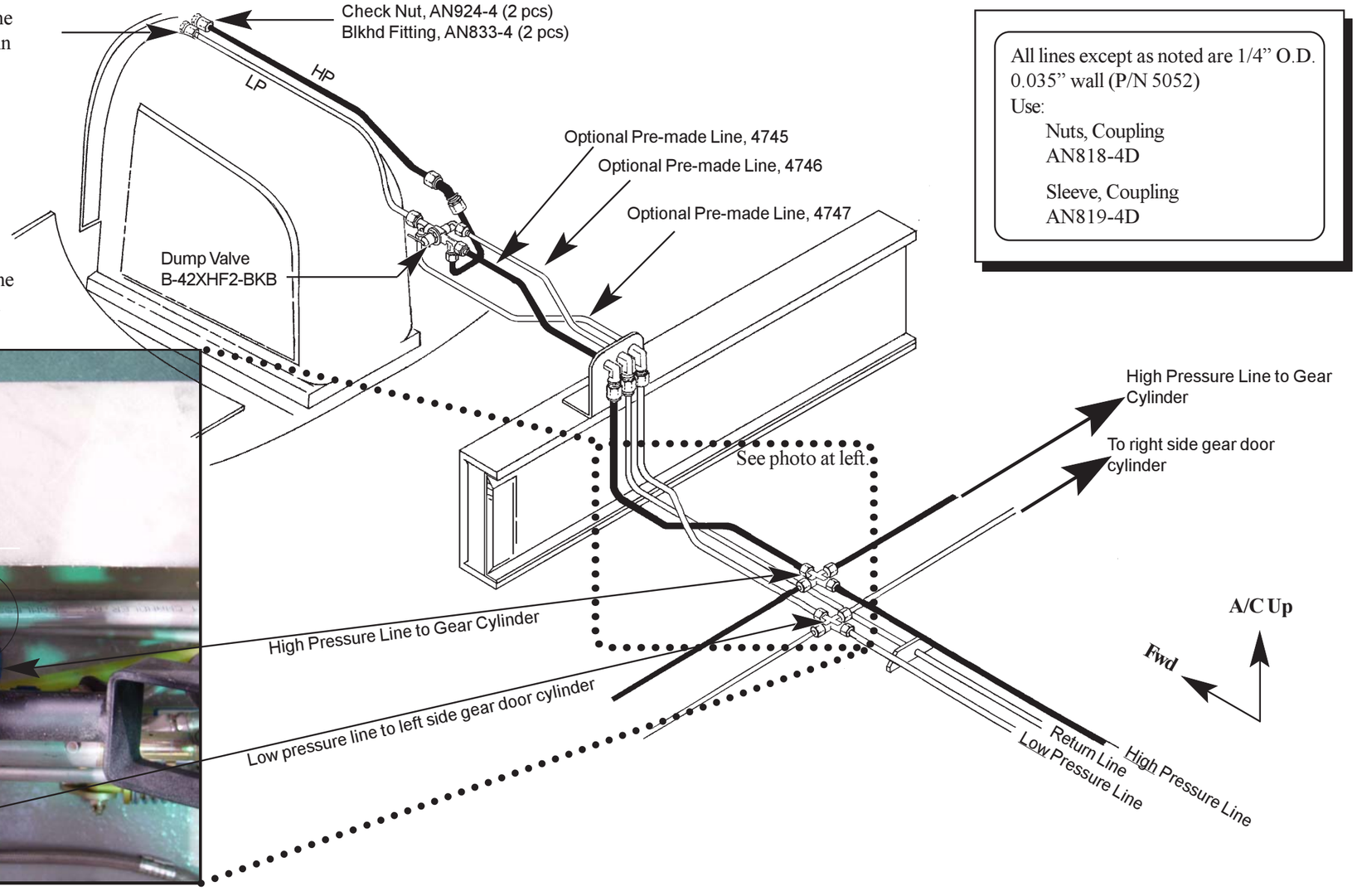
Note: Center Console not shown for clarity

Refer to blueprint number 4862 for the location of the bulkhead fittings installed in firewall

Observe the shape of the lines to allow for crossing over the spar and remain under the center console.

The lines must clear the cross-over weldment.

Center Console




All lines except as noted are 1/4" O.D. 0.035" wall (P/N 5052)
Use:
Nuts, Coupling
AN818-4D

Sleeve, Coupling
AN819-4D



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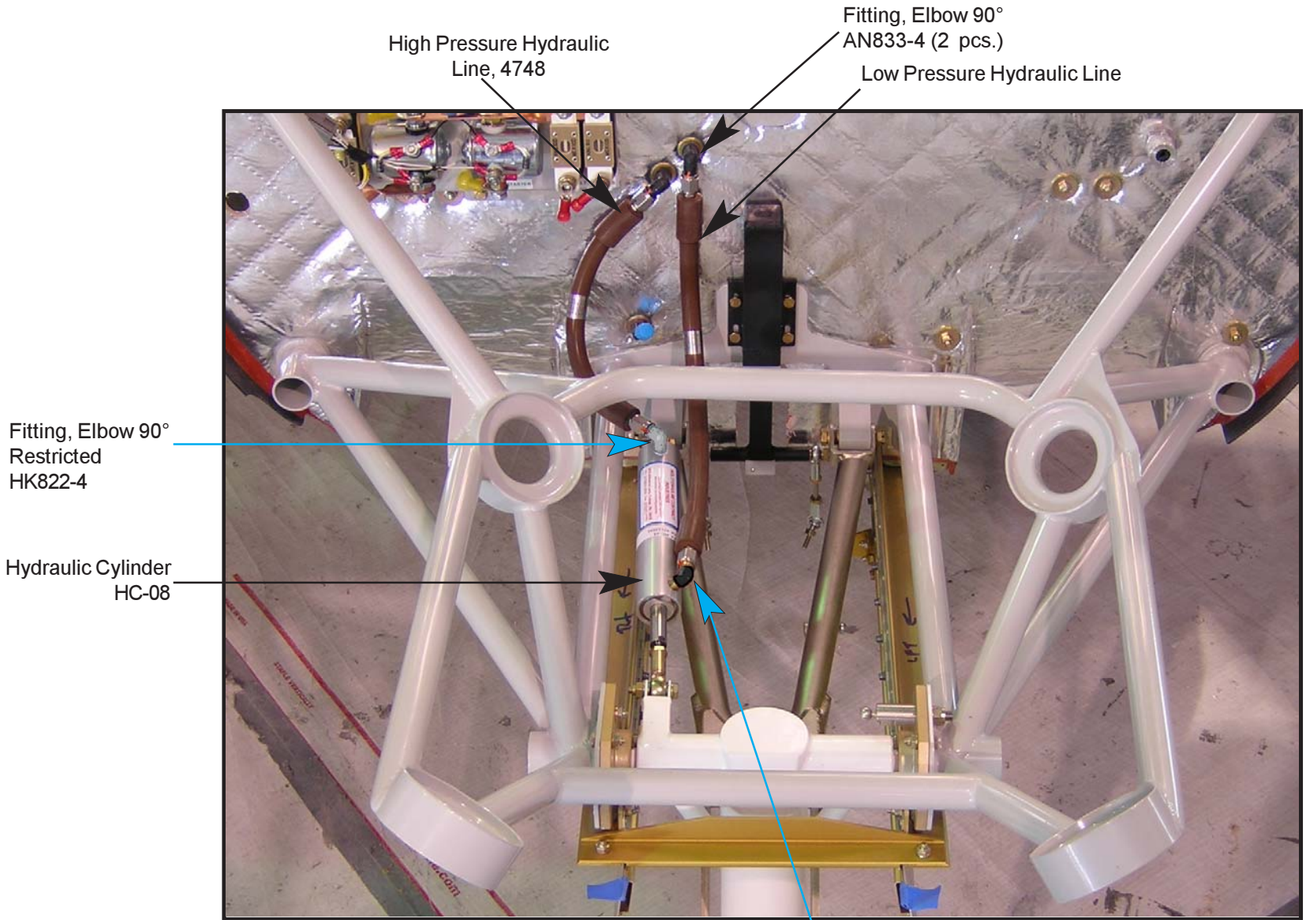
**Hydraulics: Firewall Forward**
**Fig. 16:B:3**




Note: Restricted fitting should be installed on the high-pressure side of the cylinder.

Note: Engine mount for Continental 550 shown. Lycoming installation similar.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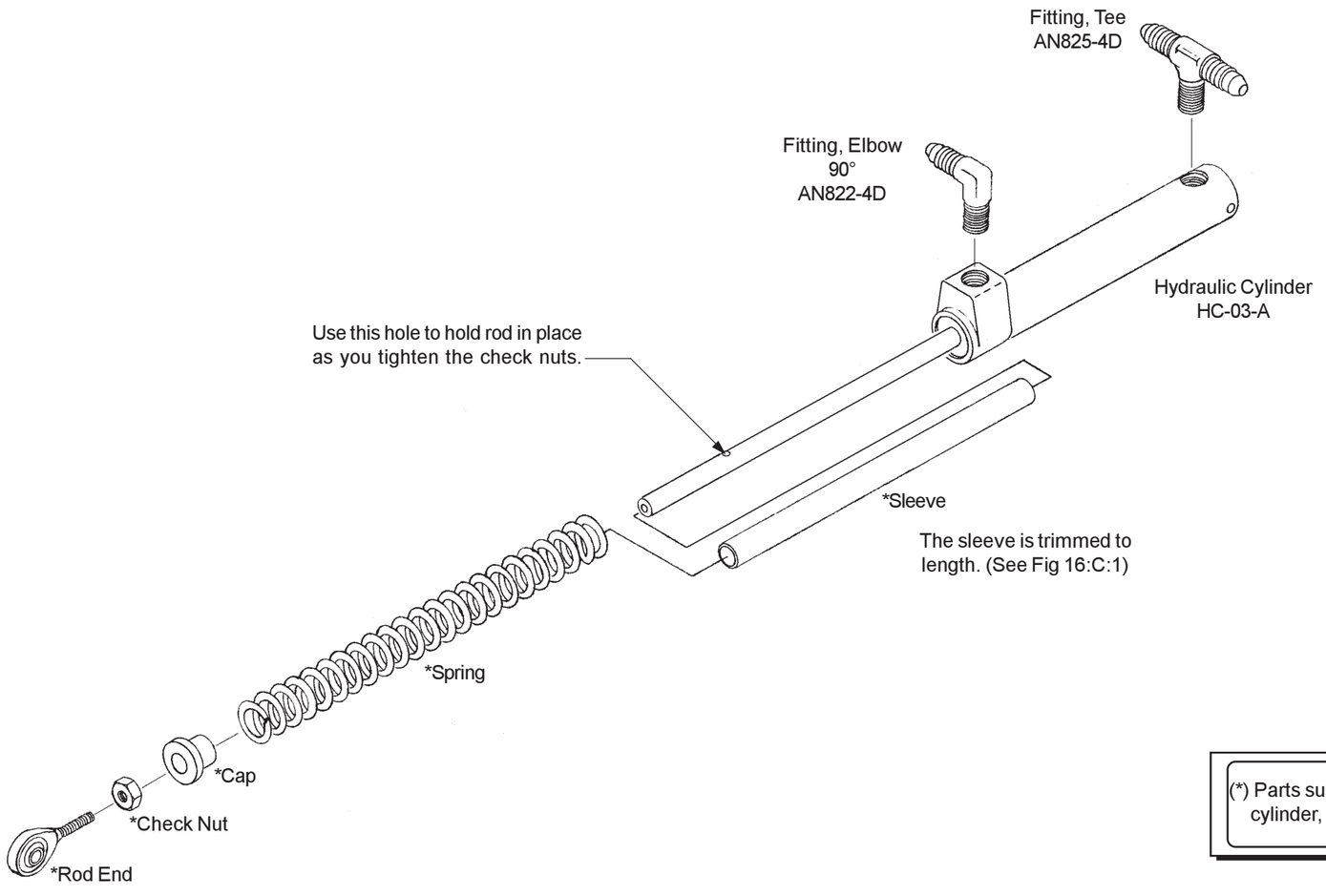
## C. Adjusting the Inboard Main Gear Doors

**Inboard Gear Door Hydraulic Cylinder**
**Exploded View**
**Fig. 16:C:1**




(*) Parts supplied with hydraulic cylinder, HC-03-A.

**Note: Parts shown and labeled are for one side of the airplane only.**



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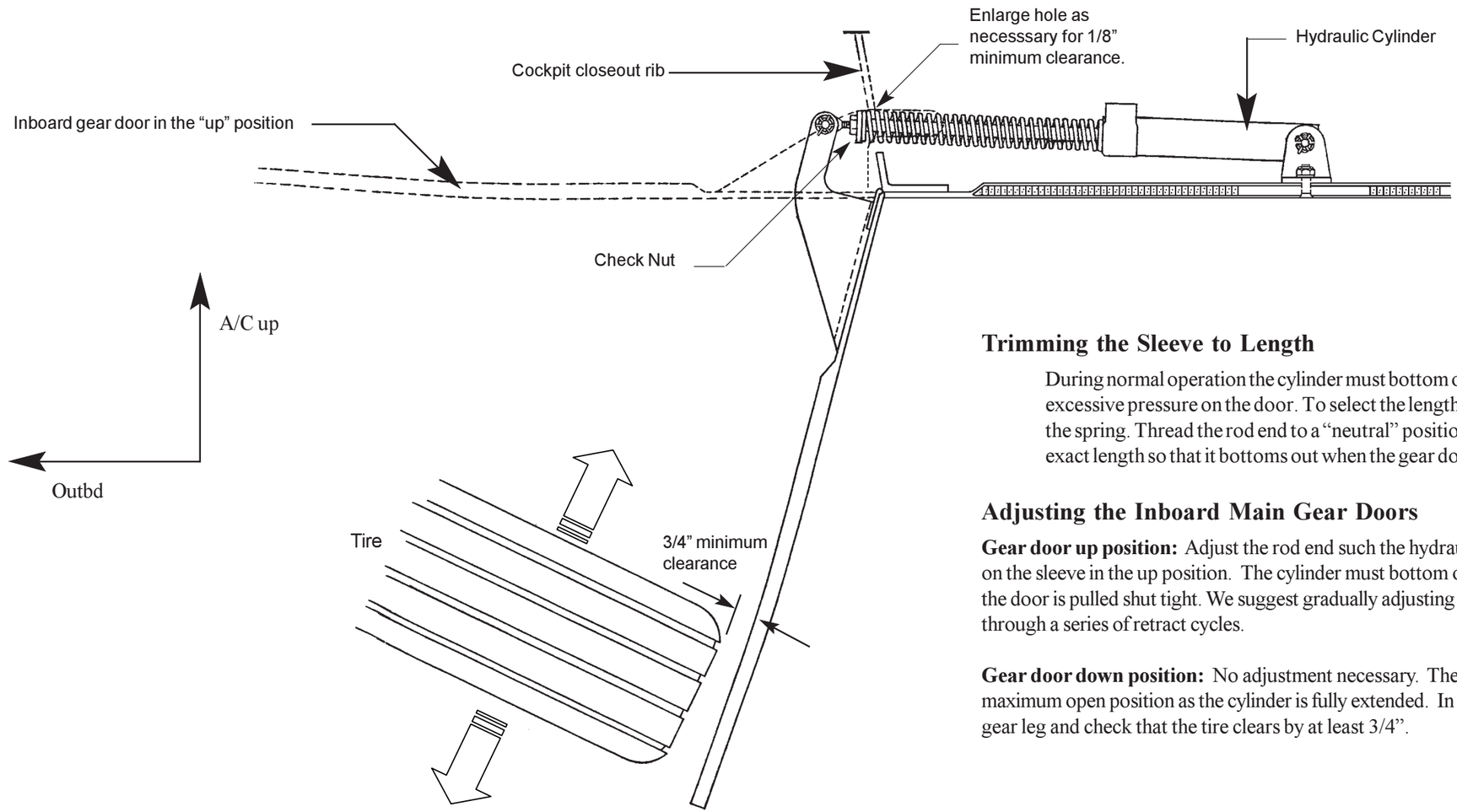
**Adjusting Inboard Main Gear Doors**
**Fig. 16:C:2**




## Trimming the Sleeve to Length

During normal operation the cylinder must bottom out on the sleeve to avoid excessive pressure on the door. To select the length it is easiest to remove the spring. Thread the rod end to a "neutral" position. Cut the sleeve to the exact length so that it bottoms out when the gear door is closed.

## Adjusting the Inboard Main Gear Doors

**Gear door up position:** Adjust the rod end such the hydraulic cylinder bottoms out on the sleeve in the up position. The cylinder must bottom out at the same time as the door is pulled shut tight. We suggest gradually adjusting the inboard doors through a series of retract cycles.

**Gear door down position:** No adjustment necessary. The door will travel to its maximum open position as the cylinder is fully extended. In this position, swing the gear leg and check that the tire clears by at least 3/4".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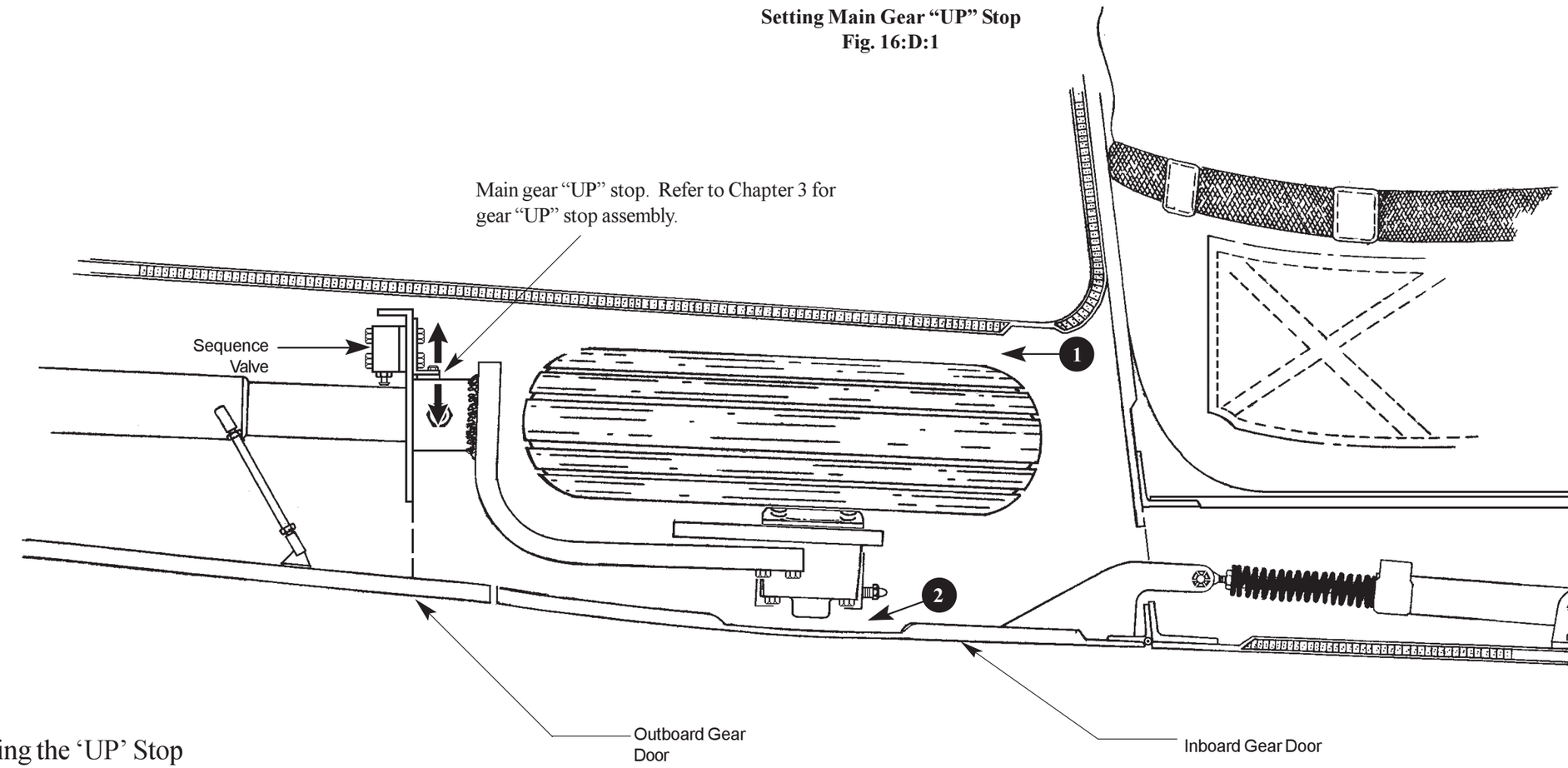
## D. Setting the Main Gear 'UP' Stop

The main gear "UP" stop is the mechanical adjustment for limiting the "UP" travel of the main gear. Note that the hydraulic cylinder continues to exert pressure against the "UP" stop when you retract the gear.

**Setting Main Gear "UP" Stop**
**Fig. 16:D:1**




### Setting the 'UP' Stop

1. The 'UP' stop is adjusted such that the line sits as high as possible in the wing. There should be a minimum of 1/8" clearance between the tire and the upper wing skin. One method of setting the height is to tape 1/8" thick spacers around the perimeter of tire. Then retract the gear (by hand!). Set the up stop in the position.

2. Check for adequate clearance between the brake and the inboard gear door.

Adjust the sequence valve. The sequence valve is adjusted so that it engages (but not bottoms out) when the gear is in the "up" position.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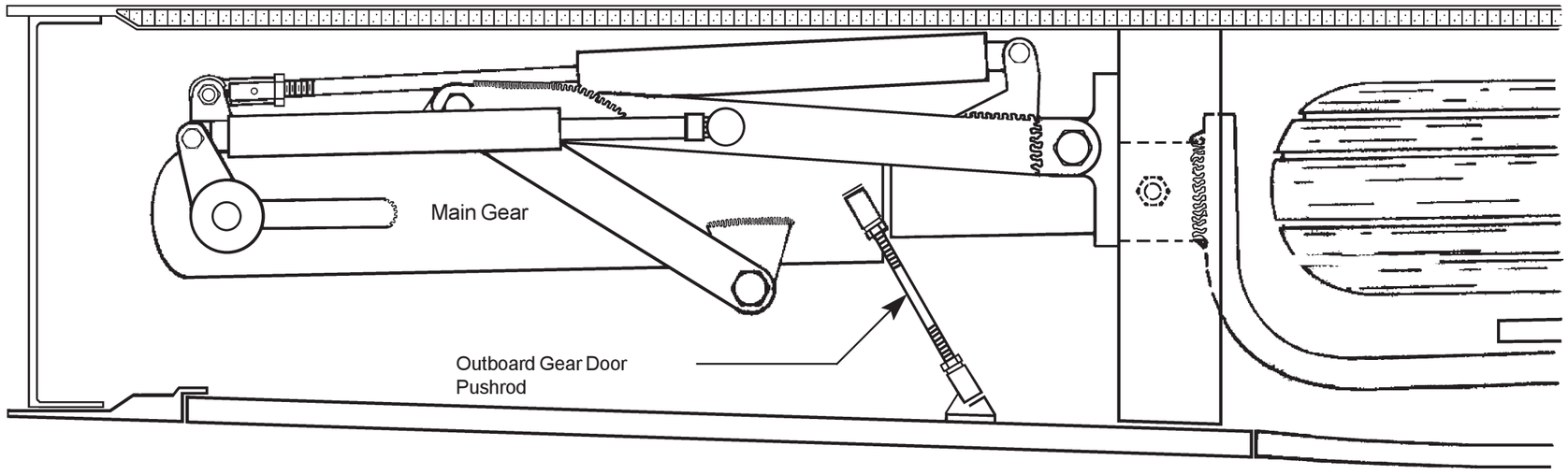
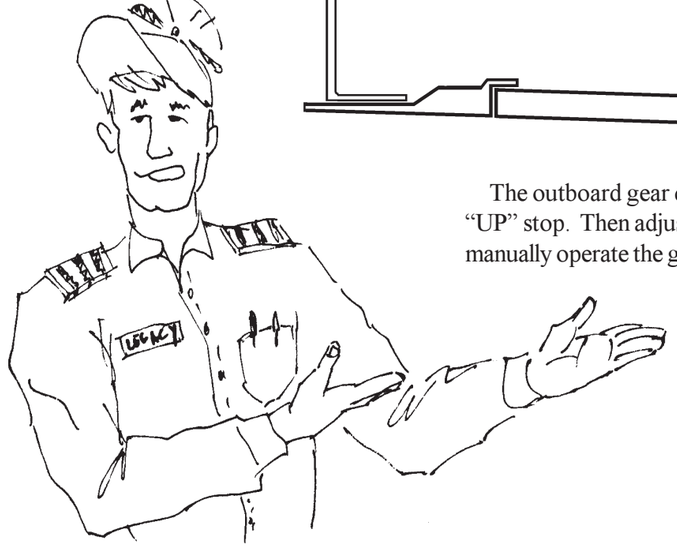
## E. Adjusting the Outboard Main Gear Doors

**Adjusting Outboard Main Gear Door**
**Fig. 16:E:1**



The outboard gear door is adjusted by holding the gear up against the "UP" stop. Then adjust the gear pushrods so the door is closed. Always manually operate the gear before you operate it hydraulically.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## F. Gear Switch and Lights

The standard gear switch is a locking switch, as shown in Figure 16:F:1. It takes up little room on the instrument panel. The switch is an SPDT meaning that it "pulls" voltage from a single source and can "throw" that voltage in either of two directions. The switch is in addition positive locking and must be gently pulled out of its detents before it can be shifted to the opposite position. As with all electrical parts, it should be handled with care and kept clean.

The center contact of the gear switch will have the primary "hot" lead from the battery soldered to it. The other two contacts will connect to either of the pressure switches. The wire on the pressure switch that connects to the gear switch can be either the red or the blue lead (the white lead is not used at all).

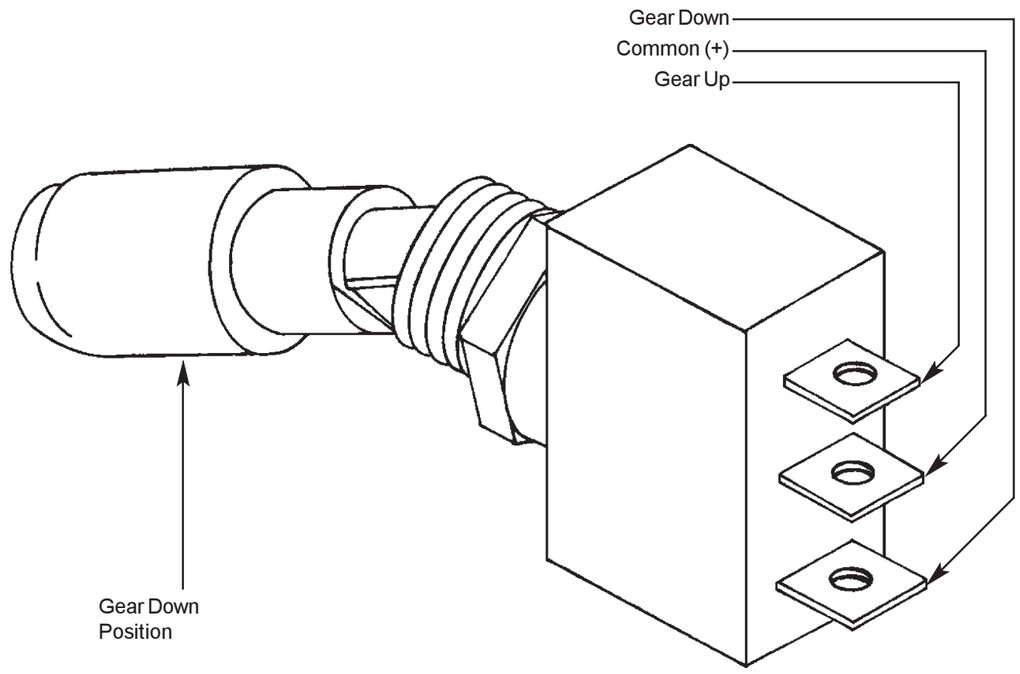
**NOTE:** It should be pointed out that the alignment between gear switch handle position and the back contacts is perhaps opposite to what you might think is correct, i.e., if the gear switch handles is "UP" then the contact on the "bottom" is activated, and vice versa. This will obviously become important when you wire it.

### Gear Transition Light

A gear "transition" light (amber or yellow) is provided. This light allows you to monitor exactly when and how long the gear motor runs. It is an excellent safety feature in that it can indicate problems that you might not otherwise be aware of.

**Example:** If you have a small hydraulic leak, the gear transition light will warn you of the condition since you will see this transition light blinking on and off repeatedly during cruise. This will alert you to start looking for leaks as soon as you next land. That's much better than running the system out of fluid unexpectedly. Also, if for any reason the pump motor does not shut off within 20 to 30 seconds, you will be alerted and you should then immediately pull the relay breaker on the instrument panel to shut down the system. Otherwise you would run the risk of burning up the pump motor.

**Wiring Landing Gear Switch**
**Fig. 16:F:1**





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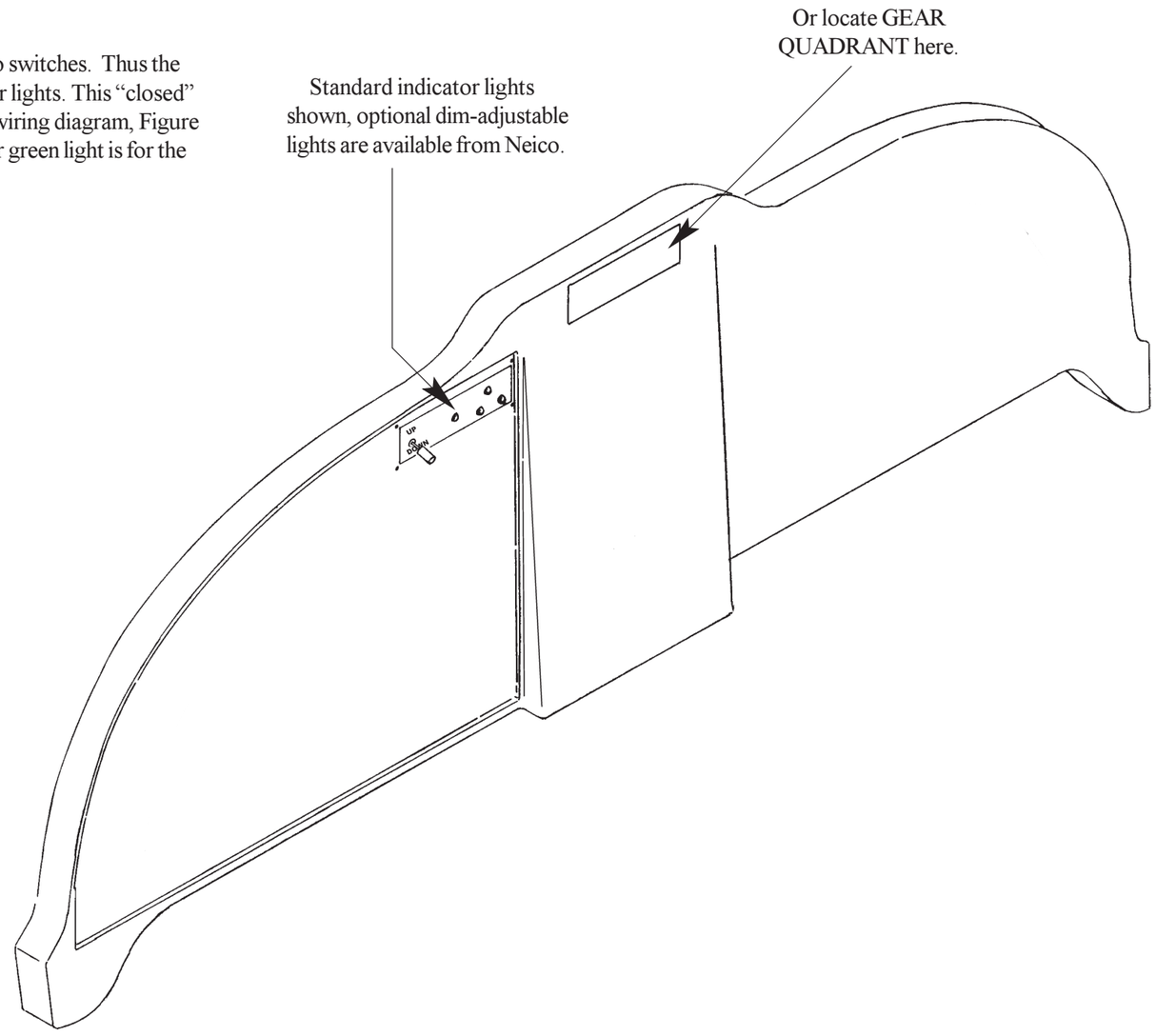
The gear transition light is generally placed just to the left of the three green gear down lights, near the gear switch. These units together comprise the "gear quadrant".

## Gear Down Lights

The standard gear lights are AMP type lights and are non-dimmable. For night flight, you will want to install an adjustable "pot" to be able to dim the lights at night. Optional gear lights with push to test and dim features are now available from Neico.

These lights will be illuminated by voltage that is interrupted by the gear micro switches. Thus the micro switches must be "CLOSED" in order for voltage to pass by and reach the gear lights. This "closed" position is only achieved when the gear is down and locked. See Figure 16:G:1 and wiring diagram, Figure 16:I:1. Generally, the gear down (green) lights are arranged visually so that the center green light is for the nose gear and the left is for the left main, etc.

**Gear "Quadrant" Location**
**Fig. 16:F:2**





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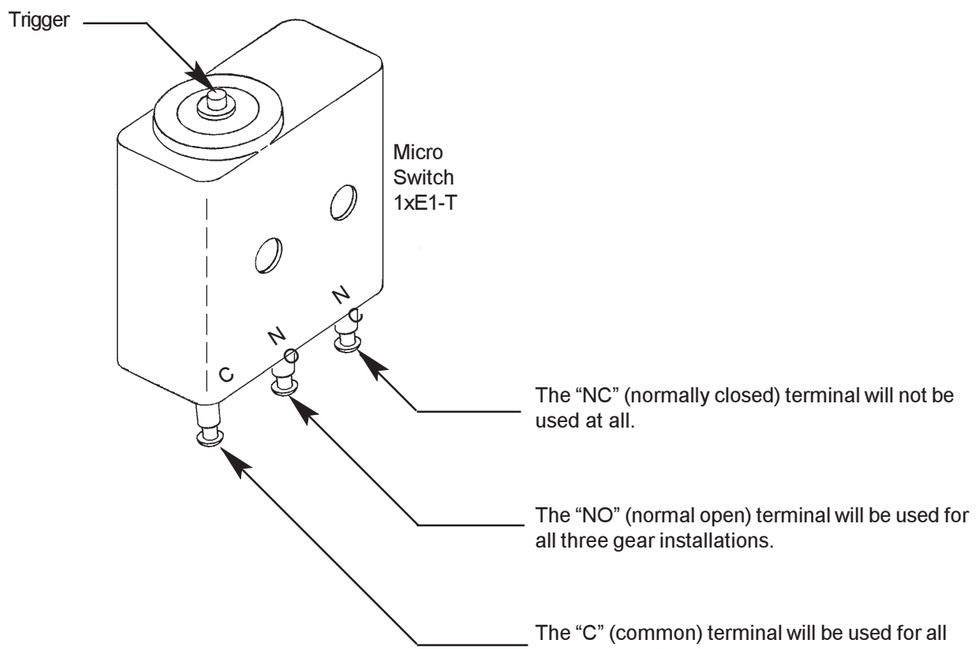
## G. Gear Micro Switch Wiring

The wiring for the micro switches is quite simple. The stock switches are built such that they can be used as NO (normally open) or NC (normally closed). We will only use the NO (normally open) circuit and thus one spade connector will not be used on the switch. If you look closely you will see the markings on the switch case.

**Micro Switch Wiring Connectors**
**Fig. 16:G:1**




The micro switch wires should be soldered directly to the switch.

The micro switch wires should be tied securely in the gear wells since considerable air turbulence will be encountered. Use the nylon type wire ties Also, it is important to use the insulated type of terminal connectors to prevent water, etc., from making a contact and giving a false reading.

We generally use the (-) side of the electrical system to route through the micro switches and wire the (+) side directly to the gear lights. See page 18.

The wiring can be 18 or 22 gauge. Two wires are needed for each micro switch which must be routed to the back central area of the instrument panel. This wiring can enter the cockpit area through the cockpit closeout rib. A good location is between the spar closeout web and the aft phenolic attachment for the retract cylinder.

From there, route under the main spar (at the central console area) and up behind the instrument panel. The nose gear switch wiring can simply travel up the side of the tunnel and punch through the radius where the side of the tunnel rolls into the top portion.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## H. Gear Pressure Switch Wiring

**Gear Pressure Switch Wiring**
**Fig. 16:H:1**

The high pressure switch which operates the "gear up" cycling is located above the left port on the power pack. One wire on that switch will connect to the relay that operates the pump (high pressure side). The other wire on the pressure switch will connect directly to the lower solder terminal on the gear switch (remember that the lower terminal makes electrical contact when the switch handle is up).


The low pressure switch will connect in a similar manner to its respective contacts.

Also see section K of this chapter for possible adjustments of the pressure switches.


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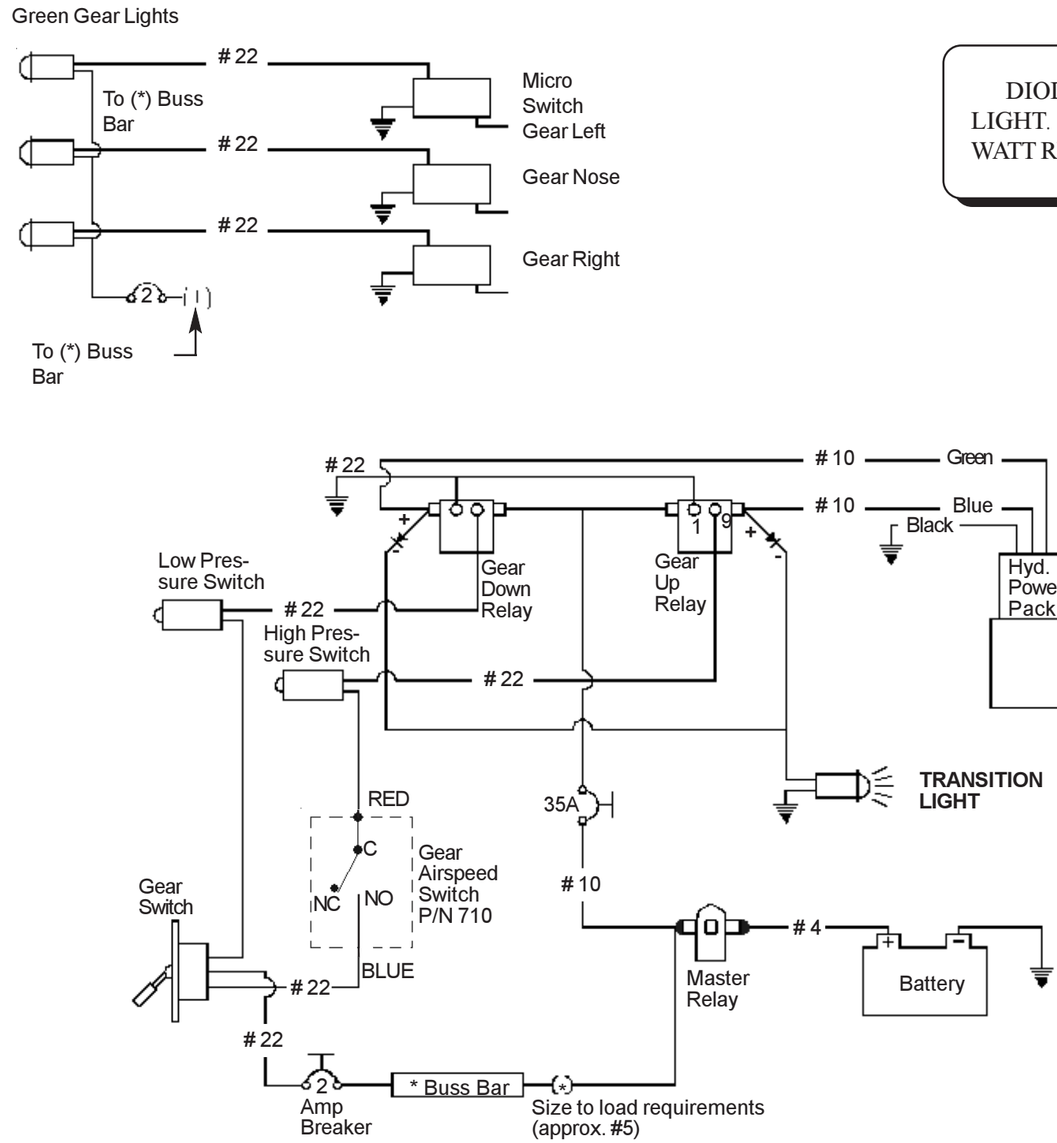
# I. Gear Wiring Schematic

**Gear Wiring Schematic**
**Fig.16:I:1**




DIODES FOR TRANSITION LIGHT. USE ANY COMMON 1/4 WATT RECTIFIER DIODE.



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# J. Hydraulic Gear Start Up and Test Operations

## Adding Hydraulic Fluid

Fluid type: Petroleum based
MIL-H-5606-Red (old #)
Shell Fluid 4, Code 60421 (new #)

You'll need about 1 quart minimum therefore you should get 2 quarts. This fluid is the same as used for the brake system.

1. Remove the filler cap and fill with fluid. A piece of 1/4" vinyl tubing works well as a siphon tube from a 1-quart can of fluid. Pinch off the tube when the reservoir is full.

   **NOTE:** Before starting the system up for the first time, go around and check each and every fitting to insure that it is tight. The odds are very high that no matter how many times you "thought" you checked that fitting, it will still be loose and that will cause a mess. Also, have many rags around and have a very quiet room when you first start up. A quiet room will allow you to hear the "**fissss**" of a leaky fitting that's under pressure.

2. The reservoir will hold about a pint of fluid, which will be emptied as the gear is first run and the empty lines are filled. This will then require refilling of the reservoir. The reservoir will usually require three or even four fillings until all is working well and the reservoir is again full.

**NOTE:** The gear system will self bleed but this will take many back and forth cycles which is OK but time consuming so don't expect the cycle time to be particularly fast in the beginning. You will encounter many small "**burps**" of the pump motor once the gear is fully retracted because the air in the lines is compressing and the motor therefore comes on for only an instant to re-establish the operating pressures dictated by the pressure switches.

## Start up of the Hydraulic Gear

When the gear is all installed, and known to operate by hand without any binds or interferences, and the pump is filled… its time for the real thing. This, for most builders, is considered to be a monumental event and a major milestone. There is great joy in watching all that gear tuck up into the airframe and totally disappear-all by itself. Of course the odds are abut 25% that you'll have some sort of a small problem to correct before it all tucks away neatly but in a short tie all will be working well and the excitement of the event will still be real.

1. The airframe will have to be supported for this testing and there are two good ways to do that. One is to simply use the jack pads for the main gear if you put them into the fuselage. Jack the airframe up only enough to clear the main tires of the ground and then weight the tail down or pull it down so as to lift the nose gear off the ground. The other means is to simply use a portable jack and lift the engine by the normal engine hook that temporarily bolts to the upper case bolts of the engine and slide a rigid support under the forward baggage area of the fuselage. The fuselage is strong enough to be supported from such a point. (Don't ever try that with a sheet metal plane though.) We've used a small stool with a good thick foam pad on it to disperse the loads over an area of about 1 square foot. You'll then have to steady the wing tips. Whichever approach you use to elevate the airframe, check to verify that it is indeed stable before retracting the gear.

   **WARNING:** Don't ever assume that you have wired everything correctly prior to this first start up. You must assume that you have wired everything **WRONG** and that the gear switch, although placed in a down position, might actually cycle the gear up as soon as power is put through it. Thus don't put power to the system until the plane is supported and can thus tolerate those kinds of surprises!

2. If you prefer, with the help of a friend, undo a line as far down stream as possible. Place a piece of hose on the line and place the other end in a clean container. One guy watches the hose while the other works the gear and master switch. Bump the system on and off until fluid and no air is coming out of the hose. Reconnect the hydraulic hose or aluminum line. Do this in a couple of locations and your system will take fewer cycles to come on line.

3. Install a battery temporarily into the system and establish the following:
   a. Plane supported off the ground, steady and secure.
   b. Gear switch is in the down position.
   c. Gear itself is down and locked.
   d. Free-fall valve is closed.
   e. Nose gear is straight.
   f. Cycle each gear leg up by hand to verify that there are no obstructions or interferences, etc.


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Now connect the power (12V DC)

The motor will produce a good deal of noise and will run for several seconds beyond the normal 6-7 seconds for cycling since there is no fluid in the lines at this time.

**WARNING:** The motor must not be allowed to run more than 20 seconds continuously. Running beyond that length of time could generate too much heat and damage the motor.

4. If the motor runs more than the 20 seconds allowed, remove the power thus shutting the motor off. The motor is not designed for continuous operation and must be allowed to cool down somewhat before operation can continue. Give it just a few minutes (5 minutes should be sufficient) to cool down before continuing.

5. Check all fittings for leaks and correct as required.

6. Check the reservoir to see if all the fluid has been pumped out, refill and continue to pump in the down direction. Fill three runnings like this do not shut the pump off automatically then stop and continue with the next step. Thus don't worry about it for the moment.

7. Check again that the nose gear is straight.

8. Flip the gear switch to the up position and observe as it starts to retract. The order of retraction is unimportant as that is strictly a function of which system gets the fluid first.

9. As the gear retracts, generally the mains will retract first and the nose will follow last. Once all the gear is up, assuming it all goes up on the first try here, the motor should run for just two or three seconds only and automatically shut down.

**WARNING:** If the motor has adequate amounts of fluid available, you will hear a distinctive tone change as the pump reaches its higher PSI loads. It will slow down and sound as if it is working harder. This is when the heat can really build up fast in the motor as it can pull over 40 amps so do not let it run more than two or three seconds in this condition.

10. If the gear comes up and the motor bogs down without shutting down automatically, then the pressure switch will require adjustment. This rarely will happen though.

    If the gear comes up most of the way and the motor continues to run with little or no tone change, then you are again out of fluid in the reservoir. Shut the system down, free-fall the gear down and locked and crawl back in to refill the reservoir.

11. Cycling the gear up and down several times will work to bleed the air out of the system and you'll notice that the cycle times will become shorter. Once the system is fully charged and free of air, the cycle time should be about 7 seconds.

12. When the gear retracts, the motor will shut off due to the pressure switch being tripped which cuts the current to the "UP" relay. If, as mentioned in step 9, the pump does not shut off automatically, then the pressure switch will need adjusting (or you've got a basic wiring problem that's having the effect of bypassing the high pressure switch). See wiring diagram and the section following this one, "Pressure switch adjustment".

    **NOTE:** As the nose gear retracts into the well, if it is allowed to hit the GM27 weldment, a pretty loud "clunk" may result. This should be avoided by attaching a rubber strip around the weldment to serve as a cushion. A couple of nylon wire ties will adequately secure it in place.

13. It is common for the motor to cycle on for a couple of periodic "burps" when the gear retracts. This is the system "tightening" up on itself as air is compressed and slowly forced out of the loop as cycling continues.

    If you get repeated, continuous bursts of the pump motor, then there is a leak some place so shut it down and go hunting.

14. At some point it is a good idea to run the gear up with some of the gear doors removed so that you can inspect the condition of everything up in the wells. Look for any interferences, binds or rubs.


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## K. Pressure Switch Adjustment

These must be corrected immediately.

1. The two pressure switches control the power to the pump motor through the relays and thus the power to the motor itself. These switches are preset but they are also easily adjustable. They are wired in the NC (normally closed) configuration. When the pressure setting is reached, they will open thus cutting current flow to the motor, opening the relay and shutting the system down.

   Sometimes the pressure switches will require a little adjustment to achieve proper operation of the gear system. Here are two possible problems:

2. **SYMPTOM 1:** The gear in the retract mode runs in short, on and off bursts until the gear is fully retracted.

   **CAUSE 1:** The high-pressure switch is most likely prematurely shutting off current to the relay and as the backside pressure drops, the switch closes again thus providing current.

   **CURE 1:** The UP side pressure switch will require a higher setting.
   a. There is small slotted screw in the top of the pressure switch. Turn this screw 1/4 turn to the right. Turning to the right increases pressure and to the left decreases pressure.

   b. Test the gear again and tighten additionally if required.

3. **SYMPTOM 2:** The gear retracts up but the motor does not shut off at all, it merely bogs down and continues running (As previously mentioned, this is dangerous to the life of the motor and should therefore be disconnected immediately if this symptom occurs.

   **CAUSE 2:** The high-pressure switch is set too high and although the power pack has reached full pressure, the motor cannot shut off since the pressure switch has not reached its higher-pressure setting. **NOTE:** The power pack has internal bypass valves that are factory set. The pressure switch must be set lower than the internal bypass valve setting.

   **CURE 2:** Lower the pressure of the high-pressure switch, see "cure 1" above. The procedure is similar except you will be backing off the internal screw 1/4 turn at a time.

4. It is also possible that similar circumstances could occur involving the low-pressure side of the system. History has however indicated that usually no problem is found or if there is a problem, it will be with the high-pressure system.

This must be conducted on a regular basis to insure safety on the event of either a hydraulic loss or an electrical loss.

## L. Free Fall Test

The ability for the gear to successfully free fall to the down and locked position is critical. Flight cannot be made if this condition is not achievable. In addition, you should make it a practice to check it on a regular basis (monthly) during operation so you will not be caught off-guard by a broken spring or deflated pressure strut.

1. While still in your ground testing setup, run the gear up and disconnect the power.

2. Open the free-fall valve by making the 90° rotation of the handle in one smooth, quick movement.

   A bit of "clang" will result and the gear will start coming down. The nose gear will usually be the first down and locked due to the 100 lb gas spring up front.

3. The main gear will usually fall about halfway very quickly and the remaining half could be a slow struggle for the springs. This is OK. In fact it is OK if they never do lock down by themselves but you must measure the pressure against the sides of the tires that is required to bring them down and locked.

4. If the main gear does not lock down, take a scale and press against the inside of the tire bottoms. The force required to lock the gear down should not exceed about 5-8 lbs. This force is easily achieved by simply kicking a little rudder left to create a sideslip, which will lock the left main then right rudder to lock the right main. If more force is required, then you have a "bind" condition somewhere in the linkage or the springs are stretched out of shape. You'll have to correct the condition before flight.


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## M. In-flight Free Fall Testing

**CAUTION:** This Free-fall check should be made monthly during normal operations. It's easy and only takes a couple of quick steps.

1. Start with the A/C in a normal gear up, cruise mode at a speed of 140 m.p.h. or less.
2. Pull the circuit breaker (or fuse) that operates the gear relays.

   WARNING: Do not pull ***only*** the 50A gear pump circuit breaker, this would appropriately disconnect the pump but it would not disconnect the relays. This would then allow the relays, which are for intermittent use ***only***, to close. Possible damage could result to the relays if left on for too long. Thus you should pull the circuit breaker ***for the relays*** when shutting down for this test.

3. With the electrical system disconnected, place the gear switch into the down position. Of course, nothing will happen.

4. Open the Free-fall valve with a fast smooth 90° rotational movement.

   The gear will now drop down and lock in place, the three green gear down lights should illuminate. There is no particular locking sequence between the three gears. Sometimes the nose will lock first and we've seen cases where the nose gear is last to lock down. And you ask, "what if they don't lock down?"

**If the main gear does not lock down:** If, after one minute, the mains do not lock down (no green light appears) then try kicking a little rudder to cause a slip in the direction of the non-locking gear leg, i.e., left rudder to lock the left main, etc. This additional air load on the gear door and gear itself will provide the extra force to cause the gear to lock. The main gear should easily lock down with no more than half rudder applied at 140 m.p.h. indicated. If this is not successful, then you have a problem of either too much friction or too little spring pull. Ground adjustments must be made before your next flight.

**If the nose gear does not lock down:** If the nose gear does not lock down, first try slowing up to reduce the air loads acting against the gas strut that is trying to push the gear out into the air stream. Slow up by 10 m.p.h. increments, wait at least 1 minute between speed changes and not the speed at which the nose gear does lock down, keep this for reference to determine whether or not the nose gear is requiring more and more help as the flight hours build.

If at 85 m.p.h. indicated, you still cannot lock the nose gear down, then you have a problem, do not go slower in attempting to lock it down. Increase speed back to about 110 m.p.h. and try pulling about 2 g's. If after two or three attempts at this, you still cannot lock the nose gear down, then you have a problem and ground adjustments must be made before your next flight.

5. With the test completed, either all the gear will be down and locked or the stubborn ones will not be locked down. At this point, there is a three-step procedure to follow when reactivating the hydraulic power system.

   1. Close the Free-fall valve by rotating it 90° back to the closed position.
   2. Check to make sure the gear switch is still in the "down" position.
   3. Push in the ***gear relay*** circuit breaker to reactivate power to the pump. The gear will now recharge and establish a down and locked position under hydraulic pressure.

**WARNING:** If there is ever a test which results in the inability to free-fall the gear down and locked, pump the gear down, land and do not resume flight until the problem has been identified and corrected.

6. If you had Free-fall trouble with any of the gear, then ground inspection and adjustment MUST be made prior to your next flight. Repeat the ground cycling procedure until all the gear is free-falling well. Then go back up and repeat this test procedure. Normal flight cannot be made until this free-fall test is successful.

   (As a final note, it should be mentioned that the free fall test has an extremely high percentage of first flight test successes).

**This concludes the chapter on the landing gear hydraulic systems.**


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# REVISION LIST

# CHAPTER 17: RUDDER COMPLETION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 17-1 | 1/09-18-02 | R&R | Corrected Bill of Materials |
| 17-2 through 17-7 | 0/02-15-02 | None | Current revision is correct |
| 17-8 | 1/09-18-02 | R&R | Text correction |
| 17-9 through 17-14 | 0/02-15-02 | None | Current revision is correct |
| 17-15 | 1/09-18-02 | R&R | Part # Correction |
| 17-16 through 17-22 | 0/02-15-02 | None | Current revision is correct |
| 17-23 | 1/09-18-02 | R&R | Text correction |
| 17-24 | 0/02-15-02 | None | Current revision is correct |
| 17-25 | 1/09-18-02 | R&R | Corrected Fig. 17:G:1 |
| 17-26 through 17-28 | 0/02-15-02 | None | Current revision is correct |
| 17-29 | 0/02-15-02 | None | Current revision is correct |
| 17-30 | 1/09-18-02 | R&R | Corrected Fig. 17:I:4 |
| 17-31 through 17-32 | 0/02-15-02 | None | Current revision is correct |
| | | | |
| 17-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 17-2 | 3/12-15-04 | R&R | Added floorboard parts, bellcrank parts and rivets. |
| 17-14 | 3/12-15-04 | R&R | Updated floorboard part numbers in figure 17:E:1. |
| 17-22 | 3/12-15-04 | R&R | Updated rivet part nbrs. |
| 17-22 | 3/12-15-04 | R&R | Updated part nbrs. |
| 17-25 | 3/12-15-04 | R&R | Updated bushing part, added washers and notes to figure 17:G:1. |
| | | | |
| 17-27 | 4/09-30-06 | R&R | Added drawing of the baggage bulkhead, #4039, to Fig:17:I:1. |


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| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 17-2, 17-25 | 6/08-10-07 | R&R | Part number changes only. |



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# Chapter 17: Rudder Completion

## Contents



## 1. INTRODUCTION

At the end of this chapter, you will be able to sit in the cockpit and operate the rudder. You will start by separating the rudder from the vertical and then install the rudder leading edge. You will install the rudder bellcrank in the back of the fuselage - not as bad as it sounds - but you might want to start looking for a long skinny guy! Finally you will install the rudder pedals. The brakes are installed in Chapter 18.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **RUDDER LEADING EDGE CLOSEOUT** | | | | |
| 1) | 4065 | 1 | Rudder Leading Edge Closeout | |
| 2) | 4657 | 1 | Rudder Actuator Arm, Pre-Installed | |
| 3) | REH053-U | 1 | Upper Rudder Hinge, Pre-installed | |
| 4) | REH053-U | 1 | Center Rudder Hinge, Pre-installed | |
| 5) | REH053-U | 1 | Lower Rudder Hinge, Pre-installed | |
| 6) | AN3-6A | 2 | Bolts | |
| 7) | AN960-10 | 2 | Washers | |
| **RUDDER TRIM SYSTEM** | | | | |
| 1) | 5-020016 | 1 | Access Panel, Pre-Installed | |
| 2) | MS24693-S28 | 6 | Machine Screw, Pre-Installed | |
| 3) | T2-7A (S4A) | 1 | Rudder Trim Servo | **Yes |
| 4) | TT-01 | 1 | Trim Tab Actuator Arm, Pre-Installed | |
| **RUDDER PEDAL INSTALLATION** | | | | |
| 1) | 4034-1 | 1 | Floorboard Access Panels, Left Side | |
| 2) | 4034-2 | 1 | Floorboard Access Panels, Right Side | |
| 3) | 4662 | 2 | Clevis | |
| 4) | 4925-01 | 1 | Adjustable Rudder Pedal Kit (Left Side) | **Yes |
| 5) | 4925-02 | 1 | Adjustable Rudder Pedal Kit (Right Side) | **Yes |
| 6) | 6061-T6 | 1’ | Alu. Tube, 1.65” Length x 0.875 Dia. x 0.058” Wall | |
| 7) | RD-PD-01 | 2 | Rudder Pedal Castings | |
| 8) | RDP-02 | 4 | Bushing, Nylon | |
| 9) | AN3-6 | 2 | Bolt, Drilled | |
| 10) | AN3-6A | 2 | Bolt, Undrilled | |
| 11) | AN3-11A | 2 | Bolt, Undrilled | |
| 12) | AN316-5 | 2 | Checknut | |
| 13) | MS24665-132 | 2 | Cotter Pin | |
| 14) | 10-88 | 2 | Master Cylinder | |
| 15) | AN310-3 | 2 | Nut, Castle | |
| 16) | K1000-3 | 4 | Nutplate | |
| 17) | BSPQ-44 | 2 | Rivet, Pop | |
| 18) | AN426A3-5 | 4 | Rivets | |
| 19) | AN960-10 | 2 | Washer | |
| 20) | AN960-10L | 4 | Washer | |

**Note:**

**Optional Parts available through :**

**(*) Lancair Avionics**

**(**) Kit Components, Inc.**




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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **FLOORBOARD INSTALLATION** | | | | |
| 1) | 4034-01 | 1 | Floorboard, left side | |
| 2) | 4034-02 | 1 | Floorboard, right side | |
| 3) | 4034-03 | 1 | Floorboard Acces Panel, left side | |
| 4) | 4034-04 | 1 | Floorboard Acces Panel, right side | |
| 5) | K1000-3 | 8 | Nutplate | |
| 6) | MSC-34 | 16 | Rivets | |
| 7) | AN526-1032-R10 | 8 | Screw (For Version 1 Floorboard) | |
| 8) | AN526-1032-R8 | 8 | Screw (For Version 2 Floorboard) | |
| 9) | AN960-10 | 8 | Washer | |
| **RUDDER BELLCRANK** | | | | |
| 1) | 4650 | 1 | Rudder Bellcrank | |
| 2) | 4651 | 1 | Rudder Bellcrank Bracket | |
| 3) | 4652 | 1 | Rudder Bellcrank Bracket Shear Support | |
| 4) | 4653 | 1 | Rudder Bellcrank Shear Support | |
| 5) | 4659 | 2 | Rudder Bellcrank Bumper | |
| 6) | 4665 | 1 | Rudder Bellcrank Shear Support Spacer | |
| 7) | AN4-12 | 1 | Bolt | |
| 8) | AN4-13A | 2 | Bolt, Undrilled | |
| 9) | AN3-13A | 5 | Bolt, Undrilled | |
| 10) | **112-0037** ~~6381K412~~ | 1 | Bushing | |
| 11) | AN365-1032A | 3 | Locknut | |
| 12) | AN960-416 | 2 | Washer, Flat | |
| 13) | AN960-416L | 2 | Washer, Thin | |
| 14) | AN960-10 | 5 | Washer, Flat | |
| 15) | AN970-4 | 2 | Washer | |
| 16) | AN310-4 | 1 | Castle nut | |
| 17) | MS24665-132 | 1 | Cotterpin | |
| **RUDDER PUSHROD** | | | | |
| 1) | 4039-02 | 1 | Aft Bulkhead | **Yes |
| 2) | 4658 | 1 | Pushrod Rudder Pre-Fab. | |
| 3) | AN3-12A | 1 | Bolt | |
| 4) | AN3-13A | 1 | Bolt | |
| 5) | AN365-1032A | 2 | Nut | |
| 6) | AN960-10 | 2 | Washer | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **RUDDER CABLE** | | | | |
| 1) | AN3-10 | 4 | Bolt, Drilled Shank | |
| 2) | AN42-B11A | 2 | Bolt, Clevis | |
| 3) | SHC-1010 | 3 | Connector, Bulkhead | |
| 4) | MS24665-132 | 4 | Cotter Pin | |
| 5) | AN310-3 | 4 | Nut, Castle | |
| 6) | 18-3-M | 2 | Nicopress Sleeve | |
| 7) | 44P | 9’ | Poly Tubing | |
| 8) | RDC-18 | 2 | Rudder Cable | |
| 9) | AN111-4 | 2 | Thimble | |
| 10) | AN960-10L | 12 | Washer | |
| 11) | AN960-10 | as required | Washer | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**


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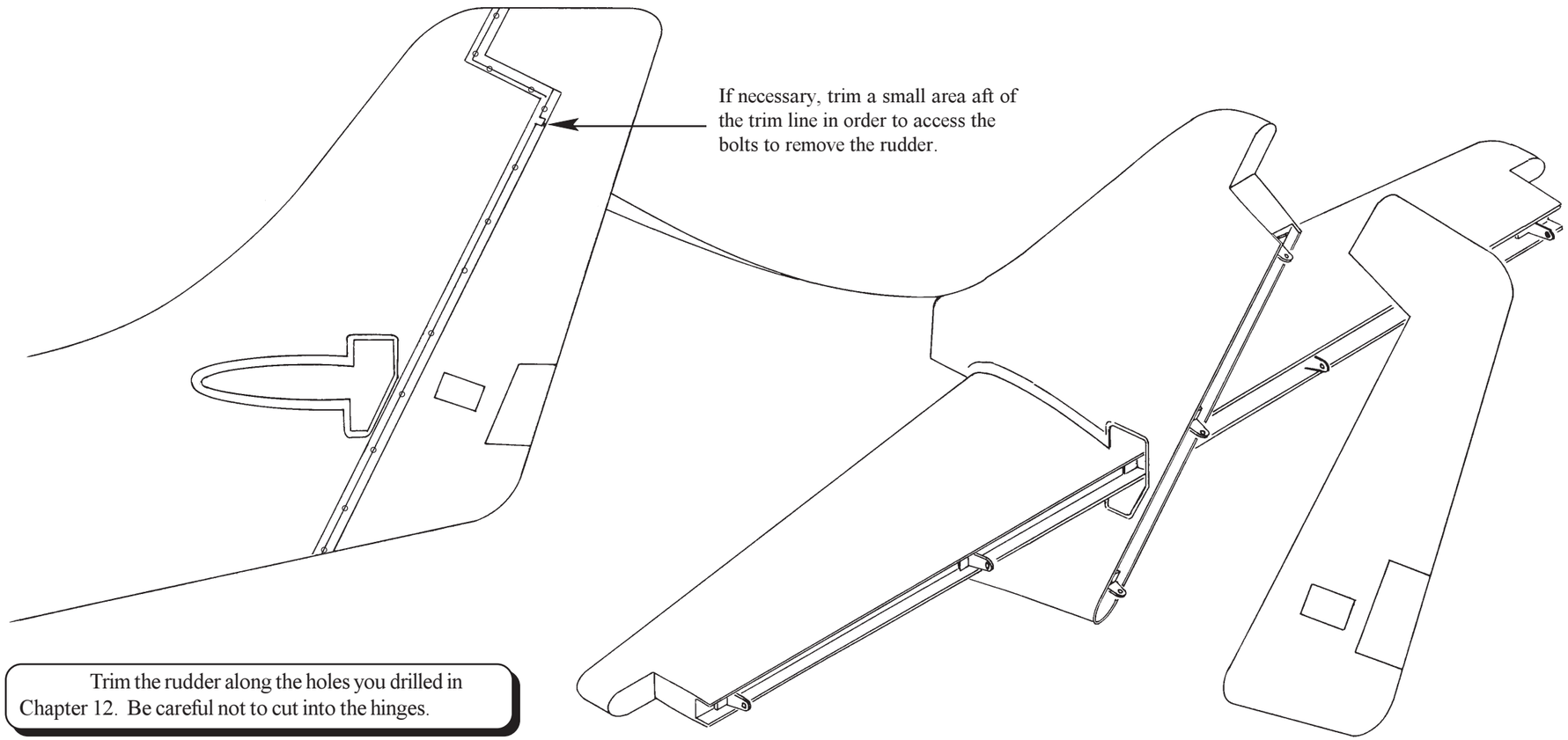
# 3. CONSTRUCTION PROCEDURES

## A. Trimming the Rudder

**Trimming Rudder**
**Fig 17:A:1**




Trim the rudder along the holes you drilled in Chapter 12. Be careful not to cut into the hinges.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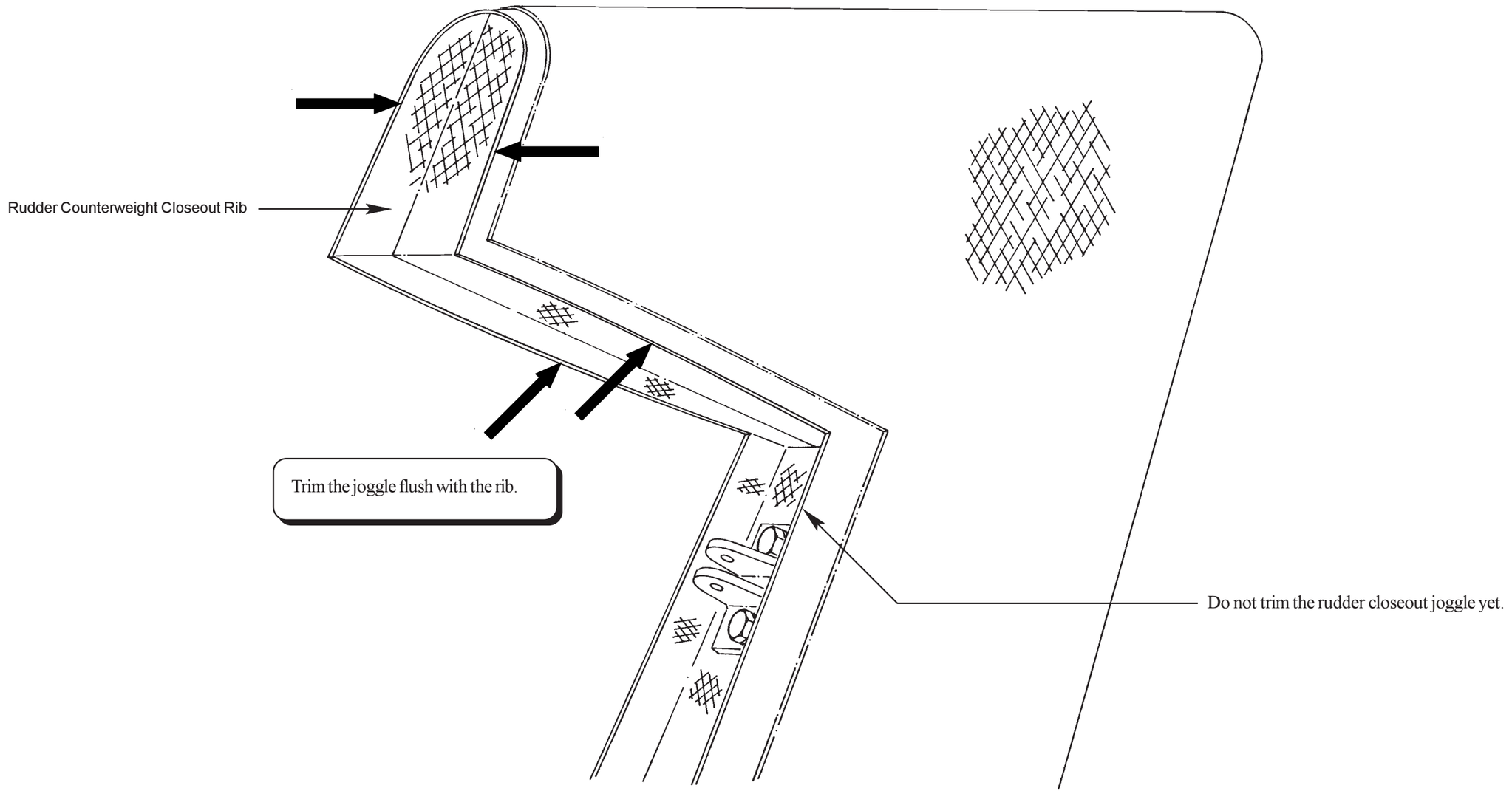
**Trimming Joggle in Rudder Counterweight Area**
**Fig 17:A:2**





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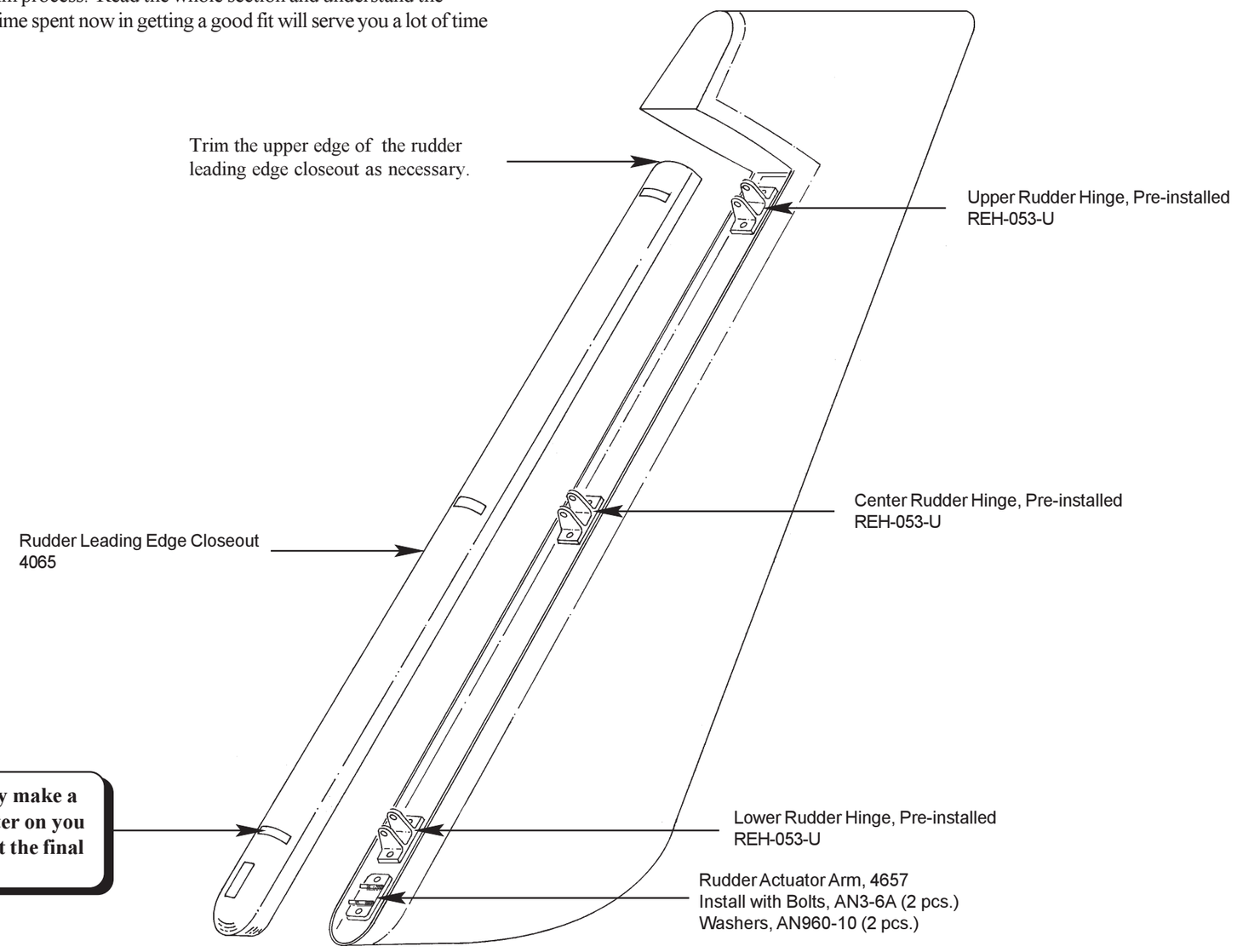
## B. Rudder Leading Edge Closeout

The rudder leading closeout completes the rudder structure. The pre molded shape provides a constant gap between the rudder and the vertical trailing edge through the rudder travel range.

Fitting the closeout is a gradual fit and trim process. Read the whole section and understand the alignment criterias before starting. A little more time spent now in getting a good fit will serve you a lot of time later on in body works.

**Rudder Leading Edge Closeout Installation**
**Fig 17:B:1**




**NOTE: The slots cut in the closeout. Initially make a 3/4" hole centered on the hinge. Later on you will use blueprint pattern, 4417 to cut the final slot.**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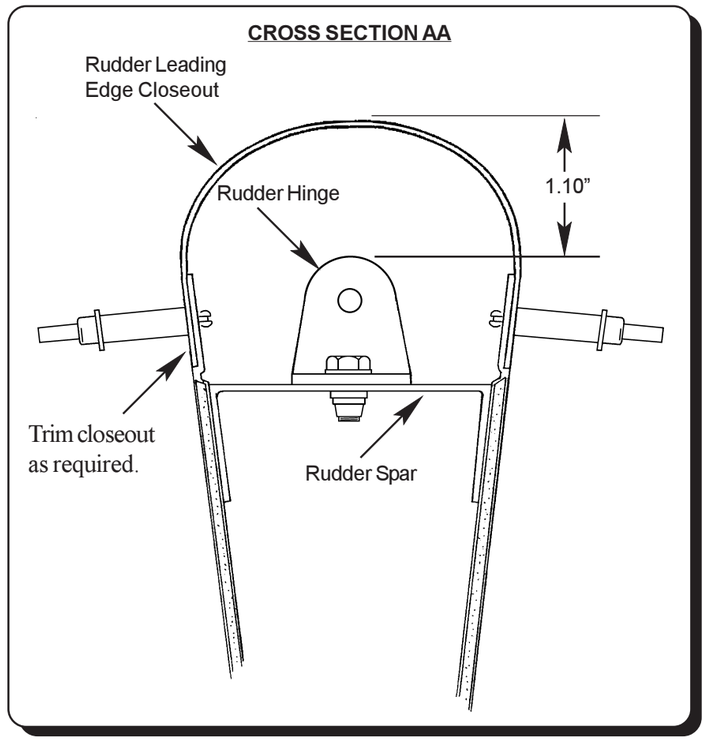
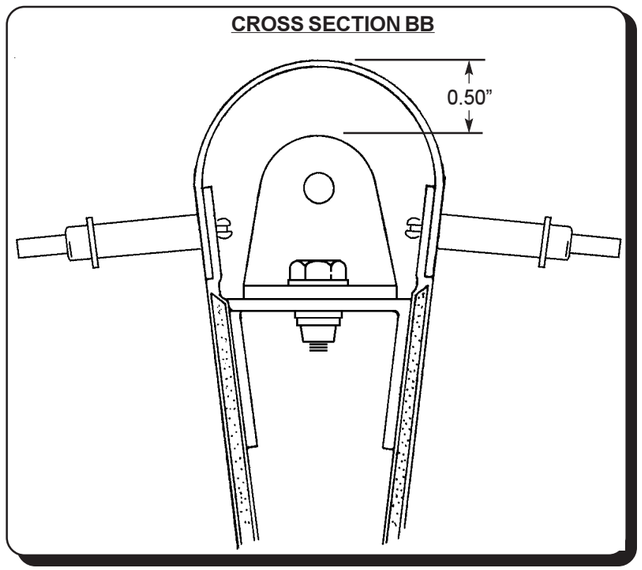
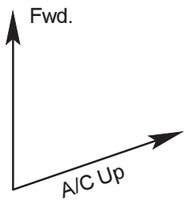
## Rudder Leading Edge Closeout Alignment
## Fig 17:B:2

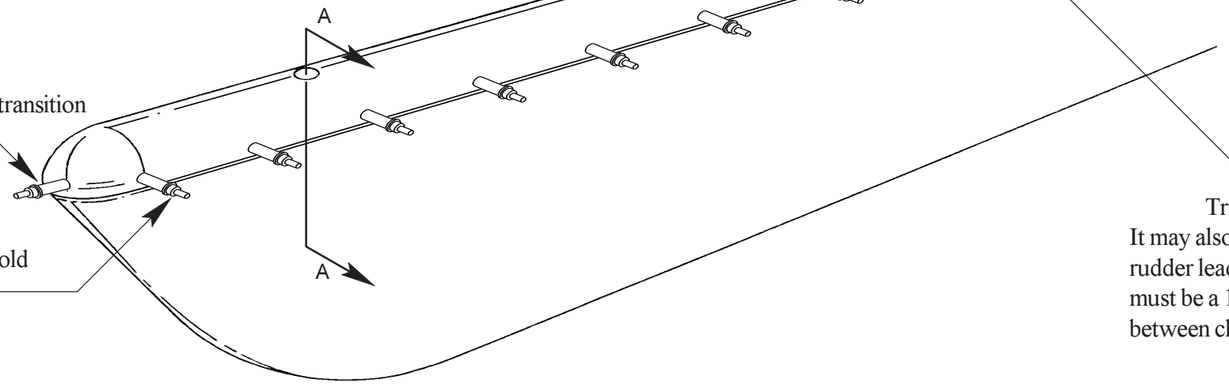



**NOTE:** **Avoid drilling through spar or hinges when drilling cleco holes.**








The rudder closeout should transition smoothly to the rudder in this area.

Install clecoes every 2” to hold closeout in place when you bond.

Trim the aft edge of the closeout as necessary. It may also be necessary to trim the joggle for the rudder leading edge. Refer to Figure 17:B:3. There must be a 1/2” minimum bond width (contact surface between closeout and joggle).

Bond the closeout using standard bonding procedures.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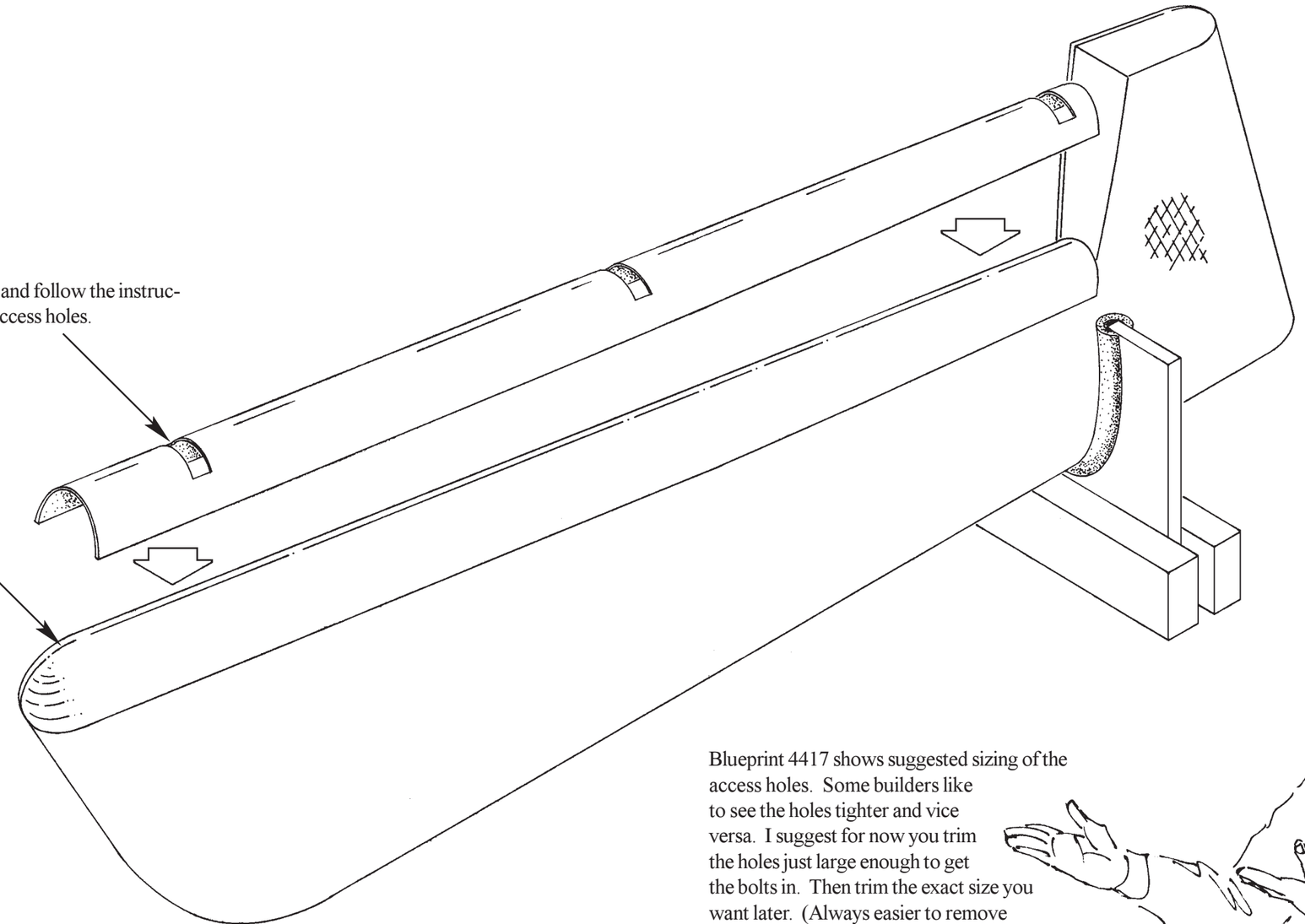
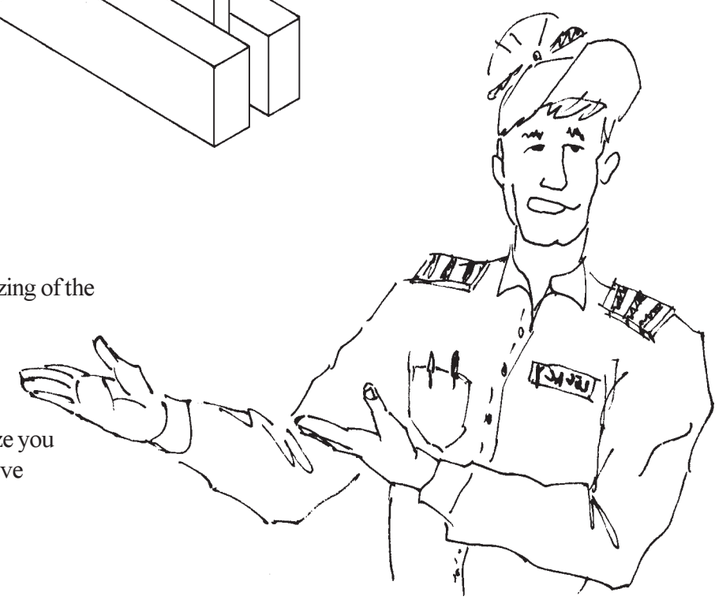
**Trimming the Rudder Access Holes**
**Fig 17:B:3**

Cut out blueprint 4417 and follow the instructions for trimming the access holes.

Accurately create a center line along the closeout leading edge.



Blueprint 4417 shows suggested sizing of the access holes. Some builders like to see the holes tighter and vice versa. I suggest for now you trim the holes just large enough to get the bolts in. Then trim the exact size you want later. (Always easier to remove more later than to add).

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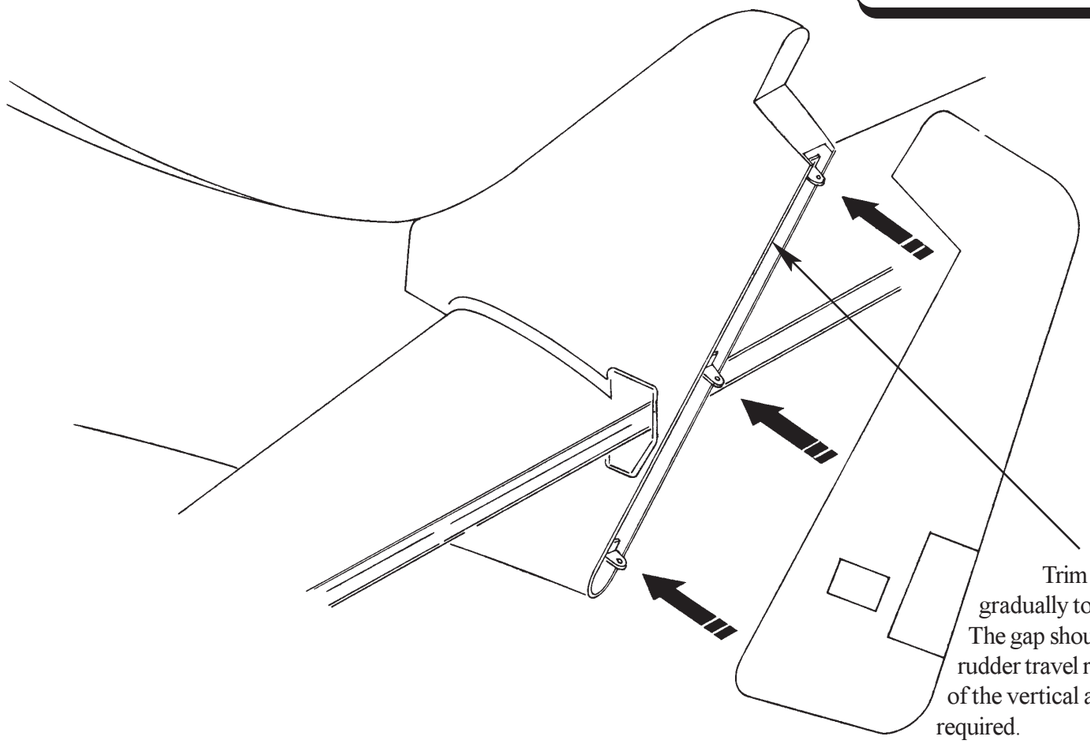
**Trimming Vertical Trailing Edge**
**Fig 17:B:4**

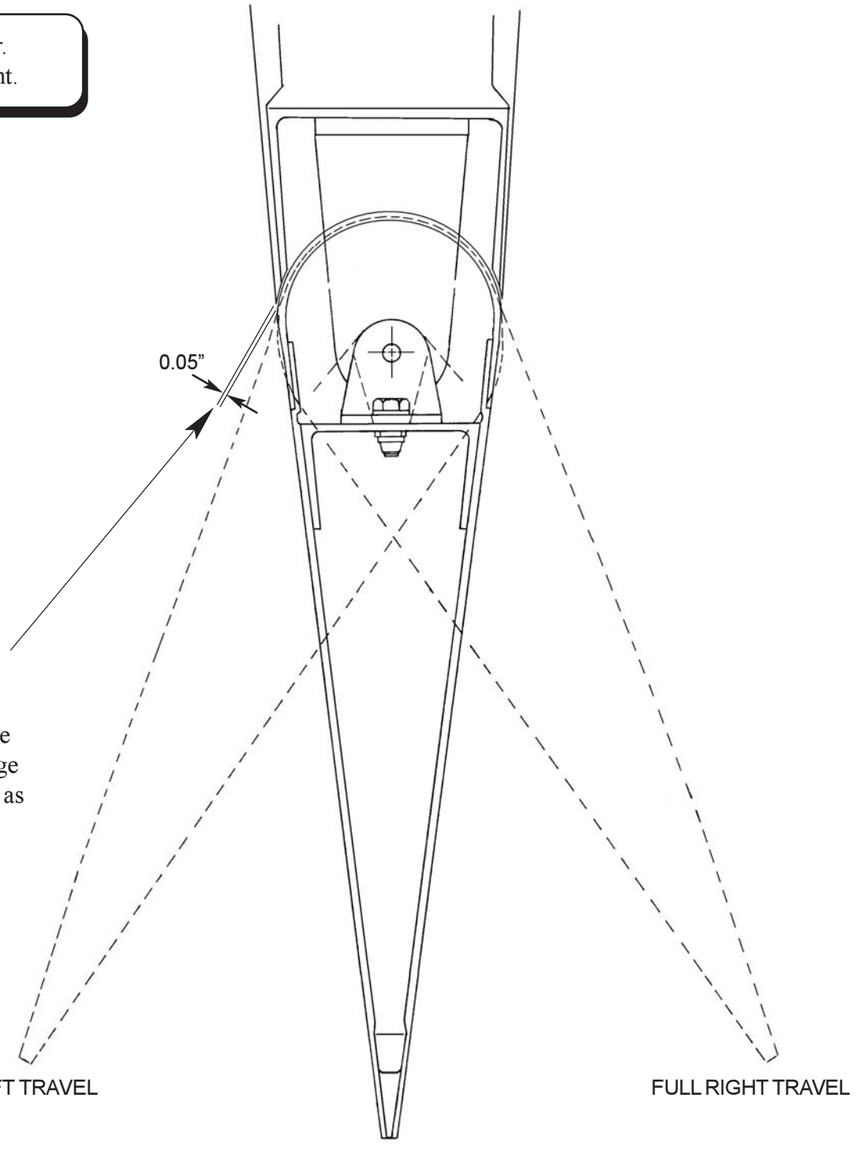
Use AN4-10A bolts to secure the rudder.
There is no need to install the locknuts at this point.



Trim trailing edge of vertical gradually to obtain an even .05" gap. The gap should remain even through the rudder travel range. Trim the trailing edge of the vertical and body work the rudder as required.




**NOTE: The Legacy rudder travel is approximately 32° full left and full right. The exact degree of travel will ultimately be determined by the stops.**





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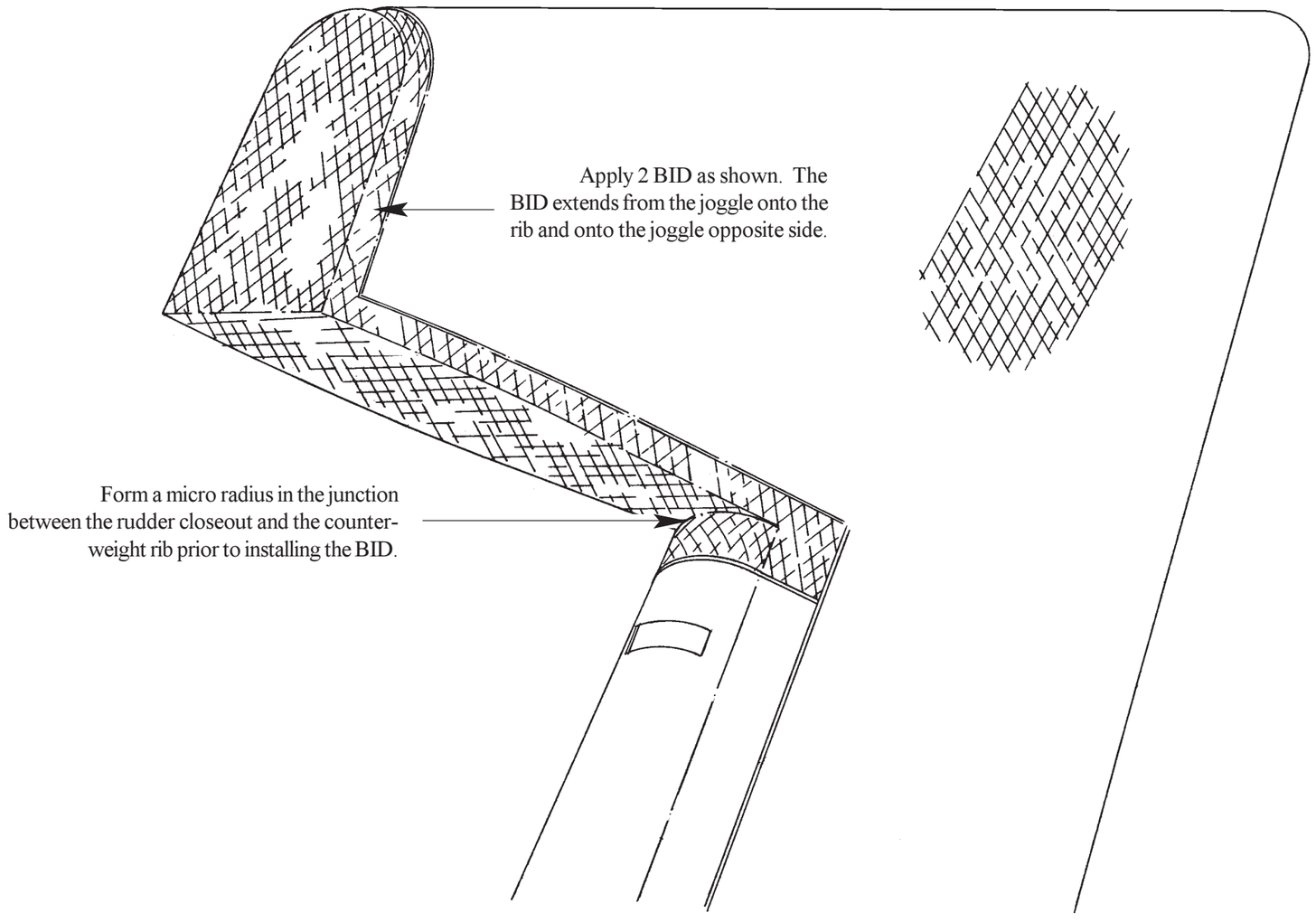
**Closing Out Rudder Counterweight Area with BID**
**Fig 17:B:5**





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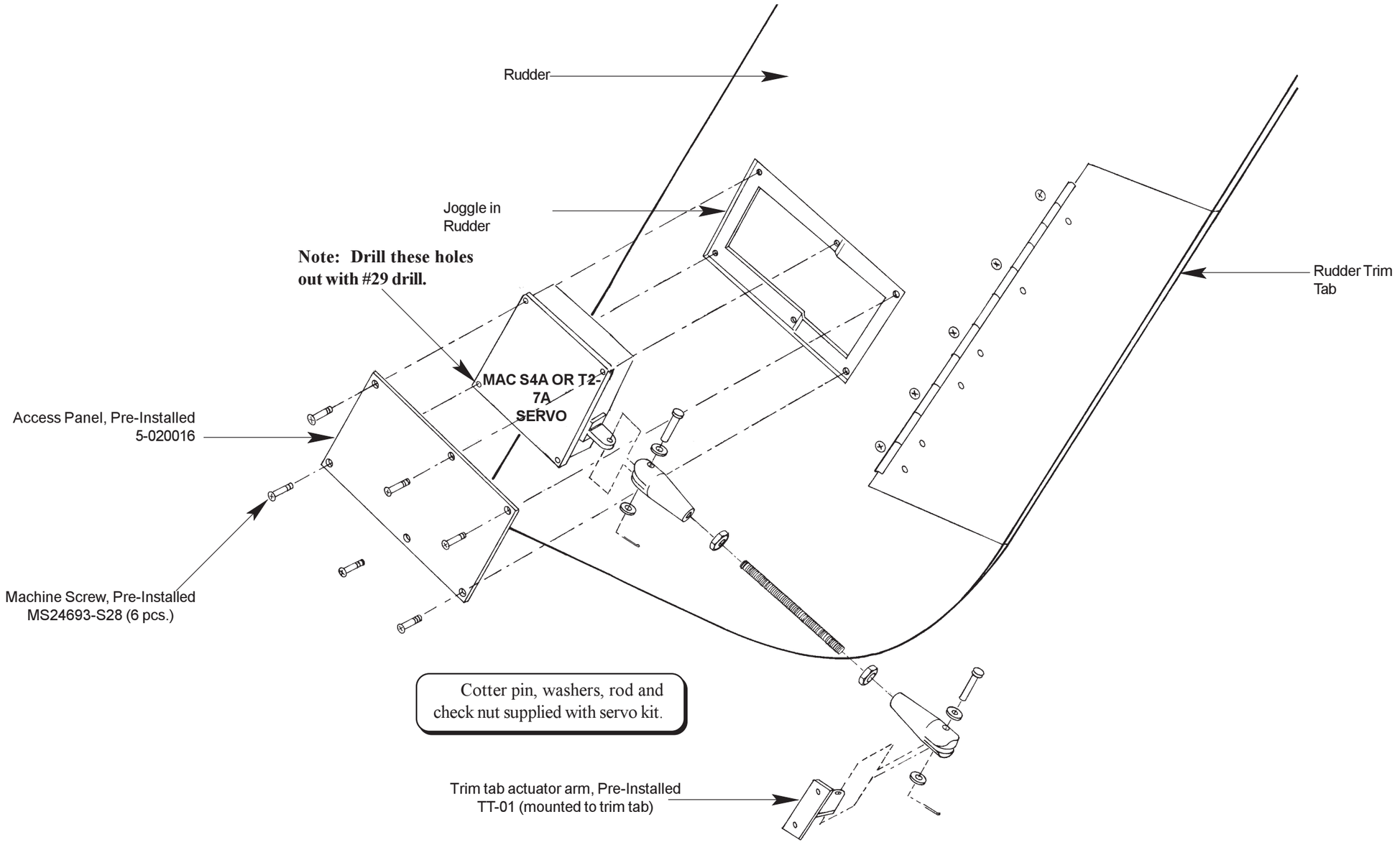
## C. Rudder Trim System (Optional)

**Rudder Trim System (Exploded View)**
**Fig 17:C:1**





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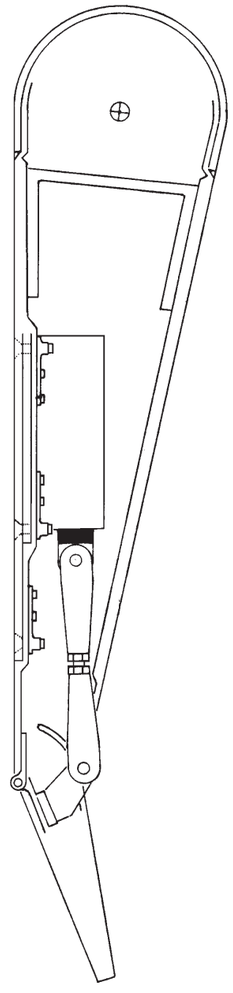
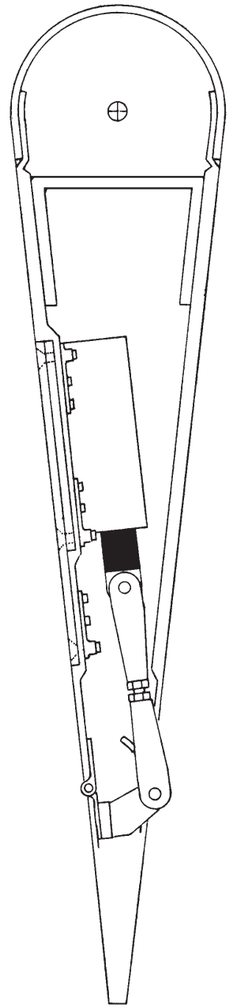
**Adjusting Rudder Trim System**
**Fig 17:C:2**

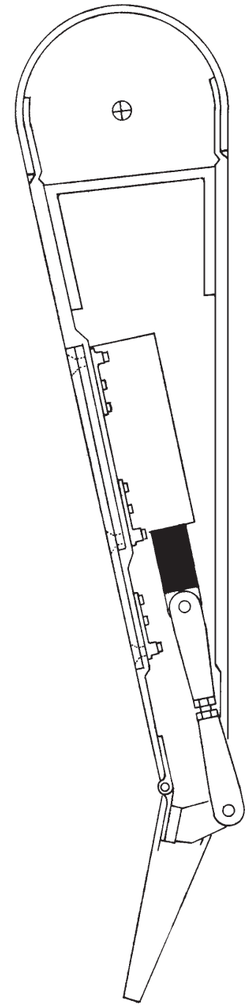
The total travel of S4A trim servo is 7/10". The rudder trim is set so that at the servo's neutral point (half travel) the trim tab is also in the neutral position. Use a 12 volt battery to operate the servo.



- Full Left Rudder
- Servo motor "in"
- The trim tab moves to the right causing the rudder to deflect left.



- Neutral Rudder
- Servo motor "centered"
- The trim tab centered causing no deflection of the rudder.



- Right Rudder
- Servo motor fully "extended"
- The trim tab moves to the left causing the rudder to deflect right.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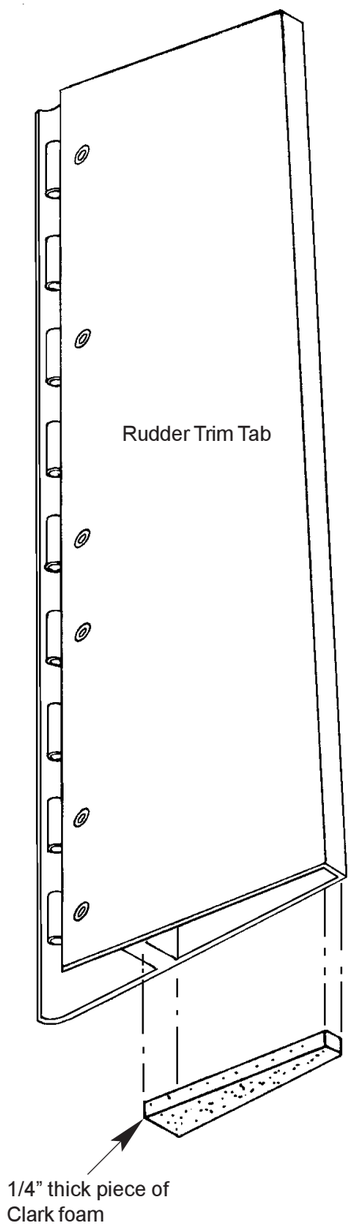
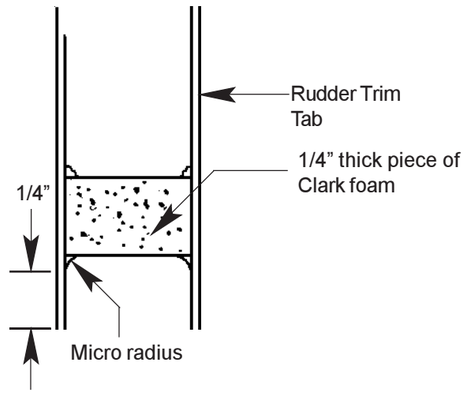
**Closing Out The Rudder Trim Tab**
**Fig 17:C:3**

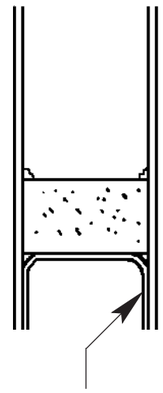



Step ①



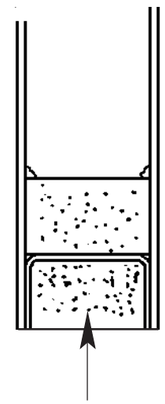

Fit and install a 1/4" thick piece of Clark foam. Install with epoxy/micro.

Step ②



Apply 1 BID 7781 as shown.

Step ③



Fill with epoxy/micro as shown.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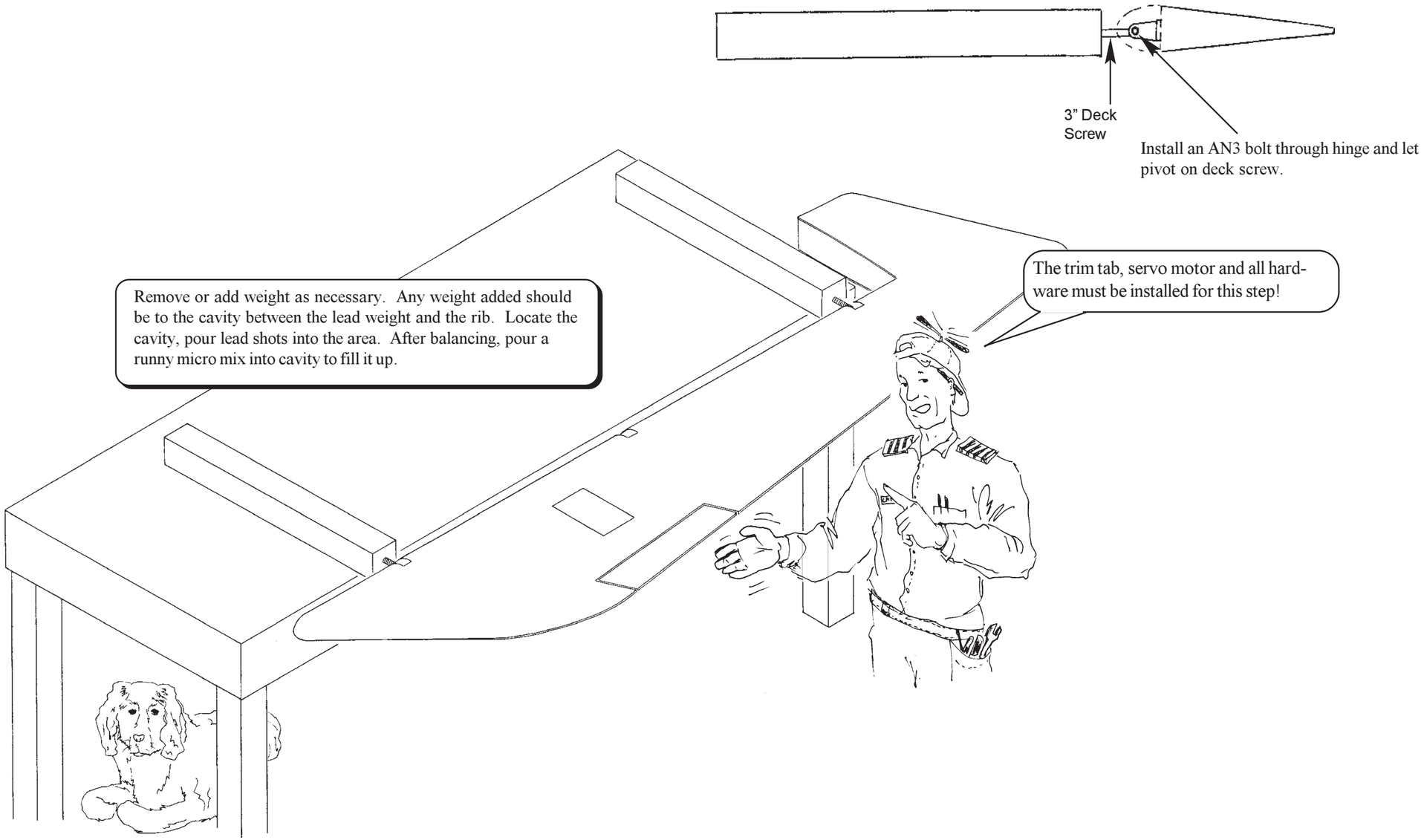
## D. Adjusting the Rudder Counter Weights

**Adjusting Rudder Counter Weights**
**Fig 17:D:1**

This step should be done after the body work and priming and just before paint. Provided you are 100% mass balanced prior to paint, the added weight of the paint is within tolerance.





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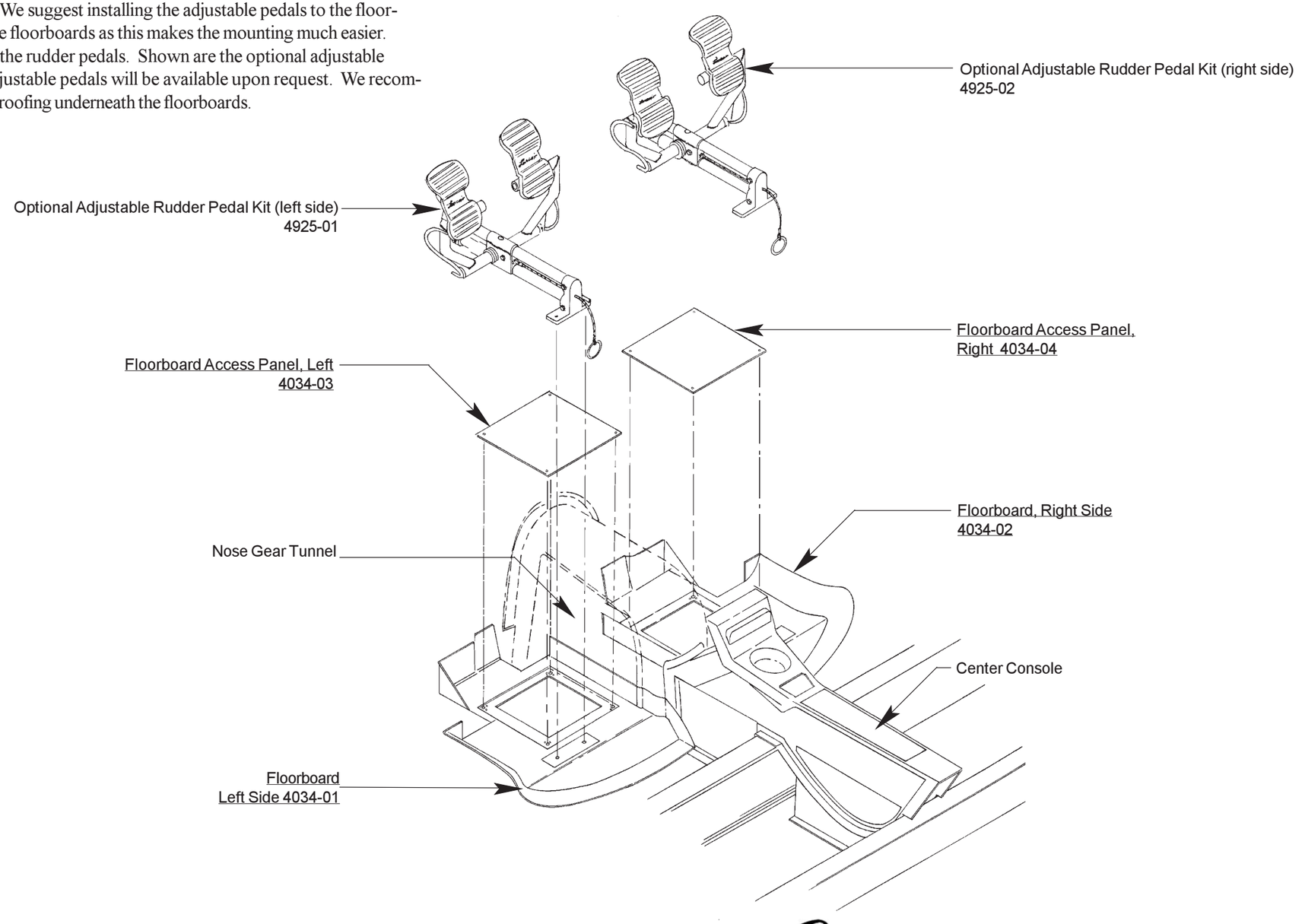
## E. Rudder Pedal Installation

The floorboards install by the pilot's and co-pilot's feet. The rudder pedals mount to the floorboards. We suggest installing the adjustable pedals to the floorboards prior to bonding the floorboards as this makes the mounting much easier. There are two options for the rudder pedals. Shown are the optional adjustable rudder pedals. The nonadjustable pedals will be available upon request. We recommend installing the soundproofing underneath the floorboards.

**General Overview**
**Fig 17:E:1**





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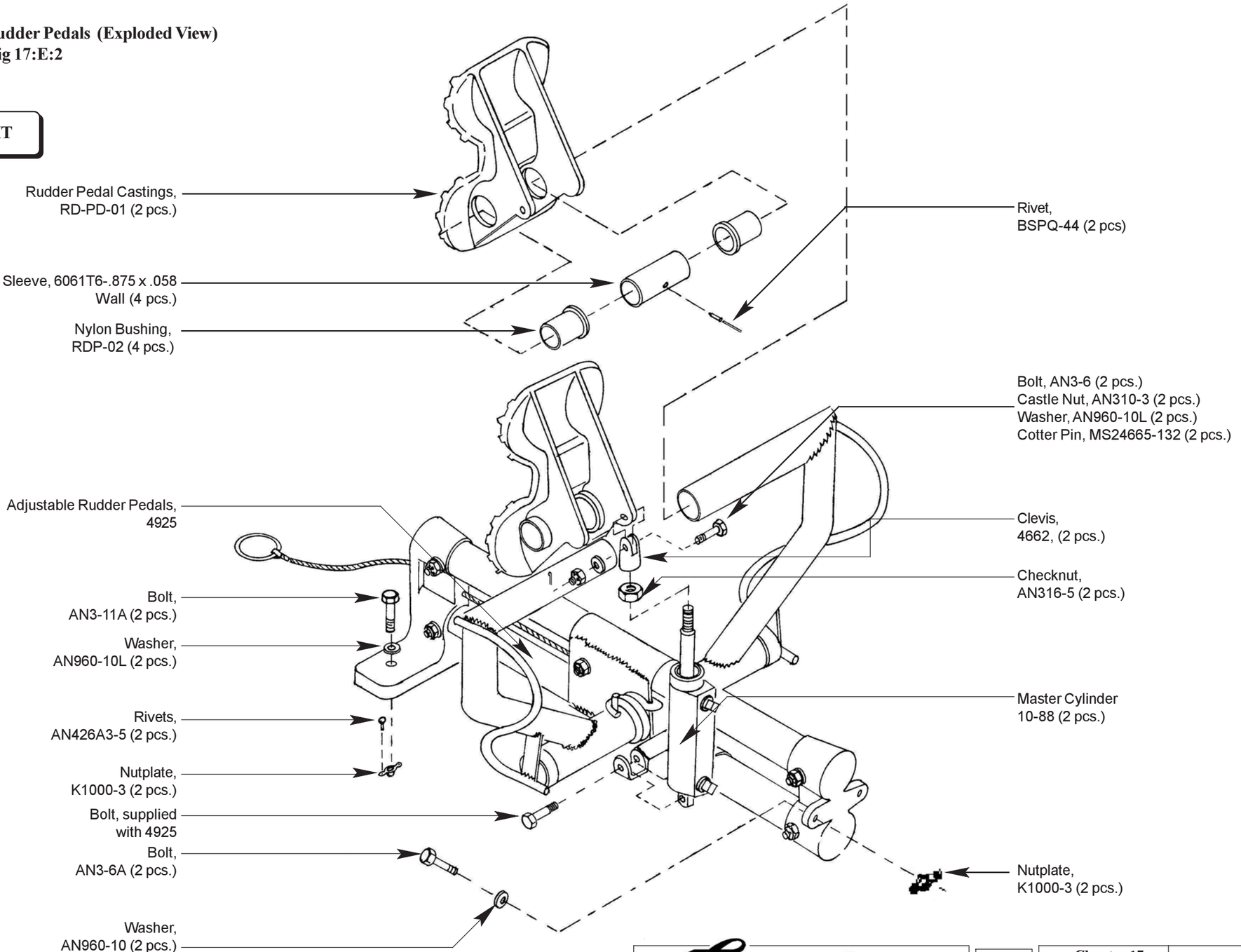
**Optional Adjustable Rudder Pedals (Exploded View)**
**Fig 17:E:2**

**(*) Included with KIT**





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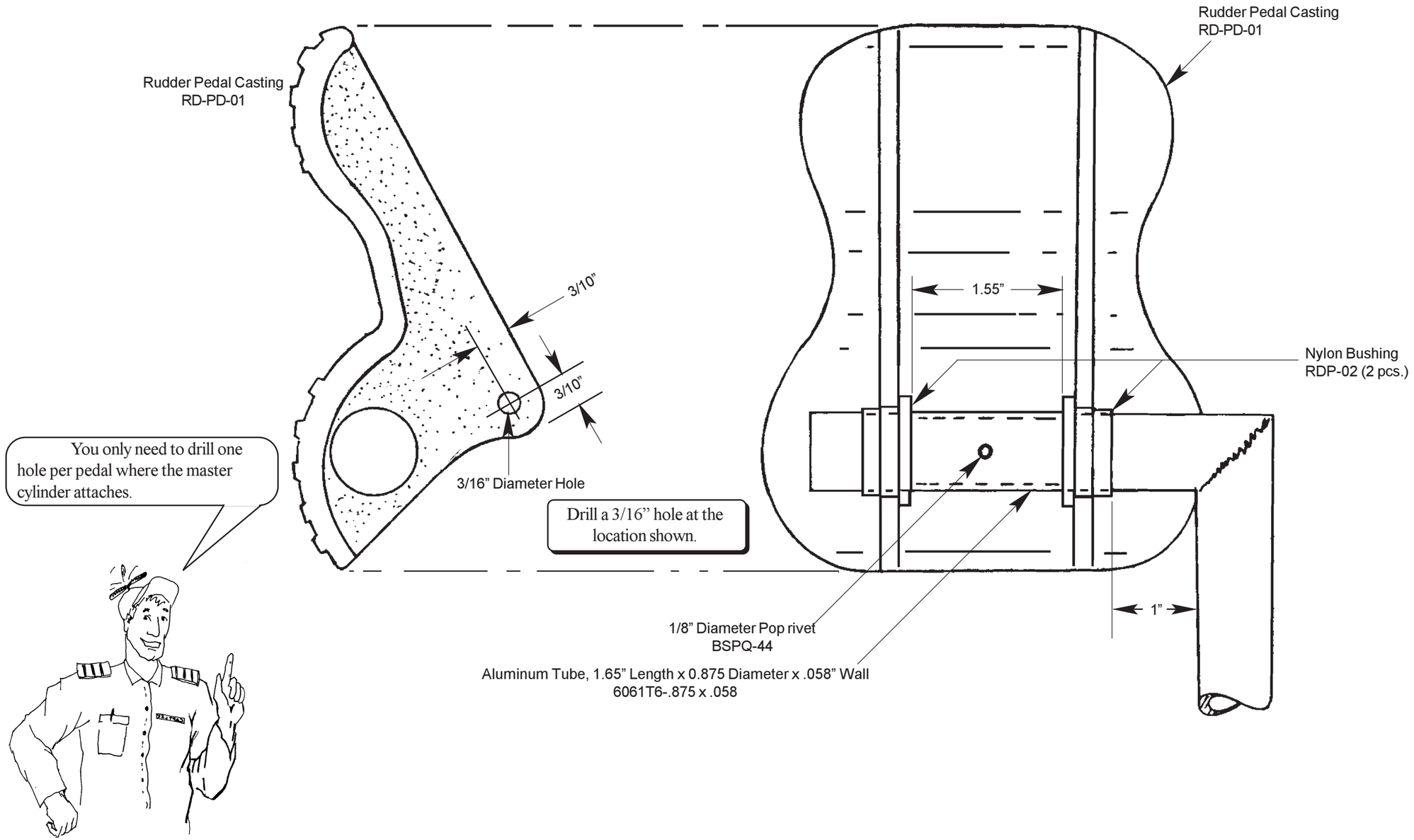
**Installing The Rudder Pedal Casting**
**Fig 17:E:3**





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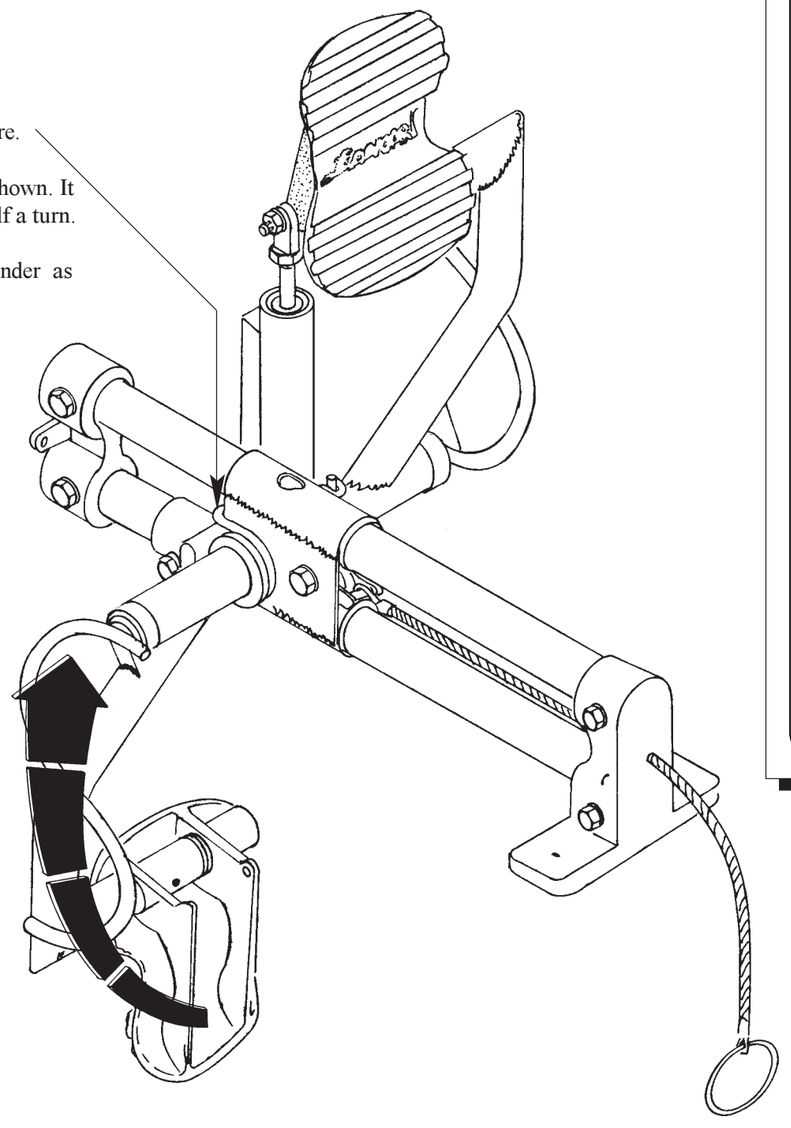
**Installing Rudder Pedal Master Cylinder**
**Fig 17:E:4**

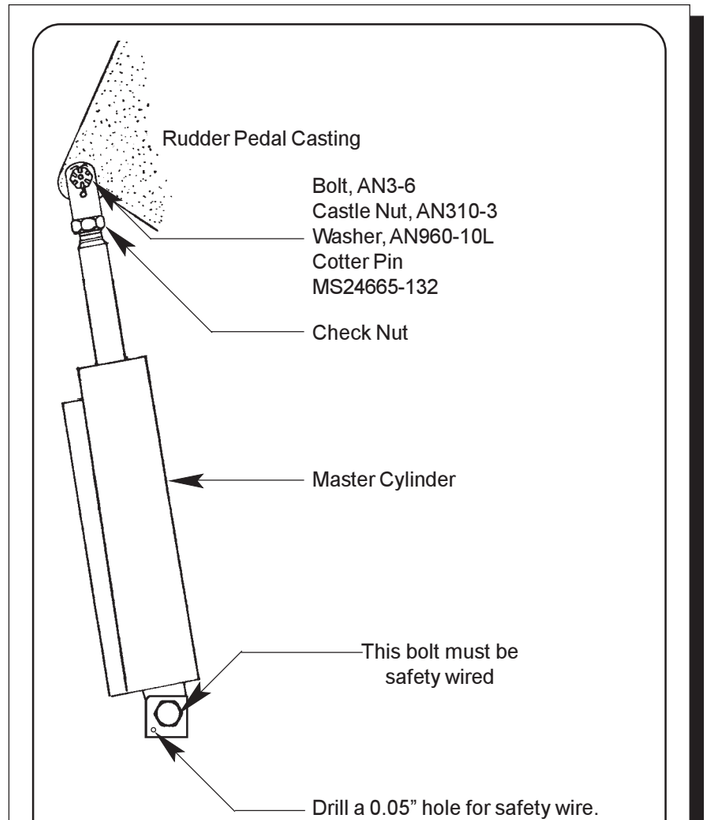
"Winding up the pedal:"

1. Attach the spring here.

2."Wind" the pedal as shown. It takes approximately half a turn.

3. Install the master cylinder as shown.







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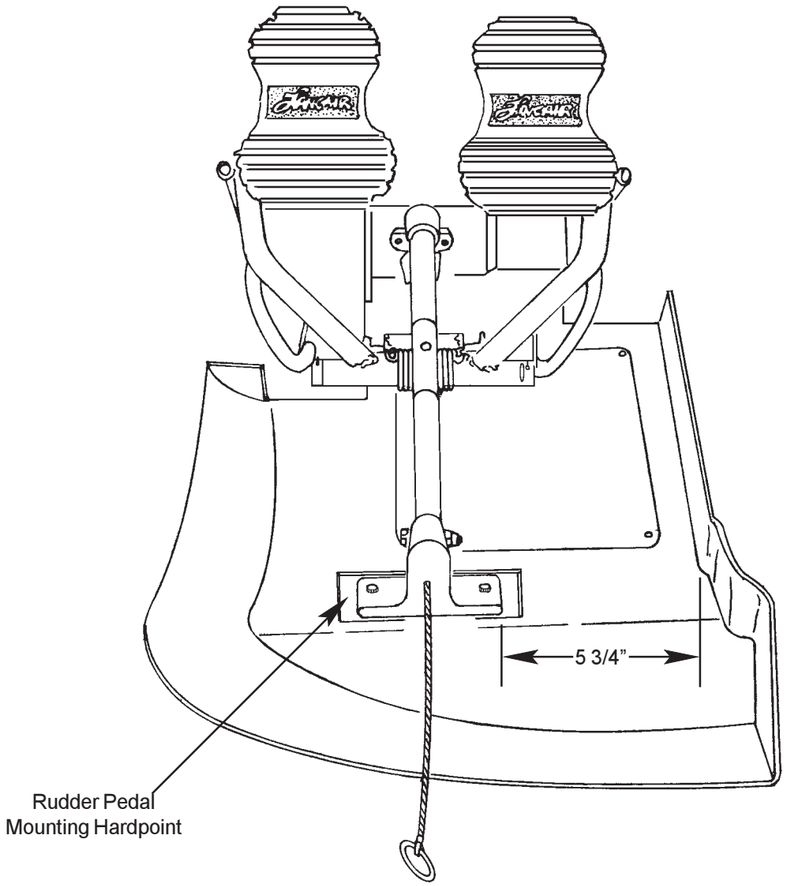
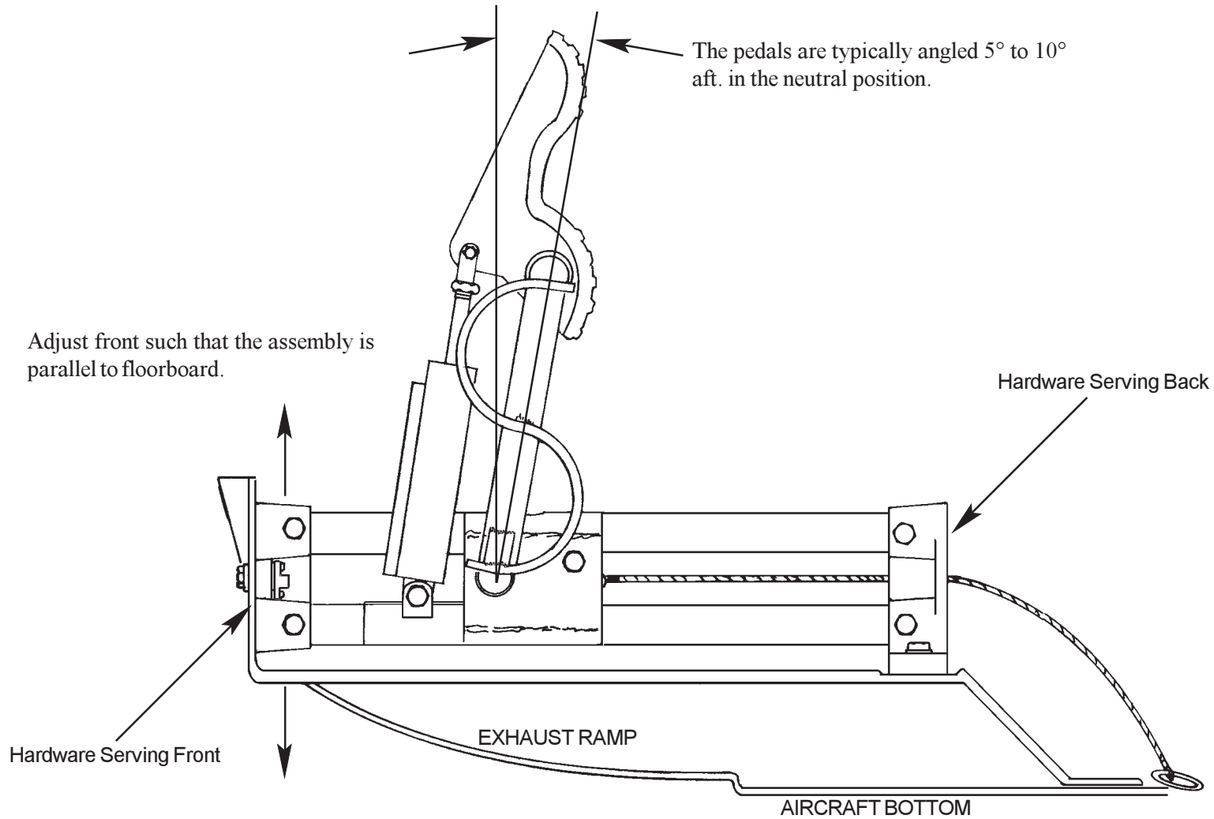
**Mounting Rudder Pedals To Floorboard**
**Fig 17:E:5**

**TOP VIEW**




**SIDE VIEW**





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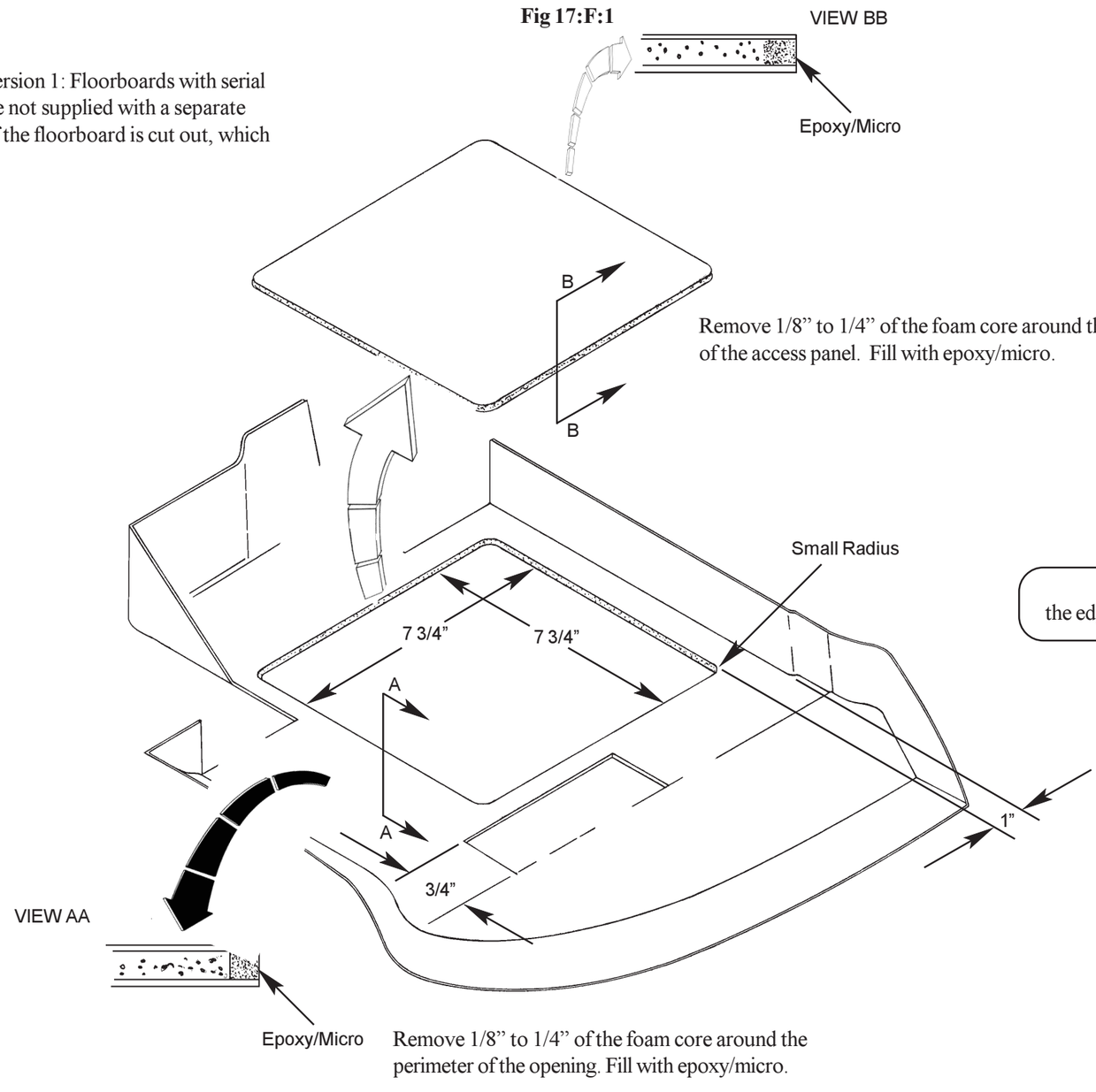
# F. Floorboard Installation

## Version 1

There are two different versions of floorboards. Version 1: Floorboards with serial number 2000-2021. The version 1 floorboards are not supplied with a separate floorboard access panel. A 7 3/4" x 7 3/4" piece of the floorboard is cut out, which becomes the floorboard access panel.

**THIS PAGE APPLIES TO VERSION 1.**

**Floorboard Access Panels Version 1**
**Fig 17:F:1**




Remove 1/8" to 1/4" of the foam core around the perimeter of the access panel. Fill with epoxy/micro.

Remove 1/8" to 1/4" of the foam core around the perimeter of the opening. Fill with epoxy/micro.



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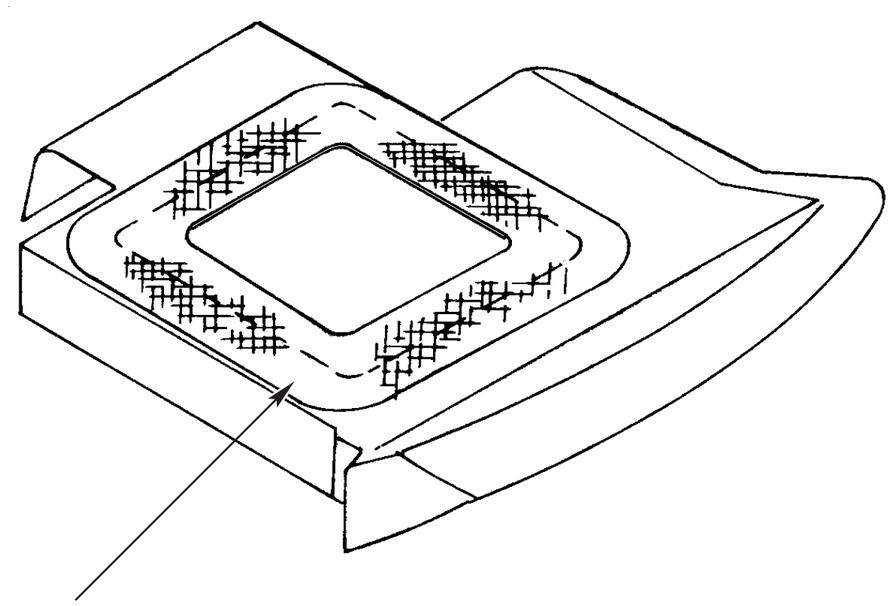
**Floorboard Access Panels Version 1**
**Fig 17:F:2**

To form the flange for Access Panel:

1. Release tape the lower surface of the access panel. Clean tape or duct tape works well.

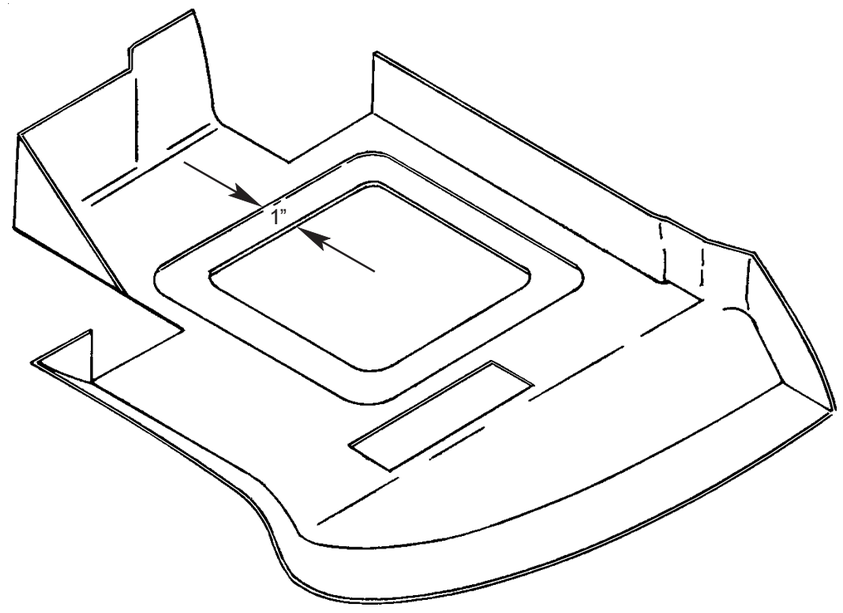
2. Hold the access panel in place by gluing pieces of tongue depressors across the upper surface between floorboard and the access.

3. Prepare the bonding surfaces



4. Apply 2” wide 6 BID as shown.

5. Trim the flange width to 1”.




**THIS PAGE APPLIES TO VERSION 1.**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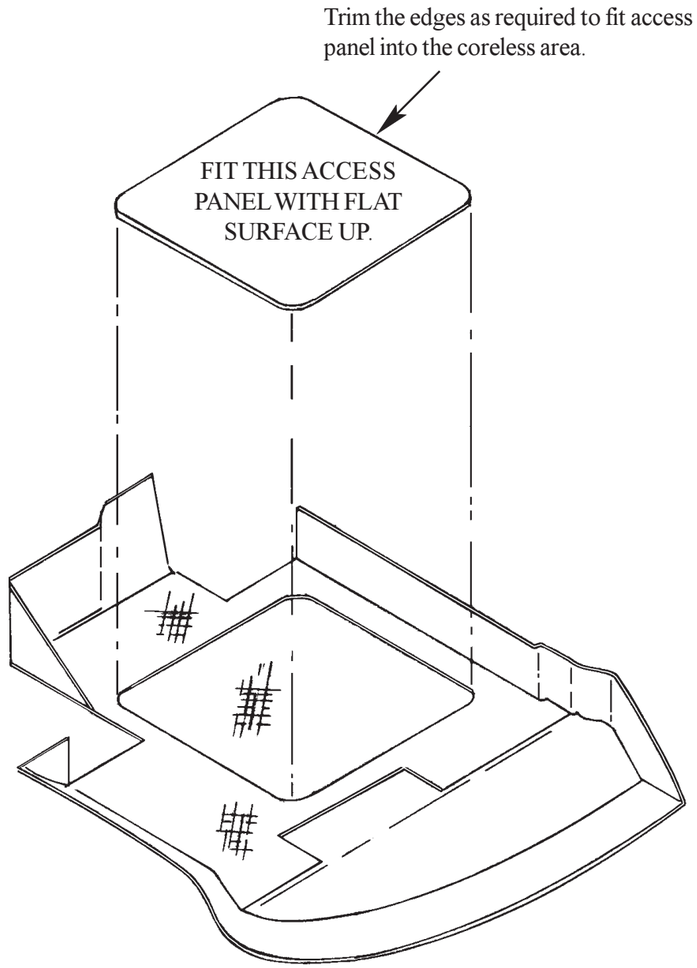
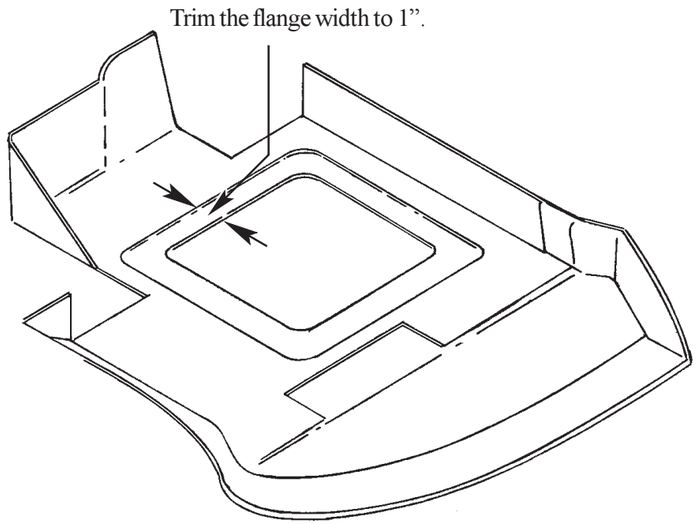
## Version 2

Floorboards with serial numbers 2021 and above have separate access panels supplied. There is also a reinforced coreless area.

**Fitting Floorboards Version 2**
**Fig 17:F:3**




**THIS PAGE APPLIES TO VERSION 2.**





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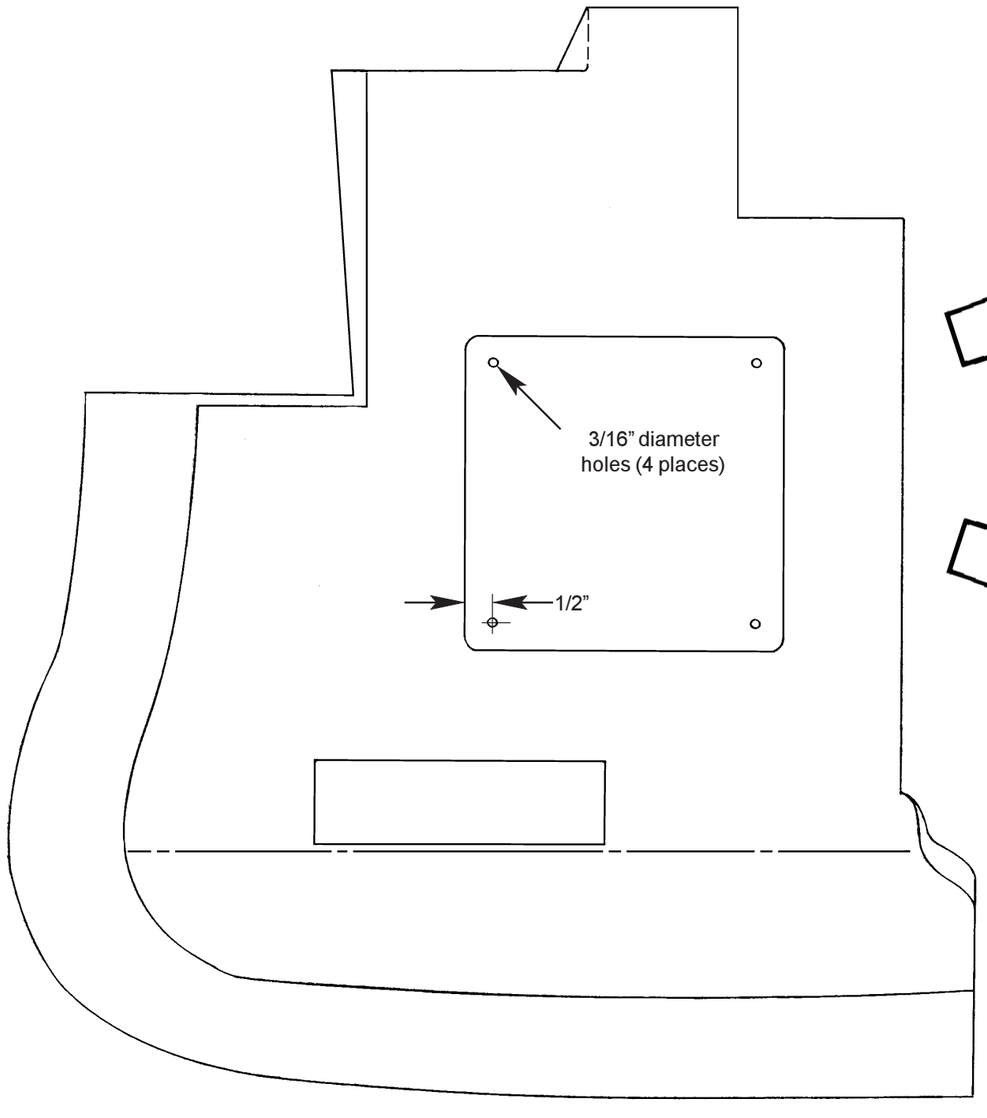
**Securing Access Panels**
**Fig 17:F:4**

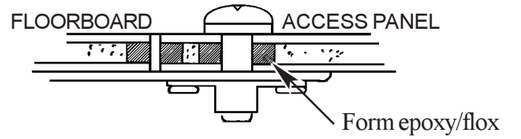
**THIS PAGE APPLIES TO VERSION 1 & 2.**

FLOORBOARD TOP VIEW




VERSION 1

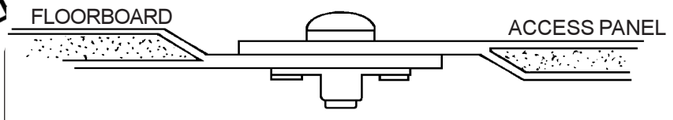
**CROSS SECTION OF VERSION 1**




Secure with:
- Screws, AN526-1032-R10
- Washers, AN960-10
- Nutplate, K1000-3
- Rivets, MSC-34

VERSION 2

**CROSS SECTION OF VERSION 2**




Secure with:
- Screws, AN526-1032-R8
- Washers, AN960-10
- Nutplate, K1000-3
- Rivets, MSC-34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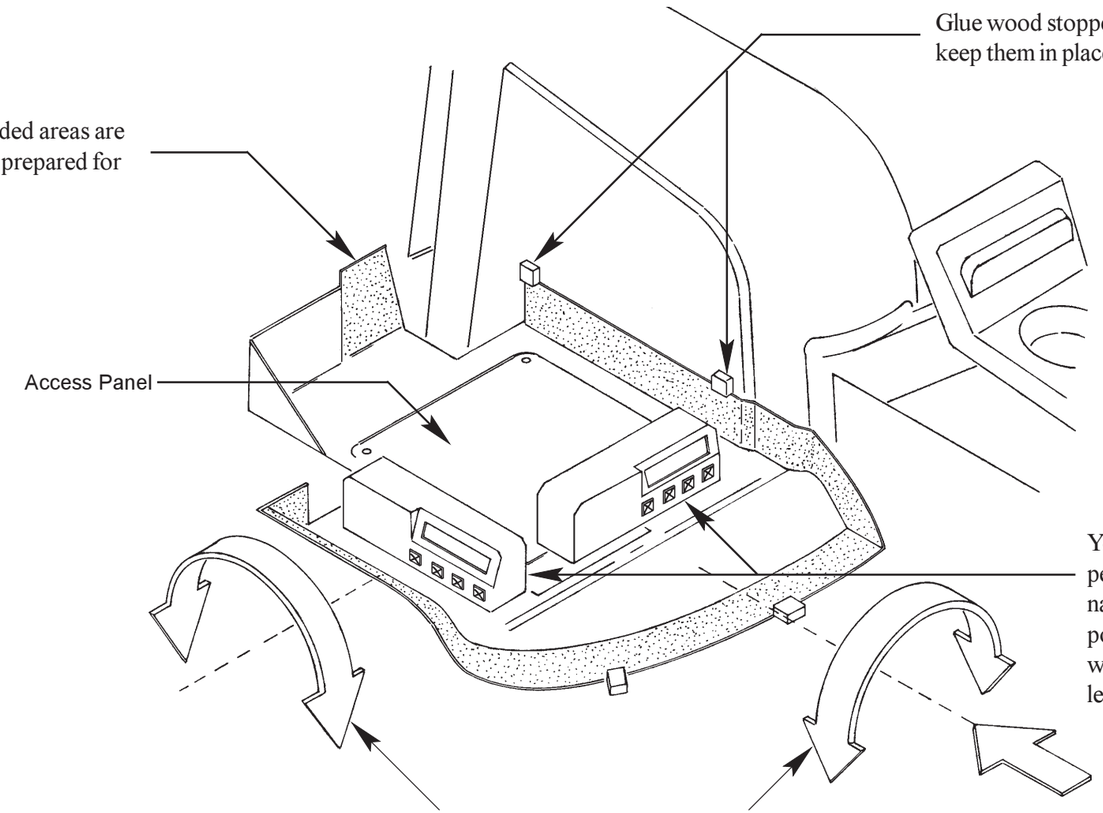
**Setting Rudder Floorboards in Place**
**Fig 17:F:5**

After installing the access panels and rudder pedals onto the floorboards you are now ready to bond the floorboards in the fuselage.

**F 1.** Remove the rudder pedals from the floorboards to ease floorboard installation.

**F 2.** Set the floorboards in place. They should fit snugly in place and shouldn't require much adjustments.





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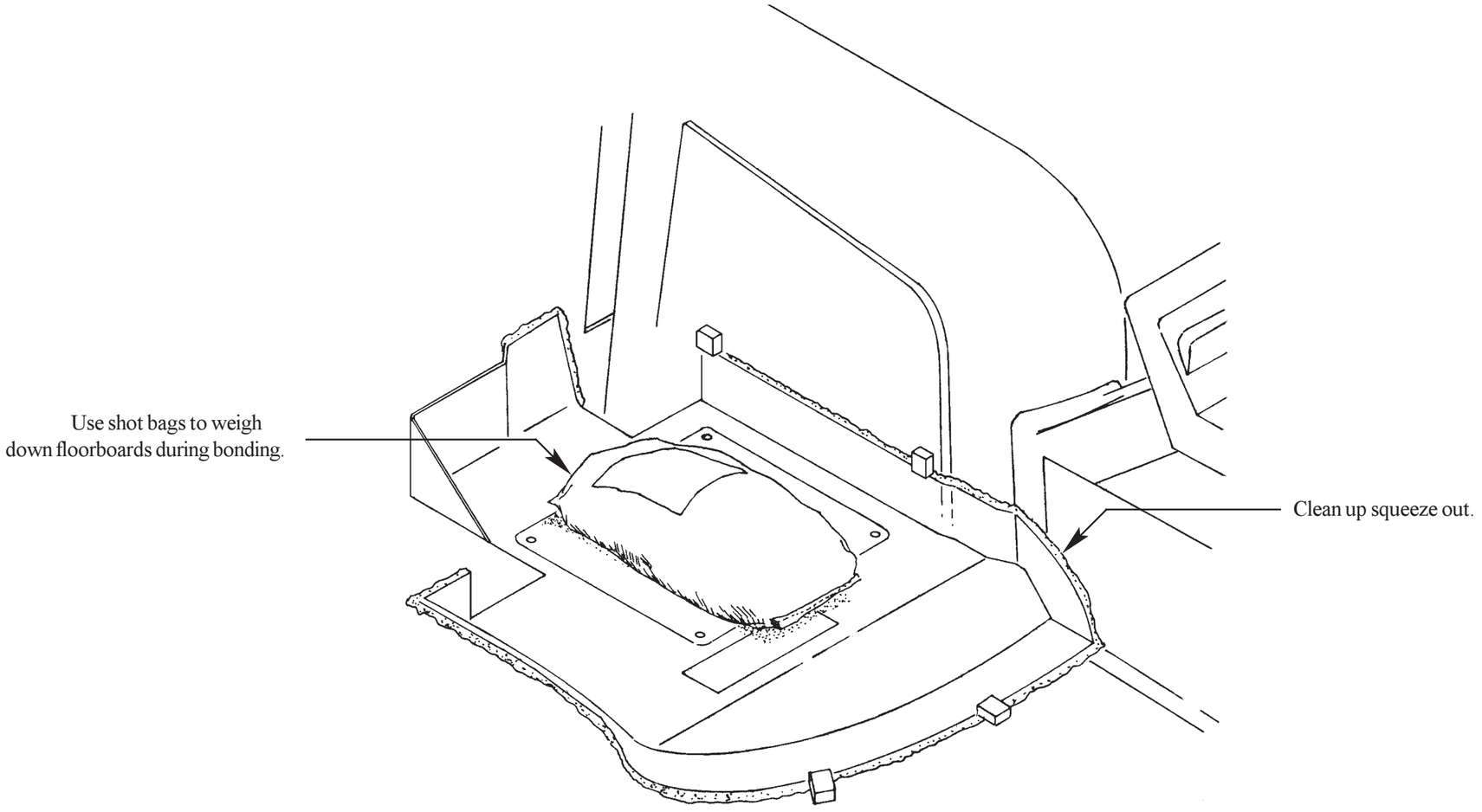
**Bonding Rudder Floorboards**
**Fig 17:F:6**




**F 3.** Bond the floorboards using Standard Bonding Procedures.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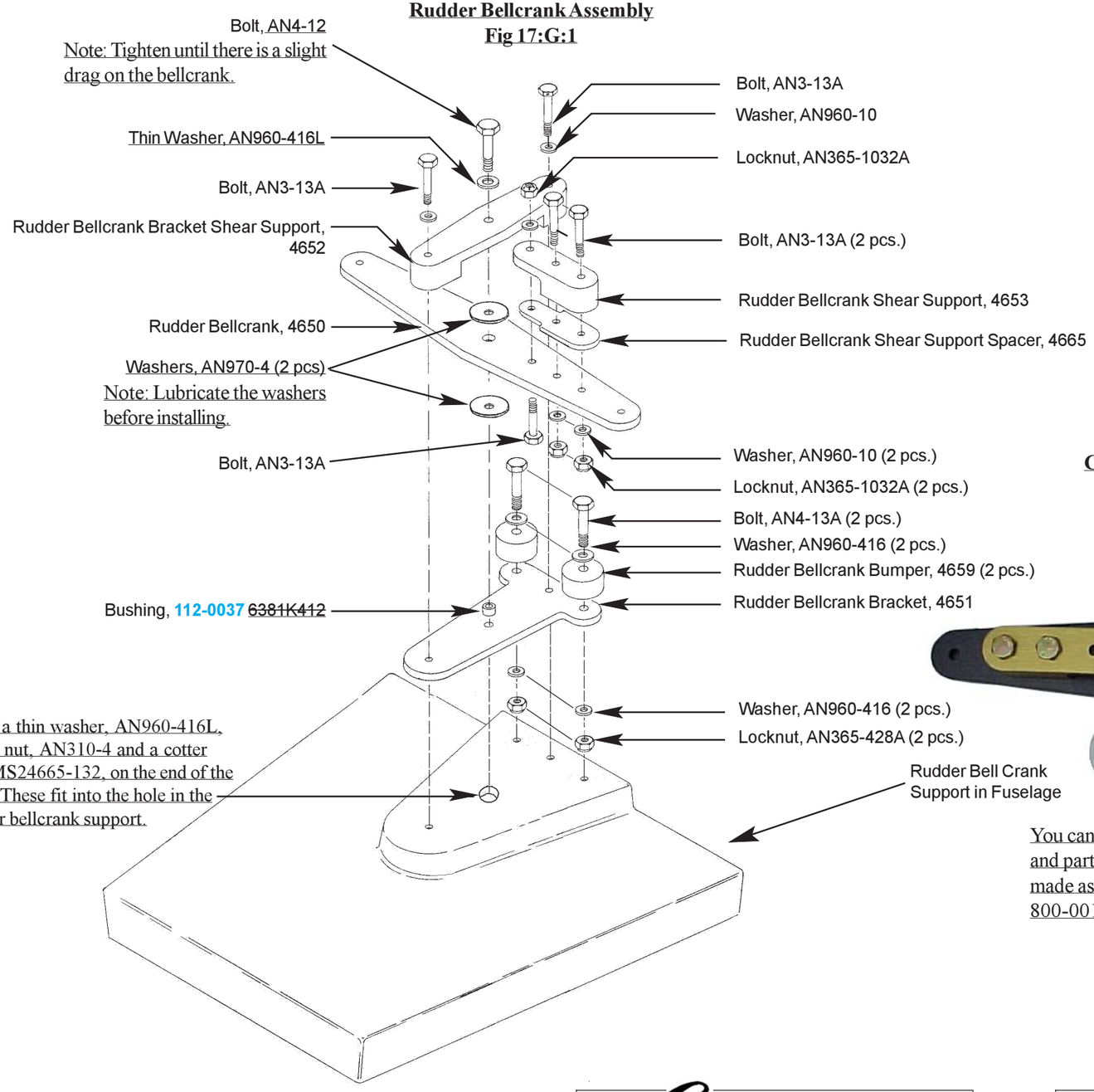
## G. Rudder Bellcrank

Most of the rudder bellcrank assembly may be completed outside the aircraft, including the rudder pushrod. Note that one of the bolts going through the rudder bellcrank shear support points up. This is necessary for the bolt to clear the rudder bellcrank support in fuselage.

As always, double check all hardware lengths. There must be a minimum of one thread showing through the fastener.

Note: If your bellcrank has a couple of "bumps" on it, install such that the bumps face aft. The flat side should make contact with the bumpers.

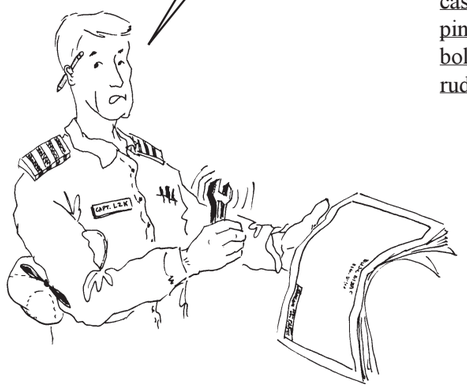
**Rudder Bellcrank Assembly**
**Fig 17:G:1**




**Completed Rudder Bellcrank**
**Fig. 17:G:1a**

You can assemble the bellcrank using the diagram and parts in figure 17:G:1 or you can request a pre-made assembly from KCI by ordering part number 800-0013.

Also study figure 17:H:1 prior to installation.

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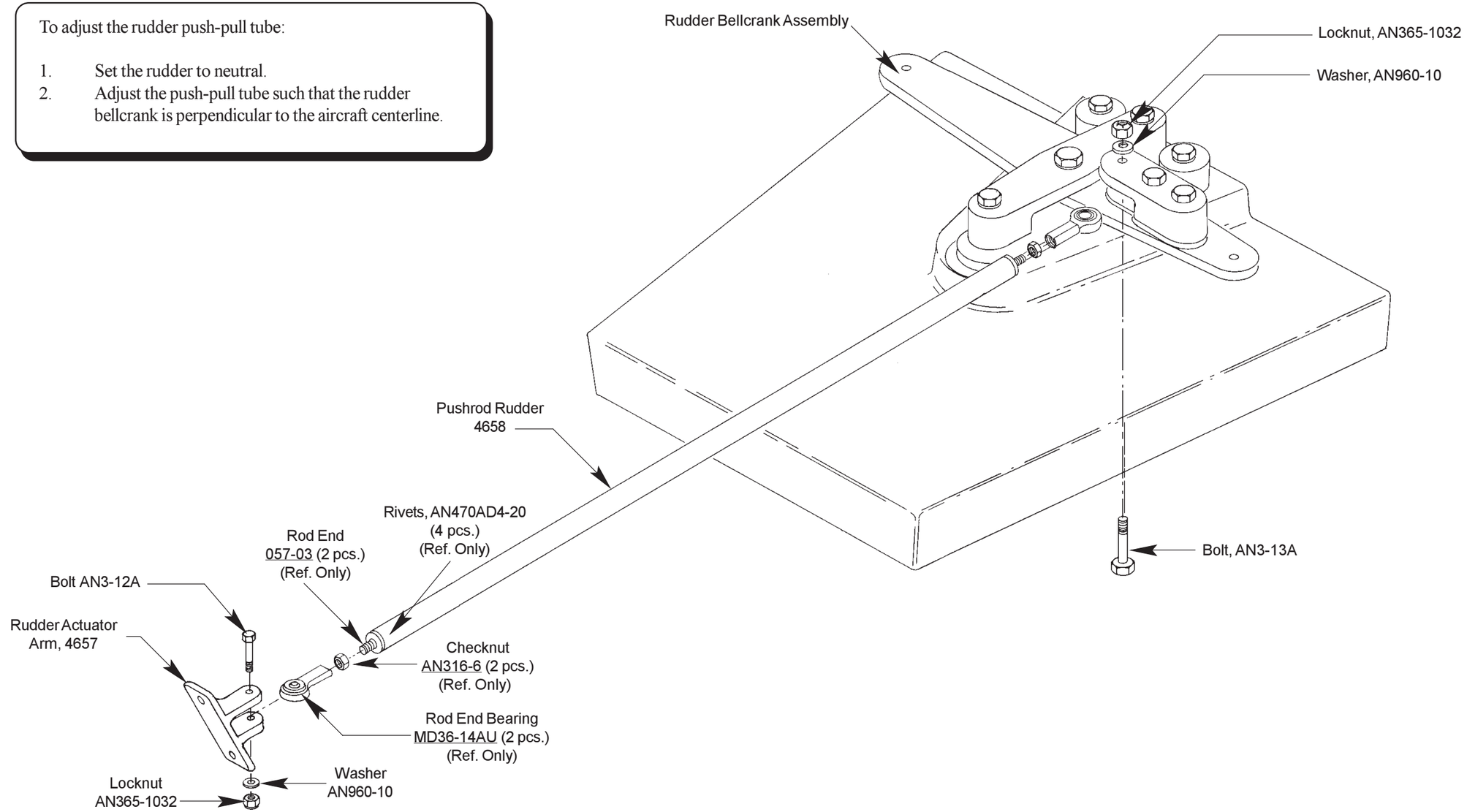
## H. Rudder Pushrod

To adjust the rudder push-pull tube:

1. Set the rudder to neutral.
2. Adjust the push-pull tube such that the rudder bellcrank is perpendicular to the aircraft centerline.

**Rudder Pushrod Installation**
**Fig 17:H:1**





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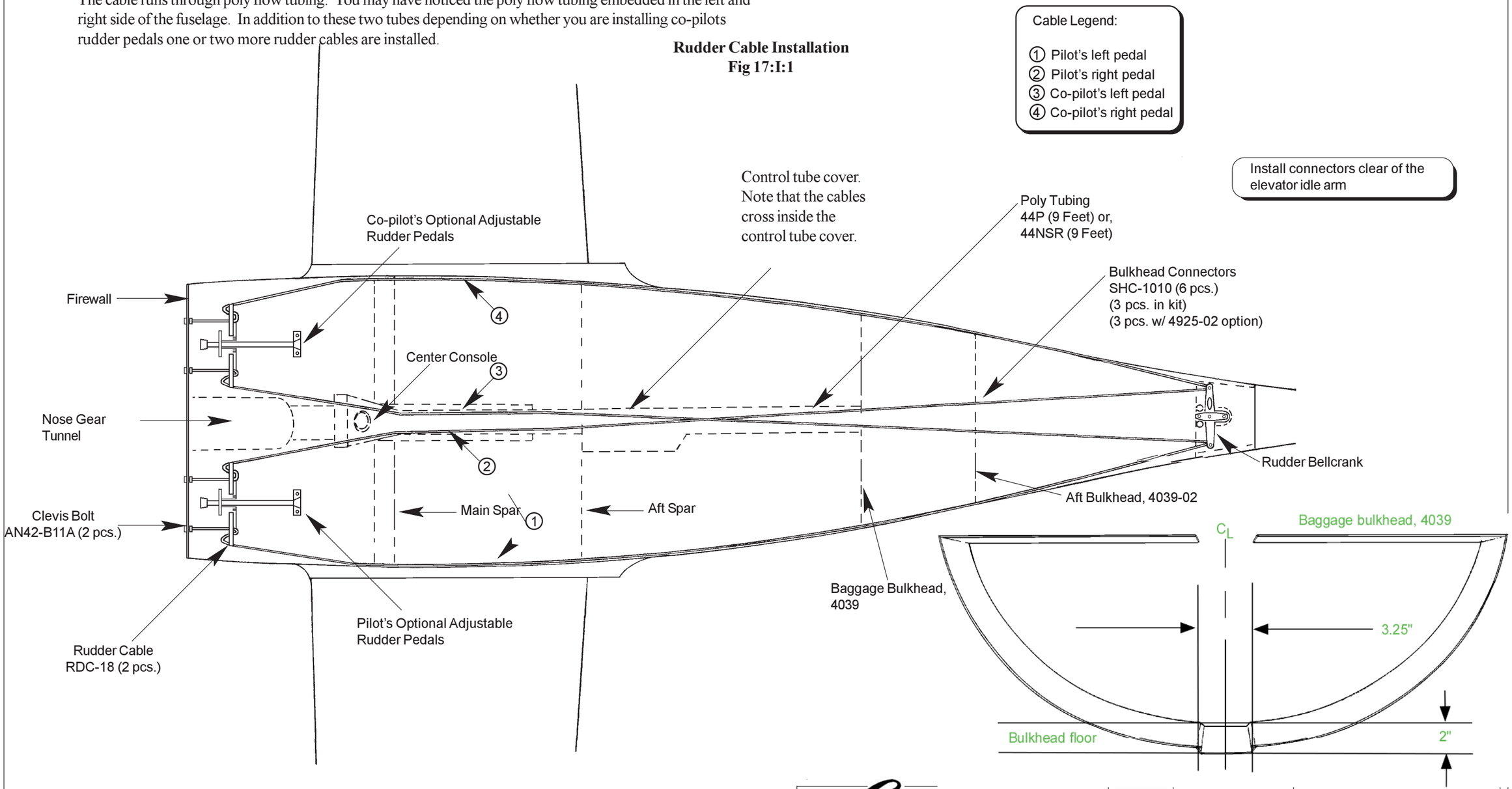
# I. Rudder Cable

The final link in the rudder controls is the cable that runs from the firewall to the rudder bellcrank. The cable runs through poly flow tubing. You may have noticed the poly flow tubing embedded in the left and right side of the fuselage. In addition to these two tubes depending on whether you are installing co-pilots rudder pedals one or two more rudder cables are installed.

**Rudder Cable Installation**
**Fig 17:I:1**



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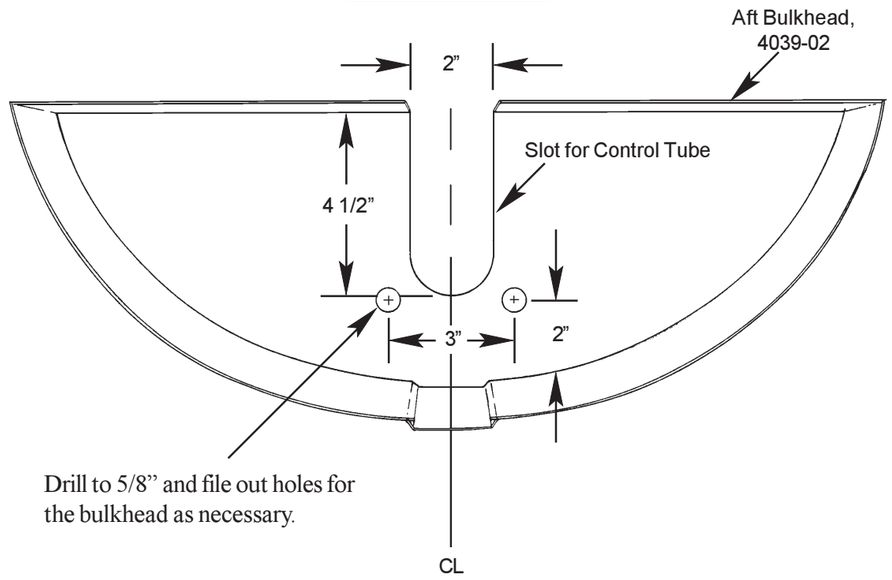
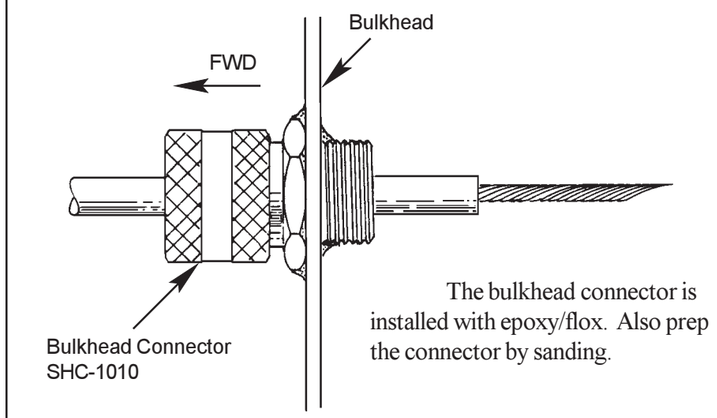
**Aft Bulkhead Installation**
**Fig 17:I:2**

**Note: This bulkhead is optional and typically only installed if installing an Autopilot. 4039**

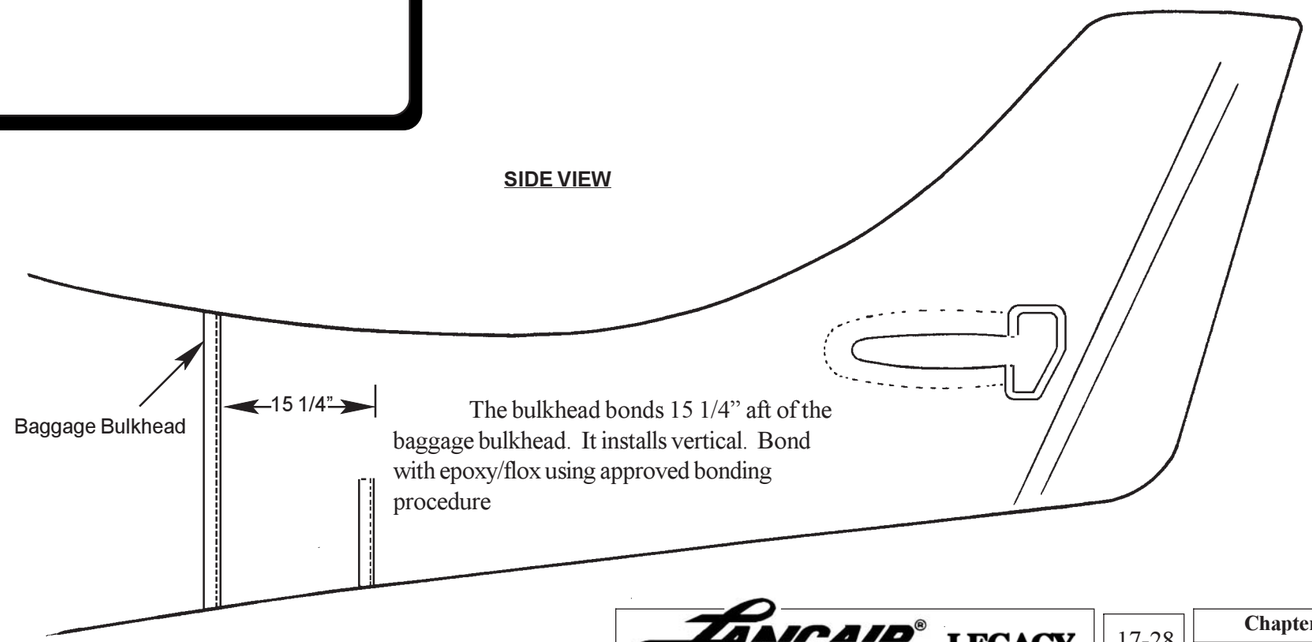
**VIEW LOOKING AFT**




**BULKHEAD CONNECTOR INSTALLATION**




**SIDE VIEW**





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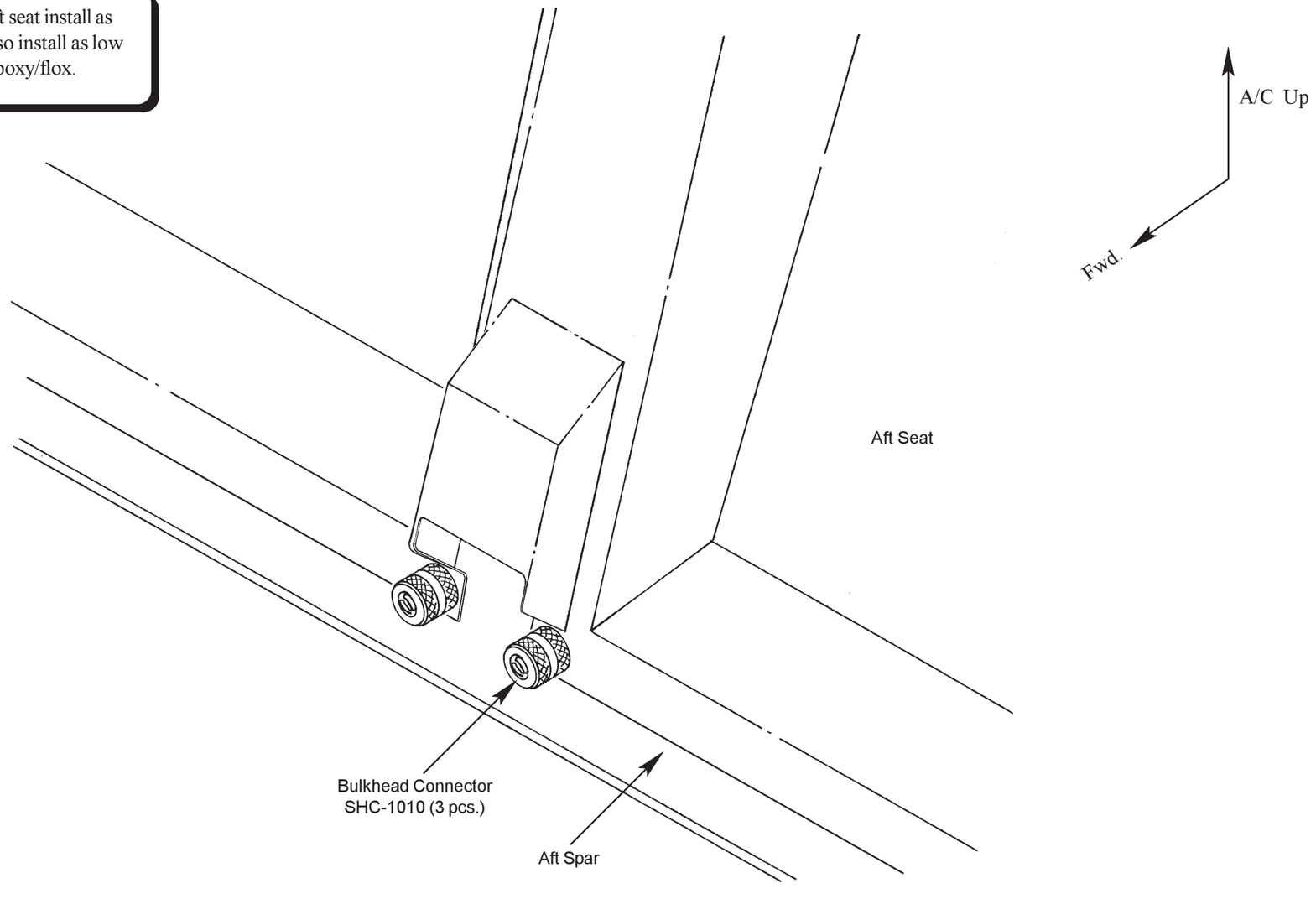
**Bulkhead Connector Installation In Back Seat**
**Fig 17:I:3**

The bulkhead connectors in the aft seat install as close as possible to the center console. Also install as low as possible. Install the connectors using epoxy/flox.





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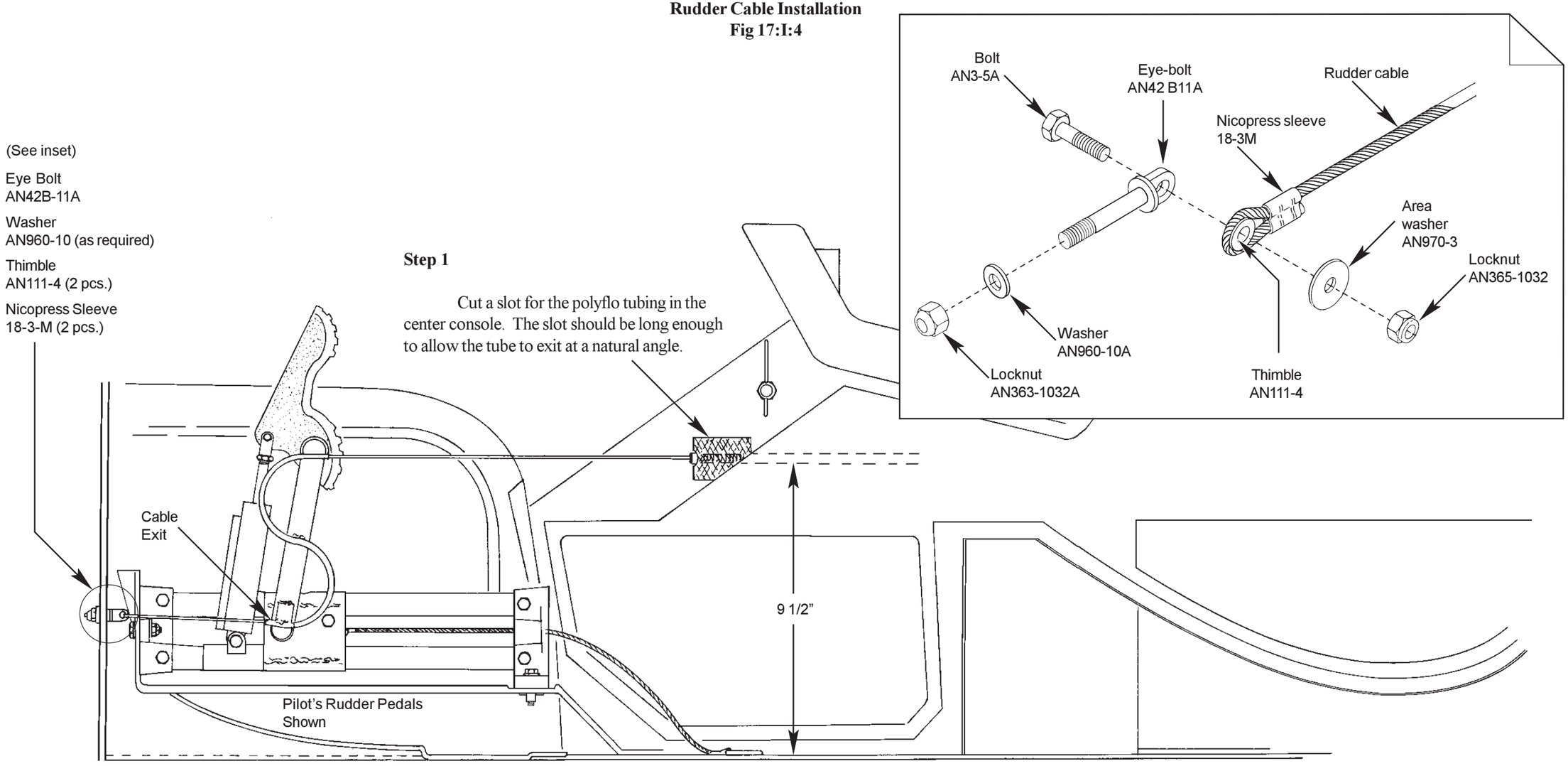
**Rudder Cable Installation**
**Fig 17:I:4**




**Step 2**

Prior to bonding the polyflo tubing, route the entire piece. Install into the bulkhead connectors. Make sure the lines are routed as straight as possible. The cables should align well with the rudder pedals.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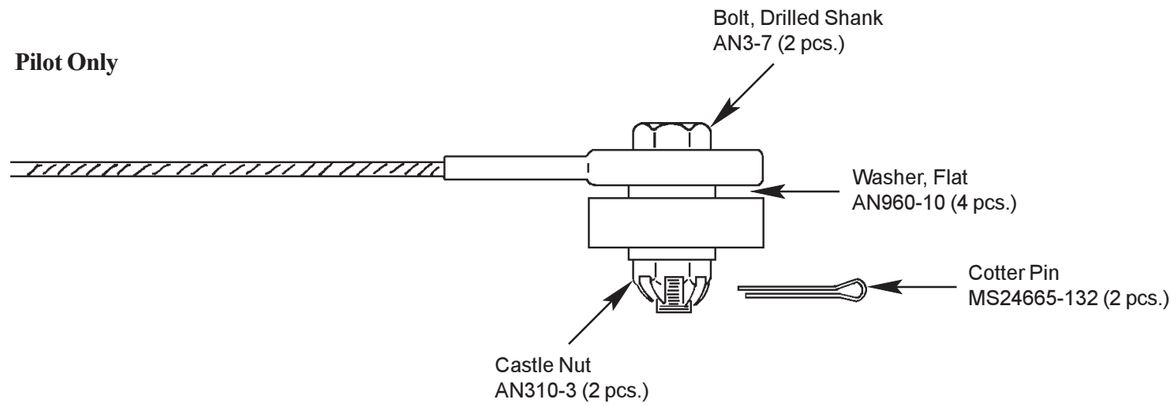
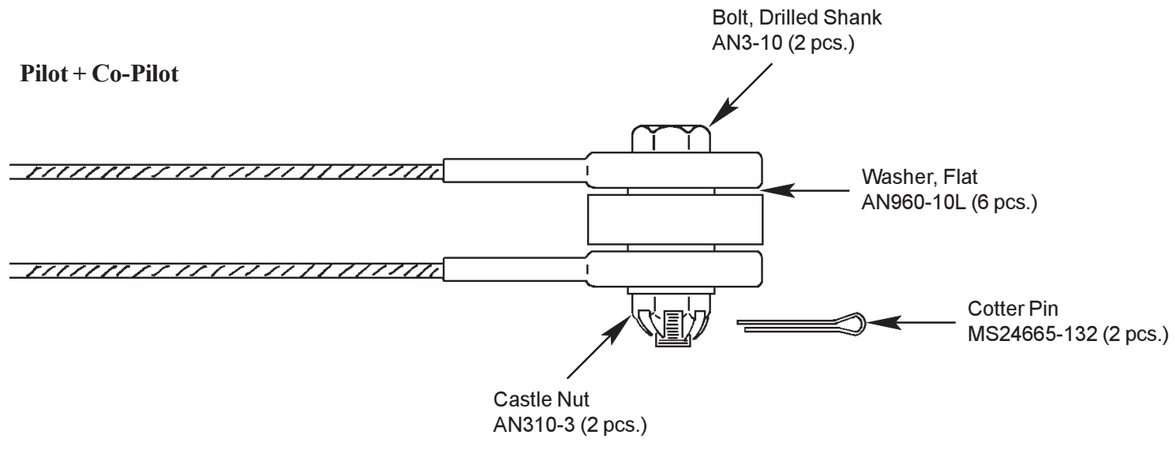
**Rudder Pedal Bellcrank Hardware**
**Fig 17:I:5**

**Pilot Only**




**Pilot + Co-Pilot**





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**Step 3**

Once you're satisfied with the routing of the cables, bond the exit end at the center console. First bond the end in place with epoxy/flox. (The tube must first be thoroughly sanded and prepped like any bond). Form a nice fillet and let cure. After cure, apply 4 BID extending the BID 1" above and below the tube.

**Step 4**

Clamp the two rudder pedals to each other such that they are both in the same position. They should be angled aft approximately 10°.

**Step 5**

Install the clevis bolts in the firewall. The bolts must be installed directly in front of the cable exit. Refer to Figure 17:I:4. Note that the outboard end will install in the engine mount reinforcement. On the inboard side the bolt installs in the cored area. Accurately mark the location of the bolt and de-core the firewall in this area. We suggest a coreless area of approximately one square inch. Reinforce the cored out area with a 4 BID extending onto the core by at least one inch.

**Step 6**

Install the clevis bolts with the majority of the washers on the aft side. This will allow you to tighten the cables later by removing washers.

**Step 7**

Fit and attach one cable using the nico press sleeve. Pull the cable snug as the length for the AN111 thimble is sized. Put some pressure on the rudder pedals to see how far they move when the slack is taken up. (Hopefully, not too much.)

If it seems the assembly refuses to install correctly, use a dremel with a good abrasive cutter blade to cut the nico press sleeve off and try it again.

**WARNING: BE CAREFUL TO NOT EVEN NICK THE CABLE, IF THE OLD NICO PRESS SLEEVE IS BEING CUT OFF. A NICK IN THE CABLE COULD RESULT IN RUDDER, BRAKE AND GROUND STEERING FAILURE.**

Put a small amount of lubrication on the lower tube of the pedal assembly where the holes for the locking pin can be seen. This is to allow the lock pin to easily slip into the detent under its spring load.

## Adjusting the Pedal Position Aft

Simply pull the ring at the aft end of the assembly and the pedals will slide aft. Release the cable and apply forward pressure on both pedals, they will slide forward to the first available detent and lock there.

## Adjusting the Pedal Position Forward

Hold a bit of pressure on both pedals and at the same time, pull the ring. While holding tension on the ring cord, push the pedals forward. Release and continue pushing. The pedals will lock into the next available forward position. (Thus it is best to release the ring cable tension when the pedals are nearly, but not quite, as far forward as one might like them. Then by pushing forward to the next detent, an appropriate length will be set.)


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# REVISION LIST

# CHAPTER 18: BRAKE SYSTEMS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 18-1 through 18-6 | 0/02-15-02 | None | Current revision is correct |
| 18-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |


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# Chapter 18: Brake System

Contents



## 1. INTRODUCTION

The brakes perform two very critical functions in the Legacy. Number one (of course) they serve as brakes. Secondly, the brakes are used for ground steering at lower speeds. Obviously the brakes are very important! With this in mind, take your time and assemble carefully.

In assembling the brake system we will start at the brakes and work our way to the reservoir. At the end of this chapter, you will have functioning brakes.

**Note:**

**Optional Parts available through :**

**(*) Lancair Avionics**

**(**) Kit Components, Inc.**

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **BRAKE SYSTEM** | | | | |
| 1) | 4662 | 2 | Brake Cylinder Clevis | |
| 2) | 9-42016 | 1 | Brake Fluid Reservoir | |
| 3) | AN316-5 | 2 | Check Nut | |
| 4) | 10-88 | 2 | Cleveland Master Cylinder | |
| 5) | 272P-03x02 | 1 | Poly-Flo Fitting, T | |
| 6) | 269P-03x02 | 4 | Poly-Flo Fitting, Elbow | |
| 7) | 71-T-187 | 30 | Poly-Flo Tubing | |
| 8) | B44-3 | 30 | Tygon Tubing | |
| **INSTALLING BRAKE ASSEMBLIES** | | | | |
| 1) | AN823-4 | 2 | Fitting, Elbow | |
| **BRAKE LINES MAIN GEAR LEGS** | | | | |
| 1) | 4740 | 2 | Premade Hose | |
| 2) | AN3-4A | 2 | Bolts | |
| 3) | MS21919-DG10 | 2 | Clamps | |
| 4) | MS21919-DG6 | 8 | Clamps | |
| 5) | 268 - 03 x 02 | 2 | Fitting | |
| 6) | C5275 x 4 | 2 | Fitting | |
| 7) | MS35489-11 | 2 | Grommet | |
| 8) | AN365-1032A | 4 | Locknuts | |
| 9) | AN924-4 | 2 | Nut | |
| 10) | CS125-103212GCR | 2 | Studs | |
| 11) | AN960-10L | 4 | Washers | |
| 12) | AN960-10 | 2 | Washers | |
| **MOUNTING BRAKE RESERVOIR** | | | | |
| 1) | 5052-.250 x .035 | 4 | Aluminum Tubing | |
| 2) | AN3-7A | 2 | Bolts | |
| 3) | MS21919-DG4 | 2 | Clamps | |
| 4) | AN822-4D | 1 | Fitting, Elbow | |
| 5) | AN363-1032 | 2 | Locknut | |
| 6) | AN818-4D | 1 | Nut, Coupling | |
| 7) | AN819-4D | 1 | Sleeve, Coupling | |
| 8) | AN970-3 | 2 | Washers | |
| 9) | AN960-10L | 2 | Washers | |




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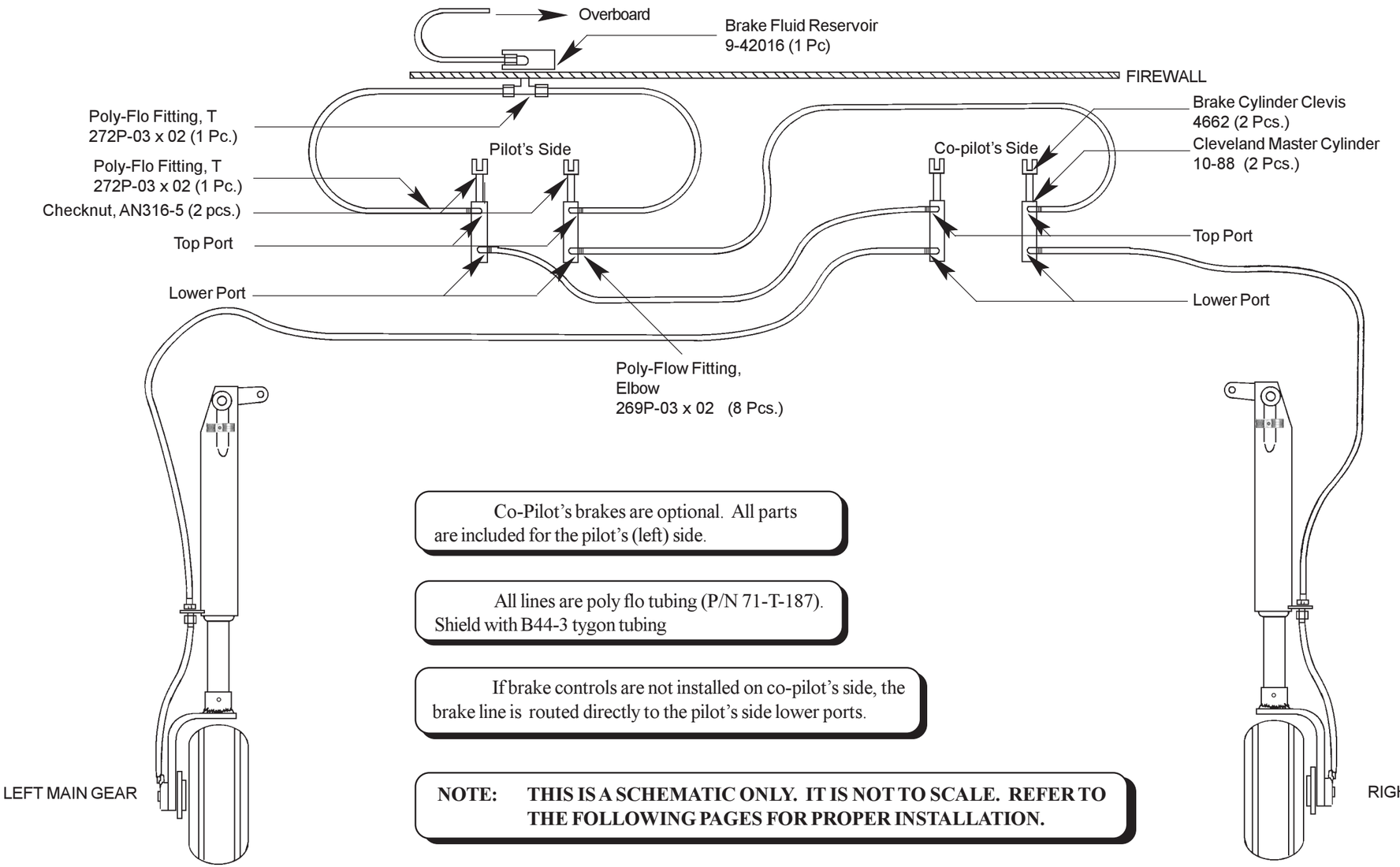
# 3. CONSTRUCTION PROCEDURES

## A. Brake System

**Legacy Brake Line Schematic**
**Figure 18:A:1**




Co-Pilot's brakes are optional. All parts are included for the pilot's (left) side.

All lines are poly flo tubing (P/N 71-T-187). Shield with B44-3 tygon tubing

If brake controls are not installed on co-pilot's side, the brake line is routed directly to the pilot's side lower ports.

**NOTE: THIS IS A SCHEMATIC ONLY. IT IS NOT TO SCALE. REFER TO THE FOLLOWING PAGES FOR PROPER INSTALLATION.**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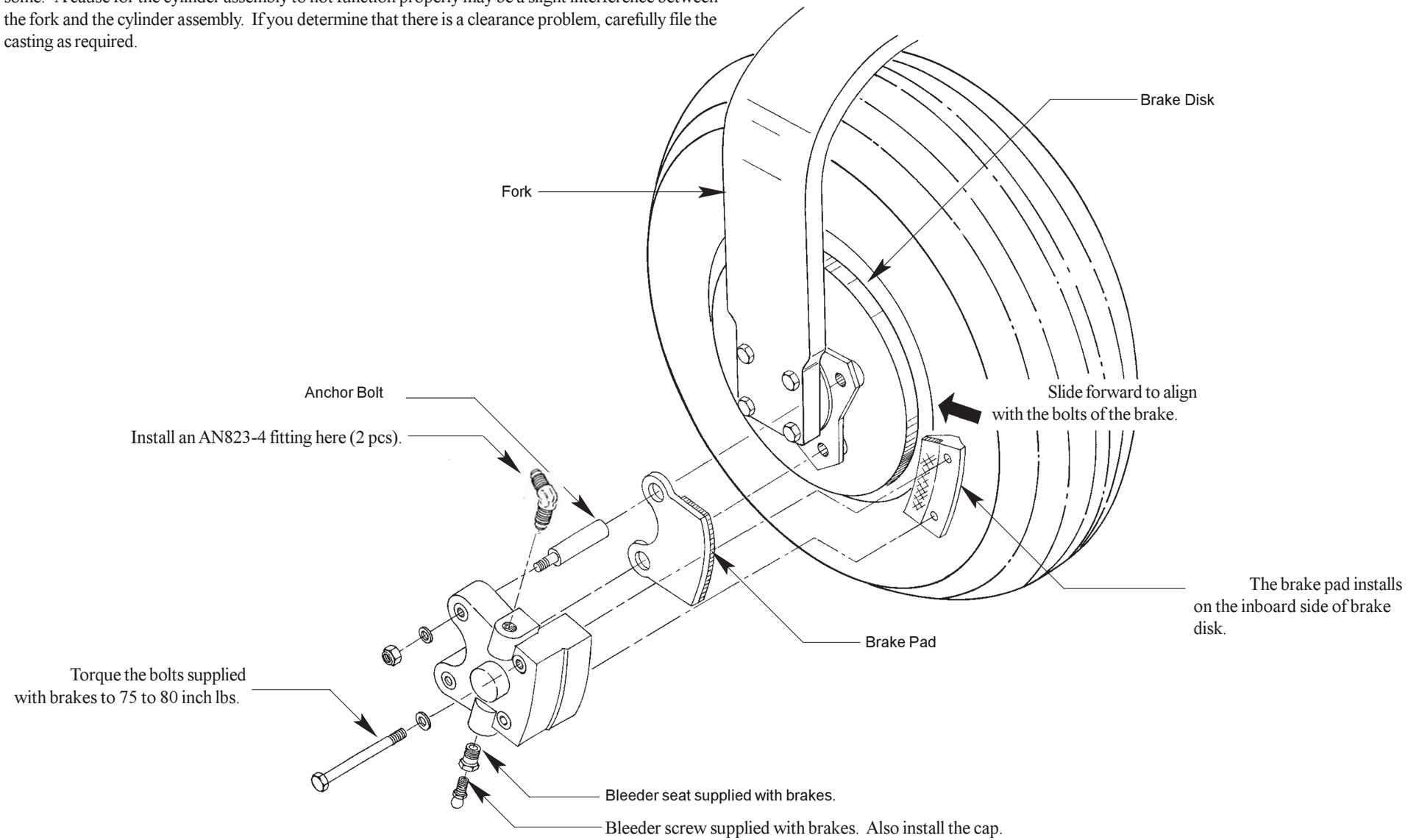
## B. Installing the Brake Assemblies

**Installing Brake Assemblies**
**Figure 18:B:1**

The brake cylinder assembly must slide freely on the anchor bolt. Inspect for clearance between theforkand the brake cylinder assembly. We have noticed that the casting of the cylinder assembly may vary some. A cause for the cylinder assembly to not function properly may be a slight interference between the fork and the cylinder assembly. If you determine that there is a clearance problem, carefully file the casting as required.





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**Brake Lines Main Gear Legs**
**Fig. 18:B:2**

**NOTE: STAY CLEAR OF FLAP TORQUE TUBES!**

When the installation is complete, manually retract the gear and make sure the brake lines do not pinch or interfere.

Secure brake lines using:
Studs, CS125-103212GCR (2 pcs.)
Clamps, MS21919-DG6 (8 pcs.)
Locknuts, AN365-1032A (4 pcs.)
Washer, AN960-10 (2 pcs.)

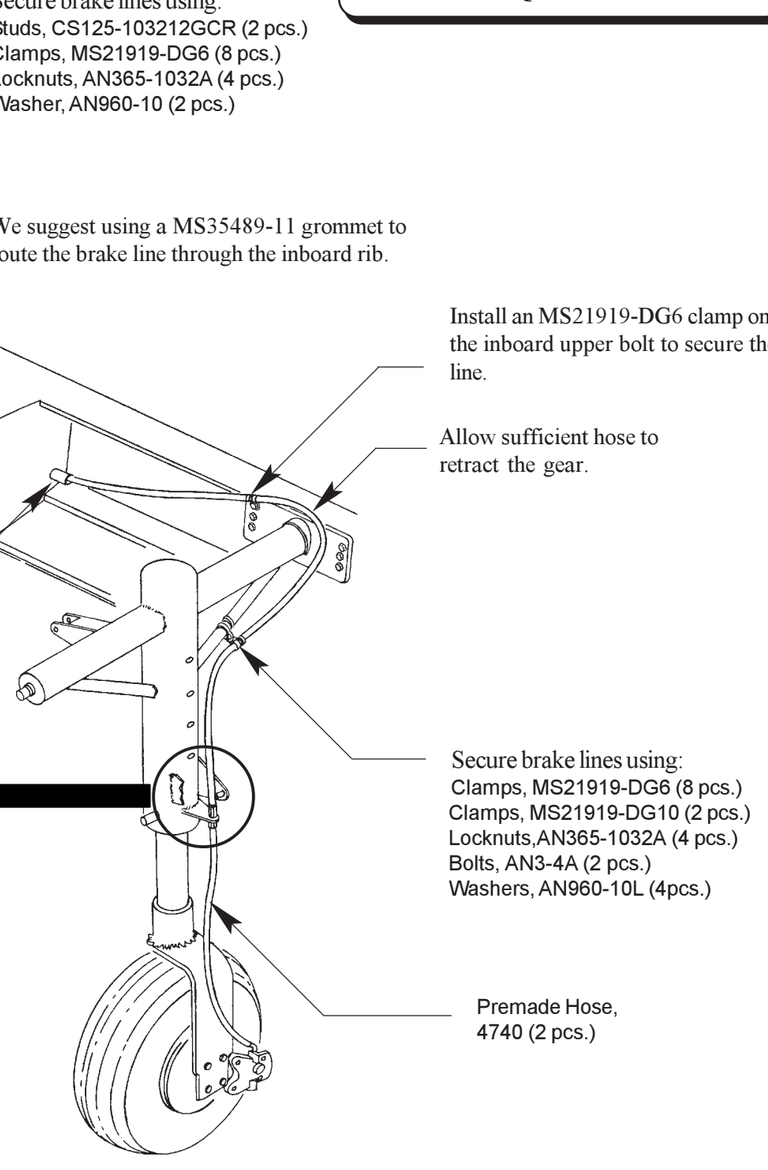
We suggest using a MS35489-11 grommet to route the brake line through the inboard rib.

Install an MS21919-DG6 clamp on the inboard upper bolt to secure the line.

Allow sufficient hose to retract the gear.

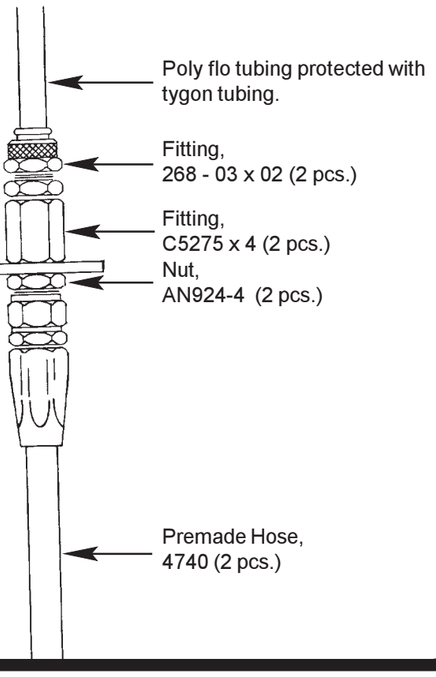
To master cylinder

We suggest installinng a 1" O.D. piece of a conduit through the rib to route the brake line



Secure brake lines using:
Clamps, MS21919-DG6 (8 pcs.)
Clamps, MS21919-DG10 (2 pcs.)
Locknuts,AN365-1032A (4 pcs.)
Bolts, AN3-4A (2 pcs.)
Washers, AN960-10L (4pcs.)

Premade Hose,
4740 (2 pcs.)



Poly flo tubing protected with tygon tubing.

Fitting,
268 - 03 x 02 (2 pcs.)

Fitting,
C5275 x 4 (2 pcs.)

Mounting Tab on Gear Leg

Nut,
AN924-4 (2 pcs.)

Premade Hose,
4740 (2 pcs.)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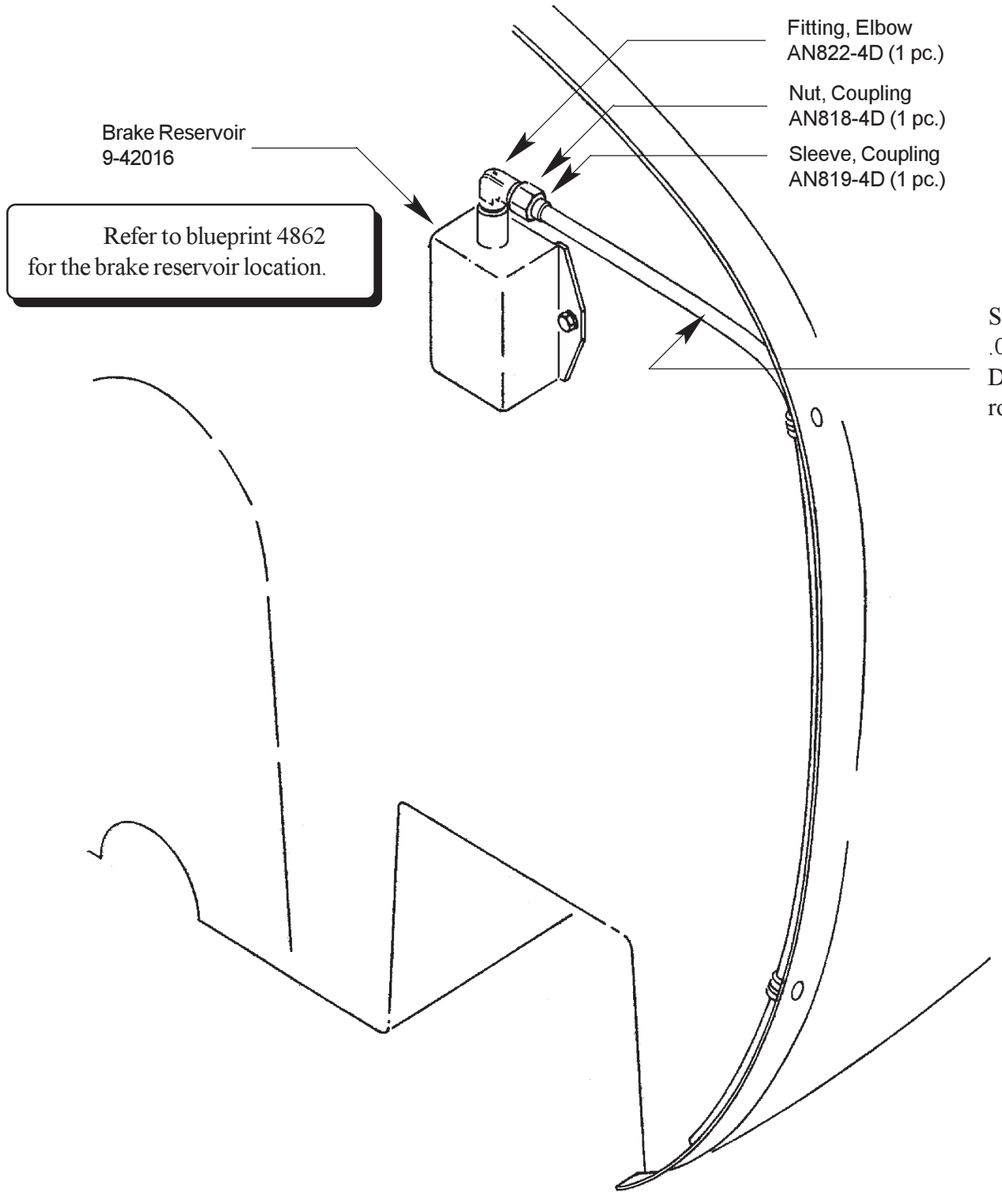
**Mounting Brake Reservoir**
**Fig. 18:B:3**



Brake Reservoir
9-42016

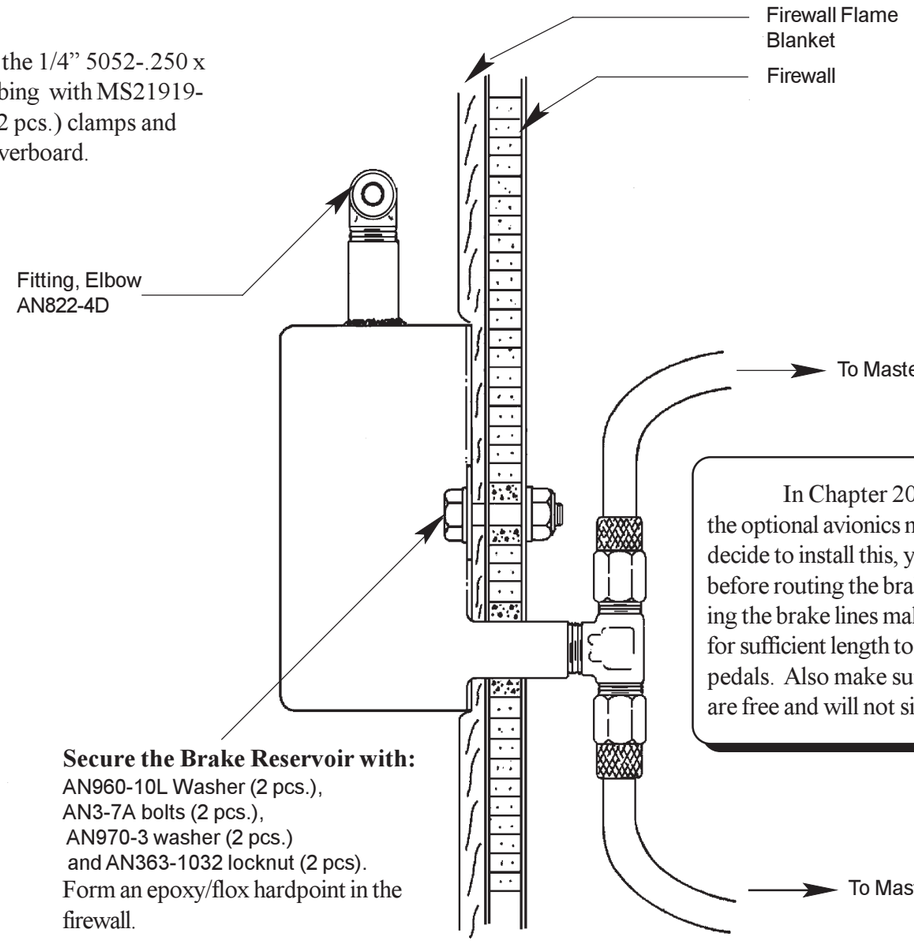
Refer to blueprint 4862 for the brake reservoir location.

Fitting, Elbow
AN822-4D (1 pc.)

Nut, Coupling
AN818-4D (1 pc.)

Sleeve, Coupling
AN819-4D (1 pc.)

Secure the 1/4" 5052-.250 x .035 tubing with MS21919-DG4 (2 pcs.) clamps and route overboard.



Firewall Flame Blanket

Firewall

Fitting, Elbow
AN822-4D

To Master Cylinder

To Master Cylinder

In Chapter 20, Section C, read about the optional avionics mounting shelf. If you decide to install this, you should do this before routing the brake lines. When installing the brake lines make sure that you allow for sufficient length to adjust the rudder pedals. Also make sure that the brake lines are free and will not sink.

**Secure the Brake Reservoir with:**
AN960-10L Washer (2 pcs.),
AN3-7A bolts (2 pcs.),
AN970-3 washer (2 pcs.)
and AN363-1032 locknut (2 pcs).
Form an epoxy/flox hardpoint in the firewall.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## C. Filling and Bleeding the Brakes

To finish the brake system, you'll have to fill the system with brake fluid and bleed the brakes. The standard fluid for both hydraulic and brake systems is MIL-H-5606 type and is available from Aircraft Spruce and Specialty, or your local FBO. Fill the reservoir with fluid and loosen the bleeder valves on the bottom of the brake assemblies. Pump the PILOT'S brakes until the system begins to fill, then close the bleeder valves. To get all the air out of the brake system, you'll have to have a friend pump up and hold the brakes until the lines are pressurized, then you will crack open the bleeder valve for a moment to release the air. Reclose the valve quickly though, to avoid allowing air back into the system. Repeat the "PUMP-HOLD-VALVE OPEN-VALVE CLOSE" until there is no air visible in the Nylaflow lines and the brakes feel normal. Remember to refill the reservoir as the fluid fills the lines and master cylinders. It's hard to get every little air bubble out of the lines, but this is normal and should not affect brake performance if kept to a minimum.


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# REVISION LIST

# CHAPTER 19: ELEVATOR CONTROLS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 19-1 | 1/09-18-02 | R&R | Part # Correction |
| 19-2 | 1/09-18-02 | R&R | Part # Correction<br>Add additional fig. to 19:A:1 |
| 19-3 | 0/02-15-02 | None | Current revision is correct |
| 19-4 | 1/09-18-02 | R&R | Text Correction |
| 19-5 | 0/02-15-02 | None | Current revision is correct |
| 19-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 19-2 | 4/09-30-06 | R&R | Removed note about two styles of cross-over weldment. |


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# Chapter 19: Elevator Controls

Contents



## 1. INTRODUCTION

There are two control tubes in the Legacy elevator control system. Both tubes are pre-assembled in the factory. The forward control tube mounts to the cross over weldment and the idler arm. The idler arm installs on the baggage bulkhead. You will notice four pivot holes pre-drilled on the elevator weldment in the back. In this chapter we will install these components as well as explain how to rig the elevator system.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **ELEVATOR CONTROLS RIGGING** | | | | |
| 1) | 3205-A | 1 | Idler Arm | |
| 2) | 4454 | 2 | Elevator Idler Arm Bracket | |
| 3) | 4455 | 2 | Elevator Idler Arm Spacer | |
| 4) | 4465 | 1 | Control Tube, Forward 6061T6 (1" O.D. x 0.083" wall x 62.75" Length) | |
| 5) | 4466 | 1 | Control Tube, Aft 6061T6 (1 1/4" O.D. x 0.065 wall x 76" Length) | |
| 6) | AN3-7A (Rev. A) | 1 | Bolt, Undrilled | |
| 6) | AN3-10A | 4 | Bolt, Undrilled | |
| 7) | AN4-7A | 2 | Bolt, Undrilled | |
| 8) | AN4-16A | 1 | Bolt, Undrilled | |
| 9) | AN365-428A | 3 | Locknut | |
| 10) | AN365-1032A | 8 | Locknut | |
| 11) | MS24694-S56 | 4 | Machine Screw | |
| 12) | AN960-416L | 3 | Washer, Flat | |
| 13) | AN960-10 | 8 | Washer, Flat | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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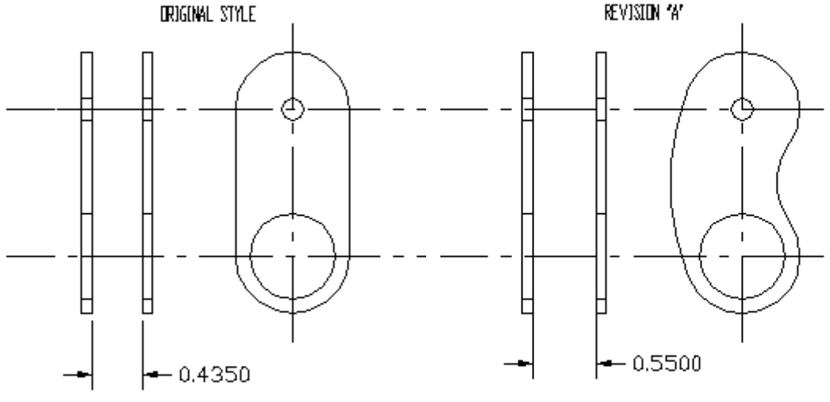
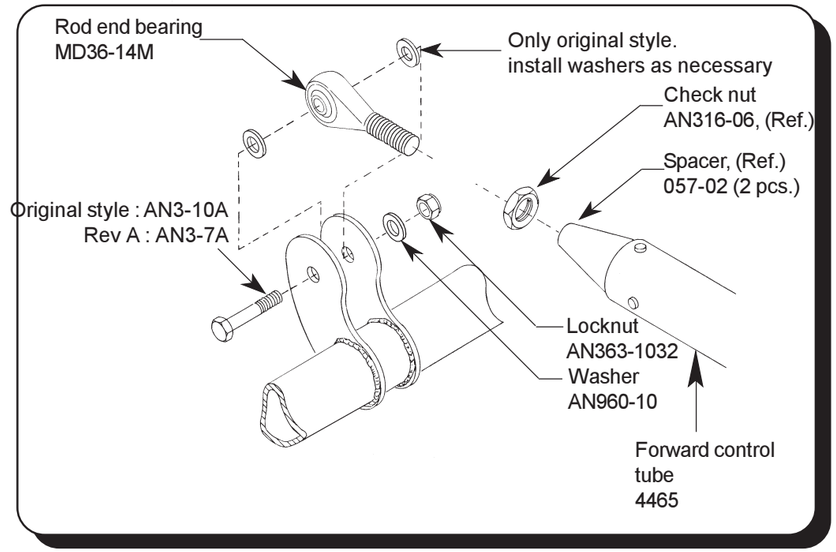
# 3. CONSTRUCTION PROCEDURES

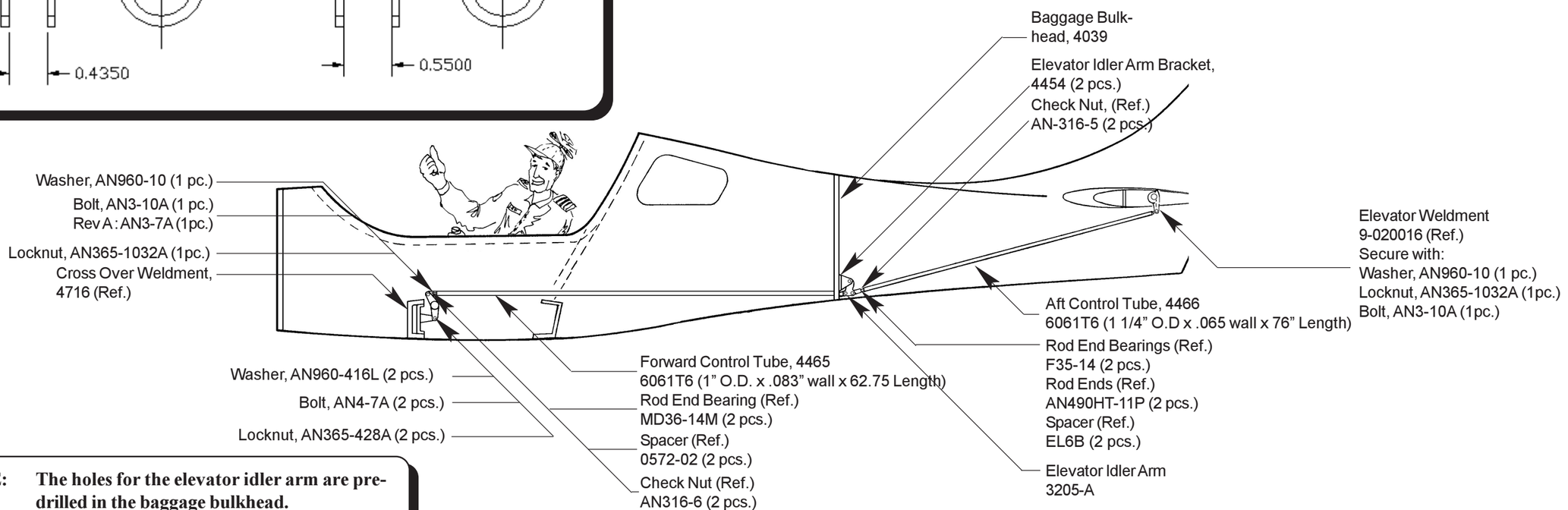
## A. Elevator Controls Rigging

**NOTE:** **Verify the length of the forward control tube (p/n 4465). The length of the tube itself should be 62.75". Please contact a tech representative at Lancair should the tube be off by more than 1/4".**




**Elevator Control System**
**Figure 19:A:1**




**NOTE:** **The holes for the elevator idler arm are pre-drilled in the baggage bulkhead.**



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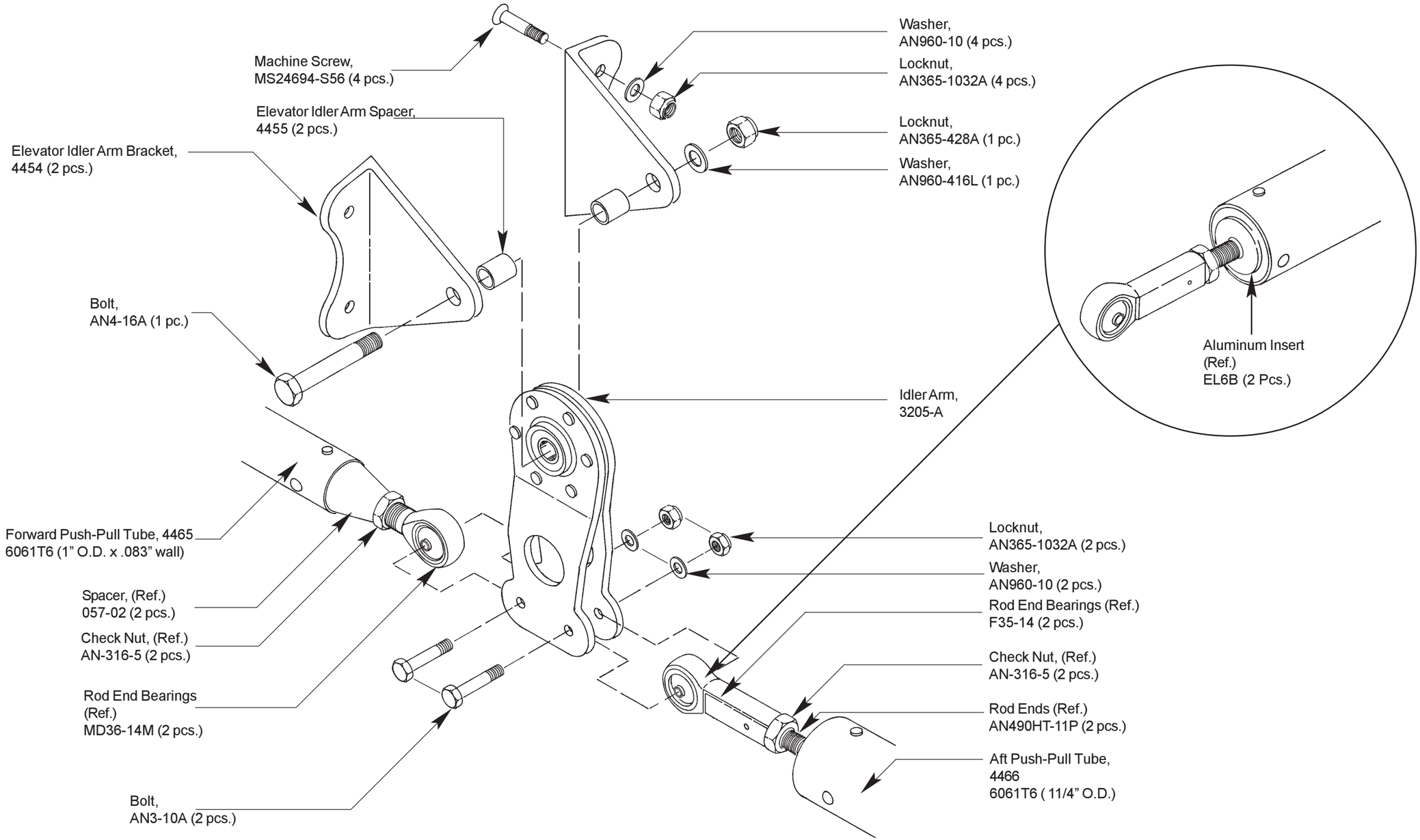
**Elevator Idler Arm Assembly**
**Figure 19:A:2**





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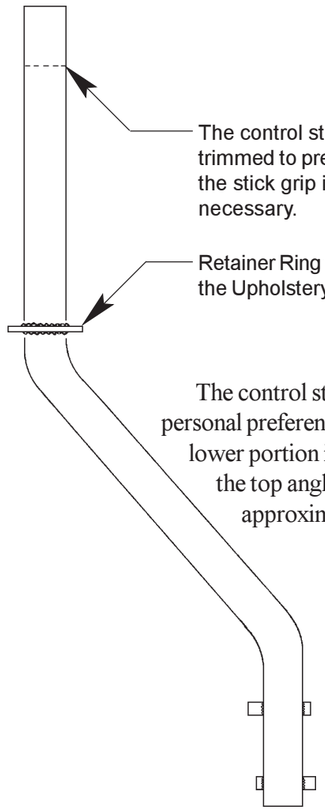
**Rigging Elevator Controls**
**Fig. 19:A:3**

## Control Stick



The control stick height is trimmed to preference. With the stick grip installed trim as necessary.

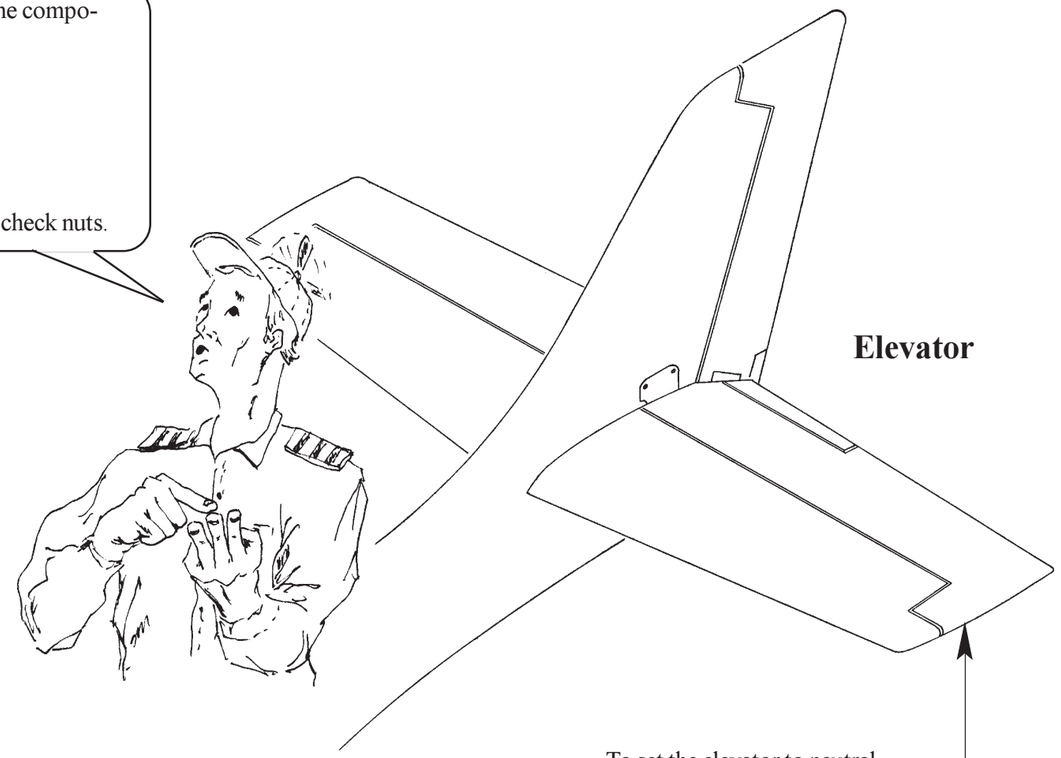
Retainer Ring for the Upholstery

The control stick angle is set to personal preference. Typically the lower portion is set vertical and the top angled forward approximately as shown.

In order to rig its controls, we need to set the components in a neutral position:

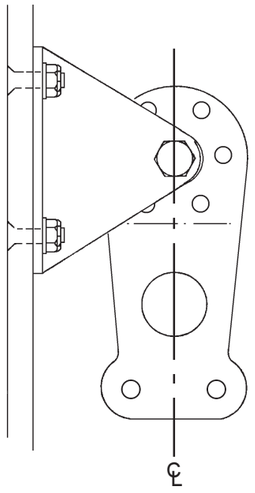
1. Set the elevator to neutral.
2. Set the idler arm to neutral.
3. Set the control stick to neutral.

Adjust the rod ends and tighten the check nuts.




To set the elevator to neutral, the counterweight is set flush with the horizontal stabilizer. This corresponds to 0 degrees of deflection.

## Elevator Idler Arm



Set the idler arm approximately vertical.

**NOTE: You may need to shorten the stick depending on preference and stick grip used.**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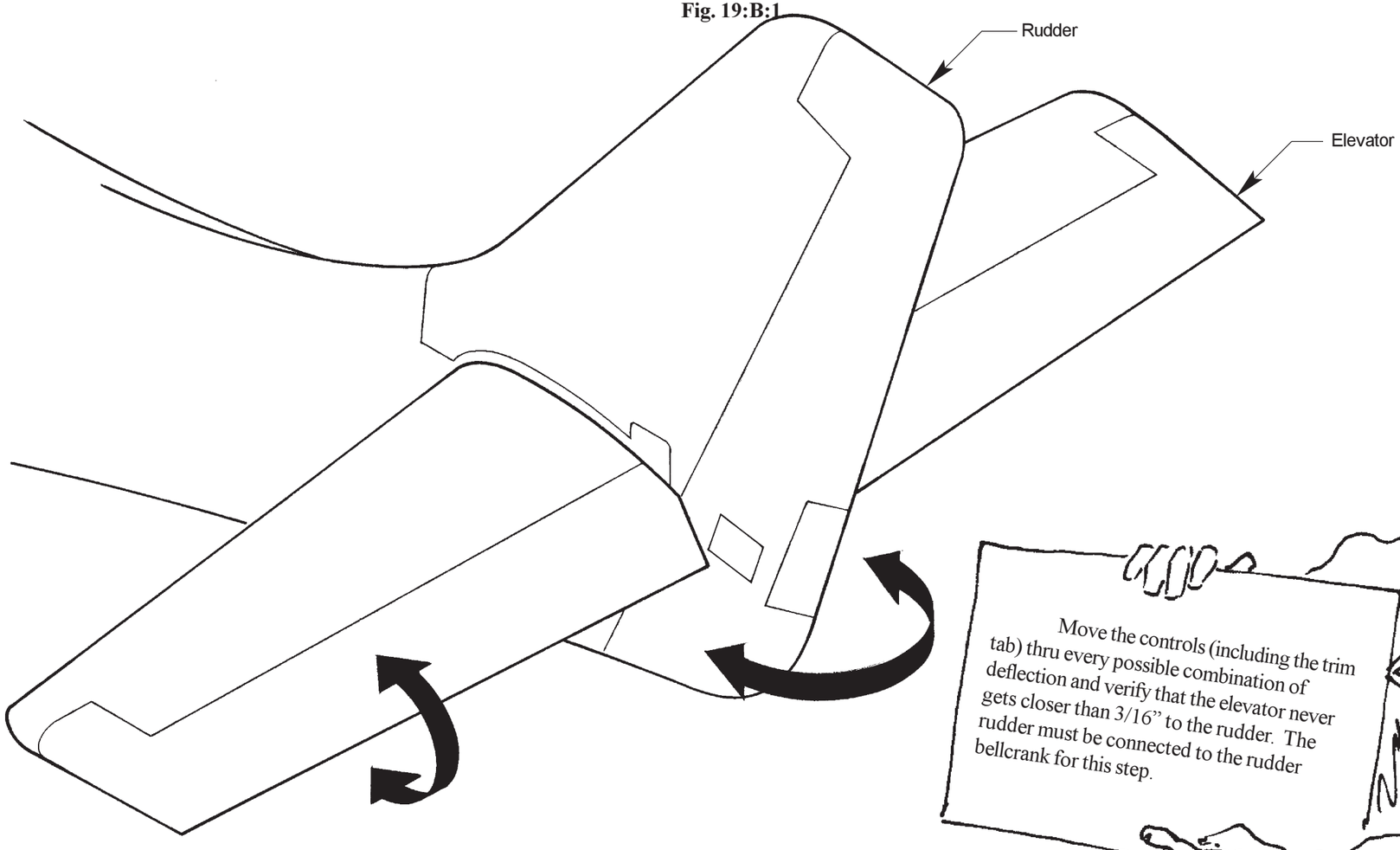
## B. Trimming Inboard Ends for the Rudder

The inboard ends of the elevator (and the elevator trim tab) must betrimmed such that there is a minimum of 3/16" clearance between the elevator and the rudder during any combination of control surface deflections.

**Trimming Inboard Ends of Elevator**
**Fig. 19:B:1**





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# REVISION LIST

# CHAPTER 20: INSTRUMENT PANEL

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 20-1 through 20-8 | 0/02-15-02 | None | Current revision is correct |
| 20-9 | 1/09-18-02 | R&R | Text Correction |
| 20-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 20-1, 20-5 | 5/05-15-07 | R&R | Changed part numbers. |
| 20-1, 20-5 | 6/08-10-07 | R&R | Changed part numbers only. |


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# Chapter 20: Instrument Panel

Contents



## 1. INTRODUCTION

The instrument panel is a relatively simple installation. The placement is largely dictated by the center console. The instrument panel is a pre-molded fiberglass piece. The instruments are usually mounted on a removable piece of aluminum (not part of the kit). If you are interested in purchasing the inserts, they are available through Lancair Avionics. You will notice a raised area in the center of the panel typically used to mount the radio stack. A dust cover installs on top of the panel.

In this chapter we will not go into detail about avionics. However, the last section of the chapter offers a few panel layouts. Please contact Lancair Avionics for more information.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **iNSTRUMENT PANEL INSTALLATION** | | | | |
| 1) | 4028 | 1 | Instrument Panel | |
| 2) | AN3-3A | 2 | Bolt | |
| 3) | **101-0066** ~~35157~~ | 2 | Bolt, Allen | |
| 4) | K1000-3 | 4 | Nutplate | |
| 5) | AN426A3-5 | 8 | Rivets | |
| 6) | AN960-10 | 4 | Washer | |
| **DUST COVER** | | | | |
| 1) | 4028-01 | 1 | Instrument Panel Dust Cover | |
| **AVIONICS MOUNTING SHELF** | | | | |
| 1) | 4943 | 1 | Avionics Mounting Shelf | *Yes, |
| **TYPICAL PANELS** | **Contact Lancair Avionics** | | | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**




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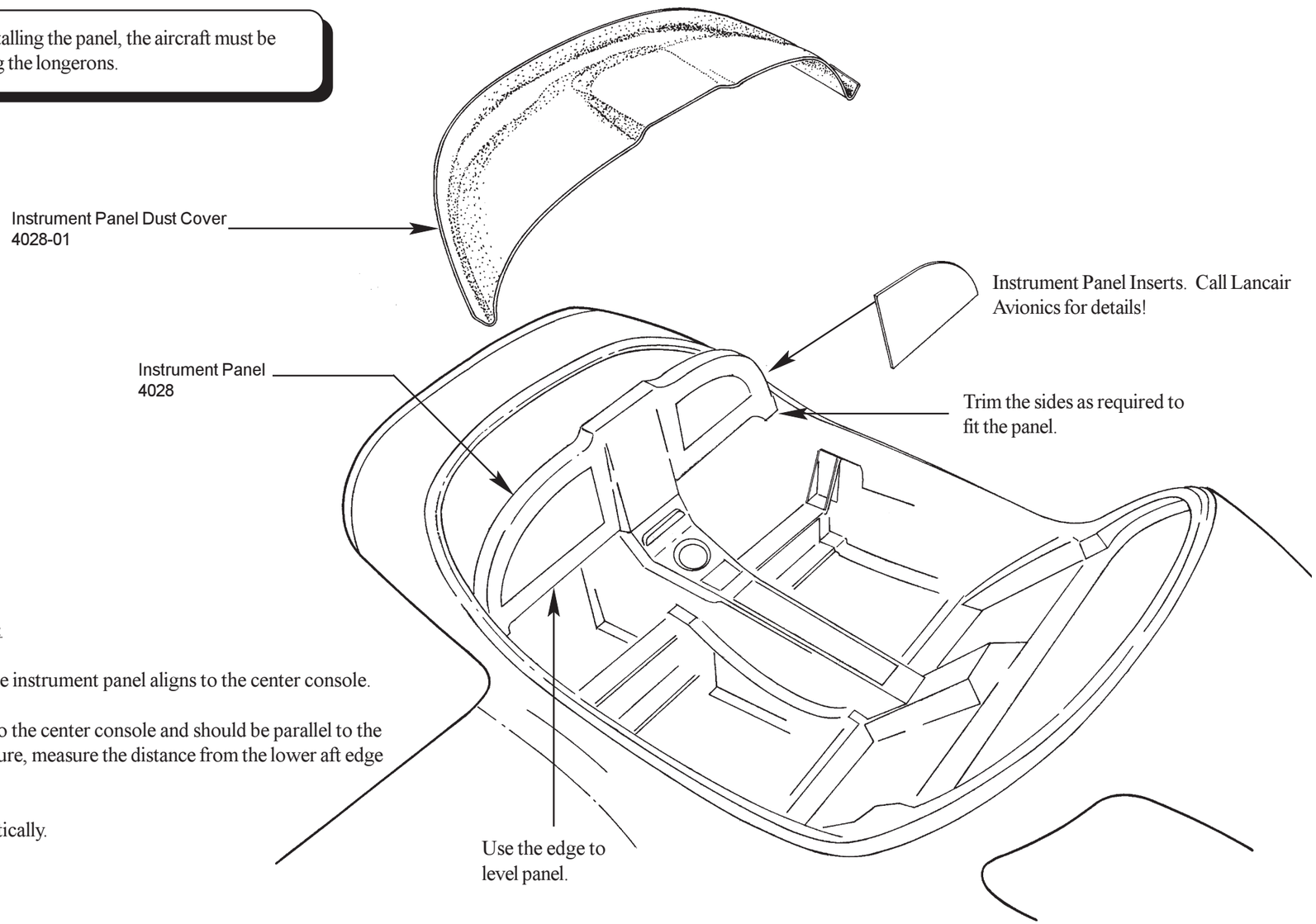
# 3. CONSTRUCTION PROCEDURES

## A. Instrument Panel Installation

Prior to installing the panel, the aircraft must be leveled. Level using the longerons.

**Instrument Panel Installation (General Overview)**
**Fig. 20:A:1**




**Basic Alignment Criteria:**

***Left-Right Placement*** - The instrument panel aligns to the center console.

***For-aft*** - The panel aligns to the center console and should be parallel to the firewall. Using a tape measure, measure the distance from the lower aft edge of the panel to the firewall.

***Tilt*** - The panel mounts vertically.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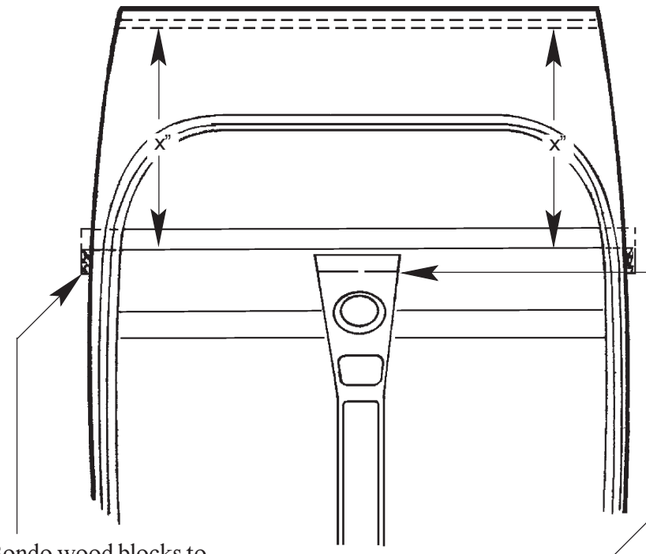
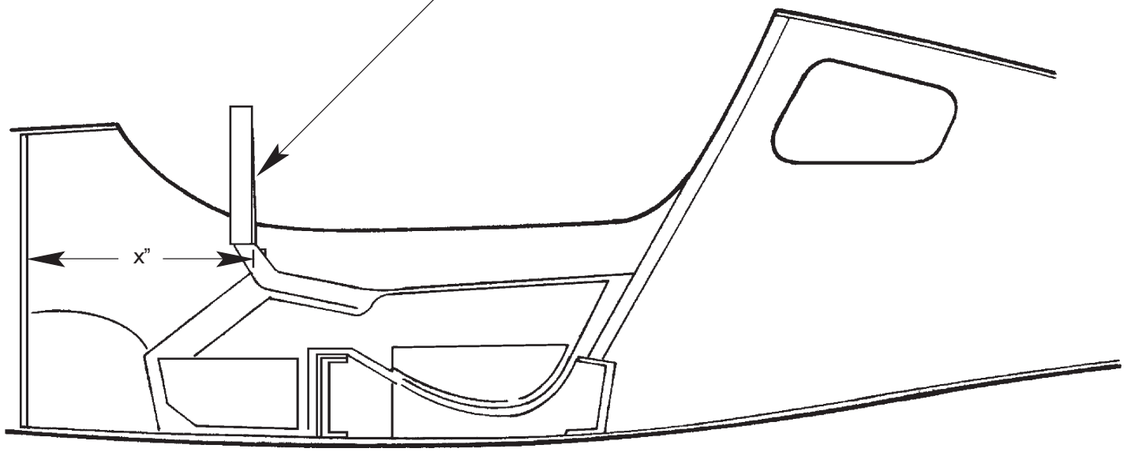
**Aligning Instrument Panel**
**Fig. 20:A:2**




Bondo wood blocks to the side of the fuselage right aft of the panel to support.

1. Align the panel parallel to the firewall. Measure the distance from the firewall to the panel.
2. Align the panel to the center console.
3. The panel must be vertical.
4. Level the instrument panel. The lower left edge of panel must be horizontal (see Fig. 20:A:1). Once aligned, bondo wood blocks to the sides of the fuselage so you can remove the panel and easily realign the panel.




It is very important to level the panel to the aircraft--or your instruments will be off!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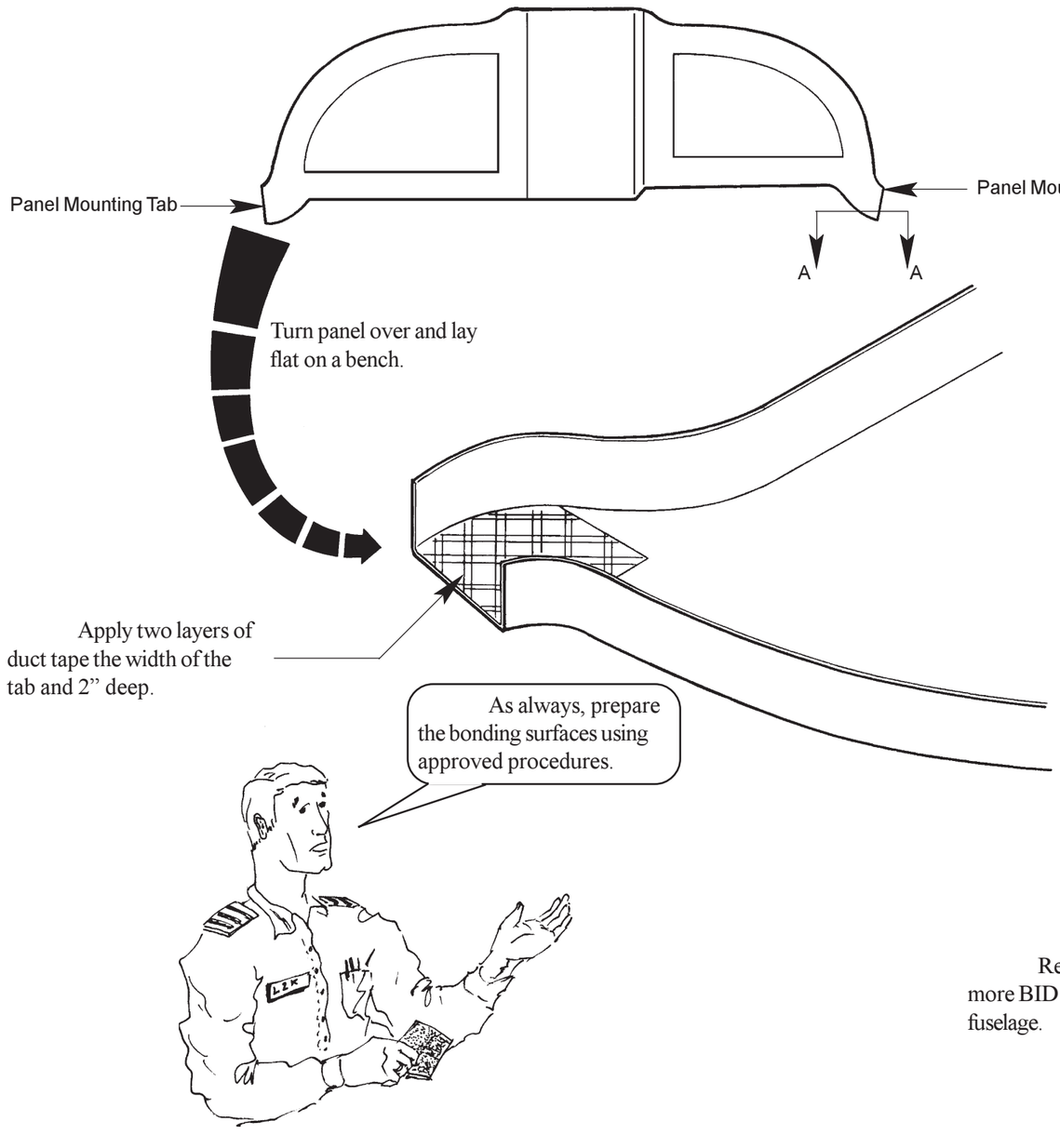
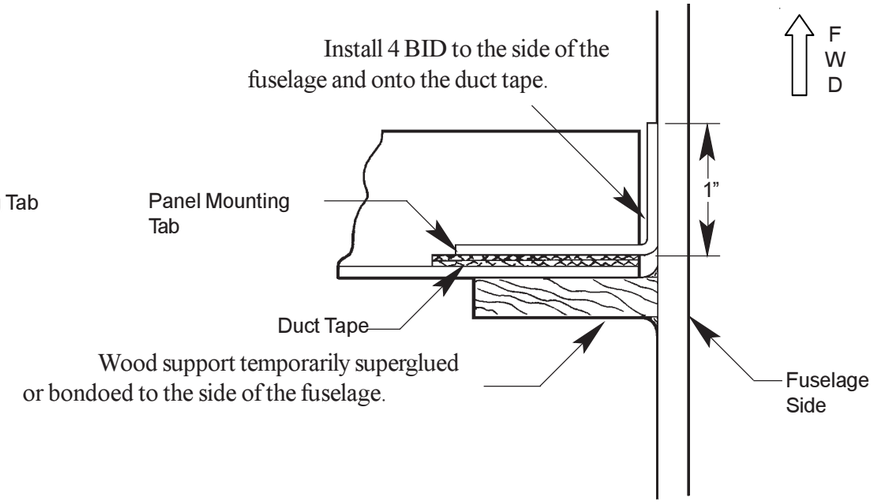
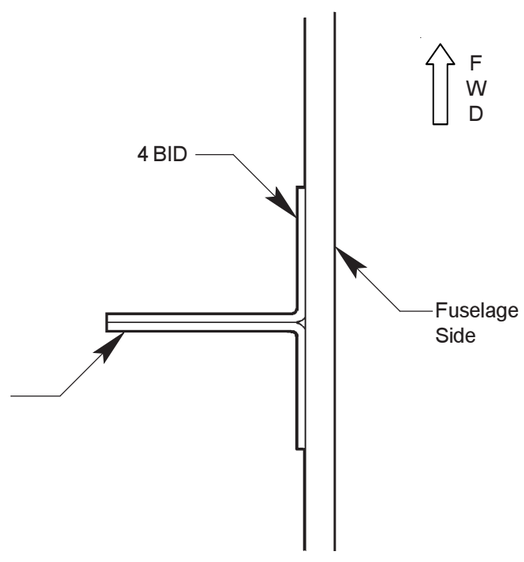
**Securing Panel Side Supports**
**Fig. 20:A:3**




Remove duct tape, panel, wood and apply 3 more BID to the initial 4 BID and the side of the fuselage.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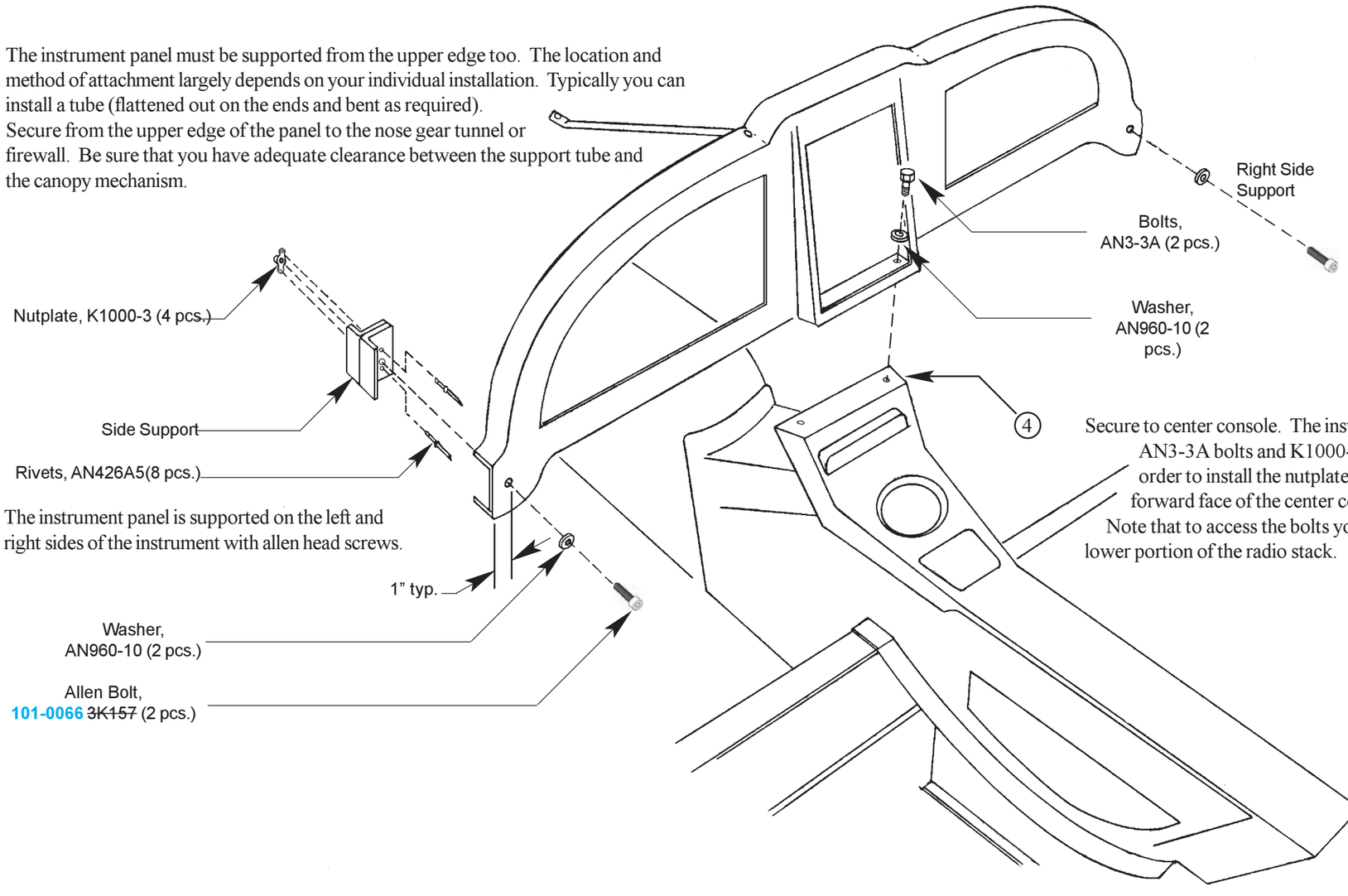
**Securing The Instrument Panel**
**Fig. 20:A:4**

The instrument panel is typically secured in four places, from the top of the panel, left and right sides of the panel and to the center console.




(1) The instrument panel must be supported from the upper edge too. The location and method of attachment largely depends on your individual installation. Typically you can install a tube (flattened out on the ends and bent as required). Secure from the upper edge of the panel to the nose gear tunnel or firewall. Be sure that you have adequate clearance between the support tube and the canopy mechanism.

(2 & 3) The instrument panel is supported on the left and right sides of the instrument with allen head screws.

(4) Secure to center console. The instrument panel is typically secured through with AN3-3A bolts and K1000-3 nutplates installed in the center console. In order to install the nutplates, we suggest creating an access hole in the forward face of the center console (where the engine control cables exit). Note that to access the bolts you must remove a couple of the radios out of the lower portion of the radio stack.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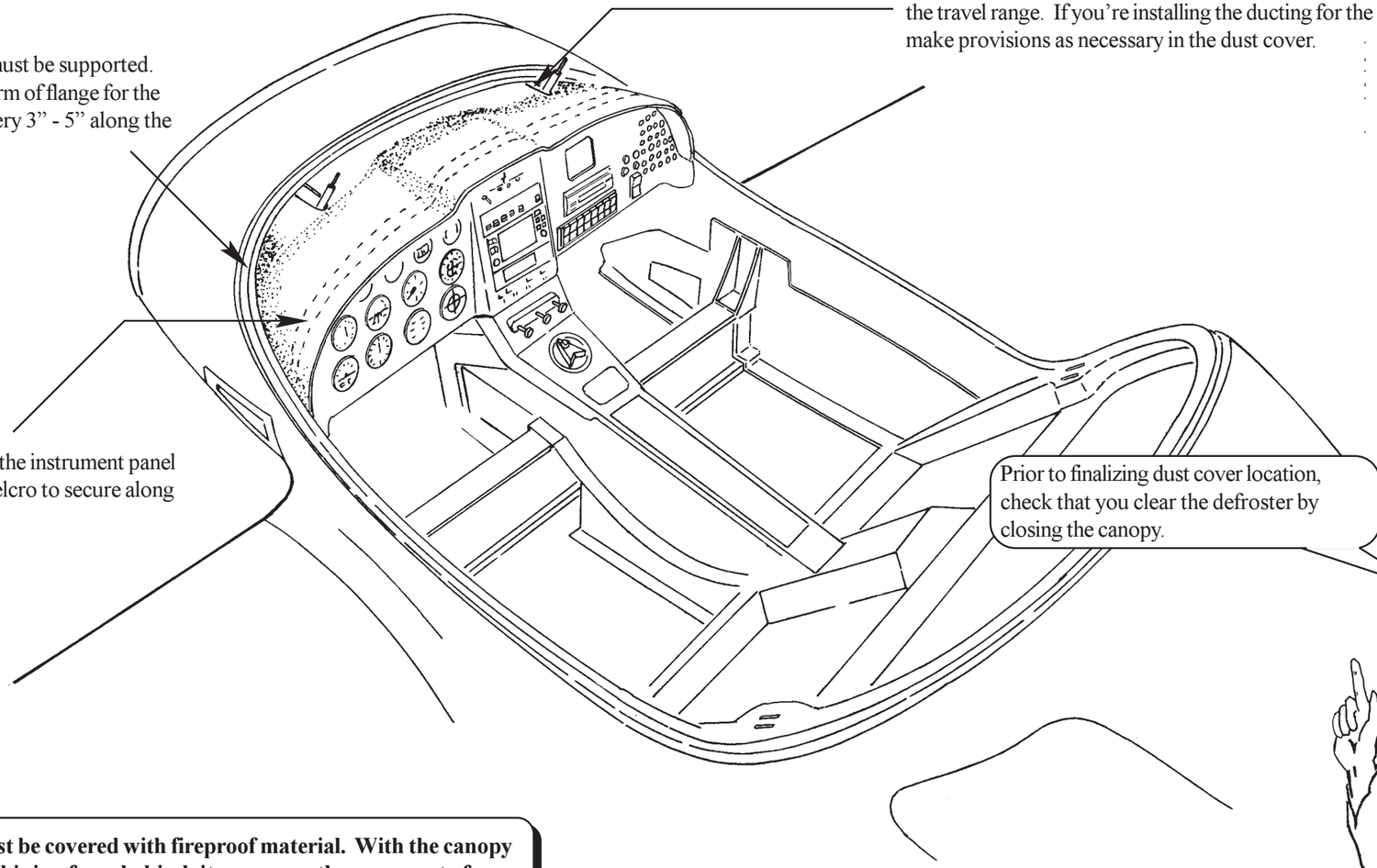
## B. Dust Cover

The instrument panel dust cover is often also called a glare shield. By leaving a lip of approximately 4" over hang, it helps block some of the outside light from reflecting on the instruments. Trim to desired length.

**Installing The Dust Cover**
**Fig. 20:B:1**

Make slots for the gas struts large enough to accommodate the travel range. If you're installing the ducting for the defroster, make provisions as necessary in the dust cover.

Somehow the sides must be supported. We suggest installing some form of flange for the cover to rest on. Support every 3" - 5" along the front edge.



The dust cover is supported by the instrument panel along the aft edge. We suggest using velcro to secure along this edge.


**WARNING: The dust cover must be covered with fireproof material. With the canopy open and the sun shining from behind, it can cause the sun rays to focus producing the same effect as a magnifying glass and burn holes.**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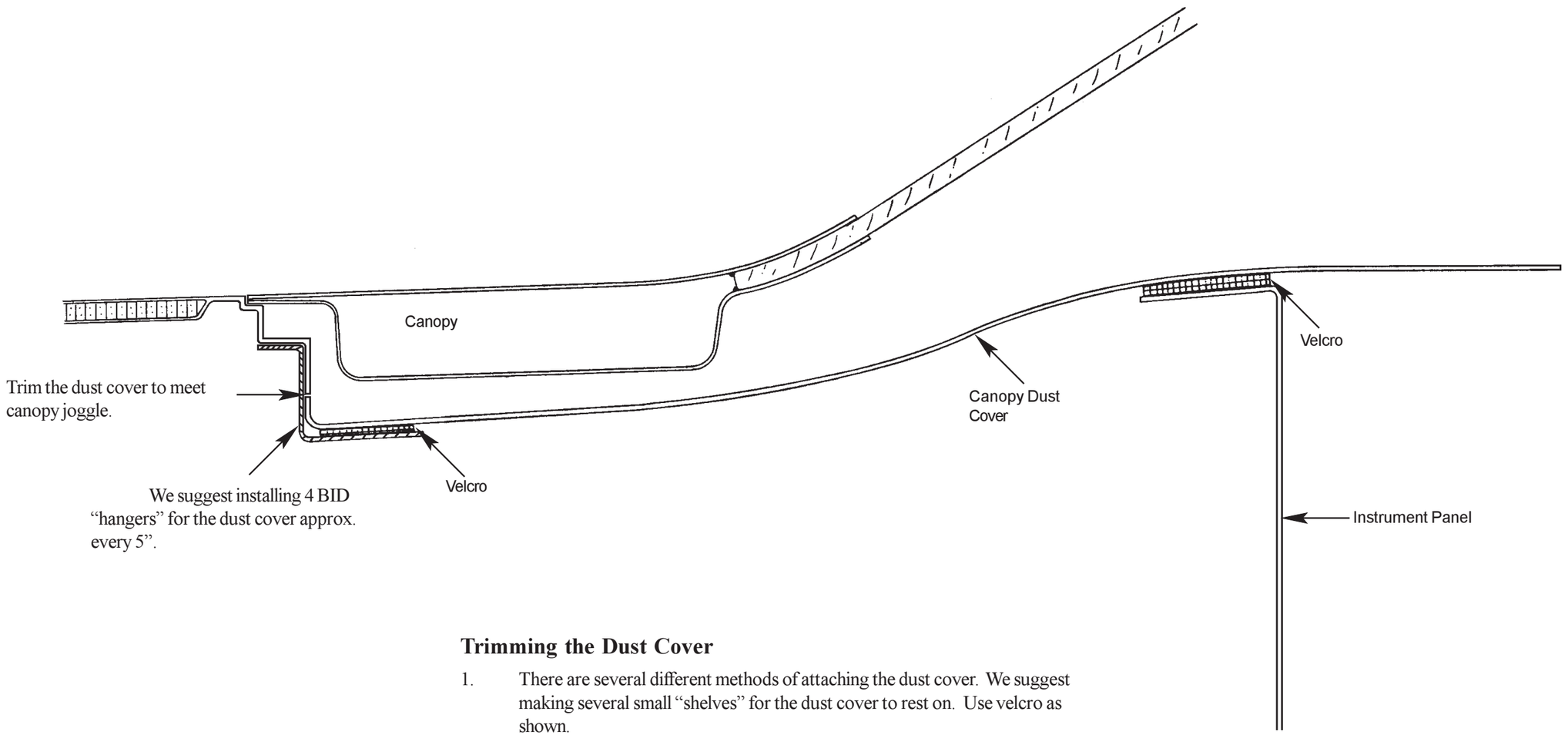
**Trimming The Dust Cover**
**Fig. 20:B:2**




## Trimming the Dust Cover

1. There are several different methods of attaching the dust cover. We suggest making several small "shelves" for the dust cover to rest on. Use velcro as shown.

2. Trim the aft edge of the dust cover to preference we like to have at least 4" aft of the panel.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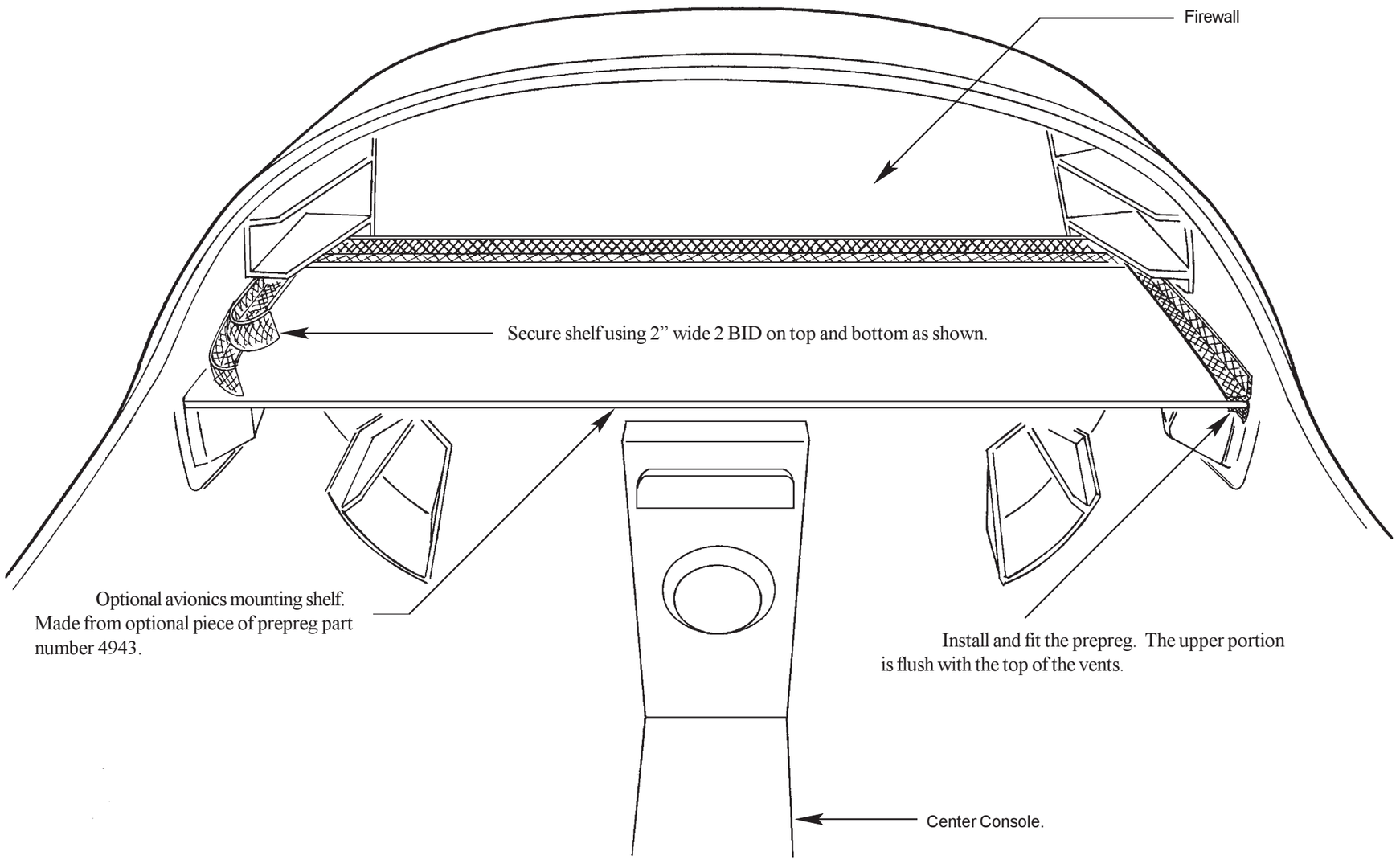
## C. Avionics Mounting Shelf

We suggest installing the optional mounting miscellaneous equipment such as VMS DPV, vacuum system filter, backup battery or anything else.

**Avionics Mounting Shelf**
**Fig. 20:C:1**





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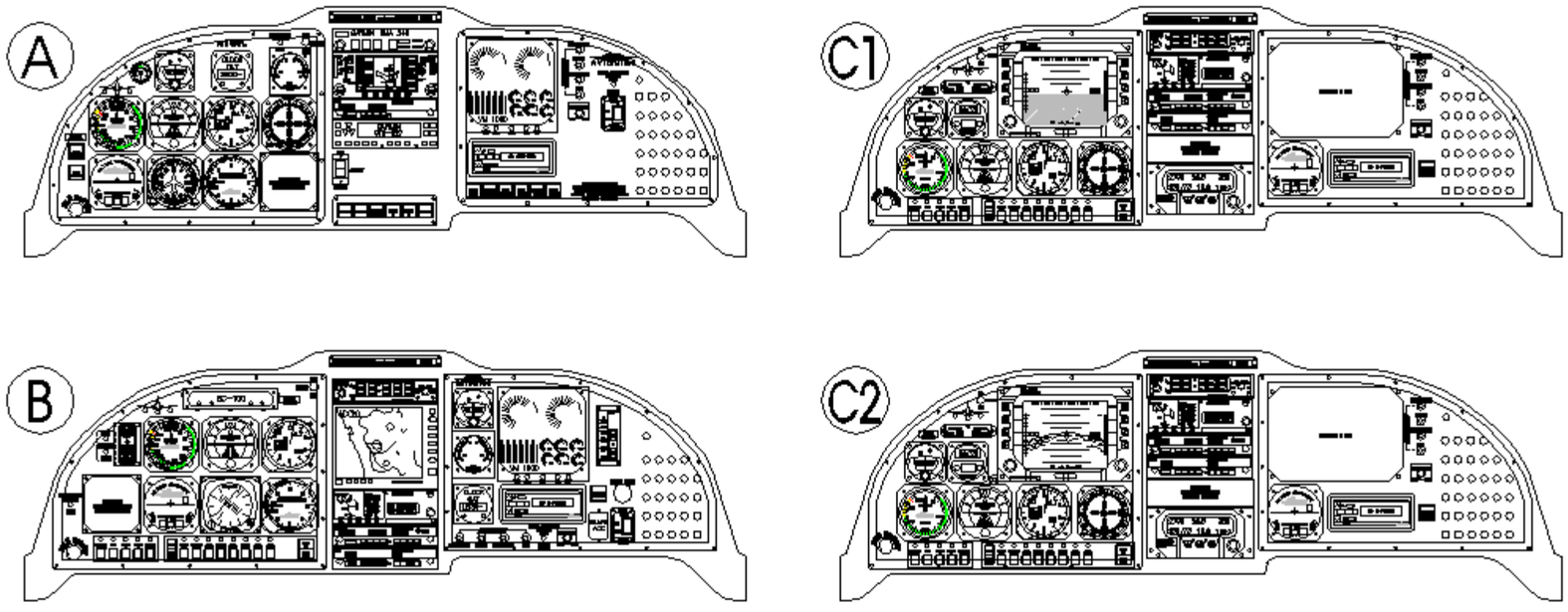
## D. Typical Panels

For further information on Lancair Avionics instrument panels please see our website at www.lancairavionics.com or call Lancair Avionics for details.

**Typical Panels**
**Fig. 20:D:1**




Note: The inserts for mounting the instruments are typically 0.09” aluminum. The inserts are not included with the kit. They are typically cut by laser. Custom cut inserts are available through Lancair avionics.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# REVISION LIST

# CHAPTER 21: FLAP SYSTEM COMPLETION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 21-1 through 21-2 | 0/02-15-02 | None | Current revision is correct |
| 21-3 | 1/09-18-02 | R&R | Corrected Fig.21:A:1<br>Text correction |
| 21-4 through 21-10 | 0/02-15-02 | None | Current revision is correct |
| 21-11 | 1/09-18-02 | Add | Added Fig. 21:D:1 |
| 21-10 | 2/06-30-04 | R&R | Corrected figure 21:C:2 and added photo. |
| 21-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 21-2 | 3/12-15-04 | R&R | Updated parts list. |
| 21-5 | 3/12-15-04 | R&R | Changed rivet part number. |
| 21-2 | 4/09-30-06 | R&R | Removed invalid part number. |
| 21-3 | 4/09-30-06 | R&R | Updated invalid part number. |


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# Chapter 21: Flap System Completion

Contents



## 1. INTRODUCTION

The Legacy uses slotted type flaps. That means the flaps pivot about a point below the wing. As the flaps deploy they follow an arc moving aft and down. The flaps depend on airflow through the flap slot, hence the reason for the gap opening up as the flaps are deployed.

The flaps are operated by an electric motor. The electric motor mounts aft of the aft spar and passes through the aft spar. The travel is set by two limit switches.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **CENTER TORQUE TUBE SUPPORT** | | | | |
| 1) | 4310-01 FB | 1 | Left Flap | |
| 2) | 4310-02 FB | 1 | Right Flap | |
| 3) | 4551-01 | 2 | Inboard Flap Mount Spacer | |
| 4) | 4551-02 | 2 | Outboard Flap Mount Spacer | |
| 5) | 4553 | 2 | Flap Hinge, Inboard, Wing Side | |
| 6) | 4554 | 2 | Flap Hinge, Outboard, Wing Side | |
| 7) | 4555 | 2 | Flap Hinge, Inboard, Flap Side | |
| 8) | 4556 | 2 | Flap Hinge, Outboard, Flap side | |
| 9) | 4559-01 | 1 | Flap Torque Tube, Left | |
| 10) | 4559-02 | 1 | Flap Torque Tube, Right | |
| 11) | 4560 | 2 | Flap Actuator Support Bracket | |
| 12) | 4562-01 | 1 | Flap Tube Support Bracket, Left | |
| 13) | 4562-02 | 1 | Flap Tube Support Bracket, Right | |
| 14) | 4580 | 1 | Flap Activator Arm | |
| 15) | FL1061-03 | 2 | Flap Torque Tube Bushing | |
| 16) | FL1A | 1 | Flap Motor Clevis | |
| 17) | FL1 | 1 | Flap Motor | |
| 18) | FL6 | 1 | Flap Motor Bracket | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **CENTER TORQUE TUBE SUPPORT (CONTINUED)** | | | | |
| 19) | AN3-7A | 6 | Bolt, Undrilled | |
| ~~20)~~ | ~~AN3-9A~~ | ~~6~~ | ~~Bolt, Undrilled~~ | |
| 21) | AN3-10A | 4 | Bolt, Undrilled | |
| 22) | AN3-13A | 2 | Bolt, Undrilled | |
| 23) | AN3-16A | 2 | Bolt, Undrilled | |
| 24) | AN3-27A | 2 | Bolt, Undrilled | |
| 25) | AN4-10A | 12 | Bolt, Undrilled | |
| 26) | FL1060-01 | 2 | Bushing Block | |
| 27) | FL1060-02 | 2 | Bushing Block Sleeve | |
| 28) | AN365-428A | 12 | Locknut | |
| 29) | AN365-1032A | 8 | Locknut | |
| 30) | K1000-3 | 4 | Nutplates | |
| 31) | MSC-34 | 8 | Rivets | |
| 32) | MS24694-S63 | 4 | Screws, Machine | |
| 33) | AN960-10 | 22 | Washer, Flat | |
| 34) | AN960-10L | 2 | Washer, Flat | |
| 35) | AN960-416L | 12 | Washer, Flat | |
| **FLAP INSTALLATION** | | | | |
| 1) | 4550-05 | 4 | Flap Pin | |
| 2) | 4550-06 | 4 | Circlip | |
| 3) | 6061T6 -.500 x .035 | 12” | Aluminum Pushrod | |
| 4) | F34-14 | 4 | Bearings, Rod End | |
| 5) | AN316-4 | 4 | Checknut | |
| 6) | AN470AD4-12 | 8 | Rivets | |
| 7) | AN490HT-8P | 4 | Rod End | |
| **FLAP MOTOR INSTALLATION** | | | | |
| 1) | FL2 | 1 | Housing and Switches | |
| 2) | AN365-1032A | 2 | Locknut | |
| 3) | PH-250-3 x 5 | 1 | 3” x 5” Piece of Phenolic | |
| 4) | LY1 | 2 | Relays | |
| 5) | MS24694-S54 | 2 | Screws | |
| 6) | AN960-10 | 2 | Washer, Flat | |


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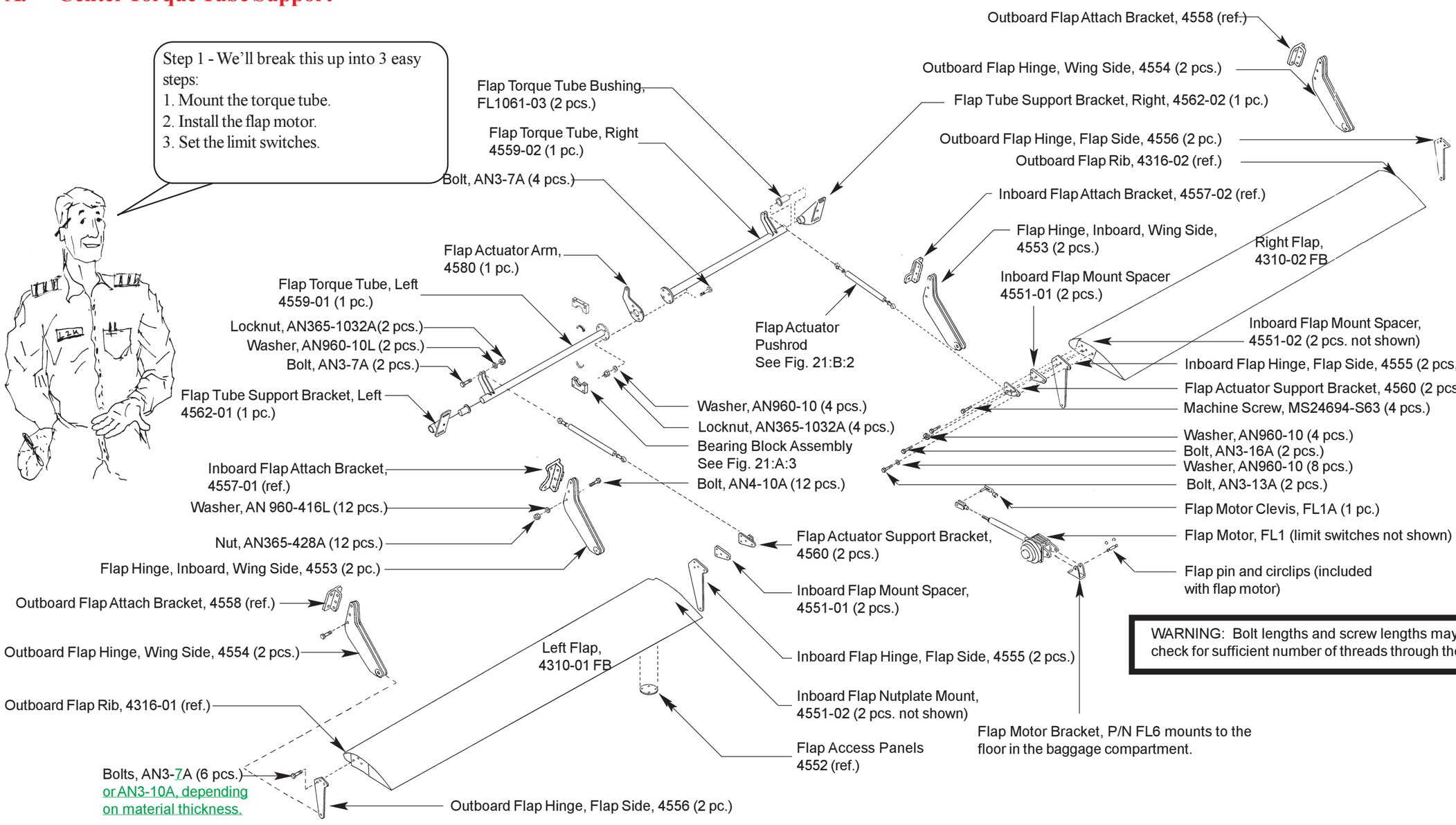
# 3. CONSTRUCTION PROCEDURES

## A. Center Torque Tube Support

**Flap Assembly Exploded View**
**Fig. 21:A:1**




**WARNING: Bolt lengths and screw lengths may vary. ALWAYS check for sufficient number of threads through the fastener.**



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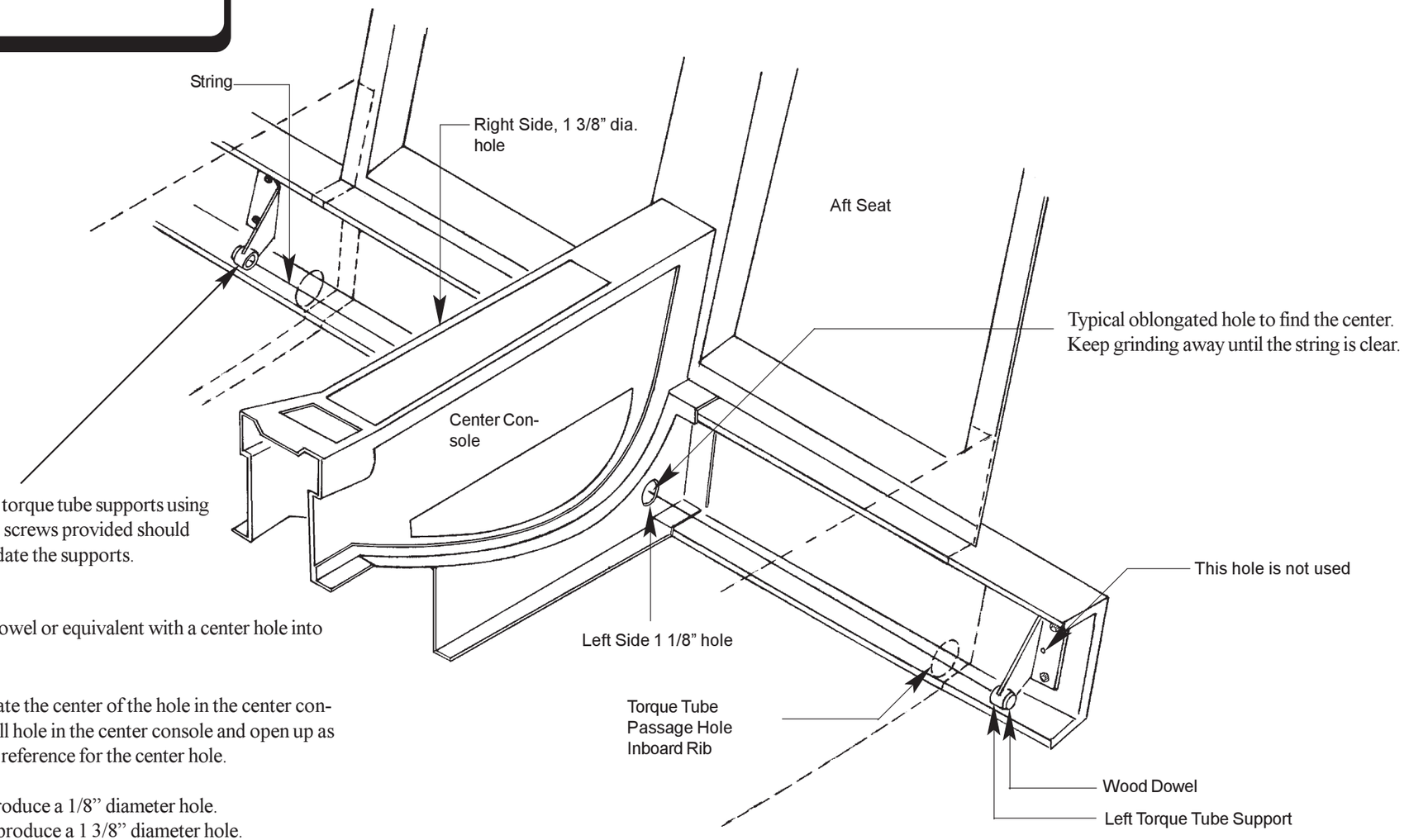
**Locating Torque Tube Center**
**Fig. 21:A:2**

In order to mount the torque tube we must first establish the center line of the torque tube in the center console.




Step 1. Temporarily mount the flap torque tube supports using the existing hardware. The screws provided should be long enough to accomodate the supports.

Step 2. Install a 1 3/8" dia. wood dowel or equivalent with a center hole into the flap attach bracket.

Step 3. As close as possible, estimate the center of the hole in the center console. Start by drilling a small hole in the center console and open up as required to get an accurate reference for the center hole.

Left Side: Centered on the string produce a 1/8" diameter hole.
Right Side: Centered on the string produce a 1 3/8" diameter hole.

**PULL THE STRING TIGHT!**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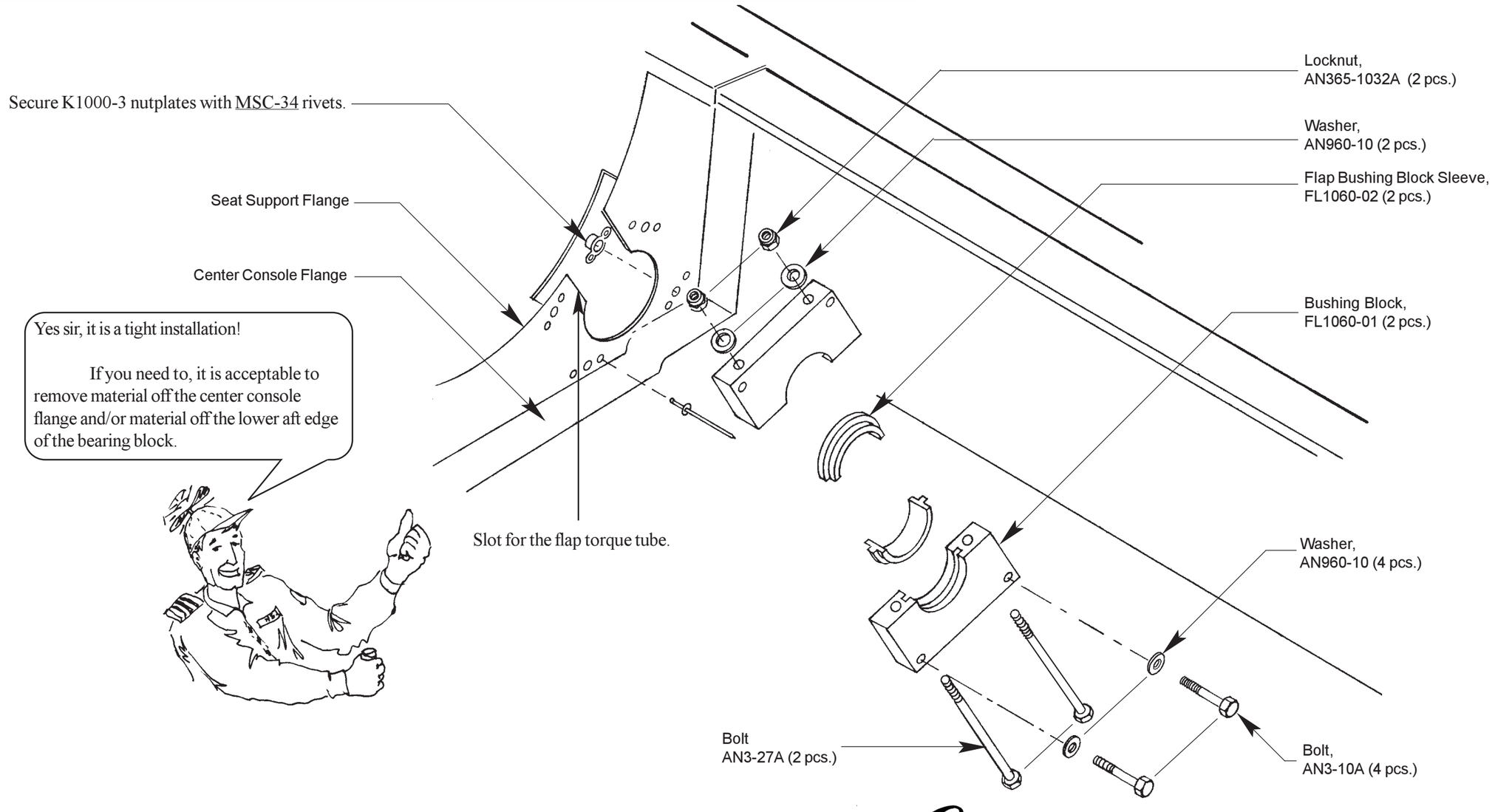
**Mounting Center Bearing Block**
**Fig. 21:A:3**

Once you have drilled the 1 1/8" diameter hole, position the bearing block on the center console. The bearing block (including the hardware) must clear the floor and be below the seat support flange. Angle the bearing block to accomplish this. Once aligned, drill the four 3/16" diameter mounting holes. Next produce a slot large enough to accommodate the flap torque tube.




Yes sir, it is a tight installation!

If you need to, it is acceptable to remove material off the center console flange and/or material off the lower aft edge of the bearing block.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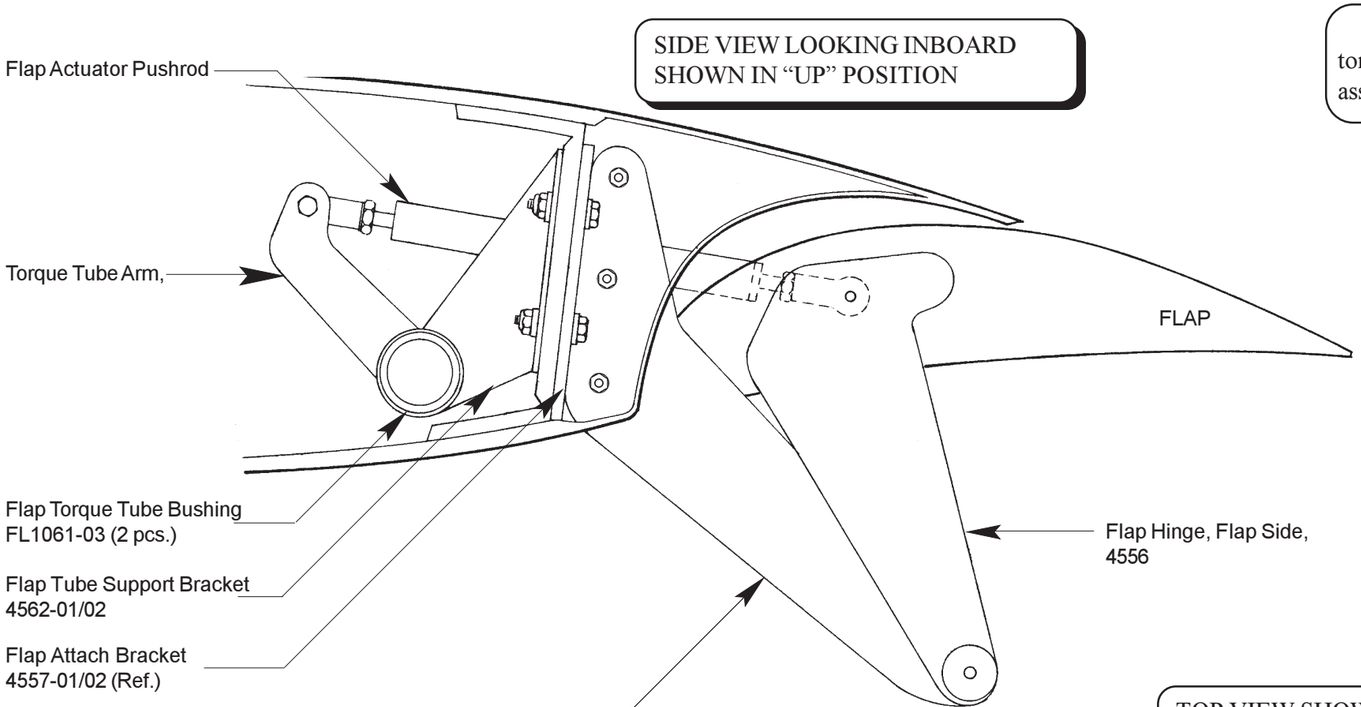
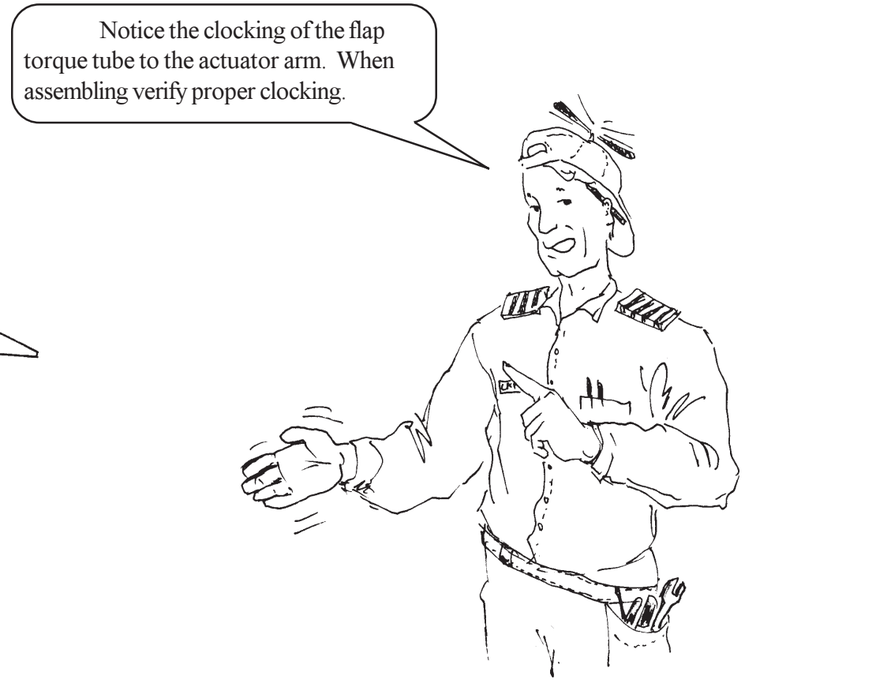
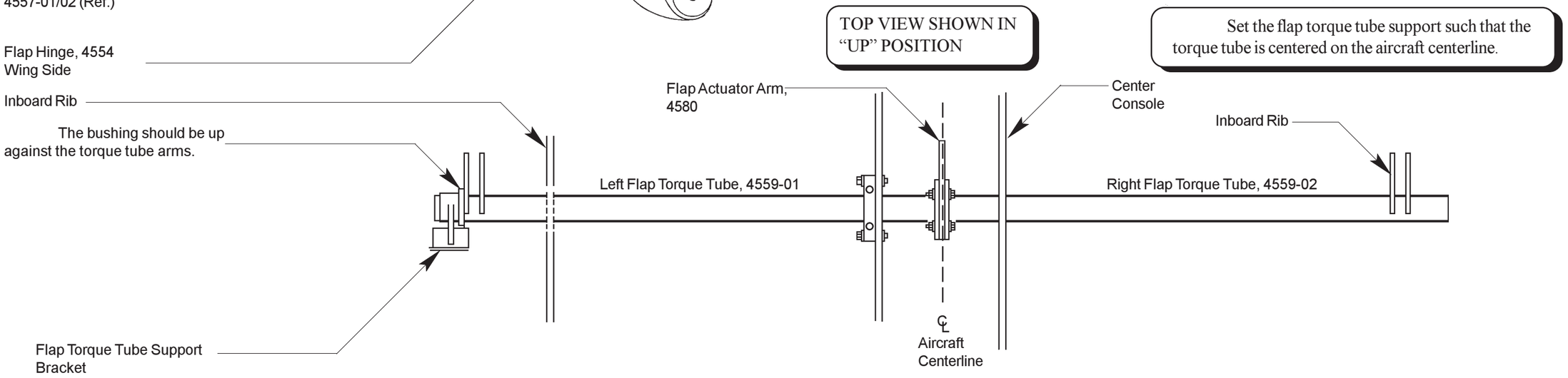
**Flap Torque Tube Support Installation**
**Fig. 21:A:4**





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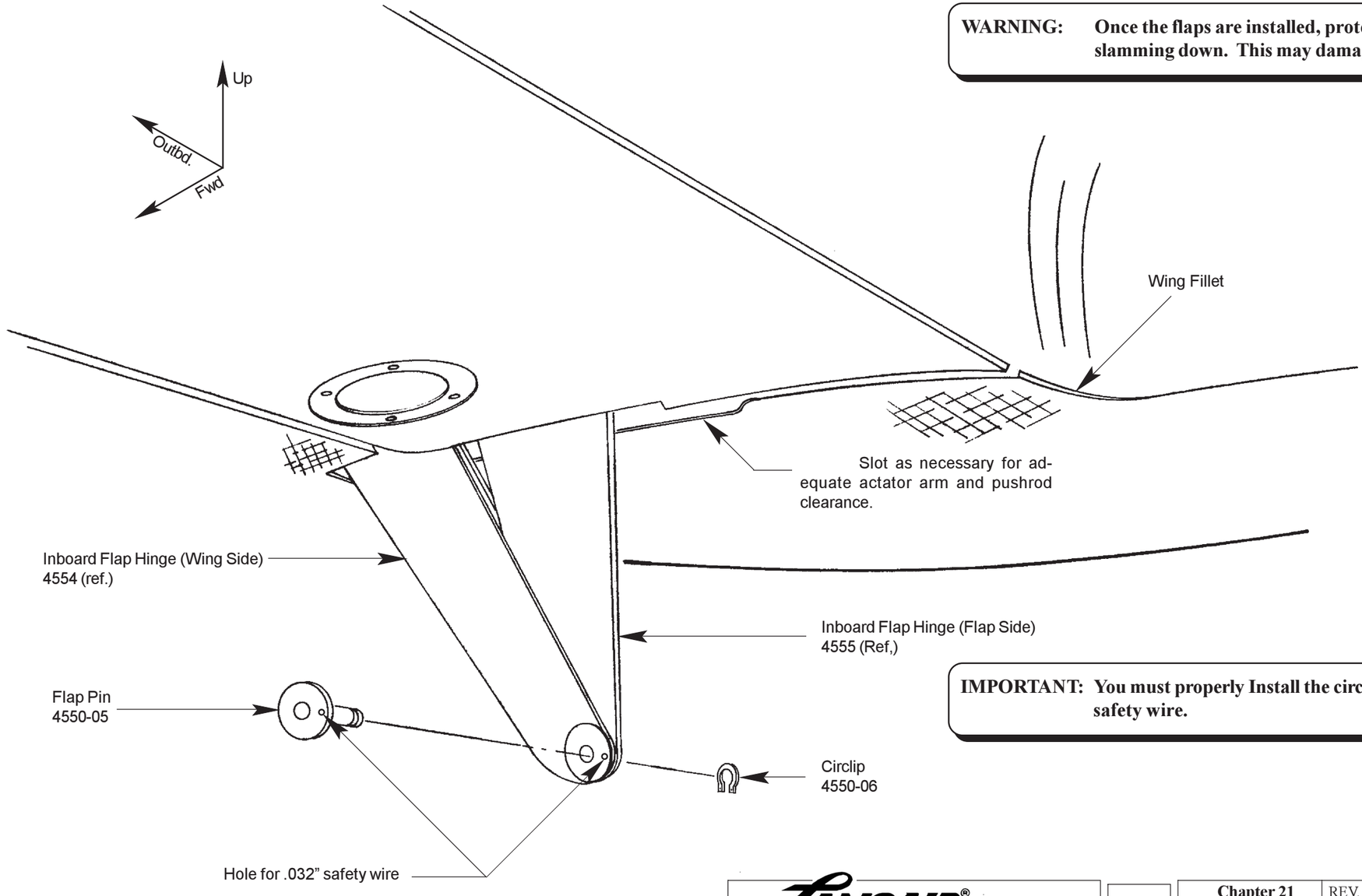
## B. Flap Installation

**Flaps Installation**
**Fig. 21:B:1**




**WARNING:** **Once the flaps are installed, protect them from slamming down. This may damage the flap hinges.**

**IMPORTANT:** **You must properly Install the circlip and safety wire.**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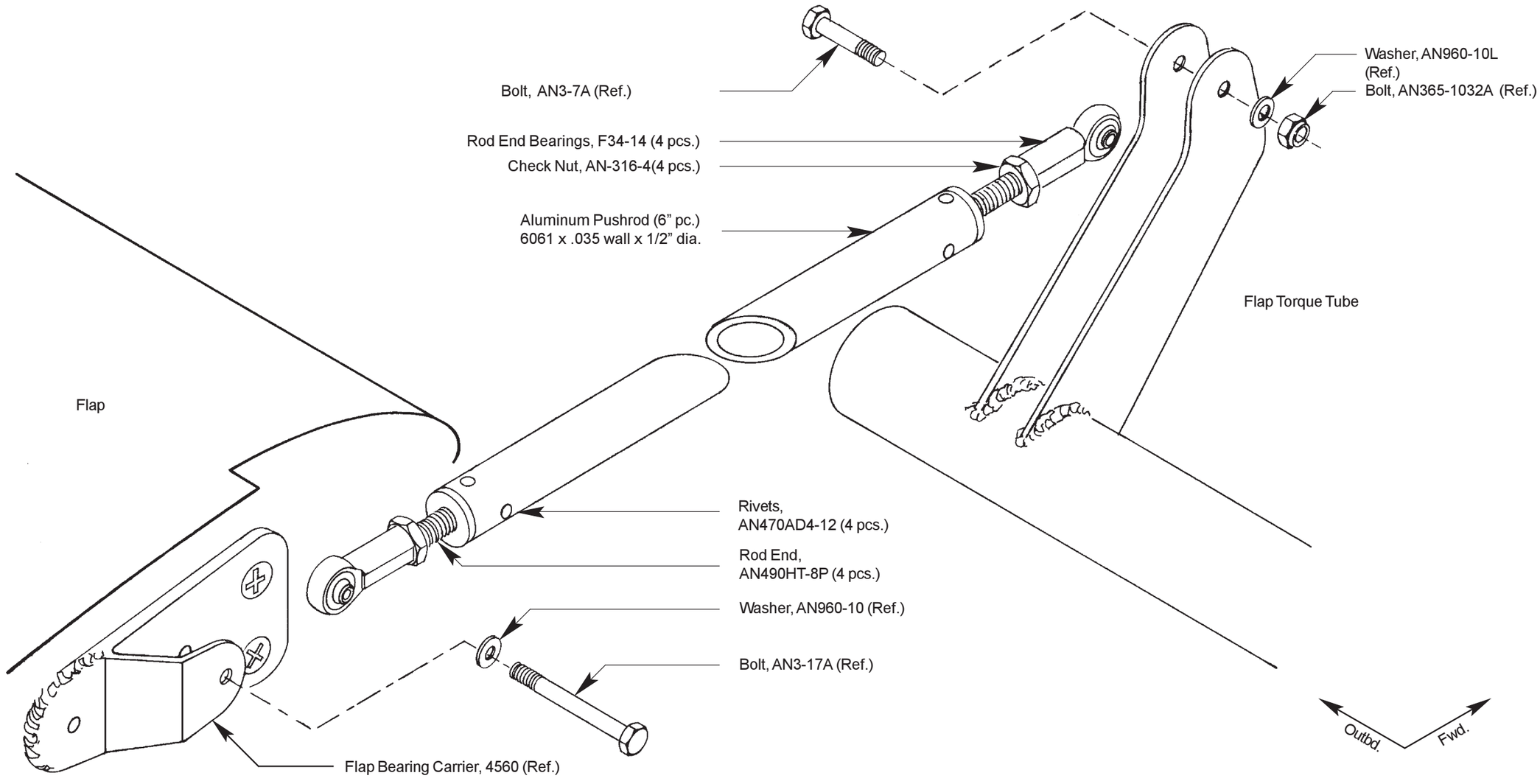
**Flap Actuator Pushrod Installation**
**Fig. 21:B:2**





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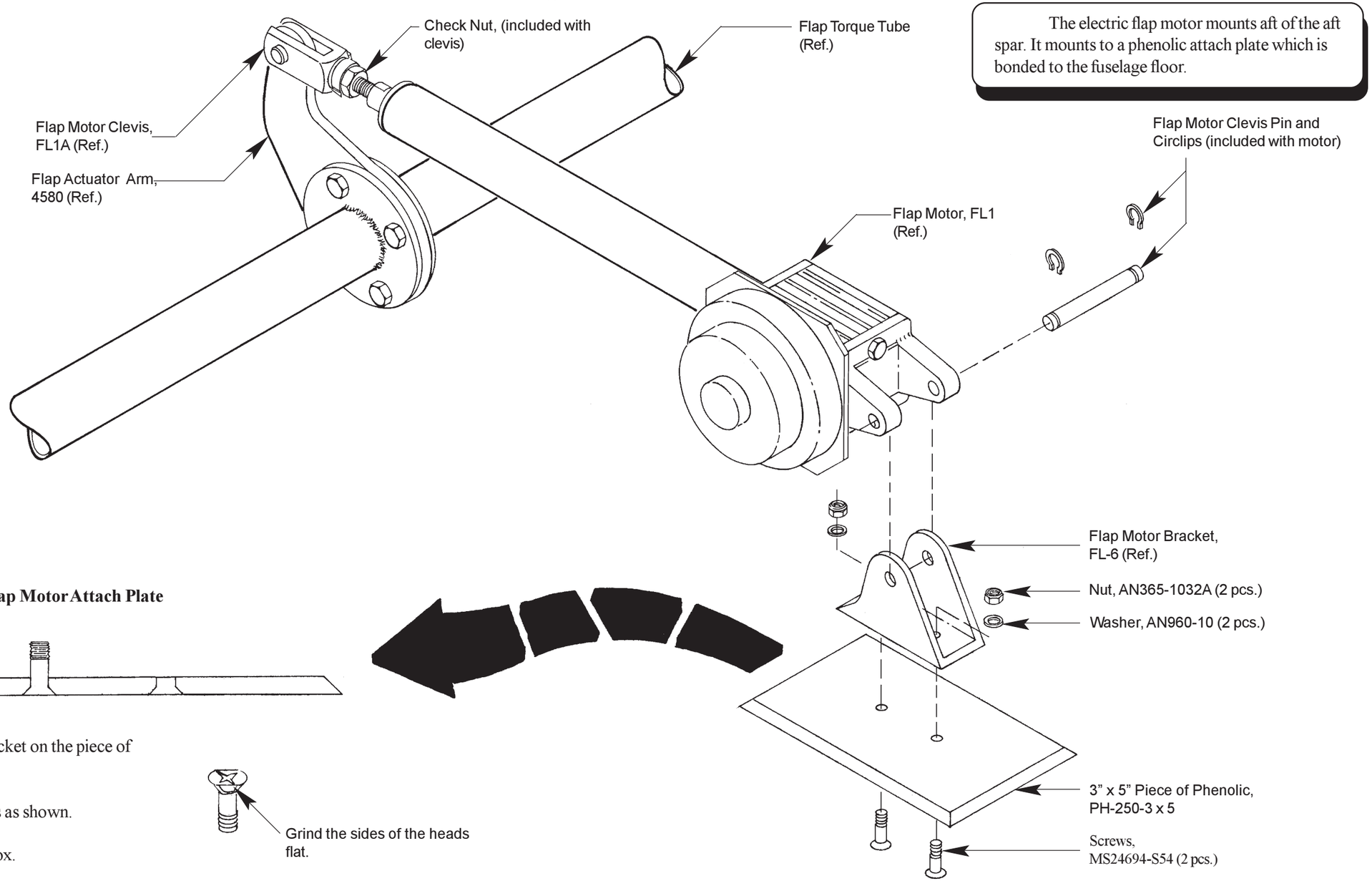
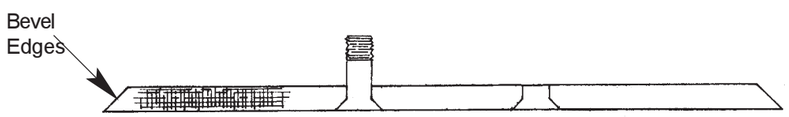
## C. Flap Motor Installation

**Flaps Actuator Mechanism Exploded View**
**Fig. 21:C:1**




The electric flap motor mounts aft of the aft spar. It mounts to a phenolic attach plate which is bonded to the fuselage floor.

**Flap Motor Attach Plate**




1. Center the flap motor bracket on the piece of phenolic.
2. Countersink the holes.
3. Grind the heads of screws as shown.
4. Sand bottom.
5. Pot in place with epoxy/flox.





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## Flap Motor Alignment

1. The flap installs on the aircraft center line

2. The aft edge of the flap bracket is 17 1/2” aft of the aft spar.

## Flap Adjustments

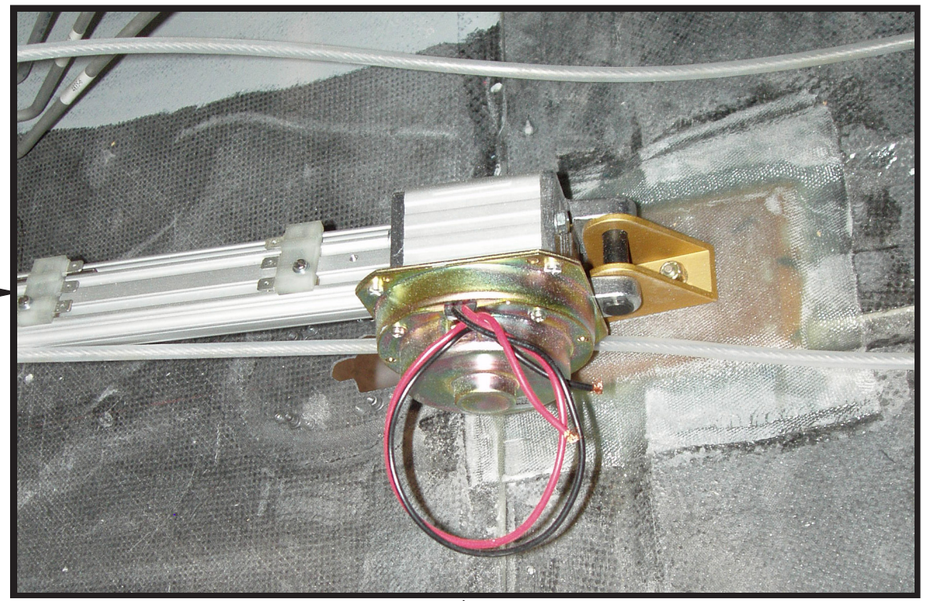
The flaps can be adjusted at each of the rod ends as well as adjusting the flap motor.

1. The flaps should be adjusted to be symmetrical. Use the short push rods to adjust as necessary. Be sure to tighten the check nuts when completed. Also check the tag wire holes of the rod end bearings to ensure you have enough thread.

2. Set the micro switches so the control horn stops approximately 1/4” (4mm) short of the aft shear panel. See Chapter 27.

3. Set the micro switches so the maximum flap deflection is 40°. Perhaps the easiest method of accomplishing this is to use a SMART level or inclinometer.

**Flap Motor Location**
**Fig. 21:C:2**





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## D. Bonding the Wing Trailing Edge

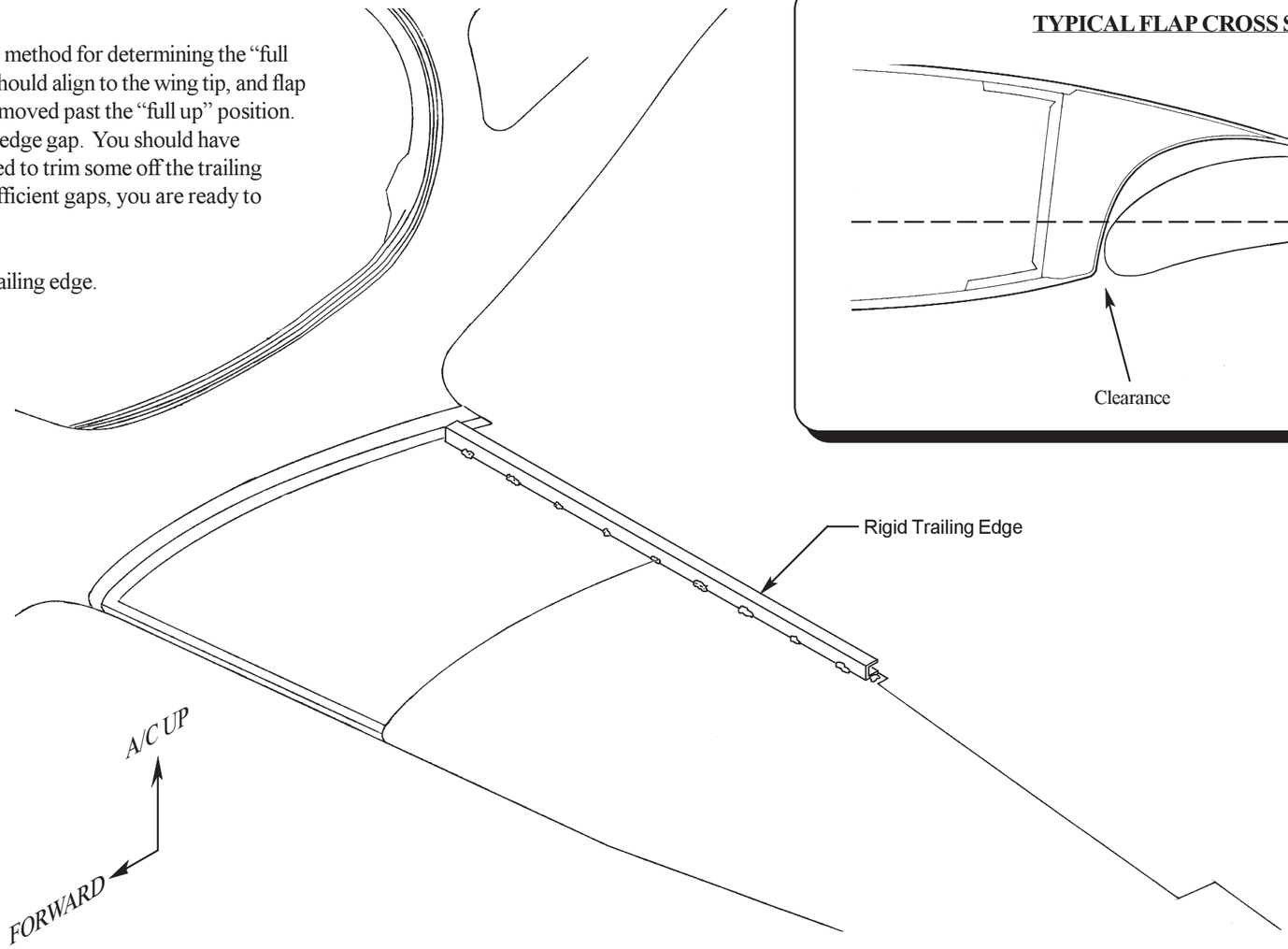
**Bonding Wing Trailing Edge**
**Fig. 21:D:1**

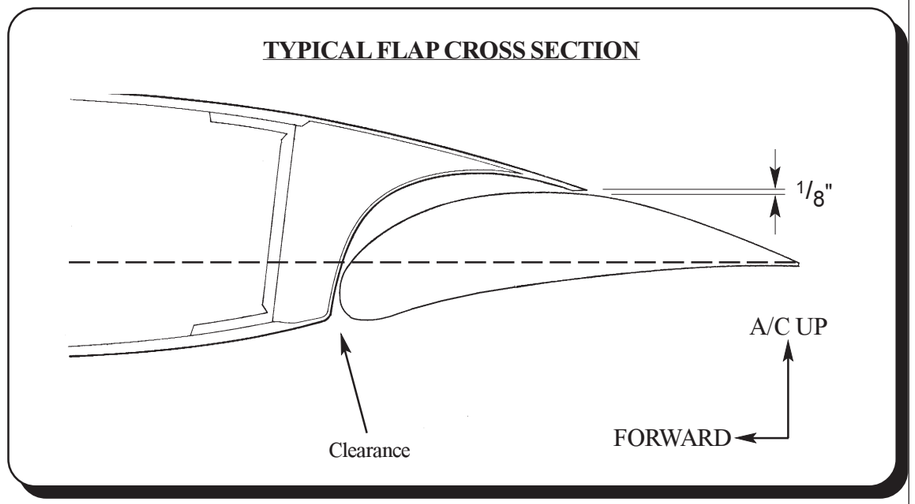
In Chapter 10 you closed out the inboard wing section. We suggested you hold off on closing out the trailing edge in the flap cove area. The reason for holding off on this is to check for adequate flap/trailing edge clearances. We recommend reading this entire section before getting started.

1. Use a rigid straight edge such as a "U" channel to hold the trailing edge straight. We suggest using bondo to secure the straight edge.

2. Install the flap. Move to the full up position. One method for determining the "full up" position is to install the aileron. The aileron should align to the wing tip, and flap to the aileron. Note that the flap may actually be moved past the "full up" position. With the flap in place, visually inspect the trailing edge gap. You should have approximately $^1/_8$" gap. Most likely, you will need to trim some off the trailing edge to get the gap you need. Once you have sufficient gaps, you are ready to bond the trailing edge.

3 Using approved bonding procedures, bond the trailing edge.





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# REVISION LIST

# CHAPTER 22: CABIN VENTILATION

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 22-1 through 22-2 | 0/02-15-02 | None | Current revision is correct |
| 22-3 | 0/09-18-02 | R&R | Corrected Fig. 22:B:1 |
| 22-4 | 0/09-18-02 | R&R | Text Correction |
| 22-1 | 2/06-30-04 | R&R | Updated parts list. |
| 22-2 | 2/06-30-04 | R&R | Corrected figure 22:A:1. |
| 22-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 22-3 | 3/12-15-04 | R&R | Removed reference to figure 22:B:3 which does not exist. |
| 22-1 | 4/09-30-06 | R&R | Corrected two part nbrs. in parts list. |
| 22-2 | 4/09-30-06 | R&R | Corrected two part nbrs. |
| 22-1, 22-3 | 6/08-10-07 | R&R | Changed part numbers only. |


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# Chapter 22: Cabin Ventilation

Contents



## 1. INTRODUCTION

The Legacy cabin ventilation consists of a fresh air system and cabin heat.

1. Fresh Air. On each side of the fuselage there is a NACA scoop which is the intake for the fresh air. As part of the fresh air system we suggest installing adjustable eyeball vents available through KCI.

2. The source of the cabin heat is through a heat muff installed on the exhaust. The heat muff is installed on the left exhaust pipe on the Continentals and on the right exhaust pipe on Lycomings. The heated air is routed to a cabin heat valve installed on the firewall. From the heat valve the air is either dumped overboard or routed to the defroster or directly into the cabin.

The cabin heat system is optional and available through KCI.

An important part of the cabin air system is an exit. We suggest providing a passage in the baggage bulkhead for the air to exit. One creative way of doing this is to find a nice (smaller) loud speaker cover. This will allow the air to exit into the tail cone and out through the elevator weldment covers.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **FRESH AIR (UNHEATED)** | | | | |
| 1) | 4021-01 | 1 | NACA Scoop Closeout | |
| 2) | 4021-02 | 1 | NACA Scoop Closeout | |
| 3) | KEV0110 | 2 | Eyeball Vent | **Yes |
| 4) | MS24693-C46 | 8 | Machine Screw | **Yes |
| 5) | K1000-08 | 4 | Nutplates | |
| 6) | MSC-34 | 8 | Rivets | |
| **CABIN HEAT*/CABIN DEFROSTER*** | | | | |
| 1) | 4933-01 | 1 | Cabin Heat Valve | **Yes |
| 2) | 4933-02 | 1 | Cabin Heat Valve Cap | **Yes |
| 3) | AN3-3A | 1 | Bolt, Undrilled | **Yes |
| 4) | AN3-7 | 1 | Bolt, Drilled | **Yes |
| 5) | A700-BK-3 | 1 | Cable, Button Lock | **Yes |
| 6) | **145-0004** ~~5416K15~~ | 2 | Clamp, Hose | **Yes |
| 7) | **145-0005** ~~5416K16~~ | 3 | Clamp, Hose | **Yes |
| 8) | MS21919-DG20 | 1 | Clamp, Loop Type | **Yes |
| 9) | AN742D4 | 1 | Clamp, Plain Loop Type | **Yes |
| 10) | SCAT - 5 | 14’ | Ducting | **Yes |
| 11) | SCEET - 6 | 11’ | Ducting | **Yes |
| 12) | 561 | 1 | Inlet Flange | **Yes |
| 13) | AN363-1032 | 4 | Locknut | **Yes |
| 14) | AN365-1032A | 2 | Locknut | **Yes |
| 15) | 05-16100 | 1 | Terminal Bolt Kit | **Yes |
| 16) | AN960-10L | 4 | Washer, Flat | **Yes |
| 17) | AN960-10 | 1 | Washer, Flat | **Yes |

**Note: 4933 Cabin Heat System, w/ Above Items**

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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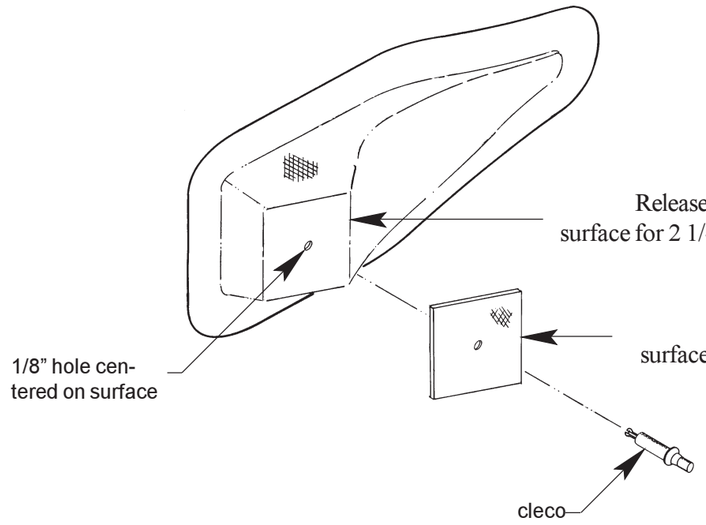
# 3. CONSTRUCTION PROCEDURES

## A. Fresh Air (Unheated)

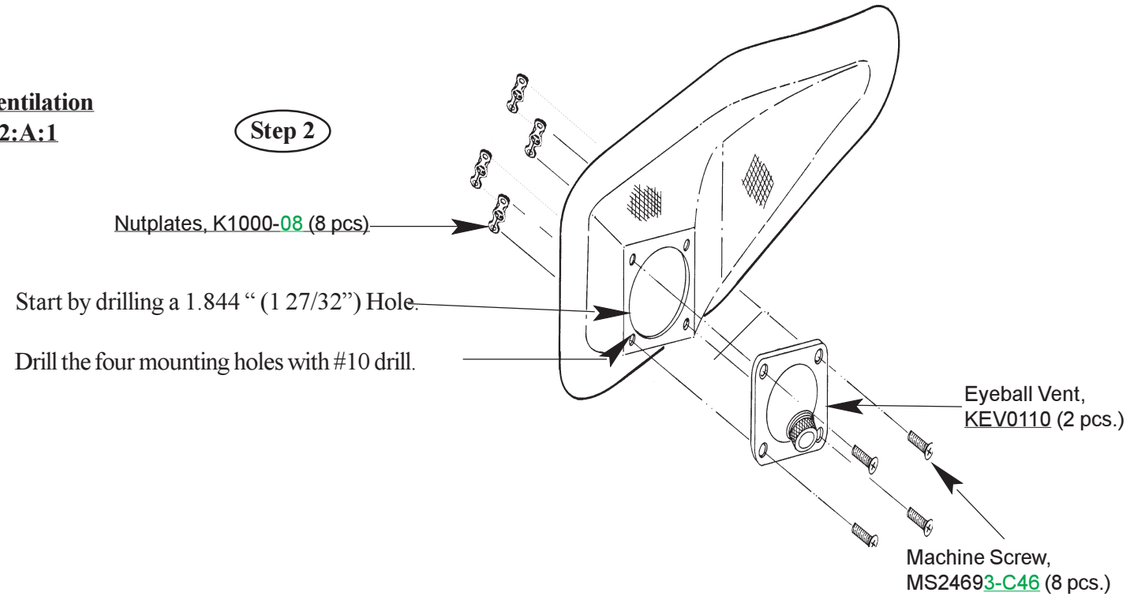
The eyeball vents for fresh air install on the inside of the premolded NACA scoops. In order to mount the eyeball vents it is necessary to form a flat mounting surface. This is accomplished by performing a release as described below. Then the eyeball vents are mounted and the NACA scoop closeout installed.

**Step 1**



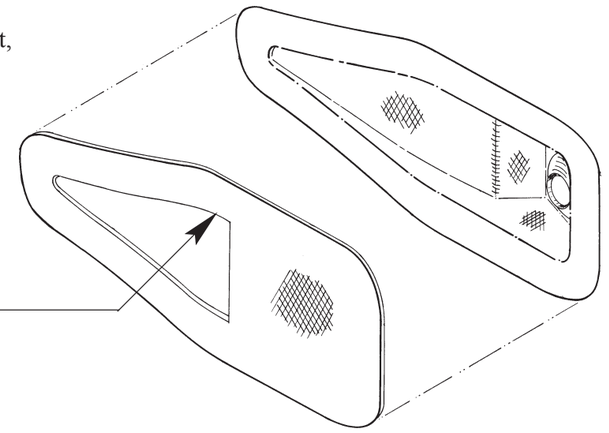

**Cabin Ventilation**
**Fig 22:A:1**

**Step 2**




**Step 3**

Fit and bond the NACA scoop closeout, 4021-01/02, to the joggle.





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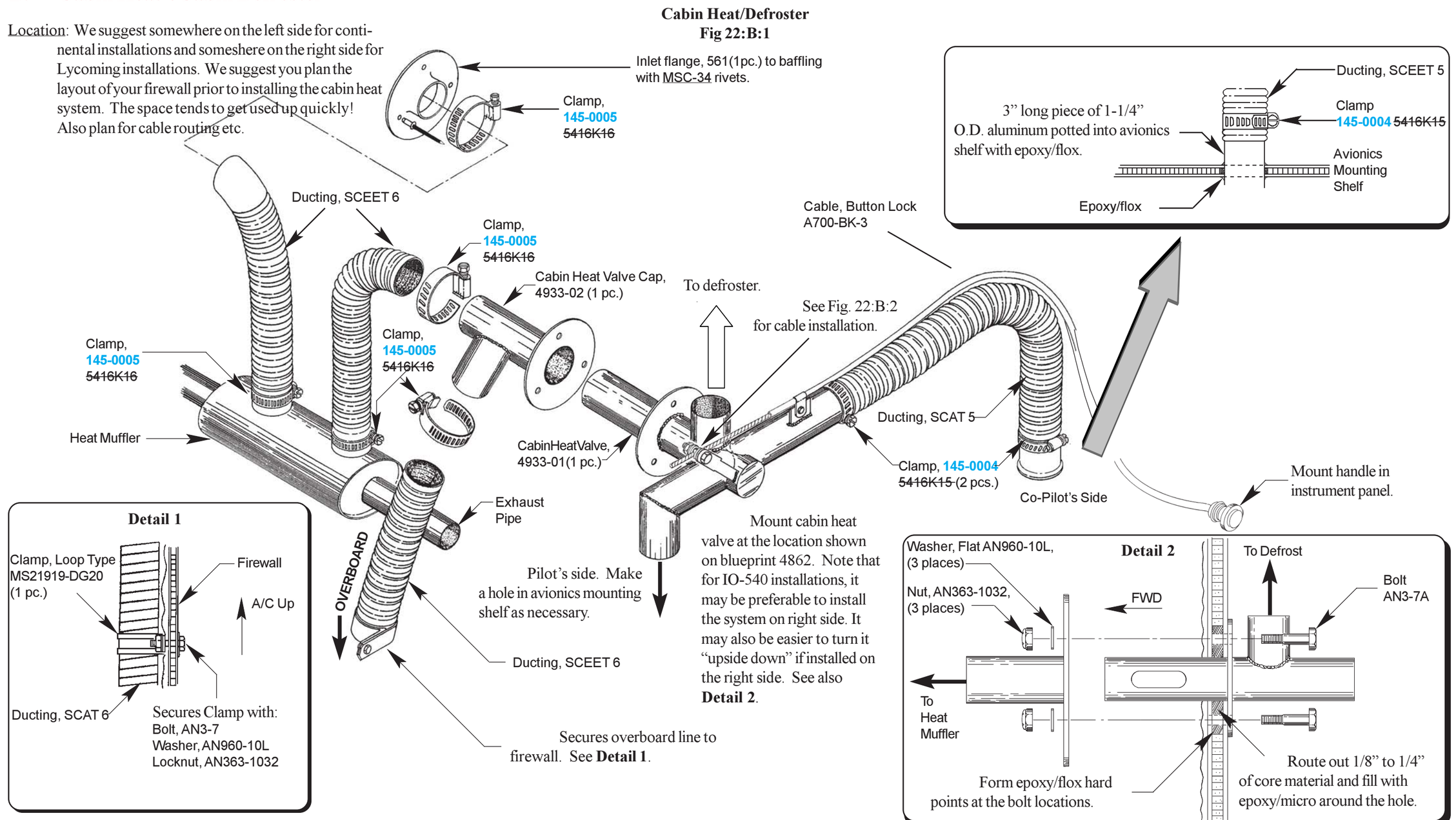
## B. Cabin Heat*/Cabin Defroster*

Location: We suggest somewhere on the left side for continental installations and someshere on the right side for Lycoming installations. We suggest you plan the layout of your firewall prior to installing the cabin heat system. The space tends to get used up quickly! Also plan for cable routing etc.

**Cabin Heat/Defroster**
**Fig 22:B:1**



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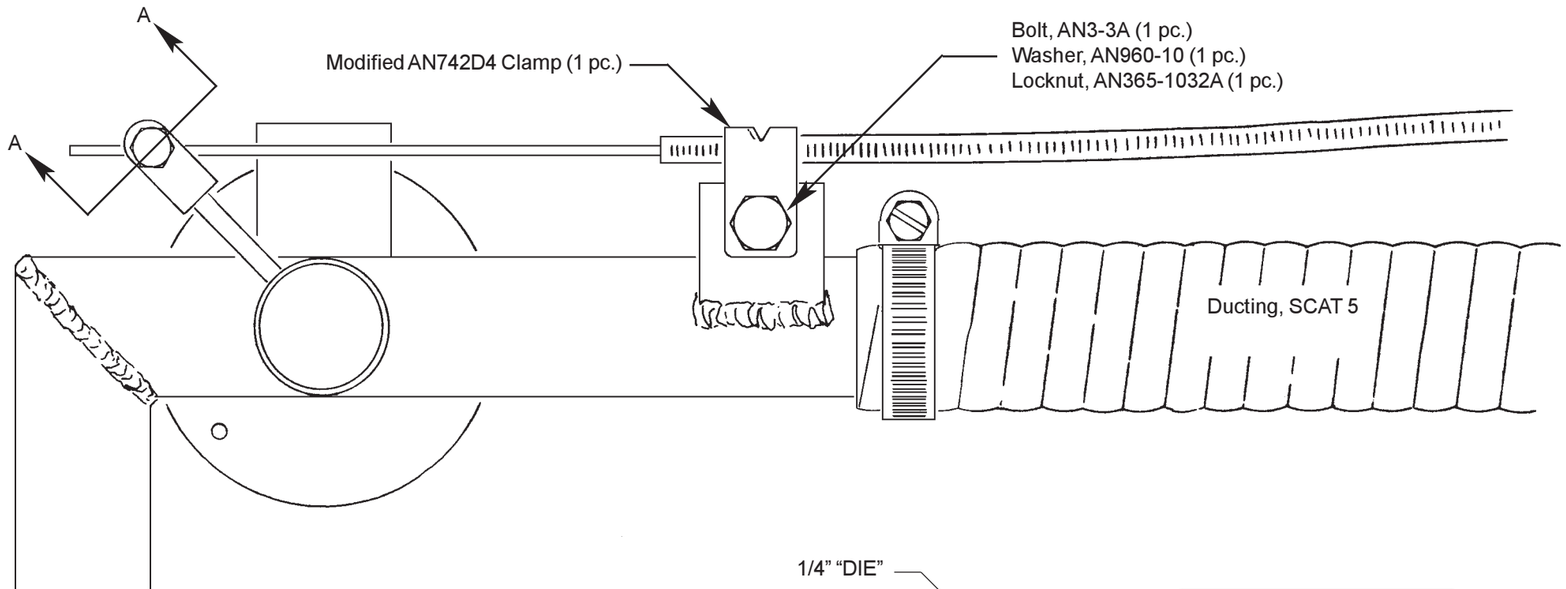
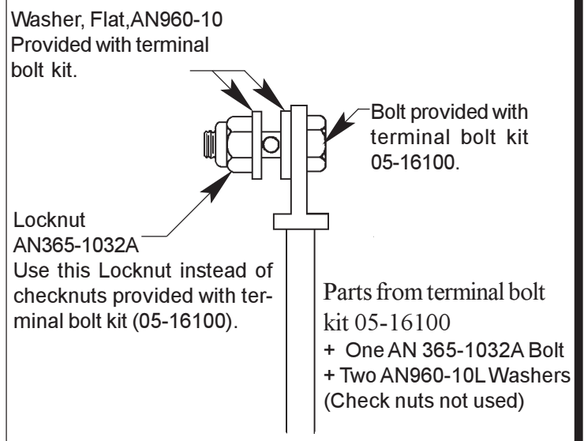
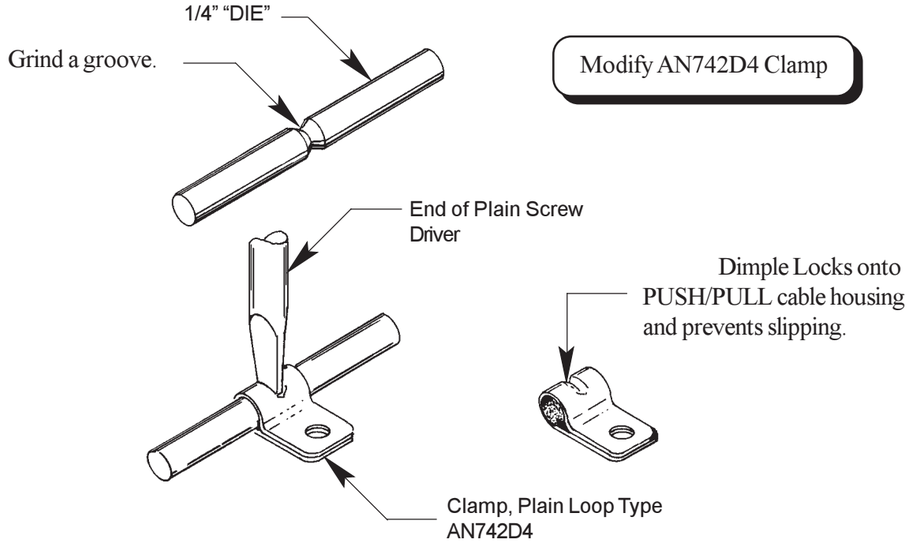
## Mounting Cable On Mixer Valve
## Fig 22:B:2




**VIEW AA**





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# REVISION LIST

# CHAPTER 23: BAGGAGE COMPARTMENT

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 23-1 through 23-15 | 0/02-15-02 | None | Current revision is correct |
| 23-1 | 2/06-30-04 | R&R | Updated parts list. |
| 23-6 | 2/06-30-04 | R&R | Updated parts in figure 23:C:1. |
| 23-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers and parts list. |
| 23-3 | 3/12-15-04 | R&R | Updated parts. |
| 23-6 | 3/12-15-04 | R&R | Updated parts. |
| 23-11 | 3/12-15-04 | R&R | Updated parts. |
| 23-1, 23-6 | 6/08-10-07 | R&R | Changed part numbers only. |


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# Chapter 23 Baggage Compartment

**Contents**



## 1. INTRODUCTION

The baggage compartment or the area between the aft spar and the baggage bulkhead is also the area for the elevator control tube, flap motor, hydraulics, and wiring. To finish off the baggage compartment we supply a control tube closeout and bulkhead cover.

Optional installations:

The overhead console installs just aft of the rollover closeout. The closeout is tailored to fit head set jacks and lights.

The optional floorboards install between the control tube closeout and the fuselage sides. They provide for a flat surface as well as additional storage room underneath.

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| CONTROL TUBE CLOSEOUT | | | | |
| 1) | 4035 | 1 | Control Tube Closeout | |
| 2) | 4035-1 | 1 | Control Tube Closeout Top Cover | |
| 3) | 4035-2 | 1 | Control Tube Closeout Aft Cover | |
| 4) | K1000-3 | 7 | Nutplate | |
| 5) | K3000-3 | 4 | Nutplate | |
| 6) | MSC-32 | 22 | Rivets | |
| 7) | AN525-10R8 | 11 | Screw, Washer Head | |
| BULKHEAD COVER | | | | |
| 1) | 4041 | 1 | Baggage Bulkhead Cover | |
| 2) | K1000-3 | 9 | Nutplate | |
| 3) | MSC-32 | 18 | Rivets, Pop | |
| 4) | AN526-1032R8 | 9 | Screw, Machine | |
| 5) | AN960-10 | 9 | Washer, Flat | |
| OVERHEAD CONSOLE (OPTIONAL) | | | | |
| 1) | 4030 | 1 | Overhead Console | *Yes |
| 2) | 4901-02 | 1 | Overhead Light Retainer Ring .09” | *Yes |
| 3) | 4901-01 | 1 | Overhead Console Insert | *Yes |
| 4) | 101-0085 ~~92196A192~~ | 4 | Bolt, Allen | *Yes |
| 5) | MOD1 | 2 | Cabin Light | *Yes |
| 6) | AN365-440A | 4 | Locknuts | *Yes |
| 7) | K3000-08 | 4 | Nutplates | *Yes |
| 8) | S3989 | 1 | Overhead Light | *Yes |
| 9) | MSC-32 | 8 | Rivets, Pop | *Yes |
| 10) | MS35206-21A | 4 | Screws | *Yes |
| 11) | AN960-4 | 4 | Washers | *Yes |
| FLOORBOARDS (OPTIONAL) | | | | |
| 1) | 4350-01 | 1 | Left Floorboard, Baggage Compartment | **Yes |
| 2) | 4350-02 | 1 | Right Floorboard, Baggage Compartment | **Yes |
| 3) | 4351-01 | 1 | Left Aft Access Panel | **Yes |
| 4) | 4351-02 | 1 | Right Access Panel | **Yes |
| 5) | 4351-03 | 1 | Left Forward Access Panel | **Yes |



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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| FLOORBOARDS (CONTINUED) | | | | |
| 6) | MS20001-5 | 2’ | Hinge, Continuous | **Yes |
| 7) | H-5000-2 | 4 | Latch, Hartwell | **Yes |
| 8) | K1000-08 | 26 | Nutplates | **Yes |
| 9) | AN426AD3-4 | 16 | Rivets | **Yes |
| 10) | AN426A3-4 | 52 | Rivets, Aluminum | **Yes |
| 11) | MS24693-S50 | 26 | Screw, Machine | **Yes |
| OXYGEN SYSTEM (OPTIONAL) | | | | |
| 1) | 4932 | 1 | Oxygen System | **Yes |

**Note:**

**Optional Parts available through :**

**(*) Lancair Avionics**

**(**) Kit Components, Inc.**


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# 3. CONSTRUCTION PROCEDURES

## A. CONTROL TUBE Cover

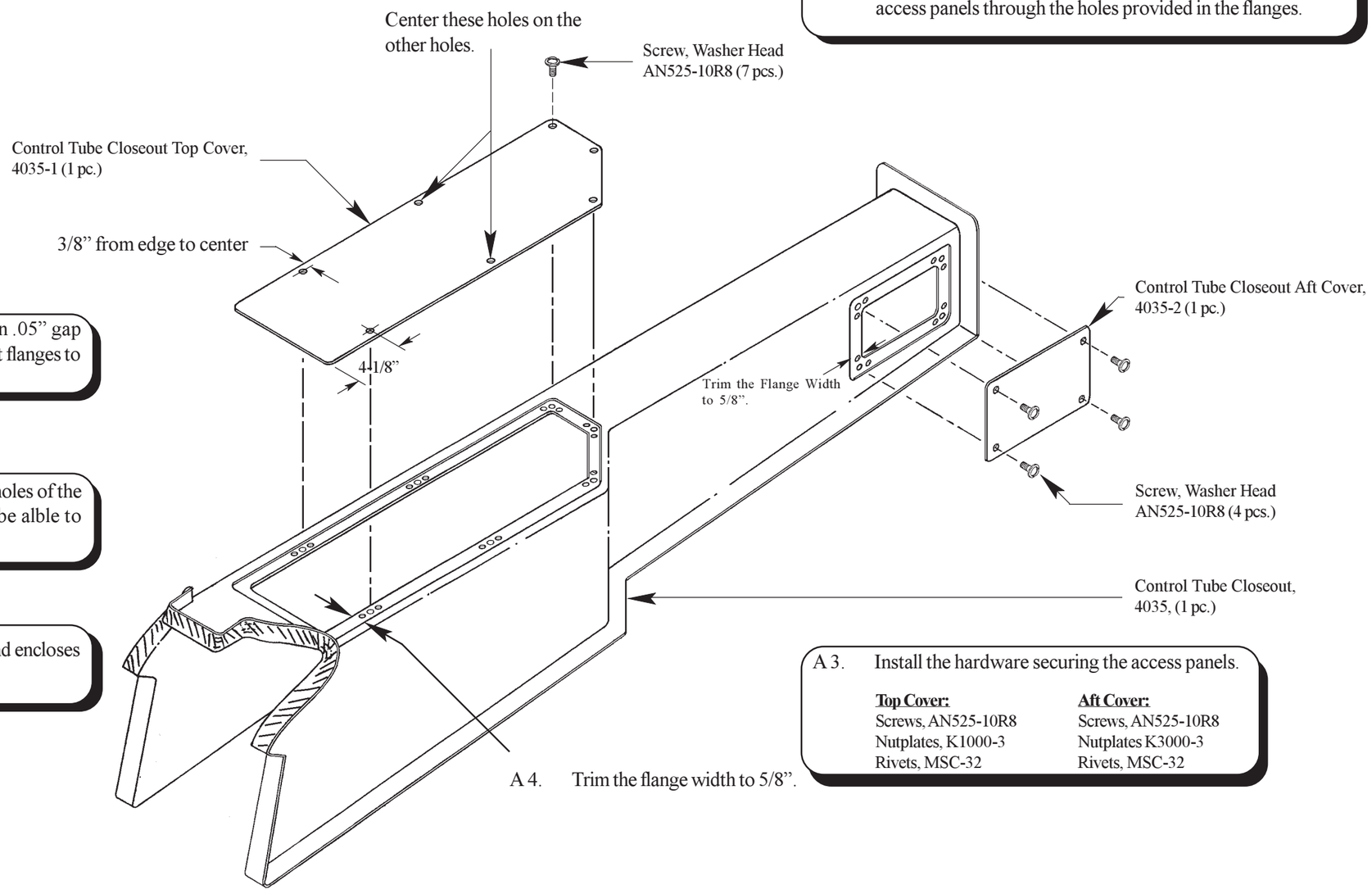
A 1. Fit the access panels to their openings.

Trim the acceess panels such that you have an even .05” gap between the access panel and the edge of the joggle. Trim eht flanges to 5/8”

Note: The reason we don’t install the two forward holes of the top cover all the way in the front is because you will not be alble to access the holes due to the angle of the seat back.

The control tube closeout isolates the control tube and encloses the hydraulic lines and the flap motor.

**Control Tube Closeout Access Panels**
**Figure 23:A:1**




A 2. Turn the control tube closeout upside down and backdrill the access panels through the holes provided in the flanges.

A 3. Install the hardware securing the access panels.

| **Top Cover:** | **Aft Cover:** |
|---|---|
| Screws, AN525-10R8 | Screws, AN525-10R8 |
| Nutplates, K1000-3 | Nutplates K3000-3 |
| Rivets, MSC-32 | Rivets, MSC-32 |

A 4. Trim the flange width to 5/8”.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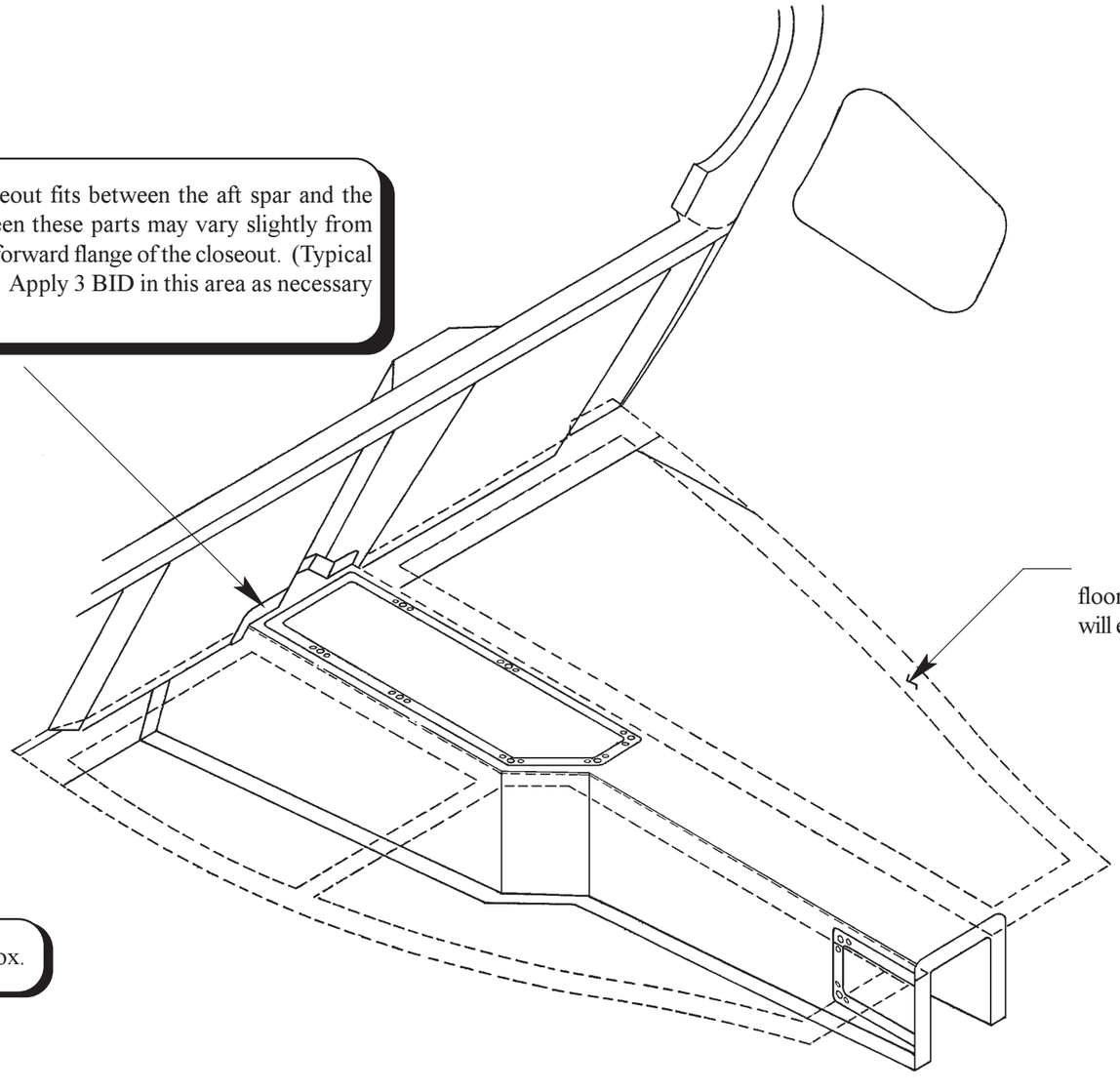
**Control Tube Closeout Installation**
**Figure 23:A:2**

A 5. Fit the control tube closeout. The closeout fits between the aft spar and the baggage bulkhead. The distance between these parts may vary slightly from aircraft to aircraft. As necessary trim the forward flange of the closeout. (Typical trimming shown shaded in Fig. 24:A:1). Apply 3 BID in this area as necessary after bonding console in.



If you plan on installing the optional floorboards it is a good idea to check the fit now. This will ensure that the center console is properly centered.

A 6. Bond closeout in place using epoxy/flox.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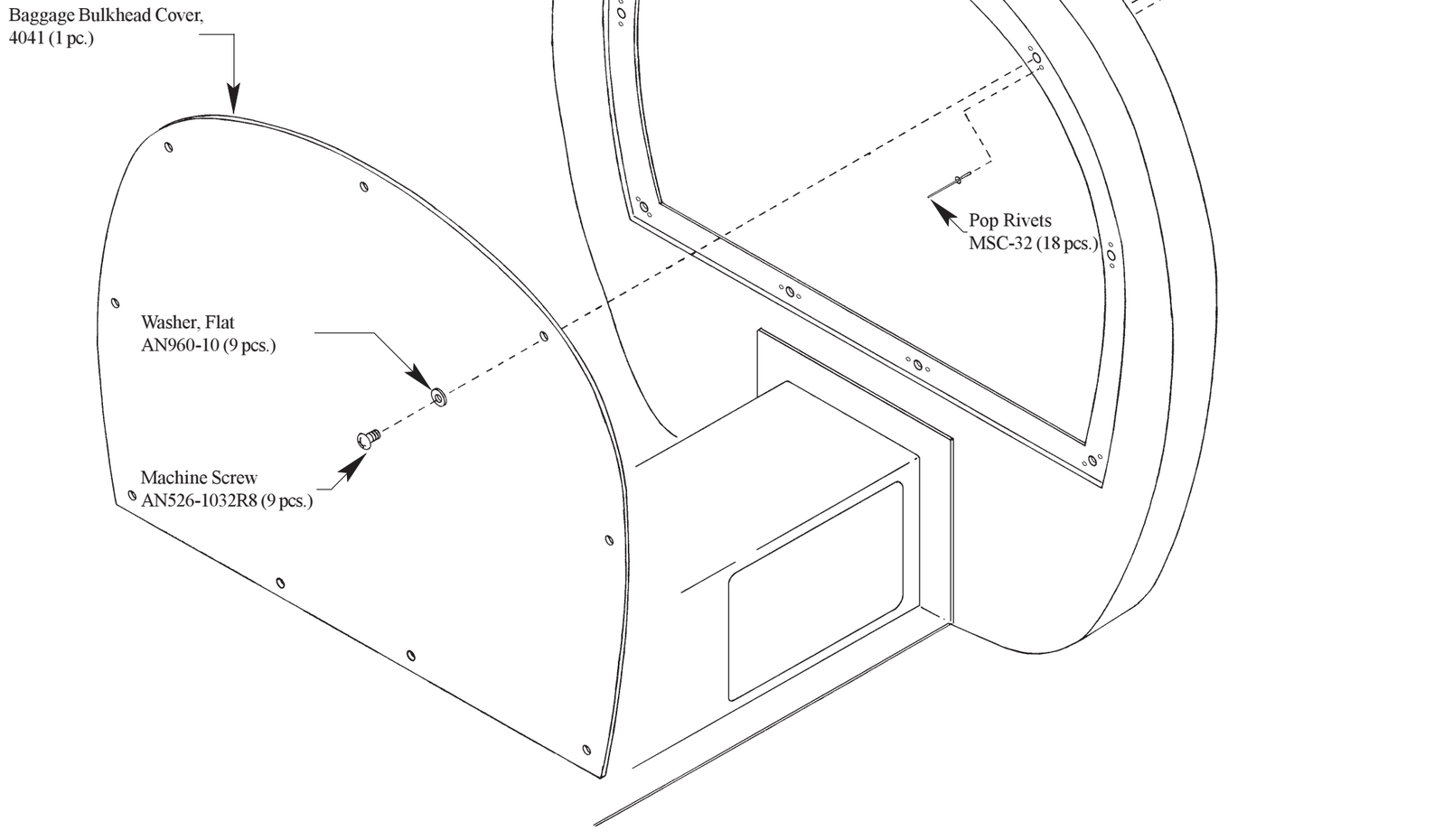
## B. BULKHEAD COVER

The bulkhead cover closes out the aft end of the "cockpit." The holes for the screws are already pre-drilled. Start by fitting the bulkhead cover. For now provide .05" clearance between the cover and the joggle. Install the nutplates.

**Baggage Bulkhead Cover**
**Figure 23:B:1**





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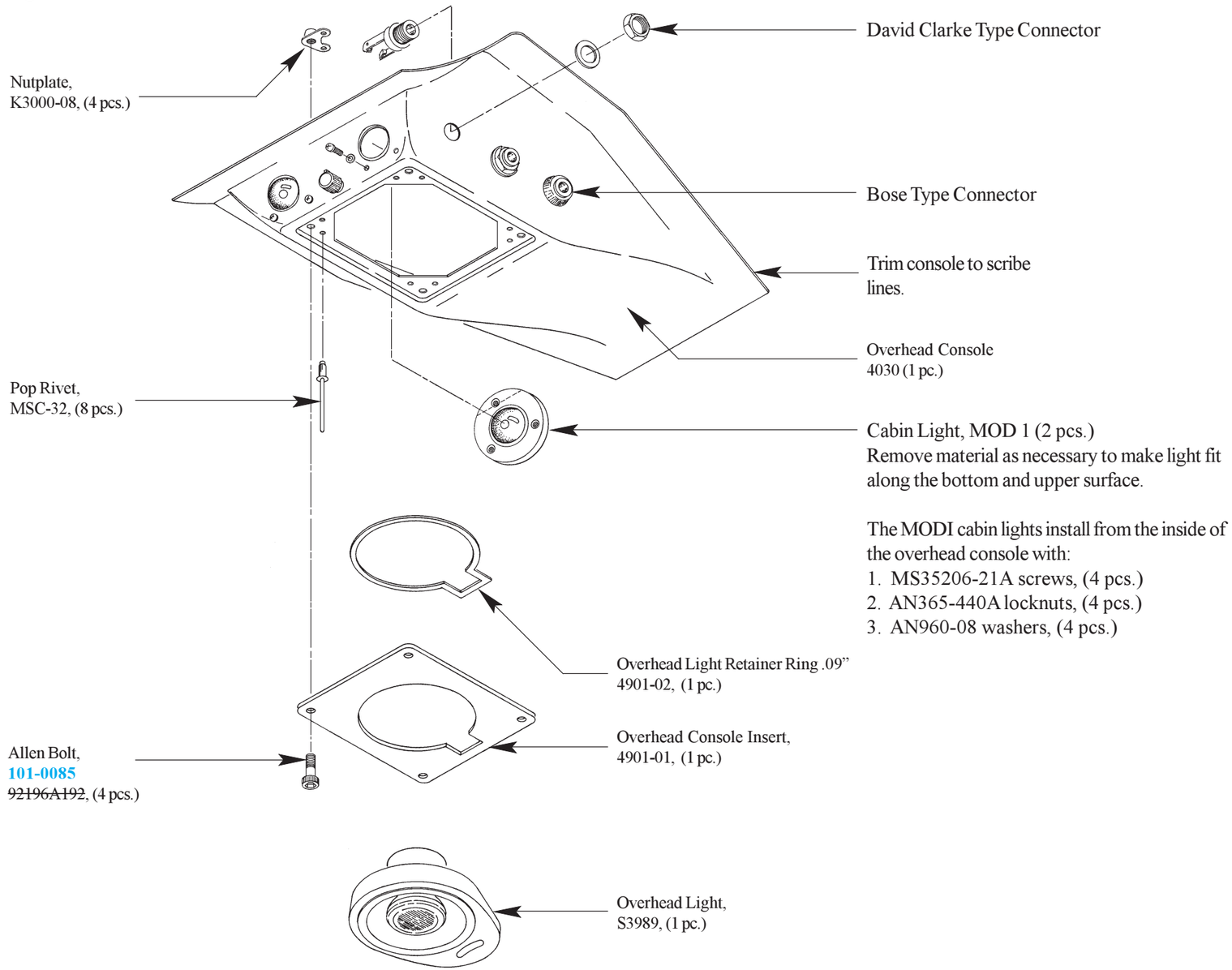
## C. OVERHEAD CONSOLE*

The overhead console is available through KCI.

**Overhead Console**
**Figure 23:C:1**




The MODI cabin lights install from the inside of the overhead console with:

1. MS35206-21A screws, (4 pcs.)
2. AN365-440A locknuts, (4 pcs.)
3. AN960-08 washers, (4 pcs.)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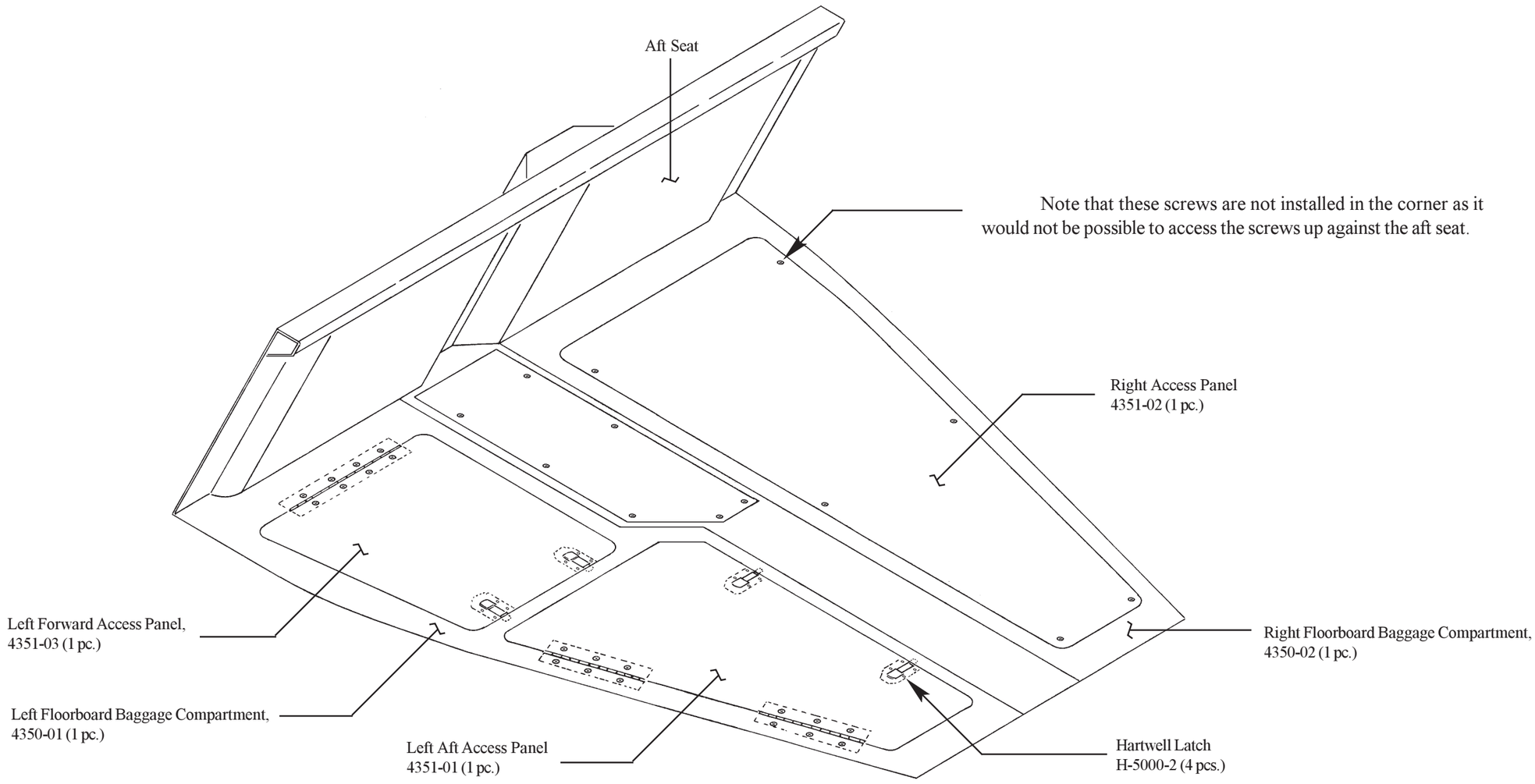
## D. FLOORBOARDS*

**Baggage Compartment Floorboard**
**Figure 23:D:1**

The optional floorboards may require some trimming to fit into place. Before bonding the floorboards into place, the access panels are installed. Note that the right access panel is typically installed with screws. This is the compartment for items not removed on a regular basis. It is a good place for oxygen, ELT, stormscope, TCAS and other equipment.





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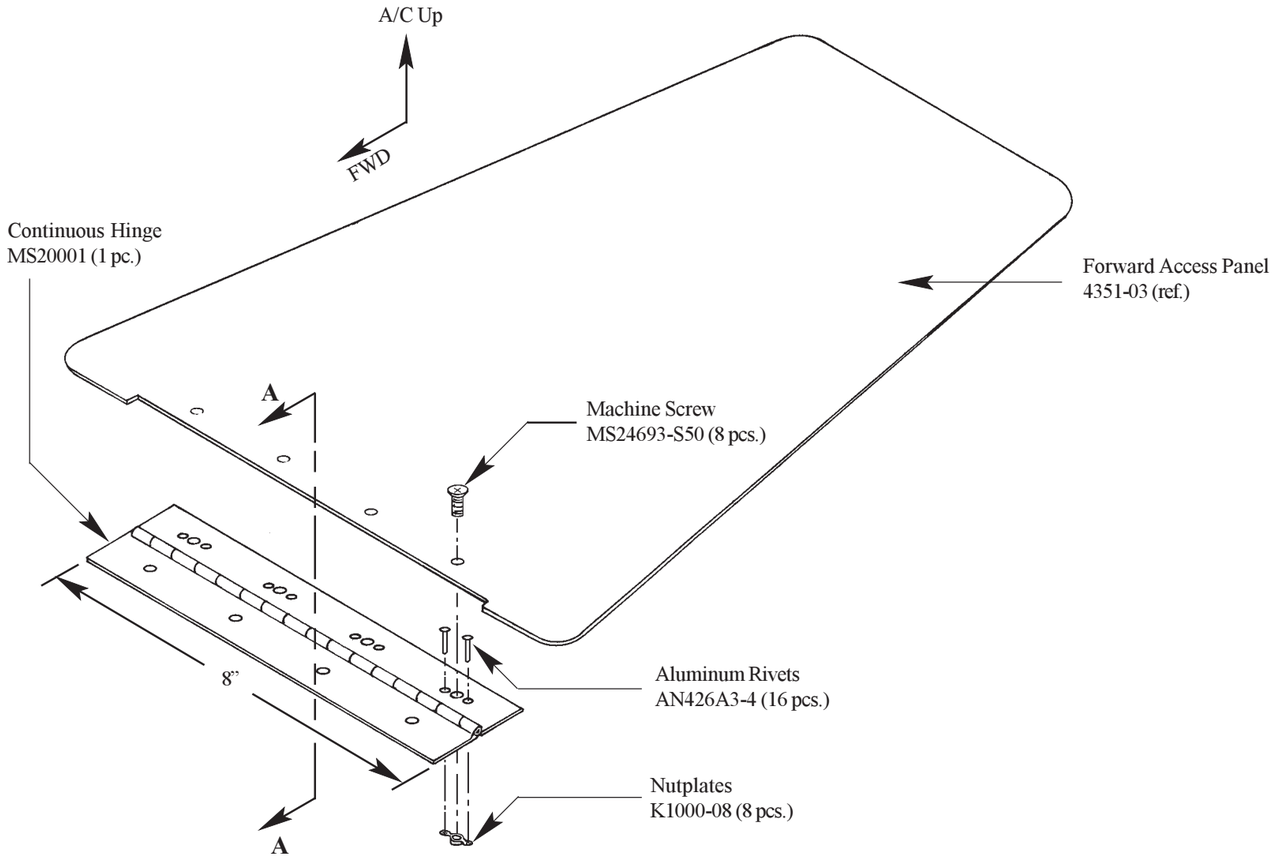
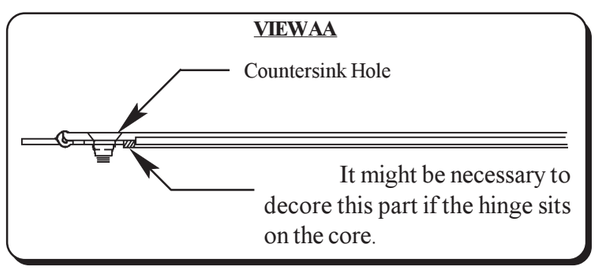
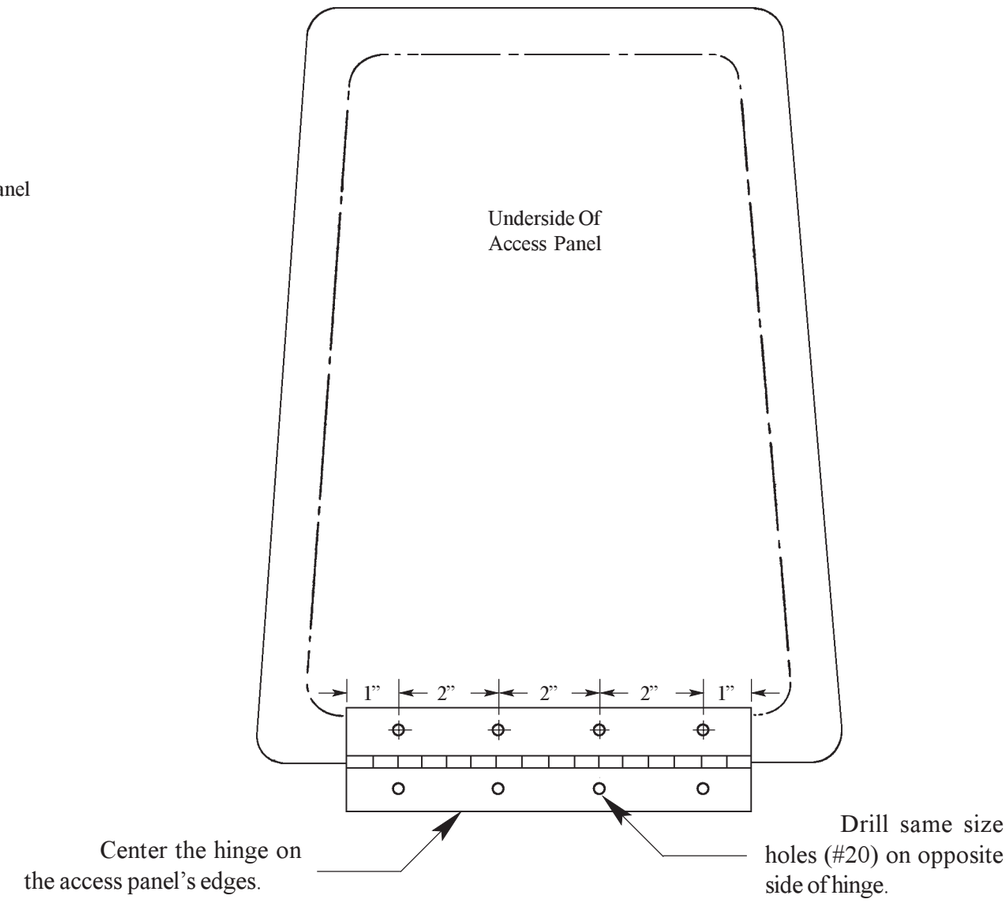
**Installing the Hinge on the Left Floorboard Forward Access Panel**
**Fig. 23:D:2**

**D 1.** Trim the floorboard's (P/N 4350-01/02) access panel joggles to 5/8" width and sand the edges flat.

**D 2.** Trim and fit the acccess panels (P/N 4351-01/02/03) onto the joggles.





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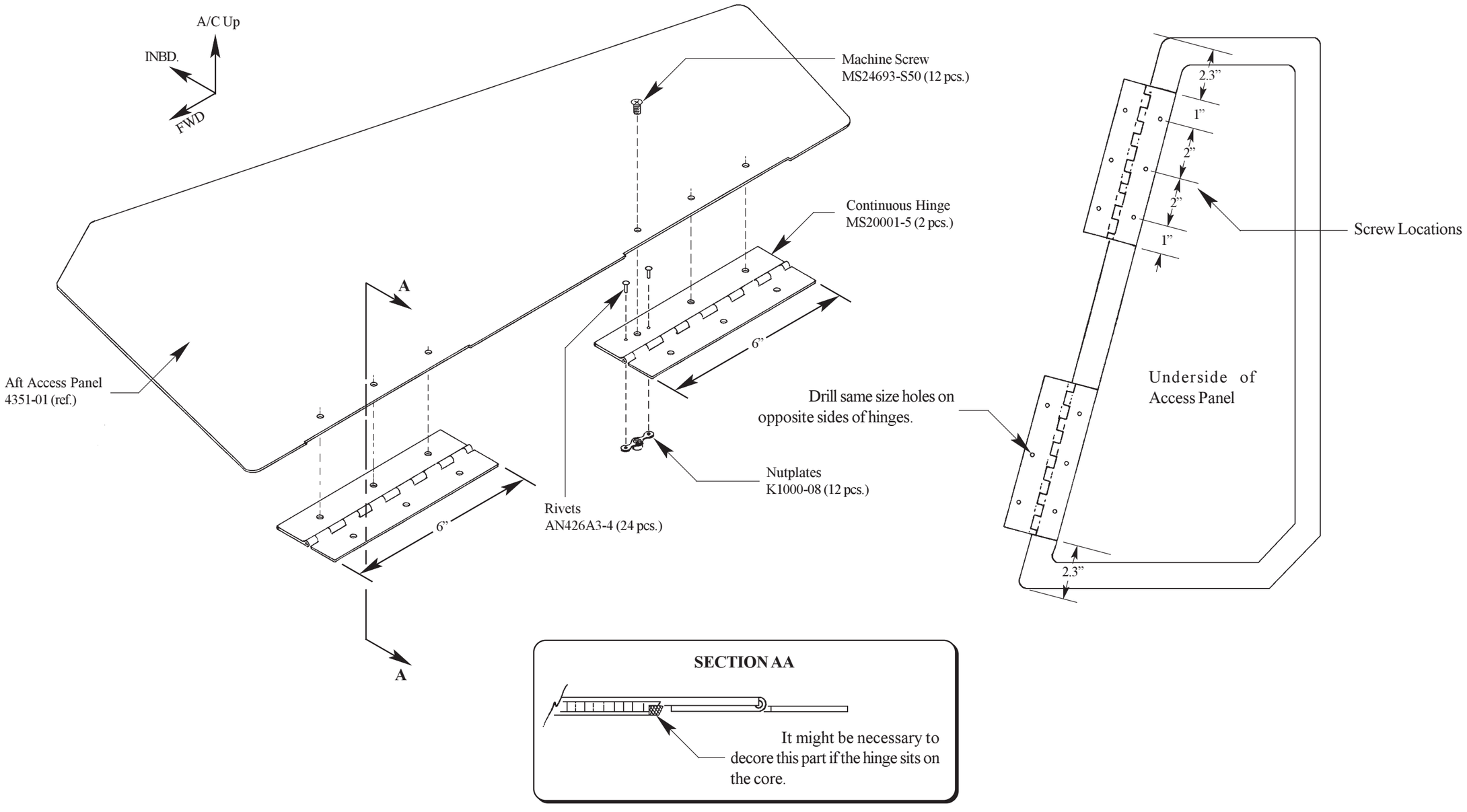
**Installing the Hinge on the Left Floorboard Aft Access Panel**
**Figure 23:D:3**




**SECTION AA**



It might be necessary to decore this part if the hinge sits on the core.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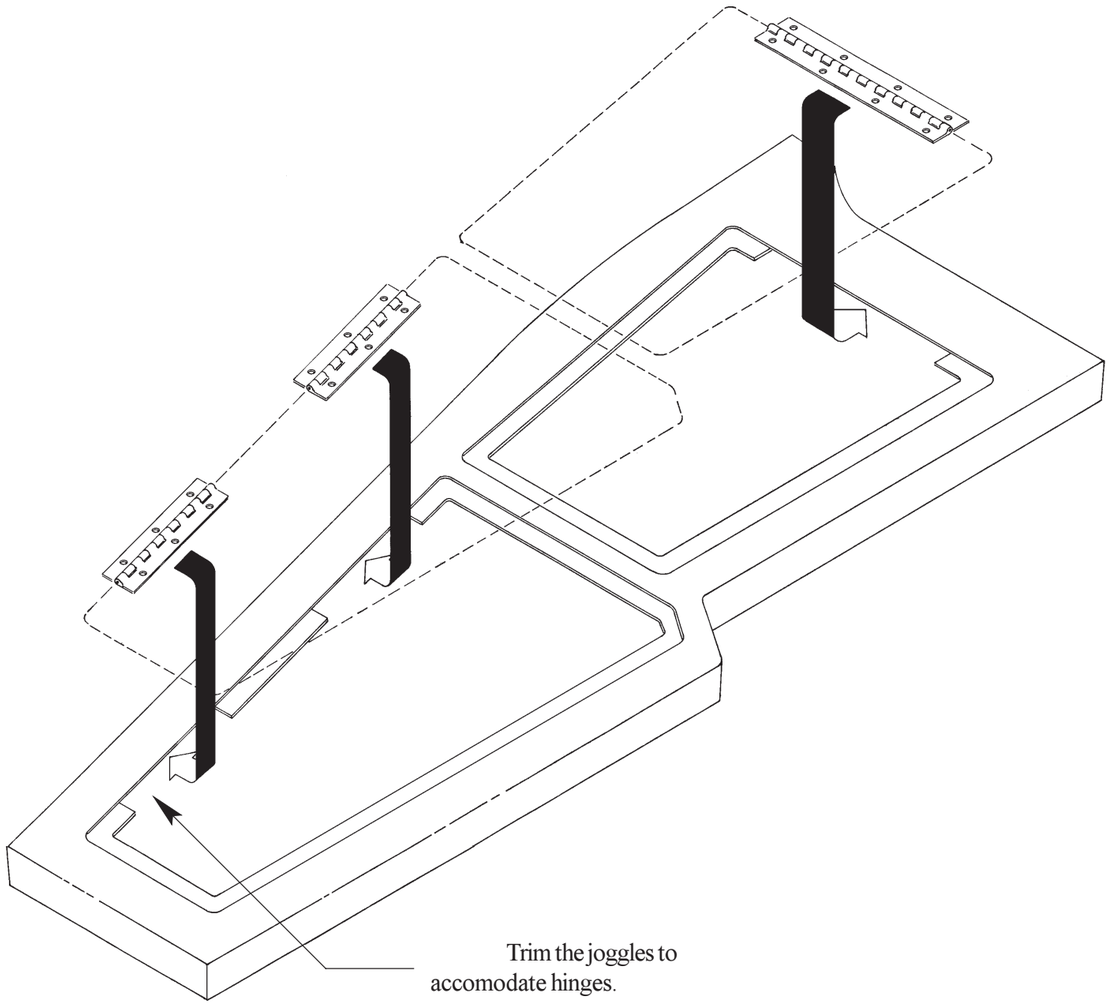
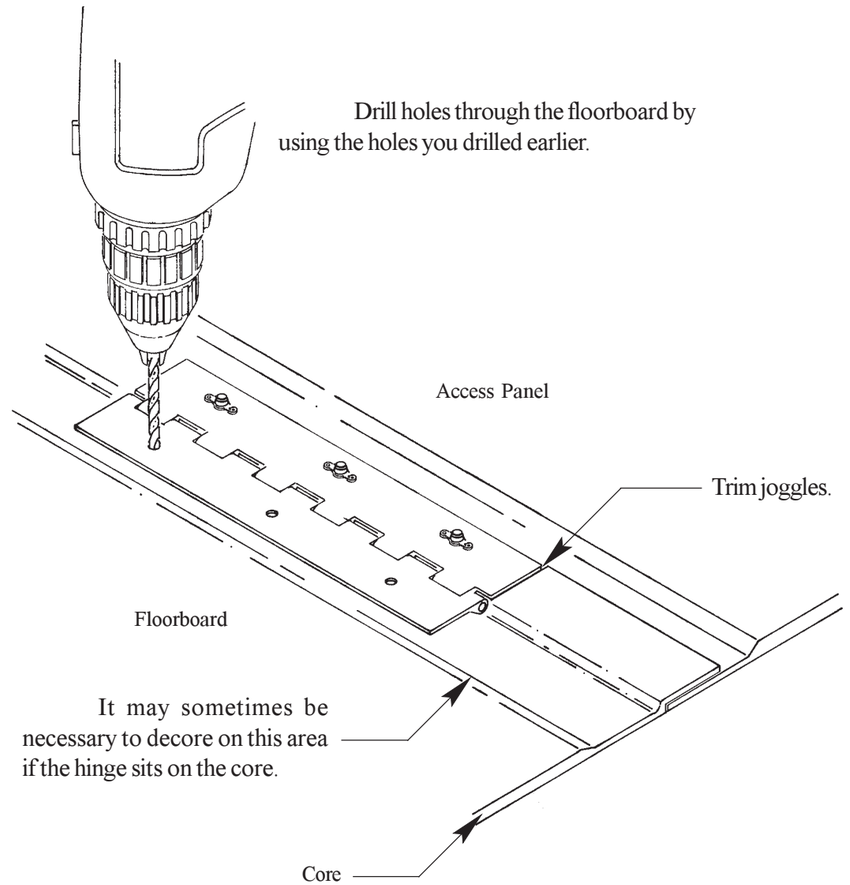
**Securing Access Panel to Floorboard**
**Figure 23:D:4**





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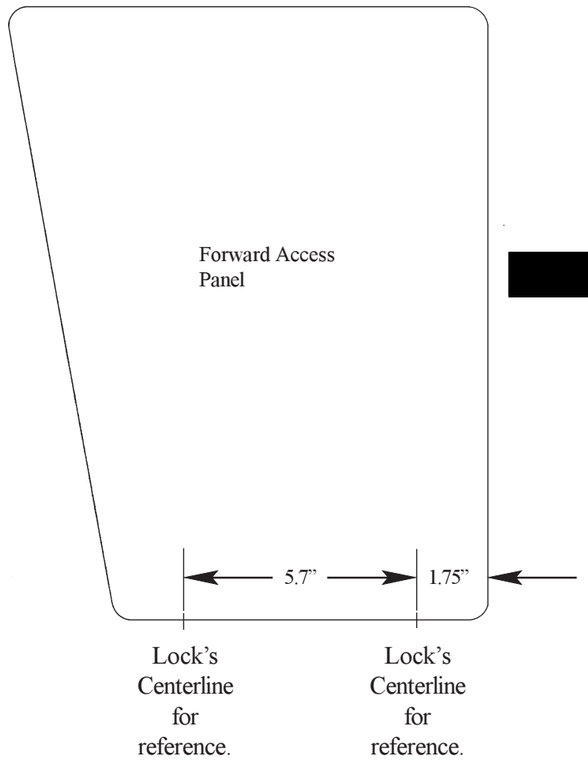
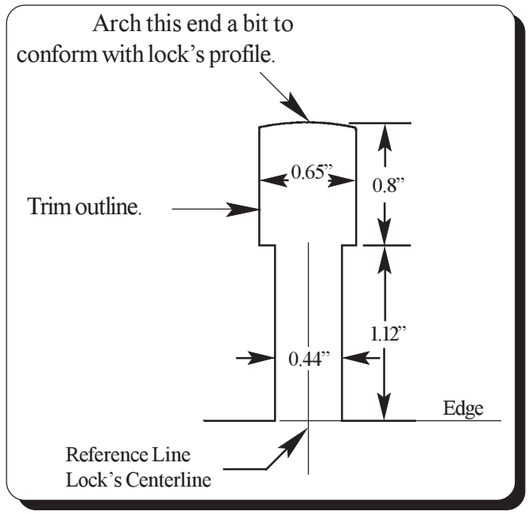
## Installing the Hartwell Trigger Locks
**Figure 23:D:5**

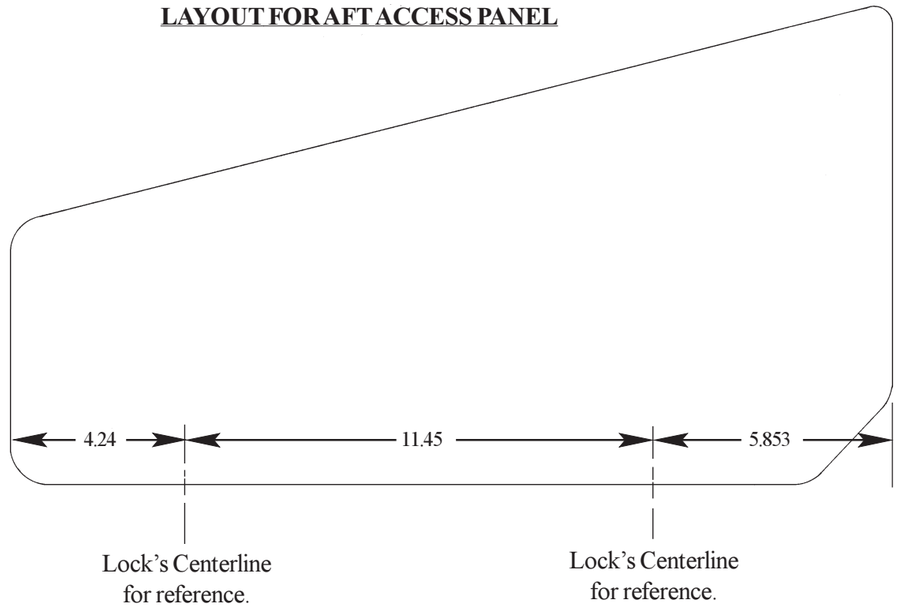
Trim the access panels to fit the locks.

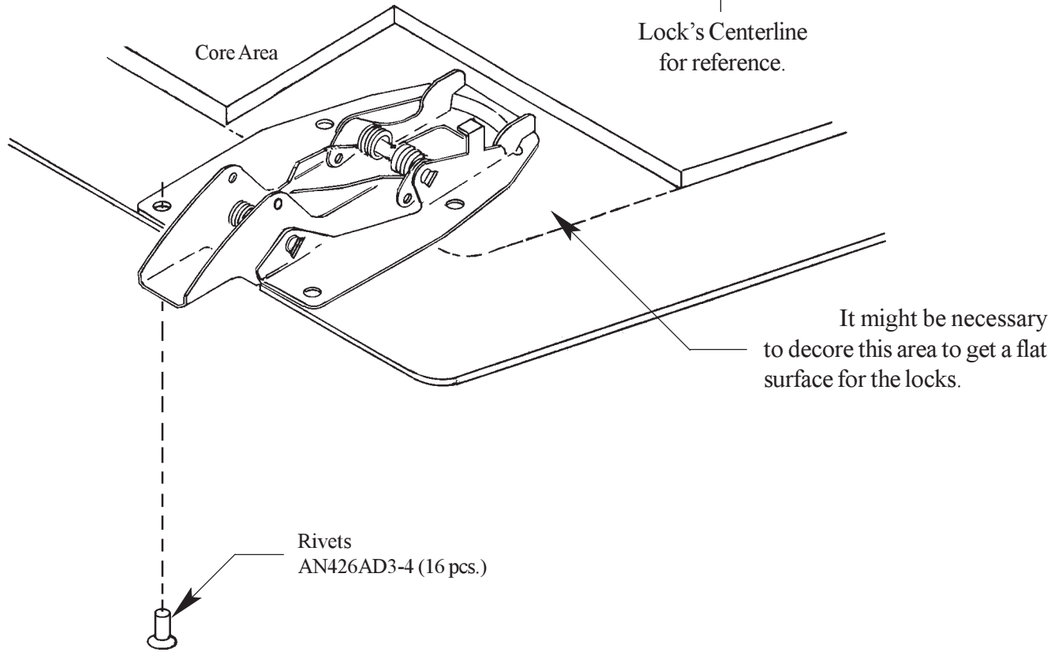
**LAYOUT FOR FORWARD ACCESS PANEL**




**LAYOUT FOR AFT ACCESS PANEL**



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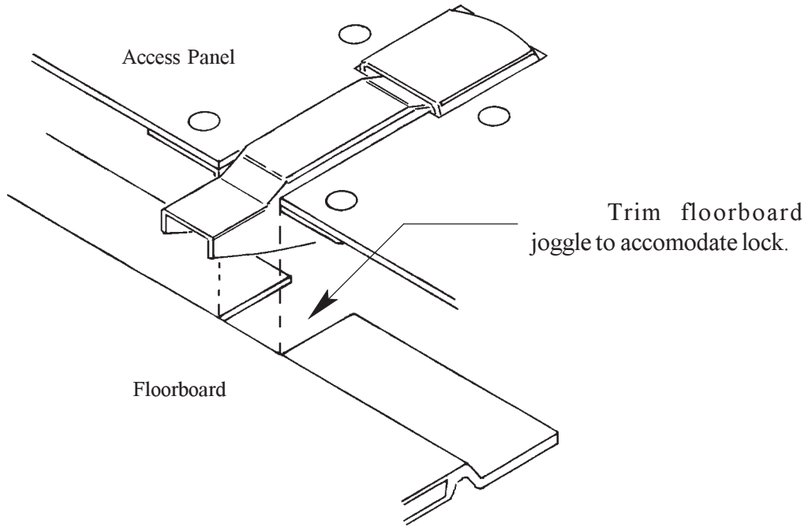
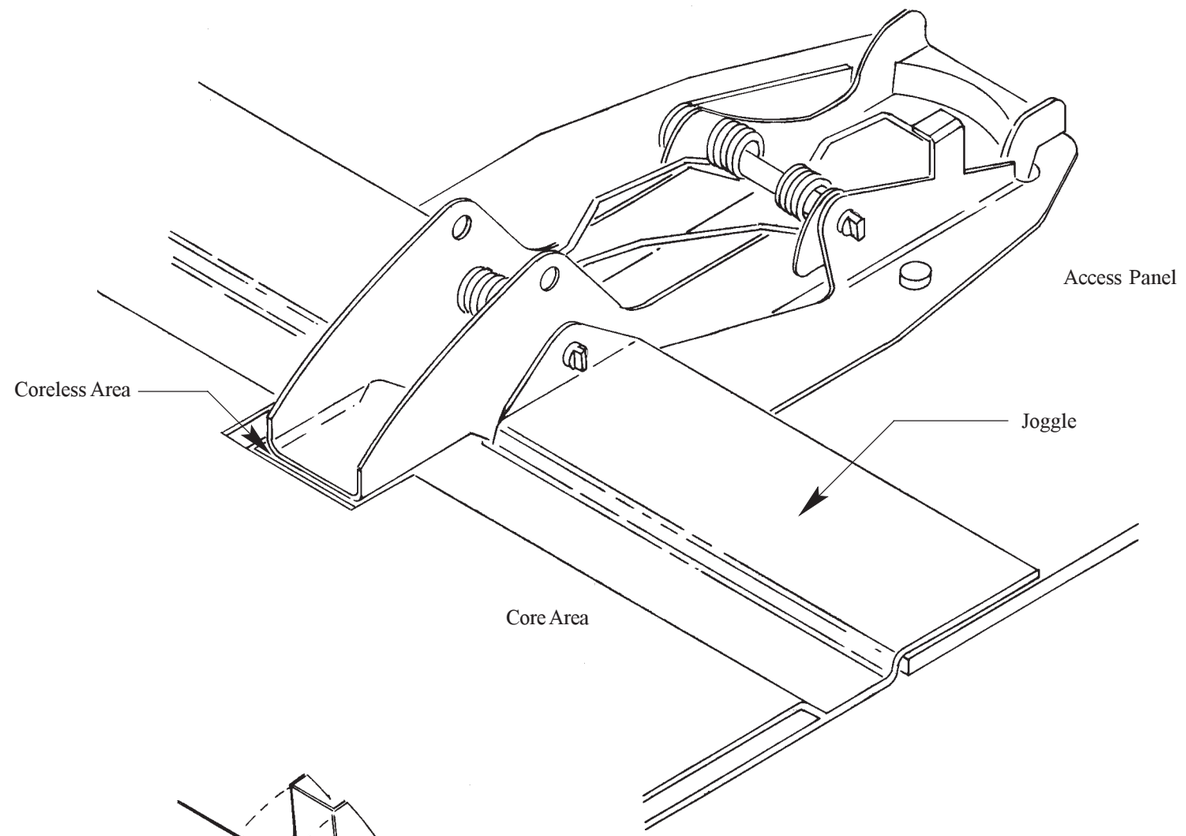
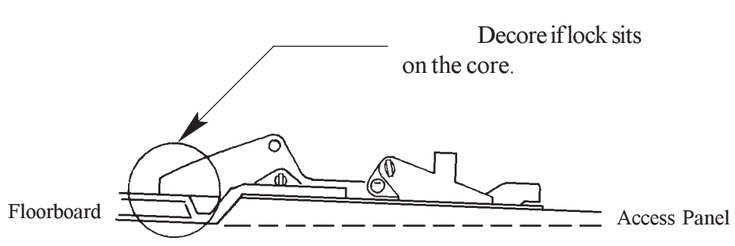
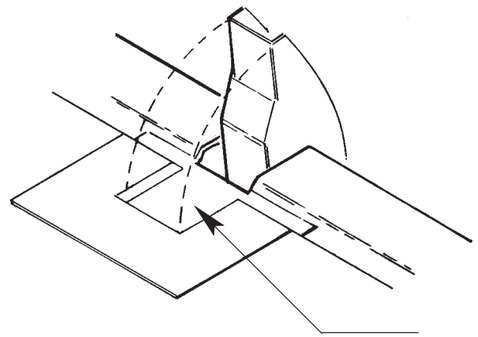
**Trimming Joggles to Accomodate Hartwell Locks**
**Figure 23:D:6**



Decore and glass with 2 BID cloth.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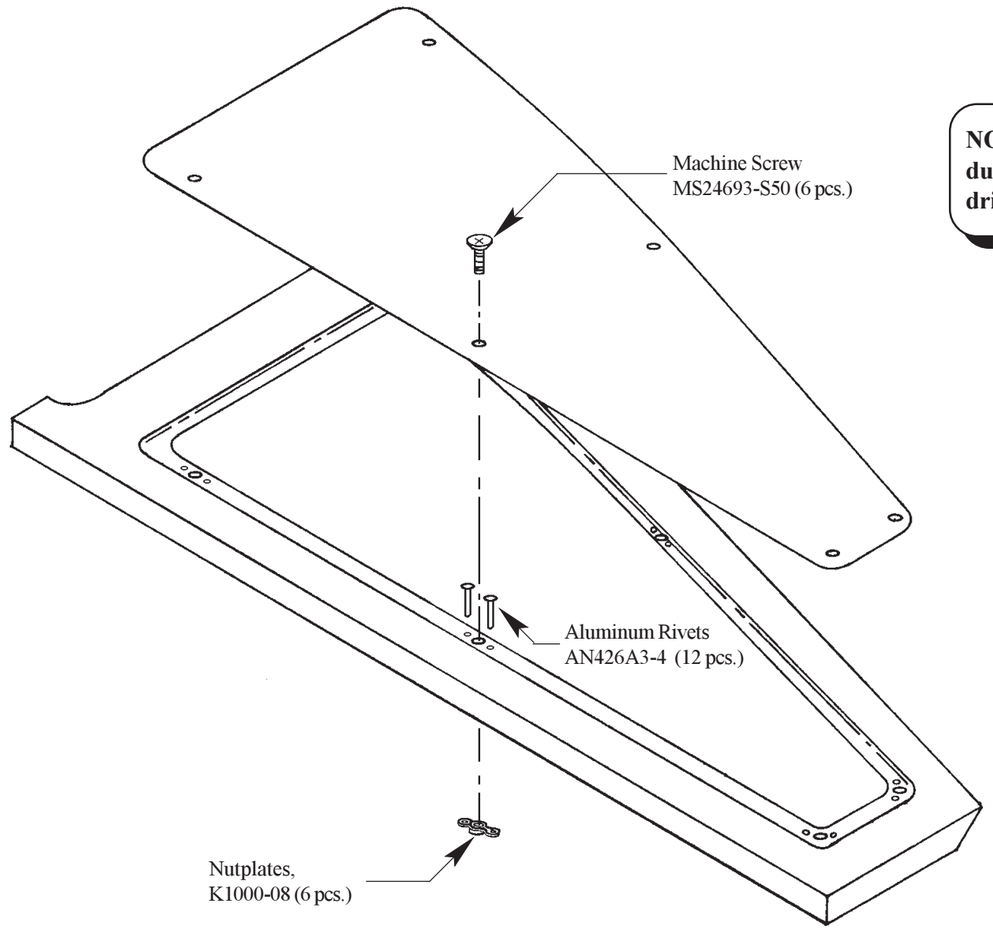
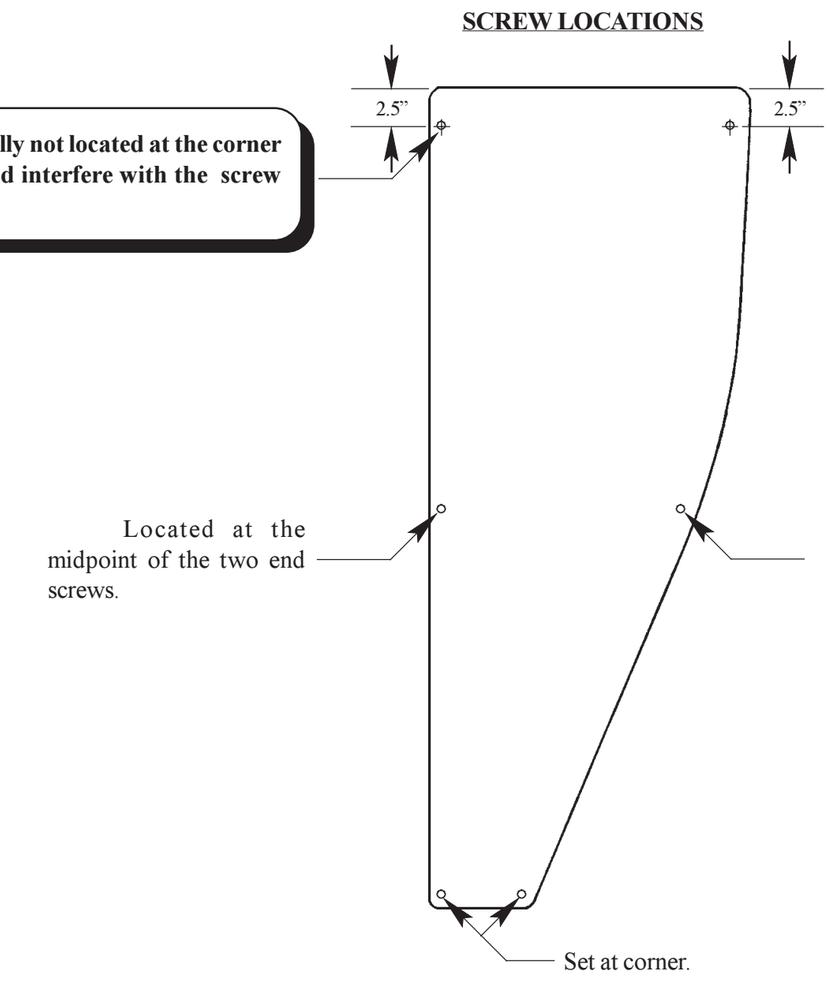
**Installing Screws for the Right Baggage Floorboard Access Panel**
**Figure 23:D:7**




**NOTE: These screws were intentionally not located at the corner due to the seat backs angle that would interfere with the screw driver when the screws are removed.**

**SCREW LOCATIONS**





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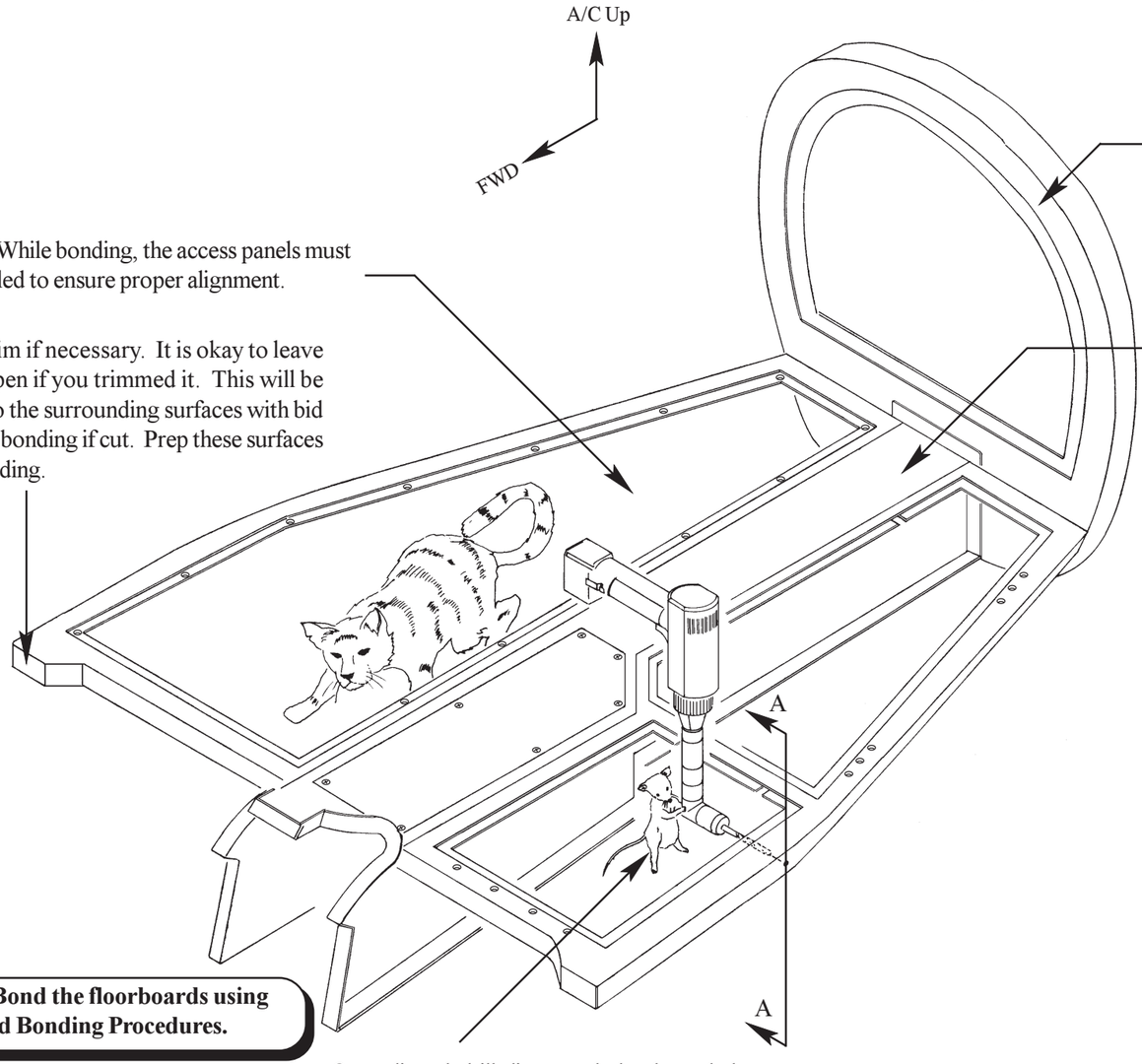
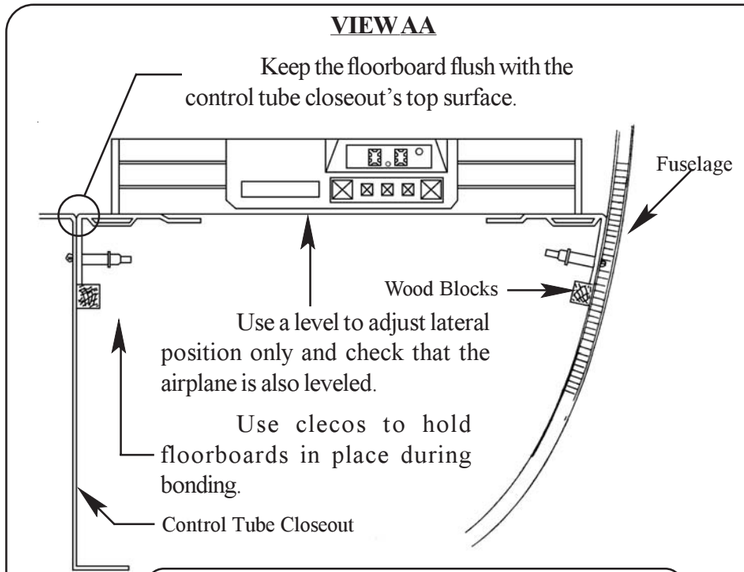
## Fitting Baggage Floorboards
**Fig. 23:D:8**




**Bond the floorboards using Standard Bonding Procedures.**

Once aligned, drill alignment holes through the bonding flange and into the fuselage side. These holes are used for clecos during the bonding process. We suggest installing a few wood blocks (see VIEW AA) for initial alignment while bonding.

**VIEW AA**




**NOTE: A couple of woodblocks make the initial alignment easier.**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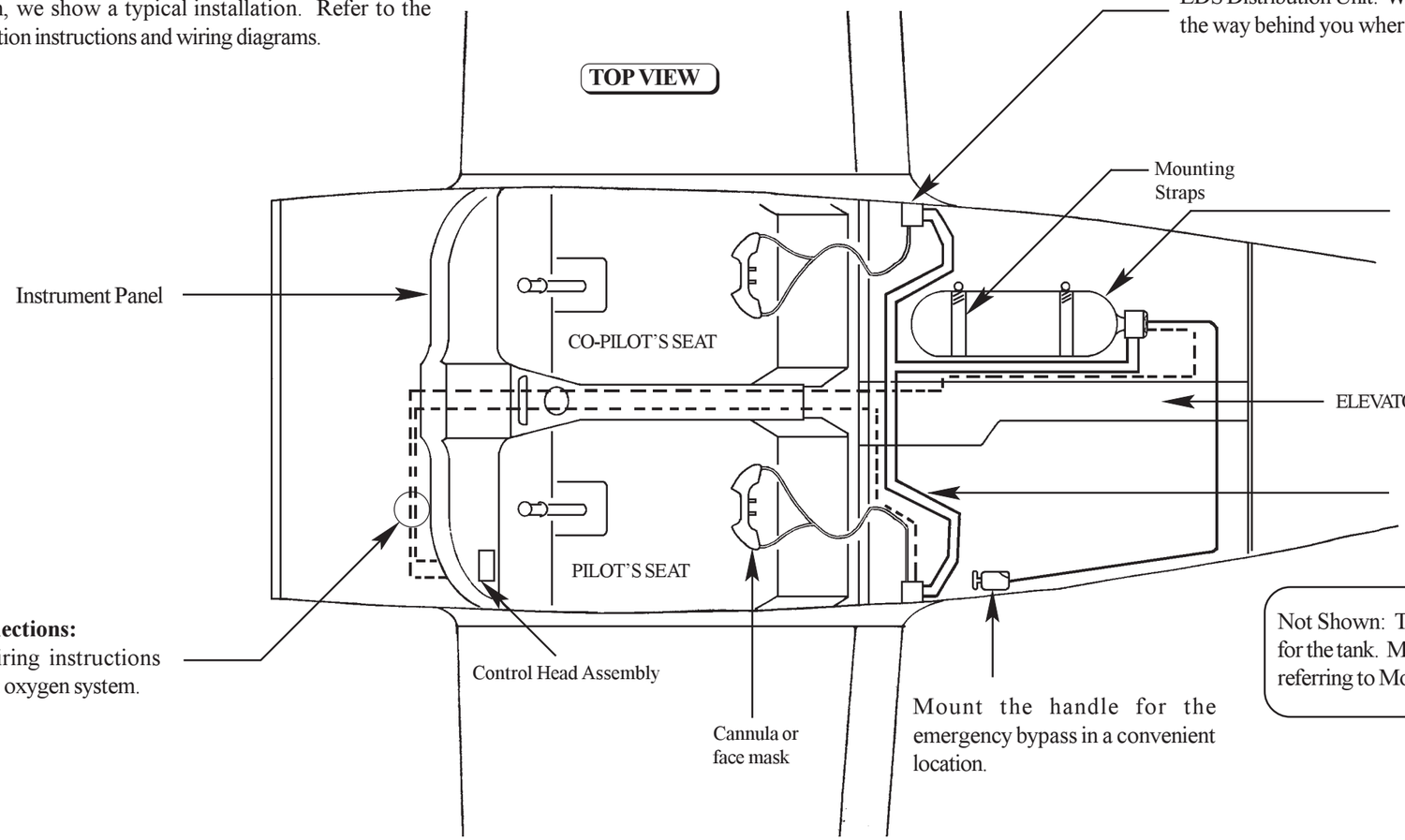
# E. OXYGEN SYSTEM (optional)

The recommended oxygen system for the Lancair Legacy is Mountain High's on demand pulse system. A kit developed for the Lancair Legacy is available through Lancair Avionics. Refer to http://www mtn-high.com to learn more abut how the system works.

In this section, we show a typical installation. Refer to the Mountain High installation instructions and wiring diagrams.

**Oxygen System - General Overview**
**Fig. 23:E:1**





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# REVISION LIST

# CHAPTER 24: MISCELLANEOUS SYSTEMS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 24-1 through 24-2 | 0/02-15-02 | None | Current revision is correct |
| 24-3 | 1/09-18-02 | R&R | Corrected fig. 24:A:2 |
| 24-4 through 24-16 | 0/02-15-02 | None | Current revision is correct |
| 24-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers and modified parts list. |
| 24-2 | 3/12-15-04 | R&R | Updated pitot tube part nbrs. |
| 24-4 | 3/12-15-04 | R&R | Updated part nbrs. |
| 24-6 | 3/12-15-04 | R&R | Updated part nbrs. |
| 24-1, 24-3, 24-14 | 6/08-10-07 | R&R | Adjustments to static port and added part numbers. |


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# Chapter 24: Miscellaneous Systems

Contents



## 1. INTRODUCTION

This Chapter includes the odds and ends that didn't end up anywhere else! They are all optional items and you may not be installing all of them. They are options we recommend but you may choose to install a different brand such as a different brand of autopilot. All options are available through Kit Components or Lancair Avionics. Call for details.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **PITOT STATIC SYSTEM** | | | | |
| 1) | 4937-A | 1 | Pitot Static System | **Yes |
| 2) | 268-N-04x02 | 1 | Fitting, Male Connector | **Yes |
| 3) | 271-N-04x02 | 3 | Fitting, Male Run T | **Yes |
| 4) | 272-N-04x02 | 1 | Fitting, Male Branch T | **Yes |
| 5) | 264-N-04 | 2 | Fitting, Union T | **Yes |
| 6) | 266-N-04x02 | 2 | Fitting, Female Connector | **Yes |
| 7) | 266-N-04x04 | 1 | Fitting, Female Connector | **Yes |
| 8) | 6505-4x4 | 1 | Fitting, Tube | **Yes |
| 9) | AN5812-12 | 1 | Pitot Tube | **Yes |
| 10) | 44-P | 24' | Poly Flo Tubing | **Yes |
| 11) | 259N-04 | 18 | Sleeve | **Yes |
| 12) | 710 | 1 | Squat Switch | **Yes |
| 13) | 4937 | 1 | Static Port, Right | **Yes |
| 14) | 4937 | 1 | Static Port, Left | **Yes |
| **ELT INSTALLATION** | | | | |
| 1) | 4355 | 1 | Bracket, Mounting | *Yes |
| 2) | K1000-3 | 4 | Nutplates | *Yes |
| 3) | MSC-34 | 8 | Rivets | *Yes |
| 4) | AN526-1032-R10 | 4 | Screws | *Yes |
| **STORM SCOPE INSTALLATION** | | | | |
| 1) | NY-163 | 1 | Antenna | *Yes |
| 2) | NY163 | 1 | Cable | *Yes |
| 3) | 002-11503-002 | 1 | Dealer's Literature Package | *Yes |
| 4) | WX-500 | 1 | Install Kit | *Yes |
| 5) | 002-11504-002 | 1 | Owner's Literature Package | *Yes |
| 6) | WX-500 | 1 | Processor, WX-500 | *Yes |
| **TRANSPONDER ANTENNA INSTALLATION** | | | | |
| 1) | K1000-3 | 4 | Nut, Anchor | *Yes |
| 2) | MSC-34 | 8 | Rivets | *Yes |
| 3) | MS24694-S51 | 4 | Screw, Machine | *Yes |
| **AUTOPILOT INSTALLATION (TRU-TRAK,)** | | | | |
| 1) | 4039-01 | 1 | Autopilot Mount Bracket | *Yes |
| 2) | 4039-02 | 1 | Aft Mounting Bulkhead | *Yes |
| 3) | 4080 | 1 | Mount Bracket (Roll) | *Yes |
| 4) | 4944 | 1 | Spacer | *Yes |
| 5) | DSP-B | 1 | Autopilot Servo (Pitch) KCI #901-0021 | *Yes |
| 6) | DSB-B | 1 | Autopilot Servo (Roll) | *Yes |
| 7) | MM-3 | 2 | Bearing, Rod Ends (Pitch) | *Yes |
| 8) | CM3B-14 | 2 | Bearing, Rod Ends (Roll) | *Yes |
| 9) | AN3H-3 | 8 | Bolt, Drilled | *Yes |
| 10) | AN3-7A | 1 | Bolt, Undrilled | *Yes |
| 11) | AN3-10A | 1 | Bolt, Undrilled | *Yes |
| 12) | AN3-37A | 2 | Bolt, Undrilled | *Yes |
| 13) | AN315-3 | 2 | Nut, Check | *Yes |
| 14) | AN315-4 | 2 | Nut, Check | *Yes |
| 15) | AN365-1032A | 4 | Nut, Nylock | *Yes |
| 16) | L101 | 1 | Pushrod, Roll | *Yes |
| 17) | L102 | 1 | Pushrod, Pitch | *Yes |
| 18) | CD315-12 | 1 | Spacer | *Yes |
| 19) | AN970-3 | 5 | Washer, Area | *Yes |
| 20) | AN960-10 | 10 | Washer, Plain | *Yes |



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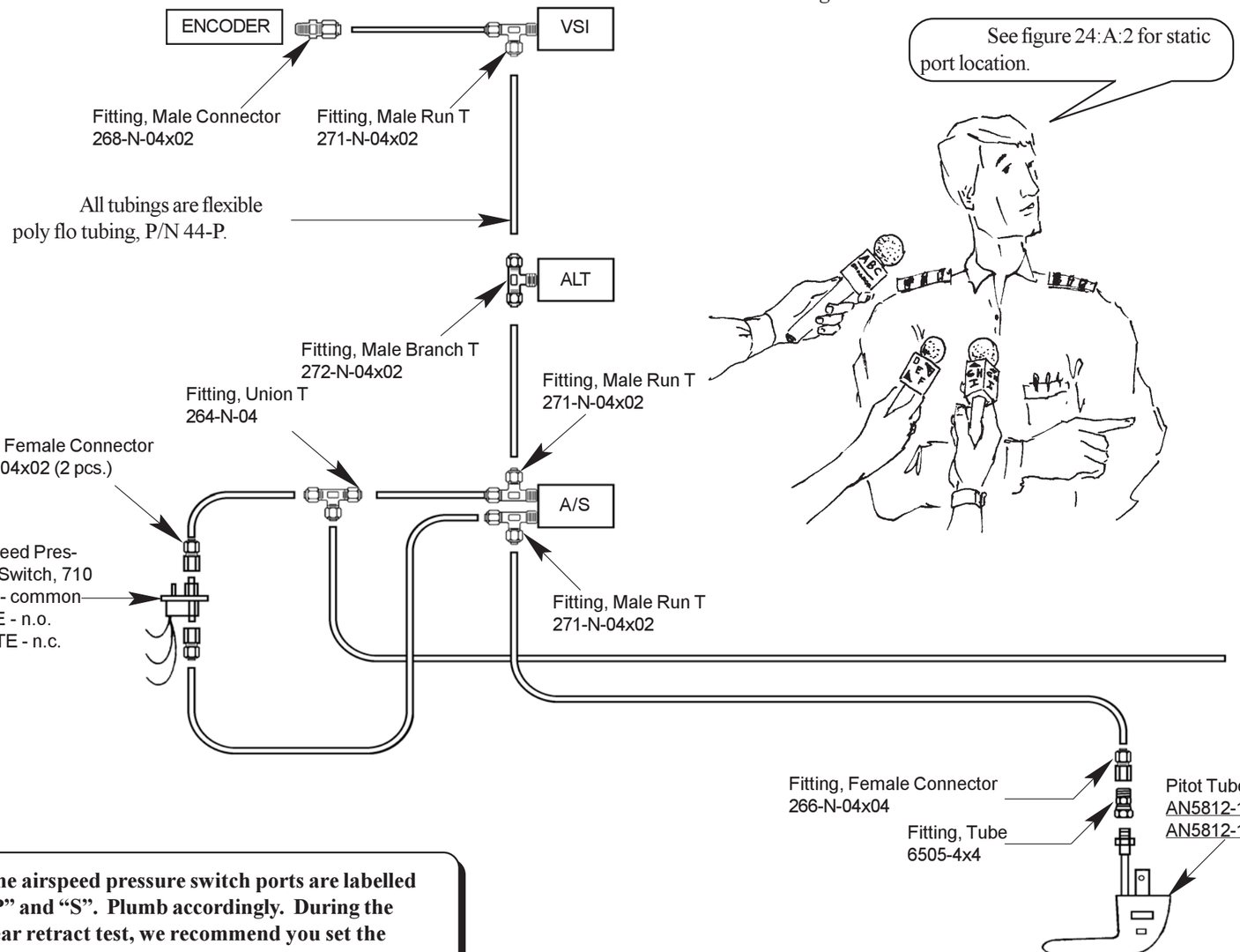
# 3. CONSTRUCTION PROCEDURES

## A. Pitot Static System

**Pitot Static System**
**Fig. 24:A:1**

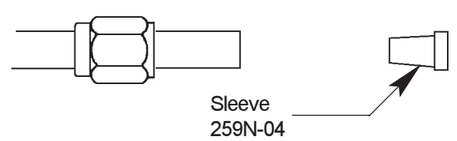



**NOTE:** **Dual static ports are not required but a good idea.**

**NOTE:** **The static system should be drained at its lowest point on a regular basise. It would be a good idea to install a drain at this location.**

**NOTE:** **The airspeed pressure switch ports are labelled "P" and "S". Plumb accordingly. During the gear retract test, we recommend you set the switch to 90 KIAS.**

**NOTE:** **USE 259N-04 SLEEVES AT ALL TUBE TO FITTING JUNCTIONS.**





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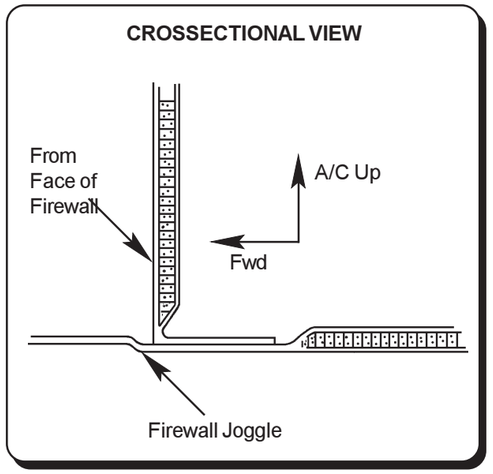
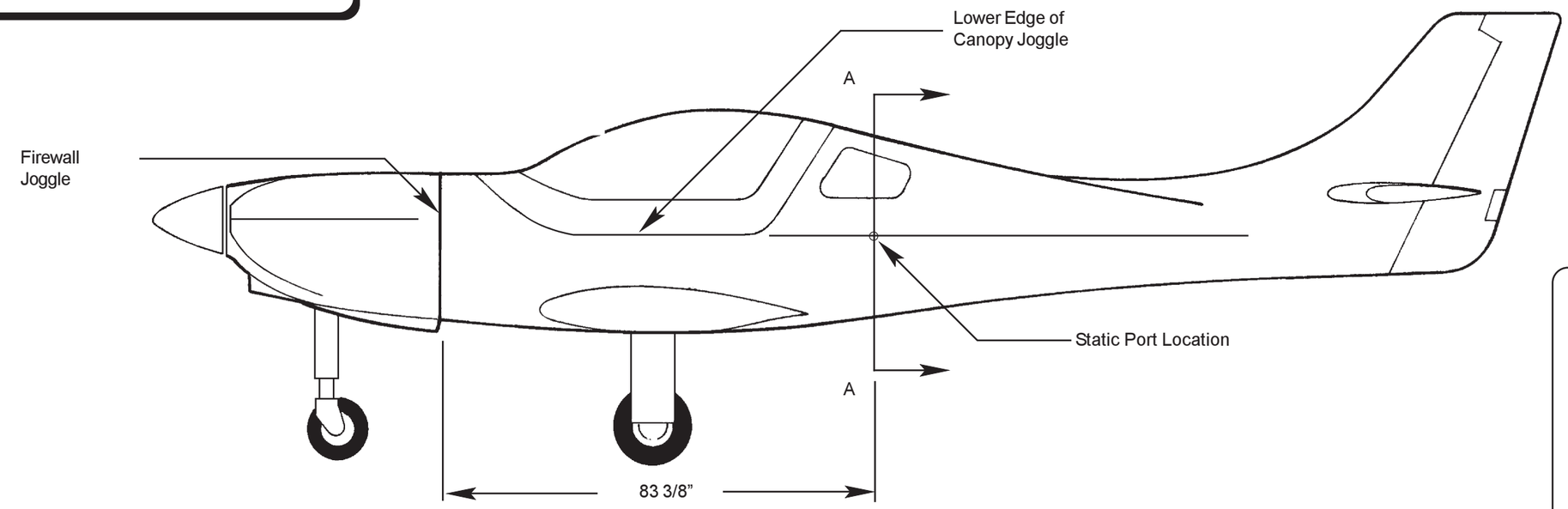
**Static Port Installation**
**Fig. 24:A:2**

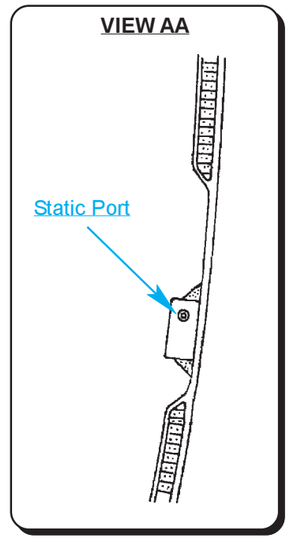



## Static Port Installation

**A 1**. Using the lower edge of the canopy joggle, extend a line aft. We suggest using a long flexible straight edge or level the aircraft and use a water level.

**A 2.** Measure 83 3/8" back from the firewall joggle.




**A 3.** Verify that the hole will be in the unidirectional carbon fiber.

**A 4.** Drill the hole in the lower edge of the unidirectional belt. See View AA for location.

**A 5.** To avoid water accumulation in the lines, we suggest you angle the line slightly up. This will help water drain back out through the static port.

**A 6.** Bond in place using epoxy/flox.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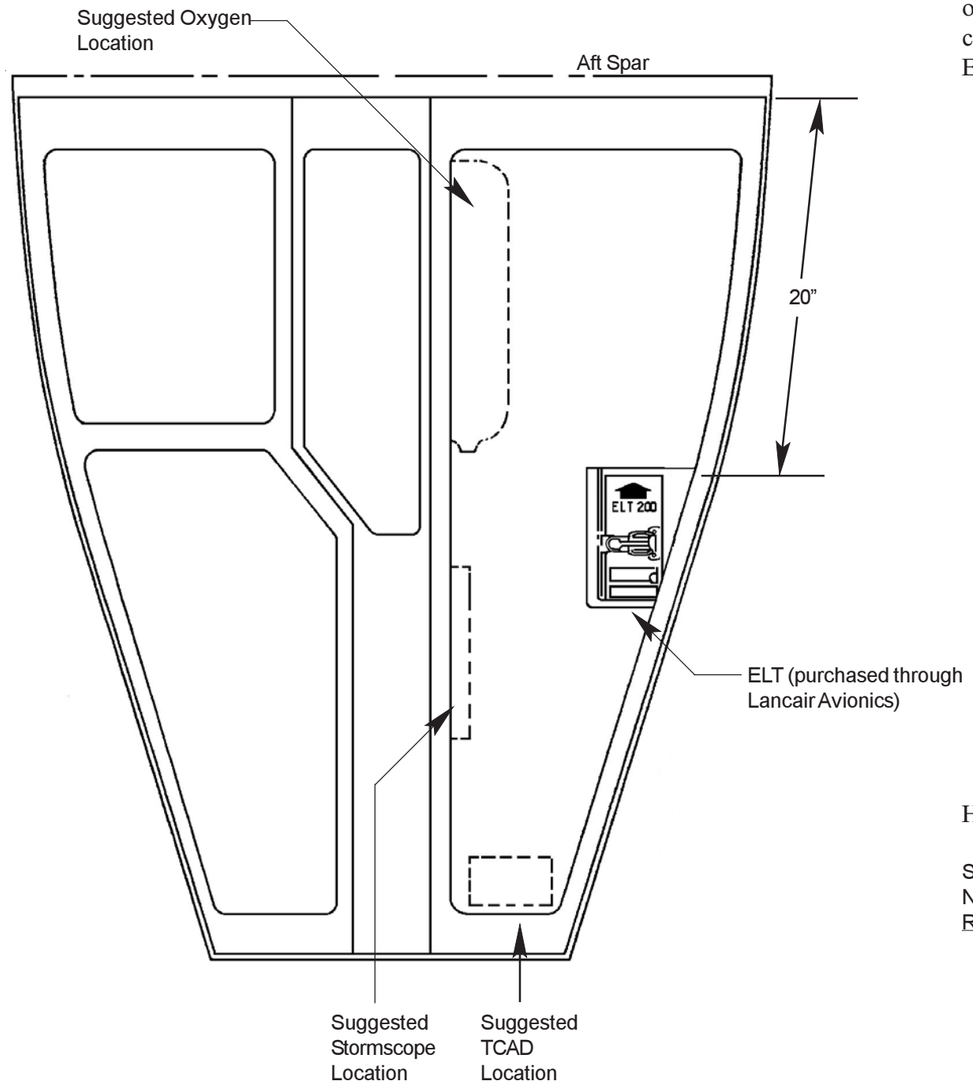
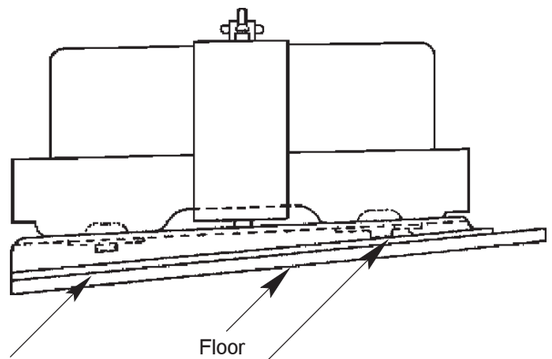
## B. ELT Installation

**ELT Installation**
**Fig. 24:B:1**




We recommend the ARTEX ELT-200 for the Legacy available through Lancair Avionics. This illustration is only a suggestion for the mounting of the transmitter. All mounting instructions included with the ELT must be complied with. Note that for optimum performance an external antenna must be installed. We suggest installing the ELT underneath the right floorboard as shown. It should be installed as far right as possible.




Hardware used to secure ELT mounting tray:

Screws, AN526-1032-R10 (4 pcs.)
Nutplates, K1000-3 (4 pcs.)
Rivets, MSC-34 (8 pcs.)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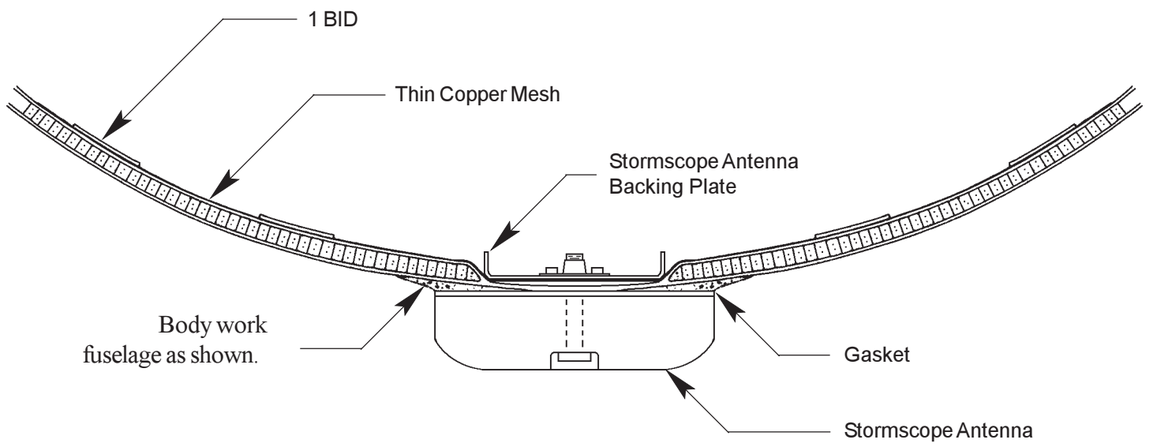
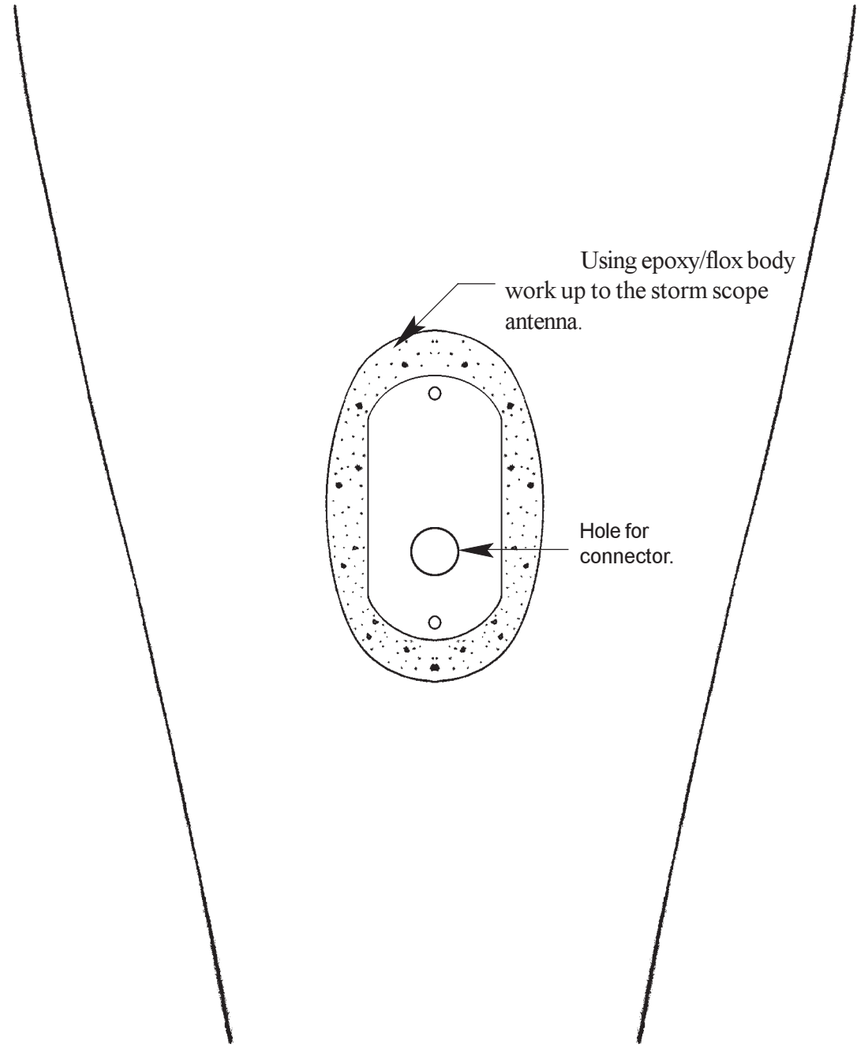
## C. Storm Scope Installation*

The exact location of the BF Goodrich Stormscope antenna has to be determined by Skin mapping the aircraft. This is done with sensitive equipment while the engine and all avionics are powered up. The stormscope will not work if placed incorrectly. Please contact the Lancair Avionics department to make arrangements for skin mapping.

Skin mapping may be performed either after or before the aircraft is painted. If after paint, the mounting area will have to be repainted. There must be at least 2' x 2' copper mesh on the inside of the fuselage centered on the backing plate. This serves as the ground plane for the antenna.




**Storm Scope Installation**
**Fig. 24:C:1**




**NOTE: These instructions are for reference only. Refer to the BF Goodrich Installation Instructions.**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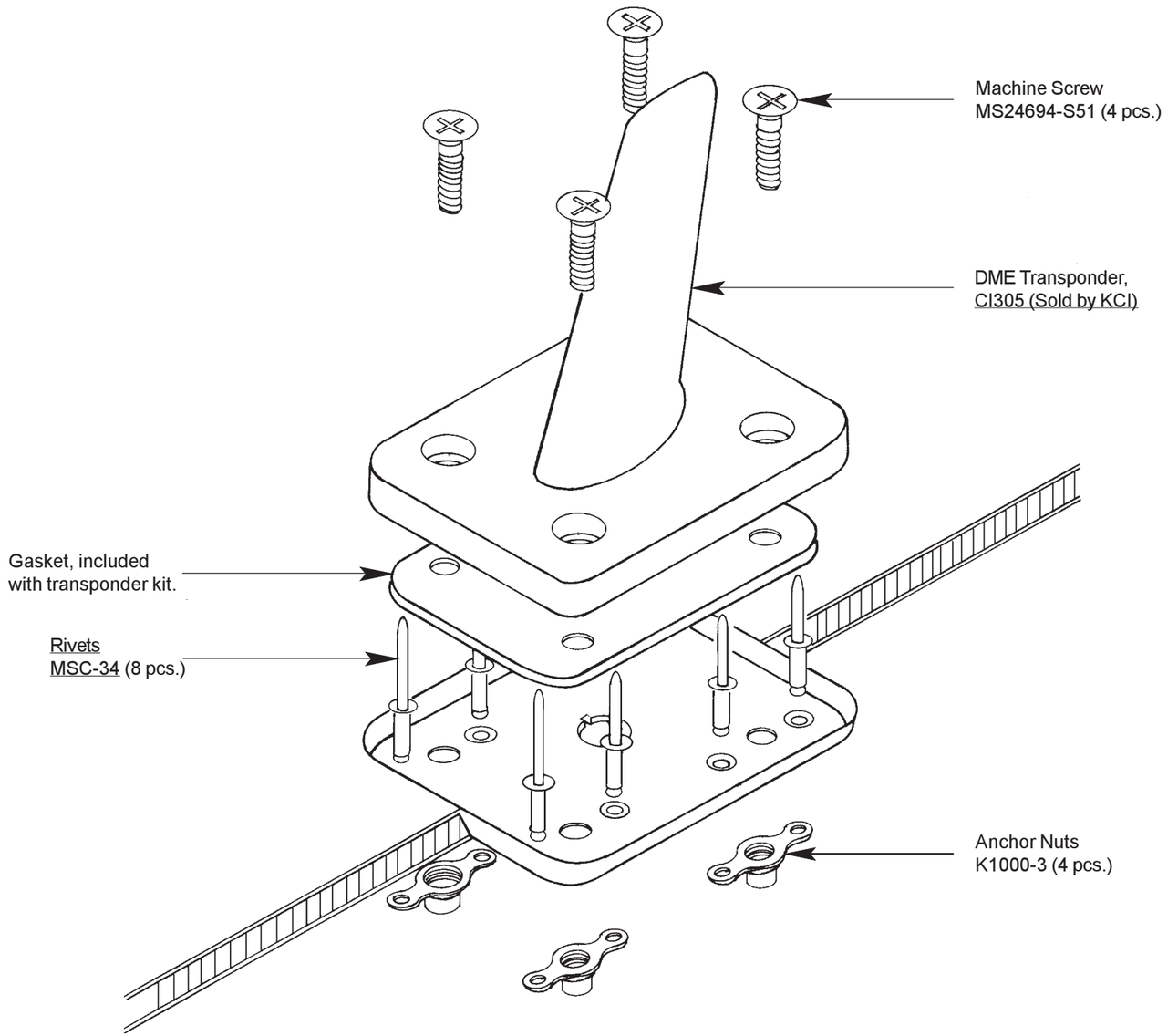
## D. Transponder Antenna Installation

**Transponder Antenna Exploded View**
**Fig. 24:D:1**





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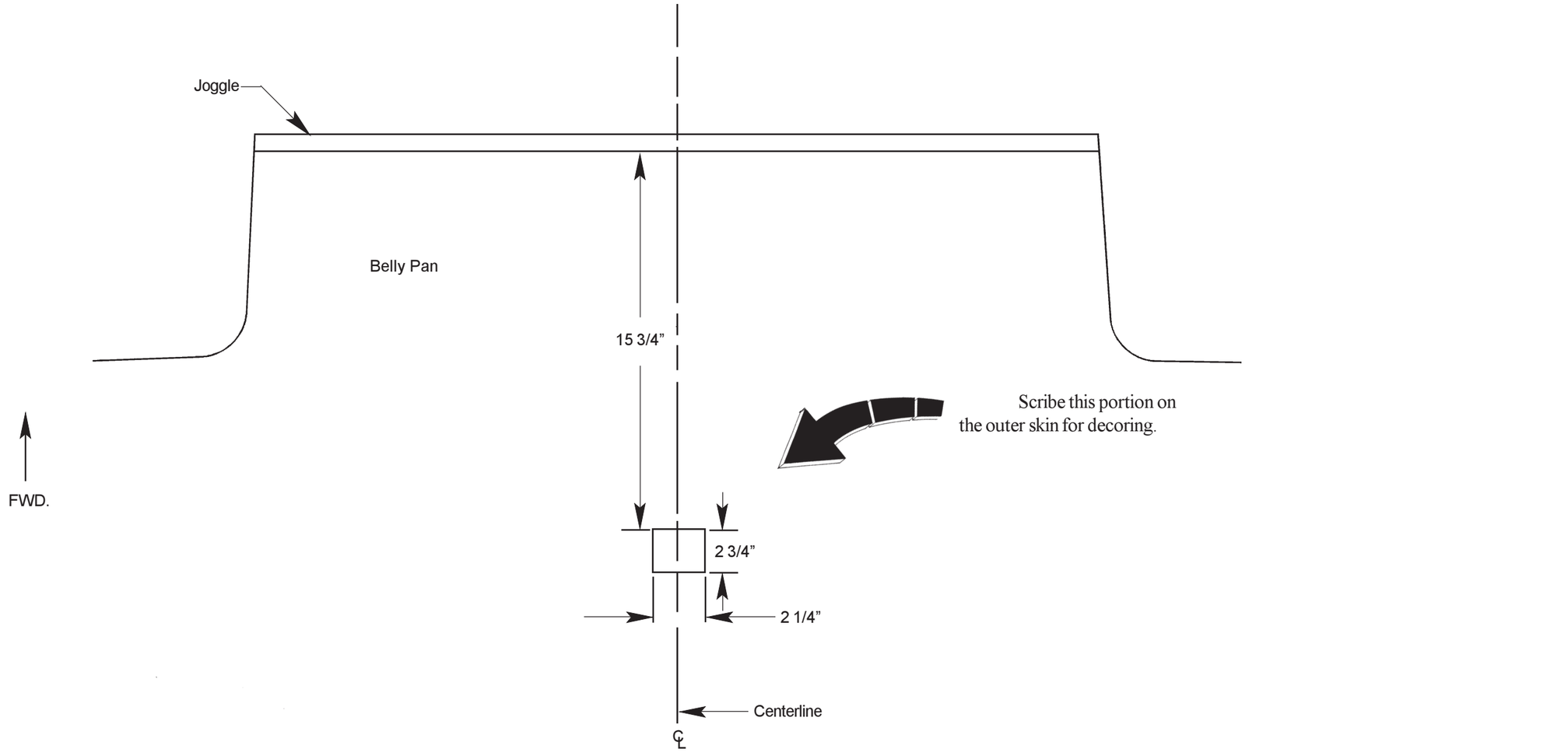
**Locating the Position of the Transponder Antenna**
**Fig. 24:D:2**

The transponder antenna is installed on the belly pan. Kits starting from FB 148 have recessed joggles to accommodate the base plate of the transponder antenna. For earlier kits, an alternative process is explained on the succeeding paragraphs.

**D 1.** Locate the position of the antenna on the belly pan using Fig. 24:D:2 as reference.





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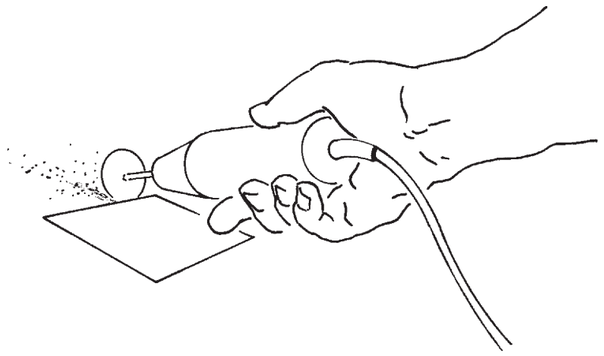
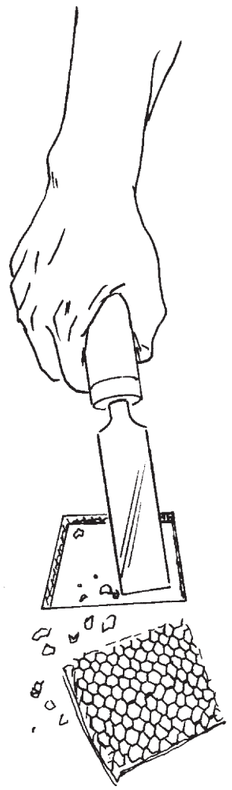
**Decoring The Area For The Transponder Antenna**
**Fig. 24:D:3**

**D 2.** Decore the area from the outer skin.

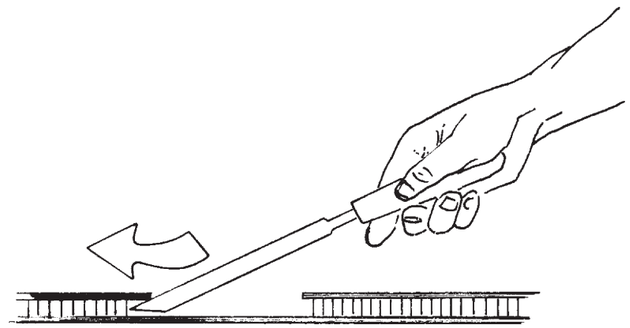
① Use a Dremel or equivalent tool to cut through outer skin and core.



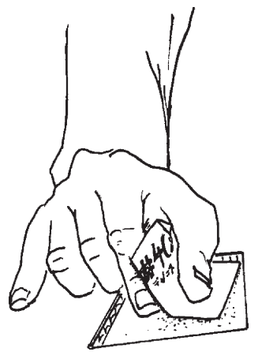
② Pop out the outer skin and core using a chisel.



③ Dig the core 1/4" back from the perimeter of the decored area.



④ Sand the decored area with a # 40 sandpaper to remove the core remains.

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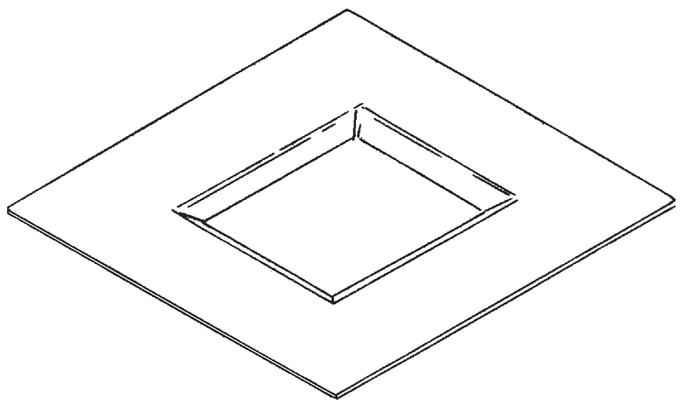
⑤ Vacuum and dewax the decored area. Form a bevel around the perimeter using micro. Let cure.

⑥ Sand the bevel smooth and round off the corners a bit.

⑦ Dewax the skin around the decored area. Sand and clean.

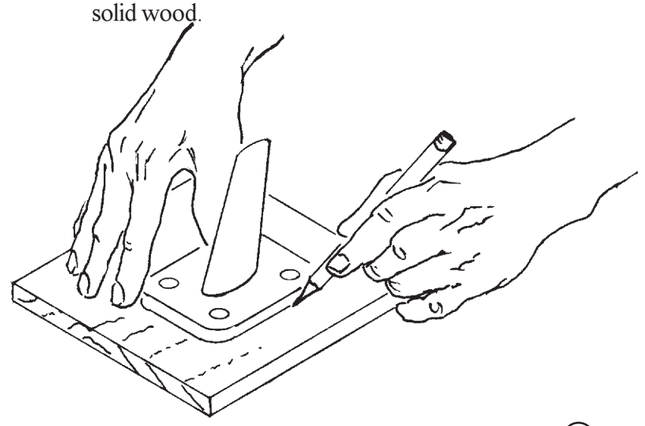
⑧ Reinforce with four bid overlapping 1" around the perimeter.



**Preparing Wood Pattern for Release**
**Fig. 24:D:4**

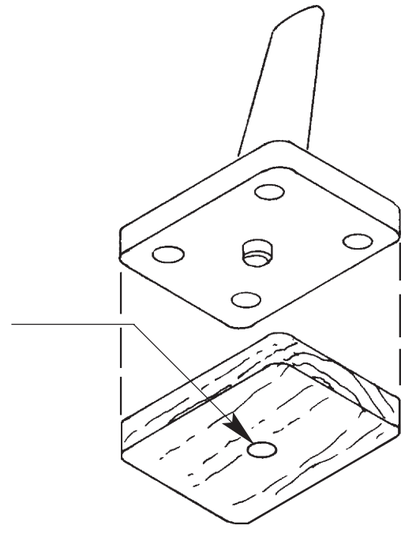
**D 3.** Use the transponder antenna's base to make a wood pattern for release.

① Cut a piece of wood patterned to the base of the antenna. Use a 1/2" piece of solid wood.



② Finish sanding the wood pattern to the exact size of the base.

Pre-drilled hole for the antenna's male connector.

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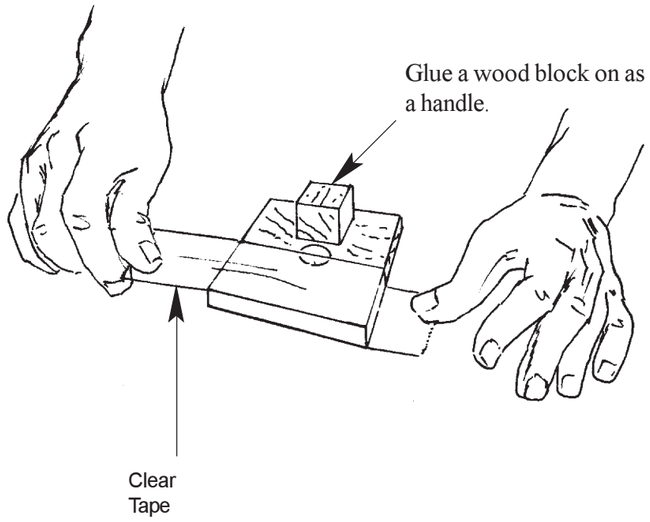
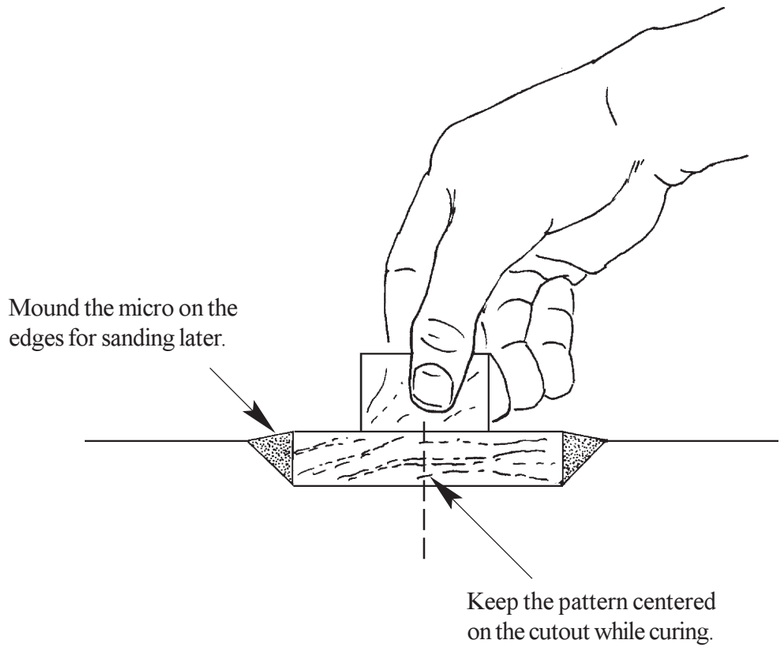
③ Cover the pattern with clear tape.




**Releasing The Wood Pattern**
**Fig. 24:D:5**

**D 4.** Release the wood pattern on the decored area. Keep the pattern centered on the cutout.




Let cure.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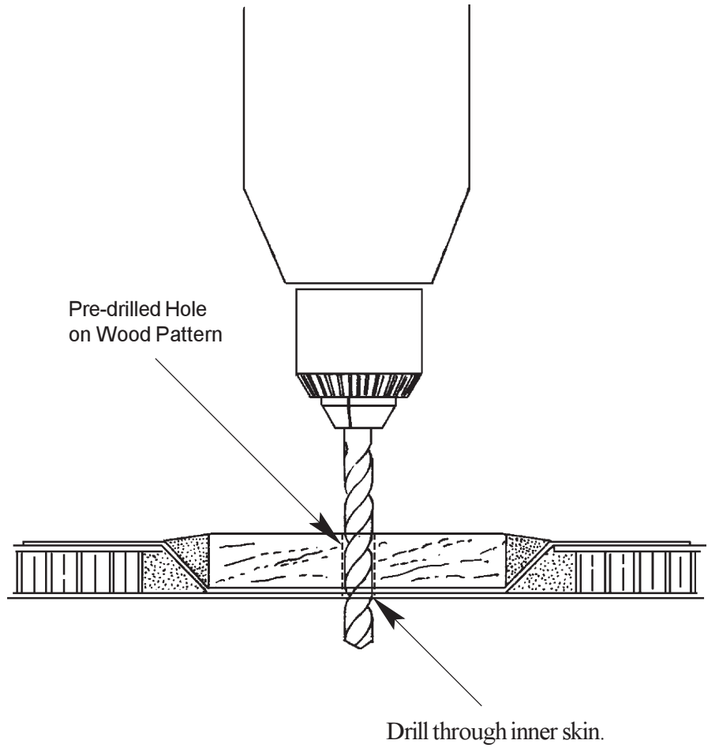
**Drilling Hole for the Cable Connector**
**Fig. 24:D:6**

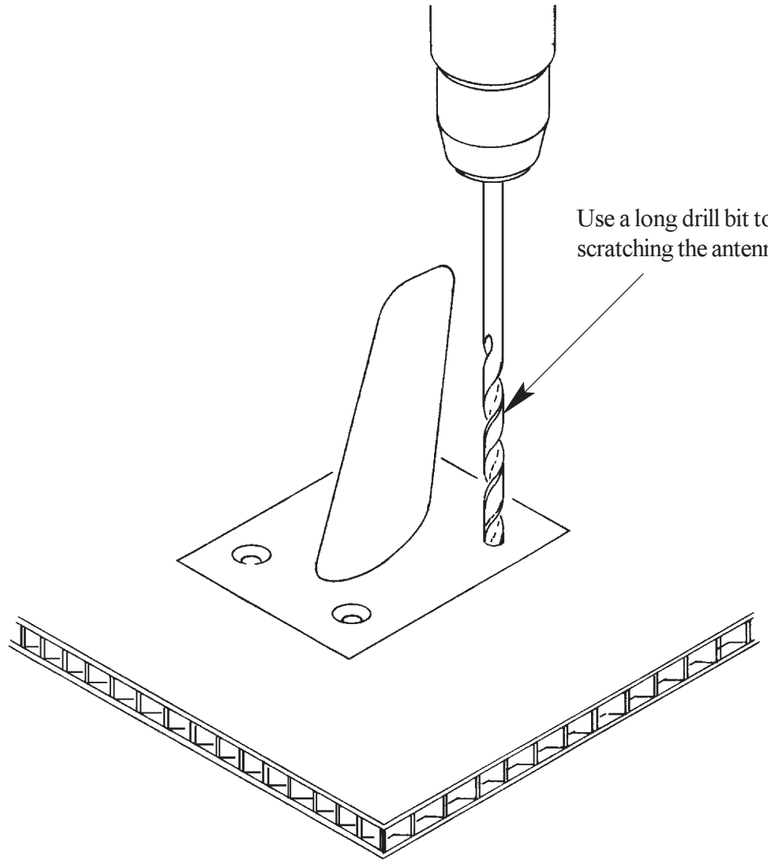
**D 5.** Drill the hole for the antenna's connector by drilling through the hole on the wood pattern.




**D 6.** Remove the wood pattern and sand the mounded edges flat.

**Drilling for Nutplates**
**Fig. 24:D:7**

**D 7.** Put the antenna in place and drill through the 4 mounting holes on the base for nutplates installation.





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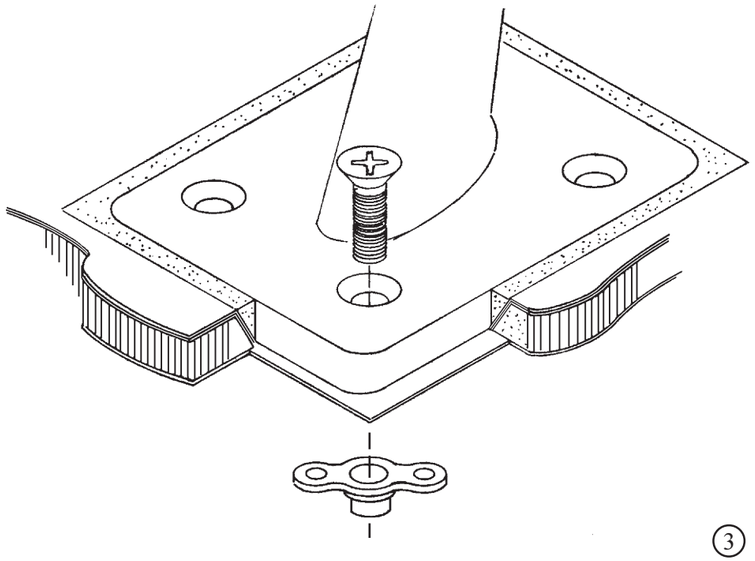
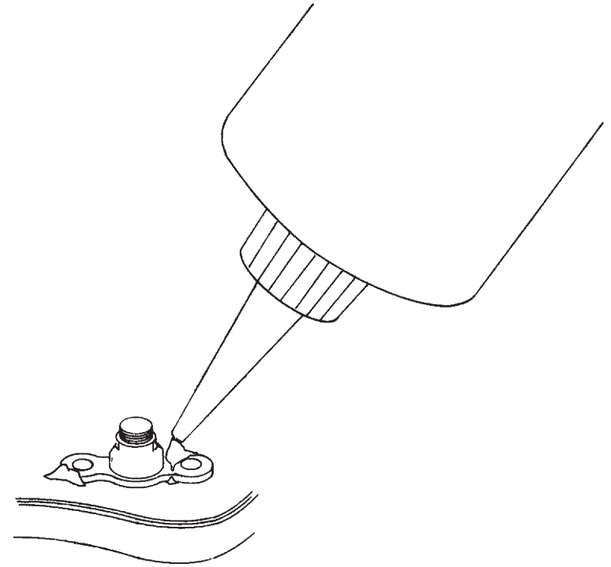
**Installing Nutplates**
**Fig. 24:D:8**

**D 8.** Install nutplates.

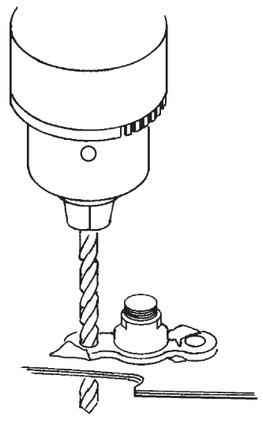
① Install screws.

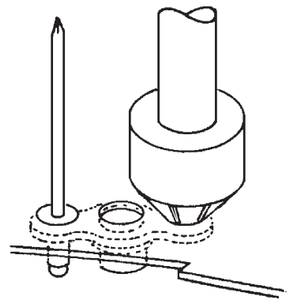


② Use instant glue to hold the nutplates in place.



③ Drill for pop rivets.





④ Countersink the rivet holes from the outside and secure with countersink pop rivets.

**D 9.** Mount the Antenna using MS 2469-S51 screws.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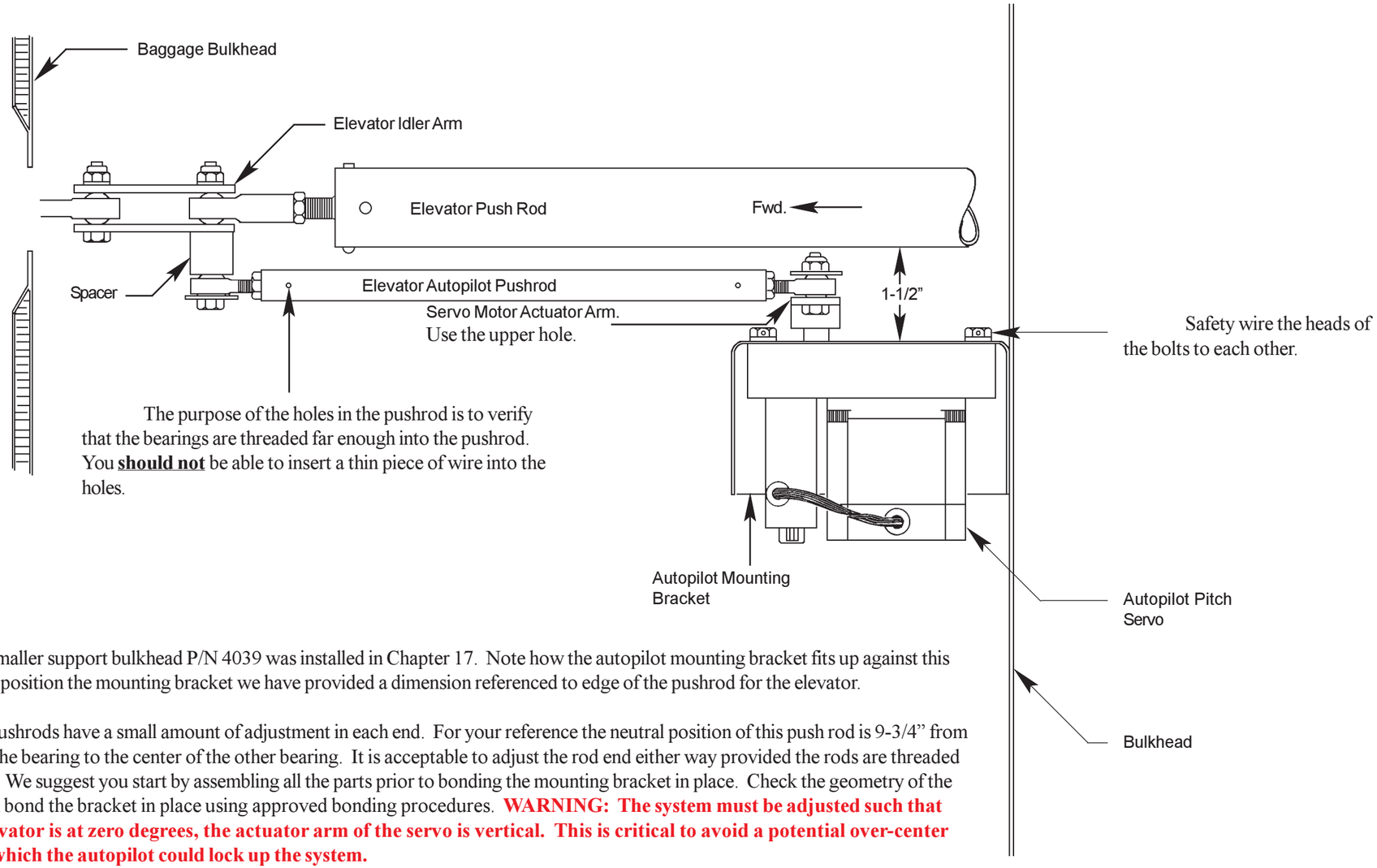
## E. Autopilot Installation (TRU-TRAK)

**Autopilot Pitch Configuration**
**Fig. 24:E:1**




The smaller support bulkhead P/N 4039 was installed in Chapter 17. Note how the autopilot mounting bracket fits up against this bulkhead. To position the mounting bracket we have provided a dimension referenced to edge of the pushrod for the elevator.

The pushrods have a small amount of adjustment in each end. For your reference the neutral position of this push rod is 9-3/4" from the center of the bearing to the center of the other bearing. It is acceptable to adjust the rod end either way provided the rods are threaded far enough in. We suggest you start by assembling all the parts prior to bonding the mounting bracket in place. Check the geometry of the system. Then bond the bracket in place using approved bonding procedures. **WARNING: The system must be adjusted such that when the elevator is at zero degrees, the actuator arm of the servo is vertical. This is critical to avoid a potential over-center situation in which the autopilot could lock up the system.**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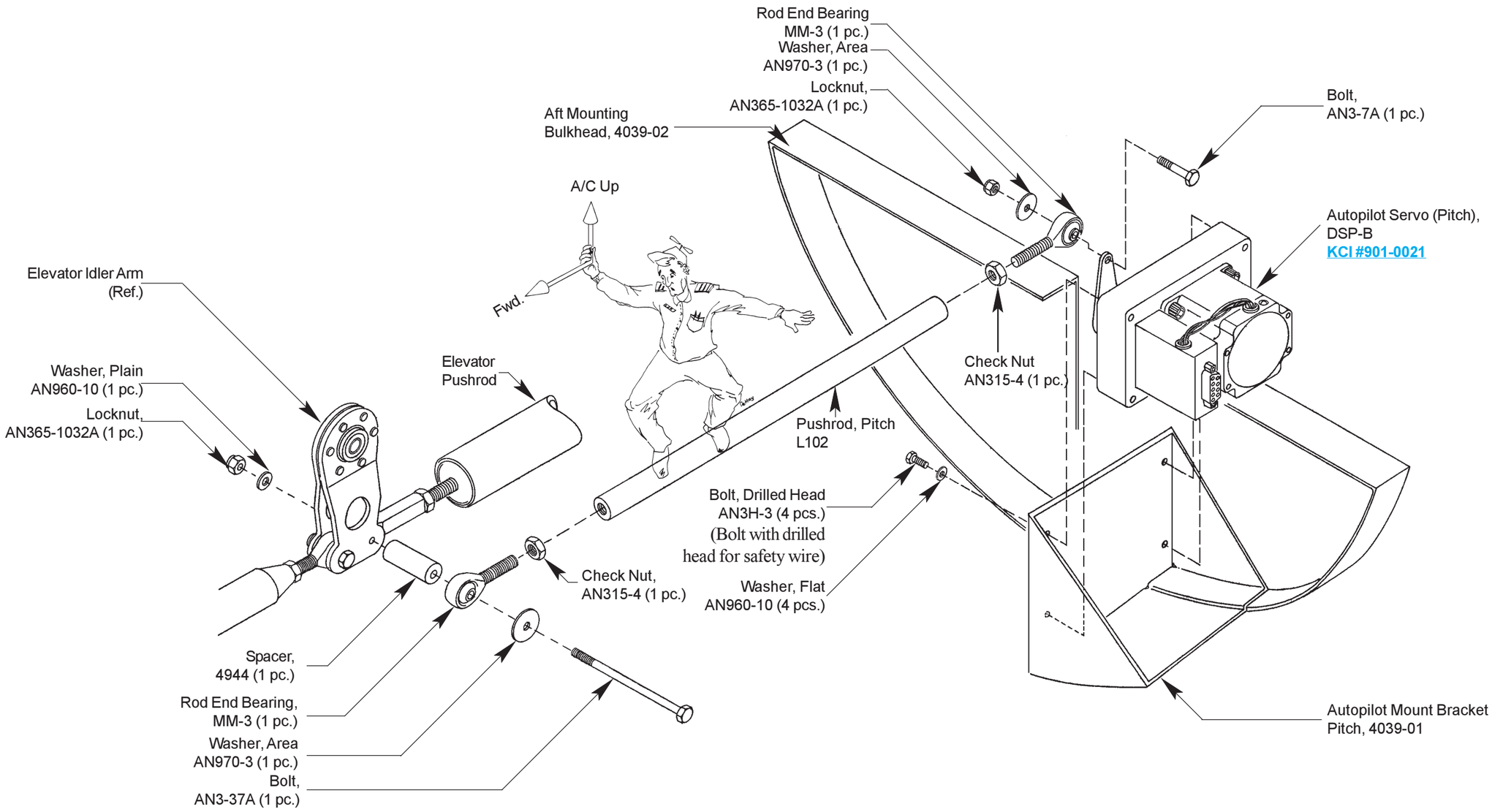
**Autopilot Pitch Servo Installation**
**Fig. 24:E:2**





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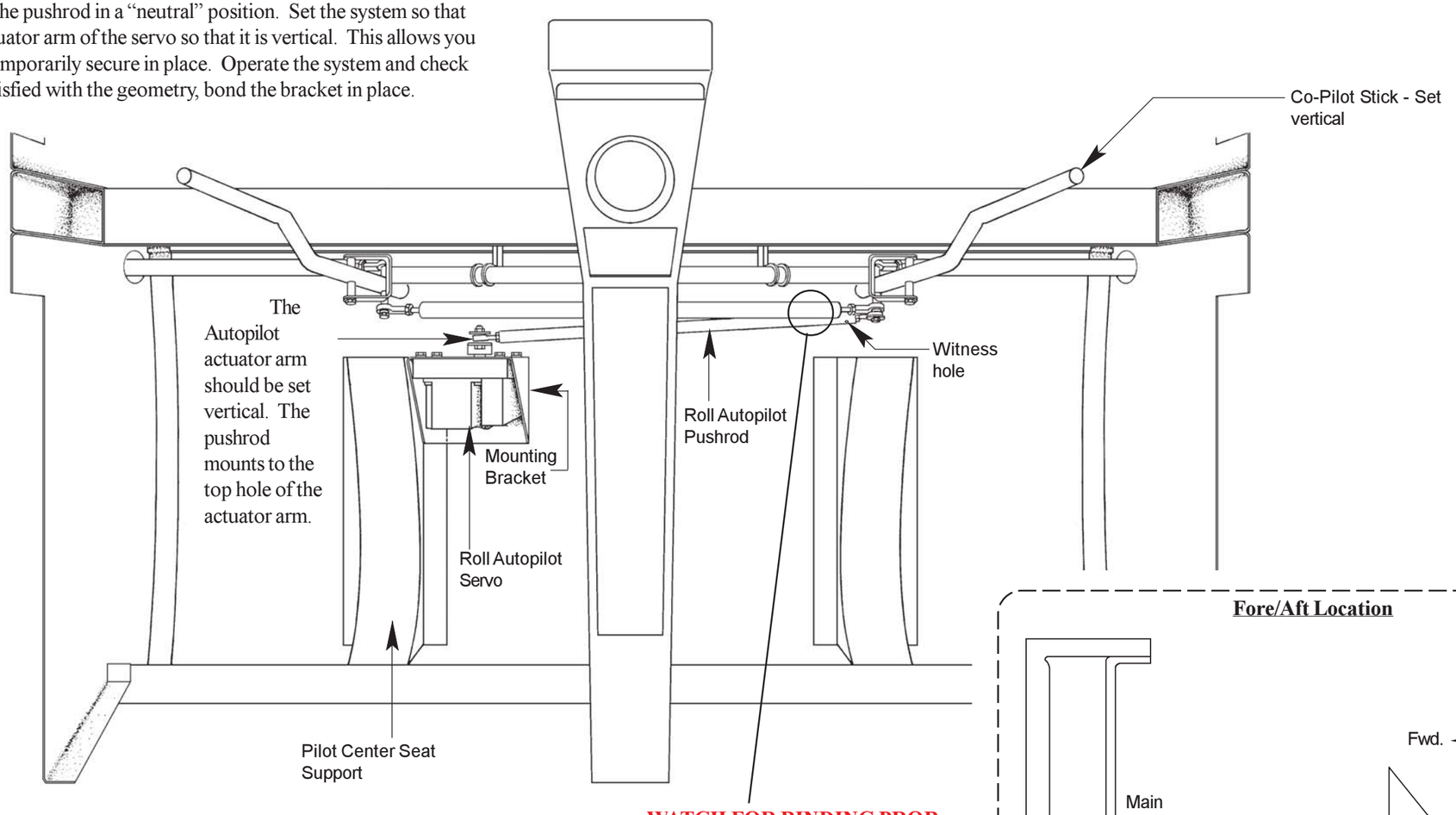
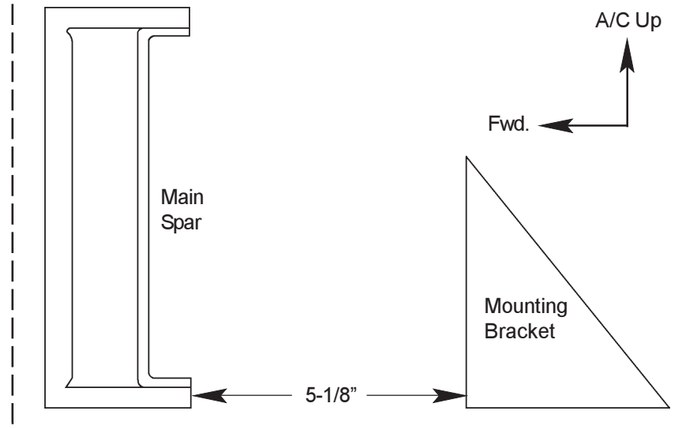
**Autopilot Roll Configuration**
**Fig. 24:E:3**

The autopilot roll servo installs underneath the pilot's seat. Note that we provide a dimension from the spar to the autopilot mounting bracket. However to locate the autopilot left-right we suggest you assemble the whole system. Start by adjusting the roll pushrod such that the pushrod measures 18-1/2" from center to center. This puts the pushrod in a "neutral" position. Set the system so that the control stick is vertical and set the actuator arm of the servo so that it is vertical. This allows you to determine the position of the servo. Temporarily secure in place. Operate the system and check for clearance between all parts. Once satisfied with the geometry, bond the bracket in place.




**WATCH FOR BINDING PROBLEMS BETWEEN THE ROLL AUTOPILOT PUSHROD AND THE CENTER CONTROL TUBE. IF NECESSARY, ADD ADDITIONAL WASHERS BETWEEN THE BEARINGS.**

**Fore/Aft Location**





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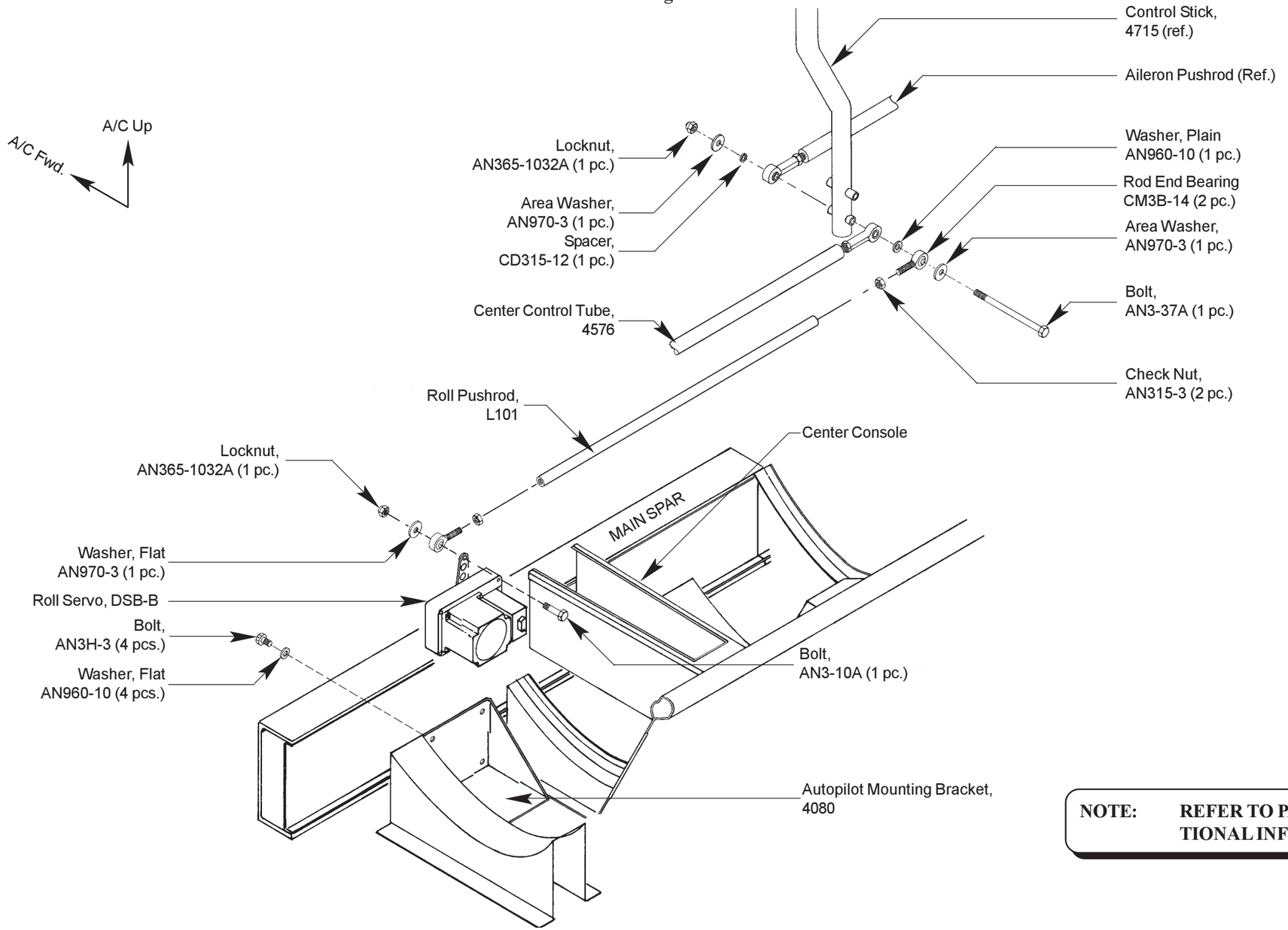
## Autopilot Roll Servo Installation
## Fig. 24:E:4




**NOTE:** **REFER TO PAGE 6-3 FOR ADDITIONAL INFORMATION.**



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# REVISION LIST

## CHAPTER 25: AFT WINDOWS

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 25-1 | 0/02-15-02 | None | Current revision is correct |
| 25-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |


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# Chapter 25: Aft Windows

Contents



## 1. INTRODUCTION

The aft windows improve rear visibility and also look good! The aft windows install in a similar manner to the canopy. We like to wait as long as possible to install the aft windows for access. If you have completed all preceding chapters and don't think you need access through the aft window openings, now is the time to install them.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| 1) | 4600-01 | 1 | AFT WINDOW, LEFT | |
| 2) | 4600-02 | 1 | Aft Window, Right | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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# 3. CONSTRUCTION PROCEDURE

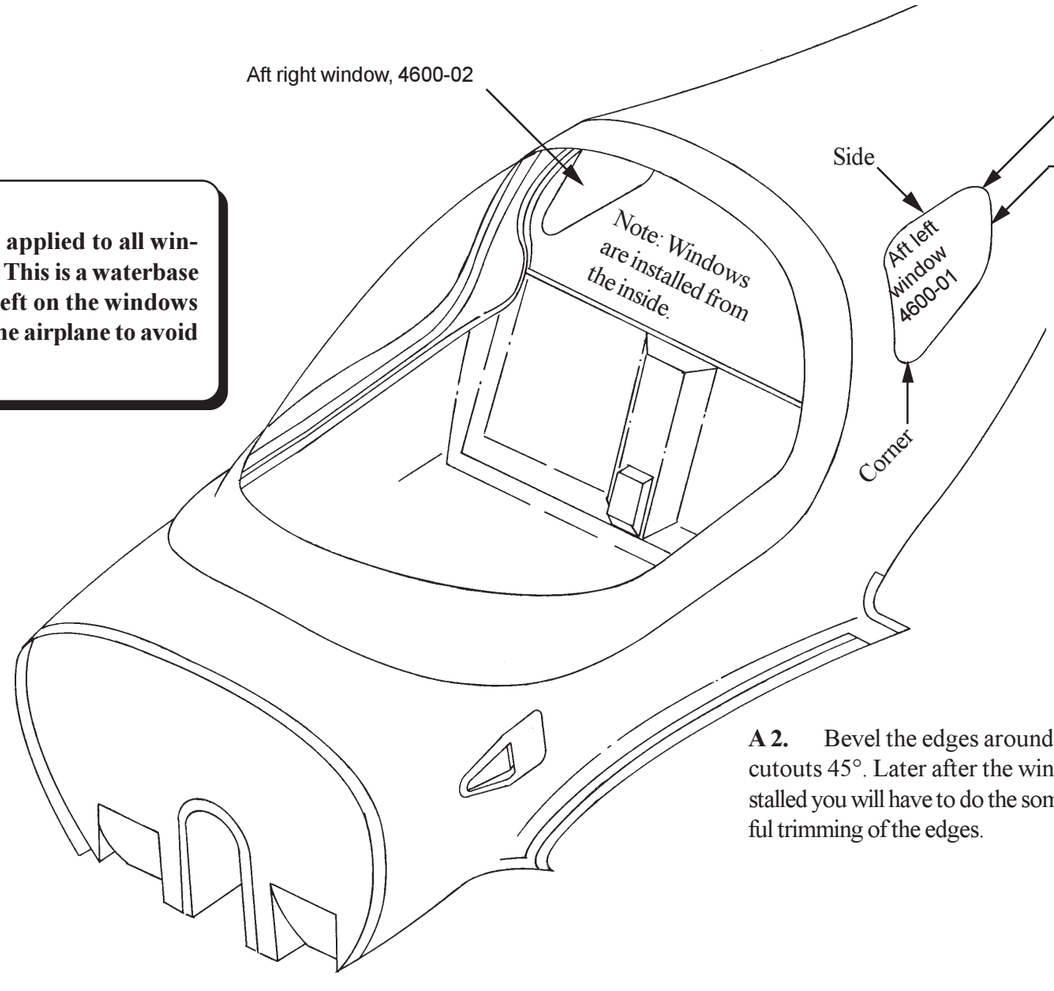
**Aft Windows**
**Fig 25:A:1**

## A. Preparing the Fuselage Shell

This chapter deals with the installation of the windows. Treatment and installation of the two aft windows is very similar to the canopy.

**Note:**

**A protective film is applied to all windows by the manufacturer. This is a waterbase protectant and should be left on the windows until you have completed the airplane to avoid nicks and scratches.**



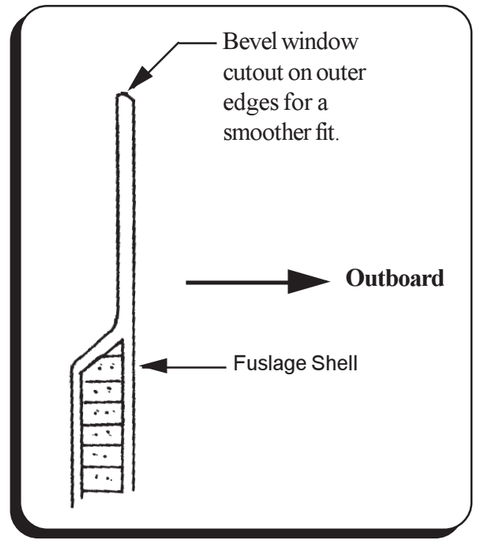

Use a piece of 80 grit sandpaper wrapped around a tube with a 4" diameter for the corners.

Use a short sanding block for the sides.

**A 1.** The window openings have been roughly trimmed at the factory. The first step is to final sand the opening.

Note that the sides have a slight curve. Don't attempt to sand them straight. Rather sight down the edges and corners and sand untill it looks right.

**A 2.** Bevel the edges around the window cutouts 45°. Later after the windows are installed you will have to do the some more careful trimming of the edges.



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## B. Preparing the Windows

The windows provided in your kit are oversized and must be trimmed down before bonding them to the upper fuselage shell.

Here are some do's and don'ts for handling plexiglass that have been learned from much ($$) experience.

**DO:** Leave the protective barrier on as much of the windows as possible for as long as possible.

**DO:** Cut the plexiglass with a band saw or an angle grinder. The band saw should have a fine tooth blade and set on low speed.

**DO:** Always keep the plexiglass held firmly against the working surfaces when cutting or trimming. An old section of carpet on your work bench lessens the danger of scratching the plexiglass.

**DON'T:** Cut plexiglass with a reciprocating blade, like a saber saw.

**DON'T:** Drill holes through plexiglass. It's to easy to crack.

**DON'T:** Clean plexiglass with acetone or MC. They may not seem to affect the surface, but these chemicals dry out the plexiglass and later cause discoloration. Cleaning should be done with Isopropyl (rubbing) alcohol.

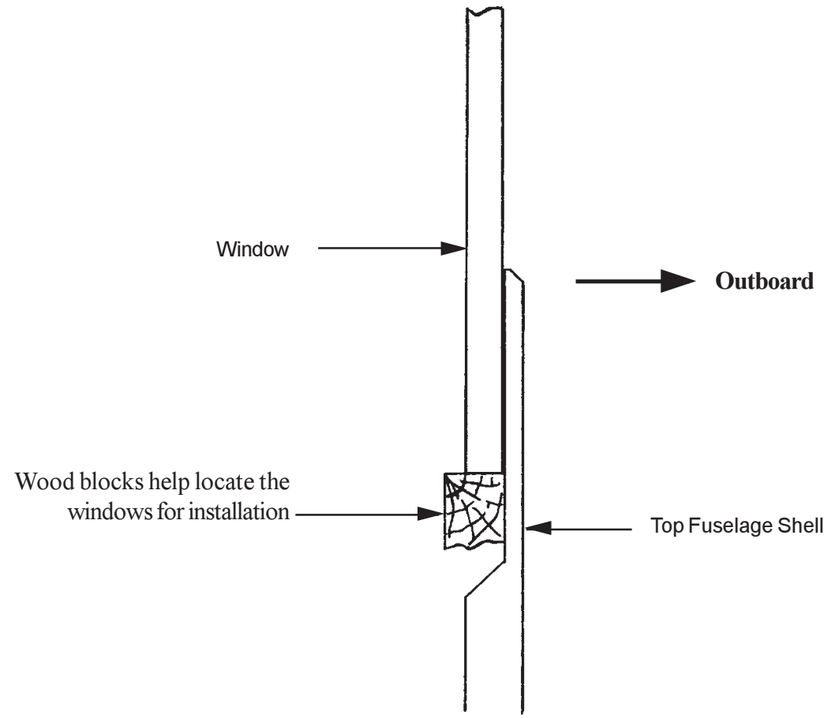
**DON'T:** Clean the plexiglass window with rubbing alcohol in the bonding areas after sanding. The plexiglass may absorb the rubbing alcohol if sanded. Never clean the edges. The edges are rough and may absorb the rubbing alcohol.

The correct method of cleaning the plexiglass window is to first clean the (unsanded) bonding surface with rubbing alcohol. Apply with a soft cloth such as a T-shirt. Sand the bonding areas thoroughly so no glossy areas remain. Using high pressure air or a clean cloth, remove the dust from the surface. Don't touch the bonding surfaces prior to bonding.

**B 1.** Set the windows into their respective locations. The windows should be equally oversized around the window cutouts. The window must be 1" (25 mm) larger than the cutouts. This will provide 1" wide bond between the windows and fuselage. You may trim the window in the areas where there is more than 1" bonding area. For cutting large areas of plexiglass, a band saw works well. For the smaller trimming jobs use an angle grinder with a 40 grit wheel.. And **be careful!** The plexiglass is tough stuff, but if you try to cut too fast, or drop the window on the floor, the plexiglass can break. It is also a good idea to remove the protective barrier only in the areas that you are cutting or grinding. This will prevent the protectant from contaminating later bonds.

Note: Take your time in cutting and trimming the windows. If you are rushed, then you are more likely to damage the windows. More than one builder has lost control of a high speed grinder and permanently engraved the plexiglass with unwanted graphics.

**Fitting Windows**
**Fig 25:B:1**




NOTE: The drawings in this chapter will all show one, generic view of a typical window installation. All side windows and windshield are installed similarly, (bonded from the inside of the top fuselage shell).

**B 2.** Carefully locate the windows in the fuselage shell. Use instant glue to bond a few temporary wood locating blocks ($^1/_2$" x $^1/_2$" x $^1/_2$") to the fuselage. These blocks will hold the windows in place and free up your hands for other work.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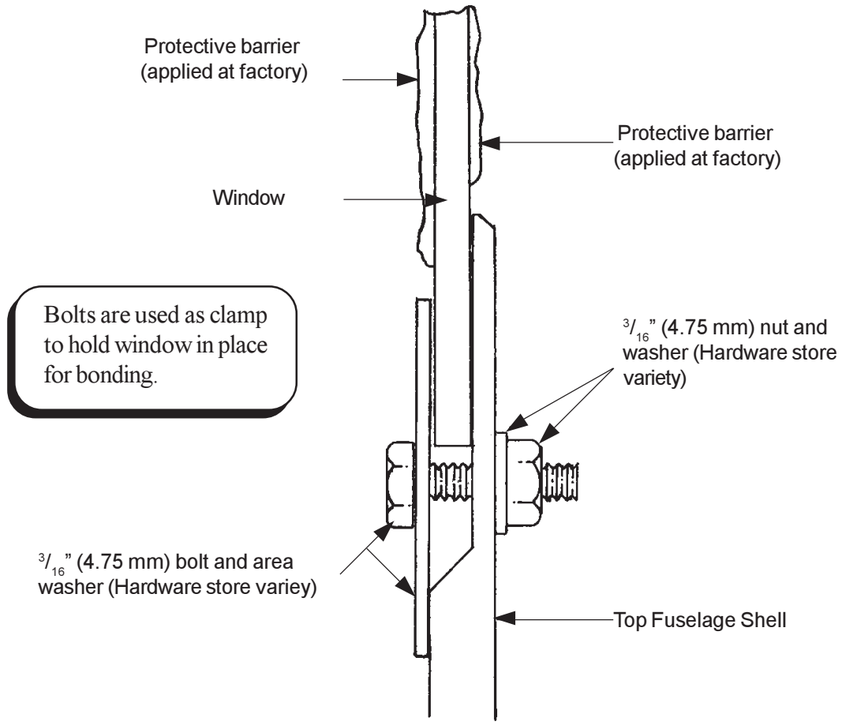
**Using Bolts to Clamp Windows in Place**
**Figure 25:B:2**




**B 3.** To clamp the window against the fuselage when bonding, use 3/16" (5 mm) diameter bolts (hardware store variety is fine). Drill 3/16" (5 mm) diameter holes every 4" (100 mm) around the parameter of the window. The holes should be centered at about 1/4" (5 mm) away from the edges of the plexiglass. Don't drill through the plexiglass!

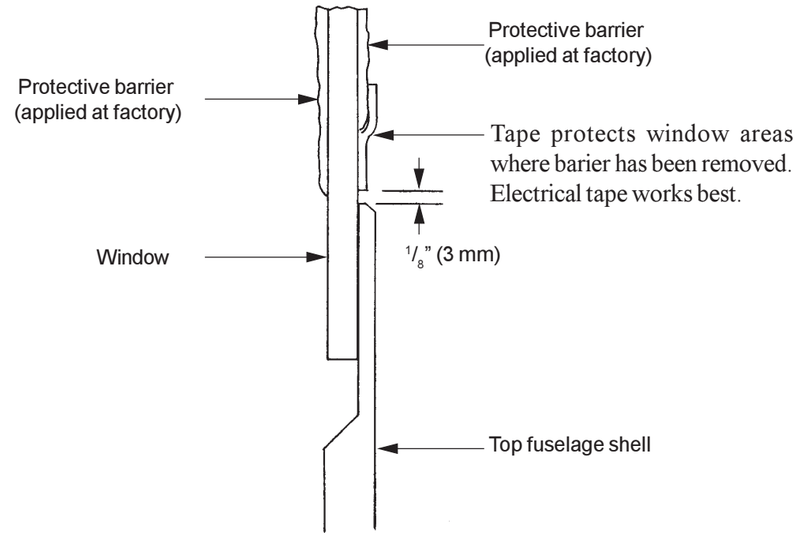
**B 4.** Do a trial clamping run with no adhesive to figure out the proper lengths of the bolts. Large area washers should be inserted on the bolts, then the bolts should be inserted through the holes you drilled around the windows. Insert the bolts from the inside. Use small washers and nuts on the outside surface to snug up the bolts. There will be gaps in some areas around the parameters of the windows, especially around the windshields, but these gaps will be filled with adhesive. Because of the differences in ply thickness, it would be impractical to try and get a perfectly even recess around all the windows. Do not grind away fiberglass thickness to get a flusher fitting window!

**B 5.** While you have your windows located, draw a reference line on their outer surfaces showing the edges of the cutouts. You will use this line to trim away the outer protective material from the windows.

**B 6.** Remove the windows from the fuselage shell.

**B 7.** Peel away the protective material from both inner and outer surfaces in their bonding areas as shown in Figure 19:B:3. There should be a 1/2" (12 mm) clear space between material and the bonding areas. Use the reference line you drew in step B5 as a guide for removing the material.

**Protecting Windows From Adhesive**
**Fig. 25:B:3**




**B 8.** Apply a layer of 1/2" (12 mm) wide tape to the outer surface of the windows, covering the narrow clear areas between the protective barrier and the edges of the fuselage cutouts. Electrical tape works well for this job, giving better protection than masking tape. The edge of the tape should be held 1/8" (3 mm) short of the cutout edges. After the windows have been glued in, the tape will be removed leaving a sharp, clean edge around the windows. So treat the tape application carefully and make the corners smooth and round.

**B 9.** Clean the bonding areas of the windows with alcohol. Clean right up to the protective tape.

**B 10.** Use 40 grit to sand the bonding areas of the windows (or if you're very careful, you can use a grinder). Sand thoroughly so no "glossy" areas remain. Be careful while sanding up to the tape edges not to damage the tape. If you do damage the tape, replace it before bonding in the windows.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## C. Window Installation

The windows are bonded in position with Hysol structural adhesive. The bond is reinforced with 2 BID from behind.

**C 1.** With 40 grit, sand the inner surface of the fuselage shell where the windows will be bonded.

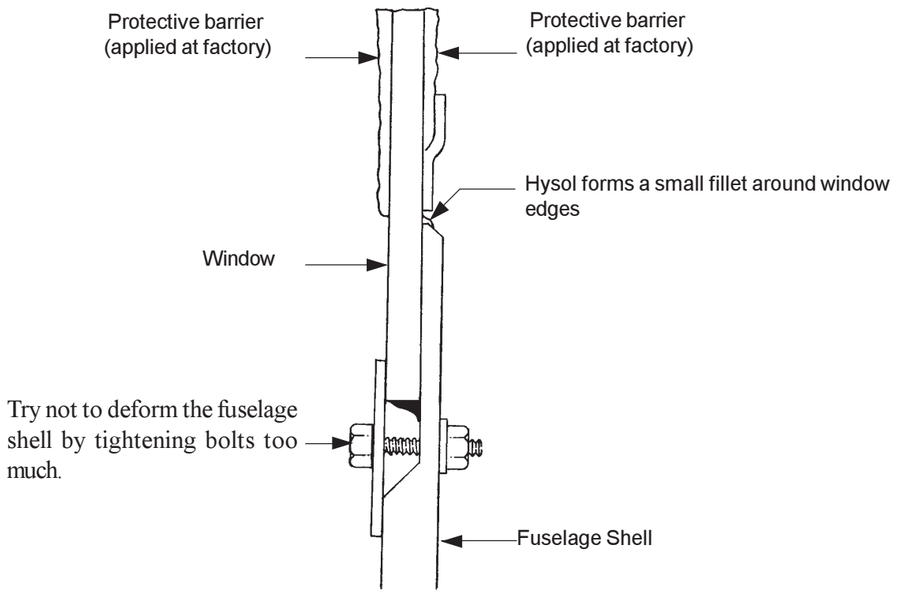
**C 2.** Clean all bonding areas with MC. (Except the windows of course).

Note: You don't have to bond both the windows at the same time. If you're alone, best not to push your luck and stick to bonding one or two windows in at a time.

**C 3.** Bond the windows to the fuselage with Hysol. A little flox mixed with the hysol helps with the consistency. Snug up the clamping bolts just enough so you can get a squeeze out, but not so that the outer surface of the fuselage is deformed. If there is still Hysol squeeze out but no skin deformation, snug up all the nuts just a bit more and recheck.

Use a modified tongue depressor to scrape away the excess Hysol and form a small radius perimeter of the fuselage cutout. Scrape away enough Hysol so the edge of the tape is visible. Don't let any drips or yucky fingers touch unprotected glass.

**Bonding in Windows**
**Fig. 25:C:1**



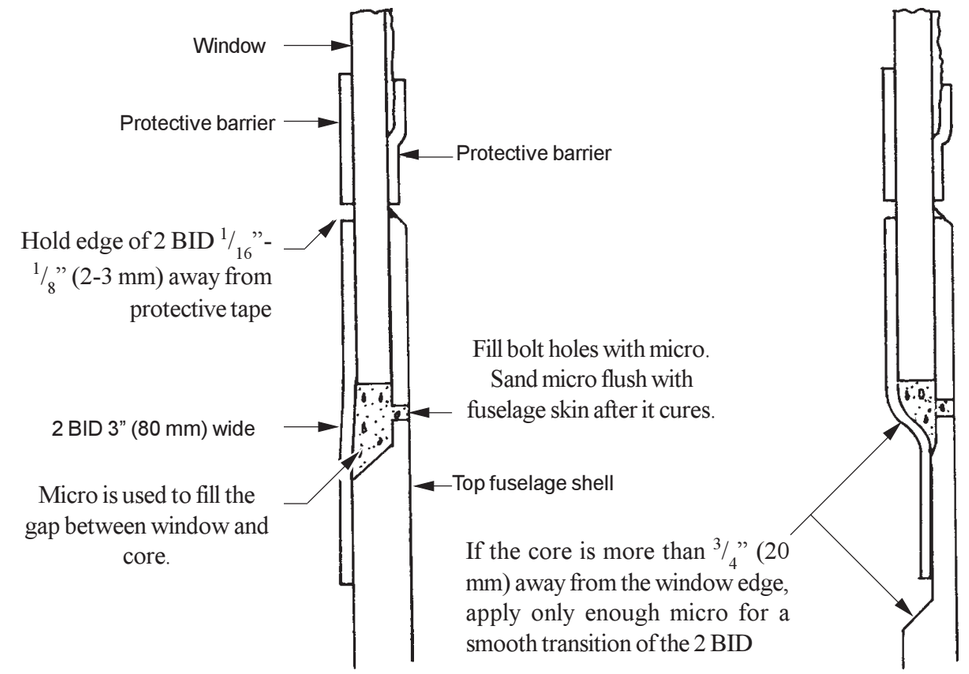

**C 4.** It is suggested that you leave the window bolted in place until the Hysol has gone through it's full cure time of 5-7 days at room temperature. This will eliminate the possibility of the windows pulling away from the fiberglass (when this happens, it looks like an air bubble in laminate).

**C 5.** Remove the clamping bolts around the windows.

**C 6.** With 40 grit, sand inner surface of the windows and the top fuselage shell where the 2 BID reinforcement will be applied. Remember, There should be no glossy surface left in the plexiglass area that will receive the laminates. It is highly suggested that you apply a layer of protective tape to the inner surface of the windows around the perimeter of the fuselage cutouts (just like you did on the outer surface before bonding). This tape will keep wayward epoxy or fiberglass off the clean unprotected surface. Align the edge of the inner tape with the edge of the outer tape.

**C 7.** With alcohol, clean the plexiglass where the BID tapes will be applied. Clean the carbon fiber areas of the fuselage with MC.

**Reinforcing Window/Fuselage bond**
**Fig. 25:C:2**





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**C 8.** Fill the areas between the edges of the plexiglass and the fuselage core with a thick epoxy/micro mixture as shown in Figure 10:C:2. If the distance from the edge of the windows to the beginning of the fuselage core is greater than 3/4" (20 mm), filling the entire depression is not necessary, just apply a micro radius around the window edge for a smooth BID transition. This micro will also fill the bolt holes in the fuselage.

**C 9.** Apply 2 BID, 3" (80 mm) wide strips to reinforce the bond between the windows and the fuselage shell. It would be impossible to do these laminates in one piece for each window, so segment the laminates and overlap them onto each other by 1" (25 mm). Using the protective tape as a reference, carefully position the edges of the 2 BID laminates in a straight line, about 1/16" - 1/8" (2-3 mm) away from the edge of the masking tape. Using a gentle touch on the fiberglass, it is fairly easy to get a good straight edge and save yourself some tricky sanding later. Another time saving suggestion is to use peel ply on these laminate for a smooth finish if you later want to simply paint around the windows.

**C 10.** For a nice, finished look to the outer edges of the window cutouts, bevel the edges with a folded piece of 80 grit sandpaper. Of course, you must be very careful not to scratch the unprotected plexiglass. You can also apply a small amount of epoxy/micro around the edges of the windows. The Micro is much easier to sand than Hysol. Another round of applying electrical tape, but it's better protection than nothing.


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# REVISION LIST

# CHAPTER 26: FIREWALL FORWARD (PART II)

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 26-1 through 26-21 | 0/02-15-02 | None | Current revision is correct |
| 26-22 | 1/09-18-02 | R&R | Text Correction |
| 26-23 through 26-32 | 0/02-15-02 | None | Current revision is correct |
| 26-33 | 1/09-18-02 | R&R | Corrected Fig. 26:H:1 |
| 26-34 through 26-35 | 0/02-15-02 | None | Current revision is correct |
| 26-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers and part nbrs. |
| 26-2 through 26-3 | 3/12-15-04 | R&R | Updated part nbrs. |
| 26-4 | 3/12-15-04 | R&R | Updated engine isolator kit information. |
| 26-6 | 3/12-15-04 | R&R | Updated part nbrs. |
| 26-18 | 3/12-15-04 | R&R | Updated part nbrs. |
| 26-20 through 26-21 | 3/12-15-04 | R&R | Updated part nbrs. |
| 26-26 | 3/12-15-04 | R&R | Updated location of bulkhead fitting. |
| 26-3 | 4/09/30/06 | R&R | Corrected plug part nbr. |
| 26-26 | 4/09/30/06 | R&R | Corrected plug part nbr. |
| 26-27 through 26-33 | 4/09-30-06 | R&R | Updated hose numbers and bolded so easier to read. |
| 26-1, 26-4, 26-2, 26-3, 26-20, 26-2, 26-24, 26-34, 26-35 | 6/08-10-07<br>6/08-10-07 | R&R<br>R&R | Updated engine mounts.<br>Part number changes only. |


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# Chapter 26: Firewall Forward (part 2) Continental 550

Contents



## 1. INTRODUCTION

The firewall forward construction is divided into two chapters: Chapter 13 and chapter 26. In Chapter 13 you installed the firewall flame blanket, engine mount and nose gear doors. Chapter 26 completes the firewall forward installation. Chapter 26 is issued in two different versions: One for the Continental 550 and one for the Lycoming 540. More specifically the Continental IO 550 N engine and the Lycoming IO 540V4A5 engine. If you have a different model of either of these engines you will discover differences in the instructions as well as the fit of the parts that we offer. In the case of the baffling for example the IO 550 N versus the IO 550 G you will notice a difference in the fit of the baffling against the cylinders, etc. Most parts required for these two engines are available through Lancair.

We can also provide the engine mount and cowling for Lycoming IO 360 installations. However we do not currently support or approve of any other installations than the 3 engines mentioned.

## 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **MOUNTING ENGINE** | | | | |
| 1) | J-9613-54 (Lord) | 4 | Engine Mount | **Yes |
| or | 94011-20 (Barry) | | Vibration Isolator kit (low temp.) | **Yes |
| or | 94001-01 (Barry) (recommended) | | Vibration Isolator (high temp.) | **Yes |
| 2) | AN7-33A | 4 | Bolt, Undrilled | **Yes |
| 3) | AN970-7 | 4 | Washer, Flat | **Yes |
| 4) | 588-02 | 4 | Safety wire | **Yes |
| 5) | 98-9074-11 | 4 | Washer, for vibration isolator | **Yes |
| **PROPELLER/SPINNER** | | | | |
| 1) | A-2295-P | 1 | Polished 14" Diameter Harzell Spinner | **Yes |
| 2) | BHC-J2YF-1B/F7694-4TX | 1 | 69" Dia. 2 Bladed Hartzell Propeller | **Yes |
| **COWLING** | | | | |
| 1) | 4000-01 | 1 | Upper Cowling | |
| 2) | 4000-02 | 1 | Lower Cowling | |
| 3) | H-5000-2 | 1 | Hartwell Latch | |
| 4) | MS20001 | 1 | Hinge | |
| 5) | K1000-08 | 48 | Nutplates | |
| 6) | AN426A3-5 | 20 | Rivets (Nose gear door rails) | |
| 7) | MSC-34 | 76 | Rivets | |
| 8) | MS24694-S5 | 48 | Screws | |
| **BAFFLING** | | | | |
| 1) | 4851-001 | 1 | Front Upper Shroud | **Yes |
| 2) | 4851-002 | 1 | Front Lower Shroud | **Yes |
| 3) | 4851-003 | 1 | Front Left Shroud | **Yes |
| 4) | 4851-004 | 1 | Front Right Shroud | **Yes |
| 5) | 4851-005 | 1 | Left Deck | **Yes |
| 6) | 4851-006 | 1 | Right Deck | **Yes |
| 7) | 4851-007 | 1 | Left Wing | **Yes |
| 8) | 4851-008 | 1 | Right Wing | **Yes |
| 9) | 4851-010 | 1 | Right Rear Panel | **Yes |
| 10) | 4851-011 | 2 | Stand Off | **Yes |
| 11) | 4851-012 | 1 | Left Rear Panel | **Yes |
| 12) | 4851-013 | 1 | Oil Cooler Box | **Yes |
| 13) | 4851-014 | 1 | Cable Bracket | **Yes |
| 14) | 4851-015 | 1 | Oil Cooler Door | **Yes |



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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **BAFFLING (CONTINUED)** | | | | |
| 15) | 4851-016 | 1 | Front Left Inner Baffle | **Yes |
| 16) | 4851-018 | 1 | Right Aft Inner Baffle | **Yes |
| 17) | 4851-019 | 1 | Bracket | **Yes |
| 18) | 4851-020 | 1 | Bracket | **Yes |
| 19) | 4851-021 | 1 | Left Outer Baffle | **Yes |
| 20) | 4851-022 | 1 | Right Front Outer Baffle | **Yes |
| 21) | 4851-023 | 1 | Left Aft Inner Baffle | **Yes |
| 22) | 4851-024 | 1 | Front Right Inner Baffle | **Yes |
| 23) | 4851-025 | 1 | Bracket | **Yes |
| 24) | 4851-026 | 1 | Bracket | **Yes |
| 25) | 4851-027 | 1 | Bracket | **Yes |
| 26) | 4851-028 | 1 | Bracket | **Yes |
| 27) | 4851-029 | 6 | Deck Bracket | **Yes |
| 28) | 4851-030 | 4 | Stand Off | **Yes |
| 29) | 4851-031 | 4 | Stand Off | **Yes |
| 30) | 4851-032 | 6 | Stand Off | **Yes |
| 31) | 4851-033 | 2 | Bracket | **Yes |
| 32) | 4851-034 | 1 | Aft Center Brace | **Yes |
| 33) | 4851-035 | 1 | Left Front Outer Baffle | **Yes |
| 34) | 4851-036 | 1 | Stand Off | **Yes |
| 35) | 4851-037 | 1 | Stand Off | **Yes |
| 36) | 4851-A | 1 | Baffling Kit (Includes Roll of Seal) | **Yes |
| 37) | 4853 | 1 | Di-cut Baffling Seal | **Yes |
| 38) | AN3-3A | 30 | Bolt, Undrilled | **Yes |
| 39) | AN3-4A | 13 | Bolt, Undrilled | **Yes |
| 40) | AN3-5A | 10 | Bolt, Undrilled | **Yes |
| 41) | 05-16100 | 1 | Terminal Bolt Kit | **Yes |
| 42) | A-740BL0720 | 1 | Cable | **Yes |
| 43) | MS35649-202 | 2 | Checknut | **Yes |
| 44) | 145-0004 ~~5416K15~~ | 4 | Clamp, Hose | **Yes |
| 45) | AN742-D4 | 1 | Clamp, Modified | **Yes |
| 46) | 05-29904 | 24” | Ducting, SCAT | **Yes |
| 47) | 05-29904 | 24” | Ducting, SCAT(Vacuum Pump Ducting) | **Yes |
| 48) | 561-1 | 2 | Flange | **Yes |
| 49) | 518-02 | 1 | Fuel Pump Shroud | **Yes |
| 50) | AN365-1032A | 8 | Locknut | **Yes |
| 51) | AN363-1032 | 38 | Locknut | **Yes |
| 52) | AN364-832A | 1 | Locknut | **Yes |
| 53) | K1000-3 | 11 | Nutplate | **Yes |
| 54) | MS20001 | 11” | Piano Hinge | **Yes |
| 55) | AN426A3-4 | 4 | Rivets | **Yes |
| 56) | AN426A3-5 | 10 | Rivets | **Yes |
| 57) | AN526A3-4 | 12 | Rivets | **Yes |
| 58) | MS24693-S4 | 4 | Rivets | **Yes |
| 59) | MSC-34 | 11 | Rivets | **Yes |
| 60) | AN525-10R6 | 4 | Screw, Panhead | **Yes |
| 61) | MS24694-S48 | 6 | Screw, Machine | **Yes |
| 52) | AN500-A416-6 | 6 | Screw, Fillister Head | **Yes |
| 63) | 518-3 | 1 | Stud, 8-32 | **Yes |
| 64) | AN960-10 | 20 | Washer, Flat | **Yes |
| 65) | AN960-10L | 22 | Washer, Flat | **Yes |
| 66) | AN960-08L | 2 | Washer, Flat | **Yes |
| 67) | AN970-3 | 5 | Washer, Large Area | **Yes |
| 67) | MS35338-44 | 6 | Washer, Lock | **Yes |
| 68) | 216CW | 1 | Vacuum Pump | **Yes |
| 69) | 1085 | 1 | Vacuum Pump Shroud | **Yes |
| **ENGINE CONTROL SYSTEMS** | | | | |
| 1) | HFC-3 | 3 | Bearing, Rod End | **Yes |
| 2) | AN3-4A | 4 | Bolt, Undrilled | **Yes |
| 3) | AN3-7A | 2 | Bolt, Undrilled | **Yes |
| 4) | AN3-10A | 1 | Bolt, Undrilled | **Yes |
| 5) | AN3-11A | 1 | Bolt, Undrilled | **Yes |
| 6) | AN3-12A | 1 | Bolt, Undrilled | **Yes |
| 7) | AN6-5A | 1 | Bolt, Undrilled | **Yes |
| 8) | 565-02 | 1 | Bracket, Mixture Cable | **Yes |
| 9) | PG564 | 1 | Bracket, Prop Cable | **Yes |
| 10) | TB653 | 1 | Bracket, Throttle | **Yes |
| 11) | A750-RD-5 | 1 | Cable, Mixture | **Yes |
| 12) | A750-BU-5 | 1 | Cable, Propeller | **Yes |
| 13) | A800-BL-5 | 1 | Cable, Throttle | **Yes |
| 14) | AN315-3 | 2 | Checknut | **Yes |
| 15) | 31509 | 3 | Clamp, Cable | **Yes |
| 16) | 103-0026 ~~91811A031~~ | 1 | Nut | **Yes |
| 17) | AN363-1032 | 6 | Nut, Lock | **Yes |
| 18) | SP565 | 1 | Spacer | **Yes |
| 19) | AN970-6 | 2 | Washer, Area | **Yes |
| 20) | AN970-3 | 3 | Washer, Area | **Yes |
| 21) | AN960-10 | 20 | Washer, Flat | **Yes |
| 22) | AN960-10L | 4 | Washer, Flat | **Yes |
| 23) | AN960-616 | 1 | Washer, Flat | **Yes |
| 24) | 9115DA114 | 1 | Washer, Lock | **Yes |


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| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **MANIFOLD PRESSURE AND TACHOMETER** | | | | |
| 1) | C5205x4x4 | 1 | Fitting | **Yes |
| 2) | MS27404-4D | 2 | Fitting | **Yes |
| 3) | 193-4 | 1 | Hose | **Yes |
| **FUEL SYSTEMS** | | | | |
| 1) | 4875 | 1 | Gascolator Shroud | **Yes |
| 2) | 4876 | 1 | Attach Bracket | **Yes |
| 3) | 4890 | 28” | Fuel Supply Line | **Yes |
| 4) | AN912-1D | 1 | Bushing Reducer | **Yes |
| 5) | 5416R14 | 2 | Clamp, Hose | **Yes |
| 6) | MS21919-DG32 | 2 | Clamp | **Yes |
| 7) | MS21919-DG10 | 2 | Clamp | **Yes |
| 8) | AN624-4D | 1 | Fitting, T | **Yes |
| 9) | AN816-4-4 | 2 | Fitting | **Yes |
| 10) | AN822-4D | 1 | Fitting, Elbow | **Yes |
| 11) | AN822-4 | 1 | Fitting, Elbow | **Yes |
| 12) | 2240-6-8S | 1 | Fitting, Bulkhead | **Yes |
| 13) | 561-1 | 1 | Flange, Inlet | **Yes |
| 14) | 510A | 4 | Fuel Return Line | **Yes |
| 15) | 193-4 | 7’ | Fuel Divider Drain Line | **Yes |
| 16) | 530 | 21” | Fuel Line | **Yes |
| 17) | A500 | 1 | Andair Gascolator | **Yes |
| 18) | MS35489-13 | 1 | Grommet | **Yes |
| 19) | AN931-12-23 | 1 | Grommet | **Yes |
| 20) | 514 | 1 | Hose, Prebuilt | **Yes |
| 21) | 515 | 1 | Hose, Prebuilt | **Yes |
| 22) | 516 | 1 | Hose, Prebuilt | **Yes |
| 23) | K3000-3 | 3 | Nutplate | **Yes |
| 24) | AN913-2D | 1 | Plug | **Yes |
| 25) | MSC-34 | 4 | Rivets, Pop | **Yes |
| 26) | AN426A3-4 | 6 | Rivets | **Yes |
| 27) | SCAT 4 | 1 | Tubing, Flexible | **Yes |
| 28) | CCA-1550 | 1 | Valve, Drain | **Yes |
| 29) | AN960-6D | 1 | Washer | **Yes |
| 30) | 539 | 24” | Fuel Pump Drain on Firewall | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM (not included with kit) |
|---|---|---|---|---|
| **OIL SYSTEMS** | | | | |
| 1) | 165-0000 ~~8500K83~~ | 1 | Anti Chafe Material | **Yes |
| 2) | AN3-7A | 1 | Bolt, Undrilled | **Yes |
| 3) | MS21919-DG16 | 1 | Clamp | **Yes |
| 4) | 145-0003 ~~5416K14~~ | 1 | Clamp | **Yes |
| 5) | AN912-3 | 1 | Coupling, Steel | **Yes |
| 6) | HK822-4 | 1 | Fitting (with .05” Restriction) | **Yes |
| 7) | AN363-1032A | 1 | Locknut, Nylon | **Yes |
| 8) | 124F001-4CR0160 | 16” | Oil Pressure Line | **Yes |
| 9) | MIL-H-6000x3/4 | 1 | Oil Breather Line | **Yes |
| 10) | AN960-10 | 1 | Washer, Flat | **Yes |
| **VACUUM SYSTEM INSTALLATION (OPTIONAL)** | | | | |
| 1) | 212CW | 1 | Airborne Dry Air Pump | **Yes |
| 2) | 145-0001 ~~5321K16~~ | 10 | Clamps, Hose | **Yes |
| 3) | 145-0003 ~~5416K14~~ | 2 | Clamps, Hose | **Yes |
| 4) | 1K1-6-10 | 1 | Fitting, Airborne 90° | **Yes |
| 5) | 1K8-6-10 | 1 | Fitting, Airborne 135° | **Yes |
| 6) | AN840-6D | 4 | Fitting, Straight | **Yes |
| 7) | AN840-4D | 2 | Fitting, Straight | **Yes |
| 8) | 193-10 | 2 | 5/8” I.D. Vacuum Stratoflex Hose | **Yes |
| 9) | 193-6 | 7 | 3/8” I.D. Vacuum Stratoflex Hose | **Yes |
| 10) | 193-4 | 3 | 1/4” I.D. Vacuum Stratoflex Hose | **Yes |
| 11) | H3-12 | 12 | Vacuum Pump Regulator | **Yes |
| 12) | 1J7-1 | 1 | Vacuum Pump Filter | **Yes |


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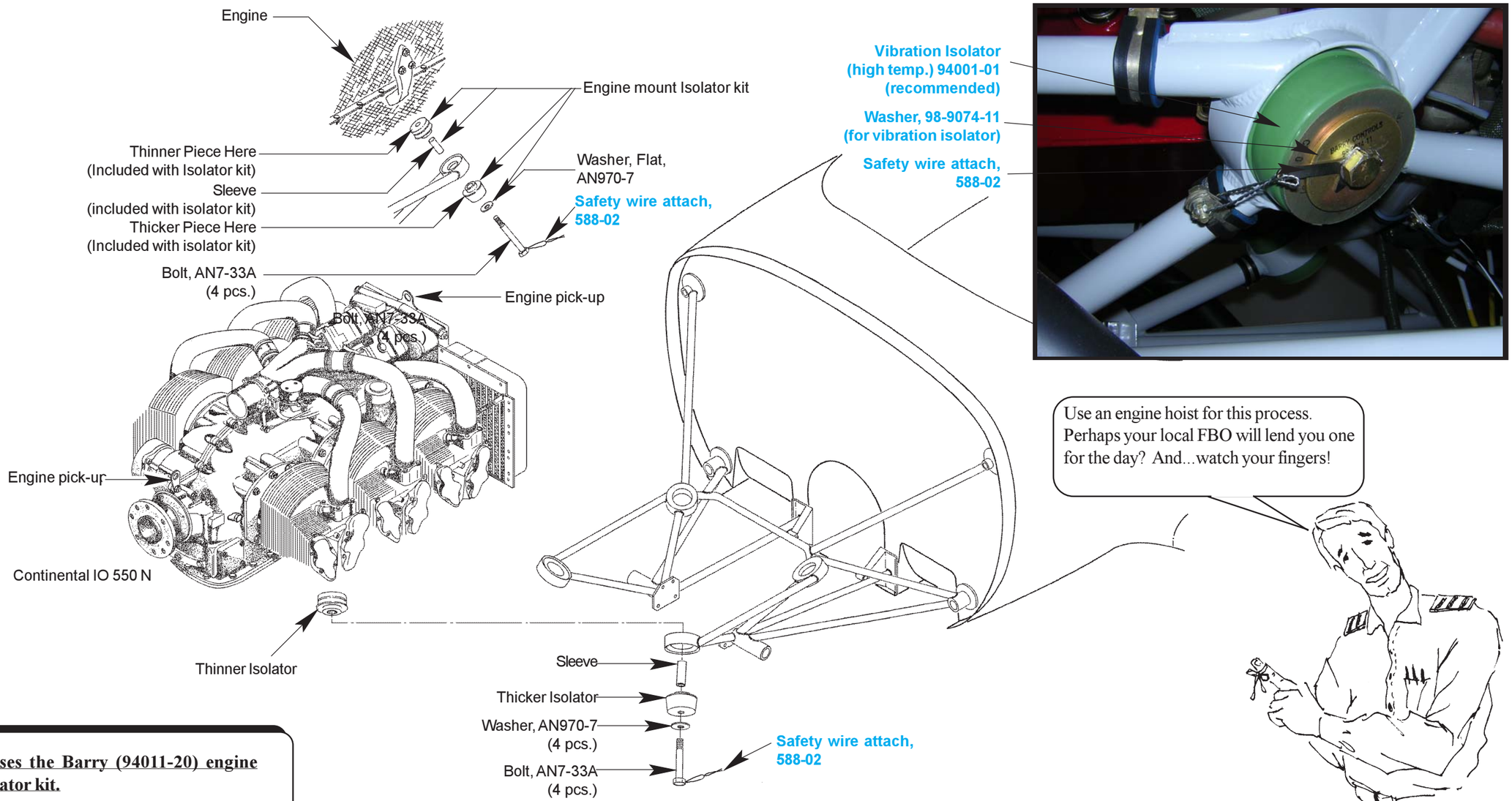
# 3. CONSTRUCTION PROCEDURES

## A. Mounting the Engine

**Mounting Engine**
**Fig. 26:A:1**




**The 550 uses the Barry (94011-20) engine mount isolator kit.**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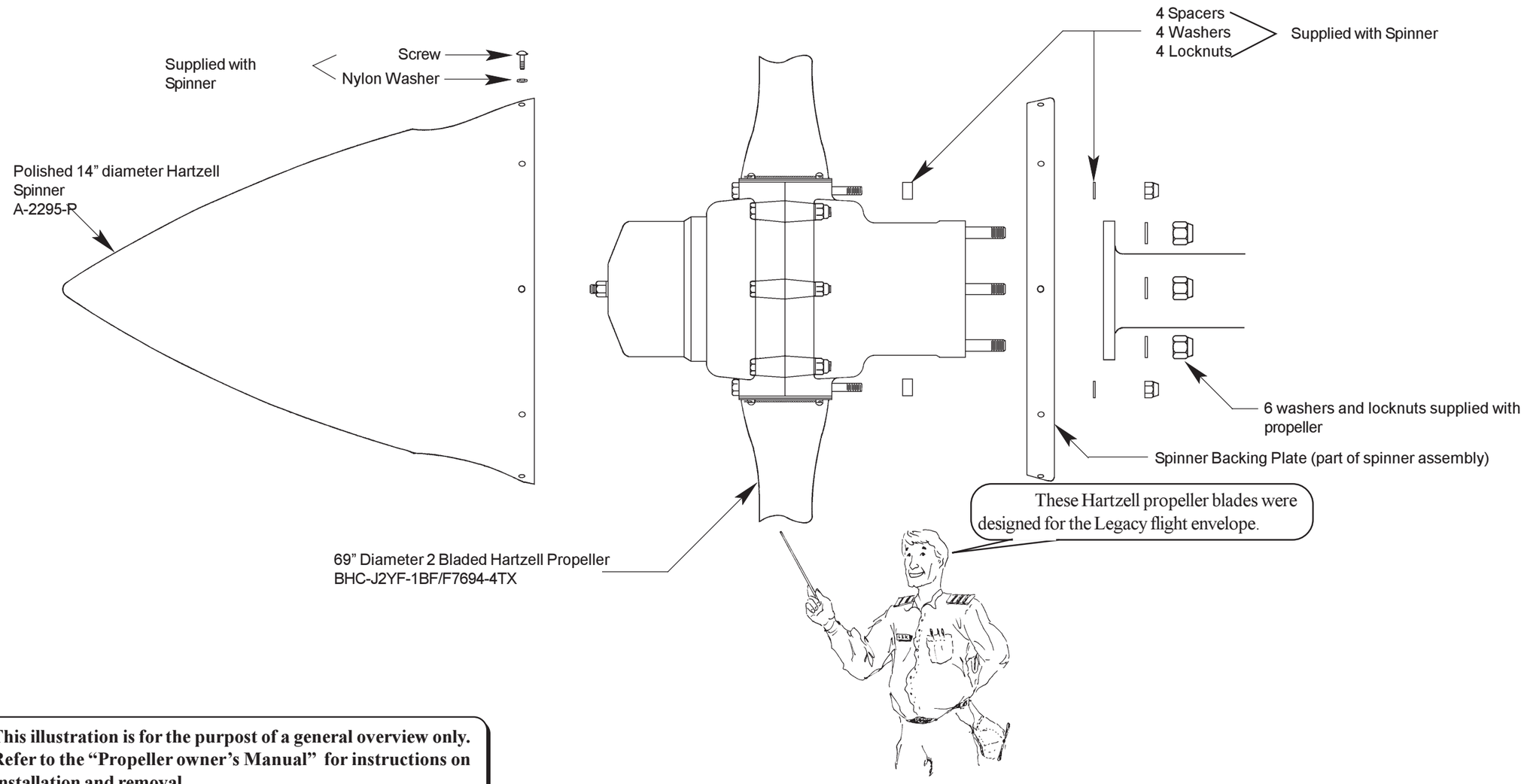
## B. Propeller/Spinner

**Propeller/Spinner**
**Fig. 26:B:1**

Continental Installation

CONTINENTAL MOTORS




**NOTE:** **This illustration is for the purpost of a general overview only. Refer to the “Propeller owner’s Manual” for instructions on Installation and removal.**



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## C. Cowling

For the purpose of installing the cowling, the propeller and the spinner backplate must be installed. We suggest removing the spinner itself to avoid scratches. For the same reason protect the propeller blades. Before starting this section, the aircraft should be leveled for reference.

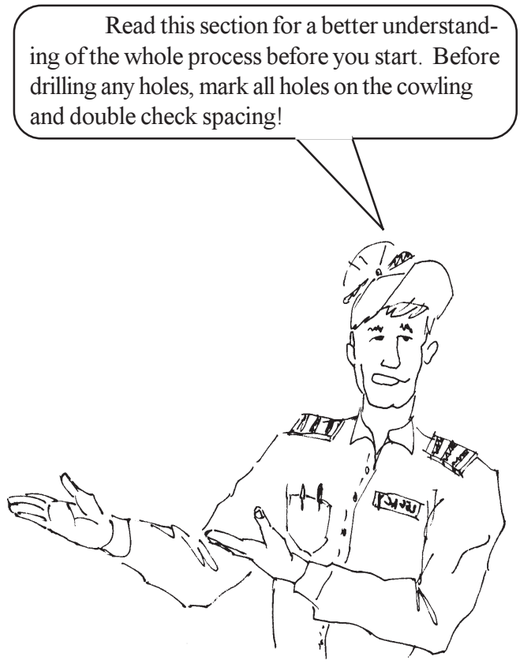
The cowling is aligned to the spinner and the fuselage. You will need to cut out for the nose gear doors to fit the cowling. We suggest you start by making a cut just large enough to start fitting the cowling. Once aligned properly cut to exact dimensions.

NOTE: When drilling for the cleco holes (that will eventually be used for the screws) install the holes first at the fixed locations. For example for the lower cowling start at the bottom and work your way up along the sides. When drilling the holes for the upper cowling, make sure the cowling matches up good in the front then start drilling in the aft center where it secures to the fuselage. Work your way down the side making sure it is pulled nice and tight. Then drill for the sides. As you are drilling each hole keep checking the rest of the cowling.

The lower cowl is first aligned and then the upper cowling. When the engine is running it "pulls" down a little so we generally set the cowling 1/8" to 3/16" below the spinner. Also allow for a 3/16" clearance between the spinner and the cowling. Trim excess material off along the back.

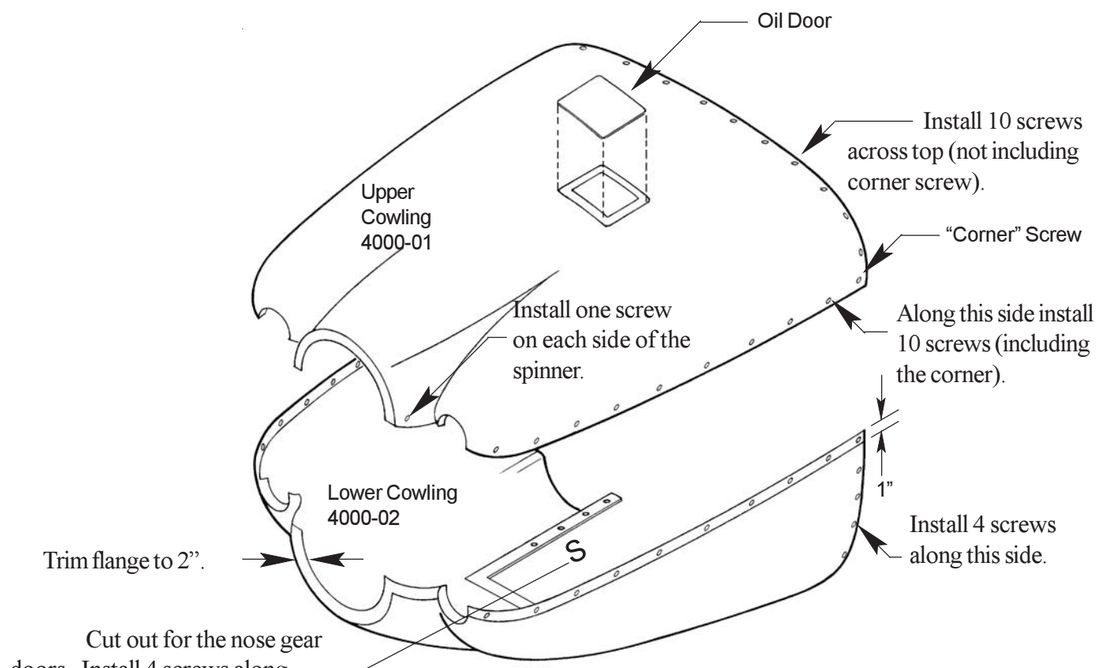
The upper cowl is set in a similar manner to the lower cowling. Note that at first the cowling may appear to backlock at the air inlets. If this is a problem grind a little off the lower cowl joggle to eliminate this backlock.

**Cowling Screw Patterns**
**Fig. 26:C:1**




**Continental Installation**

CONTINENTAL MOTORS




**Hardware:**

| | | |
|---|---|---|
| Screws | MS24694-S5 | (48 pcs.) |
| Nutplates | K1000-08 | (48 pcs.) |
| Rivets | MSC-34 | (76 pcs.) |
| Rivets | AN426A3-5 | (20 pcs.) for nose gear door rails. |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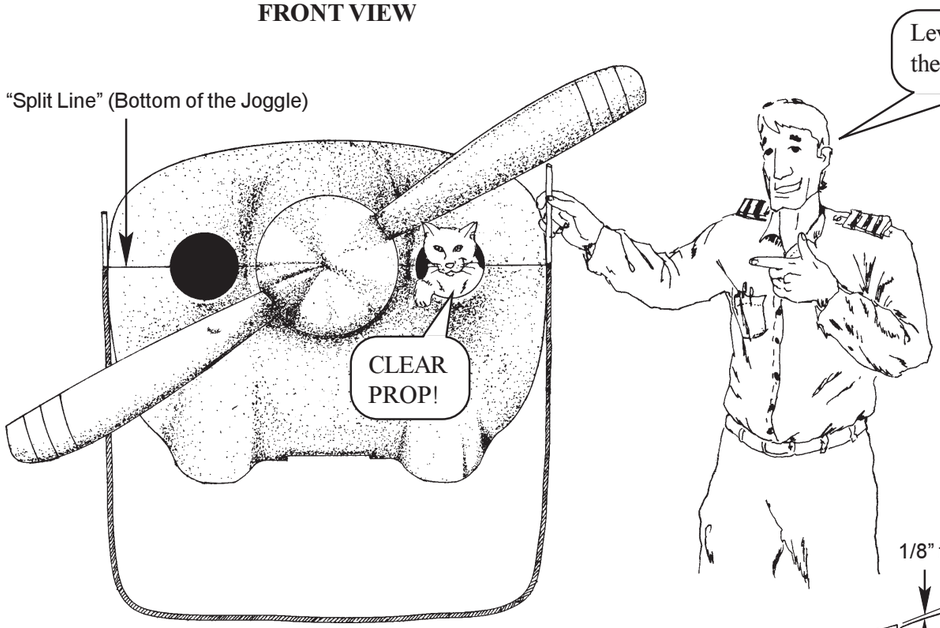
**Cowl Installation (3 Views)**
**Fig. 26:C:2**

**Continental Installation**

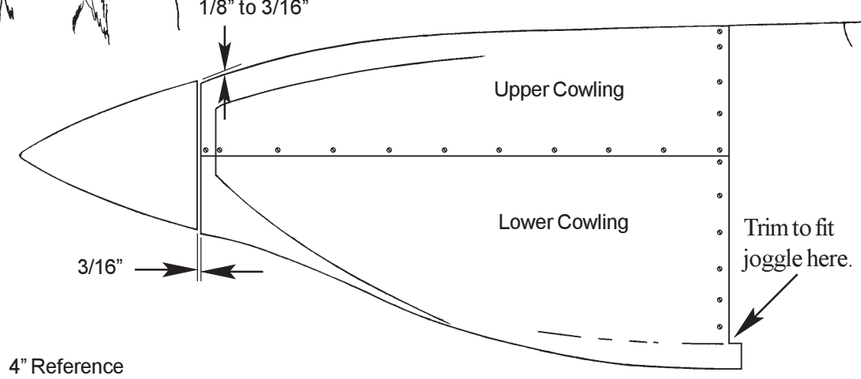
CONTINENTAL MOTORS

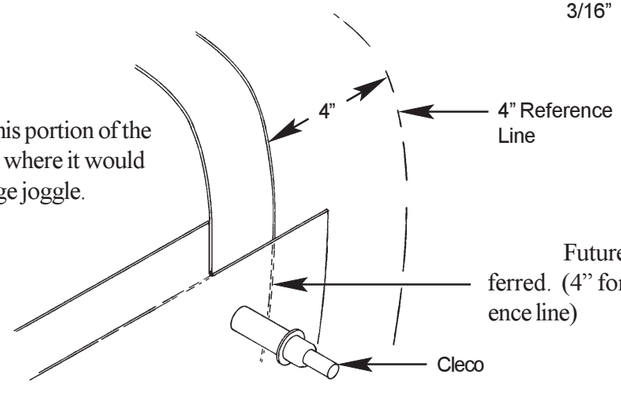
The aircraft must be leveled for reference to fit the cowling.

**FRONT VIEW**



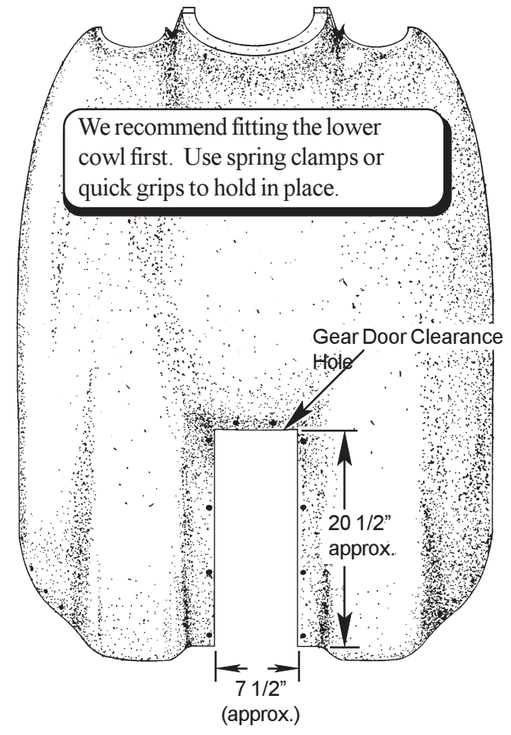

**SIDE VIEW**




**BOTTOM VIEW**

We recommend fitting the lower cowl first. Use spring clamps or quick grips to hold in place.




Gradually trim the gear door opening to custom fit your cowling. The dimensions given are approximate only.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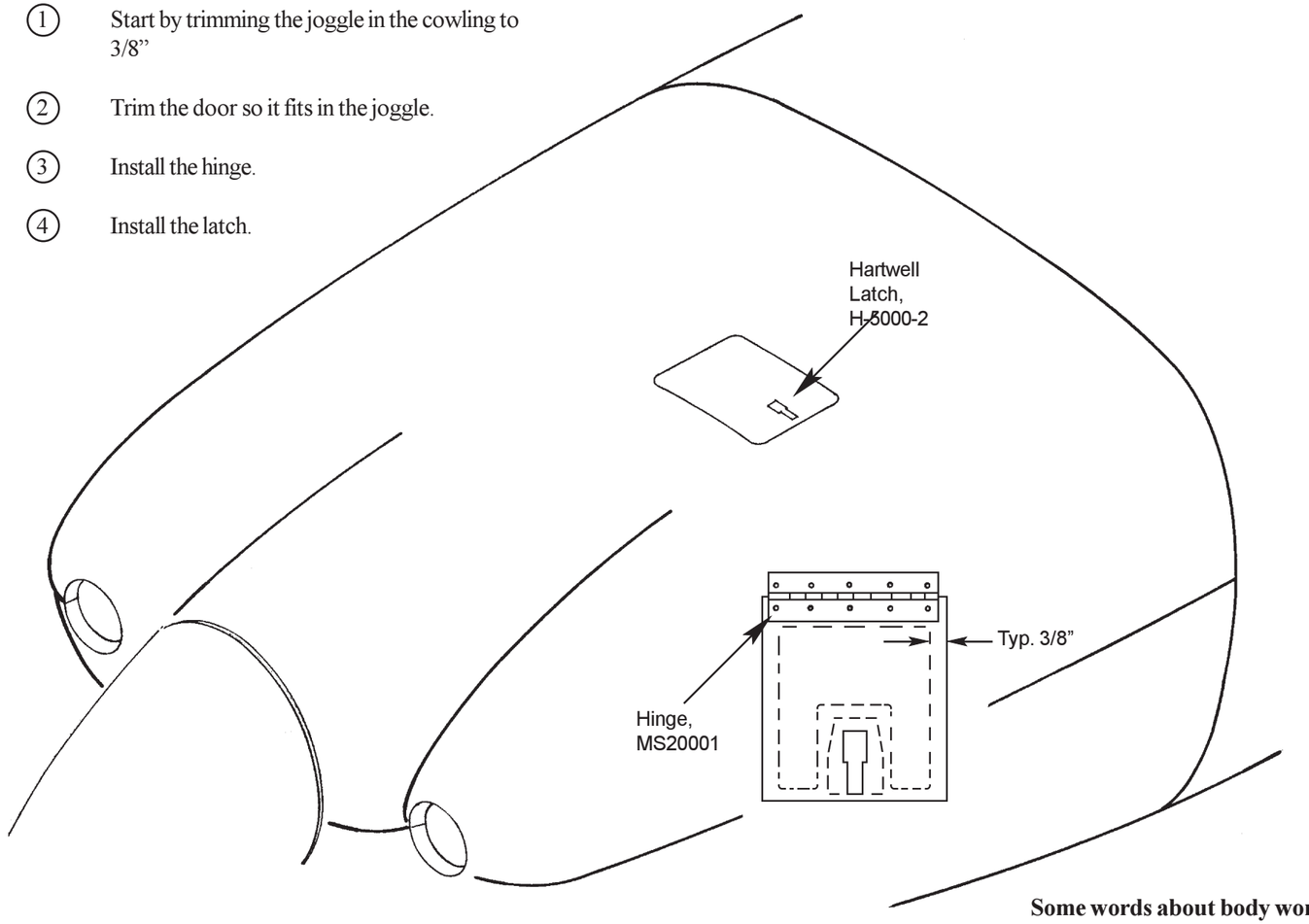
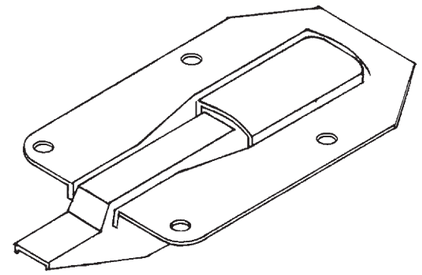
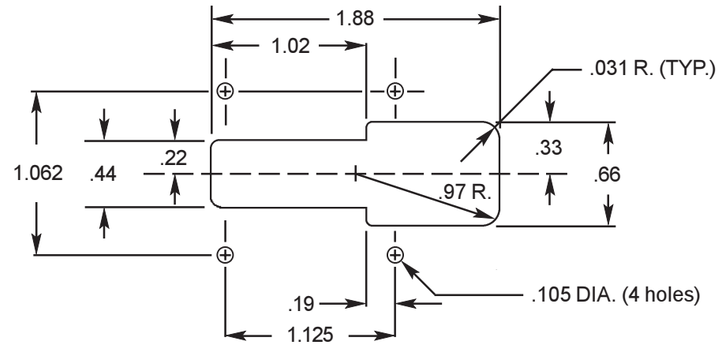
**Oil Access Door**
**Fig. 26:C:3**

1. Start by trimming the joggle in the cowling to 3/8”
2. Trim the door so it fits in the joggle.
3. Install the hinge.
4. Install the latch.






**SUGGESTED CUTOUT**

**Some words about body working the cowling!**

Micro finishing the seam between fuselage and cowl. With the cowl installed, prep and spread a layer of micro (thickness as required but thin as possible) along the joint between cowl and fuselage. Don’t bother laying release tape or anything else, just spread the micro right over the seam.

When the micro is slightly firm, but not set up, take a kinife blade (twisted sideways just a little) and run it around the joint. It is easy to stay in the joggle, just keep the knife blade against the cowl edge which has a good edge and keep the knife twisted just a little to set the size of the gap. The micro will mound up just a bit - that’s o.k. Make this quick, simple circling maneuver and then let the micro cure. Sand smooth, remove the cowl, give it a little final prep and you’ve got a great seam!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## D. Baffling

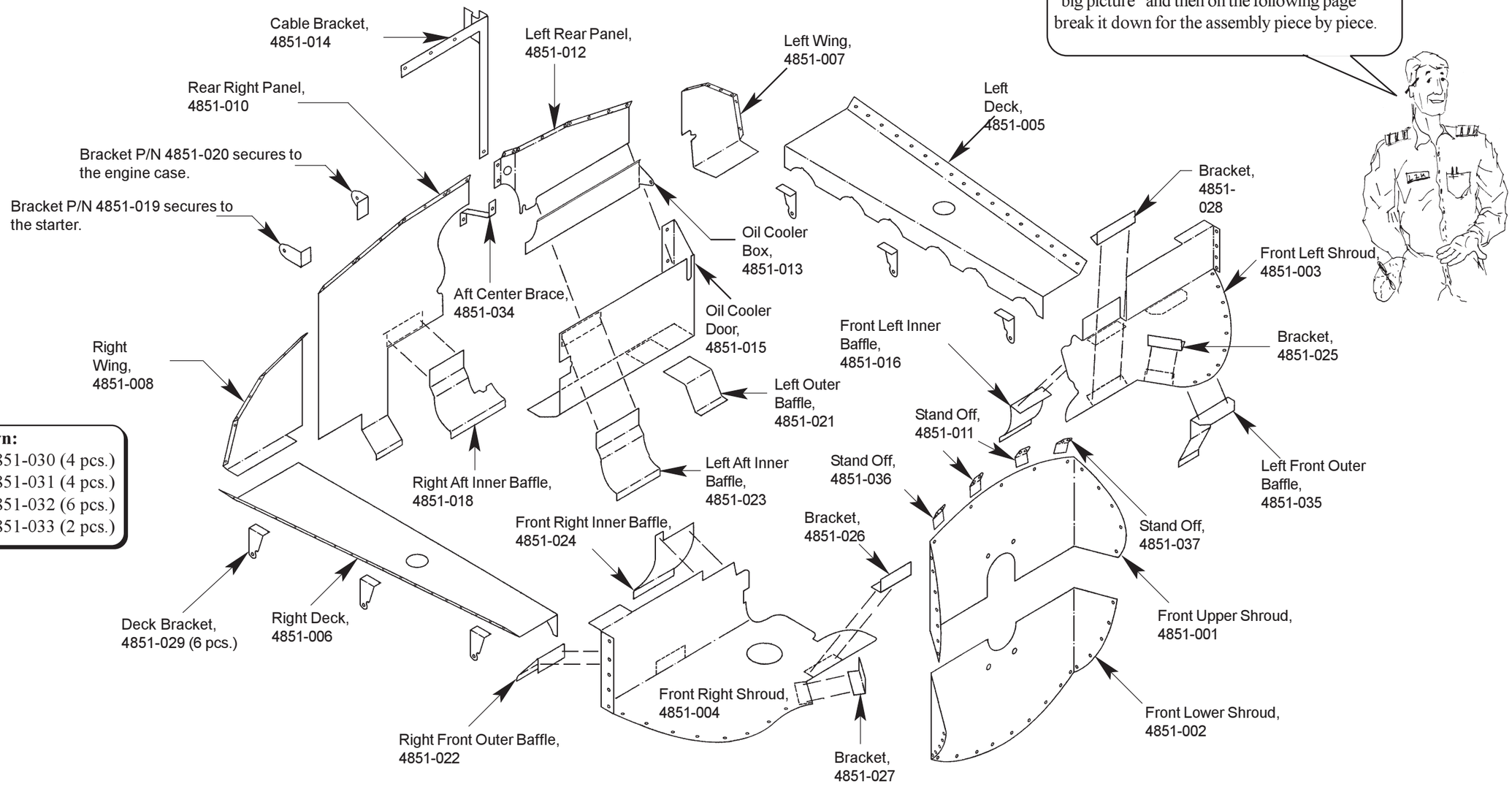
**Baffling Exploded View**
**Fig. 26:D:1**

The baffling is at first glance, a lot of odd looking pieces of aluminum. If taken systematically, it's not too tough to install. The factory new Continental 550 engines all come with the center, lower cylinder baffles already in place. If you don't have a factory new engine, be sure to install these baffles as they are critical.

**Continental Installation**

CONTINENTAL MOTORS

We'll start with an exploded view for the "big picture" and then on the following page break it down for the assembly piece by piece.




**Pieces not shown:**

| | | |
|---|---|---|
| Support | : | 4851-030 (4 pcs.) |
| Support | : | 4851-031 (4 pcs.) |
| Support | : | 4851-032 (6 pcs.) |
| Support | : | 4851-033 (2 pcs.) |



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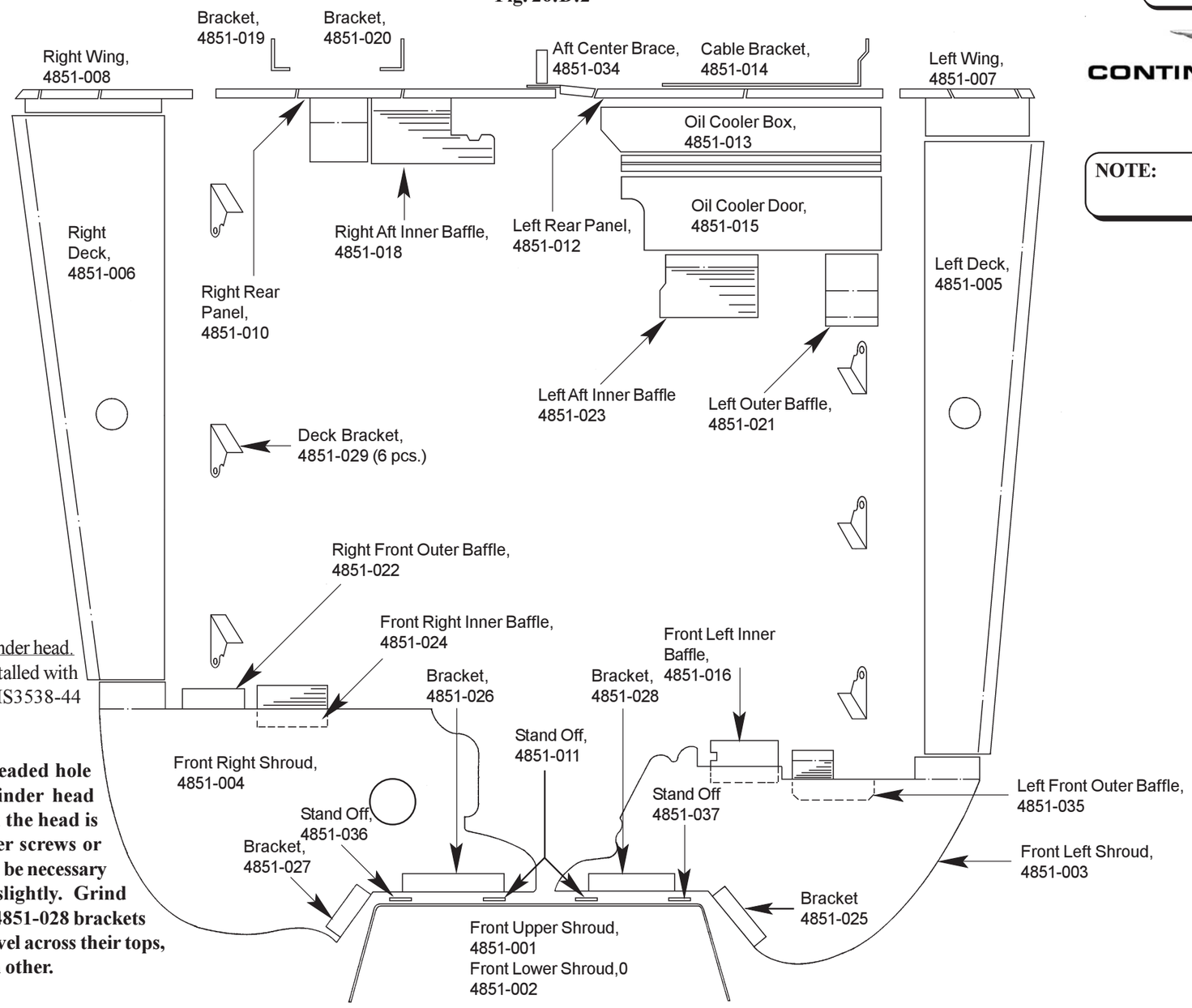
**Baffling Alternate View**
**Fig. 26:D:2**




**Continental Installation**

CONTINENTAL MOTORS

**NOTE:** **Install oil cooler now. It is too difficult to reach later.**

C1. Install 6 (-021) brackets, one to each cylinder head.
Use: Six 4851-029 steel brackets installed with AN500-A416-6 Screws and MS3538-44 lockwashers.

**NOTE:** **These screw into the threaded hole located between the cylinder head valve covers. The hole in the head is shallow, do not use longer screws or bolts. Local grinding may be necessary as the castings can vary slightly. Grind only enough to allow the 4851-028 brackets to set flat and relatively level across their tops, ie: in alignment with each other.**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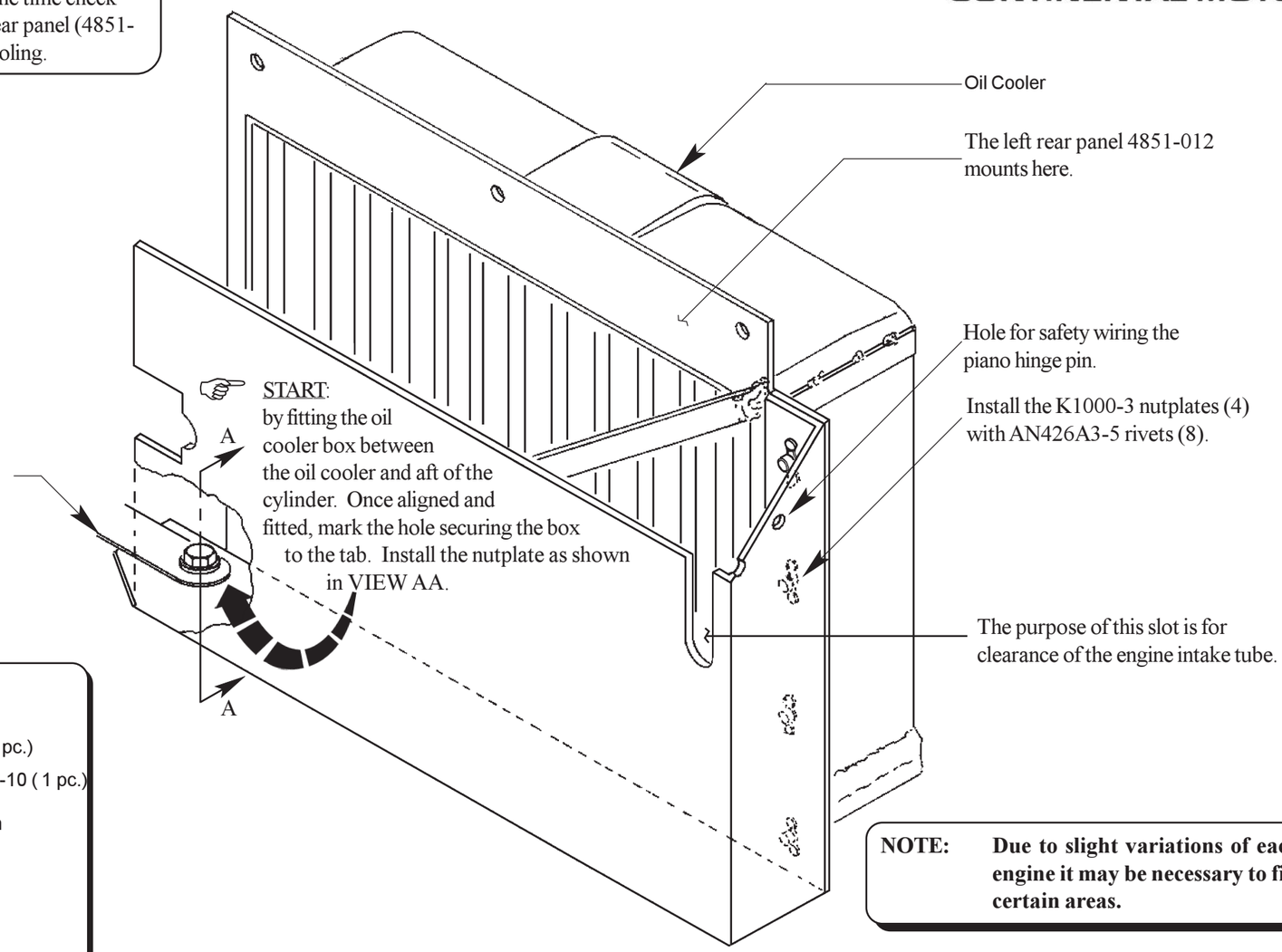
**Oil Cooler Box Installation**
**Fig. 26:D:3**

**Continental Installation**

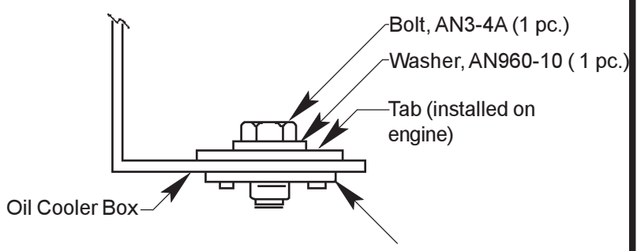
CONTINENTAL MOTORS

When installing the baffling it is particularly important to understand how the pieces fit together. For example, when installing the oil cooler box 4851-013, at the same time check the fit to the left wing (4851-007) and the left rear panel (4851-012). It is crucial to get a good fit for proper cooling.

Tab on engine




**VIEW AA**




Install the K1000-3 nutplate with (2) AN426A3-5 rivets.

**NOTE:** **Due to slight variations of each engine it may be necessary to file certain areas.**



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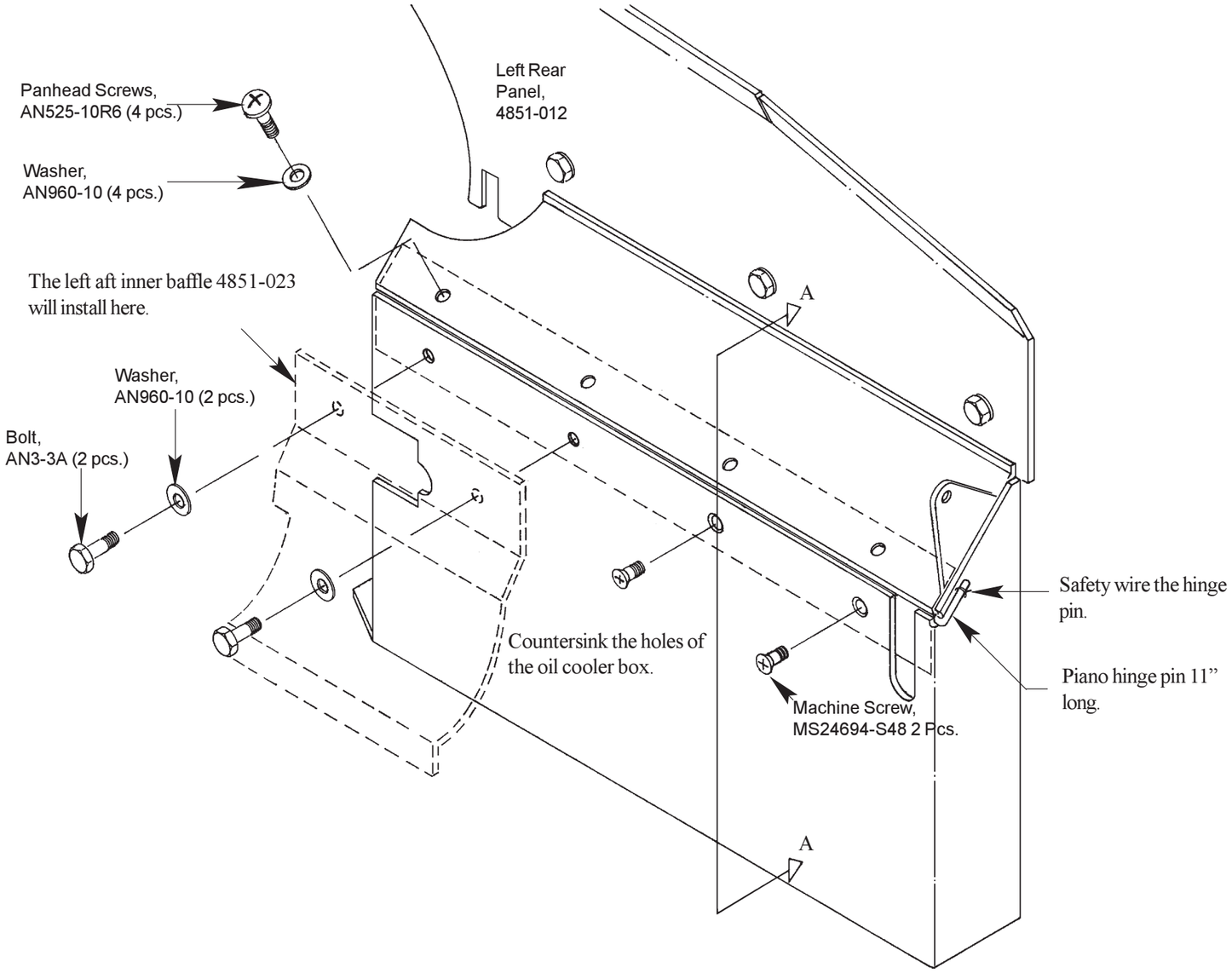
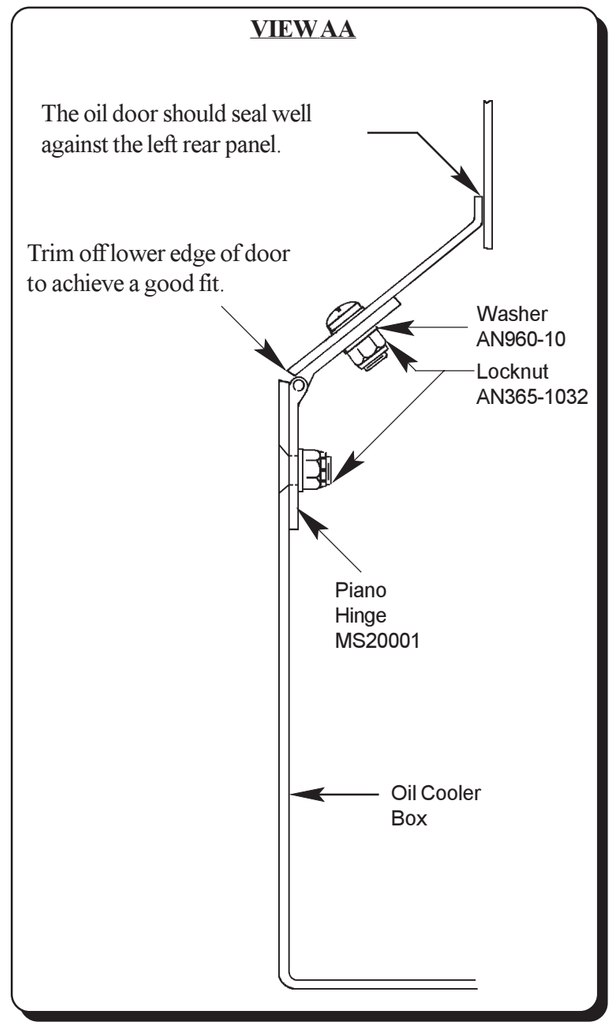
**Oil Door Installation**
**Fig. 26:D:4**

**Continental Installation**

CONTINENTAL MOTORS



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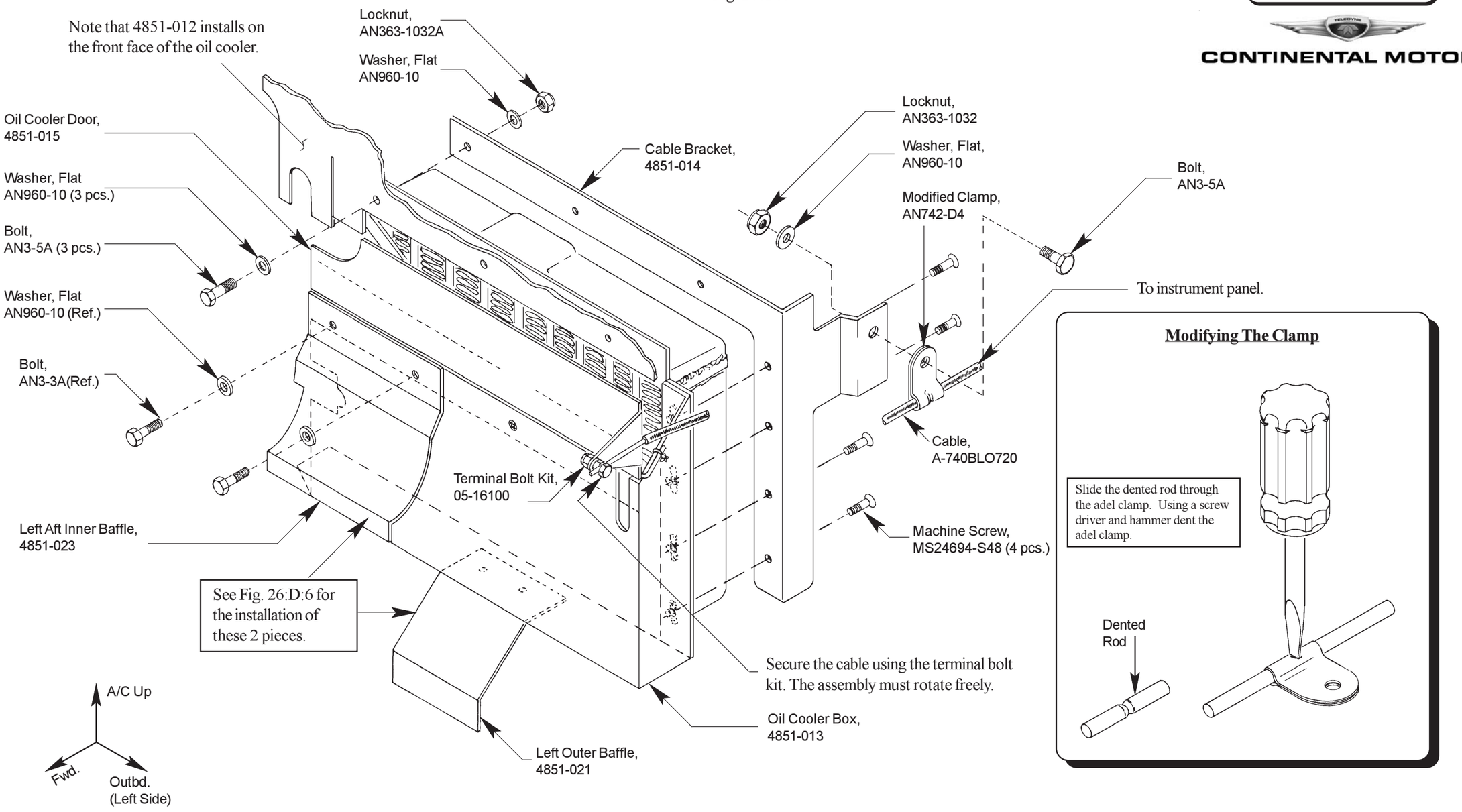
**Oil Cooler Box Installation**
**Fig. 26:D:5**

**Continental Installation**

CONTINENTAL MOTORS




**Modifying The Clamp**





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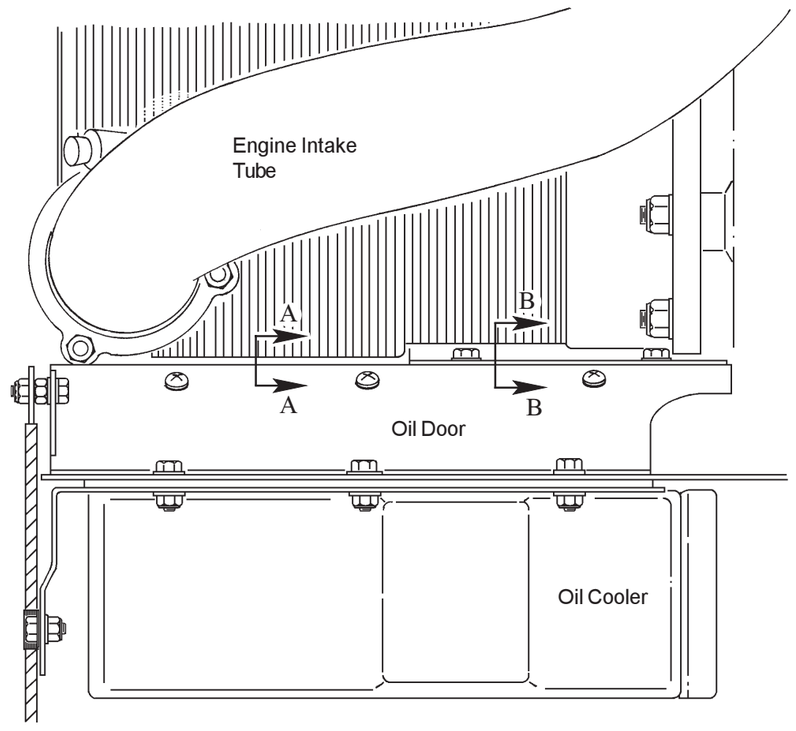
**Left Baffles Installation**
**Fig. 26:D:6**

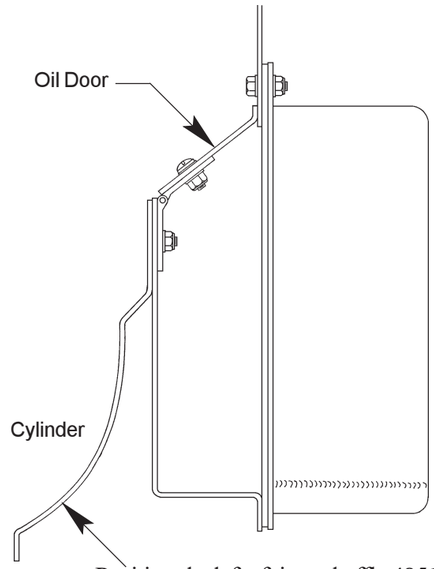
**Continental Installation**

CONTINENTAL MOTORS

**TOP VIEW**

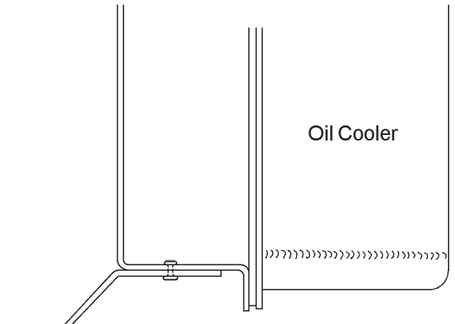



**VIEW BB**




Position the left aft inner baffle 4851-023 to get a tight fit against the cylinder.

**VIEWAA**




Position the left outer baffle 4851-021 to get a nice fit against the cylinder.



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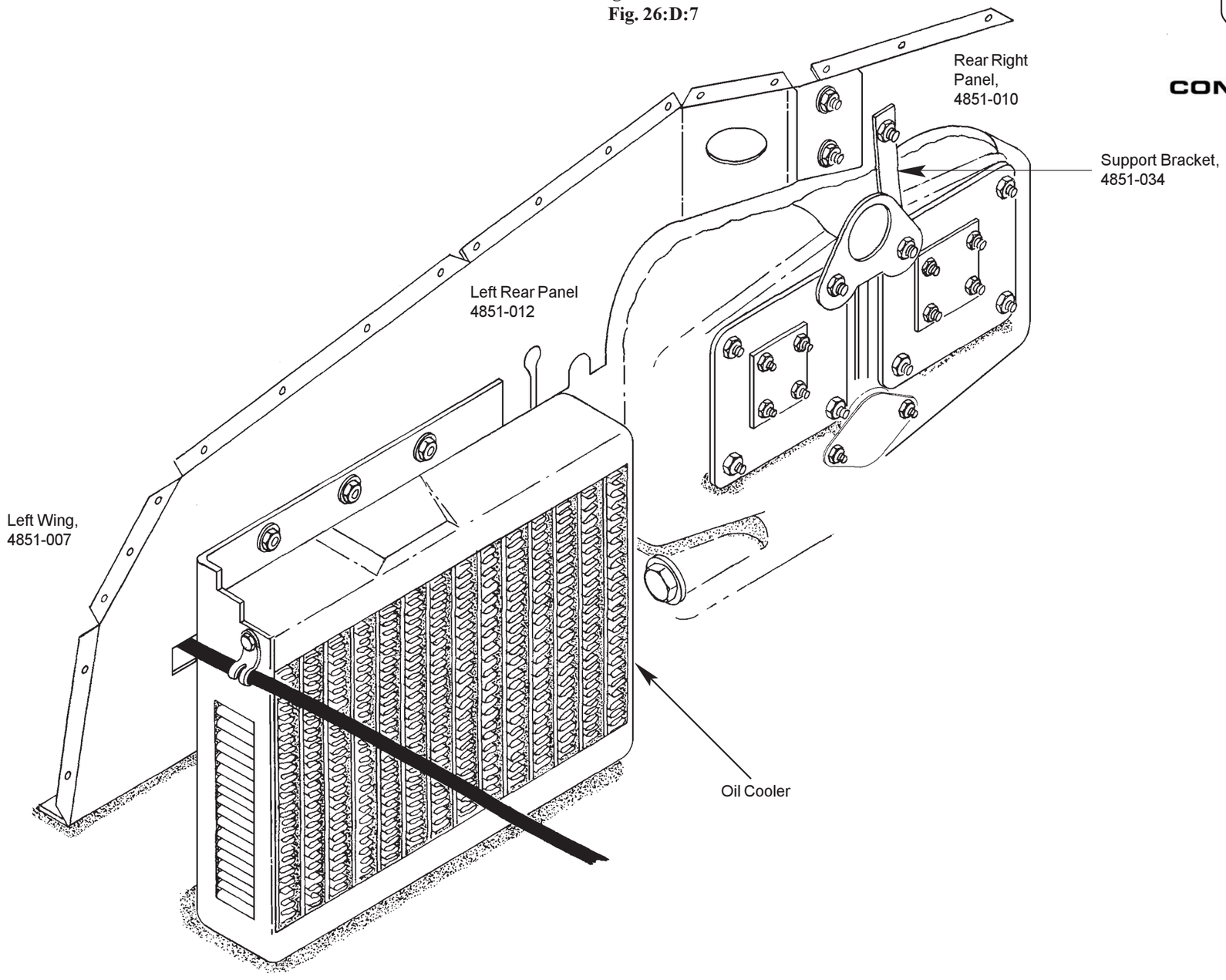
**Baffling Aft Left Corner**
**Fig. 26:D:7**





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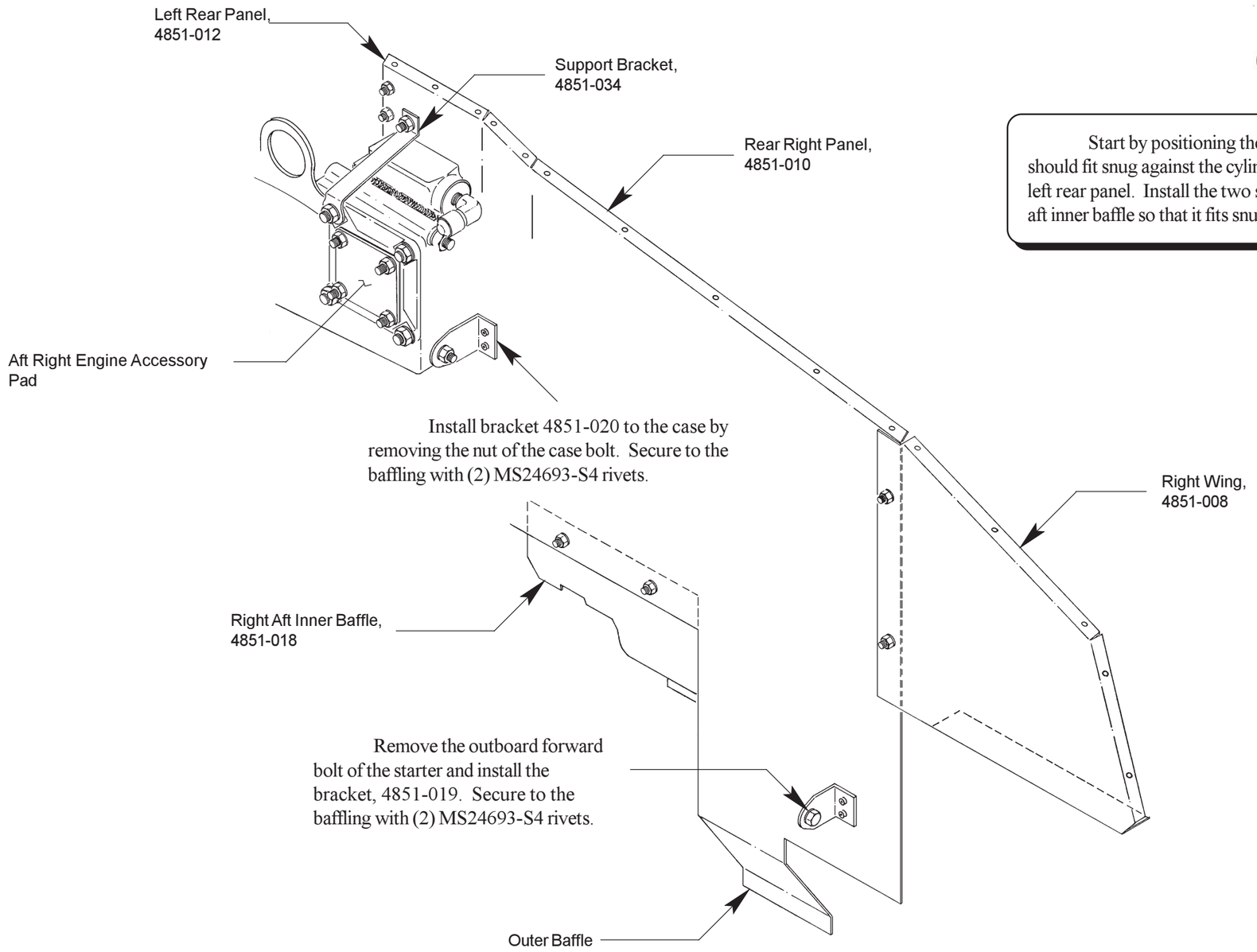
CONTINENTAL MOTORS

## Installing Right Rear Panel
## Fig. 26:D:8




Start by positioning the right rear panel. The outer baffle should fit snug against the cylinder. Once filled align and attach to its left rear panel. Install the two support brackets. Position the right aft inner baffle so that it fits snug against the cylinder baffling.

Install bracket 4851-020 to the case by removing the nut of the case bolt. Secure to the baffling with (2) MS24693-S4 rivets.

Remove the outboard forward bolt of the starter and install the bracket, 4851-019. Secure to the baffling with (2) MS24693-S4 rivets.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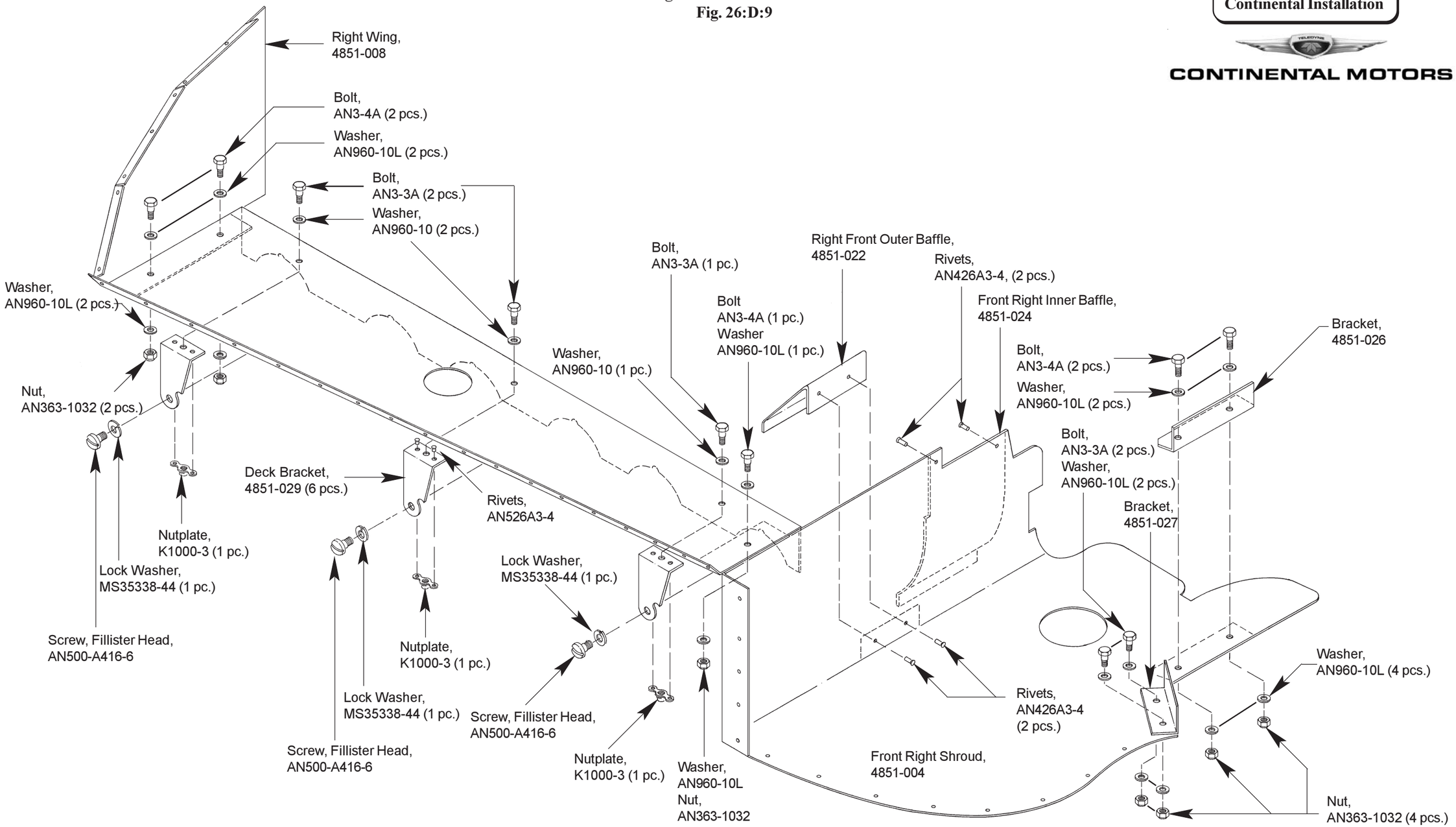
**Right Baffles Installation**
**Fig. 26:D:9**

**Continental Installation**

CONTINENTAL MOTORS



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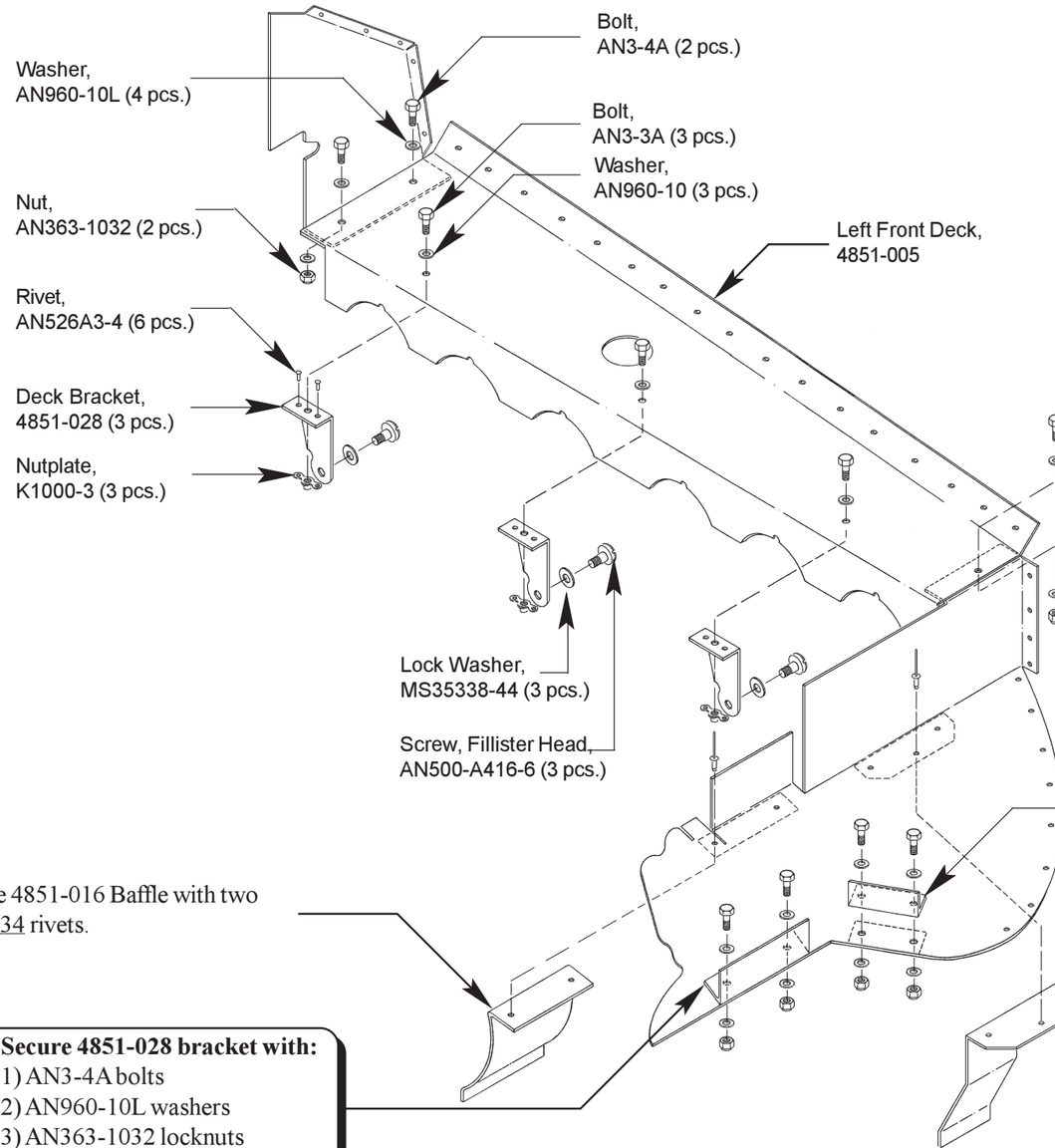
**Left Baffles Installation**
**Fig. 26:D:10**

**Continental Installation**

CONTINENTAL MOTORS




**Secure 4851-005 left front deck to the baffle with:**
1) AN3-4A bolts
2) AN960-10L washers
3) AN363-1032 locknuts

Baffle pieces 4851-035 and 4851-016 should fit snug up against the cylinder.

**Secure 4851-025 bracket with:**
1) AN3-4A bolts
2) AN960-10L washers
3) AN363-1032 locknuts

Secure 4851-016 Baffle with two MSC-34 rivets.

Secure 4851-035 Baffle with three MSC-34 rivets.

**Secure 4851-028 bracket with:**
1) AN3-4A bolts
2) AN960-10L washers
3) AN363-1032 locknuts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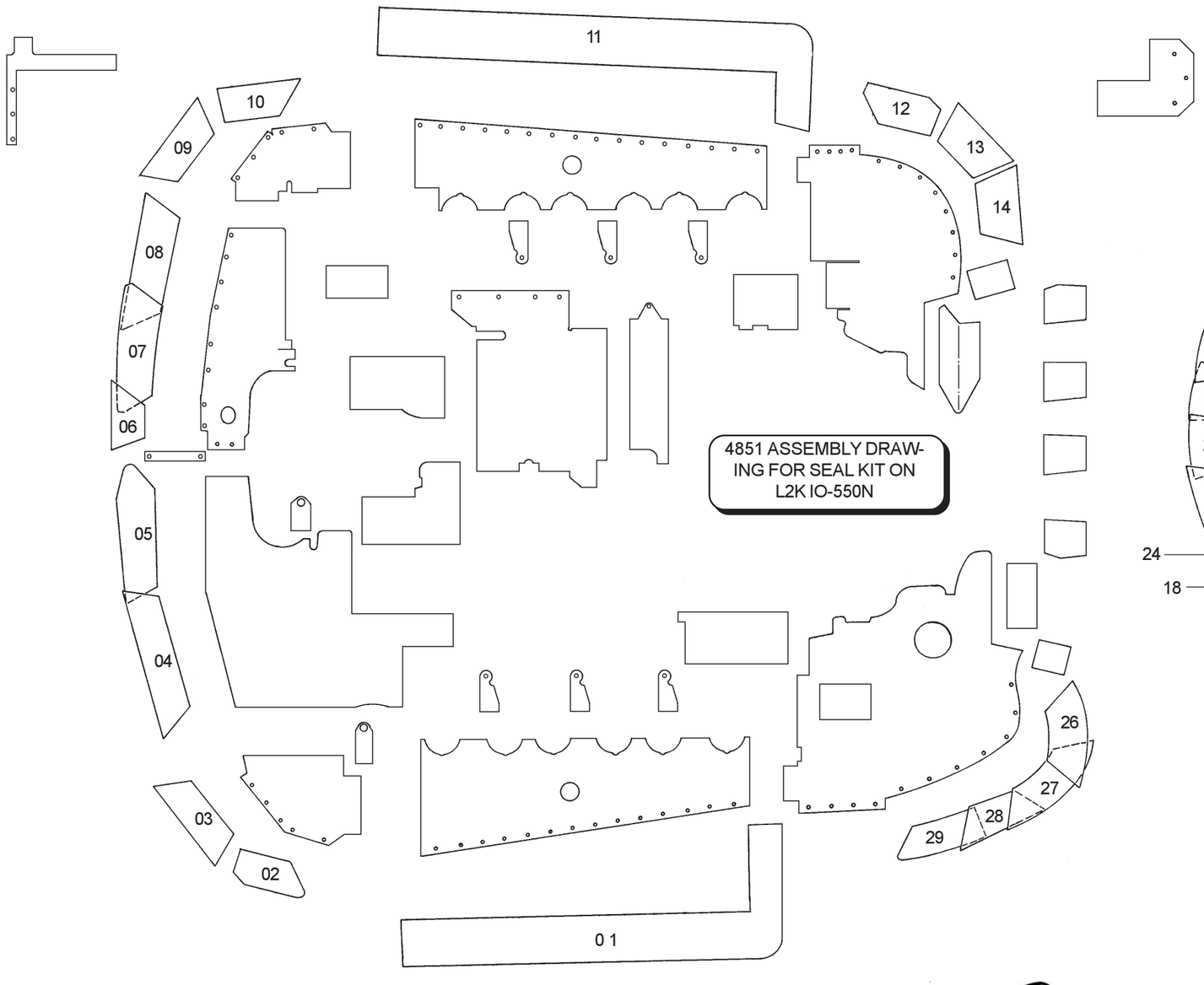
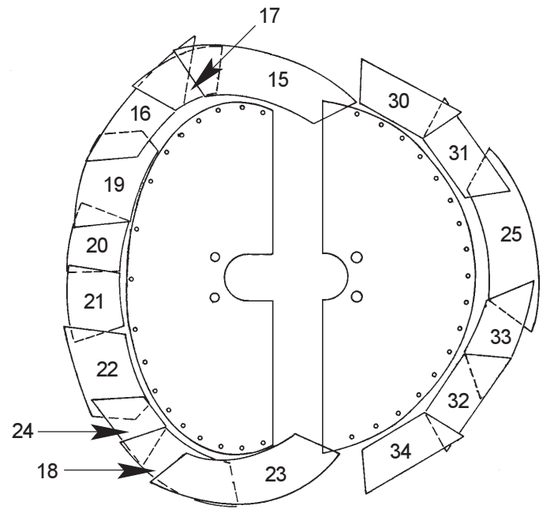
**Baffling Seal**
**Fig. 26:D:11**

**Continental Installation**

CONTINENTAL MOTORS





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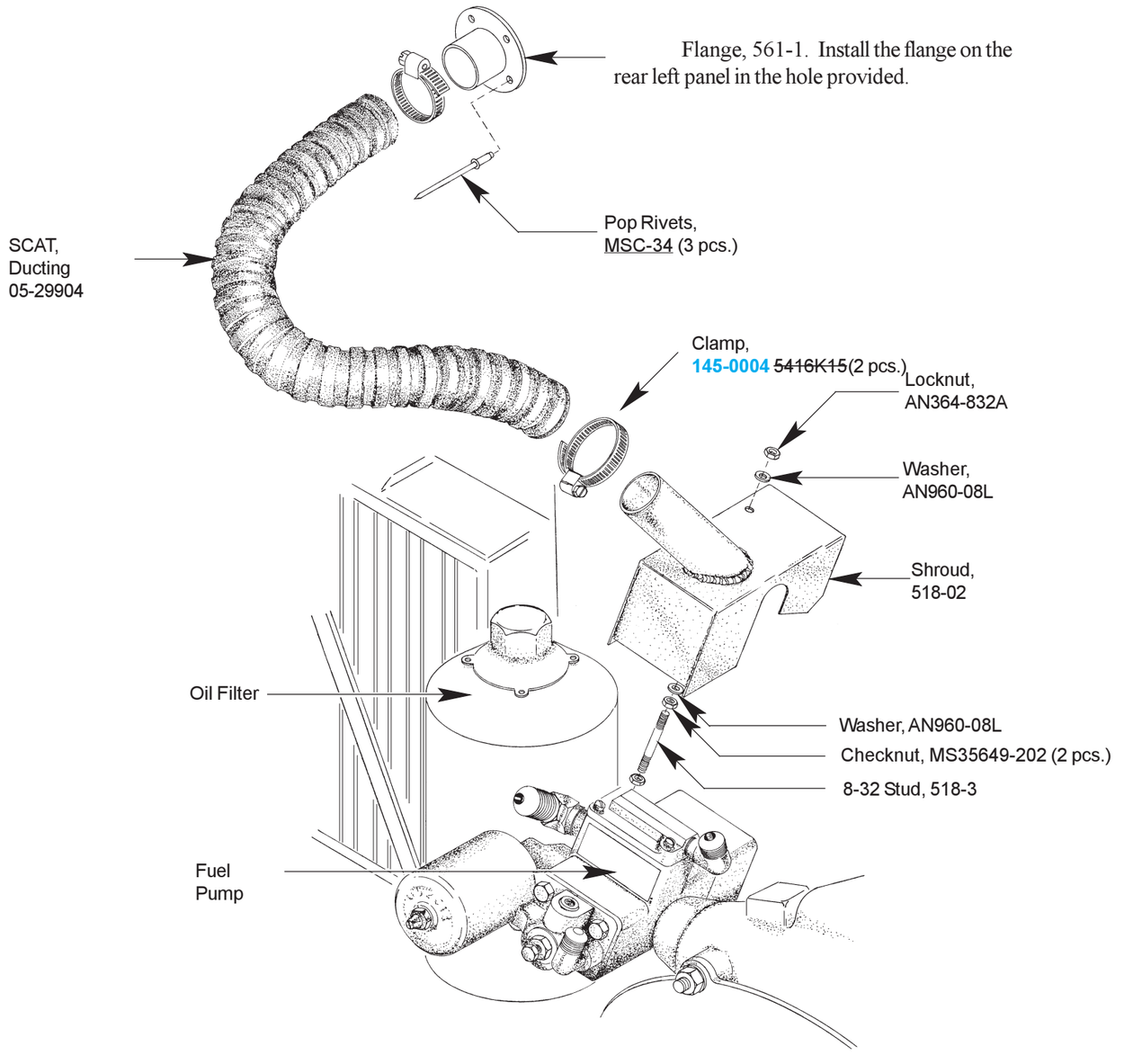
**Fuel Pump Shroud**
**Fig. 26:D:12**



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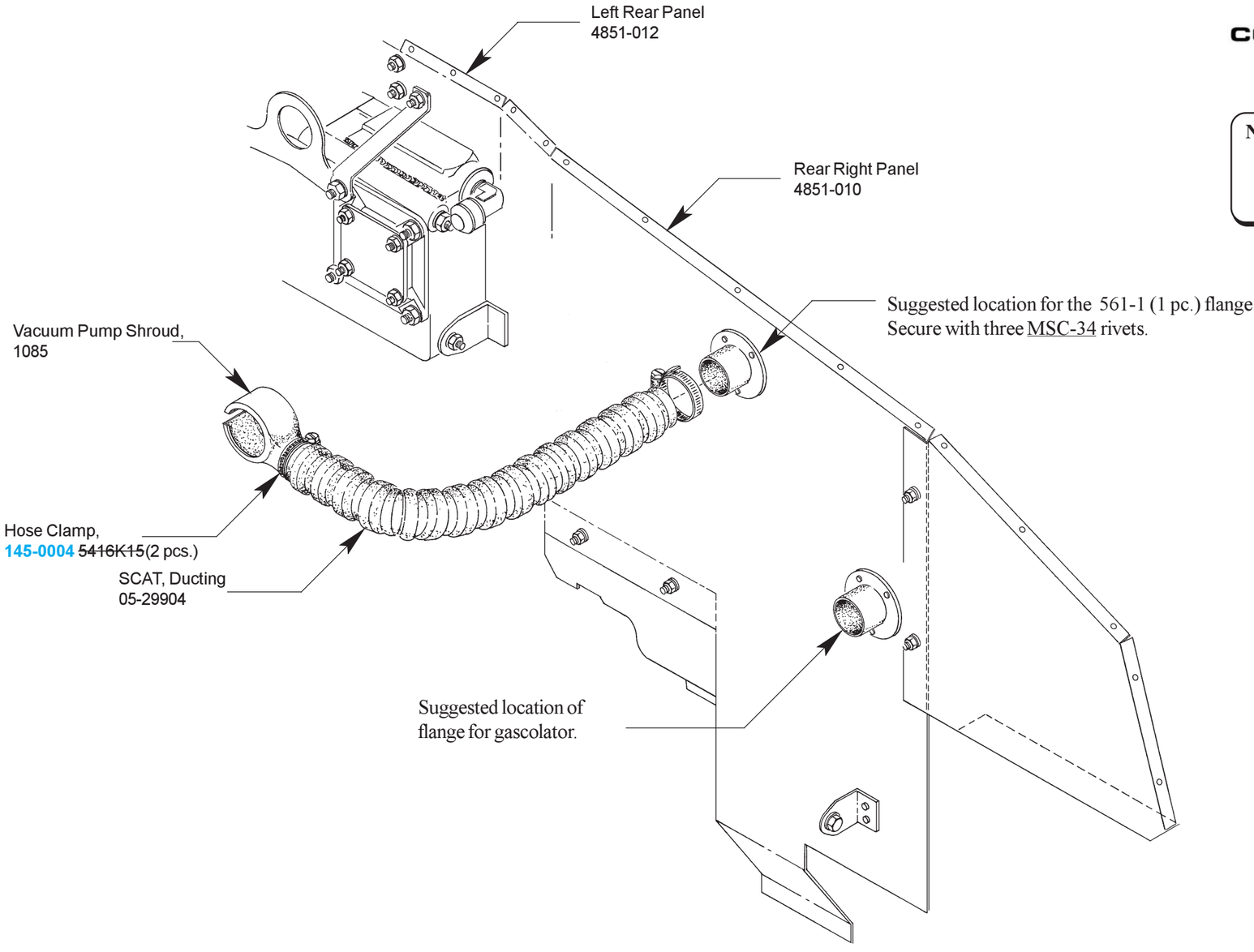
**Right Rear Panel**
**Fig. 26:D:13**

**Continental Installation**

CONTINENTAL MOTORS

**Note: If you have a vacuum pump we suggest that you install the vacuum pump shroud to keep the vacuum pump cool.**





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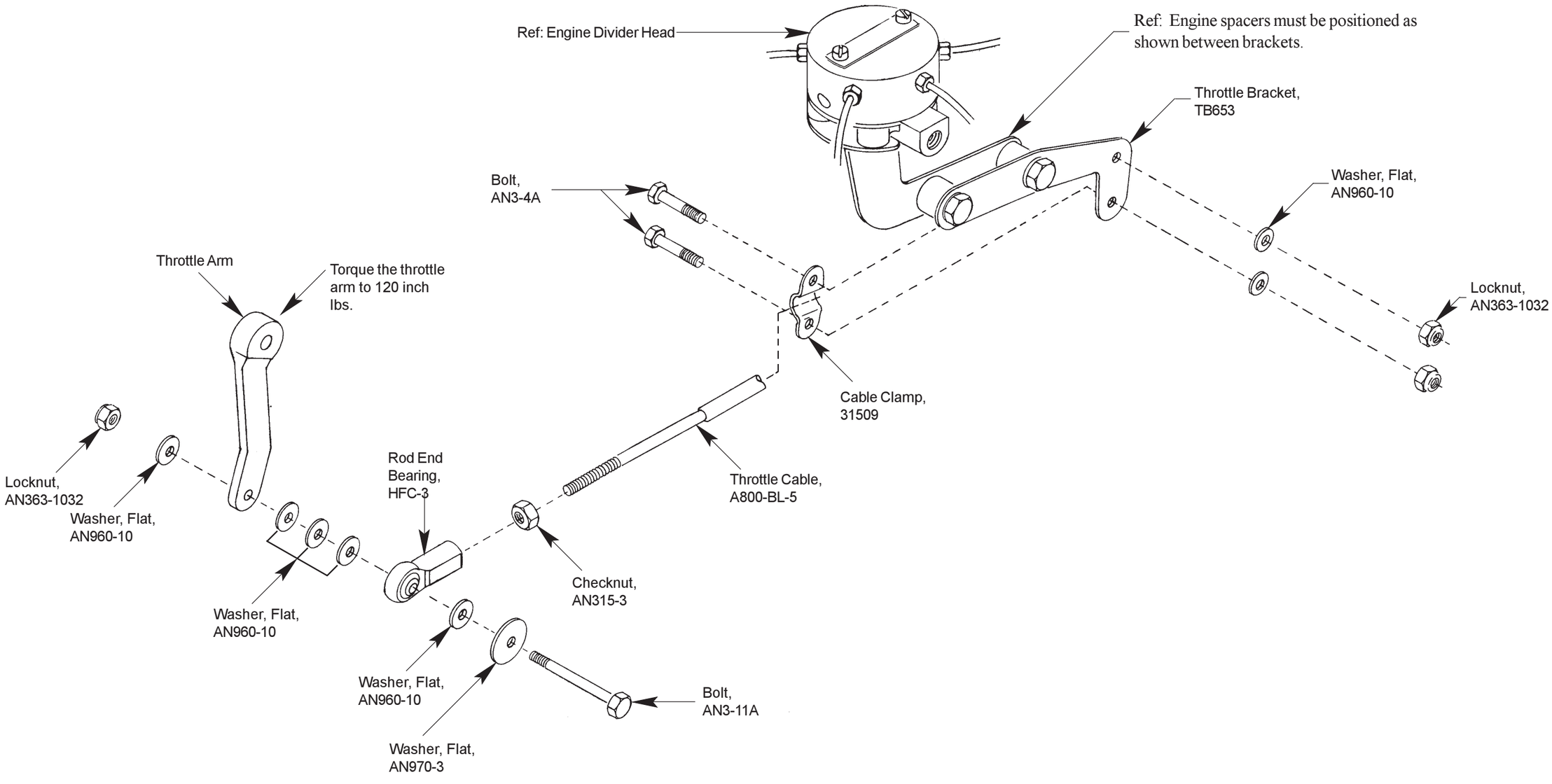
Continental Installation

CONTINENTAL MOTORS

**Throttle Cable Attach Bracket**
**Fig. 26:E:1**





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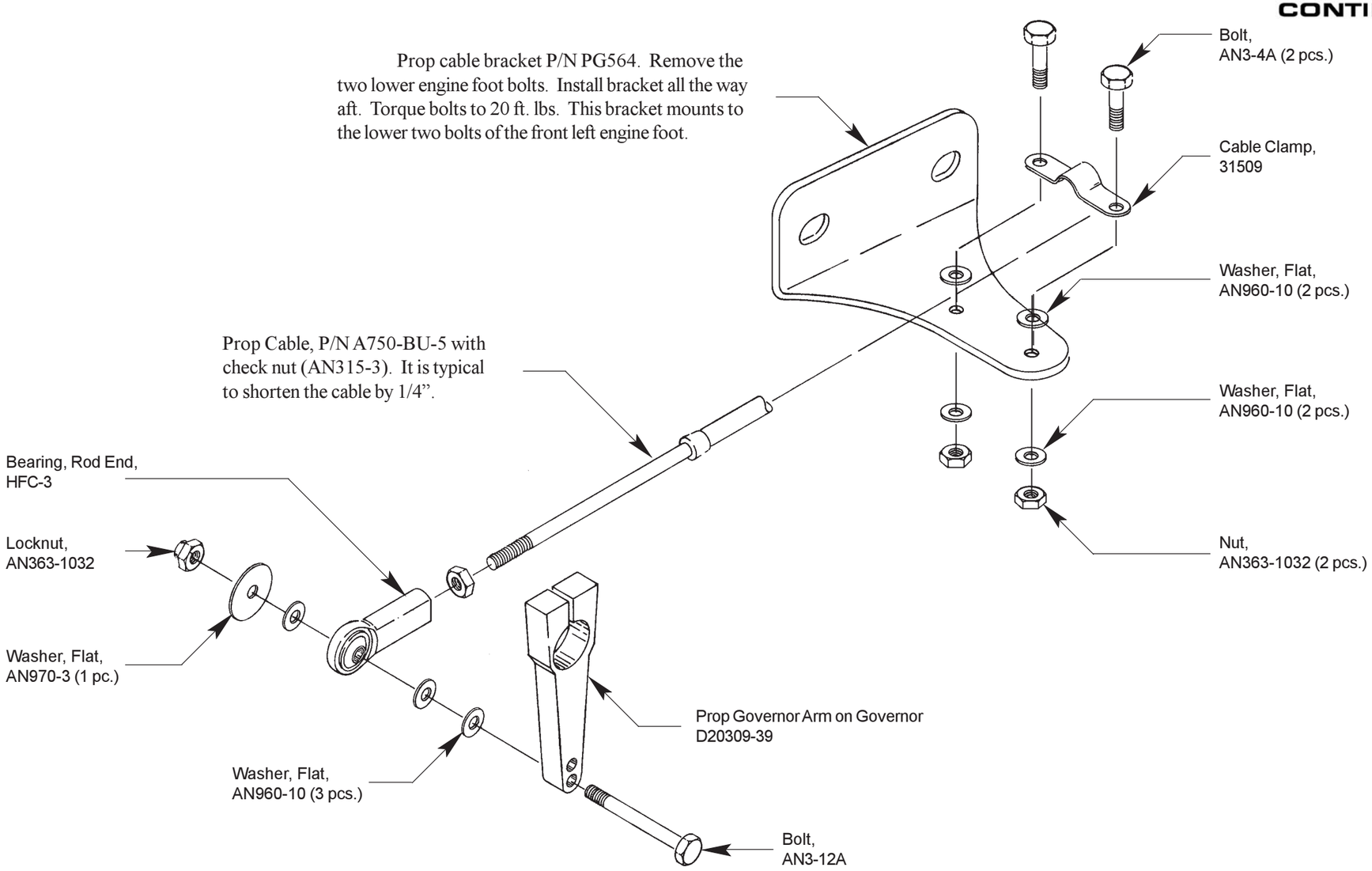
**Prop Governor Cable Installation**
**Fig. 26:E:2**

**Continental Installation**

CONTINENTAL MOTORS

Prop cable bracket P/N PG564. Remove the two lower engine foot bolts. Install bracket all the way aft. Torque bolts to 20 ft. lbs. This bracket mounts to the lower two bolts of the front left engine foot.

Prop Cable, P/N A750-BU-5 with check nut (AN315-3). It is typical to shorten the cable by 1/4".





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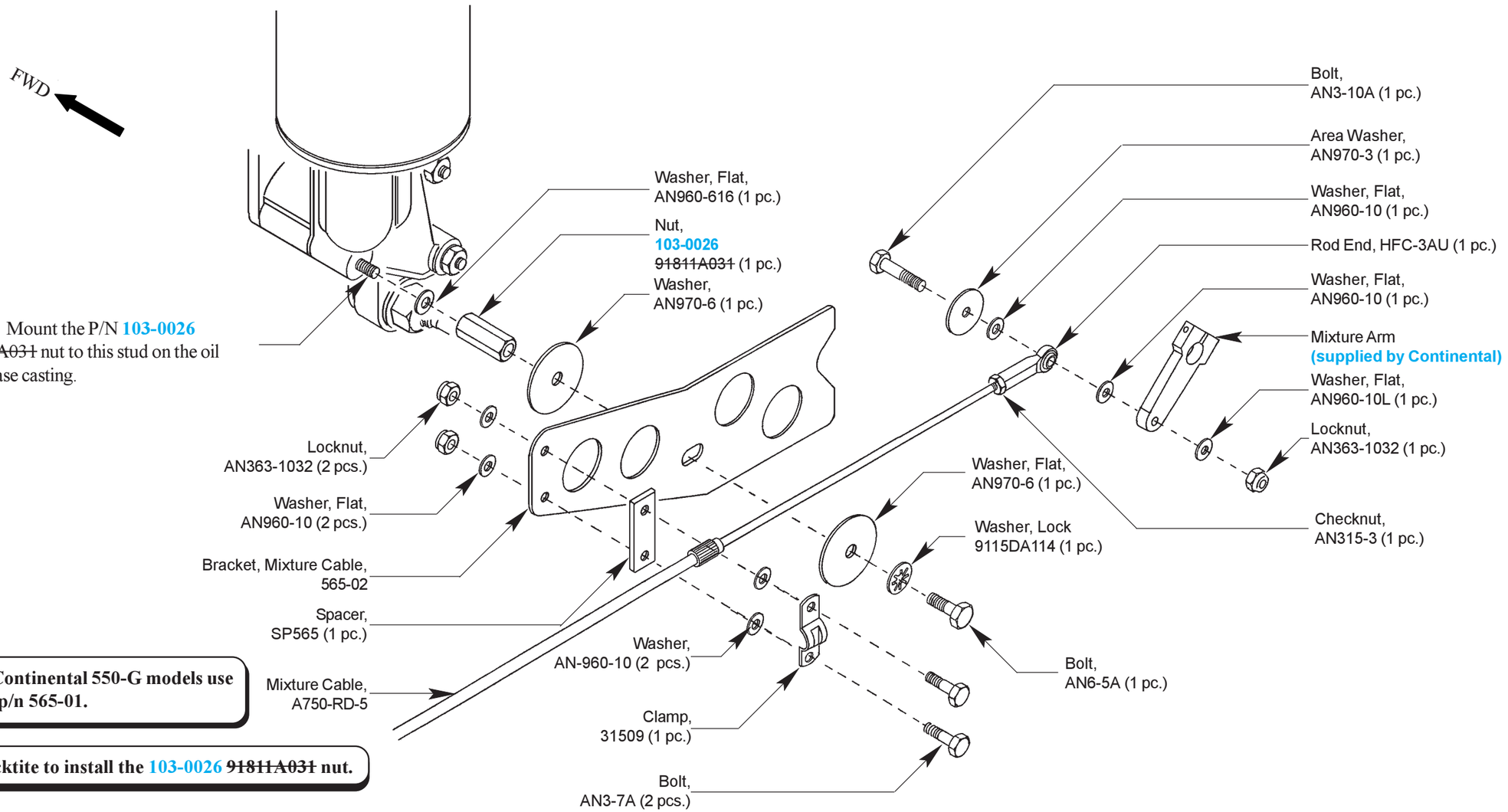
**Mixture Control Installation**
**Fig. 26:E:3**

**Continental Installation**

CONTINENTAL MOTORS

Install the mixture cable per Figure 26:D:2. the 565-1 bracket installs on the stud of the oil filter base casting. The inboard end of the 565-1 bracket will fit to the contour of the engine casting. This keeps the bracket firmly in place. Clamp the mixture cable temporarily. Work the mixture cable from lean to rich and adjust as necessary to get proper travel. Adjust the mixture as necessary.




**NOTE: For the Continental 550-G models use bracket p/n 565-01.**

**NOTE: Use Locktite to install the 103-0026 ~~91811A031~~ nut.**



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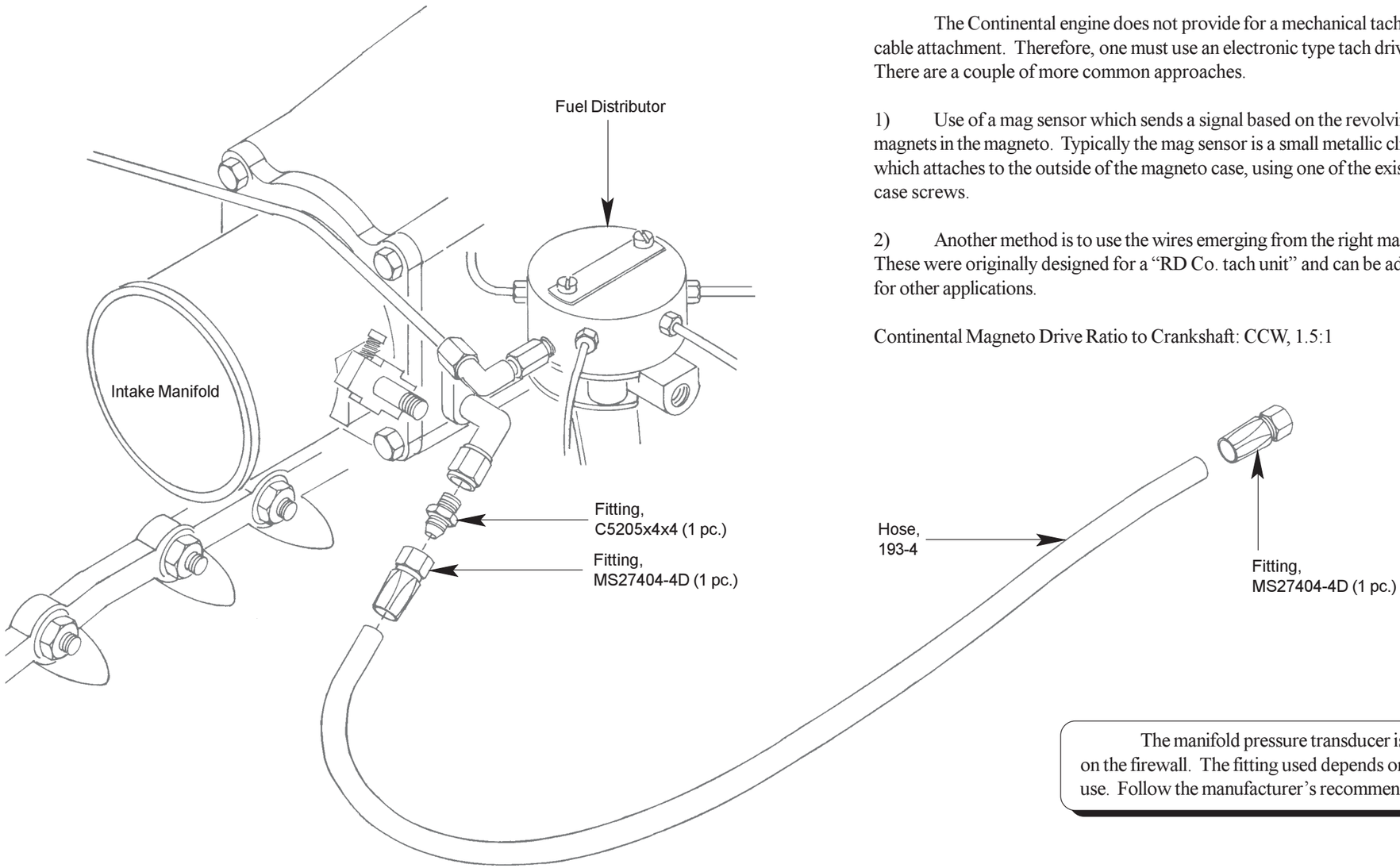
## F. Manifold Pressure and Tachometer

**Manifold Pressure**
**Fig. 26:F:1**

The manifold pressure is picked up at the forward left side of the throttle body. As with all of the engine instrumentation the final size will depend on the type of MP gage you select. We suggest the shown arrangement routed aft to the firewall. Follow the manufacturer's recommendations of the sender installation.




**Continental Installation**

CONTINENTAL MOTORS

### Tachometer

The Continental engine does not provide for a mechanical tach drive cable attachment. Therefore, one must use an electronic type tach drive. There are a couple of more common approaches.

1) Use of a mag sensor which sends a signal based on the revolving magnets in the magneto. Typically the mag sensor is a small metallic clip which attaches to the outside of the magneto case, using one of the existing case screws.

2) Another method is to use the wires emerging from the right mag. These were originally designed for a "RD Co. tach unit" and can be adapted for other applications.

Continental Magneto Drive Ratio to Crankshaft: CCW, 1.5:1

The manifold pressure transducer is normally installed on the firewall. The fitting used depends on which system you use. Follow the manufacturer's recommendations.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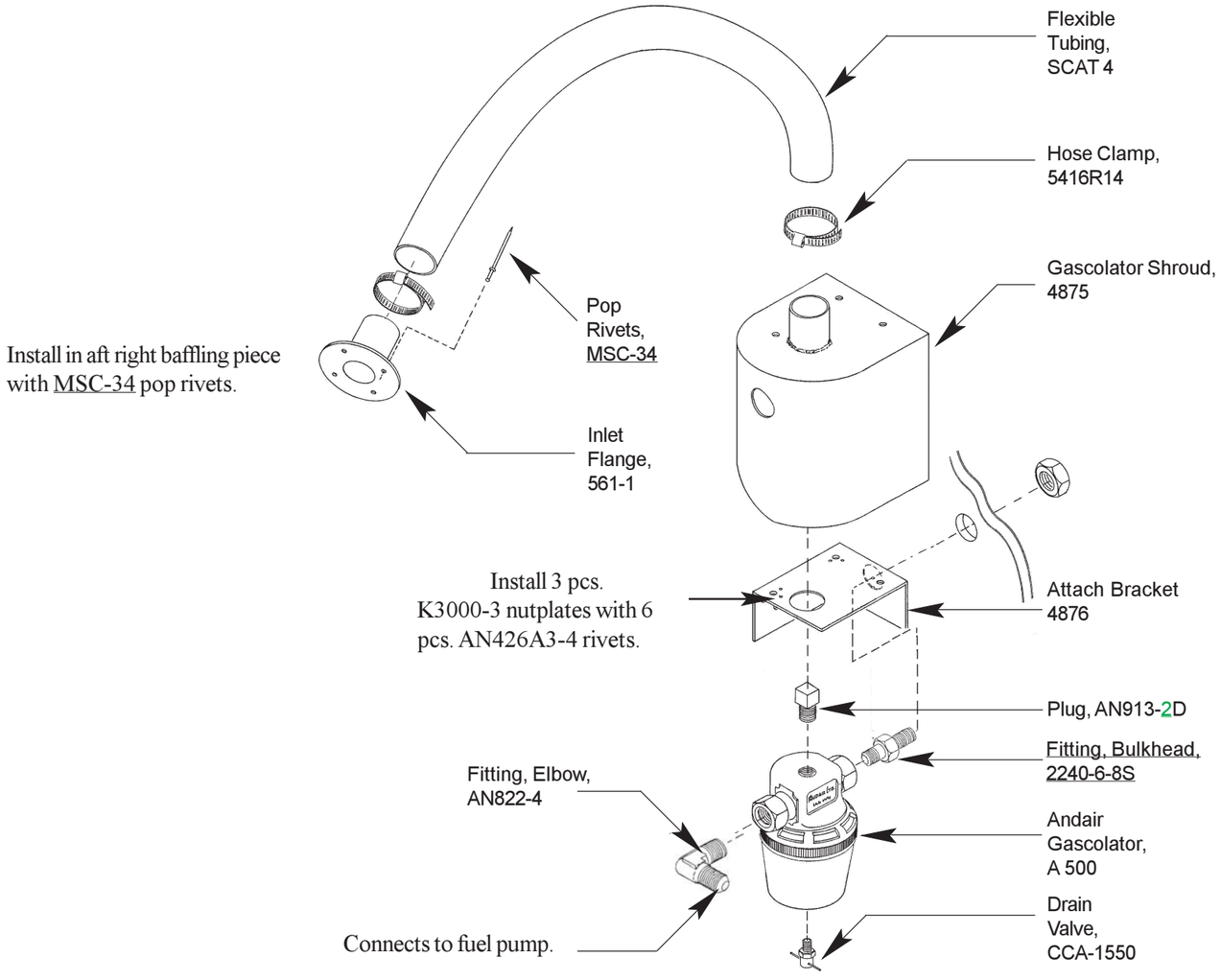
## G. Fuel Systems

Continental Installation

CONTINENTAL MOTORS

The gascolator mounts to the lower right side of firewall. Refer to blueprint #4862 for the location of the gascolator. We suggest creating a coreless area for the gascolator as shown on the blueprint. Remove a 2" diameter section of the aft laminate and corecentered on the gascolator location. Reinforce with 4-BID. Assemble and install the gascolator as shown.

**Gascolator Installation**
**Fig. 26:G:1**





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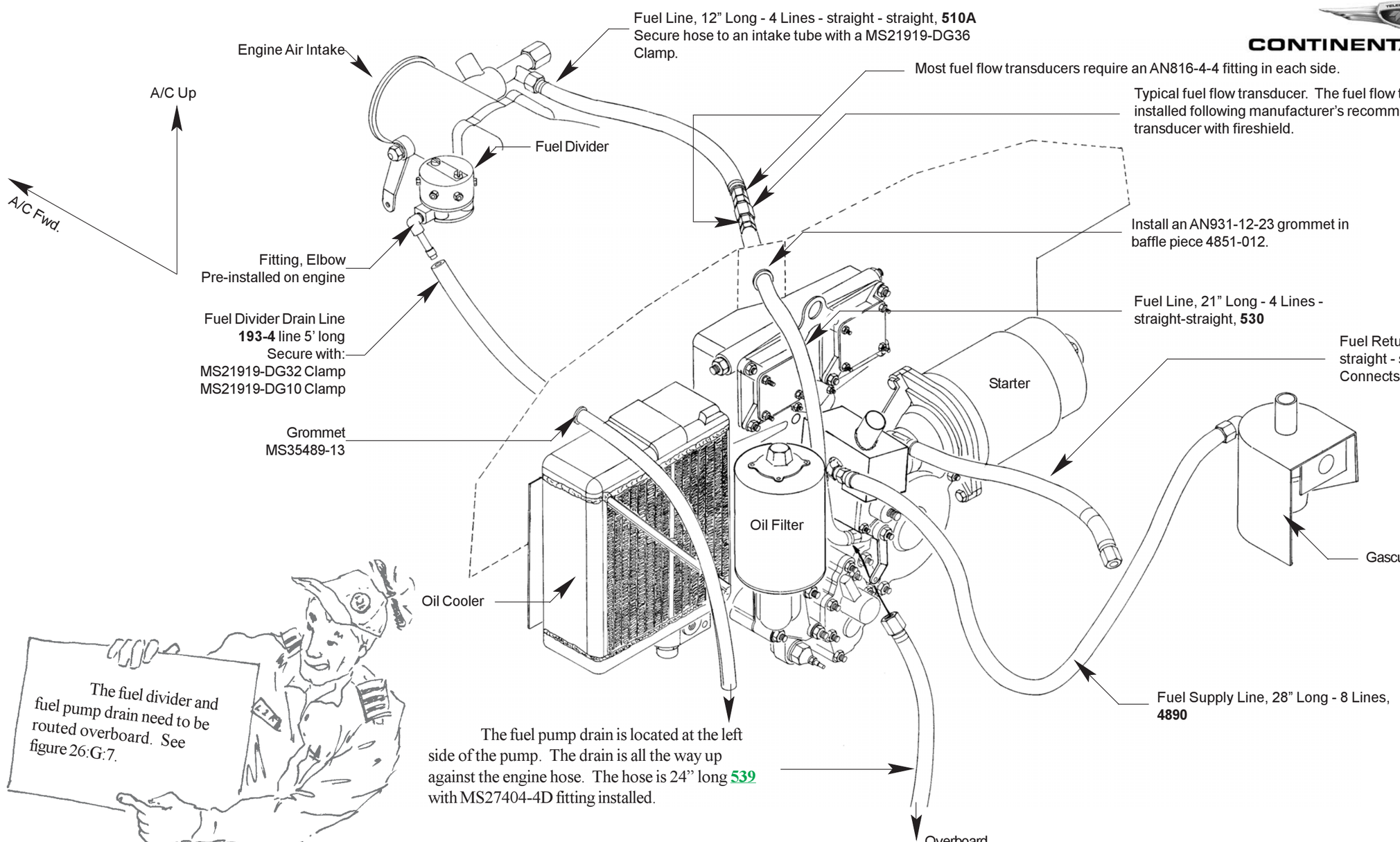
## Primary Fuel System Layout
## Fig. 26:G:2

**Continental Installation**

CONTINENTAL MOTORS







The fuel pump drain is located at the left side of the pump. The drain is all the way up against the engine hose. The hose is 24” long **539** with MS27404-4D fitting installed.



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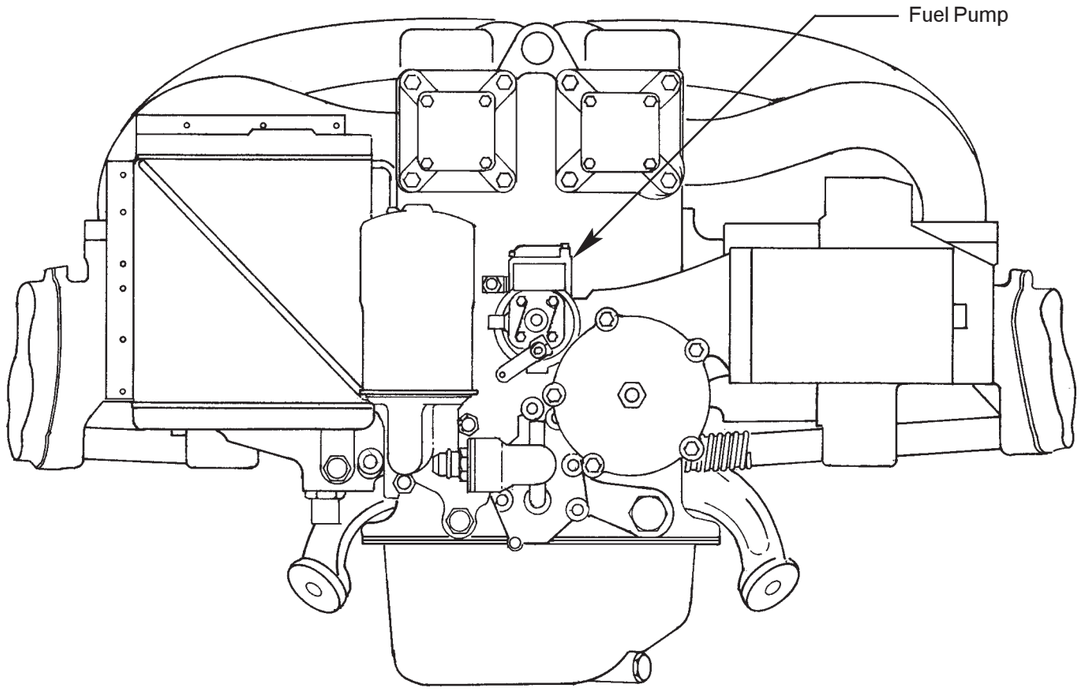
**Engine Driven Fuel Pump**
**Fig. 26:G:3**

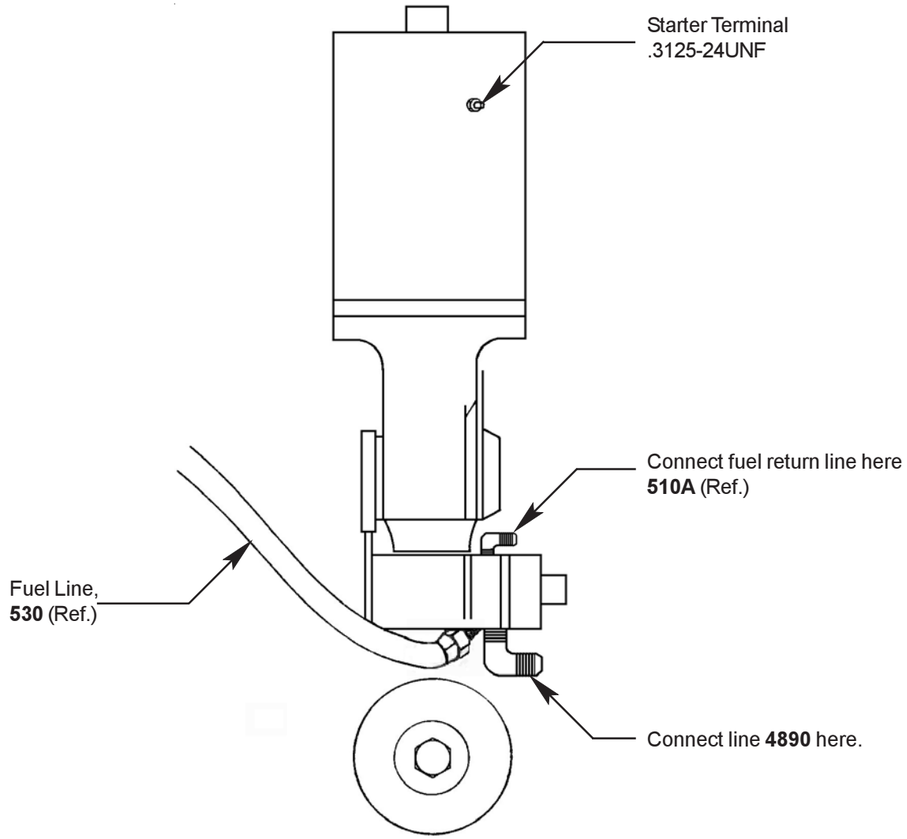
**Continental Installation**

CONTINENTAL MOTORS

**AFT VIEW**




**TOP VIEW**





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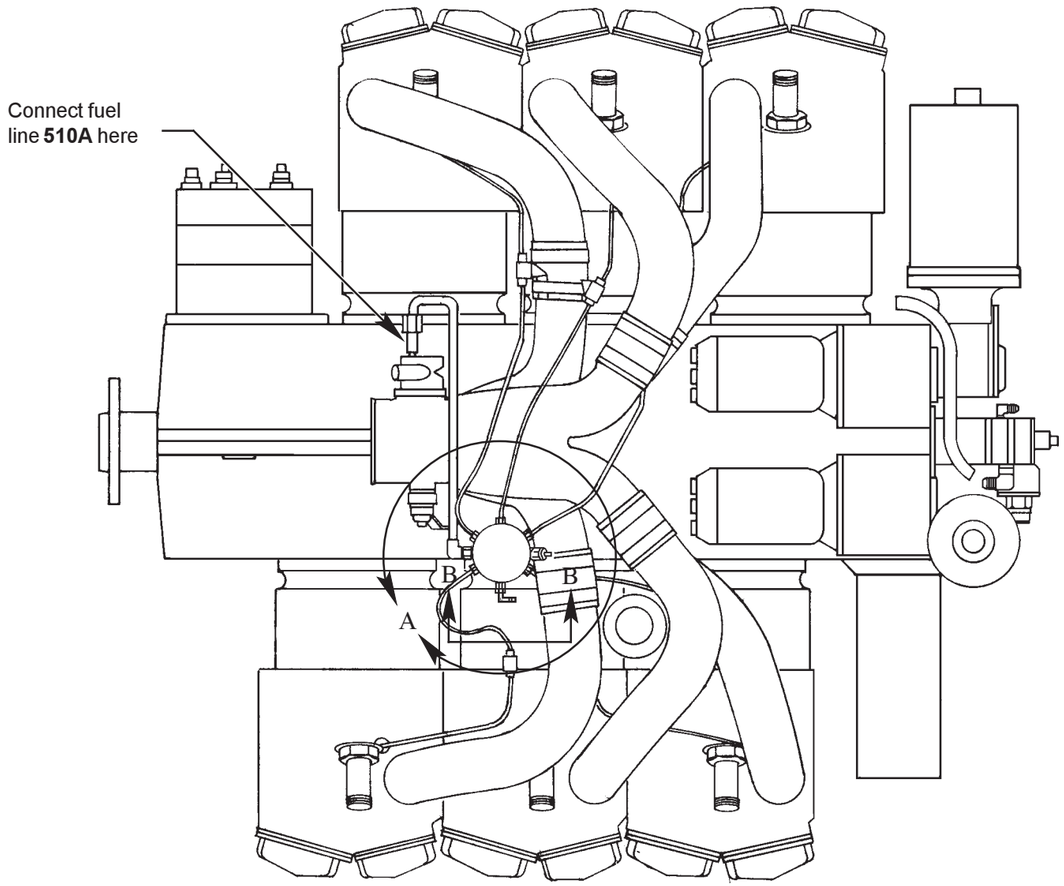
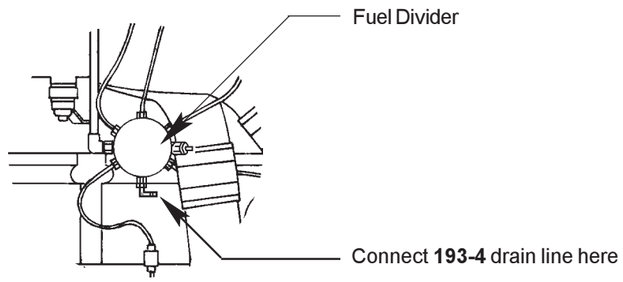
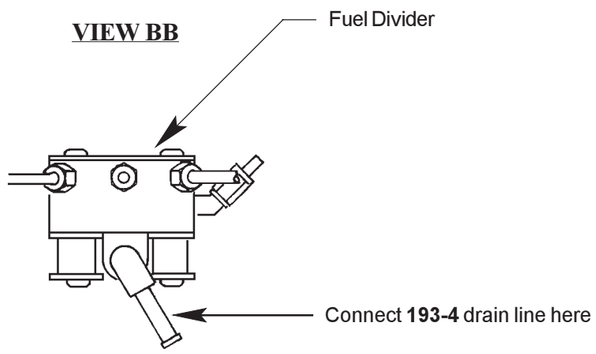
**Fuel Distributor**
**Fig. 26:G:4**




**VIEW A**




**VIEW BB**





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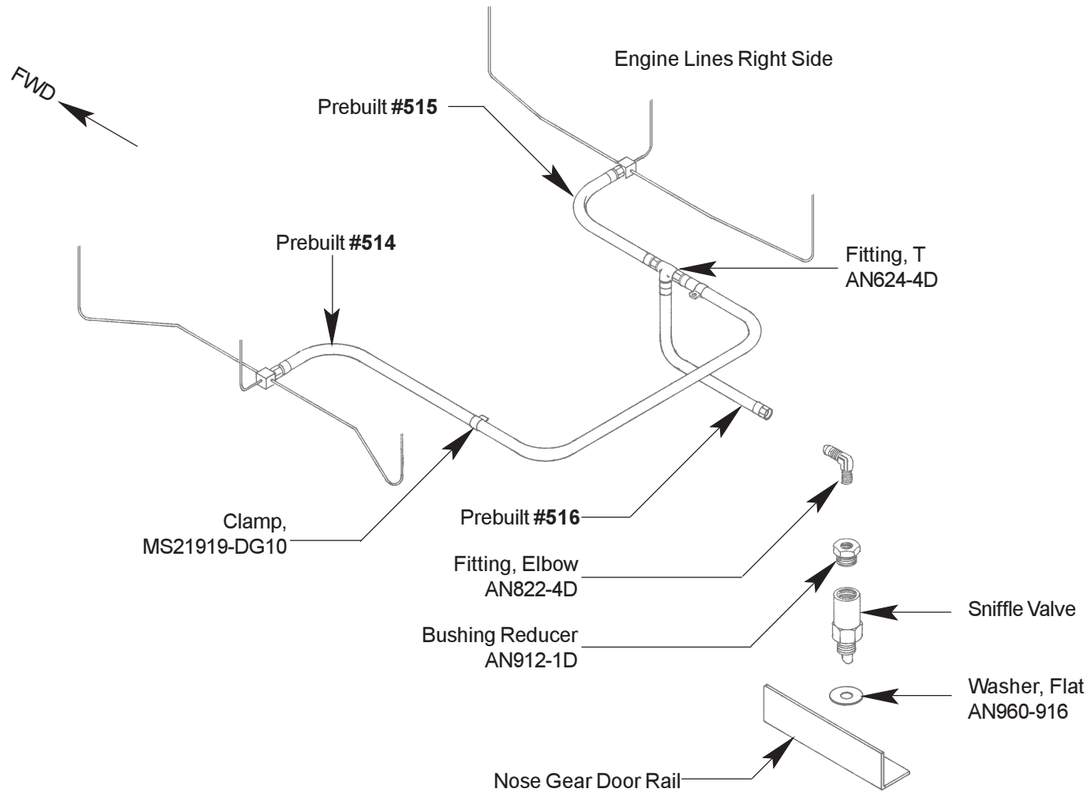
CONTINENTAL MOTORS

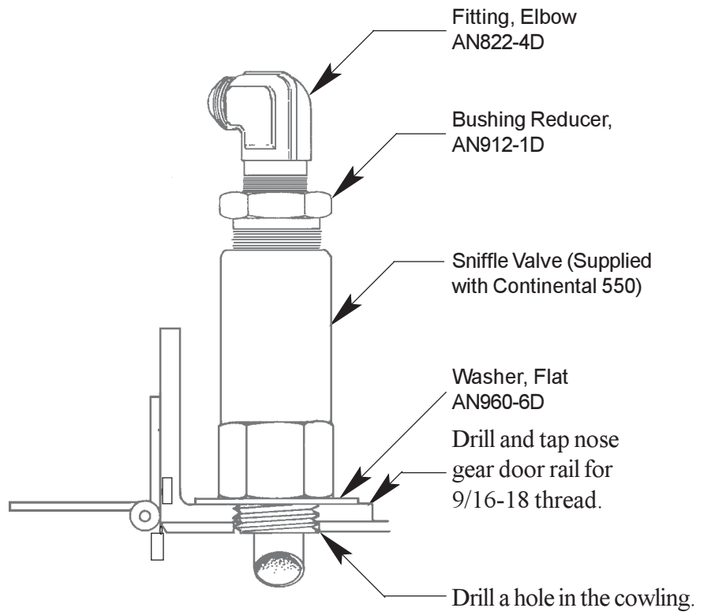
## Drain Line Assembly
## Fig. 26:G:5

The cylinder drain lines provide an escape for excess fuel that accumulates during both priming and shut down. The fuel is allowed to drain out of the cylinders through the lines and out the sniffle valve. The sniffle valve is supplied with all Continental 550 N models but not the 550 G model. If you have a 550 G model you can either purchase a sniffle valve through Continental or use an HK822-4 fitting and an FUI mounting block available through KCI. The sniffle valve is normally packaged in the same box as the spark plugs.

**NOTE: It is not considered necessary to wrap the overflow lines with fireshield. However be sure to allow sufficient clearance between the exhaust and the lines.**

**The sniffle valve must install such that the exit is in the slipstream. We suggest mounting it in the right nose gear door rail.**





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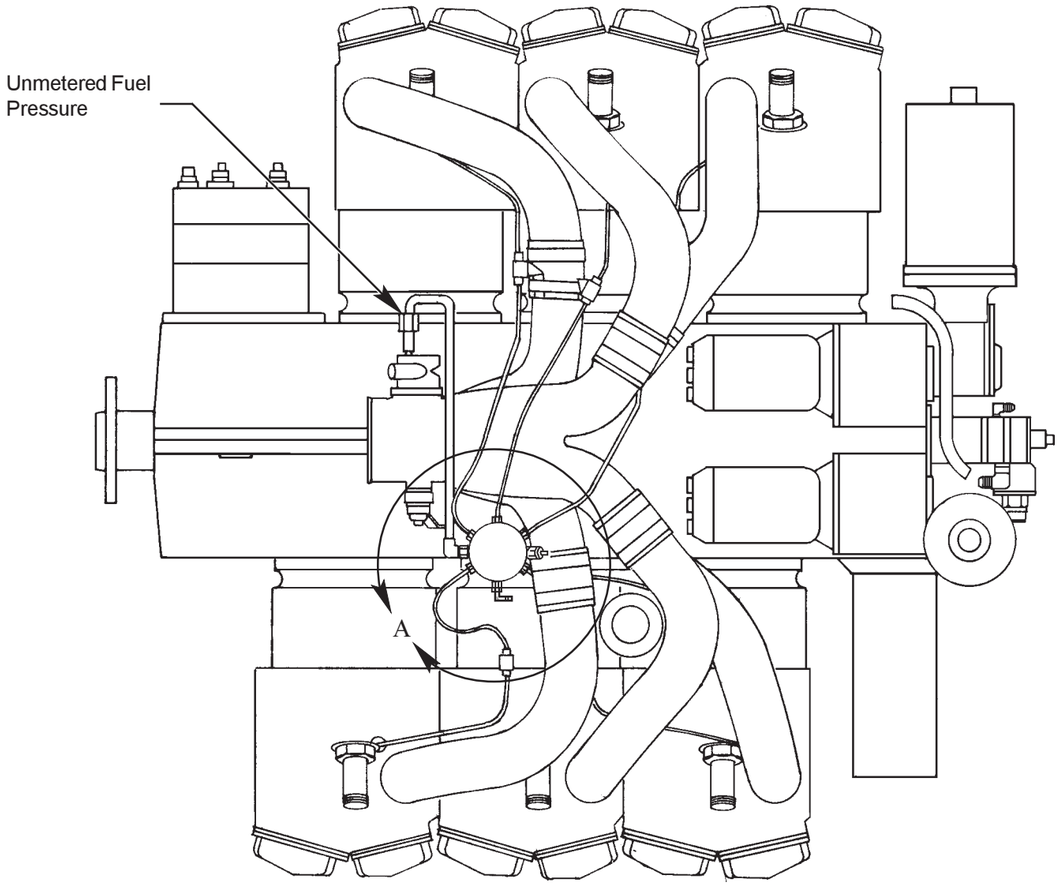
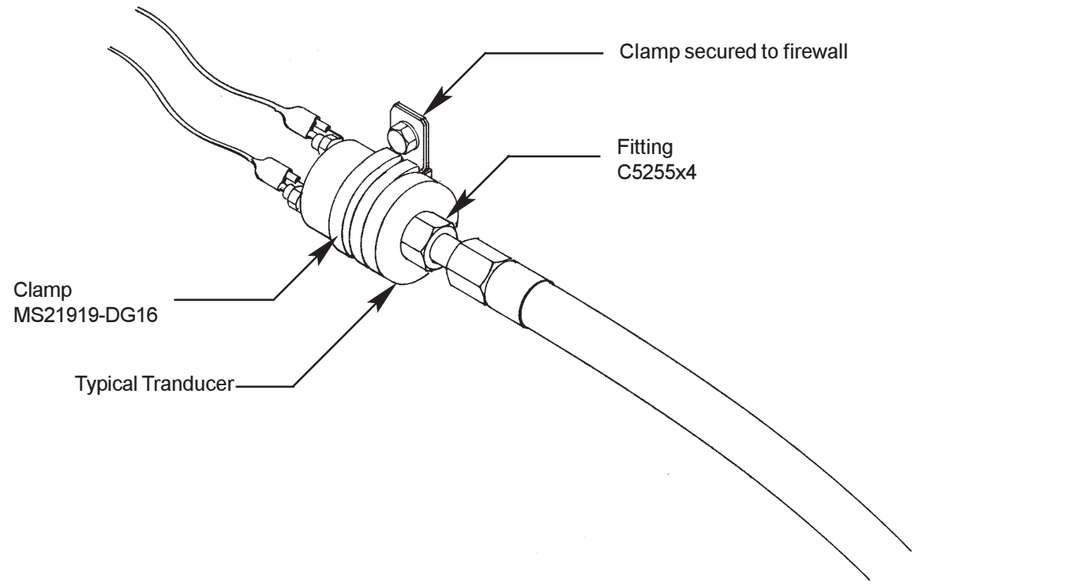
**Fuel Pressure Ports**
**Fig. 26:G:6**

Fuel pressure transducer readings are taken either from the unmetered side or the metered side of the fuel system. This depends on the engine monitoring system used. Consult with the installation manual of the system used to determine to install your system.




**Typical Transducer Installation**




It should be noted that the recommended method of sender installation is to "remote" locate the sender. Typically, an electronic sender will have a pipe port on the sender and fro the sender, one runs #18 or #20 wire to the instrument panel. As an example, Vision Micro Systems uses a male 1/8 NPT port their senders, others we've seen use a male 1/4 NPT. Since vibrations can cause failures in these senders (the worst being a cracked housing which then begins to spew raw fuel over your hot engine!), one should mount the sender at a convenient location on the engine using an Adel clamp or similar means, then run a 1/4" flex line to the pickup port on the engine.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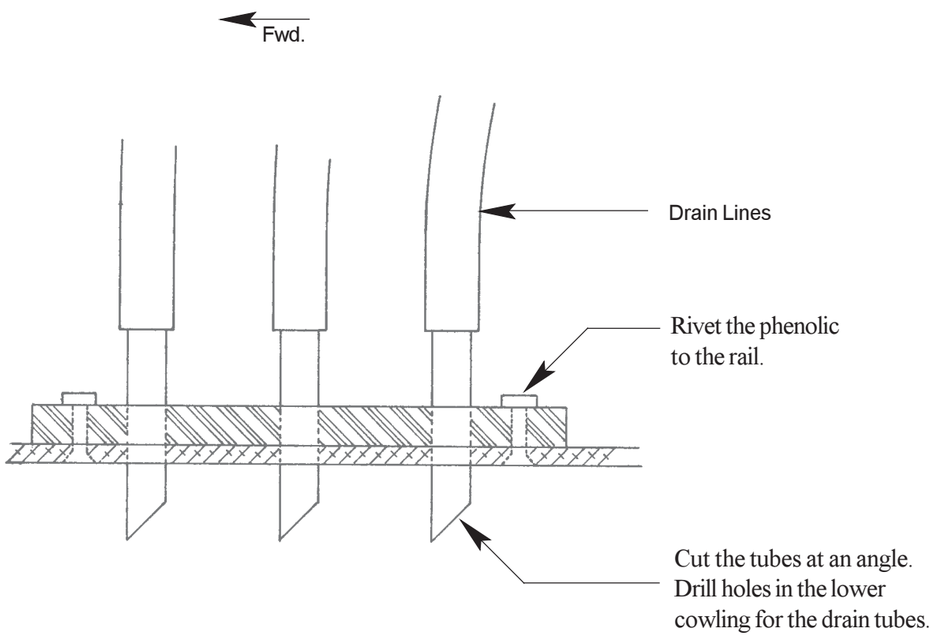
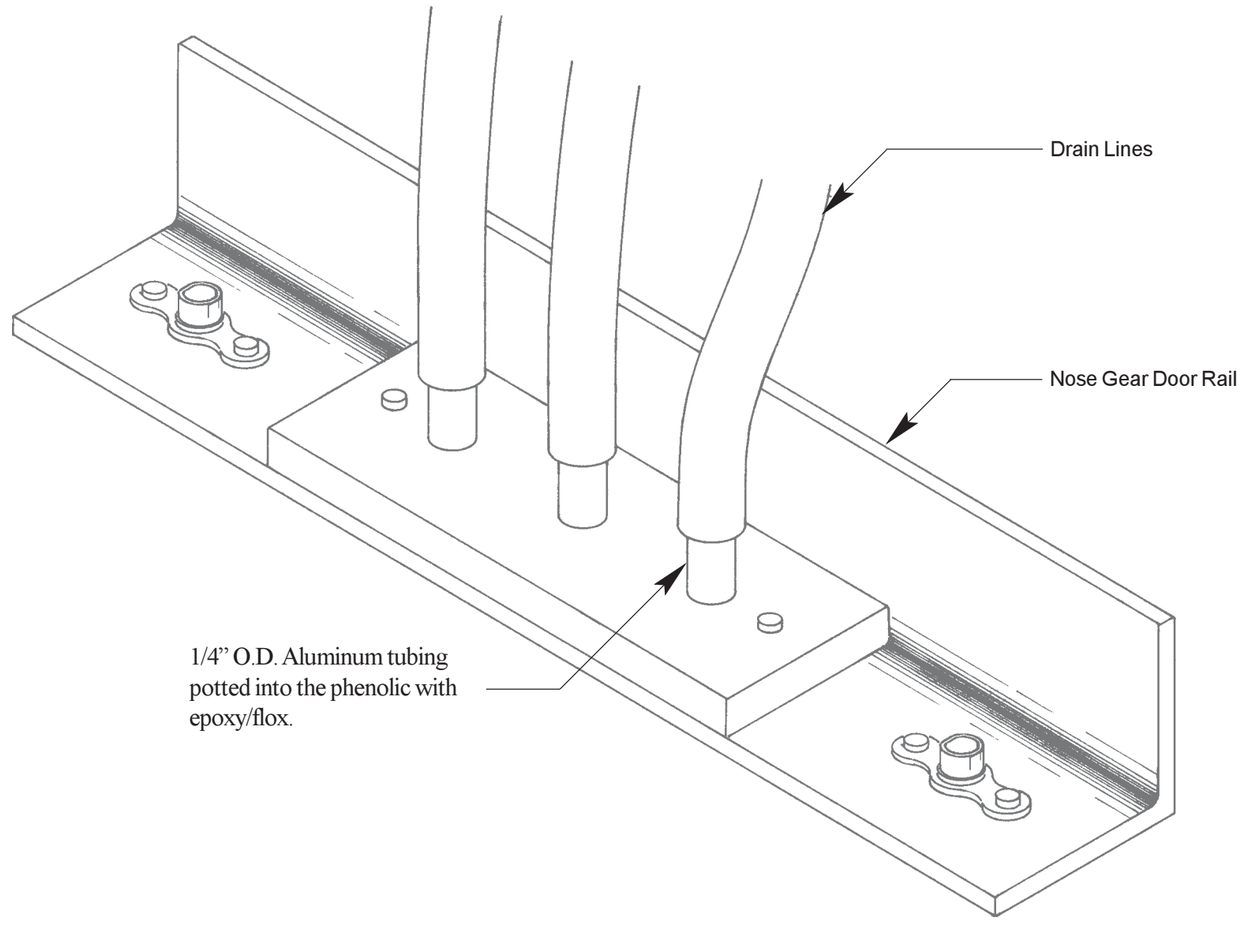
**Drain Line Exits**
**Fig. 26:G:7**

There are several ways to terminate the drain lines. The drain lines must dump the fluids overboard and not inside the engine compartment. The following is one method for terminating the lines.





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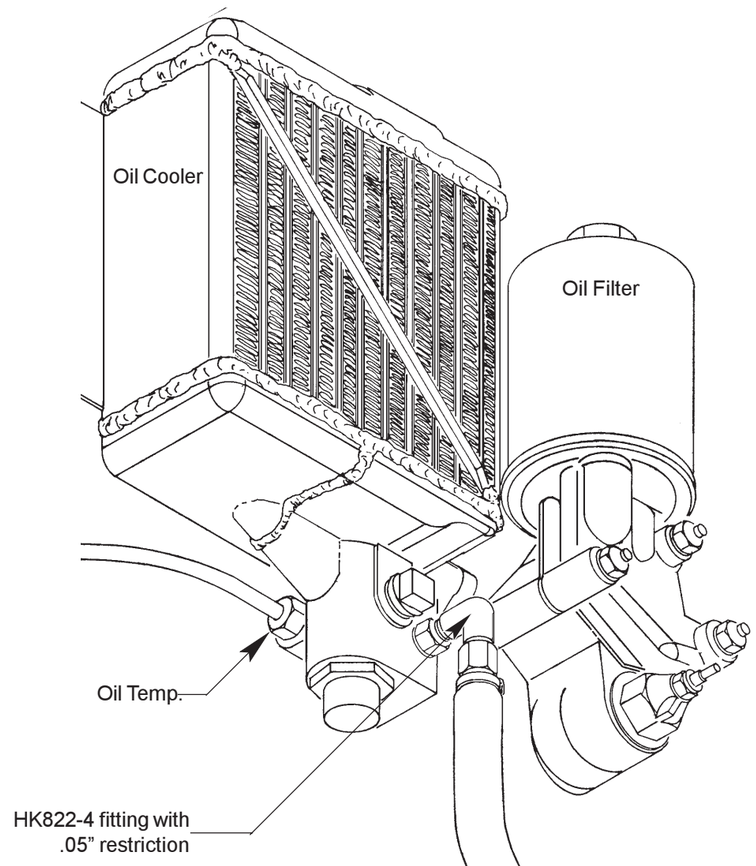
# H. Oil Systems

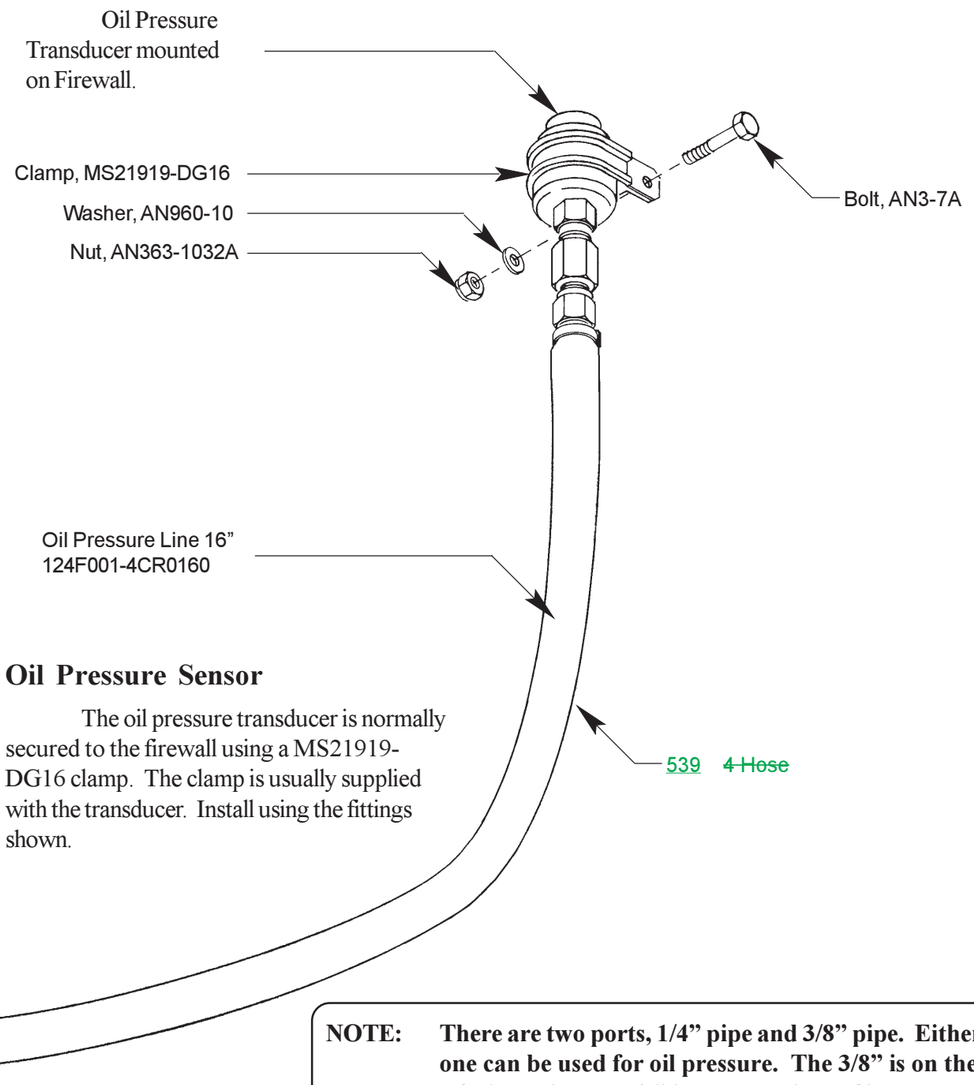
Continental Installation

The oil system addresses several areas and gauge line installations. An air/oil separator is not required on the IO-550 engines. There are no ports provided for returning oil to the engine.

**NOTE: All lines must have fireshield covering.**

**Engine Oil Systems**
**Fig. 26:H:1**




## Oil Pressure Sensor

The oil pressure transducer is normally secured to the firewall using a MS21919-DG16 clamp. The clamp is usually supplied with the transducer. Install using the fittings shown.

## Oil Temperature Sensor

The oil temperature pickup is located at the bottom of the oil cooler. Refer to the above figure. It is designed to accept a common brass type screw in thermocouple.

**NOTE: There are two ports, 1/4" pipe and 3/8" pipe. Either one can be used for oil pressure. The 3/8" is on the left side, with the 1/4" just to the right of it.**



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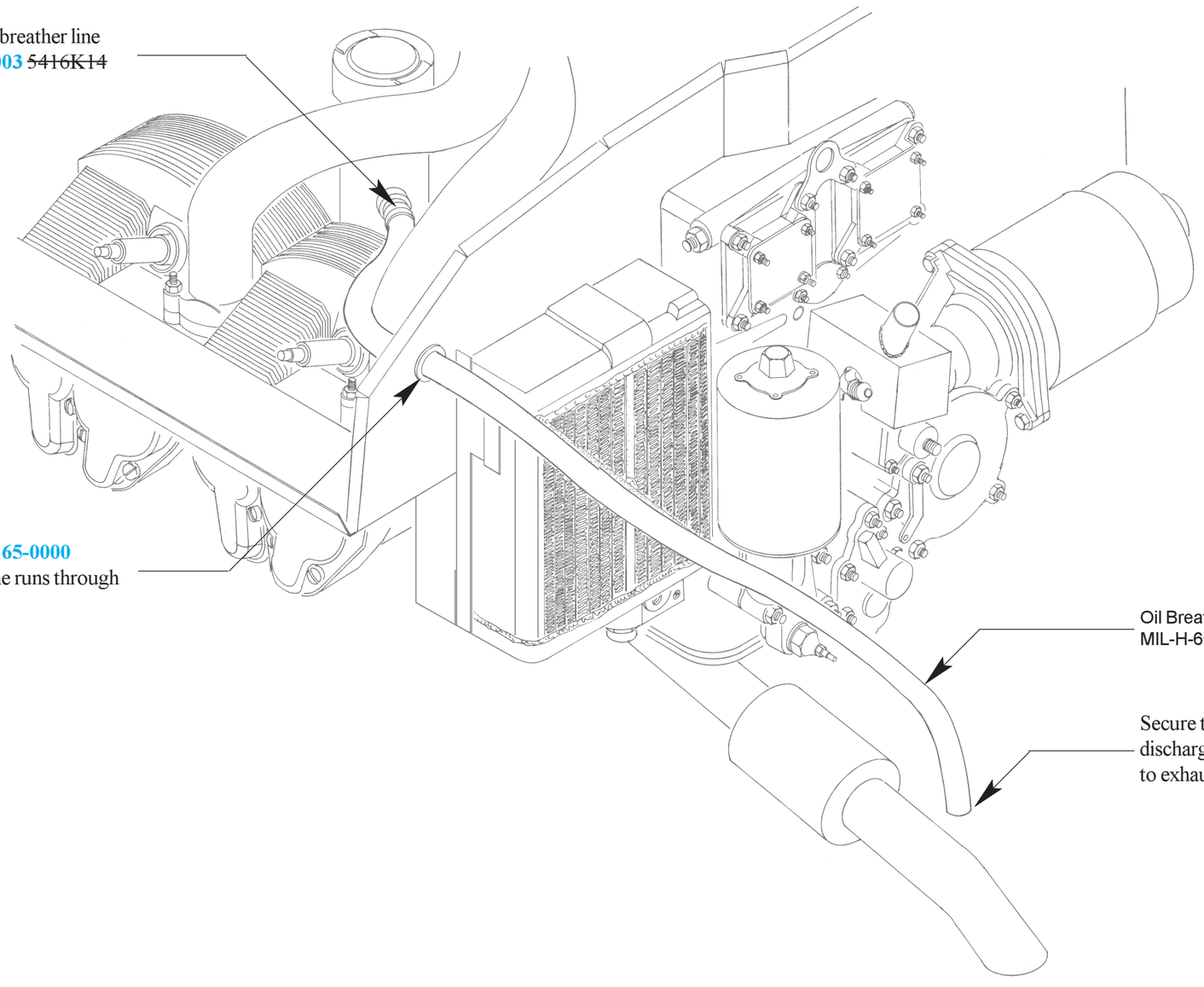
**Oil Breather Line**
**Fig. 26:H:2**

**Continental Installation**

CONTINENTAL MOTORS

The primary purpose of the oil breather line is to vent the crank case to ambient pressure. Fumes will escape through the breather line and any oil particles will burn off on the engine exhaust. Note that negative-G maneuvers may cause large amount of oil to expel through the breather line.





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# I. Vacuum System Installation (Optional)

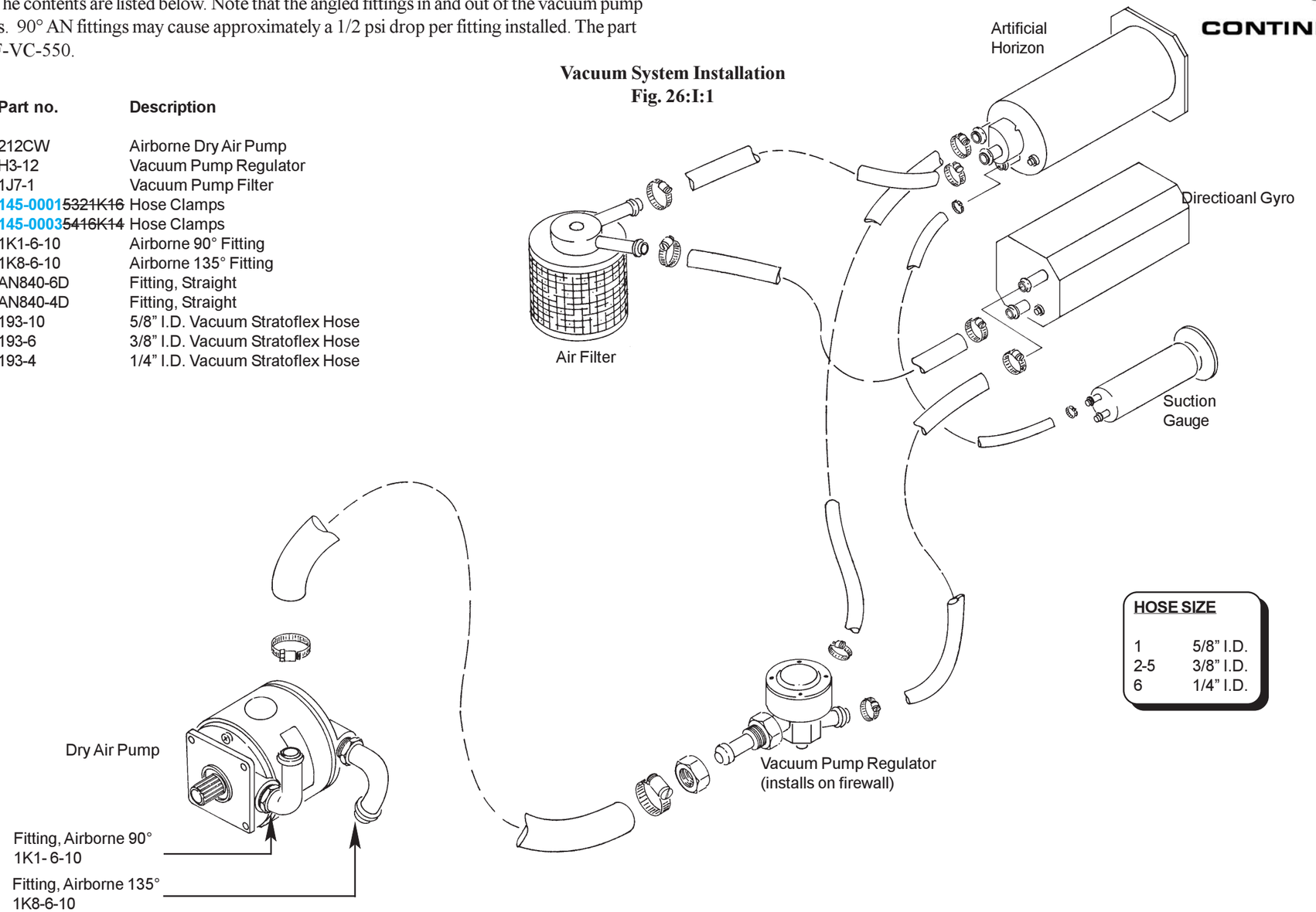
Continental Installation

CONTINENTAL MOTORS

This section illustrates a vacuum system consisting of an artificial horizon and a directional gyro. We offer a kit for this configuration. The contents are listed below. Note that the angled fittings in and out of the vacuum pump are not standard AN fittings. 90° AN fittings may cause approximately a 1/2 psi drop per fitting installed. The part number for this kit is LESF-VC-550.

| Qty. | Part no. | Description |
|---|---|---|
| 1 | 212CW | Airborne Dry Air Pump |
| 12 | H3-12 | Vacuum Pump Regulator |
| 1 | 1J7-1 | Vacuum Pump Filter |
| 10 | 145-0001~~5321K16~~ | Hose Clamps |
| 2 | 145-0003~~5416K14~~ | Hose Clamps |
| 1 | 1K1-6-10 | Airborne 90° Fitting |
| 1 | 1K8-6-10 | Airborne 135° Fitting |
| 4 | AN840-6D | Fitting, Straight |
| 2 | AN840-4D | Fitting, Straight |
| 2 ft. | 193-10 | 5/8" I.D. Vacuum Stratoflex Hose |
| 7 ft. | 193-6 | 3/8" I.D. Vacuum Stratoflex Hose |
| 3 ft. | 193-4 | 1/4" I.D. Vacuum Stratoflex Hose |

**Vacuum System Installation**
**Fig. 26:I:1**




**HOSE SIZE**

| | |
|---|---|
| 1 | 5/8" I.D. |
| 2-5 | 3/8" I.D. |
| 6 | 1/4" I.D. |



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# 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **BASIC WIRING TECHNIQUES** | | | | |
| **LEGACY GENERAL WIRING** | | | | |
| 1) | 4038 | 1 | Battery Box Mount | Yes** |
| 2) | VB-35 | 1 | Battery Box | Yes** |
| 3) | AN3-5A | 4 | Bolt, Undrilled | Yes** |
| 4) | AN3-10A | 4 | Bolt, Undrilled | Yes** |
| ~~5)~~ | ~~193-4~~ | ~~1~~ | ~~Hose~~ | ~~Yes**~~ |
| ~~6)~~ | ~~**145-0000** 5321K14~~ | ~~1~~ | ~~Hose Clamp~~ | ~~Yes**~~ |
| 7) | K1000-3 | 8 | Nutplate | Yes** |
| 8) | PH-250 (1" x 3" x 3/8") | 2 | Phenolic Block ,1" x 3" x 3/8" | Yes** |
| 9) | 737-L2K-14 | 1 | Power grid | Yes** |
| 10) | MSC-34 | 8 | Rivets | Yes** |
| 11) | AN960-10 | 8 | Washer, Flat | Yes** |
| 12) | AN960-10 | 4 | Washers | Yes** |
| **BASIC AIRCRAFT WIRING** | | | **Contact Lancair Avionics** | |
| **LANDING GEAR WIRING** | | | | |
| 1) | 710 | 1 | Airspeed Safety Switch | Yes** |
| **LIGHTS WIRING** | | | | |
| 1) | 4926 (Left) | 1 | Taxi Light, Landing Light Kit | Yes** |
| 2) | 4927 (Right) | 1 | Taxi Light, Landing Light Kit | Yes** |
| 3) | 0144 | 1 | Dimming Rheostat | Yes** |
| 4) | 14-100 | 1 | Instrument Light Switch | Yes** |
| 5) | A600 PR | 1 | Left, Nav/Strobe Lights (Whelen) | Yes** |
| 6) | A600 PR | 1 | Right, Nav/Strobe Lights (Whelen) | Yes** |
| 7) | 14-100 | 1 | Nav Light Rocker Switch | Yes** |
| 8) | A-413, HDA, CF | 1 | Power Pack (Whelen) | Yes** |
| 9) | 14-100 | 1 | Strobe Light Rocker Switch | Yes** |
| **ELECTRIC FUEL PUMP WIRING** | | | **Contact Lancair Avionics** | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **TRIM SYSTEM WIRING** | | | **Contact Lancair Avionics** | |
| **FLAP WIRING** | | | **Contact Lancair Avionics** | |
| **PITOT TUBE** | | | | |
| **ANTENNA PLACEMENT** | | | **Contact Lanair Avionics** | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**


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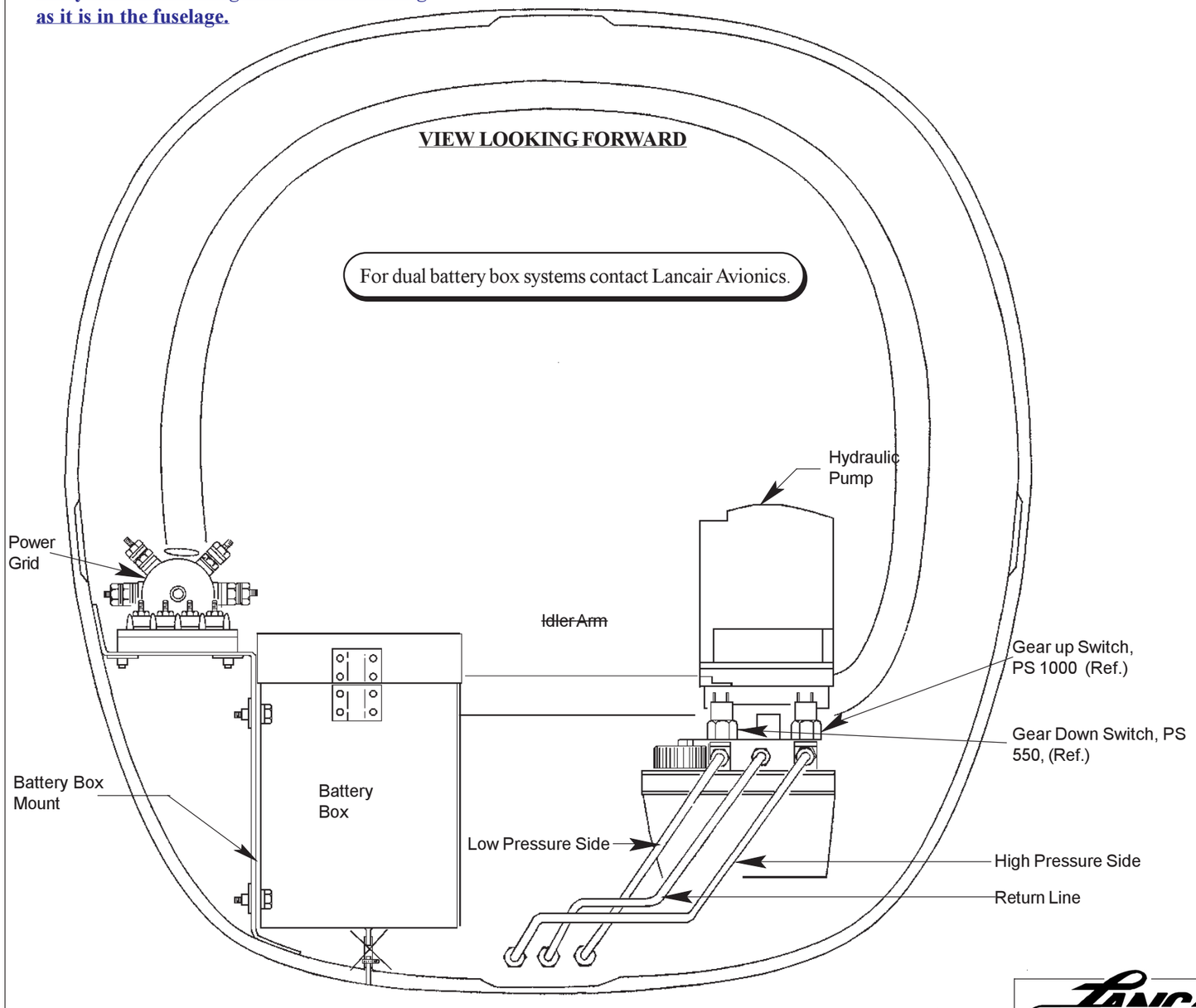
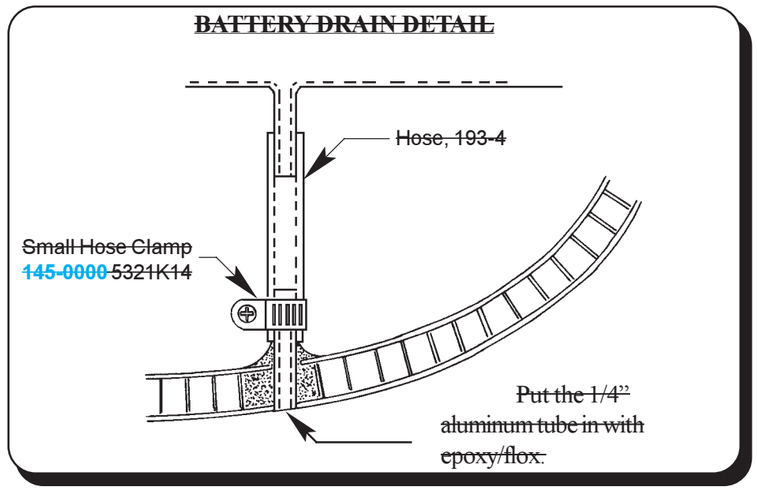
## Battery Box Installation
## Fig 27:B:2

**Note: The "View Looking Forward" has been modified so the hydraulic pump is now correctly located on the right side of the drawing as it is in the fuselage.**




**Use dry cell batteries only.**





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# REVISION LIST

# CHAPTER 27: GENERAL WIRING

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 27-1 through 27-17 | 0/02-15-02 | None | Current revision is correct |
| 27-17 | 1/09-18-02 | R&R | Part # Correction |
| 27-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |
| 27-2 | 3/12-15-04 | R&R | Part number update. |
| 27-4 | 3/12-15-04 | R&R | Part number update. |
| 27-2, 27-5 | 6/08-10-07 | R&R | Part number change only |


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# Chapter 27: General Wiring

## Contents



## 1. INTRODUCTION

This chapter will deal with the wiring necessary to get your Lancair Legacy functional. We will show you how to get power to the engine starter, then after the engine is fired up, how to get power from the alternator into the cockpit. From this point various systems, such as lights, trim systems, hydraulic system, fuel pump, etc., will be shown in wiring diagrams from the cockpit.

We can't show you how to wire all the different types of radios, GPS's, VOR's, HSI's, NDB's, and all those other various systems that can fill up a panel so expensively. These items must be wired by the builder or a local radio shop using their own expertise. The basic goal of this chapter is to acquaint you with important parts of the electrical system, such as the alternator, starter and master solenoid, mag switch, and the primary and avionics power sources (buses).

Wiring can be one of the most intimidating of all the different skills you learn when constructing a homebuilt aircraft. What makes matters even worse is that when you ask three different wiring "experts" about the best way to wire an alternator system, you will most likely receive three different answers. If you plan on wiring your own Lancair Legacy , start reading! Tony Bingelis is the guru of homebuilding "how to". His Sportplane Builder column in *Sport Aviation Magazine,* and his books are a wealth of information on all aspects of homebuilding, including wiring. If you have kept your back issues of *Sport Aviation,* Mr. Bingelis 'column in the April, May, and June 1990 issues are excellent for gaining a good understanding of electrical systems.

Robert Nuckolls is also an excellent reference for wiring. He publishes a newsletter, The AeroElectric Connection, and also contracts his services to individual builders to design custom electrical schematics. He can be reached at:

Medicine River Press
6936 Bainbridge Road
Wichita, Kansas 67226-1008
(316) 685-8617

Another popular option is to have a local electrical pro do your electric system for you. This is generally a good idea at least for the radio stack wiring, but for the basic electrical system in your Lancair Legacy, you might be surprised how simple it is to wire.

This chapter is a general wiring chapter. The diagrams are generalized for typical Lancair legacy installations. Equipment types and locations will vary from aircraft to aircraft. This chapter serves as a start to base your customized schematics on.

Since this is a composite airframe, you don't have the luxury of grounding to a convenient aluminum surface. You must bring a few ground posts into the cockpit, then terminate all your circuits to one of these posts. Although only one cockpit ground post is shown in the following schematic, it is a good idea to have several, even a couple in the gear box area for the systems behind the wings. Ahead of the firewall, circuits are usually grounded to one of the engine bolts, which is in turn grounded to the battery.

It seems that more and more breakers are being incorporated into the modern electrical system. You'll notice in most of the wiring diagrams, a breaker symbol is shown adjacent to the master bus bar. The number in the symbol is the breaker size.

Install circuit breaker sizes according to manufacturer's recommendations.



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# 2. PARTS LIST

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **BASIC WIRING TECHNIQUES** | | | | |
| **LEGACY GENERAL WIRING** | | | | |
| 1) | 4038 | 1 | Battery Box Mount | Yes** |
| 2) | VB-35 | 1 | Battery Box | Yes** |
| 3) | AN3-5A | 4 | Bolt, Undrilled | Yes** |
| 4) | AN3-10A | 4 | Bolt, Undrilled | Yes** |
| 5) | 193-4 | 1 | Hose | Yes** |
| 6) | **145-0000** ~~5321K14~~ | 1 | Hose Clamp | Yes** |
| 7) | K1000-3 | 8 | Nutplate | Yes** |
| 8) | PH-250 (1" x 3" x 3/8") | 2 | Phenolic Block ,1" x 3" x 3/8" | Yes** |
| 9) | 737-L2K-14 | 1 | Power grid | Yes** |
| 10) | MSC-34 | 8 | Rivets | Yes** |
| 11) | AN960-10 | 8 | Washer, Flat | Yes** |
| 12) | AN960-10 | 4 | Washers | Yes** |
| **BASIC AIRCRAFT WIRING** | | | **Contact Lancair Avionics** | |
| **LANDING GEAR WIRING** | | | | |
| 1) | 710 | 1 | Airspeed Safety Switch | Yes** |
| **LIGHTS WIRING** | | | | |
| 1) | 4926 (Left) | 1 | Taxi Light, Landing Light Kit | Yes** |
| 2) | 4927 (Right) | 1 | Taxi Light, Landing Light Kit | Yes** |
| 3) | 0144 | 1 | Dimming Rheostat | Yes** |
| 4) | 14-100 | 1 | Instrument Light Switch | Yes** |
| 5) | A600 PR | 1 | Left, Nav/Strobe Lights (Whelen) | Yes** |
| 6) | A600 PR | 1 | Right, Nav/Strobe Lights (Whelen) | Yes** |
| 7) | 14-100 | 1 | Nav Light Rocker Switch | Yes** |
| 8) | A-413, HDA, CF | 1 | Power Pack (Whelen) | Yes** |
| 9) | 14-100 | 1 | Strobe Light Rocker Switch | Yes** |
| **ELECTRIC FUEL PUMP WIRING** | | | **Contact Lancair Avionics** | |

| # | PART NO. (P/N) | QTY | DESCRIPTION | OPTIONAL ITEM *(not included with kit)* |
|---|---|---|---|---|
| **TRIM SYSTEM WIRING** | | | **Contact Lancair Avionics** | |
| **FLAP WIRING** | | | **Contact Lancair Avionics** | |
| **PITOT TUBE** | | | | |
| **ANTENNA PLACEMENT** | | | **Contact Lanair Avionics** | |

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**


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# 3. CONSTRUCTION PROCEDURES

## A. Basic Wiring Techniques

The wiring diagrams of this chapter do not include wire sizes. Wire sizes are determined from the wire size diagram.

The wire size depends on load, length and voltage. As an example:

1) 14 feet installation
2) 28V source
3) 20 ampere draw

Find the wire size.

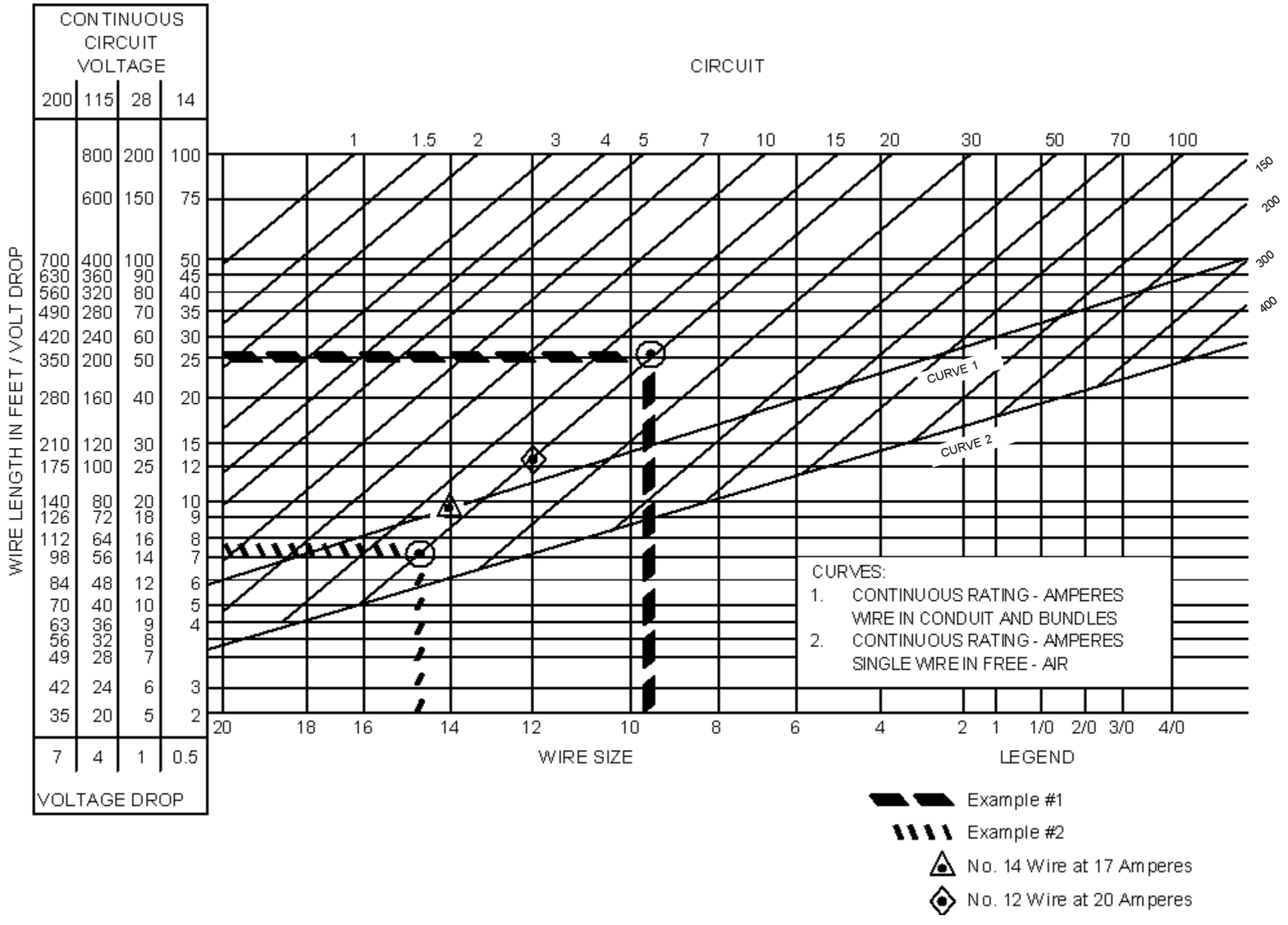
***Answer:***

Find the number 14 under 28 volts source column. Follow the horizontal line to the right until intersects the slant 20-ampere line. At this point drop to the bottom of the chart. The value falls between No. 16 and No. 14, select the larger size, No. 14.

The wire will be placed in conduit, so curve 1 applies. The maximum continuous current for No. 14 wire is 17 amperes.

**Note: Use aircraft quality wire. In choosing the proper wire consider requirements, operating temperatures, and environmental conditions**

**Wire Size, Continuous Flow**
**Fig 27:A:1**





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## B. Legacy General Wiring

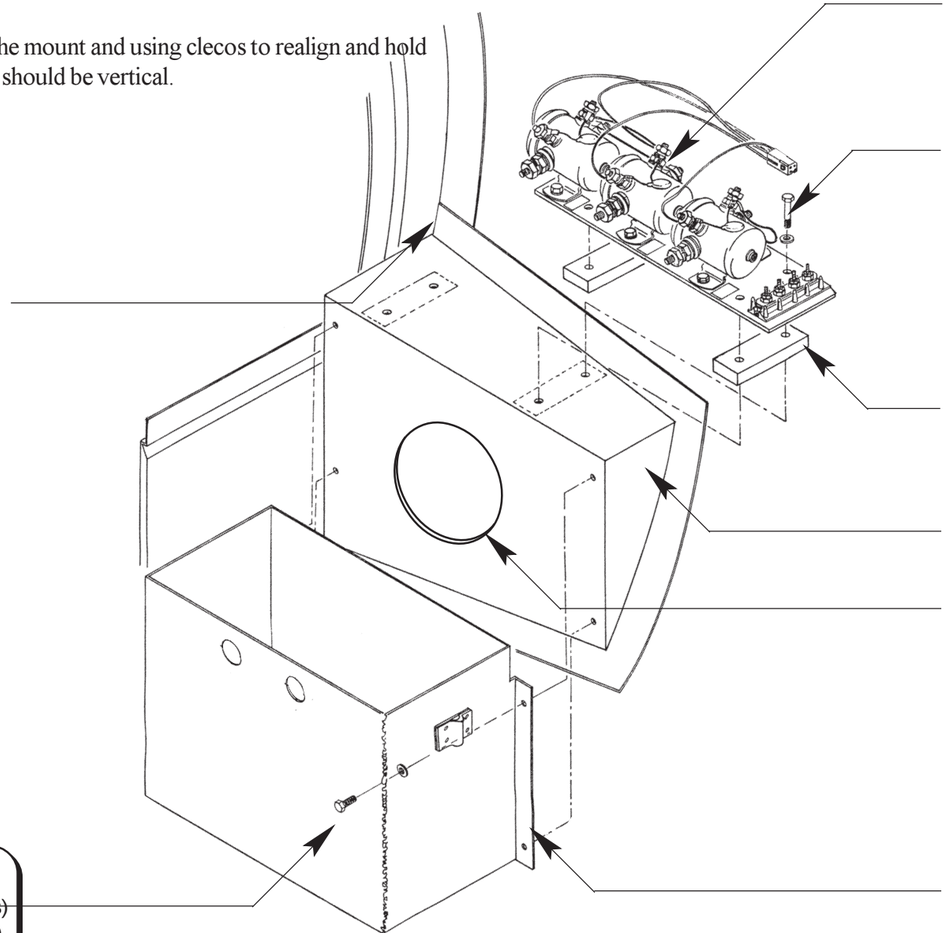
**Battery Box Installation**
**Fig 27:B:1**

The battery box installs aft of the baggage bulkhead on the right side of the push-pull tube. You have been supplied with a premolded battery box mount that bonds to the fuselage side.

1. Mount the battery box to the battery box mount before bonding the mount in place. The battery box should mount as high as possible and be centered on the mount.

2. Install the power grid to the battery box mount.

3. Bond the battery box mount in place. We suggest pre-aligning the mount and using clecos to realign and hold in place during bonding. The flat face where the battery mounts should be vertical.





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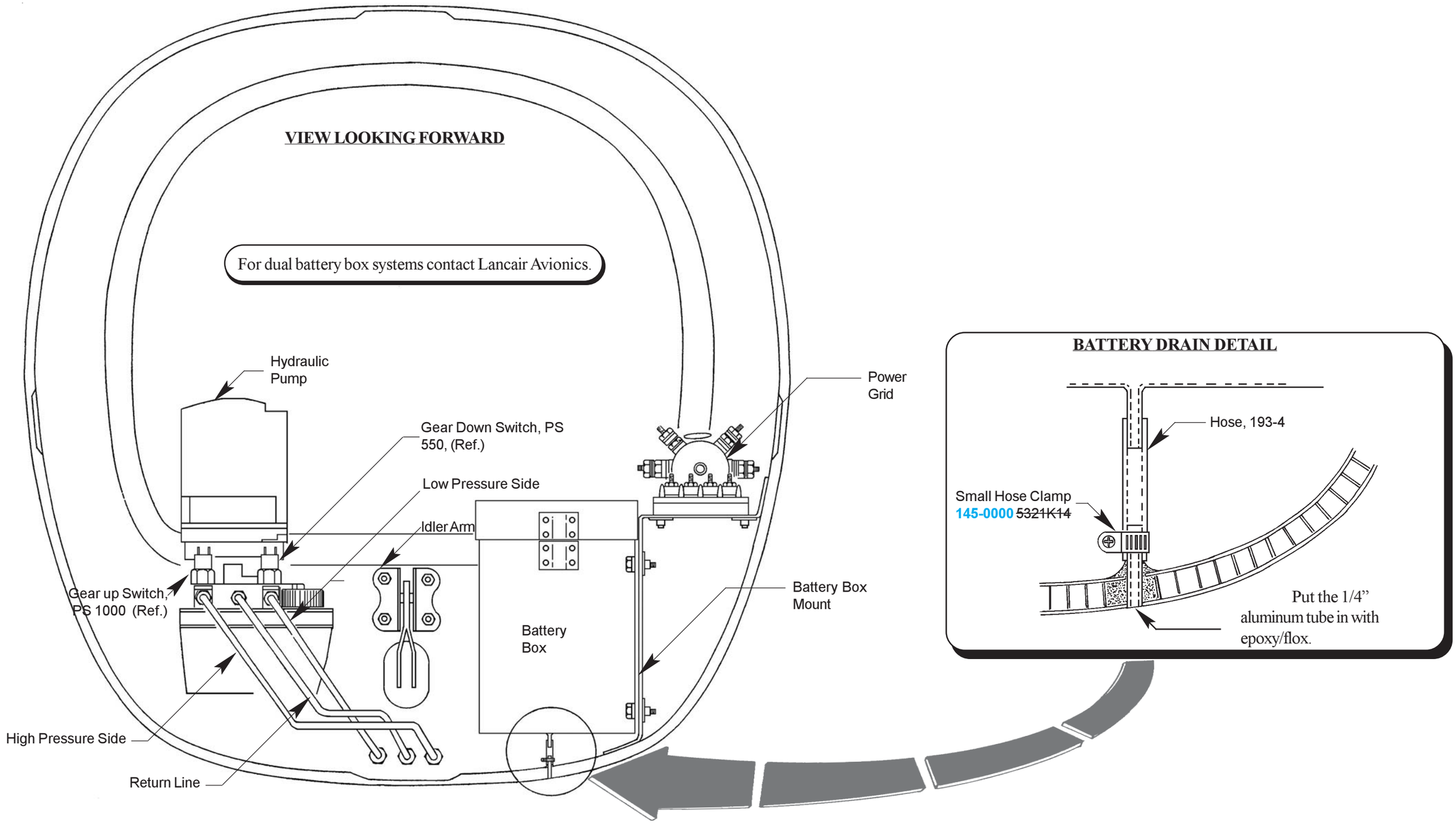
**Battery Box Installation**
**Fig 27:B:2**





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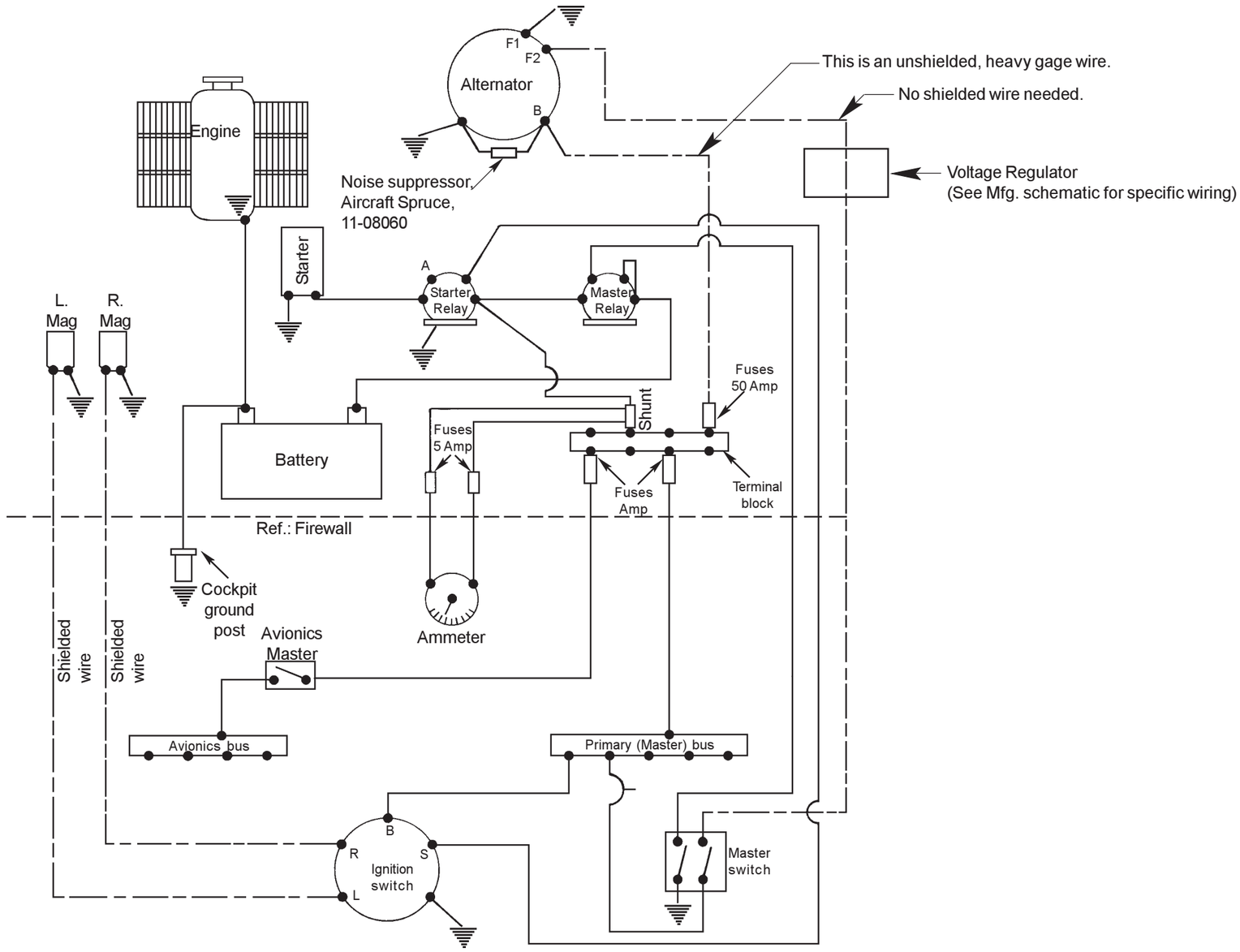
## C. Basic Aircraft Wiring

This diagram shows a very basic aircraft system. All other systems would branch off this system.

**Basic Aircraft Wiring Diagram**
**Fig 27:C:1**



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## D. Landing Gear Wiring

The landing gear wiring consists of three main systems, hydraulic pump, gear indicator light, and an airspeed safety switch. The hydraulic pump is controlled through pressure switches that activate the solenoids. The gear up solenoid should be protected by an airspeed safety switch. This switch basically leaves the circuit open until the aircraft reaches a pre set speed. This is to prevent accidental gear retraction on the ground. The switch has an adjustment feature for setting the speed. We suggest you set the speed between 80 to 90 KIAS. The switch is available through KCI.

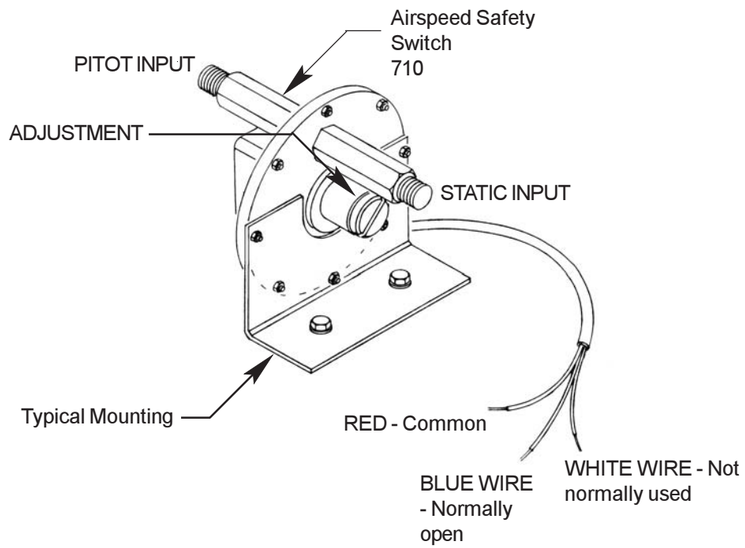
An important part of the gear system is the gear indicator lights. The gear indicator light switches are installed on the over center links. This very simple circuit basically closes when the over center link is locked in the down position.

There is also a light to indicate the pump is running. This light is typically amber in color and indicates when either the up or down circuit is activated.

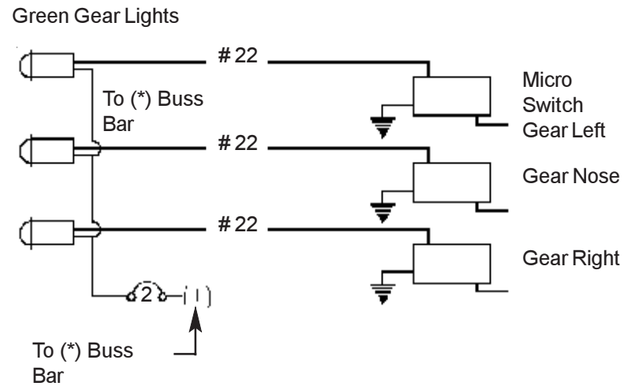
Mount the indicator lights as high as possible on the panel to take advantage of the shade provided by the glare shield. As with any light it is hard to see if it is lit if the sun is shining on it. The lights are usually mounted in a triangular pattern, with the nose gear indicator above the two mains.

The landing gear indicator lights work through the micro switches you have already installed on the main gear and nose gear. This circuit is as simple as it gets. When the micro switch at each gear location is grounded out, the indicator light on the instrument panel illuminates.

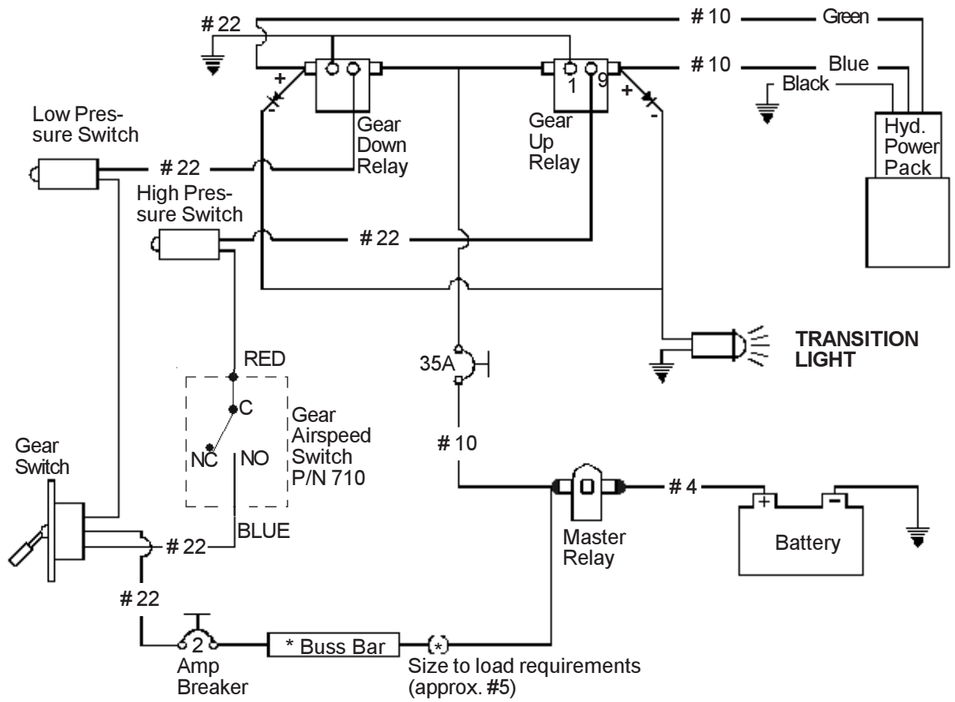
Next to the gear position indicators, mount the hydraulic pump indicator, which is amber in color. This light will now illuminate when the hydraulic pump is running, like when the gear is cycling, or when hydraulic system pressure falls off.




**Landing Gear Wiring Diagram**
**Fig 27:D:1**




DIODES FOR TRANSITION LIGHT. USE ANY COMMON 1/4 WATT RECTIFIER DIODE.





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## E. Lights Wiring

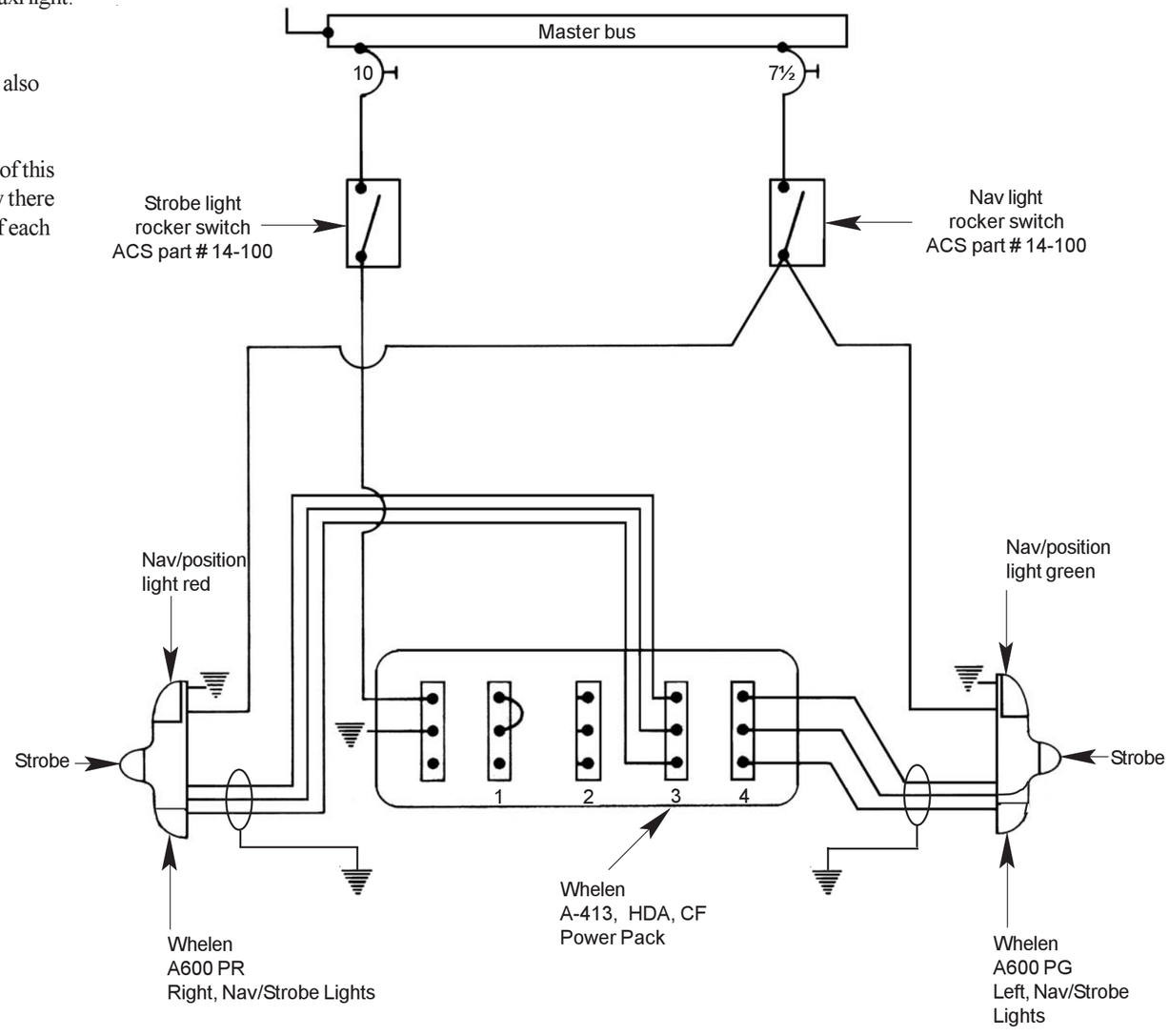
Exterior lighting on the Lancair Legacy consists of wingtip position/strobe light, a landing light, and a taxi light. There are variations, of course, but this section will stick to the basics.

Inside the cockpit, instrument lights, or post lights, illuminate the panel for night flying. A cabin light is also sometimes installed. A schematic is given for the simple instrument wiring, but not for the cabin light.

The following schematic shows the wiring of the position/strobe lights. A more complete explanation of this system is provided in the installation kit commonly purchased along with the lights and power pack. Basically there are two wires coming out of each light unit for the red/green/white position lights. The other three wires out of each unit are used for the strobes.

**NOTE: Also refer to the installation and service manual supplied by Whelen.**

**Position/Strobe Light Schematic**
**Fig 27:E:1**




**NOTE: Use shielded wire to strobe lights.**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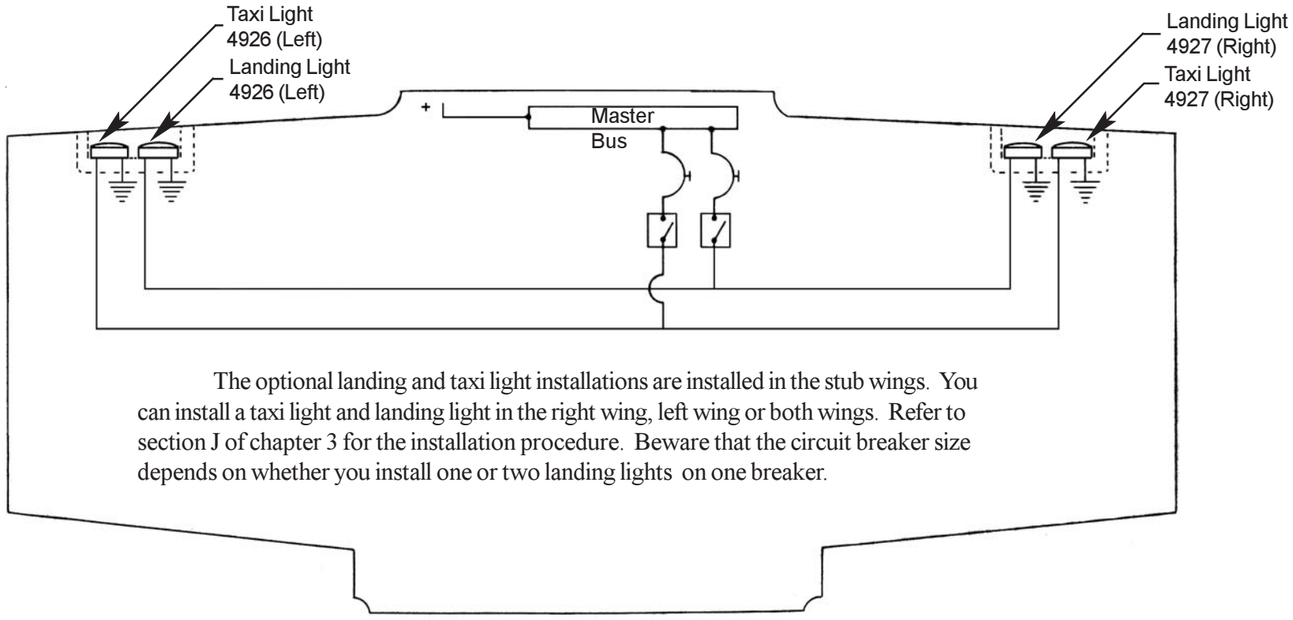
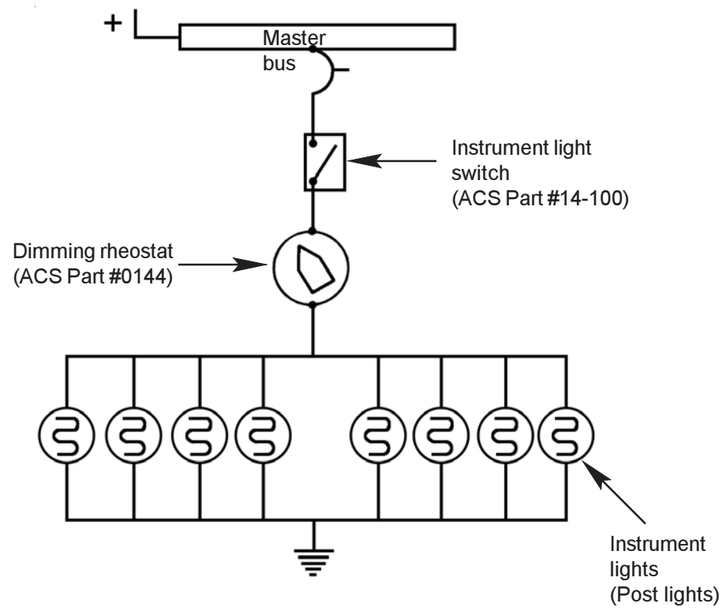
**Landing and Taxi Lights**
**Fig 27:E:2**




The optional landing and taxi light installations are installed in the stub wings. You can install a taxi light and landing light in the right wing, left wing or both wings. Refer to section J of chapter 3 for the installation procedure. Beware that the circuit breaker size depends on whether you install one or two landing lights on one breaker.

**Instrument Light Schematic**
**Fig 27:E:3**

There are an increasing number of instrument lighting methods. The old standby, postlights mounted adjacent to every instrument are giving way to internally lit instruments and lighted instrument covers. Whichever method you choose, most likely they will be wired similarly to the schematic below.





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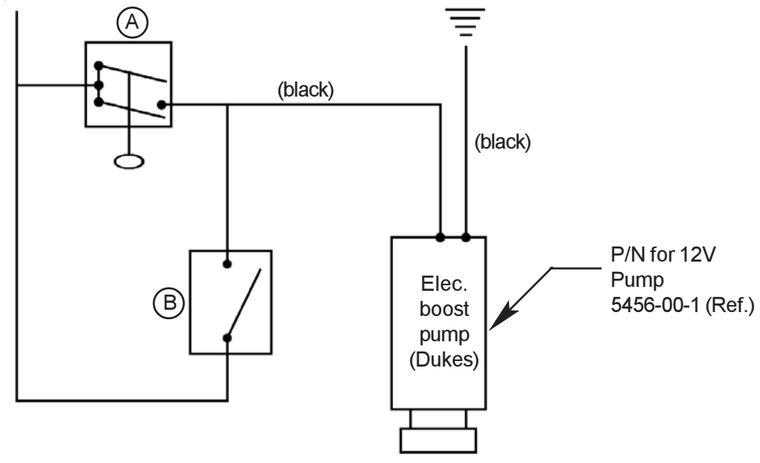
## F. Electric Fuel Pump

The electric fuel pump mounts in front of the main spar in the center console. There are two different versions of pumps installed depending, a single stage for the Lycoming installations and a dual stage for the Continental installations (refer to chapter 4, section G).

The Lycoming installations use a single stage pump (high boost). The boost pump is used for priming the engine, takeoff (not landing), and emergency.

The Continental installations use a dual stage. Again the high boost is used for priming the engine and for emergency and the low boost can be used for vapor suppression.

**Fuel Pump Wiring, Lycoming Installation**
**Fig 27:F:1**

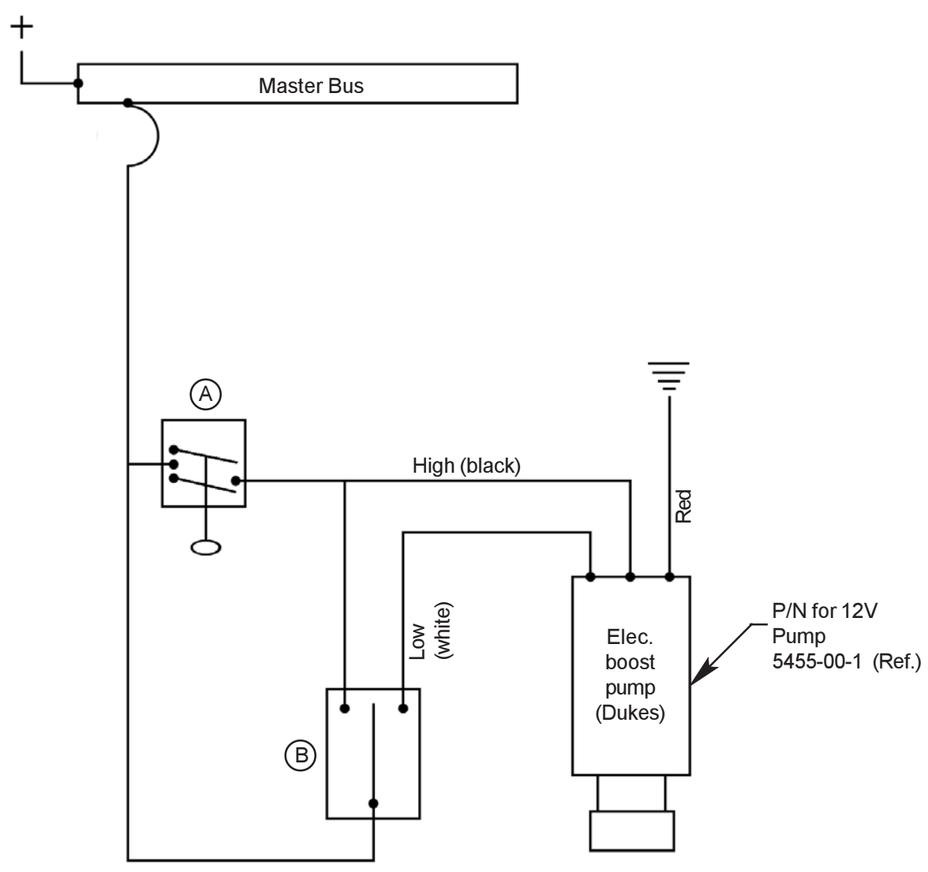



Ⓐ - Primer switch , SPDT, MOM On, Push button

Ⓑ - Boost pump rocker switch, SPDT, Center Off, Hi/Off/Low

**NOTE: The pump is not polarity sensitive so either of the two lines can go to ground.**

**Fuel Pump Wiring, Continental Installation**
**Fig 27:F:2**




Ⓐ - Primer switch , SPDT, MOM On, Push button

Ⓑ - Boost pump rocker switch, SPDT, Center Off, Hi/Off/Low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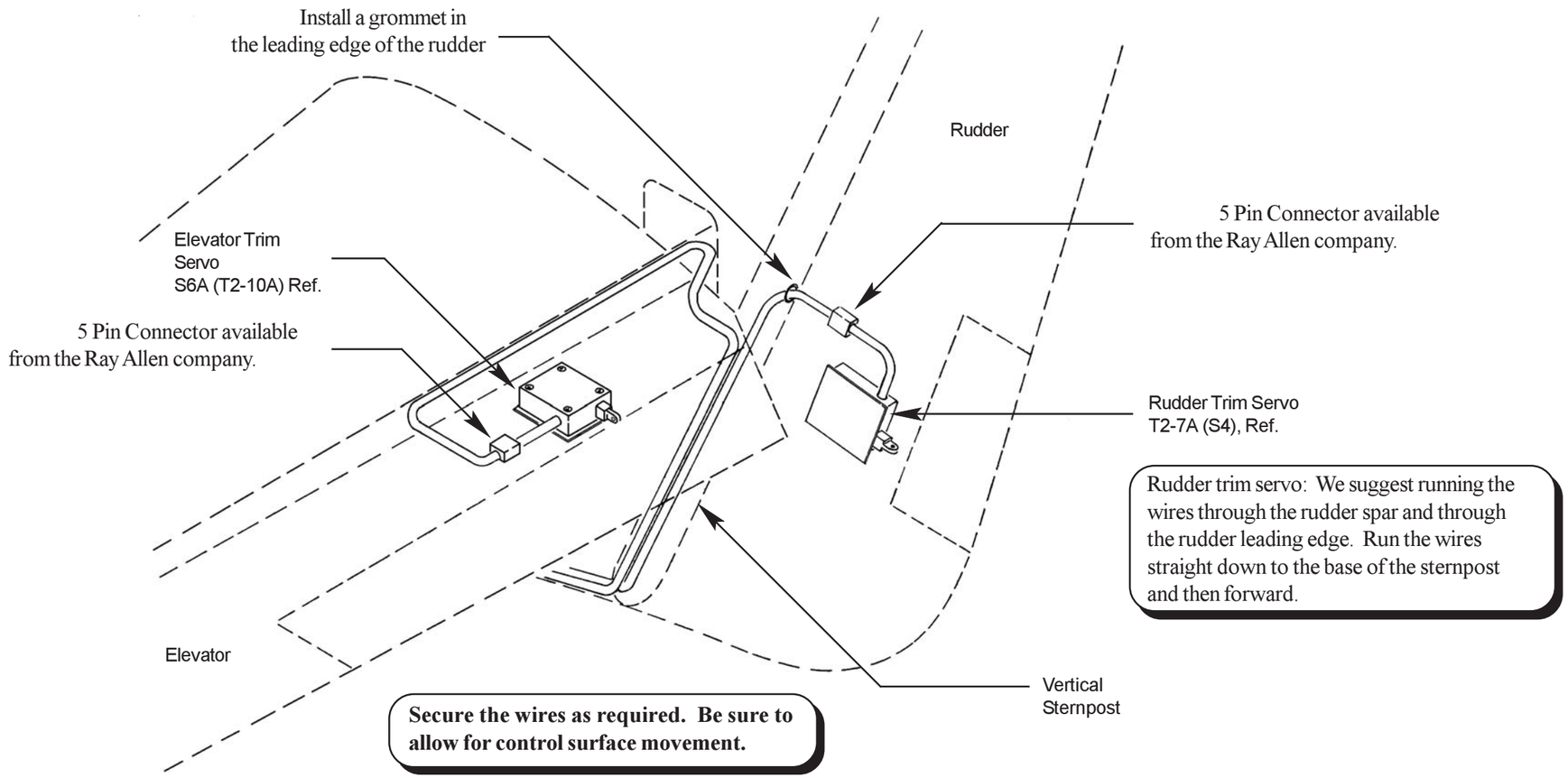
## G. Trim System Wiring

Wiring instructions are included with your trim systems. The following diagrams suggest wire routing and plug locations. You should be able to remove one servo alone or a control surface by unplugging the servo. For wiring the T2-10A (elevator trim servo) refer to the wiring diagram that comes with the servo kit.

Elevator trim servo wiring: We suggest running the wires through the elevator spar and inboard through the elevator access panel. Then through the vertical sternpost and down to the bottom of the sternpost and forward through the aircraft.

**Elevator and Rudder Trim Systems**
**Fig 27:G:1**





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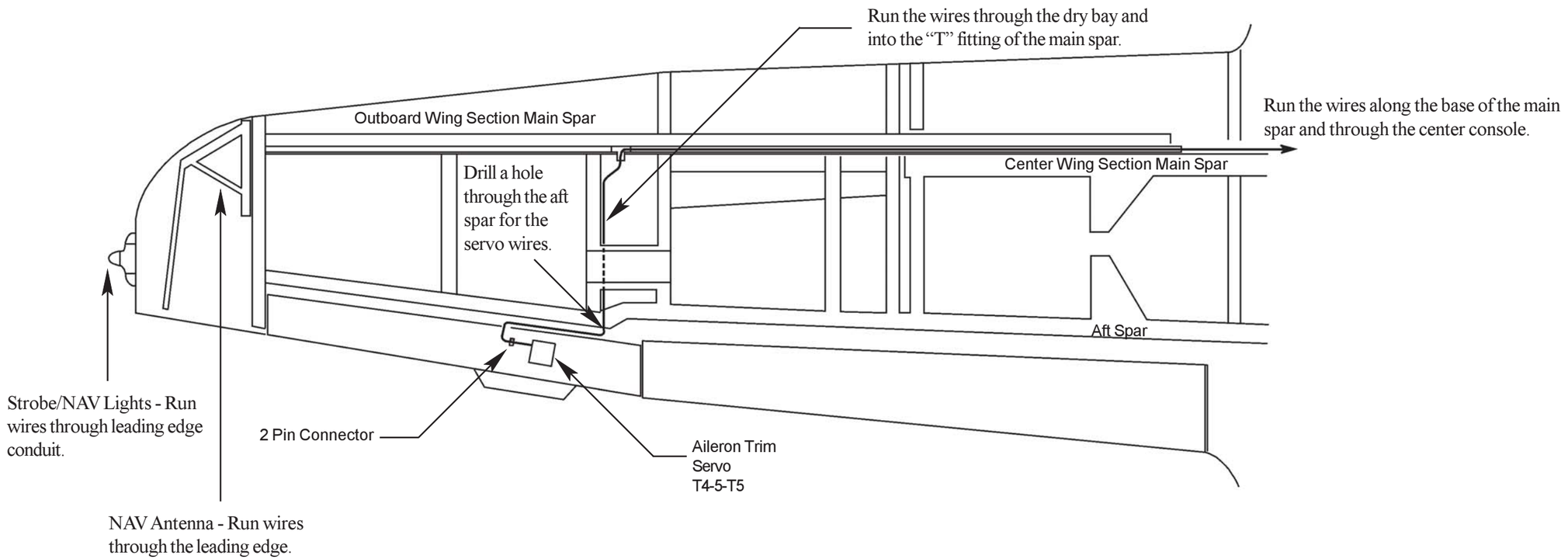
**Aileron Trim Servo Wiring**
**Fig 27:G:2**

Both wires out of the aileron servo are white. For now you can wire the servo without identifying which is which. When the system is completely wired, check that the trim tab moves the servo the correct direction. If it doesn't switch the wires at one of the plugs.




**NOTE:** **By running the servo wires close to the hinge line, the wires will not have to bend so much when the aileron is deflected, saving wear and tear.**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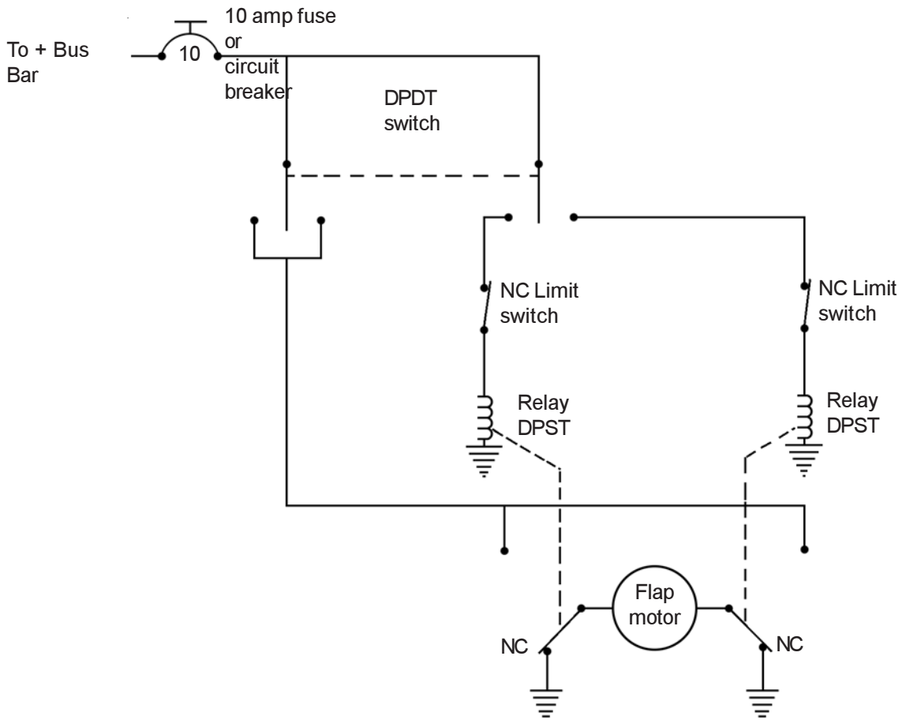
## H. Flap Wiring

The Lancair Legacy flaps are driven by the 12V electric linear actuator. Also the limit stops are set by the custom limit stop (micro switch) assembly that mounts directly over the actuator shaft. It is operated by magnetic reed switches.

There are two DPST (double pole, single throw) relays required to connect them. The part number for the 12V system is LY1 and for 24V it is LY1-24V. Also a DPDT Momentary On switch is needed to operate the flaps (Part # MS24658-23D).

See Figure 27:H:1 for the flap wiring. If you have trouble interpreting the schematic, don't worry, the additional drawings will take you through this installation in a simple pictorial manner.

**Flap Motor Wiring Schematic**
**Fig 27:H:1**




The relays can be secured to the motor or elsewhere.

**H 1.** Per figure 27:H:2, connect the wiring to these relays and attach the wires to their respective locations. The "spade" connectors on the relays are .187" in width. Use #18 wire.

**NOTE:** There are 4 wires that will travel forward to the instrument panel:
1. Ground
2. Up limit switch
3. Down limit switch
4. Positive (+) to the relays.

**H 2.** Secure the wires so that they can not possibly get tangled up with any of the flap actuator movements.

**H 3.** Before wiring the relay / flap motor assembly it is important to first establish the proper polarity of the motor. Or put another way, you must determine which wire on the motor is (+) when the actuator is extending. By placing one of the motor leads on (+) and one on (-) on any handy 12V battery, locate the correct combination that extends the actuator shaft. Mark that appropriate wire (+) for future reference. This extension movement will act to bring the flaps UP.

**H 4.** Attach the limit switch assembly to the actuator shaft. (The final position will be determined later, but for now, just put the magnetic reed switches on opposite ends of the base bracket - not all the way to the ends though.) The limit switch that is at the far end of the shaft (away from the motor) is the one that will limit the flaps UP position.

**H 5.** For the sake of discussion, let's pick relay #2 as the one to be used for flaps UP. The other relay will be used for flaps DOWN. With this established, the wire marked "Limit Switch #2 is connected to that limit switch. See figure 27:H:2. Also, the wire on relay #2 marked "to motor" must be connected to the flap motor wire which was earlier labeled (+). Now we have the motor turning in the correct direction for flaps UP and the motor will be stopped by the correct magnetic reed switch (or limit switch).

**H 6.** The flap control switch has two possible wires that could connect to the above limit switch #2. See drawing of a typical control switch in figure 27:H:4. Either wire can be used on limit switch #2, this will however determine which way the flap control switch moves to extend the flaps. Naturally, you want the movement on the control switch to be either "downward" or "aft" when dropping flaps. If the direction ends up being opposite, just turn the switch around in its instrument panel mounting hole.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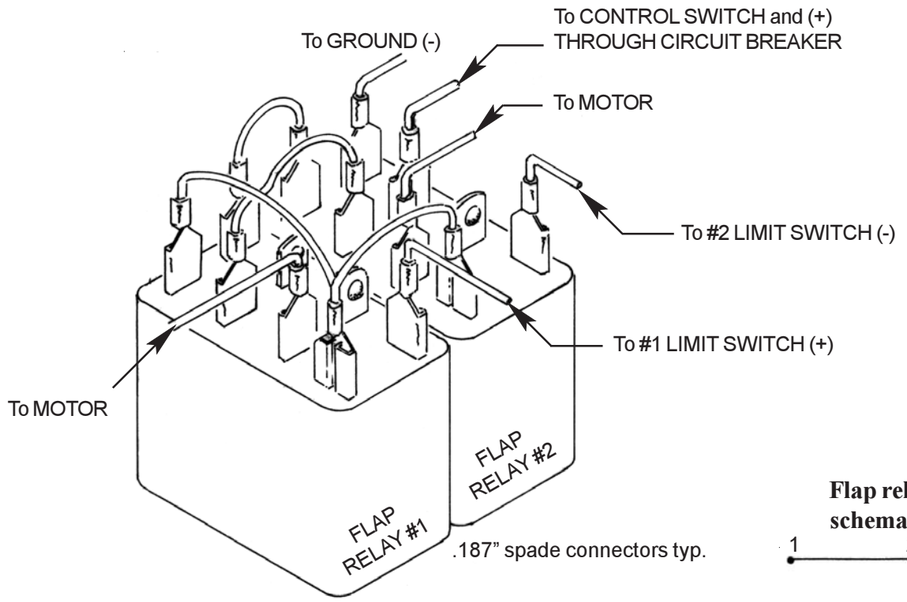
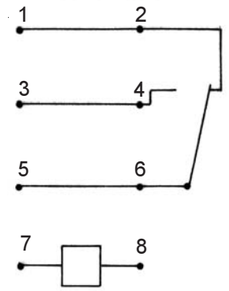
**Flap Relays**
**Fig 27:H:2**




**Flap relay schematic**




**H 7.** The magnetic reed switch will have three possible contact points. Use the center contact and ONLY the contact labelled "W".

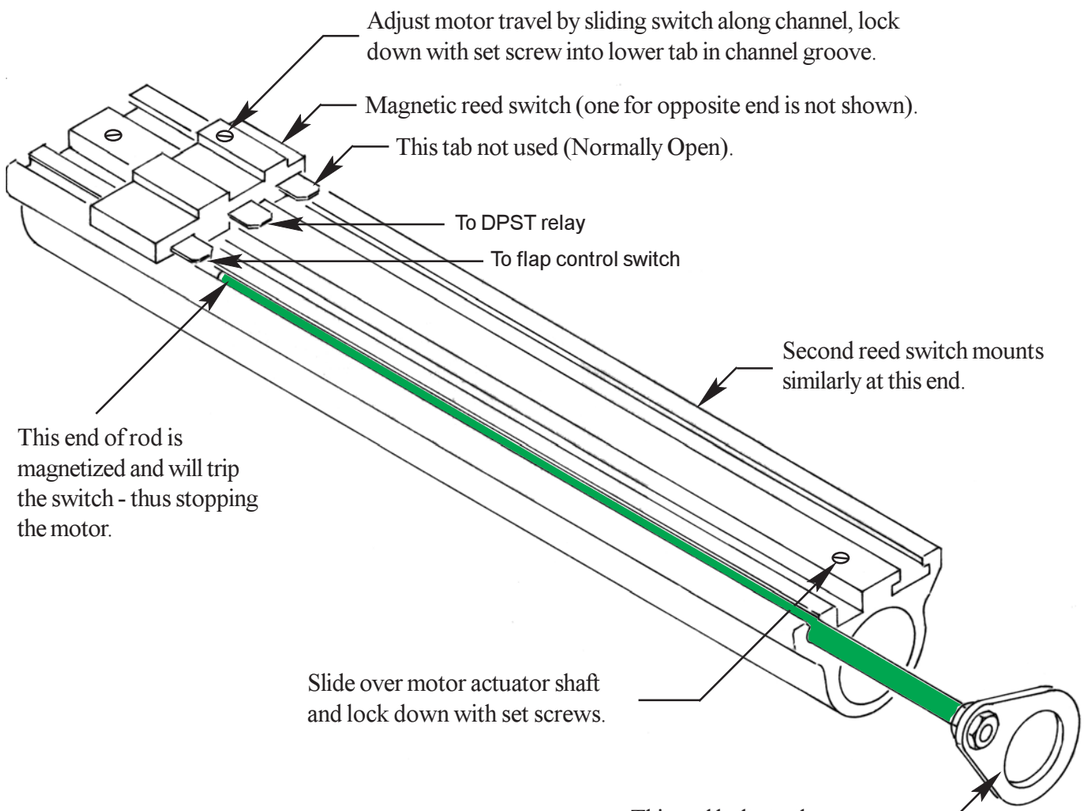
NOTE: When setting the wiring for the limit stops, calculate extra wire so that you will be able to fit the custom dust cover over this limit switch installation and be able to route all the wires through its exit hole which is on the END.

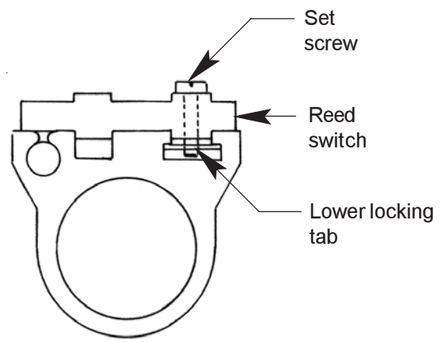
**H 8.** After completing all the wiring, test run the system and check for two things:

a. The limit switches must stop the travel in their respective directions;

b. The motor must be self braking. That is, when you release the control switch, the motor should stop quickly instead of gliding or coasting for two or three seconds. Such coasting is not acceptable and will not occur if everything is wired correctly.

**Flap Reed Switch**
**Fig 27:H:3**





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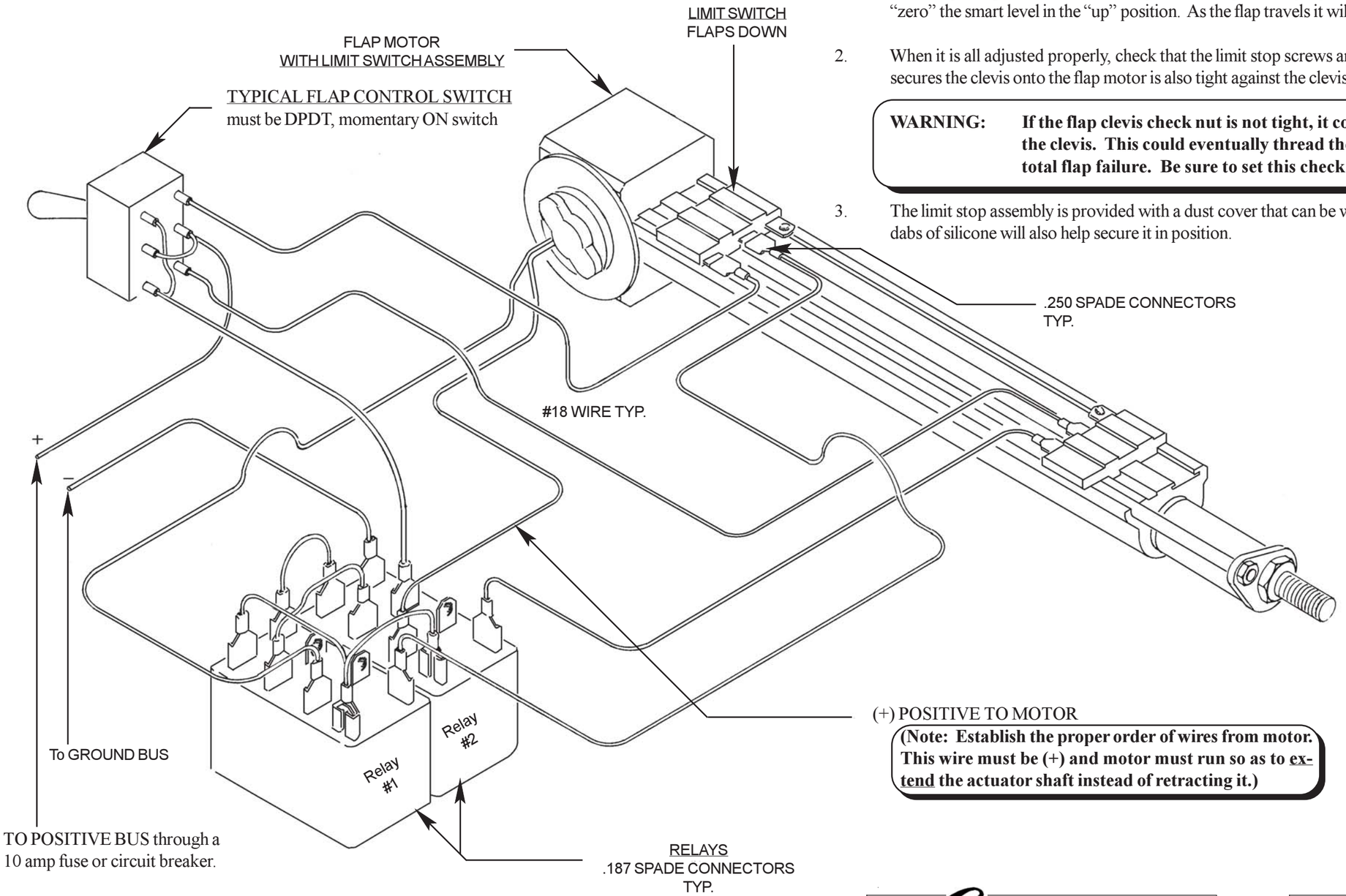
**Flap Wiring Diagram**
**Fig 27:H:4**




## Setting the Flap Limit Stops

1. When adjusting the DOWN limit stop, run the flaps to the proper down limit position (40 degrees). Simply "zero" the smart level in the "up" position. As the flap travels it will read the actual flap setting.

2. When it is all adjusted properly, check that the limit stop screws are snug and check that the hex nut that secures the clevis onto the flap motor is also tight against the clevis.

**WARNING: If the flap clevis check nut is not tight, it could allow the actuator shaft to turn in the clevis. This could eventually thread the actuator out of the clevis and cause a total flap failure. Be sure to set this check nut.**

3. The limit stop assembly is provided with a dust cover that can be wire tied over this installation. A couple of dabs of silicone will also help secure it in position.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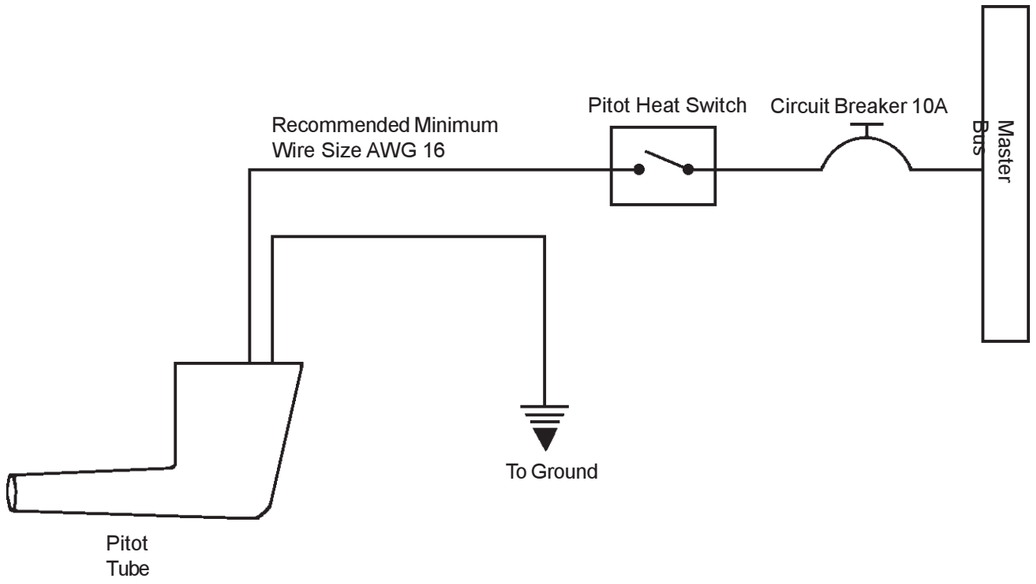
# I. Pitot Tube Heat Wiring

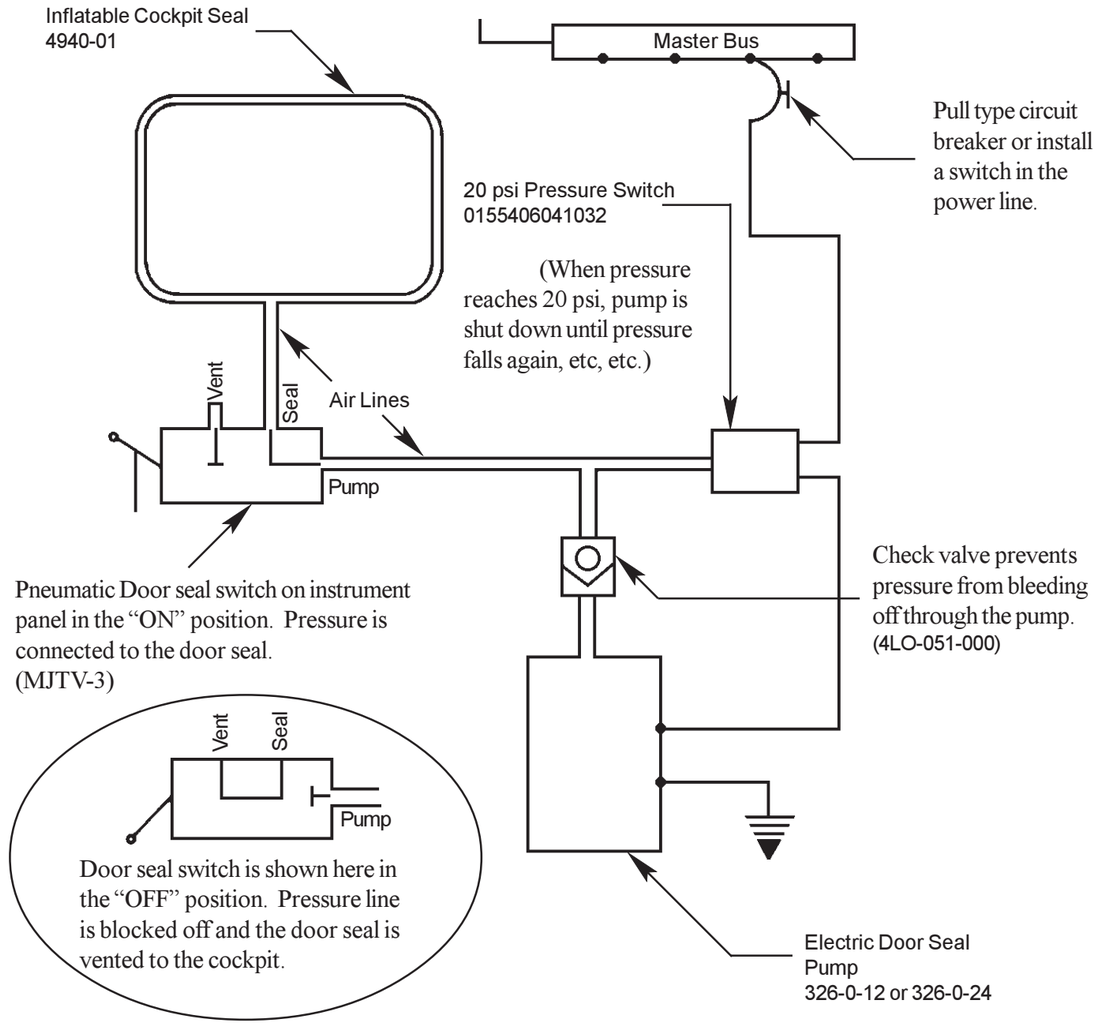
**Pitot Tube Heat Wiring**
**Fig 27:I:1**




# J. Electric Door Seal Wiring

**Electric Door Seal Wiring**
**Fig 27:J:1**

The inflatable cockpit seal is kept at 20 psi by a remotely mounted air pump. In this system, a pressure switch activates the pump when the seal pressure falls below 20 psi. When the pump is turned off, the pressure in the door seal will vent out through the panel mounted on/off switch. Refer to Chapter 9 for seal installation.





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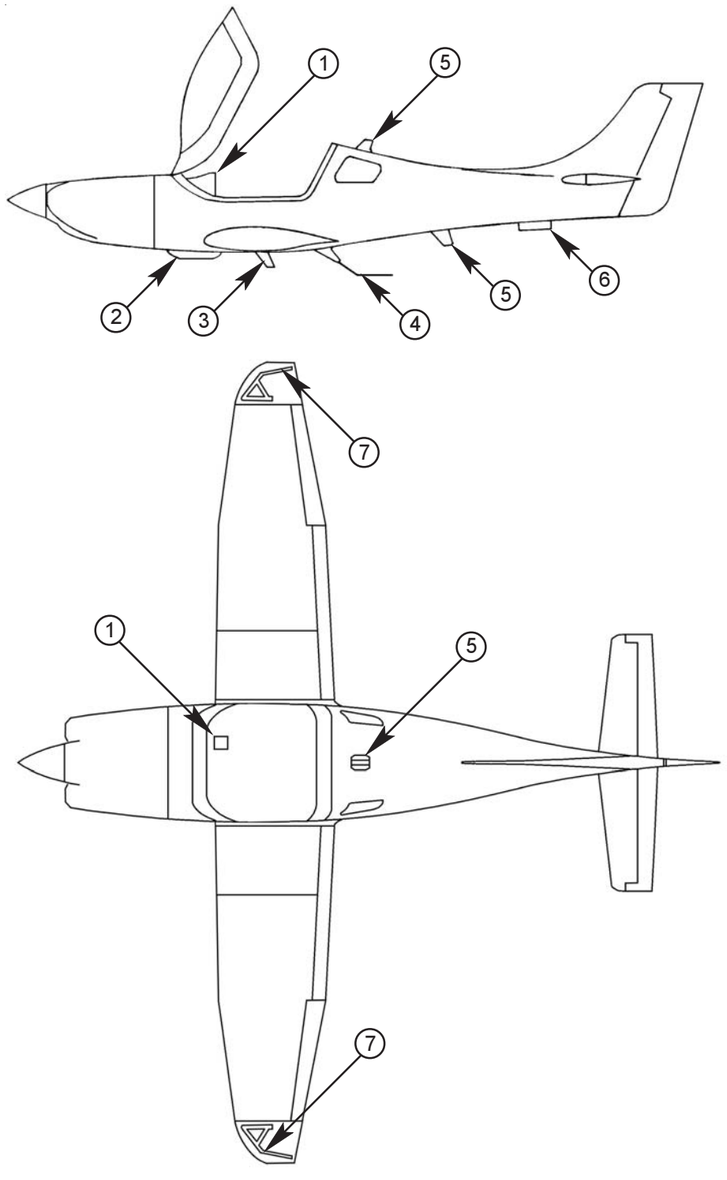
# K. Antenna Placement

**Antenna Placement**
**Fig 27:K:1**




In the constantly changing world of avionics, what you read in this section may be outdated in a year. As an example Loran was the hot thing just a few years ago. With the GPS the Loran system is now obsolete. This section outlines recommended placement and location.

1. **GPS**. Recommended placement is under the dust cover. It must be far enough aft so the antenna can "see" through the window. Remember: The GPS signals will not penetrate carbon. The antenna itself is normally supplied with the GPS.

2. **Marker Beacon**. Recommended placement is in the joggle provided in front of the spar. Also see section 3-B. The antenna part number is CL-102.

3. **Transponder Antenna**. Recommended placement is just aft of the main spar in line with the com and marker beacon antennas. Later kits have a premolded joggle for the transponder antenna. Refer to section 24-D.

4. **Com Antenna**. Recommended placement is in the joggle provided just aft of the aft spar. See section 3-C. the antenna part number is CL122C. If you're installing 2 com radios you can use a splitter or install 2 antennas.

5. **TCAD Antenna**. Call Lancair Avionics.

6. **Stormscope Antenna**. See chapter 25-5. Also call Lancair Avionics.

7. **Nav Antenna**. The NAV antenna may be in either the left or right wing tip. The antennas are pre-installed at the factory.

8. **ELT (not shown)**. Refer to section 24:B:1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# REVISION LIST

# CHAPTER 28: FINISHING TECHNIQUES

The following list of revisions will allow you to update the Legacy construction manual chapter listed above.

Under the "Action" column, "R&R" directs you to remove and replace the pages affected by the revision. "Add" directs you to insert the pages shows and "R" to remove the pages.

| PAGE(S) AFFECTED | REVISION # & DATE | ACTION | DESCRIPTION |
|---|---|---|---|
| 28-1 through 28-4 | 0/02-15-02 | None | Current revision is correct |
| 28-5 | 1/09-18-02 | R&R | Text Correction |
| 28-1 | 3/12-15-04 | R&R | Updated table of contents with page numbers. |


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# Chapter 28: Finishing Techniques

Contents



## 1. INTRODUCTION

### Painting and Interiors

The final look of your airplane is obviously an important aspect. It will affect performance but its primary effect is on ones ego. Luckily, it is not difficult to achieve an attractive finish on your Lancair, after all, you're starting with the best looking airframe in the air! Some very simple hints and techniques are all it will take.

## 2. PARTS LIST

A variety of finishing material/tools are available through KCI.

**Note:**

**Optional Parts available through :**
**(*) Lancair Avionics**
**(**) Kit Components, Inc.**



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# 3. CONSTRUCTION PROCEDURES

## A. Bid Tapes

**A 1.** The BID tapes that are applied to the exterior joggles will naturally require the most finishing and a little blending.

One simple trick in starting the process off is to apply an epoxy/micro blend (heavy on the micro here) to the tapes within just a few hours of application. When the tapes are still tacky, mix up a small batch of micro and apply it to the joint area. Be sure that the tapes are set up enough that you won't disturb them with the application of micro. Of course, you can always wait until they are fully cured, that's perfectly acceptable.

You'll probably find that it is a good idea to perform the basic finish on the BID tapes as you progress through the assembly of the airframe as opposed to waiting until all the glass work is completed and then starting on the finish. If you break it up a little, the task will seem much easier and in fact it will be easier.

**A 2.** As you are progressing through the assembly processes, you will usually have some excess epoxy mixed up from time to time and it should not be wasted. Simply mix it with generous amounts of micro and find a BID tape somewhere that can use it.

## B. Mixing Micro

**B 1.** When you are applying the initial micro to an area, you should mix it quite thick. Thick means LIGHT and inversely thin and runny means HEAVY. The thick micro should have the consistency of bread dough (or perhaps just a *little* bit less thick. Next, you might experience a bit of difficulty in the application of this thick micro. It may want to roll up behind your squeegee. If that proves to be an unsolvable problem, then perhaps it is just a little too thick, thin it back down with a little more epoxy. (But, always premix the epoxy thoroughly before adding it to an existing batch of epoxy/micro.)

One final method of evaluating the micro blend is by its sheen. If it smoothes out, sags or runs on vertical surfaces and/or achieves a nice smooth shiny look to it as it sets up, then it definitely is too thin. You can usually determine this quickly after an application since it will quickly smooth out and get shiny on the surface. If you see that, then you will still have time to remove it and add some more micro to the mix and reapply. Generally, one or two applications will be all that is required to "get the hang of it." And, that's why it is best to start with small areas first so if you didn't quite get the blend figured out, you won't be stuck with large areas to deal with.

**B 2.** In general, the first applications of micro will be the thickest mixture. As you apply a second coating for "fine adjustments", the mixture should be somewhat thinner since you don't need much "build" and you don't want to trap any air bubbles in the mixture. Any trapped air bubbles, if they are too large or to close to the surface can result in popping the paint loose in that small area as the air in the bubble heats up, expands and loosens you sure don't want any shiny bumps in your otherwise smooth paint job.

**B 3.** When you're ready to first sand the micro, use a 50 grit paper on a long board. These "long boards" area available in any auto body repair shop and use the standard 3" x 14" sanding sheets. It's a good idea to buy a pack of 50 grit and 80 grit.

**B 4.** You should always sand on a 45-degree angle to the contour and run the sanding board in a bit of a diagonal direction. Also, change directions of stroke regularly so that you achieve a nice smooth transition across the BID tapes thus not generating any grooves or waves.

**B 5.** If you start with a 50 grit sandpaper, you should only use that to get the lumps and bumps off of the micro, then switch to an 80 grit to get down to a nice smooth blend. Any second applications of micro will usually be best treated with 80 & 120 grit.

**B 6.** A small 3" x 6" sanding block is also quite helpful as is a "half round" sanding board. The half round is used along sharply rolled surfaces like the wing to fuselage joggles, etc. The half-round sanding boards will use 1/4 of a standard sheet.

**B 7.** The pressurized fuselages need to have a 1 BID layup of fiberglass applied over the thick micro areas, around the door area. We have noticed our micro around the door and fairing area is experiencing some cracking. The carbon can take the loads but unfortunately the micro alone cannot take the stretching. Again the micro areas that are over 1/8" thick should have one layer of glass applied over it.

**B 8.** With micro well dressed over the BID tapes, etc., you're ready for primer.

## C. General Surface Preparation

**C 1.** As mentioned above, the general means to attaining good smooth transitions is with micro. Small spot touch-ups can be made easiest with the light weight body fillers available in auto supply stores. Use only the light weight types (typically about 5-7 lbs. per gallon), these will have micro balloons mixed into them already - but to a much lesser degree than with out epoxy/micro. This type of filler should NOT be used in large amounts, but only for small touch up areas. It dries very quickly and thus allows for final prep on a fast basis.

**C 2.** To achieve the best possible adherence of paint, all surfaces should be cleaned with a suitable cleaner to remove dirt and oils. After cleaning, sand the surfaces with 80-120 grit prior to applying any primers. The best filling primers are of an epoxy basis. Lacquers should generally be avoided. Some Polysters are acceptable, however, they will shrink and the shrinkage will eventually allow imperfections to show through the finished paint job. Again, epoxies are highly recommended.

We have tested a wide variety of filling primers. Sure, there are many excellent types available that we have not had the opportunity to test out, however, generally stocked by KCI, consult our options catalog.


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## D. Priming Materials

The WLS system is a two part epoxy system and can be reduced by up to 10% for thin applications. When applying the last coat of primer, it is generally best to thin it. Thinner / reducer is supplied with each WLS set.

**D 1.** The first application of primer is primarily to fill the small depressions in the weave. These are very shallow and are very small. It is generally effective to first squeegee or brush a filling primer onto the surfaces. This helps get the material down into the tiny depressions.

If you were to begin by spraying a heavy application of filling primer onto the surfaces, it would tend to bridge the small depressions but, when sanded back down, the bridging would be sanded away and the depressions would reappear. A spray technique that does work satisfactorily is to spray a very light coat and allow it to set up a bit. Follow with another very light coat. These coats should be so light that it requires about four passes to get a solid color change. Then allow that to cure. This process helps allow the filling primer to get into the depressions and exclude the air that must be displaced without causing any bubbling on and allow it to set up a bit. Follow with another very light coat. These coats should be so light that it requires about four passes to get a solid color change. Then allow that to cure. This process helps allow the filling primer to get into the depressions and exclude the air that must be displaced without causing any bubbling on the surface. If you see any bubbles occurring, it is because the primer is displacing small amounts of trapped air, which causes a bubble in the too thick application of primer.

**D 2.** After the primer cures, use either a machine sander or sand by hand. Start with 120 grit and progress up to 150 grit for this sanding. (If you are careful, you can speed the process by starting with 80 grit, but don't sand with that course of a paper too long or you'll not have anything left to sand with the finer grits.) This sanding will go quite quickly since you are not doing any contour work, just knocking down the primer. We generally will sand an entire wing surface down in about 30-40 minutes. An air driven 8" dual action sander (DA), and the air file (long board 3" x 14"), will work the best. The 6" orbital sanders will take much more time and leave hard to fill sanding marks. The 8" DA will require a 2 hp compressor, which it will work pretty hard, and it usually can just keep up with the air demand. Keep the sander moving and use a similar diagonal motion so that no grooves or waves result.

**D 3.** You should sand this application down until you just begin to see the prepreg starting to show through.

**NOTE: It is very important to keep the primer applications THIN. Excess amounts of primer could easily increase the weight of your aircraft by as much as 30 lbs. Also, remember that the goal should be to achieve a finish on the bottom surfaces that is conductive for good aerodynamics *only*.**

**D 4.** With that first application of primer sanded down, go over the surfaces and look for imperfections. Use a spot light at a low angle to the surfaces in a dark room to quickly point out any imperfections. You should use compressed air to blow off the surfaces first. Wiping them will leave sanding material down in any imperfections that may exist, and you'll miss seeing them.

**D 5.** Spray a second coat of primer. This coat can be a thinner application. After curing, sand it down with 220 grit. You can either wet or dry sand. If you wet sand, the sandpaper will not tend to clog up (use 3M wet / dry - black sandpaper). However, with wet sanding, you should allow at least one to two weeks for the surfaces to fully dry before painting. If you dry sand, use the aluminum oxide sandpaper (light grayish color).

**D 6.** If you are intending to use a urethane type of paint, then generally a 220 grit finish is acceptable as a paint base. If you choose an acrylic / enamel type of paint, you should go to a 360 grit finish since it will show the scratches more readily than a urethane.

**D 7.** The second coating of primer should also be sanded down quite thoroughly. If the prepreg begins to show through, touch-up with a spray of primer and lightly resand. This will assure the thinnest possible primer coat, yet allow full coverage.

**D 8.** If you have some (few) imperfections located after everything else is readied for paint, limited use of a lacquer spotting putty is acceptable. This should be used sparingly. It is packaged in a tube and will set up in about 20 minutes. Use a small squeegee to apply it, then spot sand with 220 grit. Make sure that it is feathered out nicely or else an edge will result and show through in the paint. The two part spot putties, or glazing compounds, are much better though and will set up equally fast.
This is not intended to be a painting instruction, we will only touch on a couple of basics. You should consult local sources or available technique books for tips on painting.


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## E. Paint Preparations

**E 1.** It is recommended that the airframe be disassembled as much as possible more pieces but a better paint job when it's all put back together.

**E 2.** Remove the control surfaces, gear doors, wings, door and cowling. Mask off all appropriate areas. Tape off the gear wells and wrap plastic bags around the wheels. If you roll the plane up onto some stands, the lower surfaces of the fuselage will be easier to spray but be sure that you can still reach the top or have a stool available.

**E 3.** Blow off everything with compressed air and be extra careful to blow off areas that are near any possible spray gun blast. Even if some areas are not destined for paint, such as, the gear wells, back by the flap attach locations along the aft spar webs, etc. Sometimes these areas can have big cakes of dried sanding residue that is just waiting to be launched into the air when your spray gun hits it. And that can make a huge mess on a nice clean, wet paint surface. Also, check the hose, near the area of the spray gun, since it will likely be suspended over some wet paint as you make your spray passes.

**E 4.** Wings, control surfaces, etc. can be hung on wires or clamp up to make-shift fixtures. Again, be sure these fixtures are also dirt free. Use recommended surface cleaner (prep-sol, etc.) and tack rags to remove any contaminants.

**E 5.** It's not easy to paint all surfaces at the same time but it is recommended to at least mix all the paint cans so that the color is guaranteed to be identical from one gallon can to another.

Generally, three gallons of top coat paint (plus its recommended thinner and catalyst, etc.) is sufficient. So, mix the two-gallon cans together by pouring them into a bucket, mix them and then pour them back into their own gallon cans again. Even though the colors are supposed to be the same, they often have slightly different hues from one can to another. Whites are particularly susceptible to this problem.

## F. Painting

**F 1.** Generally, the urethane paints are preferred. That is because they will allow the greatest amount flex without cracking or chipping. You will generally use less spraying volume with these, but they are heavier with less evaporative solvents. So, the weights come out about the same in the end. Imron is the most readily identified name brand but there are several excellent brands available such as, Sterling and Ditzler.

Another acceptable type is the acrylic / enamels. These, when used with the catalyzed hardeners, produce an excellent finish. One such paint type is DuPont's Centari. Often, the acrylic / enamels are easier to touch up and blend in with the existing paint finish. The urethanes often do not blend very well together when making any spot repairs. On aluminum (rivet-bucket) aircraft, that problem is more easily dealt with since you can mask off individual panels. But with our composite airframes, there are no "panels" since all parts are blended into one another. Thus, there is simply no convenient place to stop a spot repair short of an entire wing surface or fuselage.

**F 2.** A word of caution, when preparing to paint, be sure to read the safety instructions and follow them carefully. The fumes from these paints can cause serious harm or death.

## G. Base Colors

**G 1.** Keep your color choices to **LIGHT** pastels **ONLY**. Yes, you've seen other darker colors on aircraft and one of our company planes has had a darker color but that was for a testing program and **IS ABSOLUTELY NOT RECOMMENDED. In fact by policy, we prohibit dark base colors on all Lancairs.**

Yes, our Lancair materials are better suited to higher thermal tolerances but as with all composites with any type of resin system, strength will drop as temperature rises.

The biggest difference with Lancair materials involves the core materials. Our high temperature cores will not sustain any permanent damages from elevated temperatures, but the common low temperatures cores would. Our materials will tolerate elevated temperatures without any permanent damages, but, as with all resin systems, a temporary strength drop will result as temperatures rise. This temporary drop reduces the effective safety margins until the composite cools.

When it cools, all strength will return. But, due to this temporary, potentially in-flight drop in margins, we only recommend light pastels for a base color. We cannot stress the importance of this enough. Keep your colors LIGHT and let us do the testing.

However, with your Lancair, you can enjoy a much wider color choice than any other kit plane on the market, since all the vinylester / low temp foam kits should ONLY be painted white. Any other color choices (even light pastels) could run their expected surface temperatures too high thus causing permanent structural damages. This will never happen with your Lancair and it is just one of the many reasons why we have chosen these superior, high temperature advanced composites for the Lancair. That is also one of the key reasons why virtually all of the commercial composite industry uses ONLY high temperature epoxy based composites for airframe applications.


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## H. Trim Colors

**H 1.** There really is no problem with any of the trim colors provided you keep them down in size. It is recommended that you do not paint any trim on the fwd 50% of chord along the wing. This is because the resultant paint edge, even though it might only be .010" thick, could trip the laminar flow and cause added drag. Fwd / aft orientated wing tip striping is however acceptable.

**H 2.** Generally, the trim is painted onto the airframe after the base coat has been applied. Usually, the simpler the trim design, the better it looks. Designs that have a lot of vertical direction changes within them generally tend to break up the smooth flowing lines of the Lancair and detract from it in the process.

**H 3.** It is highly recommended that you use the 3M type "fine line tape" for masking the paint areas. This should be used for the base coat colors as well, such as around the canopy and windows, etc.

This fine line tape is usually found to be slightly greenish / gray in color and of a mylar type material. It is much thinner than the masking tapes and produces a very nice, crisp line.

**WARNING: When you are finished with the painting, etc., be sure to check your pitot and static ports, especially the static. Verify that it is still clear and functioning, as primer and paint could plug it up. Also, check the balance of the rudder and aeilerons to make sure they are perfectly balanced.**


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## E



## F



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## H





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## W





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